Attachment 10
Wetlands Discipline Report

CAPITOL LAKE – DESCHUTES ESTUARY

Long-Term Management Project Environmental Impact Statement

Wetlands Discipline Report

Prepared for:

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Executive Summary

Long-term management strategies and actions are needed to address issues in the Capitol Lake – Deschutes Estuary project area. An Environmental Impact Statement (EIS) is being prepared to document the potential environmental impacts of various alternatives and determine how these alternatives meet the long-term management objectives identified for the watershed. This report was originally prepared to support the project's Draft EIS, and has been revised for the Final EIS. In general, revisions have been made to provide additional information, update and expand analyses and findings, refine measures to mitigate potentially significant impacts, and correct inadvertent errors. Notable substantive revisions in the Wetlands Discipline Report are as follows:

- The types of wetland impacts considered in the analysis were clarified in the Methodology section.
- The significance criteria used in the analysis were clarified in the Methodology section.
- The analysis was updated to reflect changes to the Estuary and Hybrid Alternatives to avoid long-term closure of the 5th Avenue Bridge.
- The approximate areas of wetland fill and shade impacts were clarified, or recalculated.
- The characterization of wetland changes under the Hybrid Alternative was updated to reflect the change from a saltwater pool to a groundwater-fed, freshwater pool.

This Wetlands Discipline Report addresses wetlands and the potential changes in wetlands as a result of the Capitol Lake – Deschutes Estuary Long-Term Management Project. The analysis examines the No Action Alternative, as well as three action alternatives (Managed Lake, Estuary, and Hybrid). For purposes of this report and the analysis, the term "wetland" encompasses five broad groups to enable characterization of all the freshwater and estuarine habitats present in the Capitol Lake Basin and the West Bay of Budd Inlet. The groups are:

- Vegetated wetlands – freshwater
- Vegetated wetlands – estuarine
- Deepwater habitats – freshwater (i.e., Capitol Lake)

- Deepwater habitats – estuarine (i.e., West Bay)
- Mudflats (also called "tideflats")

Wetlands are important resources that perform vital ecological functions, including hydrologic, water quality, and habitat functions. Impacts from project alternatives are assessed based on the potential changes to the areas of wetland habitats as well as changes in wetland functions.

The No Action Alternative would not implement sediment management strategies, and the Capitol Lake Basin would continue to accumulate sediment. Wetlands would gradually transition from deepwater habitat – freshwater, to emergent, scrub-shrub, and forested vegetated wetlands, but full transition to these vegetation wetland types would extend beyond the 30-year time horizon for the project. Overall, there would be a net gain in wetland function, providing a **minor beneficial effect**.

Under all action alternatives, with implementation of mitigation measures, impacts to existing wetlands from construction would be avoided or minimized; thus, impacts would be **less-than-significant**.

Under the Managed Lake Alternative, Capitol Lake would remain a freshwater system. The North Basin would be dredged to maintain the historic reflecting pool, which was created in 1951 following the construction of the 5th Avenue Dam, and would remain deepwater habitat. Habitat areas would be created in the Middle Basin, and the Middle and South Basins would transition from deepwater habitat to vegetated wetlands, similar to the No Action Alternative. Similar to the No Action Alternative, there would be a net gain in wetland functions, providing a **minor beneficial effect**.

The removal of the 5th Avenue Dam with the Estuary and Hybrid Alternatives would restore saltwater and tidal influences to the Capitol Lake Basin, and it would convert to an estuarine system similar to historic conditions. Estuarine wetlands provide additional functions that are not available in freshwater deepwater habitats. Compared to freshwater deepwater habitats, estuarine wetlands have been disproportionately affected by past development practices and are considered to be a relatively scarce resource in the Puget Sound region. For these reasons, the Estuary and Hybrid Alternatives would have **substantial beneficial effects**. The reflecting pool in the Hybrid Alternative would be a constructed deepwater habitat and thus the extent of beneficial effects, although still substantial, would be less than with the Estuary Alternative.

Under all action alternatives habitat areas would be constructed using dredge spoils from initial dredging to create greater habitat complexity. The habitat areas would include different elevations to support a diversity of wetland plant communities -emergent, scrub shrub, and forested as well as some upland conditions. The design of habitat areas would be refined in the design phase for the selected alternative to maximize wetland habitat area and complexity.

All of the action alternatives would include boardwalks along the shorelines in the Middle and South Basins, a boat launch, and a dock. These overwater structures would result in similar areas of shade and fill within wetlands, across the alternatives. Impacts would be primarily to freshwater deepwater habitats under the Managed Lake and to estuarine deepwater habitats or mudflats under the Estuary or

Hybrid Alternative. The removal of the 5th Avenue Dam under the Estuary and Hybrid Alternatives would remove an area of approximately 3 acres of fill from deepwater habitats. The Hybrid Alternative would have approximately 50,300 square feet more fill than the Estuary Alternative because of the construction of a barrier wall for the reflecting pool. However, with the removal of the 5th Avenue Dam and creation of the habitat areas using dredged materials, both the Estuary and Hybrid Alternatives would still result in a net gain in wetland area and function.

Mitigation for the loss of a water of the U.S. would be required if an action alternative has impacts that cannot be fully avoided or offset through design of habitat features or implementation of the Habitat Enhancement Plan. For the selected alternative, the design would be refined to minimize the wetland loss and maximize habitat benefits. Mitigation for unavoidable direct and indirect impacts on wetlands would be compensated for at ratios determined by the permitting agencies, if necessary. Mitigation could include replacing existing wetlands in-kind onsite, or offsite if replacement cannot be supported within the project area. With consideration of improved habitat functions and self-mitigating functions of the alternatives, the need for compensatory mitigation may be reduced to zero. With habitat features included in the action alternatives, and additional mitigation, if required by regulatory agencies, direct impacts from fill and indirect impacts from shade under all action alternatives would be **less-than-significant**.

Construction and operation impacts of the No Action and action alternatives are summarized in Tables ES.1 and ES.2.

Table ES.1 Summary of Construction Impacts and Mitigation Measures

	Impact Finding	Minimization and Other Mitigation Measures	Significant and Unavoidable Adverse Impact
Managed Lake Alternative			
Short-term impacts on wetland area and/or function during construction	Less-than-significant	BMPs[1] and other measures to avoid and minimize impacts in Section 5.7	No
Estuary Alternative			
Short-term impacts on wetland area and/or function during construction	Less-than-significant	BMPs and other measures to avoid and minimize impacts in Section 5.7	No
Hybrid Alternative			
Short-term impacts on wetland area and/or function during construction	Less-than-significant	BMPs and other measures to avoid and minimize impacts in Section 5.7	No

[1]BMPs = best management practices.

Table ES.2 Summary of Operations Impacts (including Benefits) and Mitigation Measures

	Impact Finding	Minimization and Other Mitigation Measures	Significant and Unavoidable Adverse Impact
No Action Alternative			
Improved hydrologic, water quality, and habitat functions over time as the system transitions into a more diverse complex of freshwater wetlands.	Minor Beneficial Effect	N/A	N/A
Managed Lake Alternative			
Impacts on wetland area and/or function from direct impacts from fill and indirect impacts from shade. No net loss of waters of the U.S. or state are anticipated from structures proposed as part of this alternative.	Less-than-significant	BMPs[1] and other measures to avoid and minimize impacts in Section 5.7	No
Improved hydrologic, water quality, and habitat functions with the construction of habitat areas and transition of the North and Middle Basins to a greater complexity of vegetated wetland types.	Minor Beneficial Effect	N/A	N/A
Estuary Alternative			
Impacts on wetland area and/or function from direct impacts from fill and indirect impacts shade. No net loss of waters of the U.S. or state is anticipated from structures proposed as part of this alternative.	Less-than-significant	BMPs and other measures to avoid and minimize impacts in Section 5.7	No
Improved hydrologic, water quality, and habitat functions given the re-establishment of an estuarine system, construction of habitat areas, and establishment of high-value estuarine wetlands.	**Substantial Beneficial Effect**	N/A	N/A

	Impact Finding	Minimization and Other Mitigation Measures	Significant and Unavoidable Adverse Impact
Hybrid Alternative			
Impacts on wetland area and/or function from direct impacts and from fill and indirect impacts from shade. No net loss of waters of the U.S. or state is anticipated from structures proposed as part of this alternative.	Less-than-significant	BMPs and other measures to avoid and minimize impacts in Section 5.7	No
Improved hydrologic, water quality, and habitat functions given the re-establishment of an estuarine system, and construction of habitat areas.	**Substantial Beneficial Effect**	N/A	N/A

[1]BMPs = best management practices.

Table of Contents

Exhibits

Tables

Figures

List of Acronyms and Abbreviations

Acronyms/ Abbreviations	Definition
BMPs	Best Management Practices
CAO	Critical Areas Ordinance
CFR	Code of Federal Regulations
Corps	U.S. Army Corps of Engineers
CWA	Clean Water Act
cy	cubic yard(s)
DNR	Washington Department of Natural Resources
Ecology	Washington Department of Ecology
EIS	Environmental Impact Statement
Enterprise Services	Washington State Department of Enterprise Services
ESA	Environmental Science Associates
GIS	geographic information system
GMA	Growth Management Act
HPA	Hydraulic Project Approval
LiDAR	Light Detection and Ranging
MSL	mean sea level
NWI	National Wetlands Inventory
OMC	City of Olympia Municipal Code
PAB	Palustrine Aquatic Bed
PEM	Palustrine Emergent
PFO	Palustrine Forested
PHS	Priority Habitats and Species
ppt	parts per thousand
PSNERP	Puget Sound Nearshore Ecosystem Restoration Project
PSS	Palustrine Scrub-Shrub
RCW	Revised Code of Washington
RSLR	relative sea level rise
SEPA	State Environmental Policy Act
SF	square feet
SMA	Shoreline Management Act

SMP	Shoreline Master Program
TMC	City of Tumwater Municipal Code
TRPC	Thurston Regional Planning Council
USFWS	U.S. Fish and Wildlife Service
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife

1.0 Introduction and Project Description

1.1 PROJECT DESCRIPTION

The Capitol Lake – Deschutes Estuary includes the 260-acre Capitol Lake Basin, located on the Washington State Capitol Campus, in Olympia, Washington. The waterbody has long been a valued community amenity. Capitol Lake was formed in 1951 following construction of a dam and provided an important recreational resource. Historically, the Deschutes Estuary was used by local tribes for subsistence and ceremonial purposes. Today, the expansive waterbody is closed to active public use. There are a number of environmental issues including the presence of invasive species, exceedances of water quality standards, and inadequate sediment management.

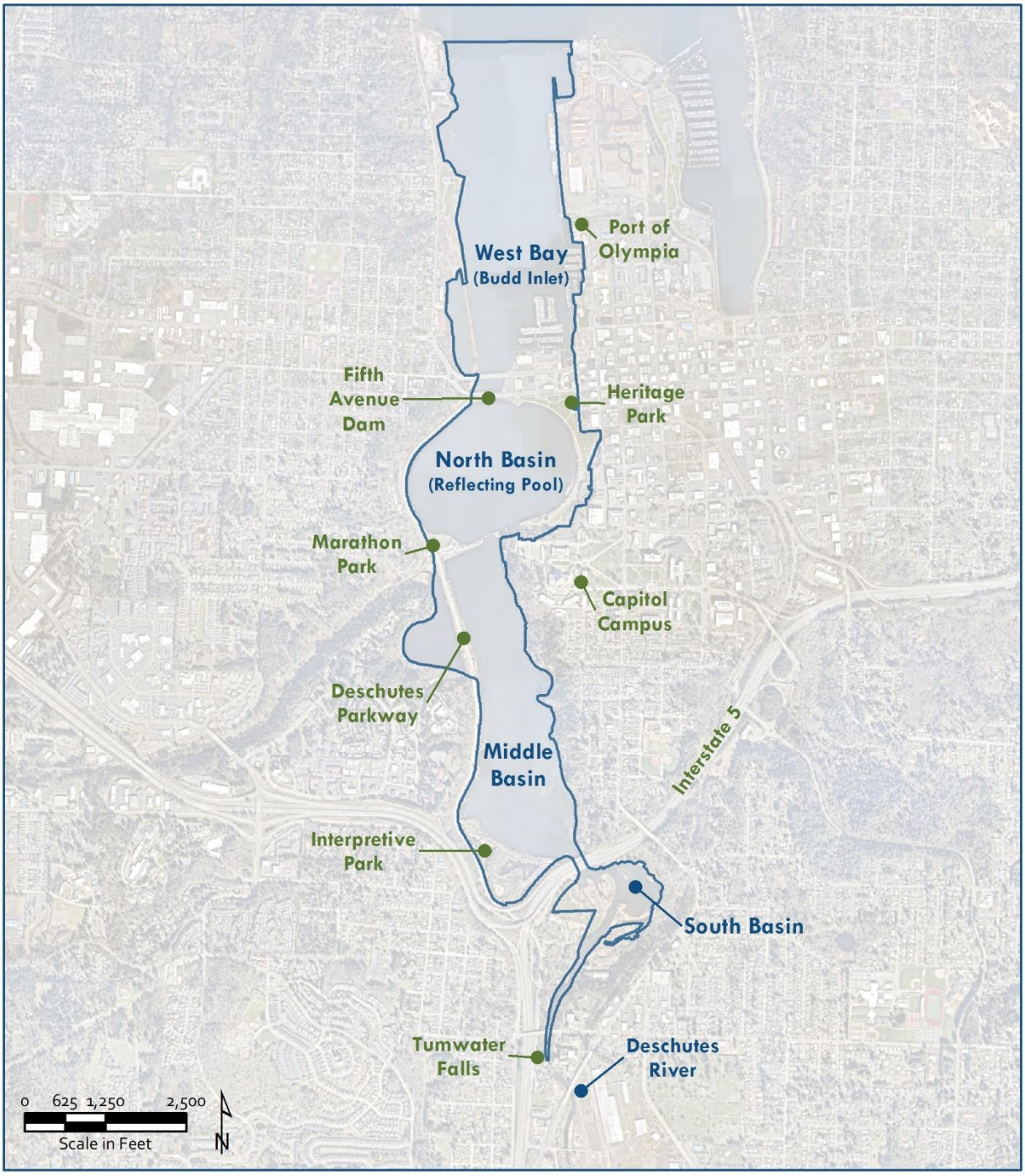
The Washington State Department of Enterprise Services (Enterprise Services) is responsible for the stewardship, preservation, operation, and maintenance of the Capitol Lake Basin. The 260-acre Capitol Lake Basin is maintained by Enterprise Services under long-term lease agreement from the Washington Department of Natural Resources.

