MONITORING PLAN

Ala Spit Restoration

Prepared for

Island County Public Health

Prepared by

Herrera Environmental Consultants

November 7, 2011 Draft

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Prepared for

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1.0 Introduction

Island County was awarded a grant from the Salmon Recovery Funding Board (SRFB) to restore Ala Spit. The primary goal of the Ala Spit Restoration Project is to maximize the recovery of salmon species through the preservation and restoration of their habitat and the habitat of their forage base, while continuing to maintain the current recreational use of Ala Spit County Park.

Ala Spit lies on the northeastern shore of Whidbey Island, immediately across from Hope Island, Washington (Figure 1). The project site is located within Ala Spit County Park. The beach area of Ala Spit provides forage fish (surf smelt and sand lance) spawning habitat. Adjacent to the spit is a pocket estuary. The pocket estuary includes a lagoon, marshlands, and mudflats; and provides vital rearing and cover habitat for juvenile salmonids as they transition from their freshwater habitats in the Skagit River to the Pacific Ocean. The pocket estuary also provides rearing habitat for forage fish and many other marine fish as well as shellfish species. The restoration project includes removal of riprap and construction debris located along the spit neck and the northern two-thirds of the park bulkhead.

Island County Public Health Department (Island County) retained Herrera Environmental Consultants, Inc. (Herrera) to provide services for Phase II design of the Ala Spit Restoration Project. Herrera services for the project include supporting Island County with stakeholder coordination, preparation of permits, preparation of site plans, preparation of final design and drawings, preparation of bid documents (including plans, specifications, and estimates), bid and construction assistance, and preparation of a monitoring plan.

This document presents the monitoring plan for the Ala Spit Restoration Project. The elements of this monitoring plan were discussed and agreed upon with Island County. The monitoring plan is intended to determine the extent the primary goal of the project is achieved. Specifically, the monitoring will assess to the extent salmon and forage fish habitat is restored through implementation of the project.

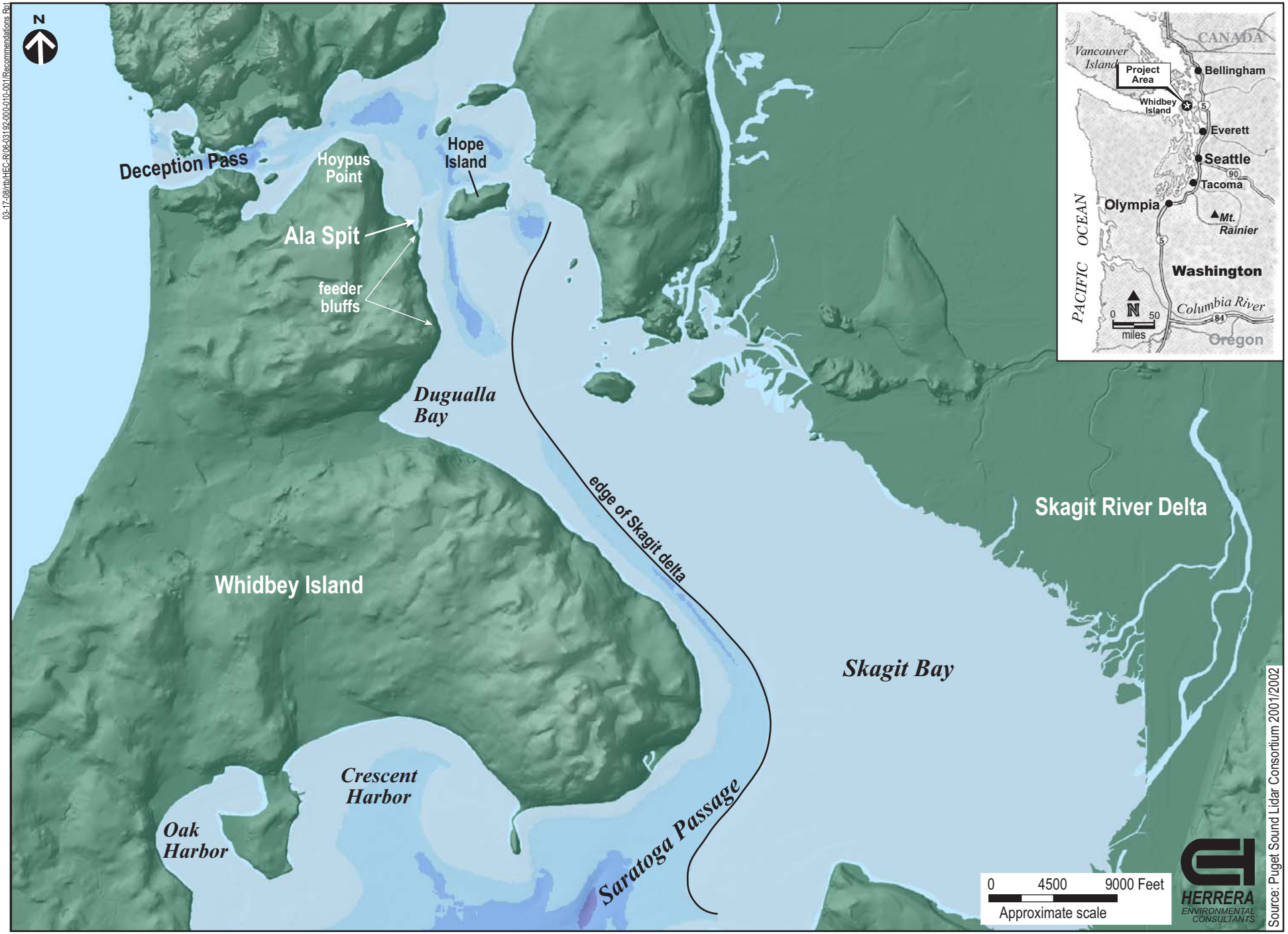

Figure 1. Vicinity map of Ala Spit on Whidbey Island, Washington.

2.0 Restoration Elements

Following is a description of each of the three restoration elements, which includes riprap and concrete debris removal, shoreline stabilization, and restoration of the temporary construction impacts on salt marsh vegetation.

2.1 Riprap and Concrete Debris Removal

The project will remove approximately 800 linear feet of riprap revetment and isolated pieces of concrete debris from the southern third of Ala Spit. A construction access route 12 feet wide and 800 feet long will be cleared to allow access for construction equipment (e.g., track-mounted excavators, dump trucks). The access route will be used for the temporary removal of driftwood which will be stockpiled on the existing parking lot adjacent to the project site. Driftwood will be replaced along the spit following the riprap and concrete debris removal process. On areas along the parking lot, existing driftwood will be used in combination with some of the removed riprap to provide protection. This riprap will be buried and will not be engaged by wave action (see *Shoreline Stabilization* section below). Excess riprap will be loaded in dump trucks and hauled off-site to an approved disposal site.

