Livingston Bay Pocket Estuary Stewardship Plan

Prepared by

The Nature Conservancy
Protecting nature. Preserving life.™

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Cover photo of Livingston Bay taken by Kris Knight 2012.

Contents

1 Overview

1.1 Introduction

The Livingston Bay pocket estuary restoration project is located on the eastern shore of Camano Island, Washington (Figure 1). Livingston Bay is part of the larger Port Susan Bay that spans from the mouth of the Stillaguamish River north toward the town of Stanwood, Washington. The restoration project is located on the Nature Conservancy's property purchased from the Nelson family in 2009 which consists of 43 acres and includes forested uplands and tidelands. The restoration project is located on the tideland portion of this property.

Figure 1 The Livingston Bay Restoration Project site is located on the north eastern shore of Camano Island, WA.

Historically, the tidelands portion of the Nelson property was a functional pocket estuary – a small sub-estuary that forms behind a barrier within a larger estuary – in this case Port Susan Bay. The organic matter generated by barrier salt marshes and exported to other nearshore habitats yields wide-ranging benefits to many species, including salmon and other fishes, shellfish and marine birds. Given the extensive losses of wetland habitat in the region's major river deltas, pocket or barrier estuary habitats have become increasingly important for providing juvenile salmonid habitat. Healthy, functioning pocket estuaries are important for

salmon in early life stages as they provide refuge, support food production and provide a transition area between fresh and salt water habitats. Other wildlife species such as migratory shorebirds also use and rely on these productive estuary habitats for food and wintering habitat. Many of the regions pocket estuaries and barrier lagoons have been altered and tidal access limited.

Sometime in the early 20th Century an earthen dike was built around approximately 10 acres where there was a natural spit forming the pocket estuary. The earthen dike created a pasture where cattle were grazed and was also used as a landing strip for small planes (Figure 2). In the mid 1980's a storm breached the southern end of the dike and it was never repaired. As a result, large amounts of large woody debris carried in during high tide events accumulated in the interior of the diked area, thereby reducing the salt marsh habitat. When the Conservancy purchased the property in 2009 nearly the entire area inside the dike was filled with wood from decades of accumulation (Figure 3).

Figure 2 Aerial photo from 1977 of the Livingston Bay restoration site. The dike built around the pocket estuary created a pasture for grazing cattle.

Figure 3 Aerial photo of the restoration site taken in 2011 (after the breach in the southern portion of the dike). Large amounts of wood carried in during storms and high tide events piled up in the interior.

The goal of the restoration project at Livingston Bay is to return the site to a functional pocket estuary, through restoring natural processes such as the daily tidal regime (Figure 4). Through restoring natural processes, approximately nine acres of intertidal emergent marsh will return to the site. This will lead to improved rearing habitat and access for juvenile Chinook salmon, a listed species under the Endangered Species Act.

The project includes two major elements that will address factors impeding natural processes:

1. Breach of north levee and excavation of tidal channel. This will provide fish such as juvenile Chinook salmon access to the habitat and promote further channel development through scouring by re-introducing daily tidal exchange to the site.

2. Repair breach in the south levee. Repairing the breach in the south levee will help prevent more large woody debris from entering the site. In addition, it will allow for a more efficient point for tidal exchange to enter the pocket estuary. Tidal connection will be restored to where it is believed to have historically been.