In 2016, as part of Phase 1 of long-term planning, a group of stakeholders representing a broad range of interests, in collaboration with the state, identified shared goals for long-term management and agreed an Environmental Impact Statement (EIS) was needed to evaluate a range of alternatives and identify a preferred alternative. In 2018, the state began the EIS process. The Draft EIS was published on June 30, 2021, and evaluated four alternatives: a Managed Lake, Estuary, Hybrid, and a No Action Alternative.

The long-term management alternatives are evaluated against the shared project goals of improving water quality, managing sediment accumulation and future deposition, improving ecological functions, and enhancing community use of the resource. Refer to Figure 1.1 for the project area for long-term management.

Within the Final EIS, Enterprise Services has identified the Estuary Alternative as the preferred environmentally and economically sustainable long-term management alternative for the Capitol Lake – Deschutes Estuary. The EIS process has maintained engagement with the existing Work Groups, which include the local governments, resource agencies, and tribe. It also provides for expanded engagement opportunities for the public, such as a community sounding board.

Figure 1.1 Project Area



1.2 SUMMARY OF PROJECT ALTERNATIVES

1.2.1 Managed Lake Alternative

The Managed Lake Alternative would retain the 5th Avenue Dam and Bridge in its existing configuration. The 5th Avenue Dam would be overhauled to significantly extend the serviceable life of the structure. The reflecting pool within the North Basin would be maintained, and active recreational use would be restored in this area. Sediment would be managed through initial construction dredging and recurring maintenance dredging in the North Basin only. Sediment from construction dredging would be used to create habitat areas in the Middle Basin to support improved ecological function, habitat complexity, and diversity. Sediment would continue to accumulate and over time would promote a transition to freshwater wetlands in the South and Middle Basins. Boardwalks, a dock, and a boat launch would be constructed for community use.

This project would also construct a new, approximately 14-foot-wide non-vehicular bridge south of the existing 5th Avenue Bridge to provide a dedicated recreational trail connection.

Adaptive management would be needed to maintain water quality, improve ecological functions, and manage invasive species.

1.2.2 Estuary Alternative

Under the Estuary Alternative, the existing 5th Avenue Dam and Bridge would be removed, and an approximately 500-foot-wide (150-meter-wide) opening would be established in its place. This would reintroduce tidal hydrology to the Capitol Lake Basin, returning the area to estuarine conditions where saltwater from Budd Inlet would mix with freshwater from the Deschutes River. Sediment would be managed through initial construction dredging in the Capitol Lake Basin and recurring maintenance dredging within West Bay. Dredged materials from construction dredging would be used to create habitat areas in the Middle and North Basins to promote ecological diversity, though tideflats would be the predominant habitat type. Boardwalks, a dock, and a boat launch would be constructed for community use. This alternative also includes stabilization along the entire length of Deschutes Parkway to avoid undercutting or destabilization from the tidal flow. Existing utilities and other infrastructure would be upgraded and/or protected from reintroduced tidal hydrology and saltwater conditions.

The Estuary Alternative has been updated in the Final EIS to include a new 5th Avenue Bridge that would be constructed south of the existing 5th Avenue Dam and Bridge. The new bridge would include a vehicle lane, bike lane, and sidewalk in each direction, with the sidewalk on the south side providing a dedicated recreational trail connection. This bridge would be constructed and connected to the transportation system before the existing 5th Avenue Dam and Bridge are removed.

Adaptive management plans would be developed to improve ecological functions and manage invasive species during the design and permitting process.

1.2.3 Hybrid Alternative

Under the Hybrid Alternative, the existing 5th Avenue Dam and Bridge would be removed, and an approximately 500-foot-wide (150-meter-wide) opening would be established in its place. Tidal hydrology would be reintroduced to the western portion of the North Basin and to the Middle and South Basins. Within the North Basin, a curved and approximately 2,600-foot-long (790-meter-long) barrier wall with a walkway would be constructed to create an approximately 45-acre reflecting pool adjacent to Heritage Park. The reflecting pool of the Hybrid Alternative has been updated in the Final EIS to be groundwater-fed, rather than saltwater. Construction and maintenance of this smaller reflecting pool, in addition to restored estuarine conditions in part of the Capitol Lake Basin, gives this alternative its classification as a hybrid.

Sediment would be managed through initial construction dredging in the Capitol Lake Basin and recurring maintenance dredging within West Bay. In the Middle and North Basins, constructed habitat areas would promote ecological diversity, though tideflats would be the predominant habitat type. Boardwalks, a dock, and a boat launch would be constructed for community use. This alternative also includes stabilization along the entire length of Deschutes Parkway to avoid scour or destabilization. Existing utilities and other infrastructure would be upgraded and/or protected from reintroduced tidal hydrology and saltwater conditions.

The Hybrid Alternative would also construct a new 5th Avenue Bridge, as described for the Estuary Alternative, prior to removing the existing 5th Avenue Dam and Bridge.

Adaptive management plans would be needed to improve ecological functions, manage invasive species, and maintain water quality in the freshwater reflecting pool.

1.2.4 No Action Alternative

The No Action Alternative represents the most likely future expected in the absence of implementing a long-term management project. The No Action Alternative would persist if funding is not acquired to implement the Preferred Alternative. A No Action Alternative is a required element in a State Environmental Policy Act (SEPA) EIS and provides a baseline against which the impacts of the action alternatives (Managed Lake, Estuary, Hybrid) can be evaluated and compared.

The No Action Alternative would retain the 5th Avenue Dam in its current configuration, with limited repair and maintenance activities, consistent with the scope and scale of those that have received funding and environmental approvals over the past 30 years. In the last 30 years, the repair and maintenance activities have been limited to emergency or high-priority actions, which occur sporadically as a result of need and funding appropriations.

Although Enterprise Services would not implement a long-term management project, current management activities and ongoing projects in the Capitol Lake Basin would continue. Enterprise Services would continue to implement limited nuisance and invasive species management strategies.

In the absence of a long-term management project, it is unlikely that Enterprise Services would be able to procure funding and approvals to manage sediment, improve water quality, improve ecological functions, or enhance community use. The No Action Alternative does not achieve the project goals.

1.3 CONSTRUCTION METHODS FOR THE ACTION ALTERNATIVES

This impact analysis relies on the construction method and anticipated duration for the action alternatives, which are described in detail in Chapter 2 of the EIS.

2.0 Regulatory Context

2.1 RESOURCE DESCRIPTION

This discipline report addresses wetlands and the potential changes in wetlands as a result of the project alternatives. For purposes of this report and the analysis, the term "wetland" encompasses five broad groups to enable characterization of all the freshwater and estuarine habitats present in the Capitol Lake Basin and the West Bay of Budd Inlet and that would be expected under future conditions with any of the action alternatives. The five groups are:

- Vegetated wetlands – freshwater
- Vegetated wetlands – estuarine
- Deepwater habitats – freshwater (i.e., Capitol Lake)
- Deepwater habitats – estuarine (i.e., West Bay)
- Mudflats (also called "tideflats")

This includes deepwater areas and mudflats that are not technically considered "wetlands" but are protected and regulated by multiple federal, state, and local laws as "waters of the U.S.," "waters of the state," and/or critical areas (see Section 2.2). Streams and rivers, such as the Deschutes River and Percival Creek, are also waters of the U.S., waters of the state, and critical areas. See the *Fish and Wildlife Discipline Report* (ESA 2022) and *Water Resources Discipline Report* (Herrera 2022b) for more information on these waters. Wetlands are important resources that perform vital ecological functions and provide many societal benefits, including the following:

- Water storage
- Flood protection
- Groundwater recharge/discharge
- Water quality improvements
- Nutrient retention/ transformation

- Streamflow maintenance
- Habitats for wetland-dependent and wetland-associated species
- Sediment retention
- Food web maintenance and production
- Passive recreation

2.2 RELEVANT LAWS, PLANS, AND POLICIES

Wetlands, including those within the study area (as defined in Section 3.0), are protected by a variety of federal, state, and local laws, plans, and policies. These laws, plans, and policies have slightly different but overlapping requirements, and work in concert to protect and maintain these habitats and their functions. Projects that disturb or alter wetlands require review and approval by multiple federal, state, and local agencies as well as tribes. Project proponents are required to avoid and minimize impacts to the maximum extent practicable and must compensate for any unavoidable impacts to ensure no net loss of wetland functions.

2.2.1 Federal and State

At the federal level, the Clean Water Act (CWA) is the overarching law for protecting wetland resources through regulating the discharge of pollutants. Two sections of the CWA relate to wetland impacts: Section 404 and Section 401. Section 404 regulates the discharge of dredged or fill materials into waters of the U.S., and is administered by the U.S. Army Corps of Engineers (Corps), and Section 401 requires the review of water quality standards as set and issued by states or tribes. The Washington Department of Ecology (Ecology) implements Section 401 of the CWA through the Water Pollution Control Act (Revised Code of Washington [RCW] 90.48) and also protects and regulates wetlands through the Shoreline Management Act (RCW 90.58). Ecology also uses the SEPA process to identify potential wetland-related concerns early in the environmental review process.

Both federal and state laws define wetlands as areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 Code of Federal Regulations [CFR] Part 328.3; RCW 36.70A.030). The methods for wetland identification and delineation are the same at the federal and state level (Washington Administrative Code [WAC] 173-22-035).

The federal and state policies and regulations listed below in Tables 2.1 and 2.2 influence planning, land use, and management activities that can affect wetlands within the study area.

Table 2.1 Federal Laws, Plans, and Policies

Regulatory Program or Policies	Lead Agency	Description
Clean Water Act (33 CFR 320) Sections 401 and 404	Corps and Ecology	Regulates discharges of dredged or fill materials into waters of the U.S., including wetlands and streams. Also requires any activity that may result in a discharge of a pollutant into waters of the U.S. to obtain a certification from the state that the discharge complies the applicable water standards.

Table 2.2 State Laws, Plans, and Policies

Regulatory Program or Policies	Lead Agency	Description
Water Pollution Control Act (RCW 90.48)	Ecology	Enables the review and approval, condition, or denial of projects proposed in waters of the U.S., including wetlands. Generally administered via Section 401 of the Clean Water Act.
Shoreline Management Act (SMA) (RCW 90.58)	Ecology	Requires all counties and most towns and cities to develop and implement shoreline master programs (SMPs) to protect shoreline natural resources including the land, vegetation, wildlife, and aquatic habitats against adverse environmental effects. Administered by the local jurisdiction (i.e., county or city) via the SMP.
Growth Management Act (GMA) (RCW 36.70A)	Washington Department of Commerce (technical assistance only)	Requires local governments to adopt regulations that protect wetlands and their functions based on best available science. Administered via the local jurisdiction via the critical areas ordinances (CAO).
Hydraulic Project Approval (HPA) (RCW 77.55)	Washington Department of Fish and Wildlife (WDFW)	Requires that any person, organization, or government agency wishing to conduct a construction activity that will use, divert, obstruct, or change the bed or flow of state waters (including wetlands) must do so under the terms of an HPA permit issued by WDFW. WDFW's HPA rules also prescribe specific windows during which in-water work can occur (known as in-water work windows).

2.2.2 Local

The study area includes lands located in the cities of Olympia and Tumwater. The municipalities of Olympia and Tumwater have developed shoreline master programs and critical areas ordinances to protect these resources within their jurisdictions. The CAOs and SMPs use a rating system that categorizes wetlands based on their hydrologic, water quality, and habitat functions. Olympia and Tumwater both base their wetland rating systems on the Wetland Rating System for Western Washington (Hruby 2015). The CAOs and SMPs require that each wetland has a regulatory buffer, typically between 25- and 300-feet wide, that is intended to protect the wetland from adjacent land uses. The CAOs and SMPs specify what types of activities are allowed in wetlands and in their buffers, as well as what and how much mitigation is required for impacts on those protected areas. Table 2.3 presents a summary of applicable local laws, plans, and policies.

Table 2.3 Local Laws, Plans, and Policies

Regulatory Program or Policies	Lead Agency	Description
OMC 18.20 Shoreline Master Program	City of Olympia	Regulates activities along shorelines of the state (Budd Inlet, Capitol Lake, and portions of the Deschutes River) and their associated wetlands and buffers under the Shoreline Management Act.
OMC 18.32 Critical Areas	City of Olympia	Regulates activities in and around wetlands, buffers, and other critical areas under the Growth Management Act.
Ordinance No. O2012-005	City of Tumwater	Regulates activities along shorelines of the state (Capitol Lake and portions of the Deschutes River) and their associated wetlands and buffers under the Shoreline Management Act.
TMC 16.28 Wetland Protection Standards	City of Tumwater	Regulates activities in and around wetlands and their buffers under the Growth Management Act.
TMC 16.32 Fish and Wildlife Habitat Protection	City of Tumwater	Regulates activities in and around fish and wildlife habitat areas, which include lakes, ponds, and streams and their buffers under the Growth Management Act.

OMC = City of Olympia Municipal Code; TMC = City of Tumwater Municipal Code.

