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INLAND WATERWAY SYSTEM FUNDING: PROBLEMS AND SOLUTIONS

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PART 1

INTRODUCTION

The inland waterway system (IWS) serves as a cost-effective, environmentally friendly method of transporting freight throughout the country. An insufficiently funded and maintained IWS has led to a system plagued with breakdowns and unscheduled closures. Delays and scheduled closures for maintenance also plague lock and dam systems scattered throughout the IWS, raising costs for producers, shippers, and consumers who rely on waterborne freight transportation.

This instability has contributed to an ongoing trend of decreasing waterborne commercial activity, especially on inland routes.[1] COVID-19 exacerbated the problem further, leading to a greater decrease in waterborne activity along the IWS due to a sudden trough of demand.[2] When instability (especially delays) plagues the system, shipping over the waterways becomes less cost-efficient, driving shippers to other modes as shown by lowered demand.

Given the importance of the IWS to supply chains across the country, it must be revitalized in a more cost-effective manner that doesn't unduly burden general taxpayers. Currently, barge vessels pay a small lockage fee that covers a dwindling percentage of capital costs. However, taxpayers pay for 100% of IWS operations and maintenance costs, as well as an

1 "National Transportation Statistics," Bureau of Transportation Statistics, www.bts.gov, https://www.bts.gov/content/us-waterborne-freight (19 December 2022).

2 Leonardo M. Millefiori et al., "COVID-19 impact on global maritime mobility," *Scientific Reports* 11 (2021), *Nature*. www.nature.com/articles/s41598-021-97461-7 (19 December 2022).

increasing share of new construction capital costs. Creating a sustainable revenue source will benefit IWS users and consumers as a whole. This move begins the process of shifting more of the burden to inland waterway users.

> *Given the importance of the IWS to supply chains across the country, it must be revitalized in a more cost-effective manner that doesn't unduly burden general taxpayers.*

Further, long-term infrastructure should be financed and not funded, because it stretches limited resources further. One potential financing option is public-private partnerships (P3s). In addition to stretching the funds, P3s transfer risks—specifically construction cost overruns, late completion, and operations as well as maintenance of the locks. By modernizing the IWS—through a new funding and financing mechanism—Congress can improve the efficiency and reliability of U.S. waterways.

This study examines the various challenges affecting the IWS, including:

- Operations expenditures,
- Maintenance expenditures,
- Shipping delays,
- Current IWS funding methods,
- Innovative funding for new construction, operations, and maintenance including lock usage fees, and
- New financing mechanisms specifically public-private partnerships (P3s).

PART 2

A BRIEF HISTORY OF THE INLAND WATERWAY SYSTEM

The IWS as we know it today owes its foundations, legally, to the General Survey Act of 1824.[3] This act formalized the use of Army engineers in civil projects, including the IWS. Overall, the General Survey Act was the first major step in the U.S. Army Corps of Engineers' (USACE) involvement in future federal waterway development, which created the system shown in Figure 1.

> *When USACE decentralized after the Civil War, it split into eight regional offices, which still exist today.*

3 Lynn Alperin, "History of the Gulf Intracoastal Waterway," Institute for Water Resources, January 1983. https://www.publications.usace.army.mil/Portals/76/Publications/Miscellaneous/NWS_83-9.pdf.

FIGURE 1: MAP OF FEDERAL FUEL-TAXED INLAND WATERWAYS

Source: Charles Stern and Nicole Carter, "Inland Waterways Trust Fund", U.S. Library of Congress, Congressional Research Service, crsreports.congress.gov, 26 February 2018. https://crsreports.congress.gov/product/pdf/IF/IF10020 (20 December 2022).

In 1826, President James Monroe requested that USACE determine the best area for a canal directly connecting the Gulf of Mexico and the Atlantic Ocean on the Florida peninsula. One of USACE's proposals founded today's Gulf Intracoastal Waterway (GIWW) running along the Gulf Coast from Texas to Florida. But, during the Civil War, federal focus shifted wholly to carrying out the war, and the IWS fell to the wayside for a time.[4]

As the post-Civil War economic disaster claimed much of government finances, the IWS languished for some time. When USACE decentralized after the Civil War, it split into eight regional offices, which still exist today. These eight regional offices divide managing 38 local district offices. In the late 1800s, interest in the IWS was revived by the Interstate Inland Waterway League, today known as the Gulf Intracoastal Canal Association. This group of business leaders organized support for the IWS, leading to expanding important

4 Ibid. 3.

elements of the fledgling IWS.[5] The Rivers and Harbors Act of 1925 authorized a waterway between New Orleans and Galveston, which eventually expanded to cover most of the Gulf Coast. By the mid-20th century, some 12,000 miles of rivers and over 200 lock chambers at almost 200 different locations on the Mississippi, Ohio, Tennessee—Tombigbee Waterway, Illinois, Snake and other rivers and canals comprised the U.S. inland waterway system.

In 1978, the Inland Waterways Revenue Act created the Inland Waterways Trust Fund (IWTF), modernizing IWS funding. Established in 1986, the Inland Waterways Users Board (IWUB) oversees USACE budget proposals and monitors the overall status of the IWTF, which consists of 11 members representing all geographic areas on the IWS.

5 Ibid. 3-4.

PART 3

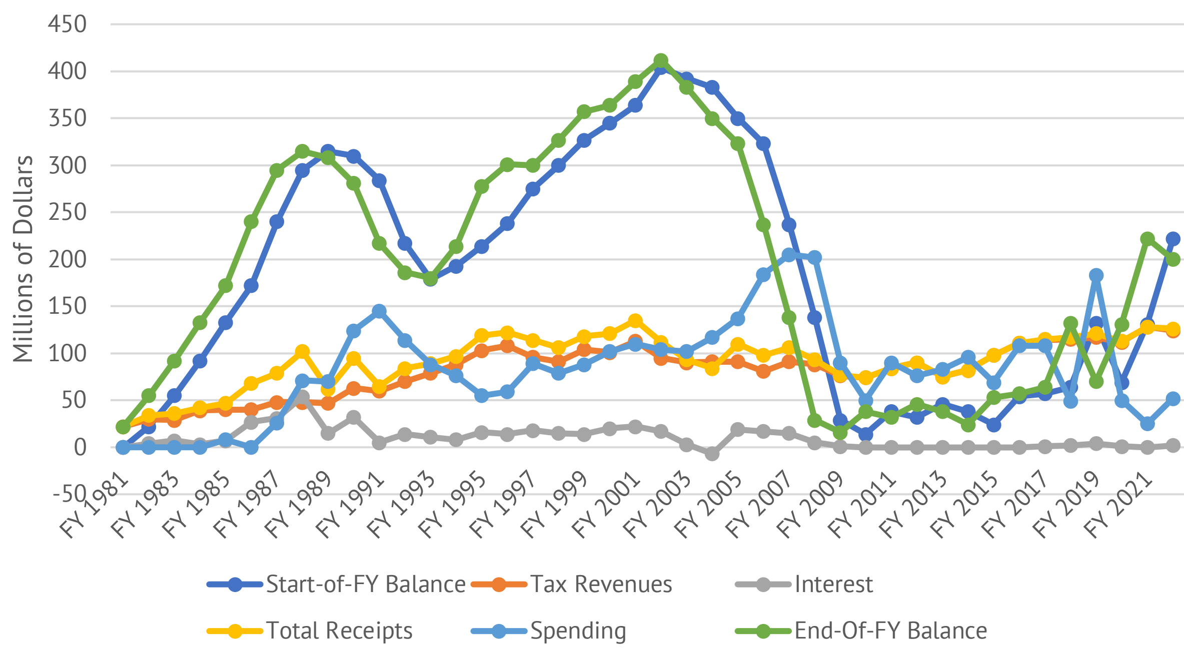
HOW THE IWS BECAME UNDER-FUNDED: CAPITAL PROJECTS (NEW CONSTRUCTION)

Administered by the Department of Treasury, the IWTF is funded entirely by the diesel fuel taxes that commercial vessels pay when using the IWS. IWTF funding levels have varied throughout its history, but it still serves as the principal, congressionally established fund for the system. The IWTF currently provides 35% of the construction costs for new dams and navigation locks, as well as rehabilitation projects totaling over $20 million. The remaining 65% of funding comes from the general fund.[6] IWTF funds are only eligible for use in capital construction projects, which exclude routine operations and maintenance (O&M) expenses. Once projects are completed, 100% of O&M costs are funded by appropriations from the general fund.

6 Nicole Carter and John Frittelli, "Inland and Intracoastal Waterways: Primer and Issues for Congress," U.S. Library of Congress, Congressional Research Service, crsreports.congress.gov, 7 July 2020. https://crsreports.congress.gov/product/pdf/IF/IF11593 (19 December 2022).

As shown in Figure 2, since reaching its peak of $413 million in 2002, the IWTF's balance has fluctuated wildly from year to year.[7]

FIGURE 2: IWTF SPENDING AND REVENUE SOURCES, FY 1990-FY 2020



Source: Adapted from Jeff Davis, "The History of the Inland Waterways Trust Fund," Eno Center for Transportation, August 2023. https://enotrans.org/article/the-history-of-the-inland-waterways-trust-fund/ (25 September 2023).

The overall financial health of the IWTF has varied throughout its history. Revenues and the overall balance have heavily fluctuated. While it has seen revenue windfalls in the past, its lack of funding makes it difficult to sustain, lagging far behind necessary capital and maintenance projects. This underfunding has two chief causes.

