Economic Benefits of Reopening the Willamette Falls Locks

Prepared for The Willamette Falls Locks Working Group

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TABLE OF CONTENTS

Cover photo: 2010 Lock Fest. *Courtesy of the Willamette Falls Heritage Foundation*

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SUMMARY

The Willamette Falls Locks ("the Locks") are an important piece of Oregon history and the oldest significant navigational facility west of the Rockies. Prior to their closure in 2011, the Locks provided a vital passage for freight and recreation users around Willamette Falls ("the Falls"), connecting the Mid-Willamette Valley to Portland and beyond.

Closing the Locks cut the Willamette River in two. No longer can boats upriver of the Falls access Portland and the Columbia River. At the same time, the two paper mills adjacent to the Falls have both closed, and the redevelopment possibilities on these sites have sparked the imagination of many local and state stakeholders.

The U.S. Army Corps of Engineers ("the Corps") has determined that insufficient "federal interest" exists to continue maintaining and operating the Locks. In May 2017, the Corps released a draft report (Disposition Study) describing its assessment of alternatives for transferring the Locks to another entity, or decommissioning them. The Corps concluded that from a federal perspective, the best disposition alternative is transferring the Locks to a new owner in a non-operational condition after completing minimal seismic upgrades.

Moving forward with the disposition of the Locks requires a willing partner who is aware of the potential costs and benefits of operating the Locks. To address this need, the Oregon Legislature allocated funds for an economic study of reopening the Locks. Clackamas County, on behalf of the Willamette Falls Locks Working Group, contracted with ECONorthwest to conduct an economic assessment of reopening the Locks. This assessment will help inform state and local decision making regarding the costs and benefits of operating the Locks by taking a broader view of the asset value of the Locks, focusing specifically on state and local interests. We inventoried and quantified, where possible, the benefits of an operational Locks across five categories: transportation, recreation and tourism, local and regional development, cultural and historical value, and infrastructure resiliency. We also summarized available information on the costs of operating the Locks.

Our analysis shows that the Locks remain a viable and valuable asset for local and regional economies and communities, and if reopened would produce millions of dollars of public and private benefits. If the Locks are decommissioned, the communities and stakeholders near the Locks would not be able to capitalize on the transportation, recreation, tourism, cultural, historic, and economic development benefits that one of the nation's most historic and unique transportation infrastructure assets could provide.

OVERVIEW OF BENEFITS

Our assessment evaluates how benefits and costs vary across two operational scenarios.

- The **Public Ownership** scenario assumes that a public entity would acquire and operate the Locks, much like it has operated historically.
- The **Private Ownership** scenario assumes that a private entity would acquire and operate the Locks for their own commercial interests.

BY THE NUMBERS:

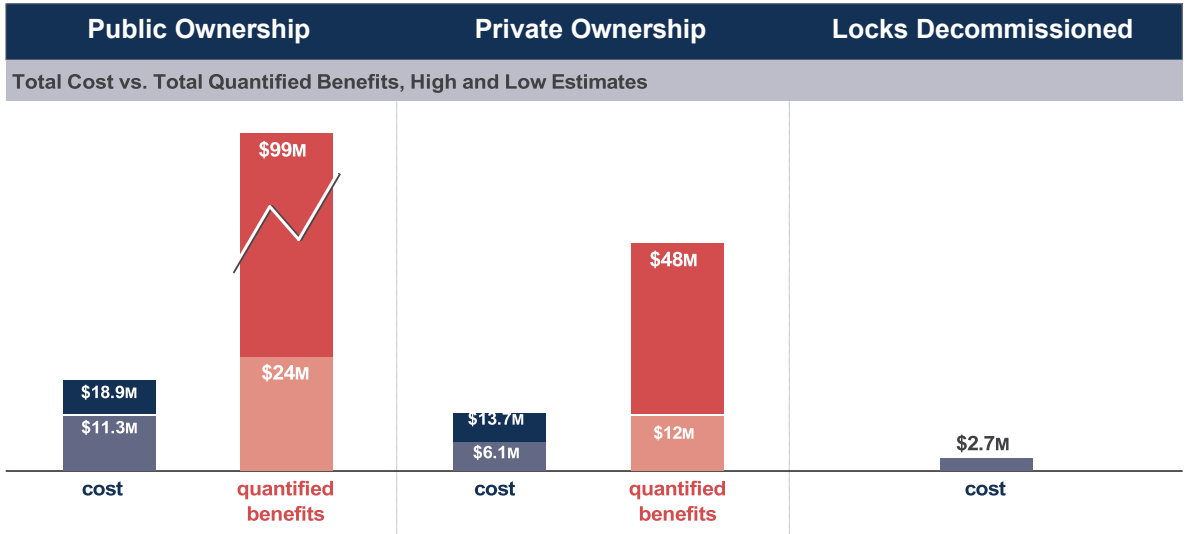
- Quantified transportation benefits of between **$12–$49 million** over 30 years.
- Quantified recreation benefits of between **$12–$50 million** over 30 years.
- **80,000–220,000 trucks trips removed** from Portland area roads over 30 years.
- **11,000–32,000 metric tons** of CO_2 reduced over 30 years.
- **5,400–15,400** metric tons of NO_X reduced over 30 years.
- **2-6%:** Cost as percent of Army Corps restoration investment above the Falls over 30 years.
- **Over 4,000 annually:** Estimated number of recreational boats that may use the Locks, based on historical use patterns, population growth, and increase in demand for recreational boating since 2000.

We compare the benefits and costs of these operational scenarios against a "Baseline" scenario in which the Corps decommissions the Locks and builds a concrete bulkhead at the upstream end of the Locks canal to regulate river levels upstream. The Corps stated in its Disposition Study that this would be the preferred course of action if a transferee is not identified.

We summarize the benefits and costs of each scenario in Figure 1. We divide the benefits into two categories:

- **Quantified Benefits:** In both the Public and Private Ownership scenarios, the quantified benefits of repairing and operating the Locks exceed the costs.
- **Unquantified Benefits:** The quantified benefits shown in Figure 1 do not capture all of the benefits that are likely to materialize, especially in the Public Ownership scenario. The lower half of Figure 1 outlines additional benefits we identified, but were not able to quantify. We grouped these benefits by their certainty to materialize: those that are certain but unquantifiable immediately add to the total quantified benefits. Those that are highly likely to occur now or in the future also imply our total quantified benefits are very likely underestimated. Benefits listed in the potential and unlikely categories may further increase the total benefits should they materialize in the future.

Figure 1. Cross-Scenario Comparison



Unquantified Benefits

	Public Ownership	Private Ownership	Locks Decommissioned
Certain	• Additional Recreation-Tourism Revenue • Cultural and Spiritual • Historical Interpretation and Education Historic Preservation		
Highly Likely	• Transportation Infrastructure Resiliency	• Transportation Infrastructure Resiliency	
Likely	• Future Transportation Cost Savings • Future Environmental and Congestion • Future Recreation-Tourism Revenue • Local Development	• Historic Preservation • Future Transportation Cost Savings • Future Environmental and Congestion	
Potential	• Upriver and Downriver Development Benefits	• Cultural and Spiritual • Local Development • Upriver and Downriver Development Benefits	• Local Development
Unlikely		• Recreation-Tourism Revenue • Historical Interpretation and Education	
Unquantified Costs			• Additional NEPA study costs • Additional litigation costs

Figure 1 Notes:

All quantified benefits and costs are over 30 years, estimated in 2017 dollars, and discounted at 3 percent. For more information, see technical appendices.

The Corps estimated that all scenarios would protect its investment of $194-$694 million in restoration projects located upstream of the falls. Because this benefit is the same across all scenarios, we omit it from this analysis.

Our conclusion that benefits exceed costs holds, even though we employed conservative analytical assumptions that likely underestimate the true value of the benefits of reopening the Locks. For example, we assumed that during thirty years of future operations, no commodities other than aggregate would move through the Locks. In reality, it is highly likely that with the Locks operating on a regular schedule, businesses that produce and transport other goods and commodities would also take advantage of the cost savings that barging provides over trucking and ship their products through the Locks, especially as congestion increases on the region's highways.

Figure 2 shows a range of quantified benefits from the public ownership scenario. The major categories of benefits include revenues from overnight cruise operators ($11.7–$48.4 million), reduced moorage costs ($8.1–$40.4 million), and transportation cost savings ($2.0–$5.6 million).

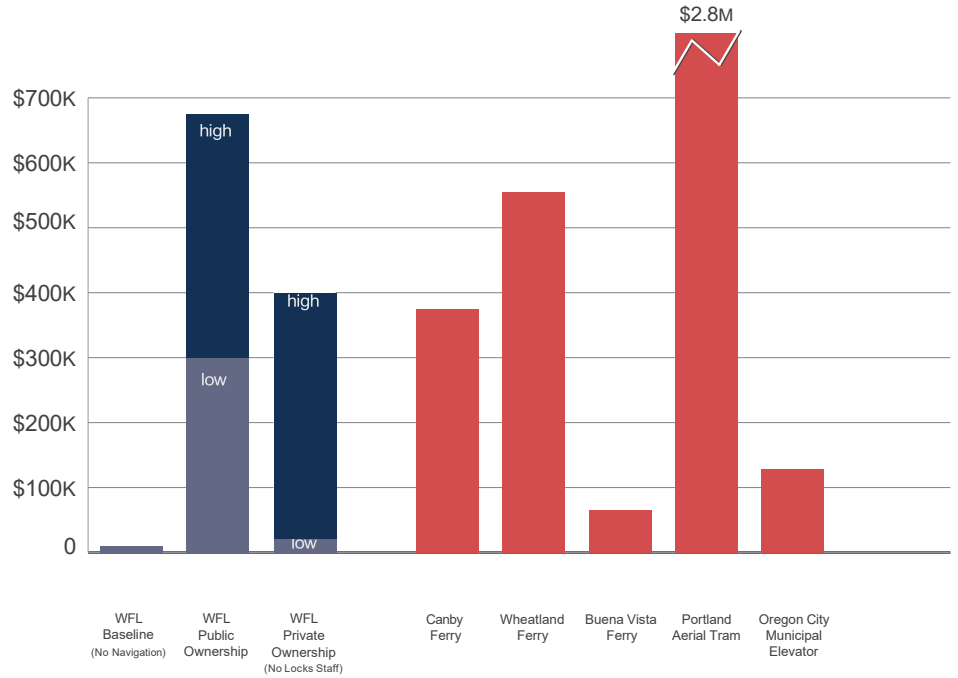
On the cost side, our high-end cost estimate is based on a conservative assumption of operating the Locks seven days per week, fifty-two weeks per year. This estimate likely overstates the true cost of operating the Locks, which would most likely run fewer days per week. For example, our low-end cost estimate assumes six months of operations at four days per week, and six months of operations at two days per week, which is a more realistic schedule, especially during the first few years of operations. We also found that the costs of operating the Locks are generally in line with the costs of operating other transportation assets in the region, e.g., ferries (see Figure 3).

Figure 2. Quantified Benefits for Public Operating Scenario over 30 years (2017 dollars)

	Low	High
Transportation Benefits		
Moorage Cost Savings	$8.1 million	$40.4 million
Transportation Cost Savings	$2.0 million	$5.6 million
In-Water Construction Cost Savings	$1.2 million	$1.2 million
Environmental and Congestion Benefits	$500,000	$1.4 million
Recreation		
Overnight Cruise Revenues	$11.7 million	$48.4 million
Personal Watercraft Recreation Benefits	$600,000	$2.4 million
Total Quantified Benefits	**$24.1 million**	**$99.4 million**

Note: Totals may not sum due to rounding.

