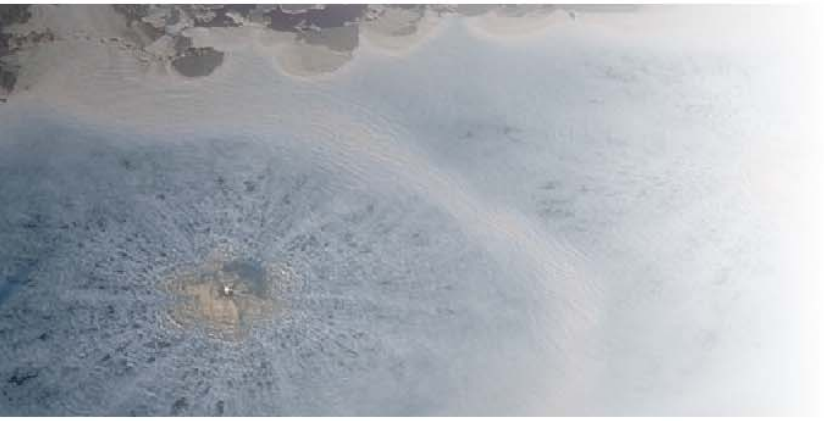

2009 (Year 2) Monitoring Report
Santosh Landfill
Wetland Mitigation Project
Scappoose, Oregon

Prepared for
Oregon Department of
Environmental Quality

December 30, 2009
15563-02/Task 4

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Scappoose, Oregon

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15563-02/Task 4

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2009 (YEAR 2) MONITORING REPORT
SANTOSH LANDFILL
WETLAND MITIGATION PROJECT
SCAPPOOSE, OREGON

1.0 INTRODUCTION

This Year 2 monitoring report documents the mitigation site conditions in 2009 at the Santosh Landfill in Scappoose, Oregon. The Santosh Landfill is currently being maintained by the Oregon Department of Environmental Quality (DEQ). The project area is located west of Hogan Ranch Road across from the Glacier Northwest facility, and is located in Section 31 of Township 4 North, Range 1 West in Scappoose, Oregon (Figure 1).

In this report, we summarize the site conditions for the wetland enhancement area and present results of the monitoring compared to the performance standards described in the approved mitigation plan. This monitoring report is being submitted to comply with permit conditions. We will complete future mitigation monitoring reports in years 3, 4 and 5. The monitoring schedule is presented in Table 1.

1.1 Background

In 2007, we completed repair of leachate seeps observed at three locations along the southern perimeter of the landfill. The repair work resulted in the filling of 0.04 acres or 1,900 square feet of wetland used as grazed pasture.

We identified a mitigation site located near the southwestern corner of the landfill as mitigation for the permanent wetland impacts. The mitigation site includes 0.13 acre (5,700 square feet) of wetland enhancement. The wetland mitigation plan was designed to replace the lost wetland area and provide additional wetland functions by enhancing the existing degraded wetland. The approved mitigation plan which included grading, plantings, and fencing was implemented in 2007.

Prolonged inundation from November 2007 through a large portion of 2008 resulted in plant loss within the mitigation area. The high water levels appeared to affect many of the trees and shrubs planted in the mitigation area, the emergent (herbaceous) vegetation remained healthy and growing well. In November 2008, replacement plant stock was installed throughout the site. The replanting efforts appear to have been largely successful resulting in increased cover of native plants.

This compensatory wetland monitoring report has been prepared to meet the permit requirements for the U.S. Army Corps of Engineers and the Oregon Department of State Lands (DSL) under wetland fill application number 38390-RF. We present the results of our Year 2 monitoring in Section 3.

1.2 Project Goals and Objectives

The project goals and objectives include providing mitigation for project impacts in the form of enhancement of the existing wetland complex adjacent to the Santosh Landfill to achieve "no net loss" of wetland functions and to increase wetland functions through the creation of more diverse habitat and plant communities. The project provides vegetation and hydrologic enhancements improving water quality, increasing flood storage, and enhancing the natural biological support functions of the wetland compared to pre-construction conditions.

