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**NEW APPROACHES FOR U.S. LOCK AND DAM MAINTENANCE AND FUNDING**

**January 2013**

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Prepared by  
**CENTER FOR PORTS AND WATERWAYS  
TEXAS TRANSPORTATION INSTITUTE  
701 NORTH POST OAK, SUITE 430  
HOUSTON, TEXAS 77024-3827**

for  
**UNITED SOYBEAN BOARD**





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**by**

**C. James Kruse, Director, Center for Ports & Waterways  
David Ellis, Research Scientist  
Annie Protopapas, Associate Research Engineer  
Nick Norboge, Assistant Transportation Researcher**

**Texas Transportation Institute  
The Texas A&M University System  
College Station, Texas**

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## EXECUTIVE SUMMARY

### BACKGROUND

The U.S. Army Corps of Engineers (Corps) is responsible for building and maintaining much of the federal water resources infrastructure in the nation and is responsible for construction and maintenance of navigation projects on 12,000 miles of river channels that comprise 27 inland river systems, and 207 lock chambers at 171 lock sites.

The Corps faces a higher demand for building and maintaining its projects than available federal funding allows. This situation is raising basic questions about how the Corps functions, including the effectiveness, efficiency, and equity of Corps planning and implementation.

The objectives of this research comprised a two-pronged effort to investigate the possibility of alternative solutions to these issues. The first prong analyzed policy, legislative, economic, planning, and project implementation data and information to estimate impacts of alternative maintenance and funding approaches, both at the national level and to the individual shipper. The second prong of this effort analyzed economic, funding, and financing issues.

### OBJECTIVE 1: ANALYZE THE POSSIBILITY OF TRANSITIONING FROM THE CURRENT “BUILD AND EXPAND” APPROACH TO A “REPAIR AND SUSTAIN” APPROACH TO OUR LOCK AND DAM INVENTORY

#### I. SUMMARY OF APPROACH TO FUNDING LOCK AND DAM PROJECTS IN THE LAST WATER RESOURCES DEVELOPMENT ACT AND THE CURRENT PROPOSAL

Corps water resources projects receive congressional authorization in a federal Water Resources Development Act (WRDA) and receive project funding through a separate annual appropriations process. Authorization does not include a plan or timeline for funding appropriations. The process of partial project funding through the annual appropriations process results in many projects moving forward in a piecemeal, start-stop manner resulting in inefficient project delivery and higher overall costs.

New construction and major rehabilitation projects are financed 50% by the Inland Waterways Trust Fund (IWTF) and 50% from general appropriations, while Operations and Maintenance (O&M) costs are 100% funded by general appropriations. The various Administration proposals and practices related to the Corps’ planning and budgeting process in budget submittals over the last 20 years have been pushing to increase user financing of the inland waterways. A lockage fee has been proposed repeatedly, but has been opposed by industry and not accepted by Congress. In FY 2006 the Administration’s Performance Budgeting Initiative proposed (and Congress accepted) to reduce the

construction backlog by placing a higher priority on completing high-return projects and limiting the start of new projects to the highest performing projects. Implementation of this strategy has met with modest levels of success.

Ten stakeholder organizations that have been actively involved in various issues pertaining to the Corps' civil works program expressed their opinions on the following subjects:

- Level of funding for the Corps.
- Project prioritization scheme used by the Corps.
- Postponing new construction and major rehabilitation in favor of adequately maintaining and preserving current infrastructure.
- Potential sources of additional funds for lock and dam projects (e.g., increased fuel taxes, lockage fees).
- Critical lock infrastructure needs.
- Definition of a "lock in good condition."

The consensus is that significant changes need to be made with respect to all the above issues in order to improve the capacity and ensure the long-term viability of inland waterway infrastructure.

## II. DEFINING THE REPAIR AND SUSTAIN APPROACH

There are three basic maintenance policies the Corps has examined and employed at various times:

- Fix-as-fails.
- Advance maintenance
- Rehabilitation/reconstruction.

After examining the practical implications of these various policies, the researchers define "repair and sustain" as a program of advance maintenance that includes (1) ongoing maintenance designed to avoid a failure by any critical component, (2) replacement or major rehabilitation only when acceptable performance levels cannot be achieved or maintained, and (3) staging of equipment and repair parts to minimize the time and cost of emergency repairs. The Corps has investigated the possibility of establishing a program of the third type and determined that with current funding levels and the demands on those funds there is insufficient funding to pursue it.

## III. DIFFERENCES IN COST DERIVING FROM THE ADOPTION OF A REPAIR AND SUSTAIN APPROACH

Average project costs indicate that the cost of one construction project (\$376.8 million) is approximately equal to the cost of nine major rehabilitation projects (\$40.7 million average). If each of 9 New Construction/Expansion projects currently underway were to be downgraded to a major rehabilitation, their total cost would drop to \$366.3 million compared to the listed total of \$3,193.5 million—a difference of \$2,827.2 million, or \$2.8 billion.

#### IV. FUNDING REQUIREMENTS UNDER CURRENT APPROACH VERSUS PRESERVE AND MAINTAIN APPROACH, AND FUNDS AVAILABLE VIA THE INLAND WATERWAYS TRUST FUND (IWTF)

The Corps and the Inland Waterways Users Board (IWUB) recently collaborated in an effort that resulted in the *Inland Marine Transportation Systems (IMTS) Capital Projects Business Model*. The total amount of funding proposed in the Business Model for new construction projects from FY 2011 to FY 2030 is \$6.047 billion, of which \$2.642 billion are allocated to 7 non-critical projects. The funding amounts proposed in the Business Model consist of IWTF collections and general fund appropriations. If each of the non-critical projects is downgraded to an average major rehabilitation project described above, the total allocation to these projects drops to \$256.1 million. This is an average of \$119.3 million per year over the 20-year period, which is 28.1% of the Administration's FY 2013 budget proposal for the Lock and Dam subaccounts within the Construction and O&M accounts (\$425 million—see Table 21 later in this report).

In the Business Model, the must finish projects are completed in FY 2028. In all but 3 of the 18 years, these projects consume at least 50% of the proposed funding. While the average that could be saved each year through the reclassification described above is significant, the funding stream is such that the real opportunity to reclassify projects will be sporadic during the first 15 years of the 20-year funding period, and will be weighted heavily toward the latter years. In order to have a major effect on funding requirements during the first half of the period, one or more of the current must finish projects would have to be canceled or delayed.

#### V. VIABILITY OF REPAIR AND SUSTAIN APPROACH AND NECESSITY FOR MAJOR REHABILITATIONS AND CAPACITY EXPANSIONS

Every major study done by the Corps indicates that it is more cost-effective over the long term to perform advance maintenance and periodic major rehabilitation than to allow the system to fail and then reconstruct it. Unfortunately, the current level of appropriations does not allow for implementation of this approach.

The Corps' inland waterways projects already in the construction phase require an estimated \$4.77 billion to complete. At current IWTF revenues of \$75 million–\$85 million per year, plus the matching federal appropriations, these projects would not be completed until FY 2040 at the earliest.

The IWUB is of the opinion that the status quo would eventually result in the end of the IMTS—the system cannot be maintained under the current funding level and would become increasingly unreliable at the current level of investment. The IMTS Team recommendations included (1) an average of \$380 million per year for new construction and major rehabilitation over a 20-year capital investment strategy (\$110 million from the IWTF and \$270 million from general appropriations), (2) an alternative

cost-sharing structure, and (3) a 30–45% increase in fuel tax (\$0.06–\$0.09 per gallon), which makes the \$110 million possible.

## VI. COST TO SHIPPER OF USING NEW AND EXPANDED LOCKS AND DAMS VERSUS USING PROPERLY MAINTAINED CURRENT INFRASTRUCTURE

A lock chamber with length of 1200 ft is considered the standard, but many locks only have 600-ft or smaller chambers. Any flotilla larger than 8 barges has to be broken up and moved through a 600-ft chamber in two stages (cuts), causing the barge operator to incur additional expense and delays. The time penalty for processing two cuts instead of one is 1.11 times the processing time for one cut. The cost of the extra time is reflected in additional towboat costs and barge costs. For example, a double cut at only one lock on the Mississippi would cost \$618 more than one cut (\$538 in towboat costs and \$80 in barge costs). The penalty for each lock traversed would need to be calculated and all penalties would need to be added together to determine the total cost of this inefficiency along a voyage. The worst case scenario occurs at locks that can only accommodate one barge at a time, which would necessitate 14 cuts in the case of a 15-barge tow. (These locks are located on the Allegheny River, the Upper Cumberland River, and the Upper Tennessee River.)

## VII. AMOUNT OF FUNDING DIRECTED EACH YEAR TOWARD LOCK AND DAM MAINTENANCE AND REPAIR OVER LAST TWENTY-FIVE YEARS

The report contains detailed data on Corps budgets and appropriations from FY 1994 through the FY 2013 budget request, for both the Construction and O&M accounts. There was a spike in appropriations in FY 2009 and FY 2010, which reflects the infusion of funding resulting from (1) the American Recovery and Reinvestment Act of 2009, and (2) the decision by Congress to spend the entire balance of the Inland Waterways Trust Fund. The ongoing appropriations are declining in real dollar terms.

## OBJECTIVE 2: ANALYZE THE POSSIBILITY OF TRANSITIONING FROM THE GOVERNMENT'S CURRENT LOCK AND DAM FUNDING APPROACH TO A BONDING STYLE APPROACH

### I. TRANSITIONING FROM "PAY-AS-YOU-GO" TO "BONDING STYLE" APPROACH

Bonding is often used when the initial capital required to fund the construction of a transportation infrastructure project exceeds the available funding from current revenue streams, allowing for a quick, immediate influx of cash in the form of bond proceeds. There are several benefits a bonding style approach could bring to funding and financing the development of the U.S. lock and dam infrastructure:

1. It can facilitate capital flow to transportation projects from various classes of investors.
2. While bond financing imposes interest and other costs related to issuing debt, bringing a project to construction more quickly can sometimes offset these costs.

3. Debt finance brings future revenues into present use; achieves economic, safety, and congestion benefits now; and provides opportunities for economies of scale, while avoiding potential inflation costs. Through a quick infusion of cash up-front, lock closures can be minimized, resulting in reduced waterway congestion due to mechanical or structural failures.

## II. BONDING STYLE APPROACH: 3 POSSIBLE SCENARIOS

The report presents three possible bonding scenarios. They each assume a 30-year amortization (payback) period.

1. Bond against existing IWTF revenue: It is estimated that the IWTF revenue stream would be able to support a total of \$1.8 billion in lump-sum payments for lock and dam projects over the next 8 years
2. Raise the Inland Waterway Fuel Tax by 4 cents and bond against entire new revenue stream (base plus increase): It is estimated that this IWTF revenue stream would be able to support a total of \$2.3 billion in lump-sum payments for lock and dam projects over the next 8 years.
3. Raise the Inland Waterway Fuel Tax by 4 cents and bond only against the increase: It is estimated that this incremental IWTF revenue stream would be able to support a total of \$377 million in lump-sum payments for lock and dam projects over the next 8 years.

All three provide an immediate infusion of cash that would allow a much more efficient level of funding than what is currently being experienced. These scenarios could provide a cash infusion of \$1.3 billion, \$1.6 billion, or \$275 million in the first year of financing, depending on the specific scenario selected.

## III. LOCK AND DAM PROJECT UNDER CURRENT APPROACH VS. LOCK AND DAM UNDER BONDING STYLE APPROACH: MCALPINE LOCKS AND DAM PROJECT CASE STUDY

Due in large part to the 13-year duration of the McAlpine Locks and Dam Rehabilitation project, the overall cost increased by 38% to a total cost of \$430 million. For most fiscal year funding cycles, the McAlpine project did not receive the full year funding capability limit<sup>1</sup>; it received on average 61% of full capability funding levels. A bonding style approach (i.e., 100% of funding for a project provided up front) would likely have resulted in significant reductions in the construction time for the McAlpine project. Conservative construction schedule estimates suggest that the McAlpine Lock, if built to full capability funding levels, could have been completed in FY 2005, rather than FY 2009 (i.e., four years sooner), assuming no design changes. The available data begin with FY 2001, but the construction phase officially began in FY 1996. If the same ratio of time savings is applied to the first 5 years, another 2.7 years could possibly have been taken off the actual duration of the construction project. Altogether, the

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<sup>1</sup> Capability is defined as the amount of funds that can be obligated effectively and efficiently on a project in a fiscal

data indicate that 6 ½ years might have been saved had the project been fully funded up front or at full capability each year (a completion date sometime in 2002 versus early 2009). Allowing the McAlpine Lock project to be constructed under a bonding style approach could have meant that the construction schedule would have been significantly reduced, which would have reduced the time during which traffic relied on the older structure and therefore would have reduced the risk of an interruption in service.

#### IV. FUNDING AND FINANCING OF LOCK AND DAM INFRASTRUCTURE: U.S. VS. FOREIGN APPROACHES

The United States funds lock and dam infrastructure very differently than other countries fund theirs. For this research effort, two foreign case studies were chosen: the Panama Canal and the Belgium Deurganck Lock project at the Port of Antwerp. Both of these projects are currently under construction. While the U.S. funds its lock and dam infrastructure through general revenues and taxes currently levied on diesel fuel used in commercial transportation on inland waterways, the Panama Canal Authority (ACP) and Antwerp Port Authority fund their infrastructure primarily through a toll approach. The financing sources tapped by these two projects do not generally make investments in the United States. However, the construction time of these two projects indicates that upfront financing plays a significant role in the determining the time it takes to bring a project to completion.

#### V. PROJECTED COSTS/COMPLETION DATES AND ACTUAL COST/COMPLETION DATES: U.S. VS. FOREIGN CASE STUDIES

There is a notable difference with respect to schedules and budgets between the foreign projects and the U.S. projects. The Panama Canal expansion is scheduled to be completed within budget and just slightly behind the original schedule. The ACP has achieved this success in part because of how the project was financed. The ACP took advantage of access to four international lending facilities that provided an immediate influx of cash from various investors, bringing the project to completion more quickly than could otherwise be realized. ACP will, in turn, use enhanced toll revenue to service the debt on the capital investment required to accelerate construction. These, and other, factors help explain why the Panama Canal can be completed so much faster than projects in the U.S. To be able to construct a project of this magnitude in the United States would require a completely different funding paradigm than is currently in place. Given the current rate of collections for the IWTF, it would likely take over 30 years to build such a project—assuming the IWTF and matching federal appropriations were spent only on the one project! Although it is an extreme example, if the Panama Canal were funded and constructed at the same rate as the McAlpine Lock project in the U.S. (a \$430 million project overall), it would likely take over 150 years to construct. An examination of the Deurganck Lock project results in similar observations.



## OBJECTIVE 1: ANALYZE THE POSSIBILITY OF TRANSITIONING FROM THE CURRENT “BUILD AND EXPAND” APPROACH TO A “REPAIR AND SUSTAIN” APPROACH TO OUR LOCK AND DAM INVENTORY.

### I. SUMMARY OF APPROACH TO FUNDING LOCK AND DAM PROJECTS IN THE LAST WATER RESOURCES DEVELOPMENT ACT AND THE CURRENT PROPOSAL

#### BACKGROUND

The U.S. Army Corps of Engineers (Corps) is responsible for building and maintaining much of the federal water resources infrastructure in the United States. The Corps faces a higher demand for building and maintaining its projects than available federal funding allows. This situation is raising basic questions about how the Corps functions, including the effectiveness, efficiency, and equity of Corps planning and implementation.

The modern context of water resources management involves smaller budgets, cost sharing, an expanded range of objectives, and inclusion of more public and private stakeholders in management decisions. Two important implications of these conditions are (1) given current budget realities, the nation may have to consider more flexible, innovative, and lower cost solutions to achieving water-related objectives, and (2) the Corps will, by necessity, have to work in settings with more collaboration and public and private participation than in the past.<sup>2</sup>

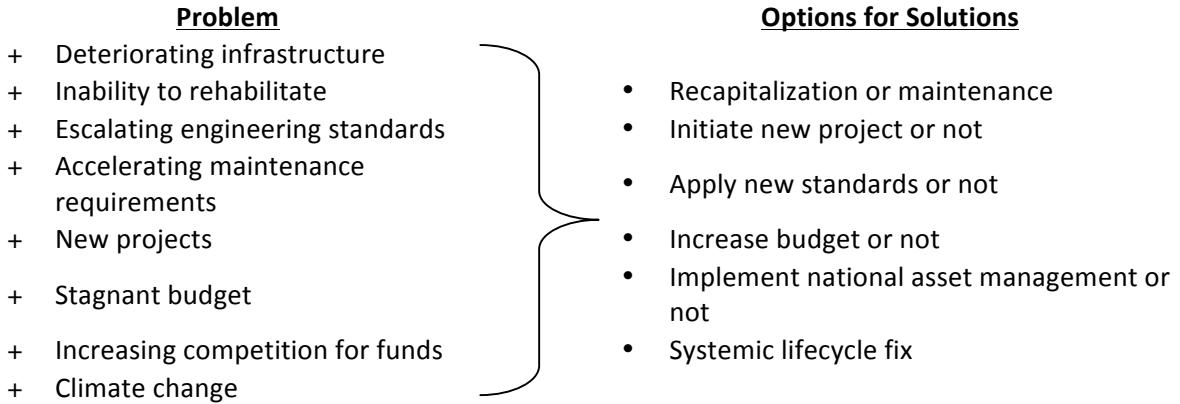
The Corps is responsible for construction and maintenance of navigation projects on 12,000 miles of river channels that comprise 27 inland river systems. There are 207 lock chambers at 171 lock sites that fall within the Corps’ responsibility.<sup>3</sup>

A crisis is developing in the area of maintenance of lock and dam infrastructure. Congress does not appropriate enough funds each year for the Corps to do preventive (proactive) maintenance. Figure 1 illustrates the current dilemma.

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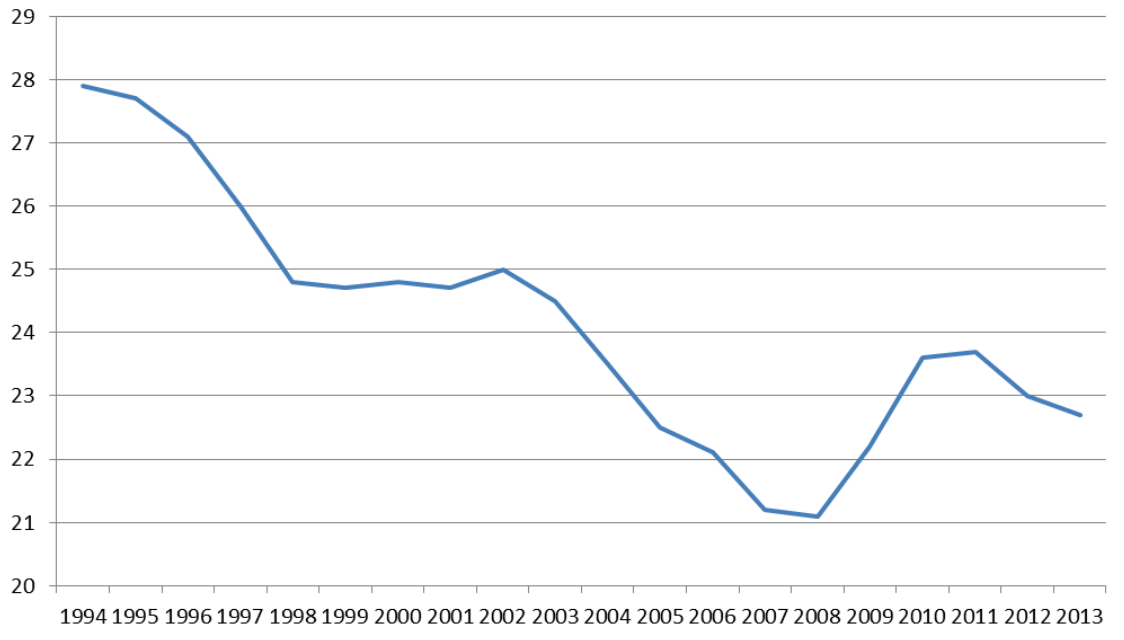
<sup>2</sup> National Research Council, *National Water Resources Challenges Facing the U.S. Army Corps of Engineers* (Washington, DC: The National Academies Press, 2011), 19. Available at [http://www.nap.edu/catalog.php?record\\_id=13136](http://www.nap.edu/catalog.php?record_id=13136) as of June 11, 2012.

<sup>3</sup>McKee, Jeff. *Presentation for American Association of Port Authorities Harbors & Navigation Meeting* (Washington, DC: July 25, 2011). Available at <http://aapa.files.cms-plus.com/PDFs/AAPA%20Harbors%20and%20Navigation%20Jul%202011%20-%20Corps%20Nav%20Branch%20Jeff%20McKee.pdf> as of June 11, 2012.



**Figure 1. Funding Dilemma.**

To compound this situation, Congress has greatly broadened the Corps’ work program and responsibilities thereby significantly expanding the Corps’ scope of activities. Future Corps water resources activities will be less dedicated to construction of major new civil works, and more heavily focused on (1) operating, maintaining, rehabilitating, and upgrading existing infrastructure, (2) re-allocating reservoir storage and releases among changing water resources demands and users, and (3) providing some degree of ecosystem restoration and ecological services in heavily altered riparian and aquatic ecosystems. While this expansion of responsibility has been increasing, the Corps has experienced significant reduction in staffing levels. Figure 2 shows the decline in Full Time Equivalents (FTE) since 1994.



**Figure 2. Corps of Engineers FTEs, 1994–2013.**

Unscheduled outages at locks have been increasing in frequency and duration over the last decade. The Ohio River is a highly visible example; within the last 8 years, there have been several major lock failures on the Ohio River. In 2003, Greenup Main Chamber was closed for 52 days. In 2004, McAlpine Lock experienced a total river closure of 10 days. In 2005, Hannibal Lock experienced a 13-day closure of the main chamber and, during this time, the auxiliary chamber also failed, which caused a total river shut down for 5 days. In 2009, Markland experienced a failure at the main chamber that lasted for 154 days. In 2010, there was another failure at Greenup Lock for 22 days, a failure at J.T. Meyer Lock for 9 days, and an outage at Lock 52 for 32 days. An outage at Markland Lock that started on July 11, 2011, is ongoing and this lock is not expected to be operational until August 3, 2012. This will amount to 389 days the main chamber at Markland will have been out of service. In addition, Greenup Lock is scheduled for another 90-day outage from June 3 through September 1, 2012.<sup>4</sup>

Many stakeholders have been expressing their concern that these types of outages will become much more commonplace and much more severe if the current funding and prioritization schemes are not modified.

This report examines current funding and project prioritization practices (the “improve and expand” approach) and explores alternatives. Initially, this was termed as moving from “build and expand” to “preserve and maintain.” The Corps—when analyzing these alternatives—has coined the phrase “repair and sustain.” This report will use the phrase “repair and sustain” in order to align with terminology that already has meaning and significance to government planners.

## STAKEHOLDER POSITIONS ON CORPS BUDGETING AND PROJECT PRIORITIZATION

A number of stakeholder groups have been actively involved in issues pertaining to funding for the Corps’ civil works program and the methodology employed to prioritize projects. In order to accurately report their positions, the research team asked 19 different stakeholder organizations to express their opinions on the following subjects:

- Level of funding for the Corps.
- Project prioritization scheme used by the Corps.
- Postponing new construction and major rehabs in favor of adequately maintaining and preserving current infrastructure.
- Potential sources of additional funds for lock and dam projects (e.g., increased fuel taxes, lockage fees,)

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<sup>4</sup> Hettel, Martin. *Testimony before U.S. House of Representatives, Committee on Transportation and Infrastructure* (Washington, DC: April 18, 2012), 2. Available at <http://republicans.transportation.house.gov/Media/file/TestimonyWater/2012-04-18-Hettel.pdf> as of June 12, 2012.

- Critical lock infrastructure needs.
- Definition of a “lock in good condition.”

Ten stakeholders responded, but not all stakeholders had positions on every subject. Two of the stakeholders, the American Waterways Operators and Waterways Association of Pittsburgh, stated that they supported the positions of the Waterways Council and, therefore did not submit a separate response. The remainder of this section summarizes the responses that were received by subject matter. The details are found in Appendix A.

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#### LEVEL OF FUNDING FOR THE CORPS OF ENGINEERS

Congress is inadequately funding the Corps. With constantly expanding demands on the Corps’ resources, this shortfall is making it impossible for the Corps to fulfill its navigation mission. One respondent noted that the only cases in recent years in which the Corps has received adequate funding have been due to natural disasters (i.e., Hurricane Katrina, flooding, and complete mechanical failures). In most of these instances, the Corps was given clear guidance and funding and was able to complete projects on time and within budget.

Some respondents felt the Inland Waterway Fuel Tax should be increased. Others stated that the possibility of state and other federal agencies (especially those who enjoy the benefits of the lock and dam system) being involved from a cost-sharing perspective should be explored. Another suggested that the cost-sharing arrangement between industry and the federal government might need to be changed.

Finally, one respondent noted that funding uncertainty associated with projects that span several election cycles often results in unnecessary project delays and cost escalation. It would help to fully fund all contracts (at least up to \$50 million) to allow greater efficiency in project execution.

The Capital Projects Business Model (Business Model) developed by the Inland Waterways User Board and the Corps suggests that the proper level of funding is \$380 million per year for the next 20 years for construction and major rehabilitation projects on the inland waterways navigation system. This document is discussed later in the report.

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#### PROJECT PRIORITIZATION SCHEME USED BY THE CORPS

There is very little support for the current prioritization method employed by the Corps. Some believe that new criteria—perhaps factoring in regional benefits of a waterway versus just national benefits—should be considered.

There is consensus that scarce funding is sprinkled over too many projects leading to extended timelines and cost overruns. The Business Model provides a methodology that ensures that the money will be spent in the most critical areas first. Stakeholders agree that the Inland Waterways User Board should

be given more authority in determining priorities. The Business Model the users helped develop takes the approach of completing projects already underway sooner rather than later.

One stakeholder pointed out that if tonnage is the primary criterion, smaller projects are caught in a catch-22 situation. They currently do not have sufficient tonnage, so the Corps will cut back on maintenance and operations, thereby making it impossible to increase the tonnage. Additionally, there are other users of the lock and dam system that may (or should) influence priorities.

Some stakeholders believe that too much money is allocated to non-essential features, especially environmental features.

Finally, current prioritization schemes for construction neglect remaining benefit-cost ratios (the remaining cost to be expended compared to the benefits to be realized from the expenditures). Furthermore, new projects assume an efficient funding stream in standard benefit-cost comparisons, which has proven to be a faulty assumption.

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#### POSTPONING NEW CONSTRUCTION AND MAJOR REHABS IN FAVOR OF ADEQUATELY MAINTAINING AND PRESERVING CURRENT INFRASTRUCTURE

There is a divergence of opinion on this issue. Some stakeholders feel that postponing new construction and major rehabs should be a last resort alternative after all other options to increase the capacity of the system have been exhausted. With the average age of 80% of the structures in the Upper Mississippi River basin being 50+ years old, at some point in time the feasibility of maintaining versus replacement is not cost effective. And, unfortunately, bringing a 600-ft lock up to new-lock conditions will not negate the need to split a 15-barge tow in order to transit that lock.

Other stakeholders think the focus should be kept on existing projects and that “we should finish what we have started.” They do not want to sacrifice what is already there for new construction.

Stakeholders stressed that it should be ensured that no Operations and Maintenance (O&M) money goes to construction.

Finally, some believe that there should be a well-planned mixture consisting of both capital investment in new construction and rehabilitation projects along with a well-funded operation and maintenance program.

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#### SOURCES OF FUNDS FOR LOCK AND DAM PROJECTS (E.G., INCREASED FUEL TAXES, LOCKAGE FEES)

There is strong support for an increase in fuel taxes of 6 to 9 cents per gallon. There is little or no support for a lockage fee. The lockage option would have tremendous negative impact on some tributaries; it might put a large portion of the Upper Mississippi River system out of reach of domestic

and export markets via water transport. In any case, it will be important to ensure that the fuel tax funds are used in a focused manner that addresses the critical needs of the system.

Additionally, there is support for a funding scheme in which public and private users would equitably share the burden. The public enjoys benefits from locks and dams since they provide flood control, lower consumer prices, and countless valuable environmental benefits. The portion of the cost of improvements that also provide benefit to the general public should come from the federal budget based on their proportion of economic value of the benefits to the total benefits.

The proposed Business Model, which is supported by almost every stakeholder group contacted by the research team, contains a proposal to change the cost-sharing formula. All major rehabilitation lock projects costing at least \$100 million should be cost-shared at 50% from general appropriations and 50% from the Inland Waterways Trust Fund (IWTF). Construction and major rehabilitation dam projects and major rehabilitation lock projects below \$100 million should be entirely funded from general appropriations. There should be a project-by-project cost-sharing cap to protect industry from unreasonable cost escalation and project delays.

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#### CRITICAL LOCK INFRASTRUCTURE NEEDS

Stakeholders believe that all locks are critical for those who need to move products through the inland waterway system. The Corps has done in-depth evaluations and should know what is in danger of failing. In general, critical needs are considered to stem from unsafe or emergency situations (such as loss of functionality). The definition of critical should include factors such as wait times, lock conditions, and others.

Some of the locks specifically mentioned to have critical needs include: Locks 20-25 on the Upper Mississippi River, and the Peoria and LaGrange Locks on the Illinois River.

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#### DEFINITION OF A "LOCK IN GOOD CONDITION"

There is a diversity of opinion on what constitutes good condition. One definition is that a lock in good condition is one that is currently fully operational and maintained to Corps standards with sufficient funding available to perform preventive and emergency maintenance as required. Some would add the requirement that the lock be able to accommodate modern barges and tows without the unsafe task of separating tows. It should accommodate these users without significant backups. Considerations should include the age of the lock, usage, maintenance history, impact to the whole system, etc. There should be fewer unscheduled outages than scheduled.

