2014 (Year 1) Monitoring Report

Custom Plywood Interim Remedial Action Conservation Measures and Monitoring

Anacortes, WA

Prepared for

Washington State Department of Ecology

June 2, 2015
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EXECUTIVE SUMMARY

Custom Plywood is a Washington State Department of Ecology Toxics Cleanup Program (Ecology) project site under an agreed order with the property owner (PLP). Located on Fidalgo Bay in Anacortes, Washington, Custom Plywood has progressed through a series of phases of an overall remedial cleanup action. Phase II, in-water cleanup activities, was completed in 2013. As part of the verifying the performance of design elements and complying with regulatory permit conditions specific to this project, this Conservation Measures and Monitoring Report summarizes performance of various design elements compared to performance criteria previously agreed upon by Ecology and federal and state regulatory agencies involved in this project (Hart Crowser 2012a). This report summarizes the results for the first year of monitoring following the Phase II interim remedial actions.

Ecology and other agencies established a series of monitoring criteria to compare relative performance of the remedial actions and to evaluate the success of the project from a resource perspective. Table 1 and the text below provides a summary of these tasks and indicators for success. The performance categories included physical monitoring of the restored beach, epibenthic zooplankton sampling, documenting nearshore fish species, monitoring for forage fish spawning activity and egg survival, determining the effectiveness of eelgrass transplants, and monitoring the wetland and backshore vegetation. As seen in Table 1, two out of six categories have met their Year 1 performance criteria. One category (Epibenthic zooplankton) did not meet its performance criteria during Year 1, but showed improvement and is expected to meet performance criteria in time. The physical monitoring and eelgrass transplants categories were not evaluated at this time, because they require multiple years of sampling to evaluate and compare to their respective performance criteria. The wetland and backshore vegetation appear to be meeting the success criteria; however, additional monitoring using the transect-plot method will be needed to confirm this determination in 2015.

Table 1 – Year 1 (2014) Performance Status of Monitoring Components

Monitoring Component	Status of Performance Criteria
Physical monitoring of the restored beach	Yet to be determined
Epibenthic zooplankton	Improving
Nearshore fish	Meeting criteria
Forage fish spawning	Meeting criteria
Eelgrass transplants	Yet to be determined
Wetland and backshore vegetation	Yet to be determined

The success criterion for the restored beach was to verify that beach profiles not change by more than +/−1.5 feet by Year 5. This criterion was not applicable during the Year 1 monitoring since no significant storm events had occurred prior to the Year 1 survey. Continued monitoring through Year 5 will allow for future evaluation.

Epibenthic zooplankton success was evaluated by comparing plankton densities (catch per unit effort [CPUE]) on the restored beach to densities at the reference beach. Current densities on the restored beach were less than those from the reference beach. More time is needed to allow for additional larval recruitment and increased foraging opportunities for invertebrates in the restored areas. Enhanced densities may be achieved as increased colonization of macrovegetation provides algae and detritus that support zooplankton diets. Increased presence of juvenile salmonids on the restored beaches may also be complicating the results by suppressing epibenthic zooplanktons density.

Nearshore fish surveys focused on juvenile salmonid use of the restored beach (CPUE) compared to that on the reference beach. This criterion was met in 2014. Juvenile salmonid use of the restored beach was found to be greater than in the reference site. In addition to higher CPUEs for salmonids, all five Pacific salmon species were found to occur within the restored sites, while only two species were found in the reference site.

Success criterion for forage fish was dependent on at least 50 percent of the substrate composition along the upper beach being suitable for forage fish spawning in any given year. This criterion was met in 2014, with all survey sites of the enhanced beach area documented to have forage fish spawning occur during the Year 1 monitoring period. Increased egg survival was also documented since the replacement of beach substrate in 2013.

Eelgrass transplant success was defined as no temporal loss of eelgrass productivity over time. This was measured by the density of eelgrass, multiplied by the area of shoots in the transplant areas, and adjusted for changes in the reference bed. This density was then compared to eelgrass decline in the project vicinity. These criteria were not applicable since eelgrass transplants are less than one year old. By 2015 monitoring, we expect 50 percent or greater colonization to occur, with similar area and density to the reference bed expected by 2019 (Year 5).

Wetland and backshore vegetation success is based on a combination of criteria of plant survival and cover. These include areal coverage of native vegetation in the planted area equal to 20 percent cover or greater, 80 percent plantings survival, and total cover of invasive plant species to comprise less than 10 percent. Based on limited data collected in 2014, there is an indication that these criteria were met in the Year 1 monitoring. However, final conclusions about the site meeting its success criteria require additional data collection that will be accomplished in 2015 by using a transect-based monitoring approach described in Appendix C. Low numbers of non-natives were observed on the site. Hart Crowser plans to manage the removal of non-native species in early spring 2015 to maintain low non-native cover.

1.0 INTRODUCTION AND OBJECTIVES

The Washington State Department of Ecology (Ecology) Toxics Cleanup Program (TCP) recently completed Phase II of the interim remedial actions at the Custom Plywood site located on Fidalgo Bay in Anacortes, Washington. The biological evaluation (BE; Hart Crowser 2011a) prepared for the remediation concluded that the project was not likely to adversely affect those species listed under the Endangered Species Act (ESA) and that the project will have more than minimal but less than substantial effects from short-term construction activities and will have positive long-term effects on essential fish habitat. These determinations of effects were dependent on the implementation of several proposed conservation measures designed to offset the unavoidable losses and disturbances to marine function that would result from project completion. Ecology prepared a Conservation Measures and Monitoring Plan (CMMP; Hart Crowser 2012a) to summarize potential impacts presented in the BE and propose appropriate conservation measures to offset unavoidable adverse impacts to important marine resources, especially those habitats for salmonids listed under the ESA. The restoration actions described in the CMMP were expected to provide several benefits that would exceed the anticipated adverse impacts of the project.

The restoration actions completed during the Custom Plywood Interim Remedial Action remedial cleanup were:

- Expanded and restored the shallow water migratory corridor and rearing habitat for juvenile salmonids at all tidal elevations through removal of contaminated sediment as well as in-water and overwater structures.
- Excavated/dredged contaminated sediments covering 7.1 acres (1.8 acres in the shoreline cleanup zone/intertidal zone and 5.3 acres of subtidal zone) and backfilled with clean sediment.
- Removed 1,465 creosote-treated piles, derelict structures (bulkhead, L-shaped pier, and smaller concrete structures), and debris (concrete, metal, and brick) over an area of 13,500 square feet (sf).
- Enhanced approximately 1,770 linear feet of shoreline habitat between elevations of –5 and +8.5 feet mean lower low water (MLLW) with suitable substrates and/or grading to allow forage fish spawning. Areas that received these enhancements include the main shoreline of the property,

the inner portion of the protective spit, the existing jetty, and a pocket beach located immediately north of the Custom Plywood site.

- Protected eelgrass to the extent possible and enhanced and expanded eelgrass beds through advanced plantings (2,000+ sf), to achieve no net long-term loss of eelgrass.
- Increased backshore function by planting native riparian vegetation above the upper beach and along the ordinary high water (OHW) line of the main shoreline. The area that received these enhancements totaled approximately 5,440 sf (0.1 acres).
- Compensated for unavoidable wetland losses that result from site remediation activities by hydrologically connecting a consolidated wetland mitigation area to Fidalgo Bay; this provided juvenile salmonid access to approximately 12,000 sf of wetland habitat surrounded by a vegetated buffer ranging from 50 to 75 feet in width.

The majority of these habitat enhancements occurred as part of the construction activities for the Phase II Interim Remedial action at the Custom Plywood site from July 15, 2013, to December 23, 2013. The shoreline protection features, such as the extension of the jetty and the installation of a protective spit, were completed within this window. Placement of the improved beach substrate for juvenile salmonids, forage fish spawning, shorebirds and waterfowl and other aquatic species at the site was also completed during Phase II. In late October 2013, approximately 22,000 dunegrass plants were planted along the property shoreline to provide erosion control and backshore habitat as well as along protective spit. The wetland mitigation complex was constructed during the Phase I Interim Action (July 22, 2011, to October 31, 2011) but it was not breached until Phase II, following the completion of the in-water excavation and dredging. In addition to cutting the breach, larger, heavier material was added to completely cover the sloped sides of the breach to withstand wave propagation from the south and prevent potential erosion. The channel of the breach was excavated to a depth that completely drains the pond within the wetland area at low tide with the intention of not stranding fish in shallow, isolated water.

The CMMP also laid out a 10-year monitoring program to assess the effectiveness of conservation measures implemented during design and construction. This Year 1 Monitoring Report is intended to provide the monitoring results of the restored beach substrate, epibenthic production, juvenile salmonid use, forage fish spawning, and wetland and backshore vegetation function, as well as document the 2014 advanced eelgrass transplant effort. This work will be done to satisfy the requirements associated with Nationwide Permit No. NWS-2012-868.

2.0 PROJECT LOCATION

The project is located in Anacortes, Washington, in Section 30 of Township 35 North, Range 2 East (Figure 1). The project area, where proposed activities were conducted is approximately 23 acres in size. The project area includes the area between approximately OHW and –6 feet mean lower low water (MLLW) and areas north of the site at the existing jetty owned by the City of Anacortes.

3.0 MONITORING SCHEDULE AND METHODS

3.1 Monitoring Schedule

The final in-water construction and subsequent as-built completed in December 2013 represents Year 0 of the monitoring timeline. Year 1 monitoring began in April with forage fish monitoring, which occurred bi-monthly July through October, with one final monitoring event in December. Epibenthic zooplankton and nearshore fish monitoring occurred in May and June. The advanced eelgrass planting effort was conducted in late June. The physical monitoring and wetland monitoring were conducted in September. Reporting for the Year 1 monitoring report began in December 2014. Table 2 summarizes the monitoring schedule Hart Crowser completed during the Year 1 work.

Table 2 – Monitoring and Reporting Schedule for Year 1 (2014)

Monitoring Event	Year 0 (2013)	Year 1 (2014)									
	Dec.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Final As-built Completed	X										
Physical Monitoring								X			
Epibenthic Zooplankton & Nearshore Fish				X	X						
Forage Fish Survey for Sand Lances & Surf Smelt			X			XX	XX	XX	XX		X
Eelgrass Advanced Planting					X						
Wetland Monitoring								X			
Year 1 Reporting											X

each X = one monitoring event

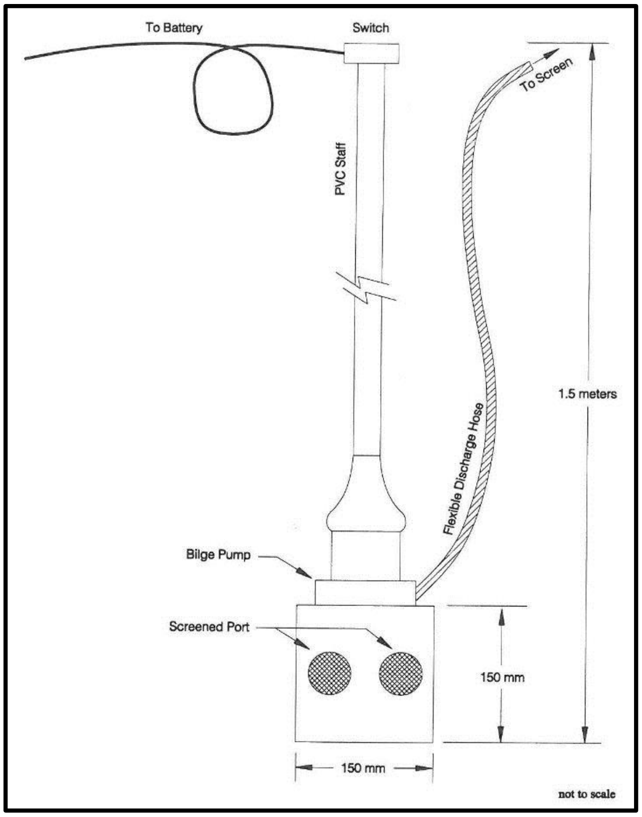
3.2 Physical Monitoring of Restored Beach

Physical monitoring of the restored beach was conducted by Coast and Harbor Engineering in accordance with the monitoring approach described in the CMMP Work Plan (Hart Crowser 2014). An as-built survey was conducted in mid-December 2013, immediately following completion of the beach construction. In September 2014, the restored beach habitat was monitored by surveying nine beach profiles (Figure 2) from near the edge of adjacent eelgrass beds (or water's edge at the time of the survey) to +15 feet MLLW to determine the degree of substrate sorting, recruitment, and migration. Beach features such as changes in slope or substrate were noted and located on each transect. Hand core samples of substrate were collected at four locations on six of the eight transects to determine the depth and grain size composition of the surficial substrate. The Year 2 (2015) report will include the series of photo points that were established during Year 1 (2014) to document physical changes in the appearance of the restored beaches (both foreshore and backshore), accumulations of large woody debris (LWD), and development of riparian vegetation as discussed in the Technical Memorandum presented in Appendix B.

3.3 Epibenthic Zooplankton

Epibenthic zooplankton are a sediment associated prey group important to juvenile salmonids. To gain insight into habitat function of the restored shoreline after restoration, epibenthic biota were quantitatively sampled within the project area and at an unaltered reference site. Four transects (one in the reference area and three in the project area; Figure 2) were sampled at two elevations (+4 and +6 feet MLLW) within the intertidal zone. Of the three transects within the project area, EB-1 was located along the south side of riprap jetty located on the northern-most section of the restored beach; EB-2 was located in the middle of the restored beach; and EB-3 was located at the outlet of a constructed pocket estuary. The reference site, located approximately 0.5 kilometers to the south of the project area, represented a more natural state; little human alteration was present except for a walking path located behind vegetation in the upland. Sampling was conducted during two periods (May 13–15 and June 13–14) in the spring to coincide with juvenile salmonid sampling.

Samples were collected using a hand-held, battery-powered epibenthic zooplankton sampler (Simenstad et al. 1991) (Figure 3). The sampler was a cylinder with 0.125-millimeter (mm) mesh screen ports that was lowered through the water to enclose the benthic boundary layer over a surface area of 0.02 square meters (m^2). Once in place, the pump discharges water enclosed in the cylinder through a 0.250-mm sieve. The material deposited on the sieve was then collected and preserved in 10 percent



buffered formalin for laboratory sorting and identification. Three replicate samples were collected at each elevation sampled along each transect.

Figure 3 – Epibenthic zooplankton sampler

In the lab, samples were sorted and epibenthic organisms were identified to the lowest practicable taxonomic level. For each sampling event, data were analyzed using 2-way analysis of variance (ANOVA) to determine if there were differences in species richness, total epibiota abundance or potential salmonid prey abundance as a function of elevation and treatment (restored vs. reference beach). Statistical differences, could be an indication of differences in habitat quality and prey resources for those species that forage in this habitat, such as juvenile salmonids.

3.4 Nearshore Fish

To determine use of the nearshore study area by juvenile salmonids and resident marine species, field teams collected nearshore fish samples using a standard 120-foot floating beach seine. The seine measured 120 feet in length, 10 feet deep at the bag, and 3 feet deep at the end of the wings. The wings were 60 feet in length with 0.375-inch bar mesh. The bag was 0.125-inch (bar) woven nylon mesh and measured 10 feet deep by 7.5 feet long. This net design was developed to capture smaller, surface-oriented fish, especially juvenile salmonids, in shoreline areas.

Photograph 1 – Field team collecting nearshore fish samples using a standard 120-foot floating beach seine

Beach seine sets were conducted at four sites—three on the restored beach and one reference site on a “natural” beach to the immediate south of the study area (Figure 2). Seining took place on May 13 and June 13–14, 2014, during the typical juvenile salmonid outmigratory period in Puget Sound. Additional beach seines were conducted in the pocket estuary adjacent to Site 3 using a 30-foot beach seine.

Beach seine methods employed during the sampling period were similar to those used in juvenile salmon studies within many estuaries in the northeast Pacific. Exact location of beach seine sampling at each site was dependent on tidal elevations and currents. For the 120-foot seine, field personnel stood on the beach holding one end of a 100-foot haul line while the skiff containing the net backed out, perpendicular to the beach. When the end of the towline was reached, the skiff was turned 90 degrees and the seine was deployed parallel to the beach in the direction of the current. After net deployment, the boat returned to the beach while releasing the second 100-foot towline. The seine was then hand retrieved to the beach by field crew (Photograph 1). Similar methods were employed for the 30-foot seine, except that the net was walked out by personnel in waders, rather than with a skiff. Beach seining at most sites occurred at higher tides so that sampling occurred over the newly constructed beach surface rather than over the lower sand flats. Two seine sets were deployed at each site.

Upon retrieval of the seine, fish and invertebrates were removed from the net and placed in a bucket of ambient water. Lengths of most fish were measured and recorded in the field; however, when large numbers of the same species were captured, a representative subsample (at least 20 fish) was measured. Fork lengths were measured on species with homocercal (notched) caudal fins (tails), and total length was taken for all other species (Photograph 2). Fish from the first set were released back into the bay away from where the second set was going to occur. Selected fish and all invertebrates from both sets at a given site were retained in a single container and preserved in 10 percent formalin for laboratory identification and enumeration.

To determine the degree of use of the restored beach by juvenile salmonids and other fish species, we calculated total catch and catch per unit effort (CPUE; defined as number of fish per set). CPUE was determined for each site, for each treatment (restored versus reference), and for all sites combined during the two sampling periods. The pocket estuary was excluded from the both the overall and restored beach CPUE, as the estuary habitat was unique among both the restored and reference sites. We examined the results for differences between the reference and newly constructed beaches with respect to utilization by the local fish assemblage.

Photograph 2 – Field personnel measuring fish length.

3.5 Forage Fish

A field biologist collected beach substrate samples on the restored beach and at an adjacent reference beach to evaluate the potential use of the study area by spawning surf smelt and Pacific sand lance. Surveys were conducted in accordance with Washington Department of Fish and Wildlife (WDFW) protocols (Moulton and Penttila 2001) by a biologist certified by WDFW for conducting such surveys.

In accordance with WDFW protocols, the study area was divided into four 100 foot transects in areas of suitable spawning substrates between +5 feet above mean lower low water (MLLW) and mean higher high water (MHHW), capturing the full extent of the restored shoreline (Figure 2). The sites were numbered from north to south, as Sites 1 to 4. One transect was also established on a reference beach, marked in Figure 2 as the southernmost sample, Site 5. During the survey, subsamples within the upper 1 to 2 inches of beach substrate were collected at spaced intervals within each transect and composited for laboratory analysis. Substrate was targeted if eggs were visible on the beach, otherwise subsamples were spaced evenly to capture the full transect.

In the laboratory, composited beach samples were condensed with screens, and winnowed to separate and remove forage fish eggs from the beach substrate. Winnowed samples were examined under a dissecting microscope to complete the search for eggs, identify species, and identify developmental stages. Data from these surveys will indicate the presence and condition of forage fish eggs for comparison between the restored and the reference beaches.

Forage fish surveys were staggered through the year, to capture spawning events during different seasons. Surf smelt spawn year-round, but are predominately summer spawners in Fidalgo Bay, spawning during nighttime high tides. Sand lance in Puget Sound spawn only in the winter, between November and February, at varying high tides depending on weather conditions. Herring spawn subtidally on submerged vegetation between late winter and early spring.

A paired survey consists of two site visits separated by two weeks, to track development of eggs present. A single site survey was conducted in April, 2014. Paired surveys were conducted in July, August, September, and October. The first of the December paired survey was conducted at the time of this report, and the second site visit will occur in late December.

3.6 Advanced Eelgrass Transplant

The primary goal of the advanced eelgrass plantings was to facilitate colonization of eelgrass into newly remediated areas that could support eelgrass habitat but currently do not. By transplanting eelgrass into the advanced planting area we expect accelerated expansion of eelgrass habitat. See Figure 2 for advanced planting area and eelgrass donor area.

The secondary goal of the eelgrass plantings was to mitigate for small patches of eelgrass that were potentially impacted during construction of the remediation protective features (jetty extension and spit). To ensure that no temporal loss of eelgrass productivity occurs, advanced eelgrass plantings were installed adjacent to the larger continuous bed on the Custom Plywood site.

The eelgrass donor sites were identified during the pre-construction baseline survey as areas that have healthy and reasonably dense populations of eelgrass, are at a depth similar to that at the respective transplant sites, and are removed from the area of potential project impact.

Intertidal transplanting occurred on June 23 and 24, 2014. Shoots from the intertidal donor beds were diver harvested by hand. Care was taken to avoid damage to surrounding unharvested shoots and rhizomes. To avoid inducing erosion damage, harvest avoided the edges of existing beds. A maximum of 5 percent of the shoots in a given donor bed was harvested.

Harvested shoots and associated rhizomes were be bundled into groups of three shoots and loosely tied with biodegradable twine. Blades were be clipped to a uniform length of about 9 inches. A U-shaped, ungalvanized wire, about 6 inches long, was slipped inside the twine to serve as an anchor. Each 3-shoot bundle was considered to be a single planting unit (PU). All plant processing was conducted with minimal exposure time, and plants were stored in a seawater bath while awaiting processing (Photograph 3).

Photograph 3 – Bundled planting units (PUs) placed in seawater bath

The PUs were then inserted into the sediment with the aid of a trowel until the horizontal rhizomes were completely buried. PU survival of 40 to 100 percent has been achieved in two recent transplants using this technique (Hart Crowser, unpublished data); in one of these transplants, expansion and spreading of surviving PUs increased overall shoot density 100 times over the initial planting density within two years.

3.7 Wetland, Backshore, and Upland Buffer Vegetation

Prior to Phase I construction, the site contained five wetlands (Wetlands A through E) totaling 11,910 square feet (sf). Wetlands A (120 sf), B (124 sf), and D (9,910 sf) were freshwater depressional wetlands, and Wetlands C (367 sf) and E (1,389 sf) were estuarine wetlands. Wetlands A, B, C, and D, totaling 10,521 sf, were permanently removed during the Phase I upland remediation. Wetland E, a federally regulated wetland, was removed in Phase II of the project (2013). To mitigate the loss of wetland areas during the upland portion of the remedial actions, one 12,000-square-foot, consolidated wetland complex was proposed to be constructed on the southern portion of the property and was established as part of the overall cleanup action during Phase I construction in 2011. The wetland mitigation area consists of estuarine wetland, backshore dunegrass habitat (backshore), and associated upland buffer that is approximately 50 to 75 feet wide and is located landward of the MHHW line. The upland buffer and the backshore habitat were created and planted with appropriate native vegetation during the Phase I construction in 2011. During Phase II construction in 2013, a protective temporary berm was constructed seaward of the wetland area to prevent potentially contaminated sediment from entering the created wetland. Also, during Phase II in 2013, pickleweed from Wetland E was transplanted into the created wetland with the goal of establishing it in the wetland. The protective berm was breached in 2014 at the end of the Phase II Interim action restoring tidal exchange. The final wetland mitigation area totals 12,000 square feet of estuarine and tidal unconsolidated bed wetland. This area was confirmed in the As-Built Verification Report (Hart Crowser 2012b). Currently within the wetland complex, there are two zones for monitoring: upland buffer (trees, shrubs and groundcover [e.g., dunegrass]), and wetland.

The upland buffer was monitored in 2012 (Hart Crowser 2013) following its completion during Phase I construction in 2011 (Appendix C). The report documented the restoration efforts to be largely successful with most of the trees, shrubs, and herbaceous vegetation healthy and growing well.

This Year 1 report includes the upland buffer area monitored in 2012 as well as the areas created during 2013. The upland buffer (within the estuarine wetland complex) was monitored as Year 3 under the SEA program and assessed as to whether the site meets the success criteria for Year 3. The estuarine wetland and backshore along the berm, beach, and spit were monitored as Year 1 beginning with this 2014 report. Table 3 at the end of this report shows the monitoring schedules for these elements. Ten years of additional vegetation monitoring will be performed for the entire site starting with 2014 as Year 1 and monitoring until 2023 (see Table 3).

For this year (2014), vegetation sampling within the upland buffer, backshore, and wetland areas deviated from the sampling design done in 2012 (which is described in Appendix C). During 2014, plots were established in the upland buffer, backshore, and estuarine wetland. Fourteen 3-m^2 plots in total were established: four in the upland buffer (including dunegrass), four in the estuarine wetland, two in the berm on water side of the wetland, one on the spit, and three in the backshore along the restored beach (Figure 9). The absolute percent cover of native and non-native species and their condition at each plot was collected and then averaged for each area listed above. Permanent photographic points were established to document growth and density of vegetation of the riparian, backshore, and wetland areas. The percent mortality/survival of installed plants in the wetland and backshore along the beach was also recorded.

