**Department of Energy**

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

ENVIRONMENT, FISH AND WILDLIFE

March 5, 2010

In reply refer to:

Mr. Tony Grover, Fish and Wildlife Division Director
Northwest Power & Conservation Council
851 S.W. Sixth Avenue, Suite 1100
Portland, OR 97204-1348

Dear Mr. Grover:

With this letter, Bonneville Power Administration (BPA) is submitting a 2008 Federal Columbia River Power System (FCRPS) Biological Opinion (BiOp) project narrative for Independent Scientific Review Panel (ISRP) review. As you know, the 2008 FCRPS BiOp is a 10 year operations and configuration plan to mitigate for the adverse effects of the hydro-system on the 13 listed fish under the Endangered Species Act (ESA). The Reasonable and Prudent Alternative (RPA) 37: Estuary Habitat Implementation 2010-2018 of the FCRPS BiOp calls for BPA and the other federal Action Agencies (AA) to implement specific mitigation actions to avoid jeopardy and adverse modification of the critical habitat of ESA listed Columbia River fish.

To this end, BPA will continue to fund ongoing Fish and Wildlife Program projects that support the RPA, and develop new projects designed to contribute to hydro, habitat, hatchery and predation management activities required under the 2008 FCRPS Biological Opinion. Additionally, many of the new FCRPS BiOp RPA projects will also assist BPA in meeting its mitigation obligations under the NW Power Act, and supplement the Northwest Power and Conservation Council's (Council) Fish and Wildlife Program. As sponsors develop narratives for these projects, we will submit them for ISRP review.

We are enclosing the detailed narrative for "CREST Estuary Habitat Restoration Project," #2010-004-00, for immediate Council and ISRP review. The purpose of this new project is to develop, design and construct on-the-ground restoration habitat actions that provide high survival benefits to meet targets required under the 2008 BiOp. The restoration actions will benefit threatened and endangered salmonid species in lower river/estuary mainstem and tributary tidal habitats that promote diverse estuarine life histories.

The work under the new CREST Estuary Habitat Restoration, project 2010-004-00, will be similar to ongoing work funded under Grays River Watershed Restoration, Project 2003-013-00 (this project will close in May/June, 2010). The Grays River Watershed Restoration Project focuses on the upper Grays River basin, above tidal influence. The 2008 BiOp prioritizes habitat projects that are in tidally influenced areas of the tributaries. CRESTS new habitat project, #2010-004-00, is focused from the mouth of the Columbia River to Bonneville Dam, including the tidally influence areas of the tributaries.

The CREST Estuary Habitat Restoration Project is intended to implement the following RPA required by the FCRPS BiOp:

a) RPA action 37: "Estuary Habitat Implementation 2010-2018 - Achieving Habitat Quality and Survival Improvement Targets. The AAs will provide funding to implement additional specific projects as needed to achieve the total estuary survival benefits identified in the FCRPS BA."

The initial contract is slated to start May 15, 2010 with a BPA FY10 funding commitment of $852,000. This will provide for continuation of estuary project development and design and implementation of two estuary habitat actions, Ft. Columbia Tidal Reconnection and Otter Point Restoration.

In addition to the ISRP review, there will be two levels of scientific review for all estuary habitat restoration projects identified and implemented under the CREST Estuary Habitat Restoration Project. CREST will utilize the Lower Columbia River Estuary Partnership's (Estuary Partnership) Science Work Group for the first level of scientific review for on-the-ground habitat projects. Ft. Columbia Tidal Reconnection and Otter Point Restoration projects underwent review by the Science Work Group in the spring of 2009. The Estuary Partnership provided a positive recommendation for these two projects in a memo to BPA on May 7, 2009. The second level of scientific review will be done by the RPA 37 Expert Regional Technical Group as required in the 2008 BiOp; this review will be conducted in coordination with the Science Work Group. This review will be done in late winter/early spring 2010. Please see Section F, Task 1, of the narrative for more detail.

If you have questions about the project narrative, please contact the project sponsor, Micah Russell at mrussell@columbiaestuary.org. If you need any additional information from the BPA project manager, please contact John Baugher at jrbaugher@bpa.gov or Marchelle Foster at mmfoster@bpa.gov, who is helping to coordinate ISRP review for new BiOp projects.

Thank you for your assistance, we look forward to working closely with you and your staff as we implement BiOp projects.

Sincerely,

William C. Maslen
Director of Fish and Wildlife

Enclosure:
CREST Estuary Habitat Restoration Project Narrative

The 2008 Federal Columbia River Power System (FCRPS) Biological Opinion (2008 BiOp) is a ten-year operations and configuration plan to mitigate for the adverse effects of the hydrosystem on the 13 listed Columbia/Snake salmon and steelhead under the Endangered Species Act (ESA). The 2008 BiOp provides mitigation actions that are required of the FCRPS action agencies to avoid jeopardy and adverse modification of the critical habitat of ESA listed Columbia River fish. Ongoing projects supported and new projects developed are designed to contribute to hydro, habitat, hatchery and predation management activities required under the 2008 FCRPS Biological Opinion. Additionally, the projects assist the Bonneville Power Administration (BPA) in meeting its protection, mitigation, and enhancement objectives and responsibilities in support of the Columbia Basin Fish and Wildlife Program adopted pursuant of the Northwest Power Act.

**Project Title:** CREST Estuary Habitat Restoration

**Table 1. Proposal Metadata:**

| | |
|---|---|
| **Project Number** | #2010 – 004 – 00 |
| **Title** | **CREST Estuary Habitat Restoration** |
| **Proposer** | Columbia River Estuary Study Taskforce (CREST) |
| **Brief Description** | Restoration of T/E Juvenile Salmon Off-Channel Rearing Habitat |
| **Province(s)** | Lower Columbia River and Estuary |
| **Subbasin(s)** | Columbia Estuary, Elochoman, Grays, Youngs, Lewis & Clark, Columbia Lower, Cowlitz, Sandy, Lewis, Kalama, Washougal, & Willamette |
| **Contact Name** | Micah Russell |
| **Contact email** | mrussell@columbiaestuary.org |
| **Projected Start Date** | 6/1/2010 |

## A. Abstract

CREST, a bi-state Council of Governments, is proposing to continue restoration of estuary habitat critical to the recovery of Threatened/Endangered Columbia River and tributary salmon Evolutionarily Significant Units (ESUs). CREST seeks to continue developing, designing and constructing on-the-ground habitat restoration actions that benefit threatened and endangered salmonid species in the Lower Columbia and Estuary, specifically the 2008 BiOp RPA 37, *Achieving Habitat Quality and Survival Improvement Targets*. This proposal represents a lower river/estuary wide effort to restore mainstem and tidal habitats, acknowledging the interconnected landscapes that comprise the lower river and estuary ecosystems.

The purpose of this estuary habitat project develop, design, and construct on-the-ground habitat restoration actions that will provide high benefits to meet targets/goals required under the 2008 BiOp. The restoration actions will benefit threatened and endangered salmonid species in

mainstem and tidal habitats that promote diverse estuarine life histories. The project will result in an ecosystem-based habitat restoration program, guided by adaptive management principles, and focused on the improved survival of juvenile salmonids.

In the past six years, BPA project dollars have supported and leveraged seven CREST habitat projects that resulted in 86 acres restored and over 18 linear miles of shoreline reconnected or enhanced. CREST has identified and is developing several additional estuary habitat restoration projects that have undergone the first level of scientific review and a second level of scientific review will completed before these projects are implemented (see Section F, Task 1, below). CREST habitat restoration projects compliment a suite of activities completed by project partners and the Action Agencies (AA). Continued funding provided through this proposal will provide a baseline level of support for ongoing development and implementation of critical estuary projects.

## B. Problem statement: technical and/or scientific background

CREST has developed this proposal with an objective of restoring estuary habitat critical to the recovery of Threatened/Endangered Columbia River and tributary salmon ESUs. The recovery of these habitats and their vital importance in the long term health of the salmon resource is described in the following sections. Action effectiveness monitoring will be utilized by CREST to adaptively manage future restoration projects. Scientific review and project selection of habitat restoration actions funded through this proposal will be driven by a process described in Section F, Task 1, below.

### Background

The Columbia River is historically the world's greatest producer of salmon. The lower Columbia River and Estuary are critical to the viability of all anadromous fish populations for the entire Columbia Basin (NMFS, 2000). Juvenile salmonids, especially juvenile Chinook and coho salmon, reside and feed for lengthy periods in shallow, tidal-fluvial channels and wetlands during their transition from the freshwater to marine environments. In the lower Columbia River and Estuary, historic emergent and forested wetland types with their complex network of dendritic tidal channels and backwater sloughs have been greatly diminished. To the extent that survival and productivity of juvenile salmonids is related to interconnected shallow water habitats, the loss of these habitats adversely affect juvenile salmonids in the lower Columbia River.

