

**I-5/SR 532 Interchange Improvements Milepost (MP) 212.35
to NP 212.88 (Stanwood) Mitigation Site
WIN A00552R**

USACE NWP (14) 200500845

Northwest Region

2010 MONITORING REPORT

Wetland Assessment and Monitoring Program

Issued March 2011



**Washington State
Department of Transportation**

Environmental Services Office

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I-5/SR 532 Interchange Improvements Milepost (MP) 212.35 to MP 212.88 (Stanwood) Mitigation Site

USACE NWP (14) 200500845



General Site Information		
USACE NWP 14 Number	200500845	
WIN Number	A00552R	
Mitigation Location	West of Pilchuck Creek, near Stanwood, Snohomish County.	
LLID Number	1222437482381	
Construction Date	2007	
Monitoring Period	2008-2017	
Year of Monitoring	3 of 10	
Type of Project Impact	Wetland	Wetland Buffer
Area of Project Impact	0.12 acre	0.63 acre
Type of Mitigation	Wetland Establishment	Wetland Enhancement
Area of Mitigation	0.33 acre	0.007 acre
Type of Mitigation	Buffer	
Area of Mitigation	0.79 acre	

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Summary of Monitoring Results and Management Activities (2010)

Performance Standards	2010 Results ¹	Management Activities
Wetland Hydrology	Partially present	
Native woody species will maintain a density of four plants per 100 square feet in the scrub-shrub and forested wetlands	6 stems/100 ft ² (CI _{80%} = 6 – 7)	Replanting occurred in Dec. 2010.
50 percent cover of FAC and wetter native herbaceous species in the emergent wetland	79% cover (CI _{90%} = 70 – 87%)	
Snohomish County Class A weeds will not exceed 20 percent cover in each zone	5% cover in the wetland 10% cover in the upland buffer	Manual and herbicide weed control occurred in Aug. and Sept. 2010.
Native woody species will maintain a density of four plants per 100 square feet in the upland buffer	8 stems/100 ft ² (CI _{80%} = 7 – 9)	

Report Introduction

This report summarizes Year-3 of 10 monitoring activities at the State Route (SR) 532 Stanwood Mitigation Site. Included are a site description, the performance standards, an explanation of monitoring methods, and an evaluation of site development. Monitoring activities included vegetation surveys and photo-documentation on August 3rd and 4th, and assessments of wetland hydrology in March and April, 2010.

¹ Estimated values are presented with their corresponding statistical confidence interval. For example, 79% cover (CI_{90%} = 70 – 87%) means we are 90% confident that the true aerial cover value is between 70% and 87%.

What is the SR 532 Stanwood Mitigation Site?

This 4.92-acre WSDOT property (Figure 1) contains established and enhanced wetlands, with an enhanced stream channel and its associated buffer. This site is located west of the Pilchuck River, in the Stillaguamish River basin. This site was established to compensate for 0.12 acre of wetland impacts, 0.08 acre of stream buffer impacts, and 0.63 acre of wetland buffer impacts related to improvements along the SR 532 and I-5 interchange. This site connects adjacent wetland complexes and is intended to provide water quality functions and create habitat for fish and amphibians.

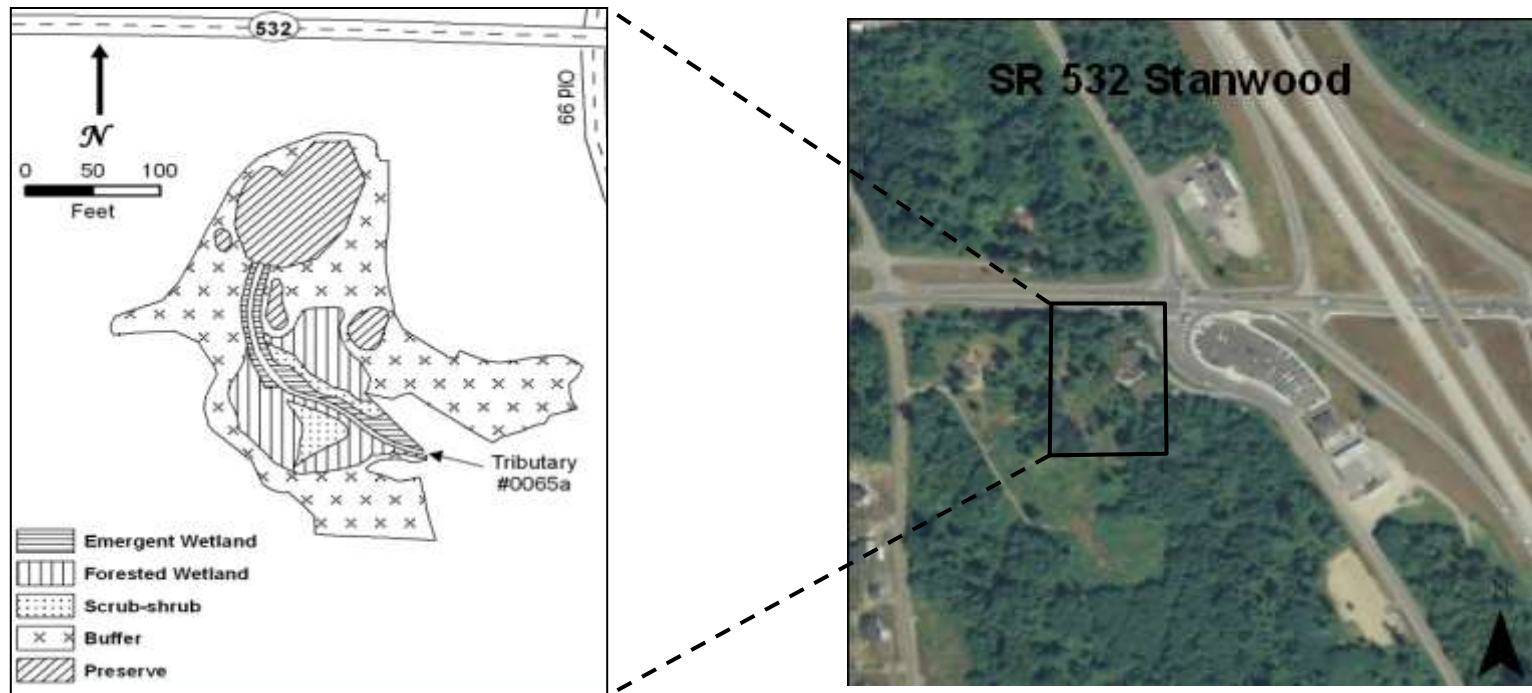


Figure 1 Site Sketch

The SR 532 Stanwood Mitigation Site includes forested, scrub-shrub and emergent wetland areas. Tributary #0065a crosses the established wetland area and connects to adjacent wetlands. Small preserve areas are scattered throughout the buffer.

What are the performance standards for this site?