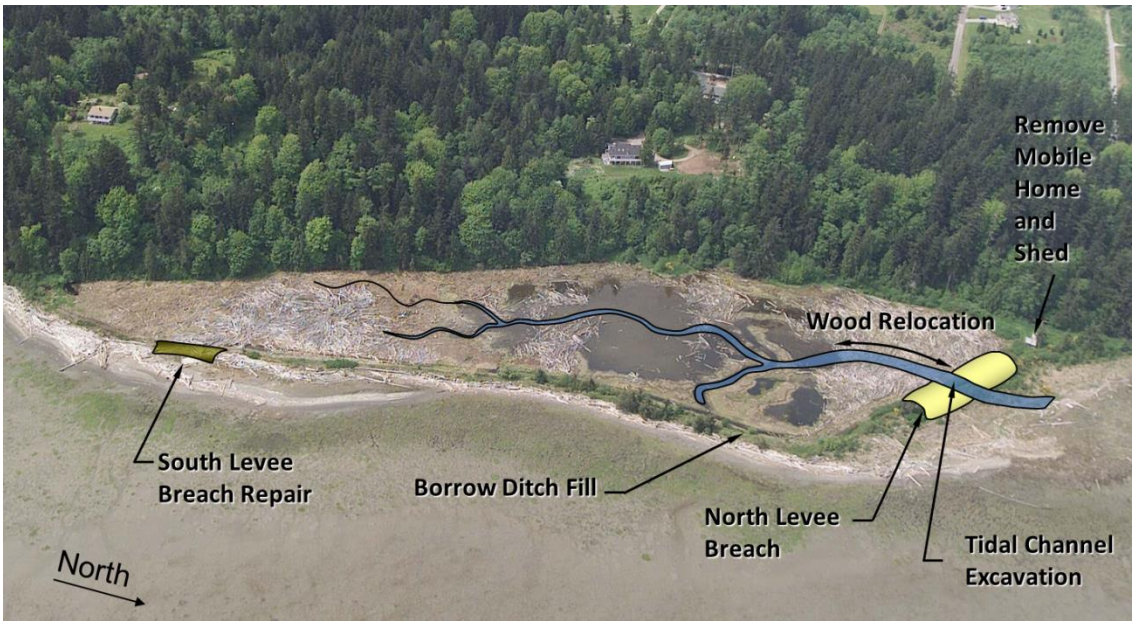

Figure 4 Map of restoration plan outlining major components of the project. Note: plans are not drawn to scale.

1.2 Active Project Partners

Project partners included Coast and Harbor Engineering and Hart Crowser who completed the restoration design and assisted The Nature Conservancy with permit applications. Herrera Environmental, Inc., provided construction management services and Sealevel Bulkhead Builders, Inc., was hired as the contractor to complete the construction work that was completed in October 2012. Two neighbors to the project site, whose names will be kept confidential, provided access through their properties to the site and provided access during restoration. Without their support, the project could not have gone forward. Also, the Stillaguamsh Tribe's Natural Resources Department is conducting ecological monitoring to document the outcomes resulting from the restoration efforts. The Washington State University BeachWatchers organization has partnered to provide volunteers to help with this monitoring effort. Additionally, the Skagit Audubon Chapter has volunteered to conduct bird surveys both before and after restoration.

1.3 Restoration Efforts Fall 2012

Restoration work commenced at the Livingston Bay Pocket Estuary on September 17, 2012 when a barge arrived at the site with equipment to complete the project (Figure 5). After the equipment arrived, crews from Sealevel Bulkhead Builders, Inc. spent approximately one month completing the restoration efforts. The last day of construction activity was October 10, 2012. The restoration work went as planned and the site is currently being inundated with tides on a regular basis (Figure 6).

Figure 5. A barge carrying equipment to complete the Livingston Bay Pocket Estuary project arrives at the project site on September 17, 2012.

Figure 6. The new tidal channel created during restoration construction. The photo was taken looking south towards the pocket estuary. This was one of the first higher tides to fill the channel and enter the pocket estuary after the North Levee Breach. Photograph was taken October 10, 2012, as construction neared completion.

2 Goals and Objectives

2.1 Livingston Bay Project Goals and Objectives

The overall goal of the Livingston Bay restoration project is to restore natural processes, habitats, and native species to the site. The project is expected to contribute directly to the long term goal of restoring regional Chinook and other salmon and trout populations by address the limiting factor of estuary habitat. Specific project objectives include:

1. Restore tidal flow to the 10-acre (4 hectare) pocket estuary via dike breaching and modification
2. Improve fish access to 10 acres (4 hectares) of rearing habitat
3. Restore nine acres (3.6 hectares) of intertidal emergent marsh and 1 acre (0.4 hectares) of estuarine scrub-shrub wetland habitat
4. Engage and educate community volunteer groups in nearshore systems and estuary restoration and through at least four project monitoring events.