According to Bottom et al, the most significant changes to the capacity of the Columbia River Estuary to support juvenile salmon are likely the results of habitat loss and recovery of those salmon life histories that depend on shallow-water rearing habitat will require restoration of peripheral estuarine wetlands (Bottom et. al., 2005). Alterations to the historic floodplain and its complex network of shallow waters have created significant limiting factors, presenting substantial restoration opportunities. Recent research describes that even small survival improvements in the estuary and coastal ocean could yield some of the most significant population increases for spring and summer Chinook salmon (Kareiva et al. 2000).

The Lower Columbia River Estuary Partnership (Estuary Partnership) has for several years developed strategies, partnerships, and prioritization plans which have provided a much needed framework for future implementation actions. CREST's efforts will compliment these actions by utilizing our community connections and reputation, staff expertise in on-the-ground project implementation, and provide high quality habitat restoration projects.

**History**

Land use activities such as diking, filling, tide gate installation, and shoreline armoring have destroyed or impaired many of the shallow, peripheral wetlands in this subbasin, and have isolated the lower Columbia River from its extensive historic floodplain. It is estimated that an area of over 80,000 acres of historic floodplain and wetlands are now positioned behind an extensive system of dikes and tide gates, and that urbanization and its associated filling and shoreline armoring account for an additional 20,000 acres of habitat loss (US ACOE, 2003). Extensive loss of historic estuarine wetlands through widespread diking and filling in Northwest estuaries may reduce or eliminate some subyearling migrant life histories that have been linked to the availability of shallow marsh habitats (e.g., Levy and Northcote 1981 and 1982).

Jay and Kukulka suggest that the annual Columbia River flow cycle has been dampened and spring-freshet flow to its estuary has been reduced by >40% due to flow regulation by more than 30 major dams, water withdrawal for agriculture, and climate change. During the freshet-season, dikes and flow-alteration together reduce average shallow water habitat in the study-reach (rkm-50 to rkm-90) by 62%. They hypothesize that taken individually, diking has reduced average freshet-season shallow water habitat by 52% and flow-cycle alteration by 29%. These results suggest that dike removal provides a substantial increase in these critical habitats even without flow restoration, greater than for restoration of flow without removal of dikes (Jay and Kukulka, 2003).

While restoration of an entire ecosystem is not generally practical, individual habitat restoration projects have the greatest likelihood of success when they are implemented with an ecosystem perspective, i.e., they are ecosystem-based. Individual restoration projects completed with ecosystem wide focus include several dike breaches in the Lewis and Clark River, land acquisitions and dike breaching on the Grays River and Deep Rivers, and other projects which group individual projects into larger, more complex habitat benefits over time. Coordination between groups provides the greatest long-term restoration and conservation success.

**Limiting Factors**

CREST proposes to target the following primary limiting factors from the Lower Columbia Salmon Recovery 6-year Habitat Work Schedule and Lead Entity Habitat Strategy – Estuary Mainstem River Subbasin which contribute towards the restoration critical habitats:

1. Availability of preferred habitat (juvenile rearing for within and out-of-basin subbasin populations pg A-3)

2. Microdetritus-based food web, increase inputs of macrodetritus to increase productivity in estuary food web, such as was supported by the historic food web (juvenile rearing for within and out-of-basin subbasin populations pg A-4)
3. Loss of habitat connectivity (juvenile rearing for within and out-of-basin subbasin populations pg A-4)

The focus of the proposed work will be Threatened/Endangered salmonid populations including the following Lower Columbia basin stocks: Lower Columbia River Fall Chinook, Chum, and Coho as well as Lower Columbia River Spring Chinook, Winter Steelhead, Summer Steelhead, and other out-of-basin stocks utilizing the Columbia River Estuary. This work will also benefit the following out-of-basin Threatened and Endangered including: Snake River Spring/Summer Chinook, Snake River Fall Chinook Salmon, Snake River Sockeye Salmon, Snake River Steelhead, Upper Willamette River Chinook, Upper Willamette River Steelhead, Middle Columbia River Steelhead, Lower Columbia River Steelhead, Lower Columbia River Coho, Lower Columbia River Chinook, Lower Columbia River Chum Salmon, Upper Columbia River Steelhead, and Upper Columbia River Spring Chinook.

CREST will refer to appropriate subbasin planning documents. The subbasin documents are as listed: Estuary Tributaries, Grays, Elochoman, Cowlitz, Kalama, Lewis, Lower Columbia Tributaries, Washougal, Wind, Little White Salmon, Columbia Gorge Tributaries, Estuary, Lower Columbia, Willamette, Sandy, and Hood.

**Location:**
Previously CREST focused mainly on the lower 46 miles of the Columbia River. This proposal would expand CREST's focus to include Bonneville Dam to the mouth of the river including the tidally influenced areas of the tributaries.

**Monitoring & Evaluation:**
Because of the diversity of project size, location, and type, CREST is proposing to conduct monitoring and evaluation activities in accordance with standard protocols, primarily referencing Monitoring Protocols for Salmon Habitat Restoration Projects in the Lower Columbia River and Estuary, Roegner et al 2009.

Broad hypothesis are:

1. Restoration activities at a treatment site will result in improved fish access and/or physical habitat structure condition when compared to a control site (Before/After/Control/Impact BACI design).
2. The treatment site will recover ecosystem function and will resemble undisturbed reference sites when restoration is complete (Parallelism hypothesis).
3. Improved productivity in the estuarine food web.

Site specific metrics will be selected based on individual project goals and expected outcomes. A systematic approach that uses the best available understanding of the ecosystem and its relationship to salmonid use is critical to the implementation of an effective and prudent restoration program in the lower Columbia River and Estuary.

## C. Rationale and significance to regional programs

Several management and prioritization programs have been developed in recent years to assist in managing and directing restoration initiatives in the lower Columbia River and Estuary. Implementation of this proposal will be a step towards significant restoration in the most critical habitats in the lower Columbia River and Estuary. Planning and strategy documents that support estuary restoration and project goals include the following:

***NOAA Fisheries/Action Agencies' ESA Consultation on Federal Columbia River Power System Operations*** (NMFS, 2008)

The Action Agencies Estuary Habitat Proposed Action (draft) states that a "key step in conserving and rebuilding Endangered Species Act (ESA)-listed salmon and steelhead is determining the potential benefits that could occur from actions implemented to conserve and improve estuary habitats." Estuary habitat improvements are expected (citing several literature sources) to improve juvenile and adult survival. Estuary habitat improvements (page 5 of the Estuary Habitat Proposed Action) will provide an increase in juvenile salmonid shallow water habitat that would benefit all listed ESUs, with the greatest habitat benefit to those ESUs expressing ocean type life histories.

CREST's projects that specifically target BiOp actions include the Gorley Springs Grays River Restoration Project and Fort Columbia Tidal Reconnection Project.

CREST is proposing the following project types: Enhancement, Restoration, and Creation. For Ocean Type and Stream Type life histories, CREST will primarily be targeting the habitat limiting factor, with additional attention to physical characteristics such as temperature and sediment limiting factors. These factors are listed on pages 11 and 12.

***NOAA Fisheries/Action Agencies' ESA Consultation on Federal Columbia River***

This project will result in a continued coordinated and systematic habitat restoration program with a sound scientific basis to select, implement, and evaluate specific projects. CREST's proposed restoration program will work with the Estuary Partnership's well-developed Science Work Group to ensure estuary goals are being met.

***Mainstem Lower Columbia River and Columbia River Estuary Subbasin Plan*** (Lower Columbia Fish Recovery Board, 2004)

The Columbia River Estuary is particularly important for anadromous salmonids, which use it for critical life stages. The estuary serves as a vital transition zone during the physiological acclimation from freshwater to saltwater, it provides juvenile salmonids an opportunity to

achieve the critical growth needed to survive in the ocean, and estuarine habitats serve as a productive feeding area, free of marine predators.

Ecosystem Diagnosis and Treatment (EDT) was not used in the estuary and lower mainstem biological object development. This was because EDT was designed as a tributary analytical tool that only predicts estuary mortality on upstream populations, rather than estuary productivity.

Since EDT was not able to be utilized, it was difficult for the subbasin planners to arrive at justifiable biological objectives. Rather than focusing on developing biological objectives, subbasin planners focused on creating a strong logic path between physical objective and strategies to prevent mortality in the lower river and estuary. The following are the critical linkages and logic path of this proposal as developed from the Subbasin plan framework.

