

As-Built Report – Oxbow Mitigation Site

I-5 / Port of Tacoma Road Interchange Improvements Project

USACE Reference No. **NWS-2014-610-DOT**

WSDOE Water Quality Certification Order No. **13038**



Prepared for:

The City of Fife
Public Works Department
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Fife, WA 98424

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April 2016

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1. Purpose of As-Built Report

Widener and Associates prepared this As-Built Report on behalf of the City of Fife Department of Public Works. The mitigation site addressed in this report was constructed in order to compensate for unavoidable permanent wetland impacts associated with the I-5 / Port of Tacoma Road Interchange Improvements Project, with additional wetland creation being held by the City of Fife for use as future mitigation. This wetland mitigation was authorized by United States Army Corps of Engineers (USACE) permit reference number NWS-2014-610-DOT and Washington State Department of Ecology (WSDOE) Water Quality Certification Order number 13038.

The purpose of this report is to document the as-built conditions of the Oxbow mitigation site. It includes the densities, sizes and locations of planted vegetation as well as which nurseries supplied the plants, the time of plantings, and locations of monitoring plots and photo points. It also describes any changes to the mitigation plan that occurred during construction.

2. Mitigation Site Location

The Oxbow mitigation site is located near the southwest corner of the intersection of Valley Avenue E and 70th Avenue E in the City of Fife, WA. It is located just south of the Union Pacific Railroad (UPRR). Wapato Creek runs through the site, entering via a culvert under the UPRR at the northeast corner of the site and exiting via another culvert under the UPRR at the northwest corner of the site. The site is located within Section 18 of Township 20N and Range 04E and is comprised of Pierce County tax parcels 0420181003, 0420181016, 0420181032, 0420181030, and 6024792540, all of which are owned by the City of Fife (Figure 1).

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1:27,660

0 0.25 0.5 1 Miles

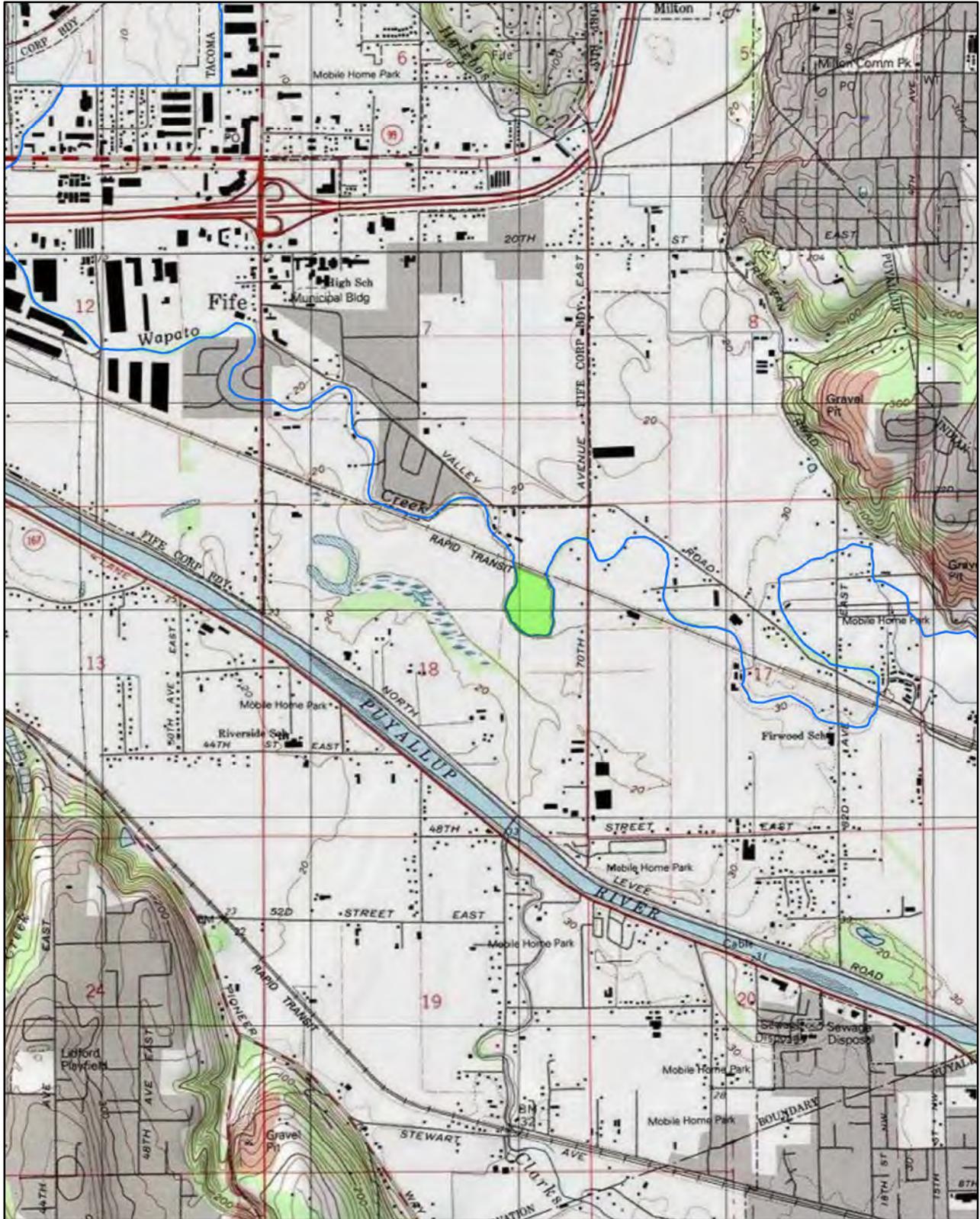
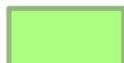


Figure 1. Oxbow Mitigation Site Vicinity
I-5 / Port of Tacoma Road Interchange Improvements

-  Oxbow Mitigation Site
-  Wapato Creek

City of Fife Public Works
Pierce County, WA
47.225572 N / -122.341333 W
S18, T20N, R04E
April 6, 2016

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3. Mitigation Site

3.1 Proposed

The approved mitigation plan included the creation of 8.46 acres of forested/scrub-shrub wetland and enhancement of 4.36 acres of existing emergent and forested wetland on the Oxbow mitigation site. 5.55 acres of buffer were also to be enhanced on the Oxbow site, with additional buffer designated but not enhanced (Figure 2).