The approximate location of non-native species (if present) within the wetland complex and the stormwater swale was also recorded and photo-documented. Each annual monitoring report will include survey results, general condition of the plant communities, and maintenance recommendations for removal of non-native vegetation and/or replacement of plants that did not survive (if necessary). Physical vegetation maintenance at the site will be completed under a separate work order authorized by the Department of Ecology.

For future monitoring of the upland buffer, backshore, estuarine wetlands, and spit will follow the transect sampling method described in the memorandum in Appendix C.

4.0 RESULTS

4.1 Physical Monitoring of Restored Beach

Monitoring of the substrate and profile of the beach restoration project was conducted on September 24, 2014. Detailed methods of the monitoring are provided in the Technical Memorandum provided in Appendix B. This Year 1 monitoring effort was used to establish post-construction baseline conditions. No data analysis was conducted as part of the Year 1 (2014) monitoring; but qualitatively, the habitat mix placed over the restored section, the beach face slope, and elevations have been maintained largely as designed and constructed. This was, however, prior to the king tide sequence and winter storm activity of November and December.

A qualitative evaluation of the spit and jetty was also conducted as part of the beach substrate and profile monitoring. A formal memo of the jetty and spit observations are included in Appendix B but the findings are summarized here. The field observations of the spit indicated that the composition of the slopes appeared the same as the condition immediately after construction (predominantly gravel and cobble with mild slopes). On the south side of the spit, the slopes were steeper (as constructed) and contained a greater percentage of sand and small gravel. The presence of sand and small gravel on the spit is presumably due to the placement of a thin layer of fish mix on the south side of the spit and the gradual migration of the sand placed above on the spit crest down the south slope. The surface substrates of the spit are generally finer on the lower part of the south spit slopes. The sand placed on top of the spit has partially eroded and formed a scarp in some areas, as would be expected to occur after a nearly one year of high tides and storms. The structural integrity of the jetty appeared similar to the condition immediately after construction. No noticeable displacement of stones or indication of instability of the jetty was observed. The top of the jetty on the east side was lower than the top of jetty on the west side. This sloping jetty top is consistent with the condition of the jetty immediately after construction, as documented in the post-construction surveys.

4.2 Epibenthic Zooplankton

The restored beach face between +6 feet MLLW and about +4 feet MLLW is composed of graded pebbles, granules, and medium to fine sands. Beach material at the reference is similar to that at the restored beach but also includes larger cobble and boulder material. The larger boulder material at the reference is likely rip rap from the original rail system that historically went along the shoreline. Organic content of the sediments would be considered low for restored beach since placement of the material occurred recently in fall 2013. In contrast, detritus at the reference site was much higher with inputs from upland vegetation and well established nearshore macrophytes not present at the restored beach. Beach sediment characteristics were similar in both the May and June 2014 sampling periods.

4.2.1 Assemblages and Relative Abundance

A detailed analysis was performed on several data strata using two-way ANOVA, including total epibenthic biota density, crustacean density, and species richness for each sampling period. Crustacean density was analyzed separately because crustaceans (especially copepods) are known to be important prey items for juvenile salmonids (Simenstad et al. 1980; Simenstad et al. 1982). We analyzed for differences by treatment (restored sites vs reference site) and by tidal height (+4 vs. +6 feet MLLW).

Shannon's diversity index and evenness index were also calculated. Whereas species richness is simply the number of different species present, diversity takes into account abundance and evenness of the community. Evenness is how close in number each species in the community is, and provides information on whether the community is dominated by a few taxa.

4.2.2 May

For total biota and species richness, no significant difference was found between site beach sites EB-1, EB-2, EB-3 and the Reference site. For total crustacean density, the difference was not statistically significant, but may be considered ecologically significant (p = 0.059). A Tukey HSD multiple comparisons analysis revealed that this difference was mainly derived from differences between EB-1 and EB-2.

Epibenthic biota in May (Table 4) were overall dominated by copepods (36 percent of total biota quantified), but differences in species assemblage were apparent by site and elevation. In general, samples collected at +6 feet MLLW tended to be less heavily dominated by one or two species than those collected at +4 feet MLLW. EB-1 at +4 feet MLLW was dominated mostly by copepods (33 percent), although mites, barnacle nauplii and larvaceans were also common (15 percent, 15 percent, and 14 percent, respectively). EB-1 at +6 feet MLLW was dominated by barnacle nauplii (27 percent), larvaceans (25 percent), and copepods (25 percent). EB-2 was dominated at both elevations by copepods (53 percent at +4 feet, 45 percent at +6 feet MLLW and barnacles (cyprids and nauplii combined mean of 20 percent at +4 feet, 35 percent at +6 feet MLLW). EB-3 was heavily dominated by annelids (larvae and eggs) at +4 feet elevations (73 percent), but was much more diverse at +6 feet; here the site was dominated by copepods (42 percent) and barnacle larvae (cyprids and nauplii combined mean of 29 percent), with moderate densities of annelids (larvae and eggs) and amphipods, as well (16 percent and 12 percent, respectively). Reference sites were dominated by copepods at both elevations (43 percent at +4 feet, 40 percent at +6 feet MLLW), but nematodes were co-dominant at +4 feet (41 percent), and annelids (larvae and eggs) were co-dominant at +6 feet (32 percent).

Total epibenthic fauna density differed significantly by elevation ($p < 0.05$), but not by treatment (Table 5). There was, however, a significant interaction between the two factors, meaning that treatment significantly influenced the effect of elevation. This result is due to the fact that while fauna density was greater at +4 feet tidal elevations in general (Table 4), this difference was much more pronounced in the reference site than in the restored sites (Figure 4). This pattern was driven by an increased density of nematodes and copepods at the +4 feet MLLW reference site.

Total crustacean density differed significantly by elevation ($p < 0.05$), but not by treatment (Table 6). Similar to total epibenthic fauna density, a significant interaction between the two factors was also found. In general, fauna density was greater at +4 feet tidal elevations, but that difference being much more pronounced at the reference site than in restored site. Mean crustacean density in restored areas was 4,777/m^2 in +4 feet MLLW samples, and 3,139/m^2 in +6 feet MLLW—a modest decrease by about a third. In contrast, in reference areas mean crustacean density was 16,089/m^2 in +4 feet MLLW samples, and 1,233/m^2 in +6 feet MLLW samples—nearly 13 times less (Table 5; Figure 5). This pattern is driven primarily by increased copepod density.

Species richness was significantly different by elevation ($p < 0.05$), but not by treatment (Table 6). No significant interaction was found. Species richness was greater in +4 feet MLLW samples than in +6 feet MLLW samples (Figure 6). Interestingly, community evenness was often higher in +6 feet MLLW samples than in +4 feet MLLW samples. As a result, diversity did not display any clear pattern by elevation or treatment; however, average diversity and evenness of restored areas was greater than that of the reference area (Table 5). Diversity was highest at EB-1 +4 feet MLLW, and lowest at EB-3 +4 feet MLLW.

Table 6 – Two-way ANOVA Results for (A) May Zooplankton Data and (B) June Zooplankton

A. May Data					
Treatment (reference/restored)	**Df**	**SS**	**MS**	**F**	**P**
Total Epibenthic Biota (#/m^2)	1	0.71	0.71	2.19	0.15
Total Crustaceans (#/m^2)	1	0.60	0.60	1.13	0.30
Species Richness	1	5.01	5.01	1.80	0.20
Depth (shallow/deep)	**Df**	**SS**	**MS**	**F**	**P**
Total Epibenthic Biota (#/m^2)	1	10.95	10.95	33.66	**0.00**
Total Crustaceans (#/m^2)	1	4.01	4.01	7.50	**0.01**
Species Richness	1	40.04	40.04	14.36	**0.00**
Treatment x Depth	**Df**	**SS**	**MS**	**F**	**P**
Total Epibenthic Biota (#/m^2)	1	2.96	2.96	9.09	**0.01**
Total Crustaceans (#/m^2)	1	6.30	6.30	11.79	**0.00**
Species Richness	1	1.13	1.13	0.40	0.53
B. June Data					
Treatment (reference/restored)	**Df**	**SS**	**MS**	**F**	**P**
Total Epibenthic Biota (#/m^2)	1	8.04	8.04	8.57	**0.01**
Total Crustaceans (#/m^2)	1	11.84	11.84	12.42	**0.00**
Species Richness	1	32.00	32.00	7.35	**0.01**
Depth (shallow/deep)	**Df**	**SS**	**MS**	**F**	**P**
Total Epibenthic Biota (#/m^2)	1	4.68	4.68	5.00	**0.04**
Total Crustaceans (#/m^2)	1	4.11	4.11	4.31	0.051
Species Richness	1	6.00	6.00	1.38	0.25
Treatment x Depth	**Df**	**SS**	**MS**	**F**	**P**
Total Epibenthic Biota (#/m^2)	1	0.00	0.00	0.00	0.99
Total Crustaceans (#/m^2)	1	0.08	0.08	0.09	0.77
Species Richness	1	0.22	0.22	0.05	0.82

Note: **Bold** values indicate significant differences ($p \leq 0.05$)

4.2.3 June

For total biota, significant differences were found between: EB-1 and EB-2; EB-1 and Reference; and EB-3 and Reference. Significant differences were also found for total crustacean density among sites. These differences were between: EB1 and EB-2; EB-1 and EB-3; EB-1 and Reference; and EB-3 and Reference. No significant difference was found among sites for species richness.

Epibenthic biota in June were again dominated overall by copepods (53 percent of total biota quantified), but barnacles were much less dominant in June samples than in May (Table 4). EB-1 at +4 feet MLLW was dominated by copepods (40 percent), though barnacles, nematodes and annelids (larvae and eggs) were also common (16 percent, 13 percent and 13 percent, respectively). EB-1 at +6 feet MLLW was dominated by annelids (larvae and eggs) (47 percent) and copepods (41 percent). EB-2 was dominated at both elevations by copepods (53 percent at +4 feet, 34 percent at +6 feet MLLW) and by annelids (larvae and eggs) (34 percent at +4 feet, and 42 percent at +6 feet MLLW). EB-3 was dominated by copepods at both elevations (56 percent at +4 feet, 48 percent at +6 feet MLLW), but nematodes were co-dominant in +4 feet MLLW samples (28 percent). Barnacles and nematodes were also common in +6 feet MLLW samples of EB-3 (19 percent and 15 percent, respectively). Reference sites were dominated by copepods at both elevations (56 percent at +4 feet, 61 percent at +6 feet MLLW), but nematodes were co-dominant in +4 feet MLLW elevations (25 percent), and unidentified nauplii were common in +6 feet MLLW elevations (13 percent).

As in May, total epibenthic fauna density differed significantly by elevation. Unlike in May, however, the density also differed significantly by treatment ($p < 0.05$ for both; Table 6). No significant interaction between the two factors was found, meaning each factor behaved independently. The +4 feet MLLW samples had greater epibenthic fauna density than +6 feet MLLW samples, and reference areas had greater epibenthic fauna density than restored areas. As a consequence, +4 feet MLLW reference samples had the greatest fauna density, and +6 feet MLLW restored samples had the least (Figure 4) though these differences were not statistically significant. This pattern was driven primarily by the density of crustaceans present (analyzed below), and to a lesser extent by nematodes.

Unlike in May, total crustacean density differed significantly by treatment ($p < 0.05$; Table 6). Differences by elevation were very nearly statistically significant ($p = 0.051$), and should probably be considered as ecologically significant. No significant interaction was found. Higher densities of crustaceans were found in reference areas than in restored areas (Table 5); this pattern was driven by copepods, although ostracods, barnacles and amphipods appear in greater number in reference sites as well (Figure 5). +4 feet MLLW samples also had greater densities of crustaceans than +6 feet MLLW sites; this pattern is driven almost exclusively by copepods (Figure 5).

Unlike in May, species richness differed significantly by treatment ($p < 0.05$; Table 6) and not by elevation. No significant interaction was found. In general, reference sites had greater species richness than restored sites (8.6 vs. 6; Figure 6). No clear pattern emerged in either Shannon's diversity index or evenness index. In EB-2, EB-3 and the Reference site, diversity and evenness was higher in +6 feet MLLW samples than in +4 feet MLLW samples; the opposite pattern is seen in EB-1. Like in May, the highest diversity and evenness is seen in EB-1 at +4 feet MLLW (Table 5).

4.3 Nearshore Fish

In total, we captured and identified 21 species of fish in beach seine sets—between 13 and 15 species at sites on the restored beach, four species in the pocket estuary, and 12 species at the adjacent reference beach site. Overall, fish were more abundant in June relative to May (CPUE of 2342.7 fish/set in June, and 570.4 fish/set in May). In May, CPUE for all fish was slightly greater in restored sites (Table 7). By June, however, the reference site had a CPUE twelve times greater than in restored sites (Table 8).

4.3.1 Salmonids

Total salmonid abundance was considerably higher in May relative to June (CPUE for all sites = 76.9 fish/set versus 5.5 fish/set, respectively), driven primarily by pink salmon (*O. gorbuscha*), and to a far lesser extent, juvenile chum (*Oncorhynchus keta*). Catch rates for both of these species declined sharply in June. Relatively few juvenile Chinook salmon (*O. tshawytscha*) were captured in the nearshore study area (33 individuals total across all sites and months). Of those, the majority were caught at restored Site 2 in June (25 individuals). Juvenile coho salmon (*O. kisutch*) were not abundant during both periods, with only two individuals found in May and a catch rate of 1.4 fish/set in June. Similarly, sockeye salmon (*O. nerka*) had only two individuals caught in May, and none caught in June.

Juvenile salmonids were captured at much higher rates at the restored beach than at the reference beach. Juvenile salmonids were common with a mean catch rate of over 48.9 fish/set (all species and months combined) on the restored beach over the spring sampling period (Tables 7 and 8). Catch rates were substantially lower at the reference beach where total CPUE for juvenile salmonids was 18.3 fish/set. No salmonids were found within the pocket estuary.

During May sampling, juvenile salmonids were captured at rates more than twice as great at the restored sites than at the adjacent reference site (CPUE = 90.3 vs. 36.5, respectively). Overall catch rates and species richness for salmonids were greatest at Site 3 in May (Tables 6 and 7). Pink salmon were the dominant salmonid species in the early sampling period. CPUEs for pink salmon on the restored beach ranged from 9.5 to 170.5 fish/set, while at the reference beach a CPUE of 30.5 fish/set was found. In June, CPUEs dramatically decreased for salmonids overall; juvenile salmonids were caught at a rate of 7.4 fish/set on the restored beach, and none were caught on the reference beach. Chinook salmon were the most frequently caught salmonid species in June. CPUEs for Chinook salmon ranged from 0.5 to 12.54 fish/set on the restored beach (Tables 7 and 8).

No recognizable differences in juvenile salmon size and age class patterns were observed between reference and restored beach sites (Figures 7 and 8). Length frequency data for pinks and chum in May show typical clusters of young-of-the-year fish, most between 40 and 60 mm (Figures 7 and 8). Young of the year sockeye in the 60- to 70-mm range were also observed in May, though in extremely low abundance (n = 2; Figure 7). In June, the abundance of pink salmon was substantially lower, though the two fish that did occur were in the 60- to 80-mm range (Figure 8). Chum and sockeye salmon did not occur in the study area at all in June (Figure 8). In contrast, juvenile coho were found mostly in June, though in low abundance, and only on the restored beach (Figure 8). Those coho caught appeared to be an age 1+ year cohort between 70 and 100 mm, typical of the larger and older juvenile coho outmigrants found in the Puget Sound nearshore. Juvenile Chinook were also found mostly in June, in low abundance, and only at restored sites (Figure 8). Of those caught, most were between 70 and 90 mm, and were likely young-of-the-year ocean-type migrants. After emergence from redds, these ocean-type migrants typically spend 90 days or less in freshwater before outmigrating to the marine nearshore. Three older specimens between 100 and 140 mm were also captured in May and June (Figures 7 and 8). These three were likely yearling stream-type migrants, which spend at least a year after emergence rearing in freshwater before migrating to the ocean, generally in the spring. Two of these yearling Chinook were unclipped, suggesting they were of wild origin.

4.3.2 Marine Resident Fish Species

The most abundant non-salmonid species in May were shiner perch (*Cymatogaster aggregata,* CPUE for all sites = 341 fish/set), snake prickleback (*Lumpenus sagitta,* CPUE for all sites = 62 fish/set), surf smelt (*Hypomesus pretiosus,* CPUE for all sites = 39.5 fish/set), Pacific herring (*Clupea pallasii,* CPUE for all sites = 35.3 fish/set), and threespine stickleback (*Gasterosteus aculeatus,* CPUE for all sites = 9.8 fish/set). Seven other non-salmonid species occurred in May, but in relatively low abundance (less than 5 fish/set). Snake prickleback and surf smelt were caught at a much higher rate at the restored beach relative to the reference beach during this sampling period. All other species at restored beach sites in May were caught at rates similar to or slightly greater than at reference sites (Table 8).

The most abundant non-salmonid species in June were shiner perch (*Cymatogaster aggregata,* CPUE for all sites = 1998.2 fish/set), surf smelt (*Hypomesus pretiosus,* CPUE for all sites = 816.3 fish/set), snake prickleback (*Lumpenus sagitta,* CPUE for all sites = 42.3 fish/set), threespine stickleback (*Gasterosteus aculeatus,* CPUE for all sites = 25.0 fish/set), and Pacific staghorn sculpin (*Leptocottus armatus*, CPUE for all sites = 5.6 fish/set). Six other non-salmonid species occurred in May, but in relatively low abundance (less than five fish/set). Shiner perch were 90 times more abundant at the reference beach than at the restored beach, while surf smelt, snake prickleback, threespine stickleback, and Pacific staghorn sculpin were all more than twice as abundant at the reference beach than restored beach. All other species at the reference beach in June were caught at rates similar to or greater than in restored sites (Table 8).

No marine resident fish were caught in the pocket estuary in May, and in June only four species were caught. Shiner perch were caught at a rate of 100.5 fish/set, while sculpins occurred at rates of less than five fish/set (Tables 7 and 8).

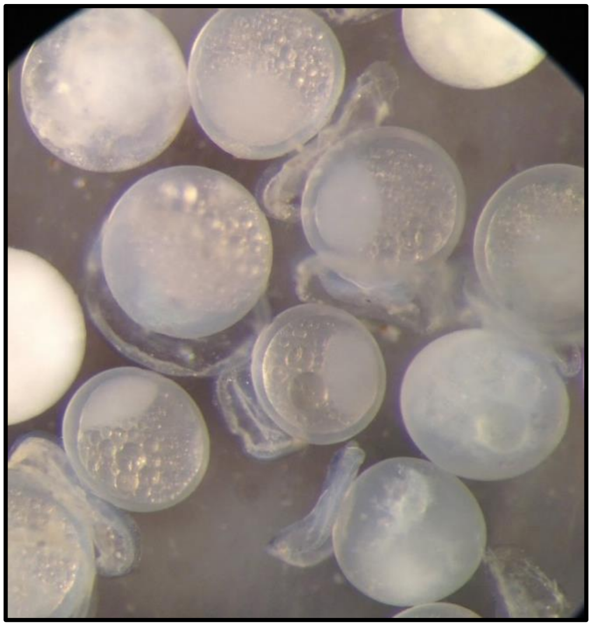
4.4 Forage Fish

The Custom Plywood beach restoration area was surveyed ten times for forage fish spawning activity between March 1, and December 19, 2014. A single site survey was conducted in April, to monitor the presence of early summer surf smelt spawning. Paired surveys in July through October were conducted to monitor the condition of eggs and track egg development for surf smelt. Winter paired surveys in December through February will investigate potential spawning for surf smelt and sand lance. Specific times and dates for the surveys varied across the year and were largely dependent on tide being below +5 feet (MLLW). The three previous nighttime high tides were logged, as a reference to when recent spawning might have occurred. Despite the near year round sampling, only surf smelt eggs have been encountered at the site (both on the restored beach and reference beach). A summary of egg presence and developmental stages is described in Table 9.

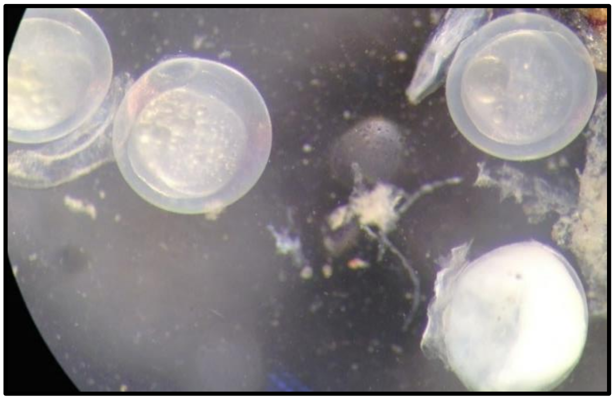
Table 9 – 2014 Summary of Surf Smelt Egg Presence and Development

Date	Sites With Eggs Found	Relative amount of Eggs	Egg Condition	Egg Development
April 2	Sites 2 and 3	Very few	Poor, all dead	Recent spawn
July 8	All 5 sites; fewest at Site 4	Many, hundreds	Mostly poor, best at reference beach	Two stages, some recently spawned, others between 1 to 2 weeks
July 21	All 5 sites; fewest at Site 4	Many, thousands	Good, most were viable	Recent spawn, less than 2 days
August 4	All 5 sites; fewest at Site 4	Many, varied between sites	Poor at Sites 1, 2, and 4; good at Sites 3 and 5	Varied: recent spawn at Site 3, near 2 weeks at Site 5
August 18	All 5 sites; fewest at Site 4	Many, hundreds	Poor, most were dead	Mostly less than 1 day, Site 5 had a few at 2 weeks
September 2	Sites 1, 2, 3, and 5; none at Site 4	Many, hundreds	Mixed, half viable	Ranged from 1 to 4 days
September 17	All 5 sites; the most at Sites 1 and 2	Many, thousands to the northern sites	Good at Sites 1, 2, and 5. Poor at Sites 3 and 4	2 weeks at Site 5, less than 1 day at Sites 1 to 4
October 6	All 5 Sites	Very few, but more at Site 1	Half viable at Site 1, all other dead	2 weeks at Site 1, recent spawn at other sites
October 20	Sites 2 and 5 only	Less than 10	All viable at Site 2, dead at Site 5	2 stages: less than 1 day and 4 to 6 days
December 15	None	None	N/A	N/A

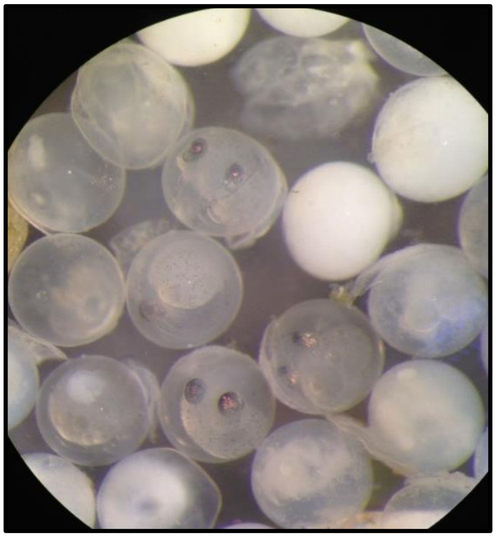
Weather conditions during surveys varied, offering a variety of temperature exposure and climate conditions to surf smelt eggs deposited on the beach. Eggs were found at different stages of development both within individual sites, and between sites during a single survey. Examples of stages of development for eggs in viable condition are shown in the following photographs. Viable eggs are relatively translucent, with discernable developmental stages visible, including blastula and early larval stages with eye-spots. Non-viable eggs are opaque white, with dented or broken shells. Most of the eggs in the photos are in excellent or good condition, with only a few dead eggs.



Photograph 4 – Eggs at 5 to 8 hours of development (recent spawn), with blastula formed on the yolk. There are two eggs in poor condition (non-viable), but most are in good condition. Site 1, September 17, 2014.



Photograph 5 – Eggs at 1 to 2 days of development, with gastrula, advanced embryo, or early larval development around the yolk. There is one non-viable egg. Site 2, July 21, 2014.



Photograph 6 – Eggs at 2 weeks of development, with advanced larvae, dark eye spots, and close to hatching. There are a few non-viable eggs, but most are in good condition. Site 5, August 4, 2014.

4.5 Advanced Eelgrass Transplant

During the 2014 transplant effort, 330 PU were placed to cover an area of 2,915 sf. PU's were planted using a 3 foot center modular PVC grid system. The transplant area is composed of two swaths approximately 15 feet wide. The intent was to construct a rectangle 30 feet wide by 120 feet long. Once both swaths were completed, residual PU's were constructed from contingency eelgrass harvested and added to the shoreward (west) swath, extending it for several feet. This means that the west side of the rectangle extends slightly further north.

