Wetland Enhancement
- Control invasive species
- Plant with native woody species
- Install habitat features

Buffer Enhancement
- Control invasive species
- Replant with native species
- Install habitat features
- Includes high-density interior buffer planting

Wetland Establishment
- Remove roadway surface and replace with soil
- Remove non-native white poplar
- Replace with native woody plant species
- Install habitat features

Buffer Enhancement
- Control invasive species
- Replant with native species
- Install habitat features
- Includes high-density interior buffer planting

Wetland Enhancement
- Control invasive species
- Plant with native woody species
- Install habitat features

Wetland Enhancement
- Remove rip-rap on surface
- Control invasive species
- Plant with native emergent species for shorebird habitat
- Install habitat features

Wetland Enhancement
- Control invasive species
- Plant with native emergent species for shorebird habitat

25TH AVE NE
MARY GATES MEMORIAL DR NE
NE 41ST ST
MONTLAKE BLVD NE
6
5
2D
4
2C
2A
1A
1D
2B
1E
E-5 Restoration
Loop Trail
1B
3A
3B
1C

Mitigation Type	Acres
Wetland Establishment	2.29
Wetland Enhancement	7.49
Ongoing Wetland Enhancement	1.90
Ongoing Buffer Enhancement	2.35
Buffer Enhancement	11.67
Total	**25.69**

Souce: City of Seattle GIS Data (2008), University of Washington (2010), BingMap (2010), PSLC (2000)

D:\GISDATA\projects\washwsdot\SR_520\Westside\map_docs\mxd\for_Mit_Report\UBNA_2011_v3.mxd

N

0 100 200 300 400 500 Feet

Legend

- Wetland Establishment
- Wetland Enhancement
- Buffer Enhancement
- Ongoing Wetland Enhancement
- Ongoing Buffer Enhancement
- Forest and Shrub Plantings
- Herbaceous and Emergent Plantings
- Wetland (Delineated in May/June 2011)
- Wetland (Estimated)
- Stream
- 1A Wetland Label

Figure 7
Union Bay Natural Area Mitigation Concept

SR 520, I-5 to Medina: Bridge Replacement and HOV Project

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WSDOT proposes 2.29 acres of wetland establishment at one location at the UBNA site. The location selected is in the E-5 Restoration Management Area (Figure 7). This location was selected for wetland establishment for the following reasons:

- Establishing wetland in this location is consistent with long term plans for the site.
- The selected location is believed to have been part of the earthen fill used to retain the landfill in place. As a result, it is expected that the substrate is clean fill and poses less risk of uncovering landfill waste. Most of the site's other locations are reported to have a much thinner cover of clean fill materials.
- The area is currently used as a parking lot and the developed surface can be readily regraded to achieve elevations that will ensure a consistent source of wetland hydrology.
- Although the Douglas Road access road to the parking area is expected to remain, removing the parking lot area will greatly reduce traffic on the access road, substantially reducing the pollutant load on this paved surface.
- The University of Washington has successfully established wetlands immediately adjacent to this location.
- Trail systems are effective at managing users and keeping the majority of the users from disturbing restoration sites. Maintaining a trail system at the site that minimizes disturbance to the mitigation is a desirable goal.

WSDOT proposes 7.49 acres of new wetland enhancement in several locations at the UBNA site (Figure 7). These locations were selected for wetland enhancement for the following reasons:

- It represents a relatively large area of disturbed wetland that would benefit from enhancement activities.
- Wetland enhancement in this location is consistent with the overall goals for the site.
- The areas are relatively removed from trails on the site.

WSDOT also proposes to complete wetland enhancement activities on 1.90 acres at the UBNA site (locations are shown on Figure 7). The activities at these locations represent the completion of ongoing enhancement work undertaken by various groups at the site. These locations were selected for wetland enhancement for the following reasons:

- The selected locations represent a relatively large area of wetland that would benefit from enhancement activities.

- Wetland enhancement activities in these locations would complete enhancement work begun by others (some of which is experimental).
- The areas selected have not been previously encumbered as compensatory mitigation, and represent enhancement undertaken purely for restorations sake.
- Activities in these areas will enhance the quality of the habitat on-site.
- Wetland enhancement at these locations is consistent with the overall goals for the site.

The existing activities at the UBNA site are generally small is size and experimental in nature. Maintenance has also been limited by staff availability (Ewing 2010 calculates the approximate maintenance need for the entire UBNA site at 3.2 full time equivalents [FTE], with approximately 0.29 FTE available in 2010). Buffer areas are also inconsistent in size and the degree of protection they provide to the wetlands. These results are consistent with the educational nature of the site, the experimental nature of the treatments, and the limits of available funding for these activities.

Mitigation proposed by WSDOT for these areas will be fully funded, consistent in treatment, will incorporate traditional protective buffer areas, and will be maintained consistently over time. As a result, we feel the proposed improvement will result in a substantial improvement in wetland function at the UBNA site.

WSDOT proposes 11.67 acres of new buffer enhancement and completion of 2.35 acres of buffer enhancement activities at locations throughout the UBNA site (Figure 7). Buffer enhancement in these locations was selected for the following reasons:

- The locations provide relatively large areas of potential buffer contiguous with existing or proposed wetlands.
- These areas will provide improved upland habitat that will contribute to the value of the adjoining wetlands.
- Enhancement activities in these locations will improve the overall value of the site.
- Buffer enhancement is consistent with the overall goals for the site.
- Buffer enhancement in ongoing enhancement areas will complete the restoration efforts for these areas. Note that these areas have not been previously used as compensatory mitigation. They represent enhancement undertaken purely for restoration's sake.

The proposed buffer enhancement activities total 14.02 acres of improvements to buffers on-site.

Specific construction activities will include grading to establish a surface consistent with wetland hydrology, replanting native wetland and upland plant species, and controlling non-native species on the site. The proposed mitigation will be developed in consultation with the University of Washington faculty and staff, and will be consistent with the intent of maintaining the site as an outdoor laboratory for wetland science.

5.2.8. Site Constraints

The UBNA site has several constraints that will affect mitigation design and construction, and will require careful and continued attention. These constraints have also been identified as potential risks for the mitigation. As a result, the project will actively evaluate these constraints and incorporate additional information to assess potential risks as the mitigation plans are further developed. Currently identified constraints include the following:

- The site was previously used as a landfill. Thus, excavated materials may require special treatment and disposal.
- Landfill materials, peat and clay beneath the UBNA result in a dynamic site. Design and construction need to account for potential changes to hydrology resulting from subsidence.
- Methane present on the site will require special construction practices.
- A 3-foot cap of clean fill must be maintained over landfill areas.
- Use of the site for mitigation must remain consistent with the University of Washington's plans for and ongoing uses of the site.
- Concerns of other stakeholders (e.g., nearby residents, birdwatchers) may affect the design and construction of the mitigation.
- Beaver and nutria in Union Bay may hinder plant survival.

5.2.9. Site Hydrology

Wetland hydrology for the wetlands along the outer portion of the UBNA site is determined by the water elevations in Lake Washington, which are controlled via the Chittenden locks. Interior wetlands are seasonally ponded and have a perched water table derived from direct precipitation and localized runoff.

The established wetland at the UBNA site will be depressional and will rely on precipitation in the wetland and surface runoff from adjacent uplands to provide wetland hydrology. Over time,

wetlands or adjacent upland areas at UBNA may subside, extending the connection to Lake Washington further into the interior of the UBNA site.

Groundwater

Site hydrology will be based on rainfall and runoff from a small watershed. No groundwater study will be completed because of the risks associated with this type of monitoring on a landfill. Other information related to hydrology will be incorporated into final site design (PS&E) as it becomes available.

5.2.10. Invasive Species

Reed canarygrass, Japanese knotweed, and Himalayan blackberry are the dominant invasive species present that are present at the UBNA Mitigation Site. Purple loosestrife is also present along the shoreline. The presence of these species likely reflects the past history of disturbance on the site.

Control of invasive species will be an important element of mitigation activities at the UBNA. A plan for the control of invasive species will be developed in consultation with the University of Washington faculty and staff. The plan will incorporate those practices necessary to achieve control of invasive species in the proposed mitigation areas, while maintaining consistency with the University's ongoing uses of the UBNA site, current management and maintenance practices, and the University's mission of educational use. The invasive species control strategy for the UBNA site will be incorporated into the discussion of Site Management (Section 7.3).

5.2.11. Grading Design

A complete topographic survey for the site has been completed and is provided in Appendix E. Existing wetland elevations and grading descriptions are based this topographic survey.

Potential wetland establishment area

Exposure of the landfill at UBNA is a significant constraint on this site. As a result, WSDOT has focused the grading activities in the E-5 area where the existing parking lot will be removed. This area is expected to have the least potential for exposing landfill material, and the greatest potential for successful wetland establishment. Activities in this area will include scarification/tilling or removal of the

parking area's gravel fill and subsoil if necessary. Excavation is expected to remove a minimal amount of earth in this area, creating a shallow depression that will retain water from precipitation and runoff from the adjacent uplands to achieve wetland hydrology. Final grading plans are included in Appendix E. WSDOT may also perform minor grading (including topsoil placement) in other portions of the site for wetland and buffer enhancement, if required.

5.2.12. Planting Design

Appropriate native planting designs for the UBNA Mitigation Site have been developed to meet the wetland establishment and wetland and upland habitat enhancement goals for the project. These designs will be refined in consultation with the University of Washington faculty and staff. WSDOT will coordinate with agencies on the refined designs..

The planting plans include forested and emergent wetland planting zones. The plantings are located in the wetland establishment area, and Wetlands UBNA 4, 5 and 6 on the west and in the Yesler Swamp area of Wetland UBNA 1 on the east.

The forested plantings will consist of a canopy of tree species with sub-canopy shrub plantings. Canopy species selected include both fast-growing and more slow-growing species, as well as both deciduous and coniferous species. The shrub understory will provide more dense cover and improved foraging opportunities for wildlife. Woody plantings will be grouped by species, and the groupings will be intermixed at the edges to provide a diffuse edge. Species requiring shade will be planted under existing canopy cover. Forest and shrub planting areas are shown in Appendix E.

Emergent wetland plantings are proposed for the enhancement areas in Wetlands UBNA 2 and 3, and the shoreline portions of Wetland UBNA 1. Plantings will consist of infilling the existing wetland vegetation with native emergent species. Live willow stake plantings will be used in selected locations on the edges of seasonally inundated portions of the wetland, and will be supplemented with shade-tolerant native emergent species. Plants will be grouped by species, and intermixed at the edges of the groups to provide a diffuse edge. The emergent planting areas are shown in Appendix E.

A proposed planting list for planting areas is shown below in Table 16. Species for all planting have been selected in consultation with University of Washington staff, with consideration for light tolerance, suitability to expected hydrologic conditions at the site (occasional shallow inundation to seasonal saturation), and ability to provide forage and cover for wildlife.

Additional modifications to the species selected may be made as additional site design information becomes available.

Table 16. Proposed Typical Planting List for Wetland Areas at UBNA

Common Name	Scientific Name	Indicator Status	Size and Condition	Plant Spacing (in feet on center)
Emergent and Water's Edge Wetland Enhancement Plantings				
Live Stakes				
Scouler's willow	*Salix scouleriana*	FAC	36" Live Stake	1'
Sitka willow	*Salix sitchensis*	FACW	36" Live Stake	1'
Emergents				
Sawbeak sedge	*Carex stipata*	OBL	Seed or Plug	2'
Slough sedge	*Carex obnupta*	OBL	Seed or Plug	2'
Creeping spikerush	*Eleocharis palustris*	OBL	Seed or Plug	2'
Tall mannagrass	*Glyceria elata*	FACW+	Seed or Plug	2'
Baltic rush*	*Juncus balticus*	FACW+	Seed or Plug	2'
Daggerleaf rush*	*Juncus ensifolius*	FACW	Seed or Plug	2'
Skunk cabbage**	*Lysichiton americanum*	OBL	Seed or Plug	2'
Small fruited bulrush	*Scirpus microcarpus*	OBL	Seed or Plug	2'
Water parsley	*Oenanthe sarmentosa*	OBL	Seed or Plug	2'
Hardstem bulrush	*Schoenoplectus acutus*	OBL	Seed or Plug	2'
Giant burreed	*Sparganium eurycarpum*	OBL	Seed or Plug	2'
Forested Wetland Establishment and Enhancement Planting				
Trees				
Red alder***	*Alnus rubra*	FAC	4', Bare Root	10'-12'
Oregon ash	*Fraxinus latifolia*	FACW	4', Bare Root	10'-12'
Sitka spruce**	*Picea sitchensis*	FAC	4', Bare Root	10'-12'
Black cottonwood	*Populus balsamifera ssp.*	FAC	4', Bare Root	10'-12'
Cascara**	*Rhamnus purshiana*	FAC-	4', Bare Root	10'-12'
Pacific willow	*Salix lucida var. lasiandra*	FACW+	4', Bare Root	10'-12'
Western red cedar**	*Thuja plicata*	FAC	4', Bare Root	10'-12'
Shrubs				
Black hawthorn	*Crataegus douglasii*	FAC	#1 Container	4'
Black twinberry	*Lonicera involucrata*	FAC+	#1 Container	4'
Nootka rose	*Rosa nutkana*	FAC	#1 Container	4'
Peafruit rose	*Rosa pisocarpa*	FAC	#1 Container	4'
Salmonberry**	*Rubus spectabilis*	FAC+	#1 Container	4'
Red-osier dogwood	*Cornus sericea*	FACW+	#1 Container	4'
Pacific ninebark	*Physocarpus capitatus*	FACW-	#1 Container	4'

Common Name	Scientific Name	Indicator Status	Size and Condition	Plant Spacing (in feet on center)
Scouler's willow	*Salix scouleriana*	FAC	#1 Container	4'
Sitka willow	*Salix sitchensis*	FACW	#1 Container	4'
Emergents				
Skunk cabbage	*Lysichiton americanum*	OBL	Seed or Plug	2
Water parsley	*Oenanthe sarmentosa*	OBL	Seed or Plug	2

* Species to be planted is drier wetland areas.

** Species to be planted in shaded areas or as secondary planting into established canopy.

*** Plantings should include soil medium inoculated with beneficial rhizobium.

5.2.13. Habitat Features

Habitat features appropriate to the target plant communities, wildlife species, and site conditions will be selected in consultation with the University of Washington faculty and staff. WSDOT will coordinate with agencies on the refined designs.

5.2.14. Buffers and Uplands

Upland buffer plantings for the UBNA will be developed in consultation with the University of Washington faculty and staff. WSDOT will coordinate with agencies on the refined designs.

Buffer enhancement plantings will consist of two vegetation types: a taller, forested buffer planting consisting of canopy trees with a shrub sub-canopy, and a lower-growing shrub planting for the buffers of emergent wetlands. Planting plans for the buffer areas are shown in Appendix E.

The woody buffer planting will be planted in the buffers of forested and scrub-shrub wetlands (i.e., in the new wetland establishment area, along UBNA 1 near University Slough, and in the buffers of Wetlands 4, 5, and 6). The canopy includes both deciduous and coniferous tree species, with greater emphasis on deciduous species that have been shown to be well adapted to the site. The sub-canopy and lower growing shrub group consists of deciduous shrub species intended to provide forage and cover. Planting densities in the woody upland planting are consistent with those proposed for the wetland plantings. A densely planted interior buffer, approximately 10 feet wide is also included in the buffer plantings.

The low-growing shrub buffer plantings will be planted along the buffers of emergent wetland enhancement areas in Wetlands UBNA 2 and 3. Plant species selected for this planting are a

subset of those proposed for the forested buffer planting, selected for size. These plantings will provide greater cover and foraging opportunities than the current conditions, while not greatly restricting views. The planting densities proposed for this buffer type are less than that of the forested buffer, to allow for a more "patchy" approach to the planting (i.e., distinct groups of plants in an upland matrix).

The buffer enhancement areas are shown in Figure 7, and a proposed planting list is shown in Table 17. Plant species for the wetland buffers at UBNA have been selected in consultation with University of Washington staff, and include those species tolerant to the light and hydrologic conditions present at UBNA. In areas where the regulatory buffer includes jurisdictional wetland, the wetland plant list may be used instead.

Table 17. Proposed Typical Planting List for Upland Buffer Areas for UBNA

Common Name	Scientific Name	Indicator Status	Size and Condition	Plant Spacing (in feet on center)
Upland Forested				
Trees				
Big leaf maple	*Acer macrophyllum*	FACU	5, Bare Root	10'-12'
Red alder	*Alnus rubra*	FAC	5, Bare Root	10'-12'
Black cottonwood	*Populus balsamifera ssp. trichocarpa*	FAC	5, Bare Root	10'-12'
Quaking aspen	*Populus tremuloides*	FAC+	5, Bare Root	10'-12'
Bitter cherry	*Prunus emarginata*	FACU	5, Bare Root	10'-12'
Douglas-fir	*Pseudotsuga menziesii*	FACU	5, Bare Root	10'-12'
Garry oak	*Quercus garryana*	NL	5, Bare Root	10'-12'
Western red cedar*	*Thuja plicata*	FAC	5, Bare Root	10'-12'
Shrubs				
Vine maple*	*Acer circinatum*	FAC-	#1 Container	4'
Serviceberry	*Amelanchier alnifolia*	FACU	#1 Container	4'
Beaked hazelnut*	*Corylus cornuta*	FACU	#1 Container	4'
Oceanspray	*Holodiscus discolor*	NL	#1 Container	4'
Indian plum*	*Oemleria cerasiformis*	FACU	#1 Container	4'
Baldhip rose	*Rosa gymnocarpa*	FACU	#1 Container	4'
Clustered rose	*Rosa pisocarpa*	FAC	#1 Container	4'
Nootka rose	*Rosa nutkana*	FAC	#1 Container	4'
Thimbleberry	*Rubus parviflorus*	FAC-	#1 Container	4'
Common snowberry	*Symphoricarpos albus*	FACU	#1 Container	4'

Common Name	Scientific Name	Indicator Status	Size and Condition	Plant Spacing (in feet on center)
Upland Shrub				
Baldhip rose	*Rosa gymnocarpa*	FACU	#1 Container	4'**
Clustered rose	*Rosa pisocarpa*	FAC	#1 Container	4'**
Nootka rose	*Rosa nutkana*	FAC	#1 Container	4'**
Thimbleberry	*Rubus parviflorus*	FAC-	#1 Container	4'**
Common snowberry	*Symphoricarpos albus*	FACU	#1 Container	4'**

* Species to be planted in shaded areas or as secondary planting into established canopy.
** Planting densities will be increased to 2.5' on center for the interior 10 feet of wetland buffers.

5.2.15. Site Protection

UBNA will be protected through a long term protection mechanism that will be approved by agencies. Ownership of the site will be retained by the University of Washington.

A long-term management plan will be developed for the wetland mitigation at the UBNA site. This plan will address such elements as: documentation of any trash accumulation, identification of any condition that impairs or threatens the ongoing ecological functioning of the site, representative photos from points that show the relative condition of the site.

5.2.16. Implementation Schedule

A complete implementation schedule for the UBNA Mitigation Site has not yet been developed. However, a number of additional studies and benchmarks are anticipated as part of the design process.

- Wetland Delineation (2011 – Complete)
- Topographic Site Survey (2011 – Complete)
- Characterization of reference wetland
- Final design of the mitigation at the UBNA Mitigation Site is expected to begin in mid-2014 and proceed through the first quarter of 2015. Site design would be completed by WSDOT.

- Construction of the mitigation at the UBNA Mitigation Site is expected to begin in mid-2014 and to be completed at the end of 2015. Site construction would be completed by WSDOT or its contractor.

- Mitigation monitoring and maintenance at the UBNA site will be completed by WSDOT or its designated agent.

- Long-term management of the UBNA site will be provided by the University of Washington.

A more comprehensive implementation schedule will be developed as the project design advances.

5.2.17. Ecological Benefits

Wetland Functions

WSDOT proposes the following mitigation activities for the UBNA site:

- Establishment of 2.29 acres of wetland.
- Enhancement of 7.49 acres of wetland.
- Enhancement activities to complete 1.90 acres of ongoing wetland enhancement.
- Enhancement of 14.02 acres of wetland buffer.

The proposed mitigation at the UBNA Mitigation Site is expected to substantially improve habitat functions at the site. Functional attributes of the mitigation wetlands that will be improved and added, compared to the existing impacted wetlands, are listed below. A summary of the potential improvements is provided in Table 18.

Improved Functional Attributes

- Reduced prevalence of invasive species
- Increased plant diversity by replanting with seven native tree species and nine native shrub species
- Increased habitat complexity by adding new areas of forested wetland
- Additional habitat features
- Enhanced connection of existing mosaic of habitats to Lake Washington

New Functional Attributes

- Establish new wetland area
- Additional habitat area

Table 18. Existing and Proposed Wetland Functions at the UBNA Mitigation Site

Characteristic	Existing Conditions	Proposed Conditions	Change in Function
Water Quality			
Sediment removal Phosphorous removal Nitrogen removal Metal and toxic organic removal	Establishment area is currently a gravel paved parking area. Does not provide sediment or pollutant removal, contributes sediment/pollutants to associated wetland and Lake Washington. Existing wetlands provide emergent and woody vegetation that can remove sediments and pollutants. This function is generally performed by Wetland UBNA 1 and 6, which are associated with the higher intensity adjacent land uses.	Establish new wetland with dense emergent and woody vegetation. Enhance existing wetland with dense vegetation	Wetland establishment will remove 2.29 acres of sediment/pollutant generating surface and create 2.29 acres of new wetland with potential for sediment and pollutant removal. 0.7 acre of pollution-generating roadway surface will also have reduced traffic use after the parking area is removed, resulting in a decrease in the amount of pollutants being generated. Improve potential for sediment removal in 2.47 acres of existing wetland (UBNA 6);
Pathogen removal	Not provided.		No change.
Hydrologic			
Peak flow reduction	Not provided.		No change.
Erosion reduction	Existing gravel paved area does not provide erosion reduction. Vegetated shoreline of Wetland UBNA provides this function on portions of the site. The open water area does not provide this function. Existing woody vegetation in wetlands UBNA 2, 3, 4, 5, and 6 does not provide this function.	Increase in dense woody vegetation of 2.29 acres. Adding additional woody species and individuals in 1.49 acres of lacustrine wetland.	Established wetland is not directly connected to a shoreline and does not provide this function. Adding additional woody species to 1.49 acres of wetland UBNA 1; enhances/supports erosion reduction functions.
Groundwater recharge	Not provided		No change

Characteristic	Existing Conditions	Proposed Conditions	Change in Function
Habitat			
Structural complexity	Open water and forested wetland provide limited structure.	Plant 2.29 acres woody wetland habitat. Enhance 9.39 acres of wetland to increase species diversity. Add woody buffers on east and west of site. Enhance 14.02 acres of buffers on site interior.	Increase in structural complexity in 2.29 acres of established forest and scrub-shrub wetland. Established wetland will expand depressional wetland habitat and connect lacustrine wetland UBNA 1 and depressional wetland UBNA 4. Enhancement activities will increase structural complexity and/or species diversity in 9.39 acres of existing wetlands. Create woody buffers along proposed wetland areas and along University Slough.
Abundant food sources	Existing wetlands provide a variety of food sources.	Established wetland will include 2.29 acres of acres of woody and emergent plant species that provide a variety of food sources. Plant 9.39 acres of wetland to increased species diversity. Plants selected include those with high food value.	Increase in primary and secondary productivity. 2.29 acres of established wetland. Increase in type and species of forage in 9.39 acres of enhanced wetland.