3.0 Methodology

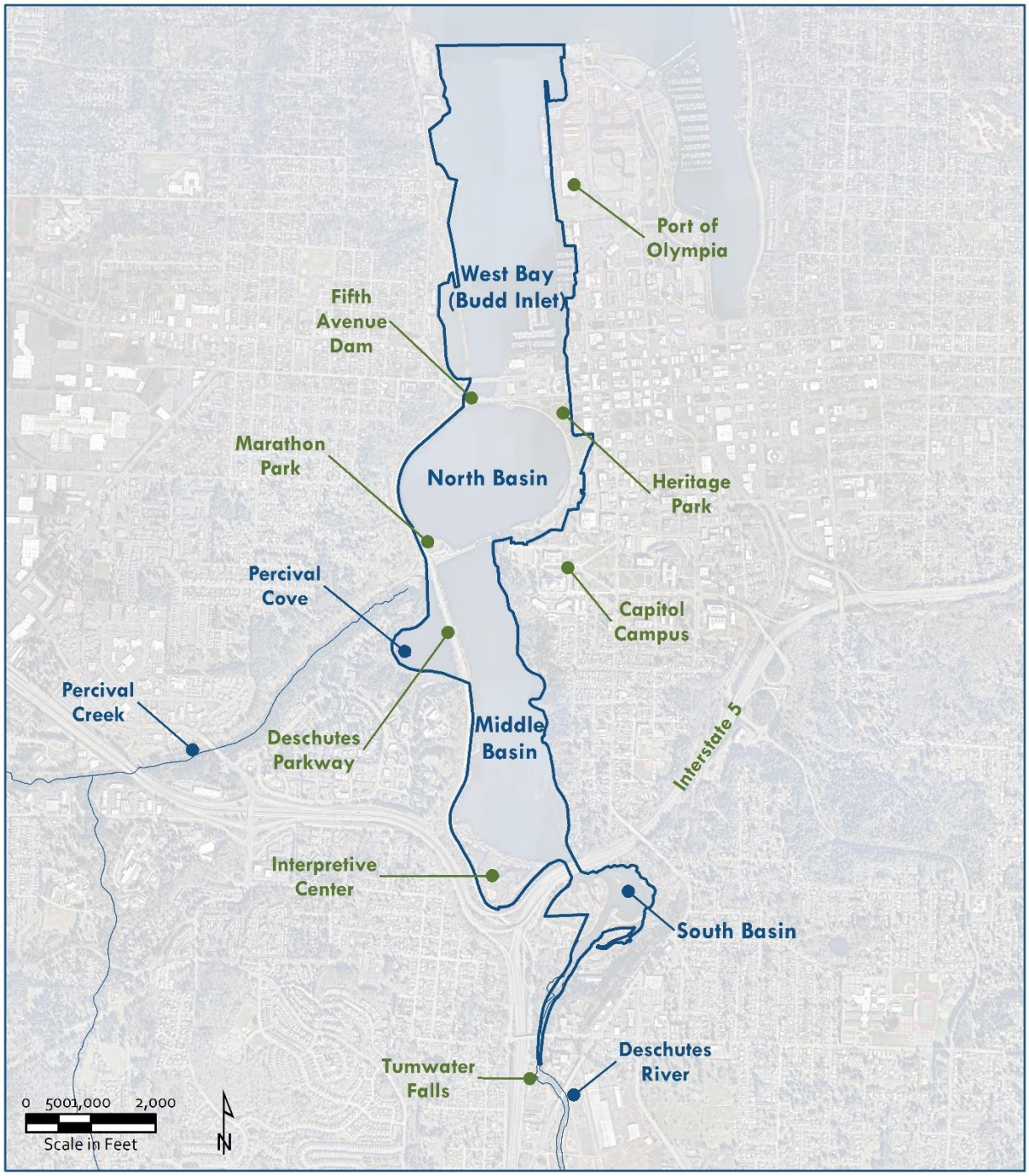
3.1 SELECTION OF THE STUDY AREA

The study area for wetlands is based on the area where wetlands could be directly or indirectly affected by the construction or operation of the project alternatives. This includes the Capitol Lake Basin and associated wetlands from Tumwater Falls to the West Bay of Budd Inlet. The study area also encompasses Percival Cove and Percival Creek and associated wetlands to where modeling indicates that geomorphic changes or tidal influence could occur. The southern boundary is generally defined as the base of Tumwater Falls, and the northern limit is the northern end of the West Bay (Figure 3.1).

3.2 DATA SOURCES AND COLLECTIONS

Existing conditions in the study area were determined based on the available geographic information system (GIS) data, aerial imagery, critical area and shoreline maps, the bathymetry survey, and previous wetland studies applicable to the study area. This information was used to estimate the presence, extent, and type of wetlands, deepwater habitats, and mudflats in the study area. This planning-level analysis was supplemented with a site reconnaissance to the project area in summer 2019, but wetlands were not delineated, rated, surveyed, or sampled. Wetland delineation would occur during final design and permitting of the selected alternative, in the next project phase.

Figure 3.1 Study Area for Wetlands



Legend

Project Area

The following data sources were also used to evaluate and identify existing wetlands in the study area:

- Nisqually National Wildlife Refuge, Final Comprehensive Conservation Plan and Environmental Impact Statement (USFWS 2004)
- Qwuloolt Project in the Snohomish River delta (Corps 2011)
- Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987)
- Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Corps 2010)
- U.S. Fish and Wildlife Service National Wetlands Inventory, Wetlands Mapper (USFWS 2019)
- Wetland Mitigation in Washington State (Ecology et al. 2006)
- WDFW Priority Habitats and Species (PHS) database (2019)
- Light Detection and Ranging (LiDAR) data (DNR 2011)
- City of Olympia Critical Area and Shoreline GIS data (2019)
- City of Olympia Shoreline Master Program (2015)
- Existing Conditions Report West Bay Park Phase I Improvements (City of Olympia 2007)
- West Bay Environmental Restoration Assessment (City of Olympia 2016)
- Final Brewery Planned Action EIS, Appendix F: Old Brewhouse Wetland and Shoreline Report (City of Tumwater 2015)
- City of Tumwater Critical Area and Shoreline GIS data (2019)
- City of Tumwater Shoreline Master Program (2014)
- Thurston County Natural Resources GIS data layers (2019)
- Thurston Regional Planning Council (TRPC) Shoreline Inventory (2006)
- Capitol Lake Adaptive Management Plan, Draft Environmental Impact Statement (Entranco 1998)
- Capitol Lake Wetland Development Feasibility Analysis (Entranco 1990)

3.3 DEFINITIONS AND TERMINOLOGY

The following definitions are used for this analysis; they generally follow the U.S. Fish and Wildlife Service (USFWS) Classification of Wetlands and Deepwater Habitats of the United States system (Cowardin et al. 1979) with a few project-specific modifications:

- **Vegetated Wetlands: Freshwater** – These wetlands are dominated by trees, such as willow (*Salix* ssp.), red alder (*Alnus rubra*), and western red cedar (*Thuja plicata*); shrubs such as spirea (*Spiraea douglasii*), twinberry (*Lonicera involucrata*), and dogwood (*Cornus sericia*); and /or emergent vegetation, such as slough sedge (*Carex obnupta*), soft rush

(*Juncus effusus*), and piggyback plant (*Tolmiea menziesii*). They are fed by surface or groundwater and occur on the edges of lakes or rivers, on slopes, or in shallow depressions. Vegetated freshwater wetlands may or may not have standing water, and when they do, it is typically shallow (less than 6.6 feet deep); salinity is less than 0.5 parts per thousand (ppt). Vegetated freshwater wetlands include palustrine forested (PFO), scrub-shrub (PSS), and emergent (PEM) wetlands.

- **Vegetated Wetlands: Estuarine** – These wetlands occur in the zone where freshwater and saltwater meet and are referred to as low marsh and high marsh. These wetlands have salinity levels greater than 0.5 ppt and are usually influenced by tides. Vegetated estuarine wetlands are characterized based on their elevation levels within the intertidal zone and dominant vegetation form. High marsh wetlands occur in the upper intertidal (between +12 and +7 feet mean sea level [MSL]) and are infrequently inundated. Typical vegetation species include tufted hair grass (*Deschampsia caespitosa*) and arrow grass (*Triglochin maritium*). Low marsh wetlands occur at lower elevations (between +7 and +3 feet MSL) and are typically characterized by the presence of pickleweed (*Salicornia virginica*), arrow grass, Lyngby sedge (*Carex lynbyei*), and saltgrass (*Distichlis spicata*).
- **Tideflats** – Also known as "mudflats". These wetlands are broad, flat areas in the intertidal zone (+3 feet MSL and below) that are exposed at low tides and inundated at high tides. The substrate is predominately clay and silt-sized (i.e., very small) particles as well as organic material. They are either unvegetated or vegetated only by algal mats or annual plants such as sea lettuce (*Entromorpha*). Eelgrass can be present at lower elevations (about -3 to -12 feet MSL) if tidal currents, sediment deposition, and water quality create appropriate growing conditions.
- **Deepwater Habitats** – These include areas where surface water is permanent and deep, such that water, rather than air, is the principal medium within which the dominant organisms live, whether or not they are rooted in, or attached to, the substrate. If present, vegetation is aquatic bed vegetation that is usually visible above the water surface. Deepwater habitats can be freshwater or estuarine. The boundary between wetlands and deepwater habitats in estuarine system is the elevation of the extreme low water. The boundary between wetlands and deepwater habitat in the freshwater environment is a depth of 8.2 feet or the edge of emergent vegetation, shrubs, or trees.

3.4 ANALYSIS OF IMPACTS

The evaluation describes expected adverse impacts on wetlands caused by the construction and operation of the project alternatives. This includes short-term and long-term changes in wetland area and/or type. Each of these impacts has associated effects on ecological functions including water quality improvement (nutrient cycling, sediment removal), hydrologic functions (alteration of flood flows, groundwater recharge), and habitat for wetland-dependent and wetland-associated fish and wildlife species. Substantial loss of wetland area or function due to construction or the operation of the project is considered an adverse impact.

Potential impacts on wetland buffers were not considered in this analysis, as the size of the buffer varies and is established following wetland delineation and rating. This work will be completed during final design and permitting of the selected alternative. Changes in wetland area and wetland type were estimated and analyzed using GIS; bathymetry data; future bathymetry models; modeling assumptions on salinity levels, tidal range, and sediment; and other information prepared by the design team. Estimates of wetland impact or wetland change in this discipline report are approximate and based on the initial design concepts. They are intended to inform a relative comparison of the alternatives and will be refined based on more detailed field investigation and mapping during final design and permitting of the selected alternative.

While the primary focus of the SEPA analysis is the identification of adverse impacts, the analysis also considered the potential for beneficial effects, related to the anticipated increase or net gain in the quality and/or quantity of wetland area and/or wetland function. Long-term beneficial effects were considered minor, moderate, or substantial based on best professional judgement.

3.4.1 Identification of Construction Impacts

Construction impacts are the temporary effects related to construction disturbance both on land and in the water. Project construction is anticipated to last 4 to 8 years, depending on the alternative, and would entail multiple in-water work seasons. Construction would likely be conducted in stages, so the area of disturbance in any particular year would be limited to the extent that could be completed within a work window or within 1 year. Wetlands affected by construction would generally revert to their pre-construction condition either through natural processes, active restoration, or some combination. Pursuant to federal, state, and local laws, the project must include best management practices (BMPs) to avoid and minimize construction impacts. Areas that are disturbed during construction must be repaired and/or restored to their pre-construction condition following construction. The types of construction impacts that would occur vary by alternative but include the following:

- Activities related to initial dredging in the North and/or Middle Basin and creation of habitat areas in the Middle Basin
- Clearing of vegetation and/or placement of temporary fill materials in wetlands to provide construction staging or access
- Temporary lowering of water levels to provide construction staging or access
- Temporary erosion and/or sedimentation to wetlands during construction activities

Potential long-term impacts on wetlands from recurring maintenance dredging are described under *Operational Impacts*.

For this analysis of construction impacts, the magnitude of short-term impacts is considered less-than-significant or significant, as follows:

- **Significant**—An alternative would have significant construction impacts if it directly disturbs more than a total of 0.5 acre of wetland continuously for a period of more than 1 year.
- **Less-than-Significant**—An alternative would have less-than-significant construction impacts if the combined duration and area of impact is less than stated above.

3.4.2 Identification of Operational Impacts

Operational impacts are the long-term or permanent effects related to the operation of the project. This includes the long-term or permanent loss of wetland habitat or functions. Pursuant to federal, state, and local laws, the project includes BMPs to avoid and minimize wetland impacts (see Section 5.7). Compensatory mitigation must be provided to offset any impacts if the regulatory agencies do not consider the project self-mitigating in consideration of the proposed habitat improvements. The mitigation would include establishing new wetlands to replace lost wetlands and/or restoring, rehabilitating, and/ or enhancing damaged or degraded wetlands to improve their functions. Notably, the distribution and extent of estuarine and freshwater wetland types in the study area may be affected by changes in water depth, tidal fluctuations, circulation, velocity, salinity, installation of overwater structures and other features, and maintenance dredging, depending on the alternative. Changes in wetland types would result in functional changes related to water quality, hydrologic function, and wildlife habitat. The functions of wetland habitats lost and gained are compared for each alternative relative to existing conditions, using modeling and conceptual design information developed by the design team. The types of wetland impacts considered include:

- Permanent loss of wetlands from placement of fill for various project elements (e.g., construction of boardwalks, dock, boat launch, 5th Avenue Bridge)
- Conversion of wetland from one wetland type to another wetland type (e.g., vegetated freshwater wetland to mudflat)
- Shading impacts and /or changes in wetland vegetation class due to overwater/over-wetland structures
- Periodic disturbance related to maintenance dredging

The types of operational impacts that would occur vary by alternative and could range from relatively minor impacts such as conversion of one wetland type to another, to more substantial impacts such as the conversion of wetlands / waters of the U.S. or state to non-wetland non-water status. The significance criteria for long-term (operational) impacts focus on the permanent loss or change in wetland types is as follows:

- **Significant**—An alternative has significant operational impacts if it causes a permanent net loss of more than 0.5 acre of wetlands or causes the loss of wetland function that cannot be replaced through mitigation. This standard assumes that mitigation would offset all

permanent loss of wetland area or function and would occur in the vicinity of the project (within the same watershed).

- **Less-than-Significant**—An alternative has less-than-significant operational impacts if the overall (net) area of permanent impact is less than 0.5 acre and the loss of wetland (area and function) can be fully offset through mitigation.

4.0 Affected Environment

Capitol Lake is a freshwater lake in Olympia and Tumwater; it was formed by the damming the outlet of Deschutes River. The Deschutes River basin drains approximately 166 square miles and includes commercial forestry in the upper basin and agriculture and rural residential in the middle of the watershed. Urban land uses in the lower watershed include portions of the cities of Tumwater and Olympia. Riparian cover is limited within much of the study area, reflecting current land uses, with riparian conditions including a combination of high-density urban land use, mixed coniferous and deciduous forest, and maintained grass areas. However, high-quality riparian shorelines are located along the east shore of the Middle Basin, the east and south shore of the South Basin, and the west shore of Percival Cove.

The study area has been substantially altered in the last 100 years, including construction of BNSF railroad tracks across the mouth of the Deschutes River in 1929, separating what is now the North Basin and Middle Basin, and a railway installed at the mouth of Percival Creek, creating Percival Cove (TRPC 2008). Around 1942, the 5th Avenue Bridge was constructed using earthen fill. The lake was created in 1951 when the 5th Avenue Dam was constructed at the mouth of the Deschutes River to form a reflecting pool for the State Capitol Building. In 1956, the construction of the I-5 bridge filled additional area and separated the Middle and South Basins. More fill was placed in the North Basin to construct Deschutes Parkway and Marathon Park in the 1970s, and additional armoring and fill were placed in 1999 for the construction of Heritage Park (Herrera 2005).

