Planning and Combination (Planning and Acquisition) Project Proposal

Project Number	15-1485 PLN
Project Name	Whidbey Basin Pocket Estuary Census
Sponsor	Skagit River System Cooperative

List all related projects previously funded or reviewed by RCO:

Project # or Name	Status	Status of Prior Phase Deliverables and Relationship to Current Proposal?
07-1863N	Completed	Deliverables completed; The WRIA 2 project helped determine the spatial scale in which pocket estuary habitat was important to juvenile ESA listed Chinook salmon
07-1589N	Completed	Deliverables completed; The WRIA 6 project helped determine the spatial scale in which pocket estuary habitat was important to juvenile ESA listed Chinook salmon originating from the three Whidbey Basin Rivers (Skagit, Stillaguamish, and Snohomish)
14-2255M	Applied or funded in other program	The Skagit IMW is funded through a different venue of the SRFB process (not PSAR). The Skagit IMW has been ongoing since 2006 (Greene and Beamer 2006; Greene et al 2015) and is designed to measure the effectiveness of restoration actions that occur in the Skagit estuary and surrounding nearshore on wild Skagit Chinook salmon. Pocket estuary restoration has occurred within the vicinity of the Skagit estuary (e.g, Crescent Harbor, Lone Tree Lagoon, Turners Bay) and therefore the Skagit IMW accounts for changes in pocket estuary habitat affecting the IMW.

1. **Project Location.** *Please describe the geographic location, water bodies, and the location of the project in the watershed, i.e. nearshore, tributary, main stem, off-channel, etc.*

Island County (WRIA 6) pocket estuaries within the Whidbey Basin (see PRSIM uploaded map figures). The Whidbey Basin is known as the inside waters from Possession Point to Deception Pass. Island County's part would be the shorelines of the east side of Whidbey Island and all of Camano Island. Pocket estuaries are an important subset of the nearshore marine defined by the Puget Sound Chinook salmon recovery planning framework (i.e., Bartz et al 2013) which has been adopted by Puget Sound Lead Entities to create consistency between their salmon recovery monitoring plans.

2. **Brief Project Summary.** *Summarize your project in a few sentences. Please be brief, you will be asked for details in the following questions*.

Our project will census nearshore pocket estuary habitat within the Whidbey Basin using remote sensed imagery from a contemporary time period and GIS methods. Indicators measured include: 1) count of pocket estuaries accessible to juvenile salmon, 2) the extent of habitat by types, and 3) their landscape position (i.e., connectivity). The contemporary time period will depend on the imagery available but will likely be 2013 or 2014. This project will complement work being done by the Puget Sound Partnership (PSP) sponsored Skagit Monitoring Pilot Project (PSP Interagency Agreement #2015-64). Monitoring methods from this project are identical to the methods of the Skagit Pilot and follow the RITT Common Framework (Bartz et al 2013). The Skagit Pilot is being used to help develop regional guidance for monitoring of Common Indicators for Puget Sound Lead Entities. Pocket estuary metrics are included in the list of the Puget Sound Common Indicators (Fore et al 2015). In the Skagit Pilot, we are measuring Whidbey Basin pocket estuary habitat for a time period representing habitat conditions around the time the Puget Sound Chinook Recovery Plan was adopted (~2005). With monitoring results from both time periods, the Whidbey Basin Lead Entities (including Island County) will have a trend result for Whidbey Basin pocket estuary habitat for the first decade of Puget Sound Chinook Recovery Plan implementation.

3. **Problems Statement.** *Please describe the problems your project seeks to address by answering the following questions*.

    A. **Describe the problem including the source and scale.** Describe the information needs and how these data will be used. Explicitly identify ongoing regional or statewide motoring efforts and confirm that this information need is not met by existing programs.