Beach nourishment material (sand and small gravel) will be added as needed to fill any significant gaps created by the riprap and concrete debris removal. Beach nourishment material will also be used to restore the edge of the pocket estuary that has eroded due to the presence of riprap.

2.2 Shoreline Stabilization

The southern portion of the spit and the northern portion of the bulkhead removal area will be stabilized with imported large woody debris, reuse of stockpiled riprap and driftwood, and placement of imported sand (i.e., beach nourishment). The extent of shoreline stabilization is approximately 1,085 feet in length, 30 feet in width, and up to 11 feet in depth. The design involves embedding woody material into the bank of the shoreline supplemented with salvaged riprap from the spit, and covering it with sand. The shoreline stabilization measures mimic natural processes while preventing the need for future armoring.

2.3 Restoration of Temporary Construction Impacts on Salt Marsh Vegetation

To allow access for the riprap and concrete debris removal activity, an area of approximately 200 square feet (0.005 acres) of salt marsh vegetation (primarily pickleweed, with some

saltgrass) will be carefully removed, with intact roots and surface soils to a depth of 6 to 12 inches in large patches (at least 4 feet square). This salt marsh vegetation will be permanently placed, either adjacent to the disturbed areas after construction, or in an unvegetated portion of the lagoon (located at the same vertical elevation), isolated from the remainder of the bay by silt curtains to minimize any discharge of sediments to the bay. The removal and replacement of the salt marsh vegetation will be conducted under the supervision of a qualified biologist.

In the final position, the replanted salt marsh vegetation will continue to be regularly inundated by tidewaters at a frequency, duration, and depth that is similar to the existing condition. Therefore, the replanted salt marsh vegetation is expected to maintain its original health and vigor. All disturbed areas along the spit will be nourished with sand and small gravel to match preconstruction conditions.

3.0 Existing Site Conditions Summary

Existing site conditions were assessed during site visits conducted by Herrera on March 22, 2007, March 9, 2011, and most recently May 18, 2011. Salt marsh limits were mapped on March 9, 2011. A beach profile survey was performed on May 18, 2011. The March 2007 site visit was conducted as part of a feasibility study performed for the Ala Spit Restoration project by Herrera biologists and geomorphologists (Herrera 2008).

3.1 Nearshore Habitat: Forage Fish Habitat

Under existing conditions, limited suitable substrate (i.e., sand and pea-size gravel) for forage fish (sand lance and surf smelt) spawning occurs throughout the project area. Suitable forage fish spawning habitat generally occurs between the MHHW (approximately 7 feet NAVD88) and 5 feet above mean lower low water (MLLW) (5 feet NAVD88).

3.1.1 Large Woody Debris

Large Woody Debris (LWD) in the project area consists of 15-foot long logs with and without root wads and smaller pieces of naturally recruited driftwood. LWD is mostly located at the mean higher high water (MHHW) elevation.

3.1.2 Vegetation

Several plant communities exist within the project area, including upland, wetland (estuarine and freshwater), and intertidal plant communities (Table 1).

Table 1. Plant species observed on Ala Spit within the restoration project area.

Species Common Name	Species Scientific Name	Native/Invasive Status	Plant Community(ies)
Pickleweed	*Salicornia virginica*	Native	Salt Marsh
Salt grass	*Distichlis spicata*	Native	Salt Marsh, Upland Dune/Beach
Water iris	*Iris pseudacorus*	Invasive	Freshwater Emergent Wetland
Colonial bentgrass	*Agrostis tenuis*	Invasive	Freshwater Emergent Wetland, Upland Disturbed Herbaceous
Slough sedge	*Carex obnupta*	Native	Freshwater Wetland
Red alder	*Alnus rubra*	Native	Upland Forest and Scrub
Big-leaf Maple	*Acer macrophyllum*	Native	Upland Forest
Douglas-fir	*Pseudotsuga menziesii*	Native	Upland Forest
Nootka rose	*Rosa nutkana*	Native	Upland Forest and Scrub, Freshwater Wetland
Osoberry	*Oemleria cerasiformis*	Native	Upland Forest
Sword fern	*Polystichum munitum*	Native	Upland Forest
Stinging nettle	*Urtica dioica*	Native	Upland Forest
Himalayan blackberry	*Rubus armeniacus*	Invasive	Upland Forest and Scrub
Trailing blackberry	*Rubus ursinus*	Native	Upland Forest
Salmonberry	*Rubus spectabilis*	Native	Upland Forest and Scrub, Freshwater Wetland
Red elderberry	*Sambucus racemosa*	Native	Upland Forest
Scotch broom	*Cytisus scoparius*	Invasive	Upland Disturbed
Tall fescue	*Schedonorus arundinaceus*	Invasive	Upland Disturbed
Dune grass	*Leymus mollis*	Native	Upland Dune/Beach
Puget Sound gumweed	*Grindelia hirsutula*	Native	Upland Dune/Beach
Sea lettuce	*Ulva* sp.	Native	Intertidal
Rock weed	*Fucus* sp.	Native	Intertidal

4.0 Monitoring Plan

Field sampling associated with this monitoring plan will follow general guidelines for marine nearshore investigations (Ruotsala 1979; Simenstad et al. 1991, 2006). Island County, with assistance from consulting scientists and/or volunteers, will monitor the restoration site before construction activities and for 3 consecutive years following project completion. Monitoring will be designed to determine if performance standards have been achieved. Monitoring results will be used to determine the effectiveness of the restoration project and to inform adaptive management activities.

The goals, objectives, performance standards, and monitoring activities associated with the restoration project are generally separated into two categories; those related to 1) physical response and 2) biological response. Each category, including the associated goals, objectives, performance standards, and monitoring activities, is described in the following sections.

4.1 Physical Response

For physical response, long term aerial photographs will be used to assess changes in physical conditions at the site over time in plan view. Sequential air photos will be analyzed using geographic information system (GIS) to assess temporal changes in habitat types, specifically the area of nearshore and vegetated communities, in response to restoration actions. These aerial photographs may only be available to Island County every 5 years. The aerial photo record will be supplemented with on-the-ground site photography from permanently established photo points. At these photo points, photographs will be taken before (pre-construction), during, and after restoration to provide a record of changes in physical habitat over time.

Photographic documentation will be supplemented onsite by measuring several physical habitat variables over time including beach profile, sediment characteristics (type and distribution), and LWD abundance and location. A beach profile survey was conducted by Herrera prior to construction as part of the project design. This information could be used as the baseline for long term changes in elevation and beach profile. However, for the purpose of this monitoring plan, the physical conditions immediately following construction are also important to characterize. This would necessitate a "Year Zero" monitoring effort to document the physical conditions immediately following construction.

Post project surveys will be conducted during the winter and summer for 3 consecutive years following project implementation to document permanent site changes while accounting for known seasonal variability.

4.1.1 Goal

The restoration goal is to enhance physical nearshore habitat conditions.