One stakeholder suggested an examination of the unscheduled closures by lock. The locks that are in the lower 1/3 or do not appear on the list of unscheduled closures would be locks in good condition.

However the term critical is defined, stakeholders want to have some input into the determination of which locks are designated as critical.

The Upper Mississippi Waterway Association defines a lock in good condition as a lock that is reliable and maintained through planned and scheduled maintenance and does not incur more unscheduled outages than scheduled ones.

## THE BUDGET PROCESS

Corps water resources projects typically receive congressional authorization in a federal Water Resources Development Act (WRDA) and receive project funding through a separate appropriations process. Authorization of a federal water project does not include a plan or timeline for funding appropriations. Even if an authorized water project eventually receives federal appropriations, Congress often delivers the funding in incremental amounts. This process of partial project funding through the annual appropriations process results in many projects moving forward in a piecemeal, start-stop manner. This state of affairs can result in inefficient project delivery and higher overall costs. Congress may choose to fund or not fund any given project, even though it may have been authorized, regardless of the amount of prior funding. Furthermore, the Administration may propose to allocate funding (or not) to any given project.

There are three main accounts within the annual budget for the Corps that represent a high percentage of the total funding (and all of the funding that is relevant to this study). About 84% of the President's fiscal year 2010 budget request for the Corps' civil works program was for the following three appropriations accounts, all of which focus on specific projects or studies:

- **General Investigations (GI):** This appropriation funds studies to determine the need, engineering feasibility, economic justification, and the environmental and social suitability of solutions to water and related land resource problems; and also funds preconstruction engineering and design work, data collection, and interagency coordination and research activities.
- **Construction, General (CG):** This appropriation includes funds for construction, major rehabilitation, and related activities for water resources development projects having navigation, flood and storm damage reduction, water supply, hydroelectric, environmental restoration, and other attendant benefits to the nation. The construction and major rehabilitation for designated projects on inland and coastal waterways derives one-half of the funding from the Inland Waterways Trust Fund. Funds derived from the Harbor Maintenance Trust Fund are applied to cover the federal share of the Dredged Material Disposal Facilities Program.
- **Operations and Maintenance (O&M):** This appropriation funds operation, maintenance, and related activities at the water resources projects that the Corps operates and maintains. Work to be accomplished consists of dredging, repair, and operation of structures and other facilities,

as authorized in the various river and harbor, flood control, and water resources development acts. Related activities include aquatic plant control, monitoring of completed projects where appropriate, removal of sunken vessels, and the collection of domestic waterborne commerce statistics.

Engineer Circular (EC) 11-2-187 (Corps of Engineers Civil Works Direct Program, Program Development Guidance)<sup>5</sup> provides the latest guidance for development and submission of the civil works budget to the Office of Management and Budget (OMB). It primarily directs the budgeting focus toward maintenance of critical infrastructure, funding high-return studies and construction, and continuing the best ongoing work within available funds. It requires the use of performance based budgeting with the intent of linking budget and program performance.

Corps documentation shows that construction projects are ranked within seven categories:

1. Dam safety assurance, seepage control, and static instability correction projects.
2. Projects with mitigation or environmental requirements.
3. Projects with substantial life-saving benefits.
4. High-performing ongoing projects.
5. High-performing new start projects.
6. Qualifying ongoing projects with continuing contracts.
7. Projects scheduled to be completed in the fiscal year of the budget request.

While formal written guidance documenting priorities across categories does not exist, dam safety projects generally take the highest priority among all project categories.

Since Fiscal Year 2006, the Corps has received appropriations of over \$5 billion annually for its civil works program through the annual Energy and Water Development Appropriations Act. Committee and conference reports accompanying the appropriations bills include specific allocations of funding for individual projects. In addition to the funding received through annual appropriations acts, the Corps received supplemental appropriations in 6 of the past 8 fiscal years. Some supplemental appropriations have been designated for specific activities.

According to Corps and OMB staff, each year OMB sets minimum benefit-cost ratio (BCR) thresholds that construction and investigations projects must meet to be included in the budget request. New starts currently need a BCR of 2.5 to 1 at a 7% discount rate for future cash flows. If projects do not meet the designated BCR thresholds, they may qualify in other ways, such as by restoring a nationally significant ecosystem or addressing risk to human life. For O&M projects, imminent risk to human life

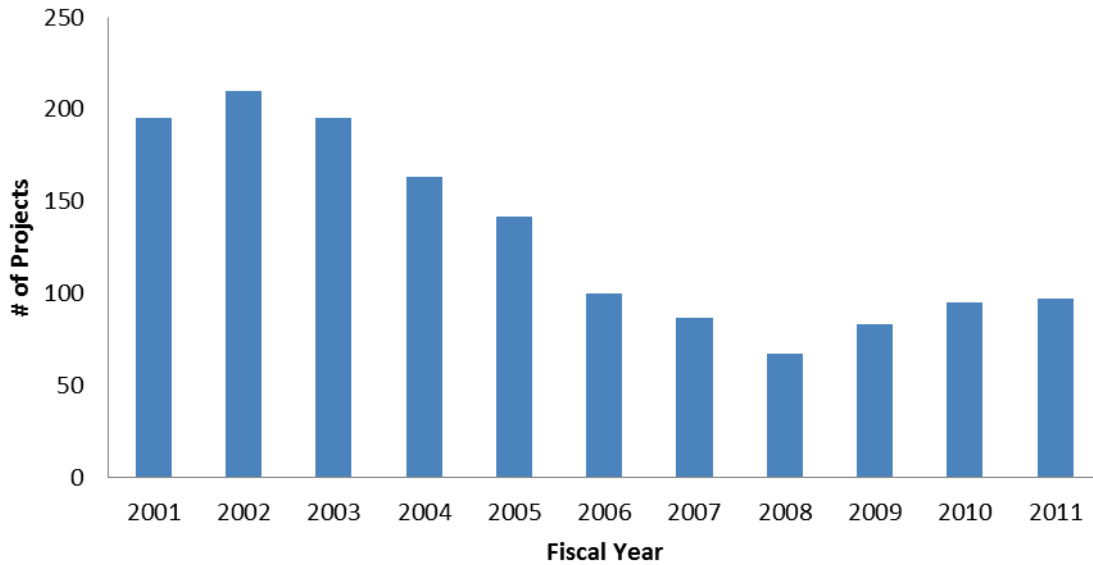
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<sup>5</sup> The latest publicly available version can be accessed at <http://planning.usace.army.mil/toolbox/library/ECs/fy09ecpub.pdf> as of April 24, 2012.

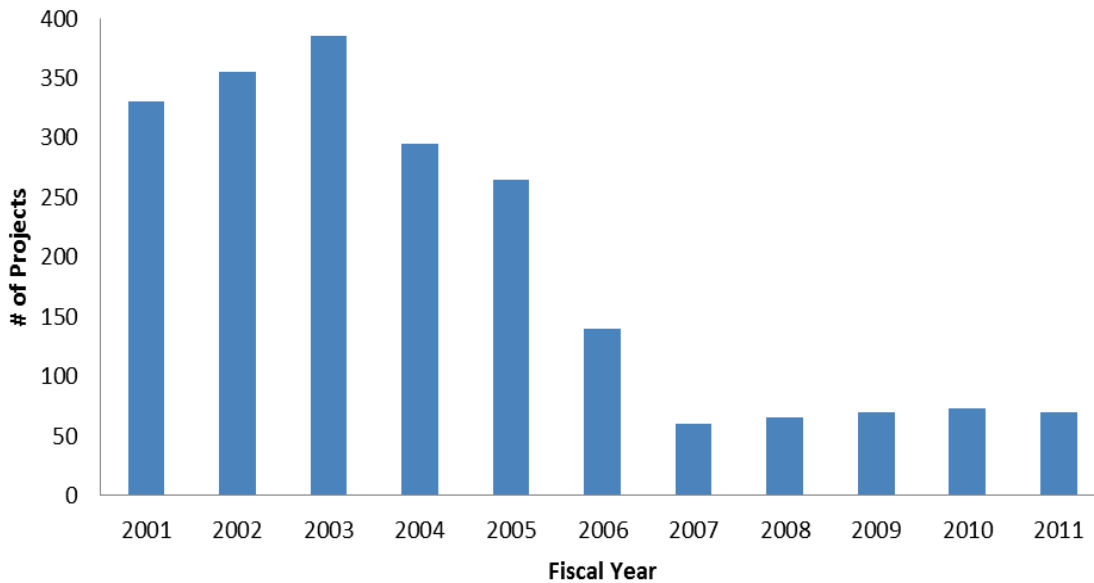


and the amount of commercial tonnage transported on a waterway are examples of the types of factors that influence the priority of a navigation project.

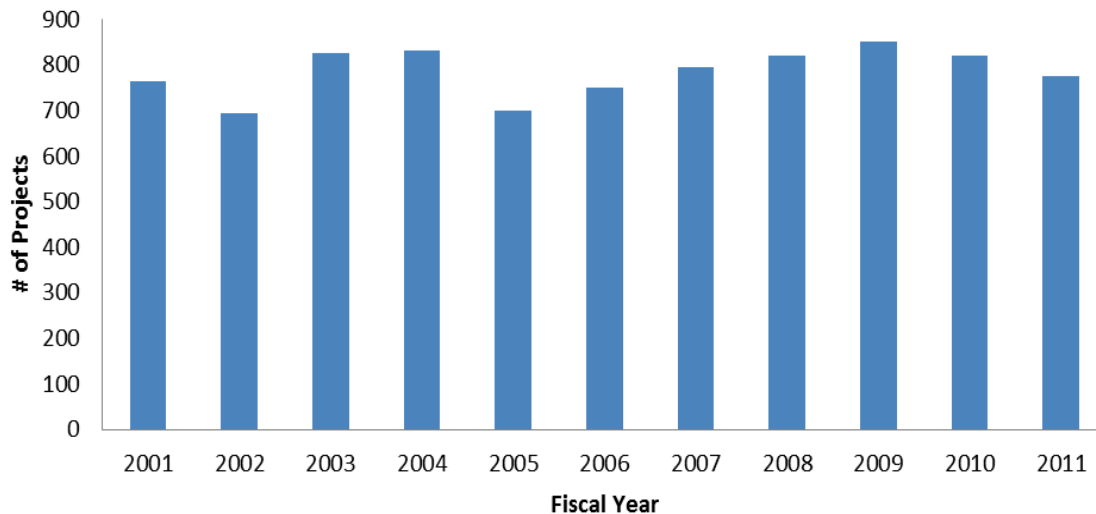
Figure 3, Figure 4, and Figure 5 show the 10-year history of the number of projects requested by the Administration for each of the three main budget accounts.



**Figure 3. Number of Construction Projects Requested, by Fiscal Year.**



**Figure 4. Number of Investigations Projects Requested, by Fiscal Year.**



**Figure 5. Number of O&M Projects Requested, by Fiscal Year.**

## ISSUES WITH THE PROCESS

Some stakeholders have taken the position that the Corps is involved in too many different activities and that Congress should cut back on the number of authorized activities. Others view the growing backlog (discussed later in this report) as a reason for efforts to reduce the expense and time needed to complete a Corps project. Some also view the Corps backlog as a reason for pursuing private sector involvement in—and alternative federal financing (e.g., infrastructure banks) for—water resources infrastructure. While these are issues and policies worthy of consideration, this discussion focuses on how the Corps budgets what it receives under the current system.

A recent study by the Government Accountability Office (GAO) provides evidence that the Corps has made significant strides in transitioning away from the build and expand approach prescribed for Construction and Investigation projects in Water Resources Development Acts (WRDA 2007 is the latest version) but that, at the same time, there is still significant room for improvement in transitioning more effectively toward the repair and sustain approach (O&M projects).

In April 2010, the GAO published a report directed to the Subcommittee on Energy and Water Development, Committee on Appropriations, House of Representatives titled *Army Corps of Engineers: Budget Formulation Process Emphasizes Agencywide Priorities, but Transparency of Budget Presentation Could be Improved*. Congress raised concerns that the criteria used by the Corps to prioritize projects are not transparent and the budget formulation process could achieve a higher return on investment.

GAO was asked to: (1) describe the information the Corps uses in its budget formulation process and the implications of the process, and (2) evaluate whether the President's recent budget requests for the Corps are presented so that agency priorities are clear and proposed use of funds transparent. The following paragraphs summarize the findings of this report.

In FY 2006, the Corps began incorporating performance information into its civil works budget formulation process (performance based budgeting). Previously, Corps division officials sought to provide continued funding to all ongoing projects that fit within administration guidelines. Now, under the current (post-FY 2006) process, Corps headquarters plays an increased role in selecting projects, and evaluates projects using certain performance metrics. The Corps gives priority to those projects with the highest anticipated returns for the economy and the environment, as well as those that reduce risk to human life.

The GAO found that the Corps' use of performance metrics makes projects in certain geographic areas more likely to be included in the budget request. For example, the BCR tends to favor areas with high property values, which are more commonly found in states such as California. Similarly, the BCR tends to be higher for more densely populated areas because the risk to human life metric is affected by population density. Another effect of the Corps' use of performance-based budgeting is that fewer projects in the CG and GI categories<sup>6</sup> have been included in the budget request in recent years (52% and 79% reduction, respectively, between FY 2001–FY 2010). However, the average requested amount per CG project increased from \$7M in FY 2001 to \$17.3M in FY 2010.

In contrast, the ranking metrics do not appear to have affected the number of projects in the O&M account greatly. The number of O&M projects has been relatively stable (7% increase between FY 2001–FY 2010), which Corps officials attribute partially to its emphasis on routine activities. Because the performance metrics used to evaluate O&M projects, (e.g., the amount of commercial tonnage transported on a waterway) tend to be consistent, and a large portion of projects are routine (recurring annually or longer), the projects given priority tend to be the same from year to year. Additionally, because there are more project activities of lower value in the O&M account, changes to specific projects generally do not affect the overall requested amount as significantly as variations in the projects in the CG account do. In FY 2010, the average amount requested per O&M project was \$2.8 million.

The metrics used by the Corps in its budget formulation process focus on anticipated benefits of completed projects. The Corps monitors the progress of ongoing projects through review boards at the headquarters, division, and district levels. However, the Corps does not have written guidance

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<sup>6</sup> General Investigation projects are typically studies to determine whether the Corps should initiate Construction General projects.

establishing a process for incorporating information on demonstrated performance, such as the review board findings, into budget formulation decisions.

The GAO further found that the Corps' budget presentation lacks transparency on key elements of the budget request. It focuses on requested CG and GI projects, but does not describe how the decisions made during the budget formulation process affected the budget request. For example, the budget presentation does not include an explanation of the relative priority given to project categories or how the Corps evaluates them against each other. Also, while the number of CG and GI projects receiving appropriations is typically much greater than the number requested, the budget presentation does not include detailed information on all projects with continuing resource needs. The budget presentation also lacks detail on the amount of the balance of unobligated appropriations (carryover) that remain available for each project. In FY 2010, appropriated funds were applied to 278 CG projects, whereas the FY 2010 budget request included 93 CG projects. Additionally, in FY 2010 appropriated funds were applied to 315 GI projects, while the FY 2010 budget request included 68 GI projects.

GAO recommendations called for the Corps to (1) establish a documented process for incorporating ongoing performance information into budget formulation decisions and (2) improve the transparency of its budget presentation. GAO believed establishing a process would ensure more complete and consistent decision making.

The Corps currently (as of the GAO report) has a portfolio of 653 feasibility studies. In FY 2011, the Corps initiated a significant effort aimed toward improving the performance and execution of feasibility studies. The purpose of the initiative was to review all ongoing, protracted feasibility studies and to reclassify those studies with limited likelihood of success to inactive, in order to focus funding on the most credible and viable projects for congressional authorization. Pending completion of reclassification, a reset initiative was to be performed on active feasibility studies to review study progress, likelihood of federal interest, and study scope, and to make a determination as to whether the study should continue as is, be re-scoped, or terminated. Though significant progress was made and 288 of 653 ongoing feasibility studies were identified as eligible to be reclassified as inactive, 365 active feasibility studies still remain with 68 feasibility studies ongoing for more than 10 years. Of these 68 feasibility studies, only 9 were identified as eligible for review and re-scoping.

In February 2012, the Deputy Commanding General for Civil and Emergency Operations (Major General Michael J. Walsh) issued a Memorandum for Major Subordinate Commands indicating that the review must be more aggressive and instituting a national target goal to reduce the 365 active feasibility studies by one-third. In order to achieve this objective, he directed each district to diligently review its respective active studies to identify those studies that should be terminated or placed in an inactive

category. This process was to be completed no later than June 29, 2012.<sup>7</sup> The memorandum has increased the emphasis on termination and fiscally closing out studies that meet the criteria. The termination process is complex and has been—and will continue to be—ongoing for a number of our studies. It requires coordination with non-Federal sponsors and Congressional interests before the information can be made available to the public. Since the Corps is a decentralized agency, it does not maintain a comprehensive list of studies that the District offices are in the process of terminating.

One association that provided input into this study stated that the Administration is lacking in its analysis of the success and benefits of a waterway. Metrics that only consider the tons or number of lockages capture only a small part of the benefits associated with a waterway. It neglects the benefits from water compelled rates—the number one benefit used to originally justify the waterway project. Rail and trucking freight rates tend to increase sharply without waterborne competition. Other national benefits include recreation, environmental, and water for municipal use. The association strongly urges the Administration to conduct post-project studies to determine the true benefits of waterways, which would demonstrate the need to increase civil works funding.

## ADMINISTRATION PROPOSALS AND PRACTICES

As part of the budget submittal process, the Administration will often propose major changes or new directions in the Corps' planning and budgeting process. Such proposals have appeared on several occasions over the last 20 years.

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### FY 1996

The Administration proposed the elimination of the role of the Army Corps of Engineers in local projects. The budget proposed to focus the Corps' role on water projects that provide national benefits—commercial inland and deep-draft navigation, interstate waterways, multi-state flood control, environmental restoration, operation and maintenance of such projects, and emergency response to floods and hurricanes. The proposal would have phased out the Corps' role on smaller projects that primarily provide local benefits (beach erosion, local flood protection, and construction and maintenance of recreational harbors) and are best left to state and local governments.

As part of the FY 1996 budget request, the Administration proposed turning over a total of 500 small or low-use harbor projects to nonfederal interests and limiting flood control projects to those with a strong interstate nexus. Congress did not adopt either of these proposals.

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<sup>7</sup> *Memorandum for Major Subordinate Commands, Subject: U.S. Army Corps of Engineers Civil Works Feasibility Study Program Execution and Delivery*, Available at [http://planning.usace.army.mil/toolbox/library/MemosandLetters/USACE\\_CW\\_FeasibilityStudyProgramExecutionDelivery.pdf](http://planning.usace.army.mil/toolbox/library/MemosandLetters/USACE_CW_FeasibilityStudyProgramExecutionDelivery.pdf) as of May 14, 2012.

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#### FY 1999

One of the major line items in the Corps budget before FY 1999 was the Formerly Utilized Sites Remedial Action Program (FUSRAP). In the FY 1999 budget, FUSRAP was removed from the Corps' jurisdiction and reclassified as a national defense function. The non-defense discretionary spending limits were adjusted downward, and the defense discretionary spending limits were adjusted upward to accommodate this classification change.

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#### FY 2000

The Administration proposed to replace the ad valorem Harbor Maintenance Tax with a cost-based user fee, the Harbor Services User Fee. The user fee would finance harbor construction, operation, and maintenance activities performed by the Army Corps of Engineers, operation and maintenance of the Saint Lawrence Seaway, and program administration costs. The Administration projected the fee would raise an average of \$980 million annually through FY 2004. Congress did not accept this proposal.

The Energy and Water Development Appropriations Act, 1999 (Public Law 105–245—Oct. 7, 1998) SEC. 101 directed the Secretary of the Army, acting through the Chief of Engineers, to undertake projects using continuing contracts. The Administration subsequently confirmed in the FY 2000 budget that the Corps was doing so.

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#### FY 2001

Again, the Administration proposed to replace the ad valorem Harbor Maintenance Tax with a cost-based user fee, the Harbor Services User Fee, and, again, Congress did not accept this proposal.

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#### FY 2002

Given the large backlog of construction projects already underway and in need of funding to be completed (\$21 billion), this budget focused on completing ongoing projects, rather than starting construction of new projects that would add to this backlog and increase delays in completing ongoing projects. Funds were redirected from lower priority activities, such as recreational harbors and low commercial use inland waterway segments.

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#### FY 2003

In this budget, the Administration proposed to reduce the backlog of ongoing construction projects and complete those projects in the budget sooner than possible under (then) current spending trends, primarily by not starting new projects. The budget proposed to complete 30 projects in 2003, or 15% of the total number of projects in the budget.

The 2003 budget targeted funds to those waterways providing the greatest economic return to the nation, and limited funding to those with little commercial traffic. It included \$77 million for construction of Olmsted Lock and Dam in Illinois and Kentucky, an increase of \$37 million over 2002, to expedite completion of this important modernization project on the Ohio River.<sup>8</sup>

The Administration noted that the Corps operates and maintains some harbors and segments of the inland waterway system that benefit few commercial users. The 2003 budget targeted funds to the waterways that provide the greatest economic return, and substantially reduced funding for those that provide minor commercial navigation benefits. In the case of two projects with minimal commercial usage—the navigation features on the Fox River, Wisconsin, and Locks and Dams (L&D) 5 through 14 on the Kentucky River, Kentucky—the Corps initiated the process of transferring ownership, operation, and maintenance responsibilities to non-federal interests. The Fox River negotiations were concluded in 2004. Transfer of Kentucky River L&D 20 ownership had already taken place in 1996; L&D 6 was transferred in 2005; and 8 additional L&Ds (5, 7-9, and 11-14) were transferred in 2006.

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#### FY 2004

The President's FY 2004 budget proposed to:

- Focus funding on projects that yield the greatest benefit for the least cost.
- Reduce the growing backlog of ongoing construction work.
- Establish principles to guide program improvement efforts.

The Administration defined the Corps' major challenges as:

- Reducing the large backlog of ongoing construction work more quickly.
- Targeting funding to priority projects.

Table 1 contains the priority projects listed in the budget.

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<sup>8</sup> The total estimated cost for the Olmsted project is now \$2.9 billion, and completion is estimated to take place after 2020. (See <http://www.lrl.usace.army.mil/poi/default.asp?mycategory=297>)

**Table 1. Priority Projects, FY 2004 Budget.**

<b>Priority Project</b>	<b>2004 Budget Authority (in millions of dollars)</b>	<b>Project Purpose</b>
Sims Bayou, Houston, TX	12	Flood Damage Reduction
West Bank, New Orleans, LA	35	Flood/Storm Damage Reduction
New York/New Jersey Harbor, NY, NJ	115	Navigation
Olmsted Locks and Dam, Ohio River, IL, KY	73	Navigation
Missouri River Fish and Wildlife Mitigation, IA, NE, KS, MO	22	Navigation/Endangered Species
Upper Mississippi River System Environmental Management Program, IL, IA, MN, MO, WI	33	Navigation/Environment
Columbia River Fish Recovery, OR, WA, ID	98	Hydropower/Endangered Species
Everglades, FL	145	Environment

The Corps was to rank projects already under construction based on the ratio of their remaining benefits to their remaining costs to complete, and for each of them show the ratio of total net benefits to total costs. This proposal was, in fact, implemented.

In order to focus on the backlog of projects actively under construction, the Administration urged Congress to adopt legislation to de-authorize or disallow funding for: 1) inactive projects automatically; 2) navigation projects for harbors and river segments that have extremely low commercial use, and 3) projects whose main purpose does not fall within any of the three main mission areas. Congress did, indeed, de-authorize a number of projects via Energy and Water Appropriations bills and the Water Resources Development Act of 2007 (the next water resources development bill after this budget).

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FY 2005

In order to restore the long-term viability of the Corps' construction program, the budget proposed to direct most of the available funds toward those ongoing projects that were either nearing completion or offer the highest returns (environmental or economic) to the nation. Table 2 lists these priority projects.



**Table 2. Priority Projects, FY 2005 Budget.**

Priority Project	2005 Budget Authority (in millions of dollars)	Project Purpose
New York/New Jersey Harbor (NY, NJ)	103	Commercial Navigation
Olmsted Locks and Dam, Ohio River (IL, KY)	75	Commercial Navigation
Missouri River Fish and Wildlife Mitigation (IA, NE, KS, MO)	69	Commercial Navigation/Mitigation
Upper Mississippi River System Environmental Management Program (IL, IA, MN, MO, WI)	28	Commercial Navigation/Mitigation
Sims Bayou, Houston (TX)	16	Flood Damage Reduction
West Bank, New Orleans (LA)	37	Flood/Storm Damage Reduction
Columbia River Fish Recovery (OR, WA, ID)	107	Hydropower/Mitigation
Everglades (FL)	125	Aquatic Ecosystem Restoration

FY 2006

In this budget, the Administration proposed what it termed the “Performance Budgeting Initiative.” Figure 6 summarizes the initiative.

**The Performance Budgeting Initiative: Guidelines for Making Better, Smarter Construction Investments**

1. *Budgeting by mission area.* Projects compete for funding in each of the Corps’ three main mission areas: commercial navigation, flood and storm damage reduction, and aquatic ecosystem restoration.
2. *Performance-based project rankings.* Projects are ranked based on objective performance criteria.
  - In all mission areas except aquatic ecosystem restoration, projects are ranked based on their remaining benefits, relative to their remaining costs.
  - Aquatic ecosystem restoration projects are ranked based on the extent to which they use resources effectively to address a significant regional or national ecological problem.
3. *Performance-based funding allocations.* The performance rankings will determine what level of funding projects will receive. Projects ranking at, or near, the top will be funded at very high levels, while low-performing projects will receive reduced funding levels, and in some cases, may be suspended.
  - Highest ranking projects will receive at least 80 percent of the amount that the Corps can efficiently spend.
  - Low-ranking projects that do not meet baseline performance thresholds will be considered for deferral.
4. *Limitations on multiyear contracts.* The Budget proposes appropriations language to repeal the Corps’ continuing contract authorities. The proposal will reduce out-year funding commitments, while allowing the Corps to issue multiyear contracts where appropriate.

**Figure 6. FY 2006 Performance Budgeting Initiative.**

The Administration's Performance Budgeting Initiative proposed to reduce the construction backlog over time by placing a higher priority on completing high-return projects and limiting the start of new projects to the highest performing projects that are consistent with long-term fiscal management goals. Table 3 lists the Administration's priority projects.

**Table 3. Priority Projects, FY 2006 Budget.**

<b>Priority Project</b>	<b>2006 Budget Authority (in millions of dollars)</b>	<b>Project Purpose</b>
Sims Bayou, Houston (TX)	18	Flood Damage Reduction
West Bank, New Orleans (LA)	28	Flood/Storm Damage Reduction
New York/New Jersey Harbor (NY, NJ)	101	Commercial Navigation
Oakland Harbor (CA)	48	Commercial Navigation
Olmsted Locks and Dam, Ohio River (IL, KY)	90	Commercial Navigation
Missouri River Fish and Wildlife Mitigation (IA, NE, KS, MO)	83	Hydropower, Flood Damage Reduction, Commercial Navigation/Mitigation
Upper Mississippi River System Environmental Management Program (IL, IA, MN, MO, WI)	34	Commercial Navigation/Mitigation
Columbia River Fish Recovery (OR, WA, ID)	102	Hydropower, Commercial Navigation/Mitigation
Everglades (FL)	137	Aquatic Ecosystem Restoration

The budget provided \$932 million for inland waterway navigation, including \$369 million to continue progress on high-performing projects such as Olmsted Locks and Dam, Illinois and Kentucky; Marmet Lock, West Virginia; and McAlpine Locks and Dam, Illinois and Kentucky.

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FY 2007

Table 4 lists the Administration's priority projects for FY 2007.

**Table 4. Priority Projects, FY 2007 Budget.**

Priority Project	2007 Budget Authority (in millions of dollars)	Project Purpose
Sims Bayou, Houston (TX)	22	Flood Damage Reduction
New York/New Jersey Harbor (NY, NJ)	90	Commercial Navigation
Olmsted Locks and Dam, Ohio River (IL, KY)	110	Commercial Navigation
Oakland Harbor (CA)	44	Commercial Navigation
Upper Mississippi River System Environmental Management Program (IL, IA, MN, MO, WI)	27	Commercial Navigation/Mitigation
Everglades/South Florida Ecosystem Restoration (FL)	164	Aquatic Ecosystem Restoration

In response to an Administration proposal from the previous year (see Item 4 in Figure 6), Congress took an important step and placed limits on the Corps' use of continuing contracts.

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FY 2008

Table 5 lists the Administration's priority projects for FY 2008.

**Table 5. Priority Projects, FY 2008 Budget.**

Priority Project	2008 Budget Authority (in millions of dollars)	Project Purpose
Sims Bayou, Houston (TX)	24	Flood Damage Reduction
New York/New Jersey Harbor (NY, NJ)	91	Commercial Navigation
Olmsted Locks and Dam, Ohio River (IL, KY)	104	Commercial Navigation
Oakland Harbor (CA)	42	Commercial Navigation
Upper Mississippi River System Environmental Management Program (IL, IA, MN, MO, WI)	23	Commercial Navigation/Mitigation
Everglades/South Florida Ecosystem Restoration (FL)	162	Aquatic Ecosystem Restoration

The FY 2008 budget proposed to authorize the Corps to issue multi-year contracts in lieu of its (then) current continuing contract authority. This would subject Corps contracts to conditions and oversight similar to those that apply to other federal contracting agencies. It would increase the ability of the Executive Branch and Congress to establish priorities by reducing the high outyear funding commitments that resulted from the existing contract authority. This proposal was implemented.

The Administration also began promoting increased user financing of the inland waterways. The commercial barges that move cargo on the inland waterways pay a beneficiary-based excise tax of 20 cents per gallon on diesel fuel. The Administration stated that the existing tax covered only about

10% of the total costs that the Corps was incurring to make barge transportation on the inland waterway system possible. The Administration informed Congress that it was developing and would propose legislation to require payment of a user fee designed to promote the efficient use of the nation's overall resources and require the commercial interests that benefit from Corps spending on the inland waterways to carry more of the costs, thereby improving future federal authorizing and funding decisions. This initiative resulted in the proposal of a so-called "lockage fee" in later budget submittals.

