

LAKE WASHINGTON SHIP CANAL PROJECT DRAFT MASTER PLAN

KING COUNTY, WASHINGTON

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of Engineers®**

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Lake Washington Ship Canal Project Draft Master Plan

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Acronyms and Abbreviations

3-D	three-dimensional
ACHP	Advisory Council on Historic Preservation
ADA	Americans with Disabilities Act
ARCW	Annotated Revised Code of Washington
CCC	Critical Content Curve
CFR	Code of Federal Regulations
cfs	cubic feet per second
DAHP	Washington State Department of Archaeology and History Preservation
DDT	Dichlorodiphenyltrichloroethane
ECS	Emergency Closure System
EO	Executive Order
EP	Engineer Pamphlet
EPA	U.S. Environmental Protection Agency
ER	Engineer Regulation
ESA	Endangered Species Act
°F	degrees Fahrenheit
Garden	Carl S. English Jr. Botanical Garden
HPMP	Historic Property Management Plan
Locks	Hiram M. Chittenden Locks
LWSC	Lake Washington Ship Canal
MLLW	Mean Lower Low Water
MOA	Memorandum of Agreement
MRM	Multiple Resource Management
M/V	Motor Vessel
NAVD	North American Vertical Datum
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NRM	Natural Resource Manager
NWI	National Wetland Inventory
O&M	Operations and Maintenance
OMP	Operational Management Plan
PA	Programmatic Agreement
PL	Public Law
ppt	Parts per thousand
RCW	Revised Code of Washington
SHPO	State Historic Preservation Office
USACE	United States Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
WDFW	Washington State Department of Fish and Wildlife
WSDOT	Washington State Department of Transportation
UW	University of Washington

1 INTRODUCTION

The Lake Washington Ship Canal (LWSC) Project (Figure 1) includes the Hiram M. Chittenden Locks (Locks, often referred to as Ballard Locks or Government Locks), a navigation channel (often referred to as LWSC or Ship Canal), and a reservoir, which includes two natural lakes, Lake Washington and Lake Union (Figure 1). In this document “LWSC” refers to the entire project and not just the navigation channel. Master Plans are required for civil works projects and other fee-owned lands (lands owned outright by the U.S. Government) for which the U.S. Army Corps of Engineers (USACE) has administrative responsibility for management. This Master Plan focuses on the natural resource management mission, managing the lands and associated recreational, natural, and cultural resources of the LWSC Project. It does not cover the operations and maintenance of the navigation mission at LWSC. This document builds upon and replaces the existing Master Plan for LWSC Project (Design Memorandum 9), which was prepared in 1994. Water management, and operation and maintenance (O&M) works are handled in the LWSC Water Control Manual and O&M Plan respectively. Detailed management and administrative functions based on guidance provided in a Master Plan are identified in the Operational Management Plan (OMP). Historic preservation activities are identified in the comprehensive Historic Properties Management Plan which manages and protects the historic resources at LWSC Project. The Master Plan anticipates what could and should happen and is flexible to changing conditions.



Figure 1. Hiram M. Chittenden Locks and the Carl S. English Jr. Botanical Garden, with Fremont Cut, Lake Union, Montlake Cut, and Lake Washington in the distance (1980 aerial photograph).

1.1 PURPOSE AND SCOPE OF MASTER PLAN

Master Plans are required for Civil Works projects and other fee-owned lands for which USACE has administrative responsibility for management of natural and anthropogenic resources. Engineer Pamphlet (EP) 1130-2-550 establishes guidance for the preparation of Master Plans. As stated therein, the primary goals of Master Plans are to prescribe an overall land and water management plan, resource objectives, and associated design and management concepts, which:

- 1) Provide the best possible combination of responses to regional needs, resource capabilities and suitabilities, and expressed public interests and desires consistent with authorized project purposes;
- 2) Contribute towards providing a high degree of recreation diversity within the region;
- 3) Emphasize the qualities, characteristics, and potentials of the project; and,
- 4) Exhibit consistency and compatibility with national objectives and other state and regional goals and programs.

The Master Plan is the strategic land-use management document that guides comprehensive management and development of all recreational, natural and cultural resources throughout the life of the USACE project. The Master Plan guides efficient and cost-effective management, development and use of project lands. The Master Plan is a dynamic planning document that deals in concepts, not in details of design or administration.

The purpose of the LWSC Master Plan is to provide guidance to preserve, conserve, restore, maintain, manage, and develop USACE project lands and associated resources pursuant to

Federal laws. The current Master Plan is over 25 years old and does not include updated information on recreation and public use, cultural resources, invasive and endangered species, wildlife habitat value, jurisdictional wetlands, and other environmental features like the Carl S. English Jr. Botanical Garden (Garden). The Garden is an important feature of the LWSC National Historic District. Therefore, there is a need to update the Master Plan to ensure USACE meets the legal requirements defined in appropriate laws and regulations. An updated Master Plan will also guide managers in future decision making and will provide the public the knowledge and information on how USACE proposes to manage the project lands. The updated LWSC Master Plan will provide a comprehensive description of the project, discuss factors influencing resource management and development, identify site-specific problems, a synopsis of public involvement and input to the planning process, and describe past, present, and proposed development.

This Master Plan does not address regional water quality, water management, shoreline management, O&M of LWSC operations facilities (i.e., locks, dam and/or spillway), or O&M of the fish ladder. Section 1.5 describes how documents in Attachment B (List National Environmental Policy Act Documents and Studies) address some of these considerations for facilities and management not covered by this Master Plan. O&M is also guided by compliance with relevant laws and regulations such as the Endangered Species Act, Clean Water Act, and Coastal Zone Management Act, in addition to tribal coordination and consultation. The fish ladder plaza and fish ladder viewing gallery, being public spaces, are addressed in the LWSC Master Plan. The plan is flexible and subject to revisions as dictated by changing needs and conditions.

1.2 PROJECT AUTHORIZATION

The LWSC was constructed and is being operated and maintained by USACE pursuant to Congressional authorization and direction in multiple congressional acts that began at the end of the 19th century (Table 1). This unique history is central to analyzing the degree of discretion available to USACE when making decisions about the LWSC's ongoing and future operation and maintenance. The following subsection seeks to provide context and clarity by listing the LWSC's most relevant Acts of Congress and highlighting the most important authorizations. The pertinent authorities are as follows:

- River and Harbor Act of 1890, 26 Stat. 426
- River and Harbor Act of 1894, 27 Stat. 88
- River and Harbor Act of 1895, 28 Stat. 338
- River and Harbor Act of 1896, 29 Stat.202
- River and Harbor Act of 1902, Public Law (PL) 57-154
- River and Harbor Act of 1905, PL 58-215
- River and Harbor Act of 1906, PL 59-218
- River and Harbor Act of 1907, PL 60-168
- River and Harbor Act of 1907, PL 60-107
- River and Harbor Act of 1910, PL 61-264
- River and Harbor Act of 1913, PL 62-429
- River and Harbor Act of 1917, PL 65-37
- River and Harbor Act of 1922, PL 67-362
- River and Harbor Act of 1930, PL 71-520
- River and Harbor Act of 1935, PL 74-409
- River and Harbor Act of 1946, PL 79-525
- River and Harbor Act of 1954, PL 83-780
- River and Harbor Act of 1956, PL 84-779
- Flood Control Act of 1944, PL 78-534

The possibility of connecting Puget Sound with Lake Union and Lake Washington was suggested as early as 1854 and was recommended for consideration by the

War Department in 1871, as being valuable for both potential naval and commercial importance. After consideration of alternative locations, Congress authorized several studies for this project (See H.Doc. 953, 60th, 1st Project Document at P.2).

In 1890, Congress made its first appropriation for the canal when it authorized a survey to select the most feasible location to construct a ship canal and give an estimate of the expense (Rivers and Harbors Act of 1890). The Chief Engineer's Report, dated December 15, 1891, considered five possible routes and ultimately authorized excavation for the present route, as described in the River and Harbor Act of 1894, which authorized "dredging Salmon Bay and the improvement of the waterway connecting the waters of Puget Sound, at Salmon Bay with Lakes Union and Washington by enlarging the said waterway into a ship canal, with the necessary locks and appliances," (Rivers and Harbors Act of 1894, August 18, 1894) to effectively complete a navigable waterway from the deep water in Puget Sound to the Locks and from the Locks to Lake Washington.

As time passed, local interests in the City of Seattle and King County supported an alternative proposition by a local citizen, Mr. James A. Moore to construct a shorter canal connecting Puget Sound with Lake Union only. See Major Chittenden's 1907 Report of Survey of Waterway Connecting Puget Sound with Lakes Union and Washington from the Chief of Engineers (See H.Doc. 953, 60th, 1st Project Document at P.2)(1907 Report). Congress authorized Mr. Moore to proceed with the work under certain specified conditions. See *Id.* However, as time passed, local interest and support shifted back to pursuit of a more expansive project, and local taxes were raised to provide local contributions and support for federal development of the project. See *Id.*

Congress then proceeded to authorize development of the federal project under the direction of the local United States District Engineer and expressed that the waterway was "to be and remain a free public highway of the United States," (See H.Doc. 953, 60th, 1st Project Document) characterizing the nature of the project's original congressionally authorized purpose: Navigation.

The Rivers and Harbors Act of 1910 authorized a congressionally approved federal project that came to be known as the LWSC with the following features: "the construction of a double lock, with the necessary accessory works, to be located at 'The Narrows,' at the entrance to Salmon Bay, in accordance with the project set forth in House Document Number Nine hundred and fifty-three, Sixtieth Congress." (See Rivers and Harbors Act of 1910, June 25, 1910, Ch. 382, 36 Stat. 666 (Public Law 61-264)) The referenced House Document contains Major Chittenden's 1907 Report. The 1907 Report includes the more detailed analysis of integral components of the federal project including a six-bay spillway, a fish ladder for fish passage, a dam to accompany the double locks, and excavation by King County or another local agency of a channel 75 feet wide and 25 feet deep at low water from the locks into Lake Washington (Fremont Cut). Congress authorized the project design as Major Chittenden described in his 1907 report. The discussion of the project in this 1907 report formed the basis of the USACE's construction.

This 1907 Report expressly analyzes a federal project that would result in extensive alterations to the surrounding area, particularly as a result of lowering Lake Washington to the same level as Lake Union before connection to the Puget Sound. For instance, it provides:

“The local considerations not relating to the canal, which make the lowering of Lake Washington important, are the drainage of the numerous low and swampy areas around the lake, the diversion of Cedar River into Lake Washington and the cutting off of the present outlet, Black River, thereby relieving to a large extent the flood situation in the lower Duwamish Valley: the purification of the waters in the southern end of Lake Washington by the inflow from Cedar River and the rendering available of a large extent of valuable shorelands around the borders of the lake. All these purposes are of very great local importance.”

H. Doc. 953, at P.7-8.

The Report further indicates that this altered hydrologic connectivity would alter the flow of water from Lake Washington and Cedar River watersheds (580 square miles) from the canal to the sea. After reviewing historic records, the 1907 Report indicates that the federal project would be built in an area that experienced a range of conditions from high flows to low flows, such that,

“...[T]he flow from the whole watershed is actually negative, the outflow from the lakes at such times being maintained solely by the storage in the lakes. Periods of negative run-off, however, are rare and brief duration, and occur only when extreme drought and high temperature reduce the land run-off and correspondingly increase evaporation from the water areas.”

H. Doc. 953, at P. 10.

This analysis of then-recorded historic conditions in the watershed were then relied upon to determine that once constructed, the federal project’s operation would be within a particular elevation range: “with an allowable fluctuation of level of 18 inches to 2 feet the flow through the canal can be kept within limits of 500 and 2,500 cubic feet per second.” H. Doc. 953, at P. 10-11.

This 1907 Report also contemplated another key project feature: that of a fish ladder given the closure of the present outlet of Lake Washington. (“Inasmuch as the present outlet of Lake Washington will be closed when the lake is lowered, it will be necessary to provide a suitable fish ladder at the controlling works”) H. Doc. 953, at P.11. Congress authorized an expansion of the federal project in 1913, where dredging and excavation of a channel from the locks to deep water in Puget Sound with the same dimensions as previously authorized in 1910 to connect the locks into Lake Washington.

Construction of the LWSC occurred between 1911 and 1917 (Figure 2). Local interests provided project support through excavation of a canal to a depth of 36 feet at low water and 100 feet wide on bottom, and a channel between Lake Union and Lake Washington to a depth between 30-36 feet deep and not less than 100 feet

wide at bottom (Fremont Cut). Local interests also conducted 1,000 feet of revetment.



Figure 2. Construction of the Locks, looking east, 1915, prior to development of the circulation system and terraced lawn.

Through the 1917 Rivers and Harbors Act, Congress approved further funding and authorization of a channel below the locks with more expansive dimensions (not less than 30 feet at extreme low water, and the wide on the bottom not less than 150 feet) , a dike on the northern part of the channel, and federal revetment of the banks of the canal between the head of Salmon Bay and Lake Union for a distance of 3,900 feet and also the north bank of the deep cut between Lakes Union and Washington for a distance of 900 feet (“the Montlake Cut”). H. Doc. 800, P.4 (64th Congress, 1st Session)(1916)(Pub. L. No. 65-37) .The supporting Report of the Board of Engineers for Rivers and Harbors Act (Feb 9, 1916) indicates: “The provision of a deep channel below the locks essential to the utilization of the improvement, as without it deep-draft vessels cannot reach the locks at lower stages of tide.” The revetments were considered “necessary...in order to protect them [the slopes] from caving back beyond the line of the right of way. To permit such caving would lead to damages claims from riparian property owners and would result in

rapid deterioration of the channel...The work is believed to be essential to the proper completion of the canal...". Id.

The accompanying District Engineer's Report indicates that: "The present difference in level between Salmon Bay and Lake Union is to be overcome by the dam under construction which will raise the waters of Salmon Bay to a mean level 25 feet above extreme low tide in Puget Sound. After completion of the canal, the level of Lake Washington, Lake Union, Salmon Bay, and connecting channels above the locks will be regulated between 24 and 26 feet, or at the mean level of 25 feet above extreme low tide." See Id at P. 6."

The small lock opened to traffic on July 30, 1916. The large lock opened on August 3, 1917. Work finished on the navigable channel between Salmon Bay and Lake Union (Fremont Cut) in October 1916. USACE completed the navigable channel between Lake Union and Lake Washington (Montlake Cut) in May 1917.

Key to fulfilling the Congressional purpose of navigation is the project's freshwater operating range and ability to continue providing lockages to vessels transversing the marine and fresh water bodies. Too low of a level of water flowing through LWSC compromises the ability of the project to provide lockages and obstructs fulfillment of its congressionally authorized project purpose for navigation. In 1922, Congress indicated that "extreme high water" was equivalent to an elevation of 26.00 feet above extreme low tide, and that "extreme low water" was equivalent to 24.00 feet above extreme low tide. House Document 324 (67th Congress, 2nd Session)(PL 67-362), page 8-9, para 7. At Mean Lower Low water (MLLW), "high water" above the locks is 22.00 feet above extreme low tide, and "low water" is 20.00 feet above extreme low tide. See Id., page 19, para 3d; as well as page 9, para 7 ("...all depths below the locks refer to MLLW (4 feet above extreme low water)").

This LWSC's Congressionally authorized operating level to fulfill its navigational project purpose, was clarified in the River and Harbors Act of 1935 when Congress authorized enlargement of the channel between the Locks and Lake Washington in accordance with a referenced House Document providing that "the water from the locks into Lake Washington is nontidal and is maintained at a mean elevation of 21 feet above mean lower low tide of Puget Sound with a maximum variation of 2 feet." House Document 140, 72nd Congress, 1st session (PL No. 74-409). In essence, therefore, the reference in House Document 800 to 26 feet at extreme low water is the same elevation referred to in House Document 324 and 140 to 22 feet at mean lower low. The project has operated within this authorized elevation range since at least 1935, except under drought conditions.

Recreation facilities were authorized by the Flood Control Act of 1944. LWSC was designated to the National Register of Historic Places in 1978.

Table 1. Congressional Authorizations and Actions related to Lake Washington Ship Canal.

Name	House or Senate	No.	Congress	Report Year	Authorization	Authorization Year	Summary
Puget Sound to Lake Washington	House			1890	26 Stat. 426	1890	Directs Secretary to appoint a board to select and survey the most feasible location to connect Lakes Union, Washington, and Sammamish to Puget Sound.
	House	Ex Doc 1	52 nd	1892	27 Stat. 88	1894	Authorizes improvement of the waterway between Puget Sound and Lake Washington, provided that right-of-way is acquired; Report of the Chief of Engineers in response to authorization evaluates various ingress/egress routes and lock structures; additional recommendation for interim dredging of a navigation channel from Puget Sound to Ballard, WA.
	House	Ex Doc 1	52 nd	1892	28 Stat. 338	1895	Authorizes dredging of a ship canal connecting Salmon Bay and Lakes Union and Washington; includes necessary locks and appliances.
	House	2	54 th	1896	29 Stat. 202	1896	Appropriates for the improvement of the waterway between Puget Sound and Lake Washington by enlarging the existing waterway, provided that right-of-way is acquired.
	House	2	57 th	1902	PL 57-154	1902	Authorizes study of locks and dams; appropriates funds for construction of a channel between Shilshole Bay and Salmon Bay to the wharves at Ballard.
	Chapter	1482	58 th	1905	PL 59-215	1905	Authorizes deeper and wider channel between Shilshole Bay and Salmon Bay to the wharves at Ballard; explicitly avoids authorizing a waterway between Puget Sound and Lake Union.
	Chapter	3072	59 th	1906	PL 59-218	1906	Authorizes canal construction by James A. Moore from Puget Sound to Lake Washington.
	Chapter	2509	60 th	1907	PL 60-168	1907	Authorizes study of a one-lock channel and authorizes construction of canal by James A. Moore.
	Chapter	157	60 th	1907	PL 60-107	1907	Authorizes transfer and land rights to City of Seattle for public purposes.
	House	953	60 th	1908	PL 61-264	1910	Appropriation for construction of locks and dams at the entrance to Salmon Bay.

Name	House or Senate	No.	Congress	Report Year	Authorization	Authorization Year	Summary
	House	953	60 th	1908	PL 62-429	1913	Appropriation for locks, dam and dredging.
	House	800	64 th	1916	PL 65-37	1917	Report recommends expanded dredging, jetty and downstream revetment; jetty rejected.
	House	324	67 th	1922	PL 67-362	1922	Authorization for expanded dredging for passing basin/log basin, guide pier and upstream revetment.
Shilshole Bay, WA	N/A				PL 71-520	1930	Authorization for preliminary examination of Shilshole Breakwater.
Puget Sound to Lake Washington	House	140	72 nd	1931	PL 74-409	1935	Report recommends expanded dredging upstream of the locks to Lake Washington.
Shilshole Bay, WA	N/A				PL 79-525	1946	Authorization for survey on beach erosion and shore protection for Shilshole Bay.
	House	536	81 st	1950	PL 83-780	1954	Authorization for jetty on the north of the channel entering Salmon Bay, south side jetty rejected.
Puget Sound to Lake Washington	N/A			1956	PL 84-779	1956	Recommendation to change the name of the locks to "Hiram M. Chittenden Locks".

The Flood Control Act of 1944, Section 4, authorized the Chief of Engineers “to construct, maintain, and operate public park and recreational facilities at water resource development projects under the control of the Department of the Army....The water areas of all such projects shall be open to public use generally for boating, swimming, bathing, fishing, and other recreational purposes, and ready access to and exit from such areas along the shores of such projects shall be maintained for general public use.” The Rivers and Harbors Act of 1954 authorized the “...construction, repair, and preservation of certain public works on rivers and harbors for navigation, flood control, and for other purposes:”

Section 101. “That the following works of improvement of rivers and harbors and other waterways for navigation, flood control, and other purposes are hereby adopted and authorized to be prosecuted under the direction of the Secretary of the Army and supervision of the chief of Engineers, in accordance with the plans and subject to the conditions recommended... Provided, That the provisions of section 1 of the River and Harbor Act approved March 2, 1945 (P.L. 79-14, 1st Session), shall govern with respect to projects authorized in this title; Shilshole Bay, Seattle, Washington: House Document 536, 81st Congress, at an estimated cost of \$3,397,300.”

Section 102. “The Secretary of the Army is hereby authorized to reimburse local interests for such work done by them on the beach erosion projects authorized in section 101.”

1.3 PROJECT PURPOSE AND LOCATION

The purpose of the LWSC Project is to provide for navigation between the extensive freshwater bodies lying in and adjacent to Seattle. By providing navigational access between Puget Sound and Lakes Union and Washington, the LWSC has contributed to the industrial, commercial, and recreational developments of the area. The LWSC affords passage from saltwater to freshwater, where saw logs were once stored free from rapid destruction by teredos (a marine worm), and commercial, naval, and leisure craft are now moored free from the destructive effects of corrosion, electrolysis, marine plant growth, barnacles and teredos. As a result, the area serves as homeport for large numbers of commercial fishing boats, and the LWSC facilitates waterborne commerce to and from Alaska. The LWSC Project also provides significant values in the regulation of lake levels, passage of anadromous fish to upstream spawning grounds, and public visitation and education.

The 8-mile-long Ship Canal connecting saltwater Puget Sound with the freshwater bodies of Salmon Bay, Lake Union, and Lake Washington, is located entirely within the city limits of Seattle, Washington (Figure 3). The inland waters cover an area of 25,000 acres with a shoreline of about 100 miles. Freshwater begins at the Locks and the adjacent dam which control the water level in the lakes upstream. The Ship Canal continues from the Locks to Salmon Bay, Fremont Cut, Lake Union, Portage

Bay, Montlake Cut, and Lake Washington's Union Bay, where it ends at Webster Point.

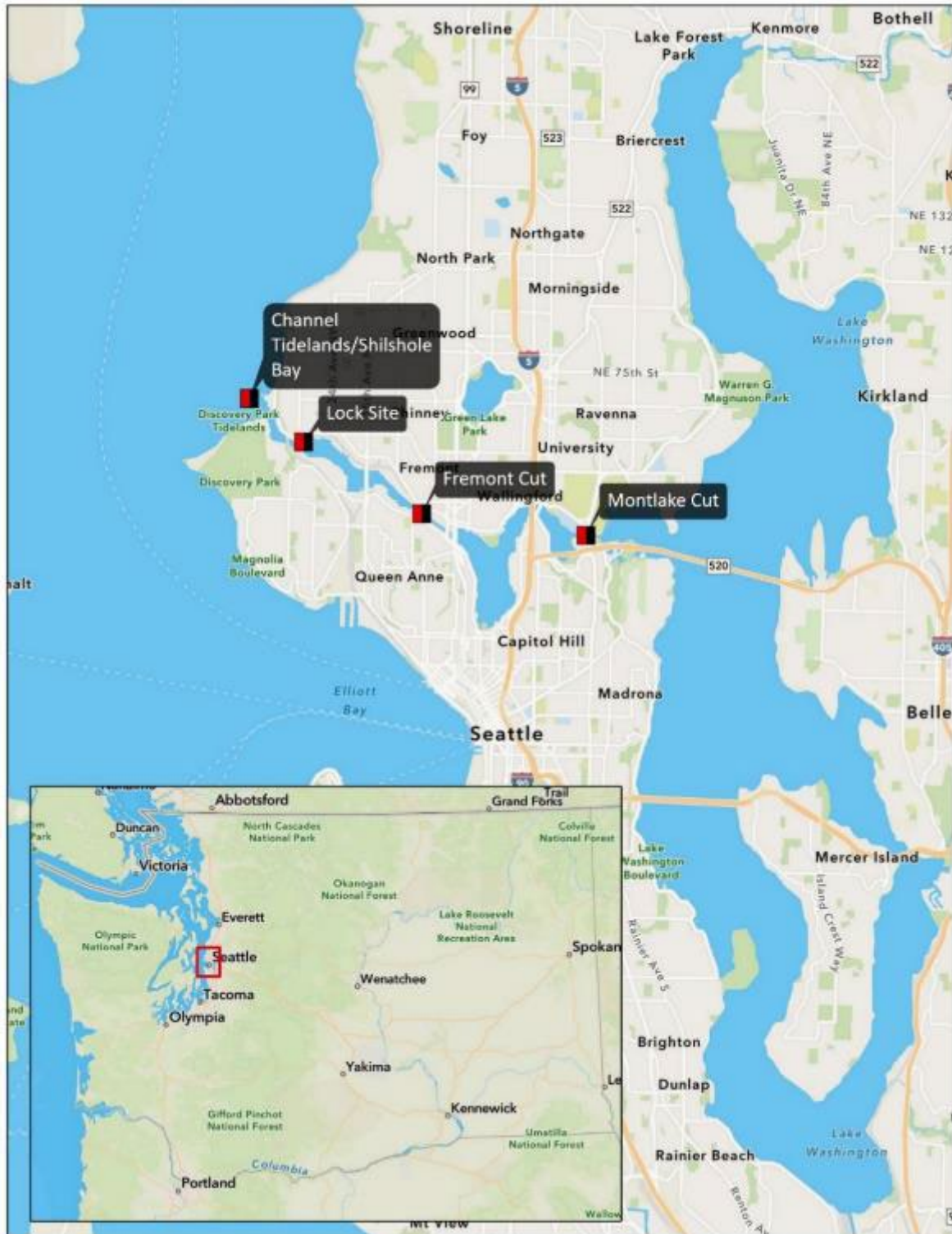


Figure 3. Location of the LWSC Project in Washington State and in the City of Seattle.

USACE property consists of a total of 68.5 acres of fee lands (lands owned by the Federal government and administered by USACE) that is a combination of uplands and submerged lands (Table 2). Two small parcels of submerged fee lands totaling about 12.7 acres occur along the Ship Canal and Shilshole Bay to the northwest of the Locks site (Figure 3). The Locks site includes a total of about 22.9 acres, 16.0 acres of which are uplands, and 6.9 acres are submerged. In addition to the Locks, USACE administers property fee lands and has an easement in two locations along the navigation channel referred to as the Fremont Cut and the Montlake Cut (Figure 3). The Fremont Cut, a federally owned property, and administered by USACE, includes a total of 35.6 acres of predominantly submerged lands. Uplands at the Fremont Cut are limited to narrow strips of land about 15 feet in width on either side of the Ship Canal. The Montlake Cut, an easement property, includes a total of 20.6 acres of which 9.1 acres are uplands on either side of the Ship Canal and 11.5 are submerged.

Table 2. Pertinent Data for LWSC Project. The reservoir consists of two natural lakes (Lake Washington and Lake Union) and the Fremont and Montlake Cuts.

Project Component	Component Aspect	Description
General	Watershed	Puget Sound
	Drainage Basin	Lake Washington
	Drainage area above Locks	607 square miles
	Tributaries	Cedar River and Sammamish River and their tributaries, North Lake Washington tributaries, Little Bear Creek, Bear/Cottage Lake Creek, Issaquah Creek, Kelsey Creek
	Location of Locks	8.6 River Miles at upstream limit of LWSC
	Operating and Managing Agency	U.S. Army Corps of Engineers
	Purposes	Navigation, Recreation
	Authorization	House Document 1, 52 nd Congress in 1892
	Year Construction Started	1911
	Year Locks Placed into Operation	1916
	Construction Cost	\$2,275,000
	Cost to replace fish ladder in 1976	\$2,400,000
Lake Washington Ship Canal	Length	8 miles
	Depth of channel above the Locks	30 feet with lake elevation at 16.75 feet
	Depth of channel below the Locks	34 feet with tidal elevation at -2.34 feet
	Channel width, minimum	100 feet

Project Component	Component Aspect	Description
Spillway Dam	Type	Concrete, ogee crest, with tainter gates
	Number of gates	6
	Crest Elevation	7.25 feet
	Top of Gate Elevation (Closed)	15.79 feet
	Gate Dimensions	32 feet wide and 8.65 feet high
	Spillway Bridge Height	19.5 feet
	Spillway Hoist Deck Elevation	27.25 feet
Large Lock	Type	Concrete
	Total length	825 feet
	Total useable length	760 feet
	Gallons of water used per foot	493,680 gallons
	Width	80 feet
	Height of operating deck	+22.75 feet
	Wall height	55 feet
	Culverts	2 at 14 x 8.5 feet
	Laterals	44 at 2 feet high by x 4 feet wide and 8 at 6 feet high by 2 feet wide
	Type of Gates	Double sheathed, miter
	Number of Miter Gates and Work Gates	5 sets
	Type and number of Valves	6 Culvert Gate Valves
Small Lock	Type	Concrete
	Total length	150 feet
	Total useable length	123 feet
	Gallons of water used per foot	33,662 gallons
	Width	30 feet, with inside floats is 28 feet
	Height of operating deck	+22.75 feet
	Wall height	42 feet (wall height varies)
	Culverts	2 at 6 feet high by 4.25 feet wide
	Laterals	12 at 2 x 3 feet and 2 at 5 x 2 feet
	Type of Gates	Single skinned miter
	Number of Miter Gates and Work Gates	4 sets
	Type and number of Valves	4 Cylindrical valves
Fish Ladder	Width	8 feet
	General Slope	1 vertical to 8 horizontal
	Weir Height	8 feet
	Distance between Weirs	8 feet
	Number of Fixed Weirs	18
	Number of Adjustable Weirs	3
	Ladder Flow	18.6 cubic feet per second (cfs) to 23 cfs
	Fishway Entrance Downstream Opening	Gate Controlled (opening 3.8 feet maximum or 0.94 feet minimum width x 22 feet high)

Project Component	Component Aspect	Description
	Fishway Entrance Side Opening	Uncontrolled (opening 1-foot-wide x 22 feet high)
	Fishway Exit	5.5 feet x 10 feet
	Attraction Water	Discharge from saltwater drain and also freshwater from lakes
Reservoir	Width	3.8 miles
	Length at Elevation	20.7 miles at 18.75 feet
	Surface Area	23,464 acres (Lake Washington) 580 acres (Lake Union)
	Maximum Operating Pool (Ordinary High Water)	18.75 feet
	Minimum Operating Pool (Lake Washington Low Water)	16.75 feet
	Normal Operating Range	16.75 to 18.75 feet
	Storage Capacity	46,424 acre-feet
Lands	USACE administered fee	Land – 17.5 acres; Submerged Lands 51.0 acres
	Easement	Land – 9.2 acres; Submerged Lands 11.5 acres
	Outgrants	9.8 acres
	Transfer of public lands	0.8 acres

1.3.1 Hiram M. Chittenden Locks Site

Hiram Martin Chittenden was an engineer that spent most of his working life with USACE, where he was involved in the early development of Yellowstone National Park and navigation, irrigation, and flood-control projects on a number of the nation's inland waterways. In 1906, Chittenden became USACE's District Engineer in Seattle, where he played a key role in determining the final configuration of the LWSC and supervised myriad projects around the state. Chittenden retired from USACE in 1910. In June of that same year, Congress appropriated \$2,275,000 for construction of the LWSC according to specifications in the District Engineer's annual report of 1907.

In September 1911, construction commenced under the direction of Colonel James B. Cavanaugh (Seattle District Engineer from 1911 to 1917). In November 1911, USACE broke ground at the Locks and poured the first concrete in February 1913. July 1916 marked the first closing of the completed Locks gates and the filling of Salmon Bay. In October 1916, USACE lowered Lake Washington approximately nine feet to the level of Lake Union. Originally referred to as the Government Locks or Ballard Locks, Congress officially honored Brigadier General Hiram M. Chittenden by naming the Locks after him in 1956 (Figure 4).



Figure 4. Hiram M. Chittenden (1858 – 1917).

The primary features of the Locks are the dam and spillway, the two vessel locks (one large and one small), the fish ladder, the buildings, and the Carl S. English Botanical Garden (Figure 5). The Locks provide a navigational passage between the freshwater portion of the LWSC Project at a mean elevation of 17.75 feet¹ and Shilshole Bay, the level of which is determined by tidal action. Depending on the tide, the lift into freshwater provided by the Locks varies from a depth 6 to 26 feet.

At the time of its completion, the LWSC Project, operating 24 hours a day with its fixed dam double locks and nearly 8-mile navigation channel, was regarded second in scope only to the multiple locks and 50-mile-long Panama Canal. While larger locks have since been built within the continental United States, Seattle's Locks likely pass more vessels each year. The large lock can accommodate ocean-going vessels up to 30-foot draft. While commercial craft and fishing boats use the Locks, recreational vessels make up the bulk of traffic, especially in the summer months.

