

# DUWAMISH BLUEPRINT: Salmon Habitat in the Duwamish Transition Zone

Green/Duwamish and Central Puget Sound Watershed (WRIA 9)  
November 6, 2014



## APPENDIX A

### Project List - Duwamish Blueprint Transition Zone

Duwamish subwatershed habitat projects were identified in five different reaches because of different conditions and constraints for each (Table 1). The transition zone, located from River Mile 1 to 10, was divided into five different reaches based on different conditions and opportunities for restoration. Foster includes the Foster Golf Links and Foster Point neighborhood, from River Mile 10 to 8. River Miles 8 to 7 are highly constrained by the Allentown and Duwamish neighborhoods, with little opportunity to set back banks other than near Duwamish Riverbend Hill. This reach also has a mid-channel island that could have Large Woody Debris (LWD) attached. North Wind, from RM 7 to 5.5 aligns with a previous project reach in the 2005 Salmon Habitat Plan; below RM 5.5 is the Superfund cleanup area, with Kellogg Island the primary feature from RM 1.6 to 1. The area outside of the transition zone was two separate reaches: one at the downstream end and one at the upstream end. Each transition zone reach has shallow water habitat creation, riparian restoration, and large wood targets. These potentials are for the period between 2005, when the WRIA 9 Salmon Habitat Plan was first approved, and 2025. This list will change frequently as the status of projects changes, and is intended to be updated on a regular basis.

Additional actions to improve Duwamish habitat include planting trees and implementing natural drainage/green stormwater infrastructure projects outside of the riparian zone to improve water quality by reducing air pollution and runoff. Tree planting and green stormwater infrastructure potential have not been quantified.

**Table 1. Duwamish Shoreline and River Habitat Potential by Reach – Short Term (by year 2025).**

Reach Name	River Miles	Shallow Water Habitat	Riparian Restoration (miles – widths per SMPs)	Large Woody Debris (pieces)
Foster	8.0-10.0	15 acres	4 miles (both banks)	1,200
Allentown	7.0-8.0	5 acres	1.4 miles (both banks)	150
North Wind	5.5-7.0	35 acres	1.8 miles	1000
Lower Duwamish	1.6-5.5	30 acres	3 miles	2000
Kellogg Island	1-1.6	15 acres (creation or enhancement)	1.5 miles	1000
<b>TOTAL TARGET</b>		<b>100 acres</b>	<b>11.7 miles</b>	<b>5,350</b>

## **Existing Conditions**

The Duwamish estuary has been modified extensively. Approximately 9.3 miles of meandering channel was dredged and filled to create a straight, deep, navigable channel 5.3 miles long, known as the Lower Duwamish (Kerwin and Nelson 2000). Over 95% of the banks of the Duwamish are armored, approximately 60% with riprap. The shoreline is vegetated along approximately 52% of its length, and 30% of the vegetation is non-native blackberry. Approximately 87% of the shoreline area has greater than 75% impervious surfaces such as pavement and roofs. There are approximately 49 pieces of large woody debris (LWD) along the length of the Duwamish, not including those pieces installed and anchored inside off-channel habitats such as North Wind's Weir and Boeing's Plant 2 restoration site. As a result of recent restoration actions and the current channel configuration, approximately 32 acres of shallow water habitat (mudflat and marsh) exist in the Duwamish, compared to the 1,300 acres of diverse wetlands present historically (Collin and Sheikh 2005). Completed habitat projects are listed in Table 7.

## **Target: Shallow Water Habitat Creation**

The 2005 Salmon Habitat Plan (p. 4-25) states that the hypothesized necessary future conditions for Chinook recovery include 173 acres of shallow water habitat in the Duwamish transition zone, plus 5 acres of off-channel habitat and 267 acres of shallow channel edge, palustrine wetlands, and riverine-tidal wetlands. These targets are based on the best available science for Chinook salmon recovery, and are considered long-term targets over 50-100 years. These targets may begin to be tested and revised as habitat is created and Chinook population responses are measured.

Shallow water habitat creation is needed along the entire mainstem Duwamish, and in particular, in the transition zone (River Miles 1-10). The overall goal for shallow water habitat creation in the Duwamish Transition Zone between 2015 and 2025 is 40 acres. Short-term targets represent less than half of long-term targets, and are based on an assessment of the maximum that could be accomplished by 2025 in individual reaches if sufficient resources were dedicated to the task. It is unlikely that the sum of reach targets (100 acres) for the entire transition zone would be reached by 2025, but targets for each reach are included to provide guidance for jurisdictions and agencies setting restoration priorities and evaluating opportunities that arise (Table 1).

Because of the large area of new shallow water habitat needed, it will likely be necessary to implement projects in phases and in multiple locations; habitat for particular reaches need not be contiguous. Meeting the targets for each reach depends on identifying suitable properties whose owners are willing to sell or, in some cases, provide an easement. This would necessarily occur in phases and multiple locations. Cost of property in this area is high. Even doing the projects in phases and multiple locations may require the simultaneous acquisition of several adjacent parcels to create projects with adequate habitat value and economies of scale. There may also be opportunities to create/improve off-channel habitat in aquatic lands outside the shipping channel, possibly in conjunction with sediment cleanup efforts. For definitions of

habitat terms in the project lists below, see Houghton (2003).

It is assumed that implementation of projects between River Miles 1.0-5.5 will occur largely if not exclusively as part of the Superfund and other cleanups and compensation for Natural Resources Damages, as it is one of the highest priority areas for the Elliot Bay Trustees.

### **Goal: Riparian Restoration**

Riparian habitat could be improved through native tree and shrub planting and invasive weed control along the Duwamish River where the banks are not overly steep and are not being used by businesses for water access, or where there is no plan to create shallow water habitat. The first priority should be areas along the Duwamish River Trail. The trail is managed by the City of Tukwila but is located on an easement in many cases (which may limit what vegetation can be placed).

Knotweed control is an important part of riparian restoration, but knotweed primarily spreads by vegetative means: plants that break off from upstream float downstream and root where they are deposited on the banks. Duwamish knotweed control needs to be done in coordination with a comprehensive Green/Duwamish watershed knotweed control program.