One month post transplanting, the transplant area was revisited in early August. Divers reported that the transplants appeared well established and that there was no loss of eelgrass. This was verified from footage taken by the diver and reviewed by a Hart Crowser eelgrass biologist. The diver noted epiphyte growth on the blades and several Dungeness crabs (*Metacarcinus magister*) using the newly established habitat.

Photograph 7 – Dungeness crab within the newly established eelgrass habitat

A comprehensive survey of the transplant area as well as the adjacent existing eelgrass habitats scheduled to be surveyed in June 2015. Performance of the transplants compared to performance criteria put forth in the CMMP will be evaluated at that time.

4.6 Wetland, Backshore, and Upland Buffer Vegetation

The wetland complex was monitored on September 25, 2014, by a Hart Crowser wetland biologist. As described earlier, the upland buffer including a zone of dunegrass within the wetland complex had been established in 2011 and Year 3 monitoring was conducted for these areas. The estuarine wetland and the backshore habitat along the berm, beach, and spit were established in 2013/2014 and Year 1 monitoring was conducted in these areas on the same date as above. Hart Crowser established 14 plots: four plots in the upland buffer, four plots within the estuarine wetland, two plots on the backshore habitat on the bay side of the estuary, one plot on the spit extending out into the bay, and three plots within the backshore habitat along the created beach (Figure 9). Percent cover of each species within each 3-m^2 plot was recorded. Also, 11 photographic points were established at the locations shown on Figure 9. Representative photos from each photo point are provided in Appendix A.

The plot sample methodology used in 2014 only provides an indication of whether the site is meeting its success criteria. The transect plot method (described in Appendix C) that will be employed in 2015 will provide more definitive data on the performance of the wetland. Table 10 below summarizes Year 3 monitoring results of the upland buffer within the wetland complex, including a range of percent native and non-native cover. Inadequate information was collected to determine if the buffer met the success criteria for Year 3. More conclusive information will be collected in the next monitoring year.

Table 10 – Summary of 2014 (Year 3) Monitoring Results for Upland Buffer Area Compared with Success Criteria

Criterion	Year 3 Performance Standard (% cover)	Range of Results Summary	Performance Standard Met?
Total areal cover of native plants	40	96–160	Yet to be determined
Total areal cover of invasive species	0 to 10	0 –10	Yet to be determined

Non-native percent cover ranged from 0 to 10 percent in the upland buffer and 0 percent in the backshore area, well within the range of the “10 percent or less” success criterion. These areas appear to be on a trajectory of exceeding the criterion.

Table 11 summarizes Year 1 monitoring results including those for the hydrologic and wetland area monitoring. Inadequate information was collected to determine if the vegetation within the estuarine wetland met the Year 1 success criteria of 20 percent native cover or greater. Within the estuarine wetland, approximately 10 percent mortality of the replanted pickleweed (the only installed plant within the wetland) was observed; meeting the success criteria of 90 percent survival or greater.

Table 12 summarizes Year 1 monitoring results for the backshore areas along the berm, beach, and spit. Inadequate information was collected to determine if the vegetation within the backshore meets the Year 1 success criteria of 20 percent native cover or greater. We collected survival information in the backshore and observed 5 percent mortality of planted species; therefore, the site meets the criteria of 90 percent or greater survival.

Table 11 – Summary of 2014 (Year 1) Monitoring Results for Wetland and Hydrology Compared with Success Criteria

Criterion	Year 1 Performance Standard (% cover)	Results Summary	Performance Standard Met?
Wetland			
Total areal cover of native wetland plants	20	45–125	Yet to be determined
Total areal cover of invasive weeds	0 to 10	0	Yet to be determined
Survival of installed plants (pickleweed)	90	90	Yes
Hydrology	Tidal inundation in wetland area to the MHHW mark (100%)	Yes	Yes

Table 12 – Summary of 2014 (Year 1) Monitoring Results for Backshore along Beach, Berm, and Spit Compared with Success Criteria

Criterion	Year 1 Performance Standard (% cover)	Results Summary	Performance Standard Met?
Backshore along Beach, Berm and Spit			
Total areal cover of native plants	20	10–30	Yet to be determined
Survival of installed plants	90	95	Yes
Total areal cover of invasive weeds	0 to 10	5–20	Yet to be determined

Table 13 (attached) shows the absolute total percent cover at each plot location. All but one of the plots in the backshore had 20 percent or greater total percent native cover. Plot 13 in the backshore along the beach contained 10 percent native cover (Table 13), indicating that vegetation coverage was less at the northern end of the beach. This was due to wave disturbance of the backshore, which resulted in mortality of some of the planted dune grass at this location.

Tidal inundation was observed to cover the estuarine wetland marsh areas diurnally with the tides up to the MHHW mark. Observations during 2014 indicated that one quarter to one eighth of the wetland is permanently inundated, depending on the tide levels. These inundated areas potentially provide resting habitat for juvenile salmonids.

It was estimated visually that approximately 20 percent of the 12,000-square-foot wetland is vegetated with estuarine plants, and 80 percent is unconsolidated bed wetland (mudflat); however, this needs to be confirmed using a Global Positioning System (GPS) unit during the 2015 monitoring.

Over time, the wetland may fill in with sediment, causing more area of the wetland to become vegetated.

Photo points did not provide a good representation of vegetative growth within the estuarine wetland. Additional photo points will be established in 2015 to capture the growth within the wetland.

Non-native, invasive cover at the site was very low overall; a more detailed estimate of non-native cover will be obtained from the 2015 monitoring using the transect-plot method described in Appendix C. No non-native species were observed within the estuarine wetland. Non-native vegetation cover within the upland buffer ranged from 1 to 2 percent to 10 percent. Non-native species observed within the buffer included morning glory, tansy ragwort, dandelion, and Himalayan blackberry of which, morning glory and Himalayan blackberry are considered invasive species. The highest percent cover of non-native vegetation was observed along the backshore along the beach, where disturbance is likely the highest within the site. The backshore vegetation plots contained 5 to 20 percent non-native species cover. Non-native species in the backshore habitat primarily included purple and white clover. Hart Crowser recommends removal of non-natives in early spring, so that these species do not spread further. Since there is so little non-native cover, early and thorough management will be very effective at keeping the non-native cover low and preventing future spreading of these species.

5.0 DISCUSSION

5.1 Epibenthic Zooplankton

Spatial and temporal variability dominated the zooplankton community assemblage at the four transects in the project area and reference beach between May and June 2014. Diversity, evenness, and species richness tended to decrease in June, even as overall zooplankton abundance increased. This corresponds with the increased dominance of copepod species seen across most sites in late spring. Notably, the highest values for diversity and evenness seen were in EB-1 at +4 feet MLLW in both May and June, closest to a jetty made from large riprap. In contrast, EB-3, located directly in front of a brackish marsh created during the restoration, had surprisingly low levels of diversity at +4 feet MLLW elevations. However, the results also showed that by June, EB-1 had significantly lower densities of total zooplankton and crustaceans than the other areas surveyed. Closer examination of the data show that EB-1 had much fewer copepods, annelids, and nematodes than other sites, and is therefore less dominated by any particular taxa at all elevations and dates. This lack of dominance by any one taxa yielded increased diversity and evenness scores, but this does not necessarily translate into “better” habitat than the other three sites. Instead, the low abundance of these taxa at all elevations and dates may indicate lower relative habitat function, with less foraging opportunities for juvenile salmonids and other forage fish.

From May to June, zooplankton densities generally increased in all transects; however, densities increased much more in reference transects. The overall increase is likely due to physical factors such as light and temperature, as well as biological factors like reproductive timing. The significant differences seen in late spring between restored and reference site zooplankton and crustacean densities, as well as species richness, may be due to food availability (discussed below).

In general, crustacean (particularly copepod) and nematode densities contributed disproportionately to the variation in total zooplankton density among sites (Figure 4; Table 3). Copepods and nematodes were generally the most abundant in reference sites at the +4 feet MLLW tidal elevation, which, as a result, had the highest densities of zooplankton in both May and June. Annelid density (mainly polychaete trochophore larvae and eggs) also moderately contributed to total zooplankton density in restored sites. Annelids were generally more abundant in restored sites at the +4 feet MLLW tidal elevation. The prevalence of nematodes and copepods in reference sites is likely related to the amount of macrovegetation and associated detritus settled there, as many species in both taxon are both grazers and detritivores. During analysis, zooplankton samples from reference sites contained higher amounts of algal fragments, fecal pellets and other large particulate organic matter. This was also support by the occurrence of fragments of algae and terrestrial debris in 120-foot beach seines conducted there. The absence of such abundant detritus within restored sites may be due to the early succession of the sandy material used to build the beach, which has yet to be significantly enriched with organic material or algae. Over time, as the new sediment within the restored sites becomes colonized by macrovegetation and enriched in organic detritus, the abundance of copepods and nematodes is likely to increase.

In a study of epibenthic zooplankton densities within constructed and natural saltwater marshes, Scatolini and Zedler (1996) found that epibenthic zooplankton densities were still suppressed in a constructed marsh 4 years after construction. Their results suggested that the lower densities in the constructed marsh were due to lower organic matter and sparse vegetative cover. These same factors are likely at play in this study. Overall, epibenthic zooplankton densities in the restored area were lower in the restored areas than in the reference area. Population densities are a function of mortality, reproductivity, immigration and emigration rates; the difference in density seen between the two areas are due to differences in these rates. Factors such as shelter and foraging opportunity, provided by macrovegetation, are likely the primary drivers influencing these rates. As discussed above, macrovegetation and detritus was sparse within the restored areas. This lack of cover raises mortality by increasing predation, and reduced fecundity by decreasing foraging success. This is further complicated by the increased presence of juvenile salmonids on the restored sites which prey on this resources, specifically the crustacean portion of this community. It suggests that there may be both bottom-up (lack of food and shelter) and top-down (increased predation by juvenile salmonids) forces limiting the epibenthic community at the restored sites.

5.2 Nearshore Fish

Catch rates and composition of non-salmonid species in the study area and reference beach were similar and typical of nearshore areas of Puget Sound. The large numbers of shiner perch is typical of protected nearshore areas when nearshore waters begin to warm in the late spring and into the summer.

Nearshore beach seine sampling during spring 2014 showed typical outmigration and apparent growth patterns for juvenile salmonids in the study area. The predominance of pink salmon in our samples reflects both: (1) the fact that pink salmon are the most abundant species of Pacific salmon; and (2) the 2-year life cycle of pink salmon in which juveniles outmigrate during even years and adult spawning runs occur during odd years. Thus, 2014 saw a large pulse of juvenile pink salmon in the nearshore. Like chum, pink salmon outmigrate soon after emerging from their redds. Peak migration for pink salmon occurs between March and April, while peak migration for chum occurs between mid-April and June. Peak migration for coho and sockeye occurs between late April and mid-May (Weitkamp et al. 1995). Chinook have more complex life histories, and juveniles may out migrate in both spring and late summer pulses (Fresh 2006). Given the timing of our sampling events, it is likely that we missed the largest pulse of juvenile salmon migrants to pass through the nearshore of our study site.

For non-salmonid nearshore fish, an interesting pattern emerged. In May, the CPUE for each species at the restored beach was similar to or moderately greater than those at the reference beach. However, by June, the CPUE for each non-salmonid species was generally greater (far greater, in some cases) at the reference beach. The only exceptions to this were relatively rare species that occurred at similar low catch rates across all sites (crabs, sculpins, and tubesnouts).

In contrast, juvenile salmon were consistently more abundant at restored beach sites relative to the reference beach, and did not occur at the reference site at all in June. This finding is somewhat surprising, as epibenthic zooplankton in general (and crustacean larvae in particular) occurred in the greatest densities at the reference beach. As we suggested before, juvenile salmon may be responsible for the relative low abundance of epibenthic zooplankton on the restored beaches through predation. This also suggests, at least peripherally, that the relative function of the restored beach is greater for juvenile salmonids than at the reference site.

The distribution observed in both salmonids and non-salmonids may also be the result of different water temperatures at the two areas. In both months, water temperature was highest at the reference sites relative to restored sites; however, in May, restored sites had only slightly cooler temperatures (17 to 17.7° C at restored, 18.1° C at reference). During this period, salmonids were found at both restored and reference areas, and non-salmonids were caught at roughly the same catch rate at both. In June the temperature difference was more pronounced (13.8 to 15.6° C at restored versus 17.8° C at reference). In this period, salmonids occurred only in cooler water at the restored beach, while non-salmonid CPUE sharply increased in the warmer water found at the reference beach. Salmonids generally require cooler temperatures (10 to 15° C), and so may be more abundant at the restored beach, using the area as a temperature refuge. Other marine resident species, shiner perch in particular, are more temperature tolerant and have the potential to become more abundant within areas that have warmer relative temperatures that may be less preferable for other species.

The greatest catch rate was observed in May at Site 3, at a rate more than three times that of the other sites (CPUE = 193 fish/set). This site, in May, was also the only area where all five species of Pacific salmon were found. While salmonid abundance and richness at Site 3 was largely dependent on seasonal pulses of juvenile migrants, the increased abundance at Site 3 over all the other sites in May was interesting. Site 3 is located directly adjacent to the pocket estuary, which was designed to provide refuge to juvenile salmon at high tide, and to accumulate organic detritus. The presence of salmon congregating at the estuary outlet may indicate that the estuary is functioning as designed by providing Site 3 with nutrients from secondary productivity. Juvenile salmonids are known to congregate in areas of lower salinity. The upland freshwater inputs into the pocket estuary may be reducing the salinity and creating this effect. The absence of salmon within the pocket estuary itself may be because the site is very shallow at high tide and fully drained of water at low tide.

In conclusion, 2014 data show that the CPUE of juvenile salmonids on the restored beach in the study area was greater than that of the adjacent unmodified reference beach. This finding is consistent even with the large temporal variation in abundance. The restored beach also outperformed the reference beach in terms of salmonid species richness. The data also show that the distribution of non-salmonid species on the restored beach can differ substantially from the adjacent reference site, depending on time of year. Sampling data indicate that the restored beach is providing suitable nearshore marine habitat for migrating and rearing salmonids.

5.3 Forage Fish

Surf smelt eggs were the only forage fish species found during beach spawning surveys at the Custom Plywood site. Pacific sand lance are documented as spawning at other locations in Fidalgo Bay, but have not been found at the Custom Plywood site, or the reference beach. Herring spawn in Fidalgo Bay (WDFW, personal communication), mostly along the western shore near the restored beach, but spawn subtidally on submerged aquatic vegetation, primarily eelgrass (*Zostera marina*). Adult Pacific herring were found at each of the beach seine sampling locations on the restored and reference beach.

There were very few eggs found in April (less than 10), and none were viable. Surf smelt spawning was episodic between the months of July and October. Summer spawning events were found to have occurred frequently at Sites 1, 2, and 3 on the restored beach; and at Site 5 on the reference beach. Although some eggs were found at Site 4, there were always fewer eggs, and they were mostly in poor condition or dead. Site 4 is located on the south side of the constructed spit, along the inside edge, facing the pocket estuary. Possible reasons for poor spawning at Site 4 include shoreline topography; finer, more organic, rich substrate; freshwater runoff from the estuary; increased frequency of egg predators (e.g., amphipods); or an increase in predatory birds that frequent the estuary.

Egg survival was monitored as the presence of fully developed eggs. Surf smelt eggs reach full development in about two weeks, at which point they hatch into planktonic larvae, and move into the pelagic zone. The condition of eggs at the three sites on the restored beach varied during individual surveys, but no single site had better egg survival or relative egg abundance between surveys. Site 5 experienced similar spawning events and egg survival as the three sites on the restored beach.

Surf smelt make full use of the restored beach, spawning at varied locations for each spawning event. Surf smelt are likely opportunistic when spawning, finding refuge along the shoreline during nighttime high tides. Locations for spawning may vary based on tidal currents, the presence of predators, or storm events. There were often eggs in different stages of development found during individual surveys, suggesting multiple overlapping spawning events throughout the summer months. Having a large area of suitable habitat along the restored beach increases the likelihood for successful spawning and survival for surf smelt in Fidalgo Bay.

Having suitable substrates for forage fish eggs during the summer months are critical for egg survival. Surf smelt can experience up to 100 percent mortality without proper shading or substrate (Rossell and Dinnel 2007). The substrate of mixed sand and pebble deposited along the restored beach has increased survival of eggs from the summer 2013, when fish were spawning on exposed boulder and contaminated material. The loose material now on the beach allows the eggs to become mixed in under the top layer, preventing desiccation and direct exposure to sunlight. Surf smelt spawning and egg survival on the restored beach is similar or better than the reference beach. Continued monitoring into 2015 should show increased spawning and better egg viability of the restored beach, as beach material continues sorting, ultimately reaching a steady state.

5.4 Wetland, Backshore, and Upland Buffer Vegetation

Overall, the plants within the estuary and berm along the estuary were healthy and growing vigorously, particularly the dunegrass in the buffer within the wetland complex. The pickleweed that was transplanted in 2013 took about a year to establish, and is now growing well within the areas where inundation is diurnal. Where inundation is longer in duration, the pickleweed was not growing well or had died out. The wetland vegetation composition will recalibrate over time to the salinity and water levels within the wetland. Other low salt marsh wetland vegetation, such as saltgrass, has voluntarily established in these areas and is growing well.

The wetland buffer has been growing well since 2011, despite an invasion of tent caterpillars in 2013 and 2014. Tent caterpillars ate a substantial number of leaves, primarily on rose and currant species, but also on a few other species within the buffer. The worst impacts of the caterpillars were seen in 2013. Ecology and Hart Crowser were aware of the tent caterpillars in 2013 and had the property owner, Bud Lemieux, start an eradication maintenance program at that time, based on a maintenance memorandum from Hart Crowser. While the growth of the rose and currant species were set back in 2013, they started to regrow in 2014 despite another caterpillar invasion that year. More caterpillar eradication was done in summer of 2014. In the fall of 2014, the plants were on a path of recovery and no plants had died due to invasion. Plants that were not affected by tent caterpillars were thriving and had vigorous and healthy growth. The buffer should continue to grow well in future years.

The backshore along the beach, berm (along the wetland), and the spit were planted with dunegrass, which had been growing well and establishing. However, due to wind and wave action, some of the backshore and spit had eroded away along with the plants. The design allowed for some natural sorting of the beach material due to tides and wave actions. The most stable backshore areas were areas where large woody debris had either been placed or washed up during storms. The backshore along the beach was the most disturbed, due to direct wave action, and resulted in some non-native species growth within the center and northern parts of the backshore. Maintenance to remove the non-natives and potentially replant is recommended, once the beach and backshore has had more time to stabilize. Placement of large woody debris may also be considered to stabilize the sand in the backshore along the beach and on the spit.

Overall, the estuary and backshore appear to be exceeding the Year 1 success criteria (see Section 6.0, "Success Criteria"); however, additional monitoring using the transect-plot method provided in Appendix C will be needed to confirm this determination. The vegetation in these areas is healthy and growing well and on a trajectory to exceed expected growth and cover rates.

6.0 SUCCESS CRITERIA

The success criteria for the beach restoration are provided in the CMMP (Hart Crowser 2012a) and are italicized below. Evaluation of each monitoring component and its success at meeting these criteria is discussed in this section.

6.1 Restored Beach

The success criterion for the restored beach is as follows:

- *Beach profiles will not change by more than +/–1.5 feet by Year 5.*

This criterion was not applicable during the Year 1 monitoring. Continued monitoring through Year 5 will allow for future evaluation. Year 1 surveys seem to indicate that this criterion, although not applicable, was largely met. This result should be interpreted cautiously since no significant storm events had occurred prior to the Year 1 survey.

6.2 Epibenthic Zooplankton

The success criterion for epibenthic zooplankton is as follows:

- *Epibenthic zooplankton densities on restored beach (CPUE) comparable to or greater than that on the unrestored reference beach in any given year.*

This criterion has not yet been met. More time is needed to allow for additional larval recruitment and increased foraging opportunities for invertebrates in the restored areas. Increased colonization of the restored areas by macrovegetation may enhance the density of epibenthic zooplankton, by providing algae and detritus that support zooplankton diets, and by attracting macroinvertebrates that produce larval zooplankton during reproduction. This may be complicated by the increased presence of juvenile salmonids on the restored beaches which may suppress epibenthic zooplanktons numbers.

6.3 Nearshore Fish

The success criterion for nearshore fish is as follows:

- *Juvenile salmonids use on restored beach CPUE comparable to or greater than that on the unrestored reference beach.*

This criterion was met in 2014. Juvenile salmonid use of the restored beach was found to be greater than in the reference site over the two month spring sampling period. In addition to higher CPUEs for salmonids, all five Pacific salmon species were found to occur within the restored sites, while only two species were found in the reference site.

6.4 Forage Fish

The success criterion for forage fish is as follows:

- *Substrate composition along the upper beach will be suitable for forage fish spawning over a minimum of 50 percent of the beach area enhanced in any given year.*

This criterion was met in 2014. Forage fish spawning occurred on a majority of the enhanced beach area during the Year 1 monitoring period with spawning documented on all survey sites. Increased egg survival was also documented since the replacement of beach substrate in 2013.

6.5 Advanced Eelgrass Transplants

The success criteria of the proposed eelgrass transplants are as follows:

- *No temporal loss of eelgrass productivity. Specifically, the density multiplied by the area of eelgrass shoots in the transplant areas must equal or exceed any declines in eelgrass in the project vicinity, adjusted for changes in the reference bed.*

- *By 2015 monitoring, we expect 50 percent or greater colonization to have occurred, with total recovery of the 2,915 sf at a similar density to a reference bed expected by 2019 (Year 5). Should this not be met, additional and similar types of effort will be carried out using the same procedures detailed above unless study results or conditions suggest that a modified approach will achieve greater success.*

These criteria were not applicable this year since eelgrass transplants are less than a year old. A macrovegetation survey of the recently transplanted eelgrass, as well as the existing eelgrass bed at the site will be conducted in June 2015 and transplant performance will be evaluated in that year-end report.

6.6 Wetland, Backshore, and Upland Buffer Vegetation

The criteria for wetland and buffer vegetation success is based on a combination of criteria for survival and cover as listed below.

Goal 1: Restore Wetland Areas through Installation of Native Vegetation Performance Standards

Survival of planted native vegetation would be monitored for two years.

- Year 1: 90 percent survival of installed plants visually estimated

- Year 2: 80 percent survival of installed plants visually estimated

Areal coverage of native shrubs and emergent vegetation would be a minimum of 80 percent after 10 years.

- Year 1: 20 percent cover
- Year 2: 30 percent cover
- Year 3: 40 percent cover
- Year 5: 50 percent cover
- Year 7: 60 percent cover
- Year 10: 80 percent cover

Goal 2: Restore Buffer Areas through Installation of Native Vegetation Performance Standards

Survival of planted native vegetation would be monitored for two years.

- Year 1: 90 percent survival of installed plants
- Year 2: 80 percent survival of installed plants

Areal coverage of native tree, shrub, and groundcover species would be a minimum of 80 percent after 10 years.

- Year 1: 20 percent cover
- Year 2: 30 percent cover
- Year 3: 40 percent cover
- Year 5: 50 percent cover
- Year 7: 60 percent cover
- Year 10: 80 percent cover

Goal 3: Control Invasive Plant Species within the Wetland and Buffer Areas

Invasive plant areal coverage would be less than 10 percent after 10 years.

- Years 1 through 10: 10 percent or less coverage of invasive plants

Goal 4: Provide Adequate Hydrologic Connection for Restored Wetland

Visual observation of tidal inundation during a normal tidal cycle each year.

- Years 1 through 10: 100 percent coverage of marsh mitigation area by tidal waters at tidal elevation of approximately MHHW

Documented coverage (in square feet) of emergent estuarine plant species using a global positioning system during Years 1, 5, and 10.[1]

- Years 1, 5, and 10: 12,000 sf or greater cover of native estuarine plant species
- A total of 12,000 sf or more of wetland would be maintained throughout the 10-year monitoring period

Insufficient data of percent cover within the buffer, wetland, and backshore along the berm, beach, and spit to determine if the success criteria have been met. This goal will be measured and assessed in 2015. Also, only 10 percent mortality of planted species (pickleweed) in the wetland was observed; therefore, the wetland meets the criteria of 90 percent or greater survival. Thirteen out of the fourteen plots had less than 10 percent non-native species, with the exception of one plot in the backshore along the beach which had 20 percent of non-native purple clover present. Hart Crowser recommends managing the removal of these non-native species in early spring to maintain low non-native cover.

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[1] This criterion for Goal 4 was not completed in Year 1, but will be completed in Year 2.

