



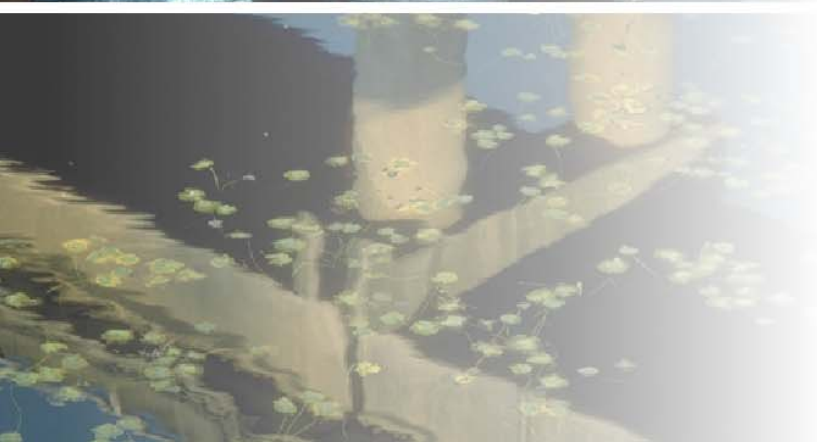
**2008 (Year 1) Monitoring Report
Santosh Landfill
Wetland Mitigation Project
Scappoose, Oregon**



**Prepared for
Oregon Department of
Environmental Quality**



**November 21, 2008
15563-02/Task 4**





***2008 (Year 1) Monitoring Report
Santosh Landfill
Wetland Mitigation Project
Scappoose, Oregon***

***Prepared for
Oregon Department of Environmental Quality***

***November 21, 2008
15563-02/Task 4***

Prepared by
Hart Crowser, Inc.

Celina Abercrombie
Wetland Biologist

Craig Dockter
Task Order Manager

| CONTENTS | <u>Page</u> |
|--|-------------|
| 1.0 INTRODUCTION | 1 |
| 1.1 <i>Background</i> | 1 |
| 1.2 <i>Project Goals and Objectives</i> | 2 |
| 2.0 MONITORING LOCATIONS AND METHODS | 2 |
| 2.1 <i>Wetland Hydrology Monitoring</i> | 2 |
| 2.2 <i>Vegetation Monitoring Transects</i> | 3 |
| 2.3 <i>Photo Points</i> | 3 |
| 3.0 RESULTS | 3 |
| 3.1 <i>Hydrology</i> | 4 |
| 3.2 <i>Vegetation Monitoring</i> | 4 |
| 3.3 <i>Cattle Exclusion Fencing</i> | 7 |
| 4.0 MAINTENANCE AND CONTINGENCY RECOMMENDATIONS | 8 |
| 5.0 REFERENCES | 8 |

TABLES

| | |
|---|--|
| 1 | Schedule for As-Built Plan and Monitoring, Santosh Landfill Wetland Mitigation |
| 2 | Year 1 Hydrology Monitoring Data |
| 3 | Summary of Year 1 Monitoring Results Compared with Performance Standards |
| 4 | Summary of Year 1 Vegetation Monitoring Results |

FIGURES

| | |
|---|-------------------------|
| 1 | Site Location Map |
| 2 | Wetland Monitoring Plan |

APPENDIX A VEGETATION MONITORING DATA SHEETS

APPENDIX B PHOTOGRAPHS

**2008 (YEAR 1) MONITORING REPORT
SANTOSH LANDFILL
WETLAND MITIGATION PROJECT
SCAPPOOSE, OREGON**

1.0 INTRODUCTION

This Year 1 monitoring report documents the mitigation site conditions in 2008 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 south 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 monitoring reports in Years 2, 3, 4 and 5 after construction. 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.

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 1 monitoring in Section 3.

1.2 Project Goals and Objectives

The project goals and objectives included 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 provided 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 included: 1) enhancing the degraded wetland through installation of native vegetation, 2) creating a permanently inundated area, and 3) providing wildlife habitat.

We identified performance standards to evaluate the success of the wetland mitigation in the approved Compensatory Wetland Mitigation Plan (2007). Performance standards for wetland enhancement included:

- Total areal cover of native plants: 30 to 40 percent in Year 1 to a minimum of 80 percent in Year 5;
- Survival of installed plants: 100 percent in Year 1 and 80 percent for subsequent years; and
- Total areal cover of invasive species: less than 20 percent each year.

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 included quantitative and qualitative data collection to measure the success of the proposed mitigation.