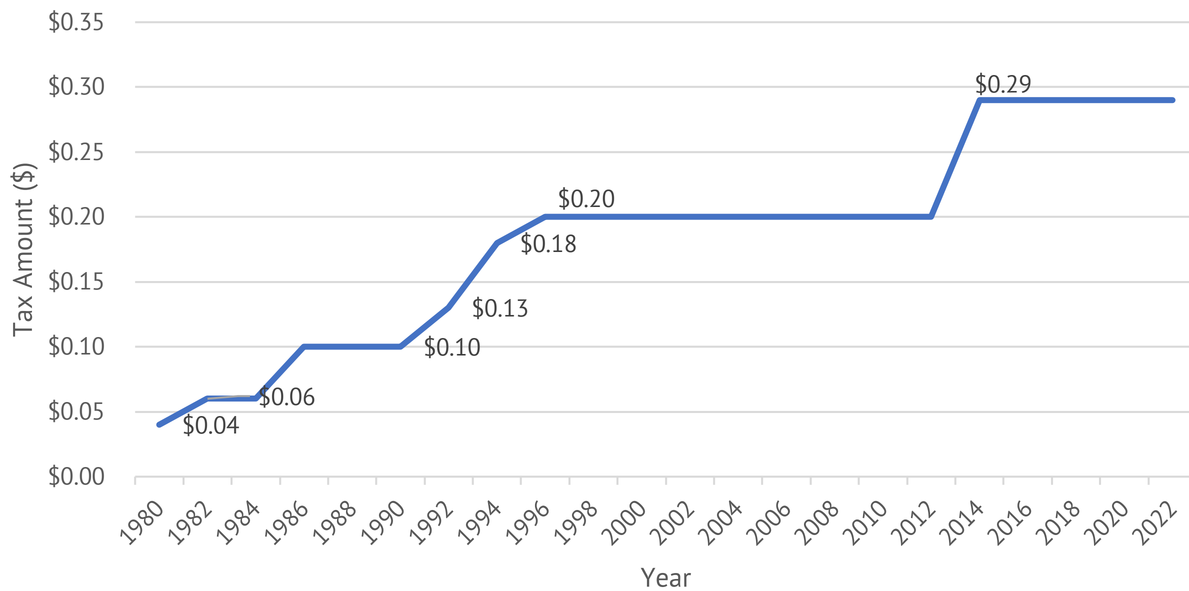
3.1 EROSION OF FUEL TAX FUNDING

The first reason is tied to the IWTF being funded solely through fuel taxes on commercial vessels using the inland waterway system. Over time, commercial vessels (especially barges) have grown more fuel-efficient. As in road transportation and aviation, improved fuel economy poses serious problems for funding mechanisms that rely on fuel excise

7 "Inland Marine Transportation Systems (IMTS) Capital Projects Business Model," Inland Waterways User Board, iwr.usace.army.mil, 13 April 2010, www.iwr.usace.army.mil

taxes. As vessels grow more fuel-efficient, they will contribute less fuel tax revenue for the same amount of commercial activity.[8] Initially set at $0.04 per gallon, the diesel fuel tax for commercial vessels has been increased repeatedly over its history to compensate for this trend, as shown in Figure 3.[9]

FIGURE 3: INLAND WATERWAY COMMERCIAL VESSEL FUEL TAX RATES (PER GALLON)



Source: Compiled from bill text of: Inland Waterways Revenue Act of 1978, Pub. L. 95-502 (21 Oct. 1978), Water Resources Development Act of 1986, Pub. L. 99-662 (17 Nov. 1986), Water Resources Reform and Development Act of 2014, Pub. L. 113-121 (10 June 2014).

The largest increase occurred due to a provision in the Tax Increase Prevention Act of 2014, going from $0.20 to $0.29, where it remains today.[10] The diesel tax is not indexed to inflation and must be manually adjusted by Congress. A Government Accountability Office (GAO) report published in 2018 found that if the tax had been indexed for inflation between 1994 and 2014 when the tax was $0.20/gallon, it would have generated about

8 Texas A&M Transportation Institute, Center for Ports and Waterways, "A Modal Comparison of Domestic Freight Transportation Effects on the General Public: 2001-2014", National Waterways Foundation, 17 January 2016. https://www.nationalwaterwaysfoundation.org/file/31/final%20tti%20report%202001-2014%20approved.pdf (19 December 2022).

9 Inland Waterways Revenue Act of 1978, Pub. L. 95-502 (21 Oct. 1978).

10 Tax Increase Prevention Act of 2014, Pub. L. 113-295 (19 December 2014).

$400 million in additional revenue for the IWTF.[11] The current inflation crisis has likely exacerbated the problem even further. While construction and rehabilitation costs have increased substantially, fuel tax revenue has remained about the same, plateauing at around $115 million per year between FY 2015 and FY 2020.[12]

But even if this diesel tax were indexed to inflation to realize more revenue, the problem would still persist, as capital and maintenance costs outpace tax revenue. With the current $800 million backlog of ongoing unfunded projects and planned construction costs totaling over $6 billion, these problems will likely get worse.[13]

3.2 HIGHER COSTS DUE TO "DRIP-FUNDING"

The second major reason for underfunding is the inefficient way projects are funded. As the IWTF's fuel tax contribution erodes, the cost-sharing agreement funding the IWS requires an increasing revenue share from the general fund.

As fuel tax revenue has declined, the IWUB has repeatedly suggested shifting more costs from shippers to taxpayers, going from the previous 50/50 split to the current 35/65 split. Indeed a 25/75 split has even been proposed. The reality is the IWS lacks sufficient funding, and increasing the general fund share has become the de facto solution.

"The reality is the IWS lacks sufficient funding, and increasing the general fund share has become the de facto solution."

11 Government Accountability Office, "INLAND WATERWAYS Actions Needed to Increase Budget Transparency and Contracting Efficiency," United States Government Accountability Office, gao.gov, 14 September 2018. https://www.gao.gov/assets/gao-19-20.pdf (19 December 2022).

12 Nicole Carter and John Frittelli, "Inland and Intracoastal Waterways: Primer and Issues for Congress".

13 "Inland Waterways User Board 33rd Annual Report," Inland Waterways User Board, iwr.usace.army.mil, 26 October 2020. https://www.iwr.usace.army.mil/Portals/70/IWUB%20Annual%20Report%2033rd%20for%202020%20Dec20%20Final.pdf (19 December 2022).

However, increasing the general fund share has its own problems. The biggest is that it delays projects. General fund revenue needs to be appropriated annually by Congress, putting these long-term major projects on the financial chopping block every year. As a result of this "drip-funding," project components are built piecemeal, with long delays between components, waiting for more funding to be appropriated.[14]

How does this occur? When builders submit estimated costs, they calculate based on a continued stream of funding. Then, when project funding is unpredictable year to year, projects can't be built in the most cost- and time-efficient manner. When building schedules are unpredictable, builders can't know which parts should be ordered when, or which workers to hire when, creating more time and cost inefficiencies. Unsurprisingly, a report from the Kentucky Transportation Center found this approach "...leads to inefficiencies and needlessly prolonged construction timelines, which increases costs and diminishes the amount of funding available for other projects."[15] According to USACE, "costs associated with extended project durations ranged from a few percent to as much as 40 percent of the total project placement costs. On a per year or annualized basis, this cost increase ranged from 1 to 3.5 percent, with an average value of approximately 2.2 percent."[16] In the case of replacing a multitude of components in a major lock, these delays could add millions in extra costs.

"These institutional deficiencies result in poor project management, leading to delayed and over-budget projects."

These institutional deficiencies result in poor project management, leading to delayed and over-budget projects. For example, the project to rebuild the Lower Monongahela Locks and Dams is currently on its 14th construction contract. Original USACE projections

14 Government Accountability Office, "INLAND WATERWAYS Actions Needed to Increase Budget Transparency and Contracting Efficiency," 28-29.

15 Doug Keis, et al. "Inland Waterways Funding Mechanisms Synthesis", Kentucky Transportation Center, 2014. https://uknowledge.uky.edu/cgi/viewcontent.cgi?article=2465&context=ktc_researchreports (25 September 2023).

16 "U.S. Army Corps of Engineers (USACE) Civil Works Public Private Partnerships Pilot Program," usace.army.mil, U.S. Army Corps of Engineers, https://www.usace.army.mil/missions/civil-works/infrastructure/infra_P3_program/ (20 December 2022).

estimated rebuilding the Lower Monongahela infrastructure would take two contracts.[17] Another project that is over budget and behind schedule is the Kentucky Lock Addition. It was estimated to be completed in 2008 but has been delayed to 2024. In 1992, when originally proposed, the cost was estimated at $775 million.[18] More recent estimates place the cost at over $3 billion.[19] In this way, the longer projects are delayed, the more—often significantly more—it costs to complete them.

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Sometimes expensive projects are funded by a higher share of general fund appropriations than what the traditional cost-sharing agreements would necessitate. For example, the $3 billion Olmsted Locks and Dam megaproject on the Ohio River between Illinois and Kentucky was funded by a 15/85 split between the IWTF and the general fund.[20]

The Olmsted Megaproject exemplifies the consequences of relying on appropriations for funding. It was originally authorized in 1988 with an estimated cost of $775 million and an estimated completion date just seven years away.[21] Now it's estimated to open in 2024, with an authorized cost of $2.918 billion. Due to the inability to provide capital up-front, projects experience delays. These delays cost more and more over time, as inflation leads to the cost of components rising year over year.

17 Government Accountability Office, "INLAND WATERWAYS Actions Needed to Increase Budget Transparency and Contracting Efficiency." 29.

18 "Factors Contributing to Cost Increases and Schedule Delays in the Olmsted Locks and Dam Project," Government Accountability Office. Highlights.

19 Elizabeth McLaughlin, "30 years and $3 billion later, one of America's largest civil works projects set to open on Ohio River," *ABC News*, 30 Aug. 2018. abcnews.go.com. https://abcnews.go.com/US/30-years-billion-americas-largest-civil-works-projects/story?id=57505266 (10 August 2023).

20 "Inland Waterways," Infrastructure Report Card, 2021. www.infrastructurereportcard.org (19 December 2022).

21 "Factors Contributing to Cost Increases and Schedule Delays in the Olmsted Locks and Dam Project," United States Government Accountability Office, gao.gov, February 2017. https://www.gao.gov/assets/gao-17-147.pdf (23 August 2023).

This unpredictability affects more than builders. On the consumer side, shippers never know when the repairs or new locks will be available. Since best business practices require arranging for shipping long in advance, this unpredictable status of the IWS results in shippers turning to other, more-reliable transportation modes, lowering demand.