**Limiting Factors** (Subbasin Plan, Chapter 4, pages 17-21)

| **Applicable Species** | **Limiting Factors** |
|---|---|
| Chum<br>Fall Chinook | **LF.1** Availability of preferred habitat (i.e. shallow water, low velocity, peripheral habitats). Chum salmon are closely associated with peripheral habitats. There has been extensive loss of peripheral wetland and side channel habitat throughout the mainstem and estuary.<br>**Supported by Hypotheses: E.H1, E.H2, E.H3, E.H4, E.H6, E.H7, E.H8, E.H9, E.H11, E.H12** |
| Chum<br>Fall Chinook<br>Coho<br>Spring Chinook<br>Winter steelhead<br>Summer steelhead | **LF.2** Microdetritus-based food web. The current microdetritus-based food web is expected to be less productive than the historical macrodetritus-based food web. Loss of wetland and side channel habitat identified above has reduced the local macrodetritus inputs from terrestrial and riparian habitats that supported the historical food web. Present detrital inputs to the food web are dominated by microdetritus from upriver sources and are controlled primarily by reservoir production and flow rates from Bonneville Dam. Further, the microdetritus-based food web is thought to be less available to chum salmon because it is pelagic in nature and may be focused on the spatially-confined estuary turbidity maximum region. **Supported by Hypotheses: E.H1, E.H2, E.H3, E.H4, E.H6, E.H8, E.H9, E.H11, E.H12** |

| Applicable Species | Limiting Factors |
|---|---|
| Chum<br>Fall Chinook<br>Coho<br>Spring Chinook<br>Winter steelhead<br>Summer steelhead | **LF.3** Loss of habitat connectivity. Areas of adjacent habitat types distributed across the estuarine salinity gradient may be necessary to support annual migrations of juvenile salmonids. As juveniles grow, they move across a spectrum of salinities, depths, and water velocities. For species like chum salmon that rear in the estuary and in tidally influenced areas of the Western Oregon tributaries for extended time periods, a broad range of habitat types in the proper proximities to one another may be necessary to satisfy feeding and refuge requirements within each salinity zone. For species like fall Chinook that rear in the estuary for extended time periods, a broad range of habitat types in the proper proximities to one another may be necessary to satisfy feeding and refuge requirements within each salinity zone. **Supported by Hypotheses: E.H1, E.H2, E.H3, E.H4, E.H6, E.H7, E.H8, E.H9, E.H11, E.H12** |
| Chum<br>Fall Chinook<br>Coho<br>Spring Chinook<br>Winter steelhead<br>Summer steelhead | **LF.11** Migration barriers/ lack of resting habitats. Elevated water temperature or high water flow may act as a temporary adult migration barrier. Additionally, high water flow likely reduces available resting habitat for migrating adults. **Supported by Hypotheses: E.H2, E.H6, E.H8, E.H12** |

**Physical Objectives (PO) that relate to this proposal** (Subbasin Plan, Chapter 4, pages 35-39)

**PO1.** Protect existing rearing and spawning habitat to ensure no further net degradation.

**PO2.** Increase shallow water peripheral and side-channel habitats toward historic levels.

**PO3.** Restore connectivity between tributary deltas and the estuary, the river and the floodplain, as well as in-river habitats.

**PO17.** Eliminate or mitigate access barriers for migrating adults, creating additional spawning and rearing habitat.

**PO19.** Restore spawning and rearing habitat in the Western Oregon tributaries.

**PO22.** Increase the availability of habitat on public lands.

**PO27**. Increase forested areas in lowlands and floodplain with hardwood and some coniferous riparian species.

CREST staff will evaluate each project in accordance with these criteria as an initial screening activity for sound restoration projects. Through the project identification process, CREST will provide quality projects to the Estuary Partnership Science Work Group to be reviewed for compliance with their Project Selection Criteria, as well as survival benefit analysis associated with RPA 37.

***Columbia River Basin Fish and Wildlife Program*** (NWPPC, 2009)
The Draft Columbia River Basin Fish and Wildlife Program summarizes five key estuary strategies which have been suggested to potentially substantially improve survival benefits. This proposal is designed target the strategies identified in Section V.A, page 32, of the program.

- Habitat restoration work to reconnect ecosystem functions such as removal or lowering of dikes and levees that block access to habitat or installation of fish-friendly tide gates, protection or restoration of riparian areas and off-channel habitat, and removal of pile dikes
- Long-term effectiveness monitoring for various types of habitat restoration projects in the estuary
- Continued evaluation of salmon and steelhead migration and survival rates in the lower Columbia River, the estuary, and the marine environment
- Evaluation of the impact of flow regulation, dredging, and water quality on estuary-area habitat to better understand the relationship between estuary ecology and nearshore plume characteristics and salmon and steelhead productivity, abundance, and diversity
- Recognition and encouragement of continued partnerships in planning, monitoring, evaluating, and implementing activities in the estuary and lower Columbia River

CREST's methods, outlined in Section F, demonstrate its commitment to critical habitat restoration work, effectiveness monitoring, and partnerships.

## D. Relationships to other projects

CREST is proposing an objective of restoring estuary habitat critical to the recovery of Threatened/Endangered Columbia River and tributary salmon Evolutionarily Significant Units. CREST projects, to which Bonneville Power Administration has contributed, demonstrate work which has been accomplished and additionally the breadth of work necessary to substantively improve habitat. Several dike breach and habitat reconnection projects have been completed with a net gain of 86 acres and 18 miles in the past 6 years. Listed below is a representation of the major work accomplished by CREST and its partners in restoring historic functions, with a goal of restoring salmon habitat and reducing limiting factors' influence on salmon production:

***CREST Projects With Direct BPA Funding***

**Blind Slough Restoration Project Brownsmead, Oregon (Project # 2003– 015– 00)**
This project restored tidal connection between the Columbia River Estuary and 7 miles of Blind Slough in the community of Brownsmead, Oregon, coordinated with Clatsop County and several private landowners. CREST was the direct grant recipient from Bonneville Power

Administration. A portion of the funds supported effectiveness monitoring of water quality, fish use, and elevation monitoring. Results have informed management of restoration work in ongoing tidal reconnection projects in the Columbia River Estuary. Other partners included Clatsop Diking Improvement Company No. 7, Portland District Army Corps of Engineers, Nicolai-Wickiup Watershed Council, and multiple landowners. The project was completed in 2005.

**Gorley Springs Restoration Project (Project #2003- 013- 00)**
CREST partnered with the Gorley family, Wahkiakum County, and PNNL to propose a habitat-forming process project in the critical Gorley reach of the Grays River. This reach, and adjacent Crazy Johnson Creek (purchased by Columbia Land Trust in 2009), is one of three remaining natural Lower Columbia River Chum spawning locations. CREST installed a series of five engineered log jams, with one non-engineered jam, to increase structural complexity and reduce velocity within an area of approximately 15 acres. The work will facilitate habitat forming processes critical for spawning and egg incubation success. Other partners included Wahkiakum Community Foundation, Columbia Land Trust, Hancock Timber Resource Group, Lower Columbia Fish Recovery Board, Wahkiakum Conservation District, and Rayonier Western Forest Resources. The project was completed in 2009.

***BPA Sponsored Partner Projects***
**LCREP Columbia River and Estuary Habitat Restoration (Project #2003 – 11 – 00)**
This project is a multiple year contract that identifies, prioritizes, and monitoring habitat restoration projects in the lower 146 miles of the Columbia River and estuary. The Estuary Partnership uses a prioritized granting process in conjunction with a Science Workgroup to select projects for funding to subcontractors (see Section F, Task 1, below). CREST projects completed through this award include:

*South Slough Restoration Project Lewis & Clark, Oregon*
In coordination with the National Parks Service, CREST managed the reconnection of 45 acres of tidal wetlands with the lower Lewis and Clark River, a direct tributary into the Young Bay embayment and Lower Columbia Estuary. The project was funded in part by Bonneville Power Administration funding through the Lower Columbia River Estuary Partnership. Other projects completed on the Lewis and Clark River: the City of Seaside Dike Breaches Phases I and II and Vera Slough tide gate retrofit. Other partners included The Conservation Fund, The Nature Conservancy, Destination: The Pacific, LCREP/NOAA, and David Evans & Assoc. The project was completed in 2007.

*Wahkiakum CD Skamokawa Creek Dead Slough, Washington*
CREST partnered with the Wahkiakum Conservation District with funding from BPA to investigate water quality and options to open 2 miles of historic channel rearing habitat immediately adjacent to Skamokawa Creek and the mainstem Columbia River.

*City of Seaside Dike Breach, Lewis and Clark, Oregon*

CREST sponsored a two-stage dike breaching project. The City of Seaside Dike Breach was completed in 2005-06 with funding from the Estuary Partnership and BPA. The goal of the project was to restore connectivity to 25 acres of tidal wetland habitat adjacent to the mainstem Lewis and Clark River.

