

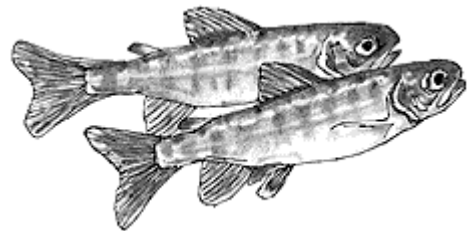
Action Plan to Implement the Federal Columbia River Power System Biological Opinion in the Columbia River Estuary

FINAL DRAFT



Prepared for:
NOAA Fisheries

Prepared by:
Bonneville Power Administration
U.S. Army Corps of Engineers, Portland District



September 30, 2003

Acronyms and Abbreviations

AA	Action Agencies
AFEP	Anadromous Fish Evaluation Program
BiOp	Biological Opinion
BPA	Bonneville Power Administration
CRFM	Columbia River Fish Mitigation
Corps	U.S. Army Corps of Engineers
ESA	Endangered Species Act
FCRPS	Federal Columbia River Power System
FY	fiscal year
GI	General Investigations
LCFRB	Lower Columbia Fish Recovery Board
LCREP	Lower Columbia River Estuary Partnership
NMFS	National Marine Fisheries Service (NOAA Fisheries)
NOAA	National Oceanic & Atmospheric Administration
NPCC	Northwest Power Planning and Conservation Council
RPA	Reasonable and Prudent Alternative
RM&E	Research, Monitoring, and Evaluation
RM	river mile(s)
SCT	System Configuration Team
WRDA	Water Resources Development Act

Preface

The Fish and Wildlife Division of the Bonneville Power Administration and the U. S. Army Corps of Engineers (known collectively as the Action Agencies for this plan) prepared this Action Plan in response to Reasonable and Prudent Alternative Action 158 of the National Marine Fisheries Service's (NOAA Fisheries) *Biological Opinion* (BiOp) on operation of the Federal Columbia River Power System, dated December 21, 2000. The intent is to develop a useful Action Plan that articulates the Action Agencies' completed, ongoing, and planned work that implements the BiOp in the Columbia River Estuary, while fulfilling Reasonable and Prudent Alternative Action 158. The actions outlined in this document are collectively referred to as the Action Agencies' "Estuary Program."

For the purposes of this document, the Columbia River Estuary includes the tidally influenced reach from the mouth to Bonneville Dam, as well as the near shore Columbia River plume. The plume is the near-shore ocean affected by the fresh water of the Columbia River. Although the Action Plan focuses on the actions of the Bonneville Power Administration and Corps of Engineers, it is anticipated that the audience will extend to other entities responsible for, interested in, or affected by actions relating to ecological restoration in the Columbia River Estuary, including federal, state, and local agencies, Tribes, non-governmental organizations, industry, and the public. The time frames to apply this plan extend from the immediate (2003) to the near-term (2004-2005) and to the long-term (2006 and beyond). It also is anticipated that the Action Plan will be revised as progress is made to the implement the applicable Reasonable and Prudent Alternative actions as defined in the BiOp.

A core team of staff from the Bonneville Power Administration (J. Wilcox), Corps of Engineers (T. Berquam, B. Ebberts), Pacific Northwest National Laboratories (G. Johnson), and NOAA Fisheries (C. Tortorici) developed the Action Plan based on the agencies' current, planned, and future work to meet the Reasonable and Prudent Alternatives that relate to the Columbia River Estuary.

Contents

Acronyms and Abbreviations

Preface

- 1. INTRODUCTION 1
- 2. ACTION PLAN ELEMENTS 4
 - 2.1 Element 1 – Planning and Investigations..... 5
 - 2.1.1 RPA Action 154..... 7
 - 2.1.2 RPA Action 156..... 8
 - 2.1.3 RPA Action 158..... 8
 - 2.1.4 RPA Action 159..... 9
 - 2.2 Element 2 – Modeling 11
 - 2.2.1 RPA Action 162..... 11
 - 2.2.2 RPA Action 194..... 12
 - 2.3 Element 3 – Habitat Restoration..... 13
 - 2.3.1 RPA Action 157..... 13
 - 2.3.2 RPA Action 160..... 14
 - 2.4 Element 4 – Research, Monitoring and Evaluation 15
 - 2.4.1 RPA Action 161..... 16
 - 2.4.2 RPA Action 195..... 17
 - 2.4.3 RPA Actions 196 and 197..... 18
- 3. ACTION AGENCY IMPLEMENTATION 22
 - 3.1 Programs..... 22
 - 3.1.1 Bonneville Power Administration..... 22
 - 3.1.2 Corps of Engineers..... 23
 - 3.2 Limitations of Action Agency Programs 24
 - 3.2.1 Bonneville Power Administration..... 24
 - 3.2.2 Corps of Engineers..... 25
 - 3.3 Linkages between Programs and Other Entities 25
 - 3.4 Updating the Action Plan 25

Appendix A – Corps Programs and Funding

Appendix B – Related Programs

Appendix C – Issue Paper River Mile 46

1. INTRODUCTION

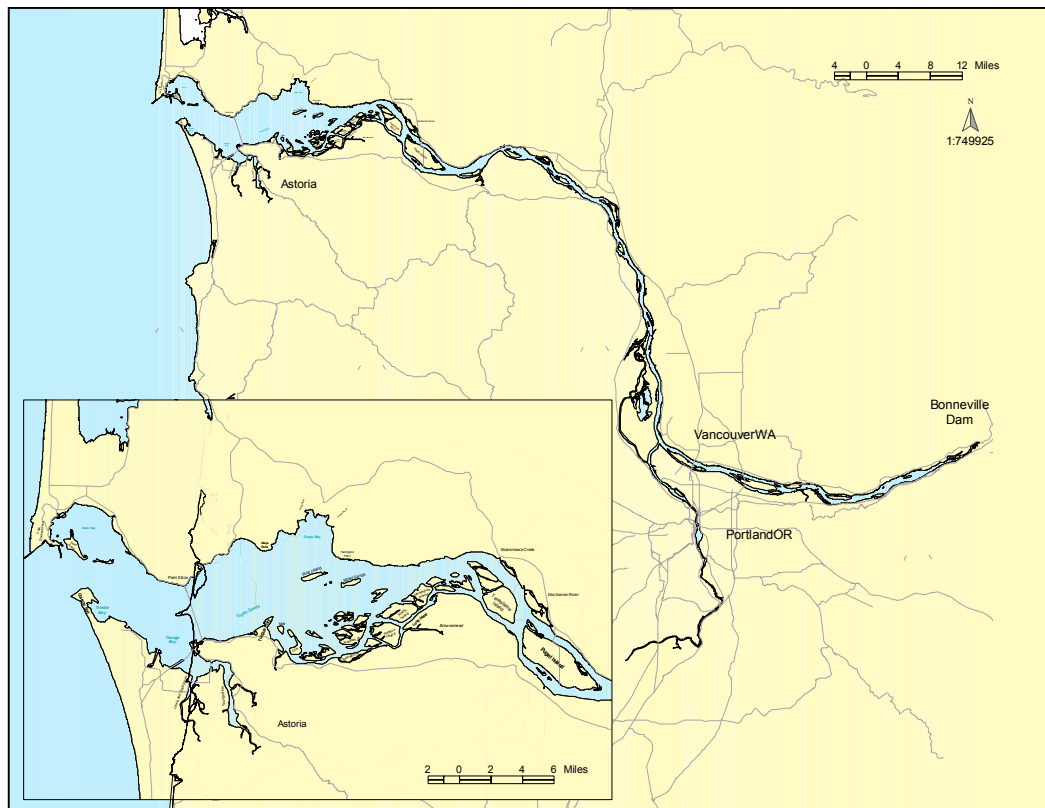
The Bonneville Power Administration (BPA) and the U.S. Army Corps of Engineers (Corps) have developed this Action Plan to implement the Federal Columbia River Power System (FCRPS) *Biological Opinion* (BiOp dated December 21, 2000) in consultation with the National Marine Fisheries Service (NOAA Fisheries). The BPA and the Corps are known collectively as the Action Agencies for this Action Plan. The Bureau of Reclamation also is an Action Agency for the BiOp but is not involved with actions in the Columbia River Estuary. This Action Plan specifically addresses Reasonable and Prudent Alternative (RPA) Action 158, which states:

“During 2001, the Corps and BPA shall seek funding and develop an action plan to rapidly inventory estuarine habitat, model physical and biological features of the historical lower river and estuary, identify limiting biological and physical factors in the estuary, identify impacts of the FCRPS system on habitat and listed salmon in the estuary relative to other factors, and develop criteria for estuarine habitat restoration.”

This Action Plan describes the work completed, ongoing, and planned by the BPA and the Corps related to the Columbia River Estuary, that fulfills RPA Action 158. The time frames to apply to this Action Plan extend from the immediate (2003) to the near-term (2004-2005) and to the long-term (2006 and beyond). Also, the anticipated audience includes all entities responsible for, interested in, or affected by actions relating to ecological restoration in the Columbia River Estuary.

For the purposes of this Action Plan, the Columbia River Estuary is defined as the mainstem Columbia River from the mouth to Bonneville Dam, a distance of approximately 146 miles.

Figure 1. Columbia River Estuary study area from the mouth to Bonneville Dam.



The goal of the Action Agencies' Estuary Program is to contribute to the increased annual population growth of listed Columbia River Basin salmonid species. The goal of this Action Plan is to articulate the Estuary Program responding to the FCRPS NOAA BiOp as applied to the Columbia River Estuary.

The RPA Action 158 is related to the other Estuary RPA actions, including those for research and modeling and those for developing and implementing restoration projects (Actions 159 and 160). This Action Plan is an overall management strategy and approach for how the Action Agencies will implement the BiOp RPA actions that relate to the Columbia River Estuary. The Action Plan addresses the individual actions *directly applicable* to the Estuary; these actions include 154, 156-162, 186-187, and 194-197. It outlines the actions completed, ongoing, or planned for executing each RPA action and how they relate to each other. The Action Plan also identifies limitations or challenges to implementing the RPA actions, as appropriate, although these issues may need to be elevated to the Federal Executives for resolution.

The Action Plan is one of several vehicles for the Action Agencies and NOAA Fisheries to clearly articulate expectations and evaluate the scope of the proposed work on the individual RPA actions. While the Action Plan will evolve over time, it will attempt to capture enough information to reach agreement on the scope of actions required to meet each action. The Action Plan supplements the annual implementation plans, progress reports, and check-ins called for in the BiOp, and serves as a tool to assist in the evaluation of the progress of the Estuary program as a whole. The Action Plan will also serve as a management tool for Action Agency staff in planning and implementing the Estuary Program as well as fulfillment of RPA Action 158. Also, the Action Plan is a tool for outlining potential issues relating to implementation of the RPA actions by the Action Agencies, and is written to inform all participating organizations of the actions being planned or untaken by the Action Agencies. This allows complementary actions to avoid duplication of work and may be useful for other entities in planning-related actions.

Although there is no plan for a formal public review of the Action Plan itself, there will be a review by the Lower Columbia River Estuary Partnership (LCREP) and the Estuary/Ocean Subgroup for Research Monitoring and Evaluation during the development and updating of the Action Plan to ensure that it captures all actions currently being undertaken or planned in the Estuary either by the Action Agencies or other entities. Many of the actions outlined in the Action Plan will have opportunities for public comment during the planning phases. For example, any restoration action that is implemented by the Action Agencies will have a formal public comment period as a part of the Environmental Assessment or Environmental Impact Assessment pursuant to requirements under the National Environmental Policy Act of 1969, as amended.

