Planning and Combination (Planning and Acquisition) Project Proposal

Project Number	15-1288
Project Name	Mud Bay, Sucia Island Salt Marsh Restoration - Preliminary Design
Sponsor	Friends of the San Juans

List all related projects previously funded or reviewed by RCO:

Project # or Name	Status	Status of Prior Phase Deliverables and Relationship to Current Proposal?
13-1430P	In progress	Feasibility Study for Salt Marsh Restoration

1. **Project Location.**

The project site is located in Mud Bay on the southeastern shore of Sucia Island, San Juan County, WA. Sucia Island is a Washington State Marine Park located along a major migratory pathway for juvenile salmon in the northern portion of the County. The waters of Georgia Strait, Haro Strait and Rosario Strait surround the island.

2. **Brief Project Summary.**

The overall goal of the project is restore Sucia Island's Mud Bay salt marsh, tidal channel and upper beach by completely removing the existing road, fill, culvert, and revetment. This will fully restore tidal exchange to the entirety of the marsh and uncover approximately 8,000 square feet of beach and salt marsh habitat. The 2.2 acre marsh and beach were altered through installation of a road and revetment along the shore. There is a single 18 inch corrugated plastic perched culvert located at approximately mean higher high water (MHHW), resulting in only partial tidal exchange between the salt marsh and Mud Bay. The culvert blocks passage and use of the salt marsh habitat for juvenile fish. The road and associated armoring buries upper beach and salt marsh habitat. During this phase of the project, Friends of the San Juans (FSJ) and Washington State Parks will work with technical experts including Coastal Geologic Services to complete a preliminary design for the salt marsh and associated pocket beach. The project team will also complete preliminary design work for a feasible, cost effective alternative to support the park operations impacted by removal of the road.

3. **Problems Statement.**

A. **Describe the problem including the source and scale.**

At the Sucia Island project site, fill and a rock revetment were used to build a road at the waterward edge of the Mud Bay salt marsh. The road goes over a low, narrow beach berm in front of the salt marsh. The berm appears to have been constructed of approximately 1–2 feet of fill placed atop a former small berm along the waterward edge of the salt marsh. The width of the berm ranges from approximately 10 feet wide in the southwest to 20 feet wide toward the northeast. The compacted road portion of the berm is approximately 7.5 feet wide throughout and ranges in elevation between 11.7 and 12.7 feet MLLW. Besides being part of the islands' trail system, the road is an access-way from the dock and boat ramp in Fossil Bay to the park maintenance buildings on the northeast side of the salt marsh.

The waterward side of the berm is armored with a variety of materials. The original armor is made up of local stones up to 3 feet in size. A single line of concrete mooring buoy anchors were placed within the past decade (when they were removed from Echo Bay as part of eelgrass restoration efforts), apparently to fill holes in the original armor. Southwest of the culvert and along the landward side of the salt marsh

is another portion of revetment that covers about 60 feet of the road/berm. The upper beach fronting the salt marsh consists of very gently-sloping pebbly sand with abundant salt marsh vegetation near the base of the revetment. The site is a typical low-energy shore and the maximum fetch for the beach is only 0.5 miles to the south into Fossil Bay, further indicating a very low energy environment.

It is not clear when the perched, narrow, culvert was placed compared to the construction of the road. The culvert is high in the tidal range, with the bottom of the pipe just below MHHW. This leads to ponding of water in the channels behind the berm and significantly decreases access and connectivity between the bay and the marsh. The culvert outlet is located approximately 1 foot above the beach surface. Angular armor stones 6–18 inches in diameter have been placed around the culvert outlet to prevent scouring by the water as it flows out of the culvert and into Mud Bay.