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TABLES

Table 3 – Schedule for Reporting and Annual Monitoring for Wetland Mitigation Area

Monitoring Element	Year												
	2011 (Year 0)	2012 (Year 1)	2013 (Year 2)	2014 (Year 3)	2015 (Year 4)	2016 (Year 5)	2017 (Year 6)	2018 (Year 7)	2019 (Year 8)	2020 (Year 9)	2021 (Year 10)	2022 (Year 11)	2023 (Year 12)
Upland Buffer Monitoring	✓	✓	✓	✓	○	○	○	○	○	○	○	○	○
Backshore in Wetland Complex Monitoring	✓	✓	✓	✓	○	○	○	○	○	○	○	○	○
Hydrology Monitoring	N/A	N/A	N/A	✓ (Year 1)	○ (Year 2)	○ (Year 3)	○ (Year 4)	○ (Year 5)	○ (Year 6)	○ (Year 7)	○ (Year 8)	○ (Year 9)	○ (Year 10)
Wetland and Backshore along Beach Vegetation Monitoring	N/A	N/A	N/A	✓ Year 1	○ (Year 2)	○ (Year 3)	○ (Year 4)	○ (Year 5)	○ (Year 6)	○ (Year 7)	○ (Year 8)	○ (Year 9)	○ (Year 10)
Annual Monitoring Report (by December 31)	✓	✓	X	✓	○	○	○	○	○	○	○	○	○

✓ - completed to date
○ - scheduled for completion
X – Not completed

Table 4 – Relative Composition of the Epibenthic Zooplankton Community in Reference and Restored Sites at Two Tidal Elevations, May and June 2014

MAY	**+4'**				**+6'**				**Total**
	EB-1	**EB-2**	**EB-3**	**EB-Ref**	**EB-1**	**EB-2**	**EB-3**	**EB-Ref**	
Annelid	10%	5%	73%	5%	5%	5%	16%	32%	20%
Collembola	0%	0%	3%	0%	0%	0%	0%	1%	1%
Crustacean									
Amphipod	1%	0%	0%	0%	0%	0%	12%	0%	1%
Total Barnacle	15%	20%	2%	6%	29%	35%	29%	10%	12%
Cyprid	*1%*	*3%*	*2%*	*4%*	*2%*	*7%*	*10%*	*9%*	4%
Nauplii	*15%*	*17%*	*1%*	*1%*	*27%*	*29%*	*18%*	*1%*	8%
Cladocera	2%	0%	0%	0%	4%	1%	0%	1%	0%
Copepod	33%	53%	7%	43%	25%	45%	42%	40%	36%
Cumacean	0%	0%	0%	0%	0%	0%	0%	0%	0%
Total Unidentified	6%	11%	0%	0%	3%	0%	0%	0%	2%
Juvenile	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	0%
Larvae	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	0%
Nauplii	*6%*	*11%*	*0%*	*0%*	*3%*	*0%*	*0%*	*0%*	2%
Isopod	0%	0%	0%	0%	0%	0%	0%	0%	0%
Decapod	0%	0%	0%	0%	0%	0%	0%	0%	0%
Euphausiid	0%	0%	0%	0%	0%	0%	0%	0%	0%
Foraminiferan	0%	0%	0%	0%	0%	0%	0%	0%	0%
Jellyfish	0%	0%	0%	0%	0%	0%	0%	0%	0%
Larvacean	14%	6%	2%	0%	25%	10%	0%	1%	4%
Mite	15%	0%	0%	0%	3%	0%	0%	1%	1%
Mollusc	0%	0%	1%	4%	0%	1%	0%	0%	2%
Nematode	1%	2%	9%	41%	2%	3%	0%	12%	19%
Platyhelminthes	4%	2%	2%	0%	2%	0%	0%	1%	1%
Unidentified	0%	0%	0%	0%	0%	0%	0%	1%	0%

JUNE	**–4'**				**–6'**				**Total**
	EB-1	**EB-2**	**EB-3**	**EB-Ref**	**EB-1**	**EB-2**	**EB-3**	**EB-Ref**	
Annelid	13%	34%	7%	3%	47%	42%	0%	3%	15%
Chaetognath	0%	0%	0%	0%	0%	1%	0%	0%	0%
Crustacean									
Amphipod	0%	0%	0%	1%	0%	0%	0%	1%	0%
Total Barnacle	16%	2%	4%	4%	3%	11%	19%	9%	6%
Cyprid	*9%*	*0%*	*2%*	*2%*	*0%*	*2%*	*6%*	*4%*	2%
Nauplii	*7%*	*2%*	*2%*	*3%*	*3%*	*9%*	*13%*	*5%*	4%
Cladocera	0%	0%	1%	0%	1%	0%	2%	0%	0%
Copepod	40%	53%	56%	56%	41%	34%	48%	61%	53%
Cumacean	1%	0%	0%	0%	0%	0%	0%	0%	0%
Ostracod	0%	0%	0%	5%	1%	1%	0%	2%	2%
Total Unidentified	1%	5%	3%	1%	3%	9%	4%	13%	5%
Crustacean	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	0%
Nauplii	*1%*	*5%*	*3%*	*1%*	*3%*	*9%*	*4%*	*13%*	5%
Zoea	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Isopod	0%	0%	0%	0%	0%	0%	0%	0%	0%
Decapod	0%	0%	0%	0%	0%	0%	0%	0%	0%
Ctenophore	0%	0%	0%	0%	0%	0%	0%	0%	0%
Foraminiferan	2%	0%	0%	1%	0%	0%	0%	0%	0%
Jellyfish	0%	0%	0%	0%	0%	0%	0%	0%	0%
Mite	1%	0%	0%	0%	0%	1%	0%	0%	0%
Mollusc	10%	0%	0%	2%	1%	2%	4%	2%	2%
Nematode	13%	0%	28%	25%	2%	1%	15%	6%	14%
Platyhelminthes	2%	3%	0%	1%	0%	2%	4%	2%	2%
Unidentified	0%	1%	0%	0%	0%	1%	6%	0%	0%

Table 5 – Epibenthic Zooplankton Density and Diversity in Reference and Restored Sites at Two Tidal Elevations, May and June 2014

		EB-1		EB-2		EB-3		Restored Total		Reference	
Month		*+4′*	*+6′*	*+4′*	*+6′*	*+4′*	*+6′*	*+4′*	*+6′*	*+4′*	*+6′*
MAY											
	Mean Epibenthic Zooplankton (#/m^2)	5,433.3	2,050.0	11,416.7	5,883.3	16,050.0	4,066.7	10,966.7	4,000.0	32,333.3	2,383.3
	Mean Crustacean Zooplankton (#/m^2)	3,033.3	1,266.7	9,716.7	4,766.7	1,583.3	3,383.3	4,777.8	3,138.9	16,088.9	1,233.3
	Shannon's Diversity Index	1.88	1.74	1.43	1.32	1.08	1.36	1.46	1.47	1.26	1.44
	Shannon's Evenness Index	0.82	0.79	0.57	0.60	0.43	0.65	0.61	0.68	0.49	0.63
	Species Richness	7.3	7.7	8.3	6.0	9.7	4.7	8.43	6.13	10.0	6.7
JUNE											
	Total Epibenthic Zooplankton (#/m^2)	2,866.7	2,933.3	29,833.3	13,333.3	21,333.3	3,600.0	18,011.1	6,622.2	44,200.0	19,333.3
	Total Crustacean Zooplankton (#/m^2)	1,666.7	1,466.7	18,366.7	7,133.3	13,800.0	2,600.0	11,277.8	37,33.3	29,733.3	16,800.0
	Shannon's Diversity Index	1.75	1.19	1.13	1.41	1.20	1.39	1.36	1.33	1.34	1.39
	Shannon's Evenness Index	0.76	0.57	0.46	0.59	0.58	0.67	0.60	0.61	0.52	0.60
	Species Richness	6.3	5.0	6.7	6.3	6.7	5	6.6	5.4	9.0	8.3

Table 7 – Beach Seine Total Fish Catch and CPUE in May 2014

	Station													
	BS-1		BS-2		BS-3		Total Restored Beach		BS-Ref		Grand Total		Pocket Estuary	
Species	**Catch**	**CPUE**	**Catch**	**CPUE**	**Catch**	**CPUE**	**Catch**	**CPUE**	**Catch**	**CPUE**	**Catch**	**CPUE**	**Catch**	**CPUE**
Buffalo sculpin			1	0.5			1	0.2			1	0.1		
Chinook salmon, juvenile	1	0.5			1	0.5	2	0.3			2	0.3		
Chum salmon, juvenile	9	4.5	18	9	41	20.5	68	11.3	12	6	80	10.0		
Coho salmon, juvenile					2	1	2	0.3			2	0.3		
Crescent gunnel			3	1.5	11	5.5	14	2.3			14	1.8		
Hermit crab (unidentified)									6	3	6	0.8		
Kelp greenling	1	0.5					1	0.2			1	0.1		
Pacific herring	88	44	29	14.5	113	56.5	230	38.3	52	26	282	35.3		
Pacific staghorn sculpin	3	1.5	21	10.5			24	4.0			24	3.0		
Padded sculpin									2	1	2	0.3		
Pink salmon, juvenile	19	9.5	108	54	341	170.5	468	78.0	61	30.5	529	66.1		
Shiner perch	20	10	1,331	665.5	641	320.5	1,992	332.0	736	368	2,728	341.0		
Snake prickleback	126	63	278	139	55	27.5	459	76.5	37	18.5	496	62.0		
Sockeye salmon, juvenile			1	0.5	1	0.5	2	0.3			2	0.3		
Surf smelt	27	13.5	86	43	202	101	315	52.5	1	0.5	316	39.5		
Threespine stickleback	4	2	23	11.5	44	22	71	11.8	7	3.5	78	9.8		
Tubesnout			1	0.5			1	0.2			1	0.1		
Total Juvenile Salmonids:	**29**	**14.5**	**127**	**63.5**	**386**	**193**	**542**	**90.3**	**73**	**36.5**	**615**	**76.9**	**0**	**0**
Grand Total:	**298**	**149**	**1900**	**950**	**1452**	**726**	**3650**	**608.3**	**914**	**457**	**4564**	**570.5**	**0**	**0**
# Reps:	**2**		**2**		**2**		**6**		**2**		**8**		**2**	

Table 8 – Beach Seine Total Fish Catch and CPUE in June 2014

	Station													
	BS-1		BS-2		BS-3		Total Restored Beach		BS-Ref		Grand Total		Pocket Estuary	
Species	**Catch**	**CPUE**	**Catch**	**CPUE**	**Catch**	**CPUE**	**Catch**	**CPUE**	**Catch**	**CPUE**	**Catch**	**CPUE**	**Catch**	**CPUE**
Chinook salmon, juvenile	1.0	0.5	25.0	12.5	5.3	2.7	31.3	5.2			31.3	3.9		
Coho salmon, juvenile			11.0	5.5			11.0	1.8			11.0	1.4		
Crab (unidentified)													1.0	0.5
Crescent gunnel	1.0	0.5	2.0	1.0			3.0	0.5			3.0	0.4		
Dungeness crab	3.0	1.5	1.0	0.5			4.0	0.7	10.3	5.2	14.3	1.8		
Pacific herring	7.0	3.5	3.0	1.5	2.0	1.0	12.0	2.0	26.1	13.0	38.1	4.8		
Pacific sand lance							0.0	0.0	5.3	2.6	5.3	0.7		
Pacific staghorn sculpin	17.0	8.5	4.0	2.0	3.0	1.5	24.0	4.0	20.8	10.4	44.8	5.6	5.0	2.5
Pink salmon, juvenile			2.0	1.0			2.0	0.3			2.0	0.3		
Sculpin (unidentified)	12.0	6.0					12.0	2.0			12.0	1.5	2.0	1.0
Shiner perch	26.0	13.0	248.0	124.0	245.7	122.8	519.7	86.6	15,465.8	7,732.9	15,985.5	1,998.2	201.0	100.5
Snake prickleback	26.0	13.0	120.0	60.0	26.7	13.3	172.7	28.8	165.3	82.7	338.0	42.3		
Surf smelt			136.0	68.0	3,511.0	1,755.5	3,647.0	607.8	2,883.6	1,441.8	6,530.6	816.3		
Threespine stickleback	13.0	6.5	88.0	44.0	9.7	4.8	110.7	18.4	89.3	44.6	199.9	25.0		
Tubesnout					2.0	1.0	2.0	0.3			2.0	0.3		
Total Juvenile Salmonids:	**1.0**	**0.5**	**38.0**	**19.0**	**5.3**	**2.7**	**44.3**	**7.4**	**0.0**	**0.0**	**44.3**	**5.5**	**0.0**	**0.0**
Grand Total:	**106.0**	**53.0**	**640.0**	**320.0**	**3,805.3**	**1,902.7**	**4,551.3**	**758.6**	**18,666.5**	**9,333.3**	**23,217.8**	**2,902.2**	**209.0**	**104.5**
# Reps:	**2**		**2**		**2**		**6**		**2**		**8**		**2**	

Table 13 – Vegetation Monitoring Data Sheet

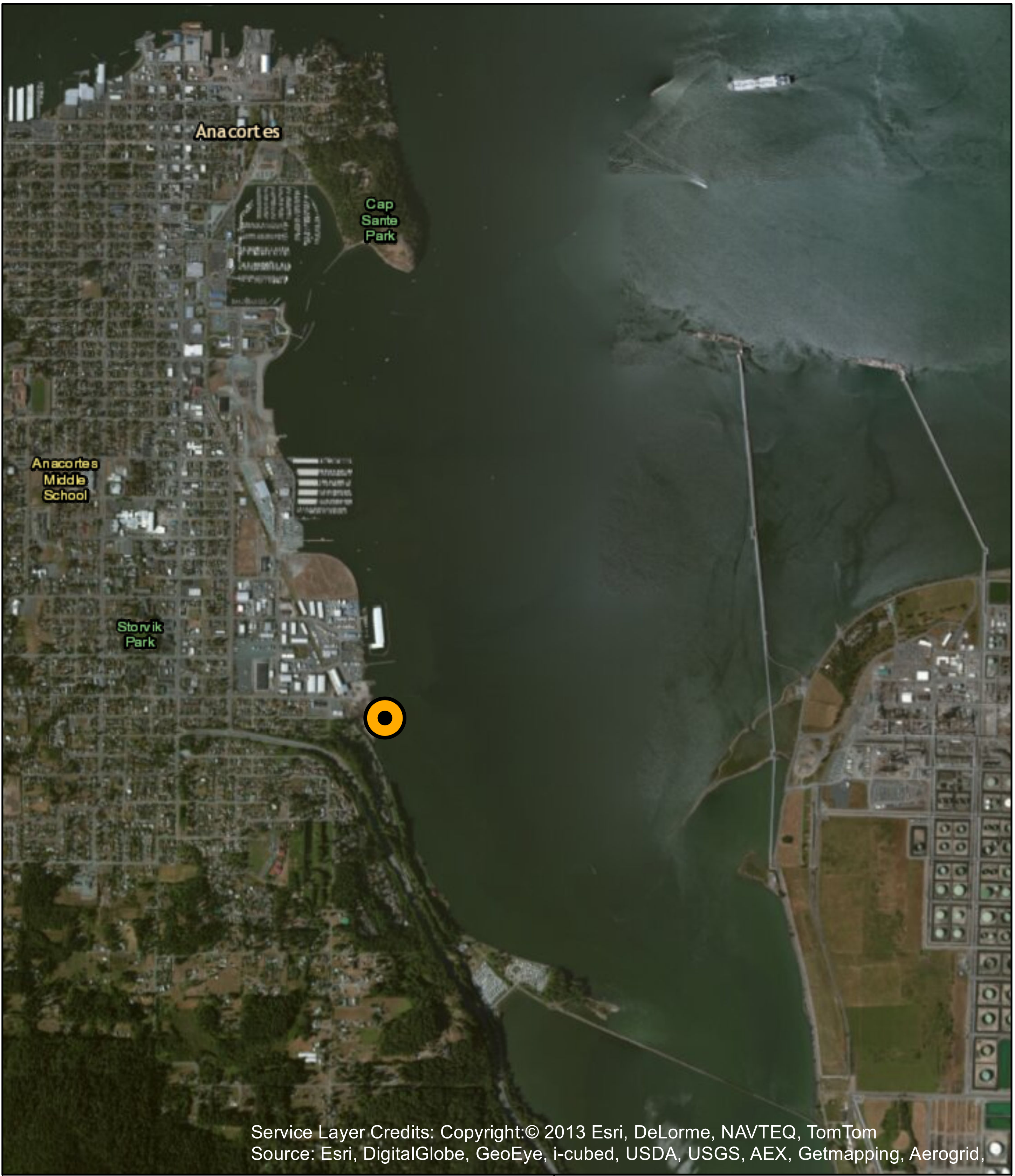
Site: Custom Plywood Remedial Action
Project Number: 17800-51
Sample Plots: Plots 1 through 14
Sample Plot Size: 0.25-meter circular - herbaceous; 3-meter circular quadrat - trees and shrubs

Plant Species installed during Phase I		**Plot Numbers**													
Scientific Name	**Common Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Upland buffer (native)															
Abies grandis	Grand fir	3													
Acer macrophyllum	Big-leaf maple	5	4												
Acer circinatum	Vine maple		2												
*Alnus rubra**	Alder		5												
Arctorstaphylos uva-ursi	Kinnikinnick														
Crataegus douglasii	Black hawthorne			10											
Fragaria chiloensis	Coastal strawberry	95	65	65	85										
Gaulheria shallon	Salal														
Holodiscus discolor	Oceanspray	3			5										
Leymus mollis	Dunegrass			2											
Pseudotsuga menziesii	Douglas fir														
Pinus contorta	Shore pine		15		15										
Populus balsamifera	Black cottonwood														
*Populus papyrifera**	Birch			2											
Ribes sanguineum	Red-flowering currant	15	5	30	25										
Rosa nutkana	Nootka rose			20	25										
Rubus parviflorus	Thimbleberry														
Sambucus racemosa	Red elderberry														
Prunus emarginata	Bitter cherry			20											
Symphoricarpos albus	Snowberry				5										
Total Percent Cover per Sample Plot (Upland Buffer)		**121**	**96**	**149**	**160**										

Plant Species installed during Phase I		**Plot Numbers**													
Scientific Name	**Common Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Wetland Emergents (native)															
*Cakile edentula**	American searocket					5	10	10	15						
*Distichlis spicata**	Saltgrass					20	10	30	50						
*Deschampsia cespitosa**	Tufted hairgrass					20	5	5	25						
*Spergularia sp.**	Sand spurry						10								
*Atriplex patula**	Spear saltbush						15	20	35						
Total Cover per Sample Plot (Native Emergents)						**45**	**50**	**65**	**125**						
Invasive Weeds															
Convolvulus sp.	Morning glory	10	0												
Total Cover per Sample Plot (Invasive Weeds)		**10**	**0**	**0**	**0**										
Other Native and Non-Native Plants*															
Agrostis stolonifera	Creeping bentgrass														
Tanacetum vulgare	Common tansy		1												
Taraxicum officinale	Dandelion		1												
Daucus carota	Queen Anne's lace														
Trifolium repens	Purple clover									1	1	1	3	5	20
Lotus corniculatus	Bird's foot trefoil												2		
Moss															
Unidentified grasses/herbs															
Bare ground															
Total Cover per Sample Plot (Native and Non-native Plants)		**10**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**5**	**5**	**20**
Backshore along Berm, Beach, and Spit (native)															
Installed Vegetation (Dunegrass), Phase II (2013/2014)										30	25	25	20	10	25
Total Cover per Sample Plot (Native)										**30**	**25**	**25**	**20**	**10**	**25**

* Volunteer plant species; note that pickleweed was installed in the wetland, but due to its small amount, no cover data was taken for that species only the percent survival data was collected due to its small amount.

FIGURES



Service Layer Credits: Copyright:© 2013 Esri, DeLorme, NAVTEQ, TomTom
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid,

Legend

● Project Site

0 0.25 0.5 1 1.5 Miles

N

Custom Plywood Site
Anacortes, Washington

Vicinity Map

17800-51

12/14

HARTCROWSER

Figure

1

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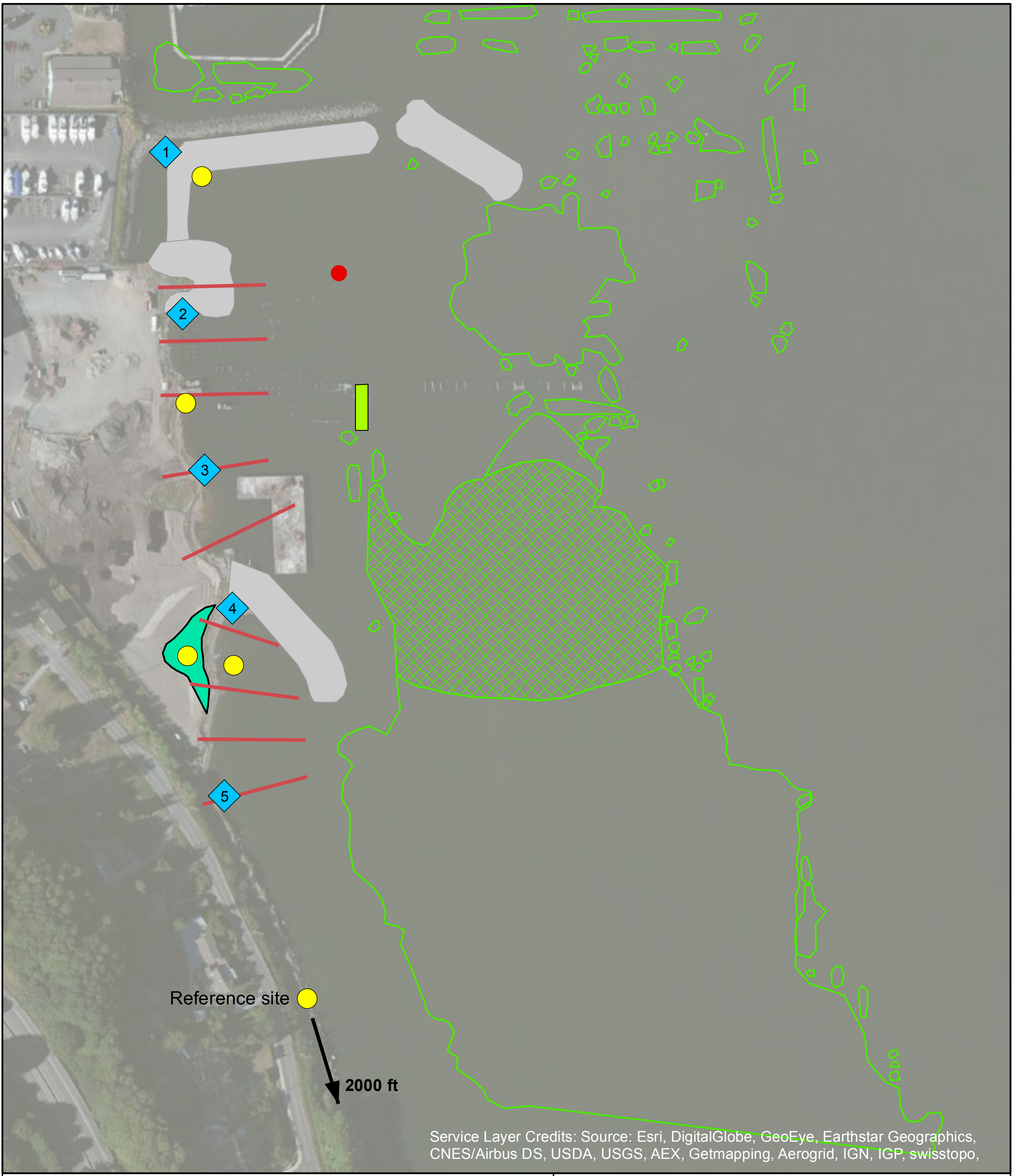