The main project goals include: 1) enhancing the degraded wetland through installation of native vegetation, 2) creating a permanently inundated area, and 3) providing wildlife habitat. We identified performance criteria and established standards for each criterion to evaluate the success of the wetland mitigation in the approved Compensatory Wetland Mitigation Plan (Hart Crowser 2007). The four performance criteria and their standards for this wetland enhancement project include:

- Total areal cover of native plants: 40 to 50 percent in Year 2 to a minimum of 80 percent in Year 5;
- Survival of installed plants: 80 percent in Year 2 and each subsequent year;
- Total areal cover of invasive species: less than 20 percent each year; and
- Presence of inundation within the open water portion of the mitigation area during the early growing season and late summer.

This monitoring report describes the project's progress in achieving the goals and objectives outlined in the approved mitigation plan as well as the above performance standards to measure the project's success over time.

2.0 MONITORING LOCATIONS AND METHODS

The DSL requires a minimum 5-year monitoring period for mitigation activities (OAR 141-085-0151(3)). Mitigation site monitoring includes quantitative and qualitative data collection to measure the success of the proposed mitigation.

2.1 Wetland Hydrology Monitoring

A number of qualitative and quantitative observations on hydrology were recorded during our spring hydrology site visit and fall vegetation data collection. Hydrology observations included surface water coverage, surface water depth, and depth to groundwater in each planting area.

2.2 Vegetation Monitoring Transects

The wetland enhancement plant communities were sampled along three permanent vegetation transects that provide coverage of the forested, scrub/shrub, and emergent plant communities. A tape measure was extended along each vegetation transect to locate the sample plots. Transect lengths measured 90 feet for transects T1 and T3, and 57 feet for transect T2 (Figure 2). Within each transect, we established 5 permanent quadrants. We used the sample plot locations from Year 1 in order to monitor and compare progress along each transect. Sample plots for herbs were measured using a 0.25-square meter rectangular quadrant, and sample plots for trees and shrubs were measured using a 1-meter circular quadrant. We used the cattle exclusion fencing as a base point for each transect location to ensure the same locations are monitored each year.

We visually evaluated the wetland enhancement plantings along each transect to determine the rate of survival, health, and vigor. Plants were recorded as live, stressed, or dead/dying. Plant survival was calculated by dividing the number of installed living plants by the number of initially installed plants.

We visually estimated the percent cover of individual plant species present within each quadrant. Data collection consisted of species composition and percent cover, total percent plant cover, percent cover of volunteer plants, and percent cover of invasive species. Species coverage values were summed to determine the total areal coverage in each quadrant.

2.3 Photo Points

We established two photo points (P1 and P2) within the mitigation area. We used the cattle exclusion fencing as a base point and permanent location for the photo points (Figure 2).

3.0 RESULTS

Conditions at the Santosh Landfill mitigation site show that the mitigation has improved since Year 1 and mitigation activities have been successful on many levels over the second year. In general, the wetland mitigation area has met three out of four performance criteria (areal cover of native plants, areal cover of invasive weeds, and hydrology) set forth in the mitigation plan.

3.1 Hydrology

A field visit was completed on April 2, 2009 to observe water levels in the mitigation area. The surface water level in the wetland mitigation area measured approximately 34 inches in depth in the open water portion of the site. Surface water levels at the northern corner of the site measured approximately 8 inches and 7 inches within the western corner. Water levels within the eastern and higher elevation portions of the mitigation area ranged from approximately 8 to 14 inches below ground surface.

Several hydrology observations were completed during our late summer vegetation monitoring site visit. During the visit, we observed full inundation of the hydrology enhancement or open water area of the mitigation site. In addition, the soil was saturated in the root zone and saturated within 12 inches of the soil surface throughout the majority of the site.

Considering the positive observations and indications of inundation and saturation observed during the spring and late summer field visits, the site met the wetland hydrology requirements.