### **Goal: Large Woody Debris**

Large woody debris (LWD) consists of large trees, logs and root wads that are fully or partially submerged in the channel. LWD is important for juvenile salmon because it provides places for them to hide from predators, rest in slower moving water, and it attracts insects that salmon eat. LWD can also create habitat diversity in the river by causing scour pools. In pristine waters in the Puget Lowlands, LWD can be extremely abundant, estimated historically at 3,410 individual pieces per mile. As of 2002, only 49 pieces were present; projects have added approximately 100 new pieces at two off-channel habitat areas. Fewer pieces than that are recommended for the Duwamish due to the need to anchor each piece and to minimize conflicts with fishing, recreational boat use, and port and other boat traffic. The most appropriate locations for LWD will be along shallow intertidal benches near the edge of the channel above River Mile 5.5, and inside off-channel habitat areas. For example, Boeing added 51 pieces of LWD to the Plant 2 project in 2014 (B. Anderson, personal communication).

Projects are listed below in tables, and individual projects, where identified, are listed under the target for a particular reach. Only projects in the transition zone are listed: projects outside of the transition zone will be suggested to WRIA 9 for consideration in the next habitat plan update. Potential projects and projects that are in progress (a project sponsor has been identified and the project is at least partially funded for acquisition or design) are listed in Tables 2-6. Completed projects are listed in Table 7. Because of the nature of land use in the subwatershed, not all potential project sites have been identified, so projects should be added as opportunities arise to achieve these goals.

Project Sponsors are listed for projects that are in progress or completed; for potential projects, project sponsors are only suggestions, and may change. New project numbers were assigned because the project numbers from the Salmon Habitat Plan of 2005 referred to reaches with multiple property owners. The New Project ID numbers were assigned by locating the river mile on the upstream end of the project to the nearest tenth, or the nearest hundredth when there were several projects in close proximity.

**Table 2. Transition zone projects in Foster Reach, River Miles 8-10. Target for 10 years is 15 acres of shallow water habitat. New Project ID numbers correspond with River Miles on the Foster Reach Map.**

Project Name	New Project ID	Old WRIA 9 Project #	Location	Project Sponsor	Description	Constraints or Issues	Status
Foster Golf Course Wetland, riverbank	Duw-10.4	Duw-1	RM 10.4-9.3 Left Bank	City of Tukwila?	Excavate freshwater wetland to create off-channel refuge and rearing habitat for juvenile salmonids and a water hazard for the golf course. Plant native trees and shrubs along the shoreline bank, removing invasives where necessary.	Requires coordination with golf course to avoid conflicts with golfers. Tukwila has already done various mitigation plantings along banks.	Potential
Seattle Rendering Works Shallow Water Habitat	Duw-10.2	Duw-2	RM 10.2-9.7 Right Bank	?	Re-slope the rock-lined and oversteepened bank to create a low bench and install large woody debris along the main river bank and within a newly excavated sandy beach landward from the bank. Excavate shallow, off-channel habitat that would be inundated during winter and spring river stages (about seven feet). Add LWD in the excavated area and plant native trees and shrubs to provide a flood refuge and off-channel habitat for juvenile salmonids. Alternatively, the entire project area could be excavated to provide shallow water habitat that extends nearly to the BNSF Railway embankment on the east edge of the property.	Acquire property from private business owner if willing to sell; remove existing structures	Potential
Restore the Duwamish Shoreline Challenge	Duw-8.8	Duw-3 (one of the alternatives )	RM 8.8-8.1 Left Bank	City of Tukwila, BECU, Forterra and other businesses	Restore riparian habitat waterward of Green River Trail & adjacent to commercial properties through volunteer efforts <ul style="list-style-type: none"> <li>Remove invasive vegetation on the riverbank and upland riparian area between the Green River Trail and the river</li> <li>Revegetate with native riparian species.</li> <li>Work with adjacent commercial property owners for permission to do voluntary restoration.</li> </ul>	Steep rip-rapped slopes in some areas; knotweed infestations	In Progress

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Project Name	New Project ID	Old WRIA 9 Project #	Location	Project Sponsor	Description	Constraints or Issues	Status
Bank Restoration and Revetment Set Back, Gateway South	Duw-8.7	Duw-3	RM 8.7-8.5; 8.4-8.1 (Left Bank)	City of Tukwila?	Lay back existing revetments on inside river bends to increase riparian and intertidal habitat as redevelopment occurs. <ul style="list-style-type: none"> <li>Relocate segments of the Green River Trail westward into existing parking lots.</li> <li>Place large woody debris and re-vegetate the river bank with native riparian species.</li> </ul>	Property acquisition, or voluntary participation by commercial property landowners, or require under Shoreline regulations as redevelopment occurs	Potential
Codiga shoreline revegetation	Duw-8.6	n/a	RM 8.6-8.4 (Right Bank)	City of Tukwila & Earth Corps/Puget Sound Stewards	Improve habitat and provide native vegetation along shoreline (waterward of previously completed off-channel habitat area – this area not restored as part of original project) <ul style="list-style-type: none"> <li>Remove invasive vegetation</li> <li>Plant variety of native vegetation, preserving existing mud flats</li> </ul>	This is a volunteer driven effort using City of Tukwila funds and grants and managed by EarthCorps with City support	In progress
Codiga Retrofit	Duw-8.5	n/a	RM 8.5-8.4 (Right Bank)	City of Tukwila?	Create a wider opening and more shallow water habitat that inundates at high water.  Remove a portion of the lobe between the off-channel inlet and the mainstem	Resolution of issues between Corps of Engineers & Tukwila needed	Potential
Codiga Off-channel habitat expansion	Duw-8.3	n/a	RM 8.3 (Right Bank)	City of Tukwila?	Add to off channel habitat area <ul style="list-style-type: none"> <li>Construct new habitat on parcel(s) immediately adjacent to north/downriver of Codiga off-channel area</li> </ul>	Property acquisition needed, steep banks are an issue	Potential

**Table 3. Potential Duwamish Transition Zone projects in the Allentown reach, between river miles 7.0 and 8.0. Goal is for riparian restoration, LWD and shallow water benches. New Project ID numbers correspond with River Miles on the Allentown Reach Map.**