In §2027 of Water Resources Development Act 2007, Congress requested a fiscal transparency report, which would have expanded the publicly available information on Corps projects and the mounting backlog. The report was never funded in the President's budget or by congressional appropriations, and no significant work on it has been performed.

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#### FY 2009

The Administration continued its push to increase user financing of the inland waterways. The Administration stated that commercial barges that use the inland waterways now pay an excise tax of 20 cents per gallon on diesel fuel, which is deposited in the Inland Waterways Trust Fund, but the tax does not raise enough revenue to cover the required 50% non-federal share of the costs that the Army Corps of Engineers is incurring to construct, replace, expand, and rehabilitate the locks and dams and other features that make barge transportation possible on the inland waterways. To address this imbalance between receipts and expenditures, the Administration proposed to phase out the current excise tax for inland waterways users and replace it with a more efficient user fee tied to the level of spending for inland waterways construction, replacement, expansion, and rehabilitation work. The proposed funding mechanism was a lockage-based user fee. Inland navigation interests strongly opposed the proposal and it was not implemented.

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#### FY 2010

The Administration proposed to phase out the Inland Waterways Fuel Tax in stages and replace it with a lock usage fee. The lock usage fee was designed to improve economic efficiency and preserve the landmark cost-sharing reform established in 1986, while also supporting investments in inland waterways construction, replacement, expansion, and rehabilitation work. Industry continued to oppose this fee proposal and it was not implemented.

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#### FY 2011

This budget emphasized a new direction for water infrastructure projects by initiating a process to update 25-year old procedures for planning federal water resources infrastructure projects. The purpose of the update was to incorporate modern planning procedures and methods, assure adequate consideration of ecosystem values, and promote non-structural solutions. The Administration did

indeed undertake the process of rewriting the planning guidance, a process that proved to be highly controversial. Development of this process is still underway as of the date of this report.

In addition, the Corps began updating its estimates of the benefits and costs of its ongoing construction projects to help assure that funding decisions would be based on the most current information available on these investments' return to the nation.

The Administration also announced its intention to develop a set of water resources reforms for the Corps of Engineers for consideration as part of the next WRDA legislation. The Administration later released a set of proposed reforms that proved to be highly controversial. There has been no WRDA since this budget was submitted, so no definitive action has taken place.

Furthermore, the budget focused resources on furthering the operational reliability, safety, and availability of the key features of the existing Corps infrastructure. The budget proposed to fund high-priority maintenance work that would improve the overall performance of the Corps' aging infrastructure, including work on the Ohio, Upper Mississippi, and Illinois Waterways.

The budget also proposed the elimination of funding for dozens of projects that have a low economic or environmental return or that are duplicative of programs in other agencies.

According to the Administration, this budget began to chart a new direction for the Corps to meet 21st century water resources challenges, including reforming the procedures for planning future projects and eliminating funding for ongoing projects and activities that are ineffective or duplicative.

The Administration continued advocating for a lockage fee-based revenue system, a proposal that industry continued to oppose.

The Administration proposed a new metric for evaluating inland waterway projects. It was defined as the number of instances where mechanically driven failure or shoaling results in the closure of a high or moderate commercial use segment<sup>9</sup> anywhere in the nation for a defined period of time. The Corps proposed to measure overall program performance based on its ability over time to reduce both the number of preventable closures that last longer than 24 hours, as well as the number of preventable closures that last longer than one week. Using these measures, the Corps would aim to achieve a level of performance each year that would be as good as the median level of annual performance over the past three years (2007–2009 in this proposal). The Corps would only count preventable closures (i.e., not closures due to low water levels from droughts, high water levels from floods, or accidents) caused by: (1) a failure in the main chamber of a lock, rather than an auxiliary chamber, or (2) shoaling due to

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<sup>9</sup> Defined by the Corps as at least 1 billion ton-miles of commerce on the segment.

inadequate dredging. The Corps began reporting this metric in the Fiscal Year 2011 Annual Financial Report for the Civil Works Program.

The Senate, in evaluating the FY 2011 budget request, included the following language in the FY 2011 Appropriations Report:

“The Committee is very concerned about the Corps planning program. Somewhere the planning process is breaking down. Despite relatively stable planning budgets, the number of reports by the Chief of Engineers has declined precipitously. In the run-up to the Water Resources Development Act of 2007, 26 Chief of Engineers' reports were completed in 2005 and 2006. However, since 2007, only six Chief of Engineers' reports have been completed. Complex planning studies seem to take unbelievable amounts of time.”<sup>10</sup>

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#### FY 2012

The Administration proposed to expand the authorized uses of the Harbor Maintenance Trust Fund, so that its receipts would be available to finance the federal share of other federal efforts in support of commercial navigation through ports. The Administration proposed to work with Congress to reform the laws governing the Inland Waterways Trust Fund, including increasing the revenue paid by commercial navigation users sufficiently to meet their share of the costs of activities financed from this trust fund. These proposals were not implemented as of this report.

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#### FY 2013

In its FY 2013 budget proposal, the Administration proposes about \$1.6 billion in total for high-return construction projects in the three main mission areas of the Corps: flood and storm damage reduction, commercial navigation, and aquatic ecosystem restoration. The Administration proposes to establish a White House-led Navigation Task Force to develop a federal strategy for future navigation investments.

The Administration continues to propose a lockage fee and industry continues to oppose it.

The Administration continues the process of proposing major actions to modernize the policies and procedures of the Corps and other federal water resources agencies. Actions proposed to date include revising the 25-year old principles and guidelines for planning water resources projects, proposing a user fee to help finance inland waterways capital investments, and establishing an Infrastructure Bank that would help finance port deepening projects, levees, and other major water resources development activities. The Administration is also considering proposals to improve the ability of the Corps to invest in and manage its assets and to enhance non-federal leadership in water resources, including removing

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<sup>10</sup> <http://aapa.files.cms-plus.com/12Jan9-PlanningModernization.pdf>

unnecessary obstacles and streamlining procedures for non-federal parties to move forward on their own with important water resources activities, while ensuring appropriate federal interests are maintained.

Figure 7 illustrates the Administration’s Capital Investment Program proposed for FY 2013.

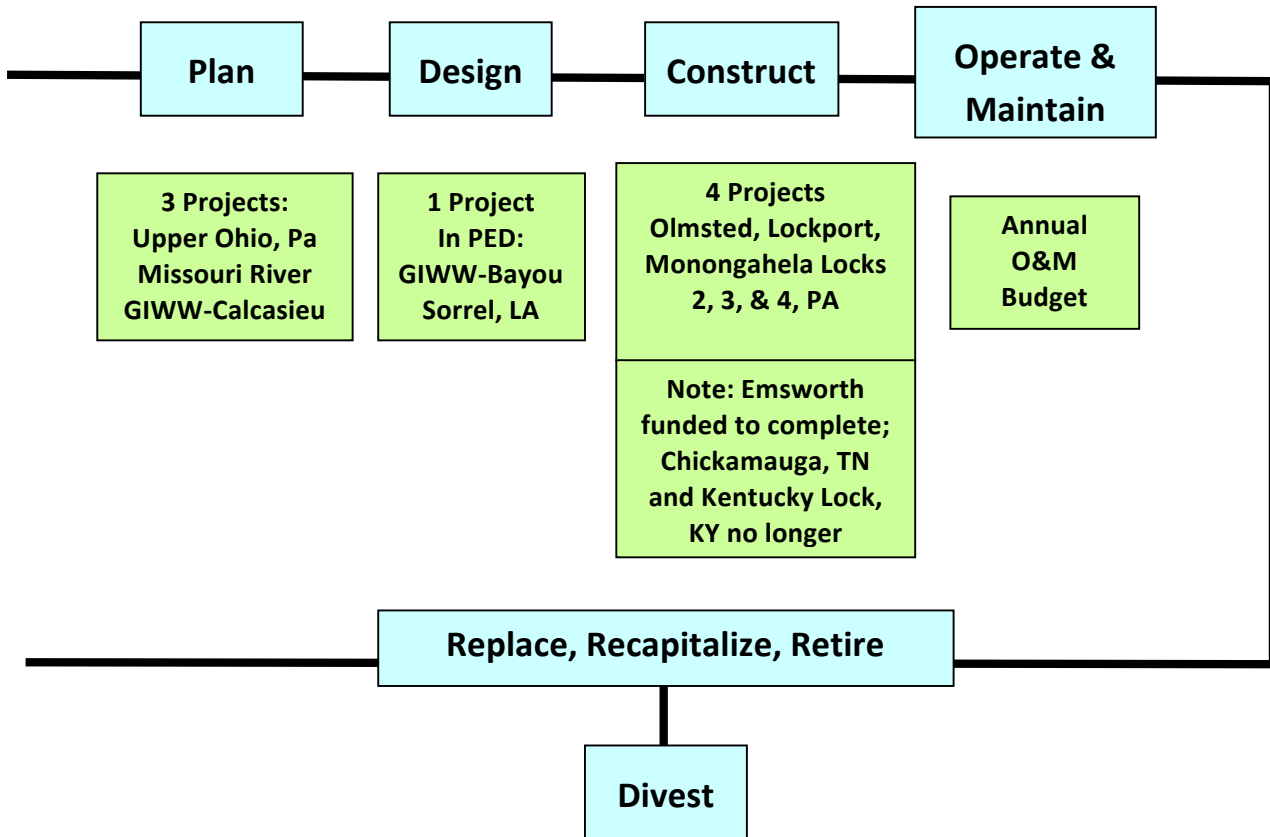


Figure 7. Inland Navigation Capital Investment Program, FY 2013.<sup>11</sup>

<sup>11</sup>Jim Walker. *USACE Navigation Overview for Waterways Council* (Washington, DC: February 14, 2012). Available at <http://www.waterwayscouncil.org/Presentations/2012WinterMtg/2012WCIJimFeb14.pdf> as of May 13, 2012.

## II. DEFINING THE REPAIR AND SUSTAIN APPROACH

### CURRENT MAINTENANCE POLICIES AND PRACTICES

There is inherent tension between providing money for multiple projects to build support for the overall program and giving a limited number of projects enough money to complete them in a cost-efficient and timely manner.<sup>12</sup> The historical practice of spreading the funds around has had the direct effect of creating a large backlog of authorized projects lacking the funding to proceed efficiently (if at all). This growing backlog, in turn, leads to projects being delayed—conducted in a start-stop manner—and to overall inefficient project delivery.

There is no authoritative, publicly available list of the projects in the backlog, but in recent presentations, the Corps has estimated the monetary value of the current backlog to be nearly \$62 billion dollars. This amount includes \$22 billion in activities that have been included in the President’s budget but have yet to be completed, as well as more than \$38 billion for other active projects that have yet to be included in the budget. Additionally, there are \$2 billion in authorized construction projects that are no longer active or have been deferred by nonfederal sponsors.<sup>13</sup> These amounts include only those projects for which the Corps has completed a study. Many facilities need major repair or rehabilitation work, but the required study has not been conducted. The size of this backlog implies that communities or other project beneficiaries often will wait years, if not a decade or longer, to receive federal water project funding.<sup>14</sup>

Not only is the construction/rehabilitation backlog mounting, but there is also a growing O&M backlog. For instance, the funding provided in the FY 2012 budget request for the Corps coastal navigation O&M was \$2.2 billion below the cost of potential work identified during the Corps budgeting process.<sup>15</sup>

Part of the problem (alluded to earlier in this report) is that project authorizations are growing at a faster pace than project appropriations. Figure 8, produced by the Congressional Research Service, illustrates this trend.

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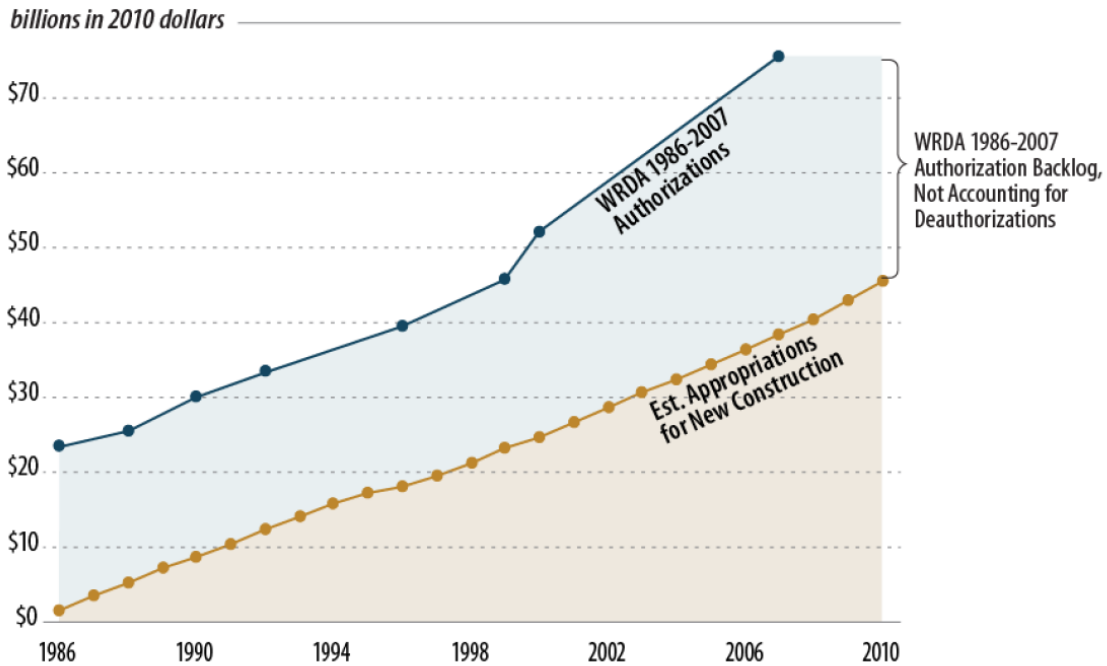
<sup>12</sup> Boselovic, Len. “Locked and Damned,” *Pittsburgh Post-Gazette*, March 20, 2012. Available at <http://www.post-gazette.com/stories/local/region/locked-and-damned-federal-budget-running-dry-for-locks-repair-627291/> as of June 12, 2012.

<sup>13</sup> Carter, Nicole T. and Stern, Charles V. *Army Corps Fiscal Challenges: Frequently Asked Questions* (Washington, Dc: Congressional Research Service, August 18, 2011), 12. Available at [http://planning.usace.army.mil/toolbox/library/Misc/R41961\\_Corps\\_fiscal\\_challenges-11Aug.pdf](http://planning.usace.army.mil/toolbox/library/Misc/R41961_Corps_fiscal_challenges-11Aug.pdf) as of June 12, 2012.

<sup>14</sup> National Research Council, op.cit., 15.

<sup>15</sup> Carter, op.cit., 13.





**Figure 8. 1986–2007 Construction Backlog.**

Secondly, aging infrastructure also is requiring higher levels of financial investments. A growing percentage of the Corps annual appropriations is going toward O&M or major rehabilitation of existing infrastructure activities as the agency’s infrastructure ages, which means fewer funds are available for construction of new projects. While this is generally true, some stakeholders claim they are experiencing more problems with the newer locks—such as Robert C. Byrd and Mel Price—than the older locks.<sup>16</sup>

Thirdly, the increase in the cost to construct water infrastructure projects increased rapidly in the mid-2000s, in part because of the rises in cost of construction materials and fuel. A project authorized in the Water Resources Development Act of 2000 that originally cost \$100 million dollars cost \$145 million by 2010.

The Corps, in recognition of these factors, has modified its approach to budgeting. Table 6 summarizes how the Corps currently prioritizes projects.

<sup>16</sup> Knoy, Mark. Testimony before U.S. House of Representatives, Committee on Transportation and Infrastructure (Washington, DC: April 18, 2012), 2. Available at <http://republicans.transportation.house.gov/Media/file/TestimonyWater/2012-04-18-knoy.pdf> as of June 12, 2012.

**Table 6. Navigation Budget Performance Measures.<sup>17</sup>**

Budget Strategy	Ranking Criteria
Keep ongoing studies or Preconstruction Engineering and Design efforts (PEDs) going if likely to produce recommendation for project or start new phase of studies or PED	Date of Agreement – executed or expected Commercial tonnage increase % reduction in delay costs Years to complete Watershed study – yes/no Benefit to Cost Ratio (Feasibility and PED only)
Complete ongoing construction to start getting benefits of high performing navigation projects	BCR Inland Waterways User Board priorities Availability of Inland Waterways Trust Fund amounts Years to complete Other Business Line purpose outputs
Initiate and complete rehabilitations	Inland Waterways Users Board priorities Availability of Inland Waterways Trust Fund monies Relative risk of failure BCR Years to complete
Initiate and complete dam safety/assurance/seepage control/static instability correction projects	Relative risk of failure Critical loss of pool and/or navigation
Operations – Assure that projects perform as designed	Cumulative benefits Cumulative O&M costs for above benefits
Maintenance – Make sure projects are safe to operate (managing risk)	Navigation channel availability Lock closure exceeding 24 hours and one week duration due to mechanical failures—scheduled and unscheduled Operational Condition Assessment and consequences/impact Relative Risk Rating Cumulative benefits Cumulative O&M costs for above benefits
Fund adequate data collection	Consequence of inadequate data

If the goal is to be cost-efficient, then it may be necessary to rethink how O&M funds are allocated. In an era of increasing scarcity of budget resources, the goal of cost-efficiency seems appropriate. The question then becomes one of, “Should scarce resources be used to improve what we have or to

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<sup>17</sup> Corps of Engineers Civil Works Direct Program, *Program Development Guidance, Fiscal Year 2014* (EC 11-2-202), March 31, 2012. Available at [http://140.194.76.129/publications/eng-circulars/EC\\_11-2-202\\_pfl/EC\\_11-2-202.pdf](http://140.194.76.129/publications/eng-circulars/EC_11-2-202_pfl/EC_11-2-202.pdf) as of May 14, 2012.

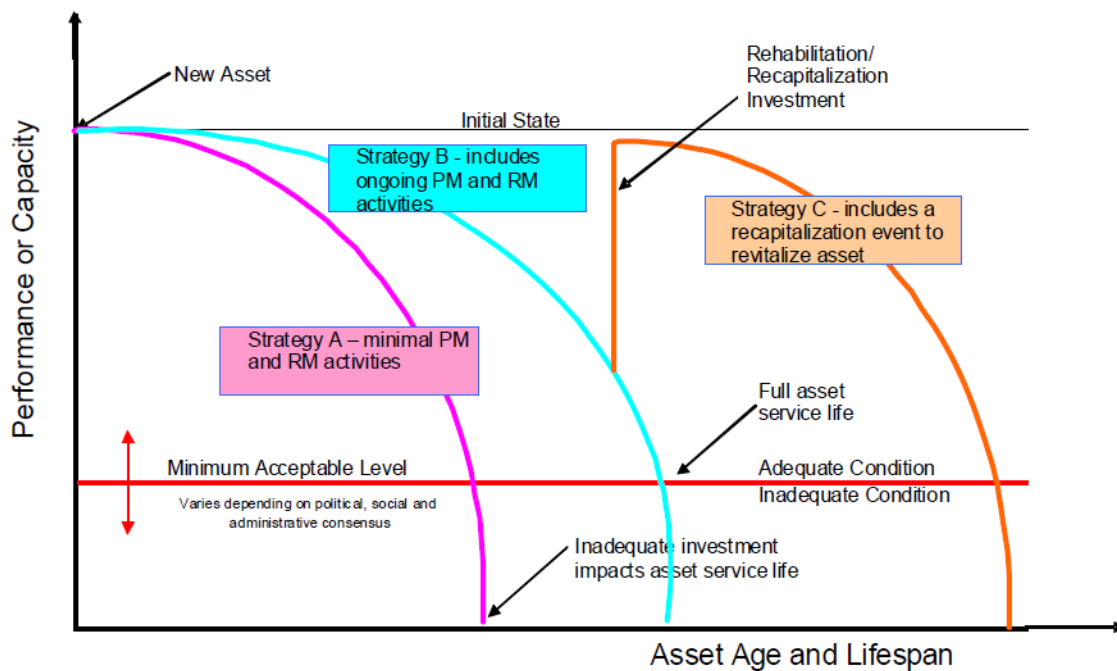
properly maintain everything we have?” To help evaluate the factors involved, this section examines current maintenance policies and practices, and compares them to what is termed as a repair and sustain alternative approach.

Investment options, or measures, addressing future navigability and navigation efficiency objectives are typically grouped by the Corps into three categories, from least to more expensive: (1) maintenance, (2) low-cost (small-scale) structural and operational, and (3) major (large-scale) structural improvements. Small-scale measures of reducing traffic congestion are generally defined as any navigation improvement less costly than constructing a new lock. In the case of the recent Upper Mississippi-Illinois Waterway study, more than 92 small-scale measures were considered. Large-scale measures involve actions such as constructing a new 1200-ft lock or extending the existing (600-ft) lock to 1200 ft.

New construction and major rehabilitation projects are financed 50% by the Inland Waterways Trust Fund and 50% from general appropriations. In contrast, O&M costs on all inland and coastal waterways are 100% funded by general appropriations, pursuant to Section 102(b) of the Water Resources Development Act of 1986.

A repair and sustain approach would, by definition, exclude new construction or significant upgrades except in specific narrowly defined instances. (The term “construction” is defined to include post-feasibility level planning; engineering and design; surveying; acquiring all lands, easements, and rights-of-way; and accomplishing all relocations, disposal of materials, and fish and wildlife mitigation.)

Figure 9 illustrates several strategies that could be used to manage lock and dam assets. Strategy A provides a new asset, performs minimal routine maintenance (RM) and periodic maintenance (PM), replaces the asset when it reaches a minimum acceptable standard, and results in the shortest asset lifespan. Strategy B involves some level of routine and periodic maintenance and results in a longer lifespan. Strategy C represents the ideal solution—when sufficient funds are available. It involves full routine and periodic maintenance of the asset, as well as major rehabilitation when conditions warrant it, and results in the longest asset lifespan.



**Figure 9. Potential Maintenance Strategies.**<sup>18</sup>

Strategies A and B have also been referred to as “fix-as-fails” and “advance” (or preventive) maintenance, respectively.

Under the advance maintenance scenario (Strategy B), scheduled repairs are undertaken before unacceptable performance is reached. The objective is to avoid component failures and the need for lengthy unscheduled repairs. There is a trade-off compared to Strategy A, as this strategy increases the up-front costs to operate and maintain a lock, but the payoff is a reduction in overall repair costs and navigation delays, and longer lifecycles.

It is difficult to determine when maintenance ceases to be standard O&M and becomes a Major Rehabilitation (i.e., construction) project. The difficulty lies in how repairs are scheduled. Individual component repairs might not be considered a Major Rehabilitation, but when several of them are grouped together, they would exceed the cost threshold for Major Rehabilitation.

<sup>18</sup> IMTS Capital Investment Strategy Team, *Inland Marine Transportation Systems (IMTS) Capital Projects Business Model* (Washington, DC: U.S. Army Corps of Engineers, April 13, 2010), 25. Available at [http://www.waterwayscouncil.org/WCIExtras/IMTS\\_IWUB\\_Report.pdf](http://www.waterwayscouncil.org/WCIExtras/IMTS_IWUB_Report.pdf) as of June 12, 2012.

By regulation, a Major Rehabilitation (MR) project:

- Requires approval by the Secretary of the Army and construction is funded out of the CG Civil Works appropriation for the Corps of Engineers.
- Includes economically justified structural work for restoration of a major project feature that extends the life of the feature significantly or enhances operational efficiency.
- Requires a minimum of two fiscal years to complete.
- Costs over \$14.5 million in capital outlays for inland navigation projects (for FY 2014) for reliability improvement projects or over \$1.8 million in capital outlays (for FY 2014) for efficiency improvement projects. (These thresholds are adjusted annually by regulation).
- Reliability and efficiency improvement projects require, for inland locks, that construction be 50/50 cost shared with the Inland Waterways Trust Fund (whereas other maintenance for inland locks is 100% federally funded from the Operations and Maintenance account).<sup>19</sup>

It might be useful to consider an engineering-based approach rather than a cost-based approach for defining Major Rehabilitations. For example, the engineering goal of a Major Rehabilitation is to extend the functional life of the asset. Regular maintenance simply repairs what breaks. Using an automobile repair decision as an example helps illustrate this point. A car owner may decide to fix the alternator this week, in 6 months he may have to fix the water pump, something else may have to be repaired 4 weeks after that, and so forth. The car owner could decide, however, to do a complete inspection of the vehicle and fix everything up-front that is substandard in performance, or has already reached or is near the end of its useful life, thereby improving the reliability and extending the life of the vehicle. The same is true for locks. A repair project designed to inspect the lock and bring everything up to a certain condition and level of performance, would constitute a Major Rehabilitation. Such projects typically call for removing, sandblasting, and repairing lock and/or dam gates. A fix-as-fails repair would constitute regular O&M.

Major Rehabilitation will be required at every lock site in the system during the next 50 years. The Corps has determined that periodic rehabilitation will be needed at most lock and dam sites approximately every 25 years. (However, for the newer locks on the Illinois River, rehabilitation was estimated to be needed approximately every 40 years at a cost of \$30 to \$42 million each.<sup>20</sup>)

Under current policy, the baseline condition assumes that major components of the existing facility will be repaired only as they fail (reach unsatisfactory performance)—the so-called fix-as-fails scenario. Under the fix-as-fails scenario, normal maintenance would continue as presently scheduled; however,

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<sup>19</sup> Corps of Engineers Civil Works Direct Program, op.cit, II-2-3.

<sup>20</sup> *Final Integrated Feasibility Report and Programmatic Environmental Impact Statement for the UMR-IWW System Navigation Feasibility Study*, (Washington, DC: U.S. Army Corps of Engineers, September 24, 2004), 167. Available at [http://www2.mvr.usace.army.mil/UMRS/NESP/Documents/Main\\_Report\\_Final.pdf](http://www2.mvr.usace.army.mil/UMRS/NESP/Documents/Main_Report_Final.pdf) as of June 12, 2012.

preventive maintenance would not be undertaken. Components are allowed to reach unacceptable performance before repairs are initiated, which is defined as unacceptable performance by a component (e.g., a certain level of fatigue in a gate or a certain level of stress in a monolith), not necessarily a total failure (e.g., a gate falling or monolith collapsing). Cyclical maintenance closures are also more costly and longer because there are no intermittent repairs to non-critical components. Thus, when cyclical maintenance is actually conducted under the fix-as-fails scenario, more problems will be encountered than under the advance maintenance scenario.

In an advance maintenance scenario, it is assumed that additional funds would be available to extend the life of the structure by increasing maintenance. This, of course, comes at the cost of not only the increased maintenance, but also of substantially more and longer closures as the project ages. With advance maintenance, the project might still eventually shut down, but the shutdown would occur later than in the baseline condition.

Note that under both the fix-as-fails and advance maintenance scenarios, replacement of the components is an option, but only if the reason for the replacement is “unacceptable performance” and not because it is a routine item in a scheduled individual component replacement program.

The Corps has investigated the possibility of establishing an advance maintenance-type program that would include positioning major spare parts and repair equipment at key strategic locations in order to reduce mobilization time and costs in the event of an emergency repair. Unfortunately, it has determined that with current funding levels and the demands on those funds there is insufficient funding to pursue such a program at this time. However, even with insufficient funding for the major rehabilitation and new construction projects that are needed, with an adequately funded advance maintenance program, the system can be kept in a state of good repair and avoid long, unplanned outages due to equipment or infrastructure issues. While the capacity and efficiency of the system would not be improved, the reliability and predictability of the system would increase significantly.

This report uses the expanded concept of an ongoing advance maintenance program as the definition of a repair and sustain maintenance approach. This approach can be defined as follows:

**REPAIR AND SUSTAIN:** A program of advance maintenance that includes (1) ongoing maintenance designed to avoid a failure by any critical component, (2) replacement or major rehabilitation only when acceptable performance levels cannot be achieved or maintained, and (3) staging of equipment and repair parts to minimize the time and cost of emergency repairs.

## PROJECT PRIORITIZATION

In its planning at the national level, the Corps has developed a new budget paradigm. Insufficient funding is available to sustain the program as it has historically been conducted, resulting in high priority, high performing projects taking longer and longer—and costing more and more—to deliver.

Congress has authorized \$8 billion in projects that would replace or rehabilitate aging river infrastructure, but it has not fully funded the projects up front. Funding the projects in a piecemeal fashion generates significant cost overruns and construction delays lasting decades, not months or years.

The key principles that underpin the new paradigm are the following:

- Finish projects once they are started.
- Focus on core mission areas.
- Take risks in non-core mission areas.
- Provide efficient funding for fewer projects.
- Focus on initiatives to fund, finance, and prioritize civil works actions, including innovative financing procurement methods.
- Align program outputs to national goals and objectives.

The Senate Committee on Appropriations seems to support this approach. In its report for HR 2354 (Energy and Water Development Appropriations Bill, 2012) the Committee made the following statements:

“We are now in the fifth budget cycle since this problem [the insufficiency of the Inland Waterways Trust Fund to pay for needed projects] with no solutions on the horizon...Due to continued declining budgets for the foreseeable future, the Committee has concluded that it would not be prudent to include any of the new starts proposed in the administration’s fiscal year 2012 budget request because of the outyear requirements that would be incurred. This also includes the new starts that the administration proposed in fiscal year 2011 and included in their fiscal year 2012 budget as continuing projects.”