2.1 Wetland Hydrology Monitoring

We recorded a number of qualitative and quantitative observations on hydrology 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

We sampled the wetland enhancement plant communities 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 a random number generator to eliminate bias in the placement of sample plots along each transects. Sample plots for herbs were 0.25 square meters in size. 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 been successful on some levels over the first year. The mitigation site remained inundated for a large portion of 2008. This long period of inundation was due to exceptionally high groundwater and surface water levels. The mitigation area remained intact considering the conditions at the site. However, the prolonged inundation from November 2007 through May 2008, resulted in plant loss.

While the high water levels appeared to affect many of the trees and shrubs planted in the mitigation area, the emergent (herbaceous) vegetation is healthy and growing well.

In general, the wetland mitigation area has met two out of four performance criteria (areal cover of invasive weeds and hydrology) set forth in the mitigation plan.

3.1 Hydrology

We completed a field visit on May 21, 2008 to observe water levels in the mitigation area. At the time of our investigation, the water level in the wetland surrounding the landfill measured approximately 3 to 4 feet in depth. We made multiple attempts to access the wetland mitigation area; however, water depth and visibility made this unfeasible. Water levels in the wetland remained relatively high throughout the month of July with an average depth estimated at approximately 1 to 2 feet.

We completed several hydrology observations during our late summer/early fall vegetation monitoring site visit in September. At the time of our observations, the water level in the wetland had receded. During our 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 site.

Considering our visual observations of inundation during the spring as well our observations and data collected in the fall, we consider the site to meet the wetland hydrology requirements.

3.2 Vegetation Monitoring

We completed a field visit on September 23, 2008 to document vegetation conditions at the mitigation site. We estimated areal cover provided by native plants using a sample plot method. We evaluated three transects (T1, T2, and T3) in the wetland mitigation area (Figure 2). In addition, we evaluated five sample plots along each transect to estimate the cover of native and non-native trees, shrubs, and herbaceous vegetation. The vegetation monitoring data sheets are presented in Appendix A.

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.

We present the results of the vegetation monitoring compared to the performance standards in Table 2. We provide a summary of vegetation survival 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 10 to 100 percent. Pacific willow performed the best within the forested zone. The majority of the remaining trees appeared healthy.

In general, the forested zone is performing 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*), Pacific willow (*Salix lasiandra*), 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 15 to 100 percent. Pacific willow, Columbia River willow, Sitka willow, and hardhack performed the best within this zone and had survival rates of greater than 80 percent. Hooker's willow and swamp rose had survival rates of around 50 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 58 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 6 percent. The total combined areal cover of native plants will be discussed in the Emergent Zone and Vegetation Summary sections (3.2.3 and 3.2.4) of this report. The low percent coverage in this area is directly related to the low rate of tree and shrub survival. High water levels in the wetland resulted in mortality and slow growth of the

installed plants and thus a lower coverage of the area than anticipated for the first year.

3.2.3 Emergent Zone

We evaluated emergent and grass species based on percent coverage in the established monitoring transects. We documented the average cover of native emergents and grasses to be approximately 18 percent along the wetland monitoring transects. The most common emergent species included creeping spikerush (*Eleocharis palustris*). In addition to this species, we observed pointed rush (*Juncus oxymeris*), sedge species (*Carex* sp.), hardstem bulrush (*Scirpus acutus*) and other 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 spike bentgrass (*Agrostis exarata*) and meadow barley (*Hordeum brachyantherum*). In addition, we observed water foxtail (*Alopecurus geniculatus*) at the site. The grass species also appeared to be colonizing the area at a moderate rate.

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

During our annual monitoring site visit, additional grass seed was dispersed throughout the bare ground and sparsely vegetated areas. This seed will provide additional coverage at the site and increase the native seed bank.

The total average areal cover of native plants (trees, shrubs, emergents, and grasses) in the mitigation area is approximately 24 percent.

3.2.4 Open Water Zone

We visually evaluated the open water portion of the mitigation area 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. No aquatic plants were observed within this area.

In addition to vegetation observations, we noted the presence of amphibian use in the open water and adjacent emergent areas. We observed Pacific chorus frog

(*Pseudacris regilla*) and bullfrog (*Rana catesbeiana*) using the open water area and the emergent planting area. These species are common throughout the adjacent wetland area.

3.2.5 Invasive Plants

We did not observe invasive plant species in the wetland mitigation area. We anticipate that regular maintenance of the area will maintain coverage of invasive plants below the required 20 percent performance criterion.