¹ All elevations in this document are in datum NAVD88 unless otherwise specified. See Attachment A for information on datums at the LWSC Project.



Figure 5. Locks site which includes the Hiram M. Chittenden Locks, Carl. S. English Botanical Garden, administration buildings, maintenance yard, and fish ladder viewing gallery at the South Entryway (hatched area is easement lands).

There is a saltwater barrier hinge-mounted to the floor of the large lock. It is air-operated via controls located in the center control tower. The barrier is usually left in a raised position to reduce the intrusion of saltwater into Salmon Bay and beyond, but is lowered to permit passage of deep-draft vessels. In the high flow season, this barrier is normally kept in the down position. Saltwater passes into Salmon Bay during lockages and settles into a saltwater basin immediately upstream of the large lock. A saltwater drain conduit, with inlet at the bottom of the saltwater settling basin, returns the saltwater by gravity through the dam and/or fish ladder.

The dam, which forms the barrier across the LWSC between the small lock wall and the south shore, is 235-feet long and has six 32-foot-wide spillway openings in which steel radial gates are installed (Figure 6). Individual electrically operated gate hoists raise and lower the six spillway gates. The maximum discharge capacity of the spillway at full gate opening is approximately 16,000 cubic feet per second (cfs).



Figure 6. The Locks dam and spillway gates in October 2016.

A fish ladder to the south of the Locks provides upstream migration for salmonids. The fish ladder has been renovated over the years, with the last renovation completed in 1976 (Figure 7). The 1976 renovation introduced the fish viewing room to allow research by fisheries resource managers and visitors' observation of fish migration.



Figure 7. Renovation of the fish ladder in 1976.

Most of the grounds accompanying the Locks lie north of the waterway, where maintenance and administrative facilities are arranged on a modified grid perpendicular to the waterway. The westerly portion of the property rises 45 feet above the Locks. The Cavanaugh House, which serves as the residence of the Seattle District Engineer, sits atop this plateau. It was originally built in 1913 as the Lockkeeper's residence. In front of the house, a terraced embankment of dredged materials descends toward the water in five-foot intervals (Figure 8). A paved walkway parallel with the waterway extends the length of the lawn-covered plateau, and at its westerly end is a viewing overlook with solid concrete railing. This secondary concourse is linked to a private gateway in the northwest corner of the reservation by curvilinear road segments which encompass the residential knoll.



Figure 8. View of the Locks and grounds (left) looking east from the Great Northern Railroad Bridge, post 1916.

In this informally landscaped westerly section is a luxuriant array of mature ornamental and specimen trees, shrubs, and bedding plants introduced by gardener Carl S. English Jr. who started working in the gardens in 1931 (Figure 9). During his 43 years working for USACE, English transformed seven acres of barren lawn into a botanical garden. English collected specimens of trees and flowers from around the world through his travels, correspondence with prominent botanists, and assistance from ship captains returning through the Locks. The Garden was named in honor of English in 1974. He passed away in 1976. Today the Garden contains nearly 900 species of plants from around the world, including fan palms, oaks, Mexican pines, rhododendrons, and a variety of roses.



Figure 9. Carl S. English Jr. pictured outside of his home in Seattle (Photograph courtesy of Cornell University 1931).

1.3.2 Fremont Cut

The Fremont Cut is located between Salmon Bay and Lake Union and is surrounded by industrial and commercial development. The Fremont Cut is approximately 5,800 feet long, 300 feet wide (including both land and water) and has an authorized depth of 30 feet. The Fremont Cut is lined with concrete revetments on either side which are bolstered by riprap. Landward of the revetment are approximately 15-foot-wide shoulders that are available for pedestrian use (Figure 10). Beyond the 15-foot-wide shoulders is private or commercial property.

1.3.3 Montlake Cut

The Montlake Cut is in the eastern portion of LWSC between Portage Bay and Union Bay. USACE has an easement interest on the property acquired from the State of Washington. The Montlake Cut property boundaries are 2,500 feet long and 350 feet wide, with a 200-foot-wide navigation channel and an authorized depth of 30 feet. The tops of the concrete revetments adjacent to the Montlake Cut are used as waterside walking paths. Beyond the revetment, the steep embankments rise to a height of about 65 feet. On the southern shore, a recreational trail was developed by USACE in cooperation with the Seattle Garden Club in 1970. It extends from West Montlake Park on the extreme west end of the cut to Horace McCurdy Park on the eastern end. The Washington Park Arboretum trail connects to the USACE trail at McCurdy Park and continues through and beyond the state-owned marshes of

Foster Island to the Washington Park Arboretum. Narrow strips on each side of the waterway contain a total of approximately 9.1 acres (Figure 11).



Figure 10. Fremont Cut along the Ship Canal.

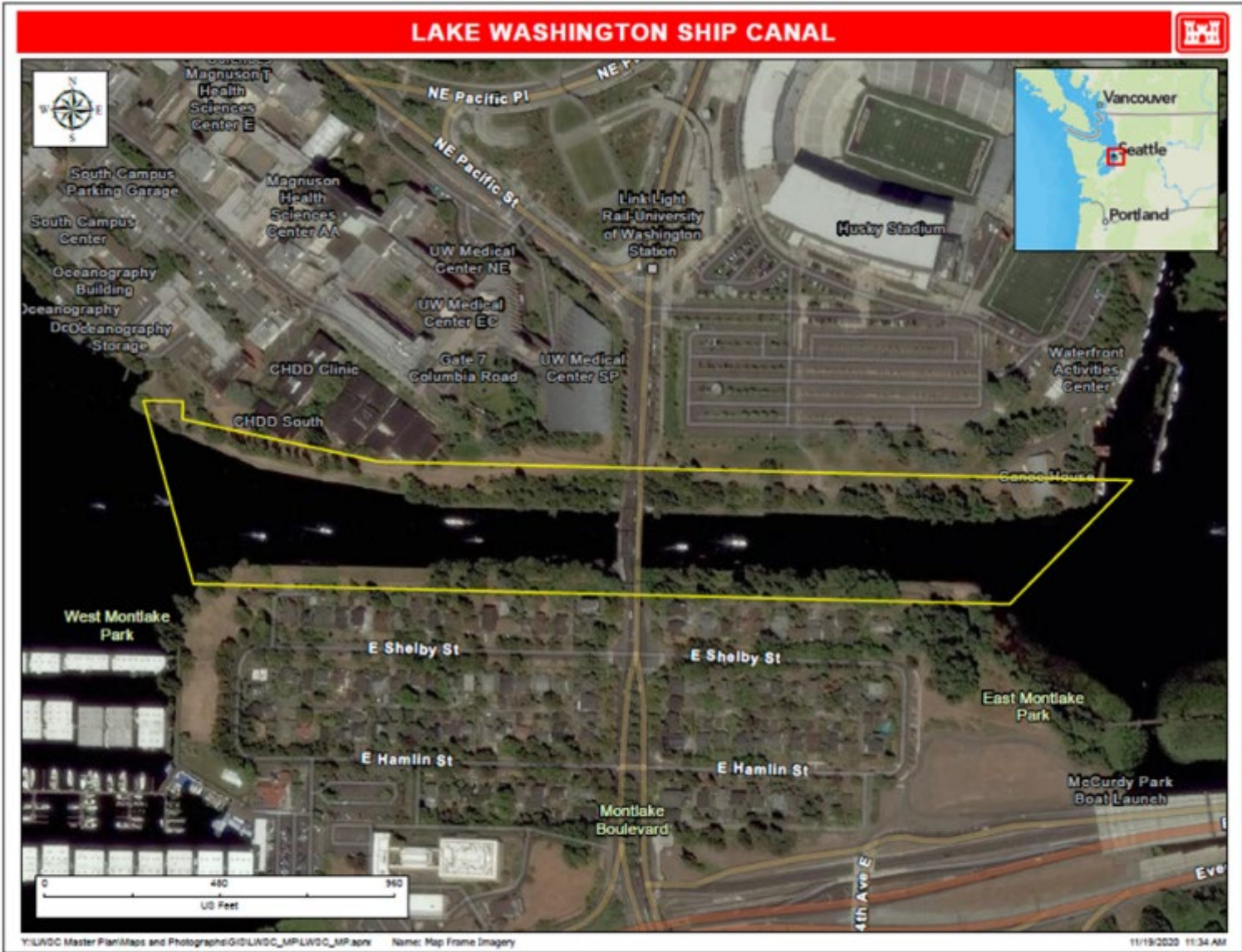


Figure 11. Montlake Cut along the Ship Canal.

1.3.4 Channel Tidelands/Shilshole Bay

USACE retains title to two smaller parcels of land along western end of the canal at Shilshole Bay totaling about 12.7 acres (Figure 12). A portion of this land was previously outgranted by license to a non-governmental business, but that license is no longer valid.



Figure 12. Location of the channel tidelands and Shilshole Bay parcels.

1.4 EARLY HISTORY AND LANDSCAPE CONDITIONS

Prior to the construction of the Ship Canal and the Locks, and the arrival of white settlers into what is present day Seattle, the area was home to the Duwamish (Dxwdewabs) Tribe. The name Duwamish is said to mean “inside the bay people” and their territory included the Black River, Cedar River, Green River and White River drainage area, extending from Puget Sound to the foothills of the Cascades. The Duwamish also included the Lake Washington people, the Thluw’ithalbsh (at Union Bay), the Sammamish at the mouth of the Sammamish River and the (Colcol-a oc) people of Salmon Bay (Smith 1941; Swanton 1952; Burge 1980; 1985; Suttles and Lane 1990; Ruby and Brown 1992). The subsistence of the Tribes was based upon seasonal harvesting of wildlife, plants, and fishery resources. Saltwater resources included herring, smelt, flounder, lingcod and rockfish. Shellfish resources included butter and horse clams, geoducks, and native oysters. In freshwater rivers and lakes, a variety of fish including salmon, cutthroat, rainbow trout, mountain white fish and suckers were caught (Suttles and Lane 1990). Tribal settlements consisted of permanent villages

made up of cedar plank longhouses. Villages were located along waterways (Suttles and Lane 1990).

The Tribes referred to the narrow estuary at Salmon Bay as “Cllico’l” or “shoving thread through a bead.” This estuary was used as a thoroughfare and canoes would “threaded” their way to and from the freshwater lakes to Puget Sound. This was also a village location on the north shore of Salmon Bay where Ballard now is (Waterman 1922; 2001). Other village sites include five longhouses that were located along the northern margin of the Union Bay and included a longhouse at the University steam plant, Edgewater Park, and the Battelle Institute (Burge 1980; 1984; Larson and Lewarch 1995).

The first official mention of a canal to connect Lake Washington with Puget Sound was by Thomas Mercer at a picnic on the shore of Lake Union on July 4, 1854. The first earth was turned in 1869 when a local citizen, Harvey Pike, began a shallow hand-shoveled canal between Lakes Washington and Union. In 1880, the Lake Washington Canal Association was formed and undertook to finish the canal to a sufficient depth to float logs. In the early 1900s, the channel between Lake Union and Salmon Bay was deepened so that its bottom was below high tide, and a dam was constructed in the channel at the lake outlet to control flows. All of these facilities were for transporting logs and did not provide sufficient depth for vessels.

The original construction of the LWSC included rerouting the Cedar River into Lake Washington along with the creation of the channel to the Locks. USACE also lowered Lake Washington by about nine feet. The Black River was the historical outlet for Lake Washington. It joined with the Duwamish River before emptying into Puget Sound. The Black River was largely eliminated when the Cedar River was directed into Lake Washington (Figure 13). In addition, the construction of the Locks displaced the original inhabitants of Shilshole Bay. The village located at Cllico’l was likely destroyed during the construction of the Locks. The description of Figure 14 from the University of Washington American Indians of the Pacific Northwest Images digital collection states: “Salmon Bay Charlie (Hwehlchtid), of the Shilshole people, lived on the southern shore of Salmon Bay, near Ballard. Charlie and his wife Madeline (Chilohleet’sa) remained in their traditional homeland long after others of their Tribe had moved away. This photo[graph], taken around 1905, shows their home at Shilshole.”

The State of Washington and King County cost-shared the upstream excavation and construction with the Federal government. Construction of the canal began in September 1911, with the small lock opened to traffic on July 30, 1916, and the large lock opened on August 3, 1916. The Fremont Cut Channel between Salmon Bay and Lake Union was opened October 1916. The Montlake Cut Channel between Lakes Union and Washington was completed May 8, 1917. Official dedication of the project was held July 4, 1917.

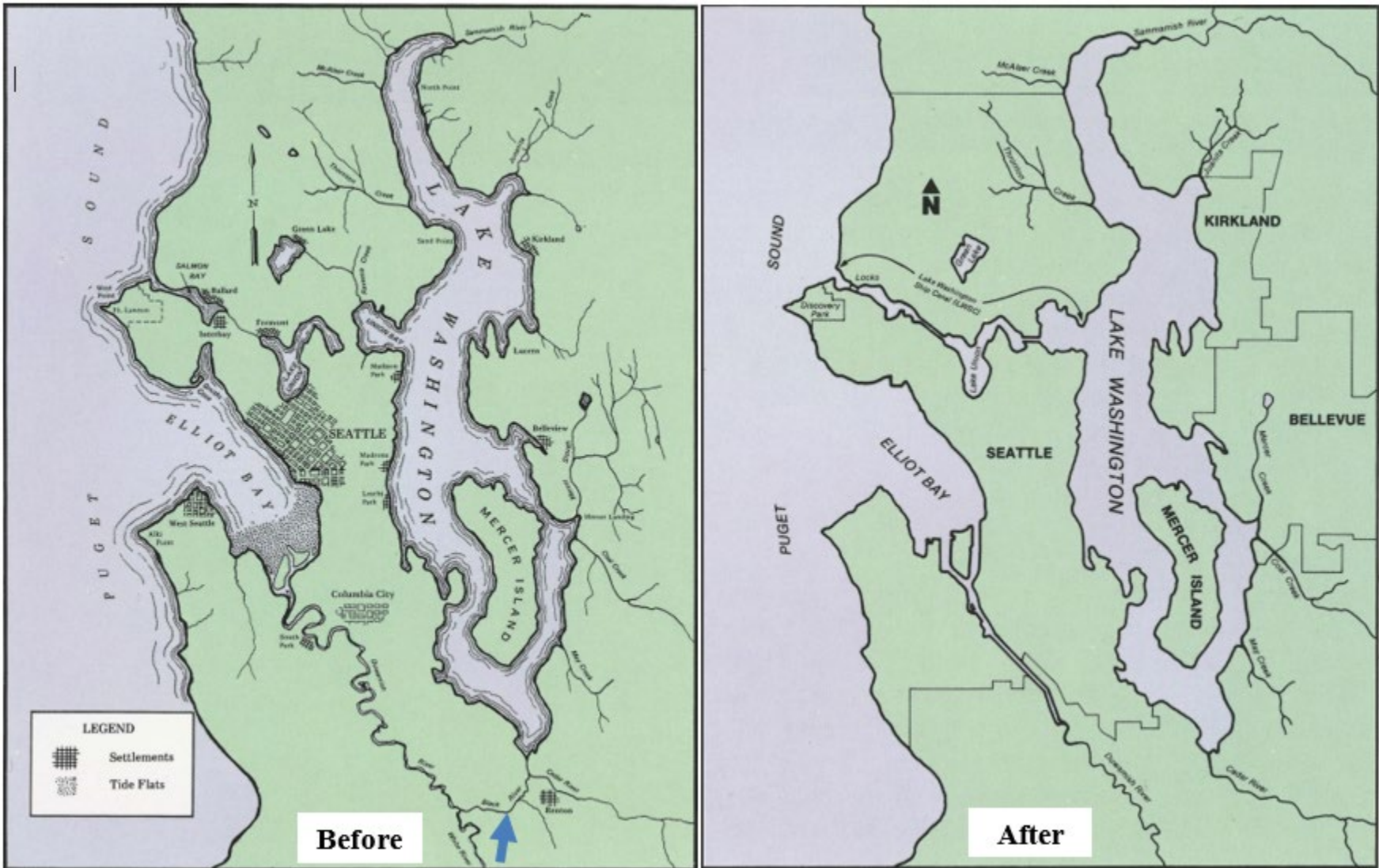


Figure 13. Seattle before the construction of the Locks started in 1911, and after construction the LWSC was completed and built in 1916. Note the Black River (arrow) is no longer present after the construction of the Locks was completed.



Figure 14. Salmon Bay Charlie's house at Shilshole with canoe anchored offshore, ca. 1905 (Photograph and description from the American Indians of the Pacific Northwest Images digital collection; <https://digitalcollections.lib.washington.edu/digital/collection/loc/id/17/>).

1.5 LISTING OF PRIOR DESIGN MEMORANDUMS AND NEPA DOCUMENTS

Prior to 1999, Design Memorandums (DM) were the formal documents which defined engineering responsibilities, requirements, and procedures during the planning, design, construction, and operations phases of Civil Works projects. This system of indexing documents is no longer used per Engineer Regulation (ER) 1110-2-1150. A full list of the previous DM for the LWSC Project, National Environmental Policy Act (NEPA) documents, and other studies can be found in Attachment B.

2 PROJECT SETTING AND FACTORS INFLUENCING MANAGEMENT AND DEVELOPMENT

2.1 DESCRIPTION OF RESERVOIR AND NAVIGATION CHANNEL

The navigation channel is eight miles long extending from deep water in Puget Sound to deep water in Lake Washington. The channel dimensions downstream (westward) of the Locks include a 34-foot deep (at zero MLLW; Attachment A)

passing basin that is 300 feet wide, extending from the deep waters of Puget Sound to the Burlington-Northern Railway Bridge (about 5,500 feet in length). There is also an 8-foot deep (at zero foot MLLW) holding basin, originally intended as a log raft holding area, located at the turn under the railroad bridge. Between the bridge and the Locks, the channel dimensions narrow to 150 to 200 feet wide (about 900 feet in length).

The reservoir upstream of the Locks consists of two natural lakes (Lake Washington and Lake Union) and the Fremont and Montlake Cuts. The channels are 30 feet deep when the lake is at its lowest controlled elevation, with bottom widths of 100 feet from the locks to Lake Union through Fremont Cut, 200 feet wide through Portage Bay, 100 feet wide through Montlake Cut, and 200 feet wide through Union Bay to Lake Washington. The banks of the Fremont and Montlake cuts are protected by revetments. Upstream of the Locks, the actual channel depth is slightly deeper than 30 feet in certain locations.

Lake Washington is a large monomictic (i.e., one regular period of mixing) lake with a mean depth of 108 feet, and about 80 miles of shoreline (Kerwin 2001). The Sammamish and Cedar Rivers are the lake's main tributaries. The lake's surface elevation is controlled between 16.75 feet and 18.75 feet. The construction of the LWSC Project in 1916, resulted in lowering Lake Washington by about nine feet.

Lake Union is an approximately 580 acres (0.89 square miles) mesotrophic lake with a mean depth of 34 feet and a maximum depth of 50 feet (King County 2015).

2.1.1 Hydrology (surface water and groundwater)

The geography, hydrology, and ecosystems in and adjacent to the LWSC have been dramatically altered by human activity since white settlers first arrived in the 1800s. Historically, a small stream flowed from Lake Union to Shilshole Bay, with no surface water connection between Lake Union and Lake Washington. The waters of Lake Washington flowed south to the Duwamish River via the Black River; during the course of lowering the lake, the Black River was pinched off and now only remnants of the original river channel remain. The LWSC Project was created by dredging and excavation that began in the 1880s to provide a navigable passage between Lake Washington and the marine waters of Shilshole Bay. The canal was completed in 1916. As part of this, the Locks were constructed near the west end of the canal to maintain navigable water levels in the canal and lakes. This permanently converted Salmon Bay from an estuary to freshwater. Flows through the Ship Canal are controlled by the Locks and are typically very slow.

2.1.2 Water Quality

While the Master Plan does not address the specifics of regional water quality, shoreline management (ER 1130-2-406), or water level management, it is important to understand the environmental challenges where the LWSC Project water restricted areas (Section 4.2.5) are located. Lake Union and the Ship Canal are on the current U.S. Environmental Protection Agency (EPA) approved Section 303(d) list of threatened and impaired waterbodies for chloride (Category 2), bacteria

(Category 5), and temperature (Category 5) (33 U.S.C. § 1313). Lake Washington is also on the Section 303(d) list of threatened and impaired waterbodies (Ecology 2016).

High water temperature is a concern in the basin, primarily because adult and juvenile salmon migrate through the Ship Canal and are sensitive to high temperatures. The temperatures of the Cedar and Sammamish Rivers can exceed 68°F in the summer. Both are listed on the EPA approved Section 303(d) list for temperature. Lake Washington and Lake Union surface water temperature can exceed 77°F in the summer when adult Chinook salmon are returning to the basin. Water temperature is typically warm throughout the water column in the canal during the summer months.

The volume of freshwater entering Shilshole Bay is much greater than it was historically due to the creation of the LWSC Project, but salinity immediately below the Locks remains generally high (approximately 10 to 29 parts per thousand [ppt]) compared to upstream conditions. A shallow freshwater lens (approximately three to six feet deep) created by the output of freshwater at the Locks is often present, but it does not extend past the railroad bridge 1,300 feet downstream of the dam (Simenstad et al. 2003). In the summer, when flows are low, saline water dominates with a very limited freshwater lens (Kerwin 2001). Salinity along the Puget Sound shoreline is generally 20-30 ppt (City of Seattle 2010). Below the Locks spillway dam, there is some mixing of freshwater and saltwater due to the spilling water.

Elevated concentrations of metals, bacteria, nutrients, and organic compounds have been found near outfalls of Lake Union (SPU 2014). Wood waste from historical lumber and wood related industries is common in Lake Union and LWSC (Tobin 1986), resulting in low dissolved oxygen concentrations. In Lake Union, the bottom waters are typically anoxic during the summer. Heavy metals, polycyclic aromatic hydrocarbons, and polychlorinated biphenyl are all present in Lake Union and the canal. There are many active and completed Washington State Department of Ecology cleanup sites within one mile of the Locks.

In June 2023, Long Live the Kings (LLTK) and WRIA 8 Salmon Recovery Council released Phase 1 Report - Addressing Temperature and Dissolved Oxygen in the Lake Washington Ship Canal. The report details the initial steps to identify potential solutions to low dissolved oxygen and high water temperatures impacting the health and migration of juvenile and adult salmon in the LWSC. LLTK contracted the services of Jacobs Engineering Group Inc. (Jacobs) and DSI LLC (DSI) to advance the next phase, which aims to build a better understanding of how potential solutions may impact water quality, could be implemented, and where more research or analysis is needed. As of 2025, LLTK and WRIA 8 continue to engage with local natural resource agencies and Tribes to collaborate on closing knowledge gaps of the LWSC system and explore potential actions to improve water quality for salmonids.

2.1.3 Climate

The climate at the LWSC is relatively temperate, as it is for most of western Washington. Summer days rarely rise above 79°F and winter days are seldom below 45°F during the day (U.S. Climate Data 2020). Spring and autumn temperatures tend to fall between 50°F and 60°F (U.S. Climate Data 2020). The occasional heat wave occurs, and summer temperatures sometimes rise into the 80 to 90°F range. Snow is variable and winter temperatures at night can range between 20 to 30°F (U.S. Climate Data 2020).

Annual rainfall in the greater Seattle area is about 34 inches. The wettest months are from October to January and the driest months are July and August (U.S. Climate Data 2020). The Pacific Ocean creates a marine layer where clouds are frequent in the winter, spring, and fall.

Climate change has affected aquatic habitats across the region and at the LWSC. During the last century, average air temperatures in the Pacific Northwest have increased by 1 to 1.4°F, and up to 2°F in some seasons (based on average linear increase per decade; Abatzoglou et al. 2014; Kunkel et al. 2013). Recent temperatures in all but two years since 1998 ranked above the 20th century average (Mote et al. 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3 to 10°F, with the largest increases predicted to occur in the summer (Mote et al. 2014). Decreases in summer precipitation of as much as 30 percent by the end of the century are consistently predicted across climate models (Mote et al. 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007; Mote et al. 2013, 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote et al. 2014). Climate models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez et al. 2012).

2.2 TOPOGRAPHY, GEOLOGY, AND SOILS

2.2.1 Geology

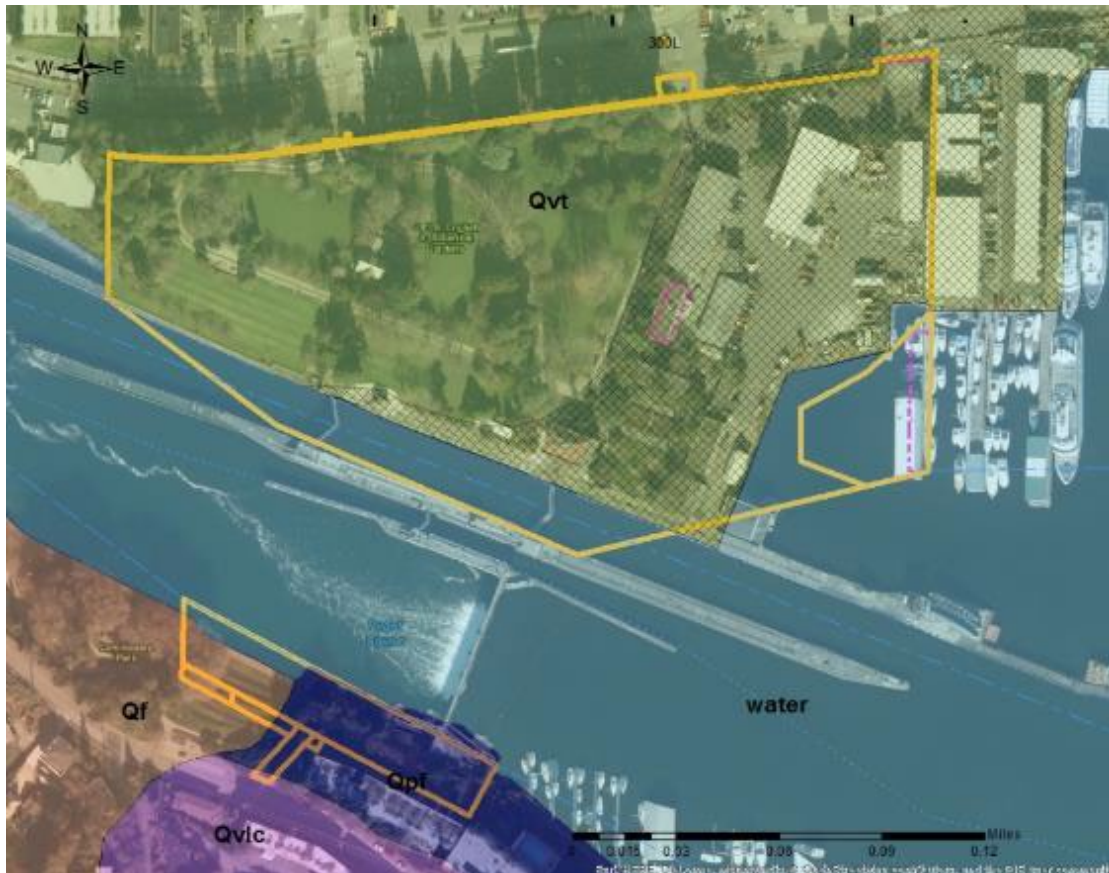
Geologic maps and data show the distribution, composition, and age of the rocks and sediments. The geologic story of the area is one of repeated glacial erosions and depositions. Glaciers advanced and retreated over the area at least four times, each glacier nearly eliminating the evidence of previous glaciers. A chronologic history of the actions of the last glacier to cover Seattle, about 14,000 years ago, can be seen in the nearby bluffs of Discovery Park (formerly Fort Lawton).

One of the first effects of each glacial advance was to block the natural drainage of Puget Sound to the north, through the Strait of Juan de Fuca. This resulted in the formation of a lake which eventually rose to a level that allowed it to drain to the south. The lake initially received clays, silts, and fine sands from glacial outwash and coarser sands and gravels from delta formations wherever streams or rivers entered

the lake. The deposited material graded from coarse to fine with increasing distance from the source. As the glacier advanced, the lake was crowded southward, and successively coarser material was deposited. As the glacier moved over the area, unsorted glacial till consisting of clay, silt, sand, gravel, and boulders were deposited. The underlying material was consolidated under the weight of the ice and eroded. As the glacier receded, the lake reformed, and successively finer material was deposited until ice retreat again permitted drainage via the Strait of Juan de Fuca.

Throughout the area there are often several hundred feet of layers of stratified and unstratified glacial deposits. The glaciation created the major landforms around Seattle and produced the north-south running basins of Lake Sammamish and Lake Washington and the many north-south trending hills of the city. Puget Sound was deepened by the erosion.

The geology of the LWSC area is characteristic of that found throughout most of the central Puget lowland. Information briefly summarized here is taken from the U.S. Department of Interior, U.S. Geological Survey (2005). Geologic maps of the area indicate the north shore of the LWSC dam and Locks site is underlain by about 7.3 acres of Vashon Till, while the south shore is underlain by Lawton Clay, deposits of the pre-Fraser glaciation age, and Alluvial Fan Deposits (Figure 15).



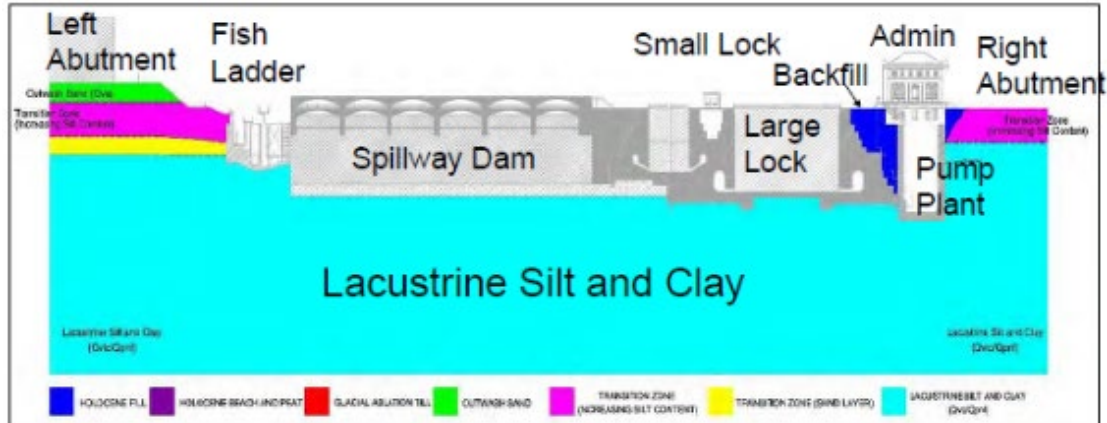


Figure 15. Glacial deposits at the LWSC Locks Site. Vashon Till = Qvt; Lawton Clay = Qvlc; deposits of the pre-Fraser glaciation age = Qpf; Alluvial Fan Deposits = Qf (Source for top figure: USGS 2005).

The O&M area at the Locks site is built upon artificial fill (cross-hatching in Figure 15), likely from excavations for other portions of the LWSC Project. Vashon till deposits are compact diamict of silt, sand, and sub-rounded to well-rounded gravel; glacially transported and deposited under ice. This deposit is commonly fractured, has intercalated sand lenses and is moderately dense. Across the channel at the fish ladder, Fish Viewing Gallery and south entryway area, the deposits are a mix of alluvial fan deposits (Holocene), deposits of pre-Fraser glaciation age (Pleistocene), and Lawton clay member of the Vashon drift. Alluvial fan deposits tend to be loose and dense and composed of sand, silt, gravel, and cobbles. Deposits of pre-Fraser glaciation age (Pleistocene) are composed of interbedded sand, gravel, and are considered dense to very dense. Deposits of the Lawton Clay Member of the Vashon Drift are stiff to hard, laminated to massive silt, clayey silt, and silty clay. This deposit layer marks transition from nonglacial to earliest glacial time.

2.2.2 Soils

The U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) has classified the soils in the LWSC Project into three different series or soil types (NRCS 2020).