Characteristic	Existing Conditions	Proposed Conditions	Change in Function
Connectivity to other natural resources	Wetlands at UBNA provide habitats connected to University and Lake Washington; The corridor along University Slough is narrow and dominated by paved areas, mowed grass, and Himalayan blackberry.	Establish 2.29 acres woody vegetation to improve connectedness. Enhance 9.39 acres of existing wetland and 14.02 acres of buffer with appropriate vegetation	Establishment on 2.29 acres of new wetland connects existing wetlands on the west side of UBNA to University Slough. Creates additional wetland to expand the complex along University Slough and Lake Washington. Wetland enhancement provides additional cover and forage in existing wetlands; enhances connection across 9.39 acres of the site. Buffer enhancements extend a corridor of natural vegetation along east side of University Slough; vegetation also screens slough from access road/trail. Enhanced buffers in site interior (40-60 feet) buffer wetlands from existing trails.
Moist and moderate microclimate	Wetland establishment area is open and paved – does not provide moist moderate habitat microclimate. Existing wetlands to be enhanced have moist, moderate microclimate.	Plant 2.29 acres of dense woody vegetation to provide shelter and shade.	Increase of moist and moderate microclimate by 2.29 acres in wetland establishment area. No change in enhancement area.

Functional Lift

The UBNA Mitigation Site provides a unique opportunity for wetland mitigation due to its location and history as wetland, landfill, and public space owned by the University of Washington. The mitigation opportunities present at the UBNA also occupy only a portion of the wetlands involved. As a result, WSDOT has provided a description of functional lift based on Sheldon et al. (2005), as described for the WSDOT-Owned Peninsula Mitigation Site.

Water Quality Functions

The UBNA Mitigation Site includes wetlands, uplands, trails, a parking lot, and an access road/driveway. The parking lot and access road are in daily use, as are the offices and greenhouses to the north and the walking trails. Existing wetlands on the eastern portion of the site may trap pollutants present in the runoff from the adjacent residential land uses. This portion of the wetland and UBNA 1 may also trap and retain suspended sediments and pollutants carried by waters in Lake Washington. Wetland UBNA 6 to the north also provides sediment and pollutant trapping functions because this area receives untreated runoff from the adjacent transfer facility.

The established wetland will remove 2.29 acres of pollutant-generating parking area, and reduce the pollutant load on the 0.7 acre of access road/driveway. The sediment load entering the newly established wetland will likely be low because the surrounding areas are generally foot or bicycle traffic only. Enhancement plantings in the easternmost portion of Wetland UBNA 1 and the northern portion of UBNA 6 have the potential to increase sediment retention and removal of pollutants bound to these sediments. However, the greatest lift to the site is the removal of existing pollution-generating surfaces.

Pathogen removal is a function of long-term water retention, and will not be affected by the mitigation.

Hydrologic Functions

The enhancement of existing wetland and buffers with woody and native herbaceous plants will improve the performance of erosion reduction functions in the shoreline areas of the UBNA by slowing incoming waves and holding soils in place over approximately 1.49 acres of lacustrine fringe wetland. The established and enhanced wetlands at the UBNA site are not classified as wetland types that provide peak flow reduction or groundwater recharge functions.

Habitat Functions

While the wetlands at the UBNA site provide aquatic bed, emergent, scrub-shrub, and forested habitats, the proposed wetland establishment area is currently a gravel paved parking area. Wetland establishment activities in this area will create 2.29 acres of additional forested wetland and remove a source of noise, light, and disturbance from the site. Enhancement activities will add more native species, increasing species diversity at the site. Establishing new wetland area and enhancing existing wetlands by planting native species and removing invasive species will increase the structural complexity of the site, increasing the habitat niches present.

Establishment and enhancement activities at the UBNA site will improve the habitat associated with University Slough, extending the corridor connection farther north into the site. Adding additional forest cover extends cover and foraging opportunities over a greater portion of the site, improving the site's potential as a connection between habitats.

The wetlands at UBNA provide a mixture of wetland vegetation types and plant species that provide a variety of primary and secondary food sources. The addition of 4.76 acres of woody plant cover (2.29 in the new wetland and 2.47 acres of enhancement in UBNA 6) and enhancement of 3.42 acres of woody vegetation in Wetlands UBNA 1 and 4 will increase the diversity of foraging types along University Slough and in the nearby wetlands, and the 6.74 acres of wetland enhancement activities in emergent areas will increase the quality of existing foraging habitat by decreasing invasive species and improving the native plant community.

The wetland communities at UBNA support a moist, moderate microclimate. Enhancement of 9.39 acres of existing wetland would continue to support this function, and the establishment of new forested wetland would extend this function to an additional 2.29 acres.

Buffer Functions

Buffers for the UBNA Mitigation Site will incorporate the following benefits:

- Improved screening of wetland from adjoining uses
- Control of invasive species
- Improved habitat function through planting with appropriate native trees and shrubs

5.3 Magnuson Park Mitigation Site

5.3.1. Site Location

Magnuson Park is located on a peninsula on the western shore of Lake Washington in the city of Seattle. The site is north of the University of Washington and about 2.5 miles north of the SR 520 Bridge in the southeast quarter of Section 2, Township 25 North, Range 4 East. The site is owned and operated by the City of Seattle as a municipal park. Within Magnuson Park, the SR 520 wetland mitigation site is located adjacent to and north east of a wetland mitigation project completed in 2009 as part of Phase II of the Magnuson Park Master Plan (Otak 2010). The eastern boundary of the site is Beach Drive, across from the Phase III Shore Pond planned for construction in 2011 (Figure 8). WSDOT is also planning to provide aquatic mitigation in the form of shoreline restoration (WSDOT 2011a), just southeast of the site between the shore trail and Lake Washington. The SR 520 wetland mitigation area is currently viewed by WSDOT as the best area for anticipated SR520 wetland mitigation needs within the park.

In the same way as previous mitigation completed on site by City of Seattle, the proposed SR 520 mitigation would be aligned with the larger overall ecological restoration vision and concept for the park documented in the park master plan (Otak 2010). There are other similar areas in the park that may provide for additional mitigation or the mitigation area may shift to these areas as the design matures.

5.3.2. Landscape Perspective

The Magnuson Park site is within the Lake Washington Subarea of WRIA 8, the Lake Washington-Cedar/Sammamish Watershed, and is located along the shoreline of Lake Washington. This site consists of lands that were under the surface of Lake Washington prior to the construction of the Hiram M. Chittenden Locks and the Ship Canal in 1916, which lowered the level of Lake Washington some 9 feet to the present day shoreline. The USACE currently maintains water level in Lake Washington at between 16.72 to 18.72 feet above sea level (NAVD 88), and Magnuson Park elevations currently range from 6 to 16 feet above the lake's water level.

5.3.3. Ecological Connectivity

The Magnuson Park Mitigation Site provides open space and wildlife habitat adjacent to and connecting with other wetland habitats in the park. Establishing a mitigation site here will

provide a connection between the recently-created Phase II wetland mitigation site (14 acres of wetlands located immediately west of WSDOT's proposed mitigation) and other existing wetland habitat located in the park to the south, west and north (Otak 2007 and Sheldon and Associates 2005). Lake Washington is located 300 to 500 feet southeast and east across Beach Drive from the proposed mitigation site. Mitigation activities at this site will improve the quality of existing wetland habitat, add additional habitat and increase habitat diversity. The project will improve the density and structure of vegetation allowing more secluded movement by wildlife between the many wetland habitats found in the park. The future Phase III (funded for construction in 2011), and Phase IV (unfunded) shore pond will provide added connectivity to Lake Washington. Lake Washington provides a corridor for waterfowl, aquatic and amphibian species between the Magnuson Park site and the Washington Park Arboretum, the Union Bay Natural Area and other wetland habitats along the lake.

A nearby restoration element under evaluation by the City of Seattle involves expansion of the shore pond system to establish an ecological connection and wildlife corridor between 24 acres of wetlands (14 acres in Phase II and 10 acres in WSDOT's mitigation site) and Lake Washington (Figure 8, Ecological Connection Area). Note that while this shore pond expansion could provide a direct connection to Lake Washington, it is not a part of WSDOT's proposed mitigation.

One proposal for this shore pond expansion would add a small discharge channel flowing downslope to Lake Washington, bordered by upland forest. This ecological connection would provide a wildlife corridor, but not a fish passageway, linking the WSDOT SR 520 mitigation site, Phase II Mitigation site and the Phase III shore pond site to Lake Washington. This connection would improve the ecological connectivity of the project and provide an important link for wildlife species that use the wetlands farther inland and move to and from the lake. The key design element is to make the shore pond–channel interface fish impassable, so the shore pond does not become a nursery for warm water fish that feed on juvenile salmon in Lake Washington. If the shore pond is constructed, additional data on potential impacts of the project will be provided to the agencies for review.

Considering that the WSDOT wetland and aquatic mitigation sites are located on both side of the ecological connection area and the site could complete the linkage between 24 acres of wetlands and Lake Washington, it seems appropriate to include a discussion of the Ecological Connection Area element in this report. However, the master plan still requires Beach Drive and the shore trail to remain, both of which must cross the Ecological Connection Area. Mitigation sites must be buffered from the road and trail (Ecology 2006b), which prevents WSDOT from obtaining

sufficient mitigation credits for completing this potential project element. WSDOT does not want to fund work in this area without obtaining reasonable mitigation credit, but may include this element as part of a negotiated settlement with the City of Seattle for use of the Park as a mitigation site.

The park's master plan identifies this restoration element as important for ecological connectivity. Further work and coordination with the City of Seattle and its citizens is necessary to clarify the full extent of the mitigation site and details of the mitigation, and to ensure that it is consistent with the park master plan.

5.3.4. Current and Historic Land Use

The Magnuson Park peninsula is a relatively low, flat peninsula that extends east into Lake Washington. The mitigation site is located on the eastern edge of the peninsula, 300 feet west of Lake Washington and Magnuson Park public beaches. Wetlands and natural areas exist at the base of Kite Hill, existing wetland mitigation and natural areas are located west and southwest of the proposed mitigation site and two relic bunkers are located north of the site. The proposed mitigation site is currently used as part of the City Park, and includes wetland and upland grasses with overgrown areas. Paved trails surround the site, one crossing through the northern area, and one on the west side of the site. Several unpaved, informal trails also cross the site.

The Magnuson Park peninsula was originally below the surface of Lake Washington, but was exposed by the construction of the Ship Canal and subsequent lowering of Lake Washington. In the 1920s and 30s, the Navy established an airfield by filling low areas, including marshes and the small Mud Lake, and grading the site level. Commander A. W. Radford noted in a memo that grading of the airfield involved more than 1,500,000 cubic yards (Seattle Parks 2011). In the early 1940s, with the onset of World War II, the runways were paved and expanded and buildings were added. In 1970 the airstrip was deactivated, and in the late 1970s, the runways, tarmac, and taxiways were demolished (Seattle Parks 2011). In the early 1990s the naval station was decommissioned and in 1995 it was officially closed. In 2004, the Seattle City Council approved a wetland and sports field master plan for the area that included a wetland mitigation site (Seattle Parks 2011). In 2009, the sports field and a wetland mitigation site were constructed as Phase II of the Magnuson Park Master Plan. A shore pond located between the mitigation site and the lake is planned for construction in 2011 as Phase III of the master plan.

5.3.5. Rationale for Site Selection

As described in Section 4.2, the Magnuson Park mitigation site was identified in a multi-stage, hierarchical selection process. This site was selected due to its relatively large size, availability, location in the affected watershed/basin, and potential for wetland mitigation activities.

5.3.6. Mitigation Site Existing Conditions

The Magnuson Park Mitigation Site is a mixture of existing low quality wetland mosaic intermixed with disturbed uplands. Past activities on the site include filling, soil compaction, runway construction and demolition that prevent significant infiltration.

Soils at the Magnuson Park Mitigation Site are largely fill materials placed over historic wetland soils and are relatively deep. The soils contain little organic matter to retain soil moisture in the summer. Excavation for the Phase II wetland mitigation sites found only pockets of peat soils (Guy Michaelson and Dyanne Sheldon 2011 pers. comm.) this soil has tended to form a hardpan of clay, silt, sand, and gravel, which limits any significant infiltration and precipitation rapidly sheet flows downslope to low areas (wetlands) or off-site. . The dense soils limit denning potential, since it is difficult for animals to burrow or dig in them. The soil invertebrate community is also sparse. Thirty years after the runway was decommissioned grasses dominated much of the site most likely because of the poor soil quality. Non-native plant species (such as reed canarygrass, Himalayan blackberry, Scot's broom, English hawthorn [*Crataegus monogyna*], white poplar [*Populus alba*] and English ivy [*Hedera helix*]) are common and also indicates the disturbed nature of the site.

Uplands

The existing uplands consist primarily of open fields, dominated by a mixture of bentgrasses, velvet grass and common weeds. There are patches of Scot's broom, Himalayan blackberry, and scattered black cottonwood, Lombardy poplars (*Populus nigra*), white poplar, and English hawthorns.

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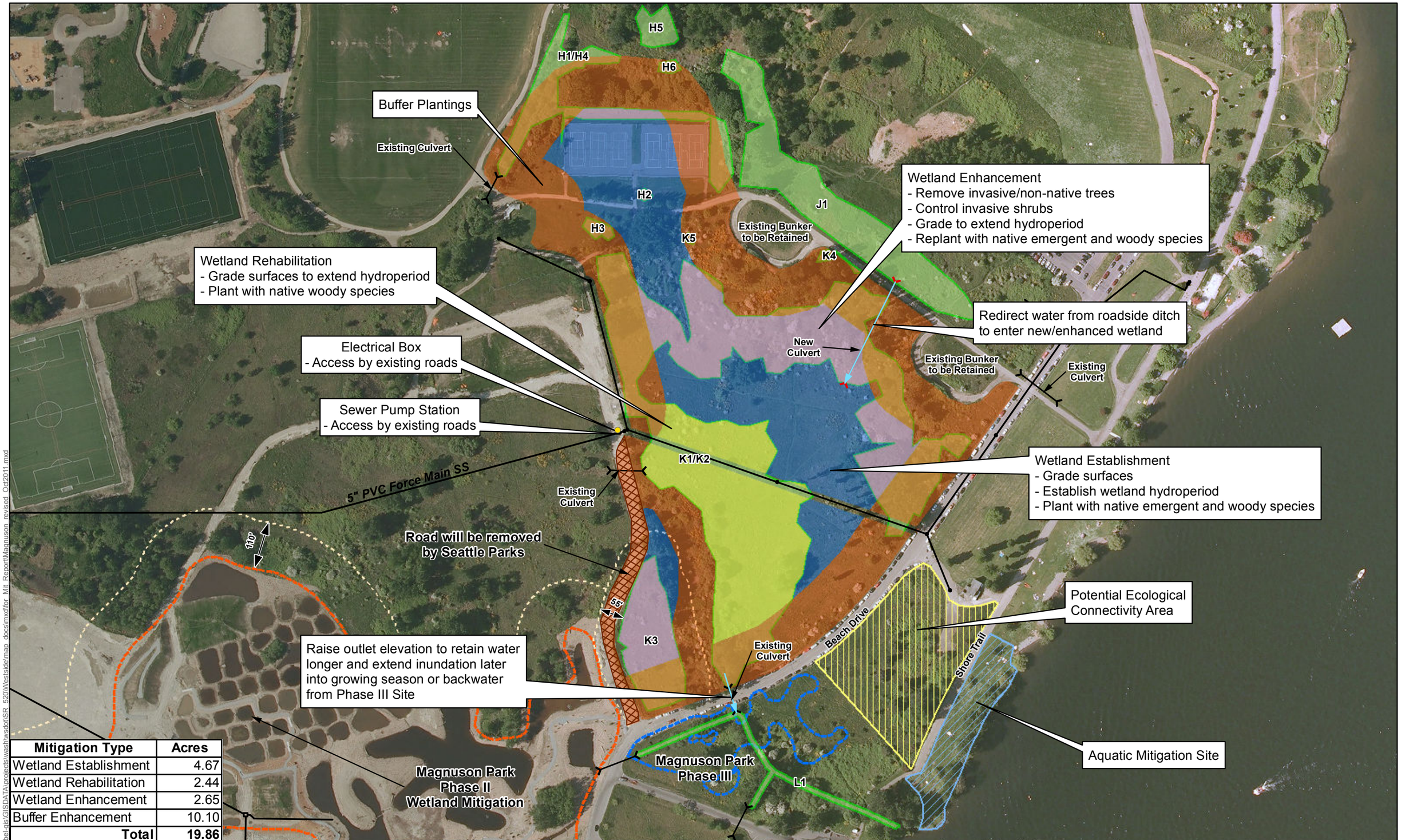

Mitigation Type	Acres
Wetland Establishment	4.67
Wetland Rehabilitation	2.44
Wetland Enhancement	2.65
Buffer Enhancement	10.10
Total	**19.86**

Souce: City of Seattle (2008 and 2011), Parametrix (2010)

N

0 50 100 150 200 250 300 Feet

Legend

- Wetland Establishment
- Wetland Enhancement
- Wetland Rehabilitation
- Wetland Buffer Enhancement
- Aquatic Mitigation Site
- Potential Ecological Connectivity Area
- Wetland (Delineated May/June 2011)
- City of Seatle Phase II Mitigation
- City of Seattle Phase III Mitigation
- Increased Flow

Figure 8
Magnuson Park Mitigation Concept

SR 520, I-5 to Medina: Bridge Replacement and HOV Project

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Wetlands

Wetland K1

Eleven wetlands were located on the Magnuson Park Mitigation Site, covering 9.4 acres. Wetland K1/K2 is the largest of these 11 wetlands, and encompasses 6.56 acres.

Two of the wetlands have forested, scrub-shrub, and emergent Cowardin classes, one wetland has scrub-shrub and emergent classes, three wetlands include only a forested class, and five wetlands include only an emergent Cowardin class. The dominant tree species present at the site include black cottonwood, white poplar, Lombardy poplar, and quaking aspen (*Populus tremuloides*). The dominant shrubs include willow (Scouler's, Pacific, and Sitka), English Hawthorn, and Himalayan blackberry. Also present are scattered domesticated apple (*Malus* spp.), Scot's broom, Douglas spiraea, and Hookers willow. Emergent species present include velvetgrass, bentgrasses, reed canarygrass, tall fescue, soft rush, hare sedge (*Carex leporina*), slough sedge (*Carex obnupta*), and lupine (*Lupinus* spp.).

Wetlands present at Magnuson Park are predominantly Category III wetlands, although four small wetlands were rated as Category IV wetlands (approximately 5 percent of the wetland area). All these wetlands are considered to belong to the depressional hydrogeomorphic class. Table 19 provides a summary of the wetlands, and additional details on these wetlands can be found in the *Draft Wetland and Stream Assessment Report for Union Bay Natural Area, Magnuson Park, and Elliott Bridge Reach Mitigation Sites* (WSDOT 2011c).

Table 19. Magnuson Park Mitigation Site Wetland Summary

Location	Peninsula on west side of lake Washington - north of SR 520	
Wetland K1 facing west across center of site	**Local Jurisdiction**	Seattle
	WRIA	WRIA 8
	Ecology Rating (Hruby 2004)	III and IV
	Seattle Rating	III and IV
	Seattle Standard Buffer Width	60 and 50 feet
	Wetland Size	Eleven wetland covering ~9.4 acres
	Cowardin Classification	PEM, PSS and PFO
	HGM Classification	All wetlands are Depressional
	Wetland Rating System Pts.	
Wetland K2, north end of site facing north	**SCORE** **Water Quality Score** **Hydrologic Score** **Habitat Score** **Total Score**	**See Wetland Assessment Report for Details**
Dominant Vegetation	Emergent areas: bentgrass, velvetgrass, reed canarygrass, and soft rush. Scrub-shrub areas: Douglas spirea. Forested areas: black cottonwood, red alder, quaking aspen, white poplars, and willow. Uplands: Himalayan blackberry, Scot's broom, white poplar.	
Soils	Mapped as Urban Land. Gray silt, clay, sand, and gravel soils forming hardpan near surface and limiting penetration by water, animals or invertebrates. Top organic layer shallow or absent. Organic matter limited soils that dry out quickly in summer.	

Location	Peninsula on west side of lake Washington - north of SR 520
Hydrology	Perched water table fed by seasonal rains producing seasonally saturated soils and small area (ditch) of seasonal inundation.
Rationale for Local Rating	Same as Ecology Rating
Functions of Wetland	The shallowness of the wetlands and their lack of soil organic matter limit their potential to store or desynchronize flood flows. The soils' hardpan character, lack of organic content, and poor infiltration limiting the de-nitrification processes and phosphate and heavy metal adsorption and reduce the wetland's capacity for water quality improvement. The short hydrologic retention time limits the wetlands' ability for water quality improvement. The site soil compaction limits the amount of soil invertebrates and the small mammals and birds that would feed on them. The site soils limit use by mammals that would burrow or forage in the duff and upper soil layers including moles, ground squirrels, shrews and some mice species. The wetlands do not retain water long enough (except maybe in a short section of the ditch in Wetland K1) to provide amphibian habitat. The open grass areas provide little cover for native wildlife. The trees provide some native wildlife habitat for passerine birds and raptors, but dominance by non-native vegetation limits the use of the site by native wildlife species.
Buffer Condition	The buffer areas are mostly grass with some areas of shrubs and trees. The shrub- and tree-dominated areas provide some screening of the wetlands. The trees provide some native wildlife habitat for passerine birds and raptors, but dominance by non-native vegetation limits the use of the site by native wildlife species.

Wildlife Habitat and Use

The dominance of non-native plant species (such as reed canarygrass, Himalayan blackberry, Scot's broom, English hawthorn, and white poplar) currently in the mitigation site provides limited habitat value for native wildlife species. The site is most likely used by passerine birds common in urban areas such as crows, robins, and house sparrows. Raptors and crows may use the larger trees for perching. Raccoons and opossum may forage in the ditch and among the blackberry, and a coyote is known to use the site. The site soils limit the amount of soil invertebrates and the small mammals and birds that would feed on them. The site soils limit use by mammals that would burrow or forage in the duff or upper soil layers including moles, ground squirrels, shrews, and some mice species. The wetlands do not retain water long enough (except maybe in a short section of the ditch in Wetland K1) to provide amphibian habitat.

5.3.7. Mitigation Site Design

The basic elements of the mitigation design include the following:

- Grading the site and harvesting additional water from nearby areas to establish new seasonally and permanently inundated wetland areas and extend the hydroperiods of existing wetlands.
- Replacing the topsoil on-site (if necessary) with material conducive to native plant growth and wetland functions such as water storage and water quality improvements.
- Removing non-native species and replanting with native species, retaining clumps of native trees.
- Locating the wetlands farther from Beach Drive and major trails to provide a wider and more densely-planted buffer with more vertical structure to increase wildlife use in the wetland and buffer.