Performance Standard 1

The soils will be saturated to the surface, or standing water will be present in a monitoring well at 12 inches below the surface or less, for a consecutive number of days greater than or equal to 12.5% of the growing season in years when rainfall meets or exceeds the 30-year average.

Performance Standard 2

The native woody species will maintain an average density of four plants per 100 square feet in scrub-shrub and forested wetland communities.

Performance Standard 3

Native herbaceous facultative or wetter vegetation will achieve 50 percent coverage in emergent wetland communities. Native colonizing vegetation will be included in this coverage calculation.

Performance Standard 4

Snohomish County Class A weeds including reed canarygrass (*Phalaris arundinacea*), non-native blackberries (*Rubus* sp.), and Scot's broom (*Cytisus scorparius*) will not exceed 20 percent coverage in each forested, scrub-shrub and emergent wetland and upland buffer community.

Performance Standard 5

The native woody species will maintain an average density of four plants per 100 square feet in buffer communities.

Appendix 1 provides the complete text of the performance standards for this project, and Appendix 4 shows the planting plan (WSDOT 2005).

How were the performance standards evaluated?

WSDOT staff collected hydrology data using methods described in the *Washington State Wetlands Identification and Delineation Manual* (Ecology 1997) (Performance Standard 1). Five permanent hydrology pit locations were established in Year-1 of monitoring and recorded on a map (Appendix 3, Figure 4). During each monitoring visit, visual observations are made to determine the extent of inundation and surface saturation. Depth and location of standing water is recorded. At each pit location, in the absence of inundation or surface saturation, subsurface observations are made.

To evaluate standards for vegetative cover in the emergent wetland and density in the forested and scrub-shrub wetlands, a baseline was established roughly south to north (Figure 2). Nineteen sampling transects were randomly placed perpendicular to the baseline. The point intercept method was used to determine herbaceous cover (Performance Standard 3) and the unequal belt transect methods was used to determine woody density in the wetland (Performance Standard 2). To evaluate the standard for woody density in the upland buffer, an additional baseline was established from east to west (Figure 3). Twenty-seven transects were placed perpendicular to the baseline. The unequal belt transect methods was used to determine woody density in the buffer (Performance Standard 5). Cover of non-native weeds was qualitatively addressed (Performance Standard 4).

For additional details on the methods, see Appendix 2 of this report or view the [WSDOT Wetland Mitigation Site Monitoring Methods Paper](#) (WSDOT 2008).

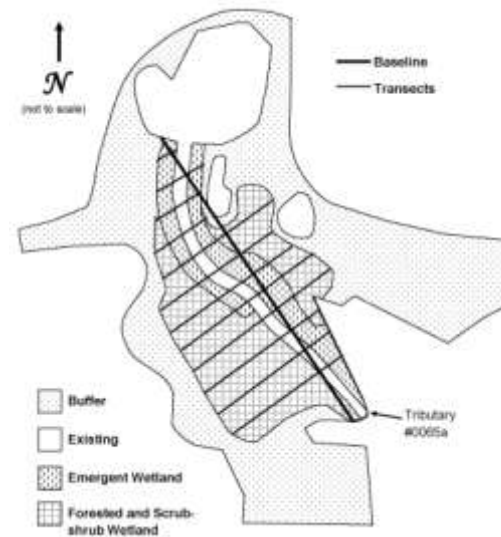


Figure 2 Wetland Sampling Design (2010)

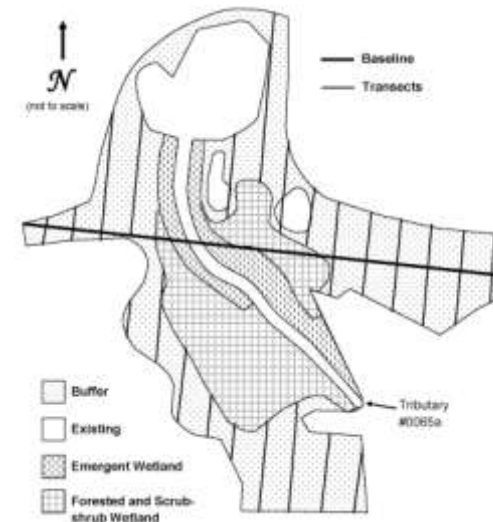


Figure 3 Buffer Sampling Design (2010)

How is the site developing?

This site is developing into a dynamic wetland system. The year-3 vegetation standards have been met and several functions are being supported as this wetland develops. At the time of monitoring, this mitigation site is on track to achieve the Year-5 (2012) vegetation standards. However, continued beaver activity is likely to affect the hydrology and vegetative cover in the future.

The site is providing general habitat for a variety of species. Wetland and upland zones are present as shown on the planting plan and are providing the planned interspersion and increased edge habitat. Several species of birds and two nests were observed. Coyote scat, garter snakes, and small rodents were observed as well as a red legged frog and a pacific tree frog. During the summer monitoring visits, beaver activity was observed. Five dams and a lodge have been built on the stream which has created a large area of standing water on the southeast end of the site. The change in site inundation due to beaver activities may affect the development of the plant communities over time.

Flood attenuation, sediment removal, toxicant and nutrient removal and production/export of organic matter are other functions present at this site. Plant establishment activities and the presence of beaver on site have likely enhanced these functions by increasing water storage capacity and residence time.

Results for Performance Standard 1
(Wetland Hydrology):

Hydrology visits in the month of March and April, 2010 show we did not achieve the hydrology standard this year. Several of five pits did not meet the wetland hydrology criteria (see results in Appendix 3, Table 1). However, the antecedent weather conditions showed that there was limited precipitation in late February and into March. This may explain not meeting the performance standard. Beaver have since moved onto the site building dams and impounding water making the site considerably wetter (Photo 1).

Results for Performance Standard 2
(Native woody density of 4 plants/100 ft² in the scrub-shrub and forested wetland):

The density of native woody species in the scrub-shrub and forested wetland communities is 6 stems/100 ft² (CI_{80%} = 6 – 7) (Photo 2). Most plantings appear to be thriving. The dominant species in these areas include redosier dogwood (*Cornus sericea*), black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), and willows (*Salix* spp.).

Results for Performance Standard 3
(50% cover in the emergent wetland):

The cover of herbaceous species in the emergent zone is 79% cover (CI_{90%} = 70 – 87%). Dominant species include slough sedge (*Carex obnupta*), and small-fruited bulrush (*Scirpus microcarpus*). The emergent zone appears to be thriving on both sides of the stream (Photo 3 – next page). A thick understory of herbaceous vegetation is developing in the scrub-shrub area as

well. The emergent zone is changing in shape and location due to the presence of beaver on the stream.



Photo 1 Beaver dam (August 2010)



Photo 2 Woody cover in the scrub-shrub wetland (August 2010)

Results for Performance Standard 4

(No more than 20% cover of Snohomish County Class A weeds including reed canarygrass, non-native blackberries, and Scot’s broom in each zone):

This standard was addressed qualitatively due to the low cover of Class A weeds observed on site. The wetland communities have an estimated invasive cover of less than five percent, mostly scattered reed canarygrass (*Phalaris arundinacea*). The buffer has an estimated invasive cover of ten percent. This zone has large patches of Canada thistle (*Cirsium arvense*) in the south end of the site. Many of the preservation areas have an understory of Himalayan blackberry (*Rubus armeniacus*). These areas have been targeted by WSDOT restoration crews and will be monitored closely.