Urban Land. Urban land is soil that has been modified by disturbance of the natural layers with additions of fill material several feet thick to accommodate large industrial and housing installations. This soil series is found throughout the LWSC Project.

Alderwood Series. The Alderwood series, found at the Locks Site and Montlake Cut, is made up of moderately well drained soils that have a weakly consolidated to strongly consolidated substratum at a depth of 24 to 40 inches. These soils are on uplands. They formed under conifers, in glacial deposits. In a representative profile, the surface layer and subsoil are very dark brown, dark-brown, and grayish-brown gravelly sandy loam about 27 inches thick. The substratum is grayish-brown, weakly consolidated to strongly consolidated glacial till that extends to a depth of 60 inches and more.

Everett Series. The Everett series, found at Locks Site, is made up of somewhat excessively drained soils that are underlain by very gravelly sand at a depth of 18 to 36 inches. These soils formed in very gravelly glacial outwash deposits, under conifers. They are on terraces and terrace fronts and are gently undulating and moderately steep. In a representative profile, the surface layer and subsoil are black to brown, gravelly to very gravelly sandy loam about 32 inches thick. The substratum extends to a depth of 60 inches or more. It is multicolored black to gray very gravelly sand.

2.3 RESOURCE ANALYSIS (INVENTORY DATA)

Inventories are used to get a basic estimate of the natural resources present at a USACE operating project and are conducted to provide baseline information for Master Plan purposes. Inventory data is used to support the resource objectives and land-use classifications for the Master Plan. Inventories may vary from performing literature research to actively conducting fieldwork to identifying and confirming project resources.

2.3.1 Ecological Setting

The ecological setting is a highly altered metropolitan area and extensively managed vegetation with little to no native habitat remaining.

2.3.2 Fish and Wildlife Resources

ER 1130-2-540 authorizes stewardship of fish and wildlife resources on USACE administered land. LWSC Project does not have any management units classified as wildlife management areas. USACE personnel work closely with the Washington State Department of Fish and Wildlife (WDFW), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), Muckleshoot Indian Tribe, and Suquamish Indian Tribe to facilitate the success and continued existence of fish runs that pass through the fish ladder and Locks.

2.3.2.1 Fish

Visitors utilize the fish ladder underwater viewing room to watch salmon, steelhead, and sea-run cutthroat trout pass through. USACE incorporated the viewing room during the rehabilitation of the fish ladder facility in 1976 and renovated it in 2020.. Salmon, steelhead, and some fish runs of bull trout and cutthroat trout mature in saltwater but must return to freshwater to reproduce. The Cedar River, Sammamish River system, and other streams feeding Lake Washington produce several runs of salmon and steelhead each year. Wild salmon and trout populations in Lake Washington have been augmented by hatchery fish stocked in the system. Chinook salmon were introduced from the Green River (part of a watershed that was historically connected) and produced in hatcheries along with coho salmon on Issaquah Creek and in Portage Bay (USACE and SPU 2008). In addition, the WDFW operate a sockeye salmon hatchery on the Cedar River.

The largest run is sockeye salmon, which occurs in the summer. Chinook and Coho salmon arrive starting in late-summer and fall, respectively, while the peak steelhead

run historically occurred in the winter. The fish ladder, on the south shore of the Locks, provides a viable route around the dam and Locks. Adult salmonids also use the Locks in their migration and in recent years the number of fish using the fish ladder and the Locks is about even.

Juvenile Chinook salmon typically migrate through the Locks during the months of May, June, and July. Unlike the adults, there are multiple pathways juvenile salmon can migrate downstream past the Locks including the smolt slides, spillway, large lock, large lock filling culverts, fish ladder, and small lock. The smolt slides, associated bulkheads, and slide operating gates are installed on the spillway annually for the juvenile salmonid emigration season and then removed prior to winter (i.e., usually removed by early September before flood season).

Historically, steelhead spawned in the Cedar River, Issaquah Creek, and north Lake Washington tributaries. By the late 20th century, the wild steelhead run was severely depressed due to overfishing, and then was largely eliminated in the 1990s by predation in the immediate vicinity of the Locks and fish ladder primarily by California sea lions. The Puget Sound steelhead populations in the LWSC are the Cedar River winter run and the North Lake Washington/Lake Sammamish winter run. Currently, these populations have very few individuals annually.

Other fish occasionally seen in the fish ladder or Locks include freshwater fish such as bass and crappie, and marine or estuary fish such as three-spine stickleback, surf perch, white sturgeon, starry flounder and wolf eel. Other marine animals found at the locks include sea anemones, mussels, barnacles and worms. The Lake Washington system supports many species of resident fish. Since these species do not migrate past the Locks, and are not generally seen by the visitor, they capture less visitor interest than salmon, steelhead, or cutthroat trout.

Upstream of the Locks site, some of the most abundant freshwater species are yellow perch, pumpkinseed, brown bullhead, largescale sucker, Northern pikeminnow, peamouth chub, smallmouth bass, bluegill, and coastal cutthroat trout (WDFW 2017). Pelagic forage fishes are mainly threespine stickleback with some longfin smelt (WDFW 2017). Prickly sculpin dominate the benthic fish community (McIntyre and Beauchamp 2006). More than 20 species are considered non-native and have been introduced into the system by agencies and private individuals over the last 140 years, including species of panfish, yellow perch, carp, catfish, and bass (USGS 2017).

2.3.2.2 Wildlife

The LWSC Project provides the chance for visitors to see large numbers of fish and wildlife, varying with the seasons. The canal vicinity supports a rather large wildlife population, largely due to the interface between salt and freshwater at the Locks and the relatively undisturbed vegetation on Magnolia Bluff and other steep hills adjacent to the canal. It has been estimated by observers that of all the native small and aquatic animal species in Seattle, the greatest populations occur in the Ship Canal vicinity.

Puget Sound supports a variety of marine mammals, including cetaceans (i.e., killer whales and gray whales) and pinnipeds (i.e., California sea lions and harbor seals). Within the LWSC Project, California sea lions and harbor seals frequent the saltwater side of the Locks. Stellar sea lions are only rarely sighted. Sea lions and seals feed on a variety of fish species, including salmon. Seals and sea lions are known to congregate below the Locks to feed on salmon. Seals and sea lions have haul-out (resting) areas to the west of the Locks among the buoys and jetties in Shilshole Bay (Jeffries et al. 2000).

The Seattle Audubon Society has observed 142 species of birds within the canal vicinity. The area is used by bird species both indigenous and in transit, with the latter group passing through the area in fall on their way to southern wintering grounds. A list prepared by Constance Sidles and Brendan McGarry (Seattle Audubon Society) of birds commonly found in the LWSC Project area appears in Attachment C. Bird life is quite abundant and clearly visible, although total numbers and distributions are largely dependent on fish and plant life of the canal. Beginning in saltwater and moving upstream, one will see a wide variety of species. Wading in the shallows of Shilshole Bay, great blue herons stalk small to medium size fish and nest in trees along the canal in Commodore Park. Along the shorelines, sandpipers and other shorebirds poke into the sand for food. Out in the bay, loons, grebes, and ducks float on the surface and dive for fish. At the Locks, the visitor will see gulls scavenging for a wide selection of food. Terns sit on wires and fly over the water, occasionally dropping to snatch fish from immediately below the spillway. Canada geese are frequent visitors and nesters at the LWSC Project while bald eagles are seen flying overhead periodically. A heron rookery is located at Commodore Park adjacent to the South Entryway Buffer Zone. The herons have recently established nests in a couple of trees in the Garden. Upstream of the Locks, the canal supports a year-round population of mallards and American coots. Union Bay is an important wintering ground for thousands of ducks of many species. Flocks of wintering Canada geese occasionally include a few white fronted geese. Double crested cormorants perch in the poplars along the Fremont Cut while following a migrating food supply.

Two of the most common hummingbirds are the Anna's and the rufous. Both feed on nectar from flowers as well as small insects and spiders. Having multiple plants that bloom throughout the season such as in the Garden provides a good natural diet for hummingbirds. It is important to minimize the use of insecticides because hummingbirds also feed on small insects as a source of protein, especially when nesting and feeding their young. For this reason, USACE gardeners limit their use of insecticides.

Owls are also present at the LWSC and tend to be more active at night as most owl species are nocturnal predators. The barred owl has been observed at the Locks by members of the Audubon Society (Attachment C). The western screech owl and the northern saw-whet owl may also be present at the LWSC Project as they prefer to

nest in tree cavities near water. The smallest owl, the northern pygmy-owl hunts in the daytime, but is often difficult to identify as it can look like a small brown songbird. Snowy owls may be present in the fall and winter during migrations from their breeding grounds in northern Canada. Snowy owls hunt the daylight and often will return to their overwintering territories each year.

The LWSC Project supports a diverse array of terrestrial mammals, in as much as the urban and industrialized area can offer. The more open areas provide patches of habitat for small mammals like shrews, moles, squirrels, rats, and opossums. Rats, common in urban areas, are often seen among the riprap that lines part of the Fremont Cut. Visitors may even see muskrat and an occasional beaver from a boat in the Union Bay portion of the Ship Canal. Otters have also been sighted in the Ship Canal. Other terrestrial wildlife that a visitor might see are racoons, rabbits, red foxes and striped skunks, although most of these species in their effort to avoid humans tend to be nocturnal. Other nocturnal wildlife observed at the LWSC Project include bats. Both little brown bats and big brown bats are common neighborhood bats; however, several other species are also present (Section 2.3.5.4).

2.3.3 Vegetation Resources

The vegetation of greatest interest at the LWSC Project is found in the Garden located at the Locks. Located to the north of the Locks, the Garden forms a background and contrast to the mechanical workings. The mission statement for the Garden is as follows: *The Carl S. English Jr. Botanical Garden Mission is to preserve, protect, and cultivate a garden of diverse and historical plant collections that is worthy of significant study and enjoyment for now and future generations.*

The LWSC Project was placed on the National Register of Historic Places as a Historic District in 1978 (Section 2.3.8). The Garden is noted in the historic designation as an area of significance, indicating that the garden is a valuable part of the LWSC Project's historic district designation. The Garden provides year-round interest which, combined with the green spaciousness of the lawn areas, form a pleasurable setting for the Locks activity (Figure 16). In 2021, the Garden received national and worldwide recognition by becoming an accredited arboretum under Arboreta Network (ArbNet), an international arboretum accreditation and networking program).



Figure 16. Carl S. English, Jr. Botanical Garden (Photograph courtesy of the National Park Service, Pacific West Region 2013).

A plant list for the Garden was researched and compiled in 1982 and updated the plant accession system in 2018. A second full plant inventory was completed in June of 2019, counting approximately 140 plant families, 400 genera, and nearly 900 species. This plant list was updated again in 2020, as part of the Supplemental Cultural Landscape Report for the Carl S. English Jr. Botanical Garden at the Hiram M. Chittenden Locks, Seattle WA (Munro et al. 2020). This report identifies and inventories the historic integrity of the Garden as a cultural landscape and recommends preservation treatments. This report also offers a brief and updated version of the 1989 Historic Grounds Report (Freier 1989) which documents the undertakings in and around the cultural landscape since 1989.

Vegetation on the south side of the Locks site consists of trees, shrubs, and ground covers. These plants were installed following construction of the fish ladder and adjacent Commodore Park between 1976 and 1978. Restoration and replanting of this area were completed in 2012. This area consists of a mix of non-native and native plants and is carefully managed to keep views for visitors looking to the north.

Areas that can be considered as vegetated habitat are highly fragmented throughout the Ship Canal due to industrial and business developments. Although important, the

existing habitat is extremely limited and, in some cases, negatively affected by noxious and invasive weeds like English ivy, Himalayan blackberry, and Canada thistle (see Section 2.3.6).

The Fremont Cut area is landscaped with a colonnade of Lombardy poplars that lines the straight narrow channel of the Fremont Cut and separates the waterway from the adjacent urban land uses. Beneath the poplars are predominantly native grasses and shrubs; however, non-native species such as scotch broom have become increasingly invasive. Vegetation on both sides of the canal west of the Fremont Bridge consists of a mixture of native and exotic trees, shrubs, ground covers, and grasses. Tree species include European birch, big-leaf maple, flowering cherry, plum, and European mountain ash. Extensive public use along the canal has created openings between the trees exposing barren and compacted soils furthering potential for natural erosion. Ewing Park, a small City of Seattle Park located on the south shore under the cable tower, has the most extensive ornamental planting along the Fremont Cut. The City of Seattle provides tree and shrub plantings on the north shore due to extension of the Burke-Gilman Trail. Lombardy poplars have a lifespan of between 30 to 50 years, and so many of the poplars planted in the 1940s are now nearing the end of their life. A management plan for removing and replacing the Lombardy poplars was approved in 2001. The poplars that line Fremont Cut are in Phase III of a four-phase removal and replacement plan (Figure 17). Phase IV is expected to be completed in or around 2030.



Figure 17. Poplars that line Fremont Cut are in Phase III (2018) of a four-phase removal and replacement plan.

The Montlake Cut is a narrower channel than the Fremont Cut and is characterized by steep side slopes, planted with a combination of English ivy, ornamental deciduous and evergreen trees, and native shrubs and grasses. The Seattle Garden Club working in partnership with the LWSC Project have contributed labor and plants to create a lush garden bed adjacent the totem pole at the east end of the cut. Trees primarily consist of native conifers, but a row of Lombardy poplars line the west end of the north shore.

2.3.4 Threatened and Endangered Species

In accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended, USACE is required to consult with the USFWS or NMFS on any actions that may affect federally-listed species on LWSC Project. Species evaluated in past ESA consultations during the mid-2000s and included Puget Sound Chinook salmon, Puget Sound/Strait of Georgia coho salmon (a candidate species at that time), Steller sea lion, bald eagle, marbled murrelet, Puget Sound steelhead, bull trout, and the Southern Resident killer whale. The Steller sea lion and bald eagle have since been de-listed under the ESA. Species newly listed since the conclusion of the previous consultations include North American green sturgeon, bocaccio, yelloweye rockfish, eulachon, streaked-horned lark and yellow-billed cuckoo. The two rockfish species are found at depths greater than those in the Ship Canal and so

are not found at the LWSC Project. Any listed bird species have the potential to fly over USACE lands, but do not forage or breed on the lands. No ESA-listed plants occur on the LWSC Project lands. Currently, six species could occur on LWSC Project lands (Table 3).

Table 3. ESA-listed species potentially found within the LWSC.

Species	Distinct Population Segment (DPS)	Federal Listing	Critical Habitat
Chinook salmon	Puget Sound Evolutionarily Significant Unit	Threatened (1999)	Designated (2005)
Steelhead salmon	Puget Sound DPS	Threatened (2007)	Designated (2016)
Bull trout	Coastal-Puget Sound DPS	Threatened (1999)	Designated (2005)
North American green sturgeon	Southern DPS	Threatened (2006)	Designation (2009) does not include LWSC
Pacific eulachon	Southern DPS	Threatened (2010)	Designation (2011) does not include LWSC
Killer whale	Southern Resident DPS	Endangered (2005)	Designation (2006) includes all waters in Puget Sound deeper than 20 feet

Of the five fish species, three of these (Chinook, steelhead, and bull trout) use the fish ladder, Locks and/or Ship Canal. Green sturgeon have not been observed in the LWSC and tend to forage more so in coastal estuaries than in inland estuaries like Puget Sound, and so it would be a rare event to observe a green sturgeon near the Locks. However, recent telemetry studies have shown the species are present in Puget Sound during the winter and summer months (Lindley et al. 2010). Pacific eulachon are usually found in deeper waters (i.e., between 66-492 feet) near the bottom on the continental shelf searching for krill and other small crustaceans. Although they migrate up rivers to spawn; eulachon have not been documented passing through the Locks. Southern resident killer whales frequent the inland waterways of Puget Sound during the spring, summer, and fall seasons (less is known about the species winter range), yet the whales are not known to venture into the vicinity of the Locks. This may be due to the high vessel traffic and the disturbance and noise associated with vessel traffic in the area. Since the southern resident killer whales are known to be in Puget Sound, and their primary prey is Chinook, they have the potential to be affected by the Locks.

Since listed species are present or have the potential to be present in the LWSC Project, USACE initiated consultation under Section 7 of the ESA with the USFWS and NMFS (collectively known as the Services) for the LWSC O&M. Biological Opinions were issued from USFWS in 2007, and NMFS in 2008. In their Biological

Opinions, the Services anticipate the amount of *incidental take*² for each of the listed species that have the potential to be affected by the LWSC O&M. In 2007, the USFWS estimated that no more than a total of five bull trout had the potential to be incidentally taken. The 2008 NMFS Biological Opinion estimated 1.5 percent of migrating adult Chinook and Steelhead, and about 5 percent of juveniles for each species would be either wounded or killed while migrating through the LWSC. The Services provide in their Biological Opinions a set of *Reasonable and Prudent Measures* and associated *Terms and Conditions* that USACE must implement to minimize the impacts of incidental take. As of 2024, USACE and the Services had reinitiated formal consultation under Section 7 of the ESA due to expiration of the prior Biological Opinions' take statements.

2.3.5 Special Status Species

Special status species is a term used for species that are considered sufficiently rare that they require special consideration and/or protection and should be, or have been, listed as rare, threatened or endangered by the Federal and/or State governments.

2.3.5.1 Bald Eagle

The bald eagle is found only in North America and ranges over much of the continent, from the northern reaches of Alaska and Canada down to northern Mexico. Bald eagles migrate to wintering ranges in Washington State in late October and are commonly found along lakes, rivers, marshes, or other wetland areas west of the Cascades, with an occasional occurrence in eastern Washington. Bald Eagles are protected under three Federal acts: the Bald and Golden Eagle Protection Act, the Migratory Bird Treaty Act, and the Lacey Act.

Bald eagles have been documented to nest in the vicinity of the Cedar River Municipal Watershed, and along Lake Washington and Lake Sammamish (Smith et al. 1997). Several nests of bald eagles occur within the city limits of Seattle including one at Discovery Park (Smith et al. 1997) and another near Woodland Park north of the LWSC. Bald eagles are observed within the Seattle metropolitan area throughout the year. Bald eagles have been sighted every month of the year near the LWSC Project, however, no nests have been confirmed in the Project area.

2.3.5.2 Purple Martin

By the late 1980s, western purple martins, a native swallow species, were considered a species on the brink of extinction. By 1996, there had been no known nests in Seattle for eight years (Li 2005). Current population estimates within Washington are about 700 breeding pairs (Western Purple Martin Working Group 2010). In Washington State, the purple martin is a State Candidate Species and considered a Species of Greatest Conservation Need under the federally mandated State Wildlife Action Plan (WDFW 2015; 2018).

² *incidental take*" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

The martin arrives in the Puget Sound region from their wintering areas in South America in mid- to late-April. They remain in the Puget Sound area to breed until late August to early September when they leave to return to South America. To support purple martins in the Puget Sound region, USACE partnered with the WDFW and other citizen conservation groups to provide supplemental nesting habitat for these birds along the LWSC. Purple martins are secondary cavity-nesters and so following the 2017 nesting season, sixteen purple martin super gourds were placed on light poles on the north pier at the Locks. In 2019, one purple martin was observed using a nesting gourd (R. Lucas, USACE, pers. comm.).

2.3.5.3 Peregrine Falcon

Peregrine falcons have slowly been making a come-back nationwide, adapting to urban life with buildings and bridges substituting for more natural cliffs for nesting. The falcon was severely endangered in the mid-20th Century, mostly due to the pesticide dichlorodiphenyltrichloroethane (DDT), which softens eggshells and results in widespread nest failure. With the ban of DDT in the United States, peregrine falcons began to recover. Nests are known to exist on both the Ballard Bridge and the I-5 Bridge over the Ship Canal (Butterfield 2012). The Washington State Department of Transportation (WSDOT) in cooperation with WDFW monitor the I-5 nest. The falcon's prey on pigeons and starlings whose droppings can be corrosive to bridges and other infrastructure.

2.3.5.4 Bats

Bats are an important component of a healthy ecosystem, performing important functions such as natural control of insects and pollination of plants. Roosting habitat loss is one of the known causes for decreasing populations. The ten bat species that are most likely to be present around Puget Sound and the LWSC include:

- Little Brown Myotis
- Yuma Myotis
- Keen's Myotis
- Long-eared Myotis
- Long-legged Myotis
- Little Brown Myotis
- Yuma Myotis
- Keen's Myotis
- Long-eared Myotis
- Long-legged Myotis

Other bat species such as the pallid bat, spotted bat, fringed myotis, western small-footed myotis and the canyon bat do occur in the State of Washington, but tend to occur in arid regions east of the Cascades (Hayes and Wiles 2013).

Little information is available on the activities, movements, and habitat use of bats around the Puget Sound or at the LWSC Project. In 2016, white-nose syndrome (a fungal disease that affects hibernating bats) was confirmed for the first time in a little brown bat found in King County (Lorch et al. 2016). The fungal disease attacks the skin of hibernating bats and often results in death. Given the recent local detection of the fungal disease, and general lack of knowledge regarding the occurrence of bats around Puget Sound, USACE conducted an acoustic bat detection survey at the LWSC Project in the summer of 2018. In this survey, seven of the above listed bat species were detected at LWSC survey sites: big brown bat, hoary bat, silver-haired

bat, California myotis, little brown myotis, long-legged myotis, and Yuma myotis. Little brown myotis was the most detected species, occurring in every study area for which species identification was possible, and was detected at more monitoring sites than other species.

2.3.6 Invasive Species

In King County, over 100 noxious weeds that have been identified by the County's Noxious Weed Control Board (King County 2020). Many of these species are so widespread that control and eradication is virtually impossible. Invasive terrestrial plant species that are widespread in King County and present at the LWSC Project include: yellow-flag iris, reed canarygrass, Scotch broom, English holly, thistles, spurge laurel, yellow archangel, burdock; leafy spurge, morning glory, Himalayan and evergreen blackberry, English and Irish ivy, garlic mustard, Japanese knotweed, white knapweeds; field bindweed; and purple loosestrife. Many of these species create monocultures, meaning they completely carpet an area, and in so doing decrease native biodiversity. Once established, these species are almost impossible to eradicate without a comprehensive weed management plan. The top three invasive plant species at the LWSC Project are English ivy, Himalayan blackberry, and Canada thistle.

In the 1970s, Eurasian watermilfoil was introduced into Lake Washington. Watermilfoil is a non-native perennial aquatic plant that grows in dense clumps and can form dense floating mats. Watermilfoil has established itself in much of the shallow shoreline habitat (less than 30 feet deep) of Lake Washington, Lake Sammamish, Lake Union, Portage Bay, and the Ship Canal. Another aquatic invasive weed species that has established in the Ship Canal is the curly leaf pondweed. There are also at least 20 non-native fish including sunfishes, minnows, carps, and catfish that have been introduced into Lake Washington (USGS 2017). Terrestrial invasive avian and mammalian species at the LWSC Project include the European starling, rock dove (pigeon), house sparrow, Norway rat, brown rat, eastern gray squirrel, and the fox squirrel.

2.3.7 Wetlands

USACE follows wetland and deepwater classification standards set by the USFWS for identification and naming of wetlands and deepwater habitats. The national standard is clarified in the document titled, "*Wetlands Mapping Standard - FGDC-STD-015-2009*" (FGDC 2009). For management purposes, USACE utilizes the USFWS National Wetland Inventory (NWI) for identification of wetlands and deepwater habitat that occur on USACE-managed lands and the NWI naming conventions identified in the *Wetlands Mapping Standard*. Two parcels at the LWSC Project, the Channel Tideland and Shilshole Bay parcels, are in the tidally influenced waters and are also considered part of an estuarine system. Lands submerged under 30 feet in the Ship Canal are considered deepwater and part of a lacustrine system (L1UBHh) under the NWI classification. All other LWSC Project lands associated with water are technically defined as "deepwater" areas and are not classified as wetlands. In summary, there are no wetlands on the LWSC Project.

2.3.8 Cultural Resources

Cultural resources are defined as sites, structures, objects, or practices that reflect prehistoric or historic habitation, and traditional knowledge and practices by humans. Cultural resources are non-renewable; therefore, they must be managed with care to ensure their preservation. The most common potential causes of loss of cultural resources include landscape modifications, erosion, vandalism, and artifact collecting. Through requirements of historic preservation policies in public laws, executive orders, and USACE regulations, it is the responsibility of USACE to ensure the identification and protection of prehistoric and historic cultural resources located on project lands administered and managed by USACE and/or owned by the Federal government.

No archaeological sites are located within the boundaries of the LWSC; however, the LWSC is a Historic District. Formally known as the Chittenden (Hiram M.) Locks and Related Features of the Lake Washington Ship Canal, the LWSC historic district was nominated on April 13, 1978, as a National Historic District. The LWSC is recognized for its major engineering achievement completed under Government auspices which added more than 90 miles to the City of Seattle's waterfront frontage accessible to ocean going vessels. The LWSC Project is recognized for its significance in architecture, commerce, engineering, landscape architecture, military, politics, scenery, and transportation (Potter 1977). In addition, the LWSC Project includes historically significant structures designed by Carl Gould, a prominent architect of the time that shaped many important designs in the region. Studying the LWSC and its associated infrastructure is of great interest to UW researchers who are using three-dimensional (3-D) modeling to understand the structure's construction.

On December 14, 1978, the LWSC was officially designated as the Lake Washington Ship Canal National Historic District. The original nomination form listed the buildings and structures of the LWSC and the Fremont and Mountlake Cuts (Table 4) to be included in the National Historic District, and did not list any landscaping elements (i.e., the Carl S. English Jr. Botanical Garden) but the inclusion of the Garden can be inferred. In 1994, the Seattle District prepared a Historic Property Management Plan (HPMP) and a Programmatic Agreement (PA). The 1994 HPMP further defined buildings, structures and landscapes that are contributing elements to the Historic District and defined what buildings and structures are considered noncontributing elements (Table 4).

Table 4. List of contributing LWSC contributing elements to the HPMP.

Historic Buildings/Structures/Landscapes at the LWSC	Listed on the Nomination Form as a Contributing Element	Listed in the HPMP as a Contributing Element	Notes
Hiram M. Chittenden Locks*	Yes	Yes	-
Lockkeeper's (Cavanaugh) house (1913)	Yes	Yes	-
Administration Building (1914-1915)	Yes	Yes	-
Operating Houses Nos. 1, 2, 3 and 4 (1914)	Yes	Yes	-
Mechanic Shop (1914)	Yes	Yes	-
Transformer House (1914)	Yes	Yes	-
Office and Shop Building (1916)	Yes	Yes	-
Machine Shop (1914)	Yes	Yes	-
Gas and Oil Building (1916)	Yes	Yes	-
Carpenter and Blacksmith Shops (1921)	Yes	Yes	Renamed and repurposed to Visitor Center Building
Emergency Dam Hoist House (1922)	Yes	Yes	Emergency Crane removed and replaced in 2017
Steel Shop (1941)	Yes	Yes	
Warehouse No. 2 (1941)	Yes	Yes	
District Garage (1941)	Yes	Yes	
Public Comfort Station (1947)	Yes	Yes	
Boathouse (1949)	Yes	Yes	
Greenhouse (1949)	Yes	Yes	
Gatehouse (1949)	Yes	No	Gatehouse removed during the rehabilitation of the north entryway
Open storage Shed (1940s)	Yes	No	Listed as built in the 1980s in the HPMP
Quonset Hut (1949)	Yes	No	Was removed
Control Tower (1969)**	Yes	No	Added to the middle lock wall in 1969. Not associated with period of significance for Historic District
Fish Ladder (1976)	No	No	Constructed in 1976. Not associated with the period of significance for Historic District
North Entry Area	No	No	Constructed in the mid-1970s. Not associated with the period of significance for Historic District

Historic Buildings/Structures/Landscapes at the LWSC	Listed on the Nomination Form as a Contributing Element	Listed in the HPMP as a Contributing Element	Notes
South Entry Area	No	No	Constructed in the mid-1970s. Not associated with the period of significance for Historic District
Carl S. English Jr., Botanical Gardens	No but inferred	Yes	Historic landscape
Fremont Cut (North Shore)	Yes	Yes	Historic landscape
Fremont Cut (South Shore)	Yes	Yes	Historic landscape
Montlake Cut (North Shore)	Yes	Yes	Historic landscape
Mountlake Cut (South Shore)	Yes	Yes	Historic landscape
<p>*Note: the HPMP defines the Locks as the Locks and Spillway Dam, Guide Piers and Waiting Piers ** Note as features added in the late 1960s, mid-1970s or later turn 50 years of age they will need be consulted under Section 106 of the NHPA. While they are currently considered non-contributing elements to the Historic District, once they are 50 years of age these elements will need to be evaluated on their own for National Register eligible.</p>			

Since the LWSC was listed on the National Register in 1978, the Seattle District USACE cultural resources staff have been responsible for overseeing the routine and non-routine activities that have an effect on cultural resources at the LWSC National Historic District and conduct National Historic Preservation Act (NHPA) consultation as appropriate. Consultation is addressed either through NHPA Section 106 or via the existing PA³. The PA was developed to cover specific routine undertakings that occur at the LWSC. This means that USACE archaeologists and the Washington State Historic Preservation Officer (SHPO) have agreed to an expedited consultation under 36 Code of Federal Regulations (CFR) §800, which states that the specific routine actions listed in HPMP Attachment D will not detrimentally affect the Historic District and that these specific actions will not require further consultation (Table 5).

³ Official title of the Programmatic Agreement: Programmatic Agreement among the U.S. Army Corps of Engineers, the Washington State Historic Preservation Office, and the Advisory Council on Historic Preservation regarding Implementation of the Lake Washington Ship Canal Project

Table 5. The list of routine activities from the HPMP Attachment D that do not require further NHPA Section 106 consultation.

Item	Type of Activity – Formal Section 106 not required
A	Sidewalk replacement or repair
B	Roadway replacement or repair
C	Maintenance of existing landscaping and Carl S. English, Jr. Botanical Garden
D	Interior rehabilitation of Operating houses, Warehouses, Shop Buildings, Control Tower, Visitor Center, Boathouse and Cavanaugh House
E	Maintenance of the existing large and small locks and spillway dam, guide piers, and waiting piers
F	Maintenance of the existing fish ladder
G	Maintenance and minor in-kind repair or replacement of the existing concrete walls and landscape colonnade at the Fremont Cut
H	Maintenance and minor in-kind repair or replacement of the existing concrete walls at the Montlake Cut
I	Maintenance and minor in-kind repair or replacement of building or site features, elements, or materials within the historic district
J	Repair and replacement of existing utility lines and poles in their present configuration and alignments

As projects are proposed at the LWSC Project, the Seattle District USACE cultural resources staff review each proposed project to determine if the action meets the conditions and standards established under the PA or if formal Section 106 consultation needs to occur. If the undertaking does not meet the conditions and standards established under the PA or is a non-routine action, then further formal NHPA Section 106 consultation must occur.

The PA is a living agreement and can be amended. Any changes to the PA require consultation with the Washington SHPO and the Advisory Council on Historic Preservation (ACHP). If amendments are to be made to the PA, then USACE is obligated to undergo the consultation process with the Washington SHPO to approve the amendments and agree to a revised PA.

Even though the LWSC is a Historic District there are projects that can cause adverse effects to the District. An adverse effect refers to the diminishment of a property's integrity, with respect to its location, design, setting, materials, workmanship, feeling, or association. The two most recent example of projects that have had an adverse effect to the historic district include the demolition of the Boat House in 2012, due to structural deficiencies and the replacement of the emergency crane at the hoist house in 2020. A memorandum of agreement (MOA) was developed for each project documenting the Section 106 consultation process and the mitigation measures agreed on that would mitigate the adverse effect(s). It is expected that there will be future projects that could have an adverse effect to the

Historic District. For projects that will have an adverse effect USACE will consult with the Washington SHPO and other interested consulting parties to determine appropriate mitigation measures which will be documented in a MOA.

2.3.9 Coordination with Tribes

USACE has a trust responsibility to federally recognized tribes. Policy Guidance Letter 57, “*Indian Sovereignty and Government-to-Government Relations with Indian Tribes*” (February 18, 1998) requires consultation with tribes when trust assets are affected. At the Locks this could include impacts to treaty fishing due to physical modifications, which might affect fish passage, fish mortality, or fish habitat within the LWSC Project area, or because of operations. Access to treaty fishing sites is another ongoing discussion topic with affected tribes. Any of these situations would trigger a consultation meeting with affected tribes. Whereas USACE’s managers at the Locks may initiate contact with Indian Tribes, the District Engineer and Tribal Liaison undertake government-to-government meetings.