Custom Plywood
Anacortes, WA

Sampling Locations

17800-51

01/2015

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Figure

2

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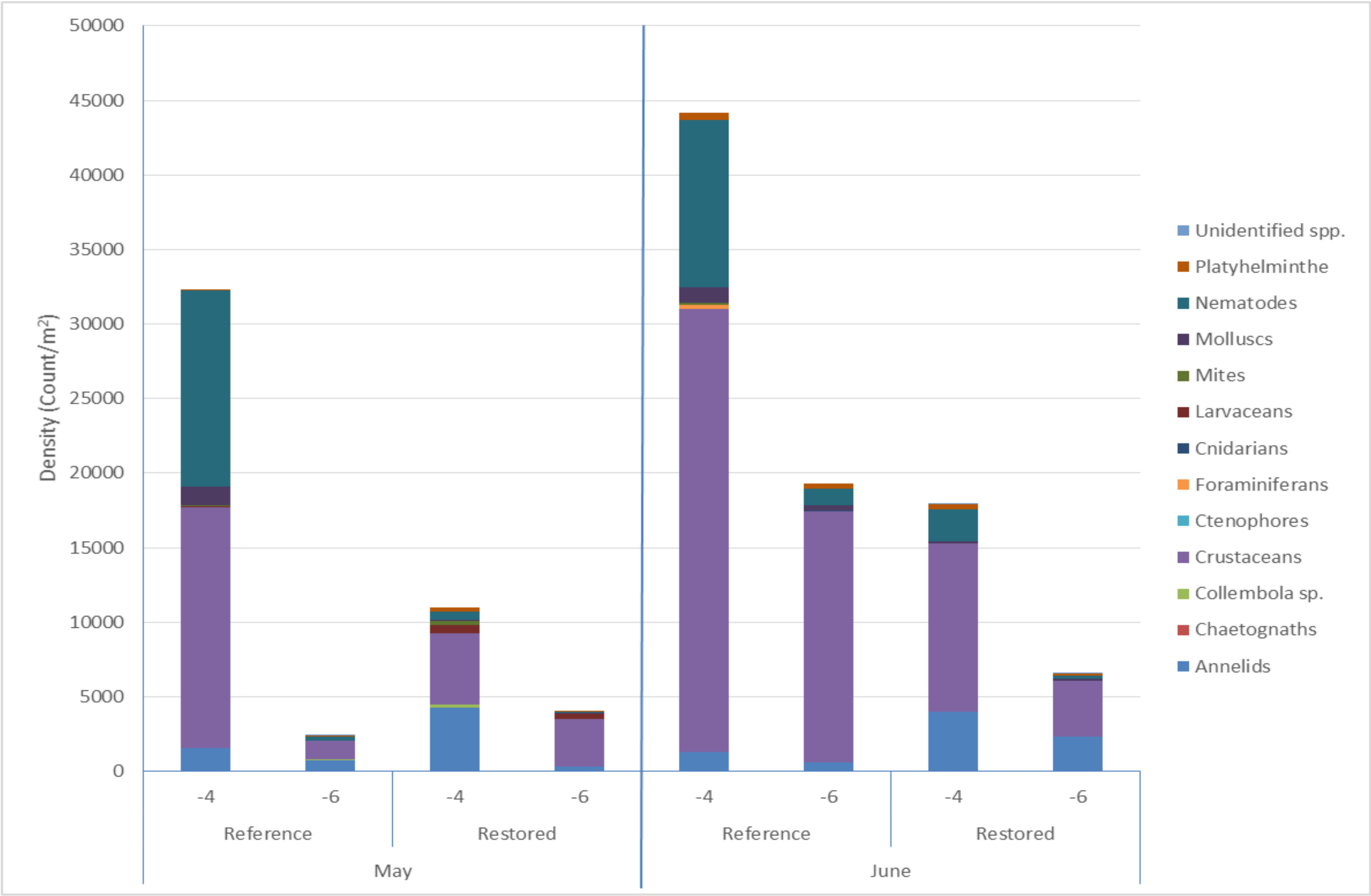

Custom Plywood
Anacortes, WA

Mean Density of Total Epibenthic Zooplankton in Reference and Restored Sites at Two Tidal Elevations, May and June 2014

17800-51 12/14

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Figure
4

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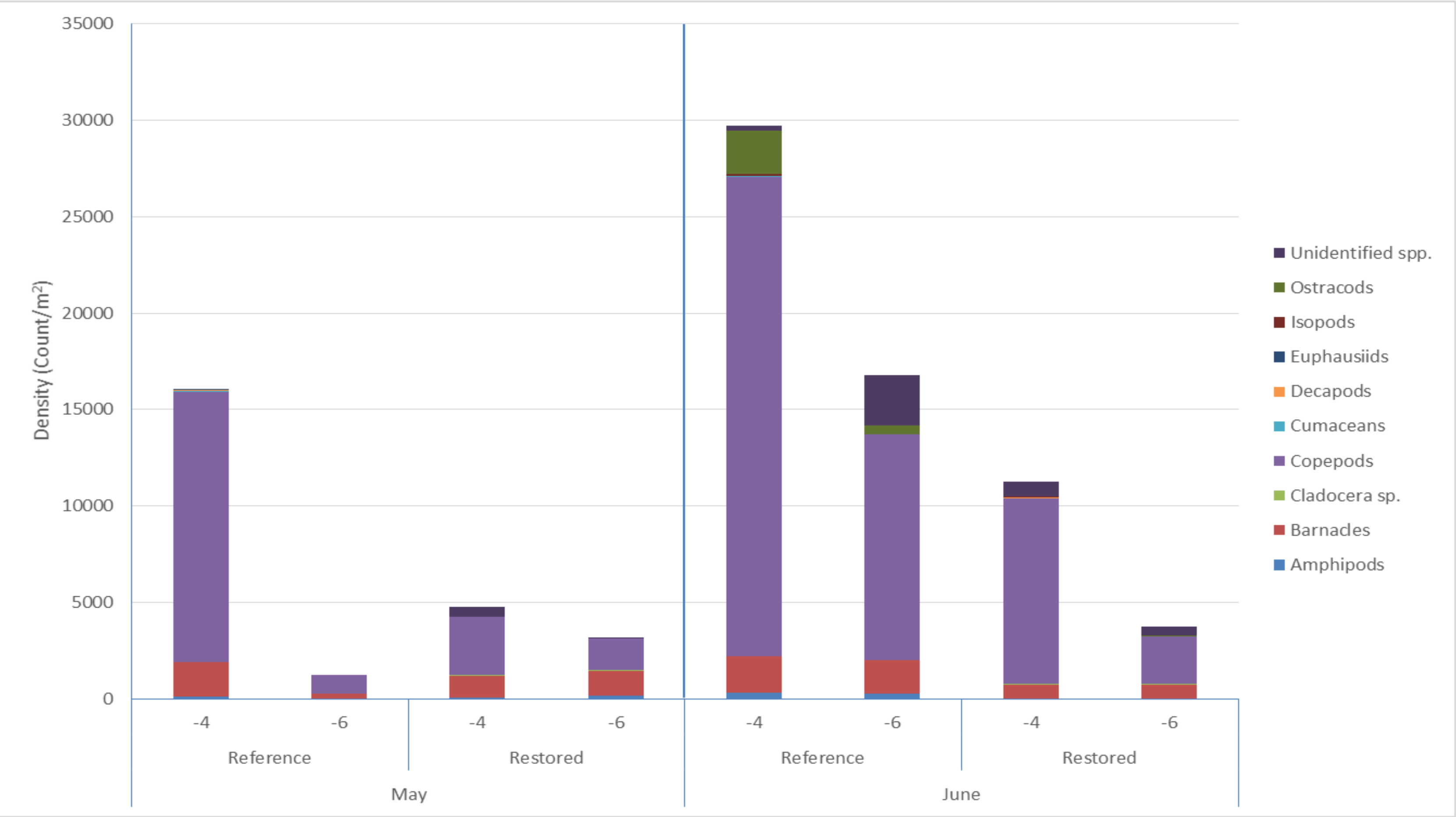


Custom Plywood
Anacortes, WA

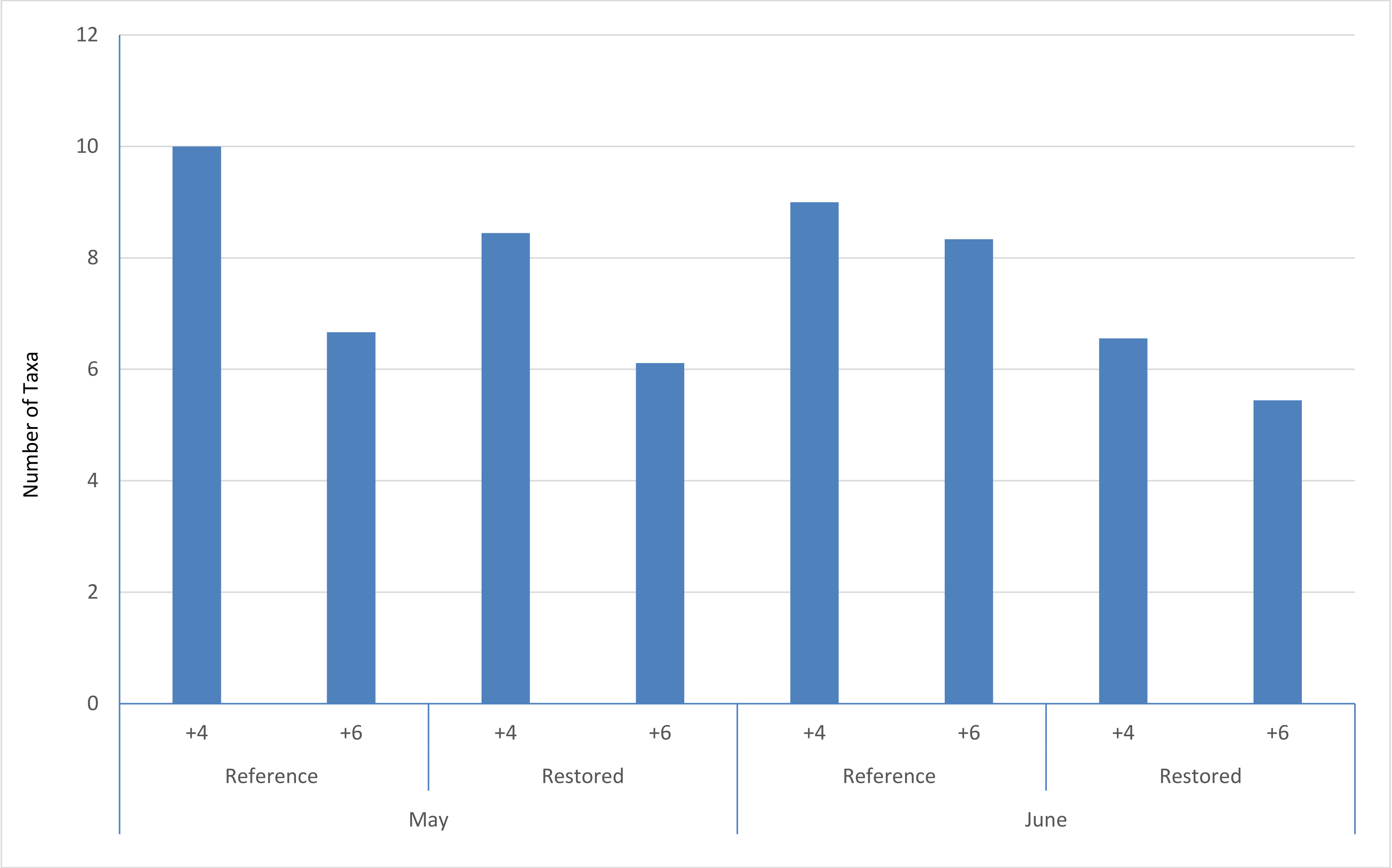
Mean Density of Total Crustacean Zooplankton in Reference and Restored Sites at Two Tidal Elevations, May and June 2014

17800-51 12/14

HARTCROWSER

Figure

5



Custom Plywood
Anacortes, WA

Epibenthic Zooplankton Taxa Richness in Reference and Restored Sites at Two Tidal Elevations, May and June 2014

17800-51 12/14

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Figure
6

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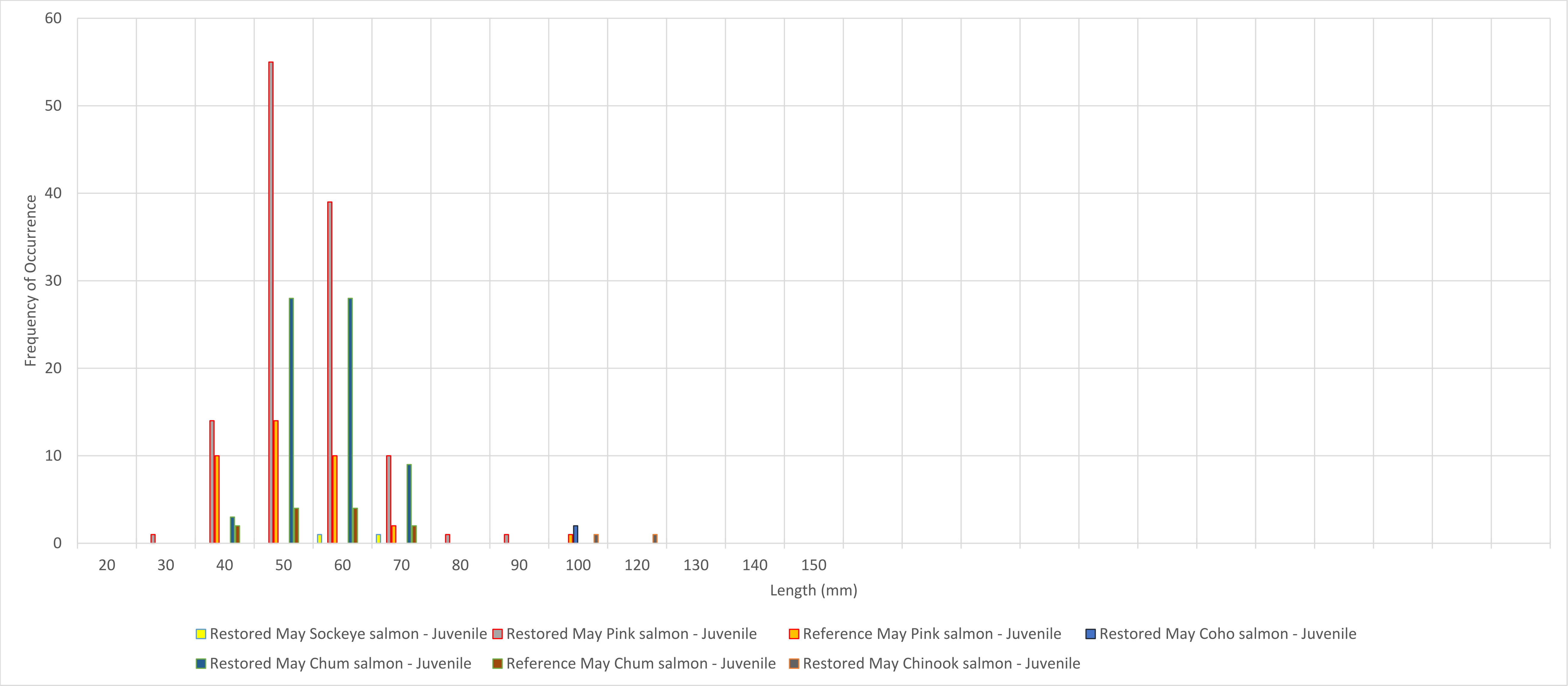

Custom Plywood
Anacortes, Washington

Size distribution of juvenile salmon species (Oncorhyncus spp.) at restored and reference sites, May 2014

17800-51 02/15

HARTCROWSER

Figure
7

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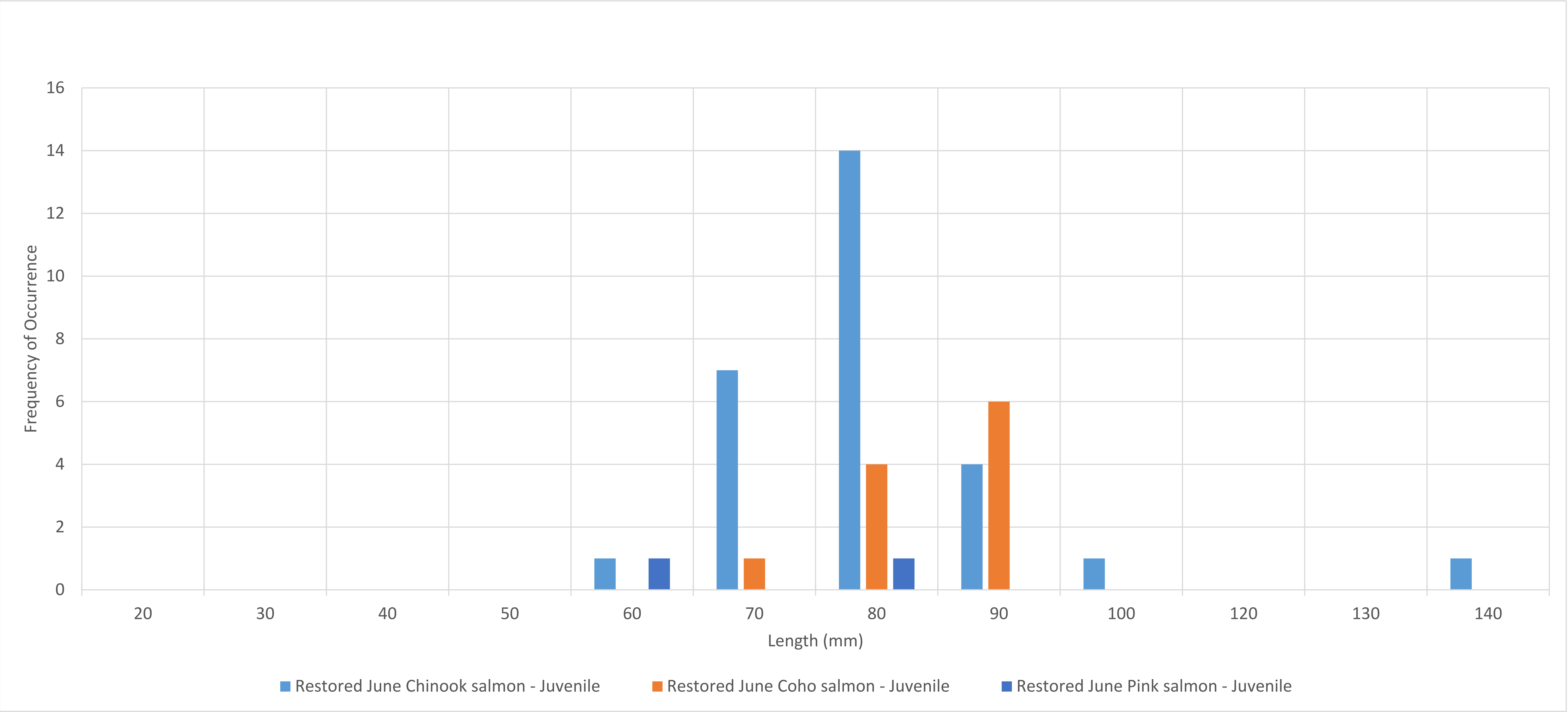

Custom Plywood
Anacortes, Washington

Size distribution of juvenile salmon species (Oncorhyncus spp.) at restored sites, June 2014

17800-51 02/15

HARTCROWSER

Figure
8

R:\NOTEBOOKS\1780051_Custom Plywood Permitting Support Ph2\Deliverables\Reports\CMMP\20150213\Figures\originals\Figures 4-8.xlsx

Imagery from Google Earth

Plot location and number

Photo location, direction, and number

Custom Plywood Site
Anacortes, WA

Upland Buffer, Backshore and Wetland Vegetation Plots

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Figure
9

APPENDIX A
Wetland, Backshore, and Upland Buffer Vegetation Photographs

Photograph A-1 – Photo point 1 buffer on south side of estuary looking northwest

Photograph A-2 – Photo point 2 wetland on south side of estuary looking northwest

Photograph A-3 – Photo point 3 buffer on south side of estuary looking south

Photograph A-4 – Photo point 3 on north side of estuary looking northeast

Photograph A-5 – Photo point 3 of north side of wetland looking northeast

Photograph A-6 – Photo point 3 of wetland at drainage swale looking west

Photograph A-7 – Photo point 4 drainage swale

Photograph A-8 – Photo point 5 of buffer looking northwest

Photograph A-9 – Photo point 6 of the spit looking east

Photograph A-10 – Photo point 7 of berm on bay side of estuary looking north

Photograph A-11 – Photo point 8 of berm on bay side of estuary looking south

Photograph A-12 – Photo point 9 of channel between bay and estuary looking east

Photograph A-13 – Photo point 10 of backshore near estuary looking north

Photograph A-14 – Photo point 11 of backshore in middle of restored beach looking north

APPENDIX B
Technical Memoranda
by Coast and Harbor Engineering

Former Custom Plywood Mill Cleanup Project
(1) Physical Monitoring Procedures and
(2) Qualitative Spit and Jetty Condition

Technical Memorandum

Former Custom Plywood Mill Cleanup Project
Physical Monitoring Procedures

1. Introduction

This Technical Memorandum summarizes procedures developed by Coast & Harbor Engineering, a Division of Hatch Mott MacDonald, (CHE) for physical monitoring of the Former Custom Plywood Mill Cleanup Project site after construction and as part of the project Conservation Measures and Monitoring Plan (CMMP). The scope of work includes two cycles of physical monitoring: 1 - Baseline monitoring after September 2014, 2 - After the summer of 2015. Physical monitoring performed by CHE includes RTK-GPS based topographic survey of the constructed beach profile at 8 transects, photographs at photo points, collection of surface sediment samples for grain size analysis to be performed by HC, and reporting after the second monitoring event (2015). Physical monitoring also includes photographs and field observations of the integrity of the new rock jetty and spit features; no surveying of these features is required.

2. Survey Procedure

2.1. General

The objective of the topographic survey is to document the slope and profile shape of the beach and shoreline features for comparison with the second monitoring event data.

2.2. Equipment list

- Ashtech – ProMark 500 dual-frequency GNSS Surveying System (RTK-GPS)
- Ashtech FT1 – Field Terminal
- Survey rod with bubble level and mounting bracket for FT1.
- Hip waders or rubber boots

2.3. Location and Extents

Transect start (landward) and end (seaward) position coordinates are listed in Table 1 below. Coordinates are referenced to the Washington State Plane North, NAD83 horizontal coordinate system, measured in U.S.-survey feet.

Table 1: Transect Start and End locations

Transect Name	Start Coordinate (Easting, Northing)	End Coordinate (Easting, Northing)
Transect 1	1211830.67, 550383.47	1212030.67, 550383.47
Transect 2	1211830.67, 550283.47	1212030.67, 550283.47
Transect 3	1211830.67, 550183.47	1212030.67, 550183.47
Transect 4	1211830.67, 550033.47	1212028.11, 550060.31
Transect 5	1211864.85, 549880.23	1212075.32, 549976.54
Transect 6	1211893.41, 549768.61	1212039.54, 549716.82
Transect 7	1211873.10, 549649.88	1212074.74, 549618.98
Transect 8	1211885.09, 549548.02	1212084.98, 549541.29
Reference Transect	1211891.42, 549427.20	1212085.95, 549473.68

2.4. Procedures

- Consult tide table and select survey date and time based upon low tide (1.0 ft MLLW or lower) during daylight hours.
- Charge GPS system and field terminal in advance to full capacity.
- Power on RTK-GPS system and mount to survey rod; wait for GPS satellites to connect.
- Set survey rod height so that articulating rod mark of 6.0 ft is level with collar of the grip rod.
- Mount and then power on Field Terminal and initiate Fast Survey software and connect toe RTK-GPS system via Bluetooth.
- Set equipment to record in WA State Plane North NAD83, ft system and NAVD88 vertical datum. Elevations will be converted to MLLW for reporting.
- Load beach transect template file "new transects 2007 feet.dxf"
- A total of 8 beach transects will be surveyed for each monitoring event. The northern extent will be the headland feature and the southern extent will be located south of the project (i.e. Reference Transect). Transect location and alignment will be the same for each monitoring event.
- For each transect, walk the beach transects from the top of beach above MHHW (See Table 1) to the water line and beyond to wading depth. The extent of survey at beach toe may be limited by the tide.
- Recorded beach elevations using the RTK-GPS unit approximately every 8 to 10 feet along the transect alignment, or more frequently to map changes in slope or substrate. Hold unit level and still to obtain "Fixed" position and record each data point.

- Record the locations of the water line for each transect.
- Record location of sediment samples.
- After completion, export data points to ASCII file.
- Exit Fast survey. Points and survey files are saved automatically by the software.

3. Sediment Sampling Procedure

3.1. General

The objective of the sediment sampling is to document the physical structure of beach surface sediment composition and size by collecting and sieve testing surface sediment samples on the surveying transects. Collect samples at same locations in second monitoring event for comparison of beach surface sediment changes.

3.2. Equipment List

- RTK-GPS
- 30 zip-top gallon bags
- Permanent marker
- Hand trowel
- Digital camera
- Plastic tote or bucket
- Quadrant (optional)

3.3. Location and Extents

- Locate sediment samples on six(6) of the identified survey transects
- Four (4) surface sediment samples collected on the survey transect for a total of twenty-four (24) samples per monitoring event.
- In baseline survey, identify sediment sampling locations based upon elevation (relative to tidal datums) and composition of beach surface. Distribute samples in the low intertidal MLLW up to above MHHW.
- In second monitoring event, repeat location of previous sediment samples.

