



## Lower Columbia River Estuary Plan

Lower Columbia River Estuary Program  
Comprehensive Conservation and Management Plan

*Artwork and Cover Design:*  
Manda Beckett, Portland, Oregon

*Principal Writer:*  
Nancy Jerrick, Counterpoint Consulting, Portland, Oregon

*Photographs:*  
Jim Douglas, Portland, Oregon

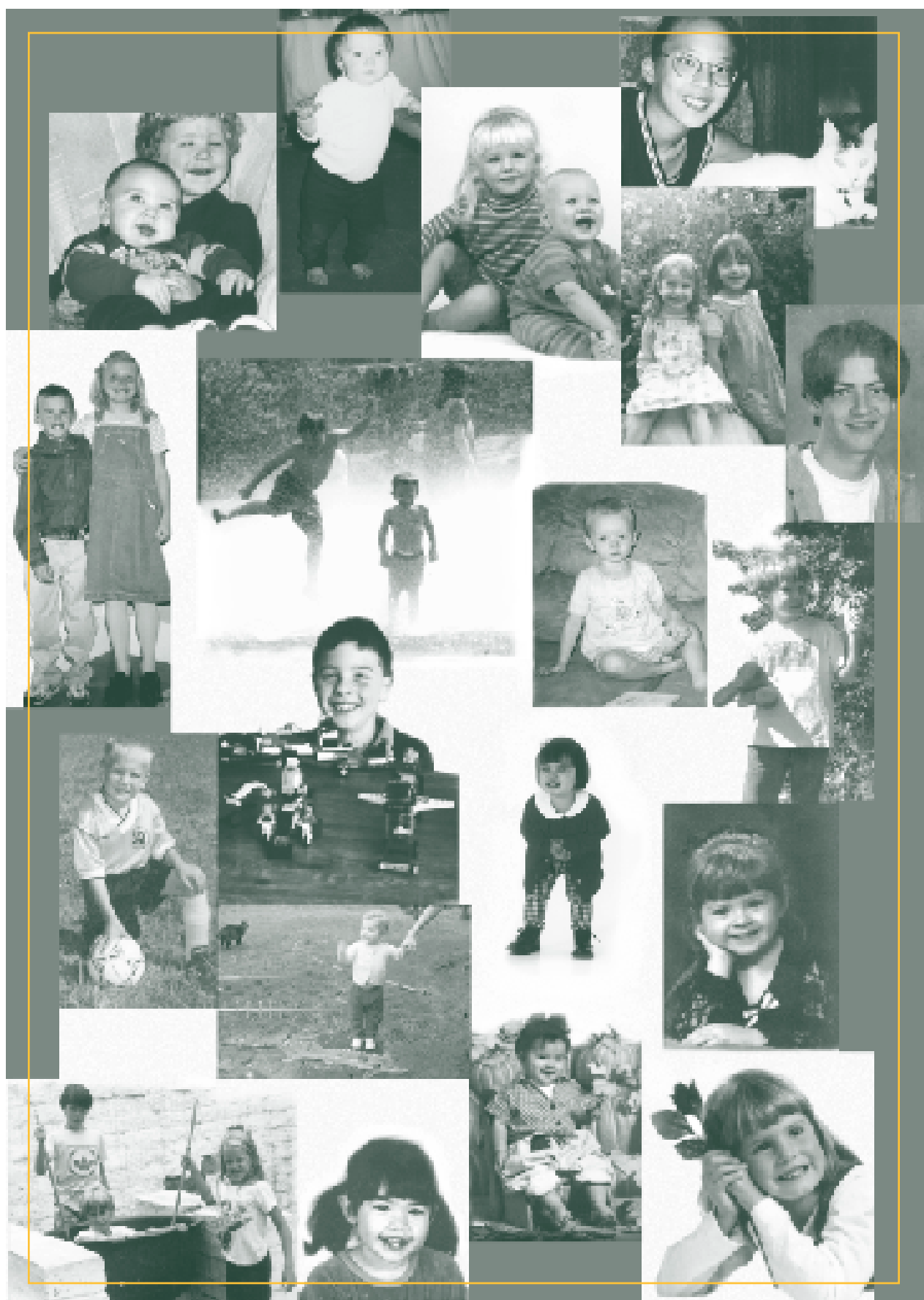
*Estuary Program Director:*  
Debrah Richard Marriott

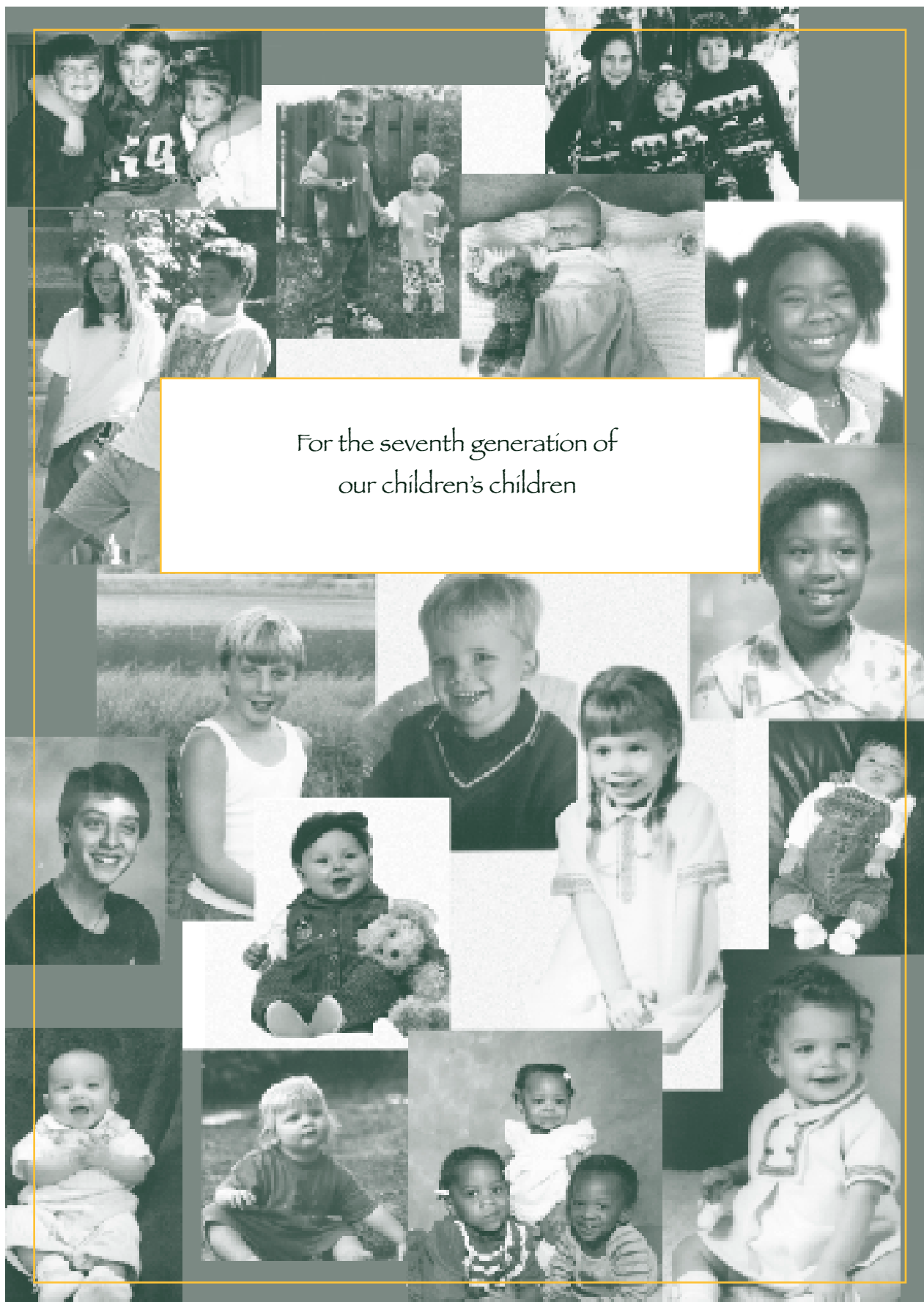
*Management Committee Chair:*  
Glenn Vanselow

*The Lower Columbia River Estuary Program is supported  
by the States of Oregon and Washington  
and the U.S. Environmental Protection Agency.*

Eventually, all things merge into one,  
and a river runs through it.

Norman Maclean





For the seventh generation of  
our children's children



THE LOWER COLUMBIA RIVER ESTUARY PROGRAM

Comprehensive Conservation  
and Management Plan

VOLUME 1

JUNE 1999

# MANAGEMENT CONFERENCE MEMBERS

---

## POLICY COMMITTEE

Carol Jolly  
Executive Policy Advisor  
*Office of Governor Locke*

Louise Solliday  
Watershed Advisor  
*Office of Governor Kitzhaber*

Sue Mauermann  
Regional Director  
*Southwest Regional Office*  
*Washington Department of Ecology*

Langdon Marsh  
Director  
*Oregon Department of*  
*Environmental Quality*

Erik Sten  
Commissioner  
City of Portland  
*Local Government*

Alphonse Halfmoon  
Confederated Tribes of the Umatilla  
Indian Reservation  
*Tribal Interests*

Jack Gakstatter  
*U.S. Environmental Protection Agency*

Carl Dugger  
*Estuary Program Management Committee*

Glenn Vanselow  
*Estuary Program Management Committee*

---

## PROGRAM STAFF

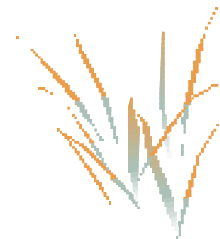
Debrah Richard Marriott  
*Director*

Nate Alexander  
*Office Manager*

Bill Young  
*Intergovernmental Coordinator*

Bruce Sutherland  
*Staff Scientist*

Chris Hathaway  
*Natural Resource Specialist*





---

## MANAGEMENT COMMITTEE

Glenn Vanselow, *Chair*  
Washington Ports  
*Pacific Northwest Waterways*  
*Association*  
(Daniel James)

Jim Bergeron, *Vice Chair*  
Citizen Representative  
*Oregon State Extension Service*  
(Jon Graves)

Kristin Reese  
Oregon Environmental  
Interests  
*Hood River Chamber of*  
*Commerce*  
(Gayle Killam)

Carl Dugger  
Washington Environmental  
Interests  
*Washington Environmental*  
*Council*

Rollie Montagne  
Oregon Ports  
*Port of Portland*  
(Bob Friedenwald)

Llewellyn Matthews  
Pulp and Paper Interests  
*Northwest Pulp and Paper*  
*Association*  
(Carol Whitaker)  
(Al Whitford)

Kristin Nadermann  
Industry Representative  
*Reynolds Aluminum Company*

Norman Cuffel  
Local Government  
Representative  
*Commissioner, Pacific County*  
(Kathy Taylor)  
(Woody Woodruff)

Nelson A. Graham  
Local Government  
Representative  
*Assistant City Manager,*  
*City of Longview*  
(Steve Harvey)

Ralph Ennis  
Commercial Fishing  
(Eldon Korpela)

Jack Peterson  
Local Government  
Representative  
*Commissioner, Columbia*  
*County*  
(Joe Bakkensen)

Dean Marriott  
Local Government  
Representative  
*Director of Environmental*  
*Services, City of Portland*  
(Linda Dobson)

