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MEMO

To:
Scott Zorn
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Copies:

From:
Brianne Cohen

Date:
May 14, 2009

ARCADIS Project No.:
B0045362.0001

Subject:
Unocal Edmonds Bulk Fuel Terminal
Willow Creek Restoration: As-built Report and Monitoring Plan

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In July 2008, Union Oil Company of California initiated Phase II of remediation activities at the Former Unocal Edmonds Bulk Fuel Terminal which included excavation of additional petroleum hydrocarbon-impacted soil which remained following Phase I remediation activities, and excavation of impacted sediment in Willow Creek near two storm water outfalls. As part of the excavation plan, the creek was to be restored to pre-construction conditions with clean backfill and environmentally compatible plant-life as part of mitigation for temporary impacts from the project. The channel excavation and restoration work was completed in September 2008. This report summarizes: the goals and objectives of the restoration of Willow Creek; any changes in the as-built design; and the monitoring plan for the site.

1 Project Background

Willow Creek is a small suburban tidally-influenced stream that runs along the boundary between BNSF railway and the Unocal properties. It drains from Edmonds Marsh and discharges via a culvert at Marina Beach Park. Edmonds Marsh was historically maintained as a freshwater marsh until a tide gate was removed to allow a saltwater marsh to redevelop. Due to direct connections with navigable water, Willow Creek, including its adjacent wetlands and associated buffers, is considered a water of the U.S. Therefore, any in-water construction in Willow Creek requires agency permits. A Joint Aquatic Resources Permit Application was submitted to the United State Army Corps of Engineers (USACE) Seattle District and a Nationwide 38 – Cleanup of Hazardous Waste permit from USACE was received in July 2008. A Hydraulic Project Approval was issued by Washington Department of Fish and Wildlife on April 24, 2008.

Due to the nature of the cleanup, all impacts to the creek were unavoidable. Backfill of the creek to pre-construction elevations with clean fill and planting of the channel banks and flood plain with native riparian plant species was included as part of the excavation plan as mitigation for these impacts.

Before the sediment excavation, Willow Creek was dominated by invasive herbs and shrubs and provided diminished wildlife habitat and ecosystem function. The restoration of the site was intended to improve conditions along the effected reach of stream by replanting with native plant species to increase ecosystem functions. The total acreage marked for restoration was 0.33 acres. The details of this restoration are described in Unocal Edmonds Bulk Fuel Terminal Project Manual (ARCADIS 2008a) and Edmonds Planting Plan Specifications Supplemental Memo (ARCADIS 2008b).

The goal of the Willow Creek restoration is to improve conditions along the creek and increase ecosystem function. Meeting this goal will be achieved by:

a. Planting native plant species to reestablish a riparian wetland community;

b. Ensuring survival of 75% or greater of planted species; and

c. Conducting routine maintenance, including removing non-native invasives and watering as necessary.

This restoration plan was implemented in September 2008. A description of the As-Built plan is included in Section 2. Enforcement of these performance standards will occur through regular monitoring on site. The Monitoring and Maintenance plan is included in Section 3.

2 As-Built Plan

Planting of the riparian corridor was conducted over a seven-day period by a team of 5 – 7 people and was completed on September 26, 2008. The final planting plan is shown in Figure 8 – As-Built Planting Plan and Details of the Phase II As-built Report (Attached). Changes from the initial planting plan are described below.

2.1 Planting polygons

The original planting plan called for planting of Emergent Wetland species and Floodplain Forest species on both sides of the creek. During a review of the planting plan with the roadmaster of Burlington Northern Santa Fe Railroad (BNSF), our project was approved under the condition that no shrubs or trees were to be planted along the right-of-way for the railroad. To be conservative, the Floodplain Forest portion along the BNSF right-of-way was removed from the plan. In the field, the decision was made to expand the emergent wetland portion to the extent of the 10’

elevation with the original numbers of plants and the overall density of the planting polygon along the BNSF right-of-way decreased accordingly.

Initially, a hotspot excavation area at Detention Basin 1 was included in the planting plan. However, in the field it was decided that the road and easement to access the pumps would remain intact. Therefore, that portion of the Forested Floodplain planting plan could not be planted.