3.4. Procedures

- Survey the sample the location and elevation with RTK-GPS and note sample number. Sample number one is lowest on the beach profile, increasing with beach elevation.
- Photograph the beach surface prior to surface sediment removal.
- Mark zip-top gallon bag by Transect Number – Sample number (T#)-(#), with permanent marker.
- Gather sample of upper 3 to 5 cm of beach surface with a hand trowel.
- Place sample in zip-top gallon bag, approximately 70% full, and close bag.
- Photograph the beach surface after surface sediment removal.
- Smooth out disturbed area with trowel.
- Carry bags in plastic tote or bucket to ensure that the bags do not tear or open.
- Repeat the above 4 times per transect.
- Provide samples to Hart Crowser for sieve analysis (samples do not require any special handling or treatment procedures).
- Hart Crowser performs sieve analysis using ASTM D6913 and provides grain size distribution test data and plots to CHE.

4. Photo Point Procedure

4.1. General

The objective of the photo points is visually document site conditions including habitat, sediments, constructed features, and qualitative features from fixed locations for comparison with the second monitoring event.

4.2. Equipment List

- RTK-GPS
- Digital camera

4.3. Location and Extents

1. Galvanized fence post at south end of site
2. East end of spit
3. West end of spit
4. Headland feature
5. West end of pre-existing jetty

6. East end of pre-existing jetty
7. East end of new jetty

4.4. Procedures

- Hold camera at eye level, approximately 6 feet from the ground.
- Position camera such that the horizon (or water line) is horizontal.
- Take photograph, viewing along the shoreline feature in both directions
- Take panoramic series of photographs covering 180 degrees (min), except on new jetty.
- If possible, incorporate reference object for physical scale such as survey rod or surveyor.
- Repeat at each location.

5. Outline for Monitoring Report

After completion of the second monitoring event (2015), the data will be compared and a report generated describing the condition and changes of the monitored features. The monitoring report will be prepared in accordance with the outline provided below.

1. Introduction
2. Beach Monitoring Data
   2.1. Physical Environment
   2.2 Survey
   2.3 Sediment Sampling
   2.4 Beach Appearance from Photo Points
   2.5 Beach Evaluation Summary
3. Jetty and Spit Data
   3.1 Jetty Appearance from Photo Points
   3.2 Spit Appearance from Photo Points
   3.3 Jetty and Spit Evaluation Summary

Appendices: Sediment Sieve Test Results

COAST & HARBOR
ENGINEERING
A Division of Hatch Mott MacDonald

Date: February 5, 2015

To: Emily Duncason, Hart Crowser

From: Joel Darnell, P.E., Coast & Harbor Engineering

Subject: Former Custom Plywood Mill Physical Monitoring – Qualitative Spit and Jetty Condition

Coast & Harbor Engineering (CHE) engineers Joel Darnell and John Dawson conducted a baseline physical monitoring survey of the project site on September 24, 2014 at low tide. This survey included photographs and field observations of the integrity of the new rock jetty and spit features; no surveying of these features was required. CHE engineers established photo points at both ends of the constructed jetty and spit features. These photos were included along with field notes on the data CD provided to Hart Crowser. Future physical monitoring will be compared with the baseline survey data to further assess jetty and spit condition. A brief summary of the qualitative spit and jetty condition from the baseline survey is provided below.

On the north side of the spit, the composition of the slopes appeared the same as the condition immediately after construction (predominantly gravel and cobble with mild slopes). On the south side of the spit, the slopes were steeper (as was constructed) and contained a greater percentage of sand and small gravel. The presence of sand and small gravel is presumably due to the placement of a thin layer of fish mix on the south side of the spit and the gradual erosion of the sand placed above on the spit crest. The surface substrates are generally finer on the lower part of the south spit slopes. The sand placed on top of the spit has partially eroded and formed a scarp in some areas, as would be expected to occur after a nearly one year of high tides and storms.

The integrity of jetty appeared similar to the condition immediately after construction. No noticeable displacement of stones or indication of instability of the jetty was observed. The top of the jetty on the east side was lower than the top of jetty on the west side. This sloping jetty top is consistent with the condition of the jetty immediately after construction, as documented in the post-construction surveys.

APPENDIX C

Memorandum re: Appendix B-1 – Conceptual Wetland Mitigation Plan for the Custom Plywood Interim Remedial Action

HARTCROWSER
www.hartcrowser.com

MEMORANDUM

DATE: September 9, 2011

TO: Hun Seak Park, PE

FROM: Celina Abercrombie
Jason Stutes, PhD
Rick Moore, LHG

RE: **Appendix B-1 - Conceptual Wetland Mitigation Plan for the Custom Plywood Interim Remedial Action**
17330-27

The Custom Plywood Site (Figure 1) contains five freshwater and estuarine wetlands totaling 11,910 square feet (sf) that would be impacted by proposed remediation activities on the property. Wetlands A, B, C, and D are isolated wetlands that will be impacted during the Phase I upland remediation. Wetland E is connected to state and navigable waters, and the U.S. Army Corps of Engineers (USACE) has determined that Wetland E is federally regulated. Wetland E will be impacted during the Phase II in-water remediation. These five wetlands will be consolidated into one large estuarine wetland and restored on site as agreed upon by applicable regulatory agencies. The restored wetland will: (1) replace the impacted wetland areas; and (2) improve the functions provided by the existing wetlands.

Off-site mitigation options, such as the Ship Harbor site in Anacortes, were given consideration as compensatory mitigation for on-site wetland impacts resulting from the cleanup. Based on the timing and feasibility of an off-site mitigation option, on-site wetland mitigation was determined to be to a preferable alternative that provides adequate compensation for impacts to existing wetlands and serves as an integrated habitat improvement piece within the larger project.

A summary of the key elements associated with proposed on-site mitigation activities for the Custom Plywood Site is provided below.

WETLAND MITIGATION AREA

The restored estuarine wetland would be a minimum of 12,000 sf in area (Figure 2). The wetland mitigation area would be constructed landward of the Ordinary High Water (OHW) line. During Phase I upland remediation activities, a bench would be excavated and graded at suitable elevations for the establishment of estuarine wetland vegetation. The wetland edge would be constructed to provide sinuosity between the wetland and the transition to the upland buffer. A protective berm would be created at and landward of the OHW line to prevent contaminant migration into the restored wetland during in-water construction as part of Phase II. The width of the berm would be approximately 10 feet, and the height of the berm would be approximately 10.5 feet Mean Lower Low Water (MLLW) or at the height of the existing shoreline berm. Near the completion of the in-water work, the protective berm would be removed and the area covered by the berm would be graded to appropriate elevations that allow for tidal connection of the wetland to Fidalgo Bay and for installation of native plantings.

Colonization of wetland vegetation would occur between elevations of 7 feet MLLW and Mean Higher High Water (MHHW), which is 8.6 feet for the Custom Plywood Site. It is anticipated that a larger area between MHHW and OHW (about 9.2 feet MLLW) would colonize with a variety of saltmarsh vegetation. The wetland would be planted and naturally colonize with native saltmarsh vegetation, including, but not limited to pickleweed (*Salicornia virginica*), saltgrass (*Distichlis spicata*), and seacoast bulrush (*Scirpus maritimus*). The restored wetland area would provide a moderate to high level of function, and support other aquatic habitats and species such as juvenile salmon rearing and migration.

A vegetated buffer would be provided around the restored wetland totaling approximately 26,000 sf. The buffer along the Tommy Thompson Trail would measure 50 feet in width and the remainder of the buffer would measure 75 feet in width as agreed upon by applicable regulatory agencies. Installation of a variety of native tree and shrub plantings may include, but is not limited to big-leaf maple (*Acer macrophyllum*), shore pine (*Pinus contorta*), black cottonwood (*Populus balsamifera*), Sitka spruce (*Picea sitchensis*), Douglas fir (*Pseudotsuga menziesii*), paper birch (*Betula paperifera*), Pacific crabapple (*Malus fusca*), salmonberry (*Rubus spectabilis*), salal (*Gaultheria shallon*), oceanspray (*Holodiscus discolor*), snowberry (*Symphoricarpos albus*), red elderberry (*Sambucus racemosa*), Indian plum (*Oemleria cerasiformis*), serviceberry (*Amelanchier alnifolia*), Nootka rose (*Rosa nutkana*), thimbleberry (*Rubus parviflorus*), red-flowering currant (*Ribes sanguineum*), dunegrass (*Leymus mollis*), coastal strawberry (*Fragaria chiloensis*), and kinnikinnick (*Arctostaphylos uva-ursi*). Following removal of the protective shoreline berm, dunegrass would be planted within the buffer along the shoreline and as a transition species between the wetland and the upland buffer. Trees would be planted 10 to 12 feet on center and shrubs would be planted 5 to 7 feet on center throughout the upland buffer. Emergent and groundcover vegetation would be planted 1 to

3 feet and 3 to 5 feet on center throughout the wetland and buffer, depending on the species designated for installation in each area. Tables 1 and 2 show the plant schedule for the wetland and buffer planting areas. In addition to native plantings, large woody debris and other habitat structures would be installed in the dunegrass and upland buffer planting areas.

A temporary fence fitted with light reduction slats would be installed along the upland extent of the wetland buffer to deter human access and protect against light and noise pollution. In addition, barrier plantings of rose (*Rosa* sp.) and Douglas hawthorne (*Crataegus douglasii*) would be densely planted along the outer perimeter of the wetland buffer and would develop into a thicket replacing the function of the temporary fence over time. The barrier planting area would measure approximately 6 to 8 feet in width. The temporary fence would be removed once the barrier plantings become established. Critical/sensitive area signs may also be installed along the edge of the buffer.

Additionally, a public access easement would be provided along the beach and possibly within the upland buffer of the mitigation area as well as a beach access area at the southern landward tip of the site. The general locations of a beach access and the buffer trail are shown on Figure 2. The final configuration of these features has not yet been determined and is ultimately subject to an agreement between the City of Anacortes and the property owner. A conceptual design is planned concurrent with the design for the Phase II in-water remediation. The final aquatic permitting required for the beach access component will also be included with Phase ii. Final design and field construction are currently planned to be completed in coordination with the City of Anacortes and the property owner. Public access to a wetland buffer trail would occur following a required 10-year wetland/buffer monitoring period after construction. Access to the public beach area may require, at a minimum, completion of the Phase II aquatic cleanup.

A plan view of the wetland mitigation area is provided on Figure 2 and a cross section is provided on Figure 3.

SITE GRADING AND CONSTRUCTION

Current site elevations over much of the area of the planned wetland mitigation area vary from about 10 to 11 feet MLLW. Although these elevations are slightly above the estuarine wetlands zone, it is desirable to further elevate the adjacent buffer area to protect buffer vegetation from damage during high tides. Typical high tides near Anacortes range between about elevation 9.2 to 10 feet MLLW. Therefore, it is desirable to raise site grades in the mitigation buffer area to about 12 feet to provide a suitable level of protection and a factor of safety. This bench would also provide sufficient elevation for constructing a stormwater conveyance system and treatment swale, as described in the Stormwater section below.

Construction of the mitigation area is planned for the southern property corner landward of the OHW line and extending to the north and west. Following excavation related to site cleanup in the wetland and buffer areas, the buffer adjacent to the southern property line along the Tommy Thompson Trail would be backfilled and the grade raised to an appropriate elevation for the establishment of the buffer plantings. Construction would then extend north into the restored wetland area.

The wetland area would be excavated an additional 3 feet beyond the proposed bottom elevation of approximately 7 feet MLLW and a layer of sand would be placed within this additional excavation area to serve as a planting medium for emergent wetland plantings (to be installed during Phase II following tidal connection to Fidalgo Bay) and to prevent vertical migration of remaining clean wood waste located on the Site. This sand layer would cover the 12,000 sf wetland mitigation area and extend landward into the buffer where dunegrass plantings are proposed. A low-gradient transition between the wetland and tree and shrub planting area would be provided. Large woody debris and dunegrass would be installed throughout this zone to mimic a more natural shoreline. Woody debris placement and dunegrass plantings would coincide with planting activities in the tree and shrub planting area.

During excavation and grading activities in the restored wetland, a temporary berm would be placed along the opening of the wetland at and landward of the OHW line. This berm is intended to protect the mitigation area from migrating contaminated sediment until in-water construction is underway and the area waterward of the mitigation area is remediated. The berm would be constructed from a combination of quarry spalls and sand. A geotextile fabric may be placed between the existing substrate along the OHW line and the quarry spalls to provide additional stability and filtration of sediments that may be present in the water column. Additional design details would be developed during the construction design process. This feature is intended to be temporary and would be removed from the existing beach during Phase II to protect the previously installed wetland area. Potential damage to this temporary berm may occur from winter storm surges but are not anticipated given the existing in-water structures will remain in-place until Phase II construction. In the event of a large storm event, a site visit would be conducted to evaluate potential damage and develop a remedy for re-stabilizing this feature. Possible remedies include, but are not limited to, repositioning of the geotextile fabric and installation of additional quarry spalls or similar material. During or following removal of the temporary berm, the wetland area would be planted as described in the Wetland Mitigation Area section.

Following excavation and backfilling of sand in the wetland area, the remaining upland buffer to the west and north of the wetland would be backfilled with a clean fill material. The upland planting area would be graded and lightly compacted for structural stability. In addition, the buffer would be graded to provide microtopography and a somewhat undulating surface. Compost would be applied and tilled into the soil throughout the tree and shrub planting area. Then a layer of mulch would be placed throughout this area for weed control and water retention. Following mulch placement, large woody debris would also be placed throughout the buffer for habitat value. Trees, shrubs, and groundcover species would be installed per the planting details previously described. A 5- to 6-foot-wide area would be retained for future public access. A geotextile fabric would be placed over the ground surface and mulch placed over the top until designs and construction details for this area are developed. Care would be taken to avoid disturbing the existing buffer during installation of the public access features. A fence would be constructed around the mitigation area during or immediately following plant installation to prevent human access during the plant establishment and monitoring period.

STORMWATER

Swale Concept

A stormwater swale located outside of the wetland buffer has been designed to treat stormwater currently routed onto the property through a City of Anacortes conveyance (Figure 2). The swale is designed and sized per the Washington State Department of Ecology's 2005 Stormwater Management Manual (SWMM) for Western Washington to provide water quality treatment. No infiltration is assumed as a conservative assumption based on subsurface soil and groundwater conditions. Infiltration that does occur provides additional stormwater management control.

The swale includes the following elements and target design dimensions:

- Size: Approximately 788 sf at the base
- Flow path length: Minimum 175 linear feet
- Side slopes: 5H:1V
- Depth: Minimum of 10 inches
- Slope: Approximately 2 percent

A combination of native trees, shrubs, and groundcover species would be planted around the perimeter of the swale.

Stormwater Routing

Stormwater from the existing 18-inch City of Anacortes conveyance pipe to Wetland D would be routed through a control box structure to control flow and provide settling in a 48-inch catch basin (Figure 4). Flow from the control box would discharge through a higher elevation outlet in the box to provide necessary elevation and gradient for downstream flow management. Specific components of the routing system downstream of the control box include:

- An approximately 50-foot-long, 18-inch-diameter conveyance pipe sloped at 2 percent grade between the control box outlet and the swale inlet;
- An in-line settling/treatment structure between the control box and the swale;
- A possible gravel pad or other energy dissipation feature at the swale inlet to accommodate a 0.5-foot drop from the upstream conveyance pipe as a required design feature;
- An approximately 175-foot-long, vegetation-lined treatment swale to manage SWMM design flow as described above;
- An approximately 45-foot swale discharge conveyance channel sloped at 0.5 percent grade between the swale outlet and the estuarine wetland complex; and
- A level spreader or energy dissipater, such as quarry spalls or a similar material, to connect the swale discharge channel to the estuarine wetland complex.

The swale and conveyance corridor would be vegetated with a standard grass seed mix to filter and remove sediment and particulates from the stormwater. The swale would provide basic treatment prior to entering a vegetated conveyance corridor that would route the treated stormwater from the swale into the restored wetland area. The conveyance corridor would be designed to meander through the restored buffer area to provide additional treatment and infiltration as well as a more natural channel configuration. The swale would also be protected with a low berm and backflow preventer at the outlet to avoid inundation during high tides.

Target design elevations at various points in the stormwater routing system are as follows, subject to continuing design analysis.

- Discharge Elevation at Estuarine Wetland: 8.6 feet
- Swale Outlet Elevation: 9.5 feet
- Swale Inlet Elevation: 13.0 feet
- Control Box Outlet Elevation: 14.5 feet
- Control Box Inlet Elevation: 10.7 feet (surveyed elevation)

To optimize the grades and locations of the stormwater and bioswale features, several factors were considered to balance the elevation of the control box outlet with the discharge point at the edge of the estuarine wetland. The discharge point at the wetland edge was set at 8.6 feet (approximately MHHW) as an optimal design target. A lower elevation for discharge to the wetland would require deeper incising of the conveyance channel from the swale outlet (approximately 9.5 feet) into the new topographic bench to be established at approximately 12 feet. A higher discharge elevation would result in progressively higher upstream elevations for the swale and control box outlet, which would be undesirable.

MONITORING ACTIVITIES

Monitoring Schedule

Monitoring of the mitigation areas would be conducted for 10 years following construction. Following upland remediation and debris removal (summer 2012), a report would be prepared to summarize the constructed conditions of the restored wetland and buffer, including, but not limited to site grading, and berm location, prior to tidal connection. Formal monitoring of the wetland and buffer areas would not begin until the completion of the Phase II in-water work and connection of the wetland to Fidalgo Bay. At this time, a formal as-built report would be prepared and monitoring would begin.

Site inspections and reporting would occur on an annual basis. The following schedule would be used for project monitoring reports:

- At time of construction/As-built (Year 0);
- Year 1: detailed annual report;
- Year 2: detailed annual report;
- Year 3: detailed annual report;
- Year 4: reconnaissance level report;
- Year 5: detailed annual report;
- Year 6: reconnaissance level report;
- Year 7: detailed annual report;

- Year 8: reconnaissance level report;
- Year 9: reconnaissance level report; and
- Year 10/Final: detailed annual report

Following construction, an as-built report would be submitted by the project applicant to the applicable federal, state, and local government agencies within approximately 30 days after completion of plant installation in both the wetland and buffer areas. The report would document mitigation site conditions at completion of plant installation and would be used as a baseline for future monitoring events. Annual detailed monitoring reports would be submitted to the appropriate regulatory agencies by December 31 of each calendar year.

GOALS AND PERFORMANCE STANDARDS

Project goals include restoring wetland areas through the creation of appropriate elevations and installation of native vegetation, restoring buffer areas through the installation of native vegetation, and maintaining invasive vegetation at low levels within the wetland and buffer areas. Performance requirements for the mitigation area would include:

Goal 1: Restore Wetland Areas through Installation of Native Vegetation

Performance Standards:

a) Survival of planted native vegetation would be monitored for two years.

- Year 1: 90 percent survival of installed plants visually estimated
- Year 2: 80 percent survival of installed plants visually estimated

b) Areal coverage of native shrubs and emergent vegetation would be a minimum of 80 percent after 10 years.

- Year 1: 20 percent cover
- Year 2: 30 percent cover
- Year 3: 40 percent cover
- Year 5: 50 percent cover
- Year 7: 60 percent cover
- Year 10: 80 percent cover

Goal 2: Restore Buffer Areas through Installation of Native Vegetation

Performance Standards:

a) Survival of planted native vegetation would be monitored for two years.

- Year 1: 90 percent survival of installed plants
- Year 2: 80 percent survival of installed plants

b) Areal coverage of native tree, shrub, and groundcover species would be a minimum of 80 percent after 10 years.

- Year 1: 20 percent cover
- Year 2: 30 percent cover
- Year 3: 40 percent cover
- Year 5: 50 percent cover
- Year 7: 60 percent cover
- Year 10: 80 percent cover

Goal 3: Control Invasive Plant Species within the Wetland and Buffer Areas

a) Invasive plant areal coverage would be less than 10 percent after 10 years.

- Years 1 through 10: 10 percent or less coverage of invasive plants

Goal 4: Provide Adequate Hydrologic Connection for Restored Wetland

a) Visual observation of tidal inundation during a normal tidal cycle each year.

- Years 1 through 10: 100 percent coverage of marsh mitigation area by tidal waters at tidal elevation of approximately MHHW

b) Documented coverage (in square feet) of emergent estuarine plant species using a global positioning system during Years 1, 5, and 10.

- Years 1, 5, and 10: 12,000 sf or greater cover of native estuarine plant species

A total of 12,000 sf or more of wetland would be maintained throughout the 10-year monitoring period. Monitoring would include qualitative observations on vegetation (cover, density, survival, and natural colonization) and wildlife, and quantitative data collection (species composition and percentage cover, total percentage plant cover, percentage cover of volunteer plants, and percentage cover of invasive species) using a sample plot method. In addition, permanent photo points would be established within the wetland and buffer mitigation areas to supplement the qualitative data.

Vegetation

The project biologist or mitigation specialist conducting monitoring activities would make a number of qualitative observations on vegetation and wildlife during quantitative data collection. Qualitative data on plant cover, density, survival and naturally colonizing plants would be collected. In addition, observations of wildlife use, including birds, amphibians, reptiles, and small mammals would be recorded during each monitoring visit.

Wetland and buffer plant communities would be sampled along permanent vegetation transects using a circular quadrat (1-meter radius). A minimum of two transects would be established in the wetland and buffer restoration areas for minimum total of four transects throughout the mitigation area. Transect lengths would range between 100 and 200 feet, depending on the as-built conditions at the site. A minimum of five permanent quadrats would be established along each transect. To ensure the same locations are monitored each year, permanent markers would be established at the ends of each transect and at each quadrat sampling point (either PVC, wood lathe, or a combination of PVC and rebar). A map of the transect and sample plot locations would be created for use during monitoring events.

Wetland and buffer plantings would be visually evaluated along each transect to determine the rate of survival, health, and vigor. Plants would be recorded as live, stressed, or dead/dying. For the first year of monitoring, plant survival would be calculated by dividing the number of installed plants still living by the number of initially installed plants.

The percent cover of individual plant species present within each quadrat would be visually estimated. Data collection would consist of species composition and percent cover, total percent plant cover, percent cover of volunteer plants, and percent cover of invasive species, including, but not limited to, Himalayan blackberry (*Rubus armeniacus*), English ivy (*Hedera helix*), Scot's broom (*Cytisus scoparius*), nightshade (*Solanum* sp.), Canada thistle (*Cirsium arvense*), and reed canarygrass (*Phalaris arundinacea*). Species coverage values would be summed to determine the total areal coverage in each quadrat.

Photo Points

Permanent photo points would be established within the wetland and buffer mitigation areas to supplement the qualitative data. Photo points would be established at topographic vantage points that provide complete views of the mitigation area, if possible. Photos would document relative changes in plant cover, density, and height. Permanent markers would be established at each photo point (either PVC, wood lathe, or a combination of PVC and rebar) or the photo points would correspond with permanent site features meeting the above requirements.

MAINTENANCE AND CONTINGENCY ACTIONS

Maintenance and contingency actions would include, but are not limited to, irrigation, pruning, replacement of dead/dying or undesirable transplants with the appropriate vegetation, substitution of plant species, regular weeding and removal of noxious and invasive weeds, and installation of plant protective devices. No post-planting applications of fertilizer are anticipated. Irrigation would be provided for the first two years following construction to aid in establishing native plantings within the buffer area.

If the mitigation area is not providing the required cover of native estuarine wetland area by the end of Year 3, adaptive management approaches and additional contingency measures would be evaluated to determine whether waiting a longer period for the desired vegetation establishment is warranted, regrading or deepening of the wetland area is needed, replanting of vegetation or other measures are necessary to meet the project's performance requirements. In addition, contingency measures would be evaluated during each monitoring event to help ensure that the proposed mitigation is successful.

Attachments:
Table 1 – Plant Schedule for Wetland Mitigation Planting Area
Table 2 – Plant Schedule for Buffer Planting Area
Figure 1 – Vicinity Map
Figure 2 – Wetland Mitigation Plan
Figure 3 – Wetland Mitigation Cross Section
Figure 4 – Conceptual Stormwater Drainage Conveyance and Swale Profile
Isolated Wetlands Information Sheet
Wetland Rating Form - Western Washington

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TABLES

Table 1 - Plant Schedule for Wetland Mitigation Planting Area

Common Name	Scientific Name	Condition	Minimum Spacing (on center in feet)	Planting Notes	Quantity
Emergents					
Pickleweed	*Salicornia virginica*	Division or plug	1 to 3	Plant in groups of 10 to 15	880
Saltgrass	*Distichlis spicata*	Division or plug	1 to 3	Plant in groups of 10 to 15	880
Seacoast bulrush	*Scirpus maritimus*	Division or plug	1 to 3	Plant in groups of 10 to 15	880
Total Emergents					**2,640**

Note: Plant species and quantities are subject to change.