Wetland area will be established, rehabilitated, and enhanced through site grading. The wetland area (including portions of K1/K2, K3, K4, K5, H1/H4, H2, and H3) will be expanded and other areas will be established by redirecting existing runoff that currently drains to Lake Washington into the wetlands. The site will be graded to create a series of interconnected depressional and slope wetlands composed of shallow, seasonally inundated emergent, scrub-shrub and forested wetlands. Existing slopes will be modified to retain water longer in the southern portion of K1/K2 to extend the seasonal hydrology in this area. Created, rehabilitated, and enhanced wetland areas are expected to consist of a matrix of wetland and may have upland inclusions. The site's rough grading will over-excavate to allow importation and spreading of suitable native soils to mimic a more natural soil layer and to reach the final grade. Because much of the site's hydrology will rely on surface water retention and shallow subsurface flow for wetland hydrology, the over-excavation will be kept to a minimum.

The mitigation will establish 4.67 acres of new wetland in three locations in the Magnuson Park Site (Figure 8). The establishment in the three areas differs in construction method and wetland type. In the northernmost portion of the site, construction will include removing the tennis courts and excavating a depression to retain water. The establishment in the interior of the site will be graded to remove the upper soils, lowering the surface, and a series of shallow depressions (approximately 6 inches deep) will be excavated into the slope. On the western side of the site, soils will be removed to extend the existing depression farther northward, extending the wetland in this area.

Wetland rehabilitation will occur in the western half of Wetland K-1. Grades in this area will be substantially altered to (1) extend the lowest area of the wetland farther to the north, (2) lower the slopes, and (3) establish a series of shallow depressions (approximately 6 inches deep) in the slope to retain water and provide micro-topographic variation on the site.

Enhancement will occur in the eastern portion of the site (Wetland K2). Grading activities in this area are similar to those proposed for the wetland establishment and wetland rehabilitation areas (reducing elevations, adding shallow depressions), but existing elevations have generally been retained in these areas. A culvert will be constructed to convey water from the ditch on the south end of Wetland J1 into a depression graded into the slope in the northern end of Wetland K1/K2 to supplement water in the enhancement area. The culvert will be approximately 260 feet long, and will cross beneath a portion of Wetland K1/K2. Mechanisms such as trench dams will be used to avoid excessive drainage of Wetlands J1 and K1/K2, and the pipe will be constructed to avoid the loss of mature willows in the northeast portion of Wetland K1/K2. Overall, the mitigation in the enhancement area places a greater emphasis on preserving the existing grades and retaining mature native woody vegetation. The enhancement activities also include removal and control of invasive/non-native plant species. Notably invasive or non-native species that occur in these wetlands are white poplar, Lombardy poplar, and domestic apple in the canopy, English hawthorn and Himalayan blackberry in the shrub/subcanopy layer, and reed canarygrass in the emergent/herbaceous stratum. Enhancement activities for the existing wetland will include removal of these undesirable species and replanting with native species. The design will attempt to retain the large black cottonwoods and willows along the central ditch as well as willows, black cottonwoods and a few Douglas-fir and other conifers at the north end of the site. Little else of the existing vegetation would be retained. Figure 8 illustrates the mitigation concept for the Magnuson Park site.

The proposed mitigation site will be developed in consultation with the City of Seattle and will be consistent with the Magnuson Park Master Plan.

5.3.8. Site Constraints

The following constraints apply to the Magnuson Park Mitigation Site:

- A sanitary sewer line crosses the center of the site east to west. The exact depth is not currently known.
- Access to an existing electrical box must be maintained along the northwest side of the site.

- Fill materials on the site may contain hazardous materials. Excavation of Phase II wetland mitigation sites identified four small, minor contamination sites which the Navy subsequently removed (Otak 2010).
- Concerns of other stakeholders (e.g., recreational users of the park, nearby residents, birdwatchers) may affect the design and construction of the mitigation.
- Future plans for nearby portions of Magnuson Park could also constrain mitigation activities.
- An east–west main paved trail must be maintained south of Kite Hill after the existing trail is removed/relocated.
- Management and maintenance activities are ongoing.
- The final plan for the proposed mitigation will be subject to a public review process. Changes resulting from this process may affect the final proposed mitigation.

5.3.9. Site Hydrology

The mitigation design expands the catchment area, and thus the amount of water reaching the site. The existing wetlands are perched above the groundwater and rely on precipitation and surface waters for hydrology.

The project does not expect to intersect the groundwater and will rely instead on the existing precipitation and surface water runoff, raising the invert elevation of the culvert under Beach Drive, and redirecting additional runoff from a ditch that drains Wetland J1 (located to the north) to provide water for the proposed mitigation site. Water also enters Wetland K1/K2 from the west (north of the existing utility line location) through the existing culvert.

The redirected runoff will be conveyed south of the existing bunkers in a culvert to enter Wetland K2 at the north end. WSDOT intends to install this culvert in a manner that will retain most existing vegetation in the northern end of Wetland K2, and clay block check dams or similar structures will be installed to prevent subsurface drainage along the exterior of the pipe.

Site grading will increase the variety of hydroperiods found within the existing wetlands by creating depressions in the slope and deeper areas near the channel and backing up water north of Beach Drive. Hydrology from the culvert on the west side of the site will be maintained. WSDOT will continue to study and evaluate wetland hydrology to support the mitigation design development.

Stream Flow

There are no streams on-site; a drainage ditch in the center of the site directs water to a culvert under Beach Drive.

Groundwater

The design for the Magnuson Park Mitigation Site relies on surface water to provide wetland hydrology, and WSDOT does not intend to install deep groundwater monitoring wells. WSDOT is evaluating the installation of shallow groundwater wells to provide additional information on hydrology at the site. Any additional hydrology data gathered at the site (from shallow wells or other sources) will be incorporated into final site design (PS&E) as it becomes available.

5.3.10. Invasive Species

Reed canarygrass, Scot's broom, English hawthorn, white poplar, Lombardy poplar, and Himalayan blackberry are the dominant invasive species present at the Magnuson Park Mitigation Site. Invasive species control for the Magnuson Park site will be discussed under Site Management (Section 7.3).

5.3.11. Grading Design

A complete topographic survey of the site has been completed. Wetland elevations and excavation descriptions for the Magnuson Park Mitigation Site are based on this topographic survey, supplemented by information from the City of Seattle.

The current proposal for grading includes five elements. Three of these grading areas will result in the establishment of new wetland areas, one will result to substantial changes to wetland hydrology (rehabilitation), and one will be with a wetland enhancement area. Details of the grading activities are provided below.

- WSDOT will remove the existing tennis courts, relocate the existing trail to the north, and create a depression that will retain water. New wetland will be established in this depression.

- WSDOT will grade the interior areas of the site to establish new wetland areas. The proposed grading will consist of lowering areas on the slope by approximately 1 foot to more closely approach the impermeable layer underlying the surface soils. Depressions

running perpendicular to the slope will be graded into the slope to slow overland flows and retain water.

- In the southern end of the site, WSDOT will excavate portions of Wetland K1 to widen the lowest areas of the site. This larger depression, combined with the raised culvert elevation at Beach Drive, will create areas of longer-term inundation at the site.

- WSDOT will also grade to extend the lower elevation areas of Wetland K3 farther north and east. This grading will establish new depressional wetland area alongside the existing wetland.

- WSDOT will provide minimal grading in enhancement areas. This grading will consist of the removal of minor high spots and creation of microtopographic variation.

Final grading plans are included in Appendix E. As more complete hydrologic data become available, this information will be used to further advance the grading plans for PS&E for the site.

5.3.12. Planting Design

The plant communities proposed for the wetland establishment, rehabilitation, and enhancement areas at the Magnuson Park Mitigation Site are anticipated to include emergent, scrub-shrub, and forested wetland areas.

Emergent plantings will be located in the interior areas of the depressions created in the wetland establishment and wetland rehabilitation areas shown in Appendix E. The plantings will consist of seed or plugs of emergent species adapted to saturation and shallow inundation, and the species selected are also consistent with the planting list used for adjoining mitigation in Magnuson Park. Emergent plants will be grouped by species, and intermixed at the edges of the groups to provide a diffuse edge. Table 20 shows the plant list for this habitat type.

Scrub-shrub plantings will be located along the margins of the depressions, and are intended to provide a gradual transition into the taller, woody habitat in the forest planting. The plants selected for this planting palette (Table 20) include species that will provide dense cover and good sources of food for wildlife, while being adapted to relatively broad hydrologic conditions. These plants will be installed in groups by species, and interspersed on the edges of the groups.

The forested plantings will include canopy and sub-canopy species. The canopy species include both fast-growing and slow-growing species, as well as both deciduous and coniferous species. The shrub understory planting is similar to the scrub-shrub habitat planting. Woody plantings will be grouped by species, and the groupings will be intermixed at the edges to provide a diffuse edge. Forested planting areas are shown in Appendix E, and the proposed plant list is shown on Table 20.

Additional modifications to the selected species may be made as additional site design information (particularly hydrology data) becomes available.

Table 20. Proposed Typical Planting List for Wetland Areas at Magnuson Park

Common Name	Scientific Name	Indicator Status	Size and Condition	Plant Spacing (in feet on center)
Emergent Planting				
Common spikerush	*Eleocharis palustris*	OBL	Seed or Plug	1’
Giant burreed	*Sparganium eurycarpum*	OBL	Seed or Plug	1’
Hardstem bulrush	*Schoenoplectus acutus*	OBL	Seed or Plug	1’
Hare sedge	*Carex leporina*	FACW	Seed or Plug	1’
Ovoid spikerush	*Eleocharis obtusa*	OBL	Seed or Plug	1’
Reed mannagrass	*Glyceria grandis*	OBL	Seed or Plug	1’
Sawbeak sedge	*Carex stipata*	OBL	Seed or Plug	1’
Small fruited bulrush	*Scirpus microcarpus*	OBL	Seed or Plug	1’
Slough sedge	*Carex obnupta*	OBL	Seed or Plug	1’
Tapertip rush	*Juncus acuminatus*	OBL	Seed or Plug	1’
Wool-grass	*Scirpus cyperinus*	OBL	Seed or Plug	1’
Scrub-shrub Wetland Planting				
Black hawthorn	*Crataegus douglasii*	FAC	#1 Container	4’
Black twinberry	*Lonicera involucrata*	FAC+	#1 Container	4’
Nootka rose	*Rosa nutkana*	FAC	#1 Container	4’
Pacific ninebark	*Physocarpus capitatus*	FACW-	#1 Container	4’
Peafruit rose	*Rosa pisocarpa*	FAC	#1 Container	4’
Red-osier dogwood	*Cornus sericea*	FACW+	#1 Container	4’
Salmonberry	*Rubus spectabilis*	FAC+	#1 Container	4’
Sitka willow	*Salix sitchensis*	FACW	#1 Container	4’

Common Name	Scientific Name	Indicator Status	Size and Condition	Plant Spacing (in feet on center)
Forested Wetland Planting				
Trees				
Black cottonwood	*Populus balsamifera ssp.*	FAC	4', Bare Root	10'-12'
Oregon ash	*Fraxinus latifolia*	FACW	4', Bare Root	10'-12'
Pacific crabapple	*Malus fusca*	FACW	4', Bare Root	10'-12'
Pacific willow	*Salix lucida var. lasiandra*	FACW+	4', Bare Root	10'-12'
Red alder	*Alnus rubra*	FAC	4', Bare Root	10'-12'
Sitka spruce	*Picea sitchensis*	FAC	4', Bare Root	10'-12'
Western red cedar	*Thuja plicata*	FAC	4', Bare Root	10'-12'
Shrubs				
Black twinberry	*Lonicera involucrata*	FAC+	#1 Container	4'
Nootka rose	*Rosa nutkana*	FAC	#1 Container	4'
Pacific ninebark	*Physocarpus capitatus*	FACW-	#1 Container	4'
Peafruit rose	*Rosa pisocarpa*	FAC	#1 Container	4'
Red-osier dogwood	*Cornus sericea*	FACW+	#1 Container	4'
Salmonberry	*Rubus spectabilis*	FAC+	#1 Container	4'

5.3.13. Habitat Features

Habitat features appropriate to the target plant communities, wildlife species, and site conditions will be incorporated into the mitigation design. These features may include some or all of the following:

- Downed logs
- Standing snags
- Bat boxes
- Brush piles

Quantities and placement of habitat features will be determined as the grading plan is established and the design is further developed.

5.3.14. Buffers and Uplands

Buffer plantings at the Magnuson Park will be largely composed of mixed upland forest species. Final planting plans are included in Appendix E, and a typical species list is shown in Table 21. The list includes canopy communities (consisting of both deciduous and coniferous tree species) and sub-canopy communities (consisting of deciduous species tolerant to a broad variety of light availability). The species selected for the upland and buffer plantings are generally adapted to drier conditions. These plantings will be used in those areas where appropriate hydrology is present. In areas where the regulatory buffer includes jurisdictional wetland, the wetland plant list shown in Table 20 may be used instead. Planting densities for the upland and buffer areas will be similar to those shown for the adjoining wetland areas.

Table 21. Proposed Typical Planting List for Upland Buffer Areas at Magnuson Park

Common Name	Scientific Name	Indicator Status	Size and Condition	Plant Spacing (in feet on center)
Upland Forested				
Trees				
Big leaf maple	*Acer macrophyllum*	FACU	4', Bare Root	10'-12'
Black cottonwood	*Populus balsamifera ssp. trichocarpa*	FAC	4', Bare Root	10'-12'
Bitter cherry	*Prunus emarginata*	FACU	4', Bare Root	10'-12'
Cascara	*Rhamnus purshiana*	FAC-	4', Bare Root	10'-12'
Douglas-fir	*Pseudotsuga menziesii*	FACU	4', Bare Root	10'-12'
Garry oak	*Quercus garryana*	NL	4', Bare Root	10'-12'
Grand fir	*Abies grandis*	FACU-	4', Bare Root	10'-12'
Pacific yew	*Taxus brevifolia*	NL	4', Bare Root	10'-12'
Red alder	*Alnus rubra*	FAC	4', Bare Root	10'-12'
Western Hemlock	*Tsuga heterophylla*	FACU-	4', Bare Root	10'-12'
Western red cedar	*Thuja plicata*	FAC	4', Bare Root	10'-12'
Shrubs				
Baldhip rose	*Rosa gymnocarpa*	FACU	#1 Container	4'
Beaked hazelnut	*Corylus cornuta*	FACU	#1 Container	4'
Common snowberry	*Symphoricarpos albus*	FACU	#1 Container	4'
Oceanspray	*Holodiscus discolor*	NL	#1 Container	4'
Red elderberry	*Sambucus racemosa*	FACU	#1 Container	4'
Redflower currant	*Ribes sanguineum*	FACU	#1 Container	4'
Serviceberry	*Amelanchier alnifolia*	FACU	#1 Container	4'
Tall Oregon grape	*Mahonia repens*	NL	#1 Container	4'
Thimbleberry	*Rubus parviflorus*	FAC-	#1 Container	4'
Vine maple	*Acer circinatum*	FAC-	#1 Container	4'

5.3.15. Site Protection

Trails and plantings at the site will be located in a manner that limits human intrusion into the mitigation site, while still allowing for viewing points. Magnuson Park is protected as a City Park. WSDOT will work with the city and regulatory agencies as needed to establish appropriate long-term protective measures that will protect the wetland functions established at the site, and to develop a long-term management plan for the site. The plan will address such elements as: documentation of any trash accumulation; identification of any condition that impairs or

threatens the ongoing ecological functioning of the site; and representative photos from points that show the relative condition of the site. Ownership of the site will be retained by Seattle Parks and Recreation.

5.3.16. Implementation Schedule

A complete implementation schedule for this mitigation has not yet been developed. However, the following studies and benchmarks are anticipated as part of the design process:

- Wetland delineation (2011 – Completed)
- Topographic Site Survey (2011 – Completed)
- Characterization of reference wetland
- Soil studies
- Shallow groundwater monitoring (early 2012)
- Permit applications
- Permit approval
- Preliminary design of the mitigation at the Magnuson Park Mitigation Site will be provided by WSDOT.
- Final design of the mitigation at the Magnuson Park Mitigation Site will be provided by Seattle Parks, and is expected to begin in mid-2012 and proceed through the third quarter of 2013.
- Construction of the mitigation at the Magnuson Park Mitigation Site will be provided by Seattle Parks, and is expected to begin in early 2014 and to be completed at the end of 2015.
- Mitigation monitoring and initial maintenance at the Magnuson Park site will be completed by WSDOT or its designated agent.

Long-term management of the Magnuson Park Site will be provided by the Seattle Parks Department. A more comprehensive implementation schedule will be developed as the project design advances.

5.3.17. Ecological Benefits

Wetland Functions

The proposed mitigation at the Magnuson Park Mitigation Site is expected to substantially improve wetland functions at this location. Functional attributes of the mitigation wetlands that will be increased, compared to the existing impacted wetlands, are listed below. A summary is provided in Table 22.

Improved Functional Attributes

- Increased flood storage volume and retention times.
- Increased water quality treatment because of increased retention times, soil organic content, and improved soil infiltration in the layers replaced or treated.
- Soils more conducive to native plant growth, invertebrate and small mammal use.
- Increased number of habitat types, interspersion, plant species richness and complexity (by adding seven native tree species and eight native shrub species through interspersed areas of forested, scrub-shrub, and emergent vegetation shown in planting plans.
- Lengthened hydroperiods, resulting in increasing habitat types and providing wildlife water source throughout the year.
- Non-native plant species removed and replaced with native plant species favoring native wildlife.
- Improved habitat connectivity within the park.

New Functional Attributes

- Additional wetland area adding functions
- Areas of permanent and seasonal inundation
- New habitat features

Table 22. Existing and Proposed Wetland Functions at the Magnuson Park Mitigation Site

Characteristic	Existing Conditions	Proposed Conditions	Change in Function
Water Quality			
Sediment removal	Access road and parking areas to east provide a source of sediments and pollutants.	Establish new wetland with depressions, multiple vegetation types. Create depressions in enhancement and rehabilitation areas. Add trees, shrubs, and emergent plants to existing wetlands.	Increased sediment and pollutant removal in 4.67 acres of new slope/depressional wetland. Activities in enhancement/rehabilitation area will improve sediment and pollutant retention in 5.09 acres of wetland.
Phosphorous removal			
Nitrogen removal			
Metal and toxic organic removal			
Pathogen removal	Existing depressional wetland may retain water long enough to decrease pathogens.	Establish new depressional wetland habitat. Create new depression in existing wetlands.	Increase area of potential pathogen removal by 4.67 acres. Increase residence time in existing wetland, 5.09 acres.
Hydrologic			
Peak flow reduction	Not performed. Landscape position limits opportunity for this function.	Create additional depressional habitat that can retain water.	Increased potential for peak flow reduction for 9.76 acres (established and existing wetland); however, the landscape position does not provide opportunity for this function.
Erosion reduction	Not performed. Landscape position limits opportunity for this function.		No change.
Groundwater recharge	Not performed. Impermeable strata limit potential for this function.		No change.

Characteristic	Existing Conditions	Proposed Conditions	Change in Function
Habitat			
Structural complexity	The mitigation site includes a mixture of disturbed wetland and uplands. Wetland areas include multiple habitat types (emergent, scrub-shrub and forested), but in discrete blocks. Wetland and upland include substantial quantities of non-native/invasive species. A paved trail crosses part of the mitigation site.	Connect existing habitats with new wetland area. Increase interspersion by creating forested and scrub-shrub habitats with pockets of emergent vegetation. Retain desirable vegetation where possible. Increase native species by removing invasive species and replanting with native species. Add created habitat features.	Increased structural complexity over 4.67 acres of established wetland. Enhance wetland by connecting existing habitats and adding additional species and habitats with complex edges, 5.09 acres. Controlling invasive and planting native species increases complexity of habitat. Habitat features add more habitat niches.
Abundant food sources	Existing wetlands include forested, scrub-shrub, and emergent habitats that provide a variety of food sources. Invasive species are common throughout the site.	Establish forest and scrub-shrub wetland habitat. Use native species that provide a variety of food sources. Control invasive species.	Established forested and scrub-shrub wetland areas create additional foraging habitat – 4.67 acres. Improve quality of forage in 5.09 acres of existing wetlands by removing invasive species and planting more native species.
Connectivity to other natural resources	Existing habitat is fragmented by access roads and trails.	Establish new wetland area to connect existing wetlands. Move existing paved trail to north. Enhance existing wetland to improve forage and cover in corridor.	Established wetland, 4.67 acres of new wetland habitat. Creates connection from area north of tennis courts to Magnuson Park Phase II mitigation, increases size of contiguous habitat by 5.09 acres. Moving paved trails reduces human and domestic animal disturbance in the habitat.
Moist and moderate microclimate	Existing wetlands provide moist, moderate microclimate.	Establish new wetland area.	Provides 4.67 acres of new moist, moderate microclimate.

Functional Lift

The Magnuson Park Mitigation Site provides a unique opportunity for wetland mitigation due to its location and history as wetland, military base, and publicly owned park space. Since, the mitigation opportunities present at Magnuson Park occupy only a portion of the wetlands involved, WSDOT has provided a description of functional lift based on Sheldon et al. (2005).

Water Quality Functions

The Magnuson Park Mitigation Site includes several wetlands, uplands, trails, a parking lot, and an access road/driveway. Seattle Parks and Recreation has successfully completed wetland mitigation on portions of the park to the east of the WSDOT mitigation site. Magnuson Park is a heavily used site due to its location in the City of Seattle and the size and quality of the facility. As a result, the paved trails and tennis courts to the north of the site are extensively used, as is the access road and parking to the east. Runoff from portions of these paved areas enters the many of the wetlands (K1/K2, K3, K4, H1/H4 and J1) on the mitigation site. These wetlands have the capacity to trap sediments and retain them, along with pollutants bound to these sediments. The mitigation will remove the tennis court area and approximately 500 feet of pollutant-generating paved trail, and create 4.67 acres of depressional and slope wetland that can retain these pollutants. Enhancement/rehabilitation activities are expected to increase residence time, improving the pollution retention capacity of these wetlands. Pathogen removal is also a function of long-term water retention, and should be improved over the same areas.

Hydrologic Functions

Due to the landscape position of the wetland at the Magnuson Park Mitigation Site, these wetlands do not have the capacity to reduce peak flows or reduce erosion. The impermeable layer beneath most of the wetlands on the site precludes performance of groundwater recharge functions. Although the creation of depressions and planting of dense vegetation increase the potential of wetlands on the site to provide hydrologic functions, the landscape position and underlying soils limit the opportunity to perform these functions. As a result, the proposed mitigation activities at the Magnuson Park Mitigation Site are not expected to result in a change to hydrologic functions.

Habitat Functions

Wetlands at the Magnuson Park Mitigation Site provide forested, shrub, and emergent habitat with the potential to provide structural complexity. However, the complexity of the site is limited by the limited interspersion of habitat types, and the presence of invasive species. The proposed mitigation will excavate depressions in both the establishment and enhancement/rehabilitation areas to increase the diversity of inundation regimes at the site. Grading and planting activities will also add more forested and scrub-shrub habitat and increase interspersion of habitat types at the site. Invasive species will also be controlled at the site, improving the quality of the habitat. These proposed changes will result in greater structural complexity in 5.09 acres of existing wetland, and in 4.67 acres of new wetland with structural complexity.

The wetlands at Magnuson Park provide a mixture of wetland vegetation types and plant species that provide a variety of primary and secondary food sources. The addition of 4.67 acres of woody plant cover will increase the diversity of foraging types at the site, and the wetland enhancement/rehabilitation activities will increase the quality of foraging habitat by decreasing invasive species and improving the native plant diversity in 5.09 acres of existing wetlands.