2.2 Species

One species change was made during the project. The original planting plan called for *Schoenoplectus americanus*, which was unavailable at local nurseries. Due to conditions at the site, a species of rush common to estuarine environments, *Juncus balticus*, was chosen to replace it. This species has been observed at other regional reference sites in the Puget Sound and was determined to be an appropriate choice by the wetland biologist.

2.3 Plant Size

The original planting plan called for 1 gallon sized pots for most species. However, the emergent wetland species were not available in this size and were ordered in bare root size. Due to the difference in size of plants between bare root and one-gallon pots, twice the number of plants were ordered for all species that were only available in bare root. Two bare root plants were planted in each hole.

2.4 Density

The final density for each species diverged from the original plan. Due to bulk ordering requirements, the total number of plants ordered per species varied. Groundcover species in the Floodplain Forest on the Edmonds Terminal side of the creek were planted at different numbers than originally specified. The final density for each species increased or decreased accordingly. Final densities are included in Figure 8.

2.5 Maintenance – Watering

Soaker hoses were used on the Edmonds Terminal side of the creek to keep shrubs and trees watered during warmer weather. These hoses were connected to DB1 via a pump and were run for several hours twice a week as necessary. Precipitation was observed more than twice a week soon after the planting was completed and use of the soaker hoses was discontinued mid-October. The soaker hoses were not removed from the creek bank and can/will be used again if

necessary. These hoses are thin-walled and therefore kinks are easily created. During each use, the hoses must be inspected to ensure that the water is reaching the plants.

3 Monitoring and Maintenance Plan

Monitoring and maintenance of a mitigation project is important to establishing the success of a project and may identify any unforeseen problems before they occur. This plan is being implemented to monitor the success of the Willow Creek restoration per USACE Seattle District General Conditions. No additional monitoring requirements were included in the project-specific conditions of the federal, state, or city permits received for this project. The monitoring plan is described below in terms of monitoring protocol, schedule, and adaptive management/maintenance techniques.

3.1 Monitoring

3.1.1 Vegetation

Two permanent vegetation plots, Plots 1 and 2, were selectively placed on the Edmonds Terminal side. The location of these plots is shown in Figure 8. Each plot is 20 feet long and extends from the top of the slope down to the creek. These two plots will represent approximately 10% of the revegetated riparian area and will provide a good indicator of the status of the entire restored area. The vegetation plots will be monitored for species composition, survivorship, percent cover, and general health and vigor. Plots 3 and 4 are located immediately opposite Plots 1 and 2 in the Emergent Wetland in the BNSF right-of-way as shown in Figure 8. If access is available at low tide, Plots 3 and 4 will be monitored for the same above parameters. Due to the removal of the coffer dams, and the potential walking hazards of crossing the creek, access is not anticipated. When access to Plots 3 and 4 is not available, vegetation will only be visually monitored for general health and vigor.

3.1.2 Photographic Documentation

A permanent photo point will be established at the southern point of each vegetation plot and marked in the field to document changes in the restoration area over time. Photos will be taken in the same orientation each monitoring year and will include a permanent marker (stake) in at least one photo for reference. If access to the far side of the creek is not available, additional photos at each photo point will also document Plots 3 and 4.

3.1.3 Schedule

Following the establishment of a baseline in the fall of 2008 (“Time-zero”), vegetation plots will be regularly monitored in the summer to document changes to the restored riparian plant communities (e.g. plant mortality, growth, vigor, etc.). Photographic documentation will be completed during each monitoring event. A technical memorandum will be submitted to USACE (with a copy to Chevron Environmental Management Company) documenting the results and trends of the restoration following each monitoring event.

3.1.4 Adaptive Management

Adaptive management is a proven method essential for ensuring the success of a restoration project. It is a feedback loop where monitoring data can be used to alter a restoration, maintenance, or monitoring plan if a project’s performance standards are not being met or if unforeseen circumstances result in problems that the original plan has not addressed. Following the results of monitoring on year 1, the wetland scientist may propose changes to these plans to the project manager or lead engineer for his/her approval.

3.2 Maintenance

3.2.1 Weeding

As per the original planting plan, a maintenance crew will be available in early spring to remove non-native invasive plant species from the channel bank if requested.