3.2 Vegetation Monitoring

A field visit was completed on August 26, 2009 to document vegetation conditions at the mitigation site. Areal cover provided by native plants was estimated using a sample plot method. Three transects (T1, T2, and T3) were evaluated in the wetland mitigation area (Figure 2). In addition, five sample plots along each transect were evaluated to estimate the cover of native and non-native trees, shrubs, and herbaceous vegetation.

The site contains a variety of wetland plant communities including forested, scrub/shrub, and emergent areas. We describe plant survival and provide general observations in each of these three communities below followed by a summary of the site's overall performance.

The results of the vegetation monitoring compared to the performance standards are presented in Table 2. A summary of vegetation survival is provided in Table 3 and a summary of sample plot monitoring results in Table 4. Data sheets are presented in Appendix A. Photographs of site conditions during our monitoring visit are shown in Appendix B.

3.2.1 Forested Zone

Trees installed in the forested zone included Oregon ash (*Fraxinus latifolia*), Pacific willow (*Salix lasiandra*), and black cottonwood (*Populus balsamifera*). Survival of installed trees ranged from 40 to 100 percent, which includes the replanting efforts performed in late 2008. Pacific willow and black cottonwood performed the best within the forested zone, and only 40 percent of the Oregon ash survived. The majority of the remaining trees in the forested zone appeared healthy.

In general, the forested zone continues to perform at a low to moderate level. We anticipate that vegetation within this zone will continue to spread over time.

3.2.2 Scrub/Shrub Zone

Shrubs installed in the scrub/shrub zone included Hooker's willow (*Salix hookeriana*), Scouler's willow (*Salix scouleriana*), Columbia River willow (*Salix fluviatilis*), Sitka willow (*Salix sitchensis*), hardhack (*Spiraea douglasii*), and swamp rose (*Rosa pisocarpa*). Survival of installed shrubs ranged from 57 to 100 percent. Columbia River willow, Scouler's willow, swamp rose, and hardhack performed the best within this zone and had survival rates of greater than 80 percent. Hooker's willow and Sitka willow had survival rates of around 60 percent. The majority of the shrubs appeared healthy.

In general, the scrub/shrub zone is performing at a moderate level. We anticipate that vegetation within this zone will continue to spread over time providing an increase in native plant coverage.

Our evaluation of plant survival is based on the quantity of live trees and shrubs in the mitigation area. The total percent survival of installed trees and shrubs is approximately 73 percent.

The total native plant areal cover criterion includes trees and shrubs as well as emergent and grass species at the site. The average percent cover of trees and shrubs in the mitigation area is approximately 19 percent. The total combined areal cover of native plants will be discussed in the Emergent Zone and Vegetation Summary sections (3.2.3 and 3.2.6) of this report. The percent coverage reflects a 13 percent increase in cover since 2008. Slow plant growth in the tree and shrub strata is directly related to the low rate of tree and shrub survival in Year 1.

3.2.3 Emergent Zone

Emergent and grass species were evaluated based on percent coverage in the established monitoring transects. We documented the average cover of native emergents and grasses to be approximately 25 percent along the wetland monitoring transects. The most common emergent species included creeping spikerush (*Eleocharis palustris*) and pointed rush (*Juncus oxymeris*). In addition to these species, we observed sedge species (*Carex* sp.) and bulrush species (*Scirpus* sp.) throughout the site. These emergent species appeared healthy and spreading at a moderate rate. We also documented the percent cover of seeded grass species in the mitigation area. Native grass species were included in our evaluation of emergent and herbaceous vegetation. The most common grass species included water foxtail (*Alopecurus geniculatus*). The grass species also appeared to be colonizing the area at a moderate rate.

The presence of a variety of native and non-native (naturalized) plant species were noted as dominating portions of the mitigation area. The dominant species included common purslane (*Portulaca oleracea*) and waterpepper (*Polygonum hydropiper*). These species are also present within the adjacent wetland areas. We will continue to monitor these species within the mitigation area.