The Magnuson Park Mitigation Site includes a variety of habitats that form a relatively large refuge in the developed urban area of Seattle. The wetland and uplands are also connected to Lake Washington, although the connection is disturbed. Moving the existing paved trail will increase the size of contiguous habitat on the site, connecting the area north of the tennis courts to Magnuson Park Phase II mitigation, an increase of 4.67 acres. The enhanced wetland buffers will also reduce human and domestic animal disturbance in this contiguous habitat.

The wetland communities at Magnuson Park support a moist, moderate microclimate. Enhancement of 5.09 acres of existing wetland would continue to support this function, and the establishment of new forested and scrub-shrub wetlands would extend this function to an additional 4.67 acres.

Buffer Functions

Buffers for the site have been designed in accordance with City of Seattle requirements to provide adequate protection for the wetland functions at the mitigation sites. The following benefits are expected to occur:

- 110-foot standard buffer along roads and paved trails.
- Increased buffer planting density and vertical structure to improve screening of created wetland from ongoing park activities.
- Control of invasive species.
- Improved upland and edge habitat function through planting with appropriate native trees and shrubs.

5.4 Elliott Bridge Reach Mitigation Site

The Elliott Bridge Reach Mitigation Site will provide floodplain wetland and aquatic habitat mitigation for the SR 520, I-5 to Medina Project. Details of the aquatic habitat mitigation can be found in the *Final Aquatic Mitigation Plan SR 520, I-5 to Medina: Bridge Replacement and HOV Project* (WSDOT 2011a).

5.4.1. Site Location

The Elliott Bridge Reach Mitigation Site is located along the Cedar River, between SR 169 (on the south) and SE Jones Place (on the north), and west of 154th Place SE. The site is currently owned by King County, and is composed of 20 parcels in the northwest 1/4 and southwest 1/4 of Township 23 North, Range 5 East, within the City of Renton, Washington.

5.4.2. Landscape Perspective

Landscape Position

The Elliott Bridge Reach Mitigation Site is located in the riparian zone and historic floodplain of the Cedar River at River Mile 5. The Cedar River drainage is within WRIA 8, the Lake Washington-Cedar/Sammamish Watershed.

5.4.3. Ecological Connectivity

The Elliott Bridge Reach Mitigation Site consists of currently and formerly developed residential parcels with publicly-owned open space both up and downstream. Mitigation at this location will establish riparian wetlands and rearing habitat for salmonids, provide additional floodplain capacity, enhance riparian vegetation and riparian buffer functions, and connect currently fragmented habitats to the east at Cavanaugh Pond Natural Area to habitats at Ron Regis Park and Maplewood Golf Course to the west of the site. Overall, the mitigation at Elliott Bridge Reach fits into a larger series of projects in the floodplains of the Cedar River planned by King County. As a result, the mitigation at the Elliott Bridge Reach site, while relatively small, will provide functions that are part of a larger riparian improvement program.

Nearby Restoration and Mitigation Activities

One existing mitigation site is located nearby. This mitigation site is located immediately to the east of the Elliott Bridge Reach Site, and was constructed by King County as apart of the mitigation for the bridge at 154th Place SE (which replaces the historic bridge at 149th Avenue SE). The King County mitigation includes wetland creation and stream mouth enhancement to the east of the Elliott Bridge Reach Site, and upland restoration on the abandoned 149th Avenue SE embankment to the west of the Elliott Bridge Reach site. These areas are excluded from WSDOT's mitigation at the Elliott Bridge Reach Site, but their presence will contribute to overall wetland and floodplain function in this area. Additional mitigation projects are located on the Cedar River, but outside the immediate project vicinity.

5.4.4. Historic and Current Land Use

The Elliott Bridge Reach Mitigation Site consists of a series of residential parcels along the north side of the Cedar River on the eastern side of Renton. The area was homesteaded in the 1870s (Slauson 1971). By the early 1900s the areas had transitioned to dairy farming. Transportation improvements (Maple Valley Highway and local railroad access) supported future development in the area (Slauson 1971), and the Elliott Bridge (which carried 149th Street over the Cedar River) was constructed in the early part of the 1910s. Training levees were installed to control flooding and channel migration of the Cedar River.

The site remained in agricultural use at least into the mid 1930s (King County IMAP aerial: http://www.kingcounty.gov/operations/gis/Maps/iMAP.aspx).

The golf course located downstream of Ron Regis Park was originally developed in 1927 as the Cedar River Golf Club. The name was changed to Maplewood Golf Club in the 1940s, and the City of Renton acquired the course in 1985. The agricultural parcels were subdivided into smaller residential lots and developed in the 1950s (King County IMAP Assessor's Data Report, http://www.kingcounty.gov/operations/gis/Maps/iMAP.aspx).

The Elliott Bridge was removed in 2005, and replaced with a new structure upstream of the site, that carries 154th Place SE over the Cedar River. Parcels in the Elliott Bridge Reach site have remained in residential use until purchased by King County in the mid 2000s as part of the Levee Setback program. Structures have been removed from four of the purchased parcels.

5.4.5. Rationale for Site Selection

The Elliott Bridge Reach site was added to the mitigation plan based on the mitigation needs of the project and input from stakeholders and regulatory agencies.

5.4.6. Mitigation Site Existing Conditions

The following sections provide a summary of the existing conditions at the proposed wetland mitigation sites.

Uplands

The Elliott Bridge Reach site is located on the broad floodplain of the Cedar River. At the site, two training dikes retain the Cedar River in its current location. The majority of the site is 5 to 7 feet above the Cedar River.

Vegetation at the Elliott Bridge Reach site is typical of developed residential areas. Trees have been retained on the site or planted to provide shade, and include native species (e.g., red alder, black cottonwood, Douglas-fir, Sitka spruce [*Picea sitchensis*], western red cedar, and western white pine [*Pinus monticola*]) and ornamental and fruiting species (e.g. *Prunus* and *Malus* sp.). Much of the site is open, and the dominant species present are landscape grasses (*Agrostis* sp., *Lolium* sp.) and disturbance-tolerant forbs (cat's ear [*Hypocharis radicata*], clover (*Trifolium* sp.), common mullein [*Verbascum thapsus*], creeping buttercup, plantains [*Plantago* sp.], and thistles [*Cirsium* sp.]). Invasive species (Himalayan blackberry, Japanese knotweed, and reed canarygrass) are common in the areas adjacent to the dike.

Wetlands and Streams

The following section provides a description of wetland conditions at the Elliott Bridge Reach Mitigation Site. Wetland functions at the mitigation site were evaluated using Hruby (2004) and Sheldon et al. (2005). Detailed information on the wetland delineation is provided in the *Draft Wetland and Stream Assessment Report for Union Bay Natural Area, Magnuson Park, and Elliott Bridge Reach Mitigation Sites* (WSDOT 2011c). Additional discussion of wetland function at the Elliott Bridge Reach Mitigation Site is provided in Section 5.5.17.

One small area of wetland vegetation was identified near the Elliott Bridge Reach site (Figure 9). The area is a small (~ 0.03 acre) , and is located on the slope of the north side training levee of the Cedar River, and within the river's ordinary high water mark. The wetland is within the active channel of the river, and is considered part of the Cedar River.

Vegetation in this area is dominated by small-flowered bullrush (*Scirpus microcarpus)*, with smaller amounts of creeping bentgrass (*Agrostis stolonifera*), Canada thistle, and soft rush. Other species present include white clover (*Trifolium repens*), lance leaf plantain (*Plantago lanceolata*), and curly dock (*Rumex crispus*). Daggerleaf rush (*Juncus ensifolius*), spikerush (*Eleocharis* sp.), tapertip rush (*Juncus acuminatus*), toad rush (*Juncus bufonius*), and Japanese knotweed are also present in limited quantities in some areas along the waterline. The surrounding vegetation is dominated by domestic grasses and disturbance-tolerant forbs (creeping bentgrass, Kentucky bluegrass [*Poa pratensis*], tansy [*Tanacetum vulgare*], and lance leaf plantain [*Plantago lanceolata*]). Additional date for this area can be found in the *Draft Wetland and Stream Assessment Report for Union Bay Natural Area, Magnuson Park, and Elliott Bridge Reach Mitigation Sites* (WSDOT 2011c).

Unnamed Stream 1 is a small stream on the north side of the Cedar River that drains the steep slope that extends northward to SE 145th Place in the Renton Highlands. Within the project vicinity, Unnamed Stream 1 flows along a driveway and agricultural field to the north of Jones Road and crosses under Jones Road in a 12-inch corrugated metal pipe culvert near the old 149th Street intersection. From this point, Unnamed Stream 1 flows southward along the old 149th Street road prism, entering the Cedar River at the old 149th Street Bridge footing.

North of Jones Road, Unnamed Stream 1 is confined to a narrow, linear ditch with mowed lawn and cultivated land to the west, and mowed lawn and a residential driveway to the east. Width of the ditch has not been surveyed, but appears to be approximately 6 feet, based on observations from the Jones Road right-of-way. South of Jones Road, Unnamed Stream 1 flows along the north/west side of the abandoned 149th Street road embankment, is approximately 3 to 8 feet wide at the top of bank, and has a silt and sand substrate. Vegetation in this area consists of naturally revegetated shrubs on the restored road embankment, and mowed residential yards with a mixture of mature evergreen and coniferous shade trees on the west. Flows were observed in October, indicating that this stream is likely perennial.

A summary of the Elliott Bridge Reach's existing vegetation is provided in Table 23.

Wildlife Habitat and Use

Wildlife species observed at the Elliott Bridge Reach site include great blue heron and mallard. Beaver presence was indicated by foraging signs and a possible den site on the north bank of the stream. Where homes have been removed and along the river, the habitat is also a suitable travel corridor for white-tail deer and black bear. Other species likely to be present include waterfowl

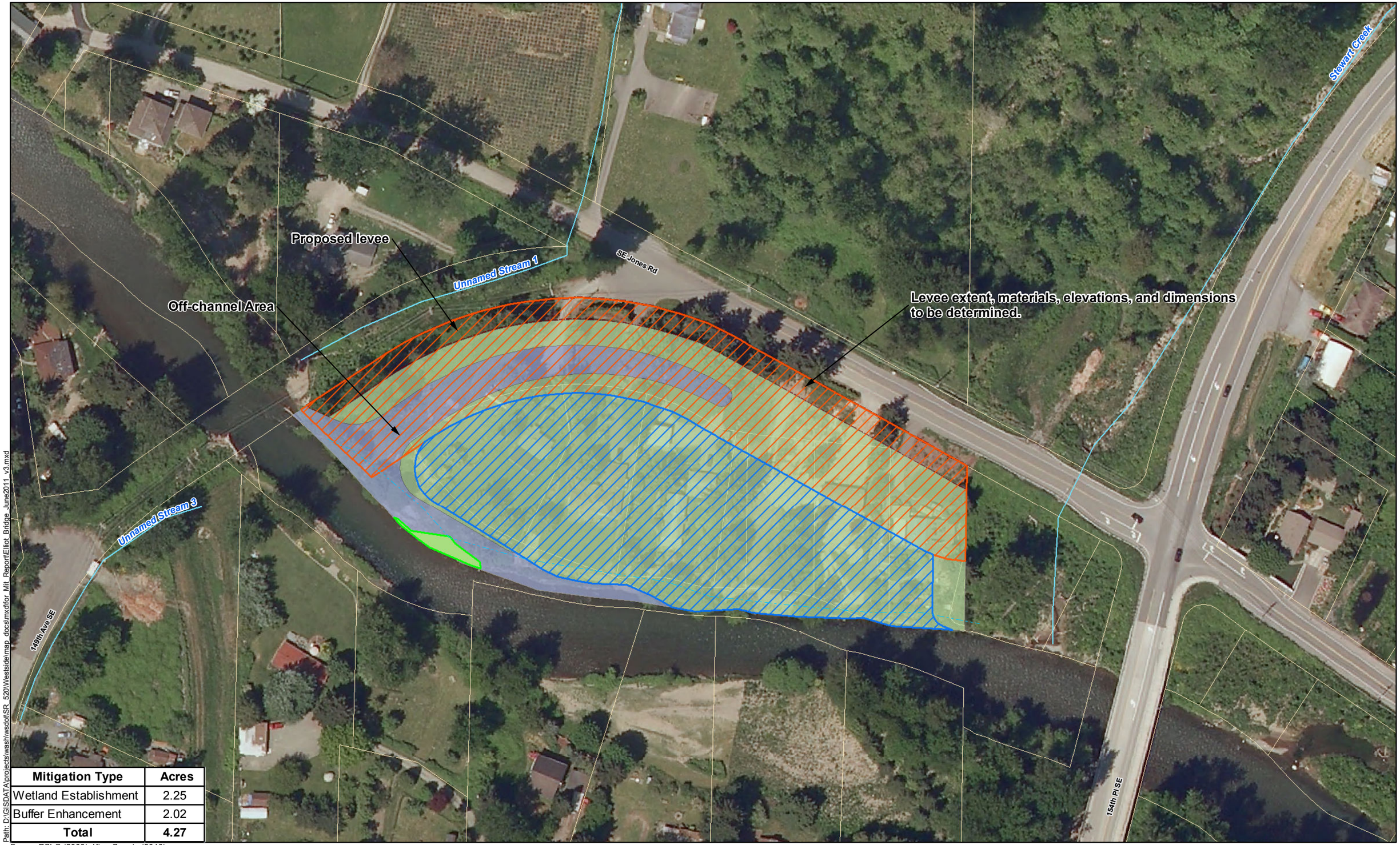
and songbirds similar to those described at the Union Bay sites (See Section 5.1.6 and 5.2.6), and disturbance-tolerant mammals similar to those noted for the other mitigation sites.

Detailed information on habitat type and potential usage will be provided in the *Draft Wetland and Stream Assessment Report for Union Bay Natural Area, Magnuson Park, and Elliott Bridge Reach Mitigation Sites* (WSDOT 2011c). Additional detail regarding fish use at the site is provided in the *Final Aquatic Mitigation Plan for the I-5 to Medina: Bridge Replacement and HOV Project* (WSDOT 2010a).

Table 23. Elliott Bridge Reach Mitigation Site Summary

Location	Banks of the Cedar River near 154th Place SE in Renton	
Elliott Bridge Reach Mitigation Site, Parcel 2323059142 facing north. Open area in Parcel 2323059141 facing north.	**Local Jurisdiction**	King County
	WRIA	WRIA 8
	Ecology Rating (Hruby 2004)	n/a
	King County Rating	n/a
	King County Buffer Width	n/a
	Wetland Size	0.03 (within OHWM)
	Cowardin Classification	within OHWM
	HGM Classification	Riverine
	Wetland Rating System Pts.	
	Water Quality Score	n/a
	Hydrologic Score	n/a
	Habitat Score	n/a
	Total Score	n/a
Dominant Vegetation	Vegetation in the wetland area inside the OHWM is dominated by small-flowered bullrush (*Scirpus microcarpus)*, with smaller amounts of creeping bentgrass (*Agrostis stolonifera*) Canada thistle, soft rush. Other species present include white clover (, lance leaf plantain, and curly dock. Japanese knotweed is also present in some areas.	
Soils	Newberg silt loam, Puyallup fine sandy loam. Observed soils consist of low chroma color sandy loam, consistent with the mapped soils for the area. The observed soils satisfy the depleted matrix (F3) and redox dark surface (F6) indicators, and so meet the hydric soils criterion.	
Hydrology	Flows from the Cedar River likely serve as the source of hydrology for Wetland A. Saturation was present at 12 inches below the surface, which meets the wetland hydrology criterion.	

Location	Banks of the Cedar River near 154th Place SE in Renton
Rationale for Local Rating	Wetland areas identified on the site are below the OHWM and were not rated.
Functions of Entire Wetland	Wetland areas identified on the site are below the OHWM
Buffer Condition	Mixed grasses and landscape plants. Surrounding areas are residential yards that have been vacated and have had the structures removed.



Mitigation Type	Acres
Wetland Establishment	2.25
Buffer Enhancement	2.02
Total	**4.27**

Souce: PSLC (2000); King County (2010)

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N

0 50 100 200 300 Feet

Legend

- Levee Setback
- Riparian and Floodplain Restoration
- Proposed Stream Channel
- Wetland Establishment
- Wetland Buffer Enhancement
- Wetland (Delineated in May/June 2011)
- Parcel
- Ordinary High Water Mark
- Stream

Figure 9
Elliott Bridge Reach Mitigation Concept

SR 520, I-5 to Medina: Bridge Replacement and HOV Project

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5.4.7. Mitigation Site Design

At this site, WSDOT proposes to establish 2.25 acres of forested and scrub-shrub wetland and to enhance 2.02 acres of forested riparian buffer in floodplain of the Cedar River. The Elliott Bridge Reach Mitigation Site is also part of the aquatic mitigation plan (WSDOT 2011a), and will be designed to meet both aquatic and wetland mitigation needs.

Specific construction activities may include setback of the existing levees, excavation to construct a blind channel on the north side of the Cedar River, excavation/grading/contouring to establish a surface consistent with wetland hydrology, replanting native wetland and upland plant species, and control of non-native species on the site. Wetland would be established within the proposed levee setback area (created active floodplain zone), and the remaining areas of the site would be revegetated with appropriate forested upland vegetation. Due to dynamic nature of the Cedar River floodplain, it is expected that the Elliott Bridge Reach Mitigation Site may experience significant change in substrate or vegetation during the monitoring period. Change of this type is consistent with the nature of existing wetland in this system, and is consistent with the overall intent of the design. Figure 9 illustrates the mitigation concept for the site.

5.4.8. Site Constraints

Constraints that may limit design or construction of the site are listed below:

- The site is located on the bank of the Cedar River, and will be subject to river stage hydrology and floodplain dynamics. The restoration must fit in this context.
- The mitigation plan must be forward-compatible and fit in the context of the larger floodplain restoration effort planned by King County.
- Adjoining land uses to the north and west require adequate buffering.
- Substantial excavation will be required to achieve appropriate wetland hydrology.
- Soil substrate may require amendment to create a suitable growing medium.
- In-water work windows may shorten work period at this location.

5.4.9. Site Hydrology

Wetland hydrology at the Elliott Bridge Reach site would be primarily determined by water levels in the Cedar River. Groundwater seepage from the slope to the north currently supports

wetland and small streams in the vicinity of the site; this groundwater seepage may provide supplemental hydrology for the site, and could serve to extend the wetland hydroperiod.

Stream Flow

Stream flow data for the Cedar River has not been collected. A more detailed hydraulic analysis of the Cedar River will be performed during the PS&E phase. WSDOT is preparing a plan for the collection of additional stream date at the site, and will continue to coordinate with the regulatory agencies as the plan evolves.

Groundwater

Groundwater information for the mitigation sites is not yet available. WSDOT is preparing a groundwater well installation plan for the Elliott Bridge Reach Mitigation Site. Data from that groundwater monitoring and other information related to hydrology will be incorporated into final site design (PS&E) as it becomes available.

5.4.10. Invasive Species

Reed canarygrass, Japanese knotweed, and Himalayan blackberry are the dominant invasive species present at the Elliott Bridge Reach Mitigation Site. The presence of these species likely reflects the past agricultural and residential use of the site. Invasive species control strategies for the Elliott Bridge Reach Mitigation Site will be discussed under Site Management (Section 7.3).

5.4.11. Grading Design

Topographic site survey has been completed and detailed topographic information is provided in Appendix E. Wetland elevations and excavation descriptions presented in this report are based on this site survey. As more complete hydrologic data becomes available, this information will be incorporated into PS&E for the site.

The proposed design for the Elliott Bridge Reach site will include: demolition and removal of the remaining structures, driveways and roads; removal of existing levees; construction of replacement setback levees; and excavation of new channels and floodplain wetlands. Final grading plans are included in Appendix E. WSDOT will excavate the surface of the site within the setback levee to more closely approach the elevations of the Cedar River, providing a consistent source of wetland hydrology. The wetland elevations were established based on the topographic site survey and the ordinary high water mark for the site (recorded with handheld GPS), and wetland elevations are presumed to extend approximately 1-foot above the OHWM

elevation. Elevations were also cross checked with the project plans for the adjoining King County mitigation. Additional survey work was done in the Cedar River, and this information was used to revise the side channel elevations. The depth of excavation on the site is expected to vary from 4 feet deep on the existing levee, to up to 8 feet deep in the interior of the site and in created side channel. WSDOT does not propose excavation on the south side of the Cedar River.

The internal portions of the site will be excavated first. The off-channel connection to the Cedar River will be created after vegetation has been established on the site, and within the established work windows for salmon. Work areas will be isolated and erosion control measures will be installed prior to the "final phase" of removing the levee and making the off-channel connection.

The mitigation design for the Elliott Bridge Reach Mitigation Site may incorporate additional minor grading activities such as lowering high spots and creating micro-topographic variations. Final grades will be established consistent with wetland hydrology requirements for the established wetlands and the proposed channel, and may be adjusted for desired habitats based on more detailed hydrologic data.

5.4.12. Planting Design

Proposed plantings for the wetland establishment areas at the Elliott Bridge Reach Mitigation Site include streamside plantings, shrub-shrub plantings, and riparian forested plantings (see Appendix E for plans). A list of typical plants species and community composition for these zones are presented in Table 24. Note that the composition of the planting zones shown in this plan may be revised in the PS&E for the site.

Canopy species identified in the proposed planting palette include both fast-growing and slow-growing species, as well as both deciduous and coniferous species. These species will be located in the higher elevation areas in the interior of the wetland establishment area and along the upper slopes on the northern edge of the site. The scrub-shrub plantings will occupy the areas between the forested zones and the streamside zones. Shrubs have been selected from species common in the areas that are tolerant to full sun and to a broad range of hydrologic conditions. Species included in the streamside palette include fast-growing woody species in live stake form to protect the shoreline and native emergent species common in these areas. These live-staked woody species will also be suitable for the waterward edges of the established wetland. Additional modifications to the selected species may be made as additional site design information (particularly hydrology data) becomes available.