The BPA and the Corps strive to balance their responsibilities under the Endangered Species Act (ESA), Tribal Trust and the federally authorized multi-uses of the FCRPS. As well, BPA's actions must be consistent with the Northwest Power Planning and Conservation Council's (NPCC) Fish and Wildlife Program. The actions currently underway or planned in response to the FCRPS BiOp are supported by the commitment of both the BPA and Corps to environmental stewardship. As stated in the December 2000 FCRPS BiOp, "Estuarine protection and restoration must play vital roles in rebuilding the productivity of listed salmon and steelhead throughout the Columbia River Basin." In keeping with this goal, the Action Agencies are working through existing Corps authorities and the NPCC's subbasin planning process to fund ecologically based efforts in the Columbia River Estuary.

The Action Agencies, under the 2000 FCRPS BiOp, have a commitment to reporting accomplishments toward required actions and future planning and implementation efforts. This Action Plan is not intended to duplicate the efforts currently underway to track Action Agency performance toward full

implementation of the recommended actions, but will serve as a broad management tool specifically focused on the Columbia River Estuary. The Action Agencies will rely upon the required annual progress reports and implementation plans for the detailed descriptions of accomplishments. The required reporting requirements are annual progress reports; comprehensive 3-, 5-, and 8-year check-ins (2003, 2005, 2008); and annual multi-year implementation plans. In addition to Action Agency reports, the NOAA Fisheries annually releases its assessment of Action Agency progress through findings letters. The released documents can be found at <http://www.nwr.noaa.gov/1hydrop/hydroweb/fedrec.htm> and <http://www.salmonrecovery.gov/>.

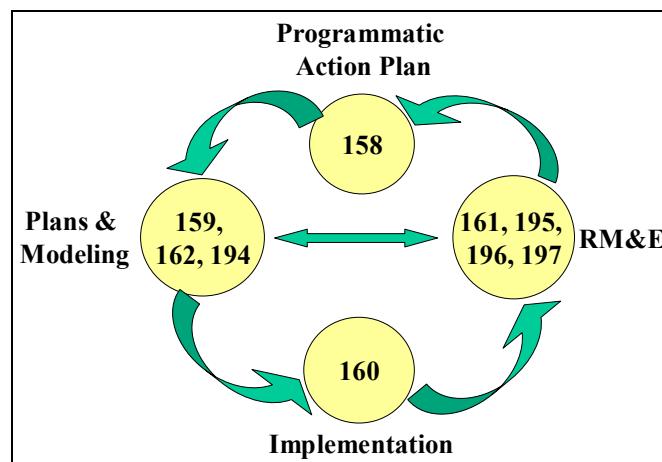
This Action Plan has two main sections, Action Plan Elements and Action Agency Implementation. The next section, Action Plan Elements, describes the components of the Estuary Program. The following section, Action Agency Implementation, explains what the Action Agencies are doing to fulfill the BiOp requirements.

2. ACTION PLAN ELEMENTS

Within this Action Plan, the activities currently underway or planned in response to the BiOp, are grouped in the following categories for discussion purposes: (1) Planning and Investigations; (2) Modeling; (3) Habitat Restoration; and (4) Research, Monitoring and Evaluation. While these categories provide for ease of communication, the Action Agencies recognize that each category informs and interrelates to the others. For example, planning and investigations, as well as modeling, will create a framework within which restoration actions will be pursued. Planning and investigations can identify and refine existing needs in the Estuary for habitat restoration and also inform the direction of ongoing and future research. Individual planning efforts will be undertaken for each identified restoration site to refine conceptual designs or ideas regarding the specific area and identify site specific monitoring and evaluation criteria for the individual projects that are consistent with the broader research efforts ongoing in the Estuary. Furthermore, as Research, Monitoring and Evaluation (RM&E) in the estuary progresses, planning and restoration actions may be modified to incorporate additional knowledge and understanding or new efforts may be initiated.

The Action Plan is related to other Estuary RPA actions (Figure 2). Action 159 will result in a restoration plan for habitat of listed-salmonids in the Estuary. A draft report addressing Action 159 by Johnson et al. (2003) includes an ecosystem-based approach and guidelines for monitoring and evaluation at the project level. Action 160 calls for implementation of on-the-ground habitat protection and enhancement work. Monitoring and evaluation to assess performance of these projects will fall under action effectiveness research described in the estuary and plume RM&E plan. Actions 162 and 194 entail modeling efforts, the results of which will be fed into restoration project planning and estuary/plume RM&E, as appropriate. Action 195 addresses sources of mortality to listed-salmonid smolts below Bonneville Dam. Actions 196 and 197 involve study of salmonid usage in the estuary and plume, respectively.

Figure 2. Relationship between Estuary RPA Actions.



The Action Plan does *not* cover RPA Actions 185, 186, and 187 that deal with phenomena pertaining to the juvenile fish transportation (barging) program that have been hypothesized to manifest themselves in the Estuary (these actions are addressed in the hydrosystem component of the basin-wide RM&E plan). In summary, the Action Plan will be coordinated and integrated with implementation of Estuary RPA actions, so that the Estuary Program can be adaptively managed.

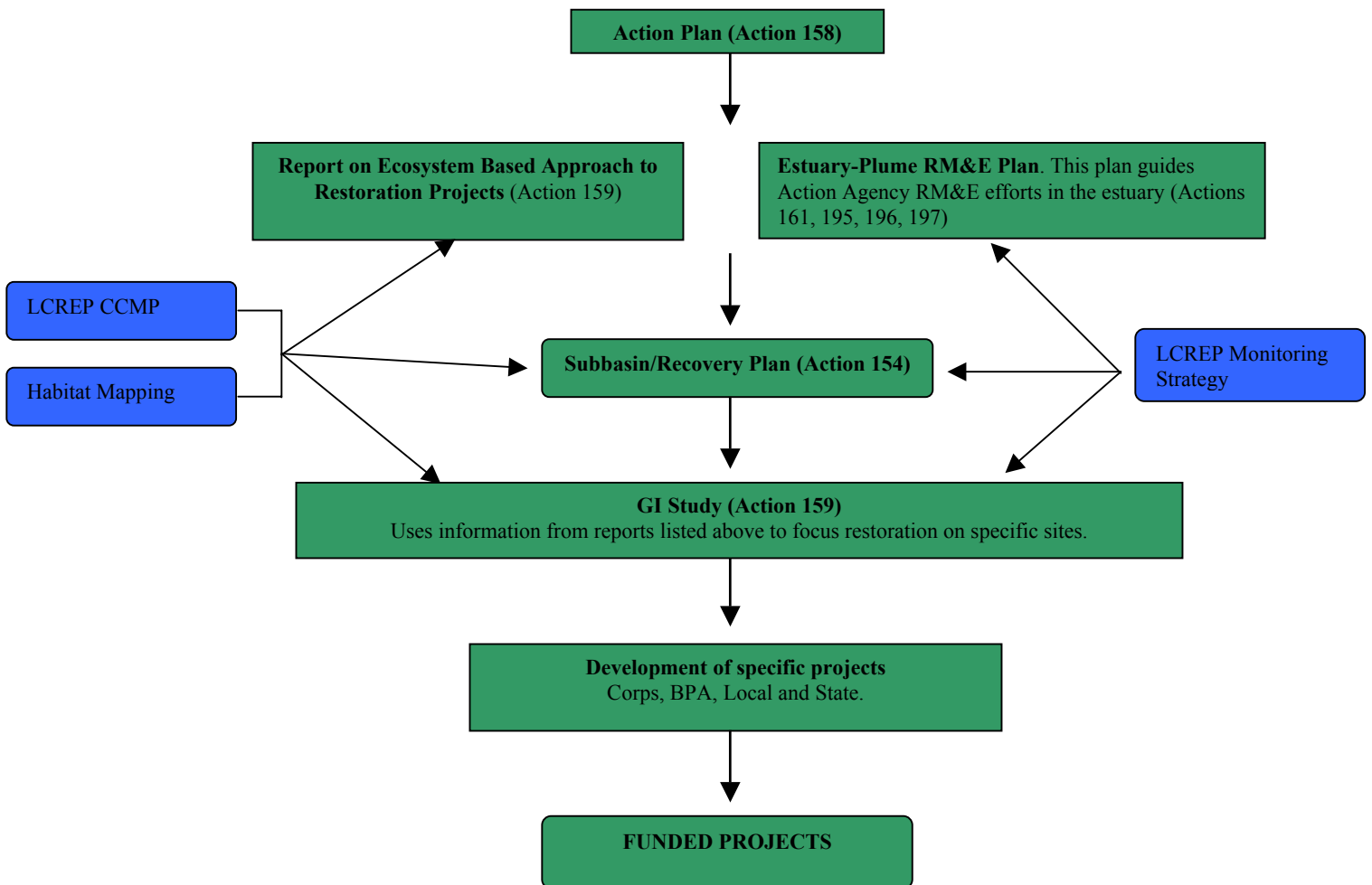
2.1 Element 1 – Planning and Investigations

There are various planning efforts underway in the Columbia River Estuary, including many site-specific planning and investigation efforts on individual projects, and two comprehensive efforts responding to BiOp requirements. The Action Agencies are undertaking the two comprehensive efforts: subbasin planning and the General Investigations (GI) feasibility study (Figure 3).

The subbasin planning process is currently underway through the NPCC/BPA fish and wildlife program. The subbasin plans applicable to the Columbia River Estuary include Mainstem Lower Columbia River, Columbia River Estuary, and to a lesser extent the Oregon and Washington Tributaries in the Columbia River Estuary. The subbasin plans will provide baseline information necessary for long term implementation planning, such as the goals for fish, wildlife, and habitat; objectives to measure progress and strategies to meet those objectives. In the case of the Washington tributaries, the subbasin planning process is moving forward concurrently with the ESA recovery planning efforts for fisheries. When complete, the subbasin plans will provide the baseline or “existing condition” from which the GI feasibility study will proceed.

The purpose of the ongoing GI feasibility study is to investigate and recommend appropriate solutions to accomplish ecosystem restoration in the Columbia River Estuary consistent with the subbasin and recovery plans. The scope includes wetland/riparian habitat restoration, stream and fisheries improvement, water quality and water-related infrastructure improvements. Outcomes of the GI study will include a strategic master plan for the Estuary resulting in long-range, larger projects; resolution of any data gaps necessary for a long term implementation plan; a programmatic Environmental Impact Statement (EIS) for identified projects; and provide a long-term funding stream for project implementation. The states of Oregon and Washington agreed to jointly sponsor the GI study in a letter of intent dated May 8, 1998. The Action Agencies along with LCFRB, LCREP, and the states of Oregon and Washington will guide the development of the GI study to insure the process is well coordinated and maximizes use of existing information. Both the subbasin plans and the GI study are described below in more detail. Figure 3 provides a graphic representation of the relationships between these efforts.

Figure 3. Relationship of planning efforts related to habitat restoration.



Planning and investigations includes RPA Actions 154 (Subbasin Planning), 156 (Ives Island Feasibility Study), 158 (Action Plan), and 159 (Restoration Planning).