Figure 3. Annual Operating Costs, The Locks vs. Other Portland Area Transportation Infrastructure (2017 dollars)



KEY TAKEAWAYS

Transportation

- Shipping aggregate by barge reduces transportation costs by approximately 18 percent compared with trucking. Reopening the Locks will provide millions of dollars of cost savings for aggregate shippers.
- There is a critical shortage of moorage sites for commercial vessels below the Falls. Reopening the Locks will provide much needed access to moorage sites for commercial vessels above the Falls at greatly reduced costs compared with costs below the Falls. These savings amount to tens of millions of dollars of reduced moorage costs over 30 years.
- Moving aggregate by barge could remove between 80,000 and 220,000 truck trips from Portland-area congested roadways over the next 30 years.
- Reducing truck traffic could also reduce the production of the greenhouse gas carbon dioxide (CO_2) by 46 percent and production of nitrogen oxides (NO_x) by 93 percent, compared with trucking. NO_x are respiratory irritants and contribute to the formation of acid rain and haze.

Recreation

- Recreation and tourism activities associated with the Locks would resume immediately after reopening, and use likely would expand beyond historical levels because of population growth and increased demand for water-based recreation since 2000.
- Quantified benefits associated with recreation, including guided overnight cruises and use by personal watercraft (e.g., motor boats and canoes) range from about $12 million to over $51 million over 30 years.
- Guided day tours, on-site visitation, and future tourism bolstered by potential development plans would all generate additional benefits beyond those quantified.

Development

- The sites immediately adjacent to the Locks, the West Linn Paper Mill and the Willamette Falls Legacy Project, will have the greatest potential development benefits from a reopened Locks.
- All of the riverfront sites near the Locks face significant infrastructure and market barriers to redevelopment that will require public-private partnerships to overcome.
- Redevelopment sites in the cities of Wilsonville and Newberg are most likely to capitalize on increased access to Portland, particularly if new overnight tourist boats visit those locations.

Cultural and Historic

- Cultural and historic benefits are unquantifiable in monetary terms, but are clearly revealed by past and current actions to protect the Locks for current and future generations.
- In addition to designations on the National Register of Historic Places and as a State Historic Civil Engineering Landmark, in 2012 the National Trust for Historic Preservation named the Locks a National Treasure, dedicating resources toward its long-term preservation.
- Willamette Falls is one of the most important gathering places for northwest Tribes. The Locks protect the Tribes' access around the Falls, especially after development eliminated traditional portage routes.

Resiliency

- During the short- and long-term recovery phases in the aftermath of the Cascadia Subduction Zone Earthquake, the Locks could provide critical transportation services long before the region's bridges and roadways return to functionality.
- These services include moving reconstruction materials, food, and fuel; reconnecting family members separated at the time of the earthquake; and, transporting volunteers and other recovery workers to damaged areas.

BACKGROUND AND INTRODUCTION

On January 1, 1873, the Locks opened and allowed passage around Willamette Falls, the second largest waterfall in the United States by volume (behind Niagara Falls). The Locks dramatically reduced transit times and transportation costs and were considered an engineering marvel at the time. The initial design for the way the Locks gates are beveled upstream came from drawings by Leonardo da Vinci.[1] Initially constructed as a private venture with financial support from the state of Oregon, in 1915 the Corps took ownership and provided free transit around Willamette Falls to encourage commerce.[2]

Fast-forward 96 years. In December 2011, in response to dwindling commercial tonnage passing through the Locks, and a mounting bill for anticipated deferred maintenance and repairs, the Corps changed the operational status of the Locks from "caretaker status" (operating the Locks at least once per month for maintenance) to "non-operational status" (Locks not operated at all).[3] That decision effectively cut the Willamette River in two. Commercial and recreational users upstream of the Falls can no longer access recreation sites, markets, or customers downstream via the river. Likewise, downstream businesses and recreational users can no longer access sites upstream from the Falls on the river.

By changing the operational status of the Locks to "non-operational" in 2011, the Corps signaled (based on their interpretation of the relevant operating and funding guidelines) that insufficient "federal interest" existed to continue maintaining and operating the Locks, given declining commercial traffic through the Locks. In May 2017, the Corps released a draft report of their assessment of alternatives for transferring ownership of the Locks to another entity or decommissioning the Locks, known as the "Disposition Study."[4] The Corps initially considered eight disposition alternatives including No Action, continuing caretaker status; Operational Lock, repairing and transferring fully-operational Locks; Non-Operational Lock, transferring non-operational Locks after minimum seismic repairs; and, a number of alternatives that would permanently disable the Locks making them unusable for navigation. After an initial screening process, the Corps studied three alternatives: No Action; Non-Operational Lock; and the Concrete Bulkhead alternative, which would permanently disable the Locks and make them unusable for future navigation. Based on their study of these three alternatives, the Corps selected the Non-Operational Lock as their preferred alternative.[5] Thus, the Corps concluded that from a federal perspective, the best alternative is transferring the Locks in a non-operational condition after completing minimal seismic upgrades.

The Locks have significant navigational, historical, and cultural importance to Oregonians. They have received official recognition as a valuable civil engineering achievement, and represent a keystone landmark in a region rich with markers of Oregon's early history.[6] But they are not just part of Oregon's past. Though the commercial

Above: Postcard circa late 19th century. Old growth logs moving through the canal. *Courtesy of the Willamette Falls Heritage Foundation.*

Below: Recreation boats: Corvallis-to-Portland Regatta sculling event. *Courtesy of Sandy Carter.*

importance of a water-based transportation corridor may have diminished due in part to expanded rail services and the construction of Interstate 5, the economic, practical, and psychological import of this connection has not disappeared. As commercial demand has waned, water-based recreational and tourism demands have grown. As the region plans for continued growth and prepares for future economic disruptions including the Cascadia earthquake and adaptation to climate change, a unified and navigable Willamette River that connects the Willamette Valley to the Portland Metro Area may hold benefits yet to be fully realized.

Recognizing these local and regional benefits, numerous cities, counties, regional governments, Tribes, and non-profit groups have passed resolutions supporting the repair and reopening of the Locks.[7] The Willamette Falls Locks Working Group, a coalition of local governments, businesses, and non-profit organizations, formed in 2015 with the primary goal of seeing the Locks repaired and reopened.[8] In 2015, the Oregon Legislature established the Willamette Falls Navigation Canal and Locks Task Force, whose charge included promoting and supporting efforts to repair and reopen the Locks.[9] In 2017, the Oregon Legislature established the Willamette Falls Locks Commission, which is a policy-making and advisory board for issues regarding the repair, reopening, and future transfer of ownership of the Locks from the federal government to another public or private entity.[10] (See the Timeline for additional significant dates in the Locks' history.)

In an effort to better understand the range of economic benefits of an operational Locks, the Oregon Legislature allocated funds for a study. Clackamas County, on behalf of the Willamette Falls Locks Working Group, contracted with ECONorthwest to conduct an economic assessment of reopening the Locks. Unconstrained by the guidelines under which the Corps conducted their recent draft Disposition Study, which focused on the federal interest in previous commercial traffic through the Locks and the Corps' interest in maintaining river levels above the Falls that ensure continuing efficacy of their upstream habitat and riparian restoration investments, our assessment takes a broader view of the asset value of the Locks, focusing specifically on state and local interests.* Our assessment includes six analytical components:

- **Transportation Benefit Assessment.** Presents the economic benefits of the Locks as an asset that facilitates commodity transport and other river-based commercial services (e.g., in-water work at docks and marinas).
- **Recreation and Tourism Benefit Assessment.** Presents the economic benefits of the Locks as an asset used by motorized and non-motorized personal watercraft that also contributes to the expansion of guided recreation and tourism opportunities.
- **Cultural and Historic Significance Assessment.** Presents the importance of the Locks to the region's Native American tribes, describes the Locks' historic significance, and their role in efforts to preserve and interpret early Oregon industrial and transportation history and interactions with Willamette Falls.
- **Economic Development Benefit Assessment.** Presents the benefits the Locks provide for proposed and potential economic development projects in the vicinity of the Locks, and for communities upriver and downriver of the Locks.
- **Resiliency Benefit Assessment.** Presents the benefits of the Locks as an additional or alternative transportation route after an earthquake or other disaster damages the region's transportation infrastructure.
- **Cost Assessment.** Presents estimated operations and maintenance costs of running the Locks on a regular, year-round basis.

Our assessment describes benefits and costs associated with three scenarios.

- A **Baseline** scenario assumes that the Locks are decommissioned in such a way that precludes future navigational use.
- A **Public Operations** scenario assumes public ownership and operation of the Locks for both public and private use and benefits.
- A **Private Operations** scenario assumes private ownership and operation of the Locks for private use and benefit.

*This analysis provides information about the types of considerations Congress recently instructed the Corps to consider in disposition studies. In section 1165 of the Water Infrastructure Improvements for the Nation Act, passed into law in December of 2016, Congress stipulated that disposition studies should address "the extent to which the property concerned has economic, cultural, historic, or recreational significance or impacts at the national, state, or local level."

This report summarizes the findings of our assessment. Appendices A through F provide technical memos that document the assumptions, data sources, and results of our assessment.

- Appendix A describes the scenarios
- Appendix B describes the costs of each scenario
- Appendices C through E provide the details of our transportation, recreation/tourism, and economic-development assessments
- Appendix F provides a complete list of the individuals consulted for our assessment

Willamette Falls Locks Timeline

Pre-1850	Native people live, travel through, and gather at Willamette Falls.		
1850's	**1858:** Willamette Falls Canal & Locks Company is established with intent to build a canal around Willamette Falls.		
1870's	**1872:** Construction begins on WFL.	**1873:** Open for business January 1.	
1880's	**1889:** Paper mill established.		
1910's	**1915:** USACE purchases WFL from Portland Railway Light and Power Co.	**1916:** USACE deepens the canal from 2' to 6'.	
1940's	**1940:** USACE upgrades WFL.	**1941:** WFL upgrades from manual operation to hydraulic operation.	
1970's	**1974:** Listed on the National Register of Historic Places.		
1990's	**1991:** Designated as a State Historic Civil Engineering Landmark by the American Society of Civil Engineers.	**1997:** West Linn Paper discontinues its use of WFL.	**1999:** Willamette River named American Heritage River.
2000's	**2001:** Transition from 365-day operation to seasonal schedule.*	**2002:** Willamette Falls Heritage Foundation organized by volunteers to advocate for WFL.	
	2004: First of six "Lock Fests" held to advocate for preservation and funding, and the first Congressional earmark for seasonal operations.	**2005:** USACE moves WFL to "Caretaker Status" with limited funding for maintenance, and Congressional earmark extended to maintain seasonal operations.	
	2006-2007: Seasonal operations supported with federal grant and local funds from Clackamas County and ODOT.		
	2008-2009: WFL closed for overdue inspections and repairs. Repairs funded by the American Recovery and Reinvestment Act of 2009.		
	2010: Last year of seasonal operations funded through Congressional earmark.	**2011:** USACE designated the status of WFL as "non-operational"; limited lockages for commercial traffic allowed until December.	
	2013: Special lockages for Canby Ferry (last lockage to date).		
	2014: Last Lock Fest held to date.	**2015:** Willamette Falls Locks Working Group established to build support for reopening WFL.	
	2016: First meeting of the State Locks Task Force to study and develop a plan for the sustainable operation of WFL.	**2017:** USACE releases Disposition Study; Oregon Legislature creates the Willamette Falls Locks Commission (to convene in 2018).	

* This date is unconfirmed: seasonal operation may have begun as early as 1999. https://www.willamettefalls.org/history-of- the-locks

TRANSPORTATION BENEFITS

Key Takeaway: Total transportation-related benefits of reopening the Locks over 30 years of future operations ranges from approximately $12 million to $49 million (2017 dollars).

This assessment estimates the cost savings for transportation-related activities that could result from reopening the Locks. These include the savings on transportation costs of moving commodities by barge on the Willamette River and through the Locks versus transporting commodities by truck. We also estimate the reduced cost of mooring barges and related vessels upriver of the Locks versus the costs of mooring these vessels in the Portland Harbor area. Reopening the Locks would also help reduce construction costs for in-water work on docks and other water-related infrastructure along the Willamette River above the Locks. We estimate these cost savings as well.