3.2.2 Replacement

The assumed survival rate planted native species is approximately 75%. During monitoring or regular maintenance, crews may determine that additional plantings may be needed to as a result of plant mortality approaching 25 percent. Additional plantings would be recommended to the wetland biologist who would confirm the mortality and necessity for additional plantings. Additional planting and/or maintenance would then be authorized by the project geologist.

3.2.3 Contact

If there are any issues on site regarding the maintenance of the plants, or any other issues that may negatively affect the restoration, the project geologist or wetland biologist should be notified immediately, per Table 1.

Table 1. Contact Information

ARCADIS employee	Role	Contact
Scott Zorn	Project Geologist	206-726-4709
Brianne Cohen	Wetland Biologist	206-726-4743

4 Time-Zero Data

4.1 Methods

Planting was completed in September 2008 and Year 0 data was collected in October 2008. Vegetation in Plots 1 and 2 were counted, evaluated for health and vigor, and percent cover was determined. Shrubs and trees were counted by stem bundle. Individual stems were not differentiated. Emergent wetland species were counted if observable. Percent cover was determined by evaluating the range of percent cover and assigning the cover class midpoint, as shown in Table 2. General health and vigor was observed and rated excellent, good, fair, or poor, using the criteria described in Table 3.

Table 2. Cover Class Midpoints

Percent Cover Range	Cover Class Midpoint
< 1%	0.5
1 – 5%	3
6 – 15%	10.5
16 – 25%	20.5
26 – 45%	38
46 – 75%	63
76 – 90%	85.5
> 90%	98

Table 3. General Health and Vigor

Classification	Description
Excellent	No evidence of stress; minor pest or pathogen damage; natives dominant
Good	Some evidence of stress; pest or pathogen damage present; non-native species present, not dominant
Fair	Moderate level of stress; high levels of pest of pathogen damage; non-native species dominant
Poor	High level of stress; high levels of pest of pathogen damage; non-native species dominant

4.2 Results

Vegetation baseline data is presented in Tables 2 and 3. Plots 1 and 2 had similar results. No immediate mortality of any species was documented. General health and vigor of the species observed ranged from Poor to Excellent. Many of the wetland emergent species were not countable at Time-zero due to size.

The general health and vigor of the species in Plots 3 and 4 ranged from Poor to Fair. The size of the plants prevented observation of *J. balticus* and *S. microcarpus*. Evidence of frequent inundation was observed on all plants in the depressions in the BNSF right-of-way. The general health and vigor of these species was poor, and all leaves were brown with sediment deposits. Species planted on the berms above regular inundation levels were green and the general health was fair.

Photo documentation of the vegetation plots is presented in Appendix A – Photographs.

Table 4. Plot 1 (Dimensions: 20 ft x 20 ft)

Species	Time-zero Number of individuals	Number survived	Percent cover	General Health and Vigor
Alnus rubra	2		3	Good
Pinus contorta	1		3	Excellent
Salix lucida	4		3	Good
Salix sitchensis	3		3	Poor
Cornus sericea	2		3	Fair
Lonicera involucrate	3		3	Excellent
Deschampsia cespitosa	6		3	Excellent
Carex obnupta	26		3	Good
Juncus balticus	--		--	*Not observed*
Schoenoplectus acutus	--		--	*Not observed*
Scirpus microcarpus	--		--	*Not observed*
Total Species Present	8			

Table 5. Plot 2 (Dimensions: 20 ft x 10 ft)

Species	Time-zero Number of individuals	Number survived	Percent cover	General Health and Vigor
Alnus rubra	3		3	Good
Pinus contorta	0		3	Excellent
Salix lucida	3		3	Good
Salix sitchensis	6		3	Poor
Cornus sericea	2		3	Fair
Lonicera involucrate	2		3	Excellent
Deschampsia cespitosa	11		3	Excellent
Carex obnupta	18		3	Good
Juncus balticus	--		--	*Not observed*

Schoenoplectus acutus	--		--	*Not observed*
Scirpus microcarpus	--		--	*Not observed*
Total Species Present	8			

Table 6. Plot 3

Species	Time-zero Number of individuals	Number survived	Percent cover	General Health and Vigor
Juncus balticus	--			*Not observed*
Carex obnupta	--			Fair
Schoenoplectus acutus	--			Poor
Scirpus microcarpus	--			*Not observed*
Total Species	4			

Table 7. Plot 4

Species	Time-zero Number of individuals	Number survived	Percent cover	General Health and Vigor
Juncus balticus	--			*Not observed*
Carex obnupta	--			Fair
Schoenoplectus acutus	--			Poor
Scirpus microcarpus	--			*Not observed*
Total Species	4			

4.3 Summary

The four vegetation sample plots provide a good representation of the restoration area and will provide a qualitative and quantitative measurement of changes to the restoration throughout future monitoring intervals.