General site preparation and construction activities were proposed to take place in the fall of 2014. At this time, the areas of proposed wetland creation and enhancement were to be cleared and grubbed. Soils within the wetland creation areas were to be excavated to an average elevation of 18.83 feet to allow for 8 inches of topsoil to be added and rototilled to a depth of 12 inches, resulting in an average final elevation of 19.5 feet. Several deeper cells (18.5' elevation) were also to be excavated within the Oxbow wetland creation area to provide additional habitat complexity. These cells would be hydrologically connected by shallow excavated channels. All exposed soils were to be hydroseeded with native grass species within 20 days to reduce erosion. One spillway was also proposed to be excavated on the Oxbow site, if needed, to control the amount of inundation across the site.

No excavation was proposed in the wetland enhancement or buffer enhancement areas. These areas were only to be selectively cleared and/or grubbed of invasive vegetation prior to planting. Herbicide treatment was also to be used as necessary to ensure successful control of noxious weeds prior to planting. Buffer slopes adjacent to wetland areas would be graded at no greater than a 2:1 slope until the proposed wetland elevations were reached. All tree and shrub plantings were to receive 3-inch deep bark mulch rings and trees were to be fitted with temporary herbivory guards. All planting holes were to be supplemented with 3 inches of compost.

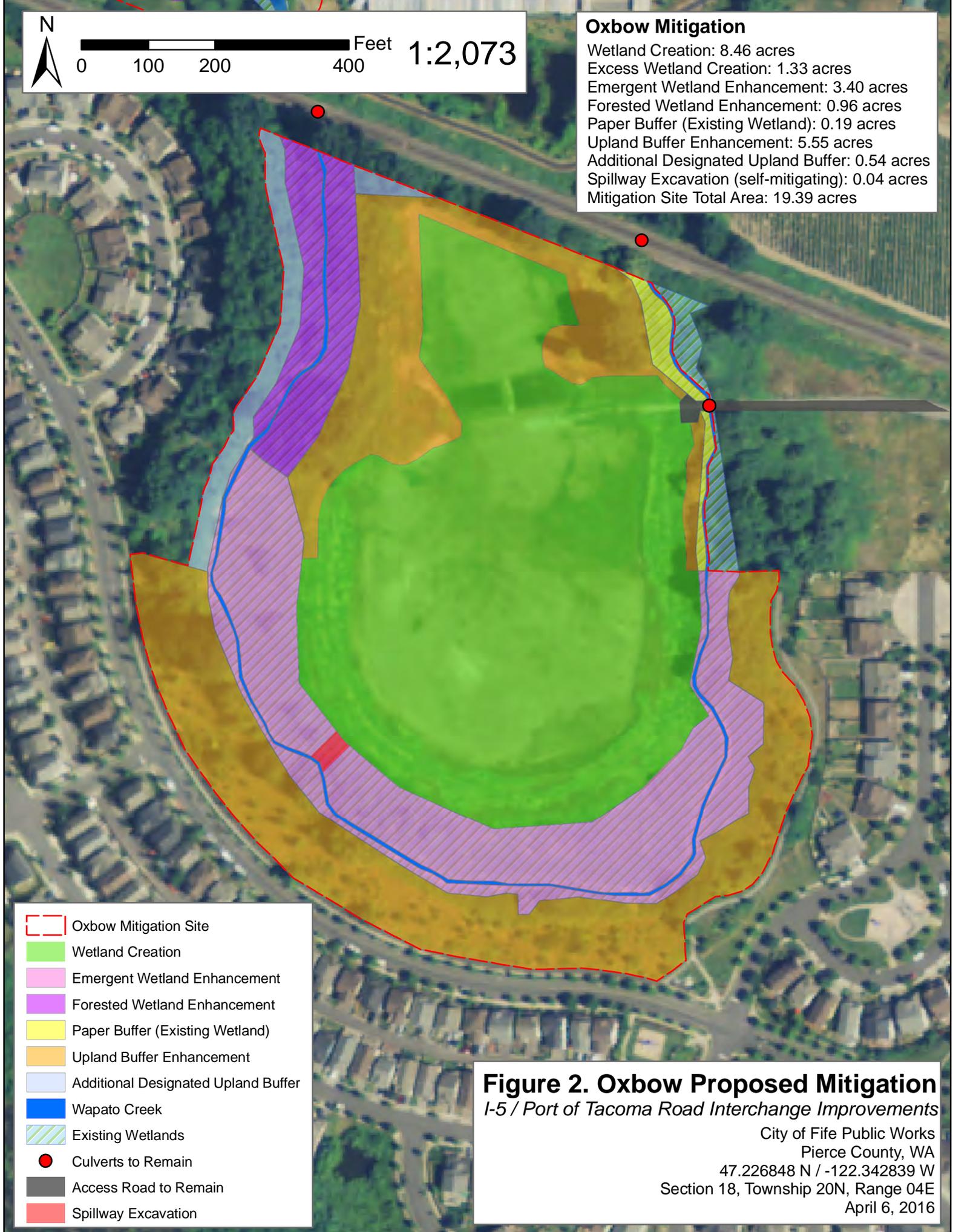
In the fall of 2014, the wetland creation, wetland enhancement and buffer enhancement sites were to be planted with native species, as displayed in the planting plan. See Figure 2 for proposed planting areas and Tables 1 through 3 for the proposed planting plan.