Two federally recognized tribes have treaty rights associated with fish runs that migrate past the Locks, the Muckleshoot Indian Tribe, and the Suquamish Indian Tribe. Fish are counted each year under a co-management arrangement between WDFW, Muckleshoot Indian Tribe, and Suquamish Indian Tribe.

2.3.10 Socioeconomics

Socioeconomic characteristics can influence the use and management of USACE lands and resources. For example, higher unemployment levels, lower incomes, and rapidly increasing population within the primary market area of recreation sites would likely increase visitation, primarily for day use activities. The LWSC Project lies within King County, Washington. King County’s population in 2020, was estimated at about 2.26 million, an increase of 15 percent since 2009 (U.S. Census Bureau 2020).

The USACE Institute for Water Research created Value to the Nation data (USACE 2022) on regional economic benefits of recreationist spending associated with visitation to the LWSC Project. The latest release of Value to the Nation data was from 2022. Based upon an estimate of 1,676,632 visits that year, the following economic effects were calculated (presented in 2022 dollars):

- \$58.7 million in visitor spending within 30 miles of LWSC Project;
- \$34.9 million in sales within 30 miles of the LWSC Project;
- 191 jobs within 30 miles of the LWSC Project;
- \$23.3 million in value added (wages and salaries, payroll benefits, profits, rents, and indirect business taxes);
- With multiplier effects, visitor trip spending resulted in:
 - \$55.2 million in total sales;
 - \$21.5 million in total income;
 - 270 jobs in the local community surrounding the lake; and,

- \$36.3 million in value added (wages and salaries, payroll benefits, profits, rents, and indirect business taxes).

The money spent by visitors to the LWSC Project area adds to the local and national economies by supporting jobs and generating income. Visitor spending represents a sizable component of the economy in communities surrounding the LWSC Project. By providing opportunities for active recreation, USACE helps combat one of the nation’s most significant health problems – lack of physical activity. Recreational programs and activities at the LWSC also help strengthen family ties and friendships; provide opportunities for children to develop personal skills, social values, and self-esteem; and increase water safety. The data above is specific to recreational spending and must fit within USACE parameters which do not reflect the full economic value of the Locks project to Seattle and the nation (USACE 2022).

A 2017 study on the Economic Impacts of LWSC was funded by the Marine Exchange of Puget Sound (McDowell Group 2017). In their study the authors state, *“The method prescribed by the federal government to evaluate the funding priority of the nation’s various locks systems is based heavily on the gross weight of shipments through the locks. The formula therefore fails to account for most of the infrastructure value provided by the Ballard Locks, which results mainly from its role as a linchpin for several different economic and infrastructure systems in and around Ballard, the Lake Washington Ship Canal, and Seattle’s inland lakes. Those systems include public safety, construction, shipbuilding and marine services, tug-and-barge companies, commercial fishing, cruise and charter vessels, and a large recreational boating community”* (McDowell Group 2017). The McDowell Group (2017) estimated the total gross sales among businesses dependent on the Locks at \$1.19 billion for 2015 (Table 6). The same authors estimated that visitors to the LWSC generate about \$40 million in spending impacts each year. The authors also found that the operation of the Locks generate about \$120 million in payroll, not including the commercial-fishing industry, equating to about 3,000 jobs (McDowell Group 2017).

Table 6. LWSC business impacts, 2015 (Source: McDowell Group 2017).

Sector	Gross Revenues of Locks-Related Business	Direct Lock-Dependent Revenue	Direct Lock-Dependent Payroll
Commercial Fishing	\$545,000,000		
Shipyards/Marine Services	\$162,900,000	\$114,500,000	\$51,800,000
Recreational Vessel Sales	\$150,000,000	\$150,000,000	\$15,000,000
Freight/Shipping Services	\$108,800,000	\$49,000,000	\$10,400,000
Passenger Services	\$83,000,000	\$62,700,000	\$21,200,000
Construction	\$50,000,000	\$30,200,000	\$4,100,000
Marinas*	\$32,200,000	\$32,200,000	\$6,400,000

Sector	Gross Revenues of Locks-Related Business	Direct Lock-Dependent Revenue	Direct Lock-Dependent Payroll
All Other	\$58,700,000	\$13,900,000	\$10,900,000
Totals	\$1,190,500,000	\$482,400,000	\$119,800,000
Locks-Related Profit (@ 10 percent)		\$48,200,000	
Locks-Related Federal Tax Revenue (@ 23.5 percent)		\$11,400,000	
*Marina revue estimate is based on the average cost of moorage. It does not include other sources of marina revenue such as pump-out, electricity, and other boating services.			

The LWSC Project is critically important to the local economy and infrastructure, regardless of the different approaches taken to describe the socioeconomic impacts of the Project. The LWSC Project is noted as one of the busiest Locks in the nation with an estimated million tons of freight moving through the Ship Canal and Locks annually (McDowell Group 2017). The unique freshwater, tide-free harbor created by the LWSC Project reduces maintenance costs and prolongs vessel life for hundreds of commercial vessels (Figure 18) and thousands of recreational vessels. Over 200 businesses and 3,000 jobs are dependent upon the continued operation of the Locks (McDowell Group 2017). Hundreds of thousands of people visit the Locks annually. The function of the Locks as a regulator of lake water level is also critical to the functioning of the Washington Route 520 and I-90 bridges across Lake Washington and the water and sewer utilities serving Mercer Island. In all the above, the LWSC meets its authorized purposes of providing navigation, recreation, and other purposes such as fish passage.



Figure 18. Tugboat navigating the Locks in 2011.

2.3.11 Recreation Facilities, Activities and Needs

The LWSC Project does not fit the standard classification for recreation in USACE. Recreation standards typically involve campgrounds or day use areas with picnic shelters, playgrounds, and sport courts (e.g., sand volleyball and horseshoes), and/or water access points with boat ramps and mooring docks. Overall, the LWSC provides unique recreational experiences within USACE (Figure 19).

The Locks site features a Class A regional visitor center, as well as the Garden. As a Class A regional visitor center, it provides information encompassing the large geographic area of the Lake Washington basin. It tells the story of USACE from the national to the local level and the mission of the LWSC. It provides information on the socioeconomic development of the area, events of archeological, historical, cultural, and natural importance in the area, and other items of interest. Visitors can access information on rules and regulations, safety, facilities, and other recreation projects in the area. Across the Locks from the Visitor Center and Garden is the fish ladder and Fish Viewing Gallery where visitors can watch fish swimming up the ladder from Puget Sound on their first leg in their journey inland. The visitor center is open year-round and offers free tours of the Locks and surrounding Garden. Educational information is provided in the form of a movie within the theater on the first floor of the Visitor Center and exhibits on the second floor interpret regional and national USACE missions related to navigation, flood control and recreation. Gifts and restrooms are also available.

USACE entered a Challenge Partnership Agreement with the Corps Foundation and Discover Your Northwest (DYNW) in 2017 to modernize the Fish Ladder Viewing Gallery. In 2021, renovations were completed including the installation of new ventilation and lighting, as well as new seating in front of the viewing windows. DYNW established a Legacy Wall comprised of metal salmon representing donations received for the design and installation of an interpretive display in the Fish Ladder Viewing Room. The completion of the interpretive design and installation of the environmental portion was completed in 2024. Fundraising is planned for another display focusing on cultural resources and Tribal perspectives, but the timeline is uncertain. Restroom facilities are also available on the south side of the Locks near the Fish Viewing Gallery.



Figure 19. View looking southeast of the terraces from the overlook toward the Locks and dam (Photograph courtesy of the National Park Service, Pacific West Region 2012).

In fiscal year 2024 (The Federal fiscal year (FY) is October 1st to September 30th), a new Recreation Use Fee Program (RUFPP) was established with venue services available through Recreation.gov. Five spaces situated on green lawn within the Garden are available beginning in December of 2023 for the 2024 season (defined in Recreation.gov as 1 May 2024 through 31 October 2024). Revenue generated will be returned to LWSC recreation business lines for spending without further

appropriation. There remains a need for increased staffing capabilities to develop the RUFPP further (e.g., sell America the Beautiful passes).

The Locks are host to many public events throughout the year and are a popular attraction for special uses such as weddings. Recreation Use Fees collected through Recreation.gov will facilitate the collection of Special Use Fees until or if the Fee Program is developed further. Some of the events held throughout the summer include concerts on the Garden lawns where visitors can sit and listen to different bands playing each weekend. Other events include plant sales, car shows, rowing events, and the boat parade on the opening day of boating season.

2.3.11.1 Visitation Profile

The Locks visitation number reported by USACE is estimated at approximately 850,000 per year. Reported visitation at the LWSC Project has varied over the last few years with numbers reported in the millions (Table 7). However, the variation in the numbers reported is at least partly due to changes in how the visitation numbers have been collected and assessed over the years and did not accurately reflect the actual visitation volume. This is an important issue because accurate visitation numbers help the LWSC managers assess and prioritize infrastructure maintenance, safety, and security measures.

Table 7. Visitation counts at the Locks between 2014 and 2023.

Fiscal Year	Visitation Count
2014	1,192,423
2015	3,585,912
2016	3,029,071
2017	1,291,097
2018	784,862
2019	849,445
2020	517,470
2021	784,938
2022	1,740,980
2023	2,126,577
Note: The Federal fiscal year (FY) is October 1st to September 30th.	

Prior to the installation of LiDAR (light detection and ranging)-based pedestrian counters and sensors in 2022 (Figure 20), collection methods and formulas used in the visitation calculations were based on a variety of factors including vehicular traffic counters. With the amount of pedestrian traffic at the Locks site, the vehicular traffic counting method is not appropriate for accurate visitation. The LWSC Project also uses beam traffic counters at the Locks site entryways that tend to count one “visitor unit” reducing a group of 12 visitors walking through the gate at the same time as a single count (one person). This suggests that visitation counts are under reported.

The [LiDAR based hardware](#) captures visitation with a minimum accuracy of 95%, can differentiate between adults, children and pets and casts a detection range of 80-foot horizontal width (Figure 20). Three of these pedestrian counters are situated at the three access points to the main Locks site.



Figure 20. LiDAR pedestrian counter (top red arrow) at northeast entrance of the Locks.

Further, the Locks is used as a bicycle commuter transit path over the Ship Canal. There are no known studies on the use of the LWSC Project by commuter traffic. Casual observations seem to indicate that commuter traffic is heavier during the off seasons with most commuters walking or using bicycles. A Seattle Center City Commute Mode Split Survey (Seattle DOT 2019) concluded that people commuting to Seattle Center City report using public transit for nearly half (46 percent) of their weekday peak commute trips. During scoping for the Master Plan, public comments spoke to the need to separate pedestrian and bicycle traffic. Some members of the public wanted bicycle traffic banned completely.

Besides visiting the Locks site, the LWSC Project trails and waterways (i.e., Fremont Cut and Montlake Cut) are heavily used by the public – both for walking and boating. Since 2016, this recreational use is no longer included in the Locks visitation counts. For example, on the opening day of the boat season, up to 60,000 people can crowd the shorelines of the Fremont and Montlake cuts, of which none of them are credited to the visitation profile.

At present, no results are available regarding the demographics of visitors to the LWSC; however, based on entries contained in a guestbook registry in the visitor center that includes visitors' home state or country, visitors come from all over the world. Visitation to other areas of the project such as at the Fremont and Montlake Cuts remains undocumented. A method of counting visitation in these two locations is needed so LWSC managers can accurately assess visitation and develop management strategies to maintain services and keep the public safe.

2.3.11.2 Recreation Analysis and Carrying Capacity

USACE has not conducted any recreational analysis other than visitor-use surveys at the LWSC Project. The latest visitor use survey was conducted in 2018. The results of this survey showed that overall customer satisfaction of visitors to the Locks was 98 percent or better. The survey recorded a response of “*Very Good*” or “*Good*” in all categories except bathroom cleanliness and parking availability which had had slightly lower ratings. Visitor Use Surveys can be found in Attachment E.

There have been no visitor carrying capacity studies at the Locks site. Staff noted during the Centennial in 2017, there were several days where visitation peaked around 10,000 visitors per day and on those days, they felt the facility had passed the Project's carrying capacity. As discussed above (Section 2.3.11.1), visitation counts are inaccurate and appear to underestimate the number of visitors, therefore, it is unknown if visitation has been increasing. What is clear is that the LWSC Project remains a popular tourist destination and provides the community critical economic and social services (Section 2.3.10). Given the importance of the LWSC Project to the local community and an inaccurate visitation rate, both recreational analysis and carrying capacity studies may be warranted.

2.3.12 Real Estate

Real estate considerations influence land and resource management at the LWSC Project. These considerations include the quantity of U.S. Government owned, USACE administered lands in fee title (“fee lands”), outgrants, easements, leases, licenses, and the ownership and use of adjacent lands. USACE administers acres (fee and easement lands) in separate parcels, all of which have shoreline access.

2.3.12.1 Acquisition History

Lands with defined legal descriptions and boundaries at the LWSC Project were acquired as early as 1899 (Table 8). Lands were acquired primarily to support construction of the Locks and related LWSC Project needs. Most of the acreage now administered by USACE was acquired between 1899 and 1907, from King County

and the State of Washington. In a 1908 Letter to Congress from the Acting Secretary of War (which included a report by Major Chittenden), reference is made to the Act of August 1894 (Table 1) which obligated Federal funding for improvements. However, Congress included a requirement that the funding could not be expended until the entire right-of-way and a release from all liability to adjacent property owners be secured to the United States free of costs.

King County and the State of Washington subsequently acquired the rights-of-way for the Ship Canal in compliance with what was understood to be the intent and purpose of Congress and donated the lands to the United States. The ground the Locks are constructed on was donated by the State of Washington, who have asserted ownership for lands under the tidal waters. Reference is made to Annotated Revised Code of Washington (ARCW) § 37.08.240, 1901, which grants to the United States the right to place, construct and operate the Locks, as well as the right to manipulate the waters of Salmon Bay and Lake Washington.

Table 8. Acquisition information for the areas within the LWSC Project.

Management Area	Acquired Estate	Year Acquired	Acquired From	Acres
Lock Site	Fee	1899	King County	13.4 – Land 1.8 – Submerged Lands
	ARCW	1901	State of Washington	2.5 – Land 2.1 – Submerged Lands
	License	1942	Great Northern Railway Company	< 0.1
	License	1967	BNSF Railway Company	< 0.1
	Use Permit	1980	City of Seattle	< 0.1
	Use Permit	2006	City of Seattle	< 0.1
	Fee	1954	Public Domain (Army)	0.8 Submerged lands
South Entryway Buffer Zone	Fee	1942	King County	1.0 – Land 0.2 – Submerged Lands
	Fee	1947	Private Landowner	0.1
	*Easement	1960	Private Landowner	< 0.1
	*Easement	1960	Private Landowner	< 0.1
	*Easement	1959	Private Landowner	< 0.1
Fremont Cut	Fee	1899	King County	3.1 – Land 35.6 – Submerged Lands
Montlake Cut	Right-of-way (Easement)	1907	State of Washington	9.1 – Land 11.5 – Submerged Lands

Management Area	Acquired Estate	Year Acquired	Acquired From	Acres
Channel Tidelands/ Shilshole Bay	Fee	1899	King County	12.7 – Submerged Lands
* Easement lands in the South Entryway Buffer Zone (denoted with an asterisk) involve no USACE management authority and were acquired for bank protection purposes only.				

Table 9. Acquisition information by management area type within the LWSC Project.

Management Area Type	Acres
Total of all Fee Areas	68.5
Total of all Easement Areas	20.7
Total of all Use Permit, Lease, and License Areas	0.1
Total of all ARCW 1901 Areas	4.6
Grand Total	93.9

Acquisitions include upland areas and lands currently submerged by water (Table 8). The Locks site was constructed in a location in Salmon Bay known as “the Narrows,” which refers to a location where the shoreline of the bay converged and created a narrow gap in the bay. The Fremont and Montlake cuts, however, were not under water at the time of acquisition as the right-of-way was acquired before excavation of the canals began. Despite the current flowage of water, the Federal government (administered and managed by USACE) still has fee ownership of the underlying lands at the Fremont Cut, and an easement interest on the underlying lands at the Montlake Cut.

The acquisition history at the Montlake Cut is unique in that one portion of the original right-of-way (later referred to as a perpetual easement) acquired from the State of Washington in 1907, was transferred back to the state in 1965. The original 500-foot-wide right-of-way was reduced to its current 350-foot width when the United States conveyed its easement interest on the northern 150 feet to the State of Washington. At the same time, the U.S. government also issued an outgrant to the University of Washington (UW) in the form of a consent to easement that allows for the placement of structures and maintenance of the remaining north portion of the cut. Thus, USACE still has the underlying perpetual easement interest that was acquired in 1907, but allows the University of Washington to use the property as described in the outgrant.

2.3.12.2 Leases, Easements, and Outgrants

Many leases, easements, and outgrants have been granted to public utilities and individuals for a variety of uses, including access roads, power transmission lines, and utility lines. Development and use of land by others outside of USACE may be allowed when in accordance with an approved Master Plan. Use must be consistent with policies, procedures, and regulations prescribed by USACE. Outgrants do not

convey ownership, but merely authorize the use of a portion of the government property.

ER 1165-2-400 states: *“The traditional policy of the Corps [USACE] has been to encourage non-federal participation in the administration of recreation opportunities provided at Corps projects. Since 1944, the Corps has entered into leases which permit state and local development and administration of recreation areas at Civil Works projects.”* This is true at the LWSC Project, where 67 outgrant licenses involving approximately 9.8 acres (14.3 percent of the total USACE fee lands at LWSC) were issued as of 2021. These outgrants are issued to a variety of individuals and public entities. They range from private use-type categories (i.e., fences, retaining walls, sheds, patios, and lawns) to public interest categories (i.e., signs, gas lines, trails, and streets). LWSC outgrant types include easements, licenses, and consent to easements. Despite the type of outgrant, it is important to remember that the Federal government owns or retains an easement to the property, but has issued a right to use the property.

2.3.12.3 Adjacent Land Use and Ownership

Neighboring land use and ownership can influence development and management of LWSC Project lands. Adjacent land uses can have a positive influence or can result in detrimental issues such as trespass, encroachment, or access. The adjacent land use and ownership for the LWSC management areas are summarized in Table 10.

Table 10. Adjacent land use and ownership for the LWSC management areas.

Management Area	Adjacent Land Use and Ownership
Locks Site	Bordered on the east and west by private property, on the north by Seattle Department of Transportation (Figure 5).
South Entryway Buffer Zone	Bordered on the west by Seattle Department of Parks and Recreation, on the south and east by private property (Figure 5 by fish ladder).
Fremont Cut	Bordered on the south by Seattle Department of Transportation, Seattle Department of Public Works, Seattle Department of Parks and Recreation, and private ownerships. Bordered on the north by Seattle Department of Transportation, Seattle Department of Parks and Recreation, and private ownerships (Figure 10).
Montlake Cut	Bordered on the south by Seattle Department of Parks and Recreation, and private ownerships. Bordered on the north by the University of Washington (Figure 11).
Channel Tidelands/ Shilshole Bay	The Channel Tidelands parcel is bordered on the east by private property; and all other surrounding water bottom State of Washington bed lands (Figure 12).

2.3.13 Pertinent Public Laws

All LWSC Project-related actions and policies must comply with Federal laws and regulations. Such regulations may include, but not be limited to:

- Rivers and Harbors Act of 1899
- Antiquities Act of 1906
- Migratory Bird Treaty Act of 1918
- The Historic Sites Act of 1935
- Fish and Wildlife Coordination Act of 1934
- Bald and Golden Eagle Act of 1940
- Flood Control Act of 1944 (PL 78-534)
- Flood Control Act of 1950 (PL 81-516)
- Reciprocal Fire Protection Act of 1955
- The Reservoir Salvage Act of 1960
- The National Historic Preservation Act of 1966
- National Environmental Policy Act of 1969
- Endangered Species Act of 1973
- The Archeological and Historical Data Conservation Act of 1974
- Safe Drinking Water Act of 1974
- Federal Land Policy and Management Act of 1976
- The Clean Water Act of 1977
- Coastal Zone Management Act
- The Archeological Resources Protection Act of 1979
- The North American Wetlands Conservation Act of 1989
- Native American Graves Protection and Repatriation Act of 1990

- Americans with Disabilities Act of 1990, Amendments Act of 2008
- Preservation of American Antiquities Act, 2008
- Executive Orders (EO)
 - EO 11593: Protection and Enhancement of the Cultural Environment, 1971
 - EO 11988: Floodplain Management, 1977
 - EO 11990: Protection of Wetlands, 1977, as amended
 - EO 13112: Invasive Species, 1999, as amended
 - EO 13186: Responsibilities of Federal Agencies to Protect Migratory Birds, 2001
- Code of Federal Regulations (CFR)
 - Title 33, Part 325: Processing of Department of the Army permits; Procedures for the Protection of Historic Properties, Nov 1986.
 - CFR, Title 36, Parks, Forests, and Public Property
 - 36 CFR Part 60: National Historic Preservation Act of 1966, as amended
 - 36 CFR Part 61: Procedures for State, Tribal, and Local Government Historic Preservation Programs, 1999
 - 36 CFR Part 63: Determinations of Eligibility for Inclusion in the National Register of Historic Places, 1977, as amended
 - 36 CFR Part 327: Rules and Regulations Governing Public Use of Corps of Engineers Water Resource Development Projects, 1985
 - 36 CFR Part 800: Protection of Historic and Cultural Properties, incorporating amendments effective 2004
 - 50 CFR Part 17: Endangered and Threatened Wildlife and Plants, 1975, as amended.

2.3.14 Management Plans

Several management plans direct activities and expenditures for USACE owned and managed lands in and around the LWSC Project. These plans are interrelated and discussed in the following paragraphs. Each must be considered when planning future actions.

2.3.14.1 Operational Management Plan

The OMP is a management action document that describes in detail how the resource objectives and concepts prescribed in this Master Plan will be implemented. The most recent OMP for LWSC was completed in 2019 and amended in 2023. Under the umbrella of the OMP are the following supplemental management plans:

- a) Historic Property Management Plan – The purpose of the document is to insure the preservation of the cultural resources at the LWSC Project by inventories, evaluation of sites for eligibility on the National Register of Historic Places, and mitigation. The plan addresses, among other topics, the background of the area, program evaluations, operating plans, schedules, funding, and coordination. The HPMP has been updated and found in Attachment D.

- b) Pest Management Plan – The Pest Management Plan describes a formal, integrated pest management program. The program addresses noxious weeds, insects, and wildlife related problems. An Integrated Pest Management Plan is being developed for the LWSC Project.
- c) Vegetation Management Plan – The primary purpose of a Vegetation Management Plan is to assist the Natural Resource Managers to improve the current conditions based on sound management practices and scientific data, providing for the perpetuation of the vegetative resources under multiple use conditions. The Lake Washington Ship Canal completed a Vegetation Management Plan that has been adopted and implemented at the LWSC Project. The document contains, for example, recommendations for the treatment of vegetation in and around critical infrastructure, maintenance of the cultural landscape within the Garden, and recommendations for tracking success.

Typically, USACE lands will also have a Wildlife Management Plan; however, due to the urban setting, LWSC Project does not have a Wildlife Management Plan. The LWSC Project collaborates with Project partners (i.e., City of Seattle, WDFW, and/or USFWS) who have management responsibilities to manage, inventory, and monitor species.

2.3.14.2 Water Control Management Plan

ER 1110-2-240 prescribes policies governing water control management activities by Federal law and directives, including the establishment of water control plans at all federally-owned and operated reservoirs, Locks, dams, and other water control projects in which storage is operated and managed for authorized purposes such as navigation, recreation, and other uses.

In general, the goal of water control management is to conform a project's operation to its authorizing legislation, to criteria defined in USACE reports prepared in the planning and design of a particular project or system, and applicable congressional acts relating to the purpose of Federal facilities or systems. Water control plans are developed to accomplish this objective and any operational changes to the plan are completed in accordance with any applicable review and approval requirements. The basic objectives of water control management can be summarized as follows:

- 1) Operate in accordance with authorized purposes and applicable law;
- 2) Maintain the structural and operational integrity of the project; and,
- 3) Avoid risk to public health and safety, life, and property.

3 RESOURCE OBJECTIVES

Sound stewardship requires the development and management of project resources for the public benefit consistent with resource capabilities. As the steward of the lands and waters at USACE water resource projects, the Natural Resource Management Mission is *“to manage and conserve those natural resources,*

consistent with ecosystem management principles, while providing quality public outdoor recreation experiences to serve the needs of present and future generations” (ER 1130-2-540).

The Master Plan provides resource objectives for the stewardship of natural and cultural resources. Resource objectives are realistically attainable outcomes for the use, development, and management of these resources. Resource objectives are developed with full consideration of authorized project purposes, applicable Federal laws and directives, resource capabilities, regional needs, plans and goals of regional and local governmental units, and expressed public desires. These objectives enhance project benefits, meet public needs, and foster environmental sustainability.

The overarching resource objective for the LWSC Project is to continue to provide benefits to the public from the congressionally authorized purposes of “*Navigation and Recreation*” (Figure 21). These benefits should be provided in a safe, effective, and efficient manner. Resource objectives for the LWSC include:

- To protect, preserve, and conserve the LWSC Project's natural and cultural resources to ensure their continued availability for use, enjoyment and recreation by present and future generations;
- To preserve and rehabilitate the Lake Washington Ship Canal Historic District consistent with the Secretary of the Interior Standards for Rehabilitation;
- To preserve, enhance and protect habitat on LWSC Project land that is used by fish and wildlife; and,
- To establish and maintain close, ongoing coordination with interested Federal, state, Tribes, local agencies, and citizen groups and organizations in managing the natural and engineered resources and cultural features associated with the LWSC.



Figure 21. Visitors observing lock operations in 2013.

4 LAND ALLOCATION, LAND CLASSIFICATION, WATER SURFACE, AND PROJECT EASEMENT LANDS

4.1 LAND ALLOCATION

Lands administered by USACE are allocated to any of four categories depending on the congressionally authorized purpose for which they were acquired. These are defined as Operations, Recreation, Fish and Wildlife, and Mitigation. USACE administers 93.8 acres of land and water at the LWSC Project as follows: 68.5 acres are owned in fee; 20.7 acres are under easement; 62.5 acres are submerged (51.0 acres fee and 11.5 acres easement); and about 0.2 acres are identified as other areas (under license or use permit).

4.1.1 Operations

Lands that are allocated as “Operations” are lands for navigation and are lands acquired for the congressionally authorized purpose of constructing and operating the LWSC Project. Most USACE project lands are included in this allocation and are thus categorized as “Operations” lands.

4.1.2 Recreation

The LWSC Project does not have lands acquired specifically for the congressionally authorized purpose of recreation. Recreation features on Operation Lands are described below under Land Classification.

4.1.3 Fish and Wildlife

The LWSC Project does not have lands acquired specifically for the congressionally authorized purpose of fish and wildlife management, but some lands do provide valuable fish and wildlife habitat. These features on Operation Lands are described below under Land Classification.

4.1.4 Mitigation

The LWSC Project does not have lands acquired or designated specifically for the congressionally authorized purpose of offsetting losses associated with the development of the Project.

4.2 LAND CLASSIFICATION

Allocated land is broken down further into classifications to provide for development and resource management consistent with authorized purposes and the provisions of the National Environmental Policy Act of 1969, as amended, as well as other Federal laws. Classification categories at LWSC include Project Operations, High Density Recreation, Environmentally Sensitive Areas, Multiple Resource Management (MRM) Lands and Project Easement Lands. Table 11 summarizes the land classification acreages for each management area. Figures 22 through 25 show the land classifications for each management area.

Table 11. Land Classification Acreages.

Classification	Management Area	Environmentally Sensitive Area	High Density Recreation	MRM: Low Density Recreation	Project Operations	Water Surface: Restricted	Total
Fee Acres	Shilshole Bay	8.29	--	--	--	--	8.29
	Channel Tidelands	4.41	--	--	0.04	--	4.45
	Lock Site	4.38	0.77	3.22	7.61	--	15.98
	South Entry Way	0.46	0.45	0.01	0.04	0.16	1.13
	Fremont Cut	--	--	2.87	0.19	35.62	38.68
	Montlake Cut	--	--	--	--	--	--
	Subtotal	17.54	1.22	6.10	7.89	35.78	68.53
ARCW 1901 Acres	Shilshole Bay	--	--	--	--	--	--
	Channel Tidelands	--	--	--	--	--	--
	Lock Site	--	0.26	--	2.19	2.09	4.54
	South Entry Way	--	0.06	--	0.03		0.09
	Fremont Cut	--	--	--	--	--	--
	Montlake Cut	--	--	--	--	--	--
	Subtotal	--	0.32	--	2.22	2.09	4.63
Montlake Easement Acres	Shilshole Bay	--	--	--	--	--	--
	Channel Tidelands	--	--	--	--	--	--
	Lock Site	--	--	--	--	--	--
	South Entry Way	--	--	--	--	--	--
	Fremont Cut	--	--	--	--	--	--

Classification	Management Area	Environmentally Sensitive Area	High Density Recreation	MRM: Low Density Recreation	Project Operations	Water Surface: Restricted	Total
	Montlake Cut	--	0.39	8.58	0.10	11.51	20.58
Overall Total	Grand Total Classified Acres	17.54	1.93	14.69	10.21	49.38	93.75*
	*Note: a total of 0.21 acres are non-classified at the locks site; these acres involve easements, leases, and use permits.						

4.2.1 Project Operations

This category includes those lands required for the Locks, spillway, switchyard, levees, dikes, offices, maintenance facilities, and other areas that are used solely for the operation of the LWSC Project.

4.2.2 High Density Recreation

Lands developed for intensive recreational activities for the visiting public such as day-use areas (e.g., walkways and comfort stations).

4.2.3 Environmentally Sensitive Areas

Areas where scientific, ecological, cultural, or aesthetic features have been identified. Designation of these lands is not limited to just lands that are otherwise protected by laws such as Endangered Species Act, the National Historic Preservation Act or applicable state statutes. These areas must be considered by management to ensure they are not adversely impacted. Typically, limited or no development of public use is allowed on these lands.

4.2.4 Multiple Resource Management Lands

This classification allows for the designation of a predominate use with the understanding that other compatible may also occur on these lands. Land classification maps must reflect the predominant sub-classification, rather than just Multiple Resource Management (MRM). The only MRM-classified lands at LWSC are those lands identified as MRM: Low Density Recreation. These are lands with minimal development or infrastructure that support passive public recreational use (e.g., fishing, walkways, wildlife viewing, etc.).

4.2.5 Water Surface - Restricted

The LWSC Project has classified water areas near the Locks site and in the Fremont and Montlake Cuts as Restricted for project operations, safety, and security purposes. These water areas are restricted to prohibit swimming to avoid conflicts between boat passage and people in the water.

4.3 PROJECT EASEMENT LANDS

Project easement lands are all lands for which USACE holds an easement interest, but not fee title. Planned use and management of easement lands will be in strict accordance with the terms and conditions of the easement estate acquired for the LWSC Project. Easements were acquired for specific purposes and do not convey the same rights or ownership to the Federal government as other lands. All easements held by USACE for the LWSC Project are for Operations. There are no flowage or conservation easements associated with the LWSC Project.

The LWSC Project has easement lands located on the South Entryway Buffer Zone (Figure 5) and Montlake Cut (Figure 24). The easements located on the South Entryway Buffer Zone involve no USACE management authority and were acquired for bank protection purposes only. As described in Section 2.3.12, USACE holds a perpetual easement on the Montlake Cut parcel for navigation and recreation.