Overall, the plants in Plots 1 and 2 exhibited vigor and some growth. However, several individual *S. sitchensis* showed significant stress following planting. They were evaluated closely and it was determined that the plants were already showing signs of improvement and will likely further establish throughout the wet season. The Emergent Wetland plants in Plots 3 and 4 are showing significant stress. There is evidence and some concern that surface water elevations at high tides are higher than expected, which may affect the overall survivability of the plants in the depressions within the emergent areas. These individuals will be evaluated closely in Year 1 monitoring to document survival.

5 References

ARCADIS. 2008a. Unocal Edmonds Project Manual. Prepared for Chevron Environmental Management Company. March 21, 2008.

ARCADIS. 2008b. Edmonds Planting Plan Specifications Supplemental Memo. Prepared for Scott Zorn and Rebecca Andresen. May 13, 2008.

USACE. 2008. USACE NW Permit 38. Reference no. NWS-2006-223-NO, Union Oil Company of California. Issued by Jonathan Smith, Project Manager. July 2, 2008.

Washington State Department of Ecology, U.S. Army Corps of Engineers Seattle District, and U.S. Environmental Protection Agency Region 10. 2006. Wetland Mitigation in Washington State Part 2: Developing Mitigation Plans. March 2006.

Appendix A

Photographs

Photo 1. Plot 1

Photo 2. Plot 2

Photo 3. Plot 3

Photo 4. Plot 3

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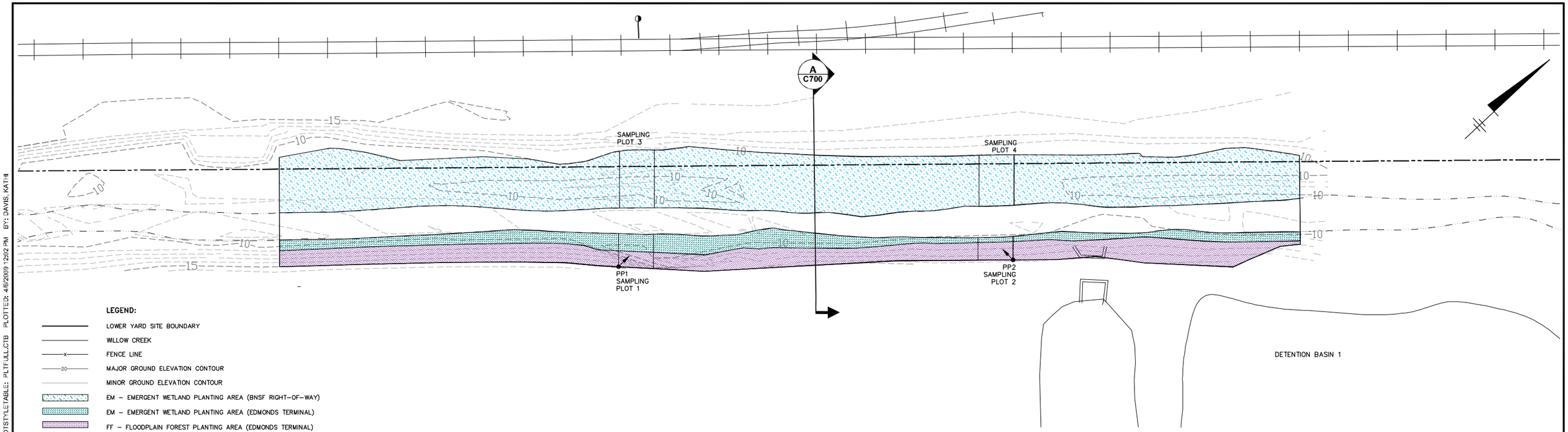
Appendix B