PART 4

HOW THE IWS BECAME UNDERFUNDED: MAINTENANCE PROJECTS

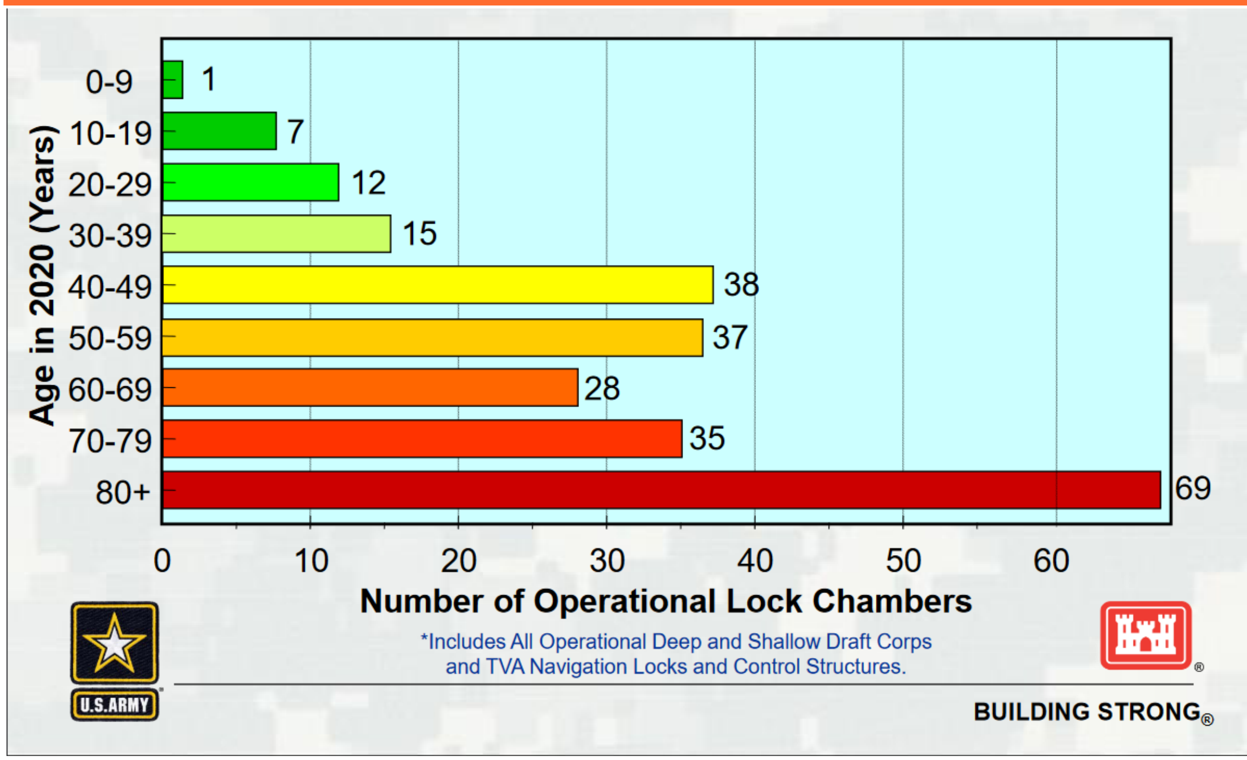
Once rehabilitations and new infrastructure are built, they have to be operated and maintained. USACE manages these repairs, rehabilitations, and day-to-day operations, and Congress funds them entirely through annual appropriations from the general fund. In FY 2020, the IWS O&M costs totaled $815 million.[22] Note that this is the amount of funding provided, not the actual needed funding, which is far higher. Regarding overall maintenance needs, one factor is the age of the system.

As shown in Figure 4, the locks across the nation are aging. However, the age of a lock is not the best indicator of its condition—a lock that has undergone major rehabilitation could last much longer than a lock of the same age without any rehabilitative work. Effectively, lock lifespans can be extended by proper maintenance and rehabilitation. But with so much

22 Nicole Carter and John Frittelli, "Inland and Intracoastal Waterways: Primer and Issues for Congress." 1.

of the system being this old, major rehabilitation must be done promptly and preventively or the system can quickly fall into disrepair, including mechanical failures.[23]

FIGURE 4: AGE OF CORPS LOCK PORTFOLIO IN 2020



Source: Edward Belk, U.S. Army Corps of Engineers "U.S. Army Corps of Engineers Civil Works Program Update," Waterways Council, Inc., waterwayscouncil.org, 13 February 2019. https://waterwayscouncil.org/file/2/Belk-WCI-Final-13-Feb-2019.pdf (20 December 2022).

4.1 DEFERRED SCHEDULED MAINTENANCE AND UNSCHEDULED MAINTENANCE (BREAKDOWNS)

USACE uses a fix-as-fail approach when it comes to maintenance, meaning it tends to request only enough funding to be able to respond to crises, but not enough to "conduct preventative maintenance."[24]

[23] "Public Lock Usage Report files, Calendar Years 1993-2020," U.S. Army Corps of Engineers, publibrary.planusace.us, 29 July 2021. https://publibrary.planusace.us/document/e82f2fcc-0ef1-4201-813b-28503b41da8e (25 September 2023).

[24] "INLAND WATERWAYS Actions Needed to Increase Budget Transparency and Contracting Efficiency," Government Accountability Office, gao.gov, November 2018. https://www.gao.gov/assets/gao-19-20.pdf (12 November 2023).

This happens because the U.S. Army Corps asks for funding for fix-it-first needs only instead of funding for all routine maintenance. Stakeholders have documented that the Army Corps believes that Congress will not appropriate the money it needs for routine maintenance, so it does not act.[25] When lack of preventive maintenance fails to keep aged system vulnerabilities in check, costly failures make money run short, deferring maintenance projects.

This lack of funding (or belief in lack of funding) is one reason that this study proposes charging lockage fees to ensure the system has sufficient revenue. This change will put the IWS on the path to be funded sufficiently.

“When lack of preventive maintenance fails to keep aged system vulnerabilities in check, costly failures make money run short, deferring maintenance projects.”

When scheduled maintenance is deferred due to lack of funds, it creates a backlog. The current backlog totals $800 million of current projects and an additional $6 billion worth of projects planned but not yet started.[26] And when maintenance is deferred, especially on aged locks, breakdowns are likely, causing unscheduled emergency failures.

Scheduled maintenance is less of a problem for shippers since they can plan around these outages in advance. However, unscheduled outages can have major impacts, rendering locks unusable and shippers waiting, sometimes with perishable cargo. Collectively, these stoppages trigger delays that deplete the whole system’s reliability, lowering demand. Individually, these delays cost shippers significantly.

25 Ibid.

26 Inland Waterways User Board 33rd Annual Report,” Inland Waterways User Board, iwr.usace.army.mil, 26 October 2020. https://www.iwr.usace.army.mil/Portals/70/IWUB%20Annual%20Report%2033rd%20for%202020%20Dec20%20Final.pdf (19 December 2022).

4.2 THE CONSEQUENCES OF DELAYS

A study from 1993 from the *Logistics and Transportation Review* found (based on traffic projections for 2000) lowering delays to one hour per tow would reduce the costs of annual corn and soybean marketing by $21.82 million.[27] The study also projected, based on 2020's anticipated congestion, that those savings would increase to $43.74 million.[28] While this study's findings were based on a projected tonnage increase as opposed to the decrease the waterway system has seen, the possibility for savings is still important.

Additionally, because the study found a strong correlation between delays and freight diversion to other, less-efficient modes, it makes sense that traffic has gone down while delays regularly continued to climb.[29] When there are delays on the inland waterway system, shippers choose less-economical modes such as rail, increasing costs to shippers and consumers.

“Further, because traffic has decreased, intuitively one would assume delays would also decrease due to lower congestion. But that hasn't been the case.”

Further, because traffic has decreased, intuitively one would assume delays would also decrease due to lower congestion. But that hasn't been the case. Delays have continued to climb despite lower numbers of lockages throughout the system.

Another study by the Vanderbilt Center for Transportation and Operational Resiliency (VECTOR) examined lock closure instances.[30] By comparing an estimate of each shipper's

27 Stephen Fuller and Warren Grant, "Effect of lock delay on grain marketing costs: an examination of the Upper Mississippi and Illinois waterways," *The Logistics and Transportation Review* 29 (1993) *Gale Academic Onefile*. link.gale.com/apps/doc/A13975874/AONE?u=mlin_oweb&sid=googleScholar&xid=877ad1cf (8 Aug. 2023).

28 Ibid.

29 Ibid.

30 Center for Transportation Research, University of Tennessee, and Vanderbilt Engineering Center for Transportation and Operational Resiliency, Vanderbilt University, "The Impacts of Unscheduled Lock

current costs for waterway-inclusive movements to the cost of the next-best available modal alternative, the study concluded that the direct cost of each instance of unplanned closure exceeds $1 billion.[31] Especially in a period where inflation is high (and continuing to rise), any delay in project completion can lead to increased costs. As the Army Corps itself says, "[…] in 5-years of traditional delivery a project could realize cost growth of 17.5% above inflation."[32]

For example, an unplanned seasonal closure of the LaGrange Lock and Dam would increase transportation costs by $1.7 billion. This would lead to a $2.1 billion loss in farm-dependent income, especially soybean and corn exports given the LaGrange Lock and Dam's central location in the nation's primary route for corn and soybean exports.[33] It would immediately affect commerce in 135 counties and 18 states.[34] Further, these lock closures would displace over 29 million tons of goods to other modes, especially rail, which would see a 25% increase in activity on the least affected railway and around four full trains running around the clock.

FIGURE 5: INSTANCES OF DELAYS

					FY 2021	
		FY 2018	FY 2019	FY 2020	Target	Actual
Inland Waterways	Measure 3.1.a: The number of instances where mechanically driven failure at locks results in delays of more than 24 hours	40	29	34	<37	38
	Measure 3.1.b: The number of instances where mechanically driven failure at locks results in delays of more than one week	19	15	16	<21	18

Source: "America's Army Transforming for the Future," United States Army Corps of Engineers, usace.army.mil, 12 November 2021. https://www.publications.usace.army.mil/Portals/76/Users/182/86/2486/Civil%20Works%20FY21%20AFR.pdf?ver=dvQNFowchY6JEDWT2zQ45g%3D%3D (20 December 2022).

As shown in Figure 5, instances of lock delays show no sign of consistent, annual improvement.

Outages," National Waterways Foundation and the U.S. Maritime Administration, 2017. https://nationalwaterwaysfoundation.org/file/2/low%20res%20lock%20outage%20nwf_final_report%202017.pdf (20 Dec. 2022).