4.1.2 Objectives

1. Improve sediment retention/accretion within the pocket estuary habitat area to support salt marsh vegetation

2. Increase the amount of forage fish (surf smelt and sand lance) spawning habitat area

3. Increase abundance of LWD and increase area that contains LWD

4.1.3 Performance Standards

Evaluation of the following four performance standards will help to document and verify that ground elevations and slope, substrate characteristics, and LWD are established according to design criteria. A beach profile survey was conducted by Herrera prior to construction as part of the project design. However, there is significant natural seasonal and interannual variability in substrate type and profile shape. Therefore, a change in profile shape or substrate may not adequately indicate project performance. Since the design was intended to increase salt marsh area, in particular the extent of pickleweed (*Salicornia virginica*), the area covered by this species is an indicator of design physical conditions. Because pickleweed is sensitive to wave disturbance, expansion of pickleweed implies that the design substrate is being retained because the wave energy has been reduced. Failure to meet the pickleweed standard will necessitate physical changes to bring it back in line with design expectations. These standards directly relate to objectives 1, 2, and 3 discussed above.

1. At the end of Years 1, 2, and 3, the beach will have retained ≥ 90 percent of the total **pre-construction** (baseline) sediment and/or accumulated additional sediment, based on beach profile elevations.

2. At the end of Years 1, 2, and 3, the beach area consisting of sand and fine gravel (suitable for forage fish spawning) will meet or exceed the **pre-construction** area.

3. At the end of Years 1, 2, and 3, the total area of pickleweed will meet or exceed the **pre-construction** area.

4. At the end of Years 1 and 3, the beach area containing LWD will meet or exceed the **pre-construction** area, and the beach will have retained ≥ 75 percent of placed LWD pieces that protect park infrastructure.

4.1.4 Monitoring Protocols

This section provides a description of the methodologies associated with the physical monitoring. Physical elements to be monitored in the field include beach profile, sediment characteristics, and LWD.

Pre-Construction

A beach profile survey was conducted by Herrera prior to construction as part of the project design.

Beach Profiles (Transects)

The purpose of monitoring beach profile is to determine potential sediment accretion, erosion, and distribution as these measurements provide information about the extent and condition of available forage fish spawning habitat. A beach profile survey was conducted by Herrera as part of the project design and can be used as pre-construction beach profile survey. However, the information generated during the beach survey element of the Year Zero monitoring should be used as the baseline for detecting long term changes in elevation and beach profile (slope), in an effort to assess the evolution of the site, once it has been restored.

Approximately eight transects will be layout perpendicular to the shoreline extending from the top of the spit between 12 and 13 feet NAVD88 elevation to approximately 0 feet NAVD88 elevation. The location of each transect will be recorded using land surveying equipment or a Trimble® global positioning system (GPS) unit. Vertical control will be provided by a NGS Monument (PID#: TR0390) on the spit.

Sediment Characteristics

Sediment plots (0.25 m^2) will be established and sampled along each transect at 10-foot intervals. At each plot, surficial beach sediment will be visually characterized and a representative photograph taken, including a scale for size reference. In addition, at-depth sediment samples will be taken at the upper (first plot), mid, and lower (last plot) along each transect to determine sediment thickness and grain size composition. At-depth sediment samples will be collected down to two feet depth or until the armor layer is encountered, whichever is shallower. Sediment grain size will be measured using sieve series and scales, and characterized using the sediment classifications included in Table 2. Presence of macroinvertebrate, algae, and/or anthropogenic materials will be noted.

Table 2. Grain size classes used to classify sediment types.

Class	Size Range (mm diameter)
Boulder	> 256
Cobble	64 - 256
Gravel	20 - 64
Fine Gravel	2 - 20
Sand	0.0625 - 2
Silt	0.002 - 0.0625
Clay	< 0.002

Large Woody Debris

Area covered by existing large woody debris within the restoration site will be mapped using a Trimble® (or similar) hand-held GPS unit.

Post -Construction

Island County will monitor the restoration site for 3 consecutive years following the project completion. Monitoring will occur during the fall-winter period, following significant storm events when feasible, during Years 1, 2, and 3 following construction. In addition, monitoring will also be performed during Years 1, 2, and 3 in the summer. This monitoring schedule will allow for contrasting best (summer) and worst (fall-winter) conditions at the restoration site, given the seasonal nature of some of the physical processes that drive sediment and drift wood transport along the shoreline.

Beach Profiles (Transects)

As stated before, a pre-construction beach profile survey was conducted by Herrera as part of the project design. The information generated during this beach survey will be used as the baseline for long term changes in elevation and beach profile (slope). Approximately eight transects will be laid out perpendicular to the shoreline, extending from the top of the spit between 12 and 13 feet NAVD88 elevation to approximately 0 feet NAVD88 elevation. The location of each transect will be recorded using land surveying equipment or a Trimble® (or similar) global positioning system (GPS) unit. Each transect location will be permanently marked on the bank for future reference during the post-construction monitoring. Vertical control was provided by a NGS Monument (PID#: TR0390) on the spit.

From the beach profile perspective, areas considered suitable for surf smelt and sand lance spawning are those areas at elevations between the MHHW (approximately 7 feet NAVD88) and 5 feet NAVD88 (approximately 5 feet above MLLW). In addition, to be suitable, these areas have to be characterized by having sand and fine gravel substrate (see next section).

Sediment Characteristics

Post-construction sediment characterization would follow the same monitoring protocol as described previously for the pre-construction event.

From the sediment perspective, areas considered suitable for surf smelt and sand lance spawning are classified as sand and fine gravel (Table 2). In addition, they have to occur at those elevations between approximately 5 and 7 feet NAVD88.

Large Woody Debris

Area covered by existing large woody debris will be mapped using a Trimble® (or similar) hand-held GPS unit. Post-construction LWD placed within the restoration area will be assessed in terms of size class and abundance. Size classes will be determined prior to initial surveys.

Observations will be compared to quantities and size classes recorded for LWD placed during restoration project construction.

4.2 Biological Response

For biological response, three components will be monitored including; 1) forage fish (sand lance and surf smelt) spawning activity; 2) fish abundance and density in the nearshore zone; and 3) vegetation species composition, density, and cover. Forage fish spawning will be monitored within the project area and adjacent areas including the entire Ala Spit. Beach seine surveys will be conducted in the project area and vicinity to monitor fish use in the nearshore zone, and will target salmonid species. Vegetation will be monitored for the restoration project site. Aerial photographs and on-the-ground site photographs from permanently established photo points will be used to assess spawning habitat and vegetation conditions. Photographs will be supplemented with biological measurements.

4.2.1 Goal

The restoration goal is to enhance existing nearshore habitat conditions including forage fish spawning substrate, nearshore salmonid rearing habitat, and salt marsh vegetation.