At a \$170 million-per-year pace (based on projected IWTF receipts), it will take more than 22 years to generate the \$3.8 billion needed to complete seven major projects already underway.<sup>21</sup> Those include rehabilitating the Emsworth Dam on the Ohio River and building new locks on the Monongahela. Once these works are completed—in the 2030s—work could start on another \$4.3 billion in projects that Congress has authorized but not funded, as of the time of this writing. Even the extended timeline is jeopardized because another \$900 million has recently been added to the cost of the Corps' top priority project: Olmsted Locks and Dam on the Ohio River near Olmsted, Ill., the nation's busiest stretch of river.<sup>22</sup>

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<sup>21</sup> This amount equals the \$85 million projected to be collected annually from the diesel fuel tax and the matching federal money.

<sup>22</sup> Boselovic, op. cit.

Faced with flat funding, the Corps has adopted a fix-when-fails or fix-as-fails approach to maintaining locks and dams. Lock failures (or imminent lock failures) are given the highest priority.

Although there is not adequate funding to allow implementation, the Corps has investigated a more aggressive approach to maintenance than the current program, as mentioned earlier, and a look at what has been recommended is instructive. (The Corps is currently collecting data in order to be able to further develop and refine the program when funding is available.)

The Great Lakes and Ohio River Division (LRD) of the Corps has developed a written standard for lock and dam maintenance that begins to address the issue of identifying and prioritizing needs. Under this standard, LRD will direct resources toward reducing the risk of unscheduled lock closures. It is expected that project features will be maintained in a fully functional condition to maximize the benefits provided by the system, given available resources. Closure of high impact projects will be considered a critical situation and restoration of services will be given LRD's highest maintenance priority. This could potentially include subordination of other division activities, consolidation of division resources, or utilization of resources from districts outside LRD, depending on the economic impacts of the situation. LRD has committed to procuring and maintaining critical spare parts and materiel for each project to the greatest extent possible on a regional basis. Inspections and assessments of LRD navigation projects (i.e., locks and dams) will include annual condition assessment inspections, underwater inspections, and lock dewaterings. The type and frequency of inspection will be scheduled based upon the relative impact and potential risk of failure of the facility. Lock dewaterings will only be conducted when no other alternative is practicable.

The risk factor will be defined by the potential for unscheduled closure, decreased service level, or failure of a critical operating component. Critical components are those whose unacceptable performance would cause an interruption in lock service. Lock gates are the most critical infrastructure component. The following factors are included in the risk assessment:

- Number of operating cycles since last major maintenance event or last inspection.
- The effective age of the facility (based on the last major rehabilitation/replacement).
- Historical maintenance/inspection/performance.

The division classifies risk as follows:

- High – probably failure of components will result in unscheduled closure within the next three years.
- Medium – probably failure of components should not result in an unscheduled closure, but would degrade the service or efficiency of the facility within the next three years.
- Low – a deficiency is identified which should not degrade the service or efficiency of the facility within the next three years.

If adequate funding is made available, further refinements will have to be made in order for this type of program to work across multiple divisions and districts. One of the most important will be the



determination of the best locations to serve as staging locations for equipment and critical components. This is because there are 17 Corps districts that maintain locks and dams and it will be a complex issue to decide how many resources to duplicate across districts and how many to provide from a single staging area.

### III. DIFFERENCES IN COST DERIVING FROM THE ADOPTION OF A REPAIR AND SUSTAIN APPROACH.

Current estimates state that it would take \$18 billion to completely modernize the system with new construction and rehabilitation of old structures. Approximately \$12.1 billion is allocated to new construction, and \$5.9 billion to rehabilitation.<sup>23</sup> The Business Model recommends a far smaller number in an attempt to arrive at an amount that can be reasonably achieved.

The main difference in a repair and sustain program would lie in the difference between funding for rehabilitation and funding for a lock extension or new construction. As noted in Section II in this report, the Corps has established a general rule that a lock will need a major rehabilitation every 25 years. Unfortunately, up until approximately 20 years ago, all construction or repair activities were classified as either New Construction or O&M—there was no third category (Major Rehabilitation). Unless a lock has undergone a Major Rehabilitation since this definition was established, there would be no clear-cut data indicating when the last rehabilitation occurred.

In the Business Model, a list was prepared comprising all cost-shared projects involving IWTF funds that have been completed since the definition of a Major Rehabilitation was employed. Those projects are listed below in Table 7. The costs shown in the table were adjusted to 2012 dollars according to directives found in the Engineering Manual EM 1110-2-1304, Civil Works Construction Cost Index System, Lock Component.

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<sup>23</sup> Gibbs, Bob. *Memorandum to Members of the Subcommittee on Water Resources and Environment re: Hearing on "How Reliability of the Inland Waterway System Impacts Economic Competitiveness,"* (Washington, DC, U.S. House of Representatives, Committee on Transportation and Infrastructure, April 13, 2012), 6. Available at <http://republicans.transportation.house.gov/Media/file/112th/Water/Water%20Briefing%20Memo%20%204-18-12.pdf> as of June 12, 2012.

**Table 7. Completed Projects Cost-Shared from the Inland Waterways Trust Fund  
(as of March 2010).**

<b>Project</b>	<b>Start Year</b>	<b>Completion Year</b>	<b>Original Total Cost \$ (Million)</b>	<b>Adjusted Total Cost \$ (Million)</b>
<b>Major Rehabilitation</b>				
Upper Miss 13 Rehab	1993	1996	20.7	34.6
Upper Miss 15 Rehab	1993	1996	19.6	32.8
Brazos Locks Rehab	1994	1995	9.0	15.4
Upper Miss 25 Rehab	1994	2000	25.9	40.3
Upper Miss 3 Rehab	1998	2009	71.2	77.2
Upper Miss 12 Rehab	2000	2003	14.7	21.4
Upper Miss 11 Rehab	2002	2008	47.3	50.6
Upper Miss 19 Rehab	2003	2008	31.6	33.8
Upper Miss 27 Rehab	2007	2011	37.3	38.0
Upper Miss 14 Rehab	1996	2000	20.0	31.1
Upper Miss 24 Rehab	1996	N/A <sup>2</sup>	N/A	
Lockport Rehab	2006	2012 <sup>3</sup>	136.8	136.8
<b>Total</b>			434.1	<b>512.0</b>
<b>Average</b>			39.5	<b>46.5</b>
<b>Lock New Construction</b>				
Bonneville New Chamber	1987	1994	341.0	602.0
Price Auxiliary 600' Chamber	1987	1993	212.6	387.0
RC Byrd New 1,200' and 600' chambers	1987	1993	383.5	698.0
Point Marion New Chamber	1989	1994	113.1	199.7
Winfield New Chamber	1989	1997	236.3	387.1
Marmet New Chamber	1998	2009	405.8	440.1
London Rehab & Lock Extension	2000	2003	22.9	33.3
McAlpine 1,200' Auxiliary	1996	2009	429.3	465.6
<b>Total</b>				<b>3212.8</b>
<b>Average</b>				<b>401.6</b>
<b>All Other</b>				
Illinois Waterway (4 Rehabs)	1993	1996	27.2	45.5
Oliver Replacement L&D	1987	1991	123.3	235.3
Grays Landing Replacement Lock	1988	1993	178.0 <sup>4</sup>	324.1
Grays Landing Dam	1993	1995	<sup>4</sup>	
Sargent Beach Protective Barrier	1994	1999	52.8	83.7

1. Completion year is when facility was placed in service, not when the project was closed out administratively

2. Cost and completion date pending results of ice vibration study and recommended repairs

3. Balance to complete was fully funded with Recovery Act funds in FY 2009

4. Grays Landing Costs include the Lock Replacement and Dam

As a rule, major rehabilitation is less expensive than extending a lock or building a new lock chamber. There are no public data available that would indicate the difference on a lock-by-lock basis. However, the Business Model provides information that leads to a reasonable rule-of-thumb approach.

Table 8 lists the costs of the Phase 1 (under construction) and Phase 2 (authorized but not under construction) projects included in the Business Model. The table includes only lock projects (no waterway maintenance or dam-only projects).

**Table 8. Phase 1 and Phase 2 Projects from Capital Projects Business Model (Locks Only).**

Project Type	Project	Cost Estimate	Adjusted Cost Estimate (\$ million) <sup>c</sup>
<b>Major Rehab/Replacement<sup>d</sup></b>			
	Chickamauga	693.0 <sup>a</sup>	693.0
	Locks & Dams 2, 3, & 4 – Monongahela	1700.0 <sup>a</sup>	1700.0
	Olmsted	2918.0 <sup>a</sup>	2918.0
	Inner Harbor Navigation Canal Lock Replacement	1425.0 <sup>a</sup>	1425.0
	Markland Locks	35.8	38.8
	Lower Monumental Lock Rehab	14.0	15.2
	Mississippi River Lock & Dam 25 - Dam Rehab	40.0	43.4
	Thomas J. O'Brien Lock Rehab	22.9	24.8
	LaGrange Lock Rehab	53.2	57.7
	<b>Total – Last 5 Only<sup>b</sup></b>	<b>165.9</b>	<b>179.9</b>
	<b>Average – Last 5 Only<sup>b</sup></b>	<b>33.2</b>	<b>36.0</b>
<b>New Construction/Expansion<sup>d</sup></b>			
	Kentucky Lock Addition	844.0 <sup>a</sup>	844.0
	Greenup Lock Extension	242.2	262.7
	John T. Myers Lock Extensions	315.1	341.8
	NESP Upper Mississippi Lock 25	396.6	430.1
	NESP Upper Mississippi Lock 22	304.5	330.3
	NESP Upper Mississippi Lock 24	379.0	411.1
	NESP Upper Mississippi Lock 21	394.5	427.9
	NESP Upper Mississippi Lock 20	269.5	292.3
	NESP LaGrange Lock	320.9	348.0
	NESP Peoria Lock	322.1	349.3
	<b>Total w/o Kentucky Lock</b>	<b>2944.4</b>	<b>3193.5</b>
	<b>Average w/o KY Lock</b>	<b>327.2</b>	<b>354.8</b>

<sup>a</sup>This number represents an adjustment to the cost estimate published after the Business Model report was released.

<sup>b</sup>Olmsted and Chickamauga have encountered engineering and funding issues that make them outliers; L&D 2, 3, & 4 involve multiple projects for which the individual costs are not known; and the IHNC project involves environmental challenges that cause it to be non-representative. All four of these projects have encountered issues that are unusual and are not expected to recur.

<sup>c</sup>Assumes all cost estimates in the Capital Projects Business Model were originally in 2009 dollars.

<sup>d</sup>Shaded boxes show outliers

Under the category of Major Rehabilitation/Replacement, both the Chickamauga and Inner Harbor Navigation Canal Lock projects have been subject to extenuating circumstances that would cause them to not be representative of a typical lock rehabilitation project. When these two are excluded (in addition to the two outliers in the table footnote), the average cost of a major lock rehabilitation is approximately \$36.0 million in 2012 dollars.

In the New Construction/Expansion category, the Kentucky Lock project is clearly an outlier when compared to the rest of the project list. Without this lock, the average cost of new construction/expansion is \$354.8 million in 2012 dollars.

Table 9 consolidates the two previous tables (completed projects plus Phases 1 and 2 from the Business Model) and provides averages for Major Rehabilitation/Replacement projects and New Construction/Expansion projects in 2012 dollars.

**Table 9. Average Project Cost by Project Category.**

<b>Project Category</b>	<b># of Projects</b>	<b>Total Cost (\$ million)</b>	<b>Average Cost (\$ million)</b>
Major Rehab/Replacement	17	691.9	40.7
New Construction/Expansion	17	6406.3	376.8

These averages indicate that the cost of one construction project is approximately equal to the cost of 9 major rehabilitation projects that could be implemented instead. Stated another way, if each of the projects in the New Construction/Expansion category that are not yet completed were to be downgraded to a major rehabilitation, the total cost for the 9 projects (excluding the Kentucky Lock project) would drop to \$366.3 million compared to the listed total of \$3,193.5 million—a difference of \$2,827.2 million, or \$2.8 billion.

## IV. FUNDING REQUIREMENTS UNDER CURRENT APPROACH VERSUS PRESERVE AND MAINTAIN APPROACH, AND FUNDS AVAILABLE VIA THE INLAND WATERWAYS TRUST FUND.

### TRADITIONAL FUNDING SCHEME

Compared to truck and rail, the inland waterways industry is relatively small, with significantly limited capacity to contribute additional revenues to the IWTF.

The IWTF was authorized by two separate acts of the U.S. Congress. The original authorization was included in the Inland Waterways Revenue Act of 1978 (Public Law 95-502, October 21, 1978, Sec. 1801 et seq; hereinafter, the “1978 Revenue Act”). Under the 1978 Revenue Act, the U.S. Congress created the IWTF within the U.S. Treasury for the purpose of “making construction and rehabilitation expenditures for navigation on the inland and coastal waterways of the United States as provided in appropriations acts.” The U.S. Congress funded the IWTF with a “tax on fuel used in commercial transportation on inland waterways” and statutorily defined 26 specific segments of the inland and intracoastal waterways to be subject to the tax and to be eligible for construction and rehabilitation expenditures from the IWTF.

As indicated in Table 10, the inland fuel tax began on October 1, 1980, at the rate of \$0.04 per gallon and gradually increased to \$0.20 per gallon after 1994. The 1978 Revenue Act did not authorize any new program, project, or activity and further provided that no expenditures from the IWTF could be made “unless the law authorizing the expenditure for which the amount is appropriated explicitly provides that the appropriation is to be made out of the Trust Fund.”

**Table 10. Inland Waterways Fuel Use Tax Rates, 1980–Present.**

Fuel Usage Period	Tax Per Gallon
After September 30, 1980	\$0.04
After September 30, 1981	\$0.06
After September 30, 1983	\$0.08
After September 30, 1985	\$0.10
During 1990	\$0.11
During 1991	\$0.13
During 1992	\$0.15
During 1993	\$0.17
During 1994	\$0.19
After 1994	\$0.20

Table 11 provides the history of Inland Waterways Trust Fund Receipts from 1987 through 2013. The figures shown in red (FY 2012 and FY 2013) are estimates as shown in the President’s budget request.

**Table 11. Inland Waterways Trust Fund Receipts, 1987–2013.**

<b>Fiscal Year</b>	<b>Receipts (Annual \$ million)</b>	<b>Index<sup>24</sup></b>	<b>2013 Dollars (million)</b>
1987	48.3	356.835	104.6
1988	48.1	371.055	100.2
1989	47.0	383.6325	94.7
1990	62.8	390.915	124.2
1991	60.5	398.7325	117.3
1992	69.9	405.8475	133.1
1993	78.6	417.9975	145.4
1994	88.4	430.975	158.6
1995	103.4	445.6475	179.4
1996	108.4	454.9425	184.2
1997	96.4	464.5	160.4
1998	91.1	472.47	149.1
1999	104.4	480.1	168.1
2000	99.6	488.8825	157.5
2001	112.7	495.4325	175.8
2002	95.3	510.9375	144.2
2003	89.5	522.4875	132.4
2004	90.8	564.925	124.2
2005	91.3	601.8525	117.3
2006	80.8	635.3925	98.3
2007	91.1	669.565	105.2
2008	87.6	710.7075	95.3
2009	76.0	701.5075	83.7
2010	73.9	719.5	79.4
2011	84.0	746.25	87.0
<b>2012</b>	<b>92.0</b>	<b>760.8425</b>	<b>93.5</b>
<b>2013</b>	<b>95.0</b>	<b>773.015</b>	<b>95.0</b>
Min			79.4
Max			184.2
Avg			126.2

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<sup>24</sup> \* This index is from EM 1110-2-1304, "Civil Works Construction Cost Index System, Tables Revised as of 30 September 2011". This is the official index for inflating/deflating nominal cost figures for Corps of Engineers projects in order to report constant dollars.



## CHANGES IN FUNDING REQUIREMENTS WITH REPAIR AND SUSTAIN APPROACH

The repair and sustain approach to maintaining the lock and dam system would essentially eliminate all new construction—whether extensions, expansion, or new construction—in favor of focusing strictly on major rehabilitations and advance maintenance. In order to evaluate the magnitude of the effect a change in the maintenance approach might have on funding, the New Construction Project Funding Profile, FY 2011 to FY 2030, in the Business Model was evaluated. Only non-channel new construction projects were examined. These are shown in Table 12.

**Table 12. New Construction Project Funding Profile, FY 2011 to FY 2030 (\$ million).**

Division	District	Project Name	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL	
LRD	LRL	Olmsted	132.0	138.0	144.3	131.1	135.1	86.9	89.6	92.2	53.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1002.7	
LRD	LRP	Locks and Dams 2, 3, and 4, Locks - Monongahela	80.0	103.0	83.3	27.2	56.3	52.2	29.9	79.9	101.3	106.5	93.9	69.2	21.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	904.1
LRD	LRP	Locks and Dams 2, 3, and 4, Dams - Monongahela	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	117.4	22.2	17.0	15.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	172.4
LRD	LRN	Chickamauga Lock	40.0	51.5	47.7	38.2	11.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	189.2
LRD	LRN	Kentucky Lock	40.0	56.7	47.7	54.6	56.3	34.8	35.8	36.9	37.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	399.9
MVD	MVS	Lock & Dam 25 - Mississippi	7.6	7.3	26.0	43.2	88.0	104.3	122.6	57.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	456.8
MVD	MVR	LaGrange Lock	0.0	0.0	0.0	0.0	0.0	0.0	3.7	6.0	12.7	26.1	60.5	62.3	114.1	104.3	63.4	0.0	0.0	0.0	0.0	0.0	0.0	453.1
MVD	MVN	Inner Harbor Navigation Canal Lock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.1	180.0	199.6	252.6	260.2	202.5	101.1	78.7	0.0	0.0	0.0	1325.8
LRD	LRH	Greenup Locks and Dam	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.0	21.1	42.8	75.0	122.6	81.0	0.0	0.0	0.0	0.0	369.5
MVD	MVR	Lock & Dam 22 - Mississippi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	2.6	2.6	2.1	2.0	21.7	47.4	75.1	144.3	300.4	
MVD	MVS	Lock & Dam 24 - Mississippi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.7	15.4	18.7	35.3	65.3	161.7	163.1	473.2	

The Corps has indicated that Olmsted, the Monongahela Locks, and the Inner Harbor Canal Lock are all projects that have been designated as critical and necessary to complete as designed and planned. These projects all experienced significant increases in their estimated cost after the Business Model was published. However, in order to maintain consistency and to be able to relate this report to the Business Model, the numbers in the Business Model are used. These locks are shown in the shaded rows of Table 12.

There is a possibility that the Chickamauga Lock project will be terminated. This report looks at both the possibility that it will be terminated or that it will continue on to full build out.

Table 12 only includes funding through 2030. Several of these projects will need funding after that date. The total amount of funding shown in Table 12 is \$6.047 billion. Of this amount, \$2.642 billion is allocated to the non-shaded projects. If each of these projects is downgraded to the average major rehabilitation category described earlier in this report, and the amounts for projects requiring funding beyond 2030 are allocated in proportion to the amounts allocated in Table 12, the total amount allocated to these projects drops to \$256.1 million (\$215.4 million without Chickamauga). Table 13 shows the new funding stream that would result.

**Table 13. Modified New Construction Project Funding Profile, FY 2011 to FY 2030 (\$ million).**

Division	District	Project Name	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL	
LRD	LRN	Chickamauga Lock	8.6	11.1	10.3	8.2	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.7	
LRD	LRN	Kentucky Lock	4.1	5.8	4.9	5.6	5.7	3.5	3.6	3.8	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.7	
MVD	MVS	Lock & Dam 25 - Mississippi	0.7	0.7	2.3	3.8	7.8	9.3	10.9	5.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.7	
MVD	MVR	LaGrange Lock	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5	1.1	2.3	5.4	5.6	10.2	9.4	5.7	0.0	0.0	0.0	0.0	0.0	40.7	
LRD	LRH	Greenup Locks and Dam	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	2.3	4.7	8.3	13.5	8.9	0.0	0.0	0.0	40.7	
MVD	MVR	Lock & Dam 22 - Mississippi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	1.7	3.6	5.7	11.0	22.9	
MVD	MVS	Lock & Dam 24 - Mississippi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.0	1.2	2.2	4.1	10.1	10.2	29.6	
																							<b>TOTAL</b>	<b>256.1</b>

The amount “saved” by reclassifying these projects is \$2.386 billion over the 20-year period (\$2.427 without Chickamauga). This is an average of \$119.3 million per year over the 20-year period (\$121.4 million without Chickamauga). These amounts represent 28.1% and 26.6%, respectively, of the FY 2013 budget proposal for the Lock and Dam subaccounts within the Construction and O&M accounts (\$425 million—see Table 21 later in this report). They are roughly 3% of the total amounts proposed for all Construction and O&M.

These reductions in cost are approximately 31% of the annual amounts proposed in the Business Model. Reprogramming this amount each year from new construction to major rehabilitations might enable the Corps to bring an additional two or three projects up to a “good condition” status each year, on the average.

Several observations can be made based on this analysis:

1. The projects that have been designated as must finish projects are consuming a large share of programmed funding.
2. In the Business Model, the must finish projects are completed in the year 2028. In all but 3 of the 18 years, these projects consume at least 50% of the proposed funding. While the average that could be saved each year through the reclassification described above is significant, the funding stream is such that the real opportunity to reclassify projects will be sporadic during the first 15 years of the 20-year funding period, and will be weighted heavily toward the latter years. In order to have a major effect on funding requirements during the first half of the period, one or more of the current must finish projects would have to be canceled or delayed.
3. Significant cost overruns of the must finish projects (and uncertainty with regard to their funding demands) make it very difficult to fine-tune the rest of the projects in the maintenance program.

## V. VIABILITY OF REPAIR AND SUSTAIN APPROACH AND NECESSITY FOR MAJOR REHABILITATIONS AND CAPACITY EXPANSIONS

Recently, the Corps and the Inland Waterways Users Board (the Team) collaborated in an effort that resulted in a document titled *Inland Marine Transportation Systems (IMTS) Capital Projects Business Model*, dated April 13, 2010. The goals of this effort were to:

1. Identify ways to improve the project delivery system (i.e., more reliable cost estimates and construction schedules, better contracting practices, improved project management) to ensure that future system improvements can be completed on time and within budget.
2. Develop a list of long-term capital needs for the inland navigation system, including an objective methodology for prioritizing those needs.
3. Develop a capital investment strategy that balances reliability with affordability.
4. Develop and recommend a strategy to help ensure that funding requirements can be met with reasonable certainty and efficiency.

Goals 2 through 4 are directly relevant to this analysis. The Business Model contains much detailed information regarding the prioritization of projects, proposed process improvements, and financial considerations. Much of the information that follows was taken from the Business Model.

Currently, (as of the writing of this report) the Corps has identified over 100 projects in the inland and intracoastal waterways system that require, or could conceivably require, capital investments in the next 20 years. Over the 20-year period from fiscal year FY 2011 to FY 2030, the Corps districts' unconstrained financial requirements to address the infrastructure needs of the inland marine transportation system (IMTS) total nearly \$18.0 billion, or an annual average of nearly \$900 million. Of the \$18.0 billion identified for expenditure, nearly \$12.1 billion (67%) would be allocated to new construction and \$5.9 billion (33%) would fund major rehabilitation projects.

The Team concluded that the most useful representation of system value and return on investment should include assessments on an asset-by-asset basis using the following:

1. The asset's current condition.
2. The likelihood of diminished asset performance.
3. The consequence of diminished performance in terms of repair costs, outages, and economic losses.
4. How the proposed investment would improve performance or reduce the asset's likelihood of diminished performance.
5. For new assets, whether the project could be expected to improve system performance.

The criteria the Team selected for ranking projects fell into two broad categories: (1) structural and operational risk and reliability and (2) economic return. The Team evaluated what should be reasonably addressed and completed in the next 20 years to maintain a reliable IMTS. It was recognized that

worthwhile projects already under construction should be completed as efficiently as possible. The Team recommended that new construction projects should be allocated an annual funding level of about \$320 million.

Because there is a large bottleneck of new construction early in the capital investment strategy, the Team proposed to skew funding allocations between new construction and major rehabilitation to new construction in the immediate near term. The target total of the 20-year capital investment strategy for new construction and major rehabilitation on average is \$380 million per year. With a \$380 million average annual investment level, this investment strategy addresses at least 27 of the candidate projects that have been identified by Corps districts and highlights how those projects would be prioritized based on the recommended investment level.

The IMTS CIS Team reviewed and evaluated more than a dozen options for funding the IMTS capital investment program. These options included maintaining the current cost-sharing arrangement of 50% federal and 50% IWTF for all capital investments; varying that percentage; excluding some projects/features, such as dam or major rehabilitation projects; setting different thresholds for the cost-sharing of major rehabilitation projects; and capping the IWTF share for some projects with significant cost increases, such as Olmsted Locks and Dam and Lower Monongahela Locks & Dams 2, 3, and 4 (Lower Mon Project). Table 14 lists these options.

**Table 14. Cost-Sharing Options Considered by the IMTS CIS Team.**

<b>Description</b>
Baseline Option—50% Federal and 50% IWTF
50/50 for New Construction, 100% Federal for Major Rehabilitation
50/50 for New Construction and Major Rehabilitation above \$50M, 100% Federal for Major Rehabilitation below \$50M
50/50 for Locks, 100% Federal for Dams
50/50 for New Construction, and 75/25 for Major Rehabilitation
60% Federal, 40% IWTF
65% Federal, 35% IWTF
75% Federal, 25% IWTF
50% Federal, 50% IWTF on all projects except Lower Mon and Olmsted
50% Federal, 50% IWTF for New Construction and Major Rehabilitation above \$50M (Locks); 75% Federal, 25% IWTF for New Construction and Major Rehabilitation above \$50M (Dams); 100% Federal for Major Rehabilitation below \$50M
50% Federal, 50% IWTF for Lock New Construction and Major Rehabilitation above \$50M; 100% Federal for Dams and Lock Major Rehabilitation below \$100M (with cap on Lower Mon)
50% Federal, 50% IWTF for Lock New Construction and Major Rehabilitation above \$50M; 100% Federal for Dams and Lock Major Rehabilitation below \$50M
50% Federal, 50% IWTF for Locks; 75/25 for Dams
50% Federal, 50% IWTF for Locks; 75/25 for Dams; 100% Federal for remaining Lower Mon
50% Federal, 50% IWTF for Locks; 80/20 for Dams

The Team recommended the exclusion of dam features of inland waterway system modernization projects from cost sharing with the IWTF because large and varied segments of the general U.S. population benefit from the presence of the dams on the system; therefore, the Team considered it more appropriate and equitable for general revenues to fully fund dam construction and major rehabilitation costs.

The Team concluded with recommending the following cost-sharing program:

- All lock construction projects and all major rehabilitation lock projects costing at least \$100 million should be cost-shared at 50% from general appropriations and 50% from the IWTF.
- Construction and major rehabilitation dam projects and major rehabilitation lock projects below \$100 million should be entirely funded from general appropriations.

With the recommended \$380 million per year for the proposed investment program, the average IWTF requirement over the next 20 years would be \$110 million per year, with the federal cost-sharing requirement averaging \$270 million per year. In the future, these average amounts may vary depending on the mix of projects in the program.

The Team also reviewed alternative options for generating revenues for the IWTF. These options included the current revenue plan consisting of a waterways fuel tax, a user fee, bonds, and other revenue sources, such as state funding or contributions by other beneficiaries of the IMTS. (Phase 2 of the IMTS report examines these and other options in more detail.) The Team acknowledged that the current revenue-raising system is a workable, understood, acceptable, and auditable system for collecting the waterways industry's share of the IMTS capitalization costs and that the additional revenues required in the Team's consensus recommendations should best be raised through an increase in the current fuel tax. The recommended program would require a 30–45% increase in the current fuel tax (a \$0.06–\$0.09 per gallon increase). The 30% increase is based on an assumption that, under current law, anticipated future revenues without a change in the tax rate would equal the average \$85 million annual amount generated over the past five years, while the 45% increase is based on FY 2009 actual revenues of \$76 million.

Under the current capital projects business model, the Corps' inland waterways projects already in the construction phase (Phase 1 in the Capital Projects Business Model) would require an estimated \$4.77 billion to complete. At current IWTF revenues of about \$75 to \$85 million per year, plus the matching federal appropriations, these projects would not be completed until 2040 at the earliest. The Corps also estimates that there is at least an additional \$4.3 billion of work already authorized on other projects. In addition, there are many projects that could be required that have not yet been authorized or studied. Table 15 shows the status of the Phase 1 projects listed in the Business Model.



**Table 15. Status of Capital Projects Business Model Phase 1 Projects.**

Project	Waterway	CPBM Cost	Current Total	Funded	Current Completion Date
Chickamauga <sup>25,26</sup>	Tennessee	374.5	693.0	186.0	On hold (2017?)
Kentucky Lock <sup>27,28,29</sup>	Tennessee	713.4	844.0	337.9	On hold (resume after 2020?)
Locks and Dams 2, 3, and 4 <sup>30,31</sup>	Monongahela	1438.3	1700.0	522.0 (thru FY 10)	2030s
Olmsted Lock and Dam <sup>32</sup>	Ohio	2044.0	2918.0	1550 (thru FY 12)	Locks completed, Total project after 2020.
Inner Harbor Navigation Canal Lock <sup>33</sup>	Gulf Intracoastal Waterway	1034.0	1425.0	221.0	Suspended
Emsworth Dam Major Rehabilitation <sup>34,35</sup>	Ohio	160.0	160.0	153.0 (as of April 2010)	2014 (with efficient funding)
Markland Lock Major Rehabilitation	Ohio	35.8	35.8	35.8	Completed

<sup>25</sup> Jenereski, Natalie. "Lawmakers Working to Fund Chickamauga Lock Replacement." *News Channel 9*, March 23, 2012. Available at <http://www.newschannel9.com/template/cgi-bin/archived.pl?type=basic&file=/news/top-stories/stories/archive/2012/03/eNjLhXV8.xml> as of May 14, 2012.

<sup>26</sup> Huddleston, Wayne. *Chickamauga Lock Replacement*, Presentation to Chattanooga Engineers Club, February 28, 2011. Available at <http://www.chattanoogaengineersclub.org/CEC28Feb11.pdf> as of May 14, 2012.