*Perkins Lane Culvert Replacement Warrenton, Oregon*
CREST, the North Coast Watershed Council, and the Skipanon Watershed Council collaborated to construct a passable culvert and remove invasive species in critical rearing habitat in the Skipanon watershed, a tributary to the Lower Columbia Estuary. Funding was provided by the Estuary Partnership and BPA.

**USFWS Preserve and Restore Columbia River Estuary (Project #2003 – 008 – 00)**
The project goals included acquiring or restoring 600 acres of tidal emergent marsh, swamp, slough, and riparian forest habitat in the Columbia Estuary to benefit salmon, Columbia white-tailed deer, and other wildlife. Elements included acquisition, fish and vegetation surveys, invasive weed removals, and restoration of tidal marsh. The project was accomplished with BPA, Corps, WDFW, and USFWS funding. This project demonstrates a large partnership working towards mainstem tidal wetland protection and restoration of critical habitats. CREST works closely with these partners in identification and implementation of estuary projects.

**WDFW Washington Estuary Accord Plan (Project #2009 – 016 – 00)**
The project goal is to plan and develop estuary habitat restoration projects listed in the Washington State Estuary MOA. Six projects have been identified in the preliminary stages of the project with a total of 974 acres to be restored if all projects are completed as proposed. Projects primarily consist of reconnection of historic habitats with active restoration occurring at some sites. Partners include LCFRB and Action Agencies. CREST is working with WDFW to identify and move projects towards implementation.

**WDFW BiOp Chum Restoration (Project #2008 – 710 – 00)**
The project goals are to assess priority chum salmon habitats, update population abundance, and develop enhancement programs to rebuild LCR chum populations. The Grays River and the Crazy Johnson and Gorley Springs area represent key natural spawning locations and conservation and trapping at the site represent features identified in the program. CREST is collaborating with WDFW scientists to identify historic chum habitat and improve existing habitat.

**NOAA Historic Habitat and Food-Web Linkages (Project #2003 – 10 – 00)**
The project was developed to reconstruct historic changes in rearing opportunities and food web linkages of salmon in the Columbia River estuary, evaluating the implications of these findings to river flows and restoration of estuarine habitats. This study provides a look into the value of quality and quantity of restored historic habitats, indicating what actions are most effective in improving survival for T/E species. CREST performed juvenile salmon data collection as a subcontractor for this project.

**PNNL Eelgrass Enhancement and Restoration (Project #2007 – 513 – 00)**
The project evaluated the potential to expand eelgrass habitat in the lower Columbia River estuary. Eelgrass restoration is proposed to enhance feeding, refuge, and rearing habitat for a number of fisheries, including juvenile Pacific salmon. Locating and testing suitable sites for eelgrass enhancement is proposed with experimental plantings in 100 m2 plots. Linked with off-channel habitat restoration, this project provides increased habitat variability for life histories and stages of juvenile salmonids. CREST will be working with PNNL scientists to determine the project's applicability for coordination with this proposal.

Table 2. Relationship to existing projects

| **Funding Source** | **Project #** | **Project Title** | **Relationship (brief)** |
|---|---|---|---|
| BPA | **2003– 015– 00** | **Blind Slough** | Project type representative of Lower Columbia and Estuary habitat availability projects |
| BPA | **2003 - 013- 00** | **Gorley Springs** | Project type representative of Lower Columbia tributary habitat availability/restoration projects |
| BPA | **2003– 008 – 00** | **Preserve and Restore Columbia** | Project type representative of Lower Columbia tributary habitat availability/restoration projects |
| BPA | **2009– 016 – 00** | **Washington Estuary Accord Plan** | Project type representative of Lower Columbia tributary habitat availability/restoration projects |
| BPA | **2008– 710 – 00** | **BiOp Chum Restoration** | Project type representative of direct salmon population data collection and enhancement. |
| BPA | **2003– 011 – 00** | **Columbia River and Estuary Habitat** | Project type representative of Lower Columbia tributary habitat availability/restoration projects |
| BPA | **2003 – 010 – 00** | **Historic Habitat and Food-Web Linkages** | Project type representative of historic condition modeling and hypothesis testing. |
| BPA | **2007 – 513 - 00** | **Eelgrass Enhancement** | Project type representative of Lower Columbia in-stream habitat availability restoration. |

**E. Project history (for ongoing projects; this includes projects that have been funded with non-BPA funds).**

Not applicable.

**F. Proposal biological/physical objectives, methods, work elements and metrics.**

As identified in Section B., the Lower Columbia Salmon Recovery 6-year Habitat Work Schedule and Lead Entity Habitat Strategy – Estuary Mainstem River Subbasin lists the following factors as limiting factors for juvenile salmon:

1. Availability of preferred habitat (juvenile rearing for within and out-of-basin subbasin populations)
2. Microdetritus-based food web, increase inputs of macrodetritus to increase productivity in estuary food web, such as was supported by the historic food web (juvenile rearing for within and out-of-basin subbasin populations)
3. Loss of habitat connectivity (juvenile rearing for within and out-of-basin subbasin populations)

CREST's objective is to restore estuary habitat critical to the recovery of Threatened/Endangered Columbia River and tributary salmon Evolutionarily Significant Units. We have identified four key tasks to accomplish this objective.

Specific biological objectives are as follows:

1. Increase shallow water peripheral and side channel habitat,
2. Protect existing rearing and spawning habitat
3. Restore connectivity between river and floodplain
4. Restore spawning/rearing habitat

***Methodology***

**Task 1: Identify and prioritize mainstem and tidal tributary projects in a scientific and systematic manner which will directly benefit ocean- and stream- type salmonids**

*Associated WE: 99, 114, 119, 185, 132 (described in detail below)*

There will be two levels of scientific review for all estuary habitat restoration projects identified and implemented under this proposal.

The Estuary Partnership established the Science Work Group, which brought together scientists and technical experts from a numerous fields to provide oversight and advice to the Estuary Partnership, and their partners such as CREST, regarding habitat restoration and monitoring in the lower river and estuary. CREST will utilize the Estuary Partnership's Science Work Group for the first level of scientific review for on-the-ground habitat projects funded through this proposal.

The Estuary Partnership's Science Work Group will review and rank the habitat projects, identified by CREST, by utilizing the Estuary Partnership's "Criteria for Identifying and Prioritizing Habitat Protection and Restoration Projects on the Lower Columbia River and Estuary." (Appendix A) The Estuary Partnership's criteria have been reviewed by the Council

and the ISRP and include ecosystem, implementation, and monitoring criteria. After the Science Work Group reviews and ranks the CREST habitat projects the Estuary Partnership will provide a written recommendation to BPA.

The second science review will be done by the Expert Regional Technical Group (ERTG), authorized under the 2008 BiOp (RPA 37). The ERTG will consider the Science Work Group's recommendation and use the approach originally applied in the 2008 BiOp, as well as all subsequent information on the relationship between actions, habitat and salmon productivity models developed through the FCRPS RM&E. This will produce an estimate for the change in overall estuary habitat and resultant change in ESU survival for all estuary habitat restoration projects they review.

The survival benefit assigned by ERTG will support and inform BPA's project selection decision. Habitat projects will be selected based on meeting BPA's survival benefit targets as required under the 2008 BiOp.

CREST has identified and is currently developing two estuary habitat restoration projects. In May 2009, the Estuary Partnership's Science Work Group reviewed and made a positive recommendation for implementation of these two habitat projects. The second scientific review will be done by the ERTG in the late winter/early spring of 2010. As discussed above, the ERTG will assign a survival benefit to each project which will support and inform BPA's project selection decision. Depending on the outcome of the completed scientific review and BPA's concurrence CREST could begin implementation of these two projects under this proposal in 2010.

**Task 2. Develop construction designs which follow Best Available Science and provide most benefit to species while cost-effective and constructible.**

*Associated WE: 99, 119, 175, 185, 132 (described in detail below)*

With funds provided through this proposal, CREST will complete project engineering designs. Projects will be moved through a streamlined design process to minimize design costs while maximizing product delivery. Final level of design will be determined by standard professional practice and CREST staff expertise. CREST's staff will utilize CREST contracting and administrative policy to complete bidding and contract administration.

CREST staff are well-trained professionals. CREST staff members engage in scientific discourse through regular engagement with agencies and professionals, and through conferences and training maintain a high level of professional competence.

CREST utilizes technical advisory committees, or TACs, to augment CREST's breadth of review and analysis, particularly during critical design phases. Review is typically conducted at 30/60/90/100% design levels. We work with Technical Advisory Committees to bring in agency,

engineers, and other members of the public so as to review designs early on in the process from multiple angles. TAC members are selected based on professional knowledge and/or regulatory region. We collaborate with other existing advisory groups when possible, such as with the Lower Columbia Fish Recovery Board's Grays River Working Group, or the Lower Columbia River Estuary Partnership's Science Work Group.