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Oxbow Mitigation

Wetland Creation: 8.46 acres
 Excess Wetland Creation: 1.33 acres
 Emergent Wetland Enhancement: 3.40 acres
 Forested Wetland Enhancement: 0.96 acres
 Paper Buffer (Existing Wetland): 0.19 acres
 Upland Buffer Enhancement: 5.55 acres
 Additional Designated Upland Buffer: 0.54 acres
 Spillway Excavation (self-mitigating): 0.04 acres
 Mitigation Site Total Area: 19.39 acres



- Oxbow Mitigation Site
- Wetland Creation
- Emergent Wetland Enhancement
- Forested Wetland Enhancement
- Paper Buffer (Existing Wetland)
- Upland Buffer Enhancement
- Additional Designated Upland Buffer
- Wapato Creek
- Existing Wetlands
- Culverts to Remain
- Access Road to Remain
- Spillway Excavation

Figure 2. Oxbow Proposed Mitigation
I-5 / Port of Tacoma Road Interchange Improvements

City of Fife Public Works
 Pierce County, WA
 47.226848 N / -122.342839 W
 Section 18, Township 20N, Range 04E
 April 6, 2016

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Table 1. Proposed Wetland Enhancement Planting

Scientific Name	Common Name	Indicator Status	Planting Density	Proportion of Planting in Strata (%)	Size of Plants
<u>Trees:</u>					
<i>Fraxinus latifolia</i>	Oregon Ash	FACW	12' on center	30	1 gallon
<i>Thuja plicata</i>	Western Red Cedar	FAC	12' on center	30	1 gallon
<i>Salix lucida</i>	Pacific Willow	FACW	12' on center	40	1 gallon
<u>Shrubs:</u>					
<i>Cornus sericea</i>	Red Osier Dogwood	FACW	4' on center	25	1 gallon
<i>Salix sitchensis</i>	Sitka Willow	FACW	4' on center	25	1 gallon
<i>Lonicera involucrata</i>	Black Twinberry	FAC	4' on center	30	1 gallon
<i>Physocarpus capitatus</i>	Pacific Ninebark	FACW	4' on center	20	1 gallon
<u>Emergents:</u>					
<i>Carex obnupta</i>	Slough Sedge	OBL	2' on center	30	Bareroot/plug
<i>Scirpus microcarpus</i>	Small-fruited Bulrush	OBL	2' on center	20	Bareroot/plug
<i>Eleocharis palustris</i>	Common Spikerush	OBL	2' on center	20	Bareroot/plug
<i>Juncus ensifolius</i>	Daggerleaf Rush	FACW	2' on center	30	Bareroot/plug

Table 2. Proposed Wetland Creation Planting

Scientific Name	Common Name	Indicator Status	Planting Density	Proportion of Planting in Strata (%)	Size of Plants
<u>Trees:</u>					
<i>Salix lucida</i>	Pacific Willow	FACW	12' on center	40	1 gallon
<i>Thuja plicata</i>	Western Red Cedar	FAC	12' on center	30	1 gallon
<i>Populus balsamifera</i>	Black Cottonwood	FAC	12' on center	30	1 gallon
<u>Shrubs:</u>					
<i>Cornus sericea</i>	Red Osier Dogwood	FACW	4' on center	30	1 gallon
<i>Lonicera involucrata</i>	Black Twinberry	FAC	4' on center	50	1 gallon
<i>Physocarpus capitatus</i>	Pacific Ninebark	FACW	4' on center	20	1 gallon
<u>Emergents:</u>					
<i>Carex obnupta</i>	Slough Sedge	OBL	2' on center	30	Bareroot/plug
<i>Scirpus microcarpus</i>	Small-fruited Bulrush	OBL	2' on center	20	Bareroot/plug
<i>Eleocharis palustris</i>	Common Spikerush	OBL	2' on center	20	Bareroot/plug
<i>Juncus ensifolius</i>	Daggerleaf Rush	FACW	2' on center	30	Bareroot/plug

Table 3. Proposed Buffer Enhancement Planting

Scientific Name	Common Name	Indicator Status	Planting Density	Proportion of Planting in Strata (%)	Size of Plants
<u>Trees:</u>					
<i>Acer macrophyllum</i>	Bigleaf Maple	FACU	12' on center	30	1 gallon
<i>Pseudotsuga menziesii</i>	Douglas Fir	FACU	12' on center	20	1 gallon
<i>Thuja plicata</i>	Western Red Cedar	FAC	12' on center	30	1 gallon
<i>Prunus emarginata</i>	Bitter Cherry	FACU	12' on center	20	1 gallon
<u>Shrubs:</u>					
<i>Acer circinatum</i>	Vine Maple	FAC	4' on center	30	1 gallon
<i>Gaultheria shallon</i>	Salal	FACU	4' on center	15	1 gallon
<i>Oemleria cerasiformis</i>	Indian Plum	FACU	4' on center	15	1 gallon
<i>Sambucus racemosa</i>	Red Elderberry	FACU	4' on center	20	1 gallon
<i>Symphoricarpos albus</i>	Common Snowberry	FACU	4' on center	20	1 gallon

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3.2 As Built

Initial planting of the Oxbow site took place in the fall of 2014 (Photo 1). Only the portion of the wetland creation area south of the access road (Zone B) was planted in the fall of 2014 as the site became too inundated for planting due to heavy precipitation. The northern portion of the enhanced buffer on the interior of the site (Zone Y) was also planted at this time. An area of petroleum contamination was also discovered during excavation of Zone B (Figure 4). An area of mulch was added in order to be able to install groundwater monitoring wells. This resulted in a slight reduction in the amount of created wetland on the site (8.42 acres) compared to the proposed creation of 8.46 acres of wetland. Large woody debris was also uncovered during initial excavation of the site and was incorporated into Zone B as horizontal and vertical habitat features to add additional habitat complexity (Photos 1 and 3).