The total average areal cover of native plants (trees, shrubs, emergents, and grasses) in the mitigation area is approximately 44 percent.

3.2.4 Open Water Zone

The open water portion of the mitigation area was visually evaluated for aquatic and emergent plant species. A variety of emergent plants and grasses described above were observed colonizing the edge of the open water area.

3.2.5 Invasive Plants

Limited quantities of invasive plant species were observed in the wetland mitigation area. A few of small patches of reed canarygrass (*Phalaris arundinacea*) were noted. We anticipate that regular maintenance of the area

will maintain coverage of invasive plants below the required 20 percent performance criterion.

The areas containing bare ground and sparse vegetation that were observed throughout the wetland mitigation area in 2008 appeared to be colonized by emergent and grass species. Limited areas of bare ground were observed and were primarily attributed to cattle entering the mitigation area (see discussion in section 3.3).

3.2.6 Vegetation Summary

The results vegetation inspection within the mitigation area is summarized below:

- Total areal cover of native plants was 44 percent, and meets the Year 2 goal of 40 to 50 percent;
- Survival of installed plants was 73 percent, and is slightly below the Year 2 goal of 80 percent; and
- Total areal cover of invasive species was less than 1 percent and easily meets the yearly goal of 20 percent.

We observed a variety of native tree, shrub, emergent and grass species that appear to be spreading and we anticipate that these species will continue to colonize the area.

3.3 Cattle Exclusion Fencing

The cattle exclusion fence around the wetland mitigation area did not effectively exclude cattle from the site. Several loose wires were observed on the northwestern and southwestern fence lines and resulted in cattle entry into the mitigation area. Little damage occurred to native vegetation as a result of cattle entry, and we noted the presence of a few small patches of bare ground created by cattle dung. The DEQ was alerted and the fence has been repaired. We recommend examining the fence during the spring hydrology site visit as well as during annual maintenance activities to ensure that it remains in good condition and effectively excludes cattle from the mitigation site.

3.4 Wildlife Observations

Wildlife observations were also recorded during the spring and late summer site visits. Species observed within the mitigation site within emergent and open water areas included a variety of ducks, sandpiper (*Actitis hypoleucos*), bullfrog

(*Rana catesbeiana*), garter snake (*Thamnophis sirtalis*), and Pacific chorus frog (*Pseudacris regilla*). Bullfrog and Pacific chorus frog are common species found throughout the adjacent wetland area. In addition, great blue heron (*Ardea herodias*), bald eagle (*Haliaeetus leucocephalus*), red-tailed hawk (*Buteo jamaicensis*), common robin (*Turdus migratorius*), flicker (*Colaptes* sp.), swallow (*Hirundo* sp.), Canada goose (*Branta canadensis*), and nutria (*Myocastor coypus*) were observed within the large wetland complex adjacent to the mitigation area.

4.0 MAINTENACE AND CONTINGENCY RECOMMENDATIONS

We recommend regular maintenance of the mitigation area including weeding and invasive species removal. No additional plantings are recommended at this time.

We will continue to monitor wetland hydrology and vegetation within the enhancement area in 2010 (Year 3).

5.0 REFERENCES

Hart Crowser, Inc., 2007. Compensatory Wetland Mitigation Plan for the Santosh Landfill. Beaverton, Oregon.

Hart Crowser, Inc., 2008. As-Built Report for the Santosh Landfill Compensatory Wetland Mitigation Project. Beaverton, Oregon.