These benefits vary by scenario. Under the baseline scenario, none of these benefits would materialize. Under the public ownership scenario, all would materialize with some variation in magnitude, depending on operating schedule. Benefits under the private operating scenario would depend on the operator's activities, but presumably they would generate some of the benefits described in this section.

Barging Advantages	Barging Disadvantages
Larger capacity yet lower transportation costs per ton-mile. ■ Barges operate with engines of comparable size and power to trucks, but can move much greater tonnage per engine. Fewer trucks on the road and reduced traffic congestion. ■ One barge load is equivalent to 40 truckloads of aggregate. Fewer environmental pollutants produced. ■ Barging's larger transportation capacity per load reduces the total output of environmental pollutants. Lower accident rates. ■ Barging's larger capacity, fewer trips, and lower staffing levels reduce overall accident rates. Ability to ship bulky goods. ■ Barging's larger capacity and ease of loading and unloading provides superior ability to move bulky goods.	Longer transport times. ■ Barges operate at slower travel speeds and sometimes use longer, less direct routes. Limited flexibility of rerouting as needed. ■ Barges can only operate on waterways of sufficient depth. Limited capacity for quick turnaround scheduling. ■ Barges operate at slower travel speeds. Requires intermodal transfer facilities located adjacent to rivers. ■ Connecting barging with other transportation modes may require dedicated rail or truck access and loading and unloading facilities.

TRANSPORTATION BENEFITS OF MOVING COMMODITIES WITH BARGES

Our assessment of the cost savings for commodity transport began by identifying the commodities most likely to be transported by barge based on barging's advantages and disadvantages relative to truck and rail mode.*

We conducted a screening analysis of the commodities most likely to be transported through the reopened Locks, based on historical usage and current production patterns. These commodities included: aggregate; recycled metal and finished steel; wood pulp and finished paper products; logs; agricultural products; trash; and recycling. We found that barging's disadvantages or other limitations would likely prevent all but aggregate from moving through the Locks, at least initially after the Locks reopening. Table 1 presents our reasoning for this conclusion, by commodity.

*Likely beneficiary companies include Wilsonville Concrete Products and CalPortland Company, Inc.

Table 1. Summary of Screening Analysis Results for Commodities that Could Be Transported Through the Locks

Commodity	Included in Analysis?	Findings of Screening Analysis
Aggregate[11]	Yes	Factors that support moving aggregate through the Locks soon after reopening include: ■ There is a long history of moving aggregate through the Locks ■ Barges currently move aggregate throughout the lower Willamette River below the Locks ■ The barges, dredges, and tugs that move gravel on the lower river will fit in the Locks ■ The larger grained aggregate from mines above the Locks is desirable for construction projects throughout the Portland area
Recycled Metal and Finished Steel Products	No	Limitations that would need to be addressed before moving metal and steel products through the Locks include: ■ Constructing an intermodal rail-barge transfer facility in the Newberg area ■ Constructing a rail spur that connects the intermodal facility with the rail line that serves the Cascade Steel Rolling Mill in McMinnville, at $1 million to $2 million per mile ■ Determining if barging could provide adequate capacity for scrap metal and finished steel products on a delivery schedule that matches the Cascade mill's requirements
Wood Pulp and Finished Paper Products	No	The recent closure of the West Linn Paper Mill makes moot at this time the question of the potential transportation benefits to the mill of reopening the Locks. Should the mill reopen, however, constraints exist that would limit the feasibility of the mill switching from trucking to barge. These limitations include: ■ Constructing new loading infrastructure ■ Loading and unloading barges in the Port of Portland would probably require employing longshoremen, which would increase labor costs relative to trucking ■ There would be additional transport handling steps and costs relative to trucking ■ Determining if barging could provide adequate capacity for wood pulp and finished paper products on a schedule that matches the paper mill's requirements
Logs **Agricultural Products** **Trash** **Recycling**	No	Limitations that would need to be addressed before moving these commodities through the Locks include: ■ Identifying and purchasing suitable properties for intermodal transfer facilities on the Willamette River upriver from the Locks that would connect road, rail, and barge transportation modes ■ Building and operating the intermodal facilities ■ Determining if barging could provide adequate capacity on schedules that meet the needs of producers and shippers

Transportation Cost Savings and Environmental and Congestion Benefits

We estimated the cost savings of switching a small percentage of aggregate currently mined in counties that border the Willamette River from truck to barge.* We also estimated the economic value of environmental benefits of such a switch regarding impacts on the production of transportation-related greenhouse gases and air pollutants.

We developed three aggregate scenarios:

1. Moving aggregate from the Santosh aggregate mine in Scappoose, Oregon to the Wilsonville Concrete Products (WCP) plant in Wilsonville, Oregon (see Exhibit 1). This would facilitate mixing finer grain aggregate from the Santosh mine with coarser grain aggregate from WCP and CalPortland facilities when making concrete.
2. Moving aggregate from the Santosh aggregate mine to the CalPortland facility in Newberg, Oregon.
3. Moving aggregate from the WCP's Wilsonville facility during remediation of the Portland Harbor Superfund site. Coarser grain aggregate from the Wilsonville facility is preferred for capping contaminated sediment in riverbeds.[12]

For the three scenarios, we estimated the costs of moving aggregate by barge and by truck, and calculated the transportation benefits as the cost savings of moving aggregate by barge. Barging, in general, is a much more efficient method of shipping aggregate compared with trucking.

- Shipping by barge reduces transportation costs by 18 percent relative to shipping by truck.
- One barge has the capacity of 40 truckloads of aggregate.
- Moving the quantities of aggregate in our scenarios described above would remove approximately 80,000 to 220,000 truck trips from Portland-area roadways over 30 years of Locks operations (see Figure 4).

Shifting commodity movements from truck to barging yields environmental benefits in the form of reduced production of greenhouse gases and air pollutants including CO_2 and NO_X. Shifting aggregate transport from trucking to barging would reduce the production of CO_2 by 46 percent, with a total reduction of approximately 11,000 to 32,000 metric tons (see Figure 5).

Figure 4. Total Truck and Barge Trips Over 30 Years

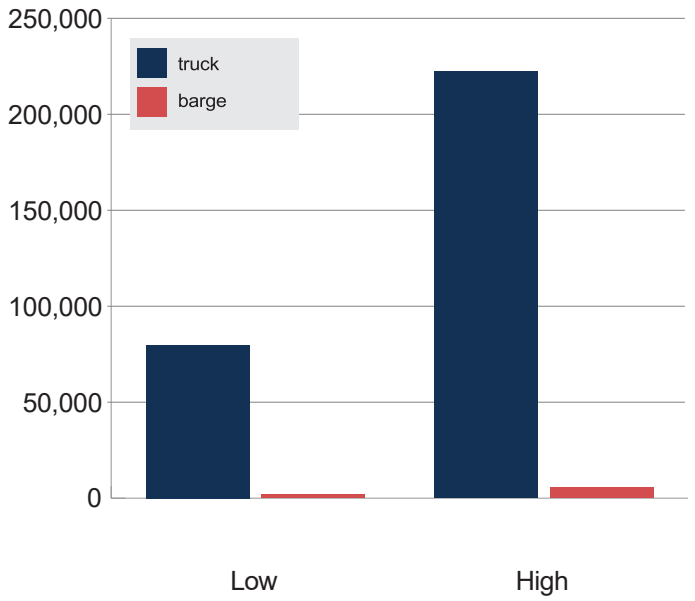
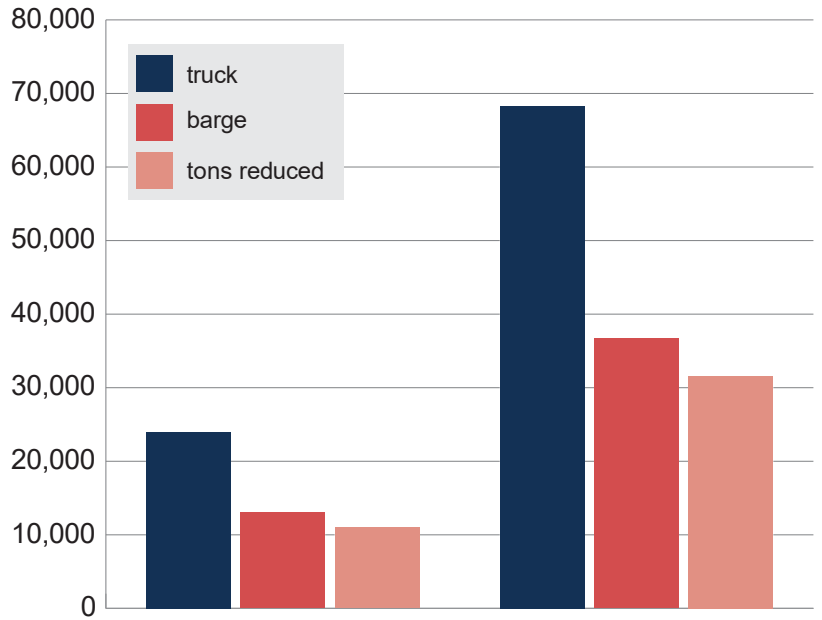


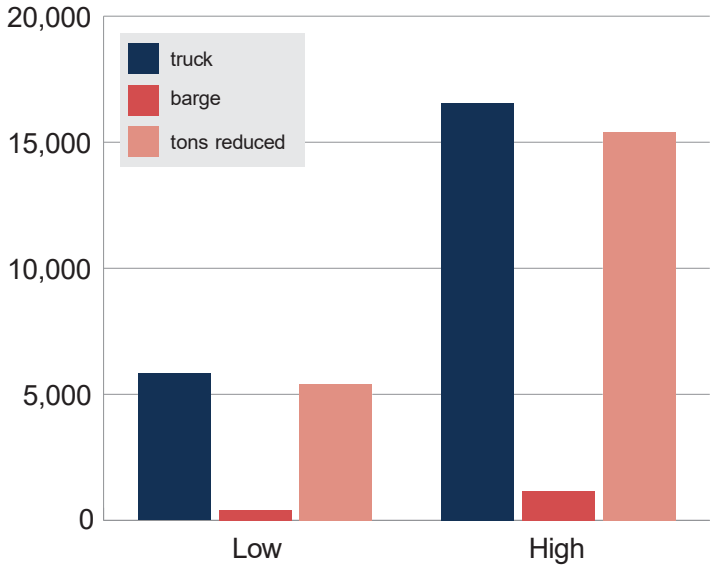
Figure 5. Metric Tons of CO_2 Produced Over 30 Years



*Less than 1 percent of aggregate mined in Clackamas, Marion, Multnomah, and Yamhill Counties in 2015.

Similarly, barging reduces the production of NO_X by 93 percent over 30 years, with a total reduction of approximately 5,400 to 15,400 metric tons (see Figure 6).