Photo 1. Southern portion of Oxbow wetland creation (Zone B) after planting (November 18, 2014)

It was determined that excavation of the proposed spillway on the west side of the site would be necessary in order to regulate the inundation across the site. This spillway was constructed through a portion of the existing wetland on January 26, 2015 after obtaining coverage under Nationwide Permit 27 (NWS-2014-1000-DOT). This spillway was stabilized with sod and a wooden weir was installed in order to be able to have some control over the inundation level within the wetland creation area (Photo 2).



Photo 2. Spillway construction on west side of Oxbow site (January 26, 2015)

While the spillway was able to decrease the inundation depth and period across the wetland creation area, there was some loss of plants due to the prolonged inundation throughout the winter. A majority of western red cedars (*Thuja plicata*) within the wetland creation area (Zone B) died as a result of the prolonged inundation (Photo 3). Western red cedars around the perimeter of the wetland creation area survived, but it was determined that western red cedars should not be replanted in the wetland creation area. In addition, almost all trees and shrubs planted within the deeper cells were lost.

As it was determined that the site would be too wet for establishment of western red cedar, 1000 Pacific willow (*Salix lucida*) live stakes were planted throughout the 1.69 acres of deeper cells within Zone B (Zone I) on the Oxbow site to supplement the lost trees (Photo 3). These willows were planted in order to obtain rapid coverage that would discourage geese and limit invasion by noxious weeds, especially reed canarygrass. These supplemental willow plantings were done in the spring of 2015. While it was initially thought that there was total loss of plant material in the deeper cells, growth of planted emergents was observed during the spring of 2015. In addition, there was significant natural recruitment of sitka willow (*Salix sitchensis*), pacific willow, and

black cottonwood (*Populus balsamifera*) into the portion of the wetland creation area that had been deeply inundated during the winter of 2014.



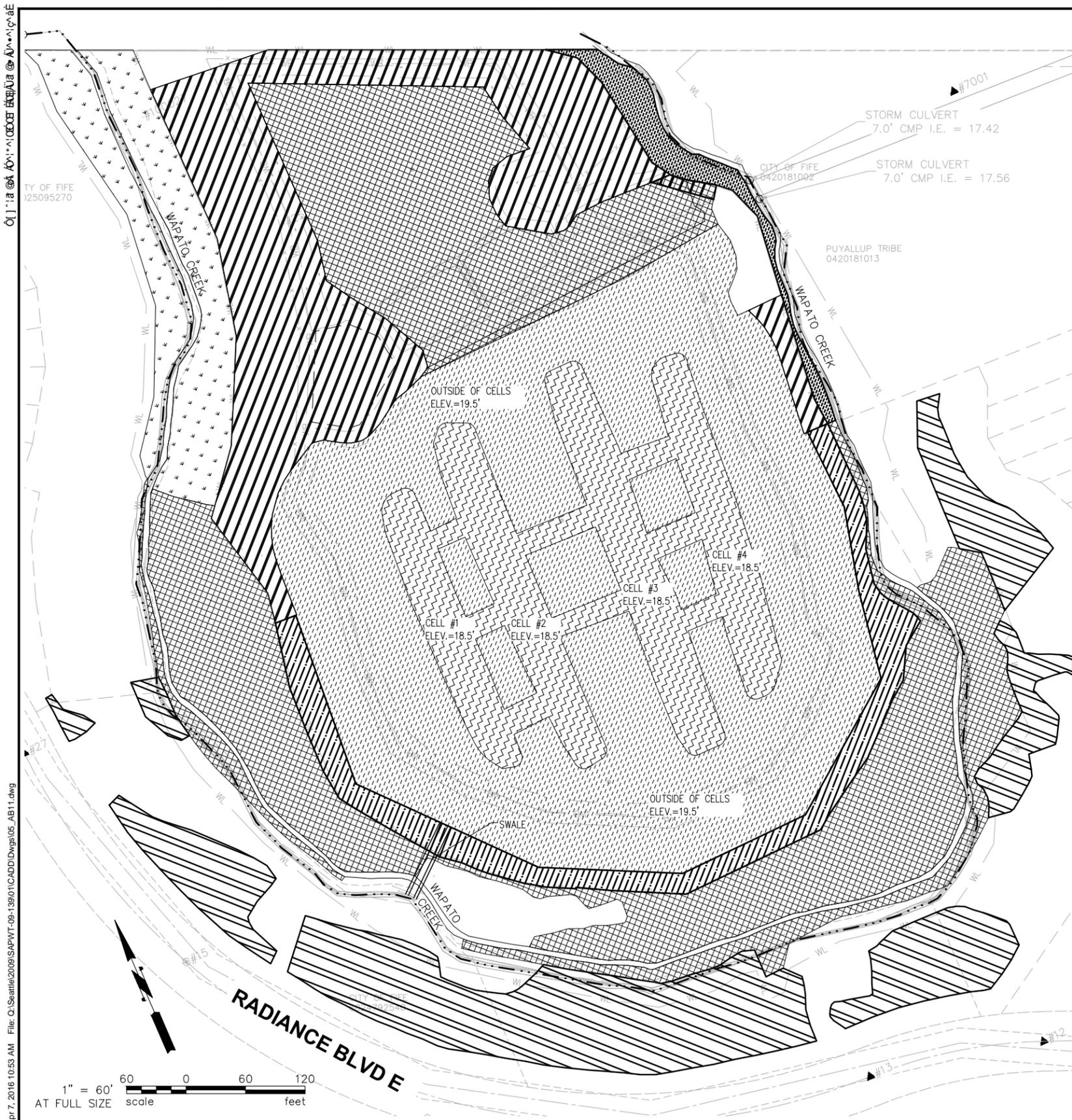
Photo 3. Planted willow stakes and dead western red cedars in wetland creation area (May 22, 2015)

The remaining portion of the wetland creation area (Zone X) was planted in the late spring of 2015. This planting corresponded with the installation of a temporary irrigation system for the wetland creation and buffer areas that had been planted to date. This irrigation system was operated throughout the summer drought of 2015. Noxious weed control within the planting areas also began in the spring of 2015. This included multiple herbicide treatments of the reed canarygrass in the emergent wetland enhancement area. Prior to planting of the remaining areas on the Oxbow site, the emergent wetland enhancement area was tilled and regrowth was treated with herbicide a final time. Planting of the remainder of the site, including Zones A, C, and G, then began in the late fall of 2015, with planting completed on January 14, 2016. Refer to Figure 3 and Tables 4 through 9 for the as-built planting plan including the species and number of plants that were planted in each planting zone.