4.2.2 Objectives

1. Enhance forage fish (surf smelt and sand lance) spawning activity
2. Provide habitat suitable for use by migrating juvenile salmonids
3. Increase native vegetation (salt marsh) coverage and density
4. Minimize invasive plant species coverage and density

4.2.3 Performance Standards

Evaluation of the following three performance standards will help to document and verify that forage fish spawning habitat and salmonid rearing habitat occur at Ala Spit, native vegetation coverage increases, and invasive plant species coverage decreases. These standards directly relate to objectives 1 through 4 discussed above.

1. At the end of Year 3, there will be an increase in mass of forage fish eggs (spawn) along Ala Spit.

2. By the end of the second growing season, after restoration replanting of salt marsh vegetation (planted and naturally colonized), cover will exceed 20 percent of the planted area.

3. At the end of the first, second, and third growing seasons, nonnative (i.e., exotic) vegetation cover within the restoration area will be less than 15 percent.

4.2.4 Monitoring Protocols

This section provides a description of the methodologies associated with the biological monitoring. Biological elements to be monitored in the field include forage fish spawning activity, nearshore habitat use by salmonids, and vegetation community characteristics.

Pre-Construction

Pre-construction biological monitoring will be conducted by Island County.

Nearshore Habitat – Forage Fish

Given that surf smelt's embryo development averages about 14 days and sand lance's 30 days, the sampling will be implemented twice per month, allowing about 15 days in between sampling events. Surveys will occur between April and September (for surf smelt) and between November and February (for surf smelt and sand lance). Surveys will occur twice per month, and allow about 15 days in between sampling events.

Surf smelt and sand lance spawn (i.e., egg mass) sampling methods will follow (as applicable) the protocols published by Moulton and Penttila (2000). Key elements of the protocol are provided in Appendix A. In general, presence/absence of sand lance and surf smelt spawn will be assessed through visual examination and the bulk sampling protocol (i.e., composited sediment samples from potential spawning beaches) described by Moulton and Penttila (2000). The bulk sampling method consists of collecting beach samples and subjecting the sample to laboratory examination for egg presence. The bulk sampling method is considered a much more accurate measure of spawning activity than the visual method.

In addition to monitoring the project area, surf smelt and sand lance spawn surveys will be performed at selected sites along Ala Spit. Sites will be selected based on substrate suitability of the beach. The geographic location of each selected site will be recorded using a Trimble® (or similar) hand-held GPS unit.

Salmonid Habitat Use (Beach Seine)

Beach seining locations will be the same as those previously sampled by Beamer and SRSC (2007). Salmonid use of nearshore habitat in the project vicinity is expected to occur between April and May based on sampling results in 2007 (Beamer and SRSC 2007). Beach seines will be used along both sides of Ala Spit to catch fish in order to assess their abundance, species composition, and size. Beach seining will be generally conducted according to the applicable methods described by Beamer and Henderson (2003), and Beamer and SRSC (2007). Key elements of the protocol and sampling locations are provided in Appendix B. Beach seining will

occur on flood tides or neap low tide stage. Two different habitat types (lagoon habitat and shallow intertidal habitat adjacent to the Ala Spit) will be sampled. Ten sites will be sampled twice per month from February through June. The number of hauls, timing, frequency, and precise locations will be determined based on expected migration timing, available funding, and specific site conditions. Beach seining locations will be recorded using a Trimble® (or similar) hand-held GPS unit. Sampling conditions and results will be recorded in the field for subsequent analysis.

Vegetation

Vegetation characteristics were evaluated during field investigations described previously in the section on existing site conditions. Additional pre-project vegetation monitoring is not included in this monitoring plan. Performance standards and restoration project success related to vegetation will be evaluated based on post-construction monitoring described for vegetation in the next section.

Post-Construction

Post-construction biological monitoring will be conducted by Island County. Monitoring will occur for three consecutive years following project completion as outlined in the sections below.

Nearshore Habitat – Forage Fish

Post-construction monitoring of sand lance and surf smelt spawning will be performed following the same protocol as described above under the Pre-Construction section. This monitoring will be implemented between April and September (for surf smelt) and between November and February (for surf smelt and sand lance). Surveys will occur twice per month, and allowing about 15 days in between sampling events.

Salmonid Habitat Use (Beach Seine)

Post-construction monitoring will be performed following the same protocol as described above under the Pre-Construction section. Monitoring for salmonid use of nearshore habitat will occur twice per month between February and June.

Vegetation

As stated previously, the project includes replanting of salvage salt marsh vegetation. Only the replanted salt marsh vegetation and its spread to adjacent areas will be monitored as part of this monitoring plan. Areas to be planted will be monitored using the following protocol:

- For a total of 3 years after planting (or until observe changes indicate that the project objectives are met), the salt marsh planting and immediately adjacent areas will be monitored by Island County at least twice per year

during the growing season. During both visits, photographs of vegetation conditions will be taken from permanently established photo points.

- During the early growing season visit, general conditions will be noted and maintenance measures will be identified for immediate attention (e.g., presence of nonnative species). During the late growing season visit, performance standards will be evaluated by surveying native and non-native vegetation plant cover as well as composition. A series of transects will be established throughout the salt marsh planting and immediately adjacent areas. Along each transect, vegetation will be monitored within randomly placed, fixed circular or square plots. Once established, the center of each radius plot or edge of each square plot location will be permanently marked so that the plot location can be easily found during subsequent monitoring events. The radius length and quantity of plots will be determined prior to monitoring activity and will be based in part on the dimensions of the planting area. Statistical analysis will be conducted to determine whether performance standards have been achieved.

5.0 Adaptive Management Activities

Island County will ensure restoration project success through site monitoring as described in this plan, and through implementation of the adaptive management process. Monitoring will be conducted by a qualified biologist. Island County will use monitoring results to inform and evaluate additional corrective actions that may be required to meet performance standards and plan objectives. The site will be visually inspected during monitoring visits for emerging situations which may require corrective action, such as native plant mortality, establishment of noxious plant species, erosion, problems with the water regime, or other factors. This will allow Island County to follow an adaptive management process (Figure 2).

