Lower Columbia River Estuary Plan

Lower Columbia River Estuary Program
Comprehensive Conservation and Management Plan

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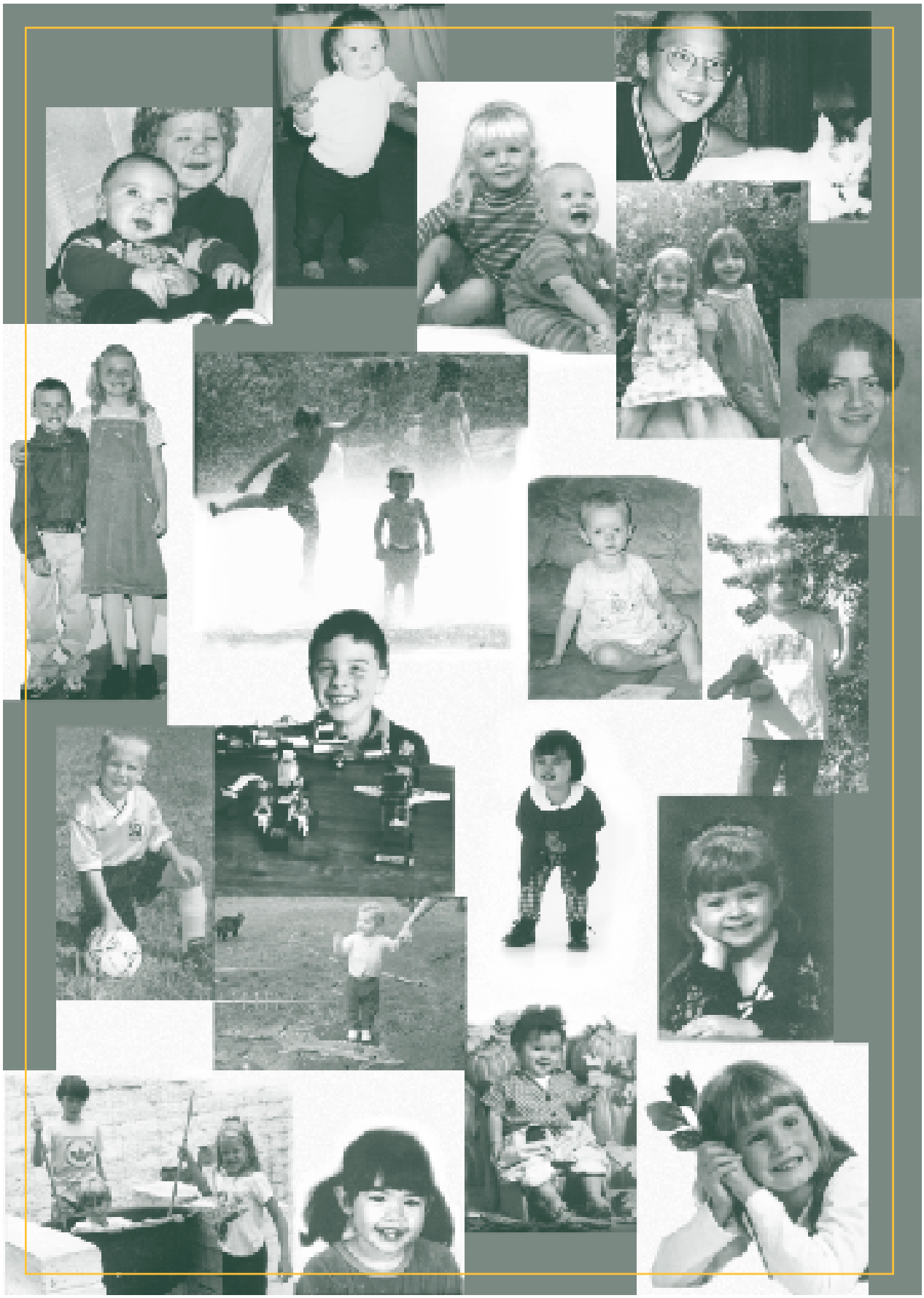
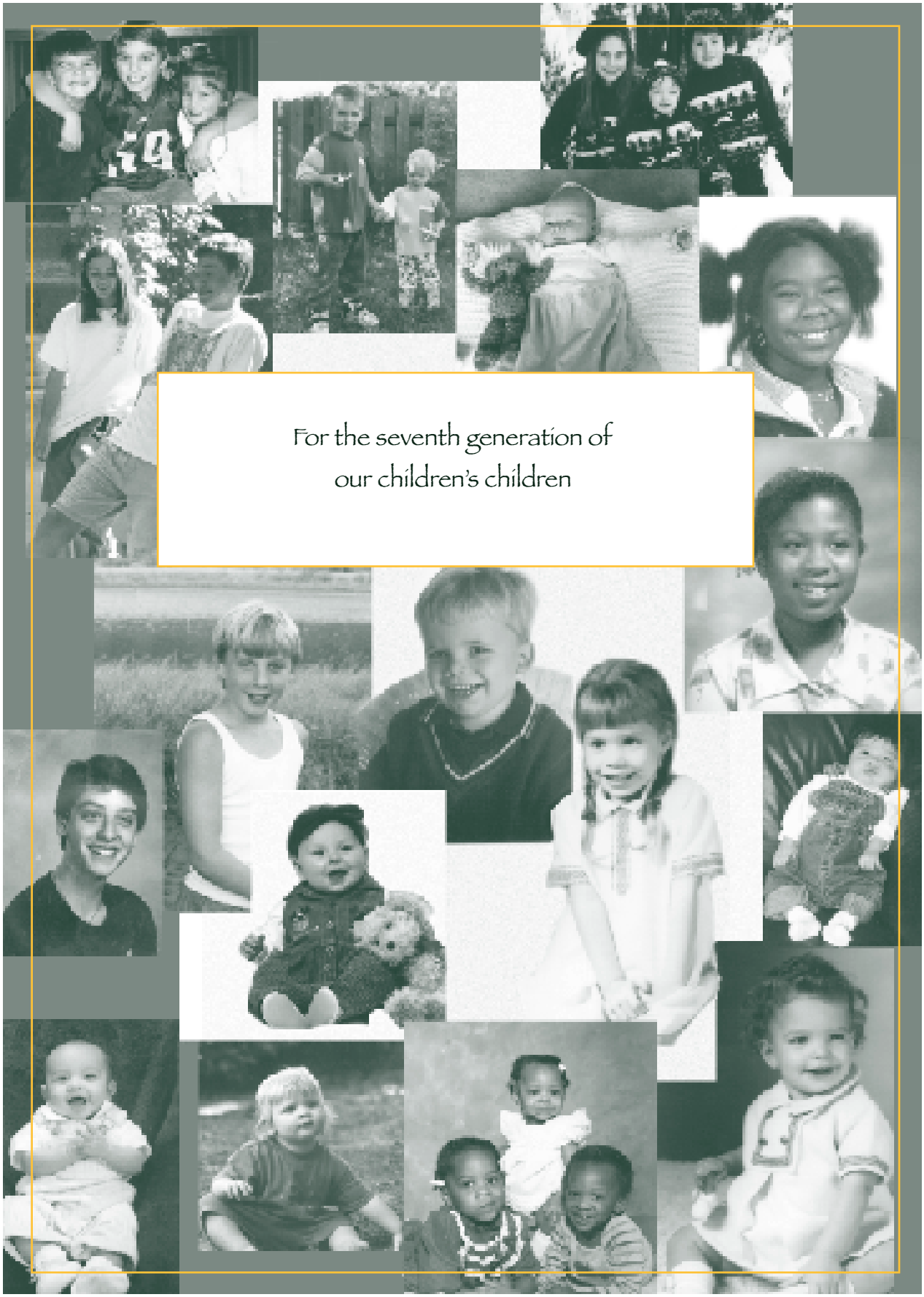
Eventually, all things merge into one,
and a river runs through it.