2.1.1 RPA Action 154

Description: Action 154 states, “The BPA shall work with the NPCC to ensure development and updating of subbasin assessments and plans; match state and local funding for coordinated development of watershed assessments and plans; and help fund technical support for subbasin and watershed plan implementation from 2001 to 2006. Planning for priority subbasins should be completed by the 2003 check-in. The action agencies will work with other federal agencies to ensure that subbasin and watershed assessments and plans are coordinated across non-federal land ownerships and programs.”

Activities: Subbasin plans are being developed in a public process that includes a wide range of state, federal and tribal governments, local managers, landowners, local governments, and other stakeholders. Thus, the final subbasin plans adopted by the NPCC should have a wide range of support from all interested parties. The plans must be consistent with provisions contained in the Northwest Power Act and the NPCC’s Fish and Wildlife Program. These plans contain the measures that will drive program implementation at the subbasin level. Subbasin planning summaries and workplans were prepared in 2001 through 2003.

There are several subbasin-planning efforts that are relevant to the Columbia River Estuary efforts; these are listed below with the Lead entity noted.

- Washington tributaries: Lower Columbia Fish Recovery Board (LCFRB)
- Lower Columbia Mainstem: LCFRB/LCREP*
- Columbia River Estuary: LCFRB/LCREP*

*LCFRB is responsible for the technical sections of the mainstem and Estuary subbasin plans.

It should be noted that the Washington efforts led by the LCFRB will result in a subbasin and recovery plan. The remaining mainstem efforts will be a subbasin plan upon which the recovery planning will be based.

The Action Agencies will continue to provide a share of technical support for subbasin assessments and plans and are working with the Council to ensure that subbasin plans are completed by 2006. In 2005-2008 the Action Agencies will use subbasin plans to identify habitat projects that meet BiOp objectives and will continue to provide technical support to the Council as necessary.

Status: Ongoing

Schedule for Completion:

Plan	Washington Tributaries	Mainstem	Estuary
Draft Technical Appendix	July 2003*	November 2003	November 2003
Final Technical Appendix	December 2003	December 2003	December 2003
Subbasin/Recovery Plan	May 2004	May 2004	May 2004

*Available at <http://www.lcfrb.gen.wa.us>

Deliverables:

- Washington Tributaries Subbasin/Recovery Plan
- Mainstem Subbasin Plan
- Estuary Subbasin Plan

Issues: Current schedules laid out by the Council call for completion of plans for the high priority subbasins as well as for 52 other Council subbasins in May 2004, although some further schedule slippage is possible. Under the master contract between BPA and the Council for subbasin planning, the BPA contracts funds support for subbasin planning by local planners through May of 2004, when the plans are scheduled for review by the Independent Scientific Review Panel (ISRP).

2.1.2 RPA Action 156

Description: Action 156 states, “The action agencies and NMFS shall study the feasibility (including both biological benefits and ecological risks) of habitat modification to improve spawning conditions for chum salmon in the Ives Island area.”

Activities: The feasibility study included reconnaissance evaluation for 24 sites, with 3 selected and funded for in-depth study and conceptual level design. Final design and implementation is dependent on cooperation between landowners and concurrence from fish and wildlife agencies. Proposed restoration activities include flow augmentation in Hamilton Creek, Lena’s Lake channel development, and development of additional spawning habitat in Hardy Creek.

Status: Instrumentation and data collection sufficient for the feasibility phase have been completed. The Feasibility Report is scheduled for completion October 2003.

Schedule for Completion: Draft Feasibility report by September 2003; review October 2003. Final Feasibility Report 31 October 2003. Final design schedule will be dependent upon funding of the recommended site(s).

Deliverables: Feasibility Report, including conceptual design for 3 restoration areas.

Issues: None at this time.

2.1.3 RPA Action 158

Description: Action 158 states, “During 2001, the Corps and BPA shall seek funding and develop an action plan to rapidly inventory estuarine habitat, model physical and biological features of the historical lower river and estuary, identify limiting biological and physical factors in the estuary, identify impacts of the FCRPS system on habitat and listed salmon in the estuary relative to other factors, and develop criteria for estuarine habitat restoration.”

Activities: The Action Agencies have drafted an implementation Action Plan outlining the Estuary Program that addresses the FCRPS BiOp RPA actions that fall within the geographic extent of the Estuary (mouth to Bonneville). The Action Plan contained herein is the Action Plan mandated by Action 158.

Status: Ongoing.

Schedule for Completion: Draft Final September 2003 with annual updates to follow beginning in

2005. Refinements will be made to the Action Plan as necessary.

Deliverables: Action Plan

Issues: The Action Plan was not completed in 2001. However, actions implementing the Estuary Program were initiated to meet the intent of the BiOp. The Action Agencies do not believe this delay impacted the direction or execution of the program as it relates to the implementation of the Estuary related actions.

2.1.4 RPA Action 159

Description: Action 159 states, “The BPA and the Corps, working with LCREP and NMFS, shall develop a plan addressing the habitat needs of salmon and steelhead in the estuary.”

Activities: The Action Agencies are implementing a number of actions that respond to this RPA action. The actions to date include: (1) Lower Columbia and Estuary Habitat Conservation and Restoration Workshop; (2) habitat mapping of river miles (RM) 46-146; (3) the BPA-funded report, *An Ecosystem-Based Approach for Restoration Projects in the Columbia River Estuary with an Emphasis on Salmonid Habitats*; and (4) the GI feasibility study. Each effort is described in more detail below.

Lower Columbia and Estuary Habitat Conservation and Restoration Workshop. This workshop was held on June 12 and 13, 2001 and included plenary presentations, panel discussions and facilitated workgroup sessions that included approximately 100 attendees interested in estuarine restoration. A significant number of potential restoration sites were identified (over 100) and criteria developed to help in the prioritization of these sites. Subsequently, working through the LCREP, specific considerations were developed to address estuarine habitat restoration criteria. All this information is presented in the workshop proceedings.

Habitat Mapping of Columbia River, RM 46-146. The Action Agencies funded a habitat-mapping project for the Columbia River Estuary. The goal is to develop highly detailed habitat information for the Estuary which will provide baseline data for implementing a systematic, effective, and scientifically grounded habitat protection and restoration program aimed at restoring a continuum of habitats throughout the Estuary. The study was initiated in April 2002 and will be complete in November 2003. This work will produce a hierarchical, spatially explicit GIS dataset of the habitats along the Estuary. Classified satellite (Landsat 7 TM) imagery will be used to characterize the landscape by providing a continuous map of habitat cover classes from the mouth to Bonneville. Once completed, the broad-brush classification of satellite imagery will be used to prioritize areas for detailed assessment using CASI hyperspectral imagery. Since both the TM and CASI imagery will be spatially explicit, together they can be used as hierarchical habitat coverages that are linked spatially. Thus, they can be used together or with other spatially explicit GIS coverages. The satellite images will be queried to prioritize areas for more detailed analysis. High spatial resolution, hyperspectral imagery will be geometrically corrected and classified from selected areas of interest (focal areas) to complement the nearly complete satellite scenes. The integrated results of the two image analyses will be used to prioritize areas for protection and restoration.

Ecosystem-Based Approach for Restoration Projects in the Columbia River Estuary with an Emphasis on Salmonid Habitats. This is a BPA-funded project by Pacific Northwest Laboratories, with the LCREP and the Columbia River Estuary Task Force. In Fiscal Year (FY) 2003, a report titled, *An Ecosystem-Based Approach for Restoration Projects in the Columbia River Estuary with an Emphasis on Salmonid Habitats* was produced. This report provided a scientific basis for

restoration projects in the Columbia River Estuary along with guidelines for project implementation. The report addressed the habitat needs of salmon in the Estuary.

General Investigations Study. The Action Agencies, LCREP, LCFRB and the states of Oregon and Washington continue to pursue the GI feasibility study. The purpose of the study is to investigate and recommend appropriate solutions to accomplish ecosystem restoration in the Columbia River Estuary, including wetland/riparian habitat restoration, stream and fisheries improvement, water quality and water-related infrastructure improvements. The study will build upon the studies listed above as well as the subbasin planning process. Outcomes of the GI study will provide more detailed planning, analysis and evaluation, including initial design, for long-range, larger projects; address data gaps necessary for a long term implementation plan; provide for ESA consultation; generate a programmatic EIS for identified habitat restoration; and provide a long-term funding stream for project implementation. This GI study for ecosystem restoration in the Columbia River Estuary is expected to continue from 2003 to 2007, but results will inform actions for the Estuary along the way. The Corps continued coordination on the GI study for ecosystem restoration in the Columbia River Estuary, covering the river from its mouth to Bonneville Dam. Efforts in 2002 and 2003 focused on identifying a cost-sharing partner and scoping.

This work as well as other efforts detailed in this Action Plan will help guide the Action Agencies Estuary Program. The Action Agencies are developing a long-range plan for protection and restoration of the Estuary that is broader in scope than the needs for implementing the NOAA BiOp. The Action Agencies plan to address the habitat needs of salmon and steelhead in the Estuary through additional efforts listed in the RM&E section of this document and with the GI study.

The action agencies continue to pursue planning activities that contribute to a site specific “strategic” plan as outlined by NOAA Fisheries in their comments on the *Ecosystem-Based Approach for Restoration Projects in the Columbia River Estuary with an Emphasis on Salmonid Habitats*. The AA view the General Investigations Study as the primary vehicle for this effort but will pursue additional opportunities as appropriate.

Status: Ongoing

Schedule for Completion:

- Habitat Conservation Workshop, August 2001.
- Report titled, *An Ecosystem-Based Approach for Restoration Projects in the Columbia River Estuary with an Emphasis on Salmonid Habitats*, September 2003.
- Habitat mapping RM 46-146, November 2003.
- General Investigations Study
Sign Feasibility Cost Sharing Agreement, October 2003
Phase I Complete, August 2004
Phase II Complete, June 2007

Deliverables:

- Lower Columbia and Estuary Habitat Conservation and Restoration Workshop Proceedings.
- *An Ecosystem-Based Approach for Restoration Projects in the Columbia River Estuary with an Emphasis on Salmonid Habitats*.
- Habitat Mapping for the Lower Columbia River RM 46-145.
- General Investigations Feasibility Study EIS.

Issues: As a result of the Independent Scientific Review Panel and NOAA reviews of the report, *An*

Ecosystem-Based Approach for Restoration Projects in the Columbia River Estuary with an Emphasis on Salmonid Habitats, a section regarding next steps for a “strategic plan” for the Columbia River Estuary was added. The Action Agencies recognize that additional work beyond the scope of the Pacific Northwest Laboratories report is necessary to provide for a comprehensive plan for the subject area.

2.2 Element 2 – Modeling

Modeling is an important element of the Estuary Program for BiOp implementation because models provide integration of processes, allow investigations of new physical and hydrologic scenarios and generate useful visualizations. Models can be conceptual, numeric, physical or physical-scale. Action 162 (conceptual ecosystem model) and Action 194 (physical/numeric model) address modeling of the Columbia River Estuary.

2.2.1 RPA Action 162

Description: Action 162 states, “During 2000, BPA, working with NMFS, shall continue to develop a conceptual model of the relationship between estuarine conditions and salmon population structure and resilience. The model will highlight the relationship among hydropower, water management, estuarine conditions, and fish response. The work will enable the agencies to identify information gaps that have to be addressed to develop recommendations for FCRPS management and operations.”