31 Ibid. 10.

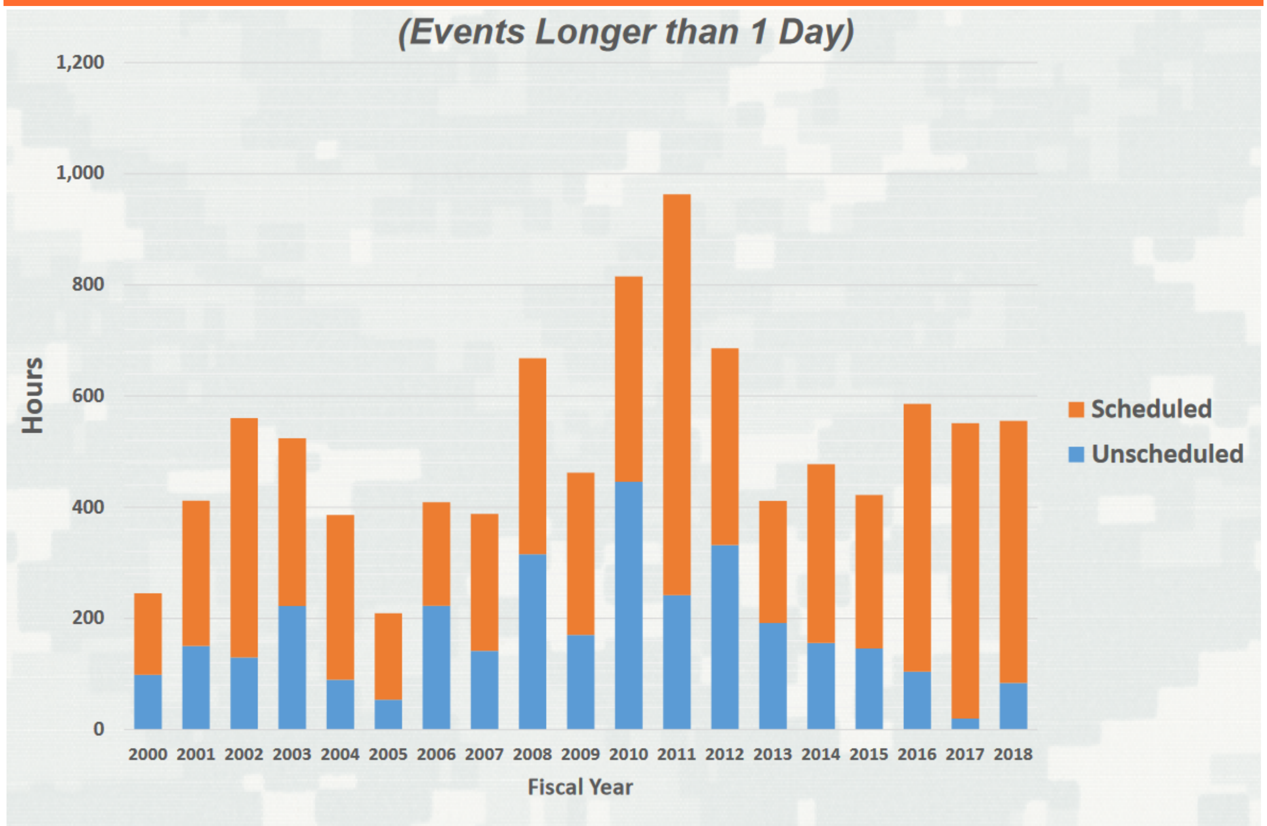
32 "U.S. Army Corps of Engineers (USACE) Civil Works Public Private Partnerships Pilot Program", United States Army Corps of Engineers, usace.army.mil. https://www.usace.army.mil/missions/civil-works/infrastructure/infra_P3_program/ (23 August 2023).

33 Ibid. 13.

34 Ibid. 13.

As Figure 6 shows, delays (both scheduled and unscheduled) continue to plague the lock and dam system.

FIGURE 6: NATIONAL LOCK PORTFOLIO SERVICE TRENDS MAIN CHAMBER MECHANICAL UNAVAILABLE HOURS



Source: "U.S. Army Corps of Engineers Civil Works Program Update," Waterways Council, Inc. waterwayscouncil.org, 13 February 2019. https://waterwayscouncil.org/file/2/Belk-WCI-Final-13-Feb-2019.pdf (20 December 2022).

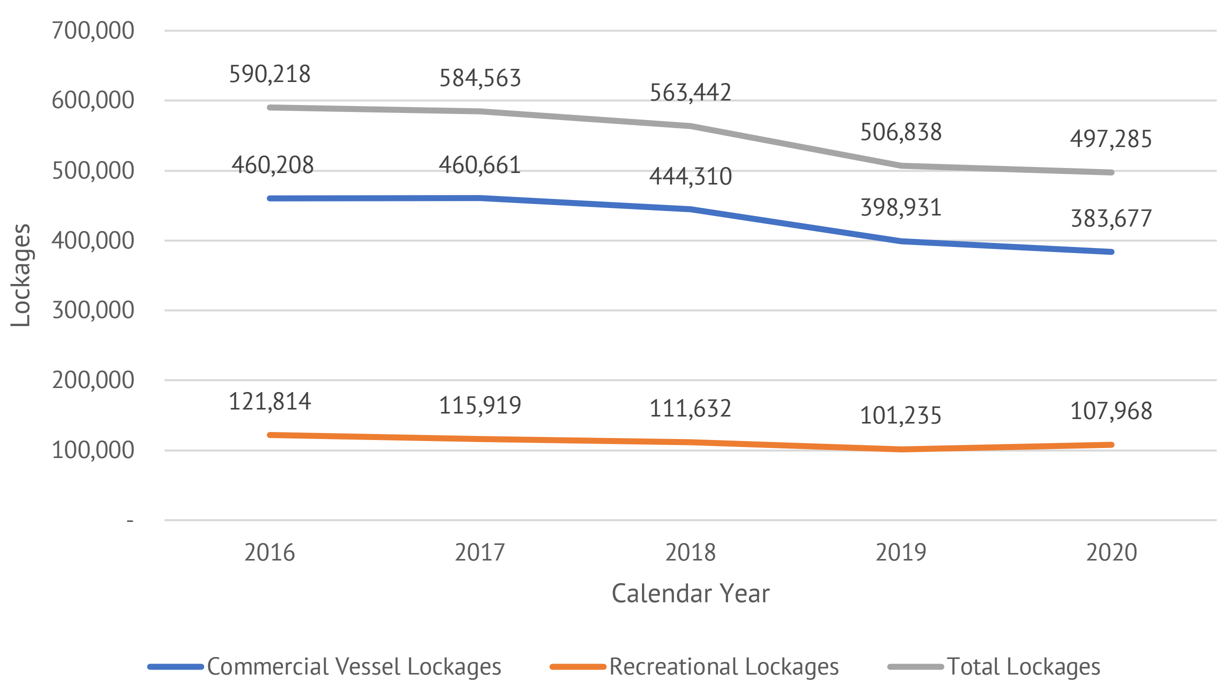
While this shows that USACE is prioritizing maintenance, these closures still happen far too regularly. There is no way to avoid closing locks for some forms of major rehabilitation, but steps can be taken to minimize the time a lock is closed for rehabilitation projects. These steps include better planning for maintenance, smarter allocation of funding for each project, and completing all of the needed work at the same time.

4.3 LACK OF FUNDING

While deferred maintenance contributes to costly delays, the main cause is the incremental and unreliable way maintenance, major rehabilitative, and capital projects are funded due to the unpredictability of annual congressional appropriations. If funding were allocated all at once, these projects could be finished with less costly processes and minimal delays.

Another factor contributing to underfunding is free-riding. This occurs when certain users consume a public good without paying for it, forcing paying users effectively to subsidize them. Currently, many vessels use the IWS in any given year, but locks and dams are also used by recreational vessels. However under the current system, only commercial vessels pay the diesel fuel tax that funds the IWTF, and those lockages are declining, signifying lower traffic. Lockages are tracked on a calendar-year basis by the Lock Performance Monitoring System.

FIGURE 7: NUMBER OF LOCKAGES BY VESSEL TYPE, CY2016-2020



Source: "Public Lock Usage Report files, Calendar Years 1993-2020," U.S. Army Corps of Engineers, publibrary.planusace.us, 29 July 2021. https://publibrary.planusace.us/document/e82f2fcc-0ef1-4201-813b-28503b41da8e (19 December 2022)

From 2016-2020, recreational users accounted for 20% of all lockages without contributing to the IWTF, comprising the largest group of non-contributing beneficiaries of the IWS.[35] While channel locks are designed and sized to accommodate commercial barges, which are far larger than most if not all the recreational vessels using these lockages, some smaller locks receive strictly recreational traffic (if any traffic at all), but currently the maintenance costs are borne only by commercial users of the waterway system. A more equitable system would charge recreational users at least some portion of a lockage fee, as well as contribute to funding of the IWS.

35 Ibid.

PART 5

A NEW FUNDING MODEL: SUPPLEMENTING LOCKAGE FEES WITH GENERAL FUND REVENUE

Traditionally, locks and dams have been funded by different sources. Typically, needed projects must be postponed to allow for funds to build up sufficiently in the IWTF, with some portion coming from appropriations (as explained in Section 3.2). The source of these appropriations can vary, be it from the biennial WRDA bills giving final project authorization and funding or via less-regular installments, such as the Infrastructure Investment and Jobs Act. For larger projects the agreed-upon cost-sharing agreements can be waived so appropriations and the general fund provide a greater share.

Locks and dams are often megaprojects on their own—especially for the construction of a completely new lock and dam system. Rehabilitation projects of existing infrastructure can cost hundreds of millions of dollars, let alone ground-up construction. Therefore, the entities governing the waterways (be it the Inland Waterways Users Board or the Army Corps itself) tend to request large sums in their budget proposals. These proposals are justified, given their growing backlogs and the needs of the system at large, but these needs help highlight the importance of finding a more reliable revenue stream than the existing fuel tax.

> *Lockage fees provide a more consistent source of revenue, and one proportional to the actual maintenance needs of the locks and dams along the system itself.*

Lockage fees provide a more consistent source of revenue, and one proportional to the actual maintenance needs of the locks and dams along the system itself. A lockage fee is unlikely to be able to fully replace the need for appropriations, but it can lessen the system's reliance on those appropriations, while improving the quality of the inland waterway system. Instead of waiting for necessary funds to build up in the IWTF from fuel taxes before beginning a project, these user fees can be used as a means of starting projects earlier and having a more robust funding mechanism for them.