The salt marsh is roughly triangular in shape and covers more than 2.2 acres (CGS, fall 2013). The majority of the marsh is flat with a dense covering of pickleweed and salt grass. There is a small drainage channel network, with the primary channel running in a mostly straight line from the culvert to the back corner of the salt marsh. In the northwestern portion, where the channels do not reach, there are two connected ponds with a dense mat of algae covering the lower ground within. The majority of this portion of the marsh is between 9 and 10 feet MLLW. Farther back and to the sides of the marsh the vegetation communities transition to freshwater wetland, upland communities and forest. Above 10 feet MLLW Pacific silverweed is abundant; above that is Nootka rose followed by upland forest. In the back northwest corner of the marsh there is a small area of cattail which indicates a transition to fresh-water inputs. Farther back the low elevation area contains a forested freshwater wetland area.

Full restoration (road, culvert and armor removal) will require some operational changes at the state marine park as it will remove the primary access to the maintenance buildings. In addition to restoration design elements, the proposed preliminary design project will complete the research and planning required to develop alternate ways to meet parks operational needs.

The shoreline modifications along Mud Bay are impacting salmon recovery in multiple ways. The road fill and culvert are limiting the many habitat benefits that estuarine wetlands provide to juvenile salmon while the shoreline armoring directly buries and degrades potential forage fish spawning habitat.

Estuarine wetlands, including pocket estuaries, lagoons and salt marshes, provide important habitat functions in San Juan County. Unfortunately, within San Juan County and across Puget Sound, many coastal wetlands have been degraded, filled and/or disconnected from the marine environment. These actions have reduced fish passage, nutrient exchange and overall habitat quality and quantity. Coastal wetlands are known to be one of the most impacted and also the most valuable of all major habitat types in the Puget Sound region (Schlenger et al. 2011). Substantial research has been conducted on the habitat values of salt marshes and small estuaries, especially in relation to Puget Sound ocean-type juvenile Chinook, which were listed as federally endangered species in 1999 (Simenstad et al 1982, Simenstad and Cordell 2000, Beamer et al. 2003). Research results find that healthy coastal wetlands support numerous ecosystem functions that benefit salmonids and salmon prey including: feeding, refugia, and nursery grounds. Coastal wetlands also provide organic nutrients, sediment filtration, pollution abatement and water quantity moderation/flood control (Beamer et al. 2003, USFWS 1980, Shared Strategy 2005).

Another important function of nearshore habitat is that it is a source of insects which are an important food source for juvenile fish (Brennan and Culverwell 2004, Duffy et al. 2010). Marshes and vegetation bordering the nearshore supply this prey either through insects falling into the water from overhanging vegetation, washing down the channel or flying over the water and being trapped in the air-water interface. Juvenile salmon, having fed on insects during their fresh water stage, enter the marine

habitat and continue to target insects while they add epibenthic prey, zooplankton and fish larvae to their diet (Fresh et al. 2006 and Duffy et al. 2010). Restoration and reconnection of coastal marshes and lagoons will increase access to more complex nearshore habitats and high quality insect prey for juvenile fish.

Forage fish, like surf smelt and sand lance, play a key role in marine food webs, with a small number of species providing the trophic connection between zooplankton and larger fish, birds and marine mammals. As a primary food source for marine birds such as Marbled Murrelet and fish like salmon, healthy forage fish spawning beaches are essential for regional recovery efforts. Armoring associated with roads and bulkheads directly buries surf smelt and sand lance spawning habitat and disrupts geologic processes vital for nearshore ecosystems (Johannessen and MacLennan 2007). Shoreline modifications such as roads also disconnect coastal wetlands from the nearshore marine environment, reducing or eliminating access to habitat and the transfer of nutrients (Thom et al 1994).