Activities: Two conceptual models exist for the Columbia River Estuary, each developed for a different purpose. In *Salmon at River’s End*, NOAA Fisheries developed a conceptual model for juvenile salmon usage in the Estuary which is being used to guide basic research. In the Corps of Engineers *Biological Assessment* for the Columbia River Channel Improvements Project, a conceptual model was developed for various ecosystem processes in the Columbia River Estuary. While both models meet RPA Action 162, the Action Agencies intend to consolidate and integrate them into a more detailed model that addresses factors controlling habitat development and maintenance. This enhanced model is needed for planning and design of habitat restoration projects and RM&E efforts, because for habitats supportive of salmon to be self-maintaining in the long run, a clear and explicit understanding of the factors controlling habitat-forming processes is critical.

A conceptual model for pollutants and toxics also will be developed under BPA project number 30015 with the LCREP. The scope of this model has yet to be determined. This model is beyond the scope of the model intended to meet this action.

Status: Ongoing

Schedule for Completion:

- Refined Conceptual Model - December 2003.
- Toxics and pollutant conceptual model - TBD

Deliverables:

- Refined Conceptual Model for the Columbia River Estuary.
- Toxics and pollutant conceptual model

Issues: This task was initially scheduled for completion in September 2003; due to budget constraints the model will be completed in December 2003. This delay is not anticipated to impact implementation of the Action Agencies’ Estuary Program.

2.2.2 RPA Action 194

Description: Action 194 states, “The Action Agencies and NMFS shall work within the annual planning and Congressional appropriation process to establish and provide the appropriate level of FCRPS funding for studies to develop a physical [numeric] model of the lower Columbia River and plume. This model will characterize potential changes to estuarine habitat associated with modified hydrosystem flows and the effects of altered flows where they meet the California current to form the Columbia River plume.”

The BiOp further states, “Physical characteristics of the estuary such as river flow, hydrograph, velocity, bathymetry, salinity intrusions, and circulation patterns define estuary in conditions. It is, therefore, important to characterize the physical aspects of the estuary and to compare existing and future physical attributes with historical conditions to assess the potential effect of hydrosystem flow regimes on estuarine habitat. Physical changes to the estuary will affect its ecology and, potentially, how salmonids use the estuary for migration, growth, and development. The plume habitat as an extension of the estuary, or as a unique habitat important to Columbia River salmon, will be similarly affected by actions of FCRPS. Characterization of these effects to assess the importance of historical and current conditions will help facilitate the recovery of all salmon stocks.”

Activities: There are two multi-dimensional hydraulic computer models of the Columbia River Estuary available that address this RPA action. One is the RMA-10 based 2- and 3-dimensional model developed by the Corps’ Hydraulics Laboratory at the Engineering Research and Development Center. The other is the ELCIRC model developed by the Oregon Graduate Institute. Both models are capable of modeling Estuary currents and salinity intrusion, but differ in their spatial and temporal scales. From an initial technical review, it appears the ELCIRC model is better suited to evaluating potential impacts from basin scale actions in the Columbia River. However, neither model is ideal for designing site-specific ecosystem restoration actions. The ELCIRC model’s resolution is 200 meters x 200 meters, this resolution is not adequate for site specific design and construction which is typically on the order of 1-2 feet. Both models could be improved with more extensive bathymetry.

The modeling results will not be prescriptive; rather, they will inform the adaptive management process the region is embarking on. The other tools include the subbasin reviews and analyses for benefits at the least cost. The models may identify potential actions, but these actions and benefits to salmon will be evaluated with other actions in the Columbia River Basin resulting in the greatest benefit for a unit of water or financial resource.

The Action Agencies are providing funding to refine the CORIE/ELCIRC model under the research, monitoring and evaluation studies detailed in Actions 195 and 197, specifically the Bottom et al. work. The AA will continue to fund incremental improvements to this model; however, the AA focus will be on funding RME actions that contribute to the understanding and knowledge base required to link biological response to physical parameters. The work plan for this action will continue to be revisited as information regarding this uncertainty is gained in the region.

Status: Ongoing.

Schedule for Completion:

- 2003 baseline estuary bathymetric and topographic survey, September 2003.
- Post-channel improvement bathymetry, 2 years post construction.
- Incremental improvements to CORIE/ELCRIC model, FY 2003-2004.

Deliverables:

- Study Plan for Implementation: Contained herein.
- 2003 baseline Estuary bathymetric (seafloor/riverbed) and topographic (intertidal beach/shoreline) survey. This survey was completed in September 2003 and met or exceeded the resolution of the 1958 and 1982 bathymetric surveys. The baseline survey covered the Estuary from bank to bank from RM 3-40. Note that this survey will be followed up within 2 years after completion of construction with a bank-to-bank bathymetric survey from RM 3-18 of the same accuracy of the 2003 baseline survey. A corresponding minimum of 10 bank-to-bank bathymetric survey transects shall be collected from RM 18-40.

Issues: Biological response to physical characteristics is not well understood at this time. This uncertainty is however being investigated in ongoing research. The Action Agencies study plan consists of funding incremental refinements to the ELCIRC model until such time as the biological response to physical changes can be quantified. Therefore, the Action Agencies implementation plan includes focusing limited funding on necessary RM&E to make these ties.

2.3 Element 3 – Habitat Restoration

Habitat restoration, enhancement, and protection will be pursued by the Action Agencies to fulfill RPA Actions 157 and 160. Over the years, the BPA and the Corps have funded, planned, designed, and constructed many restoration projects in the Columbia Basin. Actions 157 and 160 extend that effort to the Columbia River Estuary. Action 160 calls for habitat protection and restoration projects that contribute to productivity below RM 46. Action 157 is for and on chum habitat improvement from the Dalles Dam to the mouth of the Columbia River. As projects are planned and constructed under these actions, the Action Agencies will strive to ensure that monitoring and evaluation of projects is consistent to the extent practicable with existing and planned research efforts.

2.3.1 RPA Action 157

Description: Action 157 states, “The BPA shall fund actions to improve and restore tributary and mainstem habitat for Columbia River chum salmon in the reach between The Dalles Dam and the mouth of the Columbia River.”

Implementation: The AA continue to pursue activities related to chum salmon in the Columbia River Estuary. These actions include the following projects:

- Evaluate spawning of fall chinook and chum salmon just below the four lowermost mainstem dams (BPA Project 199-003-01)
- Evaluate factors limiting Columbia River Gorge Chum Salmon Populations (BPA Project 2000-012-00)
- Sandy River Delta Riparian Forest, Wetlands and Anadromous Estuary Restoration (BPA Project 1999-025-00)
- Effectiveness monitoring of the Chinook River Estuary Project (BPA Project 2003-006-00)
- Re-Introduction of lower Columbia River chum salmon into Duncan creek (BPA Project 2001-053-00)
- Lena’s Lake Channel planning and design analysis (Corps)
- Gary’s River watershed, hydraulic and geomorphic assessments (Corps & BPA)
- Lacamas Creek chum spawning channel (Corps)

The Action Agencies will continue to protect via purchase, easement, or other means existing or

potential chum spawning habitat in the Columbia River Estuary. They will also continue to monitor chum habitat improvements and transplant adults from Ives Island.

Status: Ongoing

Schedule for Completion: Varies by project, the actions will be ongoing.

Deliverables: Specific project reports, annual reports describing activities and findings.

Issues: None at this time.

2.3.2 RPA Action 160

Description: Action 160 states, “The Corps and BPA, working with LCREP, shall develop and implement an Estuary restoration program with a goal of protecting and enhancing 10,000 acres of tidal wetlands and other key habitats over 10 years, beginning in 2001, to rebuild productivity, for listed populations in the lower 46 miles of the Columbia River. The Corps shall seek funds for the federal share of the program, and BPA shall provide funding for the non-federal share. The Action Agencies shall provide planning and engineering expertise to implement the non-Federal share of the on-the-ground habitat improvement efforts identified in LCREP, Action 2.”

Activities: To rebuild productivity for ESA-listed salmon populations, the Corps and BPA plan to continue a 10-year program to protect/enhance tidal wetlands and other key estuary habitats. Because much is unknown at this time about salmonid use of the estuary and Columbia River plume, the approach includes concurrent research, planning, and restoration activities. This approach will allow important on-the-ground recovery efforts to assist in salmon recovery to proceed while research and planning efforts occur to better inform future actions.

While work continues on other actions, the AA are pursuing restoration projects that are scientifically justifiable and have established local and resource agency involvement. Planning activities are ongoing but no construction activities have yet commenced. The Action Agencies are also developing monitoring and evaluation tasks for site-specific projects that are consistent with more comprehensive studies.

The AA continue to pursue restoration opportunities at the following sites:

- Brownsmead, (Blind Slough), Oregon (Corps, BPA)
- Chinook River Estuary (Corps, BPA is funding pre project monitoring)
- Crims Island (Corps, BPA)
- Gray’s River Watershed Restoration (Corps, BPA)
- Julia Butler Hansen National Wildlife Refuge (Corps)
- Young’s Bay / Walluski River (BPA Project 200301100)
- Gray’s Bay (BPA Project 200301100)
- Scapoose Bay (BPA Project 200301100)

Status: Ongoing

<u>Schedule for Completion:</u>	<u>Acreage</u>	<u>Construction schedule</u>
• Brownsmead	~90	July 2004 - September 2005
• Chinook River Estuary	~800-1000	June 2005 - September 2006
• Crims Island	~450	June 2004 - September 2005
• Gray's River	TBD	TBD
• Julia Butler Hansen NWR	~65-200	TBD*
• Young's Bay / Walluski River	~35	September 2004
• Gray's Bay	~800	September 2005
• Scapoose Bay	~400	May 2005

*USFWS, NOAA and the Corps implemented a biological test on tidegates in September 2003. A tidegate was placed in September, the agencies intend to monitor the site for both physical and biological response to the new "fish friendly tidegate" to further the region's objectives regarding tidegate retrofits.

Deliverables: Completed restoration projects, see schedule above.

Issues: This RPA Action specifically calls for the Corps and BPA to protect and enhance, "...10,000 acres of tidal wetlands and other key habitats ... in the lower 46 river miles of the Columbia River." The text further states, "As more information is gained from inventory and analytical work, the 10,000-acre goal may be modified to ensure that habitats that are determined to be important to the survival and recovery of anadromous fish are addressed." This issue is discussed further in the position paper contained in Appendix A.

Ideally, a comprehensive, ecosystem-wide plan would be developed before implementing individual projects. However, the region has supported the concurrent activities of pursuing short-term projects, while proceeding with the comprehensive studies. Overall, all these programs will be used to develop a comprehensive network of projects designed to improve the Columbia River Estuary's ecosystem.

In order to meet RPA Action 160, a mechanism to acquire willing seller land may be necessary. Land acquisition may be the limiting factor in demonstrating progress toward the 10,000-acre figure. There is limited public land available in the lower river and much that is in public ownership is already in a productive state for fish and wildlife. The federal planning processes either through the Corps or BPA/NPCC typically requires lead times on the order of years (although this can progress more quickly under certain circumstances). This timeline generally does not allow for ready acquisition of private land as it become available.

The Action Agencies are currently pursuing the definition of a process that would serve this purpose. Institutional and legal issues as well as competition in the Columbia Basin for limited funding will necessitate a regional consensus on the relative biological effectiveness of this action compared to actions addressing other priorities benefiting salmonids.