Historically, the Deschutes River formed a broad estuary as it flowed into Budd Inlet in the area that is now Capitol Lake. The historic delta consisted of river deposits, with braided channels and scattered tidal marshes (Hayes et al. 2008). An early survey in the 1870s shows the Deschutes Estuary as a waterway, with the first constriction of the estuary mouth near the 4th Avenue Bridge (Figure 4.1). Subsequent surveys performed during the next few decades, but prior to installation of the 5th Avenue Dam, show extensive mudflats as well as encroachment by railroad trestles. Capitol Lake is located within the traditional territory of the Southern Coast Salish and Southwestern Coast Salish cultural groups, which includes but is not limited to the Steh-chass, Nusehchatl, Squaxin, Nisqually, and Chehalis peoples; see the *Cultural Resources Discipline Report* for more information (ESA and NW Vernacular 2022).

Figure 4.1 Historical Condition of Capitol Lake Basin

1873 1941

Construction of the 5th Avenue Dam blocked the tidal exchange between the Deschutes River and Budd Inlet as well as altered the morphology and ecology of the lower river system. Although different from their historical condition, Capitol Lake Basin and West Bay include wetlands that provide habitat for a range of birds, fish, bats, aquatic and semi-aquatic mammals, and dozens of invertebrate species (Hayes et al. 2008). Table 4.1 and Figure 4.2a and 4.2b show the wetland types in the study area.

Table 4.1 Wetland Types in the Study Area

Wetland Types	Location	Estimated Acreage[1]
Deepwater Habitat – Estuarine	West Bay	208
Mudflat	West Bay	<1
Vegetated Wetland – Estuarine (High Marsh)	West Bay	3
Deepwater Habitat – Freshwater	North and Middle Basins	240
Vegetated Wetland Freshwater (PEM)	North, Middle, and South Basins	19
Vegetated Wetland Freshwater (PSS)	North, Middle, and South Basins	16
Vegetated Wetland Freshwater (PFO)	North, Middle, and South Basins	18
River Channel - Freshwater	Middle and South Basins	25
Upland	North, Middle, and South Basins	19
Total		**549**

Notes:

1. Areas are approximate, based on National Wetlands Inventory (NWI) data and a high-level reconnaissance investigation.

Figure 4.2a Affected Environment

Legend

- Deepwater Habitat - Estuarine
- Tideflat
- Vegetated Wetland - Estuarine (High Marsh)
- Deepwater Habitat - Freshwater
- Vegetated Wetland - Freshwater (emergent)
- Vegetated Wetland - Freshwater (scrub-shrub)
- Vegetated Wetland - Freshwater (forested)
- Upland

Figure 4.2b Affected Environment

Legend

- Deepwater Habitat - Estuarine
- Tideflat
- Deepwater Habitat - Freshwater
- Vegetated Wetland - Freshwater (emergent)
- Vegetated Wetland - Freshwater (scrub-shrub)
- Vegetated Wetland - Freshwater (forested)
- River Channel
- Upland

The affected environment of the study area is described below, by basin.

4.1 NORTH BASIN

The shoreline of the North Basin is highly modified, including a vertical bulkhead along Heritage Park on the east side (part of the Arc of Statehood) and riprap along Deschutes Parkway on the west side. Bulkheads and riprap protect shoreline from erosion, but also restrict the formation of fringing wetlands. The North Basin is the deepest portion of Capitol Lake and consists primarily of deepwater habitats with some shrub and emergent freshwater wetlands lining the lakeshore. These deepwater habitats include unvegetated open water and areas vegetated with submerged aquatic vegetation. Vegetation varies by water depth but is a mix of common waterweed (*Elodea canadensis*), pondweed species (*Potamogeton* spp.), coontail (*Ceratophyllum demersum*), Eurasian watermilfoil (*Myriophyllum spicatum*), and algal mats (Northwest Aquatic Management 2018). See the *Aquatic Invasive Species Discipline Report* for details on invasive species (Herrera 2022a). Vegetated freshwater emergent and scrub-shrub wetlands occur along Heritage Park on the east and Marathon Park in the southwest, and a few fringes along Deschutes Parkway (see Table 4.2).

Photo 1. Deepwater Habitat in the North Basin

Photo 2. Vegetated Freshwater Wetlands (Emergent and Scrub-Shrub) in the North Basin

Table 4.2 Wetlands in the North Basin

Wetland Type	Vegetation	Estimated Area (acres)
Deepwater Habitat – Freshwater	Aquatic Bed/Open Water	99
Vegetated Wetland - Freshwater	Emergent	<1
Vegetated Wetland - Freshwater	Scrub-shrub	2
Vegetated Wetland - Freshwater	Forested	2
Upland	-	2

4.2 MIDDLE BASIN

Like the North Basin, most of the Middle Basin has permanent open water and is characterized as deepwater habitat. The riprap along Deschutes Parkway extends along the entire length of the west side of the Middle Basin. The eastern shoreline of the Middle Basin has a wide strip of upland forest sloping down toward the basin along most of its length. Fringes of emergent, scrub-shrub, and forested wetlands are present along both sides of the basin, with areas of forested wetland common along the eastern shoreline. Interpretive Center on the south end of the basin includes emergent, scrub-shrub, and forested wetlands. This area was originally created to process spoils from the 1979 dredging of Capitol Lake. Over time, however, these dewatering basins evolved into wetlands. They were expanded and enhanced as mitigation for wetland fill in the North Basin as part of the development of Heritage Park (Enterprise Services 2020).

Percival Creek flows from the west into Percival Cove, then through a narrow opening under Deschutes Parkway into the Middle Basin. Percival Creek is fringed by emergent freshwater wetlands on both sides. See the *Water Quality Discipline Report* (Herrera 2022b) and the *Fish and Wildlife Discipline Report* (ESA 2022) for information on Percival Creek. Percival Cove is relatively shallow and supports freshwater emergent vegetation, and forested wetlands occur along its west and south shorelines. See Table 4.3 for details.

Table 4.3 Wetlands in the Middle Basin

Wetland Type	Vegetation	Estimated Area (acres)
Deepwater Habitat	Aquatic Bed/Open Water	141
Vegetated Freshwater Wetland	Emergent	9
Vegetated Freshwater Wetland	Scrub-shrub	7
Vegetated Freshwater Wetland	Forested	9
River Channel (Percival Creek)	None	2
Upland	-	15

Photo 3. Deepwater Habitat Fringed by Upland Shrubs in the Middle Basin

4.3 SOUTH BASIN

The hydrology of the South Basin is dominated by the Deschutes River and side-slope seeps, with freshwater vegetated wetlands forming a complex of emergent, scrub-shrub, and forested wetlands along both sides of the river in the northern portion of the basin. In the upper (southern) portion of the South Basin, the Deschutes River is constricted in a relatively narrow valley. The adjacent upland areas are forested (See Table 4.4). The Deschutes River makes up 23 acres of the South Basin; see the *Water Quality Discipline Report* (Herrera 2022b) and the *Fish and Wildlife Discipline Report* (ESA 2022) for information on the Deschutes River.

Table 4.4 Wetlands in the South Basin

Wetland Type	Vegetation	Estimated Area (acres)
Vegetated Freshwater Wetland	Emergent	8
Vegetated Freshwater Wetland	Scrub-shrub	7
Vegetated Freshwater Wetland	Forested	6
River Channel (Deschutes River)	None	23
Upland	-	3

Photo 4. Vegetated Freshwater Wetlands (Emergent and Scrub-Shrub) in the South Basin

4.4 WEST BAY

Budd Inlet is the most heavily developed and most heavily armored of the inlets in Thurston County, with nearly half of the shoreline armored (Coast and Harbor Engineering 2016). West Bay, located within the City of Olympia on the southwest corner of the inlet, is surrounded by development.

The West Bay of Budd Inlet is characterized as primarily estuarine deepwater habitat with a small amount of vegetated estuarine wetlands and mudflats along the west side of West Bay (see Table 4.5). However, water depths and circulation patterns vary along the length of the bay. The deepest portions are part of a narrow shipping channel and turning basin dredged to allow freighter access to port facilities. West Bay contains some very shallow areas with mudflats exposed during low tide on the west side (Figure 4.1). The tidal range is 14.4 feet, which results in tidal flushing of the bay (LOTT 1998). The vast majority of the east shoreline of West Bay is now armored, with industrial, commercial, and residential development in the uplands.

Historically, West Bay was a shallow water estuarine mudflat with unrestricted flows from the Deschutes River and numerous small pocket estuaries from Garfield Creek, Schneider Creek, and other small drainages. Dredge and fill activities and the construction of Capitol Lake have significantly reduced mudflat habitat in West Bay over the last 150 years.

Table 4.5 Wetlands in the West Bay

Wetland Type	Vegetation	Estimated Area (acres)
Deepwater Habitat - Estuarine	Aquatic Bed/Open Water	208
Vegetated Wetland - Estuarine	High Marsh	3
Mudflat	Unvegetated	<1
Vegetated Freshwater Wetland	Emergent	<1
Vegetated Freshwater Wetland	Scrub-shrub	<1
Vegetated Freshwater Wetland	Forested	<1

Photo 5. Deepwater Habitat – Estuarine and Mudflats along Western Shoreline of West Bay

5.0 Impacts and Mitigation Measures

5.1 OVERVIEW

This section describes the possible wetland impacts from the No Action Alternative and the action alternatives (Managed Lake, Estuary, and Hybrid Alternatives). This section also identifies mitigation measures that could avoid, minimize, or reduce the identified impact.

5.2 NO ACTION ALTERNATIVE

The No Action Alternative would not result in construction impacts on wetlands because the project would not be built. Potential impacts would be related to limited ongoing maintenance of the 5th Avenue Dam and ongoing sedimentation of the Capitol Lake – Deschutes Estuary, since no sediment management strategies would be implemented.

Sediment would continue to accumulate in the South Basin, Middle Basin, Percival Cove, and eventually in the North Basin at similar levels to the current condition. In general, the No Action Alternative likely allows for the continued development of freshwater wetlands as sediments accumulate and increase lakebed elevations, alter water depths, and create conditions that allow wetland vegetation to grow.

Each year, approximately 35,000 cubic yards (cy) of sediment accumulates in the basins. Under the No Action Alternative with no management of this sediment, the lakebed would rise approximately 3 feet every 25 years. The South and Middle Basins and the shallow areas near the edges of the North Basin would be the first areas to transition from deepwater habitat to vegetated wetland types over a period of several decades. The North Basin is much deeper than the Middle and South Basins and would be the slowest and last to convert from deepwater habitat to vegetated wetland. The evolution would be gradual, beginning with the establishment of floating or submerged aquatic vegetation. Where water depths are shallowest, emergent vegetation such as rushes, sedges, and cattails or other obligate wetland species would begin to grow. Woody plants, such as Douglas spirea and salmonberry (*Rubus spectabilis*), would eventually colonize these wetlands resulting in a transition to a scrub-shrub wetland.

Enterprise Services would continue to implement invasive species management strategies to address the spread of invasive species such as watermilfoil.

The Middle and South Basins would follow a similar pattern of transition from deepwater with aquatic bed vegetation to vegetated wetland. However, both basins are shallower than the North Basin and thus the formation of growing conditions for emergent and woody wetland vegetation would likely occur sooner. Emergent wetland habitats would continue to gradually increase in area and extent depending on the actual rate of sediment accumulation.

The transition from unvegetated deepwater habitat or deepwater habitat with aquatic bed vegetation to vegetated wetlands would have a corresponding effect on wetland functions related to water quality improvement, hydrologic function, and wildlife habitat. In general, the presence of year-round vegetation increases the potential for filtering or absorbing pollutants by providing a vertical structure. Year-round vegetation is comprised of herbaceous species with high average stem width or leaf area that are able to retain more sediment and toxic compounds than aquatic bed species that die back every year. Aquatic bed vegetation can absorb nutrients during the spring and summer months that would otherwise be available to stimulate algal blooms in lake, thereby providing important water quality functions. Overall, the gradual change from unvegetated or aquatic bed vegetation, deepwater habitat to vegetated wetland would provide a net increase in the ability of the wetlands to improve water quality.

In terms of hydrologic function, the presence of year-round vegetation would help to stabilize the lake shore from erosion and scour. Scrub-shrub wetlands with persistent, woody species can provide the most bank protection, while wetlands dominated by emergent species provide less. Scrub-shrub wetlands would not develop for many years, and thus this function would not be fully realized until near the end of the 30-year project time horizon under the No Action Alternative.

The changes in wildlife habitat functions would vary considerably due to the variety of species that use deepwater and vegetated wetland habitats. The gradual transition from deepwater to vegetated wetlands would eventually eliminate habitat for shorebirds and wading birds that use shallow open water for foraging. Insectivorous birds and bats would have reduced forage, while the presence of emergent and scrub-shrub vegetation would offer additional nesting and foraging areas for songbirds. Fish-eating mammals, such as river otter, may decline within the basin as open water areas transition to wetland and reduce the fish carrying capacity of the lake as it fills with sediment. A more detailed evaluation of the impacts on wildlife can be found in the *Fish and Wildlife Discipline Report* (ESA 2022). While different habitats with a different set of functions would develop over time, there would be no loss of waters of the U.S. or waters of the state. Overall, there would be a net gain in function, providing a **minor beneficial effect**.

Minimal changes to wetlands are expected in West Bay under the No Action Alternative.

5.3 IMPACTS COMMON TO ALL ACTION ALTERNATIVES

5.3.1 Impacts from Construction

Elements that are common to all the action alternatives have varying degrees of construction-related impacts on wetlands. Some of these common actions have little to no impact, while others may have greater impacts. The range of these potential construction impacts are described below.

5.3.1.1 Dredging and Creation of Wetland Habitat Areas

Sediment has accumulated in the Capitol Lake Basin since the 5th Avenue Dam was completed in 1951. All of the action alternatives include initial dredging of the lakebed and deepwater areas to remove sediments that have accumulated since the last dredging event in 1986. The location, volume, and duration of the initial dredging would vary by alternative, as shown in Table 5.1.

Table 5.1 Dredging Volume and Duration by Alternative

Alternative	Volume	Location	Duration
Managed Lake Alternative	348,000 CY	North Basin	20 months over 4–5 years
Hybrid Alternative	499,000CY	North and Middle Basins	23 months over 6 years
Estuary Alternative	526,000 CY	North and Middle Basins	23 months over 6 years

Dredged material would be used to create habitat areas in the Middle Basin under all of the action alternatives. This beneficial reuse of material avoids the cost and complexity of off-hauling dredge spoils, and the newly created habitat "islands" provide greater edge and complexity within the project area. Some habitat areas would also be created in the North Basin for the Estuary and Hybrid Alternatives. Dredging and habitat area construction would occur with the existing 5th Avenue Dam in place and would occur during the in-water work windows allowed by the regulatory agencies. The in-water work window is expected to be from June 1 to August 15 and November 15 to February 15 each year, based on early coordination with the regulatory agencies. The primary temporary construction-related impacts of dredging and habitat area construction are direct disturbance of wetland habitats and localized turbidity and sedimentation effects.