Results for Performance Standard 5

(Native woody density of 4 plants/100 ft² in the upland buffer):

The buffer community has a native woody species density of 8 stems/100 ft² (CI_{80%} = 7 – 9). All plantings appeared to be thriving (Photo 4). Dominant species include salmonberry (*Rubus spectabilis*), red alder (*Alnus rubra*), western red cedar (*Thuja plicata*), bigleaf maple (*Acer macrophyllum*), and vine maple (*Acer circinatum*). Plant height is estimated at one to three meters tall.



Photo 3 Cover in the emergent wetland (August 2010)



Photo 4 Woody cover in the upland buffer (August 2010)

What is planned for this site?

Continued weed control is planned through the 2011 growing season. The site will be monitored to document the effects the presence of beaver will have on the functions of the site and the achievement of future performance standards.

Appendix 1 – Goals and Performance Standards

The following excerpt is from the *I-5/SR 532 Interchange Improvements Milepost (MP) 212.35 to NP 212.88 Final Wetland Mitigation Report* (WSDOT 2005). The performance criteria addressed this year are identified in **bold** font.

Regulatory Compliance

The proposed mitigation site will be monitored for ten years to demonstrate the provision of intended functions. Goals describe the overall intent of mitigation efforts and objectives and describe individual components of the mitigation site in detail. Interim performance measures and success standards describe specific on-site characteristics that indicate a function is being provided. Interim performance measures are used to guide management of the mitigation site. Success standards are thresholds to be measured during the final year of the monitoring period that demonstrate the site has complied with regulatory requirements and is providing intended functions. Contingency plans describe what actions can be taken to correct site deficiencies.

Goals

The goal of the proposed compensatory mitigation is to replace wetland types, acreage and functions lost due to wetland impacts associated with the proposed project. The proposed mitigation intends to create a depressional out-flow and riverine flow-through wetland that contains forested, scrub-shrub, and emergent communities.

Functions and Values

The created and enhanced wetlands are anticipated to provide the functions listed below.

Flood Flow Alteration

The proposed wetland mitigation area is adjacent to several existing wetlands associated with an unnamed tributary to Pilchuck Creek. The on-site excavation required to maintain hydric conditions will provide greater floodwater storage than what currently exists. The installation of woody and herbaceous vegetation, incorporation of organic soil amendments and removal of structures will provide a reduction in precipitation runoff over the currently large landscaped lawn areas, driveways and trails.

Sediment Removal

The mitigation area is adjacent to existing roadways and a gravel driveway that may provide a source of sediments. Where planting is intended, the mitigation area will be amended, seeded with a grass mixture following grading operations, and mulched. Forested, scrub-shrub and emergent vegetation will be installed the first planting season following seeding to provide sediment removal. The removal of the gravel driveway and subsequent seeding will increase this function.

Nutrient/Toxicant Removal

The mitigation area is adjacent to existing roadways, a gravel driveway and a sewage drain field that provides a source of toxicants. Current lawn maintenance and the point source raw sewage on the mitigation site and adjacent properties provide a source of nutrients, fertilizers and pesticides. A site design that reduces and retains surface water flows, incorporates organic materials into the soil and increases herbaceous and woody plant cover will provide this function. In addition, the sewage drainage system at this site will be permanently removed.

Production/Export of Organic Matter

The mitigation area will be planted with a dense cover of herbaceous and deciduous woody vegetation that will provide a reliable source of decomposed and/or suspended organic material. The site will be graded to allow an outflow to an existing wetland/stream complex to the south and eventually, to tributary 05-0065.

General Habitat Suitability

The mitigation area is comprised of three Cowardin classes, and will contain five wetland and three upland vegetative communities, which will increase the available wildlife forage material. These plant communities will be interspersed to increase edge habitat. The site will be graded to include areas of semi-permanently standing water and areas of seasonally saturated soils.

Habitat for Amphibians

The mitigation site will be graded to provide connectivity to the existing wetlands to the south and tributary 05-0065a, as well as to areas of seasonal standing water and seasonally saturated soils. Finished grade elevations have been set to reduce the possibility of permanent standing water and, therefore, the likelihood of bullfrog breeding.

Fish Habitat

The mitigation will increase available habitat for fish by constructing a new stream channel, increasing habitat area and providing additional winter refugia for fish. The mitigation will increase shade and canopy closure over the stream, while enhancing potentials for recruiting large woody debris and detrital input to Pilchuck Creek and associated tributaries in this area.

Objectives, Interim Performance Measures and Success Standards

The following list describes the thresholds that will determine site success and guide management.

Objective 1 – Hydrology

The mitigation sites will provide ground or surface water inundation or saturation sufficient to support the wetland sites.

Interim Performance Measure

Years 1-9

- **The soils will be saturated to the surface, or standing water will be present in a monitoring well at 12 inches below the surface or less, for a consecutive number of days greater than or equal to 12.5% of the growing season in years when rainfall meets or exceeds the 30-year average. Wetland hydrology will be determined using indicators of wetland hydrology), as listed in the *Washington State Wetlands Identification and Delineation Manual (Ecology) publication #96-94.***

Year 5

- The wetland areas will be delineated using current methodology to assure that the mitigation site contains 0.34 (0.337 rounded to the nearest hundredth) acre of wetland area in total.

Success Standard

Year 10

The wetland areas will be delineated using current methodology to assure that the mitigation site contains 0.34 acre of wetland in total (Table 10).

Objective 2 – Wetland Vegetation

The mitigation site will include a total of approximately 0.33 acres of new emergent, scrub-shrub and forested wetland vegetation, 0.007 acre of enhanced wetland vegetation.

Interim Performance Measure

Year 1

- The vegetation will achieve 100 percent survival of planted woody species at the end of the first year plant establishment period. If all dead woody species plantings are replaced, the performance measure will be met.
- Snohomish County Class A weeds including reed canarygrass (*Phalaris arundinacea*), non-native blackberries (*Rubus* sp.), and Scot’s broom (*Cytisus scorparius*) will not exceed 20 percent coverage in each forested, scrub-shrub and emergent wetland community.