Lisa Randlette  
*Washington Department of*  
*Natural Resources*  
(Margaret Pilaro Barrette)

David Price  
*Washington Department of Fish*  
*and Wildlife*  
(Peter Birch)

Steve Purchase  
*Oregon Division of State Lands*  
(John Lilly)

Keli McKay  
*Washington Department of*  
*Ecology*  
(Iloba Odum)

Chris Wheaton  
*Oregon Department of Fish*  
*and Wildlife*  
(Greg Robart)

Andy Schaedel  
*Oregon Department of*  
*Environmental Quality*  
(Greg Pettit)

Matt Winters  
Citizen Representative  
*Publisher, Chinook Observer*

Andre L'Heureux  
Regional Interests  
*Northwest Power Planning*  
*Council*

Mary Patterson  
Agriculture Interests  
*Farmer*  
(Tom Myrum)

George Kiepke  
Labor Interests  
*Fort James Mill*  
(Brad Witt)

Troy Clark  
Recreational Interests  
(Jeffrey Kee)

Jeremy Buck  
*U.S. Fish and Wildlife*  
*Service*  
(John Marshall)

Bob Willis  
*U.S. Army Corps of Engineers*

Steve Morris  
*National Marine*  
*Fisheries Service*  
(Bruce McCain)

Jack Gakstatter  
*U.S. Environmental*  
*Protection Agency*  
(John Gabrielson)

Bill Yallup  
*Yakama Indian Nation*  
(Moses Dick Squeochs)

Alphonse Halfmoon  
*Confederated Tribes of*  
*the Umatilla Indian*  
*Reservation*  
(Raphael Bill)

Eugene Greene  
*Confederated Tribes of*  
*the Warm Springs Reservation*  
*of Oregon*  
(Olney Patt, Jr.)

Jaime Pinkham  
*Nez Perce Tribe*

*Names in parentheses are*  
*alternate committee members*

---

## PUBLIC INVOLVEMENT WORK GROUP

Matt Winters, *Chair*  
*Washington Citizen-At-Large*

Jon Graves  
*Marine Environmental Research*  
*Training School*

Steve Harvey  
*Cowlitz-Wabkiakum Council of Governments*

Tom Myrum  
*Washington Department of Water Resources*

Jim Bergeron  
*Oregon State Extension - Clatsop County*

Peter Birch  
*Washington Department of Fish & Wildlife*

Jerome Arnold  
*Ecola Creek Awareness Project*

Brad Witt  
*Oregon AFL-CIO*

Greg Furher  
*U.S. Geological Survey*

Darrel Buttice  
*Port of Portland*

Mary Ruhl  
*Action Now and Science Work Group*

George Kiepke, *Co-Chair*  
*Oregon AFL-CIO*

Llewellyn Matthews, *Co-Chair*  
*Northwest Pulp & Paper Association*

Carl Dugger, *Co-Chair*  
*Washington Environmental Council*

Steve Hinton  
*Oregon Trout*

John Marshall  
*U.S. Department of Fish & Wildlife*

Al Whitford  
*Longview Fibre Company*

Jeremy Buck  
*U.S. Department of Fish & Wildlife*

Ralph Ennis  
*Commercial Fishing*

Galen May  
*Northwest Aluminum Company*

Rollie Montagne  
*Port of Portland*

Mary Patterson  
*Clatsop Soil and Water Conservation Service*

Andy Schaedel  
Greg Pettit  
*Oregon Department of Environmental Quality*

Jack Gakstatter  
*U.S. Environmental Protection Agency*

Bruce McCain  
*National Marine Fisheries Service*

Steve Purchase  
*Oregon Division of State Lands*

Greg Furher  
*U.S. Geological Survey*

Mark Siipola  
*U.S. Army Corps of Engineers*

Chuck Henny  
*National Biological Service*

Duncan Gilroy  
*Oregon Department of Health*

Kathy Futornick  
*Port of Portland*

Phil Barrett  
*Oregon Graduate Institute*

Kathy Taylor  
*Columbia River Estuary Study Taskforce*

Eldon E. Korpela  
*Salmon for All*

Rick Vining  
*Washington Department of Ecology*

---

## LOCAL GOVERNMENT CONTACTS

Sam Adams <i>City of Vancouver</i>	Nelson A. Graham <i>Assistant City Manager, Longview</i>	Tom Neff <i>City of West Linn</i>
Jerry Anderson <i>Wood Village</i>	Gilbert Gramson <i>City Manager, Warrenton</i>	Chad Olsen <i>City of Rainier</i>
Joe Bakkensen <i>Clatsop County Commissioner</i>	Lynn Guenther <i>City of Hood River</i>	Ronald Ozment <i>Wabkiakum County Commissioner</i>
Paul Benoit <i>Director of Community Development, Astoria</i>	Lloyd Halvorson <i>City of Camas</i>	Paul Parker <i>Washington Association of Counties</i>
Don Bradley <i>City of West Linn</i>	Steve Harvey <i>Cowlitz-Wabkiakum Council of Governments</i>	Jack R. Peterson <i>Columbia County Commissioner</i>
Eddie Campbell <i>Multnomah County</i>	Eric Holms <i>City of Washougal</i>	Doug Robertson <i>City Manager, Kelso</i>
Keith Chamberlain <i>City of North Bonneville</i>	Marlia Jenkins <i>Clark County</i>	Scott Revell <i>Hood River County Planning and Community Development</i>
Larry Cole <i>City of Clatskanie</i>	Barbara Karnis <i>City of Woodland</i>	Joel Rupley <i>Cowlitz County Board of Commissioners</i>
Norman Cuffel <i>Pacific County Commissioner</i>	Steve Kenworthy <i>City of Ridgefield</i>	Harpreet Sandhu <i>Skamania County Planning Department</i>
Linda Dobson <i>City of Portland, Environmental Services</i>	Joel Komarek <i>Public Works Department, Lake Oswego</i>	Debra Smith <i>Mayor, City of Cascade Locks</i>
Pat Duval <i>City of Milwaukie</i>	Erik Kvarsten <i>City of Troutdale</i>	Ed Smith <i>City of Castle Rock</i>
Linda Elliott <i>City of Cathlamet</i>	Marian Lahav <i>Department of Community Preservation and Development, Vancouver</i>	Lisa Smith <i>City of Scappoose</i>
Stan Finkelstein <i>Association of Washington Cities</i>	Charles Leeson <i>City Manager, Oregon City</i>	Kathy Taylor <i>Columbia River Estuary Study Taskforce</i>
Gordon Fultz <i>Association of Oregon Counties</i>	Brian Little <i>City Manager, St. Helens</i>	Willie Tiffany <i>League of Oregon Cities</i>
Rosemary Furfey <i>METRO</i>	Patrick Lynch <i>Special Districts Association of Oregon</i>	Jim Trick <i>Mayor, City of Ilwaco</i>
Guy Graham <i>City of Gresham</i>	Dean Marriott <i>City of Portland, Environmental Services</i>	Ginny Van Loo <i>Clackamas County</i>
Bill Gaffi <i>Unified Sewage Agency Washington County</i>	Val Marty <i>City of Kalama</i>	Roger Vonderharr <i>Mayor, City of Fairview</i>
Ken Galloway <i>County Forestry Department Hood River County</i>	Mark McCrady <i>City of Longview</i>	Alan Willis <i>Port of Portland</i>
Janet Gillaspie <i>Association of Clean Water Agencies</i>	Ed McLarney <i>Skamania County Board of Commissioners</i>	Cheryl Young <i>Columbia City</i>

## PREFACE

This *Comprehensive Conservation and Management Plan* provides a broad framework for managing and protecting the lower Columbia River and estuary. It is a guide for preserving and enhancing water quality and habitat, to be implemented by federal, state, local, and tribal governments; river users; environmental interests; and citizens of the region.

As part of the National Estuary Program, the *Management Plan* focuses on the 146 miles of tidally influenced waters below Bonneville Dam. This river reach links ecosystems and economies north and south of the Oregon/Washington border, and east and west between the more heavily populated, wetter coastal valleys and mountains and the more sparsely populated, arid interior of the Columbia Basin. In addition to offering specific actions for the lower river and estuary, the plan provides a framework for coordinating the needs of the lower Columbia within broader, basin-wide considerations.

A diverse group of stakeholders participated on the Management Committee that prepared the *Management Plan*, with considerable input from the public. The plan is the product of a painstaking consensus process, which served not to dilute the decisions, but rather to create a better product. We tackled tough issues and make some bold decisions. The result is a plan that is ready for implementation, rather than requiring further debate.

The *Management Plan* defines specific actions for habitat, land use, and conventional and toxic pollutants. These actions will serve fish and wildlife habitat and water quality in three important ways: prevention of further loss, protection and enhancement of existing resources, and restoration where damage has already occurred. They focus both on solving existing problems and avoiding new ones. The goal is to achieve a net increase in water quality and habitat values.

The actions also address education and management. In our meetings with the public, we were told that education is key. Therefore, several actions call for the Estuary Program to provide hands-on education and technical and financial assistance to all parties as they work to implement this plan. Actions are also directed at both states and the federal agencies to increase consistency in setting standards, establishing regulations, and providing enforcement. Finally, the plan includes a long-term monitoring program so we can better identify problems and measure our progress.

This is an ambitious plan. Implementation of many actions can begin immediately. Success will not happen overnight, however. It will take years of diligence in many areas to see improvement. We will continually evaluate our efforts and adjust the plan to make sure it meets the river's needs. With the stewardship of all the citizens of the region, we can continue to enjoy the exemplary quality of life in the Pacific Northwest. We will be able to maintain the mutual regional goals of a vibrant economy and a healthy environment.

Glenn Vanselow, *Chair*  
*Lower Columbia River Estuary Program*  
*Management Committee*

## PREFACE

The Lower Columbia River Estuary Program's *Comprehensive Conservation and Management Plan* is the work of the talented and highly dedicated members of the Management and Policy Committees. For 3 years, they have worked diligently, struggled tirelessly, and given much of themselves. The decisions did not always come easily, but after months and months of listening and learning, they make here a substantial contribution to the river and to future generations.

With completion of this *Management Plan*, we are well poised to solve problems in the lower Columbia River and estuary. Not only are the specific actions in place, they were developed in a collaborative process that will well serve their implementation. The goal has been to have the citizens guide this plan. We have often been frustrated by the size of the study area and the challenges posed by the range of cultural geography. The committee members worked very hard, using a number of innovative means, to make sure they were in fact listening to and representing all our citizenry. They took their role as representatives seriously, meeting with their constituents at critical milestones to seek guidance. While each wore a specific hat from 8:00 a.m. to 5:00 p.m., it was their 5:00 p.m. to 8:00 a.m. values that drove them. In all their public involvement efforts, the committee members never settled only for getting the public's review of their decisions; they asked for direction and guidance on issues still under debate. The plan they advance here reflects the struggles and the grace it takes to work collaboratively for a common good.

We were well served by every member, past and present. The Management Committee chair and vice-chair, Glenn Vanselow and Jim Bergeron, served as great role models in representing interests and working toward consensus. Like so many members, they gave generously of their time and energy. The faith and guidance of our facilitator, Carie Fox, made all the difference. We are indebted to Jessica Cogan and Jack Gakstatter from the U.S. Environmental Protection Agency, who were generous with their time, expertise, and resources. It is teamwork such as theirs that makes the National Estuary Program a model for dealing with any environmental issue. We appreciate the confidence and support of Marilyn Katz and Debora Martin of the U.S. EPA and Kate Kramer and the Western Center for Environmental Decision Making in helping us successfully integrate a risk ranking into our efforts. We are pleased to be on time with a quality *Management Plan* that was completed under budget, leaving program money available for additional grants and special projects. The program has benefited from a highly dedicated, talented, and fun staff.