Direct Disturbance

Dredging would be accomplished with a small hydraulic high-volume dredge, but could be supplemented with a mechanical dredge. Habitat areas would be created by installing temporary sheet pile to create containment cells for placement of the dredged material. Both of these activities would disturb deepwater habitats.

Dredged materials associated with the Managed Lake Alternative would be used to create habitat areas in the Middle Basin to support improved ecological function, habitat complexity, and diversity. Habitat areas would be constructed almost entirely in deepwater habitats. Permanent changes from dredging and construction of the habitat areas (for the Managed Lake Alternative) are described in Section 5.4, Impacts from Operation.

Dredged materials removed during construction of the Estuary and Hybrid Alternatives would be used to create habitat areas in the North and Middle Basins. Permanent changes from dredging and construction of the habitat areas (for the Estuary and Hybrid Alternatives) are described in Sections 5.5 and 5.6, Impacts from Operation.

Dredging would likely be conducted in stages, so the area of disturbance in any particular year would be limited to the extent that could be completed within a work window or within 1 year. Dredging would directly remove aquatic vegetation, where present, in deepwater habitats. It is expected that aquatic vegetation would regrow within the growing season if disturbed by temporary construction activities.

Turbidity and Sedimentation

Both dredging and the construction of habitat areas would produce localized turbidity and sedimentation that could temporarily disrupt the ecological functions of surrounding deepwater habitats.

Increased sediment can negatively affect wetland vegetation growth or smother plants. BMPs such as erosion and sediment control methods will be used to minimize potential impacts on wetlands (see Section 5.7). In addition, containment cells would be allowed sufficient time to dewater before more material is placed in the cell. Water quality in the cells will be monitored, and if turbidity levels are high, additional treatment methods would be applied before the water is allowed to re-enter the lake. Dredging would be conducted in stages, so the area of disturbance in any particular year would be limited to the extent that could be completed within a work window or within 1 year.

5.3.1.2 Construction of Boardwalks, Dock, and Boat Launch

Construction of the boardwalks would occur over an approximately 4- to 6-month duration and would be staged from land or water. The dock and boat launch would be completed within one in-water work window. Construction of these elements could cause minor, temporary impacts on wetlands if the clearing of vegetation and/or the placement of temporary fill materials in wetlands is needed to allow construction access. Placement of temporary fill could reduce surface-groundwater exchange or wetland storage capacity, but effects would be short-term. These types of temporary impacts on wetlands can typically be reduced through site-specific mitigation measures such as using geotextile fabric to reduce damage to wetland soils and vegetation, and installing temporary erosion and sediment control BMPs. Construction of these structures would produce localized turbidity and sedimentation that could temporarily disrupt the ecological functions of surrounding deepwater habitats, similar to as described above.

Impacts would be minor and temporary, limited to an in-water work period or within 1 year. If emergent or shrub vegetation is removed during construction, the impacts would continue until the area has been replanted and the vegetation has re-established. Construction could include lowering of the lake level for a few months to allow equipment to work in dry conditions. Lowering of the lake level to allow work could affect the hydrology of the wetlands along the perimeter of the North and Middle Basins, which could stress vegetation and/or cause plant mortality; however, the duration is expected to be a few months and the emergent or shrub wetlands around the lake would recover.

5.3.1.3 Staging Areas

Under all of the action alternatives, Marathon Park would be used as the primary construction staging and water access point for the duration of the project. Marathon Park is primarily upland habitat but is fringed with emergent and scrub-shrub wetlands adjacent to deepwater habitat. Tumwater Historical Park would also be used intermittently for equipment needing to access the Middle Basin during the in-water work periods. The portion of Tumwater Historical Park proposed for staging use is primarily uplands but also has both emergent and scrub-shrub wetlands adjacent to the deepwater habitat. An area around the 5th Avenue Bridge would also be used. The area proposed for use is primarily uplands but also has deepwater habitats (both freshwater and estuarine). Use of these staging areas could damage vegetation and compact soils of emergent and scrub-shrub wetlands along the edge of the basins, but the staging and access areas would be sited and constructed in a way to avoid and minimize wetland impacts. Turbidity and sedimentation may also occur in deepwater habitats. Temporary impacts including soil compaction and loss of vegetation may be unavoidable if the contractors need to cross vegetated wetlands to access the lake. BMPs will be used to avoid or minimize impacts on wetlands, and measures would be implemented to mitigate for impacts (see Section 5.7).

5.3.1.4 Summary of Impacts from Construction (Common to All Action Alternatives)

Under all action alternatives, dredging, habitat area creation, and construction of the boardwalks, dock, and boat launch would result in permanent changes to wetland types, and are described in Sections 5.4, 5.5, and 5.6, Impacts from Operation. Some short-term construction-related impacts would also occur, primarily related to temporary turbidity and sedimentation in the surrounding deepwater habitats.

Construction of the boardwalks, dock, and boat launch, and use of staging areas would also result in direct disturbance and temporary turbidity and sedimentation. These impacts would be limited in duration, and the temporarily disturbed areas would return to pre-construction condition. Given this, and considering that the types of temporary impacts on wetlands from other construction elements can typically be reduced through site-specific mitigation measures, temporary construction impacts on wetlands under all action alternatives are **less-than-significant**.

5.4 MANAGED LAKE ALTERNATIVE

5.4.1 Impacts from Construction

In addition to impacts described above in Section 5.3, Impacts Common to All Action Alternatives, there would be construction impacts from construction of the 5th Avenue Non-Vehicular Bridge and the repairs to 5th Avenue Dam as an overhaul would be needed within the 5-year construction period.

Construction of the non-vehicular bridge would involve the same type of minor and temporary, short-term construction impacts described in Section 5.3.1.2. Construction would occur in stages, so the area of disturbance in any particular year would be limited to the extent that could be completed within a work window or within 1 year.

Dam overhaul activities such as maintenance of the gates and mechanical and electrical systems, jet grouting, installation of a dam buttressing berm, and some repair/patching of the concrete structure would be required during the 30-year time horizon of the project. Construction may affect scrub-shrub wetlands adjacent to the dam and freshwater deepwater habitat due to turbidity and effects of sedimentation on deepwater habitat from in-water construction of the buttressing berm. Appropriate BMPs would be implemented to avoid and minimize potential impacts, and in-water work would adhere to timing restrictions. Based on the location and short-term nature of the repairs, any impacts on wetlands would be minor and temporary, and therefore **less-than-significant**.

5.4.2 Impacts from Operation

Capitol Lake would remain a freshwater system under the Managed Lake Alternative. Wetland habitat in West Bay would be similar to existing conditions. See Figure 5.1a and 5.1b, Managed Lake Alternative Wetlands, and Table 5.2, Managed Lake Alternative Wetland Types. The long-term (operational) impacts on wetlands with this alternative would primarily be the associated changes in wetland habitat types in the Middle and South Basins, given the maintenance dredging in the North Basin, and the establishment of habitat areas using dredged materials. Additionally, the structures installed during construction (dam buttressing berm, a non-vehicular bridge, boardwalks, dock, and boat launch) would result in direct fill and indirect shading impacts, primarily to deepwater habitats (both freshwater and estuarine).

Figure 5.1a Managed Lake Alternative Wetland Types

Figure 5.1b Managed Lake Alternative Wetland Types

Legend

- Deepwater Habitat - Freshwater
- Vegetated Wetland - Freshwater (PAB)
- Vegetated Wetland - Freshwater (PEM)
- Vegetated Wetland - Freshwater (PSS)
- Vegetated Wetland - Freshwater (PFO)
- River Channel
- Upland

5.4.2.1 Changes in Wetland Habitat Types (from Habitat Areas and Long-Term Changes)

In the Managed Lake Alternative, the 5th Avenue Dam would be retained in its current configuration, and the North Basin would be dredged to maintain the historic reflecting pool. Sediment in the North Basin would then be managed through recurring maintenance dredging. The Middle and South Basins would not be dredged and would gradually transition to vegetated wetlands as sediments continue to accumulate. The Middle Basin is already relatively shallow, and emergent and scrub-shrub wetlands along the fringe of the basin would grow in extent toward the middle of the basin as sediments accrete, converting deepwater habitat into emergent or scrub-shrub wetland. Over time, as vegetation matures and sediment accumulates, forested wetlands could develop. Similarly, in the South Basin, wetlands would transition from emergent or scrub-shrub to forested wetlands as sediment accumulates depending on site-specific conditions. Transitions to vegetated wetland types would occur within the 30-year time horizon of the project, but transition to mature forested wetlands would extend beyond the 30-year time horizon. The river channel would continue to scour away accumulated sediment as it flows through the center of the basins.

The habitat areas created during initial construction in the Middle Basin would support improved ecological function, habitat complexity, and diversity. The habitat areas would be at elevations that support emergent, scrub-shrub, and forested wetlands. Additionally, ridges or hummocks on habitat areas would support upland vegetation, creating a wetland/upland mosaic. The habitat areas would be constructed with irregular shapes to resemble natural floodplain islands and be oriented and placed in locations to avoid extensive flooding or erosion.

The habitat areas would be planted with native vegetation to design specifications. Under the Managed Lake Alternative, most of the habitat areas in the Middle Basin would be a mixture of emergent, scrub-shrub, and forested vegetated wetlands, with some upland habitat (see Table 5.2 and Figure 5.1a and 5.1b). The conversion of the deepwater habitats to a greater complexity of vegetated wetland types would improve wetland functions related to water quality, hydrologic function, and wildlife habitat, as described above for the No Action Alternative. Vegetated wetlands provide greater water quality functions over deepwater habitat. The emergent and scrub-shrub vegetation on the habitat areas would help to filter and absorb pollutants while also reducing the potential for shoreline erosion by disrupting waves and currents in the Middle Basin. The habitat areas would offer edge habitat that supports additional foraging, resting, and nesting areas for ducks and wading birds, songbirds, and water-dependent mammals. The acreage of the different wetland types would change over time as sediment accumulates, but there would be no overall loss of waters of the U.S. or state. A small percentage of the total area of the habitat areas would support upland vegetation, in pockets or hummocky areas. The design would be refined to maximize wetland area and habitat complexity if the Managed Lake Alternative is selected. If the volume of dredged materials exceeds what is needed for wetland habitat area creation, some material may need to be disposed of offsite, although all dredged material is currently expected to be beneficially reused onsite under the Managed Lake Alternative. The habitat areas would be monitored and managed according to the prescriptions in the Habitat Enhancement Plan (as described in Section 5.7). Regardless, there would be a net gain in wetland

functions that would be similar to that described under the No Action Alternative, providing a **minor beneficial effect.**

There would be minimal changes to wetlands in West Bay under the Managed Lake Alternative.

Table 5.2 Managed Lake Alternative Wetland Types

Wetland Type	Vegetation	Estimated Future Acreage[1,2]	Existing Conditions[3]
Deepwater Habitat – Estuarine	Aquatic vegetation	208	208
Mudflat	--	1	1
Vegetated Wetland – Estuarine (High Marsh)	Tufted hairgrass, meadow barley, Douglas' aster, Baltic rush, seashore saltgrass, Pacific silverweed, sea plantain, pickleweed, fleshy jaumea, Puget Sound gumweed, lakeshore sedge	3	3
Deepwater Habitat - Freshwater	Unvegetated or common waterweed, pondweed species, yellow water lily, watershield, duckweed, arrowleaf	107	240
River Channel - Freshwater	None	5	25
Vegetated Freshwater Wetlands (PAB)	Aquatic Bed	87	0
Vegetated Freshwater Wetlands (PEM)	Emergent	55	19
Vegetated Freshwater Wetlands (PSS)	Scrub-shrub	62	16
Vegetated Freshwater Wetlands (PFO)	Forested	8	18
Upland	-	14	19

Notes:

1. All areas are estimated, based on future modeled conditions and rounded to the nearest acre.
2. Acreages do not account for change to in-water or overwater structures as described in Section 5.4.2.2.
3. Areas for existing conditions are approximate, based on NWI data and a high-level reconnaissance investigation.

5.4.2.2 In-water and Overwater Structures (Shading and Fill Impacts)

A buttressing berm would be built on the West Bay side of the 5th Avenue Dam to improve stability. Up to 25,000 cy of aggregate and riprap would be placed along the shoreline and in water on the downstream (seaward) side of the earthen portion of the dam. This would result in an estimated area of 23,000 square feet of fill in deepwater estuarine habitat in West Bay.

New in-water and overwater structures, including the 5th Avenue Non-Vehicular Bridge, boardwalks, dock, and boat launch, could directly impact wetland habitats through placement of fill or support piles or indirectly through shading. Fill from pile supports associated with the 5th Avenue Non-Vehicular Bridge would directly impact roughly 30 square feet of deepwater habitat. The bridge would shade an estimated 7,600 square feet of deepwater habitat, although the east-west orientation and the height of the structure above the water level would likely allow some sunlight penetration. Shade can result in a change in wetland vegetation and is either considered as no impact, or an indirect impact depending on the decking material, orientation of the structure, and height above the water. For the purpose of this evaluation, it is considered an indirect impact.

The boardwalks would be constructed on the west side of the Middle Basin, connecting through wetland habitats. In the South Basin, boardwalks would be located adjacent to Tumwater Historical Park and would replace existing boardwalk if needed. The boardwalks would most likely be pile-supported, timber deck structures, approximately 8 feet wide.

The existing dock in Capitol Lake Interpretive Center would be rebuilt to like-kind conditions. The existing dock is a timber pile supported structure, extending approximately 100 feet into the Middle Basin. An approximately 5-foot-wide timber pier leads to the dock, which is approximately 50 feet by 15 feet. There would be no or minimal increase in shade or fill as the result of the rebuilt dock, as it is replacing an existing structure.

The boardwalks and dock would shade approximately 49,000 square feet of scrub-shrub and emergent wetlands. Support piles for the boardwalks would directly impact an estimated 600 square feet of wetlands.

A boat launch for hand-carried watercraft would be constructed at Marathon Park; it is estimated to be up to 50 feet wide. The boat launch would fill an area of approximately 150 square feet of vegetated emergent or scrub-shrub wetlands or deepwater habitat, depending on exact location and design. The boat launch would be designed to minimize the loss of wetlands. This loss of wetlands would reduce the area available to provide functions related to water quality improvement, hydrologic function, and wildlife habitat.