2.4 Element 4 – Research, Monitoring and Evaluation

The Estuary/Ocean Sub-Group for RM&E was established in the summer of 2002 and began developing an RM&E plan for the Columbia River Estuary. Six RPA Actions relevant to the purview of the Estuary/Ocean Work Group address status monitoring (158, 161, 194, 196 and 197). Action 158 is addressed with this Action Plan. Action 161 requires that the Action Agencies establish a research, monitoring and evaluation program for the Estuary objectives of the BiOp, which is to be

closely coordinated with the LCREP's monitoring and research efforts. Actions 196 and 197 require the Action Agencies and NOAA to work within the annual planning and congressional appropriation processes to provide the appropriate level of FCRPS funding to develop an understanding of adult and juvenile salmonid use of the Estuary and plume.

Initial efforts of the Estuary/Ocean Sub-Group focused on assessing the on-going RM&E efforts for the BiOp and identifying any additional needs (gap analysis). This gap analysis was incorporated into the RM&E Framework document (Action Agencies, June 2003). The Action Agencies also reviewed proposals for estuarine research in the Provincial Review process and provided recommendations on those that would help meet BiOp requirements. The RM&E Framework document includes the Estuary and Ocean RME Implementation Plan as Appendix D. The reader is referred to this document for more specific details of Action Agencies RM&E program.

The AA continue to pursue a research monitoring and evaluation program to meet the requirement of this action. The Estuary Program will continue to coordinate with other entities implementing complementary action in the Columbia River estuary.

2.4.1 RPA Action 161

Description: Action 161 states, "Between 2001, and 2010, the Corps and BPA shall fund a monitoring and research program acceptable to NMFS and closely coordinated with the LCREP monitoring and research efforts (Management Plan Action 28) to address the estuary objectives of this Biological Opinion."

Implementation: In an effort to refine and direct research in the Columbia River Estuary, the Corps and its partners in the LCREP concluded that addressing and solving the complex problem of restoration in the Estuary required bringing together a large number of persons with experience working both specifically in the system, as well as in other systems. Therefore, a workshop was proposed to facilitate the level of expertise and integration needed. The Corps and the LCREP hosted the workshop to address research needs and priorities for the Columbia River Estuary. The workshop was held on March 24-25, 2003 at the World Trade Center in Portland, Oregon. The objectives of the workshop included:

- Review the basis for Corps involvement in the Columbia River Estuary;
- Review past and ongoing research being conducted in the Columbia River Estuary;
- Identify data gaps and key research needs for future studies; and
- Prioritize as much as possible those research needs.

The Estuary/Ocean RM&E Sub-Group, established in summer 2002, will complete an Estuary RM&E plan by September 30, 2003 that includes draft performance standards, a needs assessment, and an implementation plan for RM&E actions related to the Estuary and plume. This group includes representatives from NOAA Fisheries, Corps, BPA, and Pacific Northwest National Laboratory. The LCREP and its Science Work Group are kept informed of the Estuary RM&E subgroup's efforts.

Monitoring recommendations will be a component of the Estuary and Ocean RM&E plan. The Action Agencies will implement these recommendations to the extent that individual projects warrant. While study protocols are being developed, the Action Agencies will continue to fund monitoring actions for restoration projects.

Status: Ongoing

Schedule for Completion: A draft of the Estuary and Ocean RM&E plan will be complete September 30, 2003. The Action Agencies will continue to manage and fund a RM&E program through 2010. As additional information is obtained, the Action Agencies will change the direction and focus of the program as appropriate.

Deliverables:

- Lower Columbia and Estuary Habitat Conservation and Restoration Workshop Proceedings 2001.
- Lower Columbia River and Estuary Research Needs Identification Workshop Proceedings 2003.
- Estuary and Plume Research, Monitoring and Evaluation Plan.

2.4.2 RPA Action 195

Description: The Action Agencies shall investigate and partition the causes of mortality below Bonneville Dam after juvenile salmonid passage through the FCRPS.

Activities: The AA are funding several studies that will inform this action. However, the major effort involves the development of a smaller acoustic tag to track juvenile use in the estuary.

McComas et al. 2001-2003: *A study to estimate salmonid survival through the Columbia River estuary using acoustic tags*" (Corps).

This study includes the development and deployment of acoustic telemetry systems for tracking juvenile salmonids in a saline environment. It includes the technology development of downsizing acoustic tags, for estimating survival and habitat use in the Columbia River Estuary. Work performed between 2001 and 2003 was primarily research and development of the downsized transmitter, hard wired receiving nodes, and non-wired receiving nodes. Plans for 2004 will include deployment of a partial array of the hard wired receiving array, partial deployment of the non-wired secondary array, and release of approximately 1,000 juvenile salmonids that have been tagged with the miniature acoustic tag. Primary goals for 2004 are to work out deployment, operation, and maintenance of the system, and to evaluate detection probabilities. The full survival study will begin in 2005 with an estimated 3,000 juvenile salmonids being tagged with the acoustic transmitters at Bonneville Dam, and survival estimates made using the double receiving system.

Two projects discussed in Action 196 and 197 will also contribute to the knowledge base needed to partition causes of mortality below Bonneville Dam. The first is the Canada Department of Fisheries and Oceans/U.S. Shelf Salmon Survival Study, Project 1998-014-00. It is funded through FY 2004. The BPA also intends to fund the implementation of the Pacific Ocean Salmon Tracking project, Proposal 35064. The second is BPA Project 200399936, *Estimate juvenile salmon residence in the Columbia River plume using micro-acoustic transmitters*.

Status: Due to the developmental nature of the program, and funding limitations in 2003, the schedule has been slipped one year. The array testing and detection probability estimates will be completed in 2004, with the full survival study beginning in 2005.

Schedule for Completion: This evaluation currently is scheduled for 4 to 5 years of actual survival evaluations, depending on the findings in the early years. As the action states, the Action Agencies "...investigate and partition the causes of mortality below Bonneville Dam after juvenile salmonid

passage through the FCRPS;” early findings could dictate this program extend beyond the original 5 years, and/or move further upriver.

Deliverables: Yearly findings will be reported through the Anadromous Fish Evaluation Program (AFEP), annual review process each year in November. Annual progress reports are required by March 30 the following fiscal year.

Issues: None at this time.

2.4.3 RPA Actions 196 and 197

Description: Action 196 states, “The Action agencies and NMFS shall work within the annual planning and congressional appropriation processes to establish and provide the appropriate level of FCRPS funding for studies to develop an understanding of juvenile and adult salmon use of the Columbia River Estuary. These studies support the actions to develop criteria for estuarine restoration (Action 158), restoration planning (Action 159) and implementation (Action 160) in Section 9.6.2.2.”

Action 197 states, “The action Agencies and NMFS shall work within the annual planning and congressional appropriation processes to establish and provide the appropriate level of FCRPS funding for studies to develop an understanding of juvenile and adult salmon use of the Columbia River plume.”

Activities (also see Action 195):

The AA are currently funding several studies contributing to these actions, each major Research activity is described below. The AA are continuing to coordinate their programs to ensure the studies that are funded are complimentary and achieve synergy where possible. To that end, the AA will be refining the coordination process and examining the efficacy of existing reporting requirements and methods of data transfer.

Bottom et al. 2001-2003, *Estuarine habitat and juvenile salmon – current and historic linkages in the lower Columbia River and estuary*” (Corps).

This study will determine the relationship between habitat and the presence, use and benefit to juvenile salmon, with an emphasis on sub-yearling chinook salmon in the Columbia River Estuary, and understand change in flow, sediment input, and availability of habitat in the Columbia River Estuary. To be successful, the approach requires that the relevant empirical associations between habitat variables and juvenile salmon be established and the physical changes in the Columbia River Estuary be modeled. Separate objectives are outlined below; each has the scheduled completion in parenthesis following the objective tasks.

- Objective 1: Determine the temporal relationship between tidally influenced habitats and the presence/absence, abundance, and benefit to juvenile salmon, with an emphasis on shallow water areas, dendritic channels, back sloughs, and main channel margins (FY 2001).
- Objective 2: Characterize historical changes in flow and sediment input to the Estuary and changes in habitat availability throughout the Estuary (FY 2001).
- Objective 3: Compare trends in abundance and life histories of juvenile salmon at a landscape scale on representative transects of shallow-water habitat between Puget Island and the Columbia River mouth (FY 2002).
- Objective 4: Describe salmonid use and performance in selected emergent and forested wetlands and their relationship to local habitat features (FY 2002).

- Objective 5: Characterize historical changes in flow and sediment input to the Estuary and change in habitat availability throughout the Estuary (FY 2002).
- Objective 6: Compare trends in abundance and life histories of juvenile salmon at a landscape scale on representative transects of shallow-water habitat between Puget Island and the Columbia River mouth (FY 2003).
- Objective 7: Describe salmonid use and performance in selected emergent and forested wetlands and their relationship to local habitat features (FY 2003).
- Objective 8: Characterize historical changes in flow and sediment input to the Estuary and change in habitat availability throughout the Estuary (FY2003).

Bottom et al. 2003, *Historic habitat opportunities and food web linkages of juvenile salmon in the Columbia River Estuary: implications for managing flows and restoration*” (BPA 200301100).

This study will evaluate the role of river flow on habitat opportunities and food web structure for juvenile salmon by comparing historic and current conditions using model simulations and empirically derived food-web linkages. Separate objectives are outlined below; each has the scheduled completion in parenthesis following the objective tasks.

- Objective 1: Reconstruction of historic conditions (May 2005).
- Objective 2: Simulation of habitat change (May 2005).
- Objective 3: Food-web and life history responses (May 2005).
- Objective 4: Implication for Estuary restoration (May 2007).

Welch et al. 1998-2003, Canada Department of Fisheries and Ocean, *Ocean survival of juvenile salmonids in the Columbia River plume.*

The primary objective of this study is to obtain a single coast-wide set of data that will allow U.S. and Canadian scientists to begin identifying broad regions of good or poor salmon growth in the ocean, and to begin defining the reasons why growth differs between regions. Based on these preliminary results, it will be possible to refine sampling locations for future years and determine the appropriate sampling frequency that is needed. A secondary goal will be to establish which specific stocks of salmon remain resident in the areas of poorest growth, and to therefore, begin to develop some understanding of why marine survival may differ between different stocks of salmon in the ocean. Information generated from this study will quantify and allow detection of impacts of differing ocean productivity on salmon growth and survival. Documenting the cause of the changes (reduction) in growth with physical features of the ocean will help to improve our understanding of how climatic events in the ocean will affect important fish resources. The samples collected will provide an initial assessment of whether different stock groups (including ESA-listed stocks) predominate in regions of poor growth and survival.

For example, there is evidence that the Snake River chinook stock is disproportionately abundant in the region of poor ocean growth off Vancouver Island, making up about 2% of the total chinook identified in a sample from this region based on DNA analysis. If the migratory behavior of certain stocks preferentially exposes them to regions of poor ocean survival, then such information needs to be incorporated in management plans, and the assumption that the ocean presents a relatively uniform and unchanging environment for salmon needs to be reconsidered. Coded-wire tag returns from coastal chinook fisheries also indicate that maturing Snake River chinook have a more southerly distribution in coastal waters, with a center of abundance in the region off Vancouver Island which we have tentatively identified as having the poorest salmon growth and survival. Other Columbia River stocks, such as the Hanford Reach chinook, have a more northerly ocean

distribution that coincides with the region of higher growth. Therefore, they are expected to have better ocean survival for reasons described in this proposal. Direct information on the ocean distribution of juvenile chinook during the first summer of life at sea, when they are expected to be most influenced by ocean conditions is lacking, however. An important component of the work proposed here is therefore to establish which stocks of salmon are found in different regions within the study area. The large changes in ocean survival of Pacific salmon are having significant effects on fisheries management in both Canada and the U.S. This proposal for funding by the BPA is to allow the development of a collaborative research effort between Canada Fisheries and Oceans researchers with their counterparts in NOAA Fisheries. It is anticipated that on the basis of the data collected during the survey proposed here, a more extensive and tightly coordinated research program between the Canada and the U.S. will be developed. Separate objectives are outlined below; each has the scheduled completion in parenthesis following the objective tasks.