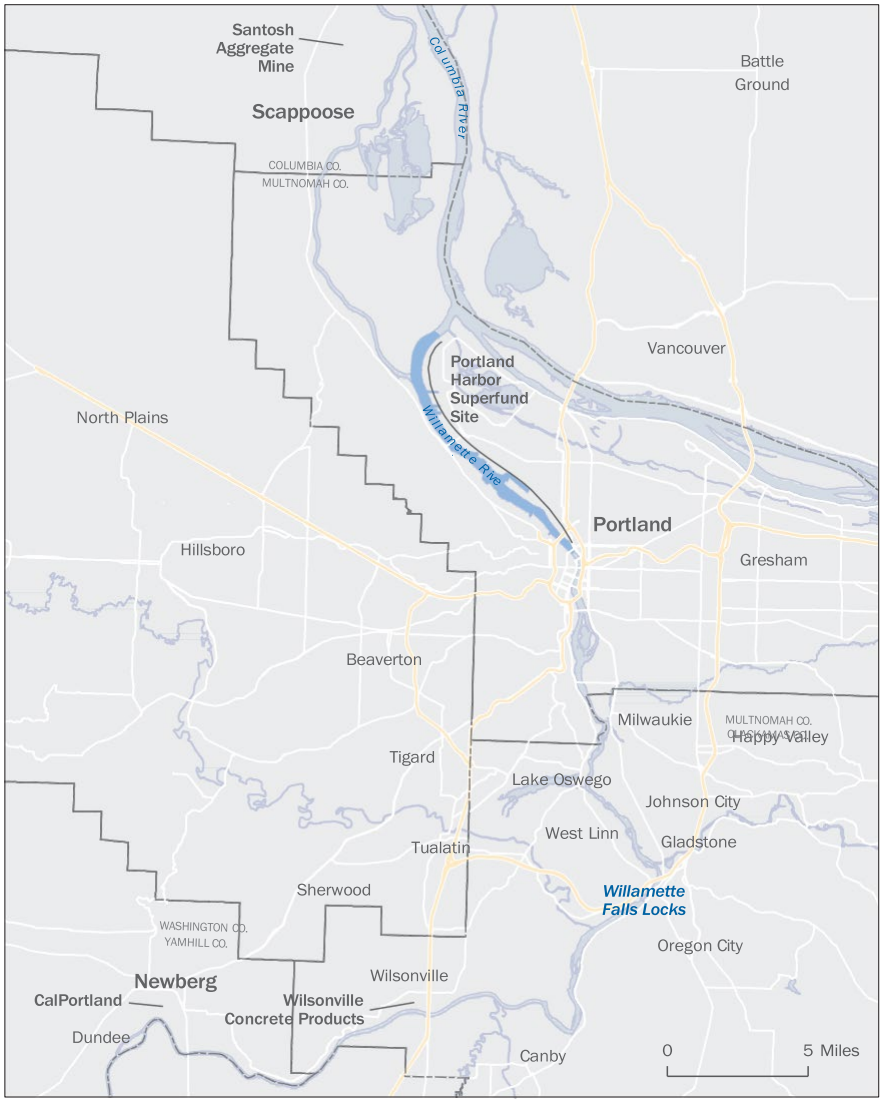
Figure 6. Metric Tons of NO_X Produced Over 30 Years



We estimate the economic value of reduced production of greenhouse gases and air pollutants based on the economic value of damages that these gases cause in the form of reduced agricultural productivity, human health effects, property damages from increased flood risks, and related costs.[13]

We estimate the total transportation benefit of barging aggregate, based on transportation cost savings and avoided costs associated with greenhouse gasses and air pollutants over 30 years of Locks operations, at between approximately $2.5 million and $7 million (in 2017 dollars).

Exhibit 1. Regional Context for Aggregate Barging Scenarios



Source: ECONorthwest

Moorage Benefits

Businesses such as Wilsonville Concrete Products (WCP) that operate commercial vessels on the Willamette River developed their business plans assuming access to their moorage facilities upriver of the Falls. These facilities are conveniently located adjacent to their processing plant in Wilsonville and many of the firm's workers lived in the vicinity. Closing the Locks forced WCP to find other moorage space downriver of the Locks or lose access to a significant portion of their business. Moorage in the Portland Harbor area is scarce and extremely expensive relative to WCP's moorage costs at its own facility on the Willamette River in Wilsonville. Moorage costs are higher because of lack of available moorage sites suitable for commercial barges and dredge,* higher fees charged by the Oregon Department of State Lands to occupy state water—which is based on assessed values of adjacent lands—and because WCP must pay rental fees that include costs for infrastructure and services that support their moorage. In addition to these costs, WCP's staff have a significantly longer commute from their homes to moorage sites in the Portland harbor area where WCP moors their vessels.

Reopening the Locks would allow barges, dredges, and tugs owned by WCP that are currently moored in the Portland Harbor area to move to WCP's moorage site in Wilsonville above the Locks. We estimated the moorage benefit based on WCP's current moorage costs in the Portland area and on the moorage costs they would pay if they could access their moorage sites adjacent to their Wilsonville facility. We calculate the moorage benefits over 30 years as the difference in these costs.

We estimate that the total moorage benefits over 30 years of Locks operations ranges from approximately $8 million to $40 million (in 2017 dollars).

In-Water Construction Benefits

A number of companies provide in-water construction services along the Willamette River, above and below the Locks. Barges with pile drivers and related equipment move up and down the river (typically during summer months), installing piles for existing or new docks and moorages at marinas and private residences. With the closure of the Locks, equipment and barges must be trucked above the Locks for work on the upper Willamette River. Reopening the Locks would allow contractors to revert to barging equipment upriver through the Locks, thus reducing their costs of operations relative to current conditions that requires additional trucking and handling costs.

We estimate that the total cost savings for in-water construction services upriver of the Falls over 30 years of Locks operations is approximately $1.2 million (in 2017 dollars).

SUMMARY OF TRANSPORTATION-RELATED BENEFITS

We summarize the results of our analysis of the transportation-related benefits over 30 years of reopening the Locks in Table 2. It includes the benefits described in each category above that we were able to quantify in monetary terms. The total benefits range from approximately $12 million to $49 million (in 2017 dollars).

Table 2. Transportation-Related Quantified Benefits of Locks Operations Over 30 Years (in 2017 dollars)

Benefit Category	Low Estimate	High Estimate
Transportation Cost Savings and Environmental and Congestion Benefits	$2.5 million	$7.0 million
Moorage Benefits	$8.1 million	$40.4 million
In-Water Construction Benefits	$1.2 million	$1.2 million
Total Transportation-Related Quantified Benefits	**$11.7 million**	**$48.5 million**

Totals may not sum due to rounding.
Source: ECONorthwest

Total transportation-related benefits over 30 years of Locks operations would likely exceed our totals in Table 2 for the following reasons:

- Actual transportation cost savings could be higher, if a larger quantity of aggregate moves through the Locks, or if other commodities begin to move through the Locks over time as businesses adapt to future predictability and certainty in Locks operations.
- We have not accounted for the benefits and cost savings of moving oversized cargo (e.g., the Spruce Goose) by barge rather than by truck or rail. In some cases, barging may be the only alternative given the size of the cargo.

*A phone survey of moorage and industrial sites in the Portland area and downriver to Longview found no moorage space available on a regular basis suitable for the commercial barges that WCP operates.

- Three ferries that operate upstream of the Falls will one day need to be replaced. If the Locks are not operational, replacing them may not be possible or would be more expensive.
- Complying with mandatory U.S. Coast Guard inspections for the three ferries and the Willamette Queen paddle wheeler that operates in the Salem area is more expensive because they cannot access boatyards in the Portland area.

Tug and barge on the Williamette River, Portland, OR. *Courtesy of John D, via Wikimedia.*

RECREATION AND TOURISM BENEFITS

Key Takeaways: Recreation and tourism activities associated with the Locks would resume immediately after reopening, and likely would expand beyond historical use. Quantified benefits associated with recreation, including guided overnight cruises and use by personal watercraft (e.g., motor boats and canoes) range from about $12 million to over $50 million (in 2017 dollars) over 30 years. Guided day tours, on-site visitation, and future tourism bolstered by potential development plans would all generate additional benefits beyond those quantified above.

People have moved through the Locks for recreation and tourism since their construction.[14] In the early days, steamboats transported people between Portland and the Willamette Valley for business and pleasure. As early as the first half of the twentieth century, the Locks were a draw for pleasure boaters in small recreational boats. As commercial traffic through the Locks waned in the last few decades of the twentieth century, recreational use of the Locks increased from guided river tours, paddlers traversing the Willamette River, and recreational boat owners from both upstream and downstream of the Locks. Our assessment of the recreation and tourism use of the Locks addresses the potential benefits from reopening the Locks across four categories, shown in Table 3.

Table 3. Summary of Recreation and Tourism Benefits

Use Category	Potential Benefits
Non-Motorized Watercraft. Owners of kayaks, canoes, and other human-powered, in-water recreational modes. Includes both local and non-local participants.	■ Increased value of a continuous paddle on the Willamette River Water Trail ■ Reduced cost of portage for through-paddles on the Willamette River Water Trail ■ Increased value of paddling through the Locks, a unique experience
Motorized Watercraft. Owners of motorized boats of all sizes	■ Increased value of connection between upper and lower Willamette River ■ Potential reduced cost of boat ownership for boats located above the Locks ■ Increased value of traversing through the Locks, a unique experience
Guided Day Tours. Operators of and participants in water-based guided tours that include the Locks	■ Increased value and revenue associated with through-Locks tours compared to existing offerings ■ Increased opportunities for cross-marketing with other regional tourism experiences
Guided Overnight Tours. Operators of and participants in hotel barge cruises to Oregon's wine country	■ Increased value and revenue associated with tours, not currently offered ■ Increased visibility and international interest in Oregon's wine country may lead to expanded revenue for the broader tourism industry.

They vary by scenario. Under the baseline scenario none of these benefits would materialize. Under the public ownership scenario, all would materialize, with some variation in magnitude, depending on operating schedule. Under the private operating scenarios, it is unlikely that these benefits would materialize, because allowing recreational use would require a private owner to operate the Locks on a predictable schedule and carry more insurance, without receiving additional compensation to cover these costs.

NON-MOTORIZED WATERCRAFT USERS

This category of use includes people who would travel through the Locks in canoes, kayaks, and rafts. Passage through the Locks could be part of a short-distance or long-distance trip. Though data on use of specific waterbodies in Oregon does not exist, there is clear demand for this kind of recreation in the area. Approximately 10 percent of the population in the regions that roughly correspond to the Willamette River watershed reported participating in flatwater rowing, paddling, tubing, and floating in 2011, the most recent year data were available.[15]

Left: Boaters returning from Steamboat Day at Champoeg in 1939. *Courtesy of the Clackamas County Historical Society.* Right: Corvallis-to-Portland Regatta sculling event. *Courtesy of Sandy Carter.*

Local businesses have developed in the area that cater to people wanting to experience Willamette Falls and the natural area upstream of the falls up close, including eNRG Kayaking in Oregon City. On any summer day or evening, dozens of paddlers explore the flatwater below and above the falls, and over the course of the year, well over a thousand paddlers likely experience the immediate area upstream and downstream of the Falls.[16]

An operational Locks likely would increase the value of this area as a local trip destination, because paddlers could combine trips above and below the Falls, linking two beautiful natural destinations with Locks passage that would increase the diversity and points of interest of the trip.

Reopening the Locks would also have benefits for long-distance trips. There is growing interest locally and internationally in long-distance trips on the Willamette Water Trail, a paddle that begins in the upper reaches of the Willamette River and ends at its confluence with the Columbia downstream of Portland. The Willamette Water Trail is one of only 20 National Water Trails in the U.S., and Willamette Riverkeeper mails trail maps all over the U.S., Canada, and internationally. Interest has been growing from people wanting to complete the entire trail: dozens of people inquire directly to Willamette Riverkeeper about how to portage around the Falls every year. eNRG Kayaking also receives a half-dozen similar calls per year.

The value the Locks would provide in completing the trail and avoiding an expensive, time-consuming, and interruptive portage cannot be understated. As with local trips, reopening the Locks would likely increase use of the entire length of the Willamette River Trail. Completing the entire trail without interruption likely would also increase the value that users place on the experience.

The total value of a day of paddling can be measured as the sum of two values: what people actually spend to participate (e.g., kayak rental or purchase, gas to drive to boat launch, etc.) and the extra amount people would have been willing to spend to participate. Being able to paddle through an operational Locks would generate benefits to local businesses by increasing the number of people interested in paddling, the amount they are willing to spend for the trip, and the enjoyment they receive from the trip over and above what they would have been willing to pay.