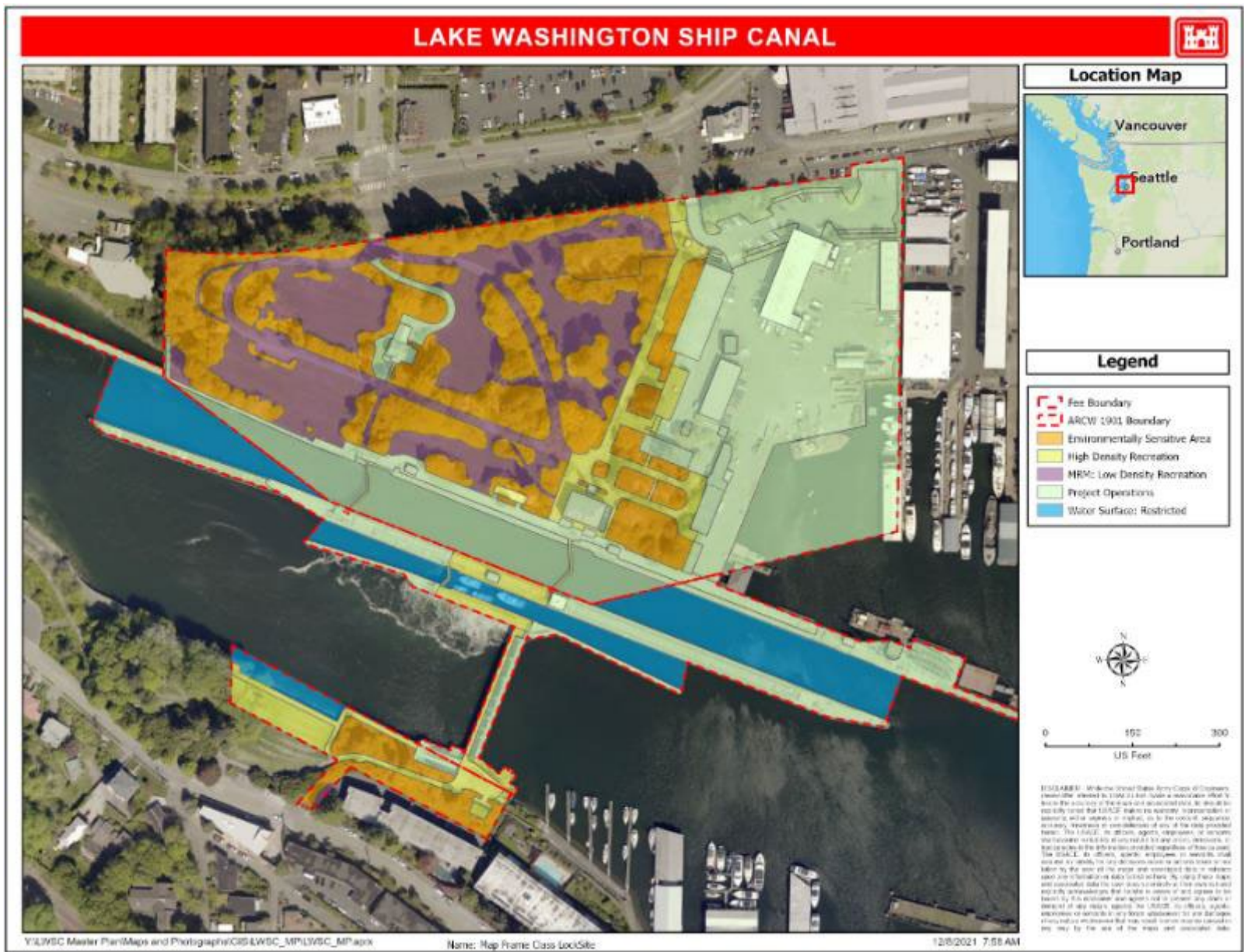


Figure 22. Locks Site land classifications. There are also water surface restrictions on either side of the dam for safety.

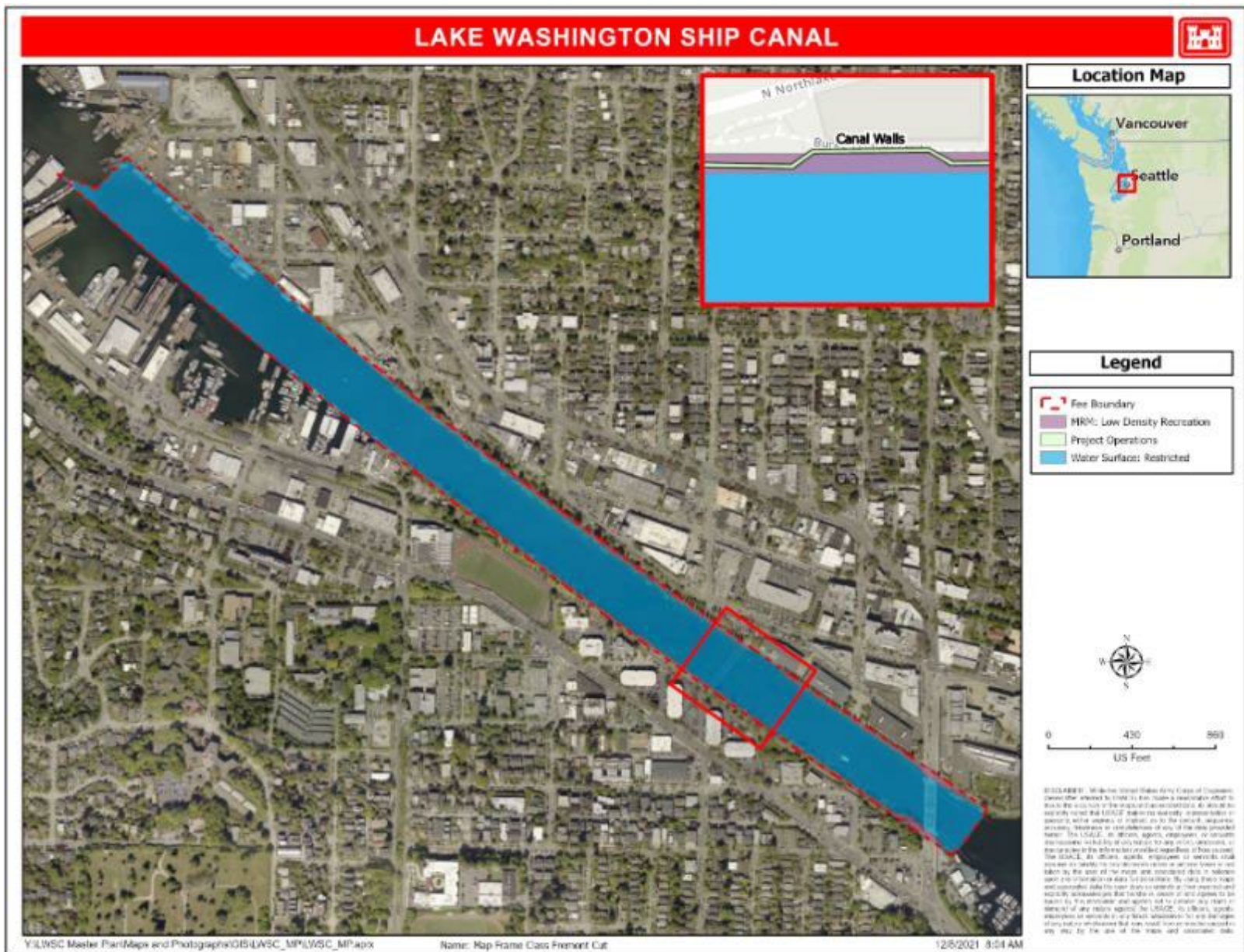


Figure 23. Fremont Cut land classifications. Note that the canal walls are classified as Project Operations.

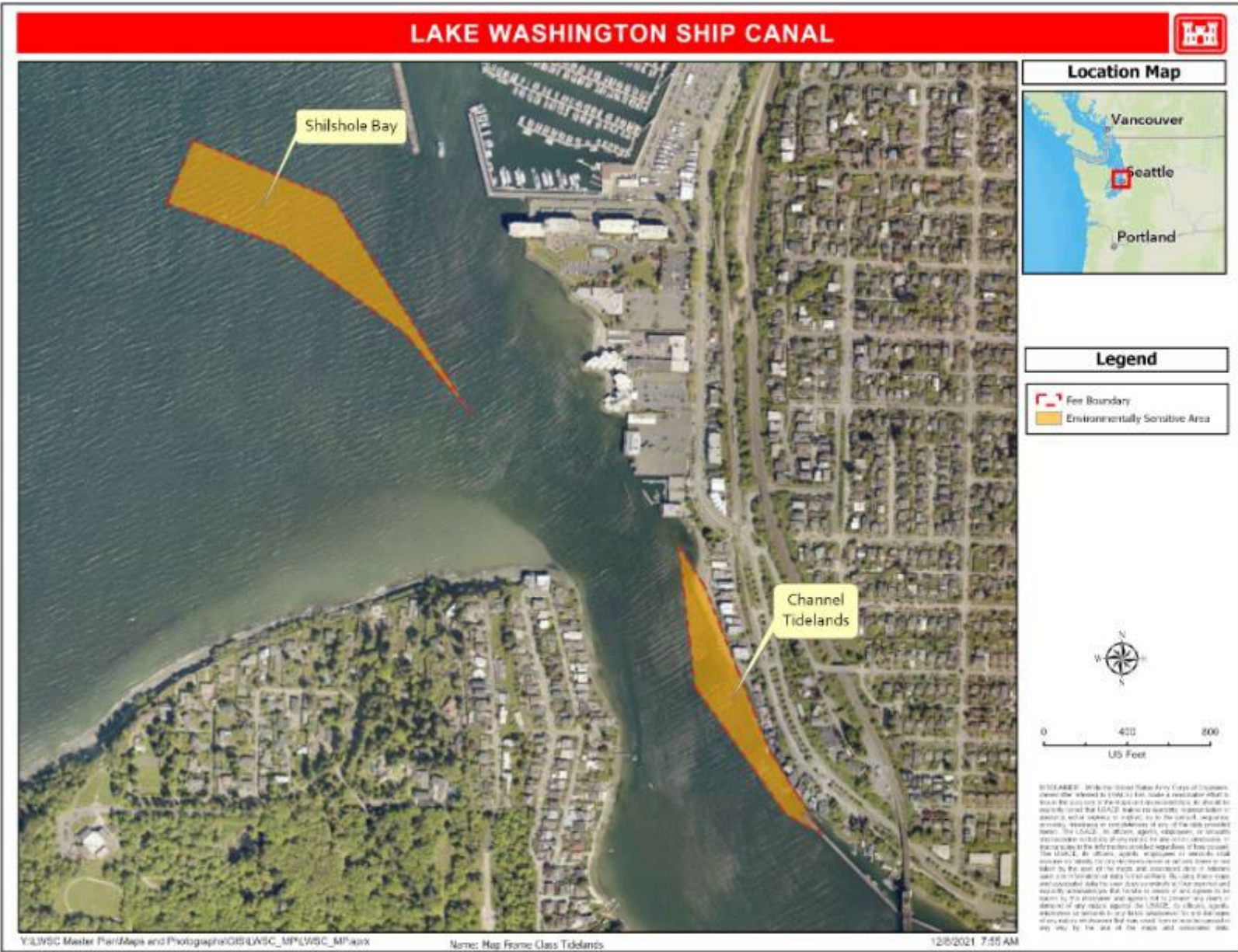


Figure 25. Channel Tidelands and Shilshole Bay land classifications.

5 RESOURCE PLAN

As described in Chapter 4, most USACE lands along the LWSC Project are congressionally allocated as Operations with some classified as Recreation. Within the allocations, the properties are classified (zoned) for different functions or uses as follows: Project Operations, High Density Recreation, Environmentally Sensitive Areas, and MRM Areas that include the subcategory of Low-Density Recreation and Water Restricted Areas. This chapter will describe each property in terms of the management area, classification, the anticipated public use, resource stewardship objectives, and any development needs or special considerations. Rationale for the site-specific resource objectives is also provided. The resource objectives developed for each management area are a guide for future LWSC Project management plans and associated development needs deal in concepts, not in details of design or administration.

5.1 HIRAM M. CHITTENDEN LOCKS SITE

5.1.1 Locks, Spillway Dam, Piers, Operating Houses

Classification and Justification

Project Operations: lands with improvements such as the Locks, dam, piers and other infrastructure that are necessary to maintain and operate the Locks for the purpose of facilitating commercial navigation between Puget Sound and Lake Washington, and for maintaining the elevation of the reservoir (i.e., Lakes Union and Washington) between 16.75 and 18.75 feet). Other infrastructure important for the operation of the large lock include the plumbing infrastructure, large lock emergency closure system (ECS) crane, crane house, stoplogs and large lock ECS carriage. For the small lock, other infrastructure includes stoplogs and a trident crane that would be used to install the bulkheads for water and/or spill control in an emergency.

Management Agency

U.S. Army Corps of Engineers

Location and Acreage

The total acreage that comprises the Locks, spillway dam, piers and operating houses is about 2.5 acres (Figure 26). The water area in the Locks occupies about 2.1 acres.

Description and Use

The Locks and Spillway Dam, Guide Piers, and Waiting Piers were constructed in 1916. The design of these items was accomplished by the Seattle District. The large lock is 825-feet long and 80-feet wide (Figure 27). Separated by a concrete wall from the large locks, the small lock is 150-feet long and 30-feet wide. The spillway dam has six 32-foot-wide steel radial gates. Each gate is raised and lowered by individual

electrically operated gate hoists. Waiting and guide piers are constructed of treated timbers.

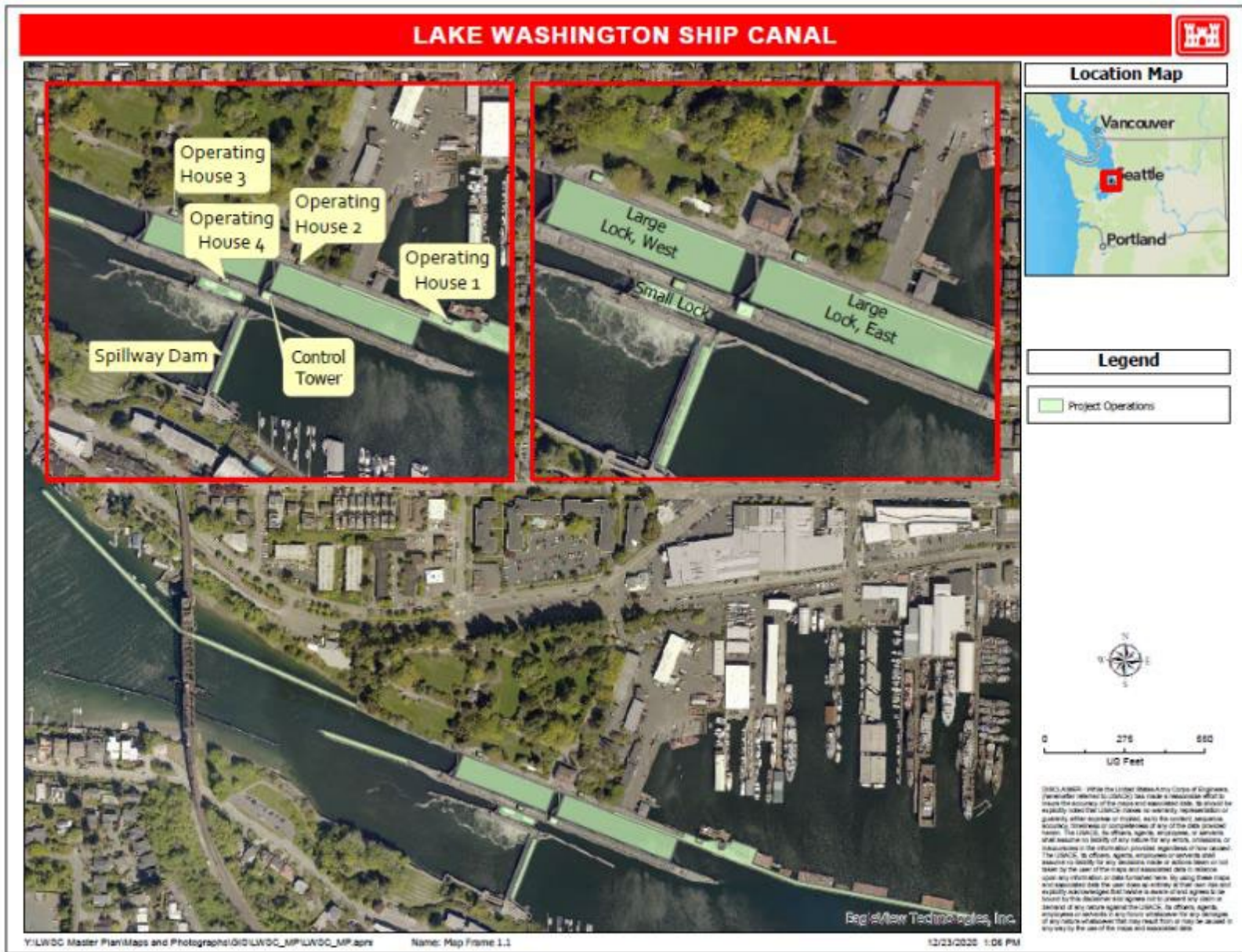


Figure 26. Location of Locks, spillway dam, piers, and operating houses.



Figure 27. Large lock dewatered in preparation for maintenance work in 2019.

The four Lock Operating Houses were constructed in 1914. Operating Houses Nos. 1 through 3 are on the north lock wall. Operating House No. 4 is situated on the middle lock wall. Each are single-story structures of reinforced concrete measuring approximately 14 feet by 21 feet containing rectilinear domed roofs, and wrap-around corner window bays with transoms gridded. Operating House Nos. 1, 2, and 3 were originally built to perform lock controls and are still operable; however, they have been functionally superseded by a central control tower installed in 1969.

The Control Tower was constructed on the middle lock wall in 1969. It provides central controls for the small and large locks, and the spillway dam. The base of the tower covers a 19-foot by 24-foot area and is constructed of reinforced concrete. The observation level is a glass-enclosed steel-frame overhang.

Resource Objectives

- 1) Operate and maintain the Locks, spillway dam, appurtenant structures in accordance with established and coordinated operation procedures and criteria.
- 2) Preserve the architectural style used in the original construction of the Locks, spillway dam, and accessory buildings.

Rationale

The Locks provide a navigation passage between the freshwater portion of the LWSC Project and Shilshole Bay, the level of which is determined by tidal action. Depending on the tide, the lift provided by the Locks varies in depth from 6 to 26 feet

depending on the tide and lake elevation. The spillway dam forms a 235-foot-long barrier between the small lock wall and the south shore and controls freshwater discharge to regulate the water surface elevation of the Ship Canal and Lakes Union and Washington. Attachment D lists both the contributing and non-contributing elements to the LWCS Historic District regarding the Locks, Spillway Dam, Piers, Operating Houses.

Development Needs

A total of six development needs were identified for the Locks as follows:

- 1) Remove abandoned equipment and remodel the control tower and Operating Houses Nos. 1 to 4 (i.e., paint, new floor, restore the outside of the building, remove old electrical panels, and improve ventilation);
- 2) Install a counter system for vessel traffic at the Locks;
- 3) Update the public announcement system to better direct boat traffic and pedestrians;
- 4) Refurbish the pier surfaces so they are safer to cross in winter weather; and,
- 5) Install a boat barrier upstream and downstream of the Spillway denoting restricted areas for project security and public safety;
- 6) Replace the Large Lock East and West Gate.

Special Considerations

A special consideration identified during the development of this plan is to strengthen the partnership with the UW and their advanced 3-D modeling classes of the historical structures (Section 2.3.8). Other special considerations identified during the public scoping period included a suggestion from the public to have the Locks generate power as well as to provide for navigation, and to install a boom to capture floating debris before it enters Puget Sound (Attachment F). At present, the LWSC Project is not authorized for power production, and new authority would need to be granted by Congress for the project to generate power. Regarding capturing floating debris, a trash boom as suggested would conflict with ship and boat navigation. Large debris (e.g., logs, trees, or disabled boats) are either removed by crane or snag boats such as the Motor Vessel (M/V) Puget. The M/V Puget is a USACE-owned debris recovery vessel which is operated under separate congressional authority throughout Puget Sound.

5.1.2 Lock Walls and Spillway Dam Walkway

Classification and Justification

Project Operations: The lock walls and spillway dam walkway infrastructure are necessary for project staff to access, maintain and operate the Locks and dam for its authorized purpose. This infrastructure is open to the public to access the fish viewing area and watch boats and ships passing through, resulting in the walkway being classified as High Density Recreation. Some members of the public use this infrastructure to commute across the Locks.

Management Agency

U.S. Army Corps of Engineers

Location and Acreage

The lock walls and spillway dam walkway occupy about two acres (Figure 28).

Resource Objectives

- 1) Maintain safe access for staff and the public to view and access the facilities on the north and south shores of the Locks without interfering with lock operations.
- 2) Preserve the architectural style used in the original construction of the Locks and spillway dam.
- 3) Improve and/or install interpretative and safety signs along the walkways, Locks, spillway dam, and piers.

Rationale

The purpose of the lock wall is to create the large and small lock chambers and facilitate management of vessels passing through the locks and O&M of facilities on both shores. The purpose of the spillway wall is to allow staff and visitors access across the dam which links the south shore, via the south entryway, to the main project grounds on the north shore.

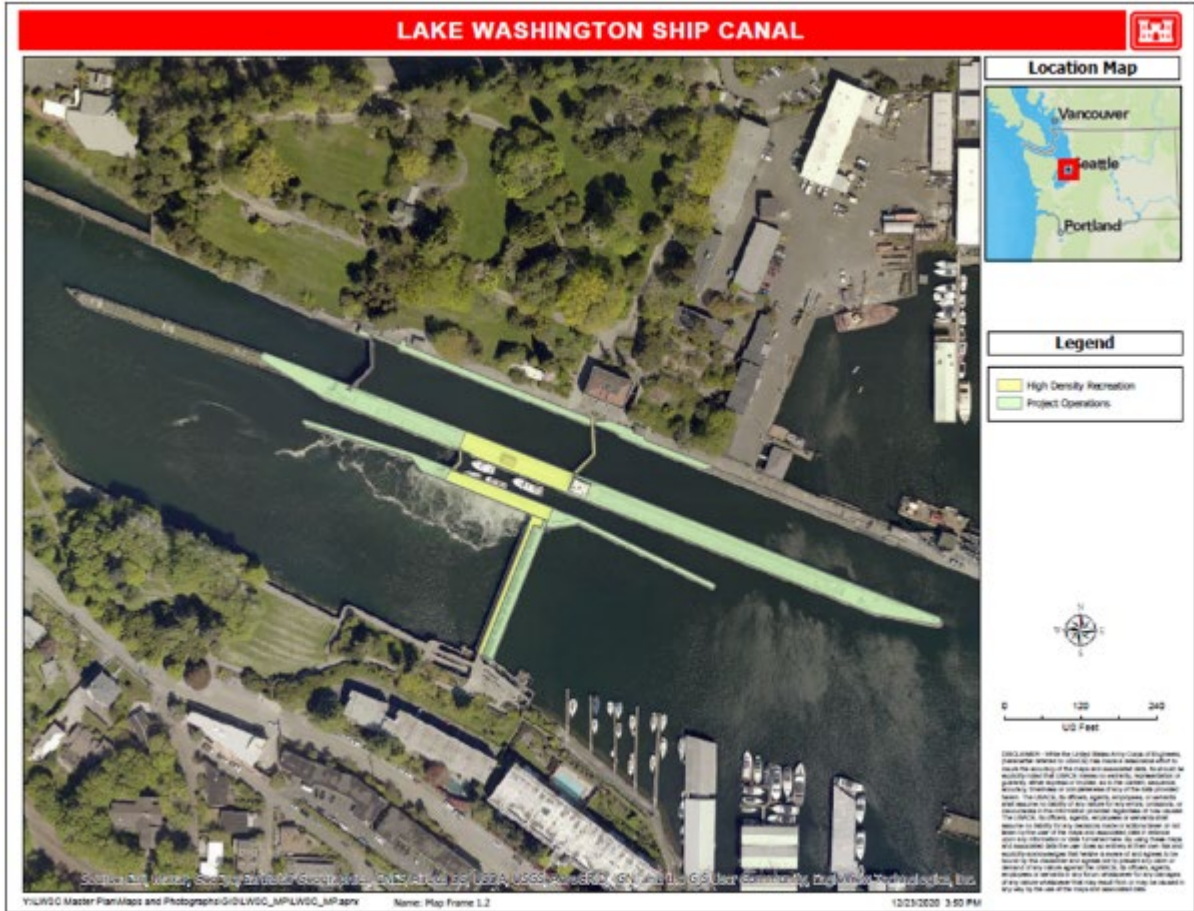


Figure 28. Lock walls, spillway dam and walkway across the Locks.

Development Needs

Update and install reader boards to better direct visitors across the spillway dam walkway.

Special Considerations

Many of the comments received from the public during scoping involved concerns over pedestrian access over the spillway walkways. The public recommended building a separate bridge for commuters across the Locks. At present, USACE is unable to build a separate bridge for commuters across the Locks as this is not part of the LWSC Project’s current authority. New authority would be needed from Congress. Another consideration suggested by Dam Safety Engineers is to review how the spillway walkway may be impacted by a large earthquake event.

5.1.3 Fish Viewing Gallery

Classification and Justification

High Density Recreation: The fish viewing area is popular with the public with thousands of people visiting the area annually to view the migrating salmon in the fish ladder.

Management Agency

U.S. Army Corps of Engineers

Location and Acreage

The fish viewing gallery is located near the south entryway of the Locks site and occupies about half an acre (Figure 29).

Description and Use

Anadromous salmon, steelhead, and cutthroat trout use the LWSC as a migratory route between freshwater habitat in the Lake Washington basin, and the ocean. The fish ladder provides a favorable route around the Locks and dam. The underwater fish viewing gallery was constructed in 1976 during the rehabilitation of the fish ladder, and renovated in 2020. The gallery features six large lighted windows below water level and provides a unique opportunity for LWSC Project visitors to view migrating fish while they are traversing the ladder (Figure 30). Various interpretive exhibits explaining the fish runs are located inside the gallery. USACE also contracts interpreters to give tours of the site to the public.

Resource Objectives

- 1) Maintain the public viewing gallery and associated interpretive exhibits to enhance the visitor's understanding and appreciation of the fish migration and the purpose and function of the fish ladder.

- 2) The viewing gallery is also used to support fish counting and fishery research efforts by the WDFW and the Muckleshoot and Suquamish Tribes.

Rationale

Anadromous fish are an important ecological, cultural, and economic resource to the Pacific Northwest region. The public viewing gallery provides an educational opportunity for visitors from within and outside this region.



Figure 29. Location of the fish viewing gallery on the Locks site.

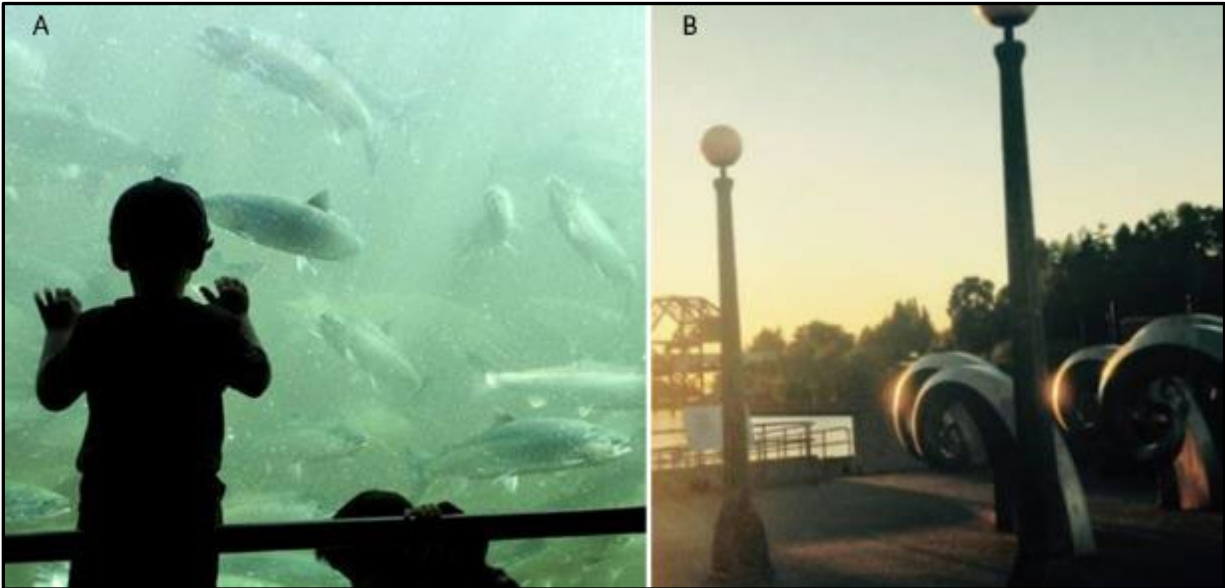


Figure 30. (A) Visitors at the fish viewing gallery; (B) View of the fish viewing plaza area.

Development Needs

USACE at present is partnering with Discover Your Northwest, the Corps Foundation, and other donors to implement improvements to public use areas at LWSC. Improvements were made to the fish viewing gallery in 2020, and the partners plan to create updated exhibits for the fish viewing gallery and upgrades to this space to include cultural aspects of the LWSC Project.

Special Considerations

The public are concerned about fish passage as reflected by comments received. One commenter felt the fish ladder needed to be improved and expressed that this should be a higher priority than to improve the fish viewing area. Although the Master Plan does not cover fish passage, fish ladder performance is considered as part of the ESA consultation with the Services as discussed in Section 2.3.4.

5.1.4 South Entryway Buffer Zone

Classification and Justification

Environmentally Sensitive Area and High Density Recreation: Part of this area is vegetated to maintain the soils on a steep embankment and to screen adjacent private residences from the visiting public. This vegetated area is classified as an Environmentally Sensitive Area. Another part of this area is turf where visitors can recreate. The High Density Recreation designation for the lawn area acknowledges the recreational use the area receives and is compatible with current and future management of the site.

Management Agency

U.S. Army Corps of Engineers

Location and Acreage

The South Entryway Buffer Zone is comprised of five separate parcels totaling about 1.1 acres; however, a portion of the area (~0.1 acres) is comprised of easements to USACE to provide bank protection (Figure 31).

Description and Use

The south entryway buffer zone was developed adjacent to Commodore Park in 1976 concurrent with construction of the south entryway and rehabilitation redesign of the fish ladder. The buffer plantings were renovated in 2011 after they had become degraded. The area is steeply sloped and neither accessible for, nor conducive to, public use.

Resource Objectives

- 1) Maintain and protect existing vegetative cover which provides a pleasing visual backdrop to the south entryway and fish ladder area.
- 2) Preserve and provide habitat for wildlife species.

Rationale

Landscaping is preferred and considered important for several reasons. The landscape consists of recently planted native plant species and some of the original plant materials, which provide an attractive low maintenance backdrop to the south entryway and fish ladder. The vegetation is managed to provide a balance of screening and vista views for residential properties located to the south.

Landscaping also provides habitat and food for songbirds, herons, and habitat for river otters, which frequent the area.