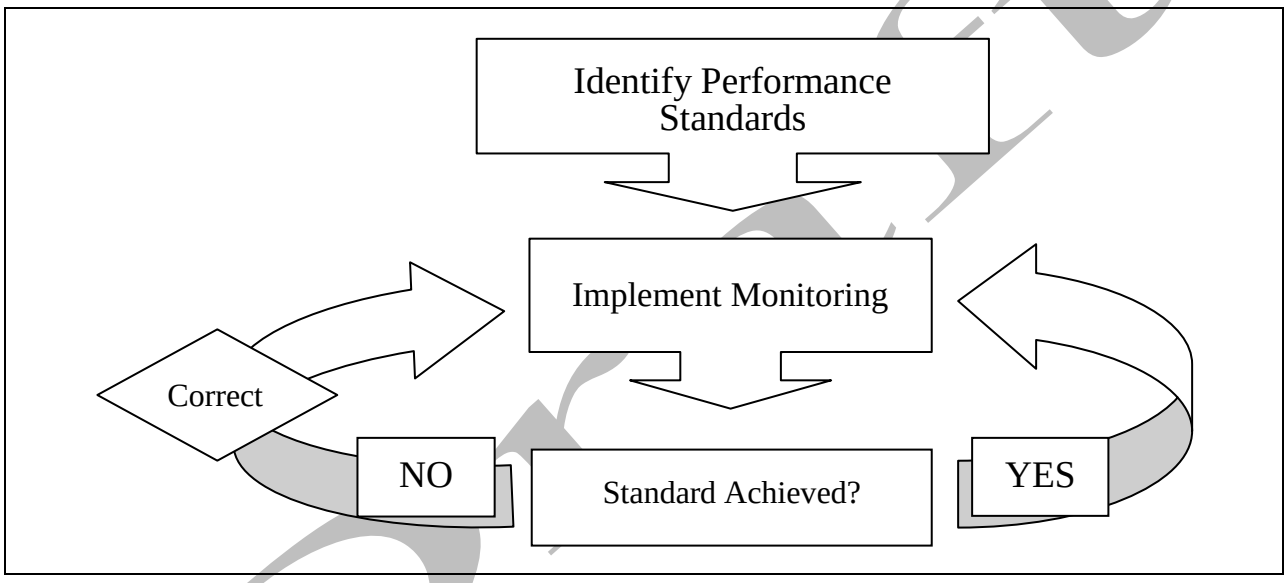

Figure 2. Typical adaptive management process.

If performance standards for physical or biological responses are not achieved at the completion of the 3-year monitoring adaptive management measures will be recommended and implemented. Specifically, if performance standards are not achieved for beach profile and sediment characteristics, contingency activities may include but are not limited to additional beach grading, substrate nourishment, vegetation plantings or LWD placement. Similarly LWD performance standards that are not achieved may result in recommendations for additional LWD placement. If the performance standards for salt marsh vegetation are not achieved, contingency activities may include but are not limited to alteration of the substrate type and elevation, plant replacement, plant supplementation, adjustment of the planting layout to reflect specific or changing site conditions, and invasive plant species control.

As previously stated, this monitoring plan does not include upland vegetation, because the areas where upland vegetation currently exists (landward of the concrete bulkhead) will not be disturbed as part of this project. If planting on the area landward of the concrete bulkhead is desired, use Table 3 to select plant species that can be planted in this area. Such planting should be preceded by the removal of invasive nonnative vegetation. Planting of areas along the spit

should only include the dune vegetation type; and if it is done through seeding then, it should be performed in the spring of 2012.

Table 3. Proposed plant species for planting the Ala Spit restoration project site.

Species Common Name	Species Scientific Name	Native/Invasive Status	Plant Community(ies)
Salt grass	*Distichlis spicata*	Native	Upland Dune/Beach
Red alder	*Alnus rubra*	Native	Upland Forest and Scrub
Nootka rose	*Rosa nutkana*	Native	Upland Forest and Scrub, Freshwater wetland
Salmonberry	*Rubus spectabilis*	Native	Upland Forest and Scrub, Freshwater wetland
Red elderberry	*Sambucus racemosa*	Native	Upland Forest

If planted, the upland vegetation should then be monitored as follows. For a total of 3 years after planting, the planting area will be monitored by Island County at least twice per year during the growing season. During both visits, photographs of vegetation conditions will be taken from permanently established photo points.

During the early growing season visit, general conditions will be noted and maintenance measures will be identified for immediate attention (e.g., presence of nonnative and/or weedy species). During the late growing season visit, performance standards will be evaluated by surveying native and non-native vegetation plant cover as well as composition according to protocols published by Elzinga et al. (1998). A series of transects will be established throughout the planting area. Along each transect, vegetation will be monitored within randomly placed, fixed circular or square plots. Once established, the center of each radius plot or edge of each square plot location will be permanently marked so that the plot location can be easily found during subsequent monitoring events. The radius length and quantity of plots will be determined prior to monitoring activity and will be based in part on the dimensions of the planting area. Statistical analysis will be conducted to determine whether performance standards have been achieved.

6.0 References

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APPENDIX A

Forage Fish Spawn Survey Protocol

Forage Fish Spawn Survey Protocol

Moulton, L.L., and D.E. Penttila. 2000
Forage Fish Spawning Distribution in San Juan County and Protocols for Sampling Intertidal and Nearshore Regions.
Northwest Straits Commission. Mount Vernon, WA.

Field Protocols

Field Equipment

Equipment needed for collecting bulk beach samples to assess surf smelt and Pacific sand lance:
• 8 ounce plastic jar
• 1 gallon ZipLoc or other sealable freezer bags
• waterproof labels

Equipment needed for condensing samples:
• Rack of sediment screens, size 4, 2, and 0.5 mm, preferably Nalgene instead of the more traditional brass screens,
• 2 - 5 gallon buckets modified to act as drain for screen rack,
• Wash bucket,
• Plastic dishpan,
• 8 ounce plastic sample jar
• Stockard's Solution:
    50 ml formalin (37% formaldehyde)
    40 ml glacial acetic acid
    60 ml glycerin
    850 ml distilled water

Field Records

Environmental characteristics of the sampled location are recorded to help analyze results of the sampling. These records are entered on the field data sheet, which is completed at the time of sampling (Figure 14). The data fields are as follows:

Sector: Location Sampled
Date of Sampling
Station: Station number, starting with 1 each area, each day.
Sample: Sample number. Blank for bulk samples, letter for scoop samples.
Latitude/Longitude: latitude and longitude in degrees, minutes, seconds
Beach: Character of the upper beach:
0 = mud,
1 = pure sand,
2 = pea gravel (fine gravel) with sand base,
3 = medium gravel with sand base,
4 = coarse gravel with sand base,
5 = cobble with sand base,
7 = boulder with sand base,
8 = gravel to boulders without sand base,
9 – rock, no habitat

Uplands: Character of the uplands (up to 1,000 ft):
1 = natural, 0% impacted (bulkhead, rip-rap, housing, etc.);
2 = 25% impacted; 3 = 50% impacted; 4 = 75% impacted, 5 = 100% impacted

Sample Zone: Distance of collection parallel from a land mark in feet to the nearest ½ foot. Used to determine the tidal elevation of the spawn deposit

Land Mark: Land mark for sample collection:
1 = down beach from the last high tide mark
2 = up beach from last high tide mark
3 = down beach from second to the last high tide
4 = down beach from upland toe
5 = up beach from the waterline at the time noted in comments

Tidal Elevation: This is determined in the office by using the data from “land mark”, the average beach slope for the sector, and the height of the tide on the previous tide exchange.