Data are not available to quantify exactly how many additional people may use the Locks for recreational purposes, how much they might spend above what they currently spend (assuming they are already taking the trip), and how much additional enjoyment they

get out of the trip. In the absence of data, we developed assumptions that allow us to model the potential benefits associated with use of the Locks by motorized and non-motorized watercraft users. The sidebar outlines our assumptions and results.

MOTORIZED WATERCRAFT USERS

Many of the benefits described above for non-motorized personal watercraft apply to users in motorized boats. Again, data on use of specific waterbodies in Oregon does not exist, however there is clear demand for motorized boating in the area. Approximately 15 percent of the population in the regions that roughly correspond to the Willamette River watershed reported participating in power boating in 2011, the most recent year data were available.[17] Although the number of boats registered in the five-county area surrounding the Locks has declined by about one percent per year since 2000,[18] demand for recreational moorage at the Boones Ferry Marina, the only public marina upstream of the Locks, has been increasing each year. The marina provides 105 in-water moorage spaces, and 22 on-land boatports. Moorage has sold out for the summer season and waiting lists build a year in advance of the season, with people paying $500 just to be included on the waitlist.[19] Sportcraft Marina immediately downstream of the Falls also reports robust demand for moorage facilities.

As with paddling, the Locks would provide for a longer, more diverse experience that users may value more highly. Reopening the Locks would also improve access to more points of interest, especially for boaters who typically moor their boats above the Falls. This could yield more trips per year, and more valuable trips, both a direct benefit of the Locks. The sidebar outlines our assumptions and results quantifying the benefits associated with use of the Locks by motorized and non-motorized watercraft users.

GUIDED DAY TRIPS

Reopening the Locks would expand the range of opportunities currently available for guided day trips on the Willamette River. Multiple tour operators have historically used the Locks to facilitate river tours in the area, and many tour operators continue to use the area, stopping at the Falls and the lower Lock chambers:

- Willamette Jetboat Excursions offers trips from downtown Portland to Willamette Falls, with views of the lower Lock chamber a highlight of the trip.
- Portland Spirit also offers a three-hour cruise to the base of the falls from May through October. Prior to WFL closure in 2011, Portland Spirit ran test cruises of a jetboat trip from Portland to Champoeg Park.
- Wy'East Expeditions, which ran school tours for 30 years through the Locks in the Talapas, a replica Native American dugout canoe, has shifted operations for all four of its boats to other locations on the Willamette and Columbia Rivers. Given the historical popularity and importance of the WFL cruise over the years, it is likely at least some through-Locks cruises would resume immediately.[20]

Quantified Benefits to Personal Watercraft Users

To quantify the benefit associated with motorized and non-motorized watercraft users traveling through the Locks, we assumed that recreational traffic through the Locks would resume at levels similar to the 2000 peak reported in the Corps' recreational lockage data, which was 1,299 boats per year. We adjusted this number of boats to account for population growth and likely increase in demand since 2000. Based on lockage fees and similar access fees in place elsewhere in Canada and the U.S., people are willing to pay at least $5 and up to $20, which is an indication of the value they place on the experience of locking through. Based on our analysis, over 30 years, recreational boaters would enjoy a benefit of between $600,000 and $2.4 million to be able to travel through the Locks. (2017 dollars)

- eNRG Kayaking runs guided tours, classes, and kids' camps on the Willamette River below and above the Falls. Annual participation in these various guided trips that currently utilize the river below the Falls numbers in the thousands, if not more, and supports revenues for these businesses in the hundreds of thousands of dollars, conservatively.

Tours through the Locks would begin immediately upon reopening. Not all of the existing tour activity would incorporate a through-lock experience, because the lockage

itself (up and down) adds over an hour to a trip. But some existing tours would be expanded and new tours would be created. It is likely, given the expanded length and unique experience, that tour operators would charge more for these tours, increasing their revenue. Customers, too, would enjoy benefits, as many of them would likely receive benefits from the experience above and beyond their willingness to pay for the trip. It is not possible, given information available at this time, to quantify the potential increase in trip offerings, demand for trips, or the new revenue and value associated with them. But the changes in participation, revenue to business owners, and additional value to participants, would likely be net positive.

The Hotel Barge L'Impressionniste on the Burgundy Canal in France. *Courtesy of Oliver Barge, via Wikimedia.*

GUIDED OVERNIGHT TOURS

Overnight tours did not occur through the Locks prior to their closure. However, at their closure, there was interest in replicating a model for overnight barge cruises through Oregon's wine country, which has proven successful in Europe. Since the closure of the Locks, overnight and week-long cruises have become popular on the Columbia River, suggesting there is a market for this kind of tourism in Oregon already. Driven by a limited supply of lodging, and especially luxury lodging in Oregon's wine country (limited primarily by land use laws), and an increasing profile and awareness of Oregon's wine country, hotel barge cruises could fit into an almost-certain pipeline of demand.

Prior to the Locks' permanent closure in 2011, several factors limited the development of this opportunity, including uncertainty of future Locks operation and prohibitions on overnight moorage and passenger access for commercial boats in Portland. The latter restrictions are in the process of being relaxed through changes to the City's Greenway Code, as part of the City's Central City 2035 planning effort, which should be finalized in Spring 2018. If the Locks were to reopen, this new type of business almost certainly would be developed. Assuming regulatory hurdles are lifted, no other technical reasons exist why operations could not begin within a short timeframe. For example, a cruise could begin in downtown Portland, and travel up through the Locks to Newberg, providing potential interpretive stops along the way. A land-based tour would take people through wine country, and return to the boat. The barge would return to downtown Portland through the Locks to complete the trip, which could be as short as two days, or longer if more side trips were included.

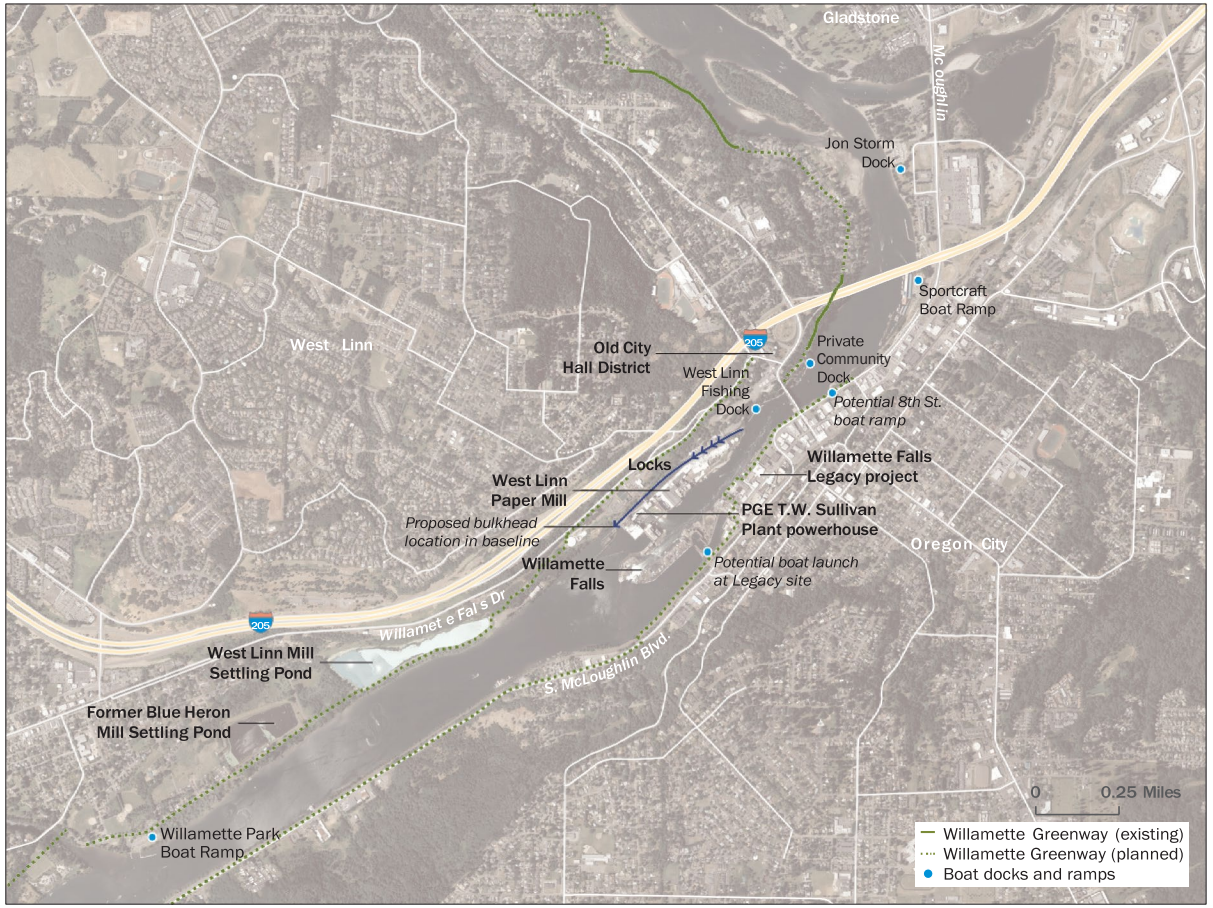
Because this type of operation could represent a substantial benefit of reopening the Locks, and would only be developed if the Locks are operating, we modeled operating scenarios based on European operations of similar cruises to estimate potential revenue over 30 years. Our assumptions are described in detail in Appendix D. Using what we believe are conservative assumptions about number of trips and rates, we estimate the benefit arising from guided

overnight trips, measured in terms of revenue over 30 years, ranges from approximately $12 to $48 million (in 2017 dollars).

NON-WATER-BASED RECREATION AND TOURISM

Recreation and tourism in the area surrounding the Locks is currently limited to the in-water recreation described above, to local parks, and to a widely distributed and diverse set of historical museums and attractions in Oregon City and West Linn. Reopening the Locks would restore public access to the Locks grounds, and potentially the historic museum that is located onsite. However, the impact this would have in terms of number of visitors or economic benefit (measured in terms of local spending or value enjoyed by the visitor) is uncertain. It likely would be positive, but under current conditions in which the Locks site and interpretive value is underdeveloped, the effect would likely be small. Looking forward to potential redevelopment possibilities described in more detail in the next section, reopening the Locks would work synergistically to enhance the value and economic potential of local redevelopment plans.

Exhibit 2. Key Recreation Features in the Local Area Surrounding the Locks



Source: ECONorthwest

DEVELOPMENT BENEFITS

Key Takeaways: The sites immediately adjacent to the Locks, the West Linn Paper Mill and the Willamette Falls Legacy Project, will have the greatest potential development benefits from a reopened Locks. All of the riverfront sites near the Locks face significant infrastructure and market barriers to redevelopment that will require public-private partnerships to overcome. Redevelopment sites in the cities of Wilsonville and Newberg are most likely to capitalize on increased access to Portland, particularly if there are new overnight tourist boats that visit those locations.

Our assessment of the development benefits of reopening the Locks looked qualitatively at the potential for opportunity sites upriver, downriver, and near the Locks, to capitalize on the transportation and recreational benefits of a reopened Locks. In addition, we considered the Locks as an amenity for the possible redevelopment sites in closest proximity to the facility. Reopening the Locks would provide an amenity that supports the broad goals of the Willamette Falls Heritage area. Our redevelopment analysis started with a series of interviews and small group meetings with local jurisdictions, stakeholders, and property owners.[21]

To qualitatively describe the benefits of the Locks, we developed a framework for thinking about the redevelopment impacts for the future of the Willamette Falls Locks (shown in Table 4). This framework summarizes the type of impact, potential benefits, and affected jurisdictions and sites.