Table 24. Proposed Typical Planting List for Wetland Areas at the Elliott Bridge Mitigation Site

Common Name	Scientific Name	Indicator Status	Size and Condition	Plant Spacing (in feet on center)
Water's Edge Planting				
Live Stakes				
Scouler's willow	*Salix scouleriana*	FAC	Live Stake	1'
Sitka willow	*Salix sitchensis*	FACW	Live Stake	1'
Scrub-shrub Wetland Planting				
Black twinberry	*Lonicera involucrata*	FAC+	#1 Container	4'
Peafruit rose	*Rosa pisocarpa*	FAC	#1 Container	4'
Salmonberry*	*Rubus spectabilis*	FAC+	#1 Container	4'
Red-osier dogwood	*Cornus sericea*	FACW+	#1 Container	4'
Pacific ninebark	*Physocarpus capitatus*	FACW-	#1 Container	4'
Scouler's willow	*Salix scouleriana*	FAC	#1 Container	4'
Sitka willow	*Salix sitchensis*	FACW	#1 Container	4'
Emergents				
Sawbeak sedge	*Carex stipata*	OBL	Plug	2'
Slough sedge	*Carex obnupta*	OBL	Plug	2'
Creeping spikerush	*Eleocharis palustris*	OBL	Plug	2'
Fowl mannagrass	*Glyceria elata*	FACW+	Plug	2'
Tapertip rush	*Juncus acuminatus*	OBL	Plug	2'
Baltic rush	*Juncus balticus*	FACW+	Plug	2'
Daggerleaf rush	*Juncus ensifolius*	FACW	Plug	2'
Skunk cabbage	*Lysichiton americanum*	OBL	Plug	2'
Wooly sedge	*Scirpus cyperinus*	OBL	Plug	1'
Small fruited bulrush	*Scirpus microcarpus*	OBL	Plug	2'
Hardstem bulrush	*Schoenoplectus acutus*	OBL	Plug	2'
Forested Riparian Wetland Planting				
Trees				
Red alder	*Alnus rubra*	FAC	4', Bare Root	10'-12'
Oregon ash	*Fraxinus latifolia*	FACW	4', Bare Root	10'-12'
Sitka spruce*	*Picea sitchensis*	FAC	4', Bare Root	10'-12'
Black cottonwood	*Populus balsamifera ssp.*	FAC	4', Bare Root	10'-12'
Pacific willow	*Salix lucida var. lasiandra*	FACW+	4', Bare Root	10'-12'
Western red cedar	*Thuja plicata*	FAC	4', Bare Root	10'-12'

Common Name	Scientific Name	Indicator Status	Size and Condition	Plant Spacing (in feet on center)
Shrubs				
Red-osier dogwood	*Cornus sericea*	FACW+	#1 Container	4’
Black twinberry	*Lonicera involucrata*	FAC+	#1 Container	4’
Nootka rose	*Rosa nutkana*	FAC	#1 Container	4’
Salmonberry	*Rubus spectabilis*	FAC+	#1 Container	4’
Emergents				
Skunk cabbage	*Lysichiton americanum*	OBL	Plug	2’
Water parsley	*Oenanthe sarmentosa*	OBL	Plug	2’

* Species to be planted in shaded areas or as secondary planting into established canopy.

5.4.13. Habitat Features

Habitat features appropriate to the target plant communities, wildlife species, and site conditions will be incorporated into the mitigation design. These features may include some or all of the following:

- Downed logs
- Standing snags
- Bat boxes
- Brush piles

Quantities and placement of habitat features will be determined as the design is developed.

5.4.14. Buffers and Uplands

Buffer plantings at the Elliott Bridge Reach will be largely composed of mixed upland forest species (see Appendix E for plans). A typical species list is shown in Table 25. The list includes canopy communities (consisting of both deciduous and coniferous tree species) and sub-canopy communities (consisting of deciduous species tolerant to a broad variety of light availability). Planting densities will be higher than similar wetland areas to reduce intrusion and provide additional screening for the resources. Note that in areas where wetland hydrology will extend into the regulatory buffer, the wetland planting palette may be substituted.

Table 25. Proposed Typical Planting List for Upland Buffer Areas at the Elliott Bridge Reach Mitigation Site

Common Name	Scientific Name	Indicator Status	Size and Condition	Plant Spacing (in feet on center)
Upland Forested				
Trees				
Big leaf maple	*Acer macrophyllum*	FACU	4', Bare Root	10'-12'
Red alder	*Alnus rubra*	FAC	4', Bare Root	10'-12'
Black cottonwood	*Populus balsamifera ssp. trichocarpa*	FAC	4', Bare Root	10'-12'
Bitter cherry	*Prunus emarginata*	FACU	4', Bare Root	10'-12'
Douglas-fir	*Pseudotsuga menziesii*	FACU	4', Bare Root	10'-12'
Cascara*	*Rhamnus purshiana*	FAC-	4', Bare Root	10'-12'
Western red cedar*	*Thuja plicata*	FAC	4', Bare Root	10'-12'
Shrubs				
Black hawthorn	*Crataegus douglasii*	FAC	#1 Container	4'
Vine maple*	*Acer circinatum*	FAC-	#1 Container	4'
Serviceberry	*Amelanchier alnifolia*	FACU	#1 Container	4'
Salal	*Gaultheria shallon*	FACU	#1 Container	4'
Beaked hazelnut*	*Corylus cornuta*	FACU	#1 Container	4'
Oceanspray	*Holodiscus discolor*	NL	#1 Container	4'
Oregon Grape	*Mahonia nervosa*	FACU	#1 Container	4'
Indian plum*	*Oemleria cerasiformis*	FACU	#1 Container	4'
Baldhip rose	*Rosa gymnocarpa*	FACU	#1 Container	4'
Nootka rose	*Rosa nutkana*	FAC	#1 Container	4'
Thimbleberry	*Rubus parviflorus*	FAC-	#1 Container	4'
Red Elderberry	*Sambucus racemosa*	FACU	#1 Container	4'
Common snowberry	*Symphoricarpos albus*	FACU	#1 Container	4'

* Species to be planted in shaded areas or as secondary planting into established canopy.

5.4.15. Site Protection

WSDOT, in conjunction with King County, will provide long-term protective measures for the Elliott Bridge Reach Mitigation Site, such as deed restrictions, conservation easements, or Native Growth Protection Easements. Mitigation areas will also be fenced (if necessary and appropriate) and appropriate signage will be installed.

A long-term management plan will be developed for the Elliott Bridge Reach Mitigation Site. The plan will address such elements as: general condition of any fencing and signage; documentation of any trash accumulation; identification of any condition that impairs or threatens the ongoing ecological functioning of the site; and representative photos from points that show the relative condition of the site. Ownership of the site will be retained by King County.

5.4.16. Implementation Schedule

A complete implementation schedule for the Elliott Bridge Reach Mitigation Site has not yet been developed. Additional studies and benchmarks to be completed are expected to be similar to those listed in Section 5.1.16.

- Wetland Delineation (2011 - Complete).
- Topographic Site Survey (2011 – Completed).
- Characterization of reference wetland.
- Final design of the mitigation at the Elliott Bridge Reach Mitigation Site will be provided by WSDOT, and is expected to begin in mid-2012 proceed through the last quarter of 2013.
- Construction of the mitigation at the Elliott Bridge Reach Mitigation Site will be provided by WSDOT, and is expected to begin in early 20142012 and to be completed at the end of 2015.
- Mitigation monitoring and initial maintenance at the Elliott Bridge Reach site will be complete by WSDOT or their designated agent.

Long-term management of the Elliott Bridge Reach site will be provided by the King County Department of Development and Environmental Services.

5.4.17. Ecological Benefits

Wetland Functions

WSDOT proposes the following mitigation activities for the Elliott Bridge Reach Mitigation Site:

- Establishment of 2.25 acres of wetland

- Enhancement of 2.02 acres of wetland buffer

The proposed mitigation at the Elliott Bridge Reach site is expected to substantially improve water quality, hydrologic, and habitat functions. Functional attributes of the mitigation wetlands that will be improved and added, compared to the existing impacted wetlands, are listed below. A summary is provided in Table 26.

Improved Functional Attributes:

- Reduced prevalence of invasive species
- Increased plant diversity by replanting with six native tree species and seven native shrub species
- Increased vertical and horizontal habitat complexity by creating new, interspersed forested and scrub-shrub wetland areas as shown in planting plans
- Additional habitat features

New Functional Attributes:

- Additional functional floodplain and floodplain wetland
- Natural side channel configuration
- Side channel habitat for salmonids and other fish species
- Corridors of riparian habitat to shade new side channel
- A new source for natural LWD recruitment
- Shading provided that assists in maintaining low water temperatures desirable for fish habitat

Table 26. Existing and Proposed Wetland Functions at the Elliott Bridge Reach Mitigation Site

Characteristic	Existing Conditions	Proposed Conditions	Change in Function
Water Quality			
Sediment removal Phosphorous removal Nitrogen removal Metal and toxic organic removal	Small area of wetland vegetation located on the levee slope provides minimal removal of sediment and pollutants.	Remove levee and fill to restore floodplain capacity. Create backwater channel. Plant dense woody vegetation to slow flows and capture sediments.	Established wetland will restore 2.25 acres of floodplain capacity. Dense woody vegetation will reduce water velocities. Woody stems and root mass will retain sediments and associated pollutants.
Pathogen removal	Existing wetland does not provide this function.		No change.
Hydrologic			
Peak flow reduction	Small wetland provides less than 0.1 acre of peak flow reduction.	Lower levee, remove 3-6 feet of fill to restore floodplains. Densely plant with woody plant species.	Lowered floodplain wetland will provide peak flow reduction by providing storage for 2.25 acres of floodplain 3-6 feet deep. Dense woody vegetation will slow water and assist in peak flow attenuation over 2.25 acres.
Erosion reduction	Existing levee has limited vegetation to reduce erosion.	Plant dense woody vegetation with emergent understory.	Dense vegetation will reduce erosion over 2.25 acres of established wetland.
Groundwater recharge	Not known to be provided by this wetland.		No change.
Habitat			
Structural complexity	The site currently is composed of abandoned residential yards with a small emergent wetland on the levee.	Regrade to create multiple hydrologic layers including permanently inundated side channel, seasonally/occasionally inundated and saturated floodplain wetland, and riparian/wetland buffer. Plant three vegetation communities: scrub-shrub and forested wetlands and forested upland	Established wetland will create multiple hydrologic periods and multiple interspersed vegetation strata, creating structurally complex habitat over 2.25 acres. Forested buffer will provide improved upland habitat and additional interspersion.

Characteristic	Existing Conditions	Proposed Conditions	Change in Function
		buffer. Intersperse communities to create complex edges.	
Abundant food sources	Landscape trees, domestic grasses, and disturbance-tolerant herbaceous species provide limited and low quality food sources.	Plant multiple vegetation types. Include plant species that provide a variety of food sources.	Established wetland will create more abundant food sources over 2.25 acres. Food sources will consist of native species.
Connectivity to other natural resources	Disturbed residential lots provide minimal connection and are subject to disturbance.	Create a wide connection between downstream and upstream habitats. Add dense woody species to provide cover and forage. Buffer the wetland and the Cedar River from adjacent residential and agricultural uses.	Established wetland will provide a wide connection extending over 2.25 acres. Dense woody vegetation will provide cover for wildlife and foraging opportunities over 2.25 acres. 110-foot-wide buffer zone will screen the wetland and the Cedar River from adjacent land uses, 2.02 acres. These 2.02 acres will include a constructed side channel as well as a forested riparian zone.
Moist and moderate microclimate	Existing conditions provide moist, moderate microclimate over a small portion of the site, less than 0.1 acre.	Establish wetland to provide moist habitat. Establish dense vegetative cover to provide cover and moderate temperatures.	Establish moist moderate microclimate over 2.25 acres of new area.

Functional Lift

The Elliott Bridge Reach Mitigation Site provides an opportunity for wetland mitigation that addresses deficiencies identified in the watershed plans for WRIA 8, such as loss of floodplain area and volume; loss of riparian vegetation; and loss of water quality improvement functions such as sediment reduction and shading to reduce water temperature. The methods used to describe functional lift are the same as those described for the WSDOT-Owned Peninsula Mitigation Site.

It is important to understand that the mitigation proposed at the Elliott Bridge Reach Mitigation Site is one component of series of floodplain and habitat restoration efforts being undertaken by King County along the lower Cedar River. As such, the Elliott Bridge Reach site functions as part of the larger whole, connecting habitats up and downstream of the site and providing localized functions that are part of a larger overall improvement in riparian function.

Water Quality Functions

No terrestrial wetlands were identified at the Elliott Bridge Reach Mitigation Site. A small area of wetland vegetation was identified on the levee slope and within the ordinary high water mark that likely performs wetland functions in the manner of riverine class wetland. Riverine wetlands can trap sediments and retain and stabilize them between flood events (Sheldon et al. 2005). Performance of sediment and pollutant trapping and retention by the wetland vegetation within the OHW at Elliott Bridge Reach are severely limited due to its small size. The proposed wetland establishment will create 2.25 acres of palustrine wetland with dense woody and emergent vegetation. This large new area of dense wetland vegetation will have the capacity to trap and retain sediments and pollutants between bank-cutting flood events. Pathogen removal is largely a function of long-term water retention. This function may be enhanced by the established wetlands, but is not expected to be a significant component of the function performed at the site.

Hydrologic Functions

In riverine wetlands of western Washington, the major characteristic judged to reduce peak flows is the storage provided by overbank areas. The presence of a wide surface with an elevation at or near that of the riverbank is the most important factor in reducing peak flows (Sheldon et al. 2005). The existing Elliott Bridge Reach Mitigation Site is within the training levee constructed to retain and redirect the flows of the Cedar River, and does not provide capacity for peak flow reduction. Establishment of wetland and floodplain restoration at the Elliott Bridge Reach will

provide a significant improvement in overbank storage capacity (3–6 feet of capacity over the 2.25 acres of wetland) and additional capacity will be provided within the buffer.

In riverine wetlands of western Washington, the major characteristic that reduces erosion is the amount of woody vegetation present that can provide a barrier to water flows (Sheldon et al. 2005). The Elliott Bridge Reach performs minimal reduction of erosion due to the presence of the training levee and limited presence of woody vegetation on the levee. The established wetland and restored floodplains will provide dense woody and herbaceous vegetation that can slow flows and reduce erosion over 2.25 acres of wetland and 2.02 acres of riparian buffer and channel, a substantial increase in this function.

Groundwater recharge occurs only in a subset of depressional wetlands and some riverine wetlands that impound and hold surface water (Sheldon et al. 2005). These functions are not currently performed at the Elliott Bridge Reach Mitigation Site. Wetlands established at the Elliott Bridge Reach Mitigation Site will be situated within the historic floodplain of the Cedar River. Considering the alluvial deposits in the vicinity of the river and the design of the wetlands, which will not include depressions that could trap fish, the establishment of new wetlands at this site is not likely to affect groundwater recharge.

Habitat Functions

Vegetation at the Elliott Bridge Reach Mitigation Site is dominated by residential landscaping and does not provide substantial structural complexity. The proposed mitigation will include planting to create interspersed forested and scrub-shrub habitats and grading to create a side channel for the Cedar River and topographic variation in the wetlands. These design elements will increase the vertical and horizontal structure of the habitats diversity of inundation regimes at the site. These proposed changes will result in greater structural complexity over 2.25 acres of new wetland, and additional structural complexity in the side channel and riparian/wetland buffer.

The residential landscaping currently present at the Elliott Bridge Reach Mitigation Site does not provide significant primary or secondary food sources for wildlife. The addition of 2.25 acres of intersperses woody plant cover will provide new foraging opportunities on the site, and the proposed side channel for the Cedar River will provide an outlet that allows export of these food sources downstream.

The Elliott Bridge Reach currently consists of a mixture of razed home sites and open lawn, and landscape trees and shrubs. Although the residences have been removed from the sites, the lack of cover and absence of foraging opportunities make this connection less desirable for wildlife. The proposed mitigation at the Elliott Bridge Reach Mitigation Site includes dense scrub-shrub and forest vegetation that will provide 2.25 acres of cover suitable for use as a wildlife corridor. The proposed buffer will reduce disturbance in the wetland area and will also provide cover and utility as a wildlife corridor. The proposed side channel may prove an obstacle to some small wildlife species; however, its location is typical of the habitats naturally present in this landscape.

The residential landscaping that dominates the current plant community at the Elliott Bridge Reach Mitigation Site does not support a moist, moderate microclimate. The forest and scrub-shrub wetland would provide an additional 2.25 acres of moist, moderate habitat at the Elliott Bridge Reach Mitigation Site.

Habitat elements specifically related to aquatic species are discussed in detail in the *SR-520, I-5 to Medina: Bridge Replacement and HOV Project Final Aquatic Mitigation Plan* (WSDOT 2011a).

Buffer Functions

Buffers for the site have been designed in accordance with USACE and Ecology joint guidance to provide adequate protection for the wetland functions at the mitigation sites. The proposed buffers for the Elliott Bridge Reach Mitigation Site will be a minimum of 110 feet wide, and are expected to provide the following:

- Improved screening of wetlands from off-site activities.
- Control of invasive species.
- Improved habitat function over existing disturbed conditions by planting with appropriate native trees and shrubs to provide additional forage and cover.
- Improved connectivity between habitats upstream and downstream of the site along the Cedar River.

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Chapter 6. Mitigation Goals, Objectives, and Performance Standards

WSDOT uses goals and objectives to guide mitigation design and construction. Goals describe the overall intent of a mitigation project, and objectives describe individual components of the mitigation plan designed to achieve the goals. Performance standards are quantitative targets that indicate whether or not the mitigation site is on-track toward achieving an objective, a goal, or a regulatory permit requirement.

6.1 Wetland Mitigation Sites

6.1.1. Goals

Mitigation at the four mitigation sites will provide the following compensatory mitigation elements:

- Establish 9.21 acres of palustrine forested, scrub-shrub and emergent wetland.
- Re-establish 2.59 acres of palustrine scrub-shrub wetland.
- Rehabilitate 2.44 acres of palustrine emergent wetland.
- Enhance 14.39 acres of existing lacustrine and palustrine wetland.
- Enhance 30.24 acres of mixed wetland and shoreline buffer.
- Enhance 0.58 acre of wetlands by removing existing ramp structures.

6.1.2. Objectives

WSDOT-Owned Peninsula Mitigation Site

PENINSULA 1: Re-establish 2.59 acres of palustrine wetland at the WSDOT-Owned Peninsula Mitigation Site.

- Re-establish wetland by restoring natural elevations in this area.
- Improve hydrologic and water quality functions by adding vegetative roughness within the re-established wetlands.
- Improve complexity of wetland wildlife habitat by increasing the number of native plant species present.

- Improve wildlife habitat value by adding constructed habitat features such as snags, downed logs, and brush piles.

PENINSULA 2: Enhance 2.35 acres of palustrine wetlands at the WSDOT-Owned Peninsula Mitigation Site.

- Add diversity to existing wetland wildlife habitat by establishing native plant species not present in the existing native wetland plant communities
- Increase structural complexity of wetlands by adding additional shrub sub-canopy species to existing forested wetland.
- Improve wildlife habitat value by adding constructed habitat.

PENINSULA 3: Enhance 4.10 acres of wetland and shoreline buffers at the WSDOT-Owned Peninsula Mitigation Site.

- Screen wetland from nearby human activities.
- Improve adjacent upland habitat by increasing native plant diversity and establishing additional woody vegetation.
- Improve wildlife habitat value by adding constructed habitat.
- Reduce fragmentation of existing wetlands and improve connectivity between them by removing existing ramps.

UBNA Mitigation Site

UBNA 1: Establish 2.29 acres of wetlands at the UBNA Mitigation Site.

- Establish wetlands by removing or grading upland fill.
- Improve hydrologic and water quality functions by establishing persistent emergent and woody vegetation to provide surface roughness within the established wetlands.
- Improve complexity of wetland wildlife habitat by adding 2.29 acres of native wetland forest and increasing the number of native plant species present.
- Improve wildlife habitat value by adding constructed habitat features such as snags, downed logs, and brush piles.

UBNA 2: Enhance 7.49 acres of wetland and complete enhancement at 1.90 acres of wetland at the UBNA Mitigation Site.

- Add diversity to existing wetland wildlife habitat by establishing native plant species not present in the existing native wetland plant communities
- Increase structural complexity of wetlands by adding additional forested habitat and increasing number of native species in emergent wetlands.
- Improve wildlife habitat value by adding constructed habitat features.

UBNA 3: Enhance 14.02 acres of wetland buffers at the UBNA Mitigation Site.

- Screen wetland from nearby human activities.
- Improve adjacent upland habitat by adding native emergent and woody plant species.

Magnuson Park Mitigation Site

MAGNUSON 1: Establish 4.67 acres of wetlands at the Magnuson Park Mitigation Site.

- Establish wetlands by excavating fill material and shaping basins to retain surface flows.
- Established wetland may include some areas of upland that do not meet all three wetland criteria. We expect these areas will be primarily wetland, but may have some mosaic characteristics.
- Improve hydrologic and water quality functions by adding vegetative roughness within the re-established wetlands.
- Add interspersed native forest, scrub-shrub, and emergent wetland to create new wildlife habitat areas.
- Increase plant diversity by increasing the number of native species in the established wetland.
- Improve wildlife habitat value by adding constructed habitat features such as snags, downed logs, and brush piles.

MAGNUSON 2: Rehabilitate 2.44 acres of wetlands at the Magnuson Park Mitigation Site.

- Modify hydrology by excavating fill material and shaping slopes and basins to retain surface flows.

- Improve hydrologic and water quality functions by adding vegetative roughness within the re-established wetlands.
- Improve complexity of wetland wildlife habitat by adding forest and scrub-shrub areas to existing emergent wetland community.
- Increase plant diversity by increasing the number of native species in the re-habilitated wetland.
- Improve wildlife habitat value by adding constructed habitat features such as snags, downed logs, and brush piles.
- Rehabilitated wetland may include some areas of upland that do not meet all three wetland criteria. We expect these areas will be primarily wetland, but may have some mosaic characteristics.

MAGNUSON 3: Enhance 2.65 acres of existing wetlands at the Magnuson Park Mitigation Site.

- Add diversity to existing wetland wildlife habitat by adding forested and scrub-shrub areas, removing invasive species, and establishing native plant species not present in the existing native wetland plant communities.
- Increase structural complexity of wetlands by adding interspersed, scrub/shrub and forested areas.
- Improve wildlife habitat value by adding constructed habitat features such as snags, downed logs, and brush piles.
- Enhanced wetland may include some areas of upland that do not meet all three wetland criteria. This is consistent with the existing wetlands on the site. We expect these areas will be primarily wetland, but may have some mosaic characteristics.

MAGNUSON 4: Enhance 10.10 acres of wetland buffers at the Magnuson Park Mitigation Site.

- Screen wetlands from nearby human activities.
- Add native emergent and woody wetland plant species.
- Improve wildlife habitat value by adding constructed habitat features such as snags, downed logs, and brush piles.

Elliott Bridge Reach Mitigation Site

ELLIOTT 1: Establish 2.25 acres of dynamic floodplains and wetlands at the Elliott Bridge Reach Mitigation Site.

- Establish additional wetlands by removing upland soil.
- Provide hydrologic functions by creating a side channel connected to the Cedar River. This will increase the area to receive flood waters, which will assist in decreasing peak flows and downstream flooding.
- Improve hydrologic and water quality functions by replacing rock levees with vegetation and creating new, vegetated wetlands.
- Provide wetland wildlife habitat by establishing new forested and scrub-shrub wetland areas with a diverse native wetland plant community.
- Provide wildlife habitat features (e.g., snags, downed logs, and brush piles) to improve the quality of the constructed habitat.
- Due to the frequent flooding on the Cedar River and the dynamic nature of its floodplain, the wetland area may experience some active deposition. As a result, the established wetland may include some areas of upland that do not meet all three wetland criteria. This is consistent with the nature of dynamic floodplain/riparian floodplain wetlands.

ELLIOTT 2: Enhance 2.02 acres of riparian buffers at the Elliott Bridge Reach Mitigation Site.

- Screen established wetlands from nearby human activities.
- Improve upland wildlife habitat adjacent to a wetland by converting formerly developed residential yards into a forested riparian buffer community.
- Improve wildlife habitat value by adding constructed habitat features such as snags, downed logs, and brush piles.

6.1.3. Performance Standards

The performance standards described below provide benchmarks for measuring the progress of the goals and objectives of the mitigation site. Mitigation activities are intended to meet these performance standards within 10 years. The performance standards are based on function characteristics described in *Method for Assessing Wetland Functions* (Hruby et al. 1999a and 1999b) and *Wetlands in Washington State, Volume I: A Synthesis of the Science*, (Ecology

Publication # 05-06-006). These performance standards measure structural attributes that serve as indicators of wetland functions. Methods to monitor each performance standard are described in general terms.