We thank Governor John Kitzhaber of Oregon and Governor Gary Locke of Washington for their leadership in watershed management and effective government. That leadership will guide this plan and us through implementation.

To the many, many citizens beyond the committees—individual, municipal, and corporate—who joined us for workshops, participated in focus groups, gave us feedback, or planted trees: please know that this document reflects your work. We could not have done this without you.

And so, to the seventh generation of our children's children, we dedicate our work.

Debrah Richard Marriott, *Director*  
*Lower Columbia River Estuary Program*

## **MISSION**

The mission of the Lower Columbia River Estuary Program is to preserve and enhance the water quality of the estuary to support its biological and human communities.

## **VALUES**

We value the biological diversity and the economic, social and aesthetic benefits of the Lower Columbia River.

We acknowledge our differences and value our ability to come together to ensure the long term prosperity and sustainability of the river.

We are united into one community by the river. Its flow carries our history, our multiple cultures, our prosperity, and our future.

We value a common sense of stewardship toward the river by all people.

# TABLE OF CONTENTS

## 1-INTRODUCTION

## 2-PROFILE OF THE LOWER COLUMBIA RIVER AND ESTUARY

## 3-DEVELOPING A PUBLICLY GUIDED *MANAGEMENT PLAN*

## 4-PRIORITY ISSUES

## 5-ACTION PLAN

## 6-IMPLEMENTATION

DEFINING THE ONGOING ROLE OF THE ESTUARY PROGRAM	191
Estuary Program Activities	192
Monitoring and Evaluation	193
WHAT THE ESTUARY PROGRAM BRINGS	194
Two-State Effort	195
Improved Management	195
STRUCTURE OF THE ESTUARY PROGRAM: TWO ENTITIES, ONE GOAL	200
Estuary Program	200
The Columbia River Foundation	200
Staffing	200
Lower Columbia River Estuary Program	202
Funding	203
Implementation Strategy	204
Ongoing Projects	207
Local Grant Projects	208
Other Projects	209
COLLABORATIVE IMPLEMENTATION	210

## THE NEXT CHAPTER



# 6 IMPLEMENTATION

There are those to whom place is unimportant,  
But this place, where sea and fresh water meet,  
Is important

—Theodore Roethke

**W**ith completion of the *Management Plan* in summer 1999, the Estuary Program moves on to implement the 43 actions. The Estuary Program's primary responsibility will be to ensure that the actions are carried through. To do that, the program will play a variety of roles.

- For some actions, the Estuary Program will *consult* with other entities about what should be done to implement the action, *tracking* the action as it is implemented by others.
- For other actions, the Estuary Program will *convene* appropriate parties to implement the action, *assisting* with the implementation of the action.
- For still others, the Estuary Program will *coordinate* and lead efforts to implement the action, *doing* the action itself.

As a two-state effort, the Estuary Program is well positioned to provide effective collaboration and coordination among the multiple efforts already underway in the lower river and estuary. At a minimum of every two years, the Estuary Program will evaluate the implementation progress and the effectiveness of the actions. This will allow the Estuary Program to respond to changing needs, evolving science, and current environmental problems.

## DEFINING THE ONGOING ROLE OF THE ESTUARY PROGRAM

At the leadership forum held in January 1999 for tribal, federal, state, and local government officials, participants reviewed the draft *Management Plan* to comment on the proposed actions. (See Chapter 3 for additional discussion of the forum.) They were also asked how the Estuary Program could best assist them and add value to their existing efforts during implementation of the *Management Plan*.

The leadership forum provided valuable input to the Management Committee in defining the ongoing role of the Estuary Program throughout the implementation phase. The Estuary Program will concentrate its efforts on actions that are currently not addressed adequately—specifically, habitat restoration and protection, education, and coordinated management.



Specific areas in which **local government officials** suggested the Estuary Program could **assist** them were:

- Restore, preserve, acquire habitat
- Monitor, analyze trends, evaluate effectiveness
- Restore and protect riparian wetlands
- Reduce discharge of bioaccumulative contaminants
- Prevent pollution
- Encourage environmentally sensitive development

Specific areas in which **federal and state government officials** suggested the Estuary Program could **assist** them were:

- Monitor, evaluate effectiveness
- Restore and protect riparian wetlands
- Maintain appropriate temperatures
- Reduce dioxin/furans
- Prevent pollution
- Track recycled hazardous waste
- Reduce use and track use of pesticides
- Encourage environmentally sensitive development
- Maintain and promote urban growth boundaries
- Increase education

Areas where many officials believed current effort was insufficient and the **Estuary Program** could take the **lead** were:

- Public awareness and stewardship, including education, volunteer monitoring and awards and recognition
- Institutional constraints, including coordination and facilitation, dispute resolution, compliance and enforcement, defining a common purpose, and providing technical assistance
- Monitoring and research, including analyzing trends and evaluating effectiveness

## **Estuary Program Activities**

The Estuary Program will play a different role for each of the three action categories described in Chapter 5:

- **Habitat and Land Use:** Actions 1 through 12 address habitat loss and modification and the impacts of land use activities. Discussions with tribal, federal, state, and local officials indicate that while numerous agencies are actively engaged in many related activities, there is also a need to do more in these areas. The Estuary Program will encourage and help other entities to implement these actions, and may implement some aspects of the actions itself. The program may eventually be in a position to actively participate in acquiring, preserving, and restoring important habitat and riparian areas.
- **Education and Management:** Actions 13 through 28 call for increased education and improved consistency and coordination among government agencies with responsibility for the lower river and estuary. Throughout development of the Estuary Plan, many parties indicated these areas are not being addressed adequately. The Estuary Program will take the lead in implementing these actions.

- **Conventional and Toxic Pollutants:** Actions 29 through 43 address conventional and toxic pollutants. The legal authority for these actions rests with existing agencies. Many of them are actively engaged in these actions. The Estuary Program's primary role will be to monitor progress, assist where possible, and motivate where needed.

## Monitoring and Evaluation

Comprehensive monitoring is a key component of the *Management Plan*. Environmental monitoring was recognized by all parties as currently deficient. No comprehensive, sustained, and systematic environmental monitoring is in place. The implementation phase will include integrated long-term monitoring of the lower river to assess water and sediment quality, physical habitat, aquatic health, and biological integrity. The *Aquatic Ecosystem Monitoring Strategy* (Volume 2 of the *Management Plan*) is an important tool to assess the effectiveness of management actions. By tracking trends in the health of the river and its resources, pinpointing problem areas, and assuring compliance with water quality standards, the monitoring strategy will further the overall understanding of the river and help guide management decisions.

The background information for the monitoring strategy and the implementation recommendations were developed during the planning phase of the Estuary Program, with assistance from the U.S. Geological Survey and a 30-person technical committee representing over 20 state and federal agencies, universities, and the private sector. The strategy provides a first-ever framework for coordinated monitoring of the lower Columbia River. It is an important step toward establishing a cooperative, long-term approach to understanding the complex ecosystem of the Columbia River. Monitoring at this scale is an ambitious undertaking and will require an unprecedented level of teamwork among all the involved parties. The *Aquatic Ecosystem Monitoring Strategy*, in conjunction with the *Management Plan*, will provide the framework for this to occur.

The monitoring strategy will build on existing monitoring programs and ongoing studies. New studies and additional sampling efforts are proposed to fill gaps in the current knowledge of the river and address potential problem areas identified in the Bi-State Program. The monitoring will be implemented in phases, based on available funding and resources, program priorities, and the development of new technologies. It will also support ongoing programs that address Estuary Program needs. In some cases, sampling sites may be added and the scope of the chemical, physical, and biological constituents may be expanded to augment existing programs.

Elements of the monitoring strategy include:

- **Conventional Pollutants:** The existing sampling network will be expanded to address conventional pollutants throughout the system, particularly those that violate water quality standards, such as temperature, bacteria, and total dissolved gas.
- **Toxic Contaminants:** The entire range of toxic contaminants in the water column, sediments, and organism tissues will be sampled. Particular attention will be directed to those toxics that have been identified as probable concerns, such as pesticides, PCBs, dioxins/furans, PAHs and trace metals.
- **Habitat:** Extensive efforts will be directed at understanding and measuring habitat throughout the river. Biological diversity, vegetative composition, benthic and wetland habitats, bathymetry, channel configuration, and bottom composition will be evaluated.
- **Exotic Species:** The extent and nature of non-indigenous species and their impact on the system will be examined.
- **Data Management:** Consistent protocols and standard formats will be developed so data can be shared through linked systems and stored for easy access. Data assessment and reassessment will be an integral part of the program to ensure that scientists, managers, and others have access to the results of the monitoring work.

New techniques and approaches will likely be needed to gain a better understanding of the river's biology and address the unique problems of sampling a river the size of the Columbia. As part of the developmental phase of the monitoring strategy, the Estuary Program hosted a workshop in May 1999 to develop methods to measure biological integrity. Workshop participants developed a suite of indicators to assess the biological integrity of the lower river and estuary. This approach provides an appropriate yardstick to measure the health of the river over time.

## WHAT THE ESTUARY PROGRAM BRINGS

Research conducted as part of the Estuary Program identified over 160 agencies of government that have some level of activity in protecting and managing the lower Columbia River and estuary. Further work revealed that at least five major plans exist that identify similar goals and call for similar actions. A fair question to ask might be: Why add the Estuary Program?

The Estuary Program, the *Management Plan*, and the 43 actions at its heart are unique:

- The *Management Plan* focuses on the lower Columbia River, from Bonneville Dam to the Pacific Ocean. Until now, most efforts have focused on the estuary itself, the lower 46 miles of the river, or above Bonneville Dam at river mile 146. Few, if any efforts, have focused on the entire lower 146 miles.
- The Estuary Program is a two-state effort, jointly managed by the States of Oregon and Washington. A two-state effort, coordinated by the Estuary Program, can maximize efficient resource protection.
- The actions can link, coordinate, strengthen, focus attention on, and advocate for the health of the lower river and its species.
- The actions represent the work of a diverse group of local stakeholders—the Management Committee that developed the *Management Plan*. These stakeholders are committed to the plan's implementation and have established a strong working relationship to deal with difficult issues and diverse opinions and needs. In developing the *Management Plan*, the Estuary Program has established a proven record of success with a multi-interest stakeholder group. The 31 committee members from both states have worked together to agree on the science and the analysis of the science, identify priority issues of concern, and define specific actions to address those issues. In 3 years, for less than a \$3 million investment, this stakeholder group produced a plan poised for implementation.
- The collaborative planning effort has established a strong base for the Estuary Program to continue to work with federal, state, local, and tribal government agencies to improve joint initiatives. The public has repeatedly asked for more coordinated government efforts. The Estuary Program can pull together technical assistance and education efforts by strengthening and supporting existing programs and filling gaps. It will seek out funds to support a two-state, unified education program focused on the mainstem Columbia River. This has been a consistent request from local governments on both sides of the river.
- The Estuary Program also can assist watershed-based efforts to implement local solutions to local problems that will positively affect the whole system. Locally driven and supported efforts are most effective when citizens in sub-watersheds can understand the impact of their activities on the Columbia River Basin system. The Estuary Program can help identify the cumulative effects of actions so the overall health of the larger basin is considered as local decisions are made.