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

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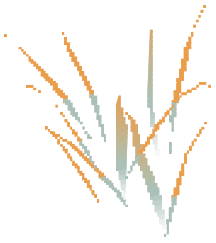

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Preface

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.

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5 Action Plan

I am I plus my surroundings, and if I do not preserve the latter,
I do not preserve myself.

Jose Ortega y Gasset

The 43 actions presented in this chapter are the heart of the *Management Plan*. They are the result of extensive work involving many committed people. They are based on scientific studies, the visions and objectives developed for each of the seven priority issues, and significant input from citizens of the lower Columbia River and estuary.

Developing the actions was a long process that started with the Bi-State Program studies in 1990. The Estuary Program picked up where that program ended in 1996 and worked for the next three years to produce the *Management Plan*. Along the way—after all the research, hundreds of hours of discussion, and heightened awareness among diverse viewpoints—one guiding theme for the Estuary Program has emerged. **Protecting and restoring the biological integrity of the lower Columbia River demands that we avoid creating new problems**. **The health of the river will not significantly improve if new problems continually emerge even as old ones are solved.** This theme has a strong economic as well as ecological rationale. Even as we struggle to fund attempts to fix existing problems, more complicated and expensive new issues arise. As a society, we cannot afford to let the cycle continue, from either an economic or ecological perspective.