Hydrologic Performance

The hydrologic performance standards document and verify that wetland area and ground elevations are established according to the criteria specified during the design. The hydrologic performance standards also ensure that the wetlands are saturated or inundated at sufficient frequency and duration to support the prevalence of wetland vegetation. These hydrologic performance standards directly relate to Objectives PENINSULA 1, UBNA 1, MAGNUSON 1, MAGNUSON 2, and ELLIOTT 1.

Performance Standard

Year 1

As-built condition documented in as-built report submitted to agencies is consistent with the proposed grading plans or revisions approved by regulatory agencies.

Years 1, 3, 5, and 7

In normal years, within the intended wetland area, the area will be inundated or soils will be saturated to within 12 inches of the soil surface for at least 30 consecutive days during the growing season in years when rainfall meets normal precipitation conditions[1,2].

Year 10

Wetlands at the mitigation sites will be delineated using the delineation methods that are approved at the time of the monitoring.

- The WSDOT-Owned Peninsula Mitigation Site will contain at least 2.59 acres of re-established wetlands.
- The Union Bay Natural Area Mitigation Site will contain at least 2.29 acres of newly established wetlands.

[1] Years with normal conditions as related to precipitation are referenced in *The Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (Corps 2010).

[2] Methods for determining the normal range of precipitation are described in *Technical Standard for Water-Table Monitoring of Potential Wetland Sites*, ERDC TN-WRAP-05-02 (http://el.erdc.usace.army.mil/wrap/pdf/tnwrap05-2.pdf).

- The Magnuson Park Mitigation Site will contain at least 4.67 acres of established palustrine wetlands.

- The Magnuson Park Mitigation Site will contain at least 2.44 acres of rehabilitated palustrine wetlands.

- The established and rehabilitated wetland at Magnuson Park may include areas of upland within the wetland boundary. This wetland/upland mosaic is consistent with the seasonally saturated depressional wetlands currently present on the site.

- The Elliott Bridge Reach Mitigation Site will contain at least 2.25 acres of dynamic floodplains and wetlands.

Wetland Vegetation

The performance standards for wetland vegetation document the establishment of wetland plant communities. Native wetland vegetation (facultative and wetter species), both planted and volunteer, will be counted to achieve the density performance standard. Native species colonizing portions of the site will be included in the cover. The performance standards listed below relate to wetland establishment and re-establishment Objectives PENINSULA 1, UBNA 1, MAGNUSON 1, and ELLIOTT 1, wetland rehabilitation Objective MAGNUSON 2, and wetland enhancement Objectives PENINSULA 2, UBNA 2 and MAGNUSON 3. Note that emergent habitat performance standards apply only to UBNA and Magnuson Park.

Performance Standard

Year 1

Forested and scrub-shrub habitats: Native wetland woody species will achieve an average density of at least four plants per 100 square feet in the wetland.

Emergent habitats: Cover of native, wetland emergent vegetation will provide at least 30 percent cover in the wetland.

Year 3

Forested and scrub-shrub habitats: Native wetland woody species will achieve an average density of at least four plants per 100 square feet in the wetland.

Forested and scrub-shrub habitats: Native wetland woody species will be evaluated for percent cover. Cover will be reported.

Emergent habitats: Cover of native, wetland emergent vegetation will provide at least 50 percent cover in the wetland.

Year 5

Forested and scrub-shrub habitats: Cover of native, wetland woody species will provide at least 35 percent cover in the wetland.

Emergent habitats: Cover of native, wetland emergent vegetation will provide at least 75 percent cover in the wetland.

Year 7

Forested and scrub-shrub habitats: Cover of native, wetland woody species will provide at least 50 percent cover in the wetland.

Emergent habitats: Cover of native, wetland emergent vegetation will provide at least 90 percent cover in the wetland.

Year 10

Forested and Scrub-shrub habitats: Cover of native, wetland woody species will provide at least 70 percent cover in the wetland.

Emergent habitats: Cover of native, wetland emergent vegetation will provide at least 90 percent cover in the wetland.

Species Diversity Performance

The performance standards for species diversity document the increase in native plant species in the established, re-established, rehabilitated, and enhanced wetland communities. Native wetland vegetation (facultative and wetter species), both planted and volunteer, will be counted to achieve the species diversity performance standard. The performance standards listed below relate to wetland establishment and re-establishment Objectives PENINSULA 1, UBNA 1, MAGNUSON 1, and ELLIOTT 1, wetland rehabilitation Objective MAGNUSON 2, and wetland enhancement Objectives PENINSULA 2, UBNA 2, and MAGNUSON 3.

Performance Standard

Year 0

All wetland habitats: Count the number of native plant species within the wetland habitats prior to construction.

Year 1

All wetland habitats: The number of native plant species within the wetland habitats will be greater than in Year 0.

Year 3

All wetland habitats: The number of native plant species within the wetland habitats will be greater than in Year 0.

Year 10

All wetland habitats: The number of native plant species within the wetland habitats will be greater than in Year 0.

Structural Complexity Performance

The performance standards for structural complexity document the increase in Cowardin vegetation classes in the established, re-established, rehabilitated, and enhanced wetland communities. The performance standards listed below relate to wetland establishment and re-establishment Objectives PENINSULA 1, UBNA 1, MAGNUSON 1, and ELLIOTT 1, wetland rehabilitation Objective MAGNUSON 2, and wetland enhancement Objectives PENINSULA 2, UBNA 2, and MAGNUSON 3.

Performance Standard

Year 0

All wetland habitats: Identify and map all Cowardin vegetation class polygons greater than 2,500 square feet in size.

Year 1

All wetland habitats: Installed vegetation is consistent with the proposed vegetation type as identified in the wetland mitigation planting plans.

Years 3, 7, and 10

All wetland habitats: Identify and map all Cowardin vegetation class polygons greater than 2,500 square feet in size to document habitat diversity.

Wetland and Riparian Buffer Vegetation Performance

The buffer vegetation performance standards document the establishment of a plant community that (1) provides habitat for native wildlife, (2) screens wetland wildlife from human activity, and (3) provides vegetative roughness to slow floodwaters and allow the deposition of sediment and associated pollutants.

Native upland vegetation, both planted and volunteer, will be counted to achieve the density performance standard. Native species colonizing portions of the site will be included in the cover. The vegetation performance standards for vegetation in the buffer directly relate to Buffer Enhancement Objectives PENINSULA 3, UBNA 3, MAGNUSON 4, and ELLIOTT 2.

Performance Standards

Year 1 and Year 3

Woody upland buffer: Native woody species will achieve an average density of at least four plants per 100 square feet.

Year 3

Woody upland buffer: Native woody species will be evaluated for percent cover. Cover will be reported.

Year 5

Woody upland buffer: Cover of native woody species will provide at least 30 percent in the upland buffer.

Year 7

Woody upland buffer: Cover of native woody species will provide at least 40 percent cover in the upland buffer.

Year 10

Woody upland buffer: Cover of native woody species will provide at least 50 percent cover in the upland buffer.

Habitat Connectivity Performance Standard

Existing ramps at the WSDOT-Owned Peninsula will b e removed to improve habitat connectivity. The habitat connectivity performance standard refers to Wetland Enhancement Objective Peninsula 3.

Performance Standards

Year 1

Verify removal of existing ramps via as-built drawing.

Habitat Structure Performance Standard

Wildlife structures such as snags, downed logs, and brush piles will be designed to provide immediate habitat for wildlife. The habitat structure performance standards directly relate to all objectives.

Performance Standards

Year 1

Installation of habitat structures will be verified and an as-built plan will document that all habitat structures were installed.

Noxious Weeds and Invasive Species Performance Standards

The noxious weeds and invasive species performance standards document the control of noxious weeds and invasive species that can compete with native plants and degrade habitat quality at wetland mitigation sites. The noxious weeds and invasive species performance standards directly relate to Wetland and Buffer Enhancement Objectives PENINSULA 1, 2, and 3; UBNA 1, 2, and 3; MAGNUSON 1, 2, 3, and 4; and ELLIOTT 1 and 2.

Performance Standards

All Years

Noxious Weeds Performance Standards

Washington State-listed or King County-listed Class A weeds designated for control by the County weed board must be eradicated. All occurrences shall be immediately reported to the site manager and an eradication program will be initiated within 30 days of the report.

Designated Class B or C by King County will be controlled to prevent all seed production and to prevent dispersal of propagative parts that are capable of starting new plants.

Invasive Species Performance Standards

The combined cover of non-native blackberries (*Rubus armeniacus* and *R. laciniatus*), Scotch broom (*Cytisus scoparius*), thistles (*Cirsium arvense, C. vulgare, Carduus nutans*, and *Onopordum acanthium*), purple loosestrife (*Lythrum salicaria*), and yellow-flag iris (*Iris pseudacorus*) will not exceed 10 percent cover, collectively, in the restored, created, rehabilitated or enhanced wetland and buffer areas. Non-native knotweeds identified on the King County noxious weed list (*Polygonum cuspidatum, P. polystachyum, P. bohemicum, P. sachalinense)* will be eradicated.

Reed canarygrass (*Phalaris arundinacea*) will be managed and controlled to reduce the competition with and to enhance the survival of tree and shrub plantings in all wetland mitigation areas. Reed canarygrass will not exceed 25% cover in any of the wetland mitigation areas. This standard will be assessed qualitatively each year to document compliance with this standard.

6.2 On-Site Temporary Impact Area Revegetation

6.2.1. Goals

The temporary impacts from the SR 520, I-5 to Medina Project include 3.55 acres of temporary impact to forested scrub-shrub and emergent wetlands, and 4.71 acres of aquatic bed wetlands (Table 7). The aquatic bed areas are expected to revegetate naturally and no plantings are proposed. The forested, scrub-shrub and emergent areas will be revegetated with appropriate native species as part of the project. WSDOT's goal for these areas is as follows:

- Revegetation of temporarily-cleared forest and shrub wetland areas and temporarily-shaded emergent wetland areas with appropriate native species.

6.2.2. Objectives

On-site 1: Revegetate temporarily-disturbed areas with appropriate native species.

Replant disturbed forested and shrub areas with appropriate woody species.

Replant disturbed emergent areas with appropriate native emergent species.

6.2.3. Performance Standards

The performance standards described below provide benchmarks for measuring the progress of the goals and objectives of the mitigation site. Temporary impact revegetation areas are intended to meet these performance standards within 10 years for woody vegetation and within 1 year for emergent vegetation. The performance standards are based on function characteristics described in *Method for Assessing Wetland Functions* (Hruby et al. 1999a and 1999b) and *Wetlands in Washington State, Volume I: A Synthesis of the Science*, (Ecology Publication # 05-06-006). . These performance standards measure structural attributes that serve as indicators of wetland functions. Methods to monitor each performance standard are described in general terms.

Wetland Vegetation

The performance standards for wetland vegetation document the establishment of wetland plant communities. This standard evaluate native woody wetland(facultative and wetter) species, including regrowth from temporarily disturbed shrubs, and both planted and volunteer material, to meet plant density and cover requirements specified for years 1, 3, 5, and 10. The performance standards below relate to On-site Objective 1.

Performance Standard

Year 1

Forested and scrub-shrub habitats: Native, wetland woody species will achieve an average density of at least four plants per 100 square feet in the revegetated wetland.

Emergent habitats: Cover of native, wetland emergent vegetation will provide at least 30 percent cover.

Year 3

Forested and scrub-shrub habitats: Native, wetland woody species will achieve an average density of at least four plants per 100 square feet in the revegetated wetland.

Forested and scrub-shrub habitats: Native wetland woody species will be evaluated for percent cover. Cover will be reported.

Emergent habitats: Cover of native, wetland emergent vegetation will provide at least 60 percent cover.

Year 5

Forested and scrub-shrub habitats: Cover of native wetland woody species will provide at least 35 percent cover in the revegetated wetland.

Year 10

Forested and scrub-shrub habitats: Cover of native wetland woody species will provide at least 50-percent cover in the revegetated wetland.

Chapter 7. Monitoring, Contingency Plan, and Site Management

7.1 Monitoring

7.1.1. Wetland Mitigation Sites

WSDOT staff (or their designated representatives) will monitor the mitigation site for 10 years after installation. If all the performance standards are achieved in fewer than 10 years, WSDOT may terminate monitoring with approval of the review agencies.

Quantitative monitoring will be completed and documented 1, 3, 5, 7, and 10 years after initial acceptance of the mitigation construction. The site should be evaluated during the summer following plant installation to assess survival rates and document the presence of non-native invasive species. The WSDOT HQ Wetland Program will also complete informal (qualitative) assessments of the mitigation site in Years 2, 4, 6, 8, and 9 for adaptive management purposes only. Quantitative monitoring will be designed to determine if the performance standards have been met.

7.1.2. On-Site Impact Areas

For on-site temporary impact areas that are being revegetated, WSDOT staff (or their designated representatives) will monitor the mitigation site for 10 years after installation in areas of woody vegetation and 1 year in areas of emergent vegetation. If all the performance standards are achieved in fewer than 10 years, WSDOT may terminate monitoring with approval of the review agencies.

Quantitative monitoring will be completed and documented 1, 3, 5 and 10 years after initial acceptance of the mitigation construction. The site should be evaluated during the summer following plant installation to assess survival rates and document the presence of non-native invasive species. The WSDOT HQ Wetland Program will also complete informal (qualitative) assessments of the mitigation site in Years 2 and 4 for adaptive management purposes only.

7.1.3. All Areas

WSDOT has established a comprehensive set of monitoring methods used to monitor mitigation sites. The actual methods used to monitor each site will be documented in annual monitoring

reports prepared by WSDOT's Wetland Program based in the Environmental Services Office in Olympia, Washington. Monitoring reports will be submitted for review to the recipients listed in Table 27 by the month of April, following the formal monitoring activities conducted the previous year.

Table 27. Monitoring Report Recipients

Permitting Agency or Organization
U.S. Army Corps of Engineers
Washington State Department of Ecology
WDFW

Reports will be submitted to regulatory agencies for permit compliance purposes. Reports will also be posted to a WSDOT website and will be available to the public.

7.2 Adaptive Management and Contingency Measures

WSDOT uses an adaptive management process to improve mitigation success and correct site deficiencies that are observed during monitoring. Adaptive management is a process through which monitoring results may initiate changes to mitigation and maintenance activities, or monitoring protocols. Mid-course corrections may be necessary if monitoring data show the site is developing in ways that were not anticipated during design and permitting of the project. Information from ongoing monitoring further directs subsequent site management activities.

WSDOT anticipates that the mitigation goals will be accomplished with the construction and installation of the mitigation design shown on the grading and planting plans. However, contingency actions may be needed to correct unforeseen problems. Contingency measures describe what actions can be taken to correct site deficiencies. Contingency revisions typically require coordination with the permitting agencies.

The following describes potential situations that can occur and the potential contingencies that may be implemented to correct the problem. Because not all site conditions can be anticipated, the contingencies discussed below do not represent an exhaustive list of potential problems or remedies.

Hydrology

Hydrologic problems that occur on a mitigation site are typically the result of either insufficient water or excessive water. Insufficient water can occur seasonally during drought conditions or can be a long-term problem. Long-term problems can result from altered surface water flows at mitigation sites that rely on surface water flows as the primary source of hydrology. For groundwater-driven mitigation sites, typical long-term hydrologic problems that result in either excessive or insufficient hydrology can occur when (1) a design is based on insufficient groundwater data, (2) incorrect final grade elevations are established, or (3) an unperceived soil condition alters groundwater flows.

Hydrologic contingency measures will be implemented based on observed conditions or monitoring data. Steps to address insufficient or excessive hydrology are as follows:

- Clearly identify the source of the problem.
- Consult with the Mitigation Design Team, including members of the Biology, Landscape Architecture, and Hydrology groups, and with the resource agencies to determine an appropriate course of action.

Vegetation

Problems related to vegetation include plant mortality and poor growth, resulting in low plant cover. These problems could be the result of insufficient site management (particularly lack of watering in the first few growing seasons), animal browsing, competition from invasive species, incorrect plant selection, altered site conditions, and vandalism. Contingencies for plant mortality and poor plant cover may include the following:

- Plant replacement – Additional planting may be required to meet plant survival and plant cover requirements. Plant species will be evaluated in relation to site conditions to determine if plant substitutions will be required.
- Weed control – Control of non-native invasive species may be required to meet survival and plant cover requirements. Weed control methods could include mechanical or hand-control, mulching, or herbicide application.
- Herbivore control – If plant survival or vegetation cover standards are not met because of animal browsing, the wildlife responsible for the browsing will be identified and appropriate control measures will be attempted. These measures could include plant protection, fence installation, or the use of repellents. However, some pestilent and invasive wildlife species are difficult to control. Implementing precautionary measures

with design and placement will minimize unwanted species but is unlikely to eliminate them. Wildlife damage and manipulation of plantings and structures should be expected to occur and, with exceptions, it may be necessary to accept the situation and allow the vegetation to mature under these conditions. Occasionally it may be necessary to dissuade or exclude destructive wildlife species.

- Measures to minimize damage from nutria will be included in the mitigation design. Shoreline slopes will be constructed at slopes of less than 3:1 rather than steep slopes to reduce burrowing by nutria (http://wdfw.wa.gov/living/nutria.html). Shorelines will be planted with a mix of shrubs and small trees, and herbaceous vegetation will be planted in small, selected patches along the shoreline.
- If damage to mitigation plantings resulting from nutria is measurable and exceeds performance standards, WSDOT will implement one or more control methods as contingency measures. Appropriate control measures for nutria as listed by WDFW may include wire and electric fencing, embankment barriers, harassment, and lethal control. Contingency measures would be implemented in coordination with WDFW. A nutria control program has been implemented on the northern shores of Union Bay with considerable success. WSDOT would also review and use, as appropriate.
- Fencing of new plantings will be considered as an additional measure to minimize herbivory by nutria and Canada geese during the vegetation establishment period.
- Native species such as beaver may initially create a perception of damaging effects on the expected outcome of a mitigation site; however, the site modifications that result from their activities can create functions and habitats suited to several other species. The following additional measures are proposed as potential contingencies for beaver-induced failure to meet vegetation performance standards:
    - Replace plants.
    - Plant less preferable species.
    - Adjust plant species and/or communities.
    - Install temporary fenced enclosures around some of the forested and/or shrub communities.
- Vandalism – To prevent vegetation disturbance from vandalism, fences and sensitive area signage will be installed.

Wildlife Structures

Wildlife structures will be installed during construction activities and will be monitored to verify presence or absence. The contingency for wildlife structures is to replace or repair missing or damaged structures. If habitat structures are vandalized, are missing, or are functionally damaged, they will be repaired or replaced as necessary.

7.3 Site Management

WSDOT (or its designated representatives) will manage the site annually for the first 10 years. Site management activities shall include noxious weed control and may include mulching, fertilizing, supplemental watering, maintaining access, repairing damage from vandals, correcting erosion or sedimentation problems, or litter pickup. During the first year, supplemental watering of buffers and seasonally saturated wetland areas will occur during July, August, and September to ensure, at a minimum, the equivalent of normal rainfall levels and no periods of drought (no rainfall or watering) longer than 3 weeks.

Reed canarygrass dominates the watershed and suppression/control of this invasive plant will require careful site preparation and active site management. While complete elimination of reed canarygrass from the mitigation site may not be possible, it should be managed sufficiently to ensure survival of the native planted species until they can effectively compete.

If Japanese knotweed is found at the mitigation site during monitoring, WSDOT (or its designated representatives) will promptly remove the stems above ground and chemically treat it to facilitate elimination of roots and rhizomes below ground.

WSDOT will develop appropriate invasive species control strategies for the individual mitigation sites as the mitigation site designs are developed.

7.3.1. Long Term Management

Long term management plans will be developed for each mitigation site. The objective of the long term management plan is to ensure that the mitigation sites are maintained and monitored to ensure the ecological functioning of the established mitigation site is protected after the ten year period of active site management and monitoring has concluded. The long term management plans will require monitoring and reporting for a period of at least ten years. Reports will include the results of qualitative monitoring assessments and summaries of management activities implemented.

Each plan will identify specific tasks or performance standards that will be monitored during the long term monitoring period to assess different elements of the site that relate to overall site condition and ongoing ecological function at the site.

The long term management plan and associated long term monitoring plan for each site will describe site specific objectives and related tasks and performance standards used to provide information about the following elements:

- Qualitative assessment of overall site condition
- Photo documentation of representative site conditions
- Qualitative assessment of King County-listed noxious weeds
- Qualitative assessment of other specified non-native invasive weeds.
- The condition of fences
- The condition of signage
- Sources of trash or vandalism
- Maintenance implemented to correct issues identified by monitoring activities.

Drafts of the long term management plans will be submitted to USACE and Ecology for approval prior to the conclusion of the ten year monitoring period for each mitigation site.