5.4.2.3 Maintenance Dredging

Maintenance dredging in the North Basin would occur approximately 20 years after construction to maintain a lakebed elevation similar to that produced by the initial dredging. With maintenance dredging, most of the North Basin would remain freshwater deepwater habitat, and functions would

remain similar to existing conditions (Table 5.2). Vegetated scrub-shrub and emergent wetlands would remain along the perimeter of the North Basin. After the initial round of maintenance dredging, the frequency of maintenance dredging in the North Basin is expected increase as the Middle Basin accumulates sediment, reaches equilibrium, and most of the sediment moves through to the North Basin. Maintenance dredging would cause the same temporary impacts on deepwater habitat and ecological functions as described in Section 5.3, Impacts Common to All Action Alternatives, for initial dredging. All dredged material would be disposed of offsite.

5.4.2.4 Summary of Managed Lake Alternative Operation Impacts

The estimated area of wetland impact under the Managed Lake Alternative is shown in Table 5.3 below. This area is small relative to the overall extent of wetlands in the Capitol Lake Basin and, as a result, the decreases in wetland functions related to water quality improvement, hydrologic function, and wildlife habitat would be small. Additionally, the habitat type that would most be affected (deepwater habitat) is relatively common in the region.

Table 5.3 Approximate Area of Wetland Fill and Shade under the Managed Lake Alternative

	Fill Area (SF)	Shade Area (SF)
Buttress Berm	23,000	0
Non-Vehicular Bridge	30	7,600
Boardwalks / Dock	600	49,000
Boat Launch	150	0
Total	**23,780 (0.54acre)**	**56,600 (1.3 acres)**

The creation of wetland habitat areas using dredged material and the natural increase in vegetated wetland areas through ongoing sediment accumulation in the Middle Basin are expected to produce a net gain in wetland functions, providing a **minor beneficial effect** overall for this alternative. Depending on the final design, some upland habitat could develop on the habitat areas; however, this change would be part of a mosaic of wetland and upland habitat and contribute to an improvement in habitat diversity.

Compensatory mitigation would be required for any loss of a water of the U.S. if the regulatory agencies do not consider the project self-mitigating in consideration of the above-described habitat improvements. With habitat improvements included in the Managed Lake Alternative and additional wetland mitigation, if required by regulatory agencies, direct impacts from fill and indirect impacts from shade under the Managed Lake Alternative would be **less-than-significant**.

5.5 ESTUARY ALTERNATIVE

5.5.1 Impacts from Construction

In addition to the construction activities noted in Section 5.3, Impacts Common to All Action Alternatives, the Estuary Alternative has the following construction activities:

- 5th Avenue Dam and Bridge removal
- Construction of a new 5th Avenue Bridge and Deschutes Parkway realignment
- Slope stabilization along the Deschutes Parkway SW
- Stormwater outfall replacement (along the Deschutes Parkway SW and the Arc of Statehood)
- Replacing culverts at Capitol Lake Interpretive Center

The removal of the 5th Avenue Dam and Bridge, construction of the new 5th Avenue Bridge, and realignment of Deschutes Parkway would be the most intensive of these activities. Some of the structures would take multiple years to construct; however, all in-water work would be limited to the in-water work windows, or constructed in the dry using cofferdams, limiting the duration of potential impacts on wetlands. Vegetated wetlands and deepwater freshwater and deepwater estuarine habitat would be temporarily affected during construction. Wetland soils may be compacted and vegetation removed by the movement of construction equipment and materials. Construction activities may also release sediment into the deepwater habitat affecting wetland vegetation, as described in Section 5.3, Impacts Common to All Action Alternatives. Potential impacts from slope stabilization, stormwater, and culvert replacement would likely be similar, temporally affecting scrub-shrub and emergent wetlands along the shoreline. As described above, BMPs will be used to avoid and minimize impacts. Additional measures will be implemented to offset impacts on wetlands (see Section 5.7). Temporary construction impacts from these activities are **less-than-significant**.

5.5.2 Impacts from Operation

Under the Estuary Alternative, the removal of the 5th Avenue Dam and creation of a 500-foot-wide opening would allow saltwater from Budd Inlet to enter the basins, transforming it from a freshwater to its historic condition as an estuarine system influenced by saltwater and daily tides (Figure 5.2a and 5.2b).

Figure 5.2a Estuary Alternative Wetland Types

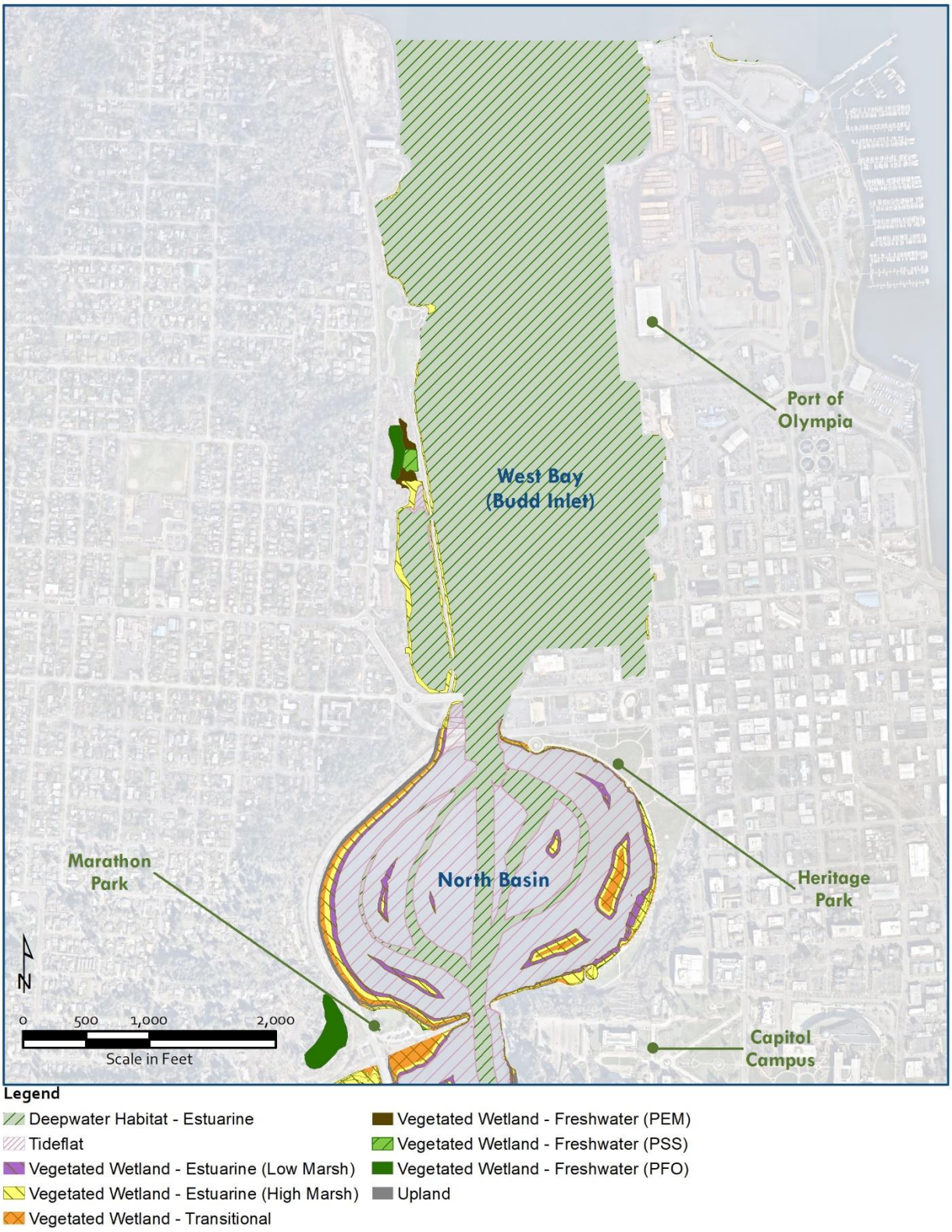
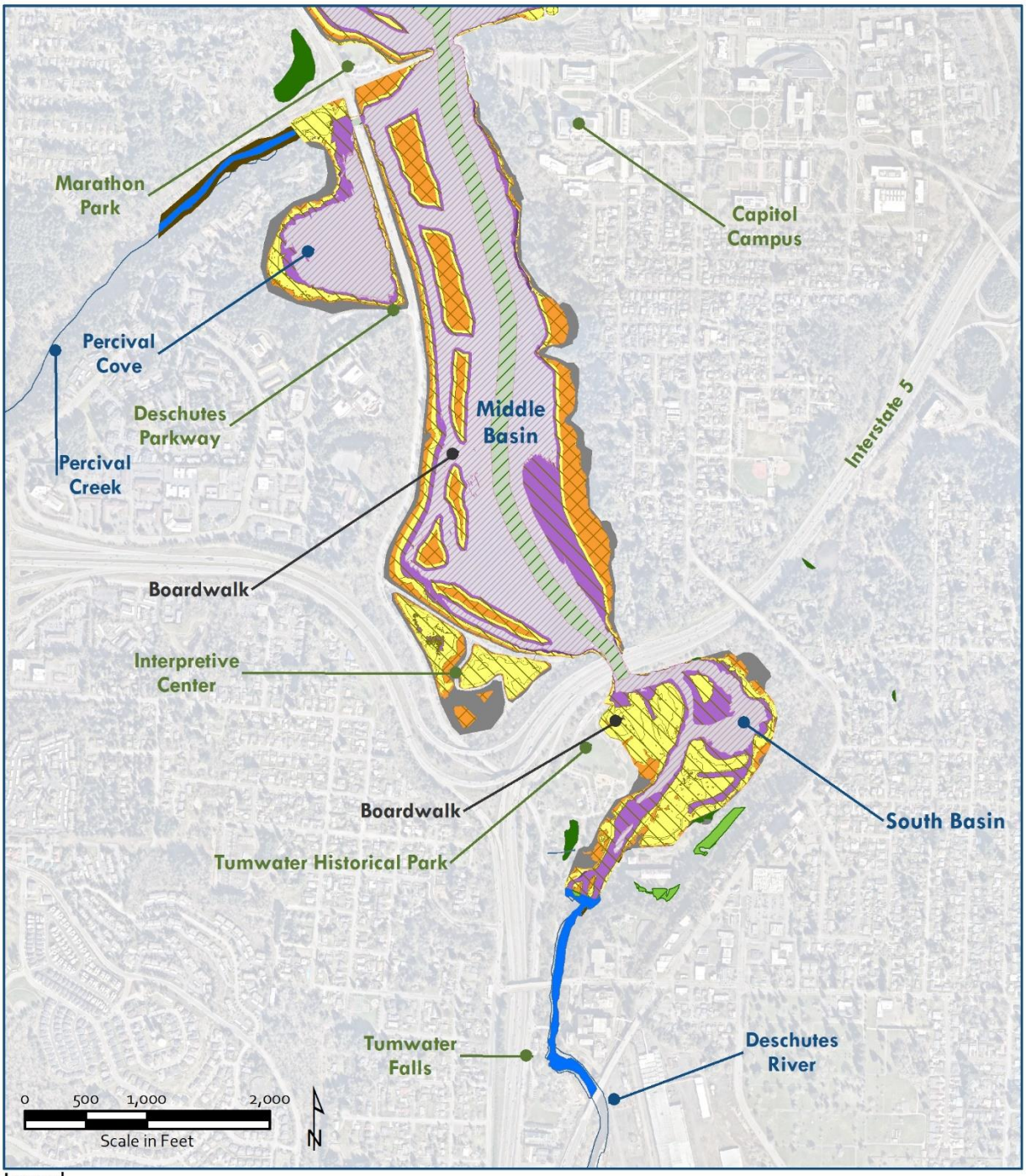


Figure 5.2b Estuary Alternative Wetland Types



Legend

- Deepwater Habitat - Estuarine
- Tideflat
- Vegetated Wetland - Estuarine (Low Marsh)
- Vegetated Wetland - Estuarine (High Marsh)
- Vegetated Wetland - Transitional
- Vegetated Wetland - Freshwater (PEM)
- Vegetated Wetland - Freshwater (PSS)
- Vegetated Wetland - Freshwater (PFO)
- River Channel
- Upland

5.5.2.1 Changes in Wetland Habitat Types (from 5th Avenue Dam Removal and Habitat Areas)

The long-term (operational) impacts on wetlands associated with this alternative would primarily be associated with the conversion of freshwater wetland habitat types to estuarine wetland habitat as a result of tidal hydrology being restored throughout the entire basin. Wetlands are considered estuarine when salinity is greater than 0.5 ppt. Estimated salinity levels for the Estuary Alternative indicate estuarine conditions throughout most of the basins, with salinity decreasing from the North Basin (24–18 ppt) to the Middle Basin (18–5 ppt) to the South Basin (5–0 ppt). The estimated salinity levels in the south portion of the South Basin cross over the 0.5 ppt threshold with less tidal influence and greater influence of freshwater from the Deschutes River.

The removal of the 5th Avenue Dam would create an opening between the North Basin and West Bay and would remove approximately 3.3 acres of fill from waters of the U.S. or state. The new area would primarily be estuarine deepwater habitat.

To promote the formation of estuarine habitat similar to historic conditions, a main channel and secondary channels would be excavated in the North and Middle Basins and habitat areas constructed using the dredged and excavated materials. The main channel would remain submerged regardless of tidal flow through the basins. Secondary channels in the North and Middle Basins would be established at shallower elevations, creating subtidal and intertidal zones and increasing habitat complexity and diversity, mimicking the historic channels.

As with the other alternatives, habitat areas would be constructed in the North and Middle Basins using materials from the initial dredging. These habitat areas would resemble natural floodplain islands with a shallow slope that allows for mudflats to transition gradually through low marsh and high marsh wetlands to a less salt-influenced vegetated wetland, providing more diversity in elevations and habitat zones. The habitat areas would be designed as mounds of varying size and elevation with the intent of creating a mosaic of wetland and upland conditions, with the majority providing wetland functions. If the Estuary Alternative is selected, the design would be refined to maximize wetland area and habitat complexity. If the volume of dredged materials exceeds what is needed for wetland habitat area creation, some material may need to be disposed of offsite. This is currently estimated at approximately 30,000 cy. The habitat areas would be monitored and managed according to the prescriptions in the Habitat Enhancement Plan (as described in Section 5.7).