## Two-State Effort

The Estuary Program is tangible evidence that two states can work together on an applied joint project that addresses environmental issues on a watershed basis, even when that watershed crosses a major political boundary. As such, it serves as a model for watershed management at any scale, including Columbia River tributaries. The program provides a vehicle for the two states to manage and protect a shared resource with consistency. It can help align Oregon's and Washington's efforts to address habitat protection, water quality protection, and species recovery. Governor Locke of Washington reminds us that "the Columbia River does not divide Oregon and Washington, it unites us. We must find new and better ways of governing the river."

The goals and actions of the Estuary Program *Management Plan* strengthen and support both states' recovery plans for multiple species now listed as threatened and endangered. The Estuary Program study area and the "evolutionary significant unit" for listed steelhead, chum, and chinook salmon are nearly the same. The Estuary Program includes the lower 146 river miles from Bonneville Dam to the mouth, including the tidally influenced portions of the tributaries. The evolutionary significant unit extends from the mouth to Hood River. Until the Endangered Species Act listings, most efforts focused on the basin above Bonneville Dam. The Columbia River Estuary Study Task Force (CREST) has focused significant work on the estuary itself. A two-state effort, coordinated by the Estuary Program, can maximize efforts and resources for efficient environmental protection for the entire lower 146 miles.

## Improved Management

### *Analyzing the Institutional Framework*

All National Estuary Programs are required to complete a *Base Program Analysis and Inventory*. The purpose is to help estuary programs develop management plans that provide for coordinated implementation among federal, state, and local agencies.

Developing the *Base Program Analysis and Inventory* is a two-step process. The *Inventory* identifies government agencies and some non-government organizations with responsibilities related to priority issues in the Estuary Program study area. It provides an outline of the program responsibilities of those agencies. The Lower Columbia River Estuary Program *Inventory* identifies over 160 different entities, including federal and state agencies, regional and local governments, and regional associations, councils, and commissions. Rather than evaluate the effectiveness of specific agencies and programs, the *Analysis* discusses factors that inhibit consistent, coordinated resource protection among these entities. It describes and evaluates the effectiveness of the existing regulatory framework and recommends ways to address gaps and expand strengths.

The *Analysis* discusses several decision-making factors and their impact on effective resource protection: uncertain and evolving science; the complexity of decision making itself; where the burden of proof currently rests; the large number of jurisdictions managing and protecting the river; the multiple cultures in the study area; the multiple uses of the river; the decision cycles; the complexity of the system; the size of the river system; and changing values. The *Analysis* makes three major recommendations:

- The process for managing the natural resources of the lower river and estuary should be unified and simplified under a system of cooperation. The natural and biological systems should be enhanced to achieve their maximum diversity.
- Dynamic decision-making processes are needed to respond to evolving scientific knowledge and public values about the resources of the lower Columbia River and estuary.
- Effective resource management requires a sustained commitment of financial and human resources.

Although the *Base Program Analysis and Inventory* was a major step toward understanding the complex nature of Columbia River governance, the Management Committee augmented it with an institutional framework analysis.<sup>1</sup> The Management Committee felt a more detailed study was needed for two reasons. First, the Estuary Program identifies institutional constraints as one of its seven priority issues. Coordinating consistent natural resource decisions among so many different agencies presents real challenges. The *Management Plan* needed to define actions to address this priority issue. Second, National Marine Fisheries Service (NMFS) listings of Columbia Basin salmon and steelhead as threatened and endangered have prompted numerous agencies and organizations to develop plans to improve habitat and recover species, further complicating an already complex process.

The institutional framework analysis examines the major laws, court decisions, policies, and regulations affecting the Columbia River. It also reviews five major plans that are working toward recovery of threatened and endangered fish species in the Columbia River.<sup>2</sup> These plans have much in common. Species recovery is the overarching goal for each of them. To reach that goal, each plan in some way comprehensively deals with river and hydropower operations, institutional structures and uses, habitat protection and restoration, monitoring and research, water quantity and quality, and species and harvest management. The Estuary Program's overall goal of biological integrity and its seven priority issues are also closely aligned with these plans. The institutional framework analysis clearly demonstrates that consistency and coordination among the various plans will be essential if efficient species recovery is to occur.

In addition to these five major plans that deal directly with species recovery, water quality, and habitat loss, many other plans and activities relating to these issues exist. These include forest management plans developed by both states, agricultural plans under development, and the Washington wild fish plan. Many activities underway at the local and state government level are also directly responding to species listings. Among these are:

- The City of Portland is developing a citywide plan to address species loss.
- The City of Vancouver recently hired an endangered species coordinator devoted entirely to handling the city's species recovery efforts.
- Both Washington and Oregon are under deadlines to identify maximum pollution loads for hundreds of streams and rivers that do not meet water quality standards.
- Both states are actively pursuing watershed management as a tool of choice for environmental protection.
- Both states are addressing the impacts of forestry practices and agricultural practices.
- The governors of Oregon and Washington and other western states are focusing efforts on river governance and trying to improve current practices to heighten resource protection.

The extent of these activities and the number of parties involved are further evidence of the need for collaborative approaches.

<sup>1</sup> The *Base Program Inventory*, *Base Program Analysis*, and institutional framework analysis are included in full in Volume 3 of the *Management Plan*.

<sup>2</sup> The five plans reviewed are: the Washington Lower Columbia Steelhead Conservation Initiative, the Oregon Plan for Salmon and Watersheds, the Biological Opinions of the National Marine Fisheries Service, the Northwest Power Planning Council Fish and Wildlife Plan, and *W̓y-kan-Usb-Mi Wa-Kish-Wit*, The Spirit of the Salmon Plan completed by the Columbia River Inter-Tribal Fish Commission.



## ***Coordination***

The Estuary Program recognizes that it can play an important role by providing needed coordination and consistency among multiple efforts, building on the important two-state process established during the course of the program. With its emphasis on collaboration and leadership, the Estuary Program can support and augment the many important efforts already underway.

The *Management Plan* has a strong emphasis on streamlining government activities, increasing efficiencies, and helping ensure that the two states' Columbia River efforts are equitable. Several actions reflect this emphasis. Action 18 calls for coordinating the two states' efforts with the threatened and endangered species listings. Action 20 specifically addresses coordination. Action 22 calls for development of consistent water quality standards and rules. Identifying and filling gaps is a critical function the Estuary Program can fulfill.

Citizens want government to improve the delivery of services and provide higher levels of environmental protection for natural resources. Many participants who commented on the draft *Management Plan* believe that government functions best when action occurs at a local level, with assistance from state and federal agencies, and when government leads by example and takes action.

The Estuary Program can serve as a clearinghouse and a watchdog, working to press industry and government to work on toxic contaminants. It can exert influence and focus on coordination, use dispute resolution approaches, and work with other entities on habitat issues and monitoring.

The lower Columbia River and estuary is a complex system. It needs a strongly coordinated framework that sets the agenda for action. The Estuary Program can establish this framework and help ensure that: 1) everything fits together, 2) all parties are committed to the process, and 3) resources and funding are used efficiently. To achieve this, the Estuary Program will coordinate with the following entities, among others: the U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service; U.S. Geological Survey; U.S. Army Corps of Engineers, the Ports, National Marine Fisheries Service, the Northwest Power Planning Council, Columbia River Inter-Tribal Fisheries Commission, Columbia Basin Fish and Wildlife Authority, the tribes, non-profit environmental groups, land managers, and industry.

The Estuary Program must keep a constant vigil to ensure that current and new efforts and initiatives fit together. Many entities and directives are working toward similar goals. These include the Clean Water Act; the Clean Water Action Initiative; the Endangered Species Act, and recent listings of threatened and endangered species and the states' plans to address those listings; the Willamette River Initiative; the Washington Lower Columbia River Fish Recovery Board; and the Northwest Power Planning Council Framework. There is a significant potential for overlap, which should be eliminated to avoid wasting resources. A goal of the Estuary Program is to help streamline and improve government efficiency without adding bureaucracy. It will concentrate its efforts on providing leadership and filling existing gaps. The Estuary Program must add clear value to the many activities already in progress.

The Estuary Program can also facilitate open debate on issues, then work collaboratively to find ways to deal with issues in a manner more protective of the river. This includes working to promote more consistent and/or comparable standards, rules, objectives, and methods among all levels of government. It also includes sponsoring workshops and seminars to reach and assist local governments and industry.

## ***Education***

When the Estuary Program first solicited public involvement three years ago, the public voiced the need for and importance of a comprehensive and inclusive education program. Throughout development of the *Management Plan*, the public continued its call for increased education. It was not surprising that when the draft *Management Plan* was released, education was once again a focal point.

Following the initial public comments, the Estuary Program established education as a primary focus. The draft *Management Plan* reflected this focus and the active education role the Estuary Program proposed to play. In the final comment period, the public concentrated more on how the education program should function. There were specific proposals, broad recommendations, and calls for immediate action.

After reviewing this public comment, the Estuary Program is anxious to get to work. The program will develop a specific education program and begin implementation in July 1999. The education program will initially have a three-pronged focus:

- Providing information about the health of the lower Columbia River and the sources of negative impacts
- Working to ensure that all sectors—business and industry; local, state, and federal government; and individuals—recognize the impacts of their actions
- Providing specific information about the impacts of those actions and choices, including alternatives that are more protective of the environment

In addition, the program will provide hands-on education and technical and financial assistance to all parties as they work to implement the goals and actions of the *Management Plan*.

The Estuary Program will work with other environmental educators to maximize resources and expertise, target as broad an audience as possible, and cover a wide geographic area. The education program will target all ages and all appropriate sectors of society. School-age children however, will be a particularly targeted audience.

To be successful, the education program will:

- Be based on science. Data from the long-term monitoring strategy will tie directly into the education program to provide accurate, up-to-date information about the river's health and what is affecting it, either positively or negatively.
- Be unique and creative in order to be appealing and accessible to people.
- Use a variety of educational tools and techniques and adapt them when necessary to fit current needs and audiences.
- Provoke discussion and be truthful and hard hitting.
- Emphasize the importance of local knowledge and local solutions.
- Be adaptive, responding to needs and issues as they change over time.
- Be regularly evaluated to ensure successful implementation.

## ***Voluntary Protection***

The strength of the Estuary Program has been the collaborative process used to develop and interpret the technical data, identify needed actions, and develop the *Management Plan*. The Estuary Program will continue to be an entity with no regulatory authority. The Management and Policy Committees decided not to create or add another regulatory agency to the current framework protecting the river and estuary. Nor did the Committees wish to transfer regulatory

authority from current agencies to a new entity. The challenge now is to maintain and expand collaborative efforts to implement the plan. The States of Washington and Oregon are poised for success, with examples of successful collaboration at many levels. The Estuary Program itself serves as a model for a successful two-state process.

Implementation of the *Management Plan* will rely heavily on voluntary support from all levels: individual, municipal, business, and industry. Environmental problems today cross every kind of boundary and affect almost everything we do as individuals and a society. Watershed management—the tool of choice—crosses political units (town, city, county, and state), agency boundaries, and business markets. Successfully dealing with environmental problems requires a full partnership among all levels of society. The Endangered Species Act listings for the lower Columbia River steelhead and salmon make this point. Successful recovery of endangered species will take extensive voluntary efforts as well as strong laws.