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Appendix A – Wetland Impact Summaries

Table A1. Wetland PBN-1 Summary

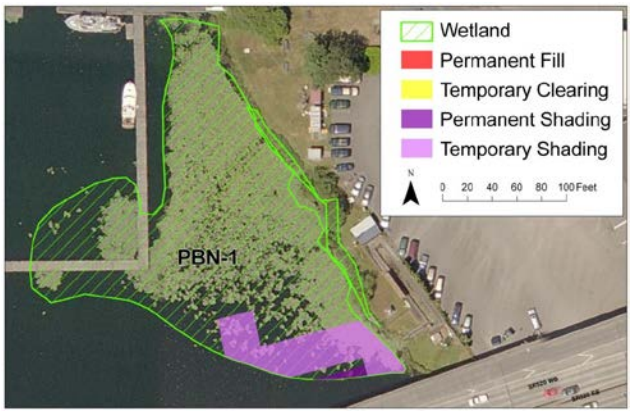
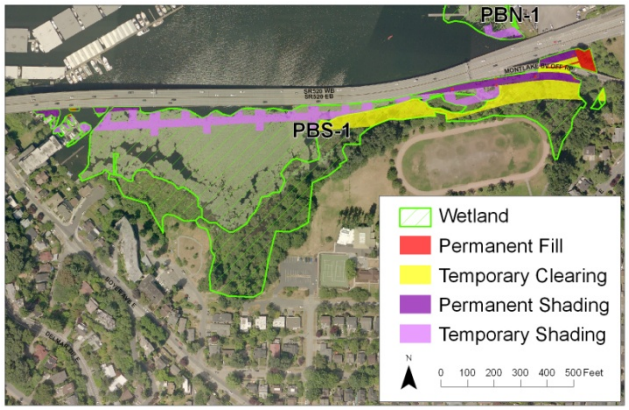
WETLAND PBN-1 – INFORMATION SUMMARY				
Location:	Wetland PBN-1 is located north of SR 520 on the east side of Portage Bay.			
		**Local Jurisdiction**	Seattle	
		WRIA	8	
		Ecology Rating (Hruby 2004)	IV	
		Seattle Rating	IV	
		Seattle Standard Buffer Width	50 feet	
		Wetland Size	0.92 acre	
		Cowardin Classification	L2AB, PEM	
		HGM Classification	Lake Fringe	
		Wetland Rating System		
		Water Quality Score Hydrology Score Habitat Score **Total Score**	2 0 9 **11**	
Wetland and Buffer Impact Summary				
Wetland Impact	Permanent Fill Permanent Shading	- 0.01	Temporary Fill Temporary Clearing Temporary Shading	- - 0.09
Buffer Impact	Permanent Fill Permanent Shading	- -	Temporary Fill Temporary Clearing Temporary Shading	- <0.01 -
Dominant Vegetation Impact	Cattail (*Typha latifolia*).			
Soil Impact	No sample plots were dug due to lack of permission for soil disturbance. No soil impacts.			
Hydrology Impact	Hydrology is driven by Lake Washington. No impact to wetland hydrology. Shading in wetland and buffer will not affect wetland hydrology.			
Wetland Functions Impact Summary				
Water Quality	Wetland PBN-1 has a low potential to improve water quality because it has a narrow vegetation width and consists primarily of aquatic vegetation. It has the opportunity to improve water quality because it can dissipate potential contamination from adjacent boat use. Shading impacts in this wetland will not affect water quality function.			
Hydrologic	PBN-1 has minimal potential to reduce shoreline erosion because it has a narrow vegetation width and consists primarily of aquatic vegetation. It does, however, have the opportunity to reduce erosion caused by boat use. Shading impacts in this wetland will not affect hydrology function.			
Habitat	Wetland PBN-1 has a low potential to provide habitat because of low vegetation structure and special habitat features. It has a low opportunity to provide habitat because it has limited habitat connectivity and buffer. Shading impacts in this wetland may result in a loss of some wetland habitat function by limiting access.			
Buffer Condition	The buffer of PBN-1 includes open water (Lake Washington) and maintained lawn. Lake Washington provides habitat for amphibious and aquatic wildlife. No impacts to the buffer of Wetland PBN-1			

Table A2. Wetland PBS-1 Summary

WETLAND PBS-1 – INFORMATION SUMMARY				
Location:	Wetland PBS-1 is located south of SR 520 along the south shore of Portage Bay.			
		**Local Jurisdiction**	Seattle	
		WRIA	8	
		Ecology Rating (Hruby 2004)	III	
		Seattle Rating	III	
		Seattle Standard Buffer Width	85 feet	
		Wetland Size	12.74 acres	
		Cowardin Classification	L2AB, PFO, PEM	
		HGM Classification	Lake Fringe/Slope	
		Wetland Rating System		
		Water Quality Score Hydrology Score Habitat Score **Total Score**	18 8 22 **48**	
Wetland and Buffer Impact Summary				
Wetland Impact	Permanent Fill Permanent Shading* Includes a small area of permanent clearing in the same area	0.13 0.53	Temporary Fill Temporary Clearing Temporary Shading	- 1.25 1.23
Buffer Impact	Permanent Fill Permanent Shading	0.31 0.04	Temporary Fill Temporary Clearing Temporary Shading	- 0.65 -
Dominant Vegetation Impact	Reed canarygrass (*Phalaris arundinacea*), English ivy (*Hedera helix*), black cottonwood (*Populus balsamifera*), and Pacific willow (*Salix lucida*). Filling will result in a small loss of wetland vegetation. Clearing will result in temporary (but long term) loss of some tall woody vegetation. Shading may result in changes to species composition and plant density.			
Soil Impact	Mucky peat (2.5Y 2.5/1). A small area of wetland soil will be lost.			
Hydrology Impact	Lake Washington. Wetland impacts are not expected to affect wetland hydrology.			
Wetland Functions Impact Summary				
Water Quality	Wetland PBS-1 has a moderate potential to improve water quality due to the width of vegetation along the shoreline. It has the opportunity to improve water quality because it can minimize potential contamination or pollutant runoff from boat use and the proximity to a park. The project is not expected to affect water quality function of wetland PBS-1.			
Hydrologic	Wetland PBS-1 has a low potential to reduce shoreline erosion because much of the vegetation is aquatic bed. Because of the presence of human structures, there is opportunity to reduce erosion. The project is not expected to affect water quality functions of wetlands.			
Habitat	PBS-1 provides high habitat functions due to the presence of special habitat features and multiple Cowardin classes and hydroperiods. It has a moderate opportunity to provide habitat. This is due primarily to its location on the shore of Lake Washington. Permanent fill and shading and temporary filling and shading will result in a loss of wetland area and changes to plant composition and or densities. These are expected			

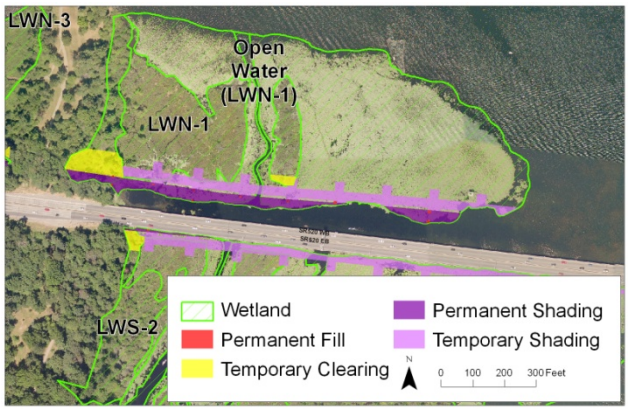
WETLAND PBS-1 – INFORMATION SUMMARY	
	to affect wildlife habitat quality.
Buffer Condition	The buffer of PBS-1 is disturbed to the north by SR 520 and to the south by an urban park and track. The buffer to the south consists primarily of maintained grasses. Permanent shading and temporary clearing will result in some loss of habitat function in the buffer of Wetland PBS-1.

Table A3. Wetland PBS-1A Summary

WETLAND PBS-1A – INFORMATION SUMMARY				
Location:	Wetland PBS-1A is located south of SR 520 and northeast of Montlake Playground Park.			
		Local Jurisdiction	Seattle	
		WRIA	8	
		Ecology Rating (Hruby 2004)	III	
		Seattle Rating	III	
		Seattle Standard Buffer Width	60 feet	
		Wetland Size	0.05 acre	
		Cowardin Classification	PSS, PEM	
		HGM Classification	Depressional/Slope	
		Wetland Rating System		
		Water Quality Score Hydrology Score Habitat Score **Total Score**	16 7 13 **36**	
Wetland and Buffer Impact Summary				
Wetland Impact	Permanent Fill Permanent Shading	0 0	Temporary Fill Temporary Clearing Temporary Shading	- 0.02 -
Buffer Impact	Permanent Fill Permanent Shading	0.04 -	Temporary Fill Temporary Clearing Temporary Shading	- 0.08 -
Dominant Vegetation Impact	Creeping buttercup (*Ranunculus repens*), Himalayan blackberry (*Rubus armeniacus*), bentgrass (*Agrostis* sp.), and Japanese knotweed (*Polygonum cuspidatum*). Some vegetation will be temporarily cleared in PBS-1A.			
Soil Impact	Mucky loam (10YR 2/2) over sandy clay loam (10YR 4/1). Wetland soils will not be impacted by the project.			
Hydrology Impact	High groundwater table. The project will not affect the hydrology of Wetland PBS-1A.			
Wetland Functions Impact Summary				
Water Quality	Wetland PBS-1A has a moderate potential to improve water quality due to the dense vegetation and lack of seasonal ponding. It has the opportunity to improve water quality because of residential land use upgradient of the wetland. The project will not affect the water quality function of PBS-1A.			
Hydrologic	Wetland PBS1-A has a moderate potential to reduce flooding and erosion because it does not have an outlet. It does not have the opportunity to reduce flooding and erosion due to its location in the watershed.			
Habitat	Wetland PBS-1A has a low potential and opportunity to provide habitat. This is due to its limited structure and its degraded buffer. The project will not affect the hydrologic function of PBS-1A.			
Buffer Condition	The buffer of PBS-1A is disturbed by a paved footpath to the west and SR 520 to the northeast. The buffer to the north, east, and south is an urban forest dominated by young red alder (*Alnus rubra*) and Himalayan blackberry in the understory. It provides some habitat and water quality functions. Permanent buffer shading and temporary buffer clearing are expected to affect the quality of habitat in the buffer of PBS-1A.			

Table A4. Wetland LWN-1 Summary

WETLAND LWN-1 – INFORMATION SUMMARY				
Location:	Wetland LWN-1 is located north of SR 520 and on the east side of Foster Island.			



Local Jurisdiction	Seattle
WRIA	8
Ecology Rating (Hruby 2004)	II
Seattle Rating	II
Seattle Standard Buffer Width	110 feet
Wetland Size	14.52 acres
Cowardin Classification	L2AB, PFO, PSS, PEM
HGM Classification	Lake Fringe
Wetland Rating System	
Water Quality Score Hydrology Score Habitat Score **Total Score**	18 8 25 **51**

Wetland and Buffer Impact Summary				
Wetland Impact	Permanent Fill Permanent Shading* Includes a small area of permanent clearing in the same area	0.01 0.75	Temporary Fill Temporary Clearing Temporary Shading	- 0.32 1.01
Buffer Impact	Permanent Fill Permanent Shading	<0.01 0.43	Temporary Fill Temporary Clearing Temporary Shading	- 0.21 <0.01
Dominant Vegetation Impact	Rose spiraea (*Spiraea douglasii*), red-osier dogwood (*Cornus sericea*), American white waterlily (*Nymphaea odorata*), and red alder. Permanent fill in LWN-1 will result in a loss of some vegetation. Permanent shading and temporary clearing and shading may result in changes to species composition and plant density in the affected area.			
Soil Impact	Loam with organics (10YR 2/1) over loam (10YR 4/2) over silt loam (10YR 5/2). Impacts will result in a small area of wetland soils lost.			
Hydrology Impact	Lake Washington. The project is not expected to result in changes to wetland hydrology.			

Wetland Functions Impact Summary	
Water Quality	Dense herbaceous and shrub vegetation provide moderate water quality functions. The urban setting and use of boats provides opportunity for this wetland to provide water quality functions. The project is not expected to result in changes to water quality function in Wetland LWN-1.
Hydrologic	The shrub vegetation provides a low hydrologic potential and the presence of infrastructure (Evergreen Point Bridge columns) provides the opportunity to improve hydrologic conditions. The project is not expected to result in changes to hydrologic function in Wetland LWN-1.
Habitat	Wetland LWN-1 has a moderate level of opportunity and high potential to provide habitat functions. This is due to the presence of multiple Cowardin classes and habitat structures. Permanent fill and shading and temporary clearing and shading are expected to result in a reduction in wetland habitat function.

WETLAND LWN-1 – INFORMATION SUMMARY	
Buffer Condition	The buffer of Wetland LWN-1 includes open water (Lake Washington) to the north and east, SR 520 to the south, and upland forest to the west. The dominant vegetation in the buffer to the west is red alder, black cottonwood, Himalayan blackberry, Oregon ash (*Fraxinus latifolia*), and English laurel. This forested buffer provides some wildlife habitat as well as water quality functions. Lake Washington provides habitat for amphibious and aquatic wildlife. Permanent filling and shading and temporary clearing are expected to result in a reduction in some buffer functions, particularly habitat functions.

Table A5. Wetland LWN-2 Summary

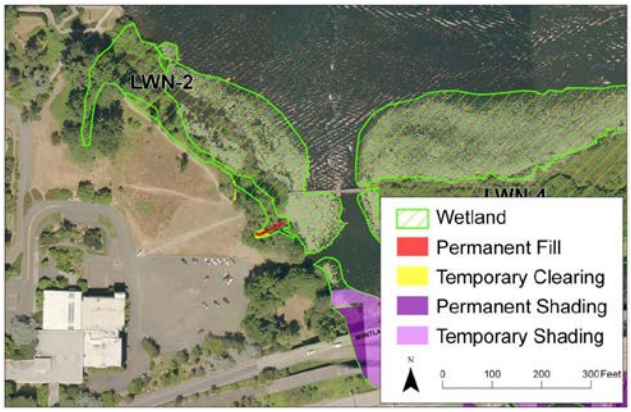
WETLAND LWN-2 – INFORMATION SUMMARY				
Location:	Wetland LWN-2 is located north of SR 520, in the vicinity of McCurdy Park, and the northwest corner of the Washington Park Arboretum.			
		**Local Jurisdiction**	Seattle	
		WRIA	8	
		Ecology Rating (Hruby 2004)	III	
		Seattle Rating	III	
		Seattle Standard Buffer Width	60 feet	
		Wetland Size	3.02 acres	
		Cowardin Classification	L2AB, PFO, PSS, PEM	
		HGM Classification	Lake Fringe	
		Wetland Rating System		
		Water Quality Score Hydrology Score Habitat Score **Total Score**	18 8 18 **44**	
Wetland and Buffer Impact Summary				
Wetland Impact	Permanent Fill Permanent Shading	0.02 0.81	Temporary Fill Temporary Clearing Temporary Shading	- 0.01 0.10
Buffer Impact	Permanent Fill Permanent Shading	0.29 0.02	Temporary Fill Temporary Clearing Temporary Shading	- 0.09 -
Dominant Vegetation Impact	Red-osier dogwood, reed canarygrass, and Pacific willow. Loss of a small area of vegetation permanently. Permanent shading may result in changes in composition or density. Temporary clearing and shading will result in temporary but long-tern vegetation changes.			
Soil Impact	Silt (10YR 3/1) over silt clay loam (10Y 5/1) with redoximorphic features over peat (10YR 2/1). A small area of wetland soil will be lost.			
Hydrology Impact	Lake Washington. No changes to wetland hydrology.			
Wetland Functions Impact Summary				
Water Quality	LWN-2 provides a moderate potential to improve water quality due to the width of vegetation along the lakeshore. Opportunity is provided by the urban setting and boat traffic. Water quality function of LWN-2 will not be affected.			
Hydrologic	The woody vegetation of the wetland provides a low potential to improve hydrologic conditions. Human structures along the upland edge of the wetland are protected by the wetland; therefore, the opportunity to reduce erosion is present. Hydrologic function of LWN-2 will not be affected.			
Habitat	Moderate potential and opportunity for wildlife habitat are provided by the wetland due to multiple Cowardin classes. Permanent shading and temporary clearing and shading will reduce performance of some indicators of habitat function.			
Buffer Condition	The buffer of LWN-2 is composed primarily of maintained lawn to the southwest, Lake Washington to the northeast, and forest to the northwest. The forested component of the buffer is dominated by black cottonwood, with English ivy in the understory. The buffer provides low levels of water quality functions. Lake Washington provides habitat for amphibious and aquatic wildlife. Permanent shading will affect a small area of LWN-2's buffer. Temporary clearing will affect a larger area of the buffer. These effects are expected to reduce habitat function in the buffer somewhat.			

Table A6. Wetland LWN-3 Summary

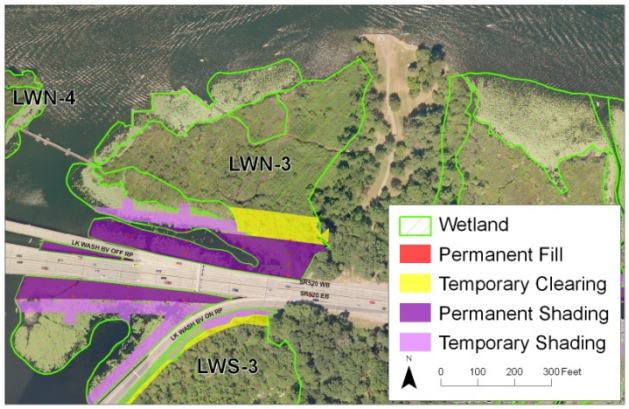
WETLAND LWN-3 – INFORMATION SUMMARY				
Location:	Wetland LWN-3 is located north of SR 520 and on the west side of Foster Island.			
		**Local Jurisdiction**	Seattle	
		WRIA	8	
		Ecology Rating (Hruby 2004)	III	
		Seattle Rating	III	
		Seattle Standard Buffer Width	85 feet	
		Wetland Size	7.1 acres	
		Cowardin Classification	L2AB, PSS, PEM	
		HGM Classification	Lake Fringe	
		Wetland Rating System		
		Water Quality Score Hydrology Score Habitat Score **Total Score**	18 8 23 **49**	
Wetland and Buffer Impact Summary				
Wetland Impact	Permanent Fill Permanent Shading	0.01 1.05	Temporary Fill Temporary Clearing Temporary Shading	- 0.38 0.31
Buffer Impact	Permanent Fill Permanent Shading	<0.01 0.23	Temporary Fill Temporary Clearing Temporary Shading	- 0.16 -
Dominant Vegetation Impact	American white waterlily, cattail, red-osier dogwood, red alder, and Oregon ash. A small area of wetland vegetation will be permanently lost. Shading will likely result in changes to plant composition and density. Temporary clearing and shading will have effects similar to the permanent effects, but vegetation is expected to recover after the construction is complete.			
Soil Impact	Silt (10YR 2/1) over mucky peat (10YR 4/2). A small area of wetland soils will be lost.			
Hydrology Impact	Lake Washington. Wetland hydrology will not be affected by the project.			
Wetland Functions Impact Summary				
Water Quality	LWN-3 provides moderate potential to improve water quality due to the width of vegetation along the lakeshore and presence of herbaceous vegetation. There is also the opportunity to improve water quality by dissipating potential pollutants from boat traffic. Water quality function in LWN-3 will not be affected by the project.			
Hydrologic	There is a low potential to improve hydrologic conditions because the wetland is partially vegetated with woody vegetation near the lakeshore. The wetland also has the opportunity to improve water quality. Hydrologic function in LWN-3 will not be affected by the project.			
Habitat	Moderate habitat functions are provided by LWN-3. Multiple Cowardin classes, high levels of habitat interspersion, and habitat structures are present in the wetland. Changes in wetland vegetation are likely to result in a reduction in some aspects of wetland habitat function.			
Buffer Condition	The buffer of LWN-3 comprises forest and maintained lawn to the east and Lake Washington to the north, west, and south. The buffer to the east is dominated by maintained grasses and nonnative ornamental trees. Lake Washington provides habitat for amphibious and aquatic wildlife. Permanent filling, shading and temporary clearing will result in changes to vegetation in the LWN-3 buffer which will reduce some habitat functions of the buffer.			

Table A7. Wetland LWN-4 Summary

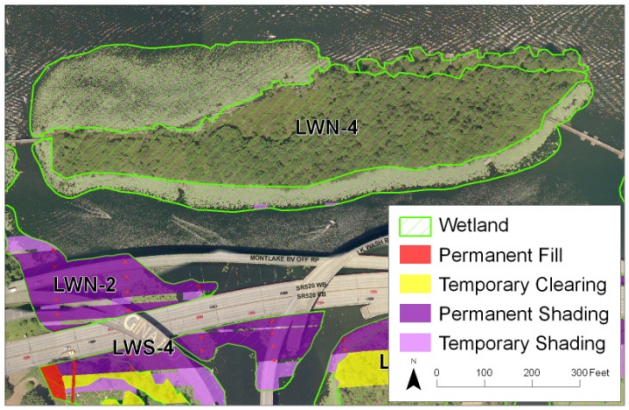
WETLAND LWN-4 – INFORMATION SUMMARY				
Location:	Wetland LWN-4 comprises Marsh Island and the surrounding aquatic bed vegetation, located north of SR 520.			
		**Local Jurisdiction**	Seattle	
		WRIA	8	
		Ecology Rating (Hruby 2004)	III	
		Seattle Rating	III	
		Seattle Standard Buffer Width	60 feet	
		Wetland Size	7.7 acres	
		Cowardin Classification	L2AB, PFO, PSS	
		HGM Classification	Lake Fringe	
		Wetland Rating System		
		Water Quality Score Hydrology Score Habitat Score **Total Score**	18 12 19 **49**	
Wetland and Buffer Impact Summary				
Wetland Impact	Permanent Fill Permanent Shading	- -	Temporary Fill Temporary Clearing Temporary Shading	- - 0.01
Buffer Impact	Permanent Fill Permanent Shading	- -	Temporary Fill Temporary Clearing Temporary Shading	- - -
Dominant Vegetation Impact	Willows (*Salix* sp.) and American white waterlily. A small area of vegetation in LWN-4 will be temporarily shaded.			
Soil Impact	No sample plots were dug due to lack of permission for soil disturbance. No wetland soil area will be lost.			
Hydrology Impact	Lake Washington. Wetland hydrology will not be affected by the project.			
Wetland Functions Impact Summary				
Water Quality	LWN-4 has a moderate potential to provide water quality functions primarily because of the dense vegetation along the lakeshore. It has the opportunity to improve water quality because it can dissipate potential contamination or pollutant runoff from boat traffic and nearby maintained lawn grasses. The small area of temporary shading is not expected to affect water quality function.			
Hydrologic	Moderate hydrologic functions are provided by the wetland due to dense woody vegetation that helps reduce shoreline erosion. Wetland LWN-4 also has the opportunity to reduce erosion. The small area of temporary shading is not expected to affect hydrologic function.			
Habitat	LWN-4 has a moderate potential and opportunity to provide habitat because it has multiple Cowardin vegetation classes and hydroperiods, moderate dispersion of habitats, and is connected to other wetlands by a relatively undisturbed corridor. The small area of temporary shading is expected to have minimal effect on habitat function in LWN-4.			
Buffer Condition	LWN-4 is surrounded by Lake Washington, which provides habitat for aquatic and amphibious wildlife. Buffer functions are not expected to be affected.			

Table A8. Wetland LWN-5 Summary

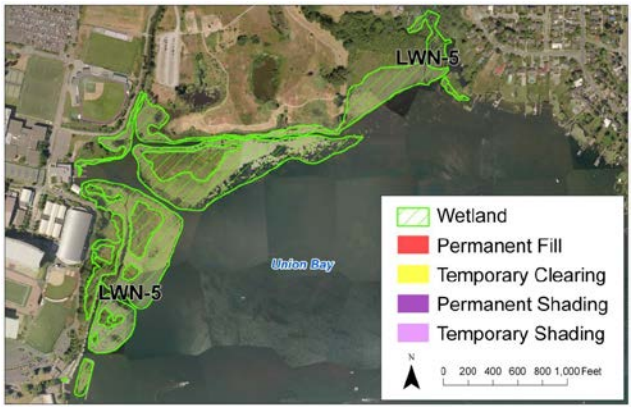
WETLAND LWN-5 – INFORMATION SUMMARY				
Location:	Wetland LWN-5 is located north of the Montlake Cut along the shoreline of the University of Washington.			
		**Local Jurisdiction**	Seattle	
		WRIA	8	
		Ecology Rating (Hruby 2004)	III	
		Seattle Rating	III	
		Seattle Standard Buffer Width	85 feet	
		Wetland Size	37.24 acres	
		Cowardin Classification	L2AB, PSS, PEM	
		HGM Classification	Lake Fringe	
		Wetland Rating System		
		Water Quality Score Hydrology Score Habitat Score **Total Score**	18 4 26 **48**	
Wetland and Buffer Impact Summary				
Wetland Impact	Permanent Fill Permanent Shading	- -	Temporary Fill Temporary Clearing Temporary Shading	- - -
Buffer Impact	Permanent Fill Permanent Shading	- -	Temporary Fill Temporary Clearing Temporary Shading	- - -
Dominant Vegetation Impact	Red-osier dogwood, Pacific willow, cattail, and black cottonwood. The project will not affect vegetation in LWN-5.			
Soil Impact	No sample plots were dug due to lack of permission for soil disturbance. Soils in LWN-5 will not be affected by the project.			
Hydrology Impact	Lake Washington. Wetland hydrology will not be affected by the project.			
Wetland Functions Impact Summary				
Water Quality	LWN-5 has moderate potential to improve water quality primarily because there is a wide band of vegetation along the lakeshore. It has the opportunity to improve water quality by dissipating any pollutant runoff or contamination from boat use in the lake and urban areas nearby. No impacts to this function.			
Hydrologic	LWN-5 has low potential to reduce shoreline erosion because nonaquatic bed vegetation along the shoreline is not very wide. It does not have the opportunity to reduce erosion. No impacts to this function.			
Habitat	LWN-5 has moderate potential to provide habitat because it has multiple Cowardin classes and high interspersion of habitats. It has moderate opportunity to provide habitat because it is connected to other habitats.			
Buffer Condition	The buffer of LWN-5 is dominated by nonnative grasses and trails. Some portions of the buffer, to the west of LWN-5, are dominated by black cottonwood and red-osier dogwood. Open water (Lake Washington) is to the south. The buffer of LWN-5 provides wildlife habitat and some water quality functions. No impacts to wetland buffers.			