The shoreline along much of Deschutes Parkway would be stabilized and enhanced through the placement of excavated material and creation of a shallow slope that is planted with native vegetation. This would create low marsh and high marsh wetlands as well as less salt influenced vegetated wetlands at the higher elevations. Native salt-tolerant plant species would be installed at appropriate elevations to assist in the establishment of these habitat types (Table 5.4).

The North and Middle Basins would consist primarily of intertidal mudflats (exposed during low tides and submerged during high tides), with a fringe of vegetated marsh around the periphery of the estuary and with subtidal channels connecting the Deschutes River through to Budd Inlet, in addition to the

constructed wetland habitat areas. The South Basin would convert from vegetated freshwater wetlands adjacent to a low-gradient river channel to saltwater habitat characterized by low and high marsh with a central area of exposed mudflat at low tide (Figure 5.2a and 5.2b). At this upper limit of tidal influence, the salinity would decrease to where salt-tolerant freshwater vegetation would become the dominant species. This transition is estimated to occur approximately where the Deschutes River begins to narrow, adjacent to Tumwater Historical Park. The influence of tidal hydrology would result in the conversion of freshwater deepwater habitat to estuarine deepwater habitat, mudflat, low or high marsh wetland, as well as transitional wetlands. Transitional wetlands would have characteristics of both fresh and saltwater habitats, as these wetlands would be high enough elevation that saltwater would not necessarily be the dominant source of hydrology. Approximately 14 acres of currently forested freshwater wetlands would convert to estuarine or transitional wetlands, which would directly impact trees currently growing in these areas (see Table 5.4).

Table 5.4 Estuary Alternative Wetland Types

Wetland Type	Vegetation	Estimated Acreage[1,2]	Existing Conditions[3]
Deepwater Habitat – Estuarine	Aquatic vegetation	245	208
Mudflat	--	152	1
Vegetated Wetland – Estuarine (Low Marsh)	Pickleweed, fleshy jaumea	39	0
Vegetated Wetland – Estuarine (High Marsh)	Tufted hairgrass, meadow barley, Douglas' aster, Baltic rush, seashore saltgrass, Pacific silverweed, sea plantain, pickleweed, fleshy jaumea, Puget Sound gumweed, lakeshore sedge	49	3
Vegetated Wetland – Transitional	Sitka spruce, shore pine, Hooker's willow, oceanspray	31	0
Deepwater Habitat - Freshwater	Unvegetated or common waterweed, pondweed species, yellow water lily, watershield, duckweed, arrowleaf	0	240
River Channel - Freshwater	None	5	25
Vegetated Freshwater Wetlands (PEM)	Emergent	3	19
Vegetated Freshwater Wetlands (PSS)	Scrub-shrub	2	16
Vegetated Freshwater Wetlands (PFO)	Forested	4	18
Upland		21	19

Notes:

1. Areas are estimated based on modeled future conditions.
2. Acreages do not account for changes to in-water or overwater structures described in Section 5.5.2.2.
3. Existing areas are approximate, based on NWI data and a high-level reconnaissance investigation.

The change from freshwater to estuarine wetlands, after saltwater and tidal flow are reintroduced, would have corresponding effects on wetland functions related to water quality improvement, hydrologic function, and fish and wildlife habitat. The key functions of estuarine wetland communities include denitrification, carbon transformation, nutrient cycling, primary production and food web support, sediment deposition and erosion, and fish and wildlife habitat, particularly for reproduction and feeding (Garono et al. 2006; Mitsch and Gosselink 2015). These functions depend upon several key ecological processes such as freshwater input, sediment transport, erosion and accretion of sediments, tidal flow, tidal channel formation and maintenance, distributary channel migration, movement of aquatic organisms, and detritus import and export (Schlenger et al. 2011).

The removal of the dam combined with the dredging of main and secondary channels through the North and Middle Basins would re-establish hydrodynamic, sediment transport, and ecologic processes, creating a nearshore estuary setting. First, dam removal would restore hydraulic connectivity to Budd Inlet and allow full tidal circulation and exchange. This would re-establish biological connectivity across the river-estuary-marine boundary or freshwater-saltwater interface, providing a source for the recruitment of a wide array of estuarine plants and animals. Second, the restored elevations, substrate types, and salinities would provide the habitat conditions necessary to support viable populations of native plants, invertebrates, birds, and fish. Over time, a dynamic biological community and functioning estuarine ecosystem would develop (Garono et al. 2006).

Furthermore, the restoration of sediment transport and accretion processes would enable the tidal marshes to adjust to changes in sea level. Tidal wetlands provide water quality functions; they intercept and physically filter sediments and associated contaminants in freshwater runoff with subsequent burial in marsh sediments. They support geochemical environments in both oxygenated and non-oxygenated sediments, which promote denitrification and other chemical reactions that remove certain chemicals from the water, thereby providing further nutrient cycling functions. Tidal marsh vegetation is highly productive, which reduces the pool of inorganic nutrients that might drive eutrophication. Tidal marshes maintain a diverse array of decomposers and decomposition processes that trap and remove organic matter from the system (Fresh et al. 2011).

The removal of the 5th Avenue Dam allows water levels in Capitol Lake to rise and fall with the tides. With relative sea level rise (RSLR), higher elevation topography will become wetted more frequently, causing changes in soil moisture content, salinity, and composition. Consequently, the types of vegetation communities supported at each elevation zone as shown in Table 5.4 would shift with RSLR. Over time, there would be a gradual change from transitional vegetated wetland to high marsh and to low marsh vegetated wetland. In some places, low marsh would transition to mudflat or deepwater habitat. A gradual transition from freshwater wetland to estuarine wetland would be expected at some higher elevations.

The Puget Sound region has experienced a dramatic loss of estuarine wetlands over the last 150 years. The 16 largest deltas of Puget Sound, including the Deschutes, have all been extensively modified to accommodate residential, commercial, or industrial uses (Fresh et al. 2011). Modification has resulted from direct fill and encroachment into wetlands, armoring of the shoreline, and downstream impacts

resulting from development in the watershed. In the Olympia area of Budd Inlet, up to 94% of the shoreline is armored (Herrera 2005).

As part of the Puget Sound Nearshore Ecosystem Restoration Project (PSNERP), Simenstad et al. (2011) documented changes in nearshore environments of Puget Sound by comparing historical (circa 1850–1880) and current (2000–2006) conditions. The study recognized four tidal wetland types that are found in Puget Sound's estuarine environments based on their relative salinity regime (in decreasing order): high salinity unvegetated wetlands (mudflats), mid-salinity wetlands (emergent marsh), low-salinity wetlands (brackish marshes and scrub-shrub, and tidal freshwater wetlands (upper limit of tidal influence). The study found that overall, 56% of all estuarine wetlands historically present in the 16 large deltas studied have been eliminated. The South Puget Sound basin, which includes the project area, has experienced similar levels of wetland losses, including 40% of emergent marshes, 81% of low salinity marshes, and 84% of tidal freshwater wetlands.

Based on the modeled future conditions under the Estuary Alternative, the wetland types expected to form are the same as those with the greatest historic losses, documented by Simenstad et al. (2011). This includes wetlands at the upper limit of tidal influence (<0.5 ppt) and wetlands in the transitional zone between freshwater and saltwater (0.5 ppt–5.0 ppt). These two wetland types have been almost completely eliminated from Puget Sound at 93% loss. Among the 16 large river deltas in Puget Sound, restoration of the Deschutes Estuary and tidal wetlands is highlighted by PSNERP as one of the best opportunities for large-scale restoration of nearshore processes (Schlenger et al. 2011). The re-establishment of estuarine wetlands and their associated functions of water quality improvement and fish and wildlife habitat would result in a net gain in wetland function compared to the No Action and Managed Lake Alternatives. Re-establishment of estuarine wetlands is a **substantial beneficial effect** under the Estuary Alternative.

5.5.2.2 In-water and Overwater Structures (Shading and Fill Impacts)

New in-water and overwater structures, including the new 5th Avenue Bridge, boardwalks, dock, and boat launch, could result in permanent impacts on wetlands through direct fill or indirectly through shading. Under the Estuary Alternative, fill and shading would primarily affect mudflats. Shade can result in a change in wetland habitat (mainly by limiting the establishment and growth of plant species) and is often considered as no or minimal impact, or an indirect impact depending on the orientation of the structure and height above the water. For the purpose of this evaluation, it is considered an indirect impact.

The new 5th Avenue Bridge would be constructed south of the opening, spanning approximately 700 feet across the North Basin. The new bridge would be approximately 63 feet wide, supported by drilled shafts. This would result in an estimated 50,000 square feet of shade from the deck and 1,573 square feet of fill from drilled shafts over estuarine deepwater habitat.

The boardwalks would be constructed on the west side of the Middle Basin, connecting through the wetland habitat areas. In the South Basin, boardwalks would replace the existing boardwalks and be adjacent to Tumwater Historical Park. The boardwalks would most likely be pile-supported, timber deck structures, approximately 8 feet wide and above the water surface. The boardwalks would shade

approximately 49,000 square feet, causing an indirect impact on waters of the U.S. or state including mudflats, high marsh, low marsh, and vegetated wetlands on the habitat areas. Support piles for the boardwalks would be placed in both upland and wetland habitats, creating an estimated area of 600 square feet of wetland fill.

The existing dock in Capitol Lake Interpretive Center would be rebuilt to like-kind conditions. The existing dock is a timber pile-supported structure, extending approximately 100 feet into the Middle Basin. An approximately 5-foot-wide timber pier leads to the dock, which is approximately 50 feet by 15 feet. There would be no or minimal increase in shade or fill as the result of the rebuilt dock.

A hand-carried boat launch would be constructed at Marathon Park; it is estimated to be up to 50 feet wide. The boat launch would fill an area of approximately 150 square feet of high marsh, low marsh, or mudflat, depending on its exact location. This loss of wetlands would reduce the area available to provide functions related to water quality improvement, hydrologic function, and wildlife habitat.

5.5.2.3 Maintenance Dredging

Future accumulations of sediment in the southern portion of West Bay would be removed through recurring maintenance dredging, approximately every 6 years (an estimated five dredge events within the time horizon of the project) within different affected areas along the east side of West Bay; see Section 1.2 in the project description for details. The dredged material is expected to be placed at an open water disposal site in Puget Sound. The purpose of the dredging is to maintain navigability for the port facilities, Olympia Yacht Club, and adjacent marinas. The impact of these dredging activities on deepwater habitat in West Bay is expected to be minor as maintenance dredging already occurs periodically and thus would be similar to existing conditions. Impacts from dredging would be **less-than-significant**.

5.5.2.4 Summary of Estuary Alternative Operation Impacts

Under the Estuary Alternative, changes in wetland habitat would occur from the reintroduction of saltwater and tidal flow, creation of habitat areas, slope stabilization along Deschutes Parkway, new structures, and from recurring maintenance dredging in West Bay. The removal of the 5th Avenue Dam would re-establish estuarine wetland habitats throughout the basin. Some of the existing freshwater forested and scrub-dominated wetlands that have become established in the Middle and South Basins since the dam was constructed would be replaced by estuarine wetlands over time, with a slight gain in the overall wetland area. These changes notwithstanding, the re-establishment of estuarine wetlands is a **substantial beneficial effect.** Estuarine wetlands provide water quality, hydrologic, and wildlife functions that are relatively rare in the region.

The impacts of the new 5th Avenue Bridge, boardwalks, and boat launch are shown in Table 5.5 below. Overall, these impacts would be more than offset by the removal of approximately 3.3 acres of fill in waters of the U.S. or state due to the removal of the 5th Avenue Dam. With habitat improvements included in the Estuary Alternative and additional wetland mitigation, if required by regulatory agencies, direct impacts from fill and indirect impacts from shade under the Estuary Alternative would be **less-than-significant**.

Table 5.5 Approximate Area of Wetland Fill and Shade under the Estuary Alternative

	Fill Area (SF)	Shade Area (SF)
New 5th Avenue Bridge	1,573	50,000
Boardwalks / Dock	600	49,000
Boat Launch	150	0
Total	**2,323 (0.05 acre)**	**99,000 (2.3 acres)**

5.6 HYBRID ALTERNATIVE

5.6.1 Impacts from Construction

Construction impacts from the Hybrid Alternatives are very similar to those described for the Estuary Alternative. The Hybrid Alternative also includes the construction of a 2,600-foot-long sheet pile barrier wall with supporting tail walls to create a reflecting pool. The wall is anticipated to take approximately 15 months, over three in-water work windows. The sheetpiling for the structure would be installed using a barge-based vibratory hammer. Wall installation could create turbidity and wetland impacts to adjacent wetlands and deepwater habitat similar to the construction work described in Section 5.3, Impacts Common to All Action Alternatives.

5.6.2 Impacts from Operation

Same as the Estuary Alternative, the removal of the 5th Avenue Dam and creation of a 500-foot-wide opening would allow saltwater from Budd Inlet to enter the basins, transforming the area from a freshwater to estuarine system influenced by saltwater and daily tides (Figure 5.3a and 5.3b). Additionally, within the North Basin, a retaining wall would be constructed to create an approximately 45-acre freshwater reflecting pool adjacent to Heritage Park.

5.6.2.1 Changes in Wetland Habitat Types (from 5th Avenue Dam Removal and Habitat Areas)

The long-term (operational) impacts on wetlands associated with the Hybrid Alternative are similar to the Estuary Alternative, with the conversion of freshwater wetland to estuarine habitat types. Estimated salinity levels for the Hybrid Alternative indicate estuarine conditions throughout most of the basins, with salinity decreasing from the North Basin (25–18 ppt) to the Middle Basin (18–5 ppt) to the South Basin (5–0.5 ppt). The estimated salinity levels in the south portion of the South Basin are higher than the Estuary Alternative and do not cross over the 0.5 ppt threshold.

As under the Estuary Alternative, the removal of the 5th Avenue Dam would create an opening between the North Basin and West Bay and remove approximately 3.3 acre of fill from waters of the U.S. or state. The new area would primarily be estuarine deepwater habitat. A main channel and secondary channels would be excavated in the North and Middle Basins. The main channel would be submerged for most tides regardless of flow through the basins. Secondary channels would be established at

shallower elevations, creating subtidal and intertidal zones and increasing habitat complexity and diversity, mimicking the historic channels. Wetland habitat areas would be constructed using the dredged and excavated materials. The habitat areas would be designed to function the same as with the Estuary Alternative, but their locations would likely be somewhat different, particularly in the North Basin. The shoreline along much of Deschutes Parkway would be stabilized and enhanced, the same as with the Estuary Alternative.