As-built Planting Plan and Details
Figure 8 – Phase II As-built Report



LEGEND:

- LOWER YARD SITE BOUNDARY
- WILLOW CREEK
- FENCE LINE
- MAJOR GROUND ELEVATION CONTOUR
- MINOR GROUND ELEVATION CONTOUR
- EM – EMERGENT WETLAND PLANTING AREA (BNSF RIGHT–OF–WAY)
- EM – EMERGENT WETLAND PLANTING AREA (EDMONDS TERMINAL)
- FF – FLOODPLAIN FOREST PLANTING AREA (EDMONDS TERMINAL)

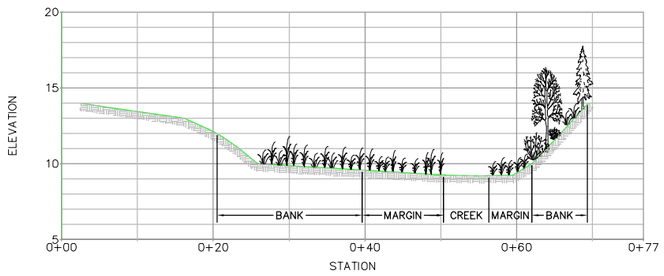
20' 0 20' 40'
1"=20'

EM – EMERGENT WETLAND (CREEK MARGIN – BNSF RIGHT–OF–WAY) 0.218 ACRES					
SPECIES	COMMON NAME	NUMBER	SIZE	DENSITY (#/ACRE)	SPACING
Carex obnupta	Slough sedge	1,200	BARE ROOT	2,800	3.9' O.C.
Juncus balticus	Baltic rush	350	BARE ROOT	800	7.3' O.C.
Schoenoplectus acutus	Hardstem bulrush	350	BARE ROOT	800	7.3' O.C.
Scirpus microcarpus	Panicled bulrush	250	BARE ROOT	600	8.5' O.C.

EM – EMERGENT WETLAND (CREEK MARGIN – EDMONDS TERMINAL) 0.043 ACRES					
SPECIES	COMMON NAME	NUMBER	SIZE	DENSITY (#/ACRE)	SPACING
Carex obnupta	Slough sedge	400	BARE ROOT	4,650	3.1' O.C.
Juncus balticus	Baltic rush	150	BARE ROOT	1,750	5' O.C.
Schoenoplectus acutus	Hardstem bulrush	100	BARE ROOT	1,200	6' O.C.
Scirpus microcarpus	Panicled bulrush	100	BARE ROOT	1,200	6' O.C.

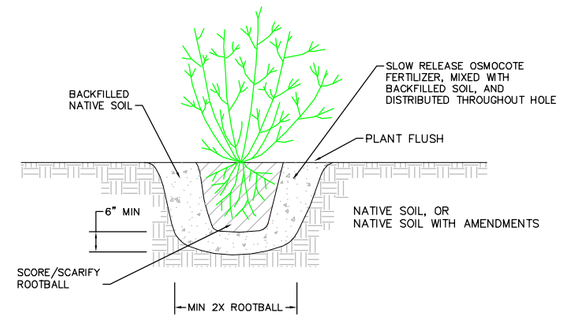
FF – FLOODPLAIN FOREST (CREEK BANK – EDMONDS TERMINAL) 0.07 ACRES					
SPECIES	COMMON NAME	NUMBER	SIZE	DENSITY (#/ACRE)	SPACING
TREES					
Alnus rubra	Red alder	51	1 GAL	725	7.6 O.C.
Pinus contorta var. contorta	Shore pine	18	1 GAL	255	13' O.C.
SHRUBS					
Salix lucida ssp. *lasiandra*	Pacific willow	51	1 GAL	725	7.6' O.C.
Salix sitchensis	Sitka willow	51	1 GAL	725	7.6' O.C.
Cornus sericea spp. *sericea*	Red–osier dogwood	42	1 GAL	600	8.5' O.C.
Lonicera involucrata	Twinberry	27	1 GAL	400	10.5' O.C.
GROUNDCOVER					
Carex obnupta	Slough sedge	800	BARE ROOT	5,700	2.8' O.C.
Deschampsia cespitosa	Tufted hairgrass	810	BARE ROOT	5,800	2.7' O.C.