Hart Crowser, Inc., 2008. 2008 (Year 1) Monitoring Report for the Santosh Landfill Compensatory Wetland Mitigation Project. Beaverton, Oregon

TABLES

Table 1 – Schedule for Annual Monitoring
Santosh Landfill Wetland Mitigation
Scappoose, Oregon

Monitoring Element	Year				
	2008	2009	2010	2011	2012
Hydrology Monitoring (Midspring)	✓	✓	○	○	○
Vegetation Monitoring (Late Summer)	✓	✓	○	○	○
Annual Monitoring Report (by December 31)	✓	✓	○	○	○

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✓ - completed to date
○ - scheduled for completion

Table 2 – Summary of Year 2 Monitoring Results
Compared with Performance Standards
Santosh Landfill Wetland Mitigation
Scappoose, Oregon

Criterion	Performance Standard (Year 2)	Results Summary	Performance Standard Met?
Total areal cover of native plants in percent	40 to 50	44	Yes
Survival of installed plants in percent	80	73	No
Total areal cover of invasive weeds in percent	0 to 20	0	Yes
Hydrology	Permanent inundation in open water area 0 to 20 percent cover of invasive plants	Inundation and saturated soil at the surface 0	Yes

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[a] Replacement trees and shrubs were installed in the mitigation area in November 2008.

Table 3 – Summary of Year 2 Vegetation Survival Monitoring Results
Santosh Landfill Wetland Mitigation
Scappoose, Oregon

Survival of Installed Native Trees and Shrubs						
Species	**Live**	**Stressed or Dying**	**Dead**	**Total Quantity Survived**	**Total Quantity Installed**	**Survival Rate (percent)**
Oregon ash (*Fraxinus latifolia*)	**4**	**---**	**---**	**4**	**10**	**40**
Pacific willow (*Salix lasiandra*)	**27**	**---**	**---**	**27**	**40**	**68**
Hooker's willow (*Salix hookeriana*)	**12**	**---**	**---**	**12**	**21**	**57**
Columbia River willow (*Salix fluviatilis*)	**43**	**---**	**---**	**43**	**53**	**81**
Sitka willow (*Salix sitchensis*)	**36**	**---**	**---**	**36**	**59**	**61**
Scouler's willow (*Salix scouleriana*)	**6**	**---**	**---**	**6**	**6**	**100**
Black cottonwood *(Populus balsamifera*)	**10**	**---**	**---**	**10**	**10**	**100**
Swamp rose (*Rosa pisocarpa*)	**11**	**---**	**---**	**11**	**11**	**100**
Hardhack (*Spiraea douglasii*)	**41**	**---**	**---**	**41**	**50**	**82**
Total	**190**	**---**	**---**	**190**	**260**	**73**

Table 4 – Summary of Year 2 Vegetation Monitoring Results
Santosh Landfill Wetland Mitigation
Scappoose, Oregon

Sample Plot Data in Average Percent Cover				
	Wetland Monitoring Transects			
	T1	**T2**	**T3**	**Total Average**
Native Plants (trees, shrubs, emergents and grasses)	39	61	33	**44**
Other Native and Non-Native Plants	33	63	59	**52**
Invasive Weeds[a]	1	0	0	**0**