Project Name	New Project ID	Old WRIA 9 Project #	Location	Project Sponsor	Description	Constraints or Issues	Status
Southgate Creek restoration	Duw-8.0	n/a	RM 7.9 Left Bank	?	Improve rearing habitat in the creek by improving the fish ladder, adding grade controls, and revegetating where possible.	Flows under Highway 509, extremely constrained and flashy, highly erosive.	Potential
Wastewater Pipeline Crossing Retrofit	Duw-7.9	Duw-4	RM 7.9	King County?	<p>Purpose: If the wastewater pipeline crossing alters salinity upstream or hinders fish passage, lower the pipe profile.</p> <ul style="list-style-type: none"> <li>Determine whether the existing profile limits saline water from moving upstream during juvenile migration, or whether it is a partial barrier to upstream fish passage.</li> <li>If reducing the profile of the pipeline crossing will extend the transition zone upstream, the project would retrofit the pipeline to lower its profile.</li> </ul>	Crossing forms the rock berm that is partially exposed when low tide coincides with late summer/early fall minimum river flows. Major capital project and may require a new pump station.	Potential
42 <sup>nd</sup> Ave S. Riparian: Bank Revegetation and LWD Installation	Duw-7.8	Duw-5	RM 7.8-7.2 (Both Banks)	City of Tukwila?	<p>Improve riparian habitat conditions along 42<sup>nd</sup> Ave. S., across the river, and in the main channel<sup>1</sup>:</p> <ul style="list-style-type: none"> <li>Remove invasive vegetation and plant native vegetation on the river banks through collaborative projects with residential property owners</li> <li>Create additional vegetated riparian areas at the top of bank, where river users currently park on unpaved surfaces</li> <li>Add large woody debris to toe of slope, such as at the bend of road between River Mile 7.3-7.2</li> </ul> <p>Add wood to existing mid-channel island with old wooden pilings towards the upstream end of the reach.</p>	<p>New guard rail may be needed to restrict parking and still allow pedestrian access to river.</p> <p>The likelihood of shifting 42<sup>nd</sup> Ave. S., as recommended in the WRIA 9 Salmon Habitat Plan, is extremely low because it would involve purchasing over 20 single-family homes from willing sellers.</p>	In Progress

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Project Name	New Project ID	Old WRIA 9 Project #	Location	Project Sponsor	Description	Constraints or Issues	Status
Duwamish Neighborhood Shoreline Bank	Duw-7.5	Duw-5	RM 7.5-6.9 (Left Bank)	City of Tukwila?	Work with willing property owners, preferably as a group, to remove invasives, create a shallow bench on the inside river bend, and use soft shoreline armoring practices to improve the bank. Use existing programs such as the King Conservation District's Landowner Incentive Program.	Very steep banks. Property owners need to be willing to participate or cost share.	Potential
Duwamish Hill Preserve	Duw-7.2	Duw-6	RM 7.2-6.9 (Right Bank)	City of Tukwila and Forterra	Create shallow water/intertidal habitat as .the third phase of the Duwamish Riverbend Preserve project. <ul style="list-style-type: none"> <li>• Set back the revetment along South 115<sup>th</sup> St. and relocate the road between 42<sup>nd</sup> Ave S and East Marginal Way</li> <li>• Place large woody debris and plant native vegetation</li> </ul>	Additional land acquisition needed; depends on willingness of property owners to sell.	Potential

**Table 4. Potential Duwamish transition zone projects in the North Wind area, from River Miles 5.5-7.0. Shallow water habitat target for the reach is 35 acres in 10 years. New Project ID numbers correspond with River Miles on the North Wind Reach Map.**

Project Name	New Project ID	Old WRIA 9 Project #	Location	Project Sponsor	Description	Constraints or Issues	Status
Duwamish Gardens	Duw-6.8	Duw-7	RM 6.85-6.7 (Right Bank)	City of Tukwila	<p>Create shallow water habitat just downstream of the East Marginal South bridge. This location is believed to be at the upper limit of the salt wedge during much of the spring outmigration of juvenile Chinook, making it a prime location for outmigrants to hold as they transition to salt water.</p> <ul style="list-style-type: none"> <li>• Purchased 2.16 acres in 2009. Land swap pending to add shoreline and 0.25 acres in 2014.</li> <li>• Remove the existing low value buildings, excavate mudflats and marsh, plant riparian vegetation, and create public access trails and water access in 2014.</li> </ul>	Cultural resources require archeologist onsite during excavation. Permitting is complex.	In progress
Chinook Wind/Duwamish Gardens Extension	Duw-6.7	Duw-7	RM 6.7-6.6 (Right Bank)	City of Tukwila	<p>Create 4 acres of shallow water, off-channel habitat ringed by native riparian forest on a 5.83 acre parcel</p> <ul style="list-style-type: none"> <li>• Shape of parcel would allow for shallow water habitat with a channel of deeper water so fish could remain during low tides</li> <li>• Spring 2014: parcel is for sale</li> </ul>	Need funding for acquisition. Requires utility relocation, building and parking lot demolition. Needs testing for contamination and cultural resources. May require relocating current residents.	In progress
Sound Transit Bank Mitigation at E Marginal	Duw-6.85	n/a	RM 6.85-6.55 (Left Bank)	Sound Transit	Remove invasives and plant native vegetation along the south shore of the Duwamish next to the Green River trail.	Narrow band of river bank.	In Progress

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Project Name	New Project ID	Old WRIA 9 Project #	Location	Project Sponsor	Description	Constraints or Issues	Status
Riverton Creek Habitat Fish Passage Improvement	Duw-6.6	Duw-8	RM 6.6 (Left Bank)	City of Tukwila	<p>3.4-acre site at the mouth of Riverton Creek - improve its connection to the Duwamish River, improve fish access and provide off-channel rearing and refuge habitat.</p> <ul style="list-style-type: none"> <li>• Replace the existing culvert and flapgate with a box culvert.</li> <li>• Revegetate with native riparian species.</li> <li>• Green/Duwamish Ecosystem Restoration Project.</li> </ul>	80% Design; Construction funds programmed for 2017 (estimate \$650,000)	In Progress
Restore the Duwamish Shoreline Challenge – Boeing CAS	Duw-6.5	n/a	RM 6.85-6.6 Left Bank and RM 6.5-6.3 Right Bank	City of Tukwila, BECU, Forterra, Boeing, and other businesses	<ul style="list-style-type: none"> <li>• Remove invasive vegetation on the steep riverbank</li> <li>• Revegetate with native riparian trees and shrubs.</li> <li>• Possibly install large woody debris</li> </ul>	Related project in Foster and Allentown reaches. Access permission and landowner participation needed.	Potential
Cecil Moses Park Habitat Enhancement	Duw-6.3	n/a	RM 6.3 (Left Bank)	King County	<p>Allow salmonid access to a project completed there in 2003 for longer durations.</p> <ul style="list-style-type: none"> <li>• Expand and deepen the off-channel habitat</li> <li>• Remove a wall of old car tires from the bank and stabilize with bioengineering.</li> </ul>	Need to acquire property downstream Utility coordination – water main owned by SPU and pedestrian bridge	Potential
Seattle City Light - Bluefields	Duw-6.15	n/a	RM 6.15-6.1 (Right Bank), immediately downstream of North Winds Weir/Site 1	Bluefields / City of Seattle	<ul style="list-style-type: none"> <li>• Layback bank</li> <li>• Plant upland and emergent vegetation</li> <li>• Create a wider intertidal bench.</li> </ul> <p>This is one of 13 small Bluefields projects being built by a private company to sell mitigation credits to those with NRDA obligations.</p>	Owned by Seattle City Light as a high voltage transmission line corridor. Contains three transmission lines, with one pole or tower for each located on the property.	In Progress