Pocket estuaries and small independent streams draining into nearshore areas within the Whidbey Basin are known to be an important rearing habitat for fry migrant Chinook salmon originating from the three Chinook salmon bearing rivers of the Whidbey Basin (Beamer et al 2003, Beamer et al 2006, Beamer et al 2013). Because of the importance of pocket estuaries to Chinook salmon, restoration and protection of pocket estuaries has been a priority for Whidbey Basin Chinook Salmon Recovery Plans. Pocket estuary habitat has been restored and improved within the Whidbey Basin (e.g, Crescent Harbor, Lone Tree Lagoon, Turners Bay, Ala Spit, English Boom). Most pocket estuaries within the Whidbey Basin are under the jurisdiction of Island County (WRIA 6) (see uploaded map figures).

All salmon recovery plan areas in Puget Sound have active capital habitat restoration programs yet little is known about the status of all salmon habitat together. The status and trend of habitat critical to Puget Sound Chinook salmon populations is not known, yet many local Puget

Sound Salmon Recovery Plans have stated goals of protecting existing habitat and/or achieving a net gain in habitat. Keeping track of restored habitat is only one part of the habitat equation for tracking salmon recovery. Without monitoring data, it is only an opinion as to whether existing salmon habitat is gaining or losing ground over time. As expected, opinions vary on the status and trend of salmon habitat. Several recent reports have attacked the tenet that existing salmon habitat is not currently being lost (Carman et al 2010; Judge 2011; NWIFC 2012). These reports have, in part, led the Puget Sound Region to more seriously track the status and trends of salmon habitat. Tracking the status and trends of salmon habitat has been included in the regional effort to develop and implement Monitoring and Adaptive Management Plans (MAMP) for all local chapters of the Puget Sound Chinook Recovery Plan. The MAMP process is being led by the PSP but implemented at the local (i.e, Lead Entity) level. A set of Common Indicators for monitoring Puget Sound Chinook salmon habitat (e.g., Fore 2015) has been generally accepted by Lead Entities in order to guide and make monitoring consistent across all of Puget Sound. Pocket estuary habitat extent, count, and connectivity are included in the Common Indicator set.

A census of pocket estuary habitat is one of the three highest priority data gaps for salmon habitat status and trends monitoring for WRIA 6 (Island County Lead Entity RFP, July 13, 2015). If funded, this project would fill the requested data gap. Combining the results from this project with the results from the Skagit Monitoring Pilot Project (PSP Interagency Agreement #2015-64) will create a trend result for Whidbey Basin pocket estuary habitat for the first decade of Puget Sound Chinook Recovery Plan implementation.

List the fish resources targeted by your monitoring effort.

Species	Life History Targeted (egg, juvenile, adult)	Current Population Trend (decline, stable, rising)	Endangered Species Act Coverage (Y/N)
Chinook Salmon	Juvenile	Undetermined at the level of nearshore juveniles at this time	Yes

4. **Project Goals and Objectives.**

A. **What are your project's goals**?

To quantify nearshore pocket estuary habitat count, extent, and landscape position within the Whidbey Basin by census using remote sensed imagery for a contemporary time period.

B. **What are your project's objectives**?

Our project objectives include 6 major tasks described as:

- Task 1: Acquire and agree with Island County Lead Entity staff on the best available remote imagery for digitizing pocket estuary habitat for the contemporary time period (~2013/14).
- Task 2: Digitize points, polygons, and lines for all pocket estuaries that are accessible to juvenile salmon for the contemporary time period (~2013/14).
- Task 3: Complete full metadata descriptions of each GIS layer (points, polygons, and lines).
- Task 4: Complete report describing descriptive statistics of results for each GIS layer which represent Common Indicators for pocket estuaries (count, extent of habitat within pocket estuaries by habitat type, and position within the landscape including connectivity to other accessible pocket estuaries and to the source of the juvenile Chinook salmon (i.e., the three Whidbey Bain natal Chinook salmon rivers).
- Task 5: Distribute report and GIS data to Whidbey Basin Lead Entities and Tribes.
- Task 6: Present results to Whidbey Basin Lead Entities upon request.