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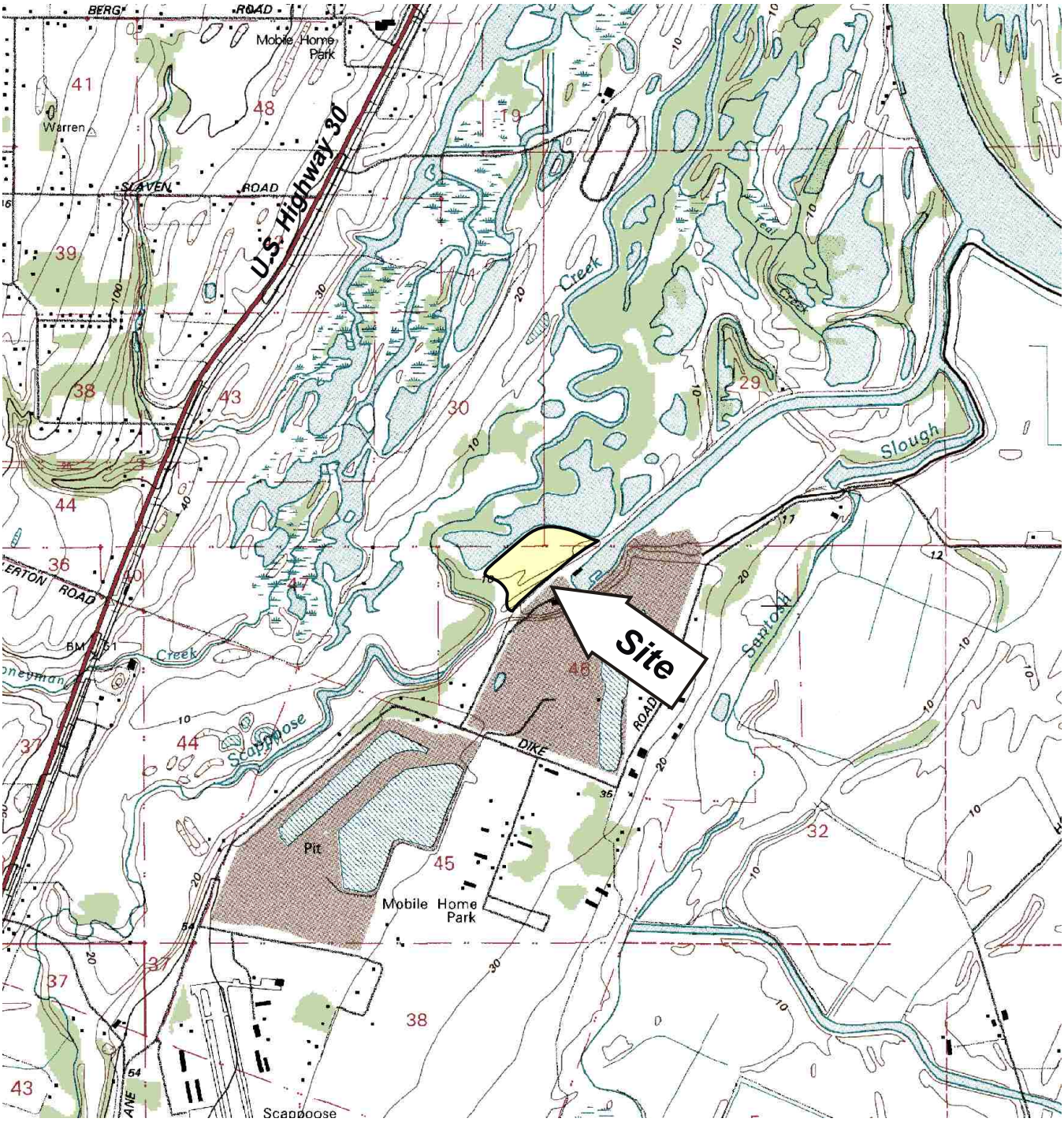
[a] Invasive weeds may include Himalayan blackberry, reed canarygrass, and bittersweet nightshade.

FIGURES



0 2,000 4,000

Scale in Feet

N

Santosh Landfill
Scappoose, Oregon

Site Location Map

15563-02/Task 4 12/09

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Figure
1

Note: Base map prepared from the USGS 7.5-minute quadrangle of St. Helens, Oregon, dated 1990.