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Project Name	New Project ID	Old WRIA 9 Project #	Location	Project Sponsor	Description	Constraints or Issues	Status
Cecil B. Moses – North Extension	Duw-6.25	Duw-9	RM 6.2 (Left Bank)	King County?	Set back and restore the left river bank: <ul style="list-style-type: none"> <li>Revegetate the river banks with native riparian species where it is not possible to set back the bank</li> <li>This project depends on voluntary participation by commercial property landowners through easement, sale, or other incentive to allow set back of the river bank</li> </ul>	If property immediately downstream of Cecil Moses Park (RM 6.2, left bank) can be acquired, the off-channel habitat substitution project completed there in 2003 could be expanded.	Potential
Carrossino on Tukwila Intl Blvd	Duw-6.1	Duw-7	RM 6.1-6.0 (Right Bank)	?	Lay back the banks and create shallow water habitat just downstream of North Wind's Weir.	Would need to purchase 6 adjacent parcels; potential contamination.	Potential
Desimone Oxbow	Duw-6.0	Duw-7	RM 6.0 to 5. (Left Bank)	?	Create shallow water habitat in the large parking lot on the inside bend of the river upstream of Turning Basin 3. Potential for removing large Post Office building and adjacent parking lot to west. Has the potential to be the largest shallow water habitat restoration site in the Duwamish.	Owned by Desimone Trust, on a long-term lease by Boeing. Contingent on property owner's willingness to sell. Lot is lightly used. Contamination unknown.	Potential
S. 104 <sup>th</sup> St. Bank Revegetation or Shallow Water Habitat Creation	Duw-5.7	Duw-7	RM 5.7-5.5 (Right Bank)	City of Tukwila	Two options: <ul style="list-style-type: none"> <li>Stabilize the failing riverbank and plant with native vegetation; or</li> <li>Vacate S. 104<sup>th</sup> Street, purchase properties to northeast, reslope the bank, create shallow water habitat, and plant native vegetation.</li> </ul>	3 properties across from 104 St from the river are owned by different landowners; some have long-term leases, project would depend on their willingness to sell.	Potential

Projects below are within in the Lower Duwamish Superfund project area. As described elsewhere in this blueprint, it is assumed that Natural Resources Damage Assessments will result in ecosystem improvement projects in this area that also will meet salmon habitat needs. Ideally, the Natural Resource Trustees and businesses seeking mitigation opportunities will consider the projects listed below in their decision making.

**Table 5. Potential Duwamish River transition zone projects in the Lower Duwamish reach, between River Miles 1.5-5.5. Short-term target for shallow water habitat for the reach is 30 acres. New Project ID numbers correspond with River Miles on the Lower Duwamish Reach Map.**

Project Name	New Project ID	Old WRIA 9 Project #	Location	Project Sponsor <sup>2</sup>	Description	Constraints/Issues	Status
Eliminate Perennial Pepperweed	Program D-1	Program D-1	RM 6.3-1.1	Multiple property owners in cooperation with the King County Noxious Weeds Program	Carry out a comprehensive cooperative weed control effort to eliminate perennial pepperweed ( <i>Lepidium latifolium</i> ), a Class B noxious weed, which has formed a heavy infestation from upstream of North Wind’s Weir (river mile 6.3) to Herring’s House Park (river mile 1.1). This weed grows well in intertidal and riprapped areas. This program is being carried out by the King County Noxious Weed Control Program in cooperation with public and private landowners, but as of May 2014, perennial pepperweed persists.	Pepperweed control is typically done by hand, making control relatively expensive and time-consuming compared to control of other weeds.	In Progress

<sup>2</sup> Project Sponsor for projects with Status “Potential” are tentative, the actual project sponsor will be determined based on site ownership and willingness to participate.

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Project Name	New Project ID	Old WRIA 9 Project #	Location	Project Sponsor <sup>2</sup>	Description	Constraints/Issues	Status
Dredging Improvements	Program D-4	Program D-4	RM 5.3	U.S. Army Corps of Engineers	<p>Encourage the U.S. Army Corps of Engineers to identify strategies for maintenance dredging at Turning Basin #3 that minimize harmful impacts to salmon habitat in the dredged area; and improve salmon habitat both in the dredged area and elsewhere in the Duwamish and Marine Nearshore Subwatersheds (e.g., through the use of clean dredged sediment to expand/improve shallow water habitat or transfer upstream to provide sediment for transport).</p> <ul style="list-style-type: none"> <li>Property is owned by the Port of Seattle.</li> <li>If the dredge location is shifted downstream, up to six acres of shallow-water mudflat could be created through natural sedimentation processes.</li> </ul>	Find out the status of 2007 discussions.	?
Levee Setback for 0.1 miles	Duw-5.5	n/a	RM 5.5-5.4 (Right Bank)	City of Tukwila?	Levee setback into the Boeing parking lot (AU 5.10) recommended in <i>Houghton (2003)</i> . Remove derelict barge downstream of the S. 102 <sup>nd</sup> St. bridge and enhance the riparian area.	Landowner willingness is unknown.	Potential
Duwamish Waterway Edge Habitat	Duw-5.4	n/a	Duwamish Waterway from RM 5.4 to Harbor Island	Port of Seattle	<p>Publicly-owned property managed by the Port of Seattle includes the 500-foot wide Duwamish Waterway right-of-way, with the center portion of the right-of-way including the navigation channel. Public ownership includes shallow water and bank along the west and east margins of the right-of-way. Potential restoration actions could include shallow water benches, emergent marsh vegetation, and riparian vegetation. Such improvements would provide cumulative intertidal, shallow subtidal, and riparian corridor habitat benefits throughout the 5.3 mile long Duwamish Waterway.</p> <p>See map for specific opportunity areas identified in the 2007 Duwamish Waterway restoration plan.</p>	Please note: The potential corridor habitat improvements described here in general are included in the 2009 Lower Duwamish River Habitat Restoration Plan inventory prepared by the Port of Seattle.	Potential