B. List the fish resources present at the site and targeted by your project.

Species	Life History Present (egg, juvenile, adult)	Current Population Trend (decline, stable, rising)	ESA Coverage (Y/N)	Life History Target (egg, juvenile, adult)
Surf Smelt	Egg	Unknown	N	Egg, juvenile, adult
Sand Lance	Egg	Unknown	N	Egg, juvenile, adult
Chinook salmon	Juvenile, Adult	Decline	Y	Juvenile, adult
Chum salmon	Juvenile, Adult	Unknown	N	Juvenile
Coho salmon	Juvenile, Adult	Decline	N	Juvenile
Pink salmon	Juvenile, Adult	Stable	N	Juvenile

C. Describe the limiting factors, and limiting life stages (by fish species) that your project expects to address.

San Juan County's marine nearshore supports spawning and rearing habitat for forage fish, eelgrass and kelp, along with feeding, refuge and migratory habitat for out-migrating juvenile chinook, chum, pink and coho salmon. Located in the highest priority salmon recovery area for San Juan County, Mud Bay's 300 foot armored road buries marsh and upper beach habitat and blocks an approximately 2.2 acre salt marsh and its relatively intact 200 foot long main channel from the nearshore marine environment. The narrow, perched culvert limits passage into the salt marsh by rearing juvenile salmon and/or forage fish, and also limits the transfer of nutrients and prey. The armored road along the marsh also impacts 300 linear feet of potential forage fish spawning habitat at the pocket beach. In 2014, surf smelt spawning was documented at Fossil Bay, a pocket beach nearby.

This project has the potential to restore fish passage and access to 200 feet of channel habitat by reconnecting a coastal marsh to the marine environment in this top region for outmigrating juvenile Chinook while also restoring upper beach habitat at a pocket beach. The project was also identified as a high opportunity to increase resiliency to sea level rise by removal of armor and fill (Whitman et al 2012). Roads, armoring and tidal barriers were identified as top stressors to the nearshore processes essential to salmon recovery in San Juan County. The proposed project addresses these top threats and improves coastal wetland, channel and beach conditions in a shoreform (pocket beach) and region (Waldron-President's channel) ranked among the top 3% of the county's marine shorelines in the strategic salmon recovery plan (Whitman et al 2012).

Benefits to salmon include:

- restoration of fish passage and access to rearing, refuge and feeding habitat for juvenile salmon and forage fish;
- improved wetland functions, water quality and prey conditions for juvenile fish;
- increased transfer of nutrients between coastal wetland and marine environment; and
- improved pocket beach values including restoration of potential forage fish spawning habitat and improved upper beach as source of insects for juvenile fish.

4. **Project Goals and Objectives.**

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

The goal of the project is to restore salt marsh, tidal channel and upper beach habitats for juvenile salmon and forage fish within a top priority salmon recovery shoreform and region of San Juan County by completing preliminary designs for full removal of the culvert, revetment and road at Sucia Island's Mud Bay.

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

Project objectives include:

- Develop a preliminary design (70%) to remove a perched culvert to restore fish passage and tidal connectivity to the Mud Bay salt marsh to improve rearing, refuge and feeding conditions for juvenile salmon by June 30, 2017.
- Develop a preliminary design (70%) to remove fill and armor associated with a road located in the backshore of a pocket beach/marsh face to improve beach conditions for spawning forage fish and backshore conditions for sea level rise resiliency, natural beach function and insect prey production by June 30, 2017.
- Develop a preliminary design (50%) for a feasible, cost effective alternative to support necessary parks operations impacted by removal of the road by June 30, 2017.

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

WA State Parks is operating in a context of extremely limited budgets and staffing. In order to not place undue burden on local operational staff and maximize experience and capacity, FSJ and WA State Parks have taken a team approach that includes Parks planning, operational and stewardship office staff. A potential physical constraint is the location of freshwater wells that serve the island located beyond the back end of the marsh. While the extent of salt marsh inundated with salt water is not expected to increase (marsh currently fills at highest tides), the length of inundation will increase. To ensure that there is no risk of sea water intrusion into the freshwater wells from the preferred full restoration option, a groundwater analysis has been initiated and will be completed before final funding for this project is awarded.