Permitting documentation will be prepared during the design phases and submitted as soon as feasible to the necessary permitting agencies and reviewing bodies. Permitting is typically submitted at 30% design. CREST permitting is streamlined and efficient and all permitting documents will be secured prior to starting work.

An element of design is collaborating with regional partners and utilizing existing metrics to develop individualized monitoring plans to evaluate effectiveness monitoring and project success to improve future restoration planning and implementation phases.

**Task 3. Implement 1-2 projects/phases per year, substantively improving available fish habitat in the lower Columbia River and Estuary.**

*Associated WE: 99, 119, 100, 29, 30, 33, 47, 180, 181, 184, 165, 132, 185 (described in detail below)*

With funds provided through this proposal, CREST will implement 1-2 projects per year in the Lower Columbia and Estuary. Projects will include combinations of the following specific activities as increasing in-stream complexity (enhance channel complexity), connecting channels (improved off-channel habitat and roughness), decommissioning roads (decrease sediment inputs), planting vegetation (increased floodplain connectivity and roughness), enhancing floodplains (riparian vegetation and overflow channel development), restoring wetlands (hydraulic connectivity and accessibility) and replacing impassable culverts with passable structures (access to habitat and improved macrodetritus transport). Limiting factors and prioritization of restoration habitat types are described in Section C. Project funds will be matched with non-BPA funds depending on the overall cost of the project and availability of funds within the annual contract. Past cost-share partners include NOAA, USFWS, WDFW, WDNR, OWEB, ODFW, ODEQ, SRFB, and the Estuary Partnership. Lower Columbia and estuary projects will be implemented systematically from bidding through site restoration.

CREST procedures follow federal and state contracting guidelines (Oregon and Washington), and all contract bidding procedures are compliant with these regulations. Once a contractor has been selected, we may require performance bonds depending on the value of the contract and such bonds are typical for most restoration projects

Construction is completed during appropriate regulated fish windows for in-water work. CREST employees are on-site during construction and maintain at least daily oversight of work activities,

as well as permit compliance oversight. Purchasing of materials is overseen or directly managed by CREST staff.

**Task 4: Monitor and evaluate project effectiveness, quantify benefits and identify areas for improvement.**

*Associated WE: 119, 157, 162, 159, 185, 132 (described in detail below)*

CREST proposes to use a portion of the funds to conduct effectiveness monitoring and evaluate the project's adherence to objectives. These actions will contribute to regional efforts to establish adaptive management principles. Further discussion of monitoring protocols is discussed in Section G, below.

**Work Elements for Tasks 1 – 4**

WE 99 –Outreach and Education
CREST will provide community outreach appropriate to the project type and complexity.

WE 114: Identify and Select Projects
CREST work with Estuary Partnership Science Work Group, BPA and ERTG as described in Task 1 to prioritize and select projects.

WE 119 – Manage and Administer Projects
CREST financial staff will administer financial and project management activities.

WE 100 – Construction Management
CREST project management staff will manage construction activities, including contract management, equipment purchasing, and construction oversight for salmon restoration projects.

WE 157 – Collect/Generate/Validate Field and Lab Data
CREST biological staff will collect pre- and post- project raw data on the restoration projects.

WE 162 – Analyze/Interpret Data
CREST biological staff develop hypotheses prior to conducting work, test hypotheses during work, analyze data, and compile and publish data.

WE 159 – Transfer/Consolidate Regionally Standardized Data
CREST biological staff will transfer data from field to office computers and upload to regional data distribution networks.

WE 175 – Produce Designs and/or Specification
CREST project management staff will publish an RFP, select an engineering consultant, contract with a consultant, and oversee design and coordination of design plans for restoration projects.

WE 29 – Increase Instream Habitat Complexity and Stabilization
Implementation projects may include an element of instream complexity for the direct outcome of a benefit to salmon.

WE 30 – Realign, Connect and/or Create Channel
Implementation projects may reconnect, realign, or create channels to increase available rearing or foraging habitat for salmon.

WE 33 – Decommission Road/Relocate Road
Implementation projects may include road decommissioning as an element of floodplain, riparian, or in-stream restoration.

WE 47 – Plant Vegetation
Implementation projects may include floodplain, riparian, or in-stream (i.e. eelgrass or other aquatic plant) vegetation plantings that benefit the overall ecosystem of the site and improve floodplain, riparian, or instream function.

WE 180 – Enhance Floodplain/Remove, Modify, Breach Dike
Implementation projects may include floodplain enhancements such as overflow channel development, excavation to reduce stranding, improved floodplain connectivity, and other elements which increase overall structural, and thus ecosystem, function.

WE 181 – Create, Restore, and/or Enhance Wetlands
Implementation projects may include activities which restore or enhance historic wetlands adjacent to or near the mainstem Lower Columbia and Estuary such that they may be utilized by rearing juveniles.

WE 184 – Install Fish Passage Structure
Implementation projects may include removing or replacing passage barriers such as roadways or culverts with fish passable structures. Such projects will increase overall habitat availability throughout

WE 165 – Produce Environmental Compliance Documentation
CREST project management staff will complete, submit, and obtain environmental compliance documents with all necessary federal, state, and local agencies, and in compliance with federal laws for each restoration project.

WE 132 – Produce (Annual) Progress Report
CREST staff will develop and complete an annual report in compliance with BPA standards and timelines for each restoration project.

WE 185 – Produce PISCES Status Reports

CREST staff will complete status reports for restoration projects in PISCES in a timely fashion.

## G. Monitoring and evaluation

The outcomes of each restoration project will be evaluated according to monitoring and assessment plans designed specifically for each project. CREST will lead monitoring efforts for tidal projects and support Pacific Northwest National Laboratory (PNNL) in their efforts at the Grays River Gorley Springs Restoration Project. Evaluations of most sites will be before/after studies; however, if is feasible a before/after control-impact design may be selected for some sites.

Monitoring design will be developed in order to quantify the cause-effect relationships among restoration activities and salmonid habitat benefits. Frameworks will be developed which focus on physical or biological metrics, or a combination that is directly linked to the proposed restoration activities. The expected habitat benefits have, or will be, restated in restoration research hypotheses. Monitoring variables and parameters for the Grays River Gorley Springs Restoration projects are described for addressing each restoration hypothesis (Hanrahan et al, 2008, Cameron et al, 2009).

The proposed project's effectiveness will be strengthened by the ongoing monitoring efforts of CREST and our partners. Simultaneous monitoring efforts, not included in this proposal, include water quality parameters at several other sites in and around the Columbia River Watershed; Chinook River, Lewis and Clark River, Skipanon River, Perkins Creek, South Slough, and Vera Slough. Fish community monitoring occurs or has occurred at all of these sites, as well as on the Youngs River, Cooperage Slough, the Gray's River, including Johnson Farm and Kandoll Farm dike breach restoration project sites, and Seal Slough. Additionally, we monitor physical indicators like landscape change photo-points and channel morphology cross-section surveys at sites like South Slough and Perkins Creek (Lewis and Clark National Historic Park). Our research partners include Pacific Northwest National Laboratory, University of Washington, Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, US Army Corps of Engineers, Lower Columbia River Estuary Partnership, National Oceanic and Atmospheric Administration, Columbia Land Trust, and North Coast Land Conservancy, PSU.

Monitoring plans will be submitted for review during the Estuary Partnership's Science Work Group and ERTG project review processes to allow adequate oversight of scientific goals and hypotheses as directly applied to each individual project.

## H. Facilities and equipment

CREST will require funds to maintain office and storage space for the employees and equipment utilized to implement this project. Specific equipment required to complete the contract also includes two (2) laptop computers with GIS software, a waterproof digital camera, surveying transom, tripod, and stadia rod, four sets of seining nets and miscellaneous fish sampling equipment, two multi-parameter water quality probes, laminator, desktop printer, and printing supplies.

## I. Literature Cited

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Levy, D. A., and Northcote, T. G. (1981). "Fish utilization of Fraser estuary marshes," *Estuaries* 4, 263.

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National Marine Fisheries Service. 2004. Biological Opinion, Federal Columbia River Power System. Portland, OR.

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Roegner et al. 2006. Monitoring Protocols for Salmon Habitat Restoration Projects in the Lower Columbia River Estuary. USACE Portland, OR.

Roni, P. (editor). 2005. Monitoring stream and watershed restoration. American Fisheries Society, Bethesda, MD.

## J. Key personnel

Micah Russell, CREST Director. Oversees staff activities, directs program within CREST and coordinates with partnering entities.
Paula Gerttula, CREST Financial Coordinator. Completes all financial transactions related to the project including receipts payable, receipts billable, and payroll.