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Project Name	New Project ID	Old WRIA 9 Project #	Location	Project Sponsor <sup>2</sup>	Description	Constraints/Issues	Status
Boeing Developmental Center	Duw-5.3	n/a	RM 5.3-4.9 Right Bank	The Boeing Company-Desimone Properties	Remove pilings, restore riparian vegetation.	Requires engagement and advocacy of the property owner	Potential
City Light North/Hamm Creek	Duw-5.0	Duw-11	RM 5.0-4.8 (Left Bank)	Seattle City Light?	<p>Create off-channel habitat in the area north of the existing substation and south of the re-channeled Hamm Creek. City Light North was ranked as a “high-priority” site in <i>King County (1994)</i>.</p> <p>If restored to its full potential, this 16.5-acre site would have shallow water, intertidal habitat fed by Hamm Creek. Shallow water that is fed by a freshwater stream creates ideal conditions for juvenile fish rearing in the transition zone estuary.</p>	Seattle City Light plans to retain the property for substation operations and potentially building training center.	Potential
Slip 6 Restoration	Duw-4.8	n/a	RM 4.8 (Right Bank)	?	<p>This project could include one or two elements: 1) adding clean sediment to some portion of the slip to raise the bottom up to an elevation at which intertidal mudflat would be created and/or 2) lay back surrounding banks and plant them. This project was first identified in <i>Tanner (1991)</i>. It was ranked as a “low-priority” site in <i>King County (1994)</i>. Excavation of uplands to expand channel along north bank of Slip 6 and into river was highly recommended in <i>Houghton (2003)</i>. Existing exposed inter-tidal substrate and bank at northwest entrance to Slip 6 could include: (1) remove approximately 550 linear feet of existing derelict creosote skeleton pier; (2) install large-woody-debris for sediment/detritus capture retention and fish cover, approximately 2.8 acres; (3) establish native riparian vegetation, approximately 850 linear feet, in existing armored bank.</p>	Boeing owns the subtidal land and southern perimeter of the boundary. Slip 6’s suitability for barge traffic makes it particularly valuable, and the company is unlikely to sell it or allow it to be used for restoration incompatible with future barge traffic. The northern bank of the slip is part of the heavily-contaminated Rhone-Poulenc (Container Properties LLC) site.	Potential

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Project Name	New Project ID	Old WRIA 9 Project #	Location	Project Sponsor <sup>2</sup>	Description	Constraints/Issues	Status
Sea-King Industrial Park	Duw-4.5	n/a	RM 4.5-4.4 (Left Bank)	?	This project would likely focus on substantial shoreline improvements including bank layback, planting of upland and emergent plants, and a wider intertidal bench. This project was identified as Site 7 in <i>Tanner (1991)</i> . It was ranked as a “medium-priority” site in <i>King County (1994)</i> .		Potential
Isaacson-Thompson	Duw-4.4	n/a	RM 4.3-4.4 Right Bank	The Boeing Company – Port of Seattle	Remove bulkhead, lay back shoreline, restore riparian vegetation –Port ownership of bank shoreline would require they need to be project proponent		Potential
Terminal 117 (T-117)	Duw-4.2	n/a	RM 4.5-4.1 (Left Bank)	Port of Seattle	Inter-tidal and shallow sub-tidal habitat restoration includes: (1) approximately 3575 linear feet shoreline; (2) exposed inter-tidal substrate, approximately 1.3 acres; (3) emergent vegetation, approximately 2.8 acres; (4) native riparian vegetation, approximately 1.2 acres. A pier for public access to the water will also be built.		In Progress
South Park Bank Restoration and Shallow Water Habitat Creation	Duw-3.9	Duw-12	RM 3.9-3.6 Left Bank, from South Park bridge to Duwamish Waterway Park	Environmental Coalition of South Seattle	Rehabilitate a series of small shallow-water habitats at street ends and revegetate and recontour shoreline to create 2.1 acres of shallow water and riparian habitat and increase the shoreline from 1,450 feet to 2,225 feet. This project was developed by local community groups in cooperation with private property owners, and has a high level of community support (Environmental Coalition of South Seattle 2001).	Multiple property owners would need to be willing to participate.	Potential
12 <sup>th</sup> & Elmgrove	Duw-3.7	n/a	RM 3.7 Left Bank south of South Park in unincorporated King County	Seattle Public Utilities, King County DOT and Port of Seattle	Small parcel was purchased by SPU, and a small house removed; adjacent to a street end that could be improved under Seattle’s Shoreline Street Ends program. Concept design was developed based on community input, which includes laying back the bank, a beach, LWD, hand carry boat access, and a lawn/plaza area.	Bank armoring, need for public access	Potential