Table 4. Summary of Redevelopment Impacts

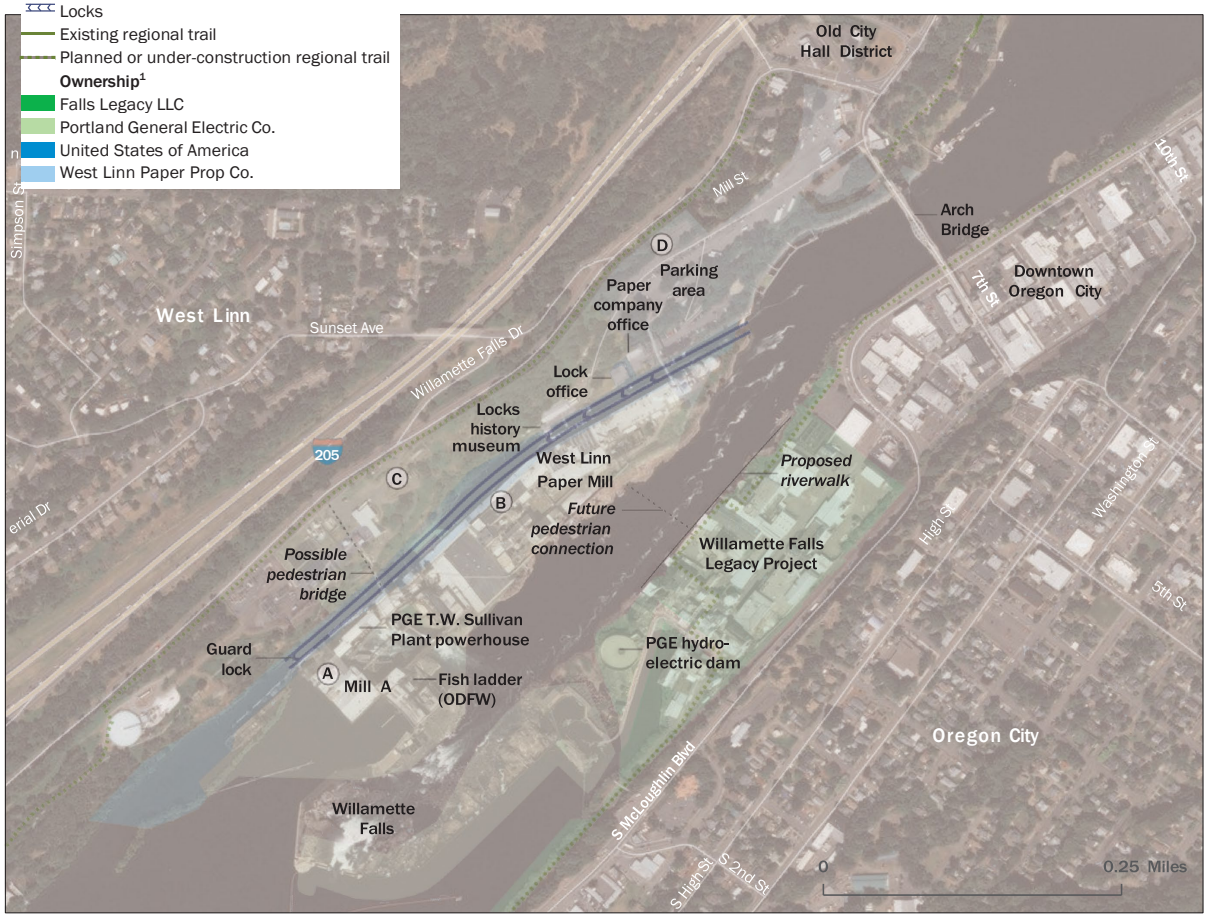
Impact Type	Potential Benefits	Jurisdictions	Specific Sites
Local Impacts. Benefits of the Locks as an amenity that would drive traffic and interest to the West Linn Waterfront area.	■ Property values ■ Access to local sites ■ Historical value, including visibility ■ Immediate tourism impacts, including related to Willamette Falls Heritage Area	West Linn	■ Waterfront, including Old City Hall District, Pond Redevelopment District, and Industrial Redevelopment District ■ West Linn Paper Mill
		Oregon City	■ Willamette Falls Legacy Site ■ Downtown Oregon City redevelopment sites
Upriver Impacts. How transportation benefits can translate into redevelopment opportunities, including the potential for tourists to access riverfront sites coming on boat tours or in private boats from Portland.	■ Tourism related to Heritage Area ■ Access to downriver areas, including Portland capitalized into land values ■ Industrial site development	Canby	■ City-owned riverfront property
		Newberg	■ Closed SP Fiber Tech. Mill
		Wilsonville	■ Arrowhead Master Plan ■ Boones Ferry Master Plan area
Downriver Impacts. How redevelopment areas downriver from the Locks could capitalize on better access to upriver areas.	■ Tourism related to Heritage Area ■ Access to upriver areas	Lake Oswego	■ Foothills District
		Milwaukie	■ Downtown redevelopment sites surrounding Waterfront Park

LOCAL IMPACTS

The West Linn Paper Company property and the sites closest to it would see the greatest impacts from the reopening of the Locks. The West Linn Paper Company spans several Company-owned properties on the riverbank and Portland General Electric (PGE)-owned properties on Moore Island. While PGE is the main landowner in this area, the West Linn Paper Company, the Oregon Department of Fish and Wildlife, and the Corps also have facilities or interests in the area. Each of these entities has easements that allow access to their respective facilities across paper mill or Corps-owned property. According to a 2008 CEDER report that examined disposition options, these easement relationships are complicated and not well documented.

Table 5 summarizes development considerations and benefits of an operating Locks for each of the key sites shown in the overview map in Exhibit 3.[22]

Exhibit 3. Locks and Surrounding Properties Overview



[1]*Property ownership shading is based on Metro's Regional Land Information System, current as of August 2017. Actual property ownership delineation may differ somewhat, and alignment with other map features is approximate.*

Source: ECONorthwest

Table 5. Development Benefits at West Linn Paper Mill and Surrounding Properties

	Development Considerations	Benefits to Site of Operating Locks
A. Vacant Mill A Building on PGE-owned Land	■ Historic buildings will require improvements to address seismic danger as well as failing roof infrastructure ■ Pedestrian and vehicular access challenges, likely requiring large capital investments to overcome. Options for visitor access include a blufftop pedestrian bridge, cable ferry, or at-grade vehicle/pedestrian bridge ■ Potential brownfield considerations that would require additional environmental assessment ■ Safety issues for PGE employees and visitors to the site ■ Seismic issues, if improvements are not made to address seepage and subsidence that has occurred at the edge of the Locks ■ Potential easement/property ownership issues unless clearly spelled out in lease agreement ■ If existing mill closes permanently, potential to master plan for the whole island and surrounding properties	■ Attract visitors to the site by providing key destination and focal point for the area ■ Capital investment at the Locks could address issues with seepage and subsidence ■ If the Mill were to close permanently, an operational Locks facility would provide visitor interest and a focal point for a redeveloped mill district ■ Potential synergy with Willamette Falls Legacy Project redevelopment efforts ■ Potential to attract visitors to the museum and watch the Locks in action ■ More attractive area with the potential for retail and recreational facilities, possibly housing ■ Could be tied into development concept for Mill A building, including pedestrian bridge across the Locks
B. Potentially Active West Linn Paper Company Buildings on PGE-owned Land	■ The drawbridge is in disrepair and needs to be replaced ■ If the mill closes permanently, it is likely the site could see some redevelopment, likely in concert with Mill A, the Locks properties, and the Willamette Falls Legacy site ■ Buildings would need to be assessed for reuse or removal ■ Potential for long-term pedestrian connection to Willamette Falls Legacy project	
C. Former Locks/Corps of Engineers Building and Museum	■ Potential rehabilitation and possible adaptive reuse of underutilized buildings ■ Potential to integrate this area with West Linn waterfront planning pedestrian and bicycle connections	
D. West Linn Paper Company Land and Parking Areas	■ The most promising development sites are parking lots and staging areas on top of the bluff near the Old City Hall District. These sites have visibility from Willamette Falls Drive and fit into the existing district ■ Lower sites could see potential development on the parking lots or adaptive reuse of the former mill office	

West Linn

The City of West Linn is starting a master planning process for the 2.5 mile stretch of waterfront between Arch Bridge (below the Falls) and the Former Blue Heron Mill Settling Pond (above the Falls). The plan is in progress, with a targeted completion date of 2018 to 2019. The purpose of this plan will be to "create a vision for future land uses and activities, based on both the past 30 years of planning/analysis work and current community values and aspirations."[23] This work will include transportation planning on Willamette Falls Drive, as well as planning for the creation of a multi-use path that would likely go along the bluff, using city easements near the settling ponds. There are several sites that could see redevelopment over the coming years within the waterfront master planning study area. The plan breaks the study area into three subareas:

- **The Old City Hall District.** Centered around the former City Hall at the intersection of Mill Street and Willamette Drive, this district faces a lack of parking availability and many transportation challenges, due to the presence of two state highways, ramps, freight routes, and city arterial routes.
- **Industrial Redevelopment District.** Though the future of the West Linn Paper Company is in flux, the plan will consider redevelopment options for other sites in the area which are currently underutilized and could be better integrated into the broader waterfront planning area. It is likely that the future of the West Linn Paper Company facilities will be better known when the Master Plan is complete. This area is described in more detail in the previous section.
- **Pond Redevelopment District.** At the upriver end of the study area, there are two settling ponds that could see redevelopment: the Blue Heron Pond and Mill Site pond. While most of the land in this area is located in the floodplain or in a wetland, these two ponds are not located in a sensitive area. These ponds could see redevelopment ranging from informal open space, formal parkland, to redevelopment into industrial, residential, or commercial pads.

A functioning Locks provides the greatest benefit to sites immediately adjacent to the facility, since an active facility would provide a focal point for West Linn's portion of the Willamette Falls Heritage Area. City of West Linn Staff recognized the opportunity for better planning on both sides of the river, to best catalyze redevelopment on the Oregon City and West Linn waterfronts. The Locks provide a historic amenity that would serve as a draw for visitors to redeveloped sites near the Locks at the bottom of the bluff.

Oregon City

WILLAMETTE FALLS LEGACY PROJECT AND OTHER DEVELOPMENT SITES

The Willamette Falls Legacy project is a partnership between four entities (Oregon City, Clackamas County, Metro, and the State of Oregon) to revitalize the former Blue Heron Paper Mill in Oregon City after its closure in 2011. While these partners were working on a framework plan for the site, it was purchased in 2014 by a private developer. Initial planning efforts have included development studies and the design of a public riverwalk that would provide the public with close-up views of Willamette Falls and potentially catalyze redevelopment of the site. Long-term public improvements include a pedestrian connection across the river to the West Linn Paper Mill site, which received broad public support throughout the framework planning process.

Staff at the City of Oregon City cited public support for the reopening of the Locks. The main benefit to the Legacy site of a functioning Locks would be the combined impacts associated with a vibrant Willamette Falls Heritage area. A functioning Locks would provide synergy with the historic preservation on the Legacy site, given that historic and cultural interpretation is one of the four core values of the Legacy project. In terms of these benefits, interviewees stressed that the Locks serve as one critical part of an array of historic resources that contribute to the heritage area. A functioning Locks could also enhance development interest by providing boat access to the upriver part of the Legacy site (above the Falls). A functioning Locks could also enhance development interest by providing boat access to the upriver part of the Legacy site (above the Falls). A functioning Locks would also provide a better connection for non-motorized boats upriver and downriver of the Falls. Identified as part of the framework plan, the site includes a portage connection through the site for non-motorized boaters.

Canby

The City of Canby has little river frontage that would be suitable for new, river-oriented development. However, downtown Canby is seeing more development activity, including the Civic Block development, as well as the

possible reuse of the library building and the Parsons Pharmacy. Access to the river contributes to local quality of life and can help to attract new residents. The Comprehensive Plan includes public access to the Willamette River as a key goal, including access for non-motorized boats. Besides the Canby Ferry, the City has no manufacturers or businesses that rely on riverfront access.