Amy Ammer, CREST Habitat Restoration Specialist. Oversees project development, design, outreach, and implementation.
Madeline Dalton, CREST Watershed Coordinator. Oversees project development, design, outreach, and implementation.
April Cameron, CREST Biologist/Ecologist. Reviews environmental documents, develops hypothesis and implements monitoring strategies.
Tim Hanrahan, PNNL Senior Research Scientist. Develops and oversees Grays River Gorley Springs Restoration Project monitoring.

Resumes are provided in Appendix B.

## Appendix A. Science Work Group Criteria

### Lower Columbia River Estuary Partnership
### Criteria for Identifying and Prioritizing Habitat Protection and Restoration Projects on the Lower Columbia River and Estuary*

### Ecosystem Criteria

**1) Habitat Connectivity**
This criterion recognizes that habitat connectivity is a landscape level concept. It emphasizes linkages between habitat areas that provide a variety of functions for species at various stages of their life cycle and that gradual alteration of landscapes through natural succession and retrogression allow species that require a variety of habitat components to disperse and survive. In the Lower Columbia, historic changes have limited or cut off species' access to resources needed for their development. Specific emphasis on species with narrow ecological requirements should be considered. Upland habitat areas adjacent to drainage ways, existing protected/restored sites, and areas offering diverse habitat types, function, and successional stages should also be considered.

**2) Areas of Historic Habitat Type Loss**
Land use activities such as diking, filling, and shoreline hardening have removed many of the shallow, peripheral wetlands along the Lower Columbia, isolating the river from its floodplain. This criterion recognizes that historic wetland types such as emergent and forested wetlands that are particularly important for salmonids and a variety of bird species, have been greatly diminished. These habitats promote networks of physical complexity such as shallow, dendritic channels and backwater sloughs.

**3) Improvement in Ecosystem Function**
This criterion acknowledges that some restoration actions can result in greater enhancement of ecosystem functions than others. This criterion emphasizes that location of a project may in some cases be more important than size of the project.

**4) Adequate Size and Shape**
Size refers to reach length and the size of the potential habitat within a reach. In general, larger size enhances habitat stability, increases the number of species that can potentially use the site, makes it easier to find by migratory species, and increases within-habitat complexity.

**5) Level of Complexity**
This criterion refers to the number and interspersion of different types of habitats within a given restoration reach or area. As the number of habitats increase, so do the number of species that can occupy an area, and the number of functions supported by an area. Higher complexity potentially results in higher biodiversity.

It is recognized that some restoration efforts, such as a chum channel, may not strive for habitat complexity.

**6) Accessibility For Target Species**
Accessibility refers to unencumbered access by Columbia River estuary habitat-dependent aquatic and terrestrial species. Projects that allow or enhance access of these species to important habitats would potentially enhance the feeding, rearing, and refuge functions of the site are preferred. This criterion acknowledges the need to restore habitat for those threatened and endangered species, both aquatic and terrestrial, whose populations are at precariously low numbers and who might benefit
from improved near-shore habitat conditions.

## Implementation Criteria

**1) Use Natural Processes to Restore and Maintain Structure over Habitat Creation**
This criterion recognizes that restoration measures should attempt to re-establish the dynamics of estuarine hydrology, sedimentology, geomorphology and other habitat-forming processes that naturally create and maintain habitat, rather than implanting habitat structures at inappropriate or unsustainable locations. Restoration tasks should initiate or accelerate natural processes. Nearly all manifestations of restoration are accomplished by these processes and not by the direct artifice of the restoration. Complex engineering manipulations to create new habitats or to enhance existing habitats can introduce levels of uncertainty about the ecological impacts of such actions and/or the application of the results to other locations. Restoration methods such as dike, levee, and tide gate removal should receive first priority for restoration since historic habitat features of the surrounding area may still be intact. Areas that require minor alterations and maximize ecosystem function and processes offer a higher certainty of outcomes and may be more cost-effective and self-sustaining. Weight should be given to tidegate improvements with access to quality stream channels where dike breaching is not an option. For purposes of setting natural processes rapidly in motion some artificial manipulation is required, the best ecological engineering practices should be applied in implementing restoration projects, using
all available ecological knowledge and maximizing the use of natural processes to achieve goals.

**2) Community Support and Participation**
Developing partnerships among communities, organizations, individuals and agencies is a critical element to long term estuary restoration success. The following are considerations regarding this criterion:

A. Choose projects with local support that are popular and visible, and have political and environmental education components.

B. Visible, local partners (i.e., those that are technically capable/and can facilitate discussions between local project sponsors and Federal/State agency representatives) are needed to build community support for habitat restoration and protection projects

C. Select habitat restoration and protection projects that are linked to community/watershed councils' goals and objectives

D. Look for synergy with existing projects, spatially and biologically, and those with community support and ecological output. That involvement requires creativity and flexibility on the part of all involved to look for ecological, social, and economics incentives when identifying potential projects

E. Depending on the stakeholder and/or landowner, social and economic considerations may be as important as environmental considerations when choosing potential habitat restoration and protection projects

**3) Potential for Self Maintenance and Certainty of Success**

Self-maintenance addresses the ability of a site to persist and evolve toward a natural (historical) habitat condition without significant on-going human intervention. Conditions for controlling factors in the reach and in the management unit must be appropriately developed and maintained. Self-maintenance means that the habitat can persist and develop under natural climatic variation, and that the system has a natural degree of resilience to natural perturbations. This criterion relies on needing to know the historical conditions and factors attributed to the current conditions.

**4) Potential for Improvement in Ecosystem Function While Avoiding Impacts to Healthy and Functioning Ecosystems**

This criterion observes that at times there are competing restoration goals, and while attempting to improve some ecosystem functions, others may be impaired or lost. This criteria stresses that restoration actions should achieve proposed benefits while avoiding the long term or permanent degradation of other ecological functions of natural habitats or broader ecosystems. Restoration actions should avoid replacing one naturally functioning habitat with another, even if the replacement is perceived to benefit salmon. In particular, activities that further reduce the estuarine tidal prism or impair other large-scale estuarine processes (e.g., circulation, salinity intrusion) or attributes should be avoided.

**5) Avoid Sites Where Irreversible Change Has Occurred**

Many aquatic ecosystems within the Estuary have been so heavily modified that the fundamental processes responsible for historic conditions have been significantly altered, in some cases irrevocably. In the Lower Columbia River, freshwater volume has been reduced or the natural flow cycle altered, inputs of

sediments and detritus have changed, and tidal flow has been compromised. In some cases, restoration of historic conditions in their original location or state is simply no longer attainable without restoration of historic processes.

Reconstructing the historical river, tidal floodplain and estuarine structure does not necessarily guarantee restoration success; it only decreases uncertainty. Historic templates often provide the framework for restoration goals, as well as a perspective on how ecosystems have been incrementally degraded. At the minimum, the modified capacities of natural processes to support restoring habitats under present conditions must be well understood to develop realistic restoration goals. In some instances, ecological engineering may be necessary to compensate for diminished processes, but such approaches should be used to initiate self-sustaining restoration rather than as an artificial “fix” requiring long-term maintenance.

**6) Capacity of Sponsor/Partnership**
Restoration projects are often complex and costly. To effectively implement and monitor a restoration project over the long term it is necessary that the sponsor and project partners have the capacity to successfully manage the project and achieve success. This criterion will consider an organization’s record of project management, its technical expertise, and financial stability.

**7) Project Context Within Broader Management and Planning Objectives**
This criterion recognizes that within the Lower Columbia system there are a number of management plans and objectives that articulate specific restoration and conservation recommendations. Some of these include; Northwest Power and Conservation Council’s Subbasin Plans, Lower Columbia Fish Recovery Board priorities, Oregon’s Coastal and Estuarine Land Conservation Plan, North American Waterfowl Management Plan, and the Columbia Land Trust’s Land Conservation Priorities. In evaluating proposed restoration projects, considerations should be made to coordinate with these initiatives to minimize duplication of services or contradictory endeavors.

## Monitoring Criteria

**1) Monitoring and Evaluation with Relationship to Stated Goals and Objectives**
Monitoring and adaptive management are essential components of restoration and habitat management. Restoration activities should be placed in the context of an experimental design strategy. Metrics should be developed that enhance an understanding of the connection between habitat variables and species’ needs. Restoration designs should be monitored and, based on the concept of adaptive management, altered if necessary to achieve desired endpoints and to insure that local projects are self-sustaining. Information already available on limiting factors and properly functioning conditions should be included in the site

selection and project design. The monitoring information must span both water quality and physical habitat parameters. Determining an appropriate scale is a critical component of developing a monitoring and effectiveness criteria. Goals and biological objectives for restoration should be clearly stated, site specific, measurable and long-term, in many cases greater than 20 years. Performance criteria should derive directly from these goals, and should include both functional and structural elements and be linked to suitable, local reference ("target") habitats. Scientific monitoring based on the established performance criteria is essential to improve restoration techniques and to achieve estuarine restoration goals.