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Project Name	New Project ID	Old WRIA 9 Project #	Location	Project Sponsor <sup>2</sup>	Description	Constraints/Issues	Status
Boeing Slip-4	Duw-3.5	n/a - Boeing Public Access (old non-WRIA name)	RM 3.5, Right Bank, South bank of slip 4, former Boeing Public Access site	The Boeing Company	Remove rip-rap, regrade shoreline, plant riparian vegetation, and place woody debris. This area was revegetated and has since overgrown with blackberries.	Needs ongoing site maintenance.	Potential
Project 19 <sup>3</sup> : S Chicago St to S Kenyon St/10 <sup>th</sup> Ave S	Duw-3.5	n/a	RM 3.5 Left Bank	Port of Seattle, Seattle Public Utilities, DOT, and King County	Unimproved, armored area adjacent to Duwamish Waterway Park in South Park. Opportunity for bank layback and/or shoreline habitat improvements, including access and native vegetation. Partially under Seattle's Shoreline Street Ends program.	Complex site ownership	Potential
South Riverside Dr.	Duw-3.35	n/a	RM 3.4, Left Bank	Port of Seattle, Seattle Parks, Seattle DOT and Seattle Parks Foundation	Create natural shoreline, pathway and bench.	Complex permitting.	In Progress
Project 17: SW corner, 8th Ave S	Duw-3.3	n/a	RM 3.3 Right Bank	Seattle DOT, Parks, Port of Seattle and South Park community	Community has done work to improve the street end; Parks property is adjacent. Opportunity to collaborate with Port of Seattle for shoreline habitat work under Seattle's Shoreline Street Ends program.	Complex site ownership.	Potential
Project 16: South Othello St to 8th Ave S	Duw-3.2	n/a	RM 3.3-3.1 Right Bank	Port of Seattle	Improvements include: (1) excavate existing rubble/derelict materials from upper bank-line, approximately 700 linear feet; (2) move top-of-bank approximately 5 feet land-ward; (3) create riparian vegetation bench/terrace. Total: approximately 3500 square feet.	Narrow band, corridor improvement. Benefit would be increased with multiple similar actions.	Potential
Project 15: S	Duw-3.1	n/a	RM 3.1 Left	Seattle DOT	Potential for small plaza and habitat		In

<sup>3</sup> Project Names with Project ##: correspond with projects in the Port of Seattle's Lower Duwamish Habitat Restoration Plan (Seaport Planning Group 2009).

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Project Name	New Project ID	Old WRIA 9 Project #	Location	Project Sponsor <sup>2</sup>	Description	Constraints/Issues	Status
Fontanelle St/5th Ave S			Bank	and Port of Seattle	improvements to the shoreline under Seattle's Shoreline Street Ends program. Under design by JA Brennan.		Progress
Project 14: Existing Barge Cargo Facility	Duw-3.0	n/a	RM 3.0 Left Bank	Port of Seattle	Excavate existing rubble/derelict bank materials, approximately 200 linear feet; move top-of-bank approximately 15 feet land-ward; and create marsh elevation upper inter-tidal bench and up-slope riparian vegetation. Total: approximately 3000 square feet.	Narrow band, corridor improvement. Benefit would be increased with multiple similar actions.	Potential
Project 12: Cold Storage Warehouse	Duw-2.9	n/a	RM 2.9 Right Bank	Port of Seattle	Excavate/re-grade approximately 600 linear feet existing rubble armor bank; install large-woody-debris; and plant riparian vegetation. Total, approximately 4800 square feet.	Narrow band, corridor improvement. Benefit would be increased with multiple similar actions.	Potential
Project 10: North 1st Ave South Bridge	Duw-2.7	n/a	RM 2.7 Left Bank	Seattle Dept. of Transportation and Port of Seattle	Boat launch and green stormwater infrastructure planned under the south span of the 1 <sup>st</sup> Ave S bridge. Designed by JA Brennan under Seattle's Shoreline Street Ends program.		In Progress
Project 11: South 1st Ave South Bridge	Duw-2.65	n/a	RM 2.6 Left Bank	Port of Seattle	Regrade approximately 400 linear feet existing armored bank; install 10-12 feet wide, intertidal substrate bench; and plant riparian vegetation. Total: approximately 4800 square feet.	Narrow band, corridor improvement. Benefit would be increased with multiple similar actions.	Potential

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Project Name	New Project ID	Old WRIA 9 Project #	Location	Project Sponsor <sup>2</sup>	Description	Constraints/Issues	Status
First Ave. South / SR 509 Intertidal Wetlands Retrofit/ WSDOT	Duw-2.6	Program D-2: Eliminate Common Reed from SR 509 Intertidal Wetlands	RM 2.6 (Left Bank)	Washington State Department of Transportation and King County Noxious Weed Program?	<p>Carry out a comprehensive cooperative weed program to eliminate non-native common reed (<i>Phragmites australis</i>) at the SR 509 intertidal wetlands site and rehabilitate the existing restoration site. This highly-invasive weed is localized, and could be controlled at much lower cost than if it were to spread.</p> <ul style="list-style-type: none"> <li>Control options could include excavating as much of the infested area as possible, as well as some of the existing upland habitat, much of which is overrun with other invasive plants.</li> <li>Excavation would flatten the bank slope angle and create elevations suitable for mudflat and emergent wetland habitats.</li> <li>Control invasive weeds in the upland areas.</li> <li>This approach would remove invasives and create conditions that favor the formation and maintenance of more desirable habitat types.</li> </ul>	Requires willingness of WSDOT to participate - owns a key parcel.	In Progress – per Noxious Weeds 2014: some common reed still exists in this area
Project 8: Terminal 115, West Bank	Duw-2.55	n/a	RM 2.6 Left Bank	Port of Seattle	Remove existing in-water and over-water structures; excavate/re-grade filled upland to restore inter-tidal elevations and low-slope bank areas; and install large-woody-debris, marsh, and riparian vegetation. Total: approximately 3.2 acres.	Large scale restoration potential, combining with adjacent publicly-owned parcels could increase area to 4.5 acres and connect with WDOT, First Avenue South Bridge habitat restoration area.	Potential
Project 9: North First Avenue South Bridge	Duw-2.5	n/a	RM 2.6 Right Bank	Seattle Dept. of Transportation and Port of Seattle	Park bench, habitat enhancements, and invasive species removal being designed by JA Brennan under Seattle’s Shoreline Street Ends program.		In Progress