C. What are the assumptions and constraints that could impact whether you achieve your objectives?

We do not foresee any (a) assumptions we've made with the methodologies included in this proposal or (b) constraints such as: available match funding, public acceptance of the project, land use constraints, geomorphic factors, additional expenses, or delay that would put this project at risk of not achieving its objective other than the three following issues:

- Assumptions: the methods are established. Error rates in remote sensed census data for pocket estuaries will be established as an addendum to the Skagit Pilot ((PSP Interagency Agreement #2015-64).
- Assumptions: adequate remote sensed data are available for a contemporary time period. While we do not have all Whidbey Basin imagery in-house, we have seen adequate imagery for much of the basin. It is just a matter of coordinating with Island County and receiving the agreed-to imagery.
- Constraints: loss of planned personnel. This would present a hardship to completing the project on time but the methods are established with the Skagit Pilot and new staff could be assigned to complete the project.

5. Project Details.

Provide a narrative description of your proposed project.

Our project will census nearshore pocket estuary habitat within the Whidbey Basin using remote sensed imagery from a contemporary time period and GIS methods. We will work with Island County Lead Entity staff on acquiring the best available remote imagery (orthophotos, LiDAR, etc.) for digitizing pocket estuary habitat for the contemporary time period. The contemporary time period is anticipated to be ~2013/14. Indicators measured include: 1) count of pocket

estuaries accessible to juvenile salmon, 2) the extent of accessible pocket estuary habitat by type, and 3) their landscape position (i.e., connectivity).

Count of Pocket Estuaries: The count of pocket estuaries accessible to juvenile Chinook salmon rearing is monitored as point data in GIS. Remote sensed imagery will show whether pocket estuaries exist and whether there is a tidal hydrologic connection. When both characteristics are observed: 1) pocket estuary habitat is present (see habitat type table below), and 2) tidal connection is present, then we infer juvenile salmon have access to the pocket estuary. If fish sampling has been conducted at the site and the results verify juvenile salmon presence, then we will attribute the pocket estuary point as a site where salmon presence is documented and we will cite the reference. Many pocket estuaries within the Whidbey Basin have been sampled for fish over the years (e.g., see: www.google.com/maps/d/viewer?mid=zUNIAgl3RJYE.kgPjK__Bg93k&hl=en&ie=UTF8&oe=UTF8&msa=0&z=9). Accessible pocket estuaries will be digitized heads-up on a Wacom DTU-2231 interactive display tablet in ArcMap GIS (v. 10.x) where the point will be placed in the visual center of habitat accessible to juvenile salmon within the pocket estuary. Digitizing scale will vary based on the actual size of the pocket estuary. Point data results can be compared to Miradi tracked goals in local recovery plans and the regional target for the number of pocket estuaries that are accessible to juvenile salmon.

Extent of Pocket Estuary Habitat: The extent of pocket estuary habitat by type is measured as polygon data. Only pocket estuaries that are determined to be accessible to juvenile salmon will be measured. We will digitize pocket estuary features heads-up on a Wacom DTU-2231 interactive display tablet in ArcMap GIS (v. 10.x) at a scale no greater than 1:2,000. Imagery resolution is not known at this time but is anticipated to be 0.2m pixel or smaller. Aerial images used to digitize channel features in this analysis are also not yet selected but are anticipated to be from 2013 or 2014. We will digitize pocket estuary feature types as polygons according to the nested scale classification developed by the RITT Common Framework (i.e. Bartz et al 2013) which has been adopted by the PSP for tracking implementation of Chinook Recovery Plans. Possible pocket estuary attributes for polygons are shown in Table 1. Habitat areas can be summarized by any polygon type, but generally the pocket estuary habitat area accessible to juvenile Chinook salmon would only include tidal and subtidal polygons. Polygon results can be compared to Miradi tracked goals in local recovery plans and the regional target for the amount of pocket estuary habitat that are accessible to juvenile salmon.