The 43 actions address this guiding theme of the Estuary Program. They focus on preventing further habitat loss and restoring degraded habitats to secure a net gain in habitat. Wetland acreage will never increase if some wetlands are restored while others are simultaneously destroyed. Similarly, the actions focus on preventing new pollution while also dealing with existing pollution problems. The actions encourage more environmentally sound land use in every sector, from agriculture to forestry to urban development. They work toward government structures and agreements capable of anticipating problems rather than merely reacting to them. Finally, the actions rely on incentives and voluntary compliance. To prevent future problems, everyone—individuals, corporations and governments—must proactively take responsibility for the future of the lower Columbia River and estuary.

The actions represent a vision for the future of the lower Columbia River and estuary. **They address what the river needs**. In some cases, other agencies and organizations have recognized similar needs. A number of agencies are currently expending considerable time and resources to address problems confronting the lower river and estuary. These efforts are included as part of each action. They are an essential component of a comprehensive plan that addresses the ecosystem as a whole. For example, state agencies are developing total maximum daily pollutant loads (TMDLs) and establishing major initiatives in watershed management. Several local governments are actively pursuing stormwater management programs and reducing

combined sewer overflows. The States of Oregon and Washington have completed comprehensive plans to recover recently listed threatened and endangered salmon and steelhead. The faltering stocks of Columbia and Snake River salmon and steelhead have prompted many different organizations and agencies to redirect their efforts on the river.

In addition to considerable efforts by individual federal, tribal, state and local agencies and governments, a number of multi-jurisdictional and multi-issue plans have been developed. The Estuary Program consulted several of these in preparing the *Management Plan:*

- The Washington and Oregon plans to restore salmon runs in the Columbia River and elsewhere in the two states
- The Northwest Power Planning Council Fish and Wildlife Plan
- *Wy-kan-Ush-Mi Wa-Kish-Wit*, The Spirit of the Salmon Plan completed by the Columbia River Inter-Tribal Fish Commission
- The Biological Opinions from the National Marine Fisheries Service (NMFS)

These plans, prepared in response to different authorities and policy imperatives, have their own goals, geographic boundaries, and priorities. There are observable differences among them and between them and the Estuary Program *Management Plan*. There are also, however, substantial areas where these plans are complementary and in some cases overlap:[1]

- The Estuary Program *Management Plan* is oriented to water quality, while the other plans focus on fish. Yet, all of them highlight the importance of habitat for fish and recognize that adequate water quality is an important part of that habitat.
- Some of the plans, such as the NMFS Biological Opinions, are oriented to a specific species, but also recognize the importance of looking at habitat with a multi-species approach.
- The primary geographic focus of *Wy-kan-Ush-Mi Wa-Kish-Wit* is above Bonneville Dam, but it and the other plans recognize the critical nature of the lower river and estuary during critical periods of the life cycle of fish.
- Similar to the overall goals, the actions identified in the plans are similar. As an example, about half of the 43 actions in the *Management Plan* are similar in content to actions in *Wy-kan-Ush-Mi Wa-Kish-Wit*.
- All of the plans, including the *Management Plan*, stress the importance of maximizing cooperative efforts among involved agencies to gain full return for the money and effort expended. All propose scientifically sound monitoring to gauge the effectiveness of implemented elements of the plans.

The Management Committee recognized the efforts of these other plans early in its process. It chose not to limit the *Management Plan* to new initiatives. The Management Committee developed the actions by focusing first and foremost on what the river needs. In doing so, the committee made the *Management Plan* comprehensive and opened the door to heightened coordination.

After defining the comprehensive set of actions, the Management Committee identified who is taking or should take the lead on each action. The intent is to build on existing efforts and use existing strengths. There is much to be gained by capitalizing on the areas where the interests of different plans intersect, and a good deal to lose by failing to grasp opportunities to make common cause. Accordingly, agencies and organizations already actively involved in a particular action were most often identified as the lead implementing entity.

[1] Chapter 6 of this Volume and Volume 3 of the *Management Plan* contain additional discussion on these plans.

The Estuary Program will be involved in every action, although its role will vary. In cases where actions are currently being pursued, the Estuary Program will recognize and build on existing efforts, as well as identify new opportunities. In other cases, the Estuary Program will take the lead in implementing the action, with support from other groups. The actions are a partnership, in both their development and their implementation. The institutional complexity of the lower Columbia River and estuary demands that we all work together and use our respective strengths to best effect.