Robust funding also brings a host of benefits, most notably the ability to begin projects faster and build them in one contract. Building locks in one contract means fewer delays in construction. The current system of multiple contracts leads to delays and cost overruns: "On average, a one-year delay or other extension of the implementation phase correlates with an increase in percentage cost overrun of 4.64 percent."[36] While these user fees should not be used as a complete fix-all approach to the problems plaguing the waterways, they could alleviate some of the financial pressures to fund the system from the general fund and circumvent the Corps' hesitance to request preventive maintenance funding from congressional appropriations. Further, users could receive a host of benefits from increased stability of the infrastructure (less delays and closures) to a more consistent level of service offered across the entire system.

36 Atif Ansar, "The True Cost of Delays At Scale," foresight.works, 12 Apr. 2023. https://www.foresight.works/blog/the-true-cost-of-delays-at-scale (accessed 24 Jan. 2024).

PART 6

A NEW FINANCING MODEL: USING P3S

The IWUB's 2020 annual report (the latest, because the secretary of defense issued a memo in 2021 suspending all IWUB activities, but it has since been reconstituted) calls for $6.3 billion for new projects on the IWS.[37] Policymakers' top priority should be examining financing alternatives for everything from capital construction to operations and maintenance. One potential financing source is a public-private partnership (P3).

> *Whether through direct user fees or another revenue source, a well-executed P3 contract can also provide decades of operations and maintenance, allowing for construction to begin sooner, and the asset to be sustained for at least 50 years.*

P3s are a financing tool. Whether through direct user fees or another revenue source, a well-executed P3 contract can also provide decades of operations and maintenance,

[37] Inland Waterways User Board, "Inland Waterways User Board 33rd Annual Report."

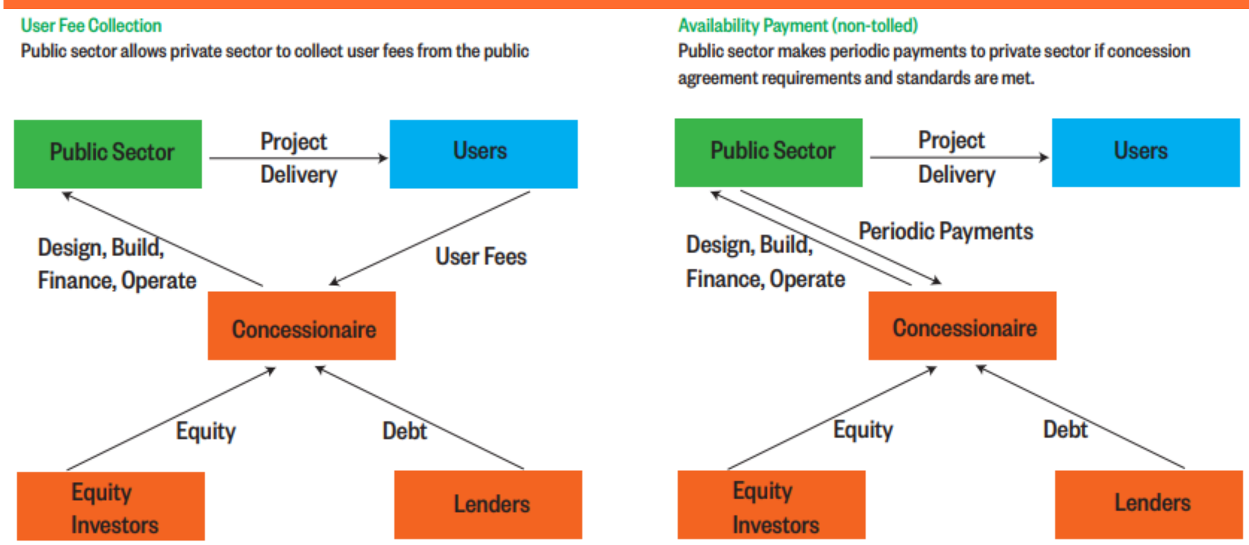
allowing for construction to begin sooner, and the asset to be sustained for at least 50 years. More importantly, a completely user-fee-funded P3 shifts the revenue risk from taxpayers to the private sector, which is critical given the cost overruns and uncertainty that has plagued the marine sector.

But a public-private partnership relies on a revenue stream, such as a lockage fee, to support it. While a self-sufficient system would be the goal, in this case, user fees by themselves—even over decades—will be unable to compensate the company (also called the "concessionaire") for its upfront financial contribution. In this case, the government partner will supplement the lockage fee with a secondary revenue source—general funds from the government—which retains the revenue risk for the life of the project.

6.1 USER FEES VS AVAILABILITY PAYMENT P3S

P3s need some form of revenue stream, otherwise they wouldn't be viable private sector projects. A P3 at the scale of a transportation megaproject (like a new lock and dam) would require a major commitment of capital. As such, it would require an equally major revenue stream. These revenue streams often take one of two forms, as shown in Figure 8.

FIGURE 8: TYPES OF DESIGN-BUILD-FINANCE-OPERATE-MAINTAIN P3S



Source: Robert Poole, "Availability Payment or Revenue-Risk P3 Concessions? Pros and Cons for Highway Infrastructure," Reason Foundation, 2017. https://reason.org/wp-content/uploads/2017/11/infrastructure_availability_payment_revenue_risk_concessions.pdf (8 November 2023).

As illustrated by Figure 8, the first is a concession P3, similar to a toll concession in the highway space. In a toll concession, the public sector contracts with a private firm (the concessionaire) to design, build, finance, operate, and maintain an infrastructure asset. The concessionaire keeps any revenue collected on the facility.

> *In an AP P3, the private concessionaire provides a fixed-price, date-certain delivery, and life cycle operations and maintenance. Each of these revenue characteristics is lacking in the current inland waterway system.*

The second is an availability payment (AP) P3, in which the public sector contracts with the concessionaire to design, build, finance, operate, and maintain an infrastructure asset in exchange for guaranteed, periodic payments from the government. In an AP P3, the private concessionaire provides a fixed-price, date-certain delivery, and life cycle operations and maintenance. Each of these revenue characteristics is lacking in the current inland waterway system. Often availability payments are used when taxpayer funds are needed to supplement user fee revenue. Given the current need for general fund revenue to supplement user fees, an AP P3 offers an appropriate interim solution. Ideally, a subsequent P3 will be a concession, funded completely out of user fees.

P3s in the IWS are not a wholly new idea. USACE was directed in WRDA 2014 to develop a P3 pilot program for the IWS. In 2019, it adopted implementation guidance. To date, the USACE pilot has identified six projects with projected federal cost savings of over $350 million and 13 years of work from using a P3 instead of the typical design-bid-build method.[38] This pilot project could be extended to the entire IWS.

P3s include quantitative metrics to ensure the concessionaire is meeting the terms of the contract. For example, the concessionaire could be required to keep delays below a certain threshold to keep its contract.

38 U.S. Army Corps of Engineers, "U.S. Army Corps of Engineers (USACE) Civil Works Public Private Partnerships Pilot Program."

6.2 HOW AVAILABILITY PAYMENT P3S USING LOCKAGE FEES WOULD WORK IN THE INLAND WATERWAY SYSTEM

In contrast to a toll concession P3, an availability payment DBFOM model would involve a private firm operating the lock, and the government partner collecting the lockage fee. The firm contracted for the P3 would receive its revenue through regular installments from USACE, assuring a revenue floor for low-traffic, high-importance locks.

In an availability payment model, the public sector is responsible for providing the revenue stream as opposed to those who use the system. Using P3s in this sense could be the best option and could help bridge the revenue gap.

To draw an example from the highway space, the Pennsylvania Department of Transportation contracted the Pennsylvania Rapid Bridge Replacement P3 program.[39] This was a bundling of AP bridge P3s, looking to replace 559 aging bridges throughout Pennsylvania in three years. Many of the bridges the Pennsylvania DOT was looking to replace were in rural areas. As Robert Poole wrote in 2017, "[…] while these bridges don't carry a lot of traffic, they are important components of the state's highway network."[40]

Just as Pennsylvania's P3 bridge program solved hundreds of problems across a system of bridges, so a similar P3 could address the wide-ranging and significant restoration and capital needs of the IWS. Regarding continued maintenance during the concession period, the Inland Waterways Users Board could continue in its advisory capacity to propose the best ways to prioritize funding maintenance projects based on the needs of the IWS as a whole. These proposed changes are best illustrated with a case study of how a hybrid P3 inland waterways project would work.

Let's compare rebuilding a lock using lockage fees and a P3 with the current drip-drip approach to funding using the LaGrange Lock and Dam located in Versailles, Illinois, which has become infamous for its delays and slow processing times.[41] LaGrange first received

39 "What Is the Rapid Bridge Replacement Project?" Plenary Walsh Keystone Partners and the Pennsylvania Department of Transportation. http://parapidbridges.com/projectoverview.html

40 Robert Poole, "Availability Payment or Revenue-Risk P3 Concessions? Pros and Cons for Highway Infrastructure," Reason Foundation, 2017. https://reason.org/wp-content/uploads/2017/11/infrastructure_availability_payment_revenue_risk_concessions.pdf (8 November 2023).

41 Pamela Glass, "Lockdown: Inside America's decaying waterways infrastructure," *WorkBoat*, 19 January 2017, workboat.com. https://www.workboat.com/coastal-inland-waterways/lockdown-decaying-inland-waterways-infrastructure (15 May 2023).

authorization for the rehabilitation project in August 2005.[42] Yet it took until FY 2018, 13 years later, to receive the necessary funding, $125,500,000. During the rehabilitation process, some three months, the lock was kept closed.

Based on lockage data published by USACE, we can examine the feasibility of funding a rehab of this scale through lockage fees.[43] A comparison of net present values (NPVs) is a useful benchmark to examine the possible return on investment a private contractor could expect if they were the ones executing this contract. In Tables 1 and 2 below, the NPVs of both Revenue (in the 6th column) and capital costs (in the 7th column) are highlighted. The reason 100% of capital costs occur in 2024 (the first year listed) is to show that all necessary capital for project completion is allocated on day one.