Table A 9. Wetland LWS-1 Summary

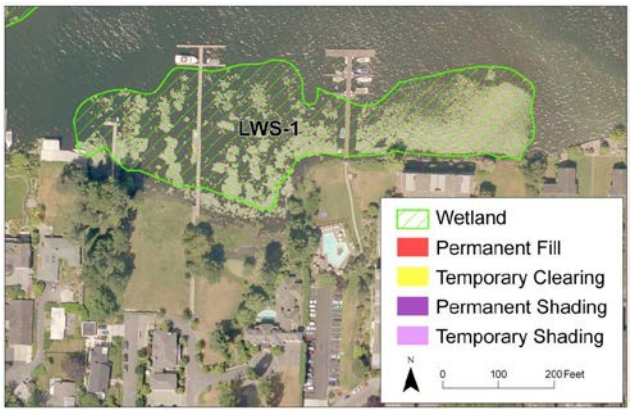
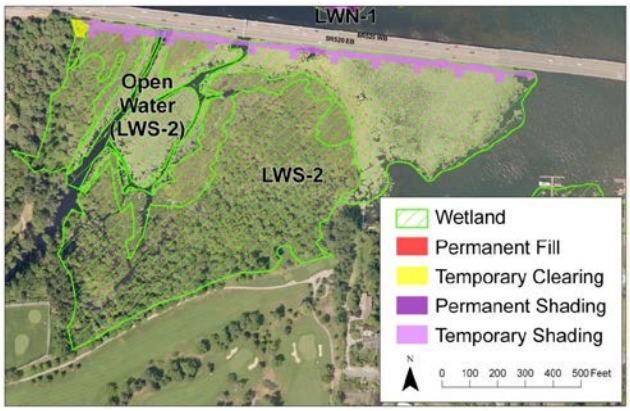
WETLAND LWS-1 – INFORMATION SUMMARY				
Location:	Wetland LWS-1 is located south of SR 520 and to the east-northeast of the Broadmoor Golf Club.			
		**Local Jurisdiction**	Seattle	
		WRIA	8	
		Ecology Rating (Hruby 2004)	IV	
		Seattle Rating	IV	
		Seattle Standard Buffer Width	50 feet	
		Wetland Size	2.94 acres	
		Cowardin Classification	L2AB	
		HGM Classification	Lake Fringe	
		Wetland Rating System		
		Water Quality Score Hydrology Score Habitat Score **Total Score**	6 4 14 **24**	
Wetland and Buffer Impact Summary				
Wetland Impact	Permanent Fill Permanent Shading	- -	Temporary Fill Temporary Clearing Temporary Shading	- - -
Buffer Impact	Permanent Fill Permanent Shading	- -	Temporary Fill Temporary Clearing Temporary Shading	- - -
Dominant Vegetation Impact	American white waterlily. No impacts to wetland vegetation.			
Soil Impact	No sample plots were dug because the wetland is aquatic bed only. No impacts to wetland soils.			
Hydrology Impact	Lake Washington. No impacts to wetland hydrology.			
Wetland Functions Impact Summary				
Water Quality	LWS-1 has the potential to provide low water quality functions because of vegetation along the lakeshore and the herbaceous plants that cover more than a third of the vegetated area. It has the opportunity to improve water quality because there are urban areas and maintained parks nearby. No impacts to water quality.			
Hydrologic	The potential to reduce shoreline erosion is low because the nonaquatic bed vegetation along the shoreline is not very wide. It has the opportunity to reduce erosion because there are structures along the upland edge of the wetland that could be damaged by erosion. No impacts to hydrologic function.			
Habitat	LWS-1 has the potential to provide habitat because it has multiple Cowardin classes, moderate habitat interspersion, and special habitat features. It has the opportunity to provide habitat because it is connected to other habitats. No impacts to wetland habitat.			
Buffer Condition	The buffer of Wetland LWS-1 encompasses Lake Washington to the north and maintained lawns to the south. Residential structures are located in the buffer to the south, which provides minimal water quality functions. Lake Washington provides habitat for amphibious and aquatic wildlife. No impact to wetland buffers.			

Table A10. Wetland LWS-2 Summary

WETLAND LWS-2 – INFORMATION SUMMARY				
Location:	Wetland LWS-2 is located south of SR 520, north of the Broadmoor Golf Club, and on the east side of Foster Island.			
	**Local Jurisdiction**	Seattle		
	WRIA	8		
	Ecology Rating (Hruby 2004)	II		
	Seattle Rating	II		
	Seattle Standard Buffer Width	110 feet		
	Wetland Size	26.38 acres		
	Cowardin Classification	L2AB, PSS, PEM		
	HGM Classification	Lake Fringe		
	Wetland Rating System			
	Water Quality Score Hydrology Score Habitat Score **Total Score**	20 12 24 **56**		
Wetland and Buffer Impact Summary				
Wetland Impact	Permanent Fill Permanent Shading	0.001 0.04	Temporary Fill Temporary Clearing Temporary Shading	- 0.06 1.20
Buffer Impact	Permanent Fill Permanent Shading	<0.01 0.03	Temporary Fill Temporary Clearing Temporary Shading	0.14 0.01 -
Dominant Vegetation Impact	American white waterlily, Himalayan blackberry, salmonberry (*Rubus spectabilis*), red-osier dogwood, and red alder. Permanent fill and shading will affect a small area of vegetation. Temporary clearing and shading will remove a small area of vegetation and shade a larger are of the wetland. This may affect plant composition and density.			
Soil Impact	Peat (10YR 2/1) over muck (10YR 2/2) over loam (10YR 2/2) over sand (10YR 4/1). A small area of wetland soil will be lost.			
Hydrology Impact	Lake Washington. Wetland hydrology will not be affected.			
Wetland Functions Impact Summary				
Water Quality	LWS-2 provides moderate water quality functions primarily due to the dense vegetation along the lakeshore. It has the opportunity to improve water quality because the wetland vegetation can sequester pollutants from boats and maintained lawn. Water quality function will not be affected by the project.			
Hydrologic	LWS-2 provides moderate hydrologic functions due to fringe vegetation along the lakeshore. It also has the opportunity to reduce erosion. Hydrologic function will not be affected by the project.			
Habitat	LWS-2 has a high potential and moderate opportunity to provide habitat because it has multiple Cowardin classes and hydroperiods (water level fluctuations over time), moderate dispersion of habitats, and is connected to other wetlands by a relatively undisturbed corridor. Effects to vegetation may result in a decrease in some parameters of wetland habitat function.			

WETLAND LWS-2 – INFORMATION SUMMARY	
Buffer Condition	A golf course is located to the south of LWS-2 and SR 520 is located to the north. To the east of LWS-2 the buffer is open water and to the west the buffer is forested. The forested component is dominated by black cottonwood, Oregon ash, and Indian plum. The buffer of LWS-2 provides some water quality and wildlife habitat functions. Permanent filling and shading and temporary clearing in the buffer of LWS-2 may result in reduction in habitat function.

Table A11. Wetland LWS-3 Summary

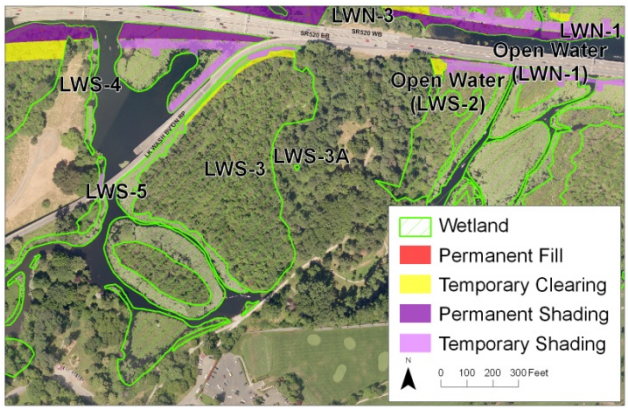
WETLAND LWS-3 – INFORMATION SUMMARY				
Location:	Wetland LWS-3 is located south of SR 520 on the west side of Foster Island.			
		**Local Jurisdiction**	Seattle	
		WRIA	8	
		Ecology Rating (Hruby 2004)	II	
		Seattle Rating	II	
		Seattle Standard Buffer Width	110 feet	
		Wetland Size	15.22 acres	
		Cowardin Classification	L2AB, PFO, PSS, PEM	
		HGM Classification	Lake Fringe	
		Wetland Rating System		
		Water Quality Score Hydrology Score Habitat Score **Total Score**	18 12 24 **54**	
Wetland and Buffer Impact Summary				
Wetland Impact	Permanent Fill Permanent Shading	0.005 0.53	Temporary Fill Temporary Clearing Temporary Shading	- 0.16 0.73
Buffer Impact	Permanent Fill Permanent Shading	<0.01 <0.01-	Temporary Fill Temporary Clearing Temporary Shading	- 0.18 -
Dominant Vegetation Impact	Birch (*Betula sp.),* salmonberry, slough sedge (*Carex obnupta*), red-osier dogwood, and Oregon ash. Permanent shading and temporary clearing and shading may result in changes in vegetation composition and density. Filling will result in a loss of a small area of wetland vegetation.			
Soil Impact	Mucky peat (10YR 3/2) over peat (10YR 2/2). A small area of wetland soil will be lost.			
Hydrology Impact	Lake Washington. Wetland hydrology will not be affected.			
Wetland Functions Impact Summary				
Water Quality	LWS-3 has a moderate potential to improve water quality because the vegetation along the lakeshore is wide. It has the opportunity to improve water quality because it can sequester contamination from boat usage. Water quality function will not be affected by the project.			
Hydrologic	LWS-3 has a moderate potential to reduce shoreline erosion because the fringe vegetation along the shore is a wide band of shrubs and trees. It has the opportunity to reduce erosion. Hydrologic function will not be affected by the project.			
Habitat	LWS-3 has a high potential to provide habitat because it has multiple Cowardin classes and hydroperiods, moderate habitat interspersion, and special habitat features. It has a moderate opportunity to provide habitat because it is connected to other habitats. Habitat function will likely be reduced by the changes in vegetation described above.			
Buffer Condition	The buffer of LWS-3 comprises SR 520 to the north, forest to the east, and a road to the south. The forested component of the buffer is dominated by Oregon ash, California blackberry (*Rubus ursinus*), English ivy, and Indian plum (*Oemleria cerasiformis*). This buffer provides some wildlife habitat and water quality functions and is relatively undisturbed to the east. Temporary clearing will result in a temporary loss of some aspects of habitat function.			

Table A12. Wetland LWS-3A Summary

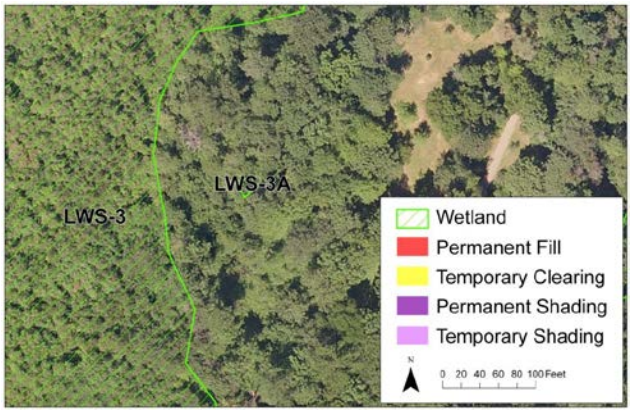
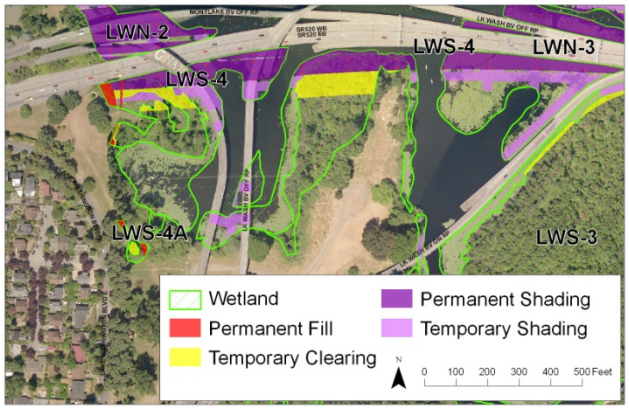
WETLAND LWS-3A – INFORMATION SUMMARY				
Location:	Wetland LWS-3A is located south of SR 520 in the southwest portion of Foster Island			
		**Local Jurisdiction**	Seattle	
		WRIA	8	
		Ecology Rating (Hruby 2004)	IV	
		Seattle Rating	IV	
		Seattle Standard Buffer Width	N/A	
		Wetland Size	< 0.01 acre	
		Cowardin Classification	PFO	
		HGM Classification	Depressional	
		Wetland Rating System		
		Water Quality Score Hydrology Score Habitat Score **Total Score**	8 7 13 **28**	
Wetland and Buffer Impact Summary				
Wetland Impact	Permanent Fill Permanent Shading	- -	Temporary Fill Temporary Clearing Temporary Shading	- - -
Buffer Impact	Permanent Fill Permanent Shading	- -	Temporary Fill Temporary Clearing Temporary Shading	- - -
Dominant Vegetation Impact	Slough sedge, red-osier dogwood, and Oregon ash. No impacts to wetland vegetation.			
Soil Impact	Silty clay loam (2.5YR 4/2) over clay (10YR 4/1). No impacts to wetland soils.			
Hydrology Impact	Seasonal high groundwater table. No impact to wetland hydrology,			
Wetland Functions Impact Summary				
Water Quality	LWS-3A has a low opportunity to improve water quality because it has persistent ungrazed vegetation for most of its area. It does not have the opportunity to improve water quality. No impacts to this function.			
Hydrologic	LWS-3A has a low potential to reduce flooding and erosion because it has no outlet and the area of the basin is 10 to 100 times the area of the wetland. No impact to this function.			
Habitat	LWS-3A has a low potential to provide habitat because it only has one Cowardin class and one hydroperiod. It has a moderate opportunity to provide habitat because it is connected to other habitats. No impact to habitat function.			
Buffer Condition	The buffer of Wetland LWS-3A is forested and dominated by Himalayan blackberry, black cottonwood, and Oregon ash. It provides water quality and habitat functions and is relatively undisturbed. No impacts to the buffer of LWS-3A.			

Table A13. Wetland LWS-4 Summary

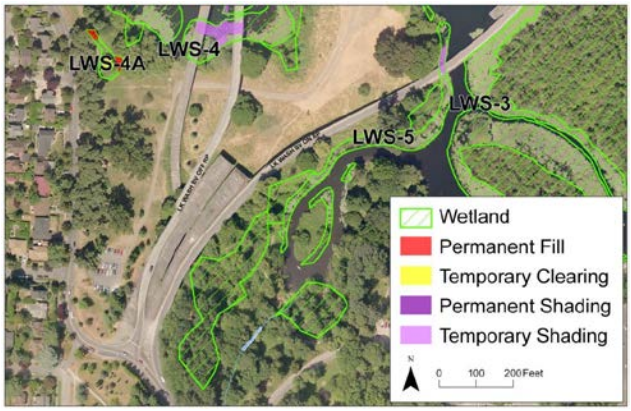
WETLAND LWS-4 – INFORMATION SUMMARY				
Location:	Wetland LWS-4 is located south of SR 520 in the vicinity of the Lake Washington Boulevard on-ramps and off-ramps.			
	**Local Jurisdiction**	Seattle		
	WRIA	8		
	Ecology Rating (Hruby 2004)	II		
	Seattle Rating	II		
	Seattle Standard Buffer Width	110 feet		
	Wetland Size	6.95 acres		
	Cowardin Classification	L2AB, PFO, PEM		
	HGM Classification	Lake Fringe		
	Wetland Rating System			
	Water Quality Score Hydrology Score Habitat Score **Total Score**	18 12 25 **55**		
Wetland and Buffer Impact Summary				
Wetland Impact	Permanent Fill Permanent Shading* Includes a small area of permanent clearing in the same area	0.09 1.15	Temporary Fill Temporary Clearing Temporary Shading	- 0.60 0.53
Buffer Impact	Permanent Fill Permanent Shading	1.21 0.02	Temporary Fill Temporary Clearing Temporary Shading	- 0.40 0.03
Dominant Vegetation Impact	Pacific willow, creeping buttercup, sweet gum (*Liquidambar* sp.), reed canarygrass, and birch. Permanent fill and shading will result in loss of a small area of vegetation and may change plant composition and density. Temporary clearing and shading will have similar effects to permanent shading, but are expected to be restored after construction.			
Soil Impact	Silt loam (10YR 2/1) over loam (10YR 3/2) with redoximorphic features. Small permanent loss of wetland soil.			
Hydrology Impact	Lake Washington. No impacts to wetland hydrology.			
Wetland Functions Impact Summary				
Water Quality	LWS-4 has a moderate potential to improve water quality because it has a wide band of vegetation along the lakeshore and the nonaquatic bed vegetation covers most of the wetland area. It has the opportunity to improve water quality because it is near urban areas and maintained parks and can dissipate potential contamination or pollutant runoff from these areas. No impact to water quality function.			
Hydrologic	LWS-4 has a moderate potential to reduce shoreline erosion because three-quarters of the fringe vegetation along the shore is shrubs or trees at least 6 feet wide. It has the opportunity to reduce shoreline erosion. No impact to hydrologic function.			
Habitat	LWS-4 has a high potential to provide habitat because it has four Cowardin classes and high habitat interspersion. It has a moderate opportunity to provide habitat because it is connected to other habitats. The changes in vegetation described above may result in loss of some aspects of habitat function.			

WETLAND LWS-4 – INFORMATION SUMMARY	
Buffer Condition	The buffer of Wetland LWS-4 includes maintained lawn, SR 520, and open water (Lake Washington). The terrestrial buffer provides minimal functions, and is disturbed by human activities. Lake Washington provides habitat for amphibious and aquatic wildlife. Permanent shading and temporary clearing are likely to result in a reduction in some aspects of buffer habitat function during the construction period.

Table A14. Wetland LWS-4A Summary

WETLAND LWS-4A – INFORMATION SUMMARY				
Location:	Wetland LWS-4A is located south of SR 520, just east of East Lake Washington Boulevard.			
		Local Jurisdiction	Seattle	
		WRIA	8	
		Ecology Rating (Hruby 2004)	IV	
		Seattle Rating	IV	
		Seattle Standard Buffer Width	50 feet	
		Wetland Size	0.11 acre	
		Cowardin Classification	PFO, PEM	
		HGM Classification	Slope	
		Wetland Rating System		
		Water Quality Score Hydrology Score Habitat Score **Total Score**	4 2 13 **19**	
Wetland and Buffer Impact Summary				
Wetland Impact	Permanent Fill Permanent Shading	0.02 -	Temporary Fill Temporary Clearing Temporary Shading	- 0.02 -
Buffer Impact	Permanent Fill Permanent Shading	0.01 -	Temporary Fill Temporary Clearing Temporary Shading	- 0.10 -
Dominant Vegetation Impact	Willow, bluegrass (*Poa* sp.), and creeping buttercup. Temporary clearing of small area of wetland vegetation.			
Soil Impact	Mucky loam (10YR 2/2) over silt clay loam (5Y 4/1) with redoximorphic features. No loss of wetland soils.			
Hydrology Impact	Surface runoff and precipitation. No impact to wetland hydrology.			
Wetland Functions Impact Summary				
Water Quality	LWS-4A has a low potential to improve water quality because much of the vegetation in the wetlands is mowed. It has the opportunity to improve water quality because it is near urban areas and a maintained park and can dissipate potential pollutant runoff from these areas. No impacts to water quality function.			
Hydrologic	LWS-4A has a low potential to reduce erosion because only a small area in the center of the wetland consists of woody vegetation. It does not have the opportunity to reduce erosion. No impact to hydrologic function.			
Habitat	LWS-4A has a low potential to provide habitat because it is small and has limited habitat interspersion. It has a moderate opportunity to provide habitat because it is connected to other habitats. Temporary clearing of vegetation may result in a temporary reduction of some habitat function.			
Buffer Condition	The buffer of LWS-4A consists of maintained lawn and it is disturbed. It provides minimal water quality functions. It may also provide minimal habitat functions for urban-adapted species. Temporary clearing is expected to result in a temporary loss of some habitat functions.			

Table A15. Wetland LWS-5 Summary

WETLAND LWS-5 – INFORMATION SUMMARY				
Location:	Wetland LWS-5 is located in the Washington Park Arboretum, south of SR 520, and north of East Foster Island Road.			
		**Local Jurisdiction**	Seattle	
		WRIA	8	
		Ecology Rating (Hruby 2004)	II	
		Seattle Rating	II	
		Seattle Standard Buffer Width	110 feet	
		Wetland Size	2.29 acres	
		Cowardin Classification	L2AB, PFO, PEM	
		HGM Classification	Lake Fringe	
		Wetland Rating System		
		Water Quality Score Hydrology Score Habitat Score **Total Score**	20 12 26 **58**	
Wetland and Buffer Impact Summary				
Wetland Impact	Permanent Fill Permanent Shading	- -	Temporary Fill Temporary Clearing Temporary Shading	- - 0.03
Buffer Impact	Permanent Fill Permanent Shading	- -	Temporary Fill Temporary Clearing Temporary Shading	- 0.32 -
Dominant Vegetation Impact	Pacific willow, creeping buttercup, and black cottonwood. Temporary shading may change plant composition and density in a small area.			
Soil Impact	Silt loam (10YR 3/1) over silt loam (7.5YR 3/1). No loss of wetland soil.			
Hydrology Impact	Lake Washington. No loss impact to wetland hydrology.			
Wetland Functions Impact Summary				
Water Quality	LWS-5 has a moderate potential to improve water quality because vegetation along the lakeshore is wide and two-thirds of the wetland is vegetated. It has the opportunity to improve water quality because it can dissipate potential contamination or pollutant runoff from boat use and maintained parks nearby. Water quality function are not expected to be affected by the project.			
Hydrologic	LWS-5 has a moderate potential to reduce shoreline erosion because vegetation along the lakeshore is wide. It has the opportunity to reduce erosion because there are trails and stormwater pipes that could be affected. Hydrologic function is not expected to be affected by the project.			
Habitat	LWS-5 has a moderate potential to provide habitat because it has multiple Cowardin classes and hydroperiods. It also has a moderate opportunity to provide habitat because it is on the shore of Lake Washington. Temporary shading may result in changes to habitat use during construction of the project.			
Buffer Condition	The buffer of LWS-5 is primarily forested with an open understory. The dominant vegetation is red alder, Himalayan blackberry, and creeping buttercup. The buffer provides some wildlife habitat and water quality functions. A small area of buffer will be temporarily cleared. This may result in temporary changes to wetland function.			