Most of the 43 actions address multiple priority issues, illustrating the interrelationship of the issues and the problems facing the river. The Columbia River is an extremely complex system. Its problems are multidimensional and interactive. They involve not only the river itself, but also its tributaries and the watersheds where the region's residents go about their daily life. Effective restoration and protection requires an approach and scale sufficient to incorporate all the significant components. The watershed approach achieves this. The Estuary Program's goal is to maintain the integrity of the whole lower Columbia River system—its chemical, physical, and biological properties, as well as its economic, recreational, and aesthetic values. Each action contributes to this overall goal. Taken together, the actions form a comprehensive plan to restore and maintain the biological integrity of the Columbia River system.

The 43 actions are organized in three broad categories: Habitat and Land Use, Education and Management, and Conventional and Toxic Pollutants. The components needed to implement each action are identified—for example, how the action will be carried out, where, by whom, and with what funding. The template on pages 96-97 explains each component. The 43 actions then follow.

List of Actions

Habitat and Land Use

1. Inventory and prioritize habitat types and attributes needing protection and conservation. Identify habitats and environmentally sensitive lands that should not be altered.
2. Protect, conserve, and enhance identified habitats, particularly wetlands, on the mainstem of the lower Columbia River.
3. Adopt and implement consistent wetland, riparian, and instream habitat protection standards to increase the quality and quantity of habitat to protect aquatic species.
4. Preserve and/or restore buffer areas in appropriate locations along tributaries and the Columbia River to a condition that is adequate to maintain a healthy, functioning riparian zone for the lower river and estuary.
5. Restore 3,000 acres of tidal wetlands along the lower 46 river miles to return tidal wetlands to 50 percent of the 1948 level.
6. Monitor the effectiveness of habitat protection, restoration, and mitigation projects.
7. Develop floodplain management and shoreland zoning protection programs.
8. Reduce the volume and velocity, and improve the water quality of stormwater runoff in developed areas.
9. Use tools and incentives in local planning ordinances and state laws to ensure that development is environmentally sensitive.

10. Establish, or modify minimum flows (including Columbia River flows) to meet instream fish and wildlife needs. Evaluate the cumulative impact of all proposed water withdrawals, diversions, or instream structures to ensure that established minimum flows are maintained.
11. Avoid the introduction of unwanted exotic species and control the deliberate introduction of desirable exotic species in the lower Columbia River and estuary.
12. Require human-caused changes in the river morphology and sediment distribution within the river channel and estuary to be managed so that native and desired species are not harmed.

Education and Management

13. Create an entity that serves as an advocate for the lower Columbia River and estuary and carries out the goals of the *Management Plan*.
14. Establish a common vision for and unified commitment to the health of the river.
15. Provide public information and education efforts about the lower river and estuary that focus on endangered species, habitat loss and restoration, biological diversity, and lifestyle practices and connections to the river.
16. Use best management practices to reduce non-point source pollution.
17. Help local governments implement federal, state, and local environmental and land use laws.
18. Coordinate federal and state threatened and endangered species recovery activities in the lower Columbia River and estuary and help local communities meet species recovery requirements.
19. Enforce existing environmental and land use laws.
20. Improve coordination among government agencies.
21. Design, support, and agree to use dispute resolution processes leading to resolution of institutional conflicts that affect the river.
22. Develop and implement consistent water quality-related activities, laws, rules, and standards. Focus on function and performance of ecosystems.
23. Establish an award program to promote successful stewardship and pollution prevention activities.
24. Administer grant programs to assist users with *Management Plan* implementation and to assist school children in educational efforts that focus on endangered species and habitat loss.
25. Coordinate volunteer monitoring programs and create or coordinate volunteer opportunities on the lower river.
26. Identify and improve points of public access to the river. Ensure that access does not cause further loss or degradation of habitat, increased erosion, loss of riparian vegetation, or degradation of water quality.
27. Implement the Estuary Program information management plan.
28. Implement the Estuary Program long-term monitoring plan.

Conventional and Toxic Pollutants

29. Monitor and evaluate potential effects of pollutants on human health, and fish and wildlife.

30. Develop a basin-wide strategy for identified toxic and conventional pollutants that defines their sources, fate, and effects and reduces their discharge.

31. Use pollution prevention to reduce or eliminate toxic and conventional pollution generated during manufacturing and industrial processes.

32. Reduce and maintain temperature and total dissolved gas in the mainstem Columbia River and tributaries to help sustain native species.

33. Reduce the bacterial contamination sometimes found in the Columbia River and its tributaries to limit human exposure to contaminated water.