Table 1. Classification of pocket estuaries based on RITT Common Framework (See Table 11 of Bartz et al 2013) used to attribute GIS polygons of accessible pocket estuaries in the Whidbey Basin.

Broad habitats	System types	System subtypes	Shoreline types	Habitat types
Nearshore marine	Drift cell	Pocket estuaries	Drowned channel lagoon Tidal delta lagoon Longshore lagoon Tidal channel lagoon (or marsh) Closed lagoon (or marsh) Open coastal inlet	Marine Riparian Zone Backshore, Berm Intertidal beach face and low tide terrace Tidal or subtidal channels (distributary, blind, alluvial fan, lagoon outlet/inlet) Tidal or subtidal Impoundments (lagoon, lake, pond) Tidal wetland (saltmarsh, scrub-shrub, forested)
	Rocky shoreline	Rocky pocket estuaries	Pocket beach lagoon (or marsh) Pocket beach estuary Pocket beach closed lagoon (or marsh)	

Landscape Position of Pocket Estuaries: Landscape position of pocket estuaries is measured as line data after methods described in Beamer and Wolf (2011) (uploaded as *Attachment 1 – Beamer & Wolf 2011*). In essence, line data depict the distance and complexity of pathways fish must take to go from one place to another (e.g, a river mouth to a pocket estuary; one pocket estuary to another pocket estuary). Line data are digitized based on prevailing tidal current direction within the landscape gained from the PNNL Whidbey Basin Hydrodynamic Model (Yang and Khangaonkar 2007) and the assumption that fry-sized juvenile salmon follow shoreline areas once in the nearshore. Landscape position results are summarized as two measures of connectivity: 1) distance to nearest accessible pocket estuary and 2) distance to nearest Chinook salmon river. Both connectivity metrics are important to Chinook salmon recovery because how easily fish can find available habitat influences their survival. Juvenile Chinook salmon have been shown to move from one pocket estuary system and then on to another (adjacent) pocket estuary system (Beamer et al 2013) suggesting connectivity of pocket estuaries within a larger landscape is important ecologically. Also, where pocket estuaries are located in proximity to the source of outmigrating Chinook salmon fry (i.e. their natal river) explains much of the variability in juvenile Chinook salmon abundance and presence in pocket estuaries (Beamer et al 2006) and small streams draining into the nearshore system (Beamer et

al 2013). Sites closer to the source of fish have more fish present. These connectivity concepts have been incorporated in local salmon recovery plans for habitat restoration and protection. Tracking connectivity of pocket estuaries is an important habitat status and trend metric. Landscape position results can be compared to Miradi tracked goals in local recovery plans and the regional target for connectivity of pocket estuaries with each other and the source of the fish that rear in them (e.g, the natal Chinook rivers).

This project will complement work being done by the Puget Sound Partnership (PSP) sponsored Skagit Monitoring Pilot Project (PSP Interagency Agreement #2015-64). Monitoring methods from this project are identical to the methods of the Skagit Pilot and follow the RITT Common Framework (Bartz et al 2013). The Skagit Pilot is being used to help develop regional guidance for monitoring of Common Indicators for Puget Sound Lead Entities. Pocket estuary metrics are included in the list of the Puget Sound Common Indicators (Fore et al 2015). In the Skagit Pilot, we are measuring Whidbey Basin pocket estuary habitat for a time period representing habitat conditions around the time the Puget Sound Chinook Recovery Plan was adopted (~2005). With monitoring results from both time periods, the Whidbey Basin Lead Entities (including Island County) will have a trend result for Whidbey Basin pocket estuary habitat for the first decade of Puget Sound Chinook Recovery Plan implementation using identical methods. Moreover, results from the Skagit Pilot (~2005) and this project (~2013/14) can be compared to estimates of pocket estuary metrics made for the ~2000 time period used in the development of the Skagit Chinook Recovery Plan (found in Beamer et al 2005).