All plants, with the exception of the live willow stakes planted in Zone I and the plantings in Zone G, came from Beaverlake Nursery in Beavercreek, Oregon. All live stakes as well as container plants that were planted in Zone G came from Sound Native Plants in Olympia, Washington.

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Figure 3. As-Built Planting Plan



Bid Items	Unit	OXBOW PLANTS PER ZONE						
		Zone A	Zone B	Zone C	Zone I	Zone G	Zone X	Zone Y
Acer macrophyllum / big leaf maple; 1 gallon container	EACH	185						196
Pseudotsuga menziesii / Douglas fir; 1 gallon container	EACH	123						131
Thuja plicata / Western red cedar; 1 gallon container	EACH	185	674	264		100	143	196
Prunus emarginata / bitter cherry; 1 gallon container	EACH							131
Acer circinatum / vine maple; 1 gallon container	EACH	1481						1568
Gaultheria shannon / salal; 1 gallon container	EACH							784
Oemleria cerasiformis / indian plum; 1 gallon container	EACH	741						784
Sambucus racemosa / red elderberry; 1 gallon container	EACH							1045
Symphoricarpos albus / common snowberry; 1 gallon container	EACH	952						1045
Salix lucida / Pacific willow; 1 gallon container or live stake	EACH		898	345	1000	100		190
Populus balsamifera / black cottonwood; 1 gallon container	EACH		673					143
Lonicera involucrata / black twinberry; 1 gallon container	EACH		11059	2106				1899
Cornus sericea / red twig dogwood; 1 gallon container	EACH		4697	1670		100		1139
Carex obnupta / slough sedge; bare root / plug	EACH		18747	7130				3847
Scirpus microcarpus / small-fruited bulrush; bare root / plug	EACH		12371	4754				2565
Eleocharis palustris / common spikerush; bare root / plug (see BI 67)	EACH		12676					
Juncus ensifolius / daggerleaf rush; bare root / plug	EACH		18216	7130				3847
Service berry (substitution for 'Salal'); 1 gallon container	EACH	741						71
Choke cherry (substitution for 'Bitter cherry'); 1 gallon container	EACH	123						
Oregon grape (substitution for 'Red elderberry'); 1 gallon container	EACH	535						47
Fraxinus latifolia / Oregon ash; 1 gallon container or live stake	EACH			264		100		
Physocarpus capitatus / Pacific ninebark; 1 gallon container	EACH		3494	1409				760
Salix sitchensis / Sitka willow; 1 gallon container or live stake	EACH			1761		100		
Eleocharis ovata / common bare root / plug (SUBSTITUTION for BI 40)	EACH			4754				2565
Rosa pisocarpa / Swamp Rose; 1 gallon container	EACH					100		

*Note: Zone B plants also planted in Zone I, but were supplemented with 1000 Pacific willow after high mortality during the winter of 2014

LEGEND

- = ZONE A - ENHANCED UPLAND BUFFER WOODY PLANTINGS - 2.04 AC
- = ZONE B - CREATED WETLAND - 4.56 AC
- = ZONE B (ADD) - CREATED WETLAND - 0.61 AC
- = ZONE C - ENHANCED EMERGENT WETLAND WOODY PLANTINGS - 2.91 AC
- = ZONE Y - ENHANCED UPLAND BUFFER - 2.05 AC
- = ZONE X - CREATED WETLAND - 1.56 AC
- = ZONE G - ENHANCED FORESTED WETLAND - 0.96 AC
- = ZONE H - ENHANCED WETLAND - PAPER BUFFER - 0.19 AC
- = ZONE I - CREATED WETLAND - 18.5' ELEVATION CELLS - ZONE B ADD - 1.69 AC

NOTE - SEE SHEET AB-14 AND THIS SHEET FOR ZONE PLANTING SCHEDULE.

AS-BUILT

MARK	REVISION DESCRIPTION	BY	APP.	DATE

33301 9th Avenue South, Suite 300
Federal Way, Washington 98003-2600
(206) 431-2300 Fax: (206) 431-2250

DRAWN BY JCR
DESIGN BY SML
CHECK BY RAF
PROJ MGR RAF

CITY OF FIFE
WAPATO CREEK WETLAND AND STREAM MITIGATION PHASE I
PLANTING ZONE LAYOUT
SHEET 2

DRAWING NO. **AB-11**
PROJECT NO. A09.0139.01
DATE: 4/5/16
SHEET NO. 14 OF 17

Last Saved by: Shawna.lenn on: Apr 7, 2016 10:53 AM File: C:\Seattle\2009\SAPWT-09-13901\CADD\Drawings\05_AB11.dwg

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Table 4. As-Built Planting of Zone A – Upland Buffer Enhancement (2.04 acres of 3.47 acres total)