In some cases, the actions will require additional regulation or changes to existing regulation to secure consistent, adequate resource protection. Regulations are necessary to maintain a level playing field and to set environmental goals and standards. The Estuary Program itself will not be regulatory; federal, state, and local entities will continue to have laws, rules, and ordinances as part of a range of tools to maintain and enhance environmental protection.

Others are also recognizing the role and relationship of regulatory and non-regulatory approaches. The Western Governors have formed a collaborative process, called Enlibra, to address environmental needs. They have developed the following eight principles to guide them. These mirror the methods and principles of the National Estuary Program.

- National standards and neighborhood strategies that call for the federal government to set environmental standards, but allow for local flexibility in implementing them
- Collaboration, not polarization, to break down barriers and find solutions
- Rewarding results, not programs, to focus on outcomes instead of process
- Using credible scientists to reduce the problem of competing science
- Placing markets before mandates to replace command-and-control whenever possible
- “Change a heart, change a nation” to educate the public on environmental stewardship and responsibilities
- Recognition of benefits and costs
- Solutions that transcend political boundaries

Governor Kitzhaber of Oregon has said that collaborative efforts do not reject the need for strong environmental laws, but rather recognize the need to look beyond those laws to create new tools to accomplish goals more quickly. While the traditional tools of compliance and litigation remain in the toolbox, they “do not have to be the first ones we reach for.”



## STRUCTURE OF THE ESTUARY PROGRAM: TWO ENTITIES, ONE GOAL

To implement the *Management Plan*, the Estuary Program will use a variety of opportunities to ensure that all actions are funded and implemented. The Estuary Program will have primary responsibility for overseeing implementation of the plan. To help that effort, a private non-profit foundation has also been established.

### Estuary Program

The structure of the Estuary Program during the implementation phase will be similar to the structure during the planning phase. A program office will exist to support and coordinate implementation. A series of committees will be put in place, comprising stakeholders, interested parties, and parties responsible for implementing the *Management Plan*. An Implementation Committee, with an Executive Committee, will replace the current Policy and Management Committees. Its focus will change from developing the *Management Plan* to overseeing its implementation. Membership will consist of representatives of tribal, federal, and state agencies, local officials, key interests, and the general public. Committee members will be of sufficient stature to hold their organizations accountable and encourage others to implement the *Management Plan*. A series of work groups and subcommittees will be established to assist in specific projects or actions or to undertake specific studies. These will allow the program structure to include broad representation from agencies and all interested parties. Page 201 shows the Estuary Programs' structure for the implementation phase.

### The Columbia River Foundation

To assist with implementing the actions, the Estuary Program has established the Columbia River Foundation, a non-profit organization. The Foundation was incorporated in July 1998, and the Board of Directors was organized in September 1998. The membership of the Board is defined to be not less than 9 and not more than 15 members. Members are Washington and Oregon community leaders who have a passion for protecting the lower Columbia River and estuary.

The Foundation will allow the Estuary Program to broaden its funding base to include private individual, corporate, and foundation support. This will lessen the dependency on federal and state funds. Primary purposes of the Foundation are to help implement specific actions in the *Management Plan* and to establish a voice for the lower river and estuary. By having this entity in place before completion of the *Management Plan*, a funding strategy is being developed to help ensure immediate implementation of the *Management Plan*.

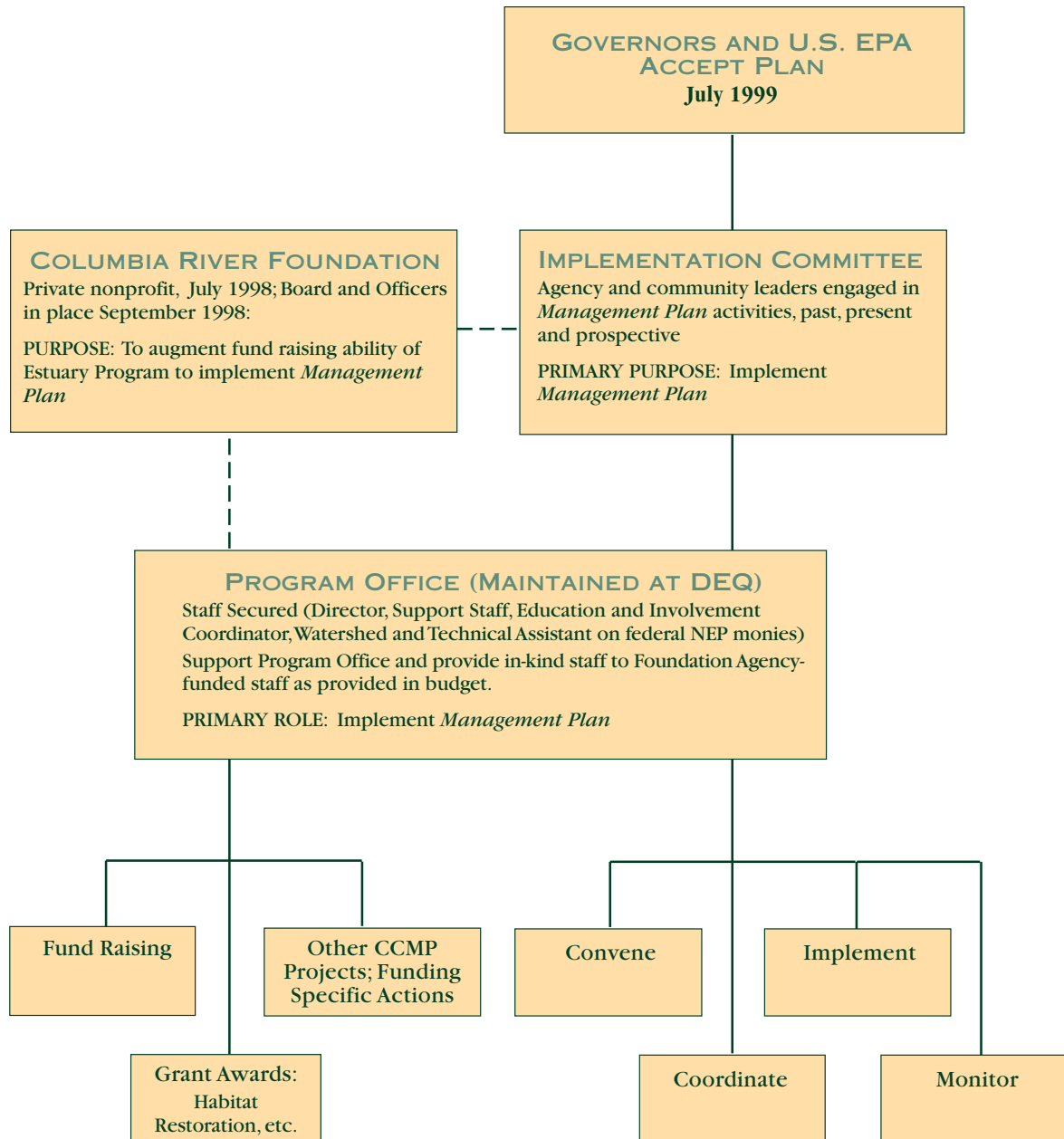
Page 202 shows the composition of the Implementation Committee, its Executive Committee, and the Foundation Board of Directors.

### Staffing

For the foreseeable future, the Estuary Program will maintain a staff and program office. The program anticipates four positions to be funded by the federal National Estuary Program monies committed to the project. These include a program director, support position, watershed management specialist, and education and outreach coordinator. In addition to the federal funds, the program anticipates some level of funding from both the State of Oregon and the State of Washington. That funding could support additional staff, contract dollars, or a combination of both.

At this time, it is anticipated that the Columbia River Foundation will employ no permanent staff. Funds received in the Foundation's initial year will be used for contract purposes, including such activities as implementing specific actions contained in the *Management Plan*, monitoring and research projects, and fund raising.

## STRUCTURE OF ESTUARY PROGRAM FOR *MANAGEMENT PLAN* IMPLEMENTATION



## BOARD AND COMMITTEE COMPOSITION

### Lower Columbia River Estuary Program

Columbia River Foundation Board Members (9-15)–Community leaders–Committed to conservation and environmental issues, committed to and interested in the lower Columbia River and estuary, experience with fund-raising.	Estuary Program Implementation Committee (35)–Policy leaders–Committed to implementing the <i>Management Plan</i> , and with sufficient leverage to ensure responsible parties participate in implementation.
Board members will include leaders from the environmental, conservation, business, academic, and political communities	State Policy Leaders (6): Ecology, DEQ, WDNR, WDFW, ODSL, OFW
Agency Directors (ex officio): Federal and state environmental agencies	Federal Agency Regional Managers (5): U.S. EPA, NMFS, Corps, USGS, USFW
Governors offices representatives (ex officio)	<p>Governors' offices (2)</p> <p>Oregon Watershed Council representative (1)</p> <p>Washington Fish Recovery Board (1)</p> <p>Business: fishing, labor, ports (4)</p> <p>Environmental, conservation, recreation (4)</p> <p>Agriculture/Forestry (4)</p> <p>Local Government (4)</p> <p>Tribal leaders, CRITFC (2)</p> <p>Open (2)</p> <p><b>Executive Committee</b> (12) made up from Implementation Committee: Governors' offices (2), state environmental agencies–DEQ, Ecology (2), U.S. EPA (1), NFMS (1), tribal (1) and 5 from non-federal or state agencies. Executive Committee members selected by the Implementation Committee.</p>

## Funding

The Management Committee specified that every action or component of an action must have an identified funding source. For entities other than the Estuary Program, these need not be new funding sources. It is important to acknowledge that many agencies and local governments already make large investments in many of these actions. The Estuary Program stipulated that it would not impose a shifting of resources from current activities to actions described in the *Management Plan*, unless the agency agreed. In addition, the Estuary Program will help secure the monies needed for implementation.

The *Management Plan* identifies some of the likely costs and possible funding sources for actions where such information could be determined (see Chapter 5). This information will need to be completed for each action before the action can be implemented. The Estuary Program will receive funds from the U.S. Environmental Protection Agency (U.S. EPA) to assist with implementation. As noted in Chapter 5, the Estuary Program has identified possible sources of federal funding for each action within the Federal Catalog of Domestic Assistance. Federal funding is available for such diverse projects as wetlands protection, prevention of toxic and conventional pollution, and funding dispute resolution programs for federal agencies. In addition, implementation of National Estuary Program management plans qualifies for potential funding under several programs and recent initiatives, including the Better America Bonds program. As the Estuary Program moves into implementing the *Management Plan*, more specific implementation strategies will be developed for each action, and specific funds can be targeted.

In addition to federal sources of funding, the States of Oregon and Washington may provide monies to implement the Estuary Program's actions. Regional agencies such as the Bonneville Power Administration (BPA) may also be likely sources of funding. BPA administers over \$125 million a year in habitat and restoration programs designed to mitigate harmful effects of federal dams in the Columbia River on anadromous fish stocks.