Year 3

- **The native woody species will maintain an average density of four plants per 100 square feet in scrub-shrub and forested wetland communities.**

- **Native herbaceous facultative or wetter vegetation will achieve 50 percent coverage in emergent wetland communities. Native colonizing vegetation will be included in this coverage calculation.**
- **Snohomish County Class A weeds including reed canarygrass (*Phalaris arundinacea*), non-native blackberries (*Rubus* sp.), and Scot's broom (*Cytisus scorparius*) will not exceed 20 percent coverage in each forested, scrub-shrub and emergent wetland community. If coverage by native plant species falls below 80 percent, then contingency actions shall be implemented and the invasive species list shall be evaluated to determine if additional invasive species should be controlled.**

Year 5

- Native herbaceous facultative or wetter vegetation will achieve 65 percent coverage in emergent wetland communities. Native colonizing vegetation will be included in this coverage calculation.
- Native facultative or wetter woody species will achieve 35 percent cover in each PSS or PFO community. Native colonizing vegetation will be included in this coverage calculation.
- Snohomish County Class A weeds including reed canarygrass (*Phalaris arundinacea*), non-native blackberries (*Rubus* sp.), and Scot's broom (*Cytisus scorparius*) will not exceed 20 percent coverage in each forested, scrub-shrub and emergent wetland community. If coverage by native plant species falls below 80 percent of the success standard, then contingency actions shall be implemented and the invasive species list shall be evaluated to determine if additional invasive species should be controlled.
- Three native facultative or wetter vegetation species will achieve 5 percent or greater relative cover in the PSS and PFO communities combined.
- Relative cover of red alder will be less than 30% in the wetland creation and enhancement areas.

Year 7

- Native herbaceous facultative or wetter vegetation will achieve 75 percent coverage in emergent wetland communities. Native colonizing vegetation will be included in this coverage calculation.
- Native facultative or wetter woody species will achieve 50 percent cover in each PSS and PFO community. Native colonizing vegetation will be included in this coverage calculation.
- Snohomish County Class A weeds including reed canarygrass (*Phalaris arundinacea*), non-native blackberries (*Rubus* sp.), and Scot's broom (*Cytisus scorparius*) will not exceed 20 percent coverage in each forested, scrub-shrub and emergent wetland community. If coverage by native plant species falls below 80 percent of the success standard, then contingency actions shall be implemented and the invasive species list shall be evaluated to determine if additional invasive species should be controlled.

- Three native facultative or wetter vegetation species will achieve 6 percent or greater relative cover in the PSS and PFO communities combined.
- Relative cover of red alder will be less than 30% in the wetland creation and enhancement areas.

Success Standards

Year 10

- Native herbaceous facultative or wetter vegetation will achieve 75 percent coverage in emergent wetland communities. Native colonizing vegetation will be included in this coverage calculation.
- Native facultative or wetter woody species will achieve 75 percent cover in each PSS and PFO community. Native colonizing vegetation will be included in this coverage calculation.
- Snohomish County Class A weeds including reed canarygrass (*Phalaris arundinacea*), non-native blackberries (*Rubus* sp.), and Scot's broom (*Cytisus scorparius*) will not exceed 20 percent coverage in each forested, scrub-shrub and emergent wetland community. If coverage by native plant species falls below 80 percent of the success standard, then contingency actions shall be implemented and the invasive species list shall be evaluated to determine if additional invasive species should be controlled.
- Three native facultative or wetter vegetation species will achieve 8 percent or greater relative cover in the PSS and PFO communities combined.
- Relative cover of red alder will be less than 30% in the wetland creation and enhancement areas.

Objective 2 – Buffer Vegetation

The mitigation site will include a total of approximately 0.79 acre of upland buffer vegetation.

Interim Performance Measure

Year 1

- The vegetation will achieve 100 percent survival of planted woody species at the end of the first year plant establishment period. If all dead woody species plantings are replaced, the performance measure will be met.
- Snohomish County Class A weeds including reed canarygrass (*Phalaris arundinacea*), non-native blackberries (*Rubus* sp.), and Scot's broom (*Cytisus scorparius*) will not exceed 20 percent coverage in the upland buffer community.

Year 3

- **The native woody species will maintain an average density of four plants per 100 square feet in buffer communities.**

- **Snohomish County Class A weeds including reed canarygrass (*Phalaris arundinacea*), non-native blackberries (*Rubus* sp.), and Scot's broom (*Cytisus scorparius*) will not exceed 20 percent coverage in the upland buffer community.**

Year 5

- Native upland buffer woody species will achieve a minimum of 15 percent coverage in each upland buffer community. Native colonizing vegetation will be included in this coverage calculation.
- Snohomish County Class A weeds including reed canarygrass (*Phalaris arundinacea*), non-native blackberries (*Rubus* sp.), and Scot's broom (*Cytisus scorparius*) will not exceed 20 percent coverage in the upland buffer community.
- Three native upland vegetation species each will achieve at least 5 percent relative cover in the buffer community.
- Relative cover of red alder will be less than 30 percent in the upland buffer community.

Year 7

Native herbaceous facultative or wetter vegetation will achieve a minimum of 35 percent coverage in each upland buffer community. Native colonizing vegetation will be included in this coverage calculation.

- Snohomish County Class A weeds including reed canarygrass (*Phalaris arundinacea*), non-native blackberries (*Rubus* sp.), and Scot's broom (*Cytisus scorparius*) will not exceed 20 percent coverage in the upland buffer community.
- Three native upland vegetation species each will achieve at least 6 percent relative cover in the buffer community.
- Relative cover of red alder will be less than 30 percent in the upland buffer community.

Success Standards

Year 10

Native upland buffer woody species will achieve a minimum of 50 percent coverage in each upland buffer community. Native colonizing vegetation will be included in this coverage calculation.

- Snohomish County Class A weeds including reed canarygrass (*Phalaris arundinacea*), non-native blackberries (*Rubus* sp.), and Scot's broom (*Cytisus scorparius*) will not exceed 20 percent coverage in the upland buffer community.
- Three native upland vegetation species each will achieve at least 8 percent relative cover in the buffer community.
- Relative cover of red alder will be less than 30 percent in the upland buffer community.

Objective 3 – Wildlife

Wildlife cover and forage availability for birds and mammals should increase substantially. The addition of fruit and nut bearing shrubs and six logs with branches will increase habitat diversity for fish and wildlife and structural complexity in newly vegetated areas and the newly created stream channel. Overall, creating emergent, scrub-shrub and forested wetland communities and

enhancing upland buffer areas should provide feeding, breeding and nesting habitat for passerines, raptors, waterfowl and shorebirds, small and larger mammals, and salamanders, frogs, toads, snakes and turtles.

Interim Performance Measure

Year 1

Habitat structures as shown on the plans have been installed.

Year 3

Vegetation standards in Objective 2 apply.

Year 7

Vegetation standards in Objective 2 apply.

Success Standards

Year 10

Vegetation standards in Objective 2 apply.

Monitoring Plan

All wetland creation and enhancement, and buffer enhancement areas will be monitored for a minimum of ten years. Formal monitoring procedures will be performed in years one, three, five, seven and ten after Initial Acceptance of the mitigation construction. The site should be evaluated informally the summer following plant installation to evaluate survival rates and to document the presence of any non-native invasive species. A monitoring report will be submitted to the Corps of Engineers, Washington State Department of Ecology, Snohomish County and other resource agencies for review and comment for monitoring years one, three, five, seven and ten. Successful mitigation will be measured by attainment of the success standards described in this mitigation plan document, unless WSDOT, in conclusion with the regulatory agencies, establish replacement standards based on circumstances and conditions observed at the mitigation site. Monitoring will cease as soon as all success standards have been attained.