<sup>27</sup> Baskin, Shelly. "Kentucky Lock Project Misses Out on Extra Funding," *WKMS 91.3 FM*, February 10, 2012.

Available at

<http://www.publicbroadcasting.net/wkms/news.newsmain/article/0/5666/1903548/Regional.Headlines/Kentucky.Lock.Project.Misses.Out.on.Extra.Funding> as of May 14, 2012.

<sup>28</sup> Tennessee River Valley Association, *Kentucky Lock Addition Fact Sheet*. Available at <http://www.trva-tcwc.org/kentucky-lock-addition-fact-sheet/> as of May 14, 2012.

<sup>29</sup> Ibid.

<sup>30</sup> Fritz, Steve. *Locks and Dams 2, 3 and 4 Monongahela River Project (Lower Mon)*, February 2011. Available at <http://operations.usace.army.mil/nav/11febimts/Fritz-LockMaintGroupFeb2011SML.pdf> as of May 14, 2012.

<sup>31</sup> Fontaine, Tom. "Lack of funding for locks promises more river traffic snarls," *Tribune-Review*, May 31, 2011. Available at <http://triblive.com/search/1136682-85/million-lock-corps-locks-funding-coal-river-unscheduled-army-closures> as of May 14, 2012.

<sup>32</sup> Olmsted Frequently Asked Questions, Louisville District, U.S. Army Corps of Engineers. Available at <http://www.lrl.usace.army.mil/poi/article.asp?id=894&MyCategory=297> as of June 12, 2012.

<sup>33</sup> Schmid, Mary Anne. *Financial Report & Project Summaries*, Presentation to Inland Waterways Users Board Meeting No. 65, New Orleans, Louisiana, April 1, 2011. Available at <http://www.waterwaysusers.us/MS%20SchmidUB65.pdf> as of May 14, 2012.

<sup>34</sup> Ibid.

<sup>35</sup> *Emsworth Locks and Dams Major Rehabilitation Project*. Available at <http://www.lrp.usace.army.mil/pm/emsworth.htm> as of May 14, 2012.

The Business Model listed 13 Phase 2 Lock and Dam projects. (Phase 2 is defined as authorized and ready to construct, but not funded.) Of these projects, only two have been initiated:

- John T. Myers Lock Extension: The total cost for this project currently stands at \$332 million. Only some basic site work has been done—specifically, the approach widening and construction of the office building. No work on lock or dam infrastructure has begun.
- Lower Monumental Lock Rehabilitation: This project was completed in 2011 at a cost of \$14 million.

Table 16 lists the projects the Team classified as high priority over the next 20 years.

**Table 16. Capital Projects Business Model High Priority Projects, Next 20 Years.**

Project Type	Project Name
New Construction	Olmsted L/D Construction Lower Monongahela LD 2, 3, and 4 Chickamauga Lock Kentucky Lock Addition Upper Mississippi LD 25 GIWW High Island to Brazos River La Grange, Illinois Waterway Inner Harbor Navigation Canal Lock Greenup Locks and Dam Upper Mississippi LD 22 Upper Mississippi LD 24
Major Rehabilitation	Emsworth Locks and Dam Markland Locks and Dam Upper Mississippi LD 25 (Scour Repairs) Lower Monumental Lock and Dam Thomas O’Brien Lock and Dam Greenup Dam John T. Myers Dam Meldahl Locks and Dam Montgomery Dam Safety Mel Price Lock No. 2 Lock Bank Slope Rehab Willow Island Locks and Dam Marmet Locks and Dam Joe Hardin Lock Upper Mississippi LD 22

The IWUB is of the opinion that the status quo would eventually result in the end of the IMTS. It is the IWUB’s view that the system cannot be maintained under the current funding level and would become

increasingly unreliable at the current level of investment. Even in an extreme funding crisis, it will still be necessary to finish the Olmsted and Lower Monongahela projects as quickly as possible. These two projects are absolutely critical, according to Corps Headquarters staff.<sup>36</sup>

The capital requirements associated with the high priority items indicate that a modest restructuring of the method for determining priorities, whether those are major rehabilitation or capital improvement, and the timing of these projects will have a negligible effect on funding requirements for the system as a whole for the foreseeable future (at least 20 years). Although it is beyond the scope of this study to analyze it in detail, every major study done by the Corps indicates that it is more cost-effective over the long term to perform advance maintenance and periodic major rehabilitation than to allow the system to fail and then reconstruct it. Unfortunately, the current level of appropriations does not allow for implementation of this approach.

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<sup>36</sup> Telephone Interview with Jim Walker, Navigation Branch Chief, Operations Division, U.S. Army Corps of Engineer Headquarters, Washington, DC April 26, 2012.

## VI. COST TO SHIPPER OF USING NEW AND EXPANDED LOCKS AND DAMS VERSUS USING PROPERLY MAINTAINED CURRENT INFRASTRUCTURE

### CURRENT VERSUS EXPANDED OR NEW LOCK OPERATIONS

Many of the lock chambers in use today are of a less-than-optimal size. A length of 1200 ft is considered the standard, but many locks only have 600-ft or smaller chambers. A tow flotilla of 15 barges (almost 1200 ft in length) is considered the standard in the lock-controlled regions of the inland waterway system. Any flotilla larger than 8 barges has to be broken up and moved through a 600-ft chamber in two stages (cuts), causing the barge operator to incur additional expense and delays.

If new construction and upgrades are put on hold, the practice of breaking up tows to move them through a lock will continue indefinitely. The cost of continuing this practice must be weighed against the cost of the required capital investment to improve that infrastructure. Larger locks reduce lockage-transit time and facilitate safe movement of traffic. The shorter processing times also improve efficiency for the towing industry and reduce transportation costs. Even when subsequent lock passages require multiple cuts, eliminating the need for multiple cuts at even one lock provides immediate time and cost savings.

Because of the time spent in decoupling, moving, and recoupling barges, a two-cut lockage time takes triple the time of a one-cut time if industry self-help is not in place, and double the one-cut lockage time with industry self-help and the n-up/n-down lockage scheme.<sup>37</sup> Given all else is the same, a double cut increases lockage times by about 111%.<sup>38</sup> A real-life example is that breaking up and reassembling a tow once it gets through the lock takes two hours or longer vs. the 45 minutes needed to move 15 barges through Markland's main lock.

On the Upper Mississippi River, the existing lock facilities limit the capacity and efficiency of the system. All of the locks (except for Lock 19, Lock 26 (Melvin Price), and Lock 27) were constructed in the 1920s and 1930s, and were designed to accommodate smaller tows (only a fraction of the traffic that currently transits the system). Forty of the 43 lock chambers on the Upper Mississippi River are 600 ft long, while the prevailing 15-barge tow size has a length approaching 1200 ft long. As a result, longer tows must lock through using a process in which the first three rows of barges (9 total) are locked through first, and

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<sup>37</sup> In an N-up/N-down operation, a number of vessels going the same direction are locked, then the locking direction is reversed and several vessels are locked in the opposite direction.

<sup>38</sup> Wilson, Wesley W. *Vessel, Firm and Lock Efficiency Measures in Lock Performance* (Alexandria, VA: U.S. Army Corps of Engineers, November 14, 2005), 4. Available at <http://planning.usace.army.mil/toolbox/library/IWRServer/05-NETS-R-13.pdf> as of June 12, 2012.

the last two rows of barges (6 total) and the towboat are locked through second. The current two-step process takes approximately 1.5 to 2 hours. In contrast, a tow can lock through a 1200-ft lock in one step (e.g., Lock 19, Lock 27, and Melvin Price Lock) in approximately 0.5 to 1 hour.

The Upper Tennessee projects have some of the longest average processing times of all the locks in the Ohio River System. This is partly a function of the fleet (i.e., the predominance of jumbo barges) and the fact that these barges must lock one at a time; the size of tows on the Upper Tennessee segment; and the greater-than-normal lift at these projects. At Chickamauga Lock,<sup>39</sup> this procedure takes approximately one hour per barge. This time will vary depending on lock delays, river conditions, and towboat crew efficiency. For a 15-barge tow, the processing time may vary from a minimum of 13 hours to as much as 24 hours, according to lock personnel.

In addition to cost and time savings, larger locks provide greater throughput capacity. The capacity of a 110-ft-by-600-ft-long lock chamber is approximately 45 to 55 million tons per year. In contrast, a 110-ft-by-1200-ft-long chamber can process roughly 100 million tons per year. Currently, 30 to 35 million tons annually are locked at Locks 20 through 25 on the Upper Mississippi River representing 70 to 80% of their capacity. As locks approach their capacity however, delays can increase exponentially—not linearly.

The Corps has expended significant resources to study the possibility of extending existing locks or building new ones. There are two primary performance differences between lock extensions and new locks: the lock approach and the filling/emptying time. On the Upper Mississippi, overall time savings due to lock extensions (versus the existing locks) average 49 minutes, and 53 minutes due to new locks.

To put it in perspective, a barge trip between Minneapolis and St. Louis takes about 11.4 days, on average, including delays. In effect, the estimated average delays add about 2 days to what would otherwise be a 9-day trip.<sup>40</sup>

All Ohio River facilities are currently operating with two lock chambers—a main chamber to lock most tows and an auxiliary (usually smaller) chamber available to process recreation vessels or small tows that can lock through in a one lockage (one cut) operation and also to process all tows in case of closure of the main chamber.

On the Ohio River, a typical large jumbo hopper barge tow consists of 15 195'x 35' barges, plus a towboat of varying dimensions, resulting in a tow of about 1170'x105'. Occasionally, tows on the

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<sup>39</sup> The Chickamauga lock consists of a single chamber measuring 60'x360' (no auxiliary chamber).

<sup>40</sup> *Re-Evaluation of the Recommended Plan: UMR-IWW System Navigation Study, Interim Report* (Washington, DC: U.S. Army Corps of Engineers, March 2008), Chapter 2, p. 8. Available at <http://www2.mvr.usace.army.mil/UMRS/NESP/Documents/NESP%20Economic%20Revaluation%20Interim%20Report%20-%20Final%2020080324.pdf> as of June 12, 2012.

lowermost reaches of the Ohio (below Smithland L&D) operate in a double-wide configuration of 30 barges (5 long x 6 wide), which is typical of the larger tows on the lower Mississippi River. The maximum number of cuts allowed is a single cut through the main chamber and a double cut through the auxiliary chamber except for the upper three projects where, due to smaller size, double cut lockages are allowed through the main chamber and five-cut lockages through the auxiliary.

The three uppermost locks near Pittsburgh, Emsworth, Dashields, and Montgomery (EDM), each have a main chamber measuring only 110' x 600' and an auxiliary lock measuring 56' x 360'. They are the lowest capacity locks on the Ohio River. These small auxiliary chambers can only process one barge at a time. Further, there is a five-cut limit at these three projects during closures of the main chamber. Therefore, larger tows that would require a double lockage through the main chamber require processing in several cuts through the auxiliary. A double lockage through the main chamber at these projects normally takes 3 hours, which processes 15 barges. A five-cut lockage through the auxiliary chamber takes 4 to 5 hours and can only process up to 5 barges.

#### CALCULATION OF COST OF MULTIPLE CUTS

Because of the time required to reset the lock before the second (or subsequent) cut of a tow can pass through, the total time required for the second pass is greater than the processing time of the first pass. The Corps estimates that, given all else is the same, a double cut increases lockage time by about 111%.<sup>41</sup> In other words, the time penalty for processing two cuts instead of one is 1.11 times the processing time for one cut.

The cost of the extra time is reflected in additional towboat costs and barge costs. While towboats are usually considered a cost of operation by carriers, barges are often considered to be revenue generators. Therefore, under certain rate structures, an idle barge represents lost revenue; however, there is *always* a cost associated with operating a barge. Given that under some rate structures it would be difficult to assign lost revenue to a barge, this analysis uses the more conservative approach of using the operating cost for the barge.

The last publicly available data for towboat operating costs published by the Corps were released in November 2004 in *Economic Guidance Memorandum, 05-06, Shallow Draft Vessels Operating Costs, Fiscal Year 2004*. The costs are shown by horsepower category. A recent analysis of towboats used on the various river components reveals the average horsepower requirements for towboats.<sup>42</sup> The data can be summarized as shown in Table 17.

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<sup>41</sup> Wilson, op.cit., 4.

<sup>42</sup> Dager, Chrisman. University of Tennessee, Knoxville, Center for Transportation Research. Unpublished work.

**Table 17. Towboat Operating Costs.**

River	Mean HP (2001-11)	EGM Category	Unadjust Daily Non- Fuel Cost	Adjusted Daily Non- Fuel Cost	Daily Fuel Consumption (Gal)	Fuel Cost per Gallon	Daily Fuel Cost	Total Daily Cost	Hourly Cost
Alabama	1100	1200	2299	3037	514	3.3355	1714	4751	198
Allegheny	1300	1200	2299	3037	514	3.3355	1714	4751	198
Arkansas	2500	2200-2400	3159	4173	1153	3.3355	3846	8019	334
Black Warrior	1800	1800-2000	2845	3758	909	3.3355	3032	6790	283
Columbia	3000	2800-3400	3790	5006	1670	3.3355	5570	10576	441
Cumberland	2500	2200-2400	3159	4173	1153	3.3355	3846	8019	334
GIWW	1300	1200	2299	3037	514	3.3355	1714	4751	198
Illinois	2700	2800-3400	3790	5006	1670	3.3355	5570	10576	441
Kanawha	2300	2200-2400	3159	4173	1153	3.3355	3846	8019	334
Mississippi	3900	4000-4400	4663	6160	2434	3.3355	8119	14279	595
Monongahela	1700	1400-1600	2532	3345	678	3.3355	2261	5606	234
Ohio	2800	2800-3400	3790	5006	1670	3.3355	5570	10576	441
Red	1800	1800-2000	2845	3758	909	3.3355	3032	6790	283
Snake	3000	2800-3400	3790	5006	1670	3.3355	5570	10576	441
Tenn-Tom	2100	1800-2000	2845	3758	909	3.3355	3032	6790	283
Tennessee (Lower)	2600	2200-2400	3159	4173	1153	3.3355	3846	8019	334
Tennessee (Upper)	2000	1800-2000	2845	3758	909	3.3355	3032	6790	283
Tombigbee	1800	1800-2000	2845	3758	909	3.3355	3032	6790	283

As an example, the average horsepower found on the Illinois and Ohio Rivers can be used—the 2800–3400 hp category. The 2004 memorandum showed a non-fuel hourly cost for towboats in this category of \$158 (\$3790/24 hrs). The Inland Waterways Towing Transportation Producer Price Index can be used to adjust the 2004 data to 2011:  $746.25/564.925 \times \$158 = \$209/\text{hr}$ . The fuel cost is calculated assuming (1) the same consumption rate given in the Economic Guidance Memorandum, and (2) the use of ultra-low sulfur No. 2 diesel fuel (ULSD). The average price to end users for the ULSD fuel in 2011 was \$3.1355.<sup>43</sup> Since this price excludes taxes, the Inland Waterways Fuel Tax of \$0.20/gal must be added, for a total of \$3.3355/gal. With the consumption rate of 69.57 gal/hr given in the 2004 memo, the fuel cost per hour is \$232/hr. Therefore, the total hourly cost for a towboat at the end of 2011 was \$441/hr.

We can now take the towboat cost per hour times the processing time for a two-cut lockage versus a one-cut lockage and calculate the penalty for having to break a tow in two.

$$\$441/\text{hr} \times 1.11 \times \text{processing time for one cut} = \text{penalty for two-cut lockage}$$

On the Mississippi River, the processing time for a single lockage averaged 48.9 minutes during the period of 2008–2011. Therefore, the penalty for breaking a single tow into two lockages equates to \$399, which does not include any delay times encountered at the lock. In other words, it costs the towboat operator \$758 to use this lock when an adequately sized lock would have only cost \$359. This penalty would then need to be calculated for each lock traversed during the voyage and all penalties would need to be added together to determine the total cost of this inefficiency along a voyage.

Using average processing times for 2008–2011, Table 18 lists the cost penalties incurred for towboat operations per lock by major waterway for a two-cut versus a single-cut lockage:

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<sup>43</sup> *Refiner Petroleum Product Prices by Sales Type, Sales to End Users, No. 2 Diesel Fuel, Ultra Low Sulfur*. Available at [http://www.eia.gov/dnav/pet/pet\\_pri\\_refoth\\_dcu\\_nus\\_m.htm](http://www.eia.gov/dnav/pet/pet_pri_refoth_dcu_nus_m.htm) as of May 14, 2012.



**Table 18. Additional Towboat Costs, Double Cut, Per Lock.**

River	Horsepower Category	Adjusted Towboat Cost per Hour (\$)	Average Process Time (Hrs)	Additional Time for 2-Cut Lockage	Additional Towboat Cost per Lock (\$)
Allegheny	1200	198	0.53	0.59	117
Arkansas	2200-2400	334	0.87	0.97	324
Black Warrior	1800-2000	283	0.84	0.93	263
Columbia	2800-3400	441	0.76	0.84	370
Cumberland	2200-2400	334	0.93	1.04	347
GIWW	1200	198	0.62	0.69	137
Illinois	2800-3400	441	0.85	0.94	415
Kanawha	2200-2400	334	0.90	1.00	334
Mississippi	4000-4400	595	0.82	0.90	536
Monongahela	1400-1600	234	0.66	0.73	171
Ohio	2800-3400	441	0.89	0.98	432
Red	1800-2000	283	0.70	0.78	221
Snake	2800-3400	441	0.59	0.66	291
Tenn-Tom	1800-2000	283	0.84	0.93	263
Tennessee	2200-2400	334	0.98	1.09	364

Using a 15-barge tow as the standard, it is also possible to estimate a cost for the barges that are part of the broken tows. This analysis uses the 195' x 35' x 12' covered hopper barge as the standard.

Referring back to *Economic Guidance Memorandum 05-06*, the stated daily cost for a barge was \$107.98 without port costs. Restating this cost in 2011 dollars, the daily cost is  $746.25/564.925 \times \$107.98$  or \$142.64, which is rounded to \$143. Multiplied by 15, the average daily barge operating cost for the entire tow is \$2,145, which (on a 24-hr basis) is \$89/hr. Table 19 provides the additional barge operating cost by major river segment.

**Table 19. Additional 15-Barge Tow Cost, Double Cut, per Lock.**

<b>River</b>	<b>Average Process Time (Hrs)</b>	<b>Additional Time for 2-Cut Lockage (Hrs)</b>	<b>Additional 15-Barge Tow Cost per Lock (\$)</b>
Allegheny	0.53	0.59	53
Arkansas	0.87	0.97	86
Black Warrior	0.84	0.93	83
Columbia	0.76	0.84	75
Cumberland	0.93	1.04	93
GIWW	0.62	0.69	61
Illinois	0.85	0.94	84
Kanawha	0.90	1.00	89
Mississippi	0.82	0.90	80
Monongahela	0.66	0.73	65
Ohio	0.89	0.98	87
Red	0.70	0.78	69
Snake	0.59	0.66	59
Tenn-Tom	0.84	0.93	83
Tennessee	0.98	1.09	97

By combining these two tables, it is possible to estimate the effect that breaking a tow has on the cost of the lockage operation for the carrier. The costs range between \$169 and \$618 per lockage, as shown in Table 20. (These costs do not include the cost of delays that may occur if additional processing times cause queues to form at the locks.)

**Table 20. Total Additional Cost, Double Cut, Per Lock.**

River	Additional Towboat Cost per Lock (\$)	Additional 15-Barge Tow Cost per Lock (\$)	Total Cost of Breaking the Tow per Lock (\$)
Allegheny	116	53	169
Arkansas	324	86	410
Black Warrior	265	83	348
Columbia	370	75	445
Cumberland	346	93	439
GIWW	136	61	197
Illinois	414	84	498
Kanawha	335	89	424
Mississippi	538	80	618
Monongahela	171	65	236
Ohio	434	87	521
Red	220	69	289
Snake	289	59	348
Tenn-Tom	264	83	347
Tennessee	363	97	460

An example of a specific lock illustrates the magnitude of the additional cost for one year. In the year 2000, 83% of the flotillas that arrived at Upper Mississippi Lock 25 required a double cut.<sup>44</sup> (A 600-ft lock will accommodate, at most, 8 barges plus the towboat). In 2007, the last year before the economic crash, there were almost 2,900 lockages at Lock 27. Eighty-three percent of these lockages equates to 2,407 flotillas that passed through the lock in 2007. With 2,407 flotillas experiencing additional costs of \$618 each at the lock, the total cost to industry comes to almost \$1.5 million for the year. When this number is replicated at all locks that have a 600-ft length, the numbers become quite large.

Increasing the time it takes to move a flotilla through the lock also potentially adds to delay times at the lock. The calculation of second tier delay costs are beyond the scope of this study. However, industry rule of thumb is that each hour of second tier delay adds at least one multiple of the costs shown in column 3 of Table 20, and in some cases, each hour of this type of delay costs 1.5 times as much as the costs shown in the table.

Finally, certain locks are small enough that they require one lockage per barge. On the major rivers shown in the tables above, these locks include the locks on the Allegheny River, two locks on the Cumberland River, and the locks on the Upper Tennessee River. Rather than using the cost shown above for a “double cut” lockage, the cost shown in the table would need to be multiplied by the

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<sup>44</sup> Wesley Wilson, *Lock Performance: A Case Study of Firm Interdependence and Production with a Common Input* (Alexandria, VA: U.S. Army Corps of Engineers, February 19, 2012), 5. Available at <http://www.corpsnets.us/docs/lockperformance/LockPerformance.pdf> as of June 12, 2012.

number of barges in the fleet minus one (incremental cost for more than one cut). For these three river segments, the actual cost could be anywhere from 6 to 14 times higher than what is shown.

## VII. AMOUNT OF FUNDING DIRECTED EACH YEAR TOWARD LOCK AND DAM MAINTENANCE AND REPAIR OVER LAST 25 YEARS

Table 21 contains detailed data on Corps budgets and appropriations from 1994 through the FY 2013 budget request. The first set of numbers shows the actual amounts appropriated by Congress, with the exception of the amounts for 2012 and 2013, which reflect budget requests—the actual appropriations for these 2 years were not available at the time of writing this report. The second set of numbers shows the appropriated amounts after adjustment for inflation. The indices used to adjust the purchasing power of these appropriations were taken from the Corps' Engineering Manual (EM) 110-2-1304, *Civil Works Construction Cost Index System*.

**Table 21. Corps of Engineers Budget Authority, Net (total), \$ million—FY 1994–FY 2013.** <sup>45</sup>

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
<i>Unadjusted:</i>																				
<b>General Investigations</b>	183	171	122	153	157	161	165	166	154	134	116	144	204	171	167	193	166	122	125	102
<b>Construction</b>	1304	919	803	1086	1475	1466	1374	1736	1711	1743	1730	1818	3043	2419	3921	6915	2017	1612	1696	1472
<i>Locks and Dams</i>	338	247	118	101	142	101	160	222	194	145	141	153	218	235	205	222	231	105	101	95
<b>Operations and Maintenance</b>	1689	1644	1731	1866	1845	1753	1854	2049	2173	2105	2030	2371	2375	2052	3376	4403	2661	2461	2945	2398
<i>Locks and Dams</i>	356	349	346	344	346	402	396	406	387	391	395	410	289	382	440	640	472	481	376	330
<b>Total Unadjusted</b>	3,176	2,734	2,656	3,105	3,477	3,380	3,393	3,951	4,038	3,982	3,876	4,333	5,622	4,642	7,464	11,511	4,844	4,195	4,766	3,972
<i>Indexed:</i>																				
<b>General Investigations</b>	183	165	116	142	143	145	145	144	130	111	88	103	138	110	101	119	99	70	71	57
<b>Construction</b>	1,304	889	761	1,008	1,345	1,316	1,211	1,510	1,443	1,438	1,320	1,302	2,064	1,557	2,378	4,248	1,208	931	961	821
<i>Locks and Dams</i>	338	239	112	94	130	91	141	193	164	120	108	110	148	151	124	136	138	61	57	53
<b>Operations and Maintenance</b>	1,689	1,590	1,640	1,731	1,683	1,574	1,634	1,782	1,833	1,736	1,549	1,698	1,611	1,321	2,047	2,705	1,594	1,421	1,668	1,337
<i>Locks and Dams</i>	356	338	328	319	316	361	349	353	326	323	301	294	196	246	267	393	283	278	213	184
<b>Total Indexed</b>	3,176	2,644	2,516	2,881	3,172	3,034	2,991	3,437	3,406	3,285	2,957	3,103	3,813	2,988	4,526	7,072	2,902	2,423	2,700	2,214

<sup>45</sup> These amounts include funds appropriated from the Inland Waterways Trust Fund (in Construction) and the Harbor Maintenance Trust Fund (in Operations and Maintenance).

Figure 10, Figure 11, and Figure 12 provide a visual illustration of how these amounts have changed over time.

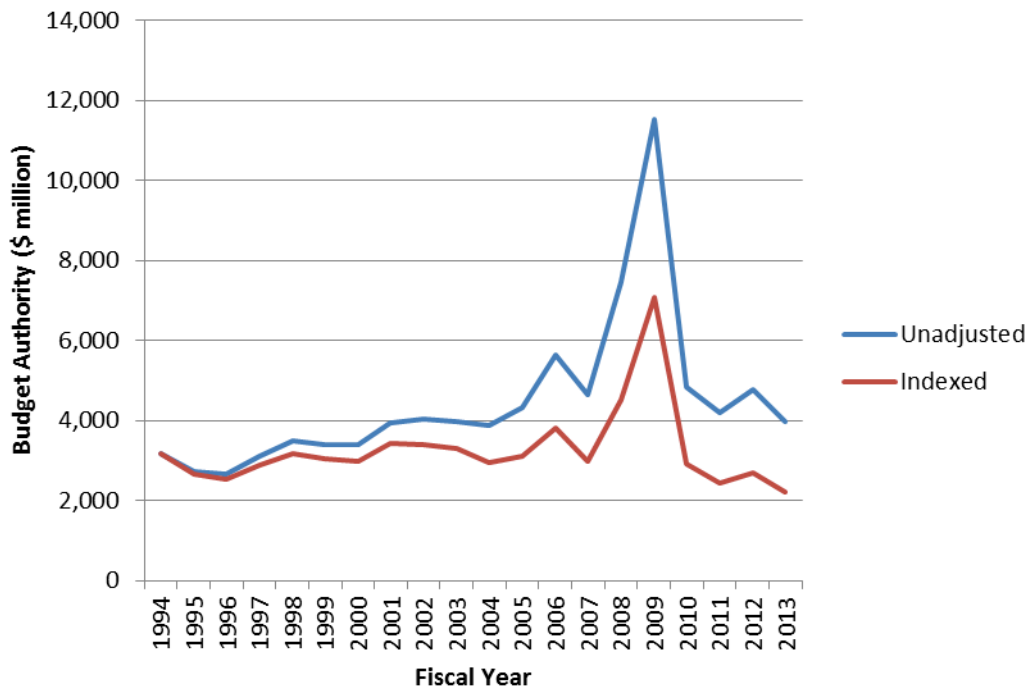
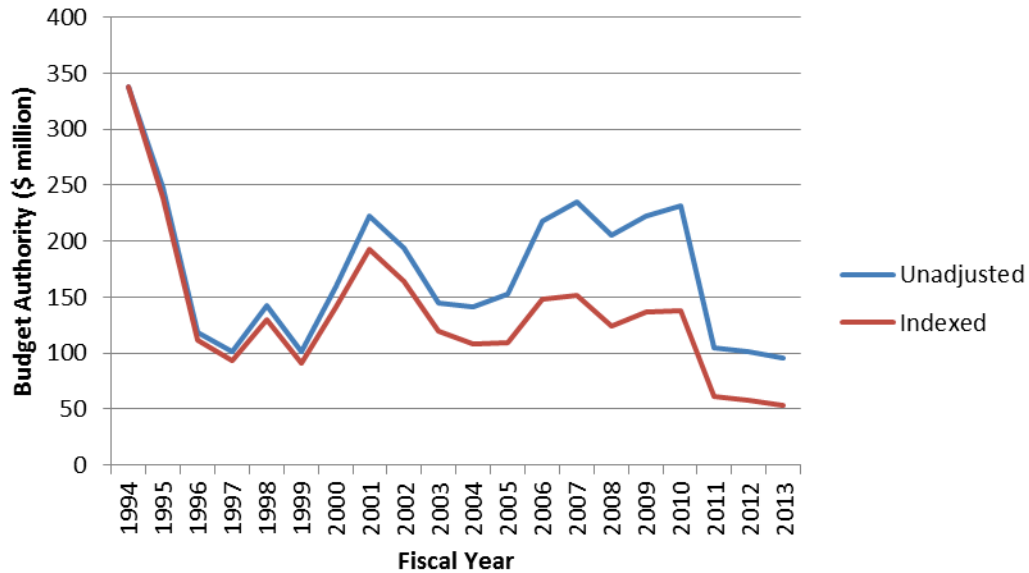
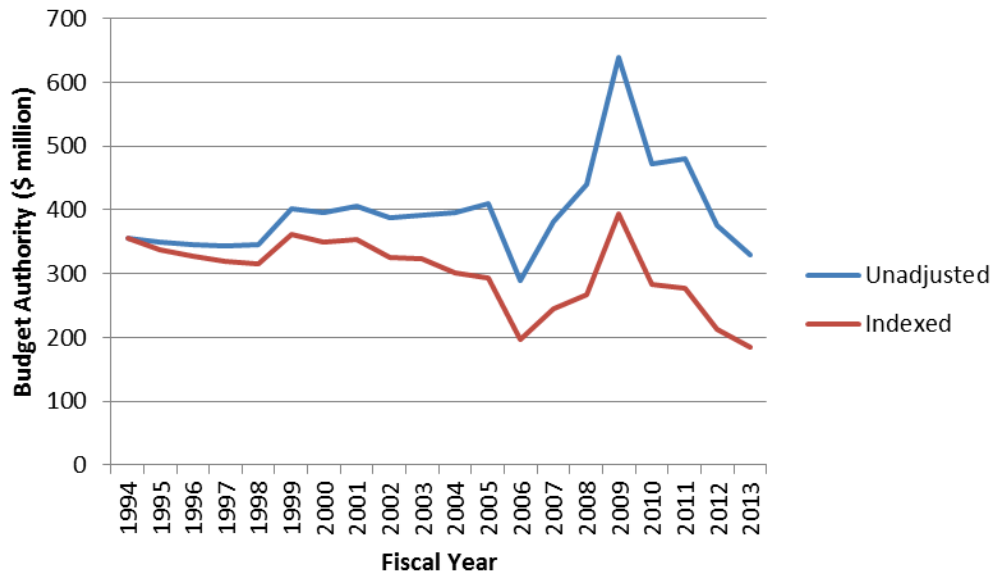


Figure 10. Corps of Engineers Total Budget Authority (Net)—FY 1994—FY 2013.