To maximize scarce funding resources, it is important to identify local government initiatives that directly relate to and in effect implement actions. Work and expenditures already underway by local governments demonstrate that they can effectively implement habitat restoration, environmentally sensitive development, and water quality protection actions, while providing valuable services to their constituents. Many cities throughout the study area are taking action to address fish recovery. For example, the City of Portland Bureau of Water Works and Bureau of Environmental Services are considering significant steps to promote fish recovery in many of the City's initiatives, including the City's own processes and those services provided to the citizenry. The City of Vancouver, Washington also has identified numerous changes it can make to address fish recovery.

One of the primary functions of the Columbia River Foundation will be to secure additional resources. Numerous foundations and corporations actively support habitat restoration, environmental education, monitoring and trends analysis, and species recovery endeavors. These resources will help the Estuary Program implement the actions and provide financial support for the activities of others, including local officials, as they implement aspects of the *Management Plan*.

## POSSIBLE PRIORITIES FOR FOUNDATION FUNDRAISING

Monitoring:	\$700,000 - \$1,000,000 dollars annually
Education:	\$300,000 - \$500,000 for initial 3 years of activity to develop on-river programs and young citizen programs, and disseminate information
Habitat Protection:	\$600,000 to \$750,000 for initial 2 years of activity to inventory and prioritize habitat, begin protection, provide grants
Land Use Practices:	\$100,000 for initial year's activity to review and develop best management practices and ordinances
Toxic and Conventional Pollutants:	\$200,000 for fate and transport study; \$200,000 for initial 2 years for human health study

### ***Revenue Projections***

The Estuary Program expects to receive \$300,000 from U.S. EPA annually for the next 3 to 5 years for base program funds. This is consistent with all National Estuary Programs currently in the implementation phase. The primary purpose of these funds is to support a program office to oversee implementation of the *Management Plan*. The Estuary Program also anticipates receiving some funding from both the States of Oregon and Washington for the next biennium to match the federal grant. The Policy and Management Committees have prepared an annual workplan for the first year of implementation based on an anticipated funding level (see page 205).

The Foundation will soon complete and begin implementing a fundraising strategy. This will allow the Estuary Program to augment state and federal funding, expanding the resources available to implement the *Management Plan*.

### **Implementation Strategy**

In June and July 1999, the Management Committee will develop an Implementation Strategy and more specific funding sources for each action in the *Management Plan*. Program funding for the first two years will be known then and real figures will be used to develop a more defined implementation schedule. For each action and each "how," the strategy will identify the lead entity, partners and collaborators, more definite costs, specific funding sources, as well as when the action will occur, and the anticipated outcomes and measures for success. This will allow the Estuary Program to track and regularly evaluate implementation. A sample Implementation Strategy is shown on page 206.

## WORKPLAN

### Implementation Year 1: FY 1999-2000

ACTIVITY	DESCRIPTION
Program Administration	Oversee <i>Management Plan</i> implementation and provide program support.
Technical Assistance	Provide assistance to local governments as prescribed in the <i>Management Plan</i> . Technical assistance will cover topics including non-point source pollution, best management practices, and habitat protection.
Habitat	Initiate inventory of critical habitat.
Education and Management	Develop education program as prescribed in <i>Management Plan</i> . Contractual funds to be used for river experience programs, interpretative sites, and outreach materials (to be determined). Continue involvement and outreach program.
Monitoring and Data Management	Begin Phase 1 of Monitoring Plan, coordination, and Phase 1 of Information Strategy Plan.
Toxic and Conventional Pollutants	Provide technical assistance.
Grants	Continue the action, planning, and demonstration grants program. A work group may want to revisit the program guidelines to align them with the <i>Management Plan</i> , if necessary.
Nonprofit	Funds to be used for legal and fiscal agent.
Facilitator	Funds to be used as necessary for workshops and meetings.

## SAMPLE IMPLEMENTATION STRATEGY

### Lower Columbia River Estuary Program *Comprehensive Conservation and Management Plan*

ACTIVITY <i>Action #3</i>	LEAD ENTITY	PARTNERS	COST	FUNDING SOURCE	WHEN	OUTCOMES	EVALUATION
<b>Adopt and implement consistent wetland, riparian, and aquatic habitat standards</b>	Estuary Program	DEQ, Ecology, Governors' Offices, USGS, U.S. EPA, USFW, OFW, WDFW, WDNR, local and tribal governments	\$50,000 to assess: \$4,000 staff annually				Periodically after implementation; for each step
<i>Assess current habitat protection standards and their implementation</i>	●	●		Estuary Program	2001	Assessment complete by 2001	●
• Assess wetlands standards and implementation					1999		
• Identify entities with existing standards					2000		
• Gather and compile information					2000		
• Analyze for consistency, effectiveness, and coverage					2001		
<i>Adopt habitat protection standards</i>			To be determined	Estuary Program for development of standards		Standards developed by 2003; adopted by 2007	↓
• Develop draft standards					2002		
• Review by affected parties	↓				2003		
• Define final list of entities to adopt standards		↓			2004		
• Outreach about new standards					2004		
• Assist entities with adopting					2005-2007		

### ***Analyzing Environmental and Economic Impacts***

As the *Management Plan* was developed, the Management Committee recognized that many of the actions under consideration could have significant environmental and economic impacts. Neglecting to take action could also have significant impacts. The committee therefore conducted a study called the *Natural Resource Valuation of the Lower Columbia River Estuary*, which estimates, where possible, the current monetary value of a number of resources and resource services. The positive and negative economic impacts of selected actions are also analyzed.

The *Valuation* assesses several key resources and resource services:

- Commercial fishing
- Recreational boating and fishing
- Swimming, wildlife viewing, and hunting
- Water withdrawal for industrial, public, agricultural, and commercial uses
- Aesthetic uses, including camping and picnicking and the ability to see vistas
- Passive use values, such as the value of preserving healthy habitats and making them available for future generations

The *Valuation* and economic impact studies will assist the Estuary Program as it develops its Implementation Strategy.

### **Ongoing Projects**

Implementation is not new to the Estuary Program. Using funding dedicated to this purpose, the Estuary Program awarded a number of grants for local demonstration projects in 1997 and 1998. The program also has funded several projects that address one or more of the priority issues. These are on-the-ground, hands-on activities that involve local people, provide direct local benefits, and demonstrate tools that can have universal application throughout the estuary (see pages 208–209). These projects serve as pathways to the future envisioned for the lower Columbia River and estuary.





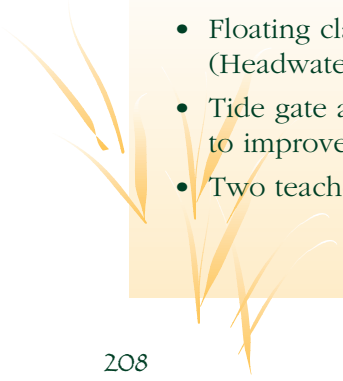
## LOCAL GRANT PROJECTS

The Estuary Program awarded 15 grants for local action, planning, and demonstration projects in 1997 and 1998, totaling \$200,000. These projects involved local people and provided direct local benefits by implementing environmental improvements or demonstrating tools that can have universal application throughout the estuary. In addition to providing an early start on implementing the *Management Plan*, these projects provided an opportunity to test new ideas that can be applied to implementation of the *Management Plan* actions.

### 1997 Projects

- Habitat restoration and stewardship project along the Sandy River near Sandy, Oregon (The Nature Conservancy)
- Stormwater pollution prevention manual and training program for local governments, developed by the Oregon Association of Clean Water Agencies
- Regional conference conducted by Clatsop Community College to encourage and initiate stakeholder involvement

### 1998 Projects

- Student projects aimed at habitat and streambank restoration on the Columbia Slough (The Wetlands Conservancy)
  - Student-run fish hatchery and watershed restoration project on the Chinook River near Chinook, Washington (Sea Resources, Inc.)
  - Study of the Caspian tern population on Rice Island, Washington, and its impacts on juvenile salmon (Coastal Studies and Technology Center)
  - Stormwater management workshops and local ordinance development for Columbia County (Columbia County Planning Department)
  - Planning for Wahkiakum School District project, using students to conduct an interdisciplinary investigation of the Columbia River estuary near Cathlamet and Skamokawa, Washington
  - Dike removal between Westport Slough and the Clatskanie River to improve fish habitat (Columbia County Parks Department)
  - Restoration of 15 acres of riparian forest in the Sandy River Delta near Troutdale, Oregon (U.S. Forest Service)
  - Continuation of the student-run watershed restoration project in the Chinook River (Sea Resources, Inc.)
  - Implementation of the Wahkiakum School District project, using students to conduct an interdisciplinary investigation of the estuary
  - Floating classroom for lower Columbia River students and communities (Headwaters to Ocean)
  - Tide gate and culvert improvements in Brownsmead area near Knappa, Oregon, to improve salmonid habitat (Clatsop Diking Improvement Co. #7)
  - Two teacher watershed restoration workshops (EcoTrust)
- 



## OTHER PROJECTS

The Estuary Program is funding several other projects to address specific areas of concern. These include:

- **Water Quality Sampling (Lipid Bag):** The Estuary Program contracted with the U.S. Geological Survey to analyze water column samples throughout the basin, using a new semi-permeable membrane device known as a lipid bag. Certain chemicals are not soluble in water, but are readily soluble in body fats tissue (lipids). Because of this characteristic, these chemicals can be very toxic to organisms. The lipid bag sampler uses lipids suspended in the water column over time to evaluate the concentrations of these toxins encountered by aquatic life. The results were released in April 1999 and provide valuable data on the sources of toxics in the water column.
- **Volunteer Monitoring:** The Estuary Program is contracting with the Columbia River Estuary Study Task Force (CREST), located in Astoria, Oregon, to develop a coordination and oversight mechanism for all volunteer monitoring efforts that occur in the study area. This will include an assessment of all existing efforts, standardization of procedures and equipment, training as needed, and identification of information gaps that could be filled by recruiting new volunteers.
- **Wetland Management Strategy:** The Estuary Program is contracting with CREST to develop a comprehensive wetland protection and enhancement strategy for the lower Columbia River. The project involves 1) an evaluation of existing wetland management structures, and 2) an evaluation of the implementation of existing wetland protection, enhancement, and restoration projects on both sides of the river.
- **Public Health Study:** The Estuary Program is contracting with EVS Consultants in Seattle, Washington, to undertake a health risk assessment of existing bacteriological data and fish tissue data in the study area. The results of the analysis will be used to develop community outreach strategies to inform the public of the possible risks associated with water contact and consumption of contaminated fish. Specific strategies will be developed for informing at-risk populations.

## COLLABORATIVE IMPLEMENTATION

The Estuary Program has worked hard to include as many parties as possible in the development of the *Management Plan*. Successful implementation of the actions will require continuing support and participation from many people and organizations.

At the beginning of the Estuary Program, the Management Committee specified that any entity responsible for implementing an action should participate in its development. Most of the entities likely to be involved in implementation were represented by members of the Management Committee, who actively participated throughout development of the *Management Plan*. In addition, several meetings were held with various entities to obtain their input and direction as actions were being identified. For example, many land use actions will be implemented at the local level. Local officials were consulted, and asked the Estuary Program to identify performance standards for the actions and to offer tools and techniques to help them achieve those standards. The Implementation Committee, with its broad representation from a variety of stakeholders, will continue this successful collaborative approach.