TABLE 1: LOCKAGE FEE FUNDED STATUS QUO

Year	Annual Lockages	Lockage Fee	Annual Lockage Fee Revenue	6% NPV Factor	NPV Revenue	NPV Capital
2024	2643	$2,550	$6,739,650	1.0000	$6,739,650	$125,500,000
2025	2619	$2,601	$6,812,573	0.9434	$6,426,981	$0
2026	2596	$2,653	$6,886,285	0.8900	$6,128,794	$0
2027	2572	$2,706	$6,960,795	0.8396	$5,844,283	$0
2028	2549	$2,760	$7,036,110	0.7921	$5,573,303	$0
2029	2526	$2,815	$7,112,241	0.7473	$5,314,978	$0
2030	2503	$2,872	$7,189,196	0.7050	$5,068,383	$0
2031	2481	$2,929	$7,266,983	0.6651	$4,833,270	$0
2032	2459	$2,988	$7,345,611	0.6274	$4,608,637	$0
2033	2436	$3,047	$7,425,091	0.5919	$4,394,911	$0
2034	2415	$3,108	$7,505,430	0.5584	$4,191,032	$0
2035	2393	$3,171	$7,586,639	0.5268	$3,996,642	$0
2036	2371	$3,234	$7,668,727	0.4970	$3,811,357	$0
2037	2350	$3,299	$7,751,702	0.4689	$3,634,773	$0
2038	2329	$3,365	$7,835,576	0.4423	$3,465,675	$0
2039	2308	$3,432	$7,920,357	0.4173	$3,305,165	$0
2040	2287	$3,501	$8,006,055	0.3937	$3,151,984	$0
2041	2266	$3,571	$8,092,680	0.3714	$3,005,622	$0
2042	2246	$3,642	$8,180,243	0.3504	$2,866,357	$0
2043	2226	$3,715	$8,268,753	0.3305	$2,732,823	$0

42 "LaGrange Lock, Illinois Waterway (Major Rehabilitation/Major Maintenance)," United States Army Corps of Engineers Rock Island District, usace.army.mil, 1 October 2021. https://www.mvr.usace.army.mil/About/Offices/Programs-and-Project-Management/District-Projects/Projects/Article/1168580/lagrange-lock-illinois-waterway-major-rehabilitationmajor-maintenance/ (16 May 2023).

43 "Public Lock Usage Report files, Calendar Years 1993-2020," United States Army Corps of Engineers, publibrary.planusace.us, 29 July 2021. https://publibrary.planusace.us/document/e82f2fcc-0ef1-4201-813b-28503b41da8e (16 May 2023).

Year	Annual Lockages	Lockage Fee	Annual Lockage Fee Revenue	6% NPV Factor	NPV Revenue	NPV Capital
2044	2206	$3,789	$8,358,221	0.3118	$2,606,093	$0
2045	2186	$3,865	$8,448,657	0.2942	$2,485,595	$0
2046	2166	$3,942	$8,540,072	0.2775	$2,369,870	$0
2047	2147	$4,021	$8,632,475	0.2618	$2,259,982	$0
2048	2127	$4,102	$8,725,879	0.2470	$2,155,292	$0
2049	2108	$4,184	$8,820,293	0.2330	$2,055,128	$0
2050	2089	$4,267	$8,915,728	0.2198	$1,959,677	$0
2051	2071	$4,353	$9,012,196	0.2074	$1,869,130	$0
2052	2052	$4,440	$9,109,708	0.1957	$1,782,770	$0
2053	2033	$4,528	$9,208,276	0.1846	$1,699,848	$0
2054	2015	$4,619	$9,307,909	0.1741	$1,620,507	$0
2055	1997	$4,711	$9,408,621	0.1643	$1,545,836	$0
2056	1979	$4,806	$9,510,422	0.1550	$1,474,115	$0
2057	1961	$4,902	$9,613,325	0.1462	$1,405,468	$0
2058	1944	$5,000	$9,717,341	0.1379	$1,340,021	$0
2059	1926	$5,100	$9,822,482	0.1301	$1,277,905	$0
2060	1909	$5,202	$9,928,762	0.1228	$1,219,252	$0
2061	1892	$5,306	$10,036,191	0.1158	$1,162,191	$0
2062	1875	$5,412	$10,144,783	0.1093	$1,108,825	$0
2063	1858	$5,520	$10,254,549	0.1031	$1,057,244	$0
2064	1841	$5,631	$10,365,503	0.0972	$1,007,527	$0
2065	1824	$5,743	$10,477,658	0.0923	$967,088	$0
					$125,523,984	$125,500,000

As Table 1 shows, if traffic continues to decline (an annual decrease of 0.9%), a firm that is operating the channel lock at LaGrange would require any commercial vessels to pay a lockage fee of $2,550 (which is increased by 2% each year to account for inflation) just to break even. At that rate, it would be cheaper for a shipper to divert to another mode—even if delays were eliminated. For a lockage fee to be effective, there must be a willingness to pay it. This will require some form of government subsidy if traffic continues to decrease (or fails to recover to pre-pandemic levels, as shown in Table 2). The required taxpayer subsidy will lessen commensurate with the portion of funding covered by user fees.

Additionally, it's fiscally feasible for a company to take on the construction costs and O&M for 40 years (like a tolling P3) since the long-term revenue is greater than the initial capital costs. But what if traffic is increasing? That would provide a greater base of users, and as such could lead to a lower user fee for individual shippers. Table 2 shows realistic traffic numbers with an annual growth rate of 1.5% in inland waterway system traffic.

TABLE 2: LOCKAGE FEE FUNDED TRAFFIC RECOVERY OF THE IWS

Year	Annual Lockages	Lockage Fee	Annual Lockage Fee Revenue	6% NPV Factor	NPV Revenue	NPV Capital
2024	2,643	$2,025	$5,352,075	1.0000	$5,352,075	$125,500,000
2025	2,683	$2,066	$5,541,003	0.9434	$5,227,382	$0
2026	2,723	$2,107	$5,736,601	0.8900	$5,105,575	$0
2027	2,764	$2,149	$5,939,103	0.8396	$4,986,471	$0
2028	2,805	$2,192	$6,148,753	0.7921	$4,870,427	$0
2029	2,847	$2,236	$6,365,804	0.7473	$4,757,165	$0
2030	2,890	$2,280	$6,590,517	0.7050	$4,646,314	$0
2031	2,933	$2,326	$6,823,162	0.6651	$4,538,085	$0
2032	2,977	$2,373	$7,064,020	0.6274	$4,431,966	$0
2033	3,022	$2,420	$7,313,380	0.5919	$4,328,789	$0
2034	3,067	$2,468	$7,571,542	0.5584	$4,227,949	$0
2035	3,113	$2,518	$7,838,817	0.5268	$4,129,489	$0
2036	3,160	$2,568	$8,115,528	0.4970	$4,033,417	$0
2037	3,207	$2,620	$8,402,006	0.4689	$3,939,700	$0
2038	3,256	$2,672	$8,698,597	0.4423	$3,847,389	$0
2039	3,304	$2,725	$9,005,657	0.4173	$3,758,061	$0
2040	3,354	$2,780	$9,323,557	0.3937	$3,670,684	$0
2041	3,404	$2,835	$9,652,678	0.3714	$3,585,005	$0
2042	3,455	$2,892	$9,993,418	0.3504	$3,501,694	$0
2043	3,507	$2,950	$10,346,185	0.3305	$3,419,414	$0
2044	3,560	$3,009	$10,711,406	0.3118	$3,339,816	$0
2045	3,613	$3,069	$11,089,518	0.2942	$3,262,536	$0
2046	3,667	$3,131	$11,480,978	0.2775	$3,185,971	$0
2047	3,722	$3,193	$11,886,257	0.2618	$3,111,822	$0
2048	3,778	$3,257	$12,305,842	0.2470	$3,039,543	$0
2049	3,835	$3,322	$12,740,238	0.2330	$2,968,475	$0
2050	3,892	$3,389	$13,189,968	0.2198	$2,899,155	$0
2051	3,951	$3,456	$13,655,574	0.2074	$2,832,166	$0
2052	4,010	$3,526	$14,137,616	0.1957	$2,766,731	$0
2053	4,070	$3,596	$14,636,674	0.1846	$2,701,930	$0
2054	4,131	$3,668	$15,153,348	0.1741	$2,638,198	$0
2055	4,193	$3,741	$15,688,262	0.1643	$2,577,581	$0
2056	4,256	$3,816	$16,242,057	0.1550	$2,517,519	$0
2057	4,320	$3,893	$16,815,402	0.1462	$2,458,412	$0
2058	4,385	$3,970	$17,408,986	0.1379	$2,400,699	$0
2059	4,450	$4,050	$18,023,523	0.1301	$2,344,860	$0
2060	4,517	$4,131	$18,659,753	0.1228	$2,291,418	$0
2061	4,585	$4,213	$19,318,442	0.1158	$2,237,076	$0
2062	4,654	$4,298	$20,000,383	0.1093	$2,186,042	$0
2063	4,724	$4,384	$20,706,397	0.1031	$2,134,830	$0
2064	4,794	$4,471	$21,437,333	0.0972	$2,083,709	$0
2065	4,866	$4,561	$22,194,071	0.0923	$2,048,513	$0
					$126,656,910	$125,500,000

As shown in Table 2, even with a marginal increase in traffic each year, the breakeven point for the NPVs can be much closer even when the lockage fee is lowered. If traffic were to increase at this level, it would be feasible to levy this lockage fee if delays were reduced to 15 minutes on average. That level of decreased delay, especially with increasing traffic, is not realistic.

Thanks to USACE data paired with the United States Department of Agriculture's (USDA) figures, we can easily quantify the cost of delays at LaGrange in any given year. Based on the most current data from LaGrange, there is an average of 2.3 hours of delay per vessel delayed. The United States Department of Agriculture states that there is an average delay cost of $739 per hour delayed (or $985 when indexed for inflation).[44] Currently, the average delay incurs $2,265.50 in costs.

It is worth noting that the complete elimination of delays is unrealistic—even in the best-case scenario, with full traffic recovery over 40 years, the volume of traffic would lead to some form of congestion during some hours. Plus some forms of maintenance will require closing the lock for a time. Aiming to reduce average delay times from the current 2.3 hours nearer to one hour should be more feasible.