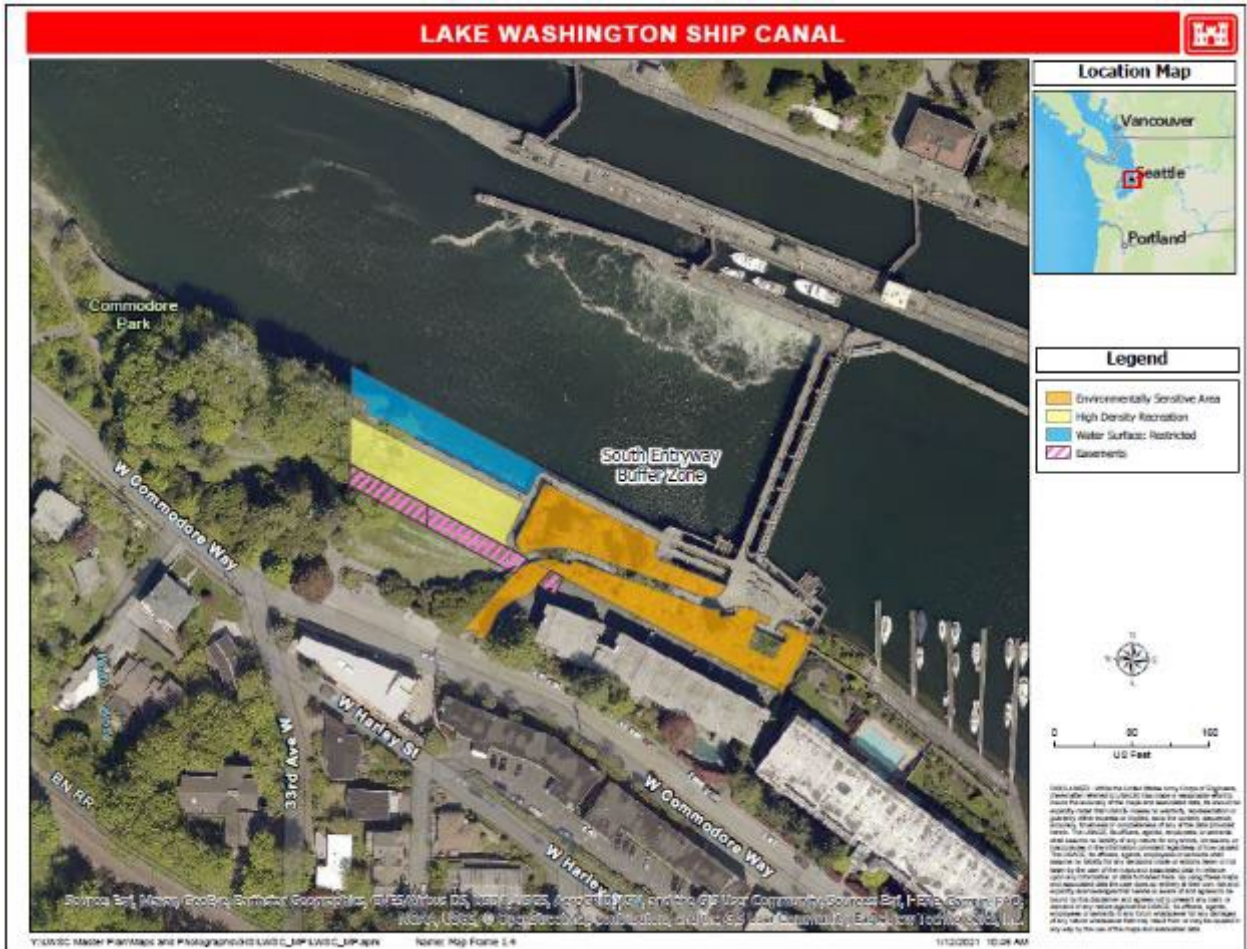


Figure 31. South Entryway Buffer Zone. Commodore Park is located to the west of the entryway.

Development Needs

A total of seven development needs were identified during the scoping process as follows:

- 1) Continue to work with partners to develop a plan to upgrade the fish ladder viewing area;

- 2) Install signage to better direct visitors to avoid certain areas near the public comfort station to protect them from a 15-foot drop;
- 3) Add barrier above comfort station (restroom) to prevent people from climbing on top of the structure;
- 4) Update comfort station to be Americans with Disabilities Act of 1990 (ADA) compliant and more user-friendly;
- 5) Construct a concession (such as a café) with tables and chairs;
- 6) Install a water source for irrigation on this side of the LWSC Project; and,
- 7) Establish a partnership with the Heron Habitat Helpers to develop educational and outreach materials regarding the breeding heron rookery located in Commodore Park.

Special Considerations

A condominium complex is located directly adjacent to the South Entryway Buffer Zone, and consequently, the vegetation in this area is maintained to provide some privacy while not obstructing views.

5.1.5 South and North Entry Areas and the Formal Promenade

Classification and Justification

High Density Recreation: The entryway and formal promenade accommodate an estimated 850,000 people annually visiting the Locks, fish ladder, visitor center and/or the Garden.

Management Agency

U.S. Army Corps of Engineers

Location and Acreage

The total area occupied by the formal promenade is approximately 1.5 acres. The north entryway is comprised of 0.1 acre while the south entryway is larger in size at 0.6 acre (Figure 32).

Description and Use

The south entryway was designed and constructed in conjunction with rehabilitation of the fish ladder and development of Commodore Park during the mid-1970s. It provides controlled pedestrian access to the fish ladder, fish viewing gallery, and north project area from Commodore Way and Commodore Park. Periodically, ambulances use this entryway to respond to emergency calls in the vicinity of the fish ladder. A restroom is located along the bank. LWSC Project vehicles also use this entryway to maintain plantings in the area.

The north entryway is the major portal for public access to the Locks. Rehabilitation of the north entryway between 1979 and 1989, included paving, fencing, provided a new employee parking area, a guardhouse (similar to the Lock Operating Houses), replaced the single story seven square foot wood frame Gatehouse originally

constructed in 1949, and associated landscaping. The first phase of this rehabilitation was completed in 1982; the second phase of construction was completed in 1989. The entryway design provides LWSC Project identification and conveys the nature of the Locks as a unique and major public attraction offering a wide variety of interesting activities in a waterside park setting.

The formal promenade consists of the tree-lined pedestrian boulevard which leads visitors from the North Entry directly to the Visitor Center, Administration Building, and the Locks (Figure 33). The promenade and other formal walks that connect buildings within the campus-like grounds of the Locks were upgraded in 1989, as part of the Phase II Entryway Project. These walkways were part of the original layout by Bebb and Gould in 1916, when vehicular use of the LWSC Project by the public was allowed. The area was redesigned when deteriorating pavements became a safety hazard and vehicles were excluded. The new design provided an 18-foot-wide concrete promenade with a trench drain running full length through the center. Exposed aggregate and broom finishes were used as contrasting patterns.



Figure 32. South and north entry areas and the formal promenade. Blue arrow denotes the Cove area.

Resource Objectives

- 1) Maintain the south entryway for pedestrian, natural resource vehicles, and emergency vehicle access to the fish ladder and the Locks.
- 2) Maintain the north entryway area to maximize visitor access to and enjoyment of the Locks, fish ladder, the Garden, and related project features. Vehicle access is restricted to necessary project maintenance, authorized project use and emergency vehicles only.
- 3) Maintain the formal promenade as the thoroughfare between the main visitor features of the Locks (i.e., visitor center, botanical garden, administration building, fish ladder, dam, and Locks).

Rationale

The south entryway is the only access to the fish ladder, fish viewing gallery, and Locks from the south. The south entryway is used by pedestrians, contract workers and USACE employees. The north entry gates separating the pedestrian thoroughfare and the service entry/employee parking lot will only be opened for access by authorized maintenance, authorized project use, and emergency vehicles. Periodically, ambulances use the north entryway to respond to emergency calls. The formal promenade is maintained to provide visitor guided access through the historic district



Figure 33. The formal promenade looking toward the Administration Building in 1984.

Development Needs

There is a need to accurately count visitation to the Locks at both the south and north entryways. The current beam counting system misses groups of people resulting in skewed counts that are lower than what occurs. There is also a need for better security and to reduce vandalism. Following are development needs and recommendations:

- 1) Upgrade the entryway gates and/or counting methods to obtain accurate visitation counts;
- 2) Replace wooden stairs in the Cove area;
- 3) Install signage regarding calendar of events and Lock updates at all entrances;
- 4) Install exhibits beside the walkways throughout the promenade with historic property elements to the Garden and Historic District;
- 5) Develop partnerships with the City of Seattle and other partners to produce education and outreach materials to be displayed at entryways and along the promenade; and,
- 6) Upgrade the entryway to provide a better security check point to ensure the security of the project, employees, and the public.

Special Considerations

Public comments recommended safer pathways and stairs, noting that tiled pathways can be difficult for people with canes or walkers to navigate. Many comments received spoke to the need for providing both pedestrian and bicycle access. Commenters felt having bicycles and skateboards on the same pathways as foot traffic was dangerous and suggested separating the pathways.

Having bicycle and skateboard use on the same pathways as pedestrians can result in collisions and injuries. For this reason, persons on bicycles and skateboards are required to dismount and walk on all pathways. Also, the LWSC Project is not specifically authorized by Congress to provide passage for city commuters. The LWSC Project is authorized to provide recreational access for visitors to view the lockages, fish passage, the Garden, and learn about the history of the LWSC Project. Providing more bicycle racks for visitors while they tour the Locks site may alleviate some of the conflict; however, most visitors on bicycles are commuters passing through. More study is needed to address this.

5.1.6 Operations, Maintenance, and Administration Areas

Classification and Justification

Project Operations: this area has all the infrastructure that is necessary to keep the LWSC Project operating such as the main pump house, offices for administrative

and Natural Resources staff, warehouses to store equipment and supplies, maintenance buildings, a boathouse, and a greenhouse.

Management Agency

U.S. Army Corps of Engineers

Location and Acreage

The total acreage in this area is about five acres (Figure 34). The parking area is about 0.7 acres in size.



Figure 34. Operations, Maintenance and Administrative Area.

Description and Use

Mechanics Shop

The Mechanics Shop was constructed in 1914. It is a single story reinforced concrete structure with a built-up roof and a foundation area measuring 18-feet by 56-feet. It features base mold, entablature⁴ and other details in the classical tradition conforming to the simple utilitarian style of the original group of accessory buildings. This building is used as storage and project personnel locker room.

Transformer House

The Transformer House was constructed in 1914. It is a single story reinforced concrete structure with a built-up roof and a foundation area measuring 25 feet by 33 feet. It contains electrical equipment. It is the only one of the original accessory buildings to have a compass orientation rather than conforming to the grid perpendicular to the waterway. The openings of the west facade are outlined with continuous plain moldings under segmental arch heads. It features entablature, belt molds and base in the classical tradition conforming to the simple utilitarian style of the original group of accessory buildings. The central doorway is protected by a pedimented hood.

Warehouse No. 1

The Warehouse No. 1 building was constructed in three parts. The Office and Shop building was completed in 1916. The seven-stall garage was completed in 1922. In 1945, the two structures were combined by covering the space between them to form the existing structure. The Warehouse is a two-story reinforced concrete structure with a built-up roof and a foundation area measuring 36 feet by 80 feet. It features details in classical tradition conforming with the established pattern.

Warehouse No. 2

The Warehouse No. 2 building was constructed in 1941. It is a high ceiling single story metal-clad steel frame structure with a built-up roof and a foundation area measuring 50 feet by 160 feet. It is used as storage and office space and contains a second story loft.

Machine Shop

The Machine Shop was constructed in 1916. It is a two-story reinforced concrete structure with a built-up roof and a foundation area measuring 30 feet by 85 feet. It features entablature, belt molds and base in classical tradition conforming to the simple utilitarian style of the original group of accessory buildings.

⁴ Classical architectural feature: the part of a temple or other building between the columns and the eaves, usually composed of an architrave (lowest section), a frieze (horizontal sculptured band, and a cornice (topmost band).

Oil House

The Oil House was constructed in 1916 and expanded in the 1930s. It is a single story reinforced concrete structure with a built-up roof and a foundation area measuring 14 feet by 22 feet. Two 300-gallon fuel tanks remain abandoned in place. It features exterior details in classical tradition conforming to the simple utilitarian style of the original group of accessory buildings.

District Vehicle Garage

The District Vehicle Garage was constructed in 1941. It is a single-story metal-clad steel frame structure with a built-up roof and a foundation area measuring 50 feet by 160 feet. It serves as the district garage and maintenance shop. The paint spray booth and wash rack are additions made in the 1990s.

Steel Shop

The Steel Shop was constructed in 1941 (Figure 35). It is used as the welding and plumbing shops, lunch and locker rooms, and offices for the chief of maintenance and yard crew foreman. It is a high ceiling single story metal-clad steel frame structure with a built-up roof and a foundation area measuring 40 feet by 102 feet.



Figure 35. Construction of the steel shop in 1941. Note greenhouse at right of the shop.

Greenhouses

The Greenhouse was constructed prior to 1941 and rebuilt in 1949. It is a single-story wood frame structure with a double-pitched roof. It has a foundation area measuring 15 feet by 15 feet. The wood frame structure is adjoined by a 15-foot by 34-foot glass panel structure.

A passive solar greenhouse nursery was constructed in 2023. It is a single story, made of transparent 8 mm polycarbonate triple wall material. The foundation is about 16 feet by 17.5 feet. The roof is between 9.5-11.5 feet tall as measured from roof peak to ground or floor.

Boathouse

The Boathouse was originally constructed in 1949 and consisted of a wood frame structure with a foundation area measuring 55 feet by 79 feet. The structure housed USACE vessels used in snagging and dredging operations. In 2011, the boathouse was found to have structural deficiencies and was demolished and replaced with a covered berth in 2012.

Storage Shed

The storage shed was constructed in the late 1980s. Its foundation area measures 25 feet by 125 feet. It is located adjacent to the east boundary and not highly visible.

Paved Areas

Portions of the operations and maintenance paved areas have been used for long-term stockpile of materials and equipment as well as employee parking.

Main Parking Area

The employee parking area was constructed along with the north entryway. The parking area provides approximately 50 spaces for government employee private vehicles during normal duty hours. Government employees have the option of parking on paved areas within the operations and maintenance area or the main parking lot. The main parking lot can only be used for contractors and volunteers when spaces are available. Visitor parking is in the adjacent City of Seattle parking lot just north of the Garden.

Administration Building

The Administration Building was constructed between 1914 and 1915 (Figure 36). The solitary initial multi-purpose public building is the focal point of the Locks Site. Its Second Renaissance Revival style sits on a rectangular foundation area measuring 47-feet by 67-feet. It is a multi-story structure, including two upper stories and a basement, constructed of reinforced concrete with a tile-clad hipped roof with central deck. The basement contains the pumping plant for dewatering the Locks for annual repairs and the original electrical distribution panel (which is intact but functionally

obsolete). The ground story has cross-axial corridors with central lobby space and principal offices in each corner. The lobby opens to the second story gallery. It features an oval ceiling light of textured and colored glass, and terrazzo floor with geometric trim of Alaska and verde antique marble. Interior walls and ceilings, including coved cornices, are plaster-finished. Woodwork, including door and window trim, baseboards, pilasters, ogee wall panel moldings, and ionic stave columns flanking the main entry vestibule, is varnished oak. The second story storerooms open onto the lobby.

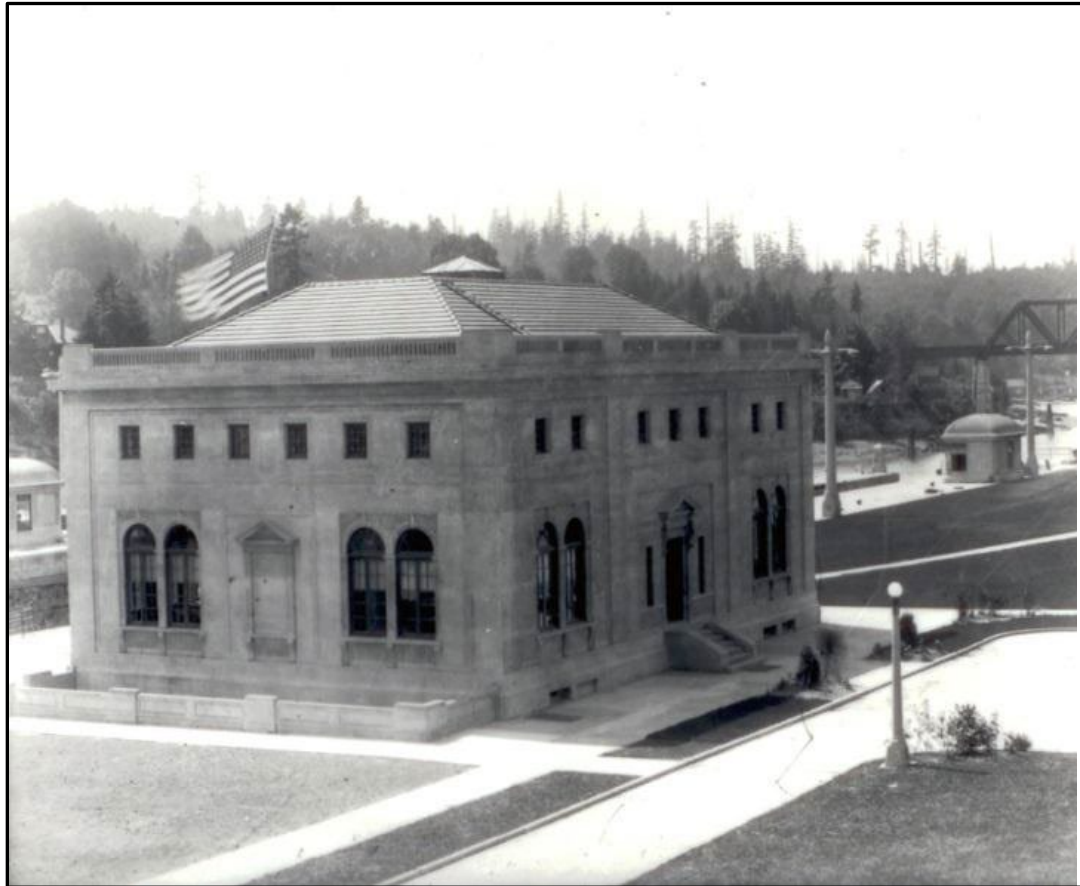


Figure 36. View of the Administration Building looking west in 1916.

Each exterior elevation has tripartite organization. Walls are topped with a decorative concrete parapet. Second story windows are covered with cast-iron grilles. Ground story arcuated windows and central pedimented doorways are in panels of concrete set off from the major wall surface by special texturing with a bush hammer. The main entry on the southwest, or waterway face, is recessed behind a two-story portal arch and surrounded by plate glass fronted by cast iron grilles. Surmounting either bulkhead of the concrete steps of this entrance are light globes mounted on fluted concrete drums with dolphin-supported bronze fittings. These are noteworthy because they are the only external lighting fixtures on the Locks Site which have remained intact.

The building has been only superficially altered, mostly on the interior. The building's lobby is open to the public, and the basement pumping plant is open to the public on guided tours. The Administration Building, as well as other LWSC structures, is of great interest to UW researchers and USACE partners with these researchers to create 3-D drawings and models of the structures. UW completes this work as an educational class and USACE has access to this material, class work, 3-D modeling and drawings of the Administration building, and other structures related to the LWSC Project. This work helps detail the construction process of when the Administrative Building and other structures were original constructed, which is most useful when repairs are necessary.

Resource Objectives

- 1) Conduct necessary operation and maintenance functions integral to the operation of the LWSC.
- 2) Preserve the classical tradition conforming to the utilitarian style of the original group of accessory structures.
- 3) Provide working space for administrative and clerical activities integral to operation of the LWSC Project, while preserving the Second Renaissance Revival style architectural character used in the original construction.
- 4) House and maintain the equipment to pump out the large lock and small lock chamber for maintenance. House and maintain the oil water separator equipment used to help USACE meet environment requirements.
- 5) House and maintain operational equipment that operates the Locks, spillway dam, and fish ladder equipment.
- 6) Allow visitors unescorted access to the first and second floor lobbies of the Administrative Building, and escorted tours to the basement as a means to foster appreciation for the unique Second Renaissance Revival style architectural character, qualities of the building, its purpose and operations.
- 7) Manage the main parking area for weekday, evening, and weekend use by government employees and for overflow parking by volunteers and contractors.

Rationale

These areas are required for project O&M purposes. This area includes industrial, warehouse, garage and related operational accessory buildings and uses of which many are contributing elements to the Historic District. See Attachment D for

contributing or noncontributing elements of the LWSC Historic District. Much of the area will continue to be off limits to the public due to the activities conducted. The main parking area was created to reduce vehicular parking conflicts with operation activities in the O&M area.

The Administration Building houses the offices of the Project Manager, Project Engineer, Natural Resource Chief and rangers, and administrative, and clerical offices. A public lobby is located on the first floor. Switchboards and lock dewatering pumps are in the basement. Architectural plans and elevations for the building were prepared between 1914 and 1916, by Carl F. Gould of the eminent local firm of Bebb and Gould. The building has been only superficially altered, mostly on the interior. Some restoration and upgrading have occurred over time in accordance with the Secretary on Interiors Standards for the Treatment of Historic Properties and Standards for Rehabilitation. The Administration Building is a contributing element to the LWSC Historic District. It is appropriate that this building be accessible for limited public viewing while serving its primary operational purpose. Visitors are allowed, unescorted, to view the lobby.

Development Needs

Several development needs were identified during the public scoping process (Attachment F) as follows:

- 1) Restore Administration Building's pump plant floor, entryway, and rust proof all walls and structures;
- 2) Install keypad access control for all buildings;
- 3) Water-seal all concrete buildings;
- 4) Repaint all warehouses and buildings;
- 5) Restore the woodwork on the door entryway of the Administration Building;
- 6) Repair/replace concrete pier where M/V Puget is moored to separate it from boat shed;
- 7) Upgrade administration building to be compliant with the Americans with Disabilities Act of 1990, as amended;
- 8) Restore the Administration building's sky light;
- 9) Upgrade the air circulation system in Warehouse No. 1;
- 10) Upgrade the technology in the Warehouse No. 1 conference room;
- 11) Install a restroom in Warehouse No. 2;
- 12) Build a carport to cover the trailer and/or chipper;
- 13) Install a secure gate in the fence behind the Conex box;
- 14) Enclose the boathouse;
- 15) Install interpretive signage about the historic elements and architecture posted on the outside of each facility all tied to an interpretive plan; and,

16) Upgrade the security room and systems in the Administration Building.

Special Considerations

A special consideration identified during the scoping period was to develop a partnership with the UW and their advanced 3-D modeling classes of the historical structures (Section 2.3.8). There are no other specific special considerations identified for the Operations, Maintenance, and Administration area.

5.1.7 Visitor Center and Public Comfort Stations

Classification and Justification

High Density Recreation: Over 2.1 million people visited the Locks in FY 2023 and many of them tour the Visitor Center to learn more about the Locks and Ship Canal. The restrooms provide needed facilities for the visiting public in the highly visited areas of the site.

Management Agency

U.S. Army Corps of Engineers

Location and Acreage

The Visitor center is located along the formal promenade and occupies less than 0.1 acre (Figure 37). The two public comfort stations sit on less than 0.1 acre.

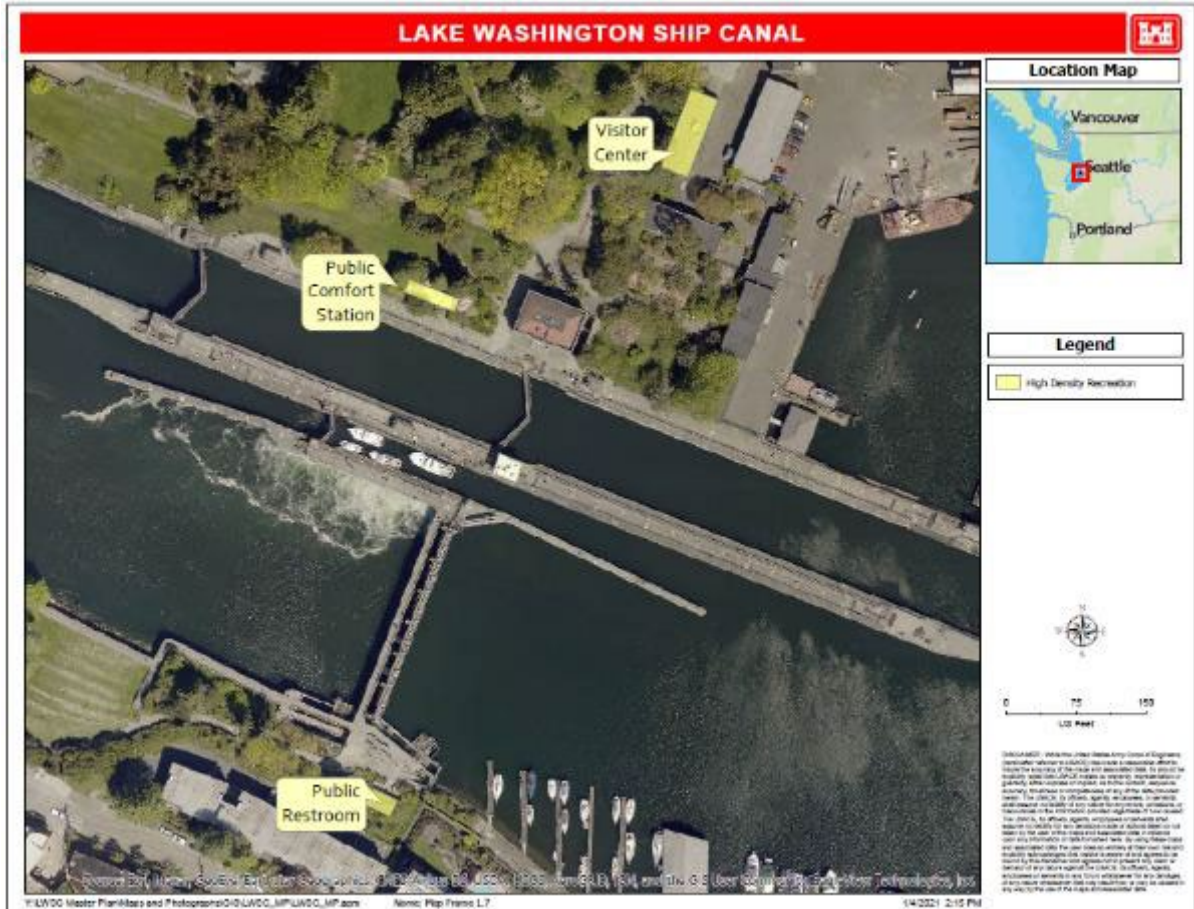


Figure 37. Locations of the Visitor Center and public comfort stations at the Locks site.

Description and Use

The Visitor Center was originally constructed as the Carpenter and Blacksmith Shop Building in 1921. It is a two-story reinforced concrete structure with a built-up roof and a foundation area measuring 31 feet by 91 feet. It features a classical entablature, belt molds and bases which conform to the pattern established by the original accessory buildings. Portions of the exterior have been altered. Current use includes exhibits, interpretive programs, and a bookstore. In winter 2023, four new offices (NRM supervisor office, NRM specialist office, ranger office, and hoteling office for NRM personnel), one IT closet, and one storage closet were added to the north side of the second floor. The existing exhibits were reorganized and consolidated to accommodate this layout adjustment. This facility includes restroom facilities for persons who are physically disabled. In 1993 areas and features that were remodeled included the facility's entrance, finishes, information desk, and theater. The interpretive features are in the process of being updated.

There are three public comfort stations on the Locks site, including one located in the Visitor Center. The public comfort station located to the west of the Administration building and overlooking the Locks was constructed in 1947. It is a

single story reinforced concrete construction measuring 14 feet by 58 feet. The third public comfort station is located at the south side of the project adjacent to the Fish Viewing Gallery.

Resource Objectives

- 1) Preserve the classical architectural style conforming to the utilitarian style of the original group of accessory structures.
- 2) Maintain Visitor Center programs to provide a multi-faceted interpretive services program, including exhibits, brochures, and guided and self-guided tours.
- 3) Provide public lavatory facilities located at the fish ladder plaza, north side of the large lock and the Visitor Center.

Rationale

This structure is a contributing element to the LWSC Historic District. The Visitor Center and interpretive services program are managed to provide interpretive exhibits and information for project visitors. The center features several exhibits on the history and operation of the Locks and Ship Canal and the role of USACE in the Pacific Northwest and nation. The Visitor Center interprets project purposes and resources and enhances visitor understanding and appreciation of USACE's various missions. Outside exhibits and the guided and self-guided tour programs also play an important role in interpreting the project to visitors.

Development Needs

A total of seven development needs were identified during the scoping period as follows:

- 1) Upgrade all touchscreen outreach kiosks with project map, to provide information about the structures, Garden (what is in bloom), history of buildings, and bronze plaques;
- 2) Update public web page with current information about Garden, such as a plant list, what is in bloom, and add a link to podcasts, and/or create new podcasts about the Locks, fish, and Garden;
- 3) Update and/or renovate Visitor Center and strengthen partnerships to produce living history displays;
- 4) Inventory, store and/or properly display historical tools and machinery that meet USACE standards;
- 5) Upgrade all comfort stations with sensor lighting, automatic doors, sinks with water on sensors, and automatic air dryers to reduce touch points;
- 6) Ensure all comfort stations are ADA compliant; and,
- 7) Install baby changing tables in all public comfort stations restrooms.

Special Considerations

With the passage of the ADA in 1990 (PL 101-336), USACE, as well as the City of Seattle, has made improvement in recreation areas to facilitate greater access for disabled visitors. Still, the public commented that the public comfort stations could be larger to accommodate an infant changing area or those who need walkers. The public further commented that the Visitor Center could be updated. At present, USACE is partnering with Discover Your Northwest, the Corps Foundation, and other donors to implement some of these improvements to public use areas at LWSC Project including the Visitor Center.

5.1.8 James B. Cavanaugh House and Grounds

Classification and Justification

Project Operations: the house and grounds are maintained as the official residence of the District Engineer and are closed to the public.

Management Agency

U.S. Army Corps of Engineers

Location and Acreage

The Cavanaugh house and grounds occupy less than 0.1 acres and are closed to the public (Figure 38).

Description and Use

James B. Cavanaugh House was constructed in 1913, as a residence for the Locks-keeper. It was the first permanent building completed on the reservation. Two sheets of drawings for the building among project records stored on the site are dated December 1912. The plans were once thought to have been drawn by local architect Carl F. Gould; however, the plans were the concept of C.A.D. Young, a "Junior Engineer". Originally the structure measured 26 feet by 35 feet, consisting of two stories with shingled gable roof and overhanging eaves with exposed rafters. Certain details were derived from the craftsman style Bungalow. Its features include the following: a cross-axial frontal gable; shed-roofed rear dormer; brick end chimneys with corbelled caps; porches with hipped roofs; shaped outriggers; and, single and coupled double-hung sash windows with nine lights over one. In 1967, the house was dedicated as the official residence of the Seattle District Engineer and renamed in honor of Colonel James B. Cavanaugh.

In 1966, the interior was remodeled; partitioning was revised and one of the fireplaces was removed; and bathroom, bedroom, and carport were added. In the early 1970s, the "Backus" room was added. In 1984, the carport was made into a garage. In 1986, a bath was added in the basement and the kitchen was remodeled. Externally, the upgrading was discreet. Among the results were: roof cover of composition shingles; gutters and downspouts; conversion of front ground story windows to bay windows within original openings; and addition of a bedroom and

carport to the rear pantry and stoop. In 1992 and 1993, slate roofing was reinstalled on the house. In 2011, a fence surrounding the house and grounds was installed due to security concerns. Updates to the first and second floor were also completed in 2011. The interior main floor and second floor of the house was remodeled in 2020. This remodeling effort included updating appliances, replacing carpet, painting, and expanding the master bedroom on the second floor.



Figure 38. James B. Cavanaugh House and Grounds at the Locks Site.

Resource Objectives

- 1) Preserve the original spirit of craftsman style bungalow construction typified by the James B. Cavanaugh House while maintaining the house as official residence of the District Engineer.
- 2) Maintain buffer planting to enhance privacy from the public.

Rationale

The building is an important example of the craftsman style bungalow construction and is a contributing element of the LWSC Historic District. The PA allows for interior

rehabilitation of the Cavanaugh House; however, the exterior and exterior elements (i.e., doors, windows, siding, footprint, massing, etc.) should be maintained near original design in keeping with its inclusion in the Historic District. In addition, the 1994 HPMP notes that public spaces of the house (i.e., entrance halls, parlors and dining rooms) are important in defining the overall historic character of the house. Buffer plantings maintain a physical and a psychological separation between public areas of the Garden and the immediate environment of the residence.

Development Needs

The development needs identified for this area include replacing the roof on the house with historically accurate materials that meet current building codes along with installing adequate ventilation and cooling for the house. Additionally, USACE is exploring updating components of the heating system to be more energy efficient and effective.

Special Considerations

There are no specific special considerations for the Cavanaugh House and Grounds.