Table 2 - Plant Schedule for Buffer Planting Area

Common Name	Scientific Name	Condition	Minimum Spacing (on center in feet)	Planting Notes	Quantity
Trees					
Douglas fir	*Pseudotsuga menziesii*	1 gallon	10 to 12	Plant individually	55
Shore pine	*Pinus contorta*	1 gallon	10 to 12	Plant individually	55
Black cottonwood	*Populus balsamifera*	1 gallon	10 to 12	Plant individually	55
Big-leaf maple	*Acer macrophyllum*	1 gallon	10 to 12	Plant individually	55
Total Trees					**220**
Shrubs					
Oceanspray	*Holodiscus discolor*	1 gallon	5 to 7	Plant in groups of 4 to 8	110
Vine maple	*Acer circinatum*	1 gallon	5 to 7	Plant in groups of 4 to 8	110
Red elderberry	*Sambucus racemosa*	1 gallon	5 to 7	Plant in groups of 4 to 8	110

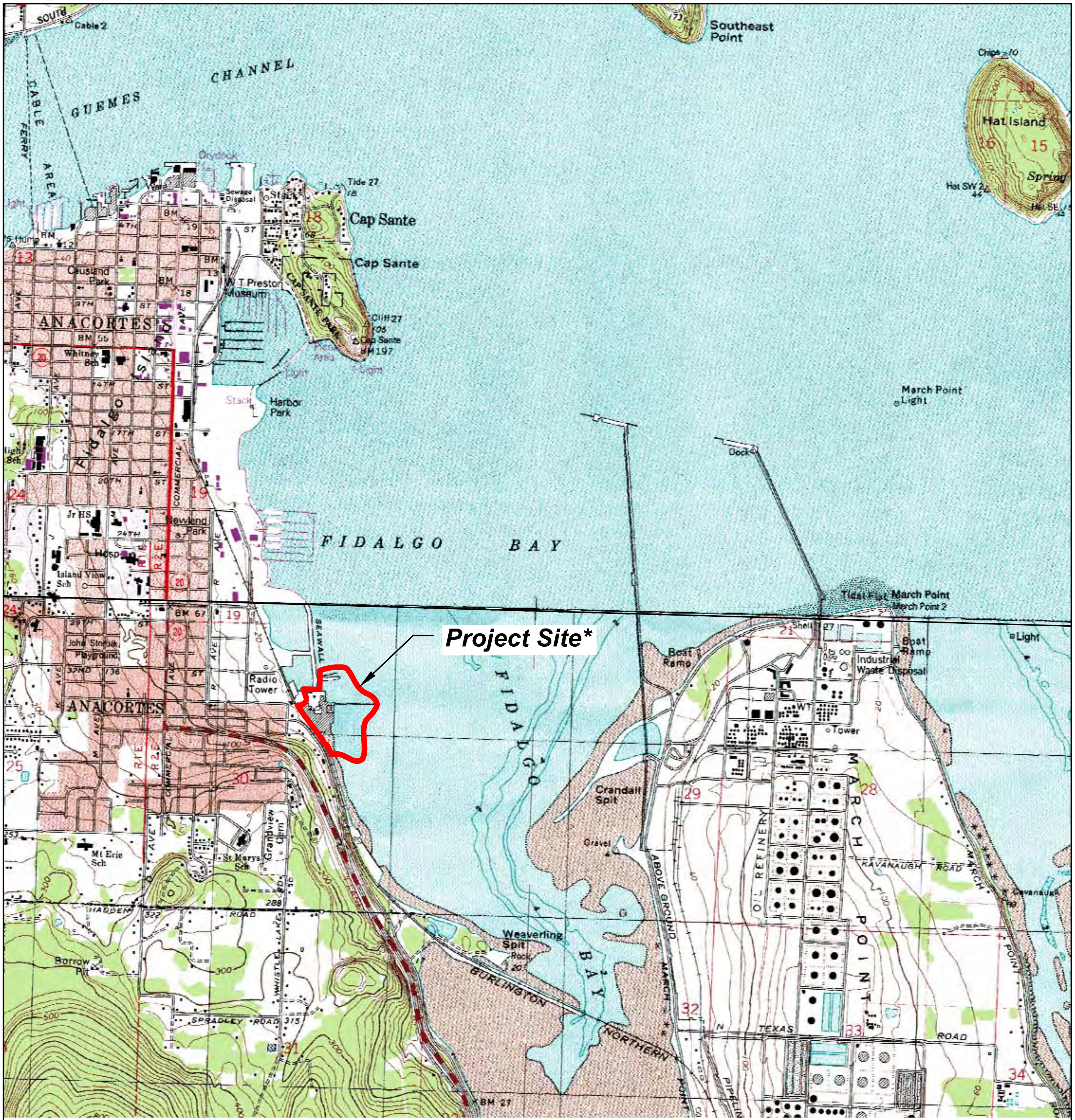
Common Name	Scientific Name	Condition	Minimum Spacing (on center in feet)	Planting Notes	Quantity
Nootka rose	*Rosa nutkana*	1 gallon	5 to 7	Plant in groups of 4 to 8	110
Red-flowering currant	*Ribes sanguineum*	1 gallon	5 to 7	Plant in groups of 4 to 8	110
Snowberry	*Symphoricarpos albus*	1 gallon	5 to 7	Plant in groups of 4 to 8	110
Thimbleberry	*Rubus parviflorus*	1 gallon	5 to 7	Plant in groups of 4 to 8	110
Salal	*Gaultheria shallon*	1 gallon	5 to 7	Plant in groups of 4 to 8	110
Douglas hawthorne [a]	*Crataegus douglasii*	1 gallon	3 to 5	Plant individually in alternating rows	110
Rose (to be determined) [a]	*Rosa* sp.	1 gallon	3 to 5	Plant individually in alternating rows	110
Total Shrubs					**1,100**
Herbs					
Dunegrass [b]	*Leymus mollis*	Division or plug	1 to 3	Plant in groups of 10 to 15	660
Coastal strawberry	*Fragaria chiloensis*	4-inch	3 to 5	Plant in groups of 4 to 8	605
Kinnikinnick	*Arctorstaphylos uva-ursi*	4-inch	3 to 5	Plant in groups of 4 to 8	605
Total Herbs					**1,870**

Note: Plant species and quantities are subject to change.

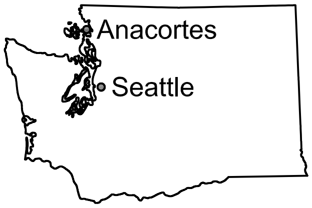
[a] For installation as a barrier planting along the perimeter of the buffer only.

[b] For installation along the shoreline and slope between wetland and buffer only.

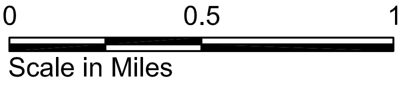
FIGURES



Source: Base map prepared from USGS 7.5-Minute Series Topographic Map, Anacortes North and Anacortes South Quadrangles.



* Represents upland and aquatic portions of the site included with current Feasibility Study.



Custom Plywood Site
Anacortes, Washington

Vicinity Map

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HARTCROWSER

Figure

1

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🟩	Estuarine Wetland (12,050 sf)
▨	Buffer (26840 sf)
≡	Swale and Conveyance
—o—o—	Temporary Fencing and Barrier Plantings
—	Temporary Shoreline Berm
▧	Stormwater Plantings
A A'	Cross Section Location and Designation

Note: See Figure 4 for stormwater conveyance and swale details.

0 80 160
Scale in Feet

Source: Aerial photo courtesy of City of Anacortes, 2003.

Custom Plywood Site
Anacortes, Washington

Wetland Mitigation Plan

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HARTCROWSER

Figure
2

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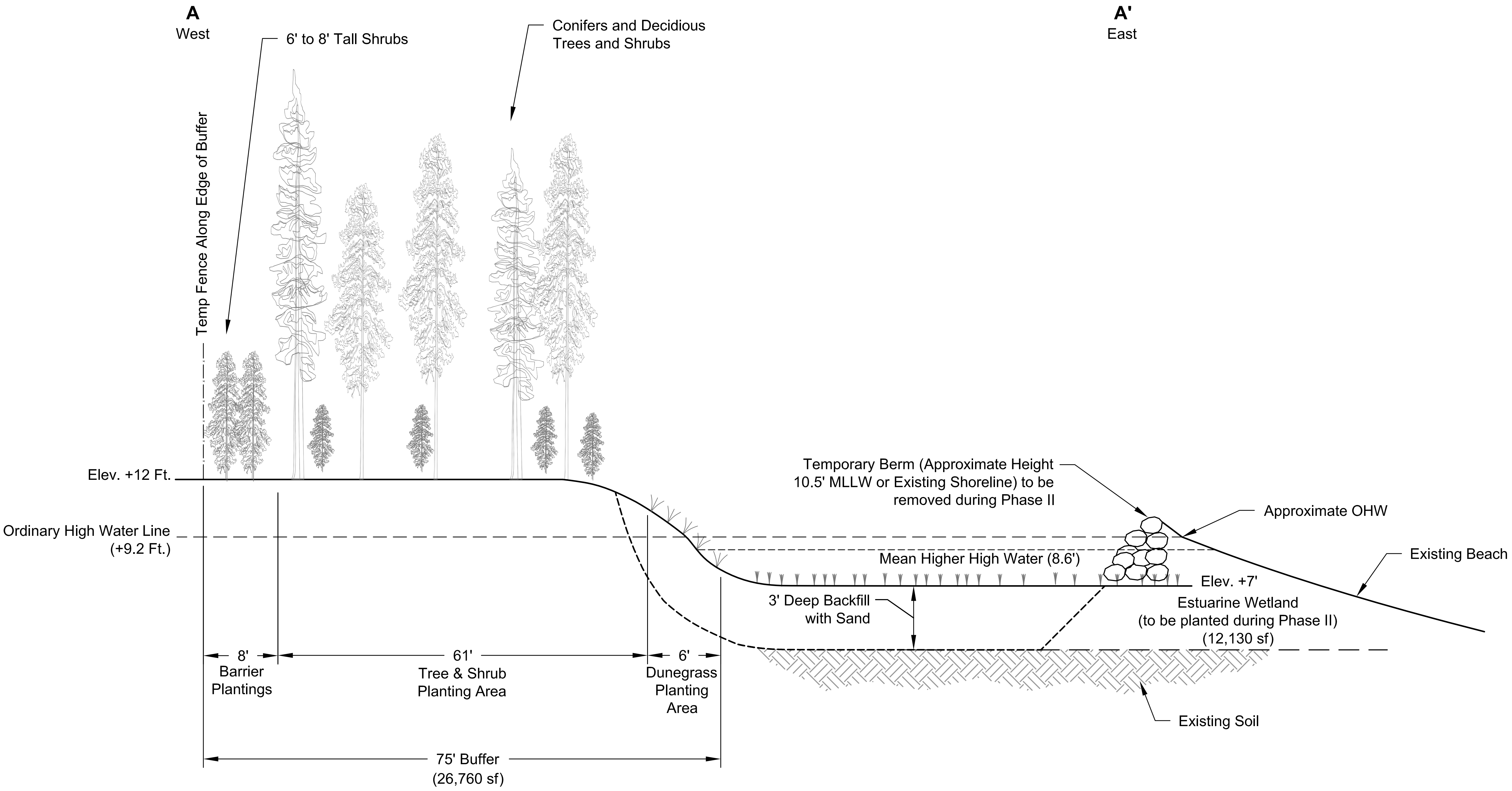

Elevation Datum: Mean Lower Low Water

Horizontal Scale in Feet
0 15 30
0 5 10
Vertical Scale in Feet
Vertical Exaggeration x 3

Custom Plywood Site
Anacortes, Washington

Wetland Mitigation Cross Section

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HARTCROWSER

Figure
3

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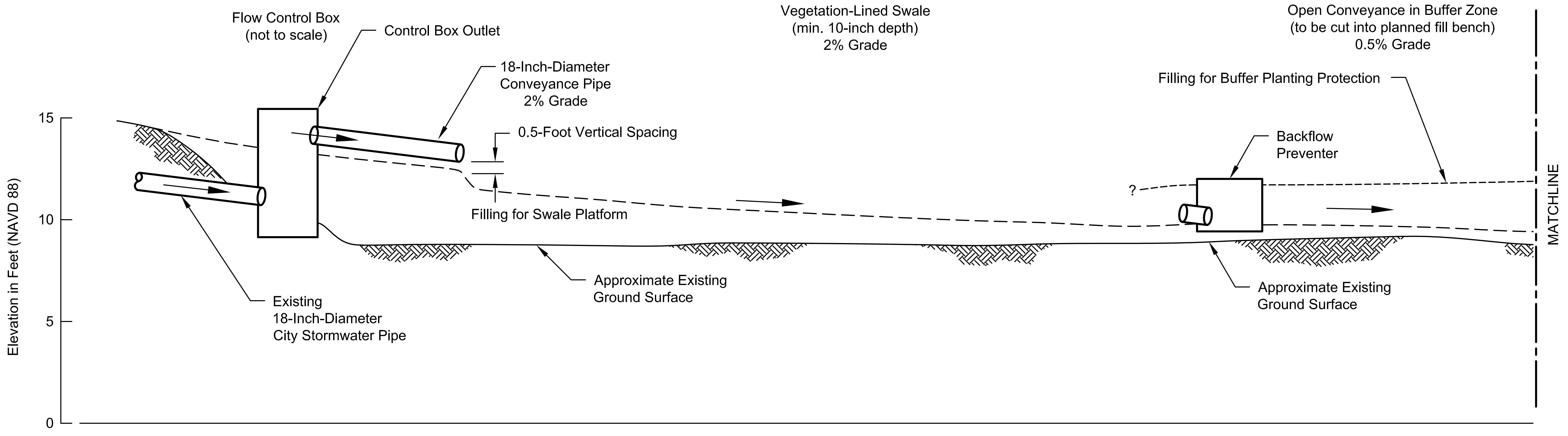
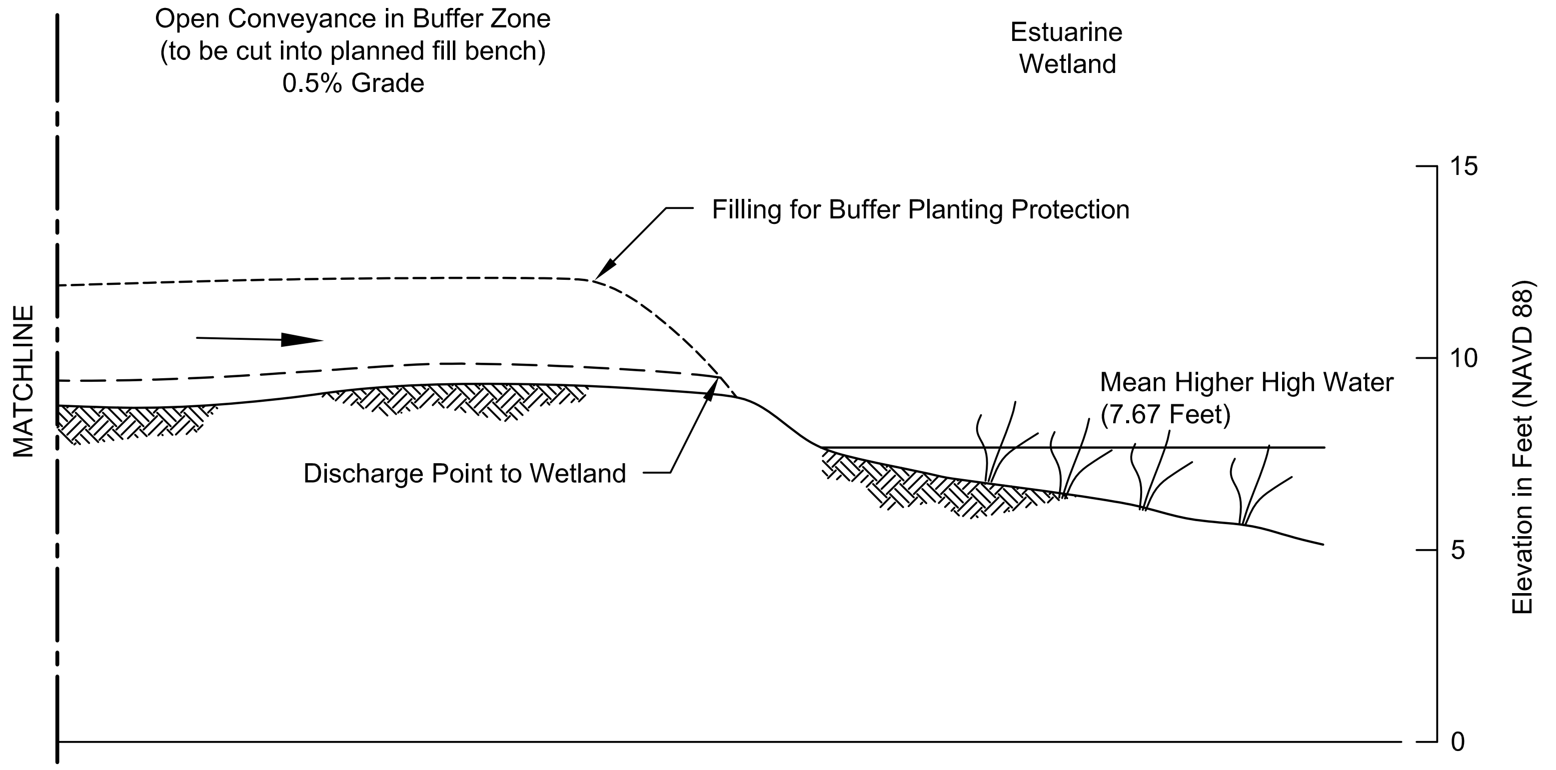




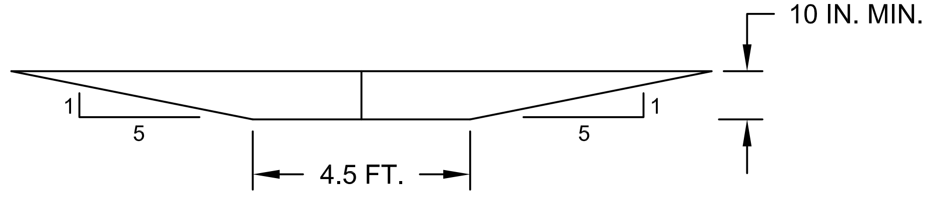
Target Design Elevations

City Stormwater Pipe Invert Elevation at Control Box: 10.14 Feet (Surveyed)
Control Box Outlet Elevation: 13.9 Feet
Swale Inlet Elevation: 12.4 Feet
Swale Outlet Elevation: 8.9 Feet
Discharge Elevation at Estuarine Wetland: 8.0 Feet

Notes:

→ Stormwater Flow Direction

Not Shown for Clarity:
- In-line treatment/settling structure between control box and swale inlet
- Energy dissipation structure at swale inlet
- Level spreader at wetland discharge point



CONCEPTUAL SWALE CROSS SECTION

Horizontal Scale in Feet
0 25 50
0 5 10
Vertical Scale in Feet
Vertical Exaggeration x 5

Custom Plywood Site
Anacortes, Washington

Conceptual Stormwater Drainage Conveyance and Swale Profile

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HARTCROWSER

Figure
4

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ISOLATED WETLANDS INFORMATION SHEET

October 21, 2010

DEPARTMENT OF
ECOLOGY
State of Washington

Isolated Wetlands Information Sheet

If you are proposing to fill or otherwise alter an isolated wetland, you will need to obtain authorization from Ecology through an administrative order. To help expedite review of your project, you can provide the information requested below. Answer the following questions to the best of your ability and attach any reports or documents that provide supporting information. This information can also augment information provided in a Joint Aquatic Resources Permit Application[1]. You may need to hire a qualified wetland professional[2] to assist you. Failure to provide this information may result in delays in review of your project.

1.	**Wetland Area and Location (provide a delineation report, including data sheets--see 5a below)**
	a. How large (in acres or square feet) is the wetland or wetlands (including contiguous portions offsite)? Wetland A = 120 sf Wetland B = 124 sf Wetland C = 367 sf Wetland D = 9,910 sf Total (Wetlands A, B, C and D) = 10,521 sf
	b. How far is the wetland(s) from the nearest surface water body (lake, river, wetland, etc.)? All wetlands are located within approximately 250 feet of the shoreline of Fidalgo Bay and within approximately 150 feet of one another.
	c. Is the wetland(s) within a FEMA-mapped 100-year floodplain? No.
2.	**Wetland Rating** (http://www.ecy.wa.gov/programs/sea/wetlands/ratingsystems/)
	What is the category(ies) of the wetland(s) according to the Washington State Wetland Rating System (eastern or western Washington version as appropriate)? Wetland A = Category 4 Wetland B = Category 4 Wetland C = Category 2 Wetland D = Category 3

---

[1] The Joint Aquatic Resource Application (JARPA) is available on the web at: http://www.epermitting.wa.gov/.

[2] For more information on how to hire a qualified wetland professional go to: http://www.ecy.wa.gov/programs/sea/wetlands/professional.html.

3. Cowardin Classification

Describe the Cowardin[3] vegetation class(es) in the wetland (for example, emergent, scrub/shrub, forested, open water, etc.), and list the dominant plant species in each class.

Cowardin Class	Dominant Plant Species
Wetland A = PEM Wetland B = PEM Wetland C = EEM Wetland D = PEM	Wetland A = Typha latifolia Wetland B = Typha latifolia Wetland C = Scirpus maritimus and Distichlis spicata Wetland D = Festuca sp., Chenopodium album, Rumex occidentalis, Equisetum arvense, and Rubus armeniacus

4. Wetland Impacts

How much wetland area (in acres or square feet) is proposed to be:

a. Filled? 10,521 sf

b. Excavated? 10,521 sf

c. Drained?

d. Flooded?

e. Cleared, vegetation altered? 10,521 sf

f. Other? (list)

5. Please provide copies of the following information if available:

a. Wetland delineation report, including data sheets (http://www.ecy.wa.gov/programs/sea/wetlands/delineation.html)

b. Photographs of wetland

c. Wetland rating form (http://www.ecy.wa.gov/programs/sea/wetlands/ratingsystems/)

d. Wetland function assessment report

e. Project plans, including grading plan

f. Erosion control and stormwater control plans, and reports

g. Wetland mitigation plan (http://www.ecy.wa.gov/programs/sea/wetlands/mitigation/guidance/)

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[3] Refers to the U.S. Fish and Wildlife Service's classification system (Cowardin et al, *Classification of Wetlands and Deepwater Habitats of the United States*, 1979).

WETLAND RATING FORM - WESTERN WASHINGTON

Wetland name or number D

WETLAND RATING FORM – WESTERN WASHINGTON

Version 2 - Updated July 2006 to increase accuracy and reproducibility among users
Updated Oct 2008 with the new WDFW definitions for priority habitats

Name of wetland (if known): D - Custom Plywood Date of site visit: 8/9/10

Rated by C. Abercrombie Trained by Ecology? Yes X No___ Date of training 4/05

SEC: 30 TWNSHP: 35N RNGE: 2E Is S/T/R in Appendix D? Yes___ No X

Map of wetland unit: Figure — Estimated size 9,900 sf.

SUMMARY OF RATING

Category based on FUNCTIONS provided by wetland

I___ II___ III X IV___

Category I = Score >=70
Category II = Score 51-69
Category III = Score 30-50
Category IV = Score < 30

Score for Water Quality Functions	16
Score for Hydrologic Functions	20
Score for Habitat Functions	10
TOTAL score for Functions	46

Category based on SPECIAL CHARACTERISTICS of wetland

I___ II___ Does not Apply X

Final Category **(choose the "highest" category from above)** III

Summary of basic information about the wetland unit

Wetland Unit has Special Characteristics		Wetland HGM Class used for Rating	
Estuarine		**Depressional**	X
Natural Heritage Wetland		**Riverine**	
Bog		**Lake-fringe**	
Mature Forest		**Slope**	
Old Growth Forest		**Flats**	
Coastal Lagoon		**Freshwater Tidal**	
Interdunal			
None of the above	X	Check if unit has multiple HGM classes present	☐

Wetland name or number D

Does the wetland unit being rated meet any of the criteria below?

If you answer YES to any of the questions below you will need to protect the wetland according to the regulations regarding the special characteristics found in the wetland.

Check List for Wetlands That May Need Additional Protection (in addition to the protection recommended for its category)	YES	NO
SP1. *Has the wetland unit been documented as a habitat for any Federally listed Threatened or Endangered* ***animal or plant*** *species (T/E species)?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state or federal database.		X
SP2. *Has the wetland unit been documented as habitat for any State listed Threatened or Endangered* ***animal*** *species?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state database. Note: Wetlands with State listed plant species are categorized as Category I Natural Heritage Wetlands (see p. 19 of data form).		X
SP3. *Does the wetland unit contain individuals of Priority species listed by the WDFW for the state?*		X
SP4. *Does the wetland unit have a local significance in addition to its functions?* For example, the wetland has been identified in the Shoreline Master Program, the Critical Areas Ordinance, or in a local management plan as having special significance.		X

To complete the next part of the data sheet you will need to determine the Hydrogeomorphic Class of the wetland being rated.