2.2 Stewardship Goals and Objectives

Stewardship and site management goals for the Livingston Bay restoration site encompass on-the-ground activities. One of primary goals of stewardship at Livingston Bay is to address and prevent any potential threats or concerns to the conservation values of the restoration site. This includes threats such as invasive plant species and unauthorized access or trespassing issues. In addition, community outreach and education are also an important component to the successful stewardship of the site. Specific stewardship objectives include:

- Support the establishment of desirable vegetation in the project area;
- Control the occurrence of invasive plant species including Scotch broom and Spartina; and
- Promote and encourage collaboration among project partners and community participation and engagement.

Vegetation

The establishment of native and desirable species will occur through monitoring and controlling invasive and unwanted species as resources permit. Qualitative vegetation monitoring will occur during opportune stewardship visits. The qualitative monitoring will be used to inform project and stewardship staff if there unwanted species that need controlled. Invasive plant species such as Scotch broom and Spartina will be priority invasive species for control.

Human Use

There is no public access to the restoration area and no plans to develop the area for public access. However, opportunities to engage community members and host community outreach events or tours to learn about estuary restoration will be pursued. Partnering with the Skagit Audubon to observe and monitor migratory birds or engage community members through volunteer events are examples of potential outreach events. The site will be closed to hunting and fishing.

3 Monitoring and Evaluation

3.1 Overall project site monitoring

The Livingston Bay Monitoring Plan includes monitoring of both structural and functional parameters to measure progress toward restoration objectives. The structural objective is to increase the pocket estuary channel length, width and complexity. The functional parameter used to measure progress toward project objectives is fish usage of the restored pocket estuary. Restoration targets for structural and functional parameters and details on specific metrics that will be monitored are included in the Monitoring Plan (Appendix 1).

As of January 2013, The Nature Conservancy has contracted with the Stillaguamish Tribe to conduct monitoring work at the Livingston Bay Pocket Estuary site. Fish monitoring will be done from February through August to sample for species abundance and density. Also, during the summer of 2013, a survey of the tidal channel will be completed and compared against the survey done at the end of construction, in an effort to understand how the channel has changed.

4 Adaptive Management

The Livingston Bay restoration project site will be adaptively managed. Site conditions and monitoring parameters will be used to inform if contingency measures are needed or adaptive management strategies need to be considered. The project is expected to be self-sustaining once construction activities are completed however, stewardship visits and monitoring activities will inform if and when alternative management measures are needed.

Appendix A: Livingston Bay Monitoring Plan

NOAA RESTORATION CENTER MONITORING PLAN

(For use with non-barrier removal projects)

For the monitoring plan below, please fill out the information for a minimum of one structural and one functional parameter. The inclusion of additional parameters in this format is discretionary, but please do provide a brief listing of the additional monitoring parameters and efforts related to this restoration project.

- Structural parameter – This parameter should have a short-term target set for the end of the award period and an actual measurement reported when the final progress report is submitted. Although it is generally discouraged, in some circumstances it may be acceptable for this short-term target to be set for and reported on after the end of the award period. However, a strong rationale for using this option should be included below, and the target set for and reported on no later than 12 months after the award end date. The grantee may also choose to include an additional longer-term target and actual measurement that is not defined by the award period, and therefore may better reflect the ultimate ecological goal of the project.
- Functional parameter – This parameter should have a short-term target set for the end of the award period and an actual measurement reported when the final progress report is submitted. If there are functional parameters that require more time than the award period to develop, these may be described and a second report submitted when the monitoring results become available.

Project Name: Livingston Bay Pocket Estuary Restoration Project
Award Start and End Date: November 1, 2010; December 31, 2012
Anticipated Construction Start and End Date: August 1, 2012; August 31, 2012
Project Proponent (include phone number or email)**:**
The Nature Conservancy of Washington, 360-419-7059; kmorgan@tnc.org
Project Goal (include habitat type)**:**
Short-term goals for the project are to restore natural processes, habitats, and species to this site. We expect the project will also contribute directly to the long term goal of restoring regional Chinook and other salmon and trout populations by addressing the limiting factor of estuary habitat. Specific project objectives are to:

1. Restore tidal flow to the 10-acre (4 hectare) pocket estuary via dike breaching and modification
2. Improve fish access to 10 acres (4 hectares) of rearing habitat
3. Restore nine acres (3.6 hectares) of intertidal emergent marsh and 1 acre (0.4 hectares) of estuarine scrub-shrub wetland habitat
4. Engage and educate community volunteer groups in nearshore systems and estuary restoration and through at least four project monitoring events.