5.1.9 Carl S. English Jr. Botanical Garden and the Loop Road

Classification and Justification

MRM - Low-Density Recreation (Loop Road and lawn areas) and Environmentally Sensitive Area (the Garden): The Garden, lawns and Loop Road are a multiple resource use area and not easily classified under EP 1130-2-550. The Garden is a cultural and historic landscape unique in USACE. It is the only federally owned, USACE managed botanical garden where plants are grown for display to the public and for scientific study. Many of these plants are not native to the Pacific Northwest and may be rare even in the places where they originated. The lawn areas are specially designed to highlight aspects of the Garden and the views of the Locks. Special public events such as weddings and concerts also occur on the lawn areas. Much of the Garden can be viewed from the Loop Road and it is estimated that over 100,000 visitors tour the Garden each year. Due to the multiple resource use in the area, the Garden (specific planting beds and areas under tree canopy) is classified as Environmental Sensitive Areas while the lawns and Loop Road are classified as MRM – Low Density Recreation. As part of the original development of the Garden, the Environmentally Sensitive Area designation highlights the importance of the Garden, vegetation, and cultural aesthetics, and acknowledges the potential sensitivity the vegetation may have to climate change, human impacts, or operational changes. The MRM – Low Density Recreation designation acknowledges the recreational use the Garden receives and is compatible with current and future management of the site.

Management Agency

U.S. Army Corps of Engineers

Location and Acreage

The Garden is composed of a mix of planting beds, trees and lawn (Figure 39). The Garden areas are classified as Environmentally Sensitive Areas and comprise about 4.18 acres. The lawn areas (2.75 acres) and the Loop Road (0.7 acres) are classified as Low-Density Recreation areas. A small nursery area (0.2 acres) is also part of the Garden and classified as an Environmentally Sensitive Area.



Figure 39. Carl S. English Jr. Botanical Garden and Loop Road at the Locks Site.

Description and Use

Since Carl English, Jr.'s development of the grounds from basic tree and shrub plantings to an elaborate botanical garden, managing the grounds became increasingly intensive. Attention has been required on the part of subsequent project gardeners and horticulturists to work with not only mass quantities of plant materials and their immense and varied cultural requirements, but also poor soils and drainage throughout the site as well as an antiquated and inefficient underground irrigation system. As plant materials within the Garden have matured, maintenance has continued to increase. The Natural Resource Manager and three gardeners manage the grounds maintenance at the LWSC Project. The current use of the nursery staging and storage area, originally the location of the tennis court and later employee parking area, is supportive of maintaining the Garden. The nursery area is undergoing changes to become an interpretative plant propagation area.

The Garden is accessed primarily using the Loop Road. Small gravel paths at the west end of the Garden and around the nursery area further enhance visitor enjoyment of the Garden. The Loop Road is a combination of an 18-foot-wide concrete roadway, 6-inch concrete curbing, and 4-foot-wide concrete walkway that extends west of the Administration Building to a viewing overlook with solid concrete railing and continues around the residential knoll tying back to the main promenade at the Administration Building. Repairs to both the Loop Road and the concrete walkway are routinely needed as concrete panels can shift and break causing safety hazards for pedestrians. The roadway is no longer required for vehicular traffic (as originally designed) other than maintenance and emergency vehicles.

Resource Objectives

- 1) Manage the Garden as it is a contributing feature to the LWSC Historic District. Retain the Garden style developed by English during his 43 years of stewardship at the Locks (Attachment D). Preserve the significant aspects and how those aspects relate within the Locks and LWSC Historic District.
- 2) The Loop Road provides access to the Cavanaugh House, Garden, west side overlook, and serves as an exercise trail. Its function and integrity should be preserved to support the access to the Garden and LWSC Project grounds.

Rationale

The Garden contains 140 plant families, 400 genera, and nearly 900 species of trees, shrubs, forbs, and grasses from many parts of the world. The Garden has received worldwide recognition and has been featured in national horticultural journals and magazines, as well as local publications. The Garden is a significant feature and contributing element of the LWSC Historic District (Attachment D). The Loop Road is maintained to provide visitors a primary access route through the

botanical garden and reduce heavy traffic through unpaved portions of the Garden. This road is also used as access for maintenance and emergency vehicles.

Development Needs

Several development needs were identified during the scoping process as follows:

- 1) Replace creosote logs with rock or concrete logs;
- 2) Replace bollards and cable surrounding plant beds;
- 3) Replace wood archway at west end of gravel path;
- 4) Replace and/or repair any damaged concrete with stone pavers;
- 5) Increase the number of electrical outlets in the Garden;
- 6) Install a secure gate at the bottom of the steps by Operating House No. 3;
- 7) Replace irrigation system to modern standards;
- 8) Replace large trees that were removed near Warehouse No. 2;
- 9) Partner with organizations to adopt and/or enhance portions of the Garden;
- 10) Incorporate pollinator initiatives;
- 11) Update maps to include current locations and extent of buried and above ground utilities (e.g., electrical light poles, domestic water, irrigation systems, fiber systems, and fire hydrants);
- 12) Update maps with details on flower beds. Add identification labels to trees in the Garden;
- 13) Construct an amphitheater for interpretative and other programs; and,
- 14) Expand ornamental planting beds.

Special Considerations

There are no special considerations for the Garden.

5.2 FREMONT CUT

Classification and Justification

Project Operations, MRM - Low Density Recreation and Water Surface Restricted: The area is maintained to provide access to the recreating public along the shoreline; however, the public is restricted from entering the water. The armor walls along the Fremont Cut are classified as Project Operations as the walls support the operation of the navigation mission.

Management Agency

U.S. Army Corps of Engineers

Location and Acreage

The north and south shores of the Fremont Cut are both about 1.5 acres in size (Figure 40).

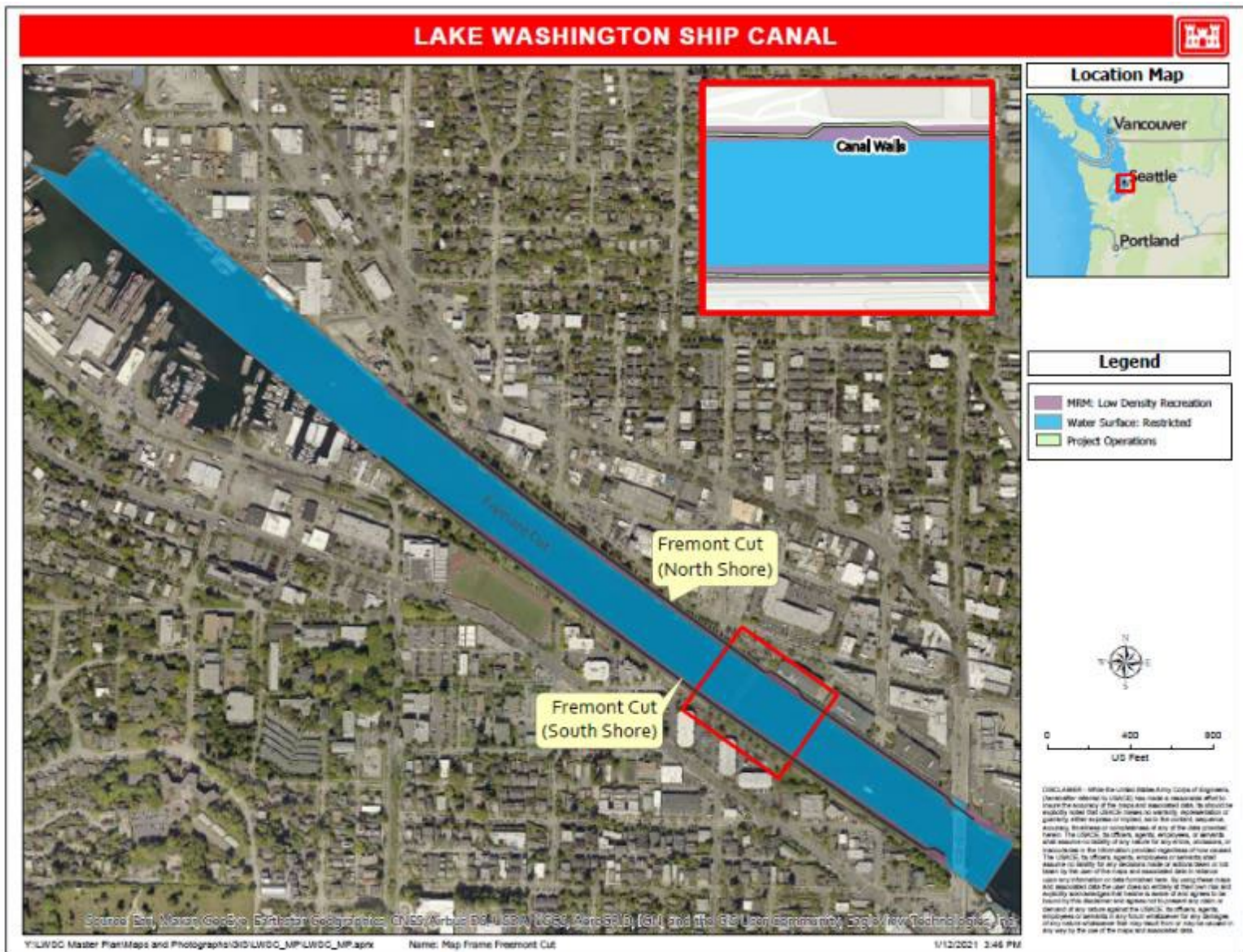


Figure 40. Fremont Cut.

Description and Use

The north shore of the Fremont Cut is approximately a 15-foot-wide strip of land behind the concrete revetment. It provides a buffer from adjacent development and is identified by the distinct row of poplars at the east end. The landscape consists of tree and shrub plantings, dominated by Lombardy poplars, and a walkway and overlook on the west end which were jointly developed in 1981 by USACE and Seattle Department of Parks and Recreation (Seattle Parks Department). In 1992, the Seattle Parks Department further developed an extension of the Burke-Gilman Trail by providing separate bicycle and foot paths. The 43 plus poplars are spaced quite closely (12 to 15 feet apart) and have reached maturity. Some of the poplars are in a declining state of health with weakened top and side branches due to aging. As of September 2020, the Seattle Parks Department possesses a lease to maintain the landscape along the Fremont Cut and USACE intends to continue this arrangement.

The south shore of the Fremont Cut is approximately a 15-foot-wide strip of land behind the concrete revetment. It provides a buffer from adjacent development and is identified by the distinct row of poplars. The landscape, dominated by the Lombardy poplars, contains various species of trees and shrubs. Some areas of the shoreline have heavy undergrowth while other areas have barren compacted soils with large surface roots poking through. The poplars are evenly spaced (25 to 30 feet apart) and based on size believed to be 75 to 80 years old. It is not known when or who initially planted the poplar colonnade.

Resource Objectives

- 1) Increase capability to carry out regular security patrols;
- 2) Maintain the armor walls to support navigation through the canal.
- 3) Maintain the historical Lombardy poplar colonnade along the narrow canal while maintaining the cut for navigational purposes.
- 4) Maintain coordination with the City of Seattle, adjacent property owners, the Fremont community, as well as other groups, organizations, and individuals to accommodate and enhance public access and use of the north shore.
- 5) Replace barren or overgrown areas with new landscaping.
- 6) Maintain public access to the management area.

Rationale

The Fremont Cut is designated as a contributing element of the LWSC Historic District and as such must be maintained to standards expressed in the HPMP.

Development Needs

A total of five development needs were identified as follows:

- 1) Repair revetment wall, sink hole erosion areas, and storm drain outflows;
- 2) Replace north side degraded and damaged armored wall;
- 3) Develop a method to count visitations to the management area.
- 4) Partnership with the City of Seattle Parks Department to treat invasive Himalayan blackberry and other noxious and invasive weeds following a Vegetation Management Plan; and,
- 5) Increase education and outreach about the Lombardy Popular Colonnade, educate the public about noxious and invasive weeds with partnerships.

Special Considerations

There are no special considerations identified for the Fremont Cut.

5.3 MONTLAKE CUT

Classification and Justification

Project Operations, MRM – Low-Density Recreation, and Water Surface Restricted: USACE maintains Montlake Cut via a perpetual easement from the State of Washington. The armor walls along the Montlake Cut shorelines are classified as Project Operations, as the walls support the operation of the navigation mission.

Management Agency

U.S. Army Corps of Engineers and University of Washington via USACE license

Location and Acreage

The north shore of the Montlake Cut is about 5.0 acres in size and the south shore is about 4.0 acres in size (Figure 41).

Description and Use

The Montlake Cut is in the eastern portion of LWSC. USACE has a real estate interest in the Montlake Cut, for the purpose of project operations, consisting of a perpetual right-of-way granted by the State of Washington on March 16, 1907 (RCW 37.08.250). The cut is about 2,500-feet long and 350- feet wide.

Both the north and south shores are narrow strips of land alongside the waterway. In 1965, the Department of the Army granted the UW an indefinite term license to use, maintain, operate, and repair the university's in-place structures and to landscape, beautify, and maintain lawns, trees, shrubbery, and other plantings within the canal right-of-way. The Montlake Cut Waterside Trail was designated a National Recreation Trail in 1971 (Figure 42) connecting to UW's Arboretum Waterfront Trail and the West Montlake Park on Portage Bay.

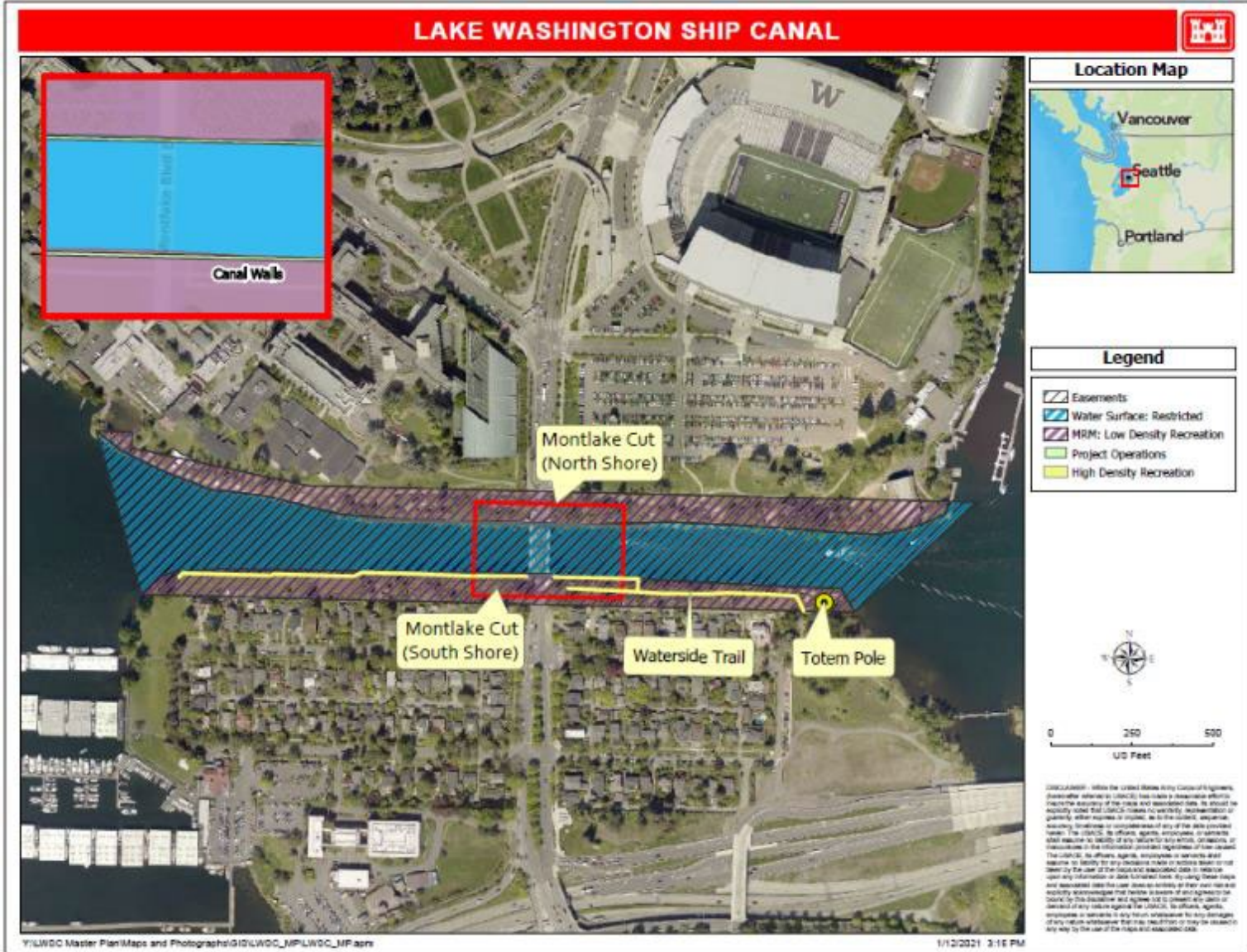


Figure 41. Montlake Cut.



Figure 42. Montlake Cut Waterside trail showing a completed repair of a portion of a stone wall in 2018.

Resource Objectives

- 1) Increase capability to carry out regular security patrols;
- 2) Maintain the armor walls to support navigation through the canal.
- 3) Maintain the existing license granted to the UW which allows the university to use, maintain, operate, and repair the University's in-place structures, and to maintain landscaping within the Ship Canal right-of-way on the north side of the Montlake Cut.
- 4) Maintain public access to the area.
- 5) Maintain and preserve the Montlake Cut Waterside Trail, fishing pier, totem pole, associated features, and landscape plantings to ensure retention of its designation as a National Recreation Trail and to ensure walkways and bank lines are stable.
- 6) Protect and maintain the historic resource of the original concrete embankments. Implement conservation methods which ensure retention and preservation of the terrain and significant landscape features.

Rationale

USACE was granted a perpetual easement by the State of Washington on March 16, 1907, for the canal right-of-way through the Montlake area. A total of 8.56 acres were deeded back to the State of Washington, for use by the university, but is administered by USACE, as the project lands are required for operations. Public use of the land is supportive of, and incidental to, the original canal concept. The public's interest in access to the north shore of the Montlake Cut is best served by

maintaining the present license granted to the UW for development and management of public access facilities and landscaping.

Development Needs

There is a need to repair and possibly rebuild large sections of the retaining walls and trail along the Montlake Cut. An investigation is needed to assess the extent of the damaged areas and determine appropriate design for repairs. Because the State of Washington and UW are involved in the management of this area, collaboration with them and other interested stakeholders is necessary to identify funding and conduct this investigation. Below are development needs identified during the public scoping period:

- 1) Replace entire walkway along the Cut to current standards for an urban trail;
- 2) Level and restore the grass turf areas;
- 3) Develop a method to count visitations to the management area
- 4) Partner with UW to rebuild the small deck and improve their structures;
- 5) Remove hazard trees; and,
- 6) Increase education and outreach about the fishing pier, USACE history, Opening Day of boating season festivities, and wildlife through interpretive signage (with graffiti resistant surface) or other means.

Special Considerations

The structures are historic and extensively used. The area is used by the public as a place to walk and to view the ships and rowing boats in the channel and by the UW as their central rowing venue. The celebration of Opening Day of boating season can attract tens of thousands of people to the Cut. Public Affairs will need to be consulted on how to manage the public while major repairs are being completed. The north and south shores of the Mountlake Cut are considered contributing elements to the LWSC Historic District and any changes beyond maintenance and minor in-kind repairs or replacement of the existing concrete walls need to be consulted on under Section 106 of the NHPA (USACE 1994 and USACE 1994 Attachment D).

5.4 CHANNEL TIDELANDS/SHILSHOLE BAY

Classification and Justification

Environmentally Sensitive Area: these areas are productive fish and wildlife habitat.

Management Agency

U.S. Army Corps of Engineers

Location and Acreage

The acreages of the Channel Tidelands and Shilshole Bay parcels are 4.4 acres and 8.3 acres, respectively (Figure 43).

Description and Use

Tidal flats are formed upon the deposition of mud by tides or rivers. This coastal landform usually occurs in sheltered areas of the coast like bays, coves, lagoons, estuaries, etc. Since most of the sedimented area of a mudflat is within the intertidal zone, the mudflat experiences submersion under water and exposure twice daily. The intertidal zone is a dynamic area and the specialized aquatic species that live there serve as food for many other animals. Substantial amounts of intertidal areas throughout the Seattle metropolitan area, including near the LWSC Project have been destroyed by development, which often changes the community structure of intertidal organisms (Lu et al. 2002). The result is damage to the trophic interactions between intertidal and offshore zones as intertidal filter-feeders play a key role in retaining offshore primary production (Ning et al. 2019). Intertidal macroalgae and the species that depend on the algae also contribute to offshore consumers through transfer from prey (Ning et al. 2019).



Figure 43. Channel Tidelands and Shilshole Bay.

Resource Objectives

- 1) Preserve the Shilshole Bay and Channel Tideland parcels for fish and wildlife use.

Rationale

The Ship Canal, which links the Lake Washington system to Puget Sound, contains many valuable but declining fisheries resources. Preservation of these lands will ensure they can remain productive for fish and wildlife. Although development of these lands is not expected, the management strategy is to preserve them in their most natural state. Public access is restricted to boat only access due to the location of these lands. Often these areas are the nursery grounds for many marine or aquatic species. Mudflats filter the water as it runs off the land and help to absorb sediment, nutrients, and pollutants and help to protect upland areas from storm surge and flooding. These areas function like sponges and buffers as the water rises and inundates the fringes of oceans, rivers, and estuaries.

Development Needs

None.

Special Considerations

There are no special considerations identified for the Channel Tidelands/Shilshole Bay parcels.

6 SPECIAL TOPICS/ISSUES/CONSIDERATIONS

USACE is authorized to regulate flow to manage the water-based activities at the LWSC Project. While the Master Plan does not address the LWSC Project's operations, having a basic understanding of the LWSC Project's operations highlights some of the limitations and challenges as it relates to the management and development of the project's lands, natural and cultural resources, and recreational activities.

6.1 WATER MANAGEMENT AND SPILLWAY OPERATIONS

In general, the spillway dam and the Locks impound water and are used to regulate the water surface upstream from Salmon Bay to Lake Washington. This includes the Fremont Cut, Lake Union, Portage Bay, Montlake Cut, Union Bay, and Lake Washington. The water is typically maintained between the elevations of 16.75 and 18.75 feet as measured at the forebay of the dam. Between these elevations, the total water storage is 46,424 acre-feet (USACE 2017). The total water surface area of Lake Washington is 23,464 acres (37 square miles) at 18.75 feet. There are four periods of seasonal reservoir operation as presented in Figure 44.

The primary uses of water are the spillway smolt slides (up to 350 cfs), saltwater drain (160 - 330 cfs), fish ladder overflow weir (23 cfs), large lock lockages (average 10 cfs per lockage), and small lock lockages (average 0.7 cfs per lockage).

Coordinated operation of the large and small locks, spillway gates, smolt slides, fish ladder, and saltwater drain system is required to manage the reservoir. This is accomplished while incorporating regional weather and hydrologic forecasts and water quality monitoring data (e.g., salinity).

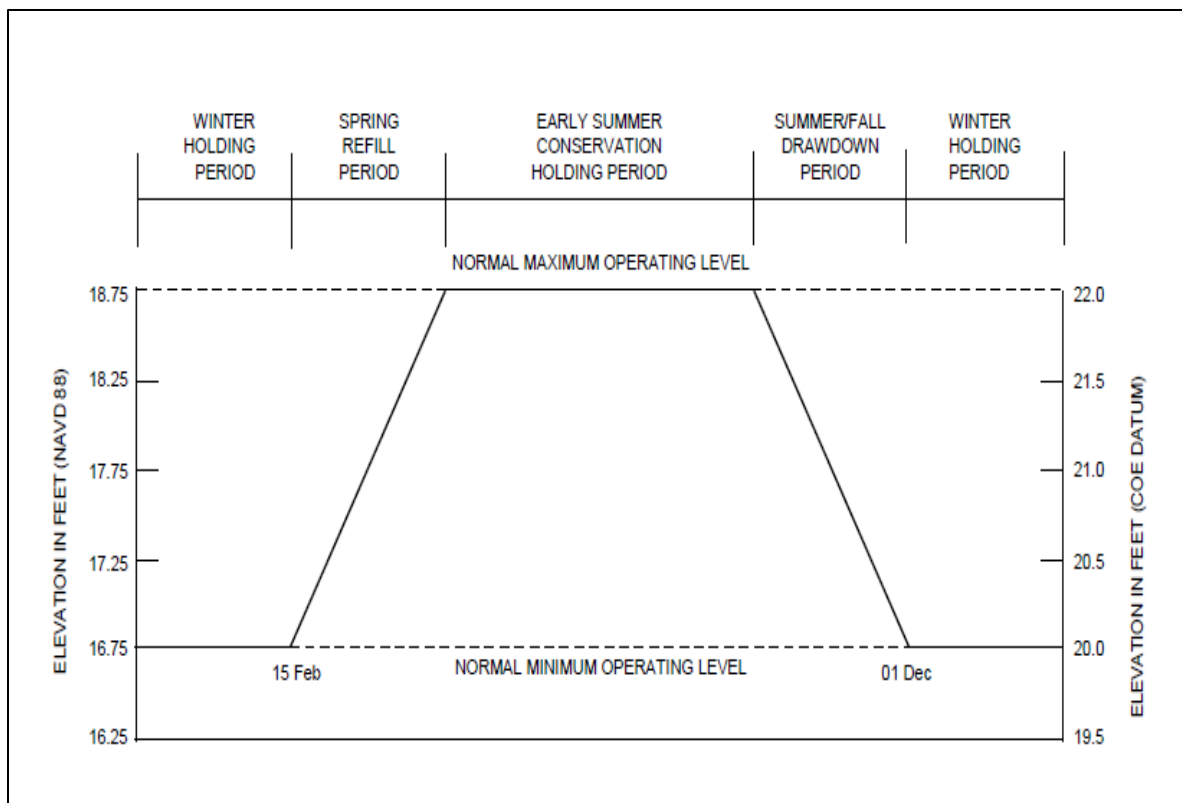


Figure 44. Normal operating guideline for the LWSC reservoir.

During dry years, the reservoir elevation can be expected to fall below 16.75 feet. USACE uses a mathematical model called the Critical Content Curve (CCC) to predict end-of-month reservoir elevations from July 1 through September 30, which, if equaled or exceeded, will ensure that at the end of September the forebay elevation will be no less than 16.75 feet 7 out of every 10 years (referred to as the historical reliability, or 70 percent reliability). The inputs to the CCC include expected or historical inflow, current forebay elevation, and expected water use over the summer. The model is used as a management tool to adjust discharge as needed to stay on or above the curve. In 2015, a period of extremely low spring and summer inflow to the reservoir, the reservoir elevation reached a low of 16.66 feet. Prior to 2015, 1987 was the last time the reservoir was below 16.75 feet. The lowest reservoir elevation in 1987 was 16.19 feet. The record low elevation was 15.09 feet in 1958.

During lockages saltwater enters the large lock along the bottom of the lock chamber. This is due to its direct connection to Puget Sound and deep bottom

elevation -28.25 feet relative to the tide. There is always some amount of saltwater in the large lock chamber. When the Lock's east miter gate opens, the saltwater moves upstream above the dam. Once upstream of the Locks, saltwater typically settles in the saltwater drain sump which is over 50 feet deep and the deepest location in the Ship Canal just upstream of the large lock.

Once upstream of the Locks, saltwater typically settles in the saltwater drain sump which is over 50 feet deep and the deepest location in the Ship Canal just upstream of the large lock. The saltwater drain removes saltwater that has collected in the sump upstream of the dam. During the late fall, winter, and spring, further saltwater migration upstream of the sump does not generally occur. This is likely due to the relatively high freshwater flow through the canal and the more limited number of lockages that occur during this period. During the summer and early fall, freshwater flow through the canal decreases significantly and the number of lockages increases due to summer recreation traffic. This combination may result in migration of saltwater farther upstream of the dam.

In accordance with the Clean Water Act, the state of Washington has established a regulatory standard of one part per thousand (ppt) salinity at the University Bridge to minimize the intrusion of saltwater upstream of the Locks. This regulatory requirement has been in place for many years and continues to be a primary management objective. The LWSC Project is managed to comply with the standard. In very dry years, there may be conflicts between minimizing the reservoir decrease below 20 feet and the one ppt regulatory standard.

In general, operations are conducted in a manner to minimize the amount of saltwater migration upstream. In addition to the saltwater return system, the primary saltwater management tool is the saltwater barrier in the large lock. The saltwater barrier is typically used during late spring through early fall to limit the migration of saline water through the large lock. It is lowered as necessary to allow deeper draft vessels passage through the lock. The barrier is typically not operated during the winter period because outflow is sufficient to slow upstream saltwater migration

USACE collects, records, and reports data that are used to operate the facility. This includes details about operations, hydrology, water quality, and fish counts. Operational data includes detail about individual lockages, spillway, smolt slides, and saltwater drain use. Hydrologic data includes water surface elevations and LWSC Project discharge. Real time water quality data including temperature, conductivity, salinity, and dissolved oxygen is collected at five locations throughout the Ship Canal. Fish counts are estimated from an electronic fish counter. Much of this data is published in real time on the USACE website.

6.2 FEDERAL TREATY OBLIGATIONS

The Federal trust responsibility to Native American Tribes arises from the treaties signed between them and the Federal Government. Under Article VI, Clause 2 of the

U.S. Constitution, treaties with the Tribes are the supreme law of the land, superior to State laws, and equal to Federal laws. In these treaties, the United States made a set of commitments in exchange for tribal lands, including the promise that the United States would protect the tribe's people. The Supreme Court has held that these commitments create a trust relationship between the United States and each treaty tribe and impose upon the government "moral obligations of the highest responsibility and trust." The scope of the Federal trust responsibility is broad and incumbent upon all Federal agencies. The government has an obligation to protect tribal land, assets, and resources that it holds in trust for the Tribes, and a responsibility to ensure that its actions do not abrogate Tribal treaty rights.

6.2.1 Executive Order 13175, Consultation and Coordination with Indian Tribal Governments

Executive Order 13175 reaffirmed the Federal government's commitment to a government-to-government relationship with Indian Tribes and directed Federal agencies to establish procedures to consult and collaborate with tribal governments when new agency regulations would have tribal implications. USACE has a government-to-government consultation policy to facilitate the interchange between decision makers to obtain mutually acceptable decisions. In accordance with this Executive Order, USACE has engaged in regular and meaningful consultation and collaboration with the Muckleshoot and Suquamish Indian Tribes who have usual and accustomed fishing rights in the LWSC Project area.

6.3 PARTNERSHIPS AND VOLUNTEERS

USACE has been extremely fortunate to have a long history of established partnerships and volunteers at the LWSC. Volunteers are the most basic and common form of partnership with members of the community donating their time and effort to support USACE recreation and environmental stewardship missions. These volunteers are essential to the continued success of the LWSC Project. Volunteers assist with developing, managing and maintaining the Fremont and Montlake Cuts, the trees and plants within the Garden, and outreach and education provided to the public. The Corps Foundation lobbies to obtain grants for improvements within the Visitor Center and the Fish Viewing Gallery. Another volunteer group, Friends of the Ballard Locks, has set up an archive room at the Locks and digitized hundreds of historical photographs that are now electronically catalogued.

It is important USACE sustain these beneficial partnerships and foster others within the local community. It is estimated the Locks generates over \$1.1 billion dollars to the local economy (Section 2.3.10). With the continued partnership program and dedicated volunteers, USACE provides recreational services that benefit the community. To continue to provide the same level of service that has been provided in the past, USACE has had to expand the partnership program. Partners contribute to the management decision-making process, as well as raise funding and solicit support for the operating project. Through the Master Plan scoping period, USACE identified a need to develop more involved partnerships. The LWSC Project is

unique in that it is located in a major metropolitan area, consistently receives high visitation and provides substantial economic benefits to the community. There are thus numerous opportunities for USACE to partner with other agencies, non-governmental organizations, community groups and industries on many levels. The partnership USACE has with the UW and city of Seattle is a good example of this. USACE partners with agencies and other non-governmental organizations conducting scientific research to sustain the local salmon populations. This could potentially be expanded.