**Figure 11. Corps of Engineers Budget Authority—L&D Construction—FY 1994—FY 2013.**



**Figure 12. Corps of Engineers Budget Authority—L&D O&M—FY 1994—FY 2013.**

The spike in years 2009 and 2010 in the last chart reflects the infusion of funding resulting from (1) the American Recovery and Reinvestment Act of 2009, and (2) the decision by Congress to spend the entire balance of the Inland Waterways Trust Fund. After indexing, the spike is a very modest spike compared



to the previous high points in the 1994–1998 timeframe and essentially cancels out the dip that occurred in 2005–2006.

## OBJECTIVE 2: EXPLORE THE VALUE AND POTENTIAL OF TRANSITIONING FROM THE U.S. GOVERNMENT’S CURRENT FUNDING APPROACH TO A BONDING STYLE (LUMP SUM UP FRONT) APPROACH

### I. TRANSITIONING FROM “PAY-AS-YOU-GO” TO “BONDING STYLE” APPROACH

In some instances, transportation projects are either so large or capital-intensive that their costs exceed available current revenue streams. Many stakeholder groups within the maritime community have expressed interest in a debt finance approach for such projects. They argue that revenues from traditional “pay-as-you-go” sources such as the Inland Waterways Trust Fund (IWTF) and general appropriations have been inadequate to fund the nation’s lock and dam infrastructure.

Much of the lock and dam infrastructure in the U.S. is steadily deteriorating—with insufficient revenues to continue maintenance and construction of those facilities.<sup>46</sup> As a result, there has been a recent push toward examining the possibility of shifting to a “bonding style” approach to funding lock and dam infrastructure. Therefore, the goal of Objective 2 is to examine the possibility of incorporating debt-based project financing tools to help improve funding for lock and dam transportation infrastructure.

### DEFINING THE BONDING STYLE APPROACH

A bonding style approach is a form of debt finance. According to the Federal Highway Administration (FHWA), debt finance is referred to as “borrowing money to pay for a transportation project, typically through a bond.”<sup>47</sup> Debt finance is typically used in cases where a pay-as-you-go does not make good planning and programming sense. For the purpose of this report, the bonding style approach is defined as using debt financing methods, including but not limited to bonds, to fund and finance transportation infrastructure.

Bonding is often used when the initial capital required to fund the construction of a transportation infrastructure project exceeds the available funding from current revenue streams. When bonds are issued, they allow a quick, immediate influx of cash in the form of bond proceeds. Similar to a

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<sup>46</sup> Stern, Charles. *Inland Waterways: Recent Proposals and Issues for Congress*, (Washington, DC: Congressional Research Service, Apr. 12, 2012.) Available at <http://www.fas.org/sgp/crs/misc/R41430.pdf> as of Jun. 19, 2012.

<sup>47</sup> *Project Finance Primer*, Federal Highway Administration Office of Innovative Program Delivery, 2010, 7. Available at <http://www.fhwa.dot.gov/ipd/pdfs/finance/ProjectFinancePrimerREV4.pdf> as of June 19, 2012.

homeowner taking out a home loan, a transportation authority can then can make principal and interest payments over a longer period of time and reduce the annual cost to an affordable amount.<sup>48</sup>

## BENEFITS OF BONDING STYLE APPROACH FOR U.S. LOCK AND DAM INFRASTRUCTURE

There are several benefits a bonding style approach could bring to funding and financing the development of the U.S. lock and dam infrastructure.

1. It can facilitate capital flow to transportation projects from various classes of investors.
2. While bond financing imposes interest and other costs related to issuing debt, bringing a project to construction more quickly can sometimes offset these costs. (Conversely, delaying the completion of a project means benefits are not being realized.)
3. A debt finance (or “bonding style”) strategy could provide asset management benefits, such as prolonging asset life because proper maintenance and rehabilitation work can be undertaken when needed as well as providing flexibility to focus resources on activities critical to sustained performance.<sup>49</sup>

In sum, a judiciously managed debt finance program allows future revenues to be brought into present use, accelerates economic, safety, and congestion benefits, and provides opportunities for economies of scale, while avoiding potential inflation costs. With an up-front infusion of cash provided through debt finance mechanisms, reconstruction and rehabilitative maintenance of lock facilities can be accomplished when needed and lock closures can be minimized, resulting in reduced waterway congestion due to mechanical or structural failures.

## TYPES OF BONDING TOOLS

There are two major types of bonds available to help finance the nation’s transportation infrastructure: corporate bonds and government bonds. With corporate bonds, the private sector can access capital markets by issuing debt securities (i.e., debt that may or may not be backed by collateral). These bonds are usually taxable for federal income tax purposes, and generally have a higher interest yield than government issued bonds. Private debt usually carries higher interest rates compared with municipal tax-free bond structures and is generally at higher risk for default. As a result, corporate bondholders are compensated for this higher risk by receiving a higher yield than government bondholders receive.<sup>50</sup>

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<sup>48</sup> *Project Finance Primer*, Federal Highway Administration Office of Innovative Program Delivery, 2010, 9. Available at <http://www.fhwa.dot.gov/ipd/pdfs/finance/ProjectFinancePrimerREV4.pdf> as of June 19, 2012.

<sup>49</sup> McElroy, Regina. *Delivering Transportation Services: Innovative Financing, Revenue Generation, and Procurement Strategies*. (Washington, DC: Federal Highway Administration, May 10, 2012). Available at [http://www.fhwa.dot.gov/publications/research/general/utc/2012webinar/crosscutting/05102012\\_crosscutting.pdf](http://www.fhwa.dot.gov/publications/research/general/utc/2012webinar/crosscutting/05102012_crosscutting.pdf) as of June 19, 2012.

One tax-exempt example of corporate bonds used to help finance construction of transportation infrastructure is Private Activity Bonds (PABs). These bonds can allow private investors to access the tax-exempt capital markets and borrow at lower interest rates.<sup>51</sup>

Government bonds (e.g., municipal bonds) are issued by the public sector to finance the capital costs of public facilities. There are two major types of government bonds. General obligation bonds (GO bonds) are backed by the full faith and credit of a state or local government. These bonds are usually backed by the credit and “taxing power” of the issuing jurisdiction rather than the revenue from a given project. General obligation bonds are issued with the belief that a municipality or government agency will be able to repay its debt obligation through taxation and general revenue, generally with no assets used as collateral. While lock and dam infrastructure is mostly funded with a combination of federal appropriations and direct user fees, other maritime infrastructure investment (e.g., ports) can be (and often is) financed and built relatively quickly through GO bonds serviced by tax revenues and backed by the issuing government entity.<sup>52</sup> Revenue bonds, on the other hand, are backed by a specific revenue source, such as a dedicated tax or tolls. Generally, revenue bonds are used to finance transportation projects that generate revenue, such as toll roads. Usually, the bond yield is higher than that of a general obligation bond due to greater risk.<sup>53</sup>

Table 22 helps illustrate the advantages and disadvantages of general obligation bonds and revenue bonds.

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<sup>51</sup> Internal Revenue Service, *Tax Exempt Private Activity Bonds Compliance Guide*, 2012. Available at <http://www.irs.gov/pub/irs-pdf/p4078.pdf> as of June 19, 2012.

<sup>52</sup> *Port Investment and Finance*, U.S. Department of Transportation Maritime Administration. Available at [http://www.marad.dot.gov/ports\\_landing\\_page/infra\\_dev\\_congestion\\_mitigation/port\\_finance/Port\\_Fin\\_Home.htm](http://www.marad.dot.gov/ports_landing_page/infra_dev_congestion_mitigation/port_finance/Port_Fin_Home.htm) as of June 19, 2012.

<sup>53</sup> *Transportation Funding and Financing: An Explanation*, American Association of State Highway and Transportation Officials. Available at [http://www.transportation-finance.org/funding\\_financing/financing/bonding\\_debt\\_instruments/municipal\\_public\\_bond\\_issues/revenue\\_bonds.aspx](http://www.transportation-finance.org/funding_financing/financing/bonding_debt_instruments/municipal_public_bond_issues/revenue_bonds.aspx) as of June 19, 2012.

**Table 22. Advantages and Limitations of Revenue Bonds and General Obligation (GO).<sup>54</sup>**

<b>Advantages</b>	<b>Limitations</b>
<b>General Obligation Bonds</b>	
<ul style="list-style-type: none"> <li>• Less complex</li> <li>• Lower issuance costs</li> <li>• Lower interest costs. Because these are backed by the full faith and credit of the issuer, they represent a low risk to investors.</li> <li>• Do not require a cash reserve</li> <li>• Can be used to support projects with low or no revenue potential</li> </ul>	<ul style="list-style-type: none"> <li>• Require voter approval; therefore, project is in risk of possible insufficient funding if bonds are not approved by popular vote</li> <li>• Issuing government is obligated to raise taxes to pay off bonds if anticipated revenue sources do not materialize</li> </ul>
<b>Revenue Bonds</b>	
<ul style="list-style-type: none"> <li>• Debt secured by dedicated revenue source</li> <li>• If revenues fall short, government entity has no obligation to cover debt with general funds</li> <li>• Generally, beneficiaries pay for debt as either user fees or dedicated taxes paid by the general population, such as sales or other taxes</li> </ul>	<ul style="list-style-type: none"> <li>• High requirements for cash needed to service debt (otherwise known as minimum debt service coverage ratio limits) may limit bonding capacity of dedicated revenue<sup>55</sup></li> <li>• Issuance costs higher because of the more complex nature of bonds</li> <li>• Because bond payment relies on sufficient project revenue, interest rates are higher to reflect higher risk to investors</li> </ul>

<sup>54</sup> Chart adapted from <http://www.fhwa.dot.gov/ipd/pdfs/finance/ProjectFinancePrimerREV4.pdf>, p.10

<sup>55</sup> A “debt coverage ratio” is the required ratio of income to scheduled principal and interest payments.

## II. BONDING STYLE APPROACH: 3 POSSIBLE SCENARIOS

In explaining how a bonding style approach would work, the researchers selected three possible bonding scenarios. These scenarios are intended to illustrate both how such an approach would function and possible revenue potential. Bond calculations were generated by data provided by the U.S. Treasury. IWTF revenue, consisting of fuel taxes collected, are estimated for years 2012 through 2016 in the March 2012 Treasury Bulletin produced by the U.S. Government Printing Office. Future years were increased based on the annual percent increase shown in years 2012 to 2016.

### BONDING STYLE SCENARIO #1: BOND AGAINST EXISTING IWTF REVENUE

The first approach calls for issuing bonds against the full Inland Waterways Trust Fund (IWTF) annual receipts. (For reference, the latest estimates are that approximately \$95 million will be collected from the 20-cent per gallon inland waterway fuel tax and remitted to the IWTF in 2013.) Using the entire IWTF revenue stream to make annual bond payments for the next 30 years, the bond estimates for this scenario are shown in Table 23.

**Table 23. Total Revenue from Bonding against Entire Current IWTF Revenue Stream.**

Bond Issuance Year	Amount Financed (\$ millions)	Annual Debt Service Amount (\$ millions)	Payment Years
<b>3% Interest Rate</b>			
2012	\$1,377	70	2012-2041
2014	\$300	15	2014-2043
2016	\$87	4	2016-2045
2018	\$63	3	2018-2047
2020	\$61	3	2020-2049
<b>4% Interest Rate</b>			
2012	\$1,200	70	2012-2041
2014	\$265	15	2014-2043
2016	\$77	4	2016-2045
2018	\$56	3	2018-2047
2020	\$54	3	2020-2049
<b>5% Interest Rate</b>			
2012	\$1,080	70	2012-2041
2014	\$235	15	2014-2043
2016	\$68	4	2016-2045
2018	\$53	3	2018-2047
2020	\$48	3	2020-2049

The estimates for bonds issued after the first year are based on the amount of IWTF funds projected for the year in question that are not already dedicated to debt service. Under this approach, an assumed interest rate of 3% would yield an estimated \$1.3 billion the first year. If additional bonds were to be issued in later years against the remaining IWTF balance, the residual revenue stream is estimated to support an additional \$300 million in bonds in 2014, \$87 million in bonds in 2016, \$63 million in bonds in 2018, and \$61 million in bonds in 2020. Overall, it is estimated that the IWTF revenue stream would be able to support a total of \$1.8 billion in lump-sum payments for lock and dam projects over the next 8 years. As shown in the table, the total amounts financed are slightly less for higher interest rate bonds.

For this analysis, a debt-coverage ratio (i.e., ratio of revenue stream income from the IWTF to the total debt service requirements) of 1.2 and a 2% issuance cost were used. The amortization period is 30 years.

#### **BONDING STYLE SCENARIO #2: RAISE INLAND WATERWAY FUEL TAX BY 4 CENTS AND BOND AGAINST ENTIRE NEW REVENUE STREAM (BASE PLUS INCREASE)**

As indicated earlier in this report, there are indications of industry stakeholder support for an increase in the tax currently levied on diesel fuel used in commercial transportation on inland waterways. These tax receipts are deposited in the IWTF, which helps fund half the cost of new construction and major rehabilitation lock and dam projects. This scenario calls for increasing the 20 cents-per-gallon tax by 20% (4 cents) to a total of 24 cents per gallon and using the entire fuel tax revenue stream (base plus new increment) to make annual bond payments. Under this scenario, researchers estimated the financing arrangement shown in Table 24.

**Table 24. Revenue from Bonding against Entire IWTF Revenue Stream with 4-cent Gas Tax Increase.**

Bond Issuance Year	Amount Financed (\$ millions)	Annual Debt Service Amount (\$ millions)	Payment Years
<b>3% Interest Rate</b>			
2012	1,652	84	2012-2041
2014	360	18	2014-2043
2016	104	5	2016-2045
2018	76	4	2018-2047
2020	73	4	2020-2049
<b>4% Interest Rate</b>			
2012	1,400	84	2012-2041
2014	318	18	2014-2043
2016	92	5	2016-2045
2018	67	4	2018-2047
2020	64	4	2020-2049
<b>5% Interest Rate</b>			
2012	1,295	84	2012-2041
2014	283	18	2014-2043
2016	82	5	2016-2045
2018	60	4	2018-2047
2020	57	4	2020-2049

Under this approach, an assumed interest rate of 3% would yield an estimated \$1.6 billion the first year. If additional bonds were to be issued in later years against the remaining IWTF balance, the residual revenue stream is estimated to support an additional \$360 million in bonds in 2014, \$104 million in bonds in 2016, \$76 million in bonds in 2018, and \$73 million in bonds in 2020. Overall, it is estimated that this IWTF revenue stream would be able to support a total of \$2.3 billion in lump-sum payments for lock and dam projects over the next 8 years. As shown above, the total amounts financed are slightly less for bonds with higher interest rates.

For this analysis, a debt-coverage ratio (i.e., ratio of revenue stream income from the IWTF to total debt service requirements) of 1.2 and a 2% issuance cost were used. The amortization period is 30 years.

**BONDING STYLE SCENARIO #3: RAISE INLAND WATERWAY FUEL TAX BY 4 CENTS AND BOND ONLY AGAINST THE INCREASE**

Since bonding against the full IWTF revenue stream may be perceived as too risky, a third bonding approach scenario was examined. This scenario assumes increasing the tax currently levied on diesel fuel used in commercial transportation on inland waterways by 20% (4 cents) and using only the increase to make annual bond payments. Table 25 illustrates this estimated financing arrangement.



**Table 25. Revenue from Bonding against Increased Revenue from 4-cent Gas Tax Increase Only.**

<b>Bond Issuance Year</b>	<b>Amount Financed (\$ millions)</b>	<b>Annual Debt Service Amount (\$ millions)</b>	<b>Payment Years</b>
<b>3% Interest Rate</b>			
2012	275	14	2012-2041
2014	60	3	2014-2043
2016	17	0.8	2016-2045
2018	13	0.6	2018-2047
2020	12	0.6	2020-2049
<b>4% Interest Rate</b>			
2012	243	14	2012-2041
2014	53	3	2014-2043
2016	15	0.8	2016-2045
2018	11	0.6	2018-2047
2020	11	0.6	2020-2049
<b>5% Interest Rate</b>			
2012	216	14	2012-2041
2014	47	3	2014-2043
2016	14	0.8	2016-2045
2018	10	0.6	2018-2047
2020	9	0.6	2020-2049

Under this approach, an assumed interest rate of 3% would yield an estimated \$275 million the first year. If additional bonds were to be issued in later years against the remaining IWTF balance, the residual revenue stream is estimated to support an additional \$60 million in bond revenue in 2014, \$17 million in bond revenue in 2016, \$13 million in bond revenue in 2018, and \$12 million in bond revenue in 2020. Overall, it is estimated that this IWTF revenue stream would be able to support a total of \$377 million in lump-sum payments for lock and dam projects over the next 8 years. As shown above, the total amounts financed are slightly less for bonds with higher interest rates.

For this analysis, a debt-coverage ratio (i.e., ratio of revenue stream income from IWTF divided by total debt service requirements) of 1.2 and a 2% issuance cost were used. The amortization period is 30 years.

### III. LOCK AND DAM PROJECT UNDER CURRENT APPROACH VS. LOCK AND DAM UNDER BONDING STYLE APPROACH: MCALPINE LOCKS AND DAM PROJECT CASE STUDY

#### MCALPINE LOCKS AND DAM: INSUFFICIENT FUNDING, COST, AND SCHEDULE OVERRUNS

In its annual letter to Congress in 2009, the Inland Waterways Users Board noted that “project completion delays result (at least in part) from a Federal budgeting and appropriations model that provides funding in...insufficient increments rather than a more reliable multi-year funding mechanism” that would provide the certainty needed to efficiently contract and built these large capital projects. “In the not-too-distant past,” the letter from the IWUB to Congress noted, “projects (such as those authorized by the Water Resources Development Act of 1986, P.L. 99-662) were completed within an average of 6.3 years and with an average increase of 32.5% in authorized costs; compared to the present day projects under construction whose authorized amounts have more than doubled and require more than 17 years to complete.” For the past 10 years, the IWUB has repeatedly highlighted cost and schedule overruns among most federally funded inland waterways.<sup>56</sup>

One of this was the construction of the 1,200-ft McAlpine Locks and Dam project. The project’s initial cost was estimated at \$268 million and included the demolition of two old locks and the construction of a new 1200-ft lock. The construction phase of the project began in 1996; actual construction began with the dam portion of the project in 2000.<sup>57</sup> (Final design and contracting consumed the first few years.)

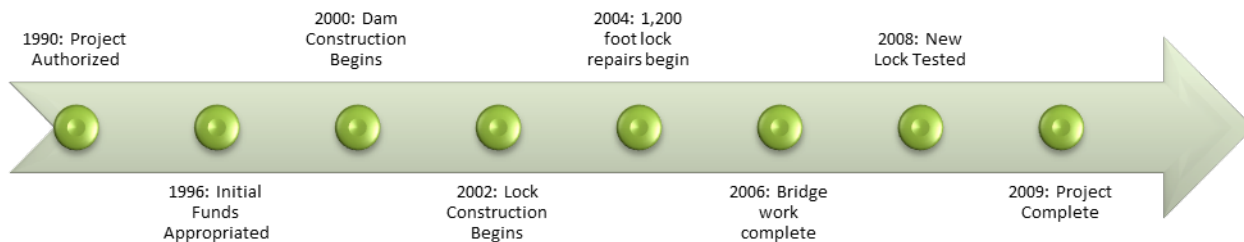
Cost overruns, design changes, and funding availability were constant challenges faced during the entire 13-year construction schedule for this project. What makes McAlpine unique is that an identical lock and dam project (adjacent to the recent McAlpine Lock project) took only three years to build in 1961. The significant difference in construction times is partially due to project delays that result from the way funding is currently disbursed—on an annual basis instead of on a full upfront or multiyear funding basis.<sup>58</sup> As shown in Figure 13 below, the project spanned a total of 13 years from initial funding to completion.

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<sup>56</sup> Inland Waterway Users Board, *23<sup>rd</sup> Annual Report to the Secretary of the Army and the U.S. Congress*, Aug. 2009. Available at [http://www.waterwaysusers.us/Annual\\_Report\\_23.pdf](http://www.waterwaysusers.us/Annual_Report_23.pdf) as of June 21, 2012.

<sup>57</sup> *Civil Works Project Facts Sheet: McAlpine Locks Replacement Project, McAlpine Locks and Dam, Kentucky and Indiana*. (U.S. Army Corps of Engineers, June 15, 2009.) Available at <https://155.80.93.240/congress/usace/reports.asp?tp=8&projid=10358> as of June 19, 2012.

<sup>58</sup> IMTS Capital Investment Strategy Team, *Inland Marine Transportation Systems (IMTS) Capital Projects Business Model* (Washington, DC: U.S. Army Corps of Engineers, April 13, 2010), 25. Available at [http://www.waterwayscouncil.org/WCIExtras/IMTS\\_IWUB\\_Report.pdf](http://www.waterwayscouncil.org/WCIExtras/IMTS_IWUB_Report.pdf) as of June 12, 2012.



**Figure 13. McAlpine Project Timeline: Project Authorization to Project Completion.**<sup>59</sup>

Extended construction times typically lead to inflation, design changes, omissions, re-estimates, and changing site conditions during construction.<sup>60</sup> Due to the duration of the McAlpine project, the overall cost of the project increased by 38% to a total cost of \$430 million<sup>61</sup> (of which \$212.9M came from the Inland Waterways Trust Fund). See Appendix C for a detailed year-by-year history of the McAlpine Locks and Dam project.

#### MCALPINE PROJECT UNDER BONDING STYLE SCENARIO

If the McAlpine Locks and Dam project were to be built under a bonding style scenario, there could be several important benefits to all waterway system stakeholders. First, a bonding approach would allow projects to be built with full project funding capability. *Full funding capability* is defined as the amount of funds that can be obligated effectively and efficiently on a project in a fiscal year, consistent with law and policy. “Capability” and “Amount That Could Be Used” are identical. Since bonds allow for needed capital to be provided up-front, a project can be built by its original design specifications and not based on available funding.

For most fiscal year funding cycles, the McAlpine Locks and Dam Rehabilitation project did not receive the full year funding capability limit. As shown Table 26, the McAlpine project was appropriated on average 61% of full capability funding levels, with only 5 of fiscal years where data were available receiving more than 50% of full funding capability.

<sup>59</sup> US Army Corps of Engineers; Louisville District

<sup>60</sup> Inland Waterways Users Board, *24<sup>th</sup> Annual Report*. Available at [http://www.waterwaysusers.us/Annual\\_Report\\_FY10.pdf](http://www.waterwaysusers.us/Annual_Report_FY10.pdf) as of June 19, 2012.

<sup>61</sup> Waterways Council, Inc. *McAlpine Locks and Dams*, Available at <http://www.waterwayscouncil.org/WWSYSTEM/FACT%20SHEETS/McAlpine.pdf> as of June 19, 2012.

**Table 26. Corps Estimated Full Year Capability Funding vs. Actual Appropriations, McAlpine Lock Project.**

Fiscal Year	Corps Estimated Fiscal Year Full Capability Funding (\$ millions)	General Appropriations Received	Percent of General Appropriations Full Capability Funding
FY 1999	N/A	1.0	
FY 2000	N/A	2.8	
FY 2001	20	14.0	70.0%
FY 2002	24	13.6	56.7%
FY 2003	30	6.19	20.6%
FY 2004	70	26.1	37.3%
FY 2005	120	58.0	48.3%
FY 2006	80	60.9	76.1%
FY 2007	87	70.0	80.5%
FY 2008	45	45.0	100.0%
FY 2009	N/A	N/A	
		<b>AVERAGE:</b>	<b>61.2%</b>

A bonding style approach (i.e., 100% of funding for a project provided up front) would likely have resulted in significant reductions in the construction time for the McAlpine project. Given the estimated remaining cost going into FY 2001, the data in the above table suggest that had the project been funded each year at full capability funding levels, the project could possibly have been completed in FY 2005, rather than FY 2009 (assuming no adjustments to the cost estimate were necessitated by design changes). This is four years sooner than what actually occurred in the construction of the McAlpine Lock project. The available data begin with FY 2001, but the construction phase officially began in FY 1996. If the same ratio of time savings is applied to the first 5 years, another 2.7 years could possibly have been taken off the actual duration of the construction project. Altogether, the data indicate that 6 ½ years might have been saved had the project been fully funded up front or at full capability each year (a completion date sometime in 2002 versus early 2009).

**Table 27. Actual McAlpine Project Duration vs. Possible Project Duration under Bonding Style Approach.**

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
McAlpine Actual Project Length														
Possible Project Length Under Bonding Approach														

In addition to providing possible schedule savings, it is also likely that McAlpine project costs could have been constrained if a majority of the funding were provided on an up-front cash basis. While it is difficult to calculate precisely how much in cost savings would result from a bonding approach, the IWUB claimed that as much as \$136 million could have been saved on the McAlpine project if full funding were provided up-front.<sup>62</sup>

Finally, a bond style approach would also lead to improved freight flows and less risk of closure to shippers. Throughout the course of the construction period, there were several instances where waterway travel was severely compromised due to emergency repairs to the structure being replaced. For example, in 2004, severe cracking of key structural components was found in the miter gates during a routine inspection. As a result, the river was shut down for 12 days in August 2004 for emergency repairs. Allowing the McAlpine Lock project to be constructed under a bonding style approach could have meant that the construction schedule would have been reduced, which would have reduced the time during which traffic relied on the older structure and therefore would have reduced the risk of an interruption in service.

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<sup>62</sup> Inland Waterways Users Board, 23<sup>rd</sup> Annual Report to Congress, Aug. 2009. Available at [http://www.waterwaysusers.us/Annual\\_Report\\_23.pdf](http://www.waterwaysusers.us/Annual_Report_23.pdf) as of June 21, 2012.

#### IV. FUNDING AND FINANCING OF LOCK AND DAM INFRASTRUCTURE: U.S. VS. FOREIGN APPROACHES

The United States funds lock and dam infrastructure very differently than other countries fund theirs. For this research effort, two foreign case studies were chosen: the Panama Canal and the Belgium Deurganck Lock project. Both of these projects are currently under construction. The Panama Canal expansion is estimated to cost \$5.25 billion USD over the course of the seven-year project. With financing assistance from five international credit sources, the project should wrap up in late 2014 and the canal should be available for commercial use in 2015. Deurganck Lock is part of the greater Port of Antwerp expansion in Belgium, which is being financed by both the European Investment Bank (EIB) and KBC Bank. At the end of the 5-year, \$460 million USD project, Deurganck Lock will be the largest lock in the world. While the U.S. funds its lock and dam infrastructure through general revenues and taxes currently levied on diesel fuel used in commercial transportation on inland waterways, the Panama Canal Authority (ACP) and Antwerp Port Authority fund their infrastructure primarily through a toll approach. Table 28 summarizes contrasting elements between U.S. and foreign examples.

**Table 28. Comparison of U.S. Funding Approach to Foreign Examples.**

<b>Analysis Component</b>	<b>United States</b>	<b>Panama Canal</b>	<b>Antwerp</b>
<b>Funding Level</b>	20-cent gas tax based on diesel fuel, matched by federal appropriations	Rate varies based on vessel type and cargo volume (toll)	Charge fixed fees in addition to tonnage dues
<b>Funding Mechanism</b>	Inland Waterways Trust Fund (through tax on diesel fuel) and federal appropriations	Toll rates based on lockage use	Toll rates based on lockage use
<b>How is payment made?</b>	Shippers—through federal motor fuels tax	Shippers- through toll bill	Shippers- through toll bill
<b>Enforcement</b>	Shippers pay when purchasing fuel	Invoiced	Invoiced
<b>Finance Mechanisms Available?</b>	No	Yes. Eligible for loans from the European Investment Bank, Japan Bank for International Cooperation, Inter-American Development Bank, & International Finance Corporation.	Yes. The Deurganck Lock is eligible for loans from the European Investment Bank and the KBC Bank.

**FOREIGN CASE STUDY OF INTEREST: PANAMA CANAL**

The Panama Canal expansion project began construction in September of 2007, with an estimated completion date in 2014. The project includes a deepening of the Pacific and Atlantic channels, the deepening and widening of the navigation channel for Gatun Lake, an increase in the maximum

operating level of Gatun Lake, construction of a new access channel for Pacific Locks, and the construction of new and larger locks for the Pacific and Atlantic channels.<sup>63</sup>

Figure 14 is a map depicting liner services through the Panama Canal.