The benefits of a functioning Locks for the City of Canby include the potential economic activity generated from tourist traffic coming from Portland to access Wine Country destinations, such as Newberg. City of Canby staff indicated that the ideal operating schedule would be three days per week, including one day on the weekend, to help the area build tourism and develop new ideas for river-related recreation.

Wilsonville

The City of Wilsonville is a vocal supporter of a reopened Willamette Falls Locks. The City is undergoing several efforts to provide greater public access to the river and increase opportunities for economic development in the City:

- **Potential Port of Wilsonville.** The City's adopted Transportation System Plan identifies the potential for a river-based port that would rely on the reopening of the Locks to move forward.
- **Boones Ferry Area.** Drawing upon previous master planning efforts, the City is in the process of considering a master plan for a residential and commercial area west of I-5 and north of the Willamette River that would explore strategies for river-oriented development and increased access to the river for non-motorized boaters.[24]
- **Arrowhead Master Plan (Area G and K).** The 2005 Comprehensive Plan cites the need for future planning in this 100-acre area to consider how to balance the mix of industrial, office, and farming uses and mitigate conflicts between non-compatible uses.[25] The City is considering a Master Plan for the area by 2019 that would explore how to best balance the area's mix of uses while attracting new development that would be oriented toward the river.

A functioning Locks would open up new opportunities for the City of Wilsonville for economic development, including allowing for the City to explore the concept of a potential Port of Wilsonville. Beyond the near-term benefits to Wilsonville businesses (including Wilsonville Concrete), the City could capitalize on new opportunities to attract tourists from downriver locations, including Portland.

Newberg

The City of Newberg is starting a new state-funded Riverfront Master Plan, updating the vision for the area now that the bypass around downtown has been completed. The plan centers around the 220-acre former WestRock paper mill site, and will look at market conditions, transportation infrastructure, river-related recreation, and zoning considerations. The paper mill site faces several challenges to redevelopment, including its location next to the City's wastewater treatment plant, lack of utility access, and challenging river access given that the site is 60 feet above the river on a bluff.

Staff at the City of Newberg indicated that planning efforts to date have not considered the role of the Locks as it relates to redevelopment. Staff did indicate that the Locks benefit boaters using Roger's Landing, a popular boat launch near the former mill property. Over the coming decade, the former WestRock paper mill site is likely to redevelop, likely as a mixed-use, river-oriented district. A functioning Locks could allow for traffic from downriver communities coming via the river, especially tourists. It could also allow for overnight moorages from Portland that take advantage of a vibrant tourist destination.

DOWNRIVER IMPACTS

Though downriver benefits are somewhat more limited, some sites downriver of the Locks would benefit from increased access to upriver sites. There are several areas downriver of the Locks that would see minor benefits of a Locks reopening.

The City of Milwaukie's riverfront has recently seen some improvements to Riverfront Park and City partnership opportunities on possible development sites, showing the City's commitment to community quality of life.

The City of Lake Oswego's riverfront is anchored by Foothills Park, which was completed in 2006. In 2012, the City completed a framework plan for the surrounding 107-acre industrial district with a private developer. However, the development stalled and there has not been redevelopment in the area. This area remains a river-oriented opportunity area for the City.

LESSONS ON ECONOMIC DEVELOPMENT NEAR OTHER LOCKS

Ballard Locks (Seattle, WA). The Ballard Locks, operated by the U.S. Army Corps, are a popular tourist attraction in Seattle, attracting over 1 million visitors each year to see the fish ladder, tour the gardens, and view the facility. This includes 150,000 tourists who book cruises through the Locks annually. The Locks are next to the Burke Gilman Regional Trail, and many nearby residents visit the area for strolling, bicycling, and picnicking. The City's Community Development Plan for the area calls for the area to be maintained as a working waterfront. Many area businesses have taken on Locks-related names, including the Lockspot Cafe and the Lockhaven Marina.[26]

Fox River Locks (Appleton, WI). The nonprofit-operated Fox River Lock System consists of 17 locks over 39 miles from Lake Michigan to Lake Winnebago, and is one of the only fully restored, hand operated locks systems in the United States. In 2017, over 18,000 boats went through the locks, even though the locks are not fully navigable due to invasive species issues. A 2017 Economic Impact Study looked at the potential economic benefits of different operating scenarios, highlighting the impact of lock users docking and accessing local services. One of the scenarios also includes the addition of a visitor center as part of a mixed-use development in downtown Appleton. This facility would serve as a major attraction for downtown Appleton, and connect with multi-use paths and river-related development activity already occurring in Appleton, including a hotel and a taphouse.[27]

A tour group at the Ballard Locks. *Courtesy of Wikimedia Commons, MB298*

CULTURAL AND HISTORIC BENEFITS

Key Takeaways: Cultural and historic benefits are unquantifiable in monetary terms, but are clearly revealed by past and current actions to protect the Locks for current and future generations. These benefits are unquestionably important to a wide range of people, and are certain to materialize under the public ownership scenario.

Our assessment of the cultural and historic benefits of the Locks addresses the effects that reopening the Locks would have for the people who have lived with Willamette Falls since time immemorial, and for all people—current and future generations—who wish to understand and experience an important era in Oregon history. These benefits are summarized in Table 6. We address all of these benefits qualitatively, and they vary by scenario. Under the baseline scenario, none of these benefits would materialize. Under the public ownership scenario, all would materialize regardless of operating schedule. Under the private ownership scenario, assuming no special access arrangements are made, the only benefit that would materialize is historic preservation. However, by preserving the Locks in working order, the private ownership scenario would hold open the option that additional benefits could be realized if private ownership transitioned to public ownership at some point in the future.

Table 6. Summary of Cultural and Historic Benefits

Impact Category	Potential Benefits
Tribal Connection to History and Place	■ Access to Locks and grounds provides connection to a place the Tribes have inhabited since time immemorial. ■ Tribal members participated in Locks construction, provides connection to that history
Tribal Access to Ecological Resources	■ Operational Locks may provide easier access to some food and fiber resources traditionally used by Tribes.
Tribal Treaty Rights to Portage	■ Operational Locks with guaranteed public access would preserve treaty right to access route around Falls ■ Uncertainty of the ability to preserve this right increases with transfer from the Corps, uncertainty varies by scenario
Spiritual Connection with River	■ Locks provide a route around the Falls that most closely mimics traditional portage routes ■ Approach to the Falls and departure below the Falls is closely maintained with Locks
Historical Interpretation and Experience	■ Locks provide a unique experience to connect people directly with the history of the area ■ Locks attract a wider variety of people than otherwise may visit historic sites, broadening potentially exposed audience ■ Locks serve as a focal point where many aspects of Oregon's history intersect, potentially broadening people's understanding of the breadth of this history
Historic Preservation	■ Protects a recognized national landmark, with local, regional, and national importance

BENEFITS TO NATIVE PEOPLES

It is difficult to overstate the importance of Willamette Falls and its surroundings as a place that holds meaning for the region's Native American people. Tribal history in the area goes back at least 14,000 years. Tribal ethnographic information, such as creation stories and oral traditions, potentially points to an even earlier presence at Willamette Falls; the phrase *from time immemorial* is commonly used to describe Native American presence in the area.[28] The Falls served as an important place for collecting food and fiber, a place of spirit and ceremony, and as such, was a regional gathering place for people from across the Columbia Basin and beyond. Members of the region's Tribes still come to Willamette Falls to fish, collect resources, and conduct ceremonies.

Tribal members passing through the Canal during 2010 Lock Fest. *Courtesy of Willamette Falls Heritage Foundation.*

Tribal members still use canoes for trips down the Willamette River, for a variety of ceremonial and practical purposes. Traditionally, this trip would pause at what is now Canemah upstream of the Falls where the portage route began. Upstream canoes would be traded for downstream canoes here, or the people living on the banks of the river would provide portage services in exchange for other goods or services. When the Locks construction began, amid rapid industrial development of both sides of the river over several decades, Native people from the Grand Ronde Reservation and elsewhere were hired to help dig. Once the Locks opened, members of the various Tribes in the region used them instead of portaging around the Falls, which had become difficult or impossible with development and enforcement of (relatively) newly acquired property rights.

Focusing on the feature of the Locks itself (apart from the Falls and the rich cultural landscape surrounding it) is difficult and complicates the story because the Locks undoubtedly contributed to both the development and destruction of many cultural resources in the area. The Locks also potentially mitigated some of the destruction by providing access around the Falls. One important aspect of this mitigation is guaranteed access to the banks of the Willamette River for portage around the Falls, as promised in the treaty between the United States and the Confederated Tribes of the Grand Ronde. Reopening the Locks would reestablish this linkage and allow the Tribe to resume its use of the River in a way that at least resembles its traditional use of the river. This benefit only materializes under the public ownership scenario.

Another important aspect of this mitigation is the way the Locks mimics the experience of the portage at Canemah. Traditionally, boaters were able to paddle almost to the Falls, take out above, and resume their journey just below the Falls. With the Locks closed, the closest portage takeout above the Falls is at Willamette Park in West Linn, and the closest put-in commonly used by paddlers is downstream, beyond the view of the Falls, at Oregon City's Sportcraft Boat Ramp or the dock at Jon Storm Park in Oregon City (see Exhibit 2 on page 18). The relatively new West Linn Fishing Dock, just upstream of the Arch Bridge and downstream of Lock Gate 1, may provide a closer put-in, though this was not mentioned by the paddlers we talked to. This disconnection from the Falls diminishes the experience of place and the cultural and spiritual significance of the journey. The Locks themselves do not enhance or diminish the availability of the ecological resources important to maintaining the cultural traditions of native people. They do, however, enhance access to the area, and in doing so, may reduce the costs associated with collecting resources.