A. **Provide a scope of work.**

Task# & description	Who is responsible	Task Deliverable	Task Schedule
Task 1: Acquire and agree with Island County Lead Entity staff on the best available remote imagery for digitizing pocket estuary habitat for the contemporary time period (~2013/14).	Eric Beamer, Aundrea McBride, Karen Wolf, Island County LE staff (D. Pucci)	SRSC has agreed to imagery	Feb 29, 2016
Task 2: Digitize points, polygons, and lines for all pocket estuaries that are accessible to juvenile salmon for the contemporary time period (~2013/14).	Aundrea McBride, Karen Wolf	GIS files for points, polygons, and lines	Oct 28, 2016
Task 3: Complete full metadata descriptions of each GIS layer (points, polygons, and	Aundrea McBride,	Metadata files (in GIS and as	Oct 28, 2016

lines).	Karen Wolf	Word or PDF)	
Task 4: Complete report describing descriptive statistics of results for each GIS layer which represent Common Indicators for pocket estuaries (count, extent of habitat within pocket estuaries by habitat type, and position within the landscape including connectivity to other accessible pocket estuaries and to the source of the juvenile Chinook salmon (i.e., the three Whidbey Bain natal Chinook salmon rivers).	Eric Beamer, Aundrea McBride, Karen Wolf	Report file posted to SRSC website	Dec 30, 2016
Task 5: Distribute report and GIS data to Whidbey Basin Lead Entities and Tribes	Karen Wolf	Log of files distributed and to whom & when	Dec 30, 2016
Task 6: Present results to Whidbey Basin Lead Entities upon request	Eric Beamer, Aundrea McBride	Log of dates of presentations to Lead Entities	Dec 30, 2016

B. **Explain how you determined your cost estimates**.

The cost of this project is shown by Task number groupings in the uploaded budget file (Research RCO Budget).

Our estimates for labor are based on time experienced to digitize pocket estuaries for the Skagit Pilot. There are approximately 18 accessible pocket estuaries within WRIA 6's portion of the Whidbey Basin (see uploaded map figure). Our budget request has approximately 15 ½ weeks of FTE effort split between two different skilled personnel (McBride, Wolf). We anticipate taking approximately 3 days of a 4 day (10hrs/day) week to digitize polygons for each accessible pocket estuary (total of 13.5 weeks), one week to update the point data files and two weeks to update the line data files.

There are no anticipated costs other than labor for this project. Any cost incurred other than labor is a donation (and unaccounted match) to this grant. Supplies supporting this work are minimal and not worth estimating. The labor for meetings to complete Tasks 1 and 6 are planned at match. The potential travel necessary to complete meetings required for Tasks 1 and 6 will be done as a regular part of SRSC's work in Chinook Monitoring and Adaptive Management with Island County.

6. **If your project includes an assessment or inventory**

A. Describe any previous or ongoing assessment or inventory work in your project's geographic area and how this project will build upon, rather than duplicate, the completed work.

This project will complement work being done by the Puget Sound Partnership (PSP) sponsored Skagit Monitoring Pilot Project (PSP Interagency Agreement #2015-64). With monitoring results from both time periods, the Whidbey Basin Lead Entities (including Island County) will have a trend result for Whidbey Basin pocket estuary habitat for the first decade of Puget Sound Chinook Recovery Plan implementation using identical methods. Moreover, results from the Skagit Pilot (~2005) and this project (~2013/14) can be compared to estimates of pocket estuary metrics made for the ~2000 time period used in the development of the Skagit Chinook Recovery Plan (found in Beamer et al 2005).

7. **Will you apply for permits as part of this project's scope?**
   No

   A. **If not, please explain why permits are not required.** No permits are necessary for remote sensed habitat monitoring.

8. **Context within the local recovery plan**.