- Objective 1: Identify the extent of the region of poor growth and survival of salmonids in the ocean environment (May 2005).
- Objective 2: Measure the growth and feeding condition of salmonids in these areas (May 2005).
- Objective 3: Identify the physical and biological changes in the ocean that lead to reduce ocean survival (May 2005).
- Objective 4: Identify stocks occurring in this region of poor growth and compare their migration strategies to stock whose migration moves them quickly out of this area (May 2005).

Casillas et al. 1998-2003, *Survival and growth of juvenile salmonids in the Columbia River plume.*

The primary objective of this study is to continue to physically characterize and model the Columbia River plume in the nearshore ocean environment, provide estimates of growth of juvenile chinook and coho salmon inside and outside the plume, and document the impact of changing ocean productivity on survival and growth rates of juvenile salmonids in the Pacific Northwest and on their prey field during what appears to be a possible regime shift to cooler, salmon friendly waters off the Oregon and Washington coast. Although the objectives will be met by executing the study plan, the degree of success will be contingent on ability to contract a vessel to conduct the trawls and whether adequate numbers of juvenile salmon can be collected. Separate objectives are outlined below; each has the scheduled completion in parenthesis following the objective tasks.

Objective 1: Long-term observations: (a) conduct mesoscale surveys; (b) predator and forage fish surveys; (c) top trophic predators; (d) salmon growth; (e) endocrine assessment; (f) genetic stock assessment; (g) pathogen assessment; and (h) prey resources and stomach content (April 2008).

Objective 2: Fine scale process studies: (a) role of fronts; (b) diel studies; (c) pycnocline studies; and (d) estuary fronts (April 2003).

Objective 3: Spatial and temporal features of the Columbia River plume: (a) develop and calibrate plume circulation model; (b) field demonstration of plume model; (c) construct simulation database; (d) develop physical habitat metrics; (e) circulation forecasts; and (f) physical habitats using historical and remote data (April 2005).

Objective 4: Coupled physical-biological modeling: (a) adapt/validate LTM for plume; (b) develop and validate spatially explicit model; and (c) reconstruct spatial-temporal histories (April 2001).

Objective 5: Develop management scenarios: (a) define management scenarios; (b) construct simulation database; and (c) analysis of management scenarios (April 2001).

NOAA Fisheries, *Estimate juvenile salmon residence in the Columbia River plume using micro-acoustic transmitters.* (BPA project number 200399936)

A key element of the project is to understand how salmonids use the plume, both spatially and temporally. We hypothesize a) that interannual, life history (ocean- and stream-type), and biological (size/age) differences impact plume residence, b) residence may vary within season, and c) plume use is patchy, not uniform, and salmonids key on specific oceanographic features associated with the plume such as fronts. Traditional methods used to characterize how juvenile salmon use marine habitats have been limited to protocols relying on marking large numbers of fish, low sampling rates, and large sampling effort. However, recent advances in micro-acoustic transmitter designs now enable telemetry to be used in the nearshore/plume environment. This new technology will be used by marking a total of 3,000 ocean- and stream-type chinook salmon each year and sampling these fish using a combination of fixed and mobile receiver arrays. The Study objective is to observe how salmon use the plume and to test the hypotheses discussed above. These observations of how long fish reside in the plume and which features of the plume they prefer fill a critical need identified by BPA Project 199801400. Therefore, the telemetry data will be incorporated into the overall analyses of survival and growth in the plume. The goal with both projects is to identify ways to improve ocean recruitment by understanding how climate, ocean, and river forcing interact and affect survival in the Columbia River plume.

Status: Ongoing.

Schedule for Completion: Ongoing through the term of the 2000 FCRPS BiOp.

Deliverables: Each study listed above has individual reporting requirements; at a minimum, each study will provide an annual report outlining accomplishments and findings.

Issues: Studies of adult use of the Columbia River Estuary were given a low priority at the Studies Review Work Group (SRWG) and no proposals were received for FY 2003 funding. Three proposals were received for the FY 2004 study review, but again given a low rating by SRWG. The Action Agencies recognize the requirement for adult studies and are working with NOAA, in accord with the Action Agencies January 28, 2003 resolution document, to develop a study plan that identifies the needed studies and establish the priority, scope, and timeline for adult use studies.

For the adult studies, additional discussion on the needs and scope of the required studies is necessary due to conflicting regional views of the importance of adult use of the Estuary. The Corps and BPA are working with NOAA to establish the scope, including identifying components and responsibilities for those components for Columbia River Estuary research. The appropriate funding levels will be established through this process and the Corps will use available funding sources to meet their requirements.

BPA funding that meets requirement includes Project number 199801400, Ocean Survival of Salmonids and Canada/U.S. Ocean Survival of Salmon (provides critical infrastructure to support this action, NOAA/BPA critical elements February 12, 2003).

3. ACTION AGENCY IMPLEMENTATION

The Action Agencies have a number of programs under which the actions as delineated in the BiOp will be implemented. The specifics of the BPA and Corps programs related to the Columbia River Estuary are outlined below.

3.1 Programs

3.1.1 Bonneville Power Administration

The BPA coordinates its BiOp off-site mitigation responsibilities with the NPCC's Fish and Wildlife Program. The NPCC is an interstate compact made up of representatives from the states of Idaho, Montana, Oregon and Washington. The NPCC, established pursuant to the 1980 Pacific Northwest Electric Power Planning and Conservation Act (Northwest Power Act), is responsible for preparing a program to protect, mitigate and enhance fish and wildlife of the Columbia River Basin that have been affected by the construction and operation of hydroelectric dams while also assuring the Pacific Northwest an adequate, efficient, economical and reliable power supply. The program includes both BiOp-related and non-BiOp projects. The Northwest Power Act also directs the NPCC to inform the public about fish, wildlife and energy issues and to involve the public in its decision-making.

Under the Northwest Power Act, the BPA uses its authorities to protect, mitigate, and enhance fish and wildlife, and their habitats, affected by the development and operation of the FCRPS in a manner consistent with the broad goals and objectives of the NPCC's Fish and Wildlife Program. Funding for the Council's fish and wildlife program, and for all of BPA's BiOp-related actions outside of the program, comes from BPA's power marketing activities including the sale of electricity generated at 29 federal hydropower dams and one non-federal nuclear power plant in the Columbia River Basin. The BPA may make these funds available for cost-sharing fish and wildlife projects administered by other federal agencies.

As an agency, the BPA has a responsibility to its ratepayers and the public to make sure that funds are allocated to those projects that deliver the highest quality product (fish and wildlife protection, mitigation, and enhancement) at the least cost. To that end, each project proposed for fish and wildlife funding is thoroughly reviewed by the Independent Scientific Review Panel, an 11-member panel of independent scientists, as well as the region's fish and wildlife managers. The Columbia Basin Fish and Wildlife Authority and the NPCC facilitate the review process. The NPCC considers all review comments and makes project recommendations to the BPA.

The BPA assesses the NPCC's project recommendations and NOAA Fisheries ranking of the projects for BiOp applicability. The BPA issues the final decision as to which projects best meet its obligations, including the NPCC's Fish and Wildlife Program and requirements of the BiOp, and proceeds with awarding contracts for those projects.

In a letter to the NPCC from the Administrator in December 2001, BPA outlined its funding commitment for the period of fiscal years 2002-2006. In March 2003, the Administrator reinforced the agency's funding commitments. For direct program expense accruals, BPA will make available up to \$139 million annually. For direct program capital accruals, BPA will make available up to \$36 million annually. Costs for replacement power when the FCRPS is operated for fish and not power, lost revenues, FCRPS capital, operation, and maintenance costs are not included in the direct program annual amounts. The BPA also reimburses the U.S. Treasury for a portion of the Corps Columbia River Fish Mitigation (CRFM) appropriations. On average this repayment is 80% of the CRFM appropriations; however, the percentage of repayment varies for each federal dam.

3.1.2 Corps of Engineers

The Corps is utilizing a number of different authorities to implement the Estuary Program. The primary authorities the Corps is relying upon are the Columbia River Fish Mitigation (CRFM) Program and its various restoration authorities (GI, Sections 1135, 206, 536). There is a small amount of operation and maintenance funding contributing to these efforts; however, due to the extremely limited funding that portion of the Corps program is not addressed in this Action Plan.

Section 306 of the Water Resources Development Act (WRDA) of 1990 established environmental protection as a primary mission of the Corps in planning, designing, constructing, operating, and maintaining water resource projects. This legislation put environmental protection on equal status with navigation and flood control. Following that change, Section 210 of WRDA 1996 established environmental protection and restoration as a primary project purpose. The other authorities that allow the Corps to plan, design, and construct environmental projects include:

- Lower Columbia River Ecosystem Restoration General Investigations (GI) Study;
- Lower Columbia Ecosystem Restoration Authority, Section 536; and
- Continuing Authorities Program, Sections 204, 206 and 1135.

The key differences between these authorities are outlined in Appendix A. All Corps restoration authorities require a non-federal sponsor to share in the costs of the projects as well as to provide operation and maintenance for the life of the project. The non-federal sponsor is typically a public entity; however, in some cases may be a 501(c)3 non-profit organization. Different rules about sharing costs and when funds must be made available apply to each phase of project development. Different cost sharing rules also apply to various project purposes and authorities. The appropriation process and cost sharing rules for the Corps programs/authorities discussed in this Action Plan are summarized in Appendix A.

The CRFM Program (AFEP) is primarily utilized to investigate and develop improvements to anadromous fish passage facilities and operations at the eight lower Columbia and Snake River projects (Lower Granite, Little Goose, Lower Monumental and Ice Harbor on the Snake; and McNary, John Day, The Dalles, and Bonneville on the Columbia). The program can be considered to have two major components: (1) a mitigation analysis intended to conduct research and evaluate measures to improve passage survival through the projects, and (2) the design and construction of recommended passage facility improvements. The CRFM project serves as one of the principle vehicles for the Corps to implement the requirements contained in the 1995, 1998 and 2000 BiOps for listed salmon and steelhead species in the Columbia River Basin. Through FY02, expenditures on the CRFM project will be about \$780 million. The total cost to complete the project is currently estimated to be about \$1.5 billion. Section 582 of WRDA 1999 expanded the CRFM to allow for research that contributes to an understanding of the biological requirements of salmonids in the Estuary. Prior to this legislation the 'footprint' or impacted area covered by the CRFM was limited to the four lower Snake River and four lower Columbia River Dams.

The CRFM project is funded through annual Congressional appropriations. Electrical power ratepayers in the region through the BPA will eventually repay approximately 80% of the funding. The Corps receives input on priorities and direction for use of the funding through what is known as the System Configuration Team (SCT), made of regional federal, state, and Tribal interests. The SCT was formed along with several other regional coordination groups in a comprehensive Regional Forum to address implementation and adaptive management of BiOp requirements following the release of the 1995 Biological Opinion for the FCRPS. The SCT meets monthly to review progress

and plan future activities for the CRFM program.