Areas containing bare ground and sparse vegetation were observed throughout the wetland mitigation area. These areas ranged in size from approximately 1 square foot to 20 square feet. We anticipate that these areas will be colonized by emergent and grass species over time.

3.2.6 Vegetation Summary

The total survival of installed trees and shrubs was approximately 58 percent. The performance standard of 100 percent survival was not met. Total areal cover of native plants in the wetland mitigation area was approximately 23 percent. The performance standard of 30 to 40 percent cover of native plants was not met. The total cover of invasive plants was 0 percent. The performance standard of less than 20 percent was met. In general, the mitigation area is developing slower than anticipated. However, 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.

As discussed above, elevated water levels in the wetland throughout the spring and summer contributed to plant loss at the site. In late November of 2008, the dead plants were replaced with species that performed well under these circumstances. Following replanting, the number of live trees and shrubs is 100 percent.

3.3 Cattle Exclusion Fencing

The cattle exclusion fence around the wetland mitigation area remains in good condition and appears to effectively exclude cattle from the site. We recommend examining the fence during the spring hydrology site visit as well as during annual maintenance activities.

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 given the recent installation of replacement trees and shrubs throughout the site.

We will continue to monitor wetland hydrology and vegetation within the enhancement area in 2009 (Year 2).

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

**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) | ✓ | ○ | ○ | ○ | ○ |

✓ - completed to date

○ - scheduled for completion

**Table 2 – Summary of Year 1 Monitoring Results
 Compared with Performance Standards
 Santosh Landfill - Wetland Mitigation
 Scappoose, Oregon**

| Criterion | Performance Standard (Year 1) | Results Summary | Performance Standard Met? |
|--|---|---|----------------------------------|
| Total areal cover of native plants in percent | 30 to 40 | 23 | No |
| Survival of installed plants in percent | 100 | 58 ^a | 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 |

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

**Table 3 – Summary of Year 1 Vegetation Survival Monitoring Results
Santosh Landfill - Wetland Mitigation
Scappoose, Oregon**