Scientific Name	Common Name	Indicator Status	Planting Density	Number of Plants	Size of Plants
<u>Trees:</u>					
<i>Acer macrophyllum</i>	Bigleaf Maple	FACU	12' on center	185	1 gallon
<i>Pseudotsuga menziesii</i>	Douglas Fir	FACU	12' on center	123	1 gallon
<i>Thuja plicata</i>	Western Red Cedar	FAC	12' on center	185	1 gallon
<i>Prunus virginiana</i>	Choke Cherry	FACU	12' on center	123	1 gallon
<u>Shrubs:</u>					
<i>Acer circinatum</i>	Vine Maple	FAC	4' on center	1481	1 gallon
<i>Amelanchier alnifolia</i>	Serviceberry	FACU	4' on center	741	1 gallon
<i>Oemleria cerasiformis</i>	Indian Plum	FACU	4' on center	741	1 gallon
<i>Mahonia aquifolium</i>	Tall Oregon Grape	FACU	4' on center	535	1 gallon
<i>Symphoricarpos albus</i>	Common Snowberry	FACU	4' on center	952	1 gallon

Table 5. As-Built Planting of Zone B (including Zone B Add and Zone I) – Wetland Creation (6.86 Acres)

Scientific Name	Common Name	Indicator Status	Planting Density	Number of Plants	Size of Plants
<u>Trees:</u>					
<i>Salix lucida</i>	Pacific Willow	FACW	12' on center	1898	1 gallon
<i>Thuja plicata</i>	Western Red Cedar	FAC	12' on center	674	1 gallon
<i>Populus balsamifera</i>	Black Cottonwood	FAC	12' on center	673	1 gallon
<u>Shrubs:</u>					
<i>Cornus sericea</i>	Red Osier Dogwood	FACW	4' on center	4697	1 gallon
<i>Lonicera involucrata</i>	Black Twinberry	FAC	4' on center	11059	1 gallon
<i>Physocarpus capitatus</i>	Pacific Ninebark	FACW	4' on center	3494	1 gallon
<u>Emergents:</u>					
<i>Carex obnupta</i>	Slough Sedge	OBL	2' on center	18747	Bareroot/plug
<i>Scirpus microcarpus</i>	Small-fruited Bulrush	OBL	2' on center	12371	Bareroot/plug
<i>Eleocharis palustris</i>	Common Spikerush	OBL	2' on center	12676	Bareroot/plug
<i>Juncus ensifolius</i>	Daggerleaf Rush	FACW	2' on center	18216	Bareroot/plug

Table 6. As-Built Planting of Zone C – Emergent Wetland Enhancement (2.91 acres of 3.40 acres total)

Scientific Name	Common Name	Indicator Status	Planting Density	Number of Plants	Size of Plants
<u>Trees:</u>					
<i>Fraxinus latifolia</i>	Oregon Ash	FACW	12' on center	264	1 gallon
<i>Thuja plicata</i>	Western Red Cedar	FAC	12' on center	264	1 gallon
<i>Salix lucida</i>	Pacific Willow	FACW	12' on center	345	1 gallon
<u>Shrubs:</u>					
<i>Cornus sericea</i>	Red Osier Dogwood	FACW	4' on center	1670	1 gallon
<i>Salix sitchensis</i>	Sitka Willow	FACW	4' on center	1761	1 gallon
<i>Lonicera involucrata</i>	Black Twinberry	FAC	4' on center	2106	1 gallon
<i>Physocarpus capitatus</i>	Pacific Ninebark	FACW	4' on center	1409	1 gallon
<u>Emergents:</u>					
<i>Carex obnupta</i>	Slough Sedge	OBL	2' on center	7130	Bareroot/plug
<i>Scirpus microcarpus</i>	Small-fruited Bulrush	OBL	2' on center	4754	Bareroot/plug
<i>Eleocharis ovata</i>	Ovate Spikerush	OBL	2' on center	4754	Bareroot/plug
<i>Juncus ensifolius</i>	Daggerleaf Rush	FACW	2' on center	7130	Bareroot/plug

Table 7. As-Built Planting of Zone G – Forested Wetland Enhancement (0.96 acre)

Scientific Name	Common Name	Indicator Status	Planting Density	Number of Plants	Size of Plants
<u>Trees:</u>					
<i>Fraxinus latifolia</i>	Oregon Ash	FACW	12' on center	100	1 gallon
<i>Thuja plicata</i>	Western Red Cedar	FAC	12' on center	100	1 gallon
<i>Salix lucida</i>	Pacific Willow	FACW	12' on center	100	Live stake
<u>Shrubs:</u>					
<i>Cornus sericea</i>	Red Osier Dogwood	FACW	8' on center	100	Live stake
<i>Salix sitchensis</i>	Sitka Willow	FACW	8' on center	100	Live stake
<i>Rosa pisocarpa</i>	Swamp Rose	FAC	8' on center	100	1 gallon

Table 8. As-Built Planting of Zone X – Wetland Creation (1.56 Acres)

Scientific Name	Common Name	Indicator Status	Planting Density	Number of Plants	Size of Plants
<u>Trees:</u>					
<i>Salix lucida</i>	Pacific Willow	FACW	12' on center	190	1 gallon
<i>Thuja plicata</i>	Western Red Cedar	FAC	12' on center	143	1 gallon
<i>Populus balsamifera</i>	Black Cottonwood	FAC	12' on center	143	1 gallon
<u>Shrubs:</u>					
<i>Cornus sericea</i>	Red Osier Dogwood	FACW	4' on center	1139	1 gallon
<i>Lonicera involucrata</i>	Black Twinberry	FAC	4' on center	1899	1 gallon
<i>Physocarpus capitatus</i>	Pacific Ninebark	FACW	4' on center	760	1 gallon
<u>Emergents:</u>					
<i>Carex obnupta</i>	Slough Sedge	OBL	2' on center	3847	Bareroot/plug
<i>Scirpus microcarpus</i>	Small-fruited Bulrush	OBL	2' on center	2565	Bareroot/plug
<i>Eleocharis ovata</i>	Ovate Spikerush	OBL	2' on center	2565	Bareroot/plug
<i>Juncus ensifolius</i>	Daggerleaf Rush	FACW	2' on center	3847	Bareroot/plug