5. **Project Details.**

A. **Provide a narrative description of your proposed project.**

The proposed Mud Bay, Sucia Island Salt Marsh Restoration project will complete all of the field research and the preliminary designs necessary to forward complete removal of the culvert, revetment and road fill. In addition, operational adjustments necessitated by the removal of this road will be evaluated and selected. The project will reconnect the salt marsh to unrestricted tidal flow result and uncover approximately 8,000 square feet (SF) of beach and salt marsh habitat. Project elements include:

Field research: Before the preliminary designs can be completed the following new field research will be conducted: surveyed site plans, geotechnical surveys, ~~sea water intrusion/fresh water well analysis,~~ wetland delineation, LiDAR analysis, fish utilization surveys in the existing channel and a cultural resources review.

Preliminary Restoration Designs (70%): Coastal Geologic Services (CGS) will complete data analysis, drawings and designs, the design report, and engineering cost estimates.

Preliminary Operations Designs (50%): FSJ will manage completion of essential base data layers and work with CGS, and a WA State Parks planner/landscape architect to evaluate and identify preferred operational solutions to accommodate parks needs in light of the full removal of Mud Bay road. Options include: improving existing alternate route; relocating an access road in a new, landward location, and relocating the maintenance building to eliminate the need for the access road.

Stakeholder communication: Partners will work together to be sure the project meets everyone's needs and provides the highest benefit to salmon and forage fish. The project team includes FSJ, CGS and WA State Parks staff from stewardship, planning and operations departments.

B. **Provide a scope of work.**

Task	Lead	Timeline	Deliverable
Sea water intrusion/freshwater well analysis – to be completed by Oct 2015 (not in scope of proposed grant)	Pacific Groundwater Group	~~Spring 2016~~ Summer/ Fall 2015	Report
Preliminary cultural resources review	WA State Parks	Winter 2016	Report
Cultural resources review & permit report *(includes Mud Bay restoration site & any new road/building locations)*	Drayton Archeology with WA State Parks Archeologists	Spring 2016	Report
Wetland mapping	Rosewood Environmental	Spring 2016	Report, drawings
Preliminary operational research, planning, and design	CGS, WA State Parks	May 2016 to Dec. 2016	Report, drawings
Preliminary marsh, channel and beach restoration design	CGS	May 2016 to Dec. 2016	Draft drawings, report, construction recommendations & cost estimates
Forage fish surveys	FSJ	Ongoing seasonal	Report
Fish utilization surveys in tide channel	FSJ, LLTK	Seasonal	Report
Project team draft design review and refinement	FSJ, CGS, WA State Parks	Jan. to Feb. 2017	Synopsis
Biological evaluation	FSJ	Winter 2017	Report
Final preliminary design documents *(salt marsh, tide channel and pocket beach restoration & operational project components)*	FSJ, CGS, WA State Parks	Winter 2017	Final preliminary design report, drawings, construction plan and cost estimates
Stakeholder and permit staff communication	FSJ (Lead) incl. CGS & WA State Parks	Winter 2016/2017	Synopsis

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

The project costs are based on individual estimates from consultants Coastal Geologic Services, ~~Pacific Groundwater Group,~~ Rosewood Environmental, Drayton Archeology as well as Parks personnel. FSJ developed the budget based on similar projects and the professional judgment of those familiar with the site and time and work required. WA State parks personnel provided their own estimates based of expected time to work on this project.

D. **How have lessons learned from completed projects or monitoring studies informed your project?**

The feasibility research/report for this site as well as for similar projects completed in San Juan County and around the region has allowed project managers (FSJ), Coastal Geologists (CGS) and WA State Parks' salmon recovery and stewardship staff to effectively communicate project actions, benefits and likely outcomes to WA State Parks' Sucia Island operational staff. This has helped build support for the full restoration option even though it will require some changes to the parks operations.

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.

N/A

7. **If your project includes developing a design:**

A. **Will your project be designed by a licensed professional engineer?**
Yes

i. **If not, please describe the qualifications of your design team**.