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Project Name	New Project ID	Old WRIA 9 Project #	Location	Project Sponsor <sup>2</sup>	Description	Constraints/Issues	Status
Glacier Dock Embayment (formerly T115)	Duw-2.56	n/a	RM 2.6-2.4(Left Bank)	?	<p>Raise the elevation of the area between the shore and the Glacier Northwest cement dock to create intertidal habitat.</p> <ul style="list-style-type: none"> <li>The area is not accessible to vessels because of the location of the dock.</li> <li>Shoreline laybacks and riparian vegetation improvements would be possible.</li> </ul> <p>This project was identified as Site 12 in <i>Tanner (1991)</i>. It was ranked as a “low-priority” site in <i>King County (1994)</i>. The shallow water area appears to be mostly if not wholly owned by Glacier Northwest. Relic meander of historic channel.</p>		Potential
Project 7: Southwest corner slip 2	Duw-2.4	n/a	RM 2.4 Right Bank	Port of Seattle	Excavate/re-grade approximately 125 linear feet existing rubble armor bank; install 20 feet wide inter-tidal substrate bench; install large woody debris and plant riparian vegetation. Total: approximately 2500 square feet.	Narrow band, corridor improvement. Benefit would be increased with multiple similar actions.	Potential
Project 6: British Plaster Board, East Bank Line	Duw-2.2	n/a	RM 2.2 Right Bank	Port of Seattle	Improvements include: (1) remove intertidal rubble and debris; (2) install approximately 175 linear feet inter-tidal bench; (3) install large woody debris, marsh and riparian vegetation. Total: approximately 1800 square feet.	Narrow band, corridor improvement. Benefit would be increased with multiple similar actions.	Potential
S Fidalgo Street	Duw-2.1	n/a	RM 2.1 Right Bank	Seattle DOT, Seattle Parks, ?	Small picnic area overlooks the water. Potential for shoreline and riparian habitat improvements including planting, Seattle Shoreline Street End.	Very narrow site, potential contamination	Potential

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Project Name	New Project ID	Old WRIA 9 Project #	Location	Project Sponsor <sup>2</sup>	Description	Constraints/Issues	Status
King County Properties	Duw-2.0	n/a	RM 2.0-1.5 (Right Bank)	King County or NRDA Potentially Responsible Party	King County owns seven contiguous properties totaling approximately 25 acres, purchased for economic development in the early 1900s. In 2006, voters authorized the County to sell them. They must be sold at fair market value and the County does not have immediate plans to dispose of them. A possible change in ownership presents an opportunity for rehabilitation/substitution projects. No projects have been described for these parcels at this time.	Long-term leases limit potential, although shoreline improvements possible in the short-term.	Potential
Project 5: Northwestern Glass Company East Bank	Duw-1.8	n/a	RM 1.8 Right Bank	Port of Seattle	Improvements include: (1) remove rubble, debris, and derelict creosote piling; (2) install approximately 275 linear feet large-woody-debris; (3) install riparian slope planting ledges. Total: approximately 3000 square feet.	Narrow band, corridor improvement. Benefit would be increased with multiple similar actions.	Potential

**Table 6. Potential Kellogg Island reach projects in the Duwamish River transition zone between River Miles 1.0 and 1.6. Short-term potential is for 15 acres of shallow water creation or enhancement. New Project ID numbers correspond with River Miles on the Reach Map.**

Project Name	New Project ID	Old WRIA 9 Project #	Location	Project Sponsor <sup>4</sup>	Description	Status
Kellogg Island Restoration	Duw-1.5	Duw-13	RM 1.5-1.1	Port of Seattle	Regrade Kellogg Island, removing previously placed dredged materials to provide native marsh and riparian vegetation improvements. Site restoration potential is linked with future Port of Seattle marine cargo development compensation/mitigation requirements. Total: up to 11.5 to 12 acres inter-tidal marsh and riparian improvements.	Potential
T-107 Extension	Duw-1.4	n/a	RM 1.5-1.3 Left Bank	?	Remove parking lot and excavate shallow water habitat; plant conifers and other native vegetation along the banks.	Potential
Project 3, Terminal 108 East Bank Line	Duw-1.3	n/a	RM 1.3 and 1.1 Right Bank	Port of Seattle	Excavate existing armor bank materials, approximately 750 linear feet; move top-of-bank approximately 20 feet land-ward, creating marsh vegetation bench; and install riparian vegetation buffer at top-of-bank. Total: approximately 0.4 acres.	Potential
SW Edmunds Street	Duw-1.25	n/a	RM 1.25 Left Bank Next to T-107	Seattle Dept of Transportation	Seattle Shoreline Street End #23. Potential for habitat improvements.	Potential
Diagonal Avenue S	Duw-1.24	n/a	RM 1.24 Right Bank, next to Diagonal Marsh	Seattle Dept of Transportation	Seattle Shoreline Street End #25. Potential to extend marsh and mudflat habitat and improve riparian vegetation.	Potential
SW Alaska Street	Duw-1.15	n/a	RM 1.15 Left Bank	Seattle Dept of Transportation	Seattle Shoreline Street End #22. Between Herring's House Park and T-107. The current condition is unknown.	Potential
S Oregon Street	Duw-1.05	n/a	RM 1.05 Right Bank	Seattle Dept of Transportation	Seattle Shoreline Street End #24. Small sandy beach and cove with potential for habitat improvement. Site has an electric pole and rock armoring. Work completed included clearing blackberries, and installing a bench and table on a concrete pad.	Potential

<sup>4</sup> Project Sponsor for projects with Status "Potential" are tentative, the actual project sponsor will be determined based on site ownership and willingness to participate.

**Table 7. Completed projects in the Duwamish transition zone, 1988-2014.**

Project Name	Year Complete	Location	Project Sponsor	Description	Habitat Types & Areas
<b>Foster Reach (RM 8-10)</b>					
Codiga Farm Park	2004 (inlet) and 2009 (shoreline bank)	RM 8.6-8.4 Right Bank	City of Tukwila, Army Corps of Engineers	Create a narrow off-channel habitat armored with rocks, restore native shoreline vegetation, and build a small parking lot with trail access to the river.	4.2 acres?: 3.5 bank, .2 marsh, .5 mud flat). 1000 feet – shoreline bank.
Restore the Duwamish Shoreline Challenge - BECU	2014	RM 8.4-8.1 Left Bank	City of Tukwila, BECU, Forterra and other local businesses	Remove invasive plants and plant native riparian vegetation on inside bend of the river.	.3 miles shoreline bank
<b>North Wind Reach (RM 5.5-7.0)</b>					
North Wind's Weir	2010	RM 6.3-6.15 Right Bank	King County	Create over 2 acres of shallow water habitat ringed by anchored large wood jams and riparian vegetation. Site preparation included removing buried debris and contaminated soils. Project Duw-7 in Salmon Habitat Plan, 2005.	2.88 acres: .46 bank, .76 marsh, 1.66 mud flat
Cecil B. Moses Park	2003	RM 6.3 Left Bank	King County/ NRDA	Created a new off-channel marsh and restored 2 acres of shoreline bank.	4.22 acres: 3.2 bank, 1.02 marsh
<b>Lower Duwamish Reach (RM 1.6-5.5)</b>					
Turning Basin #3 Coastal America	1996	RM 5.3 Left Bank	ACOE/EPA/US FWS/Port of Seattle	Coordinated by the Coastal America program, grant funds were provided by federal partners, matched with Port funds and property easement. Removed approximately 9000 tons of rubble and upland fill material. Re-graded 0.6 acre site, creating 0.4 acre inter-tidal marsh and exposed substrate and 0.2 acres riparian buffer	0.6 acres: .04 acres marsh and sand/mud substrate, 0.2 acres riparian
Turning Basin #3—compensatory habitat	1998	RM 5.3 Left Bank	Coastal America, Port of Seattle	Habitat improvements adjacent to 1996 Turning Basin Project included: (1) excavation/removal of 33,000 tons previously placed fill and derelict vessel hulls; (2) re-grading, restoring 1.3 acres marsh and exposed inter-tidal substrate; and, (3) installation 0.6 acres riparian vegetation	1.9 acres: 1.3 acres marsh and sand/mud substrate, 0.6 acres riparian