   A census of pocket estuary habitat is one of the three highest priority data gaps for salmon habitat status and trends monitoring for WRIA 6 (Island County Lead Entity RFP, July 13, 2015). A set of Common Indicators for monitoring Puget Sound Chinook salmon habitat (e.g. Fore 2015) has been generally accepted by Lead Entities in order to guide and make consistent monitoring across all of Puget Sound. Pocket estuary habitat extent, count, and connectivity are included in the Common Indicator set. Whidbey Basin pocket estuary metrics are also a high priority for monitoring in the Skagit Chinook Recovery Plan and the Puget Sound Partnership (PSP) is sponsoring the Skagit Monitoring Pilot Project (PSP Interagency Agreement #2015-64) where monitoring methods from this project are identical to the methods of the Skagit Pilot and follow the RITT Common Framework (Bartz et al 2013). The Skagit Pilot is being used to help develop regional guidance for monitoring of Common Indicators for Puget Sound Lead Entities. The Skagit Pilot will provide pocket estuary results for a different (earlier) time period than this project.

9. **Project Proponents and Partners.** *Please answer the following questions about your organization and others involved in the project.*

   A. **Describe your experience managing this type of project**. The same people (Eric Beamer, Aundrea McBride, and Karen Wolf developed and applied the methodologies used to make the Skagit Chinook Recovery Plan (Beamer et al 2005; Beamer et al 2006; Beamer and Wolf 2011) which have been updated for implementing the Skagit Pilot (PSP Interagency Agreement #2015-64).

B. **List all landowner names**. Multiple landowners occur within pocket estuaries of the Whidbey Basin. It is not necessary to list them for remote sensed habitat monitoring.
C. **List project partners and their roles and contributions to the project**.

All four Whidbey Basin Lead Entities (Island County, Skagit, Stillaguamish, and Snohomish) and the five Whidbey Basin tribes (Swinomish, Upper Skagit, Sauk-Suiattle, Stillaguamish, and Tulalip) will be recipients of the products (i.e., report, GIS files including full metadata). We do not need partners to complete the outlined work although any of the above mentioned groups are welcome to include matching funds or labor donations for developing pocket estuary data within the Whidbey Basin that is outside of WRIA 6.

Supplemental Questions

Monitoring Project Supplemental Questions

1. How will the proposed monitoring complement, enhance, or leverage ongoing monitoring efforts?

This is described in Proposal. Pocket estuary metrics are included in the Regional set of Common Indicators (Fore et al 2015).

2. Describe your methods for data collection, analysis, and management. Identify other regional and statewide protocols or monitoring programs with which your methodology is consistent or compatible.

These are described in the proposal. Our methods are identical to the PSP sponsored Skagit Monitoring Pilot Project (PSP Interagency Agreement #2015-64) and follow the RITT Common Framework (Bartz et al 2013). The Skagit Pilot is being used to help develop regional guidance for monitoring of Common Indicators for Puget Sound Lead Entities which includes pocket estuary metrics for count, extent, and landscape position.

3. Describe or provide documentation of your planned approach to evaluating data quality.

Error rates in remote sensed census data for pocket estuaries will be established as an addendum to the Skagit Pilot ((PSP Interagency Agreement #2015-64) through a field based subsampling effort to verify the accuracy of habitat type calls in the field (known) compared to remote sensed calls (predictions). Field based estimates of extent will be generated from RTK GPS will be compared to remote sensed digitized polygons. Errors of commission and omission will be generated for habitat type calls as well as for estimates of extent.

4. How will you disseminate collected data and reports?

In addition to what may be required by RCO should this proposal be funded, a copy of the GIS files (including full metadata) will be made available to all Whidbey Basin Lead Entities and Tribes. The report produced will be posted on the Skagit River System Cooperative website and be available for downloading.

5. Why are SRFB funds necessary, rather than funds from other sources?

Pocket estuary monitoring has been listed as a priority Common Indicator by PSP (Fore et al 2015) and is included as a core indictor for monitoring in both the Skagit and WRIA 6 salmon recovery plans. We are not aware of funds specifically identifying pocket estuary habitat monitoring other than the Island County Lead Entity RFP for this funding source.

References Cited within Project Proposal

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