Contingency Plan

WSDOT anticipates the mitigation goals will be achieved with the construction and installation of the mitigation design as shown on the grading and planting plans and detail sheets. However, contingency actions may be needed to correct unforeseen problems.

Hydrology

Failure to meet the proposed hydrology standard of success may result in some or all of the following contingency actions:

- Consult wetland experts and permitting agencies to determine an appropriate course of action.
- Grading revision – Site elevations may need to be adjusted in order to achieve specified water depths across the site.

Vegetation

Failure to meet the proposed vegetation standard of success will result in some or all of the following contingency actions:

- Plant additional vegetation – Additional vegetation planting may be required to meet cover or plant survival standards. Plant species will be evaluated in relation to site conditions to determine if plant substitutions will be required.
- Weed control – Control of competitive weed species may be required if plant survival or cover standards are not met. Methods of weed control could include hand or mechanical weeding, mulching or herbicide application.
- Herbivore control – If vegetation cover or survival standards are not met because of animal browse, the wildlife responsible will be identified and appropriate damage control methods employed. Possible control methods include fencing, use of repellents and temporary barriers.

Wildlife Structures

Wildlife structures will be installed during construction activities and will be monitored to verify condition.

- Replace or repair missing or damaged structures – If habitat structures are vandalized, missing or damaged in any way, they will be repaired or replaced as necessary.

Maintenance

The goal of the proposed mitigation is to create a functional, self-sustaining system that requires little or no maintenance.

WSDOT will retain ownership of the sites in perpetuity. Maintenance will be conducted on an as-needed basis by WSDOT personnel or designates and can include weeding, mulching, fertilizing, maintaining access, repairing vandalism or fencing, correcting erosion or sedimentation problems, collecting trash and managing Snohomish County-listed noxious weeds.

Supplemental water will be applied as necessary the first year following plant installation. This supplemental watering schedule includes care of all replacement plants installed during the monitoring period.

Appendix 2 – Methods

WSDOT staff collected hydrology data using methods described in the *Washington State Wetlands Identification and Delineation Manual* (Ecology 1997) (Performance Standard 1). Five permanent hydrology pit locations were established in Year-1 of monitoring and recorded on a map. During each monitoring visit, visual observations are made to determine the extent of inundation and surface saturation. Depth and location of standing water is recorded. At each pit location, in the absence of inundation or surface saturation, subsurface observations are made.

To assess wetland woody density and herbaceous cover standards, a 64-meter baseline was established east to west through the middle of the site. Nineteen temporary sampling transects were placed perpendicular to the baseline using a systematic random sampling method (Figure 2). Density of woody species in the forested and scrub-shrub zones (Performance Standard 2) was assessed using the unequal belt transect method. The point intercept method was used to determine aerial cover of herbaceous species in the emergent zone (Performance Standard 3). To determine cover in the emergent wetland, 19 randomly positioned four-meter point-line sample units (20 points each) were placed along sampling transects in this zone.

To assess woody density in the upland buffer, an additional 137-meter baseline was established approximately south to north through the site. Twenty-seven temporary sampling transects were placed perpendicular to the baseline using a systematic random sampling method (Figure 3). Density in the buffer was then assessed using the unequal belt transect method (Performance Standard 5). Invasive cover across the site was addressed qualitatively.

Sample size analysis confirmed sufficient sampling had been completed based on site sampling objectives and the desired level of statistical confidence. The sample size equation shown here (below) was used to perform the analysis on data collected (Performance Standard 3). In this equation, the precision level (*B*) equals half the maximum acceptable confidence interval width multiplied by the sample mean.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

n = unadjusted sample size
z = standard normal deviate
s = sample standard deviation
B = precision level

For additional details on the methods view the [WSDOT Wetland Mitigation Site Monitoring Methods Paper](#) (WSDOT 2008)

Appendix 3 – Data Tables

Table 1 Hydrology Observations

Date	Surface Observations	Subsurface Observations	
		Pit	Observations
March 2, 2010	No saturation or inundation throughout the site, except small patches along the creek.	Pit 1	Standing water at 9"
		Pit 2	No saturation observed
		Pit 3	Standing water at 11"
		Pit 4	Standing water at 13"
		Pit 5	Standing water at 8.5"
March 16, 2010	No inundation or saturation except for the creek.	Pit 1	No saturation or inundation observed
		Pit 2	Standing water at 16", saturation at 13"
		Pit 3	No saturation observed
		Pit 4	Standing water at 15", saturation at 4" to 7"
		Pit 5	Standing water at 12", saturation at 3" to 6"
April 1, 2010	Very little surface hydrology present at the time of site visit. Some saturation observed in lowest area of the PSS. Water flowing through the stream channel.	Pit 1	No saturation observed
		Pit 2	Standing water at 12"
		Pit 3	Saturation at 6" to 9"
		Pit 4	Standing water at 16", saturation at 12"
		Pit 5	Standing water at 11"

Table 2 Precipitation data from January 1, 2010 to April 1, 2010. Weather station KWAARLIN11 near Arlington, WA.