The design team includes licensed engineering geologist Jim Johannessen and WA State Parks' NW Region Planner, landscape architect Jamie Van De Vanter. Coastal Geologic Services also employs a civil engineer, Alexis Blue, who will participate on the design and review team.

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

A. If not, please explain why and when you will submit permits.

A grant to complete the final design and permitting will be applied for after WA State Parks approves the preliminary design plans. The best case scenario has the final design complete by December 2017, permits submitted during the winter of 2018, and implementation during the fall of 2018.

9. **If your project includes a fish passage or screening design**:

A. Has your project received a Priority Index (PI) or Screening Priority Index (SPI) number? If so, provide the PI or SPI number and describe how it was generated.

Washington Department of Fish and Wildlife (WDFW) determined that the culvert at Mud Bay is a blockage to fish passage, and that the stream has the potential for fish use based on size; the barrier number is 940509 (WDFW Fish Passage and Diversion Screening Inventory Database 2014).

B. **For fish passage design projects:**

If you are proposing a culvert or ach, will you use stream simulation, no slop, hydrologic, or other design method?

N/A - Restoration plans will include full barrier (road and culvert) removal and channel restoration.

i. Describe the amount and quality of habitat made accessible if the barrier is corrected.

There is approximately 200 linear feet of channel that will be usable by juvenile fish beyond the current barrier channel area within the >2 acre salt marsh system will be evaluated for potential enhancement as part of the preliminary design process.

ii. List additional upstream or downstream fish passage barriers, if any.

N/A as this is a salt marsh system.

10. **Context within the Local Recovery Plan**.

A. **Discuss how this project fits within your regional recovery plan and/or local lead entity's strategy to restore or protect salmonid habitat**.

San Juan County's Strategic Salmon Recovery Plan completed in 2012 used a combination of habitat factors (rearing chinook salmon, rearing and spawning forage fish) and prioritized salmon recovery sites at both the geomorphic shoreform and landscape regional scale (Whitman et al 2012). The proposed project site at Sucia Island's Mud Bay was ranked within the top three percent of San Juan County's marine shorelines and is also located in the highest priority landscape region of the county. Since that time, surf smelt spawning has been documented at a nearby pocket beach in adjacent Fossil Bay (FSJ 2014). Proposed restoration actions at this site also address three of the top four stressors causing nearshore process degradation in the county, roads, armoring and tidal barriers (Whitman et al 2012).

B. **Explain why it is important to do this project now instead of later.**

Feasibility work completed for this project along with forage fish spawning surveys and associated educational efforts on Sucia's beaches over the past two years has resulted in strong organizational support by local and regional parks staff for the project. A solid interdisciplinary team has been formed with the goal of advancing full restoration at Mud Bay. In addition, the existing road along the salt marsh was built at a very low elevation and is currently inundated at high water levels. Increasing sea levels and associated coastal flooding and erosional hazards threaten the viability of this low lying roadway and its poorly constructed culvert and armoring. The result of additional inundation will be increased maintenance costs to keep the road open or a transition to alternative means of accessing the parks building. It will be beneficial to take action now to prevent emergency repairs and improve wetland and beach conditions for fish and wildlife. Large infrastructure changes such as road removals and possible access or building relocations take time to fully execute, so taking advantage of existing relationships and progress are helping to advance this project.

C. **If your project is a part of a larger overall project or strategy, describe the goal of the overall strategy, explain individual sequencing steps, and which of these steps is included in this application for funding.**

The proposed activities are part of a larger recovery strategy that FSJ and SJC salmon recovery practitioners have been working toward for over ten years. With most assessment work completed and

the results compiled, priority project types and areas for restoration projects are clear. As noted earlier, this project is located within the top salmon recovery shoreform and region and addresses top threats.