PLANT DETAILS



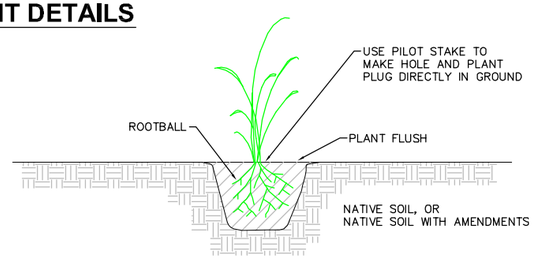
SECTION A

NOT TO SCALE



SHRUB PLANTING DETAIL

NOT TO SCALE



EMERGENT GRASSES PLANTING DETAIL

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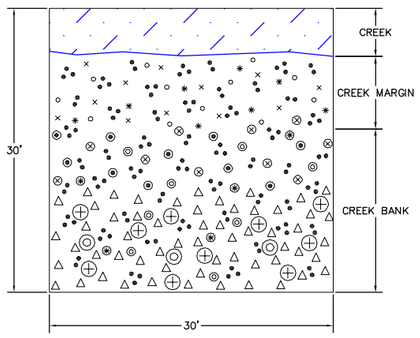

TYPICAL PLANT SCHEMATIC

NOT TO SCALE

SCALES AS INDICATED

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
FORMER UNOCAL EDMONDS TERMINAL
EDMONDS, WASHINGTON

AS-BUILT PLANTING PLAN AND DETAILS

ARCADIS

FIGURE 8

Appendix C

Monitoring Field Sheet

Former Unocal Edmonds Terminal
Willow Creek Restoration Monitoring Field Sheet
Monitoring Year_____

Monitoring Team_____Date_____

Vegetation Monitoring

Plot 1

Species planted	Time-Zero Number individuals	Number survived	Percent cover	General Health and Vigor
Alnus rubra	2			
Pinus contorta	1			
Salix lucida	4			
Salix sitchensis	3			
Cornus sericea	2			
Lonicera involucrata	3			
Deschampsia cespitosa	6			
Carex obnupta	26			
Juncus balticus	--			
Schoenoplectus acutus	--			
Scirpus microcarpus	--			
Total Species Present	8			

Plot 2

Species	Time-Zero Number individuals	Number survived	Percent cover	General Health and Vigor
Alnus rubra	3			
Pinus contorta	0			
Salix lucida	3			
Salix sitchensis	6			
Cornus sericea	2			
Lonicera involucrata	2			
Deschampsia cespitosa	11			
Carex obnupta	18			
Juncus balticus	--			
Schoenoplectus acutus	--			
Scirpus microcarpus	--			
Total Species Present	8			

Former Unocal Edmonds Terminal
Willow Creek Restoration Monitoring Field Sheet
Monitoring Year_____
Monitoring Team_____Date_____

Plot 3

Species	Time-Zero Number individuals	Number survived	Percent cover	General Health and Vigor
Carex obnupta	--			
Juncus balticus	--			
Schoenoplectus acutus	--			
Scirpus microcarpus	--			
Total Species Present	4			

Plot 4

Species	Time-Zero Number individuals	Number survived	Percent cover	General Health and Vigor
Carex obnupta	--			
Juncus balticus	--			
Schoenoplectus acutus	--			
Scirpus microcarpus	--			
Total Species Present	4			

Maintenance

Removal of non-natives required?

Maintenance of watering system required?

Replacement of any plants required?

Additional comments:

References

Cover Class Midpoints

Percent Cover Range	Cover Class Midpoint
< 1%	0.5
1 – 5%	3
6 – 15%	10.5
16 – 25%	20.5
26 – 45%	38
46 – 75%	63
76 – 90%	85.5
> 90%	98

General Health and Vigor

Classification	Description
Excellent	No evidence of stress; minor pest or pathogen damage; natives dominant
Good	Some evidence of stress; pest or pathogen damage present; non-native species present, not dominant
Fair	Moderate level of stress; high levels of pest of pathogen damage; non-native species dominant
Poor	High level of stress; high levels of pest of pathogen damage; non-native species dominant