The Estuary Program can be powerful as a non-government entity, with an emphasis on coordination and voluntary action. It will need to demonstrate that it is a significant player to capture people's attention. Establishing a travelling ambassador to work within the study area and the Columbia River Basin and to keep its work prominent with decision makers in Washington, D.C. may be an important role for the program to assume. Working with people at all levels, the Estuary Program can do much to build civic capacity for strong and ongoing stewardship of the lower river and estuary.

The active involvement of citizens will be very important to the success of the *Management Plan*. Citizens can be particularly effective in those areas where government is slow to act, where the government role should be limited, or where voluntary compliance is important. Business and industry, too, have a critical part to play in implementing actions that depend on their participation. Like other citizens, they need to be involved in making value decisions, setting priorities, and providing localized information important to decision making.

Collaboration and cooperation have served the Estuary Program well over the last three years. As implementation proceeds, they will be vitally needed to continue serving the best interests of the lower Columbia River and estuary.



I like to live in the sound of water. . . .

—William Stafford





If there is magic on this planet, and it is contained in water . . . .  
Its substance reaches everywhere; it touches the past  
and prepares the future; it moves under the poles and wanders  
thinly in the heights of air.

—Loren Eiseley







## THE NEXT CHAPTER



If rivers are the veins of our landscape, the Columbia is our heart.

**T**he lower Columbia River contains water from five states and Canada, from farms, driveways, mountains, and sewer pipes. It contains water from deserts and canyons, gorges and wetlands, and saltwater from the Pacific Ocean. The river irrigates fields and provides drinking water, cascades over scenic waterfalls and through hydroelectric dams, floats canoes and container ships. It is home to thousands of fish and wildlife, and every summer cools our feet as we dip our toes in its waters.

Charles Kuralt once said: “America is a great story, and there is a river on every page of it.” Within the great story of America are great stories of great rivers, none more compelling than the Columbia.

The lower Columbia River and estuary is at a critical point in its history. Threatened and endangered species listings hang on many of the river’s fish and wildlife. Non-point source pollution, and conventional and toxic pollutants limit water quality. Habitat loss and modification continues. Some people even refer to the Columbia River as a machine, a pipeline for commerce and energy.

The *Management Plan* charts a new course in the Columbia River story. It provides a framework for change, for how we can begin to preserve and restore the lower Columbia River and estuary. The *Plan* was developed by citizens, and it will be citizens who implement it and ultimately make it successful.

We all share responsibility. Every sector of society must do its part. Just as we all contribute to the problems, we can all contribute to the solutions by changing our behavior. Personal responsibility and individual actions will make a significant difference; so will changes in government, business, industrial, and land management practices.

The future of the lower Columbia River and estuary is our future. Each child who splashes in a puddle, admires a glistening fish, or daydreams at the edge of the Columbia is expressing an affinity for water. The Columbia River serves many purposes, different for each member of the community. One thing is certain, however: its health is important, even essential to our lives.

The Columbia River tells a long and magnificent story. How the next chapter unfolds is up to us.



## GLOSSARY

**Algal growths:** Growths of microscopic aquatic plants.

**Alluvial:** Relating to clay, silt, sand, gravel, or similar material deposited by running water.

**Ambient:** Refers to overall conditions surrounding a place or thing. For example, ambient monitoring refers to routine water quality monitoring.

**Anadromous:** Describes fish that are born in fresh water, migrate to the sea, and return to fresh water to spawn (reproduce). Examples include salmon, sturgeon, shad, smelt, and steelhead.

**Aquatic:** Living in or around water.

**Arsenic:** A naturally occurring chemical element, currently used primarily in the production of pesticides and wood preservatives. In some areas, levels of arsenic are increasing in groundwater because of seepage from hazardous waste sites. In sufficient quantities, arsenic is highly toxic to fish, wildlife, and humans.

**Basin:** An area of land drained by a river and its tributaries.

**Bathymetry:** The measurement of water depths in water bodies.

**Beneficial uses:** The specific uses of a river by people and wildlife, defined by state laws and regulations, and protected by state agencies. Oregon and Washington's defined beneficial uses for the lower Columbia River are: public and private drinking water supply, irrigation, stock watering, fish migration and spawning, other fish wildlife and aquatic plant uses, wildlife usage, preservation of significant and unique habitats, water contact sports, fishing and hunting, aesthetic quality, hydroelectric power, navigation and transportation, marinas and related commercial activity, and commercial fishing.

**Benthic:** Bottom-dwelling or substrate-oriented; at or in the bottom of a body of water.

**Best Management Practice (BMP):** A practice or combination of practices that are determined to be the most effective and practical means of controlling point and non-point source pollutants at levels compatible with environmental quality goals.

**Bioaccumulative:** Contaminants that accumulate in the tissues of individual organisms.

**Bioassay:** A laboratory test using live organisms to measure biological effects of a substance, factor, or condition.

**Biodiversity:** The number and abundance of species found within a common environment. This includes the variety of genus, species, ecosystems, and the ecological processes that connect everything in a common environment.

**Biological integrity:** The capacity of the river system to support and maintain an integrated, adaptive community of plant and animal life.

**Biota:** All living organisms that exist in a region.

**Bis (2-ethyl hexyl) phthalate:** A common plasticizer used in a wide variety of industrial processes.

**Carcinogenic:** Capable of causing or inciting cancer.

**Chronic toxicity:** Measured as the concentrations of toxics that cause long-term sublethal effects such as impaired growth or reproduction.



**Clean Water Act:** The 1973 Federal Water Pollution Control Act and Amendments are concerned with the pollution of surface water and groundwater and basically call for fishable and swimmable water everywhere. Permits are required for discharges into waters. The law provides for pretreatment standards, plans involving non-point source pollution, and effluent limitations to effectuate the statutory purpose.

**Environmental Protection Agency Cluster Rule:** An integrated, multi-media regulation to control the release of pollutants to air and water from the pulp and paper industry. The Cluster Rule sets new baseline limits for releases of toxics and non-conventional pollutants.

**Columbia River Basin:** All tributaries and their watersheds that drain into the Columbia River along its entire 1,200-mile length. The Columbia River Basin drains approximately 259,000 square miles.

**Combined Sewer Overflow (CSO):** Untreated overflow from commingled sanitary and storm sewers.

**Confluence:** The place where two or more streams or rivers meet.

**Conventional Pollutants:** Constituents or characteristics of the water that occur naturally but become problematic to aquatic organisms and humans due to human activity or, in some cases, natural events. Examples include high water temperatures and high levels of total dissolved gas.

**Crustaceans:** Invertebrates (animals without backbones) of the phylum Arthropoda, including amphipods, shrimps, crabs, barnacles, and other animals that have segmented bodies, jointed legs, and hard external shells.

**Cumulative impacts:** The combined environmental impacts that accrue over time and space from a series of similar or related individual actions, contaminants, or projects. Although each action may seem to have a negligible impact, the combined effect can be severe.

**DDD:** See DDT.

**DDE:** See DDT.

**DDT (Dichloro-diphenyl-trichloroethane):** The first chlorinated hydrocarbon insecticide (pesticide). DDT collects in the fatty tissue of some animals and was responsible for eggshell thinning and reproductive failure in eagles. The U.S Environmental Protection Agency banned registration and interstate sale of DDT in 1972 because of its persistence in the environment and accumulation in the food chain. In the environment, DDT breaks down to form DDD and DDE, which are also toxic.

**Diking:** A method of artificially changing the direction of a course of water or confining water.

**Dioxin:** A chlorinated organic compound that is widespread and persistent in the environment, some forms of which are highly toxic to fish, wildlife, and humans.

**Dissolved oxygen (DO):** Oxygen dissolved in water; necessary for the life of fish and most other aquatic organisms. The measurement of dissolved oxygen can be an important indicator of the condition of a water body.

**Dredging:** The removal of sediments from a river, estuary, or ocean, usually for navigation or docking purposes.

**Ecology:** The interrelationships of living things to one another and to their environment, or the study of these interrelationships.

**Evolutionary Significant Unit (ESU):** A population or group of populations that is considered distinct (and hence a “species”) for purposes of conservation under the Endangered Species Act. To qualify as an ESU, a population must: 1) be reproductively isolated from other conspecific (of the same species) populations, and 2) represent an important component in the evolutionary legacy of the biological species.

**Ecosystem:** A community of organisms in a given area together with their physical environment and its characteristic climate.

**Effluent:** Wastewater discharged into a body of water from point sources.

**Endangered Species:** A plant or animal that is in danger of extinction throughout all or a significant portion of its range, as identified in accordance with the Endangered Species Act of 1973.

**Endangered Species Act:** A federal act to protect plant and animal species whose continued existence is in jeopardy. When species are listed under the Act as threatened or endangered, certain actions must be taken for their conservation.

**Enhancement:** Making changes or improvements to habitat to replace functions or values lost or damaged.

**Environmental Indicators:** Conditions or occurrences that indicate the health or degradation of the environment.

**Erosion:** Wearing away of rock or soil by the gradual detachment of soil or rock fragments by water, wind, ice, and other mechanical and chemical forces. Human activities can greatly speed this detachment.

**Estuary:** The area where the fresh water of a river meets the salt water of an ocean. In the National Estuary Program, this definition is extended to include the tidally influenced waters of the river.

**Fecal Coliform:** Bacteria associated with the feces of warm-blooded animals, including livestock and humans.

**Fertilizers:** Material added to the soil to supply chemical elements needed for plant nutrition.

**Fill:** Soil, sand, and debris deposited in aquatic areas, such as wetlands, to create dry land, usually for agricultural or commercial development purposes.

**Flip lips:** A structure added to the sloping surface of a spillway to change the downward direction of flow and “flip” it outward. This minimizes deep plunging of water, thereby reducing gas supersaturation and minimizing gas bubble disease in both juvenile and adult migrating fish. Also called spill flow detectors.

**Floodplain:** The area along a stream or river that is subject to flooding.

**Food chain:** An arrangement of the organisms of an ecological community according to the order of predation in which each uses the next (usually lower) member as a food source.

**Furan:** A chlorinated organic compound closely related to dioxin.

**Gas bubble disease:** A potentially fatal disease affecting fish, triggered by exposure to elevated levels of dissolved gas when water is spilled over dams.

**Groundwater recharge:** Replenishment of water that circulates in underground aquifers.

**Habitat:** Places where plants and animals live, feed, find shelter, and reproduce.

**Infiltration:** The downward movement of water from the atmosphere into soil or porous rock.

**Instream water rights:** Rights that establish flow levels to stay in a stream on a month-by-month basis, and are usually set for a certain stream reach and measurement at a specific point on the stream. Instream water rights have a priority date and are regulated in the same way as other water rights.

**Lower Columbia River Basin:** All tributaries and their watersheds that drain into the Columbia River from its mouth to river mile 146. It is larger than the Lower Columbia River Estuary Program study area because it includes the entire watersheds of the tributaries, beyond the waters that are tidally influenced. The Lower Columbia River Basin drains approximately 18,000 square miles, about 7 percent of the entire Columbia River Basin.

**Lower Columbia River Estuary Program Study Area:** Those portions of the Columbia River and its tributaries that are tidally influenced. The study area extends from the Pacific Ocean to Bonneville Dam at river mile 146. It also includes near-coastal waters from the mouth of the Columbia to the 3-mile limit, to the extent that those waters are influenced by the plume of fresh water flowing out of the Columbia River to the sea. The study area covers approximately 4,300 square miles. It is also referred to as the lower Columbia River and estuary.