Performance criteria should indicate whether restoration is progressing as intended and how the project may be altered or redesigned to better achieve project goals.

**2) Linkages to Reference Site(s)**
Determining the effectiveness of restoration activities requires comparison to relatively unaltered reference habitats in close proximity to serve as a "control" for evaluating habitat change. This allows for monitoring the growth, species composition, successional stage and time period of the restoration site in comparison to the reference site and assist in developing performance standards and benchmarks for restoration activities in the estuary. Choosing sites that include an experimental restoration design tied to effectiveness monitoring helps promote a better understanding of the relationship between habitat restoration activities and species response and performance resulting from the restoration activity.

**3) Transferability of Results**
Projects should be designed as explicit tests of restoration actions that will be evaluated, and, if effective, can be scaled up and applied systematically across the landscape. Restoration results should be evaluated uniformly at individual sites and comprehensively at landscape and ecosystem scales to assess whether the cumulative results of local restoration actions achieve overall recovery goals. The results of monitoring can provide the foundation for more effective restoration methods in
future projects.

*Estuary Partnership criteria have been previously reviewed by ISRP.

## Appendix B. Key Personnel Resumes

# Micah Russell

750 Commercial St, Rm 205 Astoria, OR 97103 mrussell@columbiaestuary.org
(503) 325 – 0435 www.columbiaestuary.org

**Education:**

**M.S. Oceanography & Coastal Science**
***(Estuarine Ecology and Fisheries emphasis)***
*Louisiana State University, Baton Rouge, Louisiana. 2004.*
**B.S. Environmental Biology**
*Pacific University, Forest Grove, Oregon. 2001.*

**Work Experience:**

**Director [02/08 – present]**
**Biologist / Ecologist [03/07 – 01/08]**
***Columbia River Estuary Study Taskforce (CREST)*, Astoria, Oregon**
*Duties:*
Administers and directs the activities of CREST -- environmental and resource planning, habitat restoration, and ecosystem monitoring -- on behalf of CREST members (local ports, cities and counties) and other partners. Responsible for ensuring quality services and project management, budgeting, development and facilitation of contracts and grants, interfacing with the board and the public, and organizational strategy and growth. Networks and collaborates extensively with government agencies and non-profit groups to engage pro-actively in regional planning and restoration.

**Part-time Instructor (Oceanography): [01/07 – current]]**
***Tillamook Bay Community College*, Tillamook, Oregon**
*Duties:*
Teaches a survey of oceanography (lecture and laboratory) to a diverse group of college students, with an emphasis on understanding the basic principles of geology, chemistry, biology, physics, history, and conservation as they relate to marine science.

**Natural Resource Specialist 1 (Recreation): [11/06 – 03/07]**
***Oregon Department of Forestry,* Tillamook, Oregon.**
*Duties:*
Contracted as part of a broad environmental assessment of the Wilson River watershed to inventory and map all dispersed recreational campsites for inclusion in a GIS-based watershed management plan. Collected data and prioritized sites that were heavily impacted, contributed to lower water quality, and degraded salmon habitat. Made recommendations for road closures or other management strategies and coordinated with stakeholders to write work contracts.

**Team Leader [06/05 - 08/05]**
***Hawaii Youth Conservation Corp.,* Maui, Hawaii.**
*Duties:*
Supervised a crew of high-school youth in a variety of conservation projects with the purpose of introducing young people to natural resource management. Projects included: invasive plant species removal, native vegetation planting, irrigation installation, erosion control installation, fence construction and removal, feral ungulate snaring, and archaeological site preservation. In charge of logistics, safety, and transportation, while working each week with a different state / federal agency or local conservation group in a different type of wilderness environment.

**Oceanography Graduate Researcher [08/02 - 12/04]**
***Louisiana State University Coastal Fisheries Institute,* Baton Rouge, Louisiana.**
*Duties:*
Performed field and laboratory research for a master's thesis in oceanography and fisheries science involving the essential fisheries habitat (EFH) requirements of commercially viable fish in Louisiana estuaries. Biological and environmental data were compiled and analyzed using a variety of statistical computer packages, and subsequently incorporated into scientific reports and a thesis. This project required cooperation between state officials, university colleagues and faculty, and local fishermen. Results were presented orally to all involved parties and the public.

# Amy Ammer

750 Commercial St, Rm 205 Astoria, OR 97103 aammer@columbiaestuary.org
(503) 325 – 0435 www.columbiaestuary.org

## Education

*Oregon State University*
**Bachelor's Degree – Natural Resources with Policy Emphasis**
Relevant Coursework: Management Principles of Salmon in the Northwest, Fish and Wildlife Conservation, Ecological Restoration, Riparian Ecology and Management, Desert Watershed Management (water management principles), Geographical Information Systems in Natural Resources, Natural Resource Decision Making, Environmental Politics and Policy, Rangeland Management Planning, Resource Economics, Statistics, World Soil Resources, Leadership Development, & US and Natural Resource Law

*Western Washington University*
**Bachelor's Degree – English Literature with Geology Minor**
Relevant Coursework: Technical Writing, Advanced Technical Writing, Writing and Critical Inquiry, Newswriting, Physical Geology, Historic Geology, Earthquake Geology, Geomorphology, Volcanology, Chemistry, & Anthropology

## Work Experience

**Habitat Restoration Specialist**
Columbia River Estuary Study Taskforce
October 2007 - present
Responsibilities:
- All project management duties, including community outreach, volunteer coordination, and logistics for three habitat restoration projects.
- Specializing in organization of complex, large scale projects with budgets $500,000 and larger.
- Recognized for ability to network within the community and create effective links with community stakeholders.

**Planner**
Pacific County, Washington
May 2006 – October 2007
Responsibilities:
- Review 30-40 Pacific County planning applications for small to moderate sized projects.
- Conduct primary planning duties for City of Ilwaco including commercial, residential, and environmental reviews.
- Provide quality assistance to the public, present county ordinances to audiences when requested, provide first contact for many landowners to County process.
- Highly successful in developing good working relationships with all demographics of the public served.

**Office Assistant 3**
Naselle Youth Camp
*September 2003 – April 2006*
40 hours per week
Responsibilities:
- Provided clerical support for two living units in a medium-security juvenile facility. Total filing and support duties included 60 + residents and 10 – 12 staff.
- Coordinated transportation services for the facility with the state juvenile transportation system at Echo Glenn Children's Center. Received intake information for all juveniles transferred to the facility.
- Collated the Superintendent's Report from supervisor and area reporting. Input commissary inventory data for commodities received by living units.

# Madeline Dalton

750 Commercial St, Rm 205 Astoria, OR 97103 mdalton@columbiaestuary.org
(503) 325 – 0435 www.columbiaestuary.org

## Education

**University of Wisconsin- River Falls**

- Bachelor of Science, Environmental Science
- Bachelor of Arts, Spanish and International Studies minor

## Work Experience

**Watershed Council Coordinator**
**North Coast Watershed Association/ CREST**
2009- Present

- Develop and implement watershed programs and projects
- Compose and develop grant proposals and work plans
- Coordinate and manage ecological restoration and monitoring and research projects
- Manage fiscal grant accounts
- Prepare technical reports
- Facilitate monthly watershed council meetings
- Create community partnerships and recruit volunteers
- Supervise support staff
- Collaborate communication among project partners and stakeholders

**Watershed Coordinator**
**Shakopee Creek Headwaters Project**
2007- 2009

- Conducted lake and stream water quality monitoring and data collecting throughout the Shakopee Creek Watershed
- Analyzed, interpreted, and compiled water quality data
- Performed grant budget tracking and reporting
- Composed grant proposals and work plans
- Facilitated monthly meetings for the Shakopee Creek Advisory Committee
- Promoted Best Management Practices through various educational outreach programs and media outlets such as radio, newspaper ads, and informational mailings
- Assisted in the planning and installation of Best Management Practices

**Summer Intern**
**Tonka Equipment Company**
2006

- Worked as an assistant technician on a water quality pilot experiment for an oil reclamation site in Gaylord, MI
- Analyzed data collected at municipal water facilities and pilot studies
- Prepared pilot trailers for off-site water filtration study trials
- Researched and led meetings for proper disposal of laboratory chemicals
- Researched and prepared office memos on the use of filtration techniques for Puerto Rican surface water, and substituting Potassium Chloride for Sodium Chloride for drinking water filtration plants
- Developed a new organization system for a newly remodeled, on-site chemistry lab

# Paula Gerttula

750 Commercial St, Rm 205 Astoria, OR 97103 pgerttula@columbiaestuary.org
(503) 325 – 0435 www.columbiaestuary.org

## Summary of Qualifications

Expertise includes over 30 years of financial management in local governments, non-profits, and the private sector. Extensive experience in administration, customer service and purchasing.