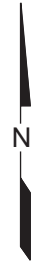
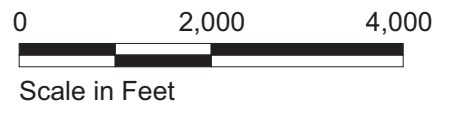
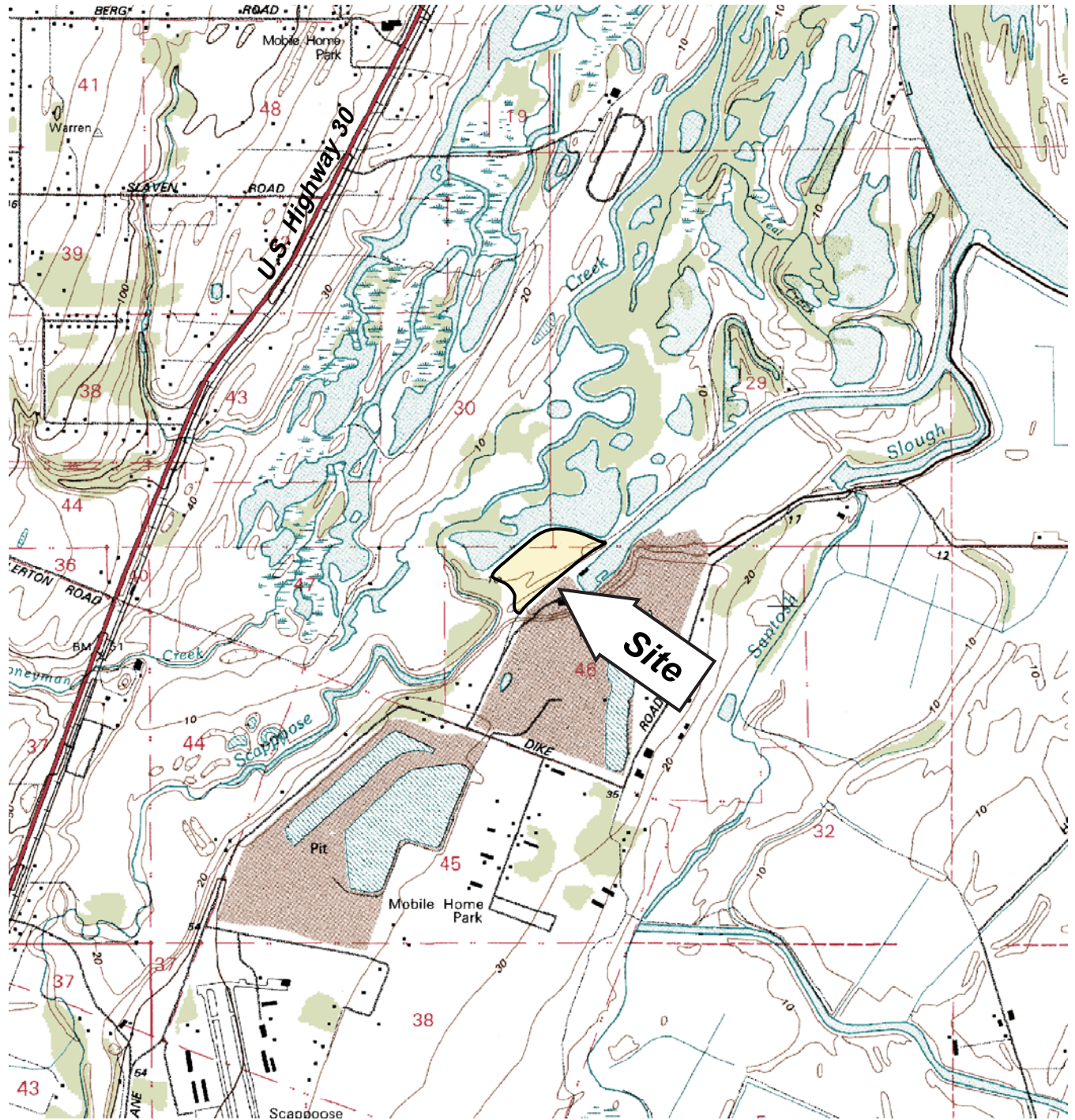
| Survival of Installed Native Trees and Shrubs | | | | | | |
|--|------------|-------------------|----------|-------------------------|--------------------------|-------------------------|
| Species | Live | Stressed or Dying | Dead | Total Quantity Survived | Total Quantity Installed | Survival Rate (percent) |
| Oregon ash (<i>Fraxinus latifolia</i>) | 1 | --- | --- | 1 | 10 | 10 |
| Pacific willow (<i>Salix lasiandra</i>) | 10 | --- | --- | 10 | 10 | 100 |
| Hooker's willow (<i>Salix hookeriana</i>) | 21 | --- | --- | 21 | 40 | 53 |
| Columbia River willow (<i>Salix fluviatilis</i>) | 32 | 1 | --- | 33 | 40 | 83 |
| Sitka willow (<i>Salix sitchensis</i>) | 37 | 2 | --- | 39 | 40 | 98 |
| Scouler's willow (<i>Salix scouleriana</i>) | 6 | --- | --- | 6 | 40 | 15 |
| Black cottonwood (<i>Populus balsamifera</i>) | 10 | --- | --- | 10 | 40 | 25 |
| Swamp rose (<i>Rosa pisocarpa</i>) | 11 | --- | 2 | 11 | 40 | 28 |
| Hardhack (<i>Spiraea douglasii</i>) | 20 | --- | --- | 20 | 20 | 100 |
| Total | 148 | 3 | 2 | 151 | 260 | 58 |


**Table 4 – Summary of Year 1 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 | 29 | 20 | 22 | 23 |
| Native and Non-Native Plants | 37 | 65 | 65 | 56 |
| Invasive Weeds ^a | 0 | 0 | 0 | 0 |

^a Invasive weeds include Himalayan blackberry, reed canarygrass,, and bittersweet nightshade.