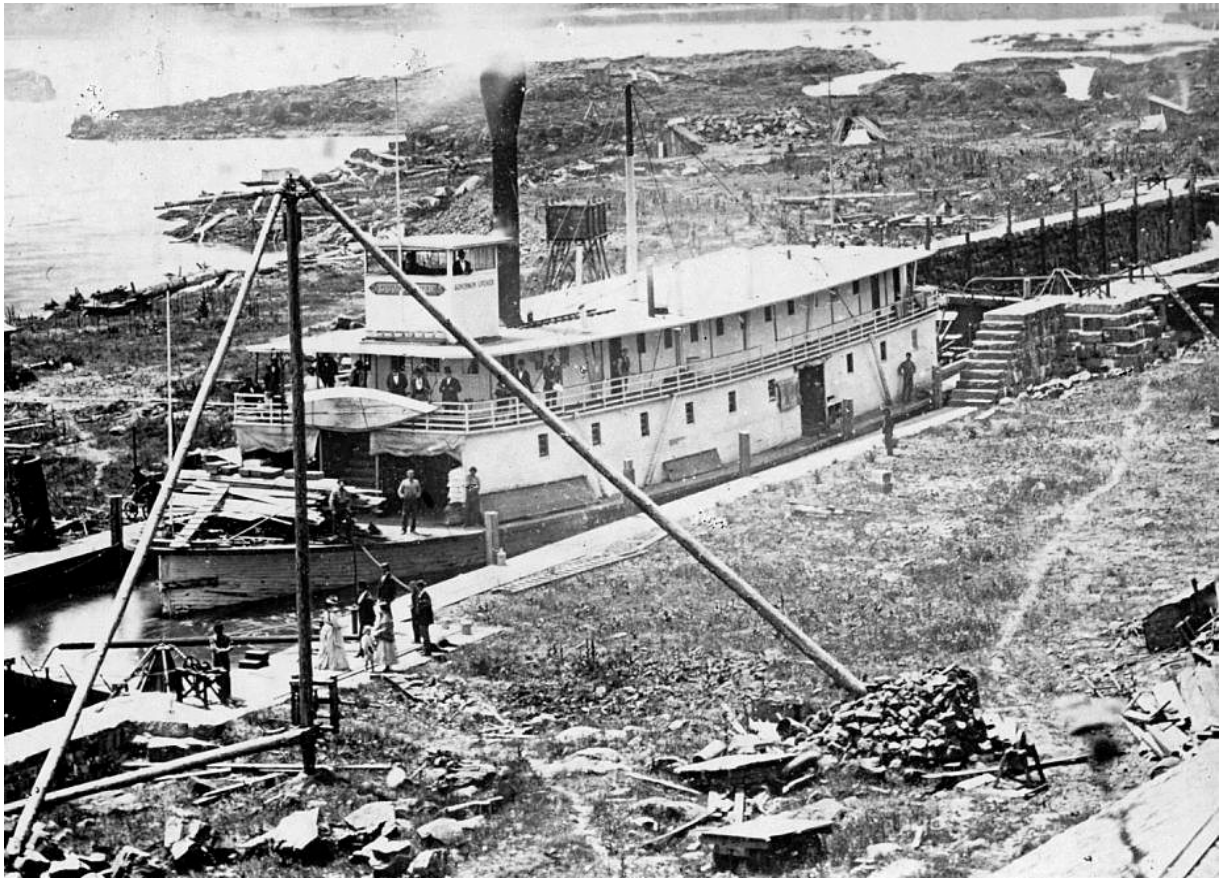
BENEFITS ASSOCIATED WITH PROTECTION AND TRANSMISSION OF HISTORY

Reopening the Locks would guarantee its continued existence for the foreseeable future and fulfill the protection goals implicit in its recognition by multiple authorities. In 1974, the Locks were listed on the National Register of Historic Places[29] and in 1991, they were designated a State Historic Civil Engineering Landmark by the American Society of Civil Engineers.[30] In 2012, the National Trust for Historic Preservation named the Locks as one of their first National Treasures, a portfolio of irreplaceable, threatened places of national significance that receive long-term organizational investments to protect.[31] The recognition that the Locks provide an important resource for connecting people with history is not new: in 1944, Congress formally recognized

the Locks' value as a historical and recreational asset, and authorized the Corps to provide a public park and recreational facilities at the Locks, opportunities to visit the Locks and the historic information center, and to safely use the recreational features on the premises (Section 4 of the Flood Control Act of December 22, 1944).[32]

The Locks are an important feature in several efforts to protect and interpret the region's history, including the recently established Willamette Falls State Heritage Area and the proposed National Heritage Area of the same name. As a feature in a broader landscape made up of many historical landmarks, the loss of the Locks would not eliminate the argument for protecting and interpreting the region, but it would diminish its value. The Locks represent one of the most interesting pieces of "working history," in the region. A functioning Locks would draw an audience that may not otherwise participate in "historical tourism" and give them a reason to connect with the region's past.

In the context of future development plans for the industrial sites on both sides of the Falls, the Locks' ability to speak for the past through continued operation becomes even more important. Development could occur—and may even be able to occur more cheaply—without the complication of the Locks. But apart from some abstract historic character in the redeveloped buildings themselves, the Locks would be the primary feature anchoring potential new hotels and restaurants to the area's historical identity.



The sternwheeler Governor Grover, in the locks at Oregon City, March 1873. *Salem Public Library, Ben Maxwell Collection.*

RESILIENCY BENEFITS

Key Takeaways: During the short- and long-term recovery phases in the aftermath of the Cascadia subduction zone earthquake, the Locks could provide critical transportation services long before the region's bridges and roadways return to functionality. These services include moving reconstruction materials, food, and fuel; reconnecting family members separated at the time of the earthquake; and, transporting volunteers and other recovery workers to damaged areas.

As described in the Oregon Resiliency Plan,[33] the Cascadia subduction zone earthquake will cause significant damage and disruption to the Willamette Valley's transportation system. These effects will make more difficult the tasks of responding to the quake and moving supplies and people to and from quake-damaged areas. The negative transportation impacts will also have considerable negative consequences for the state's economy. Most of Oregon's bridges and roads were constructed under building codes that did not take the Cascadia quake into account. As a result, many of the bridges in the Portland area will likely suffer serious damage while quake-triggered landslides will damage and close many roads, making them impassable.

Ship and barge movement on the Willamette River could provide critical transportation services in the aftermath of the Cascadia quake. A reopened Locks would allow water traffic between the upper and lower sections of the Willamette River. The Oregon Resiliency Plan notes that because of the likely sediment migration into shipping channels after the quake, that shallow draft barges of the type that move along the lower Willamette River—and are designed to fit in the Locks—may be the only viable option for moving materials along the river.[34] Experiences from other natural disasters support this conclusion. For example, barges were used to move supplies and clear debris in the aftermath of Superstorm Sandy in the New York City area.[35]

The general consensus among the resiliency experts that we interviewed is that the Locks could provide important transportation benefits in the aftermath of the Cascadia subduction zone earthquake. These experts distinguish between the response period immediately after the earthquake hits, and the short- and long-term recovery phases that follow. There is some uncertainty regarding the operational capability of the Locks immediately after the earthquake. These uncertainties have to do with factors such as the resiliency of electrical supplies to the Locks, the ability of staff to reach the Locks, debris in the vicinity of the Locks that prevents their operations, and downed bridges and other large debris that inhibits movement along the river. Our analysis assumes that before ownership transfer to another entity, that the Locks will have been seismically upgraded so that they function in the aftermath of the Cascadia earthquake.

It is during the short- and long-term recovery phases that the experts see the Locks providing significant transportation benefits. Experts anticipate that the Locks could be an integral component to the Willamette River providing much needed transportation services long before the region's bridges and roadways return to functionality. These transportation services include moving reconstruction materials, food, and fuel, reconnecting family members separated at the time of the earthquake, and transporting volunteers and other recovery workers to damaged areas.

COSTS OF OPERATING THE LOCKS

Key Takeaway: We estimate that the annual costs of operating the Locks under the highest operating cost scenario are generally in line with the costs of operating other transportation assets in the region, e.g., ferries.

Our assessment of costs includes the costs of implementing our three scenarios of Locks operations as well as the estimated annual operations and maintenance (O&M) costs. We report the estimated costs of implementing each Locks scenario based on the Corps' analysis of disposition alternatives as described in their Draft Disposition Study.[36] We estimate scenario O&M costs based on reports of the Corps' O&M costs during the last years of Locks operations, interviews with key informants knowledgeable about Locks operations, and on additional publically available data and information. We calculate high and low estimates of O&M costs. The high estimate assumes the Locks operate seven days per week and 52 weeks per year. Our low estimate assumes the Locks operate six months at four days per week and six months at two days per week. Our high estimate likely overstates the true cost of operating the Locks, which would most likely run fewer than seven days per week. We base our low estimate on a more realistic schedule, especially during the first few years of operations. We report our cost results in Table 7.

Table 7: Installation and O&M Costs by Locks Operating Scenario over 30 Years (2017 dollars)

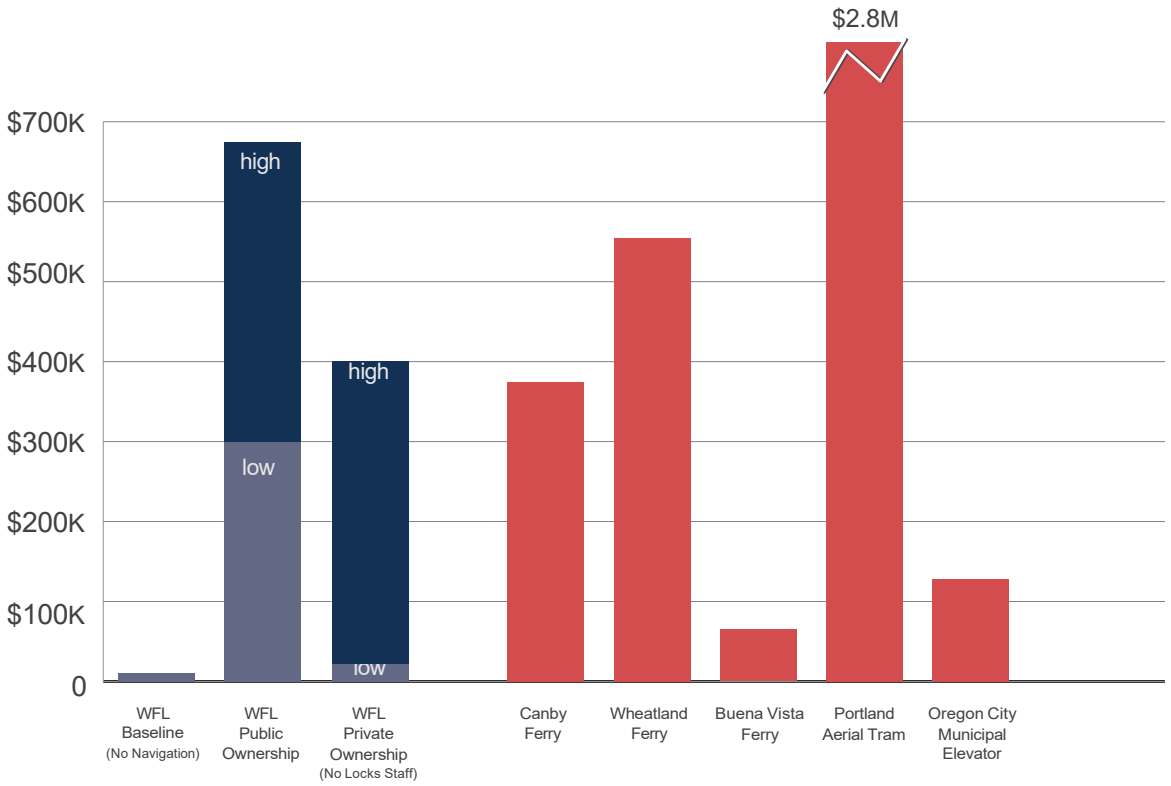
Locks Operating Scenario	Installation Costs	O&M		Total Cost	
		Low Estimate	High Estimate	Low Estimate	High Estimate
Baseline (No Navigation)	$2.5 million	$2.0 million	$200,000	$2.7 million	$2.7 million
Public Ownership	$5.7 million	$5.7 million	$13.2 million	$11.3 million	$18.9 million
Private Ownership	$5.7 million	$400,000	$8.0 million	$6.1 million	$13.7 million

Source: ECONorthwest

- The Baseline scenario with no navigational use of the Locks has the lowest total combined installation and O&M costs over 30 years of approximately $2.7 million (in 2017 dollars). Not included in this total are potential unquantified costs related to additional environmental study of the consequences of decommissioning the Locks and potential litigation costs, which likely would drive up the costs of this scenario if the Corps pursues it.
- The Public Ownership scenario has the highest combined cost of approximately $11 to $19 million over 30 years (in 2017 dollars).
- The Private Ownership scenario with no designated Locks staff—meaning that barge operators also operate the Locks—has a lower cost due to savings on labor expenses of approximately $6 to $14 million over 30 years (in 2017 dollars).

We note that the implementation costs listed in the Corps' disposition study likely overestimate the costs of completing these projects if private contractors did the work. For example, the Corps projects must comply with additional safety and other construction-related regulations that do not apply to private contractors. Complying with these regulations increases the Corps' estimated costs relative to the cost if private contractors completed the work.

Figure 7. Annual O&M Costs by Portland Area Transportation Infrastructure (2017 dollars).



For insight into the relative magnitudes of the annual O&M costs for Locks operations, we compare one year's O&M costs by operating scenario with O&M costs for other public transportation infrastructure in the Portland area. These include three ferries that cross the Willamette River, the Portland aerial tram, and the Oregon City municipal elevator. See Figure 7. We estimate that the annual costs of operating the Locks under the highest cost scenario (public ownership, seven days per week and 52 weeks per year) for one year are generally in line with the costs of operating other transportation assets in the region, e.g., ferries. We expect that, at least initially, the Locks will operate fewer days per week, and the actual costs of operating the locks will be lower than our high estimate.

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