**Macro-invertebrates:** Invertebrates large enough to be seen with the naked eye (i.e., most aquatic insects, snails, and amphipods).

**Mainstem:** The main course of a stream or river.

**Marsh:** A wetland where the dominant vegetation is non-woody plants such as grasses and sedges, as opposed to a swamp, where the dominant vegetation is woody plants and trees.

**Metabolite:** The product of the physical and chemical processes by which foodstuffs are synthesized into complex elements, complex substances are transformed into simple ones, and energy is made available for use by an organism.

**Metadata:** Information about data, such as their source, sampling protocol, and standards.

**Metals:** A group of elements found in rocks and minerals that are naturally released to the environment by erosion, as well as generated by human activities. Certain metals, such as mercury, lead, zinc, and cadmium, are of environmental concern because they are released into the environment in excessive amounts by human activity and can produce toxic effects.

**Mitigation:** Measures taken to reduce the severity of impacts resulting from an action or practice.

**Morphology:** The form and structure of a stream or river.

**Mouth:** The place where a stream or river enters a larger body of water (e.g., the ocean).

**Native species:** Species that are indigenous to the local region and have evolved to thrive in local conditions.

**Natural flood storage capacity:** The natural capacity of lands surrounding a river to absorb floodwaters and excess runoff.

**National Estuary Program (NEP):** A federal program established in 1987 by amendments to the Clean Water Act and administered by the U.S. Environmental Protection Agency. The NEP's primary goal is "to protect estuaries of national significance that are threatened by degradation caused by human activity." The NEP employs community-based environmental planning, designating primary responsibility for program development and implementation to the local community.

**Non-indigenous species:** Species not naturally growing or living in a particular area. Their introduction and expansion can destroy or deplete habitat and food needed by native populations. Also referred to as exotic or non-native species.

**Non-point source pollution:** Pollution entering waterways from broad land areas as a result of the way the land is used—for example, runoff from agricultural practices, construction and road-building, logging, and urban development.

**National Pollutant Discharge Elimination System (NPDES) permit program:** A provision of the Clean Water Act that prohibits discharge of pollutants into waters of the United States unless a special permit is issued by U.S. EPA, a state, or another delegated agency.

**Nutrients:** Essential chemicals needed by plants and animals for growth. Enriched nutrient loads from sewage, land runoff, and atmospheric deposition can result in excessive growth of algae and lead to degradation of water quality.

**PAHs (Polycyclic or polynuclear aromatic hydrocarbons):** A class of complex organic compounds, some of which are persistent and cause cancer. These compounds are formed from the combustion of organic material and are ubiquitous in the environment. PAHs are commonly formed by forest fires and by the combustion of gasoline and other petroleum products. They often reach the environment through atmospheric fallout and highway runoff.

**Particulate matter:** Material composed of minute separate particles.

**PCBs (polychlorinated biphenyls):** A group of manufactured colorless and odorless chemicals made up of carbon, hydrogen, and chlorine. Because of their insulating and nonflammable properties, PCBs were widely used as coolants and lubricants in transformers, capacitors, and other electrical equipment. Banned from production in the United States in 1976, PCBs found today are from historical use or spills. PCBs are suspected of causing cancer in humans and other animals.

**Performance standards:** Standards based on meeting certain desirable outcomes through flexible methods.

**PBTs (persistent bioaccumulative chemicals):** Toxic and long-lasting substances that can build up in the food chain to levels that can be harmful to human and ecological health. Many of these substances are man-made and have been in existence for a relatively short period. A few, such as mercury and cadmium, are naturally occurring.

**Pesticides:** Pesticides include herbicides, insecticides, fungicides, and rodenticides that are used to control unwanted plants, insects, fungi, or rodents, respectively. Most of these chemicals are manufactured and are not found naturally in the environment.

**pH:** Measure of the negative logarithm of the hydrogen ion concentration to determine the acidity or alkalinity of water. Water of pH 7 is neutral; lesser values are acidic; higher values (pH 14 maximum) are alkaline.

**Plankton:** Microscopic plants and animals that drift with currents.

**Plume:** An elongated column or cloud of water or suspended sediment.

**Point source pollution:** A source of pollutants from a single point of conveyance, such as a pipe. For example, the discharge from a sewage treatment plant or a factory is a point source.

**Radionuclides:** Decayed products of radioactive materials.

**Redds:** Nests made in gravel (particularly by salmonids), consisting of a depression that is

created and then covered.

**Restoration:** Returning a damaged habitat, as nearly as possible, to its condition prior to being damaged.

**Riparian zone:** The land bordering a stream or river, and the vegetation typical of those borders.

**Riprap:** Large rocks, broken concrete, or other structure used to stabilize streambanks and other slopes.

**Riverine:** On or near the banks of a river.

**River mile:** The mile marking a particular point along or in a river, measured from the mouth of a river to its source.

**Rock barbs:** Rock structures placed in a stream that alter flow to protect streambanks and create new aquatic and riparian habitats.

**Runoff:** Water from precipitation, snowmelt, and agricultural or landscape irrigation that runs off the land into water bodies.

**Salmonid:** Fish of the family Salmonidae, including salmon, trout, chars, whitefish, ciscoes, and grayling.

**Sanitary Sewer Overflow (SSO):** Overflow resulting from a municipal sanitary sewer system exceeding its capacity, due to unintended inflow and infiltration of storm water.

**Sediment:** Mud, sand, silt, clay and other particles that settle on the bottoms of waterways.

**Self-sustaining:** Species able to reproduce and rear successfully in their natural habitats and survive the remainder of their life stages.

**Sensitive species:** Those species that 1) have appeared in the Federal Register as proposed for classification and are under consideration for official listing as endangered or threatened species, or 2) are on an official state list, or 3) are recognized as needing special management to prevent their being placed on a federal or state list.

**Slough:** A channel through a marsh or mudflat.

**Spawn:** The act of reproduction of fish, which includes egg laying and fertilization, and sometimes nest building (e.g., salmon).

**Stewardship:** Taking care of the earth for ourselves and others; sharing knowledge and enthusiasm about that care with others.

**Stormwater:** Surface water resulting from all natural forms of precipitation.

**Substrate:** Material that forms a stream or lake bed (silt, sand, gravel, cobble, etc.).

**Supersaturation:** Water is supersaturated when concentrations of dissolved gas exceed 100 percent. This can occur when gas is forced into the water under pressure, such as when water spills over dams and forces gas into the water.

**Suspended solids:** Solid inorganic and organic materials that remain suspended in the water column.

**Synergistically toxic:** Chemicals that become toxic as they mix with other chemicals.

**303(d) lists:** State-compiled lists of stream segments that do not meet water quality standards.

They are called 303(d) lists after the section of the Clean Water Act that makes the requirement.

**Tidal wetlands:** Wetlands that have a direct connection to or are influenced by the ocean's tides. For the purposes of the *Management Plan*, tidal wetlands are defined as wetlands below river mile 46.

**Tide flats:** Flat areas of land exposed during low tides.

**Tide gate:** A structure designed to allow drainage of diked areas while preventing their inundation by the ocean's tides.

**Threatened species:** A plant or animal species likely to become endangered throughout all or a specific portion of its range within the foreseeable future, as identified in accordance with the Endangered Species Act of 1973.

**Total dissolved gas:** A measurement of the amount of nitrogen and oxygen gas dissolved in water. Water is saturated when it can hold no more dissolved gas under normal atmospheric conditions.

**Total Maximum Daily Loads (TMDLs):** Allocated measures that ensure compliance with water quality standards for 303(d)-listed water bodies.

**Toxic chlorinated hydrocarbons:** Toxic compounds resulting from the mixing of chlorine, carbon, and water.

**Toxic:** Poisonous, carcinogenic, or otherwise directly harmful to life.

**Tributary:** A stream or river feeding a larger body of water.

**Tributyltin:** An organic compound used as an additive in many marine anti-foulant plants to prevent algal and barnacle growth. Tributyltin is highly toxic to many marine organisms.

**Turbidity:** A measure of the amount of suspended material in the water, based on the material's refractory characteristics.

**Urban growth boundaries:** Generally state-wide, land use planning programs that mark the separation between rural and urban land. They are intended to encompass an adequate supply of buildable land that can be efficiently provided with urban services (such as roads, sewers, water lines, and street lights) to accommodate the expected growth during a specific time period.

**Waste load allocations:** The portion of a receiving water's loading capacity that is allocated to existing or future point source discharges.

**Water column:** The layer of water between surface and bottom sediments; the moving mass of water contained by a stream or river bed. The water column contains dissolved and particulate matter and provides habitat for plankton, fish, and marine mammals.

**Watershed:** A geographic area within which all surface water drains to a particular body of water.

**Wetland:** An area that is saturated by a surface of groundwater and subsequently is characterized by a prevalence of vegetation that is adapted for life in saturated soil conditions.



## QUOTATION SOURCES

Opening Page (Norman Maclean): *A River Runs Through It*, Norman Maclean, University of Chicago Press, 1976

Page 1 (Chinook invocation): *The Way of the Earth: Encounters with Nature in Ancient and Contemporary Thought*, Teri McLuhan, Simon & Schuster, 1994.

Page 3 (Izaak Walton): *The Columbia Dictionary of Quotations*, Robert Andrews, editor, Columbia University Press, 1993

Page 9 (William Stafford): “Pretty Good Day,” in *Even in Quiet Places: Poems by William Stafford*, Confluence Press, 1996

Page 14 (John Muir): *The Columbia Dictionary of Quotations*, Robert Andrews, editor, Columbia University Press, 1993

Page 28 (Kim Stafford): *Having Everything Right*, Kim Stafford, Confluence Press, 1986

Page 29 (Margaret Mead): *The New Beacon Book of Quotations by Women*, Rosalie Maggio, editor, Beacon Press, 1996

Page 57 (Chief Seattle): *Native American Wisdom*, Kent Nerburn, editor

Page 91 (Jose Ortega y Gasset): “To the Reader,” *Meditations on Quixote*, 1914, as quoted in *The Columbia Dictionary of Quotations*, Robert Andrews, editor, Columbia University Press, 1993

Page 189 (Wallace Stegner): *Beyond the Hundredth Meridian*, Wallace Stegner, New York Penguin Books, 1992

Page 190 (Albert Einstein): *The Columbia Dictionary of Quotations*, Robert Andrews, editor, Columbia University Press, 1993

Page 191 (Theodore Roethke): “The Rose,” *Collected Poems of Theodore Roethke*, Doubleday & Co., 1966

Page 211 (William Stafford): “Time for Serenity, Anyone?” in *Even in Quiet Places: Poems by William Stafford*, Confluence Press, 1996

Page 212 (Loren Eiseley): “The Flow of the River,” in *The Immense Journey*, Vintage Books, 1959

## HISTORICAL PHOTOGRAPHS

Page 12 - Fish net seining. Earl Moore photo, Oregon Historical Society, #OrHi GI 7185 #390-D

Page 143 - The Rapids, Upper Cascades. Charles E. Watkins photo, Oregon Historical Society, #OrHi 21089 #1100B

***In memory of Terry Husseman***

*whose vision and commitment inspires us still.*

*Terry served as Deputy Director of the Washington Department of Ecology  
and was a founding member of the Estuary Program Policy Committee.*

*In large part, it was Terry's vision and guidance for a two-state comprehensive  
environmental program that shaped the Estuary Program.*

*He is missed.*