11. **Project Proponents and Partners.**

A. **Describe your experience managing this type of project**.

Since 2001, Friends of the San Juans (FSJ) has identified and mapped most of San Juan County's nearshore ecosystems, including surf smelt and sand lance spawning beaches, herring spawning sites, eelgrass beds, kelp habitat, feeder bluffs, and shoreline modifications. FSJ uses results from nearshore assessments to identify restoration priorities, implement habitat protection and improvement projects and educate the public about nearshore habitats and shoreline protection and restoration techniques.

Since completion of the San Juan County Restoration Blueprint in 2006, FSJ has been advancing and implementing nearshore enhancement and restoration projects at priority sites with both public and private landowners. These efforts have resulted in multiple on the ground restoration projects at beach (5), coastal wetland (2), lagoon (1) and subtidal sites (multiple creosote dock and pile removal). Two additional beach restoration/armor removal projects will be implemented this fall. FSJ has worked primarily with Coastal Geologic Services on these projects and the combination of their geotechnical and extensive coastal project expertise and FSJ's nearshore habitat knowledge and community presence has provided a solid approach to generate new partnerships and advance projects that achieve salmon and forage fish habitat recovery goals.

B. **List all landowner names**.

The landowner is Washington State Parks.

C. **List project partners and their roles and contributions to the project**.

Friends of the San Juans - Tina Whitman, Science Director. Tina has managed nearshore habitat assessment, restoration and protection projects for FSJ since 2002. Tina has completed extensive nearshore habitat assessments and restoration prioritizations, including the Pulling It All Together project; as such she is intimately familiar with local salmon recovery priorities. Tina has also worked with public and private landowners to cultivate and implement restoration projects throughout San Juan County. Tina will manage the overall project and contractors, conduct the Biological Assessment and seasonal forage fish surveys and lead communications with WA State Parks.

Coastal Geologic Services - Jim Johannessen, Principal. Jim specializes in beach and estuarine assessment, mapping, and restoration design. He started CGS in 1993 and has performed coastal assessments and developed beach nourishment, soft shore protection, integrated site management approaches, and other designs from initial concept through to final construction drawings in all Puget Sound and Straits counties. Jim also monitors beach projects, and runs educational programs throughout the region to facilitate community understanding of coastal processes and interactions of coastal modifications and nearshore habitats. Jim has extensive on the ground experience in San Juan County and completed the feasibility study for this site. CGS will complete the preliminary design.

WA State Parks – Washington State Parks personnel, including the statewide salmon recovery coordinator, stewardship manager, cultural resources staff, northwest regional planner/landscape architect and local outer islands parks managers/operational staff will participate in the development and review of the field research and preliminary design.

D. **Stakeholder Outreach**. *Discuss whether this project has any opposition or barriers to completion besides funding. Describe your public outreach and feedback you have received. Are there any public safety concerns with the project? How will you address those concerns?*

The primary barrier to implementation of a full restoration option at the site are the changes to current operational practices by parks staff that the road removal will necessitate. The feasibility phase of the project allowed time to develop an integrated team of parks personnel and identify multiple potential workable operations solutions. Impacts to park users are expected to be minimal as only parks staff use vehicles on Sucia Island.

There has not been any outreach with visitors to Sucia Island at this point as the proposed project will not impact visitor use of the area and in the long run will likely improve the beach for recreation. There are not any public safety concerns during this phase of the project.

Citations

Beamer, E., A. McBride, R. Henderson, K. Wolf, 2003. The importance of non-natal pocket estuaries in Skagit Bay to wild Chinook salmon: an emerging priority for restoration. Skagit System Cooperative Research Department. La Conner, WA. 9 p.

Beamer, E. and Fresh, K., 2012. Juvenile salmon and forage fish presence and abundance in shoreline habitats of the San Juan Islands, 2008-2009: Map Applications for Selected Fish Species. Prepared for San Juan County Community Development and Planning and San Juan County Marine Resources Committee, Friday Harbor, Washington.