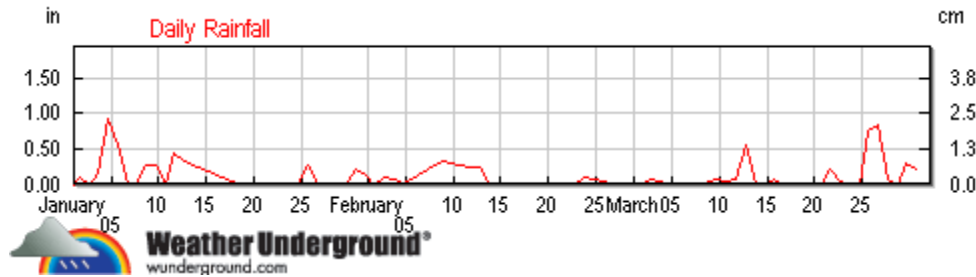
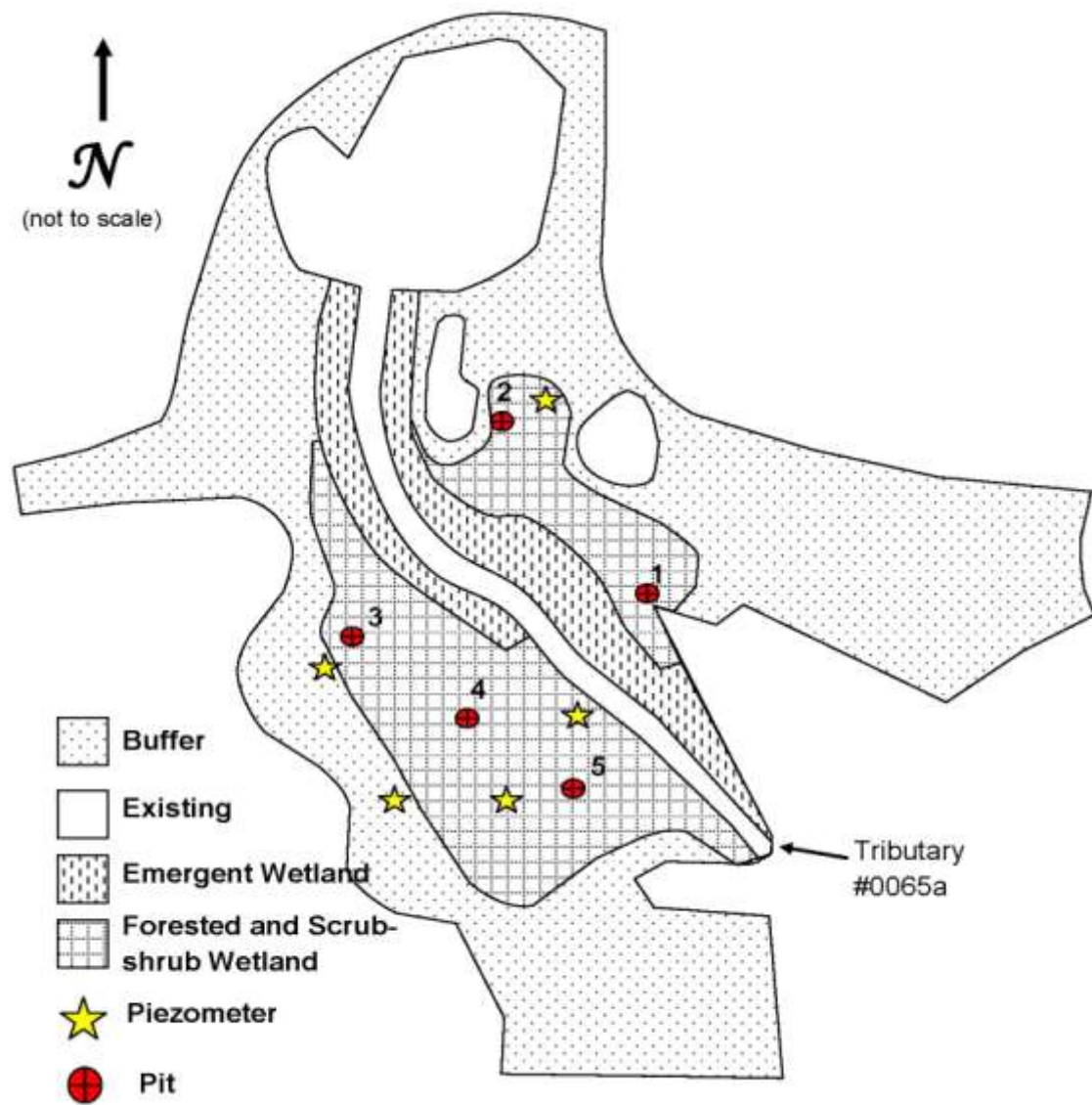
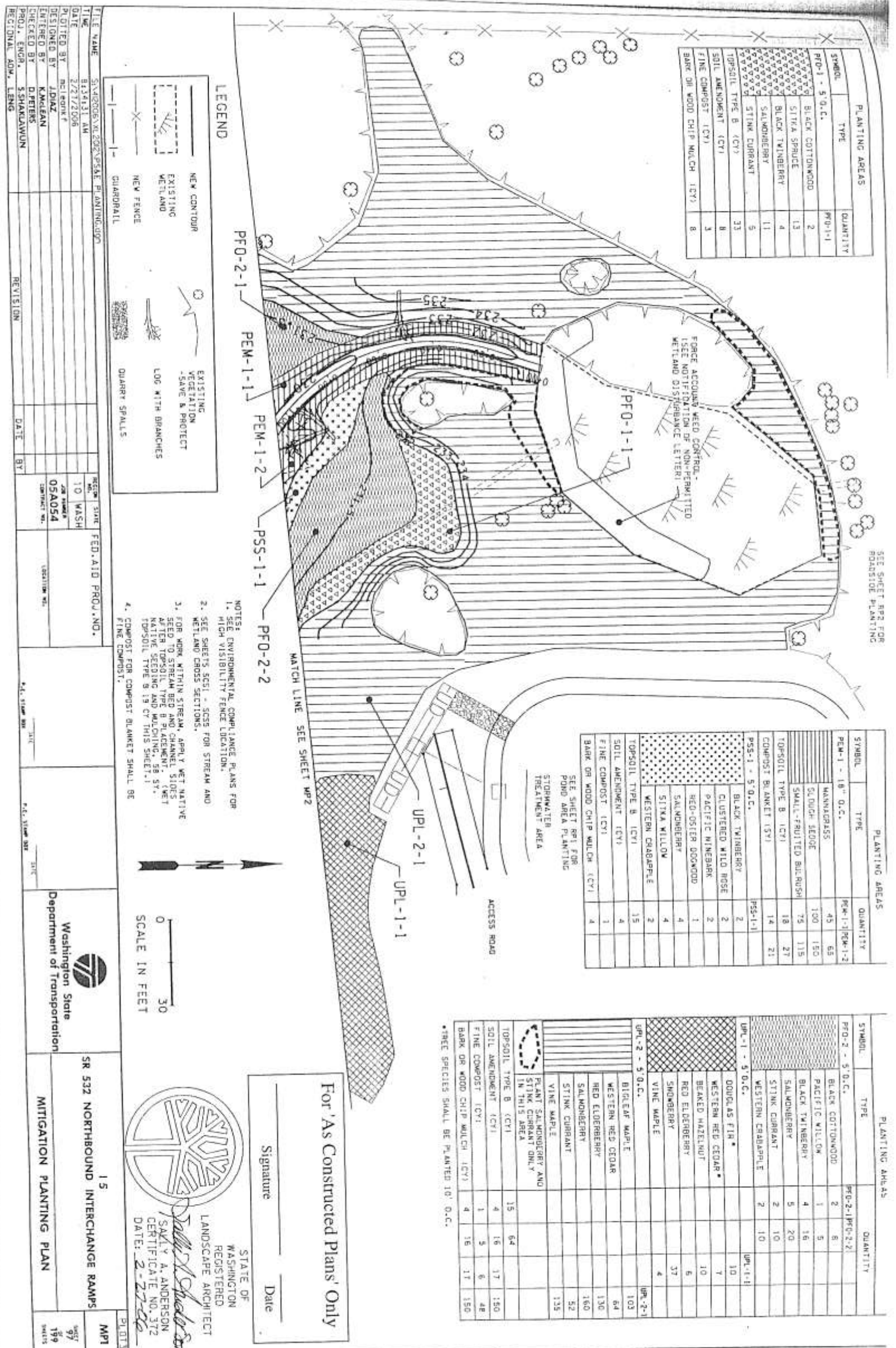