Volunteer opportunities at the LWSC Project are abundant and varied. Many volunteers assist the gardeners with vegetation work within the Garden, the Fremont Cut, the Montlake Cut, and/or the greenhouses. Other volunteers fall under the umbrella of the Friends of the Ballard Locks and author historical articles for their on-line blog or assist with organizing the archive room. Volunteers from the Audubon Society assist in eagle and bird counts, while volunteers with Heron Helpers monitor the heron colony along the canal. Volunteers have also assisted the lock and dam operators by guiding visitors away from gates and the dam spillway to ease lock operations. These volunteers answer questions or provide knowledge of the locking process to interested guests. It is important to continue to develop volunteer opportunities as these individuals become connected to the LWSC Project and care deeply for the LWSC recreational and environmental stewardship missions.

In a time of decreasing Federal funding, America's lakes and waterways are at risk of reduced access, eliminated programs, and closures. By strengthening existing partnerships and developing additional partnerships, USACE can help maintain and improve programs and facilities and keep these resources healthy and vibrant. Several USACE partners have the authority and responsibility to manage fish and wildlife resources, and USACE collaborates with them to improve fish and wildlife habitat. Other LWSC partners focus on specific missions like monitoring herons, promoting the growing of fuchsias, or studying historical structures. Regardless of the partners various missions or interests, all partnerships require collaboration and communication to be successful. To achieve this goal, it is recommended USACE create a LWSC partnership guide for mission statements on what partners do and how they work together with USACE.

6.4 WATCHABLE WILDLIFE PROGRAM

In response to the increasing interest in wildlife viewing, the LWSC participates in the Watchable Wildlife Program. The purposes of the program are to:

- 1) Provide opportunities for people to participate in watching wildlife;
- 2) Promote learning about wildlife and wildlife habitat needs;
- 3) Enhance active support of wildlife resource conservation;
- 4) Enhance Federal and State wildlife management programs; and,
- 5) Help protect wildlife habitat.

The LWSC Project is unique in that visitors not only have opportunities to view bird and marine mammal species, but visitors can also view migrating salmon. The Garden contains many mature trees and shrubs that attract a variety of songbirds and other wildlife for visitors to view. Adjacent to the South Buffer Entryway is Commodore Park and a great blue heron colony. In 2020, the heron colony was thriving with approximately 50 nests. Union Bay and surrounding habitat, including the Ship Canal itself offers the visitor opportunities to view many species of wildlife. Immediately to the west of the Locks, visitors can watch otters, harbor seals and California sea lions hunt fish. Bald eagles are common and tend to prey upon fish and heron chicks. Sockeye salmon, the largest fish run, can typically be seen anywhere from June to October with the peak of its run in July. Chinook can be seen from July through November peaking in late August. Coho can be seen from August to November with a peak in September. Steelhead salmon may be seen between the months of mid-November and May.

Despite the urban surroundings, the LWSC Project has enough diversity of vegetative habitat to attract over a hundred species of birds (Attachment C). It is recommended that the bird list for the LWSC be updated periodically and updated with each Master Plan revision. As the Seattle area has an active chapter of the Audubon Society, this provides opportunities for the LWSC Natural Resources staff to coordinate with the society to update the bird list as well as to partner to plan bird-watching events. Often changes in bird populations indicate changes in the environment. USACE can assist the agencies that manage these species (i.e., WDFW and USFWS) by strengthening partnerships with these agencies, local birding groups and researchers to improve bird monitoring efforts. Bird boxes have been installed in the past by groups interested in conservation, such as the Boy Scouts, to improve habitat for various bird species. USACE has also partnered with the WDFW and other citizen conservation groups to provide supplemental nesting habitat for purple martins along the LWSC. Opportunities to partner with other agencies and interested groups is encouraged to continue in efforts to monitor, maintain, or replace nest boxes and gourds.

Great blue herons are found year-round throughout the Pacific Northwest, feeding along both freshwater and saltwater shorelines, including along the LWSC. In 2003, the City of Seattle passed a resolution establishing the great blue heron as the official bird for the city. Herons and other wading birds roost and nest in colonies. Great blue herons primarily roost in Commodore Park; however, in recent years a

couple of nesting pairs have roosted in the Garden. Herons forage throughout the length of the Ship Canal from Shilshole to Union Bay, giving visitors many opportunities to view the species. Opportunities exist for USACE to partner with the Heron Habitat Helpers, a dedicated non-profit group that works to educate the public about nesting birds and protect the species. The Heron Habitat Helpers monitor herons and provide this information to the WDFW.

The LWSC also offers opportunities to educate the public about living with urban wildlife and the drawbacks of feeding wildlife or disturbing marine mammals at haul out areas. Getting the message to the public could include fliers, signs, and direct conversations with visitors.

6.5 INVASIVE SPECIES

Invasive species introduced into the LWSC Project have the potential to affect the project's plant and animal communities. Human activities such as trade, travel, and tourism can often escalate the speed and volume of invasive species movement. The LWSC, with about 40,000 ships, boats, and barges passing through the Locks, and at least 800,000 people visiting each year, is the perfect venue for opportunistic invasive species. And once an invasive species is established, it can be difficult and expensive to eradicate the invader. Often an established invasive species can only be controlled and will never be eliminated. Preventing the introduction of invasive species in the first place is thus an important strategy. Implementing a pest management plan at the LWSC Project is one way this could be accomplished.

USACE Seattle District has a draft Integrated Pest Management Plan, which would be adopted and implemented at the LWSC Project once complete. An Integrated Pest Management Plan uses multiple techniques to prevent or suppress invasive species and incorporate strategies for:

- 1) Preventing the introduction of invasive species;
- 2) Early detection and rapid response once invasive species are detected;
- 3) Surveying and mapping areas where the species has invaded;
- 4) Prescribed treatment to control the invasive species;
- 5) Monitoring for treatment effectiveness;
- 6) Restoration of property damaged by the species or treatments to remove the species; and,
- 7) Education and outreach.

Many Integrated Pest Management Plans also recommend establishing community-based partnerships and relationships to improve the effectiveness and efficiency of their various pest management programs at the local, regional, and state level. Once complete, the LWSC draft Vegetation Management Plan would be adopted and implemented at the LWSC Project. It is recommended that this draft, or updated version, Vegetation Management Plan with an integrated pest management plan be

approved in FY2024 to provide USACE staff and their partners guidance in preventing, controlling, and monitoring invasive species.

6.6 PROPOSED ESA CONSERVATION MEASURES AND BMPs

On May 1, 2024, USACE submitted a supplemental biological assessment to the Services for their review and to request consultation under the ESA and Magnuson-Stevens Fishery Conservation and Management Act. USACE proposed conservation measures, which are actions to benefit or promote the recovery of listed species. As of February 2025, USACE continues to work with the Services towards formally reinitiating LWSC O&M consultation. The proposed conservation measures are outlined below. Please note, these measures are not finalized and may not reflect the conservation measures and BMPs in the final biological opinion. USACE will implement the final approved conservation measures and BMPs detailed in the final biological opinion.

Coolwater Refuge for Adult Salmonids

To maintain a coolwater refuge at the SWD sump for adult salmon, the Corps proposes to use dissolved oxygen as a trigger to conduct an east-bound lockage to refresh the water near the SWD. If three consecutive hourly dissolved oxygen readings are less than 5.0 mg/L at the deepest LLLW station adjacent to the LWSC project site, the Corps would conduct an east-bound lockage of the large lock within one hour. Lock operators may use discretion on exact timing to maximize use of lockage for vessels, although a half lockage is preferred to conserve water. For this locking, the saltwater barrier should be in the down position and, if possible, the lockage should be with vessels. Corps' Water Management would also consider effects to water supply and lake level to ensure circumstances such as drought do not compromise LWSC operations while implementing this operation. If LWSC operations are compromised by this action, the Corps would coordinate with the Services prior to discontinuing this operation.

Adult Fish Passage

The fish ladder was last updated in 1976 and presents challenges to adult salmonid passage. The entrances are narrow and at high tides less than 1-foot wide. The fish ladder deviates from hydraulic criteria established for the 1976 fish ladder reconfiguration when the forebay elevations are outside of 18.5 feet (5.6 m; 15.25 ft NAVD88) to 22 feet (6.7 m; 18.75 ft NAVD88) and Puget Sound tidal elevations are below -0.5 feet or above 12 feet MLLW (-0.2 and 3.7 m; 0.41 and 12.91 ft COE datum). Two water sources, one from the forebay surface and one from the saltwater drain, means salmonids experience a shift in temperature (from cold to warm) at the midpoint of the ladder. In addition, seals can enter the fish ladder. The Corps plans to continue coordination with the Services, Muckleshoot Indian Tribe, and Suquamish Tribe on these issues for potential new operational or structural solutions while meeting other authorized purposes, pending funding and feasibility.

Juvenile Fish Passage

Smolt slides provide surface-oriented passage for juvenile anadromous salmonids past the dam during the outmigration period while conserving water. Up to two smaller smolt slides would increase water management tools to help maintain seasonal water elevations and facilitate project operations such as navigation, saltwater control, and fish ladder use that require water. A small, four-foot wide smolt slide installed previously did not fit the spillway and became structurally unstable after use. One or two smaller smolt slides would replace this ill-fitting slide. In addition, Lisi (2019 and 2021) noted that greater smolt passage appeared to be associated with more smolt slides in operation, although they acknowledge the trend could be due to detection efficiency, lower survival during migration through Lake Washington, or both. Therefore, as feasible, the Corps will design and implement use of up to two additional smolt slides (four-ft wide) to supplement the two six-foot slides.

Pinniped Monitoring and Management

The Corps will continue to provide the Lake Washington Fisheries Co-Manager personnel with access to the Locks and fish ladder, as appropriate, to support seal and sea lion predation management. When practicable, funded, and according to Corps policy, the Corps will provide monitoring and operational support, according to Federal and State guidance, to fish and wildlife co-management personnel during pinniped dissuasion and/or removal operations.

Avian Predation Deterrence Operations

The Corps will continue to implement and improve, as needed, passive avian predator deterrent measures (i.e., spillway netting and sprinklers at the west end of the large lock) at the LWSC to reduce avian predation on juvenile salmonids.

Coordination and Collaboration with NMFS and USFWS

The Corps proposes to hold an annual meeting with the Services to discuss implementation of planned O&M activities described in the proposed action.

Best Management Practices

These practices are generally applicable to routine operation and maintenance activities performed by USACE and are applied as appropriate for each activity at the LWSC.

- Schedule in-water work for October 15 through February 15 to avoid migrating salmon.
- Barnacle scraping in the large lock annually. For large lock dewatering, conduct fish crowding prior dewatering and a fish rescue.
- Install smolt slides by mid-April and run at least through July 31.
- USACE Water Management determines if sufficient water is available to operate smolt slides for more time (before or after the mid-April through July

timeframe), given other operational requirements at the LWSC without compromising other O&M activities,

- Operate the large lock valves to target average velocities in the lateral culverts of four feet per second (fps) or less during juvenile fish passage season March 15-August 15.
- Visually inspect the fish ladder daily to ensure proper function.
- Continue to deploy and maintain water quality stations along the LWSC.
- Avoid using the old saltwater drain while adult salmon are migrating unless necessary to maintain salinity requirements. If necessary, the old drain is used at tides of +6 MLLW or lower during the day and at +7 MLLW or lower at night.
- When applying herbicides, pesticides, insecticides, or fungicides, gardeners avoid contact with foliage, green stems or fruit of desirable plants and trees, avoid direct application to any body of water. USACE gardeners do not spray if wind speed is greater than five miles per hour.

Activity-Specific BMPs

These practices are generally grouped together by similarity of activities for readability, but will be implemented, as appropriate, on a task-specific basis as specific operation and maintenance work occurs, and their application is tailored for the individual task.

Concrete Work and Painting

- Ensure no walkway materials enter adjacent water, contain debris and cuttings, and following a spill prevention plan.
- Sandblasting will be contained with a bristle device that vacuums up debris as paint is removed, or with a plastic tent around the work site to prevent material from entering the air or water. Other methods of paint removal (e.g., scraping) may also be used and paint will be contained.
- Concrete shall be cured for at least seven days prior to contact with water to prevent leaching. Uncured concrete will not be allowed to come into contact with surface waters.

Bulkhead and Rip-Rap Maintenance

- Water that becomes isolated from the main channel during construction, such as by a cofferdam or during construction of a new wall waterward of the existing alignment, will be inspected by a biologist and fish removed.
- If water is pumped from behind a cofferdam or wall during construction, pumps will be screened according to current NMFS guidelines to exclude fish.
- Any imported material (e.g., ballast, armoring rock, gravel) will be clean/washed and commercially obtained from an approved source.
- Heavy equipment will be operated from the uplands or from a barge during construction. If a construction barge is used, it will not ground or rest on the substrate at any time.

Spill Prevention and Control

Contractors are typically required to submit a spill prevention control and countermeasures (SPCC) plan to the Corps prior to the commencement of any construction activities at the LWSC. The SPCC plan will identify and recognize potential spill sources at the site, outline BMPs and secondary containment, delineate responsive actions in the event of a spill or release, and include notification and reporting procedures. Implementation of the SPCC plan will minimize the effect of construction activities on the quality of surrounding waters including, but not limited to, the following measures:

- A spill containment kit, including oil-absorbent materials will be kept on-site during construction and will be deployed for any spill or if any oil product is observed in the water. The contractor must be trained in its use. If a spill were to occur, work will be stopped immediately, steps will be taken to contain the material, and appropriate agency notifications will be made.
- Secondary containment will be used for all equipment on land and on boats or barges. This includes mechanical equipment, hydraulic equipment, and concrete or grout pumping or mixing equipment.
- Fuel hoses, oil drums, oil or fuel transfer valves, and fittings will be checked regularly for leaks.
- The Corps and contractors will maintain and store materials properly on site to prevent spills.
- Equipment that enters surface waters will be maintained to prevent any visible sheen from petroleum products appearing on the water.
- A federal contractor will check all equipment for leaks and spills, including hoses, hose clamps, drums, secondary containment berms, pans, and other containment, transfer valves, fittings, forms, grout bags, etc., and will maintain and store materials properly to prevent spills.
- Equipment will be cleaned prior to construction so that it is free of external petroleum-based products while used around the waters of the state. Accumulation of soils or debris will be removed from the drive mechanisms (wheels, tires, tracks, etc.) and the undercarriage of equipment prior to its use.
- There will be no discharge of oil, fuels, or chemicals to surface waters, or onto land where there is a potential for reentry into surface waters.
- Environmentally-friendly fuel, oils, and grease oil will be used in machinery stationed on a boat or barge, unless not feasible and coordinated with the Corps.
- Refueling of equipment such as generators and forklifts will not occur in the project area (i.e., the lock chamber) and spill containment trays will be used during refueling. Vessels will be refueled offsite in accordance with applicable regulations.
- The contractor will prevent any petroleum products, chemicals, or other toxic or deleterious materials from construction equipment and vehicles from entering the water.

- Wash water resulting from wash down of heavy equipment or work areas will be contained for proper disposal, and shall not be discharged into state waters unless authorized through a state discharge permit.
- No cleaning solvents or chemicals used for tools or equipment cleaning will be discharged to ground or surface waters.

Contractors are typically required to submit a stormwater pollution prevention plan (SWPPP) prior to construction using BMPs to control stormwater impacts during construction.

- In the event of a discharge of oil, fuel, or chemicals into state waters, or onto land with a potential for entry into state waters, containment and cleanup efforts shall begin immediately and be completed as soon as possible, taking precedence over normal work. Cleanup shall include proper disposal of any spilled material and used cleanup materials.
- Work causing distressed or dying fish, discharges of oil, fuel, or chemicals into state waters or onto land with a potential for entry into state waters, is prohibited. If such work, conditions, or discharges occur, the contractor shall notify the Corps and immediately take the following actions:
 - Cease operations at the location of the non-compliance.
 - Assess the cause of the water quality problem and take appropriate measures to correct the problem and/or prevent further environmental damage.
- Concrete washout on-site will not be allowed to enter water, be dumped on land, and will not be within 50 feet of storm drains, open ditches, or water bodies. Washout will be contained in leak-proof containers for proper recycling, treatment, and/or disposal. If washout is disposed of at a municipal wastewater treatment plant, the plant will be contacted by the contractor so that any pretreatment requirements can be followed. Concrete process water and waste materials will be captured and contained by the contractor. Discharge of concrete process water or waste materials to the ground or surface waters is not allowed.

Waste Materials

- During construction, a contractor will retrieve any debris generated during construction with a skiff and net. Retrieval will occur at slack tide or when current velocity is low.
- Containment will be used for debris pulled out of the water, so no material or turbid water returns to the water.

Lighting During Construction

- Construction often occurs during daylight hours. If work occurs at night, then lighting for safety of workers will be required. Directional lighting will be used to focus light on the work area to conduct the work safely and minimize illuminating surrounding areas.

7 AGENCY AND PUBLIC COORDINATION

In early 2020, USACE prepared a Public Involvement Plan that outlined strategies to inform interested parties about the Master Plan purpose and process, and to provide opportunities for meaningful comments. With consideration of the COVID-19 public health crises, USACE solicited public comment on the Master Plan using a social media platform. On May 29, 2020, USACE issued a press release engaging media and community forums, LWSC Project Partners, and Tribes to solicit comments on the Master Plan. The scoping period lasted for two months ending on July 30, 2020. A total of 22 individuals and three non-governmental organizations provided comments that are summarized in Attachment F. Also provided in Attachment F are USACE responses to those comments.

Several suggestions received from the public like generating power or changing how the Locks operate are beyond the scope of the LWSC Master Plan (EP 1130-2-550). The Master Plan is a land-use management document that guides efficient and cost-effective management, development, and use of the LWSC Project lands and does not address the specifics of regional water quality, shoreline management (ER 1130-2-406), or water-level management. Still, USACE values feedback from the public on these topics and comments will be considered in appropriate future project planning and implementation efforts.

Overall, most of the comments received spoke to the need of providing both pedestrian and bicycle access. The public also expressed concern that the Locks and access across the grounds could be closed to the public due to an emergency like an earthquake, or for safety reasons. Suggestions were made to increase the hours of access, especially during the summer months and for commuters. Commenters said that access through the LWSC was not only for recreation but was also an essential component for commuters within the city. Commenters suggested constructing a separate crossing over the Locks for commuter traffic. While the LWSC Project allows public access to recreate on its lands, its authorized purpose is navigation and recreation. Public access is allowed so the public can recreate by viewing the operations of the Locks, fish passage and Garden, as well as enjoy the space, and learn about the history of the project. New authority would need to be provided by Congress for the LWSC Project to administer, operate, and manage commuters across the Locks and grounds.

Commenters also felt having bicycles and skateboards on the same pathways as pedestrians was dangerous and suggested separating the pathways. Other commenters suggested banning bicycles from the Garden loop roadway. For safety reasons, USACE requires all visitors to dismount from their bicycles or skateboards while touring the Locks site. As discussed in Section 5.1.5, providing more bicycle racks for visitors may assist in reducing the issue of visitors remounting their bicycles while touring the Locks and Garden.

8 SUMMARY OF RECOMMENDATIONS

8.1 CHANGE IN LAND CLASSIFICATIONS

Land classifications for most of the LWSC Project lands has not changed since the 1994 LWSC Master Plan. However, in 2013, the guidance provided in EP 1130-2-550 for the management of recreation programs and activities and for the O&M of USACE recreation facilities was updated. In addition, changes occurred to the land classification definitions. Consequently, three management areas in the LWSC Project have changed land classifications as presented in Table 12. The most notable change is the allocation of the Garden from MRM - Vegetative Management Area to Environmentally Sensitive Area and classifying the Garden lawn areas as MRM - Low Density Recreation.

Table 12. Proposed LWSC land classification changes between the 1994 and 2021 Master Plans.

Site	1994 Master Plan	2025 Master Plan
Lock Walls and Spillway Dam Walkway	Project Operations	Project Operations and High Density Recreation
Fish Viewing Gallery	Recreation	High Density Recreation
South Entryway Buffer Zone	MRM - Vegetative Management	Environmentally Sensitive Area (vegetative areas) and MRM – High Density Recreation (turf area)
Carl S. English Jr. Garden	MRM - Vegetative Management	Environmentally Sensitive Area (Garden)
Carl S. English Jr. Garden Lawn Areas	MRM - Vegetative Management	MRM - Low Density Recreation
Carl S. English Jr. Garden Loop Road	Recreation	MRM - Low Density Recreation
Fremont Cut	MRM – Low Density Recreation	Project Operations assigned to armor walls along the Montlake Cut shorelines
Montlake Cut	Easement Lands	Project Operations assigned to armor walls along the Montlake Cut shorelines

8.2 BOUNDARY SURVEYS AND MONUMENTATION

There is a need to verify boundary surveys and marking of Federal property (signs and/or fencing) and reestablish markings if necessary. This is an ongoing effort because over time markers become missing due to a variety of reasons (i.e., paved over, stolen, moved). USACE verifies boundaries and marks Federal lands when funding becomes available. This effort aids managers and informs visitors where specific activities are acceptable and helps prevent unauthorized access.

8.3 NATIONAL HISTORICAL DISTRICT

The LWSC is a National Historic District and is listed on the National Register of Historic Places. Any undertaking that may have an effect on the National Historic District as a whole or to any of the contributing and noncontributing elements is to be reviewed by USACE cultural resources staff. USACE cultural resources staff determine whether the proposed undertaking falls within any of the stipulations in the PA, and whether the proposed undertaking needs to be consulted on under Section 106 of the NHPA.

In 1994, the HPMP was developed for the LWSC and is being updated along with this Master Plan. The HPMP provides guidance for the management of cultural resources as well as further guidance for the management and care of the Garden. The HPMP includes the following information:

- Information about the National Historic District at the LWSC including which elements the Seattle District considers to be contributing and not contributing to the Historic District.
- Background information on the project area prior to the LWSC.
- Previous cultural resources work conducted at the project.
- Management of the Historic District and overall cultural resources at the project.
- Information on actions needed to identify, evaluate, and manage historic properties.

The following activities are recommended:

- 1) Period Cultural Resources Training for both new and existing USACE staff at the LWSC whose job may require them to work near and/or around cultural resources (i.e., Natural Resources Staff, Recreation Staff, and Maintenance Staff);
- 2) Continue the HPMP activities and partnerships as described above;
- 3) Ongoing consultation efforts with the Washington SHPO on projects that do not fall under the PA;
- 4) Updating the PA;

- 5) Updating the National Register Nomination;
- 6) Review current Memorandum of Agreements (Section 2.3.8) that USACE has with the Washington SHPO and determine if there are mitigation measures requiring implementation; and,
- 7) Continuing current public outreach and planning for new public outreach as necessary.

8.4 EDUCATION AND OUTREACH

Comments received from the public during the Master Plan scoping effort and suggestions from USACE LWSC Rangers identified a need to update the LWSC Project education and outreach materials. The following are a list of suggested improvements:

- 1) Update all base maps for all LWSC Project areas, including the Garden, South Entryway Buffer Zone, Montlake Cut, and Fremont Cut. These updated maps need to include layers of surveyed planting bed outlines and maintenance infrastructure like the irrigation system and hose bibs, electrical and fiber optic lines, light poles, and location of fire hydrants;
- 2) Develop an Education/Outreach Interpretive Plan regarding the historic elements at the LWSC Project;
- 3) Update public webpage with current information about the Garden, such as a plant list and a note of what is in bloom at certain times of the year. A link to the 2010 audio podcast needs to be added to the webpage;
- 4) Update or create a new audio podcast regarding the history of the LWSC, updates regarding fish passage, Tribal history, and Garden information;
- 5) Post or display events and LWSC Project activities at all entryways;
- 6) Develop interpretive signs about the heron colony;
- 7) Upgrade all touchscreen outreach kiosks with LWSC Project map, to provide information about the structures, plants (i.e., what's in bloom), history of buildings, and bronze plaques;
- 8) Add graffiti resistant interpretive signage at the Montlake Cut fishing pier about LWSC Project history, UW Opening Day, and fish and wildlife; and,
- 9) Inventory, store and/or properly display historical artifacts that meet USACE standards.
- 10) Maintain and create partnerships with agencies and non-governmental organizations conducting scientific research, such as for fish or wildlife conservation.

8.5 LANDS ACTIVELY MANAGEMENT BY USACE

8.5.1 Routine and Small-scale Actions

Table 13 lists several small-scale actions that are recommended as development needs under this Master Plan. In addition, USACE staff identified future improvements that are also included but are not limited to the items listed in Table 13. The development needs outlined in Table 13 are those that are considered to meet the conditions and standards established under the PA (Attachment D) and so a formal Section 106 consultation under NHPA would most likely not be required. This list is subject to change as new concerns arise, management priorities change, or new guidance is provided by USACE Headquarters. Depending on the scope of any proposed project, additional coordination under NEPA, NHPA, or ESA may be required.

Table 13. List of proposed projects at the LWSC organized by management area that are considered to meet the conditions and standards established under the PA.

LWSC Management Area	Sub-Area	Item No.	Proposed Projects
Hiram M. Chittenden Locks Site	Locks, Spillway Dam, Piers, Operating Houses	1	Update the public announcement system to better direct boat traffic and pedestrians
		2	Refurbish the pier surfaces so they are safer to cross in winter weather
	Lock Walls and Spillway Dam Walkway	1	Update and install reader boards to better direct the visitors across the spillway dam
	South Entryway Buffer Zone	1	Install signage to better direct visitors to avoid certain areas to protect them from a 15-foot drop
		2	Update comfort station to be ADA compliant and more user-friendly
		3	Install interpretive signs about the breeding heron colony
	South and North Entry Areas and the Formal Promenade	1	Upgrade the entryway gates and/or counting methods to obtain accurate visitation counts
		2	Replace wooden stairs in the Cove area

LWSC Management Area	Sub-Area	Item No.	Proposed Projects
		3	Install signage regarding calendar of events, and Lock updates at all entrances
		4	Install exhibits beside the walkways throughout the promenade with historic property elements to the Garden and Historic District
	Operations, Maintenance and Administrative Area	1	Restore Administration Building's pump plant floor, entryway, and rust proof all walls and structures
		2	Water-seal all concrete buildings
		3	Repaint all warehouses and buildings
		4	Restore the woodwork on the door entryway of the Administration Building
		5	Upgrade the air circulation system in Warehouse No. 1
		6	Upgrade the technology in the Warehouse No. 1 conference room
		7	Install interpretive signage about the historic elements and architect posted on the outside of each facility
	Visitor Center and Public Comfort Stations	1	Upgrade all comfort stations with sensor lighting, automatic doors, sinks with water on sensors, and automatic air dryers to reduce touch points
		2	Ensure all comfort stations are ADA compliant
		3	Install baby changing tables in male and female restrooms
	Carl S. English Jr. Garden and the Loop Road	1	Replace creosote logs with rock or concrete logs
		2	Replace wood archway at west end of gravel path
		3	Replace and/or repair any damaged concrete with stone pavers
		4	Replace large trees that were removed near Warehouse No. 2
		5	Replace the irrigation and water systems and lines through the project

LWSC Management Area	Sub-Area	Item No.	Proposed Projects
Fremont Cut		1	Install educational kiosks on noxious and invasive weeds
		2	Install educational kiosks on the Lombardy Popular Colonnade
Montlake Cut		1	Level and restore the grass turf areas
		2	Remove hazard trees
General/Project Wide		1	Treat concrete surfaces and walkways with safety coating
		2	Upgrade/Install area lights and security cameras (note: Northeast of the Garden and the South Entryway)
		3	Replace damaged fences, and vandalism proof-fences
		4	Replace and/or repair damaged sidewalks/concrete or paved surfaces throughout the project
		5	Replace and/or repair roadways, parking lots and yard space
		6	Repair and replace utility lines and poles in their present configuration and alignments
		7	Comprehensive rehabilitation of electrical system site-wide
		8	Maintenance (i.e., mow, weed, fertilize, patch holes, replace underperforming or dead/dying plants) of existing vegetative areas
		9	Finalize a Project-wide Vegetation Management Plan with an integrated pest management plan.

8.5.2 Best Management Practices

Following are best management practices that are recommended to reduce impacts on the environment while implementing routine and small-scale actions:

- The use of dust suppression methods to minimize airborne particulate matter that would be created during any ground disturbing activities. All equipment

and vehicles would be required to be kept in good operating condition to minimize exhaust emissions. Standard practices, such as soil watering, keeping storage piles covered when not in use, limiting dusty work on windy days or times of day would be used to control fugitive dust during the construction phase and during daily operations and maintenance of the proposed project.

- To avoid or minimize impacts to noise, all equipment and vehicles would have properly working mufflers and be kept in a proper state of tune to reduce backfires.
- Clearing and grubbing would be timed with construction to minimize the exposure of cleared surfaces. Such activities would not be conducted during periods of wet weather or during the bird nesting period (April 15-July 31). Construction activities would be staged to allow for the stabilization of disturbed soils.
- Soil erosion-control measures, such as soil erosion-control mats, silt fences, straw bales, would be used as appropriate.
- Provisions would be taken to prevent pollutants from reaching the soil, groundwater, or surface water. During project activities, staff and/or contractors would be required to perform daily inspections of equipment, maintain appropriate spill-containment materials on site, and store all fuels and other materials in appropriate containers. Equipment maintenance activities would not be conducted on the construction site.
- Physical barriers and "no trespassing" signs would be placed around any excavation and/or construction sites to deter children and unauthorized personnel. All construction vehicles and equipment would be locked or otherwise secured when not in use.
- Schedule any excavation or construction near the Ship Canal during times when less fish migration occurs (October 15-February 15).
- Minimize work adjacent to water to the greatest extent practicable (e.g., performing work at low tide or when a structure such as a lock or fish ladder is dewatered).
- All staff and/or contractors are to follow a spill prevention plan.
- Equipment must always have a five-gallon capacity spill kit on board when working near water, and personnel must be trained in the use of the emergency equipment.
- Ensure no construction materials enter adjacent water by containing debris and cuttings.
- Keep work areas isolated from flowing or open water to keep sediment from entering flowing or open water.
- All construction impacts must be confined to the minimum area necessary to complete the project and boundaries of clearing limits associated with site

access and construction will be clearly marked to avoid or minimize disturbance of riparian vegetation and other sensitive sites.

- Integrated Pest Management methods be applied to vegetation and pest management activities, including biological controls, cultural controls, chemical controls and mechanical controls to reduce environmental impacts when appropriate.

In addition, EPA (Region 10) Pesticide General Permit best management practices would be implemented when applying pesticides as follows:

- Do not apply when it is raining or when there is a 75 percent or greater possibility of rain forecast for the 24-hour period after an application has ended. Check the following website: www.noaa.gov for detailed weather forecasts.
- Use the lowest application rate to effectively control the species.
- Treat the minimum area necessary to effectively control the species.
- Do not apply with the spray nozzle aimed towards water.
- Do not spray when wind is blowing towards water.
- Do not spray when wind gusts exceed five miles per hour.
- Use a non-hazardous indicator dye to prevent duplicative treatment of an area.
- Spot spray using the lowest pressure and largest droplet feasible to effectively make the application without having the product run off from the plant to the ground.
- Calibrate spray equipment to ensure proper application rates.
- Drafting equipment for filling spray tanks must be equipped with back siphoning prevention devices.
- Equipment used for transportation, storage or application of chemicals should be maintained in a leak proof condition.
- Do not mix chemicals within 100 feet of surface water unless using a secondary containment system.
- Do not clean equipment within 100 feet of surface water.
- Store only the amount of pesticides needed for anticipated daily use in vehicles parked within 100 feet of surface water.
- When feasible:
 - Direct inject (e.g., basal stem treatment) or use hand application methods instead of machine applications;
 - Prioritize weed species within the waters of the U.S. in regard to treatment;

- Find and eradicate new and invasive weed species as soon as possible; and,
- Utilize biological control agents if approved, available and effective on target species.

8.6 CONCLUSION

It is recommended that USACE management, both at the LWSC Project and at the District Headquarters, continue coordination with stakeholders after the finalization of this Master Plan. Meetings offer information exchange and present challenges and needs. USACE staff and attendees should work together to identify issues, prioritize them, and seek ways to resolve.

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10 ATTACHMENTS

- (A) Understanding Datums at the Lake Washington Ship Canal Project
- (B) List National Environmental Policy Act Documents and Studies
- (C) List of Bird Species at the LWSC Project
- (D) Historic Property Management Plan
- (E) Visitor Use Surveys at the LWSC Project
- (F) Public Scoping and Comment Responses for Master Plan