Existing deepwater and vegetated freshwater wetlands in the North, Middle, and South Basins would be converted to mudflats, low marsh, high marsh, and transitional wetland habitat. In the North Basin, 45 acres would remain deepwater, freshwater habitat for the reflecting pool (Table 5.6). As with the Estuary Alternative, removal of the 5th Avenue Dam would allow water levels in Capitol Lake to rise and fall with the tides. With sea level rise, the types of vegetation communities supported at each elevation zone as shown in Table 5.6 would shift as sea levels rise. Over time, there would be a gradual transition from transitional vegetated wetland to high marsh and low marsh. In some places, low marsh will transition to mudflat or open water habitat. A gradual transition from freshwater wetland to estuarine wetland would be expected at higher elevations.

Like the Estuary Alternative, restoring tidal hydrology would have corresponding effects on wetland functions related to water quality improvement, hydrology, and fish and wildlife habitat. The key functions of estuarine wetland communities include denitrification, carbon transformation, nutrient cycling, primary production and food web support, sediment deposition and erosion, and fish and wildlife habitat, particularly for reproduction and feeding (Garono et al. 2006; Mitsch and Gosselink 2015). The reflecting pool in the North Basin would create a constructed deepwater habitat, which would not provide as much benefit as an open system.

The barrier wall and supporting tail walls for the reflecting pool would displace 50,270 square feet of estuarine deepwater habitat, which is a permanent loss of a water of the U.S. or state. However, with the removal of the 5th Avenue Dam and creation of the habitat areas using dredged materials, the Hybrid Alternative would still result in a net gain in wetland area and function. The net gains are somewhat less than with the Managed Lake or Estuary Alternative because the Hybrid Alternative has greater impacts due to the barrier wall. As with the Estuary Alternative, some of the freshwater forest and shrub-dominated wetlands that have become established in the Middle and South Basins since the dam was constructed would be replaced with estuarine wetlands over time. However, re-establishment of estuarine wetlands overall is a **substantial beneficial effect** under the Hybrid Alternative.

Figure 5.3a Hybrid Alternative Wetland Types

Figure 5.3b Hybrid Alternative Wetland Types

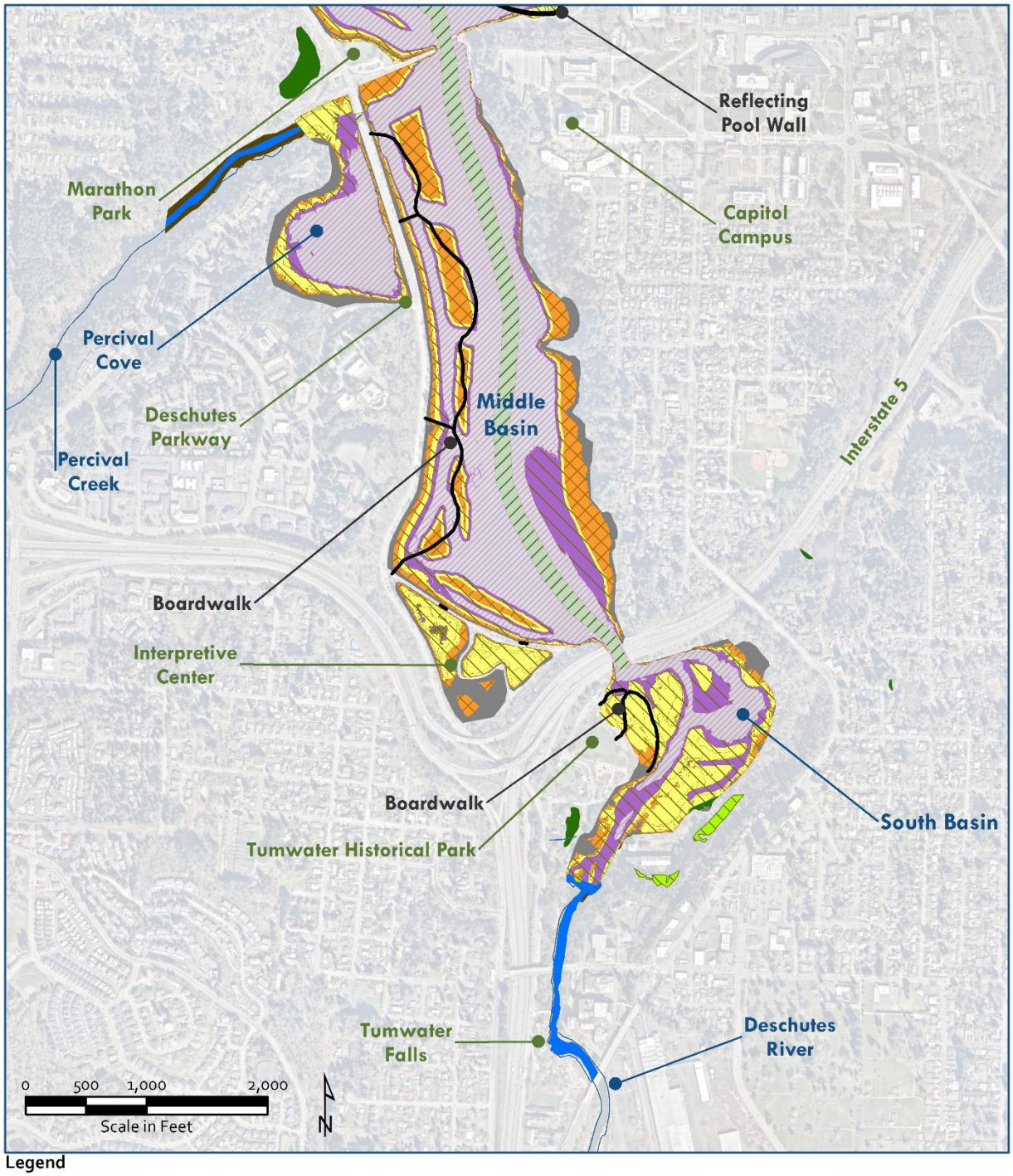


Table 5.6 Hybrid Alternative Wetland Types

Wetland Type	Vegetation	Estimated Future Acreage[1,2]	Existing Conditions[3]
Deepwater Habitat – Estuarine	Aquatic vegetation	238	208
Mudflat	--	119	1
Vegetated Wetland – Estuarine (Low Marsh)	Pickleweed, fleshy jaumea	37	0
Vegetated Wetland – Estuarine (High Marsh)	Tufted hairgrass, meadow barley, Douglas' aster, Baltic rush, seashore saltgrass, Pacific silverweed, sea plantain, pickleweed, fleshy jaumea, Puget Sound gumweed, lakeshore sedge	48	3
Vegetated Wetland - Transitional	Sitka spruce, shore pine, Hooker's willow, oceanspray	29	0
Deepwater Habitat – Freshwater (Reflecting Pool)	Unvegetated or common waterweed, pondweed species, yellow water lily, watershield, duckweed, arrowleaf	45	240
River Channel - Freshwater	None	5	25
Vegetated Freshwater Wetlands (PEM)	Emergent	3	19
Vegetated Freshwater Wetlands (PSS)	Scrub-shrub	2	16
Vegetated Freshwater Wetlands (PFO)	Forested	4	18
Upland	-	21	19

Notes:

1. Areas are estimated, based on future modeled conditions and rounded to the nearest acre.
2. Acreages do not account for changes to in-water or overwater structures described in Section 5.6.2.2.
3. Existing areas are approximate, based on NWI data and a high-level reconnaissance investigation.

5.6.2.2 In-water and Overwater Structures (Shading and Fill Impacts)

As described above, the barrier wall and supporting tail walls for the reflecting pool would result in 50,270 square feet of fill within estuarine deepwater habitat, which is a permanent loss of a water of the U.S. or state. However, with the removal of the 5th Avenue Dam and creation of the habitat areas using

dredged materials, the Hybrid Alternative would still result in a net gain in wetland area and function. Fill and shade impacts from the new 5th Avenue Bridge, boardwalks, dock, and boat launch would be the same as described for the Estuary Alternative. The pedestrian walkway on the barrier wall would be 14 feet wide and 2,600 feet long and would shade some additional deepwater estuarine habitat; however, most of this area would be over the barrier wall.

5.6.2.3 Maintenance Dredging

Accumulated sediment in the southern portion of West Bay would be removed through the initial dredging described above and subsequently managed through recurring maintenance activities, approximately every 5 years (six dredge events total) with different areas of West Bay affected; see Section 1.2 in the project description for details. The dredged material is expected to be placed at an open water disposal site in Puget Sound. The purpose of the dredging is to maintain navigability for the port facilities, Olympia Yacht Club, and adjacent marinas. The impact of these dredging activities on deepwater habitat in West Bay is expected to be minor as maintenance dredging already occurs periodically and thus would be similar to existing conditions.

5.6.2.4 Summary of Hybrid Alternative Operation Impacts

Similar to the Estuary Alternative, the re-establishment of estuarine wetlands is a **substantial beneficial effect.** Estuarine wetlands provide water quality, hydrologic, and wildlife functions that are relatively rare in the Puget Sound region.

Changes to wetlands would occur under the Hybrid Alternative from the reintroduction of saltwater and tidal flow, creation of wetland habitat areas, slope stabilization along Deschutes Parkway, new structures, and from recurring maintenance dredging in West Bay. The reflecting pool in the eastern portion of the North Basin would be a constructed deepwater, freshwater habitat, which would not provide as much benefit as an open estuarine system.

The impacts of the new 5th Avenue Bridge, boardwalks, boat launch, and barrier wall are shown in Table 5.7 below. As with the Estuary Alternative, these impacts are more than offset by the removal of the 5th Avenue Dam, which would restore approximately 145,000 square feet (3.3 acres) of a water of the U.S. Therefore, this alternative would replace/restore more wetland area than it impacts with the wall installation. Overall, habitat complexity would be increased, and water quality and hydrologic functions would improve. The habitat type that would be most affected (freshwater deepwater habitat) is relatively common in the region and would be replaced with a less common and more valuable habitat type (estuarine deepwater). With habitat improvements and additional mitigation, if required by regulatory agencies, direct impacts from fill and indirect impacts from shade under the Hybrid Alternative would be **less-than-significant**.

Table 5.7 Approximate Area of Wetland Fill and Shade under the Hybrid Alternative

	Fill Area (SF)	Shade Area (SF)
New 5th Avenue Bridge	1,573	50,000
Boardwalks / Dock	600	49,000
Boat Launch	150	0
Barrier Wall for Reflecting Pool	50,270	0
Total	**52,593 (1.2 acres)**	**99,000 (2.3 acres)**

5.7 AVOIDANCE, MINIMIZATION, AND MITIGATION MEASURES

5.7.1 Measures Common to All Action Alternatives

Regardless of the selected alternative, standard mitigation sequencing would be followed to avoid, minimize, rectify, reduce, or eliminate impacts to the extent practicable for both construction and operation of the project. The design of the selected alternative will be further refined to avoid and minimize impacts and provide an overall net ecological benefit. If potential impacts remain after following these measures, impacts would be compensated for by replacing, enhancing, or providing a substitute for affected wetlands or their functions. Required mitigation will be determined during the permitting phase. Enterprise Services would work with regulatory agencies to achieve no net loss of waters of the U.S. or state.

5.7.1.1 Habitat Enhancement Plan

A Habitat Enhancement Plan would be developed and implemented for the selected alternative during the future design phase. The plan would be developed in coordination with and approved by Ecology; WDFW; City of Olympia; City of Tumwater; other applicable local, state, and federal agencies; and tribes.

Elements of the plan would vary depending on the alternative, and generally include the following:

- Specific habitat creation, restoration, and design treatments for each habitat area (e.g., upland, riparian, wetland, and aquatic). Treatments include grading, planting, weed management, installation of habitat features, and similar actions.
- Specific performance standards for the habitat areas to measure the success of these areas. Typical performance standards would define thresholds for wetland hydroperiod; cover, density, and diversity of native plants; and other habitat attributes.
- Adaptive management and maintenance to ensure that the performance standards are met. For example, if after construction the native plant assemblages are not establishing as designed, adaptive management actions could include additional planting, soil amendment, modification of topography, weed control, or other corrective measures. The

approach to meeting performance goals and the frequency of active management required to meet the performance goals for the habitat enhancements would vary across the action alternatives. This would be further defined in the permitting process

- Measures to address nuisance and invasive species within the project area. Potential approaches to managing aquatic invasive species would include hand-maintenance (e.g., pulling or seed head removal) and the use of bottom barriers and screens to limit growth. Noxious and invasive wildlife species, including nutria and Canada geese, will continue to be managed by Enterprise Services through a vendor contract.

5.7.2 Construction

Best Management Practices (BMPs) will be used to minimize potential impacts on wetlands such as:

- Changing water access points to avoid wetland areas
- Fencing or marking wetland areas and construction limits
- Using erosion and sediment control methods and plans
- Using silt curtains to control turbidity
- Using steel plates or mats to minimize soil compaction from construction equipment
- Refueling vehicles at least 100 feet away from wetlands
- Time work to occur at low tide as feasible

5.7.3 Operation

Compensatory mitigation for the loss of a water of the U.S. would be required if an action alternative has impacts that cannot be fully avoided or offset through design of habitat features or implementation of the Habitat Enhancement Plan. For the alternative selected, the design would be refined to minimize the wetland loss and maximize habitat benefits. Mitigation for unavoidable direct and indirect impacts on wetlands would be compensated for at ratios determined by the permitting agencies, if it is determined that the alternative selected is not fully self-mitigating even with its overall improvement to ecological function. Mitigation could include replacing wetlands in-kind onsite, or offsite if appropriate locations are not available onsite.

With consideration of the improved habitat functions and self-mitigating functions of the alternatives, compensatory mitigation may be reduced to zero.

For boardwalks, pin piles may be used to minimize wetland fill under any alternative.

5.7.4 Measures Specific to Each Action Alternative

5.7.4.1 Managed Lake Alternative

Mitigation for direct and indirect impacts on wetlands from overwater water structures would be compensated for at ratios determined by the permitting agencies, if it is determined that the Managed Lake Alternative is not self-mitigating. Installation of the buttressing berm would be timed to occur at low tide as feasible.

5.7.4.2 Estuary Alternative

The Estuary Alternative would provide substantial ecological benefits through the conversion of freshwater wetland habitats to more valuable and less common estuarine wetland systems. This ecological lift would be considered by agencies in determining mitigation requirements. If it is determined that the Estuary Alternative is not self-mitigating, mitigation for the loss of waters of the U.S. or state would be compensated for using ratios similar to the Managed Lake Alternative.

5.7.4.3 Hybrid Alternative

Mitigation would be the same as for the Estuary Alternative.

5.8 SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

With mitigation, there are no significant unavoidable adverse impacts.

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