Table 9. As-Built Planting of Zone Y – Upland Buffer Enhancement (2.05 acres)

Scientific Name	Common Name	Indicator Status	Planting Density	Number of Plants	Size of Plants
<u>Trees:</u>					
<i>Acer macrophyllum</i>	Bigleaf Maple	FACU	12' on center	196	1 gallon
<i>Pseudotsuga menziesii</i>	Douglas Fir	FACU	12' on center	131	1 gallon
<i>Thuja plicata</i>	Western Red Cedar	FAC	12' on center	196	1 gallon
<i>Prunus emarginata</i>	Bitter Cherry	FACU	12' on center	131	1 gallon
<u>Shrubs:</u>					
<i>Acer circinatum</i>	Vine Maple	FAC	4' on center	1568	1 gallon
<i>Gaultheria shallon</i>	Salal	FACU	4' on center	784	1 gallon
<i>Oemleria cerasiformis</i>	Indian Plum	FACU	4' on center	784	1 gallon
<i>Sambucus racemosa</i>	Red Elderberry	FACU	4' on center	1045	1 gallon
<i>Symphoricarpos albus</i>	Common Snowberry	FACU	4' on center	1045	1 gallon

3.3 Discrepancies

There were several discrepancies between the as-built planting plan and the proposed mitigation plan that occurred throughout construction. These discrepancies include substitutions that were made for certain species that were unavailable at the time of planting or were not exhibiting high establishment success after earlier planting. In addition, there were several changes in planting quantities based on field conditions. There was also a slight decrease in the amount of wetland created and buffer enhanced due to the petroleum remediation on site and a reduction in the amount of woody plantings within the emergent wetland enhancement and upland buffer enhancement areas due to areas of existing woody vegetation.

Several plant substitutions were made during construction due to lack of availability of the proposed species at the time of planting. Ovate spikerush (*Eleocharis ovata*) was substituted for common spikerush (*Eleocharis palustris*) during the planting of Zones X and C. In addition, choke cherry (*Prunus virginiana*) was substituted for bitter cherry (*Prunus emarginata*) during the replanting of Zone Y and planting of Zone A. These substitutions were approved by a biologist with Widener & Associates prior to implementation. The substituted species are very similar to the species that they replaced as they are in the same genus and have the same wetland indicator status.

Several plant substitutions were also made due to the disproportionate lack of establishment of certain species. As was mentioned previously, all red cedar (*Thuja plicata*) that was planted in Zone B died during the period of prolonged inundation in the first winter after planting. As it was deemed that red cedar would be unlikely to establish within the wetland creation area, 1000 Pacific willow (*Salix lucida*) live stakes were planted within the deeper cells in Zone B (Zone I) to supplement the loss of tree cover. This was only done after verbal approval from Sandra Manning of the USACE and Alex Callender of the WSDOE during a walkthrough of the site on March 31, 2015. Pacific willow was chosen as it would provide rapid cover, prevent the invasion of reed canarygrass and other noxious weeds, and would deter Canada geese (*Branta canadensis*) that had been landing in the deeper cells and consuming planted herbaceous vegetation. In addition, there was disproportionately low establishment success of salal (*Gaultheria shallon*) and red elderberry (*Sambucus racemosa*) within Zone Y. As such, serviceberry (*Amelanchier alnifolia*) was substituted for salal and tall Oregon grape (*Mahonia aquifolium*) was substituted for red elderberry during replanting of Zone Y and planting of Zone A. These species were

deemed appropriate substitutions as they are drought-tolerant and would be able to compete well with herbaceous species during establishment.

The species composition and types of plantings within the area of forested wetland enhancement (Zone G) were also changed due to the presence of native willows (*Salix spp.*) and alders (*Alnus rubra*) that were to be preserved and the large source population of reed canarygrass in this area. In order to attempt to shade out the reed canarygrass, live stakes of Pacific willow, Sitka willow (*Salix sitchensis*), and red-osier dogwood (*Cornus sericea*) were planted as it was determined that live stakes would have a greater chance of successful establishment than smaller container plants. In addition, 1-gallon container plants of western red cedar, Oregon ash (*Fraxinus latifolia*), and swamp rose (*Rosa pisocarpa*) were planted to increase woody plant diversity in this area of forested wetland.

The quantities of plants within Zones A and C were also reduced from those proposed in the mitigation plan, as there were several patches of existing dense native vegetation that were preserved, preventing the planting of additional woody plants in these areas. Refer to Figures 3 and 4 for the areas within Zones A and C that were actually planted with native woody vegetation. While additional woody vegetation was not planted in areas dominated by existing native woody vegetation, non-native herbaceous species were controlled prior to seeding with native upland or wetland seed mix in Zones A and C, respectively. Zone C emergents were also still planted in the areas that were not planted with woody vegetation. Therefore, there was no change in the areas of Zones A and C that were originally proposed in the approved mitigation plan.

Lastly, the amount of wetland creation was reduced by 0.04 acre from the proposed wetland creation area of 8.46 acres. This is due to mulch that was imported to install groundwater monitoring wells to monitor petroleum remediation efforts on the east side of the site, just south of the access road. The amount of buffer enhancement was also reduced by 0.02 acre as a result of the petroleum remediation efforts (Figures 3 and 4). No wetland credits will be generated from the area that is currently being monitored until a no further action determination is made by the WSDOE.