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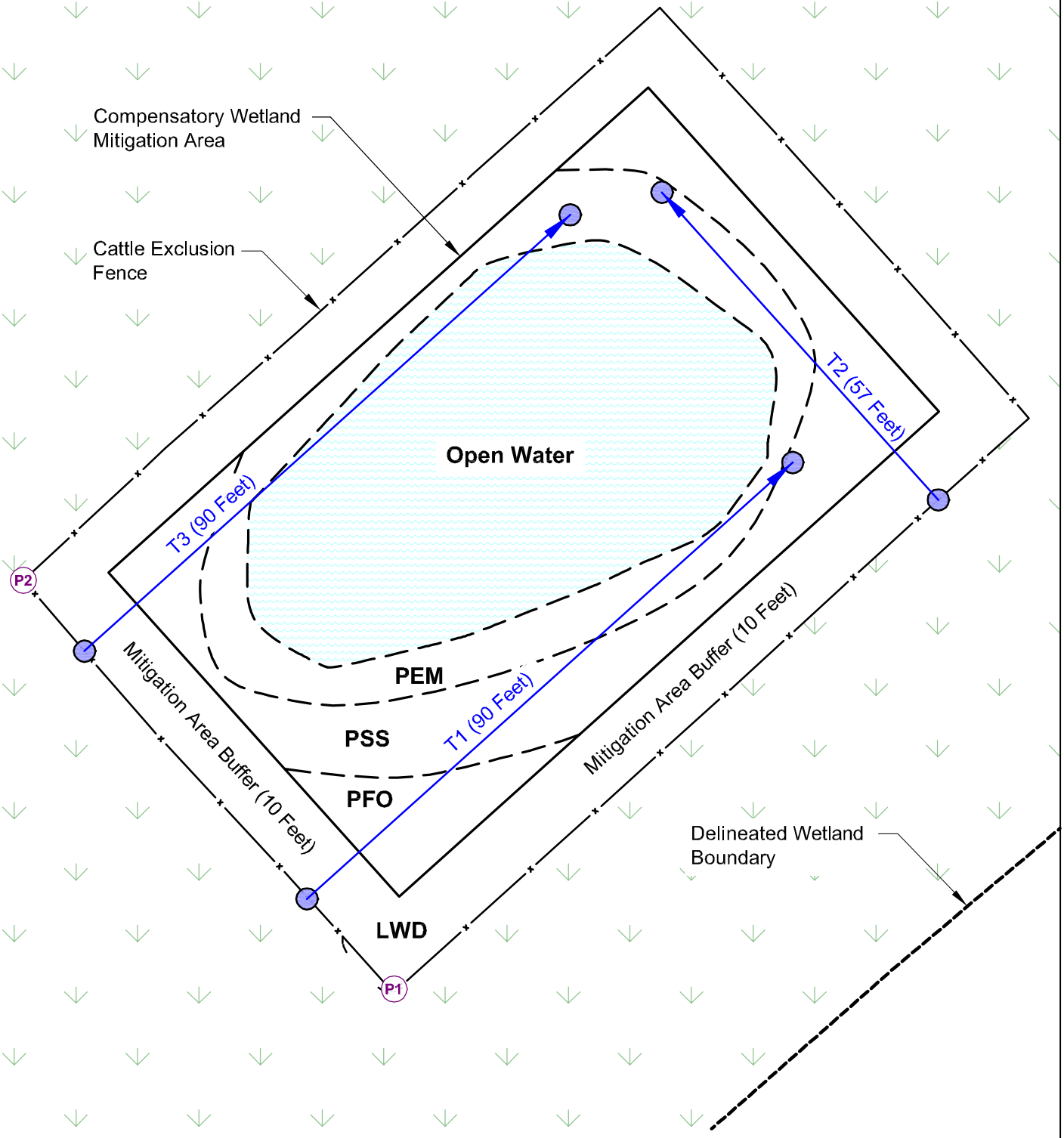

PFO	Palustrine Forested
PSS	Palustrine Scrub/Shrub
PEM	Palustrine Emergent
LWD	Large Woody Debris
P2	Photo Point Location and Number
→	Transect Location and Direction (Sample Plot Locations are Listed in Appendix A)

0 20 40

Scale in Feet

N

Santosh Landfill
Scappoose, Oregon

Wetland Monitoring Plan

15563-02/Task 4 12/09

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Figure
2

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APPENDIX A
VEGETATION MONITORING DATA SHEETS

Appendix A - Vegetation Monitoring Data Sheets
Santosh Landfill Wetland Mitigation
Scappoose, Oregon

Site: Santosh Landfill — Investigator: C. Abercrombie
Project Number: 15563-02/Task 4 — Date: 8/26/2009
Transects: 1 and 3 (90 feet); 2 (57 feet)
Sample Plots: 5 per transect
Sample Plot Size: 0.25 square meters rectangular quadrat - herbs, 1 meter circular quadrat - trees/shrubs