Smelt, Sand Lance, Rock Sole, Herring: subjective field assessment of spawn intensity:
0 = no eggs in field,
1 = very light, observed in field,
2 = light, observed in field
3 = light medium, observed in field
4 = medium, observed in field
5 = medium heavy, observed in field
6 = heavy, observed in field
7 = very heavy, observed in field
8 = eggs observed in the winnow

Width: Width of the potential spawning substrate to the nearest foot

Length: Length of the beach up to 1,000 feet (500 feet on either side of the station) or “C” if continuous.

Shading: Shading of the spawning substrate zone, averaging over the 1,000 foot station and best interpretation for the entire day:
1 = fully exposed,
2 = 25% shaded,
3 = 50% shaded,
4 = 75% shaded,
5 = 100% shaded

Comments: additional information to be entered into the computer, evaluated on a station by station basis.

Prepare a map of each location sampled using a 1:25,000 scale NOAA nautical chart or 1:24,000 scale USGS topographic sheet. Mark each sample location on the map with the appropriate sample number so that the exact site can be re-visited, if needed. If possible, use a GPS to obtain latitude and longitude of each sampled location, but priority should be placed on an accurate map.

General Guidelines for Collecting Bulk Beach Samples

Examine the beach to evaluate the most likely zone to contain eggs (+7 to +9 feet MLLW). This zone will be in the upper third of the beach, near the upper tidal limit. Typically, this zone is 1 or 2 vertical feet below the log line. For surf smelt eggs, the zone is characterized by mixed sand and small gravel. For Pacific sand lance eggs, the zone is similar, but can extend into pure sand. Mud or muddy sand are not acceptable substrates, nor are larger gravels, cobbles or solid rock and talus shores.

The sample is composed of four (4) scoops of gravel evenly spaced along a 100 ft stretch of beach (see Figure 15).

- Identify an approximately 100 ft stretch of beach to be sampled.
- Obtain location information for the transect by reading position information from a GPS or marking the location carefully on a large scale (1:24,000) USGS topographical sheet.
- Prepare a label to allow identifying the location and collection time of the sample, deposit the label in the plastic bag.
- Start at one end of the transect, scoop a jar full of sand from the top 0.5 inch of beach and dump the sand into the plastic bag. The scooped area will likely be 3-4 ft long – the idea is to skim the eggs developing in the surface one-inch of substrate.
- Move 10 paces along the transect, obtain another scoop sample and place in the bag with the previous scoop.
- Repeat pacing and scooping until the four scoops have been obtained – this constitutes the bulk sample for the chosen transect.
- Seal the bag securely and place in a cool location. This is particularly important in warmer weather because high temperatures can cause mortality and decomposition in the eggs.
- Store in a secure location to ensure that the bags are not damaged during transit from the field.

Condensing Bulk Samples

The bulk egg samples can be processed in the field to remove most of the sand and reduce the volume of the sample. This is done by washing the eggs from the sand and discarding the barren sediment. The eggs are lighter than the sand and gravel and will move upward during the washing process, allowing them to be skimmed from the surface of the material (Figures 16 and 17). The washing is conducted as follows:

- Assemble the Nalgene screens on top of the drain bucket, with the largest mesh on top, grading to the smallest mesh on the bottom.
- Remove the sample label and place it in an 8 ounce sample jar.
- Add a portion of the sample to the top screen, thoroughly wash the sediment through the screen set with either salt or fresh water, whichever is readily available.
- Discard the sediment in the top screens, retain only the material in the bottom (0.5 mm) screen.
- Dump the material retained in the 0.5 mm screen into the dishpan.
- Add water until the material is covered by 1-2 inches of water.

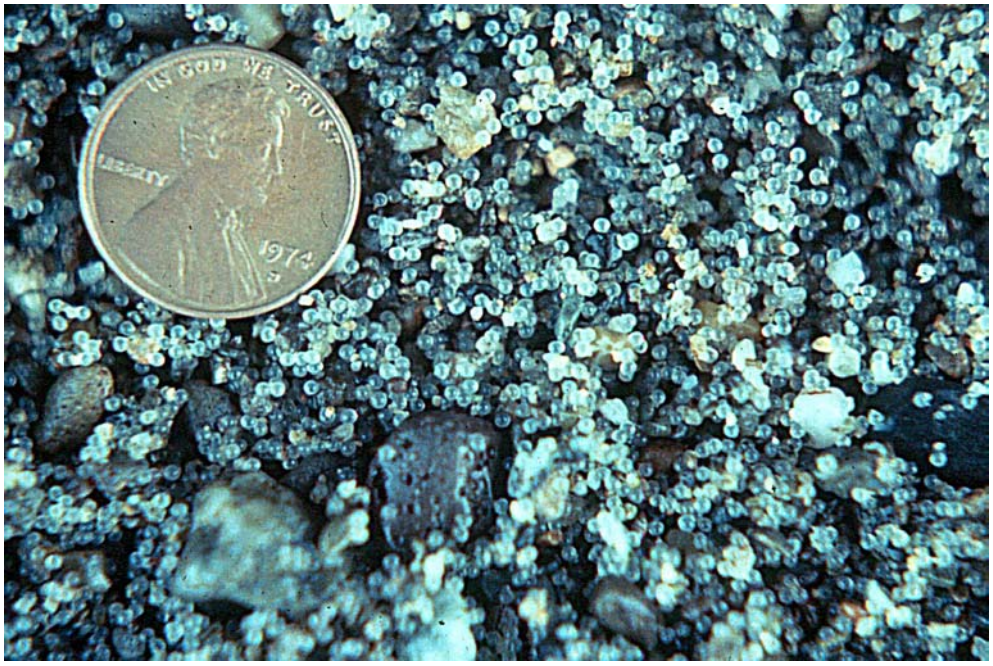
- Swirl the water around the pan, adding rocking and bouncing motions to allow the eggs to migrate to the top of the sediment. The idea is similar to gold panning, try to winnow the eggs to the surface of the material.
- After swirling for 1-2 minutes, work the lighter fraction of material to one corner of the pan.
- Carefully dry up the lighter fraction by tipping the pan so that the water drains away, and skim the lighter fraction from the surface of the sand with the sample jar.
- Repeat the winnowing process two more times.
- Process the remainder of the sample in a similar fashion, each time adding the retained lighter fraction to the sample jar.
- Fill the sample jar with Stockard's Solution to preserve the eggs. Seal the jar securely, invert carefully several times to ensure that the preservative reaches all the eggs.

Laboratory Examination

Laboratory examination begins with a further condensing of the sample. The winnowing process conducted in the field is repeated using a shallow tray to separate the eggs from the sand. Final separation is performed under a dissecting microscope at 10-20x, where the surf smelt eggs become quite visible. Pacific sand lance eggs are surrounded by sand grains, thus it is necessary to search for clumps of sand grains, then tease off the sand with fine-tipped forceps or dissecting needles to reveal the egg.