Figure 4. Hydrology Monitoring Pits

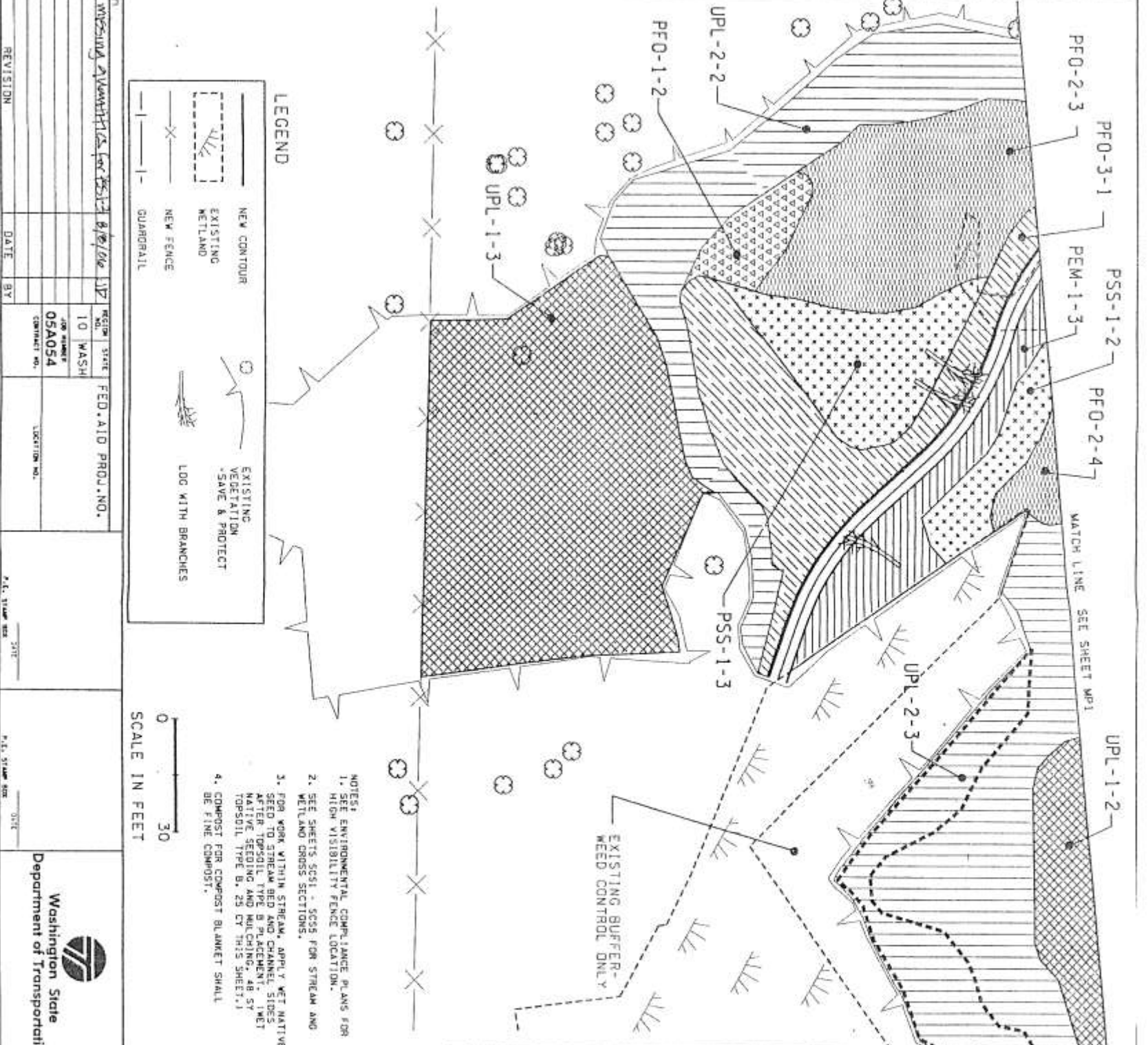


Appendix 4 – Planting Plan

(WSDOT 2005)



PLANTING AREAS		TYPE	QUANTITY
PF0-1-1	18" O.C.	PEM-1-3	105
MANNAGRASS			240
SLOUGH SEDGE			190
SMALL-FRUITED BULRUSH			45
TOPSOIL TYPE B (CY)			34
COMPOST BLANKET (5Y)			3
PF0-1-2	5' O.C.	PSS-1-2	4
BLACK TIMBERBERRY			9
CLUSTERED WILD ROSE			3
PACIFIC NINEBARK			3
RED-OSIER DOGWOOD			1
SALMONBERRY			7
SITKA WILLOW			7
WESTERN CRABAPPLE			3
TOPSOIL TYPE B (CY)			28
SOIL AMENDMENT (CY)			6
FINE COMPOST (CY)			2
BARK OR WOOD CHIP MULCH (CY)			6
PF0-1-3	5' O.C.	UPL-1-2	1
BLACK COTTONWOOD			8
SITKA SPRUCE			2
BLACK TIMBERBERRY			7
SALMONBERRY			3
STINK CURRANT			20
TOPSOIL TYPE B (CY)			5
SOIL AMENDMENT (CY)			2
FINE COMPOST (CY)			5
BARK OR WOOD CHIP MULCH (CY)			5
PF0-2-1	5' O.C.	PF0-2-3	14
BLACK COTTONWOOD			1
PACIFIC WILLOW			8
BLACK TIMBERBERRY			27
SALMONBERRY			34
STINK CURRANT			17
WESTERN CRABAPPLE			16
TOPSOIL TYPE B (CY)			107
SOIL AMENDMENT (CY)			27
FINE COMPOST (CY)			9
BARK OR WOOD CHIP MULCH (CY)			27
PF0-3-1	18" O.C.	PF0-3-1	425
PACIFIC WILLOW			125
LIVE STAKES			425
MANNAGRASS			250
SLOUGH SEDGE			250
SMALL-FRUITED BULRUSH			101
TOPSOIL TYPE B (CY)			101
COMPOST BLANKET (5Y)			76



PLANTING AREAS

SYMBOL	TYPE	QUANTITY
UPL-1-1	5' O.C.	UPL-1-2
DOUGLAS FIR		34
WESTERN RED CEDAR		5
BEAKED HAZELNUT		6
RED ELDERBERRY		4
SNOWBERRY		25
VINE MAPLE		3
UPL-2-1	5' O.C.	UPL-2-2
BIOLEAF MAPLE		22
WESTERN RED CEDAR		14
RED ELDERBERRY		27
SALMONBERRY		34
STINK CURRANT		11
VINE MAPLE		28
PLANT SALMONBERRY AND STINK CURRANT ONLY IN THIS AREA		50
SOIL AMENDMENT (CY)		4
FINE COMPOST (CY)		20
BARK OR WOOD CHIP MULCH (CY)		12
		61
		32
		50