Structural Objective: Increase pocket estuary channel length, width, and complexity

Parameter (what will be measured): Length and three cross sections of the main constructed channel

Units: Length and cross sections in meters

Technique for Measurement: Length of the main constructed pilot channel will be measured with a survey-grade RTK GPS unit along the channel edge. Cross sections will be placed at three intervals along the main channel (main channel near mouth; mid channel; final channel after side channels). Bankful width, and three to five depth measurements will be measured across the cross section depending on width. Elevations will also be collected at a minimum of 10 marsh plain and spit locations in order to allow analysis of changes in the construction channel and any new channel development with respect to position in the tidal frame and to inform projections for long-term marsh evolution. The survey data will be cross-referenced with Port Susan aerial photos and the techniques and data collection methods match the protocols for the Port Susan Dike Removal project.

Monitoring Start and End Date: Sept 2011; June 2013

Timing (sampling frequency): Site assessment will be conducted prior to construction to establish pre-construction elevations. Photos will also be taken at this time. Once construction is completed, there will be one as-built survey and one post-restoration survey will be conducted after winter storm and tide events have concluded

Sampling Sites (# and/or names): Three survey events: One preconstruction preliminary design survey (Sept 2011), one post construction as-built survey (Sept 2012) and another post construction survey after the first winter to measure changes in the constructed pilot channel (Spring 2013).

Sample Size (# of replicates and/or duplicates): Restoration site is 10 acres (4 hectares)

Baseline (pre-restoration numerical value): Assumed to be zero as the pocket estuary had been diked and pastured for several decades before restoration. The site is currently flooded and partially covered with large wood so pre-restoration assessment will establish actual topography to determine whether this assumption is correct.

Reference (ideal numerical value): Three local (4.5-13 km from project site) reference pocket estuaries of similar size and orientation were used to establish targets for this objective. Measurements of main channel width and overall pocket estuary area were calculated using 2003 aerial imagery in ArcGIS. The average main channel width for the reference sites was then scaled to our 10 acre (4 hectare) project site. The year one, short-term target for main channel width (for target establishment and comparison as part of the cross-sectional area metric) was set for year one as 30% of scaled potential. This and other short term targets are similar to year-one results experienced by other Puget Sound estuary restoration projects.

Short-Term Target (proposed numerical value to be measured in relation to award end date): The constructed pilot channel will be 74m long and will be dug both inside and outside of the estuary to direct tidal flows inside and to help initiate natural channel development inside the pocket estuary. The interior portion of the channel is roughly 56m long and 30m wide. The exterior portion of the channel is 18m long and will be up to 30m wide. This 56m interior channel should reach a length of 200m inside the estuary, with a channel cross-sectional width of at least 2.6m in the non-constructed portions of the channel inside the project area (30% of average channel cross-sectional width of reference pocket estuaries); and form at least 1 side channel inside the estuary to be reminiscent of a functioning pocket estuary that is 10 acres (4 hectares) in size.

Short-Term Target Date (date to achieve target, typically award end date): June 2013 after construction. Photo monitoring will take place in Nov/Dec 2012 after restoration to show very short term change in channel morphology as well as in Spring 2013 to show any changes to the constructed design as a result of winter storms and tidal action.

Rationale (if target date set after award end date): Changes in estuary channel morphology of this geographic area are most strongly influenced by winter storm events and tides. Post restoration monitoring for year one will take place after the winter months when storms are most likely to capture any increase in pilot channel length and its conversion to a branching channel.

Short-Term Actual (to be filled out when measurement is obtained):

Longer-Term Target – optional (proposed numerical value, not bound by award end date): Main channel length ¾ of the total pocket estuary length; 70% of channel cross-sectional area of reference pocket estuaries; at least 1 side channel. Longer-term targets are less than reference estuaries to reflect the unique position of the Livingston pocket estuary at the protected head of a long blind bay and at the edge of a very wide intertidal flat area created by the Stillaguamish River estuary. This geographic position is expected to yield different hydrodynamic conditions adjacent to the pocket estuary than most pocket estuaries experience, which may alter dynamics within the estuary.