## Work Experience

**Financial Coordinator**
Columbia River Estuary Study Taskforce
December 2003 – Present
Responsibilities:

- Administer all grant and contract files
- Track grant and contract budgets and invoice funders
- Manage an annual budget in excess of $1,500,000
- Responsible for the day to day financial management

**Grant Administrator**
Sea Resources
May 2000 – December 2003
Responsibilities:

- Administer all grant and contract files
- Manage all financial duties
- Office management

**Administrative Assistant**
Columbia River Estuary Study Taskforce
April 1997 – May 2000
Responsibilities:

- Bookkeeping, including accounts payable and accounts receivable
- Office management
- Library management

## Significant Project History

**EPA Brownfields Revolving Loan Fund Grant - $1,000,000**

Administered the financial part of this project for the five year period of the grant. In addition to managing the financial part of this project I also helped with the quarterly interim reports and completed all of the final reports.

**Fort Clatsop Bridge Project - $706,320**

Administered the financial part of this five funder project that took place in the summer of 2007. Coordinated the completion of this project with the Consultant hired by the construction company doing the major part of the work when the project manager left CREST for a position at another organization.

**Grays River/Gorley Springs Restoration Project- $761,381**

To date I have administered the financial aspect of three grants all funded through BPA for this project.

**Blind Slough Restoration Project - $423,225**

Managed the financial function of this five grant/four funder project that was completed between the years of 2004 – 2006.

**Big Creek Restoration Project - $490,590**

Administered the financial part of this project which was comprised of five funders and eight grants from 2005 to 2009.

**Timothy P. Hanrahan**
Senior Research Scientist
Battelle, Pacific Northwest Division
Pacific Northwest National Laboratory (PNNL)

P.O. Box 999 MS K6-85
Richland, WA 99354
Tel. 509 371 7182
tim.hanrahan@pnl.gov

## Employment

Dr. Hanrahan has been a research scientist at PNNL since 1993. In addition to his employment at PNNL, he is an adjunct faculty member in the School of Earth and Environmental Sciences at Washington State University where he teaches *Fundamentals of Environmental Hydrology*.

## Education

**Ph.D.**, Environmental Science (fluvial hydrology), Washington State University, Pullman, WA, 2006
**M.S.**, Natural Resource Sciences, Washington State University, Pullman, WA, 1993
**B.S.**, General Sciences, University of Wisconsin, Madison, WI, 1989

## Research Interests and Experience

Professional interests and research focus on large river processes, particularly hydrology, hydraulics and water quality, and associated interactions with aquatic organisms and their habitats. Current and recent research includes predicting and assessing aquatic habitat effects resulting from climate change, fluctuating large river flow regimes and hydroelectric dam modifications. Areas of expertise include river hydraulics and sediment transport, assessment and modeling of aquatic habitats, and evaluation of groundwater – surface water interactions in rivers.

## Select publications

Hanrahan, T. P. 2008. Effects of river discharge on hyporheic exchange flows in salmon spawning areas of a large gravel-bed river. Hydrological Processes 22(1): 127-141, DOI: 10.1002/hyp.6605.

Geist, D. R., C. J. Murray, T. P. Hanrahan, and Y. Xie. 2008. A model of the effects of flow fluctations on fall Chinook salmon spawning habitat availability in the Columbia River. North American Journal of Fisheries Management 28: 1911-1927, DOI: 10.1577/M07-074.1.

Geist, D. R., E. V. Arntzen, C. J. Murray, K. E. McGrath, Y. J. Bott, and T. P. Hanrahan. 2008. Influence of river level on temperature and hydraulic gradients in chum and fall Chinook salmon spawning areas downstream of Bonneville Dam, Columbia River. North American Journal of Fisheries Management 27: 30-41, DOI: 10.1577/M07-009.1.

Hanrahan, T. P. 2007. Large-scale spatial variability of riverbed temperature gradients in Snake River fall Chinook salmon spawning areas. River Research and Applications 23: 323-341, DOI: 10.1002/rra.982.

Hanrahan, T. P. 2007. Bedform morphology of salmon spawning areas in a large gravel-bed river. Geomorphology 86: 529–536, DOI: 10.1016/j.geomorph.2006.09.017.

Hanrahan, T. P., D. R. Geist, and E. V. Arntzen. 2005. Habitat quality of historic Snake River fall Chinook salmon spawning locations and implications for incubation survival. Part 1: Substrate quality. River Research and Applications 21 (5): 455-467.

Hanrahan, T. P., D. D. Dauble, and D. R. Geist. 2004. An estimate of chinook salmon spawning habitat and redd capacity upstream of a migration barrier in the upper Columbia River. Canadian Journal of Fisheries and Aquatic Sciences 61: 23-33.

## Professional Service

- Advisor and preceptor to graduate and undergraduate student interns at the Pacific Northwest National Laboratory
- Advisor to graduate students at Washington State University and University of British Columbia
- Reviewer for proposals submitted to the National Institutes for Water Resources 303(g) program administered for the U. S. Geological Survey
- Reviewer for proposals submitted to the CALFED Bay-Delta Science Program administered by the State of California and the U.S. Department of Interior
- Reviewer for manuscripts submitted to the journals *Advances in Water Research, Hydrogeology Journal, River Research and Applications, Canadian Journal of Fisheries and Aquatic Sciences, New Zealand Journal of Marine and Freshwater Research, Current Zoology, North American Journal of Fisheries Management*
- Judge for Outstanding Student Paper Awards, Hydrology Section of American Geophysical Union

## Professional Affiliations and Recognition

Member of the American Geophysical Union (Hydrology Section)
Member of the American Fisheries Society

# April Cameron

750 Commercial St, Rm 205 Astoria, OR 97103 acameron@columbiaestuary.org
(503) 325 – 0435 www.columbiaestuary.org

## Education

*Oregon State University* - 1999
**BS Biology, Option Marine Biology**
**BA International Studies, Minor French**
Thesis: Temporal and Spatial Variability in the Abundance of Marine Larvae on the Oregon Coast

## Work Experience

**Biologist/Ecologist**
Columbia River Estuary Study Taskforce
2/08 – present
Responsibilities:

- Coordinates biological and ecological research activities, often in collaboration with other agencies.
- Monitors research along the Columbia River's tributaries, where dikes have been breached or tide-gates removed, for example, and vegetation rehabilitated, to restore tidal connectivity and habitat to their natural state
- Collects data on salmonids and other fish communities, water quality, prey, channel morphology, and vegetation, for example, to discern the effectiveness of restorative efforts.
- Obtains scientific collection permits, applies for grants, writes reports for various funding agencies, and processes data and lab samples.

**Fisheries Biologist**
PSMFC /NOAA – Fish Ecology Division, Pt. Adams Biological Field Station,
5/02 – 2/08
Responsibilities:

- Used of pair-trawls in the upper Columbia River estuary (lower estuary in previous years) to detect PIT-tagged juvenile salmonids for a multi-year study to estimate survival through the hydropower system, and understand migration timing and behavior, for transported versus in-river migrants.
- Routinely run a pontoon barge equipped with scientific gear for daily data collection, to our sample site and back.
- Processed and analyzed all of the trawl data, interpret and synthesize the results, and prepared reports and presentations for funding agencies.
- Applied for scientific collections permits from state and federal entities, and prepare associated annual reports.

**Research Assistant**
OSU – Lubechenco/Menge Invertebrate Zoology Lab – Department of Zoology
1998
Responsibilities

- Research focused on factors affecting community structure in the Rocky Intertidal
- Monitored barnacle and mussel larval supplies and recruitment, quantified mussel and algal transects, maintained herbivore and predator exclusion experiments, and collected water samples for phytoplankton productivity analyses, along Oregon's rocky intertidal.

## Work Related Qualifications

AFEP review, Estuarine Detections of PIT-tagged salmonids presentation, co-presenter 2005, presenter 2006, alternate presenter 2007
Westport GED group, Estuarine Detections of PIT-tagged salmonids presentation and field trip with pair-trawl project, 2006and 2007
Warrenton High School, Estuarine Detections of PIT-tagged salmonids presentation, 2006 and 2007
NWFSC Training: OSHA Hazardous Communication and DOT Material Transport, 2005; Blood borne Pathogen Training, 2006
40-hour "Vessel Operations Training Program", 8-hour "Oregon Boater Education Certification", CCC, Maritime Science Department, 2004
First Aid Basics, CPR and AED, American Red Cross, 2006 (expires 2009)
Open Water Diver Certification, OSU, 1999