Plant Species		Estimated Percent Cover for Sample Plots at Each Transect														
		T1					T2					T3				
Scientific Name	**Common Name**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Trees and shrubs (native)																
Fraxinus latifolia	Oregon ash															
Populus balsamifera	black cottonwood															
Rosa pisocarpa	swamp rose															
Salix fluviatilis	Columbia River willow	8	18			3	5	20	2	10	15	8				
Salix hookeriana	Hooker's willow		1							4		2				
Salix lasiandra	Pacific willow	10	4	8	3	7	1	4	4	11						
Salix scouleriana	Scouler's willow						3	16	5	3	8	3				
Salix sitchensis	Sitka willow		8								14		12			
Spiraea douglasii	hardhack		10	8	10		15	21								
Total Percent Cover per Sample Plot (Native Trees and Shrubs)		18	41	16	13	10	24	61	11	28	37	13	12	0	0	0
Herbs (native)																
Agrostis exarata	spike bentgrass															
Alopecurus geniculatus	water foxtail	1	15	22	25	5	25	10						10		
Carex sp.	sedge sp.															
Eleocharis palustris	creeping spikerush			3			8	20	25	7	3		5	2	35	30
Hordeum brachyantherum	meadow barley															
Juncus oxymeris	pointed rush					25	8	10	12	15	2	12	18	4	15	5
Scirpus acutus	hardstem bulrush															
Scirpus sp.	bulrush sp.														4	
Total Cover per Sample Plot (Landscaped Herbs)		1	15	25	25	30	41	40	37	22	5	12	23	16	54	35
Invasive Weeds																
Phalaris arundinacea	reed canarygrass	3		3												
Total Cover per Sample Plot (Invasive Weeds)		3	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Other native and non-native plants																
Aster sp.	aster			30		2										
Lotus crassifolius	deervetch	3	4					5								
Mentha arvensis	field mint							3	10							
Plantago sp.	plantain			10												
Polygonum hydropiper	waterpepper				12	15	6	10	10						5	
Portulaca oleracea	common purslane	5	15	20	20	25	25	70	70	65	40	65	60	65	30	65
Moss												4				
Unidentified grasses/herbs					2	1	1			1						2
Bare ground																
Total Cover per Sample Plot (Native and Non-native plants)		8	19	60	34	43	32	88	90	66	40	69	60	65	35	67

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Average Percent Cover in Sample Plots (Native Trees and Shrubs)

T1	19.6
T2	32.2
T3	5.0
Transect Average	18.9

Average Percent Cover in Sample Plots (Native Herbs)

T1	19.2
T2	29
T3	28
Transect Average	25.4

Total Percent Cover of Native Plants (Trees, Shrubs, Emergents and Grasses)

T1	38.8
T2	61.2
T3	33
Total Cover	44.3

Average Percent Cover in Sample Plots (Invasive Weeds)

T1	1.2
T2	0
T3	0
Transect Average	0.4

Average Percent Cover in Sample Plots (Other Native and Non-native Plants)

T1	32.8
T2	63.2
T3	59.2
Transect Average	51.7

Sample Plot Locations (distance in feet from the beginning of the transect)

	T1	**T2**	**T3**
S1	17	15	18
S2	35	27	25
S3	51	39	39
S4	68	45	66
S5	87	57	81

APPENDIX B
PHOTOGRAPHS

Photograph 1 – Forested and scrub/shrub vegetation at monitoring Transect T2 (view looking northwest).

Photograph 2 – This photo shows the emergent portion of the wetland with a forested riparian area in the background, in contrast to the developing forested and scrub/shrub plant community in the mitigation area (taken from photo point P1, view looking north).

Photograph 3 – The primarily emergent plant community along the edge of the open water from photo point P2 (view looking northeast).

Photograph 4 – An overview of the mitigation site from photo point P2 (view looking east).