Eggs found during the smelt/Pacific sand lance spawn assessment should be archived for confirmation of species and spawn age analyses. Up to 100 random eggs of each species present should be labeled and preserved in Stockard's Solution in a small vial, to be forwarded to WDFW staff, or other knowledgeable experts, for inspection. A number of non-egg objects may be encountered in preserved upper intertidal substrate samples that may be misidentified as forage fish eggs or empty egg shells, including invertebrate eggs, algal fruiting bodies, flatworms and their egg cases, certain thecate or arenaceous foraminifera, decalcified gastropods, and fragments of annelid worm tubes. Relative abundance and ages of the forage fish eggs in the samples should be recorded in some manner, as these provide information of the relative frequency and density of spawning.

a. Surf smelt eggs - 2 eggs are on the large black stone at the tip of the forceps. Eggs are approximately 1 mm in diameter.



b. Heavy deposition of surf smelt eggs in situ.

Figure 13. Examples of surf smelt eggs in field conditions

last high tide | second effective high tide

time | elevation | time | elevation

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Intertidal Baitfish Spawning Beach Surveys

sector | month | day | year

Station	sample	latitude			longitude			beach	uplands	sample zone	land mark	tidal elevation	smelt	sand lance	rock sole	herring	width	length	shading	comments

Figure 14. Field data form used to record data associated with surf smelt and Pacific sand lance bulk sampling.

a. Obtaining beach subsample to examine for eggs.

b. Adding subsample to composited sample in bag.

Figure 15. Sampling mixed sand/gravel beach for surf smelt and Pacific sand lance eggs.

a. Standardized screens (4 mm, 2 mm, and 0.5 mm) are used to remove excess large material from the sample.

b. Sample is washed carefully to ensure eggs are removed from the large gravels and are deposited in the smallest material.

Figure 16. Screening bulk sediment sample to separate egg-bearing sediments from larger material.

a. Pan is swirled to separate eggs from sediment.

b. Lighter fraction of egg-bearing sediment is collected in a sample jar.

Figure 17. Winnowing bulk sediment sample to separate egg-bearing sediment from barren sand.

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WASHINGTON STATE DEPARTMENT OF FISH AND WILDLIFE
HERRING SPAWN DEPOSITION SURVEY LOG

AREA____ DATE__________________
PERSONNEL____
BOAT______________ MOTOR__________ TIME LAUNCHED___________ TIME RETURNED__________

SPAWN INTENSITY: VL,L,LM,M,MH,H,VH

Sta. No.	Depth (ft)	Spwn Int.	Eelgrass	Agardhiella	Gracilariopsis	Ahnfeltia	Alaria	Botryoglossum	Callophyllis	Constantinia	Desmerestia	Fucus	Gelidium	Gigatina	Hydroids	Iridiea	Laminaria	Laurencia	Microcladia	Nereocystis	Odonthalia	Plocamium	Polyneura	Prionitis	Rhodymelia	Rhodymenia	Sargassum	Ulva	Urospora	Worm tubes	Terr. Debris			No vegetation	Eyed eggs	% mortality

Figure 21. Field data form used to record data associated with Pacific herring egg sampling.

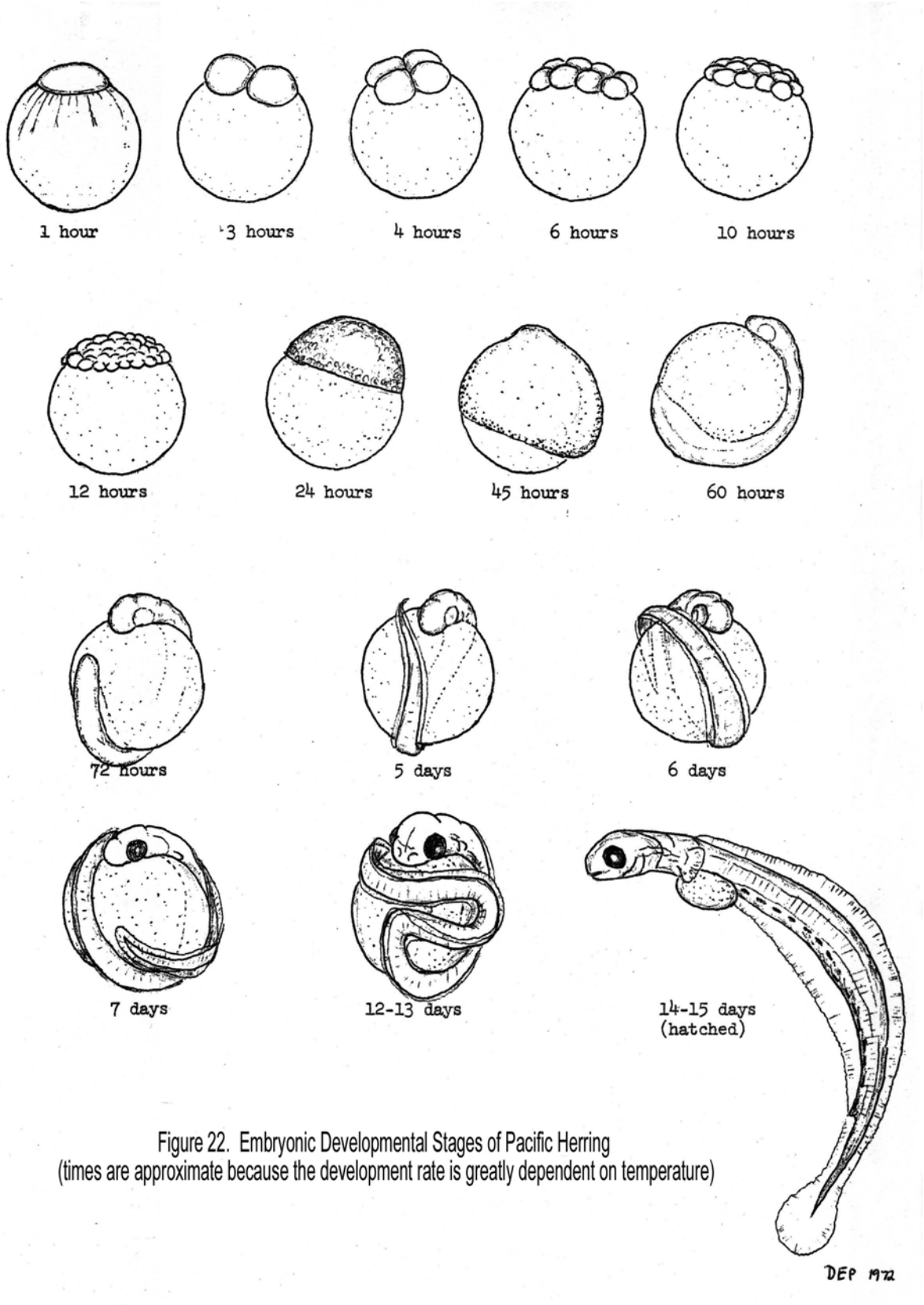

Figure 22. Embryonic Developmental Stages of Pacific Herring
(times are approximate because the development rate is greatly dependent on temperature)

APPENDIX B

Beach Seining Survey Protocol

Beach Seining Survey Protocol

The following protocol is adapted from Beamer and Henderson (2003), and Beamer and SRSC (2007). This same methodology was used in 2007 on fish surveys performed in support of the Ala Spit feasibility assessment (Beamer and SRSC 2007). The protocol provides a survey approach that is compatible with typical fish sampling protocols conducted in the region. For the Ala Spit restoration monitoring site, it is expected that the use of small net beach seines will be an appropriate method for sampling fish in the nearshore area. Typical small net beach seine sampling net diagrams and pictures of seining methods are described by Beamer and Henderson (2003), and are included later in this appendix.