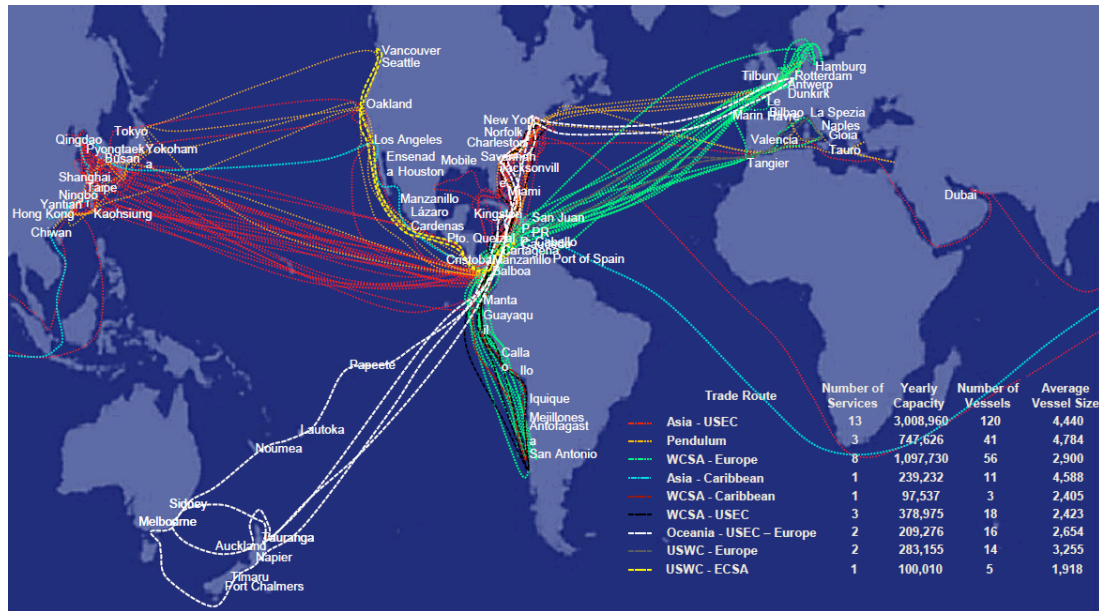


Figure 14. Liner Services through the Panama Canal.<sup>64</sup>

The expansion project will increase the vessel size that can transit the canal (ships with a carrying capacity of up to 12,000 TEU),<sup>65</sup> while reducing water consumption and increasing revenues via toll collections. The increased capacity will accommodate ships that have the capability of carrying 7,000 more TEUs per vessel. These “Post-Panamax” ships are estimated to represent 97% of new vessel orders as of 2011.<sup>66</sup>

<sup>63</sup> Sabonge, Rodolfo. *The Panama Canal Expansion: Potential Impact*. Institute for Trade and Transportation Studies, Presentation: Mar. 15, 2012 Available at <http://www.ittsresearch.org/2012conf/Presentations/SABONGE-LUNCH-ittsnorfolk1.pdf> as of June 19, 2012.

<sup>64</sup> Sabonge, Rodolfo. *The Panama Canal: Potential Impact*, slide 21, 2011. Available at <http://www.ittsresearch.org/2012conf/Presentations/SABONGE-LUNCH-ittsnorfolk1.pdf> as of June 19, 2012.

<sup>65</sup> Twenty-foot Equivalent Units, the standard unit of measure in the containerized shipping industry.

<sup>66</sup> Robinson, John *Potential Impact of Panama Canal Expansion on U.S. Cotton (Presentation)*, Texas A&M University. Available at <http://cnas.tamu.edu/SAEA%202012%20Panama%20Canal%20Exports%20Presentation%20Robinson.pdf> as of June 19, 2012.



Figure 15 is an artist's rendering of the new Pacific-side Locks.<sup>67</sup>



**Figure 15. Panama Canal Model of Pacific-Side Locks.**

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#### CONSTRUCTION SCHEDULE AND SOURCE OF FUNDS

Currently the Panama Canal Expansion is set to open for a trial run in December 2014, just slightly behind its original completion date of October 2014. The new construction schedule submitted in April 2012 indicates that the project as a whole is around 6 months behind schedule due to some issues with the concrete. While the locks will be ready for vessels in December, other ancillary construction such as parking lots will not be complete until April 2015.<sup>68</sup> Figure 16 shows the Gantt chart of the major project components as of September 2011.

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<sup>67</sup> Digital Construction, *BIM and the 21<sup>st</sup> Century Panama Canal*, Available at [http://www.constructiondigital.com/under\\_construction/bim-and-the-21st-century-panama-canal](http://www.constructiondigital.com/under_construction/bim-and-the-21st-century-panama-canal) as of June 19, 2012.

<sup>68</sup> Caribbean Shipping Association, *Panama Canal Construction Schedule*, April 4, 2012. Available at <http://www.landmarine.org/cm/index.php/latest-issue-1/46-latest-issue/no-16-may-2012-port-and-terminals/90-grapevine-panama-canal-expansion-delay> as of June 19, 2012.



Figure 16. Project Schedule as of September 30, 2011.<sup>69</sup>

The project is estimated to cost \$5.25 billion. Approximately \$2.95 billion was self-financed through increased tolls. An additional \$2.3 billion of external financing was arranged to cover peak construction activities between 2009 and 2011. This financing was arranged through the EIB, the Japan Bank for International Cooperation (JBIC), the Inter-American Development Bank (IDB), the International Finance Corporation (IFC), and the Corporación Andina de Fomento (CAF).<sup>70</sup>

#### FINANCING SOURCES AND TOOLS USED

Table 29 lists five major sources used to leverage the capital necessary for funding the Panama Canal Expansion Project. Please refer to Appendix B for more detail on financing methods.

<sup>69</sup> Wilford & McKay, S.A. *The Panama Canal Expansion Process*, 2012. Available at [http://www.wilfordmckay.com/index.php?option=com\\_content&view=article&id=139&Itemid=156](http://www.wilfordmckay.com/index.php?option=com_content&view=article&id=139&Itemid=156) as of Jun. 19, 2012.

<sup>70</sup> Sabonge, Rodolfo. *The Panama Canal Expansion: Potential Impact*. Institute for Trade and Transportation Studies, Presentation: Mar. 15, 2012 Available at <http://www.ittsresearch.org/2012conf/Presentations/SABONGE-LUNCH-ittsnorfolk1.pdf> as of June 19, 2012.

**Table 29. Sources of Financing Available to the Panama Canal Project.**

Source of Funding	Description	Amount contributed to Panama Canal Expansion Project	Available in the U.S.?
European Investment Bank (EIB)	Public long-term lending institution established in 1958, under the Treaty of Rome. Owned and operated by the member states of the European Union. <sup>71</sup>	\$500 million	No
Japan Bank for International Cooperation (JBIC)	Policy-based lending institution owned by the Japanese government. Its goal is to promote development both inside and outside of Japan in order to maintain the international competitiveness of Japanese manufacturing, prevent the disruption of the international economy, and promote environmentally beneficial projects. <sup>72</sup>	\$800 million	Yes

<sup>71</sup> European Investment Bank, *About the EIB*. Available at <http://www.eib.org/about/index.htm> as of June 19, 2012.

<sup>72</sup> Japan Bank for International Cooperation (JBIC), *Profile*. Available at <http://www.jbic.go.jp/en/about/role-function/pdf/jbic-brochure-english.pdf> as of June 19, 2012.

Source of Funding	Description	Amount contributed to Panama Canal Expansion Project	Available in the U.S.?
Inter-American Development Bank (IDB)	The Inter-American Development Bank (IDB) invests in sustainable development projects in Latin America and the Caribbean, but does not extend loans to the United States. <sup>73</sup>	\$400 million	No
Corporación Andina de Fomento	Corporación Andina de Fomento (CAF) is a development bank consisting of 18 countries in Latin America, the Caribbean, and Europe. The CAF supports sustainable development through grants, credit operations, technical support, and financing of public and private sector projects in Latin America. The CAF does not finance projects in United States. <sup>74</sup>	\$300 million	No

<sup>73</sup> Inter-American Development Bank, *About Us*. Available at <http://www.iadb.org/en/about-us/about-the-inter-american-development-bank,5995.html> as of June 19, 2012.

<sup>74</sup> Development Bank of Latin America, *What is CAF and What is its Mission?* Available at <http://www.caf.com/view/index.asp?ms=19&pageMs=61928> as of June 19, 2012.

Source of Funding	Description	Amount contributed to Panama Canal Expansion Project	Available in the U.S.?
International Financing Corporation (IFC)	The International Finance Corporation (IFC) is a subsidiary of the World Bank. It invests in small to medium enterprises, micro-financing, trade, climate change, and other development projects.	\$300 million	No

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#### REVENUE STREAM SOURCES

ACP reached a common terms agreement with the five companies listed above, with terms for a 10-year grace period followed by a 20-year amortization period.<sup>75</sup> The loans will be serviced via the revenue collected from canal activities including:

- Tolls.
- Tug services.
- Handling lines.
- Locomotives.
- Special admeasurement services.
- Transit reservation system.
- Pilotage.
- Channel fee.
- Transiting vessel inspection service.
- Security charge for transiting vessels.
- Rental charge for portable Automatic Identification System (AIS) unit.
- Inspections and/or escort service for noncompliance.
- Inspection service to verify information regarding on-deck containers.

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<sup>75</sup> Ordons News, "Financing deal for Panama Canal Expansion Signed," Dec. 24, 2008. Available at <http://www.ordons.com/americas/central-america-and-caribbean/162-financing-deal-for-panama-canal-expansion-signed.html> as of June 19, 2012.

- Chemist inspection services.
- Sanitary inspection service.
- Moorage and anchorage.
- Shifting berth and wharfage.
- Salvage service.
- Disembarkment and embarkment at locks.
- Shuttle advisor service for small craft.
- Public relation services.
- Subsistence furnished to employees aboard vessels.
- Vessels and information service.
- Service related to availability of resources for the program of response and cleanup of oil spills.
- Launch service.<sup>76</sup>

Since 1914, tolls have been steadily rising to reflect the economic value of the canal and have been adjusted to maintain competitiveness and account for inflation over time.<sup>77</sup> From 1914 until 2002, tolls on ships passing through the canal were charged by measuring water displacement and vessel classification (laden or ballast). Table 30 shows the changes in the toll up to 2002.

**Table 30. Panama Canal Toll Changes, 1914–2002.**

Time Period	Laden	% Change	Ballast	% Change	Displacement	% Change
1914 - 1938	\$1.20		\$0.72		\$0.50	
1938 - 1974	\$0.90	-25%	\$0.72	0%	\$0.50	0%
1974 - 1976	\$1.08	20%	\$0.86	19%	\$0.60	20%
1976 - 1979	\$1.29	19%	\$1.03	20%	\$0.72	20%
1979 - 1983	\$1.67	29%	\$1.33	29%	\$0.93	29%
1983 - 1989	\$1.83	10%	\$1.46	10%	\$1.02	10%
1989 - 1992	\$2.01	10%	\$1.60	10%	\$1.12	10%
1992 - 1997	\$2.21	10%	\$1.76	10%	\$1.23	10%
1997 - 1998	\$2.39	8%	\$1.90	8%	\$1.33	8%
1998 - 2002	\$2.57	8%	\$2.04	7%	\$1.43	8%

In 2002, the toll structure for the Panama Canal was revised from a one-size-fits-all toll to a graduated toll system based on whether a vessel is carrying cargo (laden) or empty (ballast), water displacement per ton, cargo type, and the number of TEU. Table 31 illustrates the toll structure as of 2002, using the

<sup>76</sup> Canal de Panama, *Marine Tariff* (updated May 1, 2012). Available at <http://www.panacanal.com/eng/op/tariff/index.html> as of June 19, 2012.

<sup>77</sup> Panama Canal Authority, Panama Canal Tolls. Available at <http://www.panacanal.com/peajes/pdf/proposal2012.pdf> as of June 19, 2012.

Panama Canal/ Universal Measurement System (PC/UMS), a modified version of the net tonnage formula that calculates a vessel's total volume. A single PC/UMS is equal to 100 cubic feet of capacity.<sup>78</sup>

In 2007, the tolls were further refined to include laden and ballast cargo status, changes in toll prices based on the vessel and cargo type, water displacement, and tonnage (the rate for each segment is calculated as a flat rate fee for the first 10,000 tons, a second flat rate fee for the next 10,000, and a third flat rate fee for the remainder). Passenger ships were given a flat toll per berth rate plus displacement charges. See Table 31 below for more information on modifications to the current toll structure.

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<sup>78</sup> <http://www.pancanal.com/eng/maritime/tolls.html>

**Table 31. Modification of the Regulations for the Admeasurement of Vessels and the Tolls System, 2007–2009 (in US Dollars).**

Market Segment		2007			2008			2009			2010			2011			2012			2013									
		Effective 1st of			Effective 1st of			Effective 1st of			Effective 1st of			Effective 1st of			Effective 1st of			Effective 1st of									
TEU Toll																													
Full Containers	Laden Ballast	May	54.00		May	63.00		May	72.00			49.00			49.00			49.00			49.00			49.00					
			43.20			50.40			57.60			39.20			39.20			39.20			39.20			39.20					
On-Deck Container Toll In Other Vessels	Laden	May	54.00		May	63.00		May	72.00			49.00			49.00			49.00			49.00			49.00					
Toll Per Berth																													
Passenger Vessels	Laden Ballast	October	100.00		October	115.00		October	120.00			N/A			N/A			N/A				N/A			N/A				
Tolls Per PC/UMS Ton																													
		Effective 1st of	1st 10K	2nd 10K	Rest	Effective 1st of	1st 10K	2nd 10K	Rest	Effective 1st of	1st 10K	2nd 10K	Rest	Effective 1st of	1st 10K	2nd 10K	Rest	Effective 1st of	1st 10K	2nd 10K	Rest	Effective 1st of	1st 10K	2nd 10K	Rest				
General Cargo	Laden Ballast	July	3.26	3.19	3.14	May	3.63	3.56	3.50	May	3.90	3.82	3.76		2.96	2.90	2.85		4.41	4.32	4.25	July	4.74	4.64	4.57	July	5.10	4.99	4.91
			2.59	2.53	2.49			2.88	2.82		2.77		3.10		3.03	2.98			2.35	2.30	2.26			3.53	3.46		3.40		3.79
Refrigerated Cargo	Laden Ballast	October	3.39	3.32	3.26	October	3.80	3.72	3.65	October	3.80	3.72	3.65		2.96	2.90	2.85		x	x	x		x	x	x		x	x	x
			2.69	2.63	2.59			3.01	2.95		2.90		3.01		2.95	2.90			2.35	2.30	2.26			x	x		x		x
Dry Bulk	Laden Ballast	July	3.20	3.13	3.08	May	3.50	3.43	3.37	May	3.73	3.65	3.59		2.96	2.90	2.85		4.38	4.23	4.16	July	4.71	4.55	4.47	July	5.06	4.89	4.81
			2.54	2.48	2.44			2.78	2.72		2.67		2.96		2.90	2.85			2.35	2.30	2.26			3.50	3.38		3.33		3.76
Tankers	Laden Ballast	July	3.29	3.22	3.16	May	3.70	3.63	3.57	May	3.90	3.92	3.85		2.96	2.90	2.85		4.46	4.39	4.31	July	4.68	4.61	4.53	July	4.92	4.84	4.75
			2.61	2.55	2.51			2.94	2.88		2.83		3.18		3.11	3.05			2.35	2.30	2.26			3.57	3.51		3.45		3.75
Vehicle Carriers	Laden Ballast	July	3.24	3.18	3.12	May	3.60	3.52	3.46	May	3.87	3.79	3.72		2.96	2.90	2.85		4.33	4.24	4.17	July	4.40	4.31	4.24	July	x	x	x
			2.57	2.52	2.47			2.86	2.80		2.75		3.07		3.01	2.95			2.35	2.30	2.26			3.46	3.39		3.34		3.52
Passenger Vessels	Laden Ballast	October	3.39	3.32	3.26	October	3.80	3.72	3.65	October	3.95	3.87	3.80		2.96	2.90	2.85		x	x	x		x	x	x		x	x	x
			2.69	2.63	2.59			3.01	2.95		2.90		3.14		3.07	3.02			2.35	2.30	2.26			x	x		x		x
Others	Laden Ballast	July	3.32	3.25	3.19	May	3.78	3.70	3.64	May	4.12	4.04	3.97		2.96	2.90	2.85		4.61	4.52	4.45	July	4.96	4.86	4.78	July	5.33	5.22	5.14
			2.63	2.58	2.53			3.00	2.94		2.89		3.27		3.20	3.15			2.35	2.30	2.26			3.69	3.62		3.56		3.97
Container/ Break Bulk	Laden Ballast		x	x	x		x	x	x		x	x	x		x	x	x		4.61	4.52	4.45	July	4.96	4.86	4.78	July	5.33	5.22	5.14
			x	x	x		x	x	x		x	x	x		x	x	x		3.69	3.62	3.56			3.97	3.89		3.83		4.27
Chemical Tanker	Laden Ballast		x	x	x		x	x	x		x	x	x		x	x	x		4.46	4.39	4.31	July	4.82	4.74	4.65	July	5.06	4.98	4.89
			x	x	x		x	x	x		x	x	x		x	x	x		3.57	3.51	3.45			3.86	3.79		3.73		4.05
LPG	Laden Ballast		x	x	x		x	x	x		x	x	x		x	x	x		4.46	4.39	4.31	July	4.75	4.68	4.59	July	4.99	4.91	4.82
			x	x	x		x	x	x		x	x	x		x	x	x		3.57	3.51	3.45			3.84	3.77		3.71		4.07
Toll Per Displacement Ton																													
Displacement		July	1.64		May	2.09		May	2.28			1.64			3.02			July	3.25			July	3.49						



ACP approved a proposal early in 2012 that will increase tolls and create a new structure for classifying vessel types by market segments, expanding the number of segments from 8 to 11. These will include full container, reefer, dry bulk, passenger, vehicle carrier, ro-ro, tanker, chemical tanker, LPG, general cargo, and others. The rate for each segment is calculated as a flat rate fee for the first 10,000 tons, a second flat rate fee for the next 10,000, and a third flat rate fee for the remainder. Beginning in July 2012, a 15% toll increase (spread over two years) will be implemented on general cargo, containers, dry bulk, tankers, chemical tankers, and others. Car carriers and ro-ro vessels will experience a rate increase of 1.6–1.7%. Small vessels will be charged by length on a four-tier price scale, with rate increases ranging from 60–113%. The rate per ton of displacement will also increase for all vessels by 15.5% in July, and a further 7.5% in the following year, bringing the rate to \$3.49.<sup>79</sup>

#### FOREIGN CASE STUDY OF INTEREST: PORT OF ANTWERP

The Belgian port of Antwerp stands at the upper end of the tidal estuary of the Scheldt. It is a key gateway for shipments to a range of countries including France and Germany.<sup>80</sup> Antwerp is Europe's second largest container port, handling 6.5 million 20-ft TEU, up 3.1% from the same period in 2010. Total cargo volume rose 7.5% to 142 million metric tons in the first three quarters of 2011.<sup>81</sup> In October 2010, the port approved a long-term investment plan worth \$2 billion USD over the next 15 years.<sup>82</sup> The project includes the development of the Verrebroek dock, the Saeftinghe Development Area, construction of the Deurganck Lock on the left bank, dock renovation, modifications to the Waasland Canal and dock, as well as various equipment and land purchases. The project will allow the inland Belgian port to keep pace with the increasing size of containerships and boost its competitive position in the Le Havre-Hamburg port range.<sup>83</sup> Figure 17 shows the layout of these various components.<sup>84</sup>

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<sup>79</sup> Panama Canal Authority, *Panama Canal Authority Announces Toll Increases*, April 21, 2012. Available at <http://www.panama-guide.com/article.php/20120421063143306> as of June 19, 2012.

<sup>80</sup> Business Monitor Online. 2011. *Antwerp Port Renovates Van Cauwelaert Lock*. July 4, 2011. Available at [http://www.businessmonitor.com/cgi-bin/request.pl?view=articleviewer&article=489970&SessionID=26E3A5EEB0B911E186F523017B297F78&iso=BE&keyword=Antwerp Port Renovates Van Cauwelaert Lock&service=11](http://www.businessmonitor.com/cgi-bin/request.pl?view=articleviewer&article=489970&SessionID=26E3A5EEB0B911E186F523017B297F78&iso=BE&keyword=Antwerp+Port+Renovates+Van+Cauwelaert+Lock&service=11) as of June 7, 2012.

<sup>81</sup> Barnard, Bruce. 2011. *Antwerp Builds Major Lock to Handle Larger Ships*. *Journal of Commerce Online*. November 22, 2011. Available at <http://www.joc.com/portterminals/antwerp-builds-major-lock-handle-larger-ships> as of June 7, 2012.

<sup>82</sup> Antwerp Port Authority. 2010. *Antwerp Port Authority Invests 1.6 Billion Euros*. Available at <http://www.prnewswire.com/news-releases/antwerp-port-authority-invests-16-billion-euros-104424638.html> as of June 7, 2012.

<sup>83</sup> *Ibid.*

<sup>84</sup> Deurganckdoksluis, *Project*, 2012. Available at <http://www.alfaforwarding.be/location.htm> as of June 19, 2012.



**Figure 17. Aerial View of the Port of Antwerp.**

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## CONSTRUCTION SCHEDULE

In 2011, Belgium began construction on the new Deurganck Lock in Antwerp, at a cost of \$460 million. This construction follows the deepening of the Scheldt River, which enables Antwerp to more easily handle the largest container ships that previously could only reach the port at high tide. The design of the new lock is based on that of the Berendrecht Lock, which currently holds the title of the biggest lock in the world. The Deurganck Lock will measure 1,640 ft long and 223 ft wide. The new lock—at 58 ft below the local datum level—will be deeper than the Berendrecht Lock and thus rank as the biggest lock in the world when it opens in 2016.<sup>85</sup>

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<sup>85</sup> Maritime Journal, 'World's longest lock' underway in Antwerp, Nov. 24, 2011. Available at <http://www.maritimejournal.com/features101/marine-civils/port,-harbour-and-marine-construction/worlds-largest-lock-underway-in-antwerp> as of June 19, 2012.

Contractors started the preparatory work on the site in October 2011. The site was cleared and topographical measurements were made. Excavation work is currently being carried out and is expected to last until the summer of 2014. Following the completion of the excavation work, contractors will be engaged in concreting while simultaneously assembling the steel structures. Work on building the lock itself will commence in autumn 2013 and is due to be completed in spring 2015. The final dredging work is scheduled for late 2014 until the end of 2015, with the opening date occurring early in 2016.<sup>86</sup> It will be difficult to ascertain whether the project is truly on schedule until the first major phase—excavation—is complete. Table 32 lists the major project phases.

**Table 32. Project Phases for Deurganck Lock.**

Phases	Project Dates
Start of the Construction Process	10/24/2011
Erection of a Water Screen	12/2011 – 5/2012
Trench Excavation	4/2012 – 4/2014
Concreting	9/2012 – 3/2015
Metal Construction	2/2012 – 3/2016
Construction of Lock Building	11/2013 – 10/2015
Dredging	2/2015 – 2/2016
Completion of the Construction Process	3/2016

## FUNDING AND FINANCING

### FINANCING SOURCES AND TOOLS USED

The Deurganck Lock is being financed by the EIB, which will pay for half of the overall construction cost for the project. Belgium’s KBC Bank will supply \$110 million to the project, and the remaining balance will come from the Antwerp Port Authority.<sup>87</sup> Over the past five years, the EIB has provided more than \$6.25 billion for infrastructure in the sector of maritime transport and inland waterways in both the EU and in developing countries abroad.

### REVENUE STREAM SOURCES

<sup>86</sup> Ibid

<sup>87</sup> Port of Antwerp, *Work Starts on the second lock on port of Antwerp’s Left*, November 21, 2011. Available at <http://www.portofantwerp.com/en/news/work-starts-second-lock-port-antwerp%E2%80%99s-left> as of June 19, 2012.

The Port of Antwerp charges a fixed fee for each vessel calling at the port in addition to tonnage dues assessed on each ship.<sup>88</sup> All logistic and transport services in the Port of Antwerp are rendered by private companies. These companies work in a very competitive environment where rates are negotiable between the service provider and each individual customer. Because of this system, rates are easily adapted to the quantity, the frequency, and the nature of the cargo. In 2008, the port froze dues and concession fees, allowing them to remain at that level until early 2012, when dues were raised by 2%.<sup>89</sup> The Port of Antwerp's profit in 2010 was \$102 million USD.<sup>90</sup>

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<sup>88</sup> Ibid p.10

<sup>89</sup> Port of Antwerp, *Antwerp port dues will not be fully index-linked*, November 21, 2011. Available at <http://www.portofantwerp.com/en/news/antwerp-port-dues-will-not-be-fully-index-linked> as of June 19, 2012.

<sup>90</sup> Port of Antwerp, Financial Report: 2008, 2009, and 2010 Income Statement. Available at <http://annualreport2010.portofantwerp.com/en/page/132/income-statement> as of June 19, 2012.

## V. PROJECTED COSTS/COMPLETION DATES AND ACTUAL COST/COMPLETION DATES: U.S. VS. FOREIGN CASE STUDIES

The following table compares the costs and completion dates of the McAlpine project versus foreign projects.

**Table 33. Estimated Project Costs and Completion Dates vs. Actual Costs and Completion Dates—McAlpine, Panama, and Deurganck Case Studies.**

Project	Start Year	Estimated Completion Year	Actual Completion Year	Estimated Cost (in million USD)	Actual Cost (in million USD)
McAlpine <sup>91</sup>	1996	2002 <sup>92</sup>	2009	\$268 <sup>93</sup>	\$430
Panama Canal <sup>94</sup>	2007	2014	2015*	\$5,250	-
Deurganck Lock, Antwerp <sup>95</sup>	2011	2016	N/A	\$460	N/A

\*new estimated completion year

Table 34 is a copy of Table 7 presented earlier in this report. It recaps the project duration and the change in project cost for all projects cost-shared from the Inland Waterways Trust Fund (as of March 2010).

<sup>91</sup> *Civil Works Project Facts Sheet: McAlpine Locks Replacement Project, McAlpine Locks and Dam, Kentucky and Indiana.* (U.S. Army Corps of Engineers, June 15, 2009.) Available at <https://155.80.93.240/congress/usace/reports.asp?tp=8&projid=10358> as of June 19, 2012.

<sup>92</sup> Little, Stephen D. *Statement on behalf of Waterways Council, Inc. before the Subcommittee on Water Resources and Environment, Committee on Public Works and Transportation, U.S. House of Representatives*, April 30, 2008. Available at [http://media.maritime-executive.com/newsletter/archives/old/pdf/steve\\_little\\_statement\\_with\\_links.pdf](http://media.maritime-executive.com/newsletter/archives/old/pdf/steve_little_statement_with_links.pdf) as of June 25, 2012.

<sup>93</sup> Business First, *Fighting the Current: McAlpine Locks and Dam Project Progressing Despite Budget Uncertainty*, Jul. 22, 2002. Available at <http://www.bizjournals.com/louisville/stories/2002/07/22/story3.html?page=all> as of June 19, 2012.

<sup>94</sup> Caribbean Maritime, Caribbean Shipping Association. *Panama Canal Construction Schedule Issued*, April 4, 2012. Available at <http://www.landmarine.org/cm/index.php/latest-issue-1/46-latest-issue/no-16-may-2012-port-and-terminals/90-grapevine-panama-canal-expansion-delay> as of June 19, 2012.

<sup>95</sup> Maritime Journal, *'World's longest lock' underway in Antwerp*, Nov. 24, 2011. Available at <http://www.maritimejournal.com/features101/marine-civils/port,-harbour-and-marine-construction/worlds-largest-lock-underway-in-antwerp> as of June 19, 2012.

**Table 34. Completed Projects Cost-Shared from the Inland Waterways Trust Fund  
(as of March 2010).**

<b>Project</b>	<b>Start Year</b>	<b>Completion Year</b>	<b>Original Total Cost \$ (Million)</b>	<b>Adjusted Total Cost \$ (Million)</b>
<b>Major Rehabilitation</b>				
Upper Miss 13 Rehab	1993	1996	20.7	34.6
Upper Miss 15 Rehab	1993	1996	19.6	32.8
Brazos Locks Rehab	1994	1995	9.0	15.4
Upper Miss 25 Rehab	1994	2000	25.9	40.3
Upper Miss 3 Rehab	1998	2009	71.2	77.2
Upper Miss 12 Rehab	2000	2003	14.7	21.4
Upper Miss 11 Rehab	2002	2008	47.3	50.6
Upper Miss 19 Rehab	2003	2008	31.6	33.8
Upper Miss 27 Rehab	2007	2011	37.3	38.0
Upper Miss 14 Rehab	1996	2000	20.0	31.1
Upper Miss 24 Rehab	1996	N/A <sup>2</sup>	N/A	
Lockport Rehab	2006	2012 <sup>3</sup>	136.8	136.8
<b>Total</b>			434.1	<b>512.0</b>
<b>Average</b>			39.5	<b>46.5</b>
<b>Lock New Construction</b>				
Bonneville New Chamber	1987	1994	341.0	602.0
Price Auxiliary 600' Chamber	1987	1993	212.6	387.0
RC Byrd New 1,200' and 600' chambers	1987	1993	383.5	698.0
Point Marion New Chamber	1989	1994	113.1	199.7
Winfield New Chamber	1989	1997	236.3	387.1
Marmet New Chamber	1998	2009	405.8	440.1
London Rehab & Lock Extension	2000	2003	22.9	33.3
McAlpine 1,200' Auxiliary	1996	2009	429.3	465.6
<b>Total</b>				<b>3212.8</b>
<b>Average</b>				<b>401.6</b>
<b>All Other</b>				
Illinois Waterway (4 Rehabs)	1993	1996	27.2	45.5
Oliver Replacement L&D	1987	1991	123.3	235.3
Grays Landing Replacement Lock	1988	1993	178.0 <sup>4</sup>	324.1
Grays Landing Dam	1993	1995	<sup>4</sup>	
Sargent Beach Protective Barrier	1994	1999	52.8	83.7

There is a notable difference with respect to schedules and budgets between the foreign projects and the U.S. projects. The Panama Canal expansion is scheduled to be completed within budget and just slightly behind the original schedule. The ACP has achieved this success in part because of how the project was financed. The ACP took advantage of access to four international lending facilities that provided an immediate influx of cash from various investors,

bringing the project to completion more quickly than could otherwise be realized. ACP will, in turn, use enhanced toll revenue to service the debt on the capital investment required to accelerate construction. These, and other, factors help explain why the Panama Canal can be completed so much faster than projects in the U.S. To be able to construct a project of this magnitude in the United States would require a completely different funding paradigm than is currently in place. Given the current rate of collections for the IWTF, it would likely take over 30 years to build such a project—assuming the IWTF and matching federal appropriations were spent only on the one project! Although it is an extreme example, if the Panama Canal were funded and constructed at the same rate as the McAlpine Lock project in the U.S. (a \$430 million project overall), it would likely take over 150 years to construct. An examination of the Deurganck Lock project results in similar observations.