Longer-Term Target Date – optional (date to achieve target, not bound by award end date): 2022 – 10 years after restoration

Longer-Term Actual – optional (to be filled out when measurement is obtained):

Functional Objective: Increase fish access to pocket estuary habitat

Parameter (what will be measured): # juvenile salmonids accessing pocket estuary per tidal cycle (total juvenile salmonid numbers per cycle and the juvenile salmonids per hectare at the site.

Units: # juvenile salmonids/hectare with juvenile Chinook salmon densities being the target.

Technique for Measurement: Beach seine capture at outgoing tide and beach net seining, with sampling results adjusted by a recovery efficiency as described by Beamer et al. 2006.

Monitoring start and end dates: Year 1 monitoring will begin in March and end in June 2013 the first spring following construction. Baseline condition is zero juvenile salmonids/ha and March 2013 is the earliest date to expect any functional salmonid response based on the newly constructed channel and opening of the pocket estuary to more frequent tidal action after the first winter storms. This is also based on life cycle of juvenile Chinook salmon and other salmonids that use

estuaries and nearshore habitats for rearing. Some salmonid species may enter the pocket estuary earlier than March and some may stay later than June but the March-June window is the best one to capture Chinook and all the other salmonid species that may be using this pocket estuary.

Timing (sampling frequency): One sampling event (Spring 2013). Beach net seining will take place monthly from March – June 2013 when previous research has shown that salmonid juveniles most heavily use nearshore habitats.

Sampling Sites (# and/or names): One to two beach net seining sites inside of the pocket estuary sampled monthly after the first winter following construction.

Sample Size (# of replicates and/or duplicates): Monthly sampling of 1-2 sites from March thru June (Beamer et al. 2006)

Baseline (pre-restoration numerical value): Assumed to be zero as there is no inlet/outlet to the pocket estuary. The intent of the monitoring is to make sure salmonids have access to the site after restoration is concluded. As there is currently no regular fish access to the site (and if fish enter the pocket estuary during storm events, they are not able to exit), we expect that there is no effective fish access prior to restoration.

Reference (ideal numerical value): Beamer et al. found average Chinook densities in Whidbey Basin pocket estuaries between 35.3 and 519 fish/ha. We expect similar densities to occur at the restoration site following fill removal. Our sampling techniques will generate fish densities to make this comparison possible. Densities for other salmonid species may vary from this density as Chinook rely heaviest on estuary and nearshore habitats relative to other salmonids. Chinook salmon are the most at risk salmonid species in Whidbey basin and restoring estuary and nearshore rearing habitat is one of the greatest limiting factors/highest recovery actions for this species.

Short-Term Target (proposed numerical value to be measured in relation to award end date): An average of at least 35.3 Chinook/ha density in year one following restoration (June 2013).

Short-Term Target Date (date to achieve target, typically award end date):
Rationale (if target date set after award end date): Following year one monitoring, ending in June 2013.

Short-Term Actual (to be filled out when measurement is obtained):

Longer-Term Target – optional (proposed numerical value, not bound by award end date): Longer term targets are similar fish numbers as seen at other Whidbey Basin pocket estuaries (between 35.3 and 519 juvenile Chinook salmon/ha). The site is 4 hectares so in theory the site could produce four times this number if it becomes fully saturated with an average density spread uniformly over the site. It is much more likely to have the highest densities in channels and high densities in low sections with more cover, like LWD so this would likely be an overestimate of this pocket estuary's carrying capacity for juvenile Chinook salmon.

Longer-Term Target Date – optional (date to achieve target, not bound by award end date): 2022 – 10 years after restoration

Longer-Term Actual – optional (to be filled out when measurement is obtained):

Please briefly list other monitoring parameters/efforts related to this restoration project:

Photo monitoring will take place before (Aug 2011) and twice after restoration (Sept 2012 and Spring 2013) as well. Long-term monitoring of habitat change in the pocket estuary and adjacent tidelands will be incorporated into our estuary-scale monitoring for the Stillaguamish estuary.