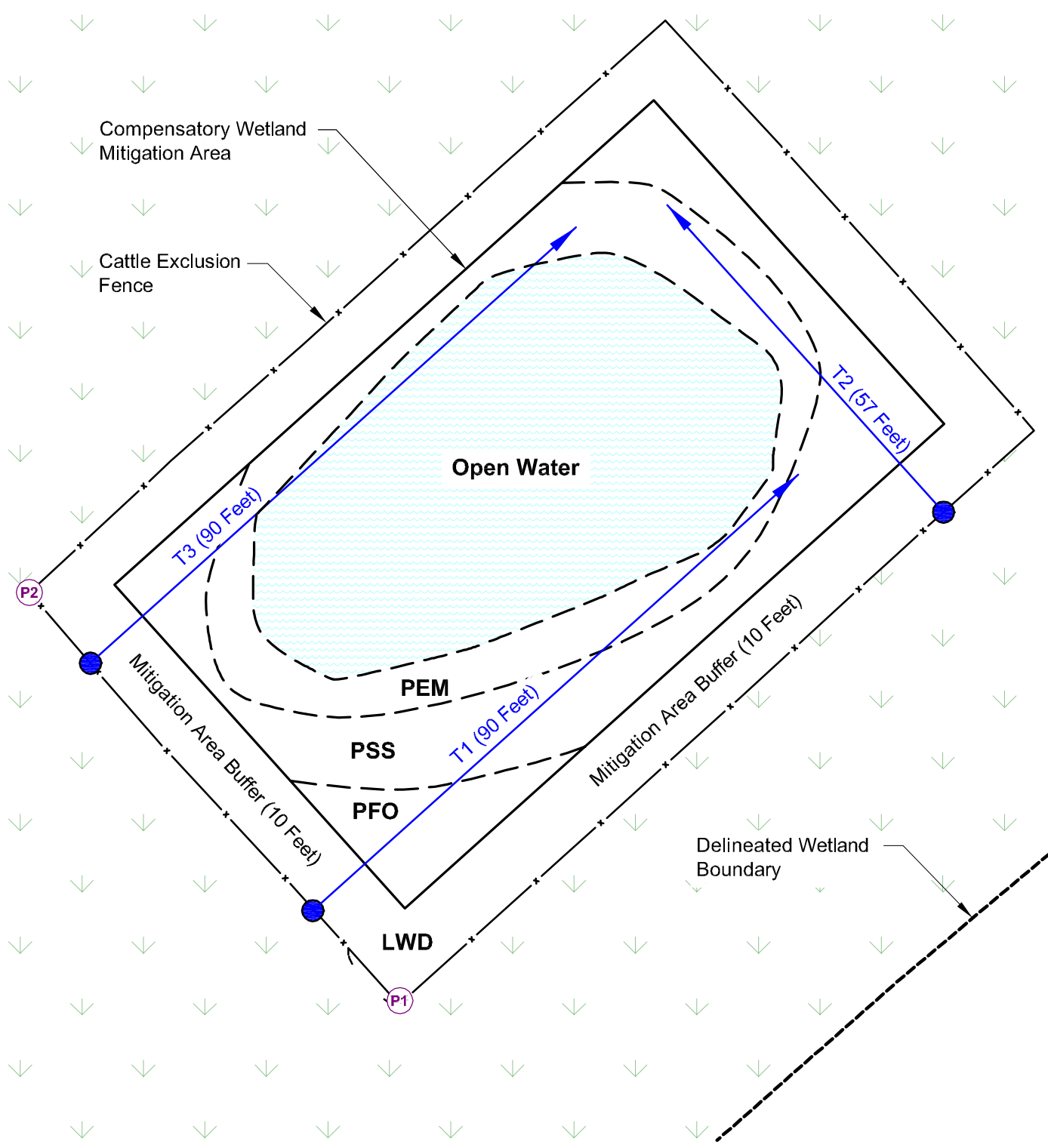
F:\Data\Jobs\DEQ\15563-02 Santosh Landfill\Task 4 Wetland Monitoring\Figures - Wetland Monitoring\155630204_001 (Site Location).cdr



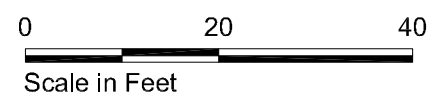
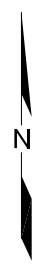
| | |
|---|--------------------|
| Santosh Landfill Scappoose, Oregon | |
| Site Location Map | |
| 15563-02/Task 4 | 11/08 |
|  | Figure 1 |

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

F:\Data\Jobs\DEQ\15563-02 Santosh Landfill\Tk 4 Wetland Monitoring\Figures - Wetland Monitoring\155630204_002 (Wetland Monitoring).dwg.dwg



- PFO Palustrine Forested
- PSS Palustrine Scrub/Shrub
- PEM Palustrine Emergent
- LWD Large Woody Debris
- P2 Photo Point Location and Number
- → Transect Location and Direction



| | |
|---------------------------------------|--------------------|
| Santosh Landfill Scappoose, Oregon | |
| Wetland Monitoring Plan | |
| 15563-02/Task 4 | 11/08 |
| HARTCROWSER | Figure 2 |

APPENDIX A
VEGETATION MONITORING DATA SHEETS

**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).