## APPENDIX A: STAKEHOLDER POSITIONS BY TOPIC

### LEVEL OF FUNDING FOR THE CORPS OF ENGINEERS

Coosa-Alabama River Association: We most certainly think the Corps is being shortchanged in receiving the funds necessary to maintain our nation's waterways. We support the positions of virtually every waterway advocacy group in the nation which is pushing for sufficient federal funds for a critical component of our transportation infrastructure.

Illinois Corn Growers Association (ICGA): ICGA feels the Corps is inadequately funded to meet the needs of 21st century agriculture production. Give or take, the Corps Civil Works budget for the past 10 years has been relatively flat. In today's deficit reduction environment this might be construed as a good thing; however, during this period, the Corps has been asked to absorb post-9/11 homeland security requirements, ever increasing environmental mitigation procedures, and sometimes unjustified litigation related to their projects. With that said, their budget has actually gone down. The only exception to this was they received around \$4 billion in stimulus funding in 2008. The Inland Waterway Trust Fund (the industry matching account for new construction and major rehab projects) peaked in 2000 with a surplus of over \$400 million dollars. Since then we have been successful in getting Congress to spend these funds for their intended purpose, but the needs have grown with the aging system and now far outweigh the income and matching appropriations from the general treasury. The only cases ICGA has seen in recent years in which the Corps has received adequate funding have been due to natural disasters; i.e., Hurricane Katrina, flooding, and complete mechanical failures. In most of these instances, the Corps was given clear guidance and funding and was able to complete projects on time and within budget.

Kentucky Corn Growers Association: The level of funding is inadequate for the amount of investment that is necessary to keep our waterways infrastructure in proper working order. The Corps' funding by way of the Inland Waterways Trust Fund should be increased.

Ouachita River Valley Association: The possibility of state and other federal agencies being involved from a cost sharing perspective should be explored. The states of Louisiana and Arkansas and the U.S. Fish and Wildlife Service benefit from the project and possibly could share in the overall operational and maintenance costs.

Red River Valley Association: The Corps' funding level is too low and continues to be reduced in actual appropriation levels and effective worth by maintaining level funding. They require at least



\$6 billion to maintain current project Operations and Maintenance (O&M) and have a modest construction program.

Tennessee River Valley Association (TRVA): Funding levels for Corps projects are not sufficient for the Civil Works Program. Currently O&M, Flood Reduction and other critical programs are straining under current budget constraints. If IWTF reforms are successful, i.e., removing or changing the cost sharing for Olmsted, the Corps will likely be forced to further rob from Peter to pay Paul. This could potentially have long-term adverse implications on critical O&M funding. That said, TRVA strongly supports the recent Senate E&W Appropriation Bill that changes the cost sharing for Olmsted to 75% federal and 25% IWTF and would encourage additional Corps funding for the remainder of the Civil Works Program.

Tennessee-Tombigbee Waterway Development Authority: Obviously, the level of funding for the Corps is not adequate. Congress and the Administration should ensure that infrastructure is maintained to avoid more expensive repairs later.

Upper Mississippi Waterway Association (UMWA): Funding uncertainty associated with projects that span several election cycles often results in unnecessary project delays and cost escalation. While an adequate budget for authorized Corps projects is fundamental to the construction process, the continuation of that funding is most critical. UMWA supports the concept of a continuing contract clause that protects the prerogative of both Congress and the Administration while not causing unnecessary project delays and cost escalation. One approach proffered by the Inland Marine Transportation System is to fully fund all contracts up to \$50 million while allowing contracts greater than that amount to include an agreed-upon continuing contract clause.

Waterways Council, Inc. (WCI): WCI believes that the proper level of funding is \$380 million per year for the next 20 years for construction and major rehabilitation projects on the inland waterways navigation system.

## PROJECT PRIORITIZATION SCHEME USED BY THE CORPS

Coosa-Alabama River Association: We do not support the current method used by the Corps to prioritize funding for project. Certainly, tonnage is important and the major waterways should have a high priority, but the smaller tributaries are just as important to the regional or local economy in which they are located. To require an inland waterway to produce one billion ton-miles to even meet the minimum threshold to warrant funds eliminates most of the small tributaries. There is no way the Alabama River, for example, at 315 river miles long, is ever likely to meet those criteria. New criteria, perhaps factoring in regional benefits of a waterway, versus just national benefits, should be considered, or it may take a new approach to federal-state-private partnerships even though theoretically Congress has the responsibility for interstate commerce.

Illinois Corn Growers Association: The Corps has more models and studies than any other group. The phase “paralysis by analysis” is a good term to use in regards to Corps projects. We as stakeholders have fought the methodology behind these models for years only to see politics take precedence over common sense that exists at the Corps district level. We now see scarce funding sprinkled over too many projects leading to extended timelines and cost overruns. A widely supported plan called the “Capital Development Plan,” crafted by industry and the key Corps officials, is now making its way around Capitol Hill. Two key components of this plan include prioritization of projects and up to a 45% increase in the barge fuel tax; however, this plan has yet to receive support from the administration.

Kentucky Corn Growers Association: Lock and Dam projects consistently and drastically exceed time and cost projections (more so than projects in other types of transportation infrastructure). This is unnecessary and unacceptable. Delinquency is due to the current prioritization scheme in place. This frustrates us. The [Inland Waterways] Users Board should be given more authority in prioritization strategy. They will do a better job in identifying and applying funding to projects in a manner that ensures that modernization efforts are streamlined and protected from politics.

Ouachita River Valley Association: It seems as if we have put ourselves in a CATCH 22 situation in that it [project funding/prioritization] is based on tonnage but you cannot increase tonnage if you go to part time operation... Our position is that the Navigation Project was signed into law by both Houses of Congress and the President of the United States in the Rivers and Harbors Act of 1950 and modified by the Rivers and Harbors Act of 1960, to be operated and maintained at full Federal expense; therefore the Corps, as the construction, operation and maintenance arm of Congress, should operate and maintain all features of the project on a 24-hour basis, year round, at project specifications, as Congressionally authorized—any reduction in services is unacceptable... Since operational levels are being based on tonnages, there is no way tonnage is going to increase with the project being operated on a limited basis...In developing alternatives in response to reduced budgets, one must keep in mind that the Ouachita-Black Rivers Navigation Project is a multi-purpose project providing navigation, recreation, flood control, water supply, and fish and wildlife benefits. Each of these purposes has a specific customer base that must be considered.

Red River Valley Association: The problem is that there are too many authorized projects for available funds. There must be a priority system. There are two philosophies: provide funding for few projects to complete them or fund more projects getting more projects done, but over a longer period of time. It probably makes more sense to get projects completed sooner based on priority; however, those projects put off will be more expensive and may have to be re-evaluated (not an easy decision). Too much funding goes to environmental projects that should go to traditional Corps missions of navigation and flood reduction projects.

Tennessee River Valley Association: Current prioritization schemes for construction neglect remaining benefit cost ratios. New projects assume an efficient funding stream in standard cost benefit comparisons. Suspension at Chick[amauga] or KY will result in declining BCRs and will adversely affect those projects under current prioritization methods.

Tennessee-Tombigbee Waterway Development Authority: The Corps' prioritization scheme should be based on needs while realizing that these exist in each waterway.

Waterways Council, Inc.: WCI supports the project prioritization process embodied in the Inland Marine Transportation Systems Capital Projects Business Model, April 13, 2010. This plan is commonly referred to as the Capital Development Plan or CDP.<sup>96</sup>

## POSTPONING NEW CONSTRUCTION AND MAJOR REHABS IN FAVOR OF ADEQUATELY MAINTAINING AND PRESERVING CURRENT INFRASTRUCTURE

Coosa-Alabama River Association: We have a system in place to address new construction (the Inland Waterways Trust Fund, or IWTF), which needs to be addressed. The waterway groups need to support the current Capital Investment Fund legislation just dropped in Congress. Still, we think it's going to take a major catastrophe (broken lock, dam rupture, spiraling costs to ship goods by barge, or whatever starts pinching the public at large) to bring this issue to prominence. From our perspective, we need to ensure that what we have working now is maintained.

Illinois Corn Growers Association: This is a relatively new discussion point which we have heard brought up and we believe it is worthy of further discussion and analysis; however, at this time ICGA feels this should be a last resort alternative after all other options to increase the capacity of the system have been exhausted. With the average age of 80% of the structures in the Upper Mississippi River basin being 50+ years old, at some point in time the feasibility of maintaining versus replacement is not cost effective. It also does not seem to be a good strategy in light of the anticipated opportunities the expansion of the Panama Canal could bring to the U.S.

Kentucky Corn Growers Association: The current process has not followed a concise strategy. Adding projects or shifting to other projects distracts from progress and dramatically adds unnecessary cost. Focus should be kept on existing projects. Exceptions should only be made for strictly defined "emergency" projects (such as a door failure or other loss of functionality).

Red River Valley Association: We do believe operational projects must be fully funded at their congressionally authorized levels of service. We cannot sacrifice what we have for new construction. Due to the reduced funding, the Administration continues to develop new metrics

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<sup>96</sup> This plan is referenced as the "Business Model" at several locations in this report.

to classify waterways as “low use” and their excuse to reduce funding levels or reduce levels of service. This alone will devastate many tributary waterways.

Tennessee River Valley Association: TRVA supports the premise that no new projects should be started until ongoing projects are completed. We should finish what we have started!

Tennessee-Tombigbee Waterway Development Authority: Major rehabs should be scheduled and completed on a pre-approved schedule. Major rehabs have to be done, but to devote all of the construction/rehab funds to one project makes no sense. We now have projects being mothballed after substantial funds have been spent because one project is continually revised and all the money is being sucked up. No O&M money should go to construction.

Upper Mississippi Waterway Association: Unfortunately, bringing a 600-foot lock up to new-lock conditions will not negate the need to split a 15-barge tow in order to transit that lock, as its very size restricts it to a 3-barge long by 3-barge wide configuration. Many locks currently in use are simply too small for today’s large tows. They are susceptible to closures and long delays for repair and are unable to effectively deal with lines and wait times that result from their obsolescence. On the Upper Mississippi River, for example, most lock chambers are 600 feet long. However, the average of a modern tow (15 barges pushed by a towboat) is 1200 feet. Consequently, it must split in half and transit the lock one section at a time, resulting in costly delays.

Waterways Council, Inc.: WCI strongly advocates for a modern and efficient inland waterways system, which requires both capital investment in new construction and rehabilitation projects and a well-funded operation and maintenance program for the Corps’ navigation mission.

## SOURCES OF FUNDS FOR LOCK AND DAM PROJECTS (E.G., INCREASED FUEL TAXES, LOCKAGE FEES)

Coosa-Alabama River Association: The Alabama waterway associations have been on record as supporting the proposed increase in fuel taxes rather than the lockage fee option. The lockage option would have tremendous negative impact on some of our tributaries, e.g., the Tenn-Tom. Our channel, the Alabama, has only three locks, but we have enough trouble finding users as it is without tacking on additional fees every time somebody locks through.

Illinois Corn Growers Association: ICGA supports a fair and equitable increase to the current barge fuel tax as long as the funds are used in a focused manner that addresses the critical needs of the system. ICGA is opposed to any type of lockage fees that put producers in an economic disadvantage the further they are up in the system (i.e., a fee assessed for each lock passage).

Kentucky Corn Growers Association: Locks and dams provide both a public and a private benefit; therefore, the cost of projects should be equitably shared by public and private users. The

public enjoys benefits from locks and dams since they provide flood control; decreased consumer prices; as well as countless valuable environmental benefits. The cost of improvements that provide benefit to the general public should come from the federal budget based on their proportion of economic value of the benefits. In order for private users to carry their share of the cost, an increase in the fuel surcharge and/or increased lockage fees are appropriate. We understand that portions of increases in cost will be passed to us from shippers. This is appropriate, as well. The Kentucky Corn Growers Association recognizes that farmers derive a private benefit from a modern lock and dam structure from the standpoint that our trade market benefits from an efficient transportation method (domestically, compared to truck and rail; and, internationally, compared to competing nations who produce agricultural commodities). We consider this added cost an investment in our logistical infrastructure that will ensure we retain the competitive advantage over trade competitors that we have enjoyed for decades.

Red River Valley Association: Proposals such as lock fees will kill tributary waterways that have most of the locks. Lock fees would be unfair to industries on these tributaries when industries on open waterways have no charge. Everyone must understand all the waterways are a system and must be treated the same. The IWTF needs to have increased funding and we believe an increase in the fuel tax is the best option.

Tennessee River Valley Association: The current fuel tax method of funding projects is in place and with needed reforms, can be adjusted to provide adequate funding. Lockage fees, or an unspecified registration fee established by unelected officials, should be rejected by Congress.

Tennessee-Tombigbee Waterway Development Authority: Our carriers support an increase in the fuel rate of 6 to 8 cents/gal. We oppose lockage fees.

Upper Mississippi Waterway Association: All lock construction projects should be cost-shared 50% from general appropriations and 50% from the Inland Waterways Trust Fund. All major rehabilitation lock projects costing at least \$100 million should be cost-shared at 50% from general appropriations and 50% from the IWTF. Construction and major rehabilitation dam projects and major rehabilitation lock projects below \$100 million should be entirely funded from general appropriations. There should be a project-by-project cost-sharing cap to protect industry from unreasonable cost escalation and project delays.<sup>97</sup> The cap places additional emphasis on the need for more reliable cost estimates and to manage projects within the agreed upon project budgets and schedules, protecting both the waterways industry and the general taxpayer from

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<sup>97</sup> Note: These are all elements of the Business Model mentioned earlier.

preventable cost escalation and delay. The CIS Team<sup>98</sup> reviewed alternative options for generating revenues for the IWTF. In the end, the Team recommended a program requiring a 30–45% increase in the current fuel tax (a \$0.06–\$0.09 per gallon increase).

UMWA does not support the establishment of a lockage fee as (1) it unreasonably penalizes the market value of commodities that are furthest away from their market and (2) because only the locked portions of navigable rivers would be subject to a lockage fee. Taken to the extreme, a lockage fee, depending on the fee level and other economic factors, would put a large portion of the Upper Mississippi River system out of reach of domestic and export markets via water transport.

Waterways Council, Inc.: The Waterways Council advocates for a 6 to 9 cent per gallon increase in the user fee collected by the U.S. government for deposit in the Inland Waterways Trust Fund. The current assessment is 20 cents per gallon of diesel fuel consumed by commercial carriers while operating on the inland waterways of the United States. WCI also supports the recommendations of the Capital Development Plan that the other beneficiaries of the inland navigation project assume the costs associated with construction of dams through 100% general fund appropriations.<sup>99</sup>

## CRITICAL LOCK INFRASTRUCTURE NEEDS

Coosa-Alabama River Association: Any comment here depends on the definition of what’s “critical.” Certainly, those on the main stems are critical, but so are those locks on the tributaries that feed those main stems. The Tennessee River, which feeds into the Ohio, has two new locks authorized and construction begun, both of which will probably be mothballed in the current budget environment. The Tennessee transports over 50 million tons annually. Kentucky Lock is a key passing point for all Tennessee River traffic into the Ohio. Chickamauga Lock near Chattanooga is falling apart and when it does, everything north of that point will be cut off.

Illinois Corn Growers Association: ICGA feels the critical needs are well defined and documented throughout the entire system. Corps district level officials know what structures are due to fail. ICGA’s primary focus of critical needs in the Upper Mississippi River basin is Locks 20-25 on the Mississippi River, and Peoria and LaGrange on the Illinois River.

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<sup>98</sup> This is a reference to the Capital Investment Strategy Team that produced the Inland Marine Transportation Systems (IMTS) Capital Projects Business Model Final Report, Revision 1, April 13, 2010.

<sup>99</sup> It should be noted that Inland Waterways Trust Fund monies can only be used for new construction or major rehabilitation projects.

Kentucky Corn Growers Association: A strict definition of “critical” is necessary to ensure that efforts remain focused. Primarily, critical needs should be unsafe or emergency situations (such as loss of functionality). Secondly, complete existing projects in order of oldest start date. Third, in an orderly fashion, update individual structures until all can meet the definition of “lock in good condition.”

Tennessee-Tombigbee Waterway Development Authority: Critical lock rehab should be based on a number of factors—wait times, lock conditions, etc.

Upper Mississippi Waterway Association: Currently, 1200-foot locks are needed at Mississippi River locks 20, 21, 22, 24, and 25; and at La Grange and Peoria on the Illinois Waterway. Moorings are needed at Mississippi River locks 12, 14, 18, 20, 22, and 24, and at La Grange on the Illinois Waterway. Switchboats are needed at Mississippi River locks 20, 21, 22, 24, and 25. All of these critical needs were authorized in Section 8003 of the Water Resources Development Act of 2007.

Waterways Council, Inc.: WCI supports the 20-year capital investment strategy of the CDP, which identifies critical lock infrastructure by priority in 3 phases.

#### DEFINITION OF A “LOCK IN GOOD CONDITION”

Coosa-Alabama River Association: A lock in good condition is one that is currently fully operational and maintained to Corps standards with sufficient funding available to perform preventive and emergency maintenance as required.

Illinois Corn Growers Association: Annually, the Corps prepares a list of locks that experienced unscheduled closures. The locks which are in the lower 1/3 or do not appear on the list are what ICGA would define as “locks in good condition.”

Kentucky Corn Growers Association: “Lock in good condition” means that it is functional for all users in a safe and efficient manner. The lock should be able to accommodate modern barges and tows without the unsafe task of separating loads. It should accommodate these users without significant backups.

Red River Valley Association: There probably need to be metrics established to determine this and risk factors (but it must be determined with industry input, too many decisions are made by Corps and Administration without industry input). Considerations should include age of lock, usage, maintenance history, impact to whole system, etc.

Tennessee-Tombigbee Waterway Development Authority: ...[W]hat defines a good lock...should include proper operation and maintenance and scheduled preventative maintenance.

Upper Mississippi Waterway Association: A “lock in good condition” would be a lock that is reliable and maintained through planned and scheduled maintenance and does not incur more unscheduled outages than scheduled ones.

Waterways Council, Inc.: WCI utilizes the Corps approach of assessing risk and reliability utilizing either a Dam Safety Action Classification rating or a Condition Index. This methodology is described in the April 13, 2010, IMTS report (CDP) at page 48-49.



## APPENDIX B: FINANCIAL INFRASTRUCTURE ASSISTANCE ORGANIZATIONS FOR PANAMA CANAL PROJECT CAPITAL COSTS

### JAPAN BANK FOR INTERNATIONAL COOPERATION (JBIC)

The Japan Bank for International Cooperation (JBIC) is a policy-based lending institution owned by the Japanese government. Its goal is to promote development both inside and outside of Japan in order to maintain the international competitiveness of Japanese manufacturing, prevent the disruption of the international economy, and promote environmentally beneficial projects.<sup>100</sup> The JBIC offers several loan and investment types that can be utilized to finance infrastructure projects:

- Overseas Investment Loans are used to fund support of overseas projects and joint ventures implemented by Japanese companies in manufacturing, sales, infrastructure, and the acquisition of natural resources. These loans can also be extended to developed countries in the sectors of railways, water business, and several forms of fuel and power production. The JBIC requires that the loan amount not exceed the value of the contract associated with the investment, and that a percentage (determined on a case-by-case basis) of the financial need must be provided by co-financing with private institutions. Loan disbursements can be provided in Japanese yen, euros, or in U.S. dollars. The repayment periods and interest rates on these loan types vary on a case-by-case basis. Loans disbursed in yen offer a fixed interest rate, while all other currencies carry floating interest rates.<sup>101</sup>
- “Untied Loans” are used to make improvements in overseas business environments in order to facilitate Japanese trade and business activities, but can also be utilized by foreign governments to finance projects that help maintain financial order, promote Japanese business, expand trade investments, and construct environmental preservation projects. Untied loans are used primarily to finance projects in developing countries.

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<sup>100</sup> Japan Bank for International Cooperation; *Role and Function*. Available at <http://www.jbic.go.jp/en/about/role-function/pdf/jbic-brochure-english.pdf> as of June 19, 2012.

<sup>101</sup> Japan Bank for International Cooperation; *Overseas Investment Loans: Loan Amount, Currencies, and Interest Rate*. Available at <http://www.jbic.go.jp/en/finance/investment/index.html> as of June 19, 2012.

## EUROPEAN INVESTMENT BANK (EIB)

The European Investment Bank (EIB) is a public long-term lending institution established in 1958 under the Treaty of Rome. Owned and operated by the member states of the European Union,<sup>102</sup> the EIB seeks to fund development in economically disadvantaged countries, while striving to create a more cohesive European Union. The EIB finances a variety of infrastructure and development projects, with transportation projects accounting for the largest segment of their loans for 2011–2012.<sup>103</sup> The EIB extends loans to countries within the EU, as well as 150 countries in Africa, Central Asia, Latin America, the Mediterranean, and South-East Europe—the United States is not included.<sup>104</sup>

## INTER-AMERICAN DEVELOPMENT BANK (IDB)

The Inter-American Development Bank (IDB) invests in sustainable development projects in Latin America and the Caribbean, but does not extend loans to the United States.<sup>105</sup>

## INTERNATIONAL FINANCE CORPORATION (IFC)

The International Finance Corporation (IFC) is a subsidiary of the World Bank. It invests in small to medium enterprises, micro-financing, trade, climate change, and other development projects. The IFC invests primarily in developing countries, and does not offer lending terms for projects in the United States.<sup>106</sup>

## CORPORACIÓN ANDINA DE FOMENTO (CAF)

Corporación Andina de Fomento (CAF) is a development bank consisting of 18 countries in Latin America, the Caribbean, and Europe. The CAF supports sustainable development through grants, credit

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<sup>102</sup> European Investment Bank; *About the EIB*. Available at <http://www.eib.org/about/index.htm> as of June 19, 2012.

<sup>103</sup> European Investment Bank; *Finance Projects by Sector*. Available at <http://www.eib.org/projects/loans/sectors/index.htm> as of June 19, 2012.

<sup>104</sup> European Investment Bank; *Projects by Region*. Available at <http://www.eib.org/projects/regions/index.htm> as of June 19, 2012.

<sup>105</sup> Inter-American Development Bank; *About us*. Available at <http://www.iadb.org/en/about-us/about-the-inter-american-development-bank,5995.html> as of June 19, 2012.

<sup>106</sup> International Finance Corporation; *What We do*. Available at [http://www1.ifc.org/wps/wcm/connect/Industry\\_EXT\\_Content/IFC\\_External\\_Corporate\\_Site/Industries/Financial+Markets/What+We+Do/](http://www1.ifc.org/wps/wcm/connect/Industry_EXT_Content/IFC_External_Corporate_Site/Industries/Financial+Markets/What+We+Do/) as of June 19, 2012.

operations, technical support, and financing of public and private sector projects in Latin America. The CAF does not finance projects in United States.<sup>107</sup>

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<sup>107</sup> Development Bank of Latin America; *Mission*. Available at <http://www.caf.com/view/index.asp?ms=19&pageMs=61928> as of June 19, 2012.

## APPENDIX C: FUNDING HISTORY OF THE MCALPINE LOCKS AND DAM PROJECT

### FY 1996

In FY 1996, Congress appropriated funds to initiate the construction of the McAlpine Lock Replacement Project.

### FY 1999

In its annual letter to Congress, the Inland Waterways Users Board warned that “congestion, navigation complexities, and obsolescence” might result in significant delays by the year 2000. Furthermore, the IWUB warned that “constrained funding” could significantly delay the project in the months and years to come. Total estimated project cost stood at \$268 million, with \$1 million requested for FY 1999 for planning, engineering, and development. The board estimated that \$246 million would be necessary after FY 1999.<sup>108</sup>

### FY 2000

For FY 2000, the IWUB again warned of possible significant delays and requested the project “be advanced at full construction capability of the U.S. Army Corps of Engineers to relieve a serious potential bottleneck.”<sup>109</sup> Total project cost estimates stood at \$268 million with \$2.8 million requested for FY 2000 for planning, engineering, and development. The board estimated that \$237.9 million would be necessary to complete the project after FY 2000.

### FY 2001

The total estimated project cost stood at \$268 million with \$14 million requested for FY 2001 for planning, engineering, and design. Estimated full capability funding for FY 2001 was \$20 million.

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<sup>108</sup> Inland Waterways User Board; *Twelfth Annual Report to the Secretary of the Army and the United States Congress*, July 1998. Available at <http://www.waterwaysusers.us/iwub1998rep.pdf> as of June 19, 2012.

<sup>109</sup> Inland Waterways User Board; *Thirteenth Annual Report to the Secretary of the Army and the United States Congress*, November 1999. Available at <http://www.waterwaysusers.us/IWUBAR99fin.pdf> as of June 19, 2012.

## FY 2002

In FY 2001, the IWUB again stated it was “very concerned” that construction could be substantially delayed due to lack of funding. “If this occurs,” the Board warned, “there’s a real possibility that traffic flows could be interrupted due to a reduced stream of funding.” Furthermore, the Board cautioned that a lack of funding “could cause huge delays if the main chamber is shut down for any reason as there is no auxiliary chamber to pass the traffic.”<sup>110</sup> The Board increased its estimated final projects cost \$10 million to a total of \$278 million. The Administration requested \$13.6 million for FY 2002. Finally, the Board suggested a full capability funding level for FY 2002 of \$24 million.<sup>111</sup>

## FY 2003

For FY 2003, the Board determined total project cost to be \$278 million, with \$6.19 million requested for FY 2003 and \$195.44 million requested after FY 2003. The estimated full capability funding level for FY 2003 was \$30 million.<sup>112</sup>

## FY 2004

For FY 2004, the total estimated cost was increased to \$338 million with \$26.1 million requested by the Administration for FY 2004 and \$195.1 million necessary after FY 2004. The estimated full capability funding level for FY 2004 was \$70 million.

In its 17<sup>th</sup> Annual Board report, the Inland Waterways User’s Board recommended that the Administration fund the project “to the maximum extent practicable” at the full efficient spending capability of the U.S. Army Corps of Engineers. The board also suggested that “the failure in past years to fund these projects at their optimum capability levels has already resulted in benefits foregone to our nation of \$2.177 billion. Over \$2 billion in benefits have simply been washed down the river by dragging out the completion of these high priority projects.”<sup>113</sup>

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<sup>110</sup> Inland Waterways User Board; *15th Annual Report to the Secretary of the Army and the United States Congress*, August 2001. Available at <http://www.waterwaysusers.us/UBAR2001final.pdf> as of June 19, 2012.

<sup>111</sup> Ibid.

<sup>112</sup> Inland Waterways User Board; *16th Annual Report to the Secretary of the Army and the United States Congress*, May 2002. Available at <http://www.waterwaysusers.us/UBAR2002finalrev.pdf> as of June 19, 2012.

<sup>113</sup> Inland Waterways User Board; *17th Annual Report to the Secretary of the Army and the United States Congress*, February 2003. Available at <http://www.waterwaysusers.us/UBAR2003final.pdf> as of June 19, 2012.

## FY 2005

The FY 2005 total estimated project cost was pegged at \$350.0 million. The Administration requested \$58.0 million—less than half of the full capability funding of \$120.0 million estimated for that year. The balance after FY 2005 needed to complete the McAlpine project was \$148.3 million.

The Inland Waterways Users Board, in its annual report to Congress, again voiced concern that “congestion, navigation complexities, and obsolescence of this facility cause major delays and are a significant bottleneck on the Ohio River.”<sup>114</sup>

## FY 2006

By FY 2006, the IWUB again voiced concern over the significant time from for the McAlpine Lock and Dam Project, noting that “another closure occurred at McAlpine Locks and Dam on the Ohio River, where there is only a single 1200-foot chamber. This lock was closed for emergency gate repairs from August 9 through 19, 2004, completely shutting down through traffic on the Ohio River. The industry was given several weeks warning and responded by stockpiling, diverting, or curtailing production, with some employee layoffs occurring.”

The total estimated project cost was pegged at \$350.0 million. The Administration requested \$70.0 million—100% of full capability funding. Funding needed to complete the McAlpine project was estimated at \$53.2 million.<sup>115</sup>

## FY 2007

By FY 2007, total estimated project cost increased from \$350 million in FY 2006 to \$395 million for FY 2007. The Administration requested \$ 70.0 million—80% of the full estimated capability funding. Funding needed to complete the McAlpine project was estimated at \$23.8 million.<sup>116</sup>

## FY 2008

By FY 2008, full efficient funding needed to complete the McAlpine project stood at \$6.8 million (no other funding information was readily available). By 2008, the prove-out was completed and lock testing began. Construction completed on the McAlpine Lock Replacement Project in March 2009.<sup>117</sup>

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<sup>114</sup> Inland Waterways User Board; *18th Annual Report to the Secretary of the Army and the United States Congress*, February 2004. Available at <http://www.waterwaysusers.us/IWUBFinalReport2004.pdf> as of June 19, 2012.

<sup>115</sup> Inland Waterways User Board; *19th Annual Report to the Secretary of the Army and the United States Congress*, February 2005. Available at <http://www.waterwaysusers.us/IWUBFinalReport2004.pdf> as of June 19, 2012.

<sup>116</sup> Inland Waterways User Board; *20th Annual Report to the Secretary of the Army and the United States Congress*, 2006. Available at <http://www.waterwaysusers.us/IWUBReport2006.pdf> as of June 19, 2012.

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<sup>117</sup> *"It Takes Time: The McAlpine Lock Replacement Project in the Making"*, U.S. Army Corps of Engineers, (unpublished).