PLANTING AREAS

SYMBOL	TYPE	QUANTITY
PF0-1-1	18" O.C.	PEM-1-3
MANNAGRASS		240
SLOUGH SEDGE		190
SMALL-FRUITED BULRUSH		45
TOPSOIL TYPE B (CY)		34
COMPOST BLANKET (5Y)		3
PF0-1-2	5' O.C.	PSS-1-2
BLACK TIMBERBERRY		9
CLUSTERED WILD ROSE		3
PACIFIC NINEBARK		3
RED-OSIER DOGWOOD		1
SALMONBERRY		7
SITKA WILLOW		7
WESTERN CRABAPPLE		3
TOPSOIL TYPE B (CY)		28
SOIL AMENDMENT (CY)		6
FINE COMPOST (CY)		2
BARK OR WOOD CHIP MULCH (CY)		6
PF0-1-3	5' O.C.	UPL-1-2
BLACK COTTONWOOD		8
SITKA SPRUCE		2
BLACK TIMBERBERRY		7
SALMONBERRY		3
STINK CURRANT		20
TOPSOIL TYPE B (CY)		5
SOIL AMENDMENT (CY)		2
FINE COMPOST (CY)		5
BARK OR WOOD CHIP MULCH (CY)		5
PF0-2-1	5' O.C.	PF0-2-3
BLACK COTTONWOOD		14
PACIFIC WILLOW		1
BLACK TIMBERBERRY		27
SALMONBERRY		34
STINK CURRANT		17
WESTERN CRABAPPLE		16
TOPSOIL TYPE B (CY)		107
SOIL AMENDMENT (CY)		27
FINE COMPOST (CY)		9
BARK OR WOOD CHIP MULCH (CY)		27
PF0-3-1	18" O.C.	PF0-3-1
PACIFIC WILLOW		125
LIVE STAKES		425
MANNAGRASS		250
SLOUGH SEDGE		250
SMALL-FRUITED BULRUSH		101
TOPSOIL TYPE B (CY)		101
COMPOST BLANKET (5Y)		76

LEGEND

- NEW CONTOUR
- EXISTING WETLAND
- NEW FENCE
- GUARDRAIL
- EXISTING VEGETATION - SAVE & PROTECT
- LOG WITH BRANCHES

NOTES

- SEE ENVIRONMENTAL COMPLIANCE PLANS FOR HIGH VISIBILITY FENCE LOCATION.
- SEE SHEETS 0291 - 0295 FOR STREAM AND WETLAND CROSS SECTIONS.
- FOR WORK WITHIN STREAM, APPLY NET NATIVE SEED TO STREAM BED AND CHANNEL SIDES AFTER TOPSOIL TYPE B PLACEMENT. IMIT NATIVE SEEDING AND MULCHING - 48 SY TOPSOIL TYPE B, 25 CY THIS SHEET, 1 TOPSOIL TYPE B, 25 CY THIS SHEET, 1 BE FINE COMPOST.
- COMPOST FOR COMPOST BLANKET SHALL BE FINE COMPOST.

For 'As Constructed Plans' Only

Signature: _____ Date: _____

STATE OF WASHINGTON REGISTERED LANDSCAPE ARCHITECT
SALLY A. ANDERSON
CERTIFICATE NO. 372
DATE: 2-27-06

Department of Transportation
Washington State

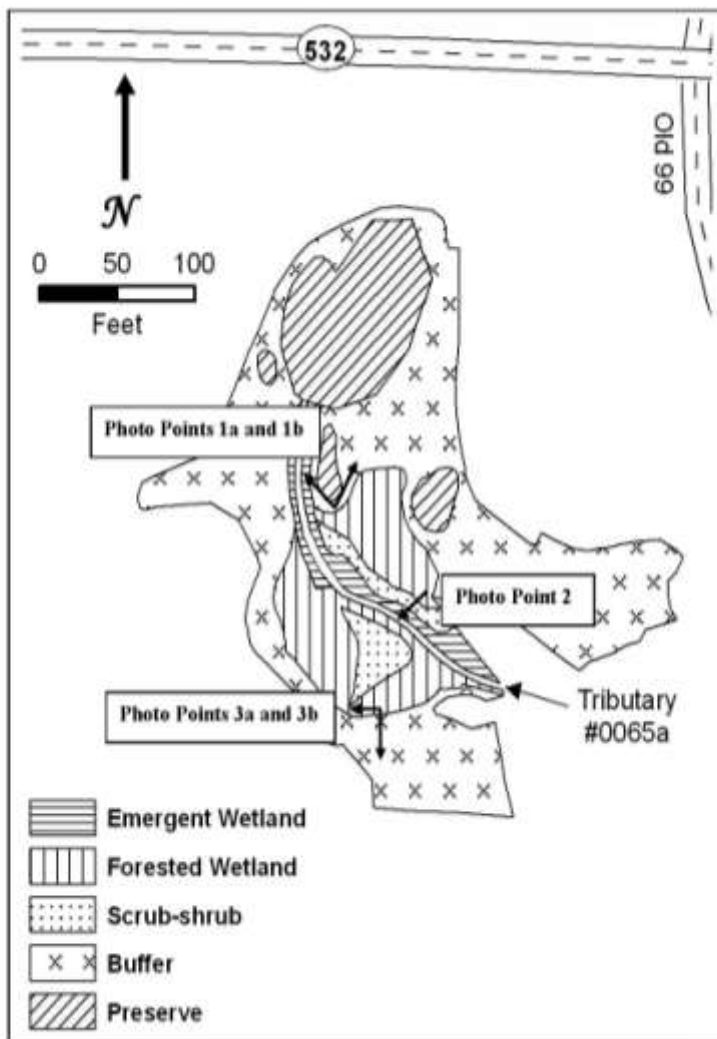
SR 532 NORTHBOUND INTERCHANGE RAMPS
MITIGATION PLANTING PLAN

SCALE IN FEET: 0, 30

PLANTING AREAS

03-

Appendix 5 – Photo Points



The photographs below were taken from permanent photo-points on August 4, 2010 and document current site development.



Photo Point 1a



Photo Point 1b



Photo Point 2



Photo Point 3a



Photo Point 3

Literature Cited

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5. Washington State Department of Transportation (WSDOT). 2005. I-5/SR 532 Interchange Improvements Milepost (MP) 212.35 to MP 212.88 Planting Plan. WSDOT, Northwest Region Biology, Seattle, WA.
6. Washington State Department of Transportation (WSDOT) WSDOT Wetland Mitigation Site Monitoring Methods (12 June 2008). <http://www.wsdot.wa.gov/NR/rdonlyres/C211AB59-D5A2-4AA2-8A76-3D9A77E01203/0/MethodsWhitePaper052004.pdf>
7. Weather Underground [Internet]. 2010. Weather history data – Washington State weather stations. Available from: <http://www.wunderground.com/weatherstation/ListStations.asp?selectedState=WA&selectedCountry=United+States>