The Corps has one additional program that may assist in studies in the Columbia River Estuary. The Planning Assistance to States authority allows for the Corps to assist states, Tribes, local governments, and other non-federal entities in the preparation of comprehensive plans for the development, utilization and conservation of water and related land resources. Examples of studies that may be implemented under this authority include habitat mapping, water quality and wetland evaluation studies. The Habitat Mapping for the Lower Columbia River work effort, initiated in April 2002, is being funded under this program.

3.2 Limitations of Action Agency Programs

Among the limitations listed below for each AA, the most significant issue relating to estuary actions is that of land acquisition in order to meet RPA action 160. To meet his requirements, a mechanism to acquire willing seller land will be necessary. Land acquisition may be the limiting factor in demonstrating progress toward the 10,000-acre figure. There is limited public land available in the lower river and much that is in public ownership is already in a productive state for fish and wildlife. The federal planning processes either through the Corps or BPA and the Council typically requires lead times on the order of years (although this can progress more quickly under certain circumstances). This timeline generally does not allow for ready acquisition of private land as it becomes available.

To overcome this limitation in program agility, the AA and other partners are exploring the viability of a land acquisition fund. The program concept is to develop a funding source with associated criteria and process to allow a non-profit land trust to negotiate and purchase “willing seller” land as it becomes available. Corps restoration authorities, among other partners’ capabilities, can then be used to implement restoration actions once the land is acquired. The advantage of this approach is that the time necessary to gain funding approval either through a grant process or the federal planning process would be significantly reduced. It would also engage local non-profits familiar with local interests and best suited to pursue land acquisition actions. The concept of the fund has been outlined before the Council’s Independent Scientific Review Panel and its Independent Scientific Advisory Board. Coordination is still occurring among interested organizations.

3.2.1 Bonneville Power Administration

Current funding by BPA for the fish and wildlife program was established by the Administrator based on a regional process that developed a range of potential fish and wildlife mitigation and recovery costs. The amount for fish and wildlife costs that BPA recovers through its rates is based on the finding from that regional process. The NPCC recommends how BPA should allocate its funding to each of the provinces, and projects “compete” for funding within those provinces. Other funding limitations exist including the following:

- BPA coordinates its fish and wildlife funding through the Council-facilitated process (provincial reviews, Columbia Basin Fish and Wildlife Authority, Independent Scientific Review Panel review and funding recommendation, etc.). The rolling cycle for provincial review may create timing limitations.
- The Northwest Power Act prohibits BPA from funding measures other entities are authorized or required to implement. In addition, like other federal agencies, the BPA is subject to the prohibition against augmentation of appropriations.
- BPA fish and wildlife funding is administered through a contract process subject to the

Bonneville Purchasing Instructions, and is generally provided on a reimbursable process (i.e. no advance funding except for the relatively rare grant or cooperative funding agreement allowing advance funding).

- BPA fish and wildlife funding is generally provided on an annual basis, although multi-year contracting is under consideration.

3.2.2 Corps of Engineers

A significant limitation in the Corps environmental restoration authorities is the restriction on monitoring and evaluation costs. Specially, monitoring and evaluation for restoration projects cannot exceed 1% of total project costs. This policy has been debated at the national level and little relief from this restrictive limit has been allowed. It is possible to request an exception to this cap; however, rarely has an exception beyond 5% of total project costs been granted. These essentially capital implementation programs may require supplementation by other funding sources should there be a desire to continue monitoring and evaluation beyond the amount allowable under current Corps policies for these authorities. Additionally, monitoring and evaluation is limited to a period not to exceed 5 years following completion of construction. A similar constraint exists for adaptive management; Corps policy includes a limitation of 3% on adaptive management for restoration projects.

A second significant policy limitation under Corps authorities as it relates to the Estuary RPA actions is that the Corps programs assign responsibility for acquisition of land for restoration projects to the non-federal sponsor. The advantage of the Corps program, however, is that the value of the lands, easements, and rights-of-way required of the sponsor are credited toward the required cost share of the project. Land acquisition and some administrative costs are the only actions retroactively creditable to the cost share under Corps authorities. This policy is advantageous in cases where a non-federal sponsor already owns the land that is going to be restored. However, there is a caution that should be noted: although land acquisition is creditable as cost share retroactively, a federal project is not guaranteed until a Project Cooperation Agreement is signed by both the non-federal sponsor and the Corps. To overcome this limitation, the Corps is pursuing actions on public land as well as in areas where existing landowners are willing to sell an interest in their property to a non-profit group.

3.3 Linkages between Programs and Other Entities

Generally speaking, both the BPA Fish and Wildlife Program and the Corps Restoration Authorities require a sponsor to participate in the development and implementation of individual projects. These sponsors may partner with both the BPA and the Corps on an individual project. Bonneville funding may be used to meet the local cost share required under Corps restoration programs. Many of the sponsors for BPA and Corps projects are implementing broader planning and restoration efforts of which BPA and the Corps is among many partners.

Staffs at both agencies continue to work closely to maximize efforts in support of the Columbia River Estuary related actions. The Action Agencies recognize the limitations of our programs and are working to leverage our authorities and organization capacity to the benefit of the Columbia River Estuary. Coordination with other entities in the Columbia River Estuary continues through locally organized groups such as the LCREP, LCFRB, and the State Fish and Wildlife divisions.

3.4 Updating the Action Plan

The Action Plan will be updated on an annual basis for completed, ongoing, and planned actions that are a part of the Estuary Program. The Action Plan may be refined on a more frequent basis as the Estuary Program matures and adaptive management actions are implemented. The focus of the update will be on the actions completed in the prior year and planned actions in light of budgets and regional priorities. Staff at the Corps and BPA will update the plan with input from locally organized groups such as the LCREP, the LCFRB, as well as the RM&E Estuary/Ocean Sub-Group. Submission of updates of the plan will be provided to NOAA Fisheries during January of each year starting in January 2005.

As the Estuary Program evolves, the Action Agencies anticipate the direction and scope of activities may change. This Action Plan will track and incorporate those changes as decisions are made in light of new information gained through ongoing efforts. There are various regional coordinating bodies that will be involved in this definition and refining of Estuary priorities. In addition, the outcome of the BiOp remand will be evaluated upon its release to evaluate the impact to the Estuary Program.

Appendix A – Corps Programs and Funding

Section 210 of WRDA 1996 established environmental protection and restoration as a primary project purpose. The authorities allowing the Corps to plan, design, and construct environmental projects include:

- Lower Columbia River Ecosystem Restoration GI Study;
- Lower Columbia Ecosystem Restoration Authority, Section 536; and
- Continuing Authorities Program, Sections 204, 206 and 1135.

The key differences between these authorities are outlined below. All Corps restoration authorities require a non-federal sponsor to share in the costs of the projects as well as to provide operation and maintenance for the life of the project. The non-federal sponsor is typically a public entity; however, in some cases may be a 501(c)3 non-profit organization. Different rules about sharing costs and when funds must be made available apply to each phase of project development. The appropriation process and cost sharing rules for the Corps programs/authorities discussed in this Action Plan are summarized below.

Lower Columbia River Ecosystem Restoration General Investigation Study

Appropriations: This project was initiated in 2001 with its first appropriation; each year a budget request is made for this project by the Corps' Portland District. Ultimately, Congress and the Administration fund the project as a line item in the Corps' appropriation.

Cost Sharing: Reconnaissance phase 100% federal cost (complete); feasibility phase 50% federal, 50% non-federal; pre-construction engineering and design phase 75% federal, 25% non-federal; construction phase (for ecosystem restoration) 65% federal, 35% non-federal; all operation and maintenance costs are non-federal.

Lower Columbia Ecosystem Restoration Authority

Appropriations: This project was initiated in 2002 with its first appropriation; each year a budget request is made for this project by the Corps' Portland District. Ultimately, Congress and the Administration fund the project as a line item in the Corps' appropriation.

Cost Sharing: Each project is funded 65% federal, 35% non-federal. The feasibility and engineering and design phases are initially federally funded. The sponsor provides its 35% cost requirement prior to initiating construction. For projects on federal land, the Corps funds 100% of the cost of the restoration features. In all cases, operation and maintenance costs are the responsibility of the landowner.

Continuing Authorities

For each of the following authorities, the planning and design effort is initially federally funded. The sponsor will share this cost at construction. In each case the non-federal sponsor is required to provide all lands easements and rights of way necessary for the project as well as operate and maintain the project in perpetuity.

For each of these authorities, Congress authorizes a specific dollar amount for the program and the

Corps has the authority to make investment decisions without specific Congressional approval. The result of the appropriation process is, in essence, that these projects compete on a nationwide basis for funding.

Section 1135 Project Modifications for Improvement of the Environment

Cost Sharing: 75% federal cost, 25% non-federal cost; all operation and maintenance costs are non-federal. 80% of the non-federal contribution may be work-in-kind.

Section 206 Aquatic Ecosystem Restoration

Cost Sharing: 65% federal cost, 35% non-federal cost; all operation and maintenance costs are non-federal.

Section 204 Beneficial Use of Dredged Material

Cost Sharing: 75% federal cost, 25% non-federal cost; all operation and maintenance costs are non-federal. The non-federal sponsor may be a governmental agency or non-profit organization.

Planning Assistance to States

Appropriations: Congress authorizes a specific dollar amount for the program and the Corps has the authority to make investment decisions without specific Congressional approval.

Cost Sharing: 50% federal cost, 50% state/Tribe cost (annual support to each state or Tribe not to exceed \$500,000).

Appendix B – Related Actions

The purpose of this Appendix is to place this Action Plan in the context of local, regional, and national restoration-related initiatives. Currently, numerous efforts involve salmon habitat restoration to varying degrees in the Columbia River Estuary; the most relevant regional initiatives include:

- Lower Columbia River Estuary Partnership
- Lower Columbia River Estuary Plan (July 1999)
- Lower Columbia River Fish Recovery Board
- Salmon Recovery Plan for Southwest Washington (under development)
- Oregon Watershed Enhancement Board
- Oregon Plan

(Note: this section is excerpted from the report by Johnson et al. 2003, *An ecosystem-based approach for restoration projects in the Columbia River Estuary with an emphasis on salmonid habitats*).

The Estuary Partnership

Based on the results of the Bi-State Study Water Quality Study (1990-1995), the Columbia River Estuary was nominated and accepted into the National Estuary Program in 1995. In 1999, after a 3-year collaborative planning process, the LCREP completed the *Lower Columbia River Estuary Plan* for the lower 146 river miles of the Columbia River. This plan identified a series of ecological problems in the Columbia River Estuary and provided 43 specific actions to address those problems. Foremost among the problems was the loss of more than 50% of the river's original wetland habitat. Accordingly, the LCREP targeted habitat conservation and protection as its top priority and began to address this issue following the adoption of the *Estuary Plan* in October 1999 by the governors of the States of Oregon and Washington. The Plan includes two main elements related to habitat: inventory/monitoring and conservation/restoration.