Beach seine sampling for fish monitoring should include same 10 sites, previously surveyed by Beamer and SRSC (2007). Figure B-1 depicts the location of these 10 sites.

Field Equipment

The following sections outline field equipment for beach seine fish surveys at the Ala Spit restoration site and vicinity:

- Beach seine
- Dark colored 5-gallon buckets with lids
- Aquarium dip nets
- MS-222 (anesthetic)
- Measuring board
- Identification guides
- Field data forms and writing instruments

Seine Cast Procedure

Typical small net beach seine sampling net diagrams and pictures of seining methods are described by Beamer and Henderson (2003), and are included depicted on Figure B-2. Specific methodology previously used at Ala Spit is provided in Beamer and SRSC (2007) and summarized here.

Set beach seine net out of a tote on shallow intertidal beach. Set the net in “round haul” fashion by fixing one end of the net on the beach, while deploying the net “upstream” of any existing current, and returning to the shoreline in a half circle. Retrieve both ends of the net to yield catch and begin transfer into buckets.

Figure B-1. Location of beach seine sites sampled at Ala Spit (Beamer and SRSC 2007). Yellow squares and white circles were sampled in 2007. The black circle was sampled by Skagit River System Cooperative as part of a juvenile salmon research effort from 1997-2002 and will not be sampled as part of this monitoring plan.

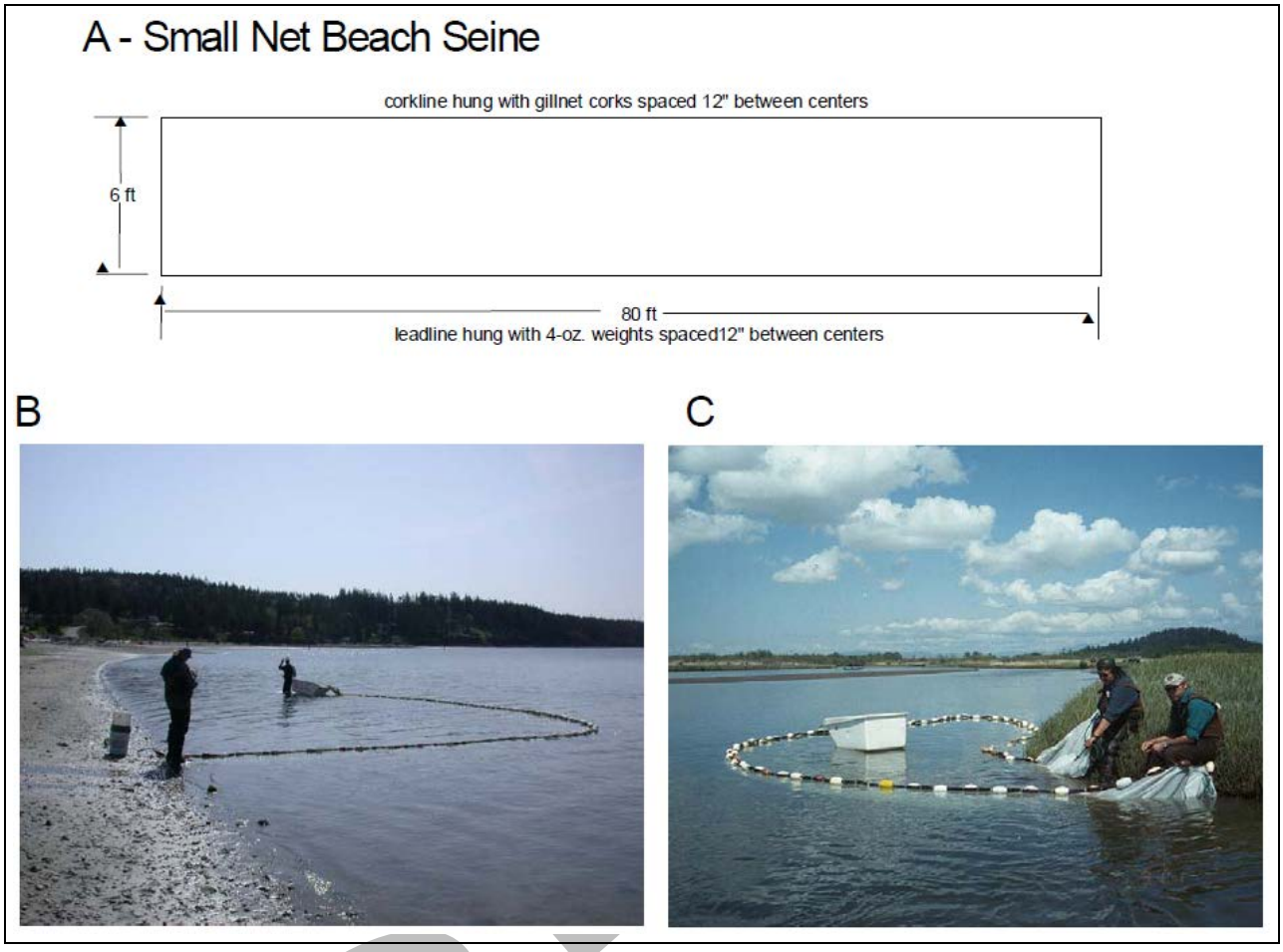

Figure B-2. ***Small net beach seine methodology*. (A) design of net (not drawn to scale), (B) setting net out of tote on shallow intertidal beach, (C) beginning to haul net in distributary channel (Beamer and Henderson 2003).**

Sampling Process

- Note the location of the net set, and units of catch effort (including set start and end times, and estimated area seined)
- Identify species and enumerate
- Sub-sample each target species to obtain and record length of at least 10 percent or up to 20 individuals within each beach seine set
- Minimize amount of fish handling during sampling and ensure adequate oxygen, temperature, and circulation of water in fish containment areas
- Record survey data on a field form including the following information:

- Project name
- Date
- Names of field crew
- Station identifier
- Equipment used
- Set number
- Beginning and end time of haul
- Species captured
- Count
- Length (if taken)
- Other notes

- Follow typical fish recovery procedures to allow fish to recover, and release fish back into water.