All of that said, a lockage fee of $2,550 as displayed in Table 1 isn't feasible. With declining traffic, and a 50% government subsidy on any lockage fee in the form of an availability payment, the fee could be lowered to $1,225. With that fee, delays would only need to be lowered to an hour. Shippers would be receiving a $119 benefit.

Even then, the goal of lowering a lockage fee down to $2,200 (below the average cost of $2,265.50 highlighted earlier in the section) is insufficient because of two factors. First, it is unrealistic to assume delays could be eliminated. Second, without fully eliminating delays, shippers would be paying the lockage fee and the cost of the remaining delay which is greater than $2,200.

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[44] "Importance of Inland Waterways to U.S. Agriculture," United States Department of Agriculture, *usda.gov*, August 2019. https://www.ams.usda.gov/sites/default/files/media/ImportanceofInlandWaterwaystoUSAgricultureFullReport.pdf (16 May 2023).

> *If the IWS is properly revitalized, there is a chance that traffic will start to recover.*

If the IWS is properly revitalized, there is a chance that traffic will start to recover. Table 2 was made to model that growth scenario. Similar to Table 1, even a growth scenario will require some level of subsidy. At a 40% federal subsidy rate, shippers would be paying $1,215 per lockage. When compared to the Bush administration's proposed lockage fee, which was levied on a per-barge basis, shippers would be paying $1,102 when adjusted for inflation (given the average of 10 barges per commercial flotilla), so the $1,215 figure is realistic when compared to that proposal.

More scenarios are displayed in the Appendix section below. Some key takeaways from these models:

- Some level of subsidy will likely be required to ensure there's private sector buy-in, both from the contracting company that is paying for the lease on the channel lock and for the shipping companies paying the fee to pass through.
- Three key factors have a major impact on the level of the lockage fee: delay reduction, traffic, and subsidy level. To minimize taxpayer burden, they ought to be prioritized in that order.

LaGrange is just one lock, albeit a historically troublesome one. This system could be expanded throughout the IWS, with lockage fees adjusted on a case-by-case basis depending on the rehabilitation needs for each lock.

> *Policymakers ought to consider alternative financing mechanisms for the IWS before forcing the general public to pay more.*

Critically, these moves would alleviate some of the burden currently borne by taxpayers. And given recent changes to the cost-sharing agreements found in WRDA 2022, it looks like the federal government is looking to do the opposite. Policymakers ought to consider alternative financing mechanisms for the IWS before forcing the general public to pay more.

PART 7

CONCLUSION

Throughout its history, the inland waterway system has undergone countless attempts at reform, from the biennial WRDA bills attempting to manage its resources to IWUB's attempts at maintaining, and worsening, the status quo for funding the system. The IWS has been plagued by delays, but is critically important as a more environmentally-friendly mode to truck and rail and as a cornerstone for agricultural exports. Policymakers need to realize it is not too late for comprehensive reform.

Policymakers and the United States Army Corps of Engineers have the opportunity to start partnerships with the private sector. The USACE P3 pilot should be expanded to allow private sector participation. If nothing else, it would be useful to gauge interest in ambitious P3 DBFOM projects like this, which channel locks throughout the system desperately need.

Policymakers and the United States Army Corps of Engineers have the opportunity to start partnerships with the private sector. It would provide the necessary capital to begin building these projects right away, eliminating the problem with drip funding via appropriations.

Any changes to the system ought to have the goal of ensuring the system's financial self-sufficiency in the future. Ideally, change would start with hybrid model P3s being used for future construction financing. As the user base increases over time due to increased reliability and decreased delays, the system could transition to more user fee funding, decreasing taxpayer burden.

Congress has a chance to act in the next Water Resources Development Act and should not miss out on this opportunity. The USACE pilot program should be expanded to allow private participation, beginning by offering DBFOM P3s for channel locks in need of repair as soon as possible.

APPENDIX

The purpose of the appendix is to compare and contrast lockage fees to determine what fee is most optimal to rebuild the system and keep it in a state of good repair.

Table A1 shows a similar calculation as Table 1, found previously. The first column shows the year. The second shows the number of lockages anticipated per year, which in this scenario is modeling a decrease in traffic similar to Table 1. The third column shows the lockage fee to be charged each year. The fourth column shows the annual revenue a private contractor could expect from lock operation (found by multiplying the second and third columns). The fifth column is the discount rate. The sixth column shows the net present value of revenue per year. The seventh column shows the net present value of capital costs, and is the same in all listed tables. The project isn't financially feasible without subsidy.

TABLE A1: LOWER LOCKAGE FEE, 0.9%/YEAR LOCKAGE DECAY

Year	Annual Lockages	Lockage Fee	Annual Lockage Fee Revenue	6% NPV Factor	NPV Revenue	NPV Capital
2024	2643	$1,100	$2,907,300	1.0000	$2,907,300	$125,500,000
2025	2619	$1,122	$2,938,757	0.9434	$2,772,423	$0
2026	2596	$1,144	$2,970,554	0.8900	$2,643,793	$0
2027	2572	$1,167	$3,002,696	0.8396	$2,521,063	$0
2028	2549	$1,191	$3,035,185	0.7921	$2,404,170	$0
2029	2526	$1,214	$3,068,026	0.7473	$2,292,736	$0
2030	2503	$1,239	$3,101,222	0.7050	$2,186,361	$0
2031	2481	$1,264	$3,134,777	0.6651	$2,084,940	$0
2032	2459	$1,289	$3,168,695	0.6274	$1,988,039	$0
2033	2436	$1,315	$3,202,980	0.5919	$1,895,844	$0
2034	2415	$1,341	$3,237,637	0.5584	$1,807,896	$0

Year	Annual Lockages	Lockage Fee	Annual Lockage Fee Revenue	6% NPV Factor	NPV Revenue	NPV Capital
2035	2393	$1,368	$3,272,668	0.5268	$1,724,041	$0
2036	2371	$1,395	$3,308,078	0.4970	$1,644,115	$0
2037	2350	$1,423	$3,343,872	0.4689	$1,567,941	$0
2038	2329	$1,451	$3,380,052	0.4423	$1,494,997	$0
2039	2308	$1,480	$3,416,624	0.4173	$1,425,757	$0
2040	2287	$1,510	$3,453,592	0.3937	$1,359,679	$0
2041	2266	$1,540	$3,490,960	0.3714	$1,296,543	$0
2042	2246	$1,571	$3,528,732	0.3504	$1,236,468	$0
2043	2226	$1,602	$3,566,913	0.3305	$1,178,865	$0
2044	2206	$1,635	$3,605,507	0.3118	$1,124,197	$0
2045	2186	$1,667	$3,644,519	0.2942	$1,072,217	$0
2046	2166	$1,701	$3,683,953	0.2775	$1,022,297	$0
2047	2147	$1,735	$3,723,813	0.2618	$974,894	$0
2048	2127	$1,769	$3,764,105	0.2470	$929,734	$0
2049	2108	$1,805	$3,804,832	0.2330	$886,526	$0
2050	2089	$1,841	$3,846,000	0.2198	$845,351	$0
2051	2071	$1,878	$3,887,614	0.2074	$806,291	$0
2052	2052	$1,915	$3,929,678	0.1957	$769,038	$0
2053	2033	$1,953	$3,972,197	0.1846	$733,268	$0
2054	2015	$1,992	$4,015,176	0.1741	$699,042	$0
2055	1997	$2,032	$4,058,621	0.1643	$666,831	$0
2056	1979	$2,073	$4,102,535	0.1550	$635,893	$0
2057	1961	$2,114	$4,146,924	0.1462	$606,280	$0
2058	1944	$2,157	$4,191,794	0.1379	$578,048	$0
2059	1926	$2,200	$4,237,149	0.1301	$551,253	$0
2060	1909	$2,244	$4,282,995	0.1228	$525,952	$0
2061	1892	$2,289	$4,329,337	0.1158	$501,337	$0
2062	1875	$2,335	$4,376,181	0.1093	$478,317	$0
2063	1858	$2,381	$4,423,531	0.1031	$456,066	$0
2064	1841	$2,429	$4,471,394	0.0972	$434,619	$0
2065	1824	$2,477	$4,519,774	0.0923	$417,175	$0
					$54,147,601	$125,500,000

The purpose of this table was to show the impact lowering the lockage fee has on the value proposition for companies. The lower the fee, the less financially feasible the project becomes.

Table A2’s columns display the same information as Table A1. The variable that was changed here is the growth rate of lockages. Even in a positive growth scenario, a lower lockage fee is only feasible to a certain extent. With a lockage fee of $1,100 and a growth rate of 1.5%, the project isn’t financially feasible without subsidy.