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Project Name	Year Complete	Location	Project Sponsor	Description	Habitat Types & Areas
Kenco Marine	1995 and 2006	RM 5.1 Left Bank	Muckleshoot Indian Tribe/NRDA	In 2006, an old building, dock, and grounded barges were removed. Fill material was removed to push back the shoreline. Marsh and riparian vegetation were planted. The site was formerly owned by Kenco Marine.	.74 acres: .33 bank, .41 marsh
Hamm Creek Estuary	1999	RM 4.9 Left Bank	King County/NRDA	Daylighted Hamm Creek near the shore, removed a tidal gate, moved the creek to the north edge of the property, added grade controls, and restored tidal marsh along the Duwamish. In 2003, additional work included adding large wood and coarser substrate to the channel to reduce erosion.	4.07 acres: 2.98 bank and 1.09 marsh
City Light South	2008	RM 4.9 Left Bank	Seattle City Light and Fleets and Facilities.	Installed shoreline LWD, removed creosote piles, shortened culvert, removed riprap, amended soils and installed plants, mulch and seed. Located south of Duwamish Substation, west of Muckleshoot Indian Tribe parcel.	?
Boeing Plant 2 Remediation/ Restoration	2014	RM 4.1-3.5 Right Bank	The Boeing Company	Rehabilitate shallow-water habitat in conjunction with removal of the buildings overhanging the bank and sediment cleanup. Location is both upstream and downstream of the 14 <sup>th</sup> Ave. S. ("South Park") Bridge.  This project consists of shoreline layback, riparian vegetation enhancements, and creation of a shallow water off-channel bay.	2.3 acres of intertidal wetlands, 2,700 feet of shoreline
South Park Bridge Replacement Mitigation	2014	RM 3.9 Left Bank	King County DOT	Riparian and inter-tidal habitat functions were restored along approximately 280 lineal feet of riverbank. Existing bank armoring was removed, and the shoreline was re-graded to increase intertidal area. Large woody debris was placed with inter-tidal vegetation, and native vegetation was planted in adjacent upland areas 20 to 120-feet landward. 352 creosote-soaked piers were removed and replaced with new pier walls made of steel and recycled plastics. The in-water footprint of the new bridge was designed to be as small as possible to maximize river habitat. Stormwater runoff from the new bridge is treated by new facilities, including an extensive rain garden, to improve water quality in the waterway.	280 feet of shoreline
Duwamish Waterway Park	2006	RM 3.6 Left Bank	Port of Seattle, Seattle Parks	Shoreline vegetation improved along 150 feet and 0.1 acres, with a pocket beach and park. Parks maintains.	0.1 acres/150 feet shoreline bank

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Project Name	Year Complete	Location	Project Sponsor	Description	Habitat Types & Areas
Slip 4 Early Action Area	2012	RM 3.4 Right Bank	City of Seattle, and the Boeing Company	Shallow-water and emergent marsh habitat was created as part of cleanup of contaminated sediments at the head of Slip 4. <ul style="list-style-type: none"> <li>The project area was purchased to convert a deep berthing area to shallow water habitat</li> <li>Clean sand, gravel and rock material was used to create shallow water habitat, and a portion of the perimeter was planted with marsh plants.</li> <li>A dock was demolished to expand the area of habitat restoration.</li> </ul>	3.83 acres; 1.55 acres mud flat
8 <sup>th</sup> & S Portland St	2014	RM 3.4-3.3 Left Bank	Seattle DOT and Port of Seattle	Removed 95 tons - derelict barge and rubble; installed large-woody-debris; and planted marsh and riparian vegetation.	350 feet shoreline bank
<b>Kellogg Island Reach</b>					
Puget Creek Marsh	1997	RM 1.3 Left Bank	Corps of Engineers/Port of Seattle	(1) Excavated approximately 6000 tons previously placed fill material; (2) installed 0.3 acres marsh vegetation; (3) installed 0.3 acres riparian vegetation buffer.	0.6 acres: 0.3 acres marsh and 0.3 acres shoreline bank
T-108 intertidal restoration/Diagonal Marsh	1998 and 2004	RM 1.2 Right Bank	Port of Seattle	Created a small cove with marsh, native riparian plantings, and lawn with a trail, picnic area, and benches.	0.6 acres: .2 bank and .4 marsh
Herring's House (formerly Seaboard Lumber)	2001	RM 1.1 Left Bank	Seattle Parks and NRDA Council	Created shallow water marsh and mudflat ringed by native riparian vegetation in a park setting, with a parking lot, trails, and benches.	5.67 acres: 2.53 bank, 3.14 marsh
T-107 Park marsh	2009	RM 1.2 Left Bank	Port of Seattle	Installed and established approximately 0.3 acres native marsh vegetation in previously un-vegetated exposed inter-tidal substrate.	0.3 acres marsh
U.S. General Services Administration (GSA Marsh)	1995	RM 1.4 Right Bank	Port of Seattle, USFWS, NOAA, Corps of Engineers, EPA, GSA	Rock riprap and a large overwater wharf structure removed to allow natural colonization by existing wetland plants; a sediment "bench" at 0.0-m elevation was constructed to promote use by juvenile salmon; and upland riparian vegetation was planted. Adjacent to Diagonal Marsh. Pilot project – included creation of habitat bench.	.49 acres: .18 bank, .31 marsh
				Total Acres Restored	32.5