The hydrogeomorphic classification groups wetlands into those that function in similar ways. This simplifies the questions needed to answer how well the wetland functions. The Hydrogeomorphic Class of a wetland can be determined using the key below. See p. 24 for more detailed instructions on classifying wetlands.

Wetland name or number D

Classification of Wetland Units in Western Washington

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides (i.e. except during floods)?
[✓ NO – go to 2] **YES** – the wetland class is **Tidal Fringe**

If yes, is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)? **YES – Freshwater Tidal Fringe NO – Saltwater Tidal Fringe (Estuarine)**

If your wetland can be classified as a Freshwater Tidal Fringe use the forms for ***Riverine*** *wetlands. If it is Saltwater Tidal Fringe it is rated as an* ***Estuarine*** *wetland.* Wetlands that were called estuarine in the first and second editions of the rating system are called Salt Water Tidal Fringe in the Hydrogeomorphic Classification. Estuarine wetlands were categorized separately in the earlier editions, and this separation is being kept in this revision. To maintain consistency between editions, the term "Estuarine" wetland is kept. Please note, however, that the characteristics that define Category I and II estuarine wetlands have changed (see p.).

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.
[✓ NO – go to 3] **YES** – The wetland class is **Flats**

If your wetland can be classified as a "Flats" wetland, use the form for **Depressional** wetlands.

3. Does the entire wetland unit **meet both** of the following criteria?
___The vegetated part of the wetland is on the shores of a body of permanent open water (without any vegetation on the surface) at least 20 acres (8 ha) in size;
___At least 30% of the open water area is deeper than 6.6 ft (2 m)?
[✓ NO – go to 4] **YES** – The wetland class is **Lake-fringe (Lacustrine Fringe)**

4. Does the entire wetland unit **meet all** of the following criteria?
____The wetland is on a slope (*slope can be very gradual*),
____The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks.
____The water leaves the wetland **without being impounded**?
NOTE: *Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3ft diameter and less than 1 foot deep).*
[✓ NO - go to 5] **YES** – The wetland class is **Slope**

5. Does the entire wetland unit **meet all** of the following criteria?

____ The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river

____ The overbank flooding occurs at least once every two years.

NOTE: The riverine unit can contain depressions that are filled with water when the river is not flooding.

[✓ NO - go to 6] **YES** – The wetland class is **Riverine**

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year. *This means that any outlet, if present, is higher than the interior of the wetland.*

NO – go to 7 [✓ **YES** – The wetland class is **Depressional**]

7. Is the entire wetland unit located in a very flat area with no obvious depression and no overbank flooding. The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.

NO – go to 8 **YES** – The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM clases. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within your wetland. NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM Classes within the wetland unit being rated	*HGM Class to Use in Rating*
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake-fringe	Lake-fringe
Depressional + Riverine along stream within boundary	Depressional
Depressional + Lake-fringe	Depressional
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE under wetlands with special characteristics

If you are unable still to determine which of the above criteria apply to your wetland, or if you have more than 2 HGM classes within a wetland boundary, classify the wetland as **Depressional** for the rating.

Wetland name or number D

D **Depressional and Flats Wetlands**
HYDROLOGIC FUNCTIONS - Indicators that the wetland unit functions to reduce flooding and stream degradation

Points (only 1 score per box)

D 3. Does the wetland unit have the <u>potential</u> to reduce flooding and erosion? ***(see p.46)***

D D 3.1 Characteristics of surface water flows out of the wetland unit
Unit is a depression with no surface water leaving it (no outlet) [✓ points = 4]
Unit has an intermittently flowing, OR highly constricted permanently flowing outlet points = 2
Unit is a "flat" depression (Q. 7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch points = 1
(If ditch is not permanently flowing treat unit as "intermittently flowing")
Unit has an unconstricted, or slightly constricted, surface outlet *(permanently flowing)* points = 0

4

D D 3.2 Depth of storage during wet periods
Estimate the height of ponding above the bottom of the outlet. For units with no outlet measure from the surface of permanent water or deepest part (if dry).
Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7
The wetland is a "headwater" wetland" points = 5
Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet points = 5
Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet [✓ points = 3]
Unit is flat (yes to Q. 2 or Q. 7 on key) but has small depressions on the surface that trap water points = 1
Marks of ponding less than 0.5 ft points = 0

3

D D 3.3 Contribution of wetland unit to storage in the watershed
Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.
The area of the basin is less than 10 times the area of unit points = 5
The area of the basin is 10 to 100 times the area of the unit [✓ points = 3]
The area of the basin is more than 100 times the area of the unit points = 0
Entire unit is in the FLATS class points = 5

3

Possibly 100 times AREA of unit

D **Total for D 3** *Add the points in the boxes above* 10

D **D 4. Does the wetland unit have the <u>opportunity</u> to reduce flooding and erosion?** ***(see p. 49)***
Answer YES if the unit is in a location in the watershed where the flood storage, or reduction in water velocity, it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows. Answer NO if the water coming into the wetland is controlled by a structure such as flood gate, tide gate, flap valve, reservoir etc. OR you estimate that more than 90% of the water in the wetland is from groundwater in areas where damaging groundwater flooding does not occur.
Note which of the following indicators of opportunity apply.
— Wetland is in a headwater of a river or stream that has flooding problems
— Wetland drains to a river or stream that has flooding problems
— Wetland has no outlet and impounds surface runoff water that might otherwise flow into a river or stream that has flooding problems
△ Other Limited downslope resources
YES multiplier is **2** **NO** multiplier is **1**

multiplier
2?

D **TOTAL - Hydrologic Functions** Multiply the score from D 3 by D 4
Add score to table on p. 1 20

Wetland development is a result of stormwater routed onto the property.

Wetland name or number D

D	**Depressional and Flats Wetlands** **WATER QUALITY FUNCTIONS** - Indicators that the wetland unit functions to improve water quality	**Points** (only 1 score per box)
D	**D 1. Does the wetland unit have the <u>potential</u> to improve water quality?**	***(see p.38)***
D	D 1.1 Characteristics of surface water flows out of the wetland: Unit is a depression with no surface water leaving it (no outlet) [✓ points = 3] Unit has an intermittently flowing, OR highly constricted permanently flowing outlet points = 2 Unit has an unconstricted, or slightly constricted, surface outlet *(permanently flowing)* points = 1 Unit is a "flat" depression (Q. 7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch points = 1 *(If ditch is not permanently flowing treat unit as "intermittently flowing")* Provide photo or drawing	**Figure** ___ 3
D	S 1.2 The soil 2 inches below the surface (or duff layer) is clay or organic *(use NRCS definitions)* YES points = 4 NO [✓ points = 0]	0
D	D 1.3 Characteristics of persistent vegetation (emergent, shrub, and/or forest Cowardin class) Wetland has persistent, ungrazed, vegetation > = 95% of area points = 5 Wetland has persistent, ungrazed, vegetation > = 1/2 of area [✓ points = 3] Wetland has persistent, ungrazed vegetation > = 1/10 of area points = 1 Wetland has persistent, ungrazed vegetation <1/10 of area points = 0 Map of Cowardin vegetation classes	**Figure** ___ 3
D	D1.4 Characteristics of seasonal ponding or inundation. *This is the area of the wetland unit that is ponded for at least 2 months, but dries out sometime during the year. Do not count the area that is permanently ponded. Estimate area as the average condition 5 out of 10 yrs.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland [✓ points = 2] Area seasonally ponded is < ¼ total area of wetland points = 0 Map of Hydroperiods	**Figure** ___ 2
D	**Total for D 1** *Add the points in the boxes above*	8
D	**D 2. Does the wetland unit have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland. *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* — Grazing in the wetland or within 150 ft X Untreated stormwater discharges to wetland — Tilled fields or orchards within 150 ft of wetland — A stream or culvert discharges into wetland that drains developed areas, residential areas, farmed fields, roads, or clear-cut logging X Residential, urban areas, golf courses are within 150 ft of wetland — Wetland is fed by groundwater high in phosphorus or nitrogen — Other___________________ **YES** multiplier is 2 **NO** multiplier is **1**	***(see p. 44)*** multiplier 2
D	**<u>TOTAL</u> - Water Quality Functions** Multiply the score from D1 by D2 ***Add score to table on p. 1***	16

GRASSES
Weedy

Wetland name or number D

These questions apply to wetlands of all HGM classes.
HABITAT FUNCTIONS - Indicators that unit functions to provide important habitat

Points (only 1 score per box)

H 1. Does the wetland unit have the potential to provide habitat for many species?

H 1.1 Vegetation structure *(see p. 72)*

Check the types of vegetation classes present (as defined by Cowardin)- Size threshold for each class is ¼ acre or more than 10% of the area if unit is smaller than 2.5 acres.

____Aquatic bed
[✓ Emergent plants]
____Scrub/shrub (areas where shrubs have >30% cover)
____Forested (areas where trees have >30% cover)

If the unit has a forested class check if:

____The forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the forested polygon

Add the number of vegetation structures that qualify. If you have:

4 structures or more	points = 4
3 structures	points = 2
2 structures	points = 1
1 structure	[✓ points = 0]

Map of Cowardin vegetation classes

Figure ___

0

H 1.2. Hydroperiods *(see p. 73)*

Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ acre to count. (see text for descriptions of hydroperiods)

____Permanently flooded or inundated
[✓ Seasonally flooded or inundated]
____Occasionally flooded or inundated
____Saturated only
____ Permanently flowing stream or river in, or adjacent to, the wetland
____ Seasonally flowing stream in, or adjacent to, the wetland
____***Lake-fringe wetland* = 2 points**
____***Freshwater tidal wetland* = 2 points**

4 or more types present	points = 3
3 types present	points = 2
2 types present	point = 1
1 type present	[✓ points = 0]

Map of hydroperiods

Figure ___

0

H 1.3. Richness of Plant Species *(see p. 75)*

Count the number of plant species in the wetland that cover at least 10 ft^2. *(different patches of the same species can be combined to meet the size threshold)*

You do not have to name the species.

Do not include Eurasian Milfoil, reed canarygrass, purple loosestrife, Canadian Thistle

If you counted:

> 19 species	points = 2
5 - 19 species	[✓ points = 1]
< 5 species	points = 0

List species below if you want to:

Rumex
Typha
Epilobium
Festuca
Equisetum
Chenopodium

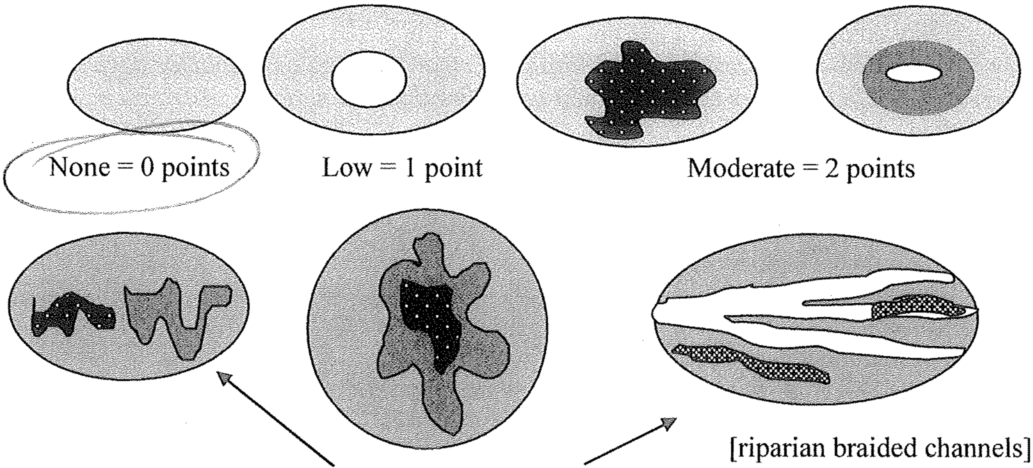
1

Total for page 1

Wetland name or number D

H 1.4. Interspersion of habitats *(see p. 76)*
Decide from the diagrams below whether interspersion between Cowardin vegetation classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, medium, low, or none.

Figure ___



[✓ None = 0 points] Low = 1 point Moderate = 2 points

[riparian braided channels]

High = 3 points

NOTE: If you have four or more classes or three vegetation classes and open water the rating is always "high". Use map of Cowardin vegetation classes

0

H 1.5. Special Habitat Features: *(see p. 77)*
Check the habitat features that are present in the wetland. The number of checks is the number of points you put into the next column.

____Large, downed, woody debris within the wetland (>4in. diameter and 6 ft long).
____Standing snags (diameter at the bottom > 4 inches) in the wetland
____Undercut banks are present for at least 6.6 ft (2m) and/or overhanging vegetation extends at least 3.3 ft (1m) over a stream (or ditch) in, or contiguous with the unit, for at least 33 ft (10m)
____Stable steep banks of fine material that might be used by beaver or muskrat for denning (>30degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet turned grey/brown)*
____At least ¼ acre of thin-stemmed persistent vegetation or woody branches are present in areas that are permanently or seasonally inundated. *(structures for egg-laying by amphibians)*
____ Invasive plants cover less than 25% of the wetland area in each stratum of plants

NOTE: The 20% stated in early printings of the manual on page 78 is an error.

0

H 1. TOTAL Score - potential for providing habitat
Add the scores from H1.1, H1.2, H1.3, H1.4, H1.5

1

Comments

Wetland name or number D

H 2. Does the wetland unit have the opportunity to provide habitat for many species?	
H 2.1 Buffers *(see p. 80)* *Choose the description that best represents condition of buffer of wetland unit. The highest scoring criterion that applies to the wetland is to be used in the rating. See text for definition of "undisturbed."* — 100 m (330ft) of relatively undisturbed vegetated areas, rocky areas, or open water >95% of circumference. No structures are within the undisturbed part of buffer. (relatively undisturbed also means no-grazing, no landscaping, no daily human use) **Points = 5** — 100 m (330 ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 50% circumference. **Points = 4** — 50 m (170ft) of relatively undisturbed vegetated areas, rocky areas, or open water >95% circumference. **Points = 4** — 100 m (330ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 25% circumference, . **Points = 3** — 50 m (170ft) of relatively undisturbed vegetated areas, rocky areas, or open water for > 50% circumference. **Points = 3** **If buffer does not meet any of the criteria above** — No paved areas (except paved trails) or buildings within 25 m (80ft) of wetland > 95% circumference. Light to moderate grazing, or lawns are OK. **Points = 2** X — No paved areas or buildings within 50m of wetland for >50% circumference. Light to moderate grazing, or lawns are OK. [✓ **Points = 2**] — Heavy grazing in buffer. **Points = 1** — Vegetated buffers are <2m wide (6.6ft) for more than 95% of the circumference (e.g. tilled fields, paving, basalt bedrock extend to edge of wetland **Points = 0.** — Buffer does not meet any of the criteria above. **Points = 1** Aerial photo showing buffers	**Figure ___** Disturbed buffers 2
H 2.2 Corridors and Connections *(see p. 81)* H 2.2.1 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 150 ft wide, has at least 30% cover of shrubs, forest or native undisturbed prairie, that connects to estuaries, other wetlands or undisturbed uplands that are at least 250 acres in size? (*dams in riparian corridors, heavily used gravel roads, paved roads, are considered breaks in the corridor*). YES = **4 points** (*go to H 2.3*) [✓ NO = go to H 2.2.2] H 2.2.2 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 50ft wide, has at least 30% cover of shrubs or forest, and connects to estuaries, other wetlands or undisturbed uplands that are at least 25 acres in size? **OR** a **Lake-fringe** wetland, if it does not have an undisturbed corridor as in the question above? YES = **2 points** (*go to H 2.3*) [✓ NO = H 2.2.3] H 2.2.3 Is the wetland: within 5 mi (8km) of a [✓ brackish or salt water estuary] OR within 3 mi of a large field or pasture (>40 acres) OR within 1 mi of a lake greater than 20 acres? [✓ YES = **1 point**] NO = **0 points**	1

Total for page 3

H 2.3 Near or adjacent to other priority habitats listed by WDFW ***(see new and complete descriptions of WDFW priority habitats, and the counties in which they can be found, in the PHS report** http://wdfw.wa.gov/hab/phslist.htm **)***

Which of the following priority habitats are within 330ft (100m) of the wetland unit? *NOTE: the connections do not have to be relatively undisturbed.*

____**Aspen Stands:** Pure or mixed stands of aspen greater than 0.4 ha (1 acre).

X **Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife (*full descriptions in WDFW PHS report p. 152*).

____**Herbaceous Balds:** Variable size patches of grass and forbs on shallow soils over bedrock.

____**Old-growth/Mature forests:** (Old-growth west of Cascade crest) Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 20 trees/ha (8 trees/acre) > 81 cm (32 in) dbh or > 200 years of age. (Mature forests) Stands with average diameters exceeding 53 cm (21 in) dbh; crown cover may be less that 100%; crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80 - 200 years old west of the Cascade crest.

____**Oregon white Oak:** Woodlands Stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158*).

____**Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.

____**Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161*).

____**Instream:** The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources.

X **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report: pp. 167-169 and glossary in Appendix A).*

____**Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human.

____**Cliffs:** Greater than 7.6 m (25 ft) high and occurring below 5000 ft.

____**Talus:** Homogenous areas of rock rubble ranging in average size 0.15 - 2.0 m (0.5 - 6.5 ft), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

____**Snags and Logs:** Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 51 cm (20 in) in western Washington and are > 2 m (6.5 ft) in height. Priority logs are > 30 cm (12 in) in diameter at the largest end, and > 6 m (20 ft) long.

If wetland has **3 or more** priority habitats = **4 points**
If wetland has 2 priority habitats [✓ = **3 points**]
If wetland has **1** priority habitat = **1 point** No habitats = 0 points

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list. Nearby wetlands are addressed in question H 2.4)

3

Wetland name or number D

H 2.4 Wetland Landscape *(choose the **one** description of the landscape around the wetland that best fits)* ***(see p. 84)*** There are at least 3 other wetlands within ½ mile, and the connections between them are relatively undisturbed (light grazing between wetlands OK, as is lake shore with some boating, but connections should NOT be bisected by paved roads, fill, fields, or other development. points = 5 The wetland is Lake-fringe on a lake with little disturbance and there are 3 other lake-fringe wetlands within ½ mile points = 5 There are at least 3 other wetlands within ½ mile, BUT the connections between them are disturbed [✓ points = 3] The wetland is Lake-fringe on a lake **with** disturbance and there are 3 other lake-fringe wetland within ½ mile points = 3 There is at least 1 wetland within ½ mile. points = 2 There are no wetlands within ½ mile. points = 0	3
H 2. TOTAL Score - opportunity for providing habitat *Add the scores from H2.1,H2.2, H2.3, H2.4*	9
TOTAL for H 1 from page 14	1
Total Score for Habitat Functions – add the points for H 1, H 2 and record the result on p. 1	10

Wetland name or number D

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Please determine if the wetland meets the attributes described below and circle the appropriate answers and Category.

Wetland Type *Check off any criteria that apply to the wetland. Circle the Category when the appropriate criteria are met.*	**Category**
SC 1.0 Estuarine wetlands ***(see p. 86)*** Does the wetland unit meet the following criteria for Estuarine wetlands? — The dominant water regime is tidal, — Vegetated, and — With a salinity greater than 0.5 ppt. YES = Go to SC 1.1 NO ✓	
SC 1.1 Is the wetland unit within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? YES = Category I NO go to SC 1.2	**Cat. I**
SC 1.2 Is the wetland unit at least 1 acre in size and meets at least two of the following three conditions? YES = Category I NO = Category II — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. If the non-native *Spartina* spp. are the only species that cover more than 10% of the wetland, then the wetland should be given a dual rating (I/II). The area of Spartina would be rated a Category II while the relatively undisturbed upper marsh with native species would be a Category I. Do not, however, exclude the area of Spartina in determining the size threshold of 1 acre. — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland has at least 2 of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands.	**Cat. I** **Cat. II** **Dual rating I/II**

SC 2.0 Natural Heritage Wetlands *(see p. 87)*

Cat. I

Natural Heritage wetlands have been identified by the Washington Natural Heritage Program/DNR as either high quality undisturbed wetlands or wetlands that support state Threatened, Endangered, or Sensitive plant species.

SC 2.1 Is the wetland unit being rated in a Section/Township/Range that contains a Natural Heritage wetland? *(this question is used to screen out most sites before you need to contact WNHP/DNR)*

S/T/R information from Appendix D ✓ or accessed from WNHP/DNR web site ✓

YES____ – contact WNHP/DNR (see p. 79) and go to SC 2.2 NO ✓

SC 2.2 Has DNR identified the wetland as a high quality undisturbed wetland or as or as a site with state threatened or endangered plant species?

YES = Category I NO ✓ not a Heritage Wetland

SC 3.0 Bogs *(see p. 87)*

Does the wetland unit (**or any part of the unit**) meet both the criteria for soils and vegetation in bogs? *Use the key below to identify if the wetland is a bog.* ***If you answer yes you will still need to rate the wetland based on its functions.***

1. Does the unit have organic soil horizons (i.e. layers of organic soil), either peats or mucks, that compose 16 inches or more of the first 32 inches of the soil profile? (See Appendix B for a field key to identify organic soils)? Yes - go to Q. 3 [✓ No - go to Q. 2]
2. Does the unit have organic soils, either peats or mucks that are less than 16 inches deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on a lake or pond?

   Yes - go to Q. 3 [✓ No - Is not a bog for purpose of rating]
3. Does the unit have more than 70% cover of mosses at ground level, AND other plants, if present, consist of the "bog" species listed in Table 3 as a significant component of the vegetation (more than 30% of the total shrub and herbaceous cover consists of species in Table 3)?

   Yes – Is a bog for purpose of rating No - go to Q. 4

   NOTE: If you are uncertain about the extent of mosses in the understory you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16" deep. If the pH is less than 5.0 and the "bog" plant species in Table 3 are present, the wetland is a bog.

1. Is the unit forested (> 30% cover) with sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Englemann's spruce, or western white pine, WITH any of the species (or combination of species) on the bog species plant list in Table 3 as a significant component of the ground cover *(> 30% coverage of the total shrub/herbaceous cover)?*

2. YES = Category I No ✓ Is not a bog for purpose of rating

Cat. I

SC 4.0 Forested Wetlands ***(see p. 90)***

Does the wetland unit have at least 1 acre of forest that meet one of these criteria for the Department of Fish and Wildlife's forests as priority habitats? *If you answer yes you will still need to rate the wetland based on its functions.*

- **Old-growth forests**: (west of Cascade crest) Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/acre (20 trees/hectare) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 inches (81 cm) or more.

  NOTE: The criterion for dbh is based on measurements for upland forests. Two-hundred year old trees in wetlands will often have a smaller dbh because their growth rates are often slower. The DFW criterion is and "OR" so old-growth forests do not necessarily have to have trees of this diameter.

- **Mature forests**: (west of the Cascade Crest) Stands where the largest trees are 80 – 200 years old OR have average diameters (dbh) exceeding 21 inches (53cm); crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth.

YES = Category I NO X not a forested wetland with special characteristics

Cat. I

SC 5.0 Wetlands in Coastal Lagoons ***(see p. 91)***

Does the wetland meet all of the following criteria of a wetland in a coastal lagoon?

- The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks
- The lagoon in which the wetland is located contains surface water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom)*

YES = Go to SC 5.1 NO X not a wetland in a coastal lagoon

SC 5.1 Does the wetland meets all of the following three conditions?

- The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of invasive plant species (see list of invasive species on p. 74).
- At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland.
- The wetland is larger than 1/10 acre (4350 square feet)

YES = Category I NO = Category II

Cat. I

Cat. II

SC 6.0 Interdunal Wetlands *(see p. 93)*

Is the wetland unit west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)?

YES - go to SC 6.1 [✓ NO] – not an interdunal wetland for rating

If you answer yes you will still need to rate the wetland based on its functions.

In practical terms that means the following geographic areas:

- Long Beach Peninsula- lands west of SR 103
- Grayland-Westport- lands west of SR 105
- Ocean Shores-Copalis- lands west of SR 115 and SR 109

SC 6.1 Is the wetland one acre or larger, or is it in a mosaic of wetlands that is once acre or larger?

YES = Category II NO – go to SC 6.2

Cat. II

SC 6.2 Is the unit between 0.1 and 1 acre, or is it in a mosaic of wetlands that is between 0.1 and 1 acre?

YES = Category III

Cat. III

Category of wetland based on Special Characteristics

Choose the "highest" rating if wetland falls into several categories, and record on p. 1.

If you answered NO for all types enter "Not Applicable" on p.1

N/A