TABLE A2: LOWER LOCKAGE FEE, 1.5%/YEAR LOCKAGE INCREASE

Year	Annual Lockages	Lockage Fee	Annual Lockage Fee Revenue	6% NPV Factor	NPV Revenue	NPV Capital
2024	2,643	$1,100	$2,907,300	1.0000	$2,907,300	$67,510,000
2025	2,683	$1,122	$3,009,928	0.9434	$2,839,566	$0
2026	2,723	$1,144	$3,116,178	0.8900	$2,773,399	$0
2027	2,764	$1,167	$3,226,179	0.8396	$2,708,700	$0
2028	2,805	$1,191	$3,340,063	0.7921	$2,645,664	$0
2029	2,847	$1,214	$3,457,968	0.7473	$2,584,139	$0
2030	2,890	$1,239	$3,580,034	0.7050	$2,523,924	$0
2031	2,933	$1,264	$3,706,409	0.6651	$2,465,133	$0
2032	2,977	$1,289	$3,837,245	0.6274	$2,407,488	$0
2033	3,022	$1,315	$3,972,700	0.5919	$2,351,441	$0
2034	3,067	$1,341	$4,112,936	0.5584	$2,296,664	$0
2035	3,113	$1,368	$4,258,123	0.5268	$2,243,179	$0
2036	3,160	$1,395	$4,408,435	0.4970	$2,190,992	$0
2037	3,207	$1,423	$4,564,052	0.4689	$2,140,084	$0
2038	3,256	$1,451	$4,725,164	0.4423	$2,089,940	$0
2039	3,304	$1,480	$4,891,962	0.4173	$2,041,416	$0
2040	3,354	$1,510	$5,064,648	0.3937	$1,993,952	$0
2041	3,404	$1,540	$5,243,430	0.3714	$1,947,410	$0
2042	3,455	$1,571	$5,428,523	0.3504	$1,902,155	$0
2043	3,507	$1,602	$5,620,150	0.3305	$1,857,460	$0
2044	3,560	$1,635	$5,818,541	0.3118	$1,814,221	$0
2045	3,613	$1,667	$6,023,936	0.2942	$1,772,242	$0
2046	3,667	$1,701	$6,236,581	0.2775	$1,730,651	$0
2047	3,722	$1,735	$6,456,732	0.2618	$1,690,372	$0
2048	3,778	$1,769	$6,684,655	0.2470	$1,651,110	$0
2049	3,835	$1,805	$6,920,623	0.2330	$1,612,505	$0
2050	3,892	$1,841	$7,164,921	0.2198	$1,574,850	$0
2051	3,951	$1,878	$7,417,843	0.2074	$1,538,461	$0
2052	4,010	$1,915	$7,679,693	0.1957	$1,502,916	$0
2053	4,070	$1,953	$7,950,786	0.1846	$1,467,715	$0
2054	4,131	$1,992	$8,231,449	0.1741	$1,433,095	$0
2055	4,193	$2,032	$8,522,019	0.1643	$1,400,168	$0
2056	4,256	$2,073	$8,822,846	0.1550	$1,367,541	$0
2057	4,320	$2,114	$9,134,292	0.1462	$1,335,434	$0
2058	4,385	$2,157	$9,456,733	0.1379	$1,304,083	$0
2059	4,450	$2,200	$9,790,556	0.1301	$1,273,751	$0
2060	4,517	$2,244	$10,136,162	0.1228	$1,244,721	$0
2061	4,585	$2,289	$10,493,969	0.1158	$1,215,202	$0
2062	4,654	$2,335	$10,864,406	0.1093	$1,187,480	$0
2063	4,724	$2,381	$11,247,919	0.1031	$1,159,660	$0
2064	4,794	$2,429	$11,644,971	0.0972	$1,131,891	$0
2065	4,866	$2,477	$12,056,038	0.0923	$1,112,772	$0
					$68,801,284	$125,500,000

Table A3 retains the same column labeling as the previous tables. This table, however, takes the growth rate a step up: What if there was a 2.5% increase in lockages each year? What level of lockage fee would make sense for that level of traffic? The project would be financially feasible with a lockage fee of $1,750 and 0% subsidy level.

TABLE A3: STANDARD LOCKAGE FEE, HIGH LOCKAGE GROWTH (2.5%/YEAR INCREASE)

Year	Annual Lockages	Lockage Fee	Annual Lockage Fee Revenue	6% NPV Factor	NPV Revenue	NPV Capital
2024	2,643	$1,750	$4,625,250	1.0000	$4,625,250	$125,500,000
2025	2,709	$1,785	$4,835,699	0.9434	$4,561,998	$0
2026	2,777	$1,821	$5,055,723	0.8900	$4,499,594	$0
2027	2,846	$1,857	$5,285,759	0.8396	$4,437,923	$0
2028	2,917	$1,894	$5,526,261	0.7921	$4,377,351	$0
2029	2,990	$1,932	$5,777,705	0.7473	$4,317,679	$0
2030	3,065	$1,971	$6,040,591	0.7050	$4,258,617	$0
2031	3,142	$2,010	$6,315,438	0.6651	$4,200,398	$0
2032	3,220	$2,050	$6,602,790	0.6274	$4,142,591	$0
2033	3,301	$2,091	$6,903,217	0.5919	$4,086,014	$0
2034	3,383	$2,133	$7,217,314	0.5584	$4,030,148	$0
2035	3,468	$2,176	$7,545,701	0.5268	$3,975,076	$0
2036	3,555	$2,219	$7,889,031	0.4970	$3,920,848	$0
2037	3,643	$2,264	$8,247,982	0.4689	$3,867,479	$0
2038	3,734	$2,309	$8,623,265	0.4423	$3,814,070	$0
2039	3,828	$2,355	$9,015,624	0.4173	$3,762,220	$0
2040	3,924	$2,402	$9,425,834	0.3937	$3,710,951	$0
2041	4,022	$2,450	$9,854,710	0.3714	$3,660,039	$0
2042	4,122	$2,499	$10,303,099	0.3504	$3,610,206	$0
2043	4,225	$2,549	$10,771,890	0.3305	$3,560,110	$0
2044	4,331	$2,600	$11,262,011	0.3118	$3,511,495	$0
2045	4,439	$2,652	$11,774,433	0.2942	$3,464,038	$0
2046	4,550	$2,705	$12,310,169	0.2775	$3,416,072	$0
2047	4,664	$2,760	$12,870,282	0.2618	$3,369,440	$0
2048	4,780	$2,815	$13,455,880	0.2470	$3,323,602	$0
2049	4,900	$2,871	$14,068,122	0.2330	$3,277,873	$0
2050	5,022	$2,928	$14,708,222	0.2198	$3,232,867	$0
2051	5,148	$2,987	$15,377,446	0.2074	$3,189,282	$0
2052	5,277	$3,047	$16,077,120	0.1957	$3,146,292	$0
2053	5,409	$3,108	$16,808,629	0.1846	$3,102,873	$0
2054	5,544	$3,170	$17,573,422	0.1741	$3,059,533	$0
2055	5,682	$3,233	$18,373,012	0.1643	$3,018,686	$0
2056	5,825	$3,298	$19,208,984	0.1550	$2,977,393	$0
2057	5,970	$3,364	$20,082,993	0.1462	$2,936,134	$0
2058	6,119	$3,431	$20,996,769	0.1379	$2,895,454	$0
2059	6,272	$3,500	$21,952,122	0.1301	$2,855,971	$0
2060	6,429	$3,570	$22,950,944	0.1228	$2,818,376	$0
2061	6,590	$3,641	$23,995,212	0.1158	$2,778,646	$0

Year	Annual Lockages	Lockage Fee	Annual Lockage Fee Revenue	6% NPV Factor	NPV Revenue	NPV Capital
2062	6,755	$3,714	$25,086,994	0.1093	$2,742,008	$0
2063	6,924	$3,788	$26,228,452	0.1031	$2,704,153	$0
2064	7,097	$3,864	$27,421,847	0.0972	$2,665,403	$0
2065	7,274	$3,941	$28,669,541	0.0923	$2,646,199	$0
					$126,444,140	$125,500,000

For the following tables, the highlighted numbers represent the range in which delays would need to be reduced for shippers to be willing to pay a lockage fee.

Table A4 was used to calculate a sketch-level benefit-cost analysis for the scenario outlined in Table 1. This scenario had lockages decreasing by 0.9% each year, and a 50% subsidy level.

The first column has some key figures. The first figure is the reduction in cost due to reduction in delay titled "Current Delay Cost." This was found by multiplying the $985 figure from USDA by the delay level for which shippers would be willing to pay a lockage fee. In Table A4, this is one hour. As such, the delay cost is $985. Second, the cell labeled "Lockage Fee" displays the feasible lockage fee with 50% government subsidy. In this case, that figure is $1,225. Third is the cell labeled "Current Total Delay Cost." This figure is consistent through the remainder of the appendix and represents the cost shippers currently pay for delays at LaGrange.

Next, in the second column, the number of hours delayed is shown. In the third column, the total delay cost per hour of delay is shown.

In the fourth column, and most critically, the total cost to a shipper is shown. This column was calculated by taking the cost of delays (assuming delays had been reduced) and adds the cost of the lockage fee. For example, if there was a delay of 0.25 hours, shippers would be paying $246 for the delay alone, and then an additional $1,225 for the lockage fee. This would cost a total of $1,471, as displayed in column four, row three.

The fifth column shows the marginal benefit. This is found by subtracting the total cost from the current total delay, shown in the first column. The cells highlighted display the range where a breakeven point occurs, and can give a private contractor that is operating a lock a good idea of what range to keep delays within.

TABLE A4: SHIPPER BENEFITS FOR TABLE 1 WITH 50% SUBSIDY

Current Delay Cost	Delay Time (Hours)	Total Delay Cost (Delay Time * 985)	Total Cost (Delay Cost + Lockage Fee)	Marginal Benefit (Current Delay Cost - Total Cost)
$985	0	$0	$1,225	$1,129
Lockage Fee	0.25	$246	$1,471	$883
$1,225	0.5	$493	$1,718	$636
Current Total Delay Cost (2.3 hrs * $985)	0.75	$739	$1,964	$390
$2354.15	1	$985	$2,210	$144
	1.25	$1,231	$2,456	-$102
	1.5	$1,478	$2,703	-$349
	1.75	$1,724	$2,949	-$595
	2	$1,970	$3,195	-$841
	2.25	$2,216	$3,441	-$1,087
	2.5	$2,463	$3,688	-$1,334
	2.75	$2,709	$3,934	-$1,580
	3	$2,955	$4,180	-$1,826

Table A5 is the same as the above, but modeling the growth scenario outlined in Table 2, shown in Section 5.4.

TABLE A5: SHIPPER BENEFITS FOR TABLE 2 WITH 40% SUBSIDY

Current Delay Cost	Delay Time (Hours)	Total Delay Cost (Delay Time * 985)	Total Cost (Delay Cost + Lockage Fee)	Marginal Benefit (Current Delay Cost - Total Cost)
$985	0	$0	$1,215	$1,139
Lockage Fee	0.25	$246	$1,461	$893
$1,215	0.5	$493	$1,708	$646
Current Total Delay Cost (2.3 hrs * $985)	0.75	$739	$1,954	$400
$2354.15	1	$985	$2,200	$154
	1.25	$1,231	$2,446	-$92
	1.5	$1,478	$2,693	-$339
	1.75	$1,724	$2,939	-$585
	2	$1,970	$3,185	-$831
	2.25	$2,216	$3,431	-$1,077
	2.5	$2,463	$3,678	-$1,324
	2.75	$2,709	$3,924	-$1,570
	3	$2,955	$4,170	-$1,816

Table A5 shows a positive growth scenario, in which annual lockages are increasing by 1.5% a year. It also shows that shippers would be willing to pay, so long as delays were reduced to one hour, and there was a subsidy rate of 40%. Therefore, a lockage fee of $1,215 was considered the most optimal.

ABOUT THE AUTHOR

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