Habitat Inventory and Monitoring: The LCREP developed a comprehensive ecosystem monitoring plan as part of its *Lower Columbia River Estuary Plan*. This monitoring plan, *Aquatic Ecosystem Monitoring Strategy for the Lower Columbia and Estuary*, provides a series of recommended monitoring actions to be phased in over time as funding and resources allow. A key component of the strategy is a detailed habitat inventory. A second important component is the implementation of a long-term habitat monitoring initiative with the goal of measuring habitat condition over time and monitoring the effectiveness of habitat conservation/restoration projects. The inventory/monitoring effort will be used to establish baseline conditions for selected environmental attributes. Performance indicators can then be monitored over time to assess the effectiveness of restoration actions relative to performance standards.

Habitat Conservation and Restoration Program Development: For the past three years, the LCREP, CREST and the Science Work Group have undertaken a series of collaborative projects funded primarily through grants from the U.S. Environmental Protection Agency. These projects were designed to establish the framework for an ecosystem restoration program and to develop a systematic, scientific approach for evaluating proposed habitat protection and restoration projects.

Lower Columbia Fish Recovery Board

The LCFRB is a coordination body established by the State of Washington. The state's Salmon

Recovery Funding Board designated LCFRB as the lead entity in southwest Washington to solicit, develop, prioritize, and submit habitat protection and restoration projects for consideration. As part of the recovery planning process, the LCFRB has initiated a strategic watershed-based planning effort toward the recovery of salmonid species in the Columbia River Estuary. The LCFRB distributes watershed planning funds to local areas through Watershed Resource Inventory Areas. Each area goes through several assessment phases to inventory current information in order to obtain a coarse understanding of watershed characteristics, including instream flows, water quality and habitat conditions. Three areas are currently doing watershed planning related to the Columbia River Estuary. Each area has a planning group representing the diverse interests of the watershed. They assist in guiding the development assessment products and action plans for their respective watershed.

The LCFRB has also led the development of a Limiting Factors Analysis to characterize the “conditions that limit the ability of habitat to fully sustain populations of salmon.” Summary information of key findings is included in the 159 Plan to enhance fine scale characterization of the study area. In addition, the 159 Plan was reviewed by the LCFRB for consistency with their efforts.

Oregon Watershed Enhancement Board

The Oregon Watershed Enhancement Board (Board) is a state agency led by a policy oversight board in charge of implementing the Oregon Plan whose goal is, “Restoring and protecting Oregon’s watersheds through locally-driven, voluntary, cooperative efforts.” They promote and fund voluntary actions that strive to enhance Oregon’s watersheds through several grant programs that awards more than \$20 million annually to support voluntary efforts by Oregonians seeking to create and maintain healthy watersheds. Board support is primarily through citizen action groups or watershed councils. In January 2003, the Board embarked on establishing regional priorities that will become the basis for funding decisions by the board. In the Columbia Basin, the Lower Columbia and Hood River subbasins have been selected to be a part of this process. This initiative is meant to be closely coordinated with the NPPC subbasin planning entity to identify and incorporate the priorities resulting from the subbasin planning process.

Related Local Restoration Efforts

Local groups are conducting conservation and restoration activities in the Columbia River Estuary. These include non-profit organizations, special districts, and partnerships. Each possesses unique capacity and contributes resources to benefit the ecological features of the study area. These resources include but are not limited to technical assistance, land acquisition expertise, site identification, planning and design, monitoring, local ecosystem knowledge, and community credibility.

There are other related actions ongoing in the Columbia River Estuary. There are many water quality monitoring efforts by various local, state and federal agencies, such as the Oregon Department of Environmental Quality’s statewide network of ambient monitoring sites, the U.S. Geological Survey’s National Ambient Water Quality Assessment program, and the Corps monitoring of temperature and total dissolved gas. In addition, the U.S. Geological Survey is performing a sediment core analysis; a NOAA Fisheries Technical Recovery Team is identifying recovery goals for all listed salmonids, Portland State University, Oregon State University, and the University of Washington are surveying invasive species distribution and abundance in the lower Columbia River; Sea Resources, a local conservation organization, has a grant from the Columbia Land Trust and Salmon Recovery Funding Board of the State of Washington to develop a habitat model to study the effects of tide gate removal on the Chinook River; and the Columbia River Estuary Study Taskforce

has funding from the LCREP to monitor the effects of tide gate removal.

Appendix C – Issue Paper River Mile 46

Issue

The language in the FCRPS BiOp, RPA Action 160, calls for the Corps and BPA, working with the LCREP, to develop and implement an Estuary restoration program with a goal of protecting and enhancing 10,000 acres of tidal wetlands and other key habitats over 10 years, beginning in 2001. The purpose of this is to rebuild productivity for listed populations in the lower 46 miles of the Columbia River. Limiting the range to the lower 46 miles is problematic because, it does not adequately recognize the importance of continuity and connectivity of habitat in the lower river, and significantly limits the potential opportunities for valuable restoration projects. (Note: The BiOp does not say the actions have to take place in the lower 46 miles, only that the productivity is rebuilt in the lower 46 miles. For instance, one possible way of rebuilding the productivity in the lower 46 miles is to enhance the connectivity of habitat in the entire 146 miles below Bonneville Dam. This would require that some of the 10,000 acres be enhanced from RM 46-146.

Background

The designation of river mile 46 as the upper limit for estuarine restoration is based on earlier estuarine work that showed this to be the furthest upstream influx of the saltwater intrusion. The significance of this saltwater intrusion to salmon is not known.

Specific habitat and rearing needs for ESA listed salmonids are just now beginning to be investigated for Columbia River Estuary and are unknown for the freshwater part of the lower river. Putting a boundary on salmonid habitat restoration efforts could be limiting in the recovery of all ESA listed salmon stocks. *Salmon at Rivers End*, a document produced by NOAA-Fisheries to evaluate the “role of the estuary in the decline and recovery of Columbia River salmon,” defines the estuary “to include the free-flowing waters that are influenced by oceanic tides: a reach spanning 240 km [149 miles] from the river’s ocean entrance to the base of Bonneville Dam” (Bottom et al. 2001). The LCREP *Lower Columbia River Estuary Plan* states, “An estuary is the area where the fresh water of a river meets the salt water of an ocean. In the Columbia River system, this occurs in the lower 46 river miles.” The plan also defines the Estuary as “the 146-mile(s) from Bonneville Dam to the Pacific Ocean.” The plan clarifies the distinction through use of the Clean Water Act. The plan states, “The Clean Water Act, which authorizes the National Estuary Program, extends the definition of estuary to include tidally influenced waters of rivers. As part of the program, the Lower Columbia River Estuary Program uses the broader definition. The LCREP study area extends from the Pacific Ocean to Bonneville Dam at river mile 146 because of the far-reaching effects of the ocean’s tides.”

The *Salmon at Rivers End* document specifies their “study area” as from river kilometer 75 [RM 46] and it also indicates the area in study is more pertinent to “ocean type” salmonids like fall-chinook, chum, and some coho salmon. However, the document also discusses the loss of lower river habitat above river mile 46 and states “the loss of these habitats between Jones Beach and Bonneville Dam was likely greater (than below river mile 46) but has not been quantified.” Different species and populations of pacific salmon evolved with different strategies for using all available freshwater and estuarine rearing and nursery habitats within a river basin (Healey 1982, Groot and Margolis 1991). While some habitat types may be of more importance to different salmonid species or types (ocean type versus stream type), all lower river and estuarine habitats will need to be evaluated as potential sites for recovery of all ESA-listed species and stock. As the document states, “Accordingly, efforts to improve or restore the estuary for salmon must be developed in concert with hatchery, harvest, and upriver habitat improvements to recover those life-history types that can benefit from estuary

restoration.” We should be making an effort to expand the productivity of the entire lower river and estuarine habitats to assist all ESA-listed salmon “types.” Also, “Recovery efforts should expand diversity of both salmon life-history and habitat opportunities to allow for the widest possible range of successful rearing behaviors. Efforts to significantly improve the productive capacity of the estuary for salmon should therefore encompass many habitats and life histories that are now rare or non-existent rather than those few that have come to dominate as a consequences of industrial development of the basin and intensive selection pressures from harvest and hatchery influences” (Bottom et al. 1991).

The definition (limit) of the estuary used in the Corps authorities for the GI study and Section 536 Ecosystem Restoration authority extends to the head of tide at Bonneville Dam. These authorities are the Corps vehicles to accomplish estuary planning and restoration actions, respectively.

An additional issue with the river mile 46 is that it does not address the need for habitat corridors and connectivity. Salmon migrate along a continuum of habitat; this mosaic of habitat is necessary along the whole of the Columbia River Corridor. Limiting or focusing on a portion of that corridor will not necessarily be consistent with an ecoscape approach as recommended by many fisheries professionals, including NOAA staff. This issue was addressed at a workshop held in Astoria, Oregon on June 12-13, 2001 that focused on developing scientific criteria for identifying and prioritizing habitat protection and restoration projects on the Columbia River Estuary. Over one hundred national and regional experts and agency resource managers met for the intensive two-day session. The consensus of that group supported the need and importance of connected habitat corridors throughout the river, not focusing on one reach of the river. They investigated potential habitat restoration areas from the mouth to Bonneville Dam. A restoration focus on the lower 46 river miles will necessarily be at the detriment of the remaining sections of the lower river as funding is applied to the lower 46 miles to meet RPA Action 160.

Finally, available land will limit the ability of the action agencies to implement that required acreage below river mile 46. According to data available on the relevant diking districts, this requirement (10,000 acres) amounts to 44% of the existing stock of land within the 23 districts along the lower 46 miles of the Columbia River. It is not realistic to assume that all of that land will be available or suitable for conversion to wetlands or habitat. A further limiting factor is that any program to implement restoration will necessarily have to rely on willing sellers for acquisition of land for restoration or take place on public land.

Options

The options to be considered include:

Continue to work to meet the 10,000-acre goal within the existing BiOp limit of the lower 46 miles. This approach limits possibilities and foregoes some opportunities, especially given budget constraints that will likely restrict funding to projects that meet the letter of the BiOp. It may be necessary to revisit and revise the limit later if we are unable to meet goal within these geographic limits, and many project opportunities may have been passed by.

Work with NOAA Fisheries to extend the limit for Estuary restoration to the head of tide at Bonneville Dam. This option opens opportunities and increases chances for success, both in terms of habitat/species recovery and meeting the goal for acreage restored or enhanced. It fully recognizes the importance of continuity/connectivity of habitat. It would be possible to still focus on the lower 46 miles (prioritize) but not restrict resources and efforts as habitat opportunities are identified up

river of RM 46 by proposed research in this area.

Recommendation

Option 2, revising the limit for Estuary habitat restoration to extend up to Bonneville Dam is recommended. It provides the greatest opportunities for restoring valuable wetlands and other habitat throughout the lower Columbia River. This maximizes connectivity and the diversity of habitat types and their distribution, to meet the needs of as wide a range of salmon sticks and life histories as possible.

References

- Bottom, D.L., Simenstad, C.A., Baptista, A.M., Jay, D.A., Burke, J., Jones, K.K., Casillas, E., and Schiewe, M.H. 2001. *Salmon at Rivers' End: The Role of the Estuary in the Decline and Recovery of Columbia Salmon*. National Marine Fisheries Service, Seattle, Washington.
- Groot, C. and L. Margolis (editors). 1991. *Pacific Salmon Life Histories*. University of British Columbia Press, Vancouver, B.C.
- Healey, M.C. 1982. Juvenile Pacific salmon in estuaries: The life support system, pp. 315-341 *In* *Estuarine Comparisons*, V. S. Kennedy, editor. Academic Press, New York.