Oxbow Mitigation

Wetland Creation: 8.42 acres
 Emergent Wetland Enhancement: 3.40 acres
 Forested Wetland Enhancement: 0.96 acres
 Paper Buffer (Existing Wetland): 0.19 acres
 Upland Buffer Enhancement: 5.53 acres
 Additional Designated Upland Buffer: 0.58 acres
 Petroleum Remediation: 0.15 acres
 Mitigation Site Total Area: 19.39 acres



- Oxbow Mitigation Site
- Wetland Creation
- 18.5' Elevation Cells
- Emergent Wetland Enhancement
- Emergent Wetland Woody Plantings
- Forested Wetland Enhancement
- Upland Buffer Enhancement
- Upland Buffer Woody Plantings
- Additional Designated Upland Buffer
- Paper Buffer (Existing Wetland)
- Petroleum Remediation
- Access Road to Remain
- Culverts to Remain
- Wapato Creek
- Existing Wetlands

Figure 4. Oxbow As-Built Mitigation
I-5 / Port of Tacoma Road Interchange Improvements
 City of Fife Public Works
 Pierce County, WA
 47.226848 N / -122.342839 W
 Section 18, Township 20N, Range 04E
 April 7, 2016

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4. Monitoring Method

4.1 *Monitoring Plots*

Twelve (12) permanent monitoring plots were established within the Oxbow mitigation site; four (4) within the wetland creation areas (Zones B and X), four (4) within the wetland enhancement areas (Zones C and G), and four within the buffer enhancement areas (Zones A and Y).

Locations of monitoring plots within the mitigation site were selected using a random point generator (Hawth's tools) in ArcGIS. The GPS coordinates of the centers of these plots are documented in Table 4. These areas were then located in the field using a handheld GPS unit, and metal stakes were hammered into the ground at these locations. Throughout the monitoring period, vegetation will be analyzed at these locations to help decide whether or not the mitigation site is meeting established performance standards. See Figure 4 for the approximate field locations of these monitoring plot centers.

Table 10: GPS coordinates of established monitoring plots

Monitoring Point	Latitude	Longitude
MP-1	47.225092° N	-122.340815° W
MP-2	47.223030° N	-122.341244° W
MP-3	47.222508° N	-122.339714° W
MP-4	47.222785° N	-122.338784° W
MP-5	47.224167° N	-122.340425° W
MP-6	47.222021° N	-122.339010° W
MP-7	47.222597° N	-122.341127° W
MP-8	47.224561° N	-122.339278° W
MP-9	47.224749° N	-122.340139° W
MP-10	47.223922° N	-122.339221° W
MP-11	47.223146° N	-122.340563° W
MP-12	47.223205° N	-122.339069° W

4.2 *Photo Points*

Permanent reference points were also established throughout the mitigation site from which to take photographs that will be submitted with each monitoring report. Eight (8) reference points were selected to provide a comprehensive view of the mitigation site. All eight of these photo points coincide with established monitoring plot centers in order to reduce the number of metal

stakes installed on site. These points will be used throughout the monitoring period to document the success and growth of vegetation across the mitigation site. See Table 5 for the GPS coordinates of these photo points and Figure 4 for approximate field locations. In addition to the photos taken at each photo point, a panoramic photo of the entire mitigation site will be provided with each monitoring report.

Table 11: GPS coordinates of established photo points

Photo Point	Latitude	Longitude
MP-1	47.225092° N	-122.340815° W
MP-2	47.223030° N	-122.341244° W
MP-3	47.222508° N	-122.339714° W
MP-5	47.224167° N	-122.340425° W
MP-6	47.222021° N	-122.339010° W
MP-9	47.224749° N	-122.340139° W
MP-10	47.223922° N	-122.339221° W
MP-11	47.223146° N	-122.340563° W

Site visits will be conducted for each monitoring year during the growing season. Monitoring will continue for ten years, or until all success criteria have been met. First-year monitoring will be conducted during the spring of 2016.



-  Oxbow Mitigation Site
-  Wetland Creation
-  Emergent Wetland Enhancement
-  Forested Wetland Enhancement
-  Paper Buffer (Existing Wetland)
-  Upland Buffer Enhancement
-  Additional Designated Upland Buffer
-  Wapato Creek
-  Existing Wetlands
-  Access Road to Remain
-  Monitoring Points

Figure 5. Monitoring Points
I-5 / Port of Tacoma Road Interchange Improvements
 City of Fife Public Works
 Pierce County, WA
 47.226848 N / -122.342839 W
 Section 18, Township 20N, Range 04E
 April 6, 2016

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7. Conclusion

While several changes were made to the proposed plant species and quantities on the Oxbow mitigation site throughout construction, there were only minimal changes to the total areas of wetland creation and buffer enhancement that were proposed in the approved mitigation plan. The total area of wetland enhancement is consistent with the area proposed in the approved mitigation plan. The plant substitutions and planting area adjustments that were made will not prevent the successful establishment of a highly-functioning Category III or higher wetland and a diverse upland buffer on the Oxbow mitigation site.

Discrepancies between the approved mitigation plan and the as-built plan include the following:

- substitution of ovate spikerush for common spikerush in Zones X and C
- substitution of choke cherry for bitter cherry in replanting of Zone Y and planting of Zone A
- substitution of Pacific willow for western red cedar in replanting of Zone I
- substitution of serviceberry for salal in replanting of Zone Y and planting of Zone A
- substitution of tall Oregon grape for red elderberry in replanting of Zone Y and planting of Zone A
- Reduction in total area of woody plantings in Zones A and C due to preserved native woody vegetation. Areas of existing woody vegetation were still treated for noxious weeds and seeded with an upland or wetland native seed mix.
- Change in planting composition of Zone G due to large source population of reed canarygrass
- Slight reduction in wetland creation and buffer enhancement areas due to area of petroleum remediation on the east side of the site.

First-year monitoring for the Oxbow mitigation site will occur during spring of 2016. Monitoring reports will be prepared in accordance with USACE and WSDOE guidelines and will be submitted by December 31st of each monitoring year. The City of Fife will continue to perform maintenance within all planting areas in order to meet established performance standards for the site.

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