Brennan, J.S., and H. Culverwell, 2004. Marine Riparian: An Assessment of Riparian Functions in Marine Ecosystems, Puget Sound Water Quality Action Team, Olympia WA, 27 p.

Duffy, E., D. Beaucamp, R.M. Sweeting, R. Beamish and J. Brennan. 2010. Ontogenetic Diet Shifts of Juvenile Chinook Salmon in Nearshore and Offshore Habitats of Puget Sound. Transactions of the American Fisheries Society 139:803–823.

Fresh, K.L. 2006. Juvenile Pacific Salmon in Puget Sound. Puget Sound Nearshore Partnership Report No. 2006-06. Published by Seattle District, U.S. Army Corps of Engineers, Seattle, Washington.

Hood, G. 2015. Geographic variation in Puget Sound tidal channel planform geometry. Geomorphology 230, 98-108

Johannessen, J. and A. MacLennan. 2007. Beaches and bluffs of Puget Sound. Puget Sound Nearshore Ecosystem Partnership Report No. 2007-04. Published by Seattle District U.S. Army Corps of Engineers, Seattle, WA.

Schlenger, P., A. MacLennan, E. Iverson, K. Fresh, C. Tanner, B. Lyons, S. Todd, R. Carman, D. Myers, S. Campbell, and A. Wick. 2011. Strategic needs assessment: analysis of nearshore ecosystem process degradation in Puget Sound. Puget Sound Nearshore Ecosystem Restoration Project. Technical Report 2011-02. Published by Washington Department of Fish and Wildlife, Olympia, Washington, and U.S. Army Corps of Engineers, Seattle, Washington.

Shared Strategy. 2005. Puget Sound Chinook Salmon Recovery Plan. Nearshore Chapter (Regional Nearshore and Marine Aspects of Salmon Recovery in Puget Sound. Compiled and edited by Scott Redman, Doug Myers, and Dan Averill Puget Sound Action Team From contributions by the editors and Kurt Fresh and Bill Graeber, NOAA Fisheries June 28, 2005.)

Simenstad, C. A., K. L. Fresh, and E. O. Salo. 1982. The role of Puget Sound and Washington coastal estuaries in the life history of Pacific Salmon: an unappreciated function. In V.S. Kennedy editor. Estuarine Comparisons. Academic Press, New York. P 343-364.

Simenstad, C. A. and J. R. Cordell, 2000. Ecological assessment criteria for restoring anadromous salmonid habitat in Pacific Northwest estuaries. Ecological Engineering, 15: 283-302.

Thom, R., Shreffler, D., and Macdonald, Keith, 1994. Shoreline armoring effects on coastal ecology and biological resources in Puget Sound, Washington: Coastal Erosion Management Studies. Washington Dept. of Ecology 7: Pub. No. 94-80.

USFWS. 1980. Tidal Marshes: the boundary between land and ocean. U.S. Fish and Wildlife Service Biological Services Program. FWS/OBS-80/15. U.S. Department of the Interior.

Whitman, T, MacLennan, A. Schlenger, P., Small, J. Hawkins, S. and J. Slocomb, 2012. Strategic salmon recovery planning for San Juan County Washington: the pulling it all together (PIAT) project. Prepared by Friends of the San Juans, Coastal Geologic Services, Confluence Environmental and Anchor QEA for the SJC Lead Entity for Salmon Recovery and the Washington State Salmon Recovery Funding Board. Final report RCO #10-1789.

Comments

Use this section to respond to the comments you will receive after your initial site visits and after you submit your final application.

Response to Site Visit Comments

Please describe how you've responded to the review panel's initial site visit comments. *We recommend that you list each of the review panel's comments and questions and identify how you have responded. You also may use this space to respond directly to their comments.*

Response to Post-Application Comments

Please describe how you've responded to the review panel's post-application comments. *We recommend that you list each of the review panel's comments and questions and identify how you have responded. You also may use this space to respond directly to their comments.*