34. Develop maximum pollutant loads for streams that do not meet water quality standards.

35. Eliminate new sources of persistent, bioaccumulative, and toxic chemicals; eliminate existing point source discharges of persistent, bioaccumulative, and toxic chemicals; and control persistent, bioaccumulative, and toxic discharges from contaminated sites.

36. Require all permitted discharges to surface water to use alternatives to chlorine to protect aquatic life where such alternatives provide equivalent removal and treatment of bacteria.

37. Require that industrial wastewater that is discharged to municipal wastewater treatment facilities does not contain materials that exhibit chronic toxicity or that interact with other chemicals to cause toxic effects.

38. Reduce hydrocarbon (PAHs) and heavy metal discharges associated with petroleum-powered vehicles and equipment that contaminate runoff with toxic chemicals.

39. Clean up hazardous waste sites.

40. Regulate and track the use of hazardous material to prevent re-uses that contaminate surface water or groundwater.

41. Provide subsidized hazardous material disposal opportunities for small-volume users and generators.

42. Require all marine facilities to have safety, spill prevention, and clean-up plans in place, and to have sewage and bilge pump-out facilities and treatment procedures.

43. Pursue safe deposition and timely clean-up of nuclear wastes stored at the Trojan and Hanford nuclear facilities.

Components of Each Action

Action: Describes a specific means to address one or more of the seven priority issues. Each action involves the following components.

Environmental Significance: Discusses why the action is important, what has contributed to the problems being addressed by the action, and what environmental benefits may be realized by implementing the action.

How: Offers methods for implementing the action. This is not an exhaustive list, but rather identifies tools believed to best address the action at this time. These tools will be evaluated and adjusted over time.

Priority Issues Addressed: Identifies which of the seven priority issues are addressed by the action and its components.

Environmental Measurement: Measures "on-the-ground" progress and effects of the action—for example, reduced pollution or waste stream, improved habitat, species recovery.

Action Measurement: Measures the process used to implement the action; assesses the progression or status of the action.

Because each action has different institutional or environmental objectives, not every action has both an environmental and an action measurement.

In some cases, the measurement categories include a discussion of when the action or aspects of the action will be implemented. This is difficult to fully determine until budget allocations are made for the Estuary Program and the Columbia River Foundation.[2] The Estuary Program's budget will be better defined after the Oregon and Washington legislatures act on its budget request in late spring 1999. In June and July 1999, the Estuary Program will develop an Implementation Strategy that will specifically define when, how, and by whom each action will be implemented. (See Chapter 6 for more detail.)

Where: Identifies where the action will be implemented. This can include the entire study area, portions of the study area, or extend beyond the study area (e.g., upriver areas or the entire Columbia River Basin) if needed to realize environmental improvement.

Who: Defines who will take the lead in implementing the action, recognizing the role that other entities are currently playing or are likely to play in implementation. This category will be further developed in the Implementation Strategy.

Estuary Program Role: Identifies the role the Estuary Program will play in implementing every action. The Estuary Program will not be a regulatory agency. Rather, the program will work to add value to existing efforts by filling voids where needed, and acknowledging and supporting the work of other entities. The range of roles is expressed as a continuum, ranging from consultation at a minimum to coordination/leadership at a maximum. The placement of the indicator (◆) identifies the level of effort by the Estuary Program.

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

[2] The Estuary Program established the Columbia River Foundation, a non-profit organization, in 1998. Chapter 6 discusses the foundation in more detail.

Consult *(Track):* The Estuary Program offers consultation to other entities about what should be done to implement the action.

Convene *(Assist)*: The Estuary Program convenes appropriate parties to implement the action.

Coordinate *(Do)*: The Estuary Program coordinates/leads efforts to implement the action.

Preliminary Cost Estimates: Estimates the likely cost of the action. Salary costs include fringe benefits and overhead. Estuary Program costs are estimated; staffing level estimates for other agencies are not defined at this time. FTE equals full-time equivalent, e.g., 1 FTE equals one full-time employee. Costs will be further refined as funding sources are identified.[3]

Funding Source: Identifies the funding source(s) for the action. The Management Committee specified that a funding source must be defined for every action or component of an action. The Estuary Program will be funded by federal and state money and will seek corporate, individual, and foundation support. Many agencies and local governments already make large investments in many of these actions. The Estuary Program, along with the Columbia River Foundation, will help secure funding sources for implementation.

In its preliminary assessments, the Estuary Program 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, one of the primary goals of Capitalization Grants for State Revolving Funds is implementation of an estuary program's management plan. Although it is not possible to assess with certainty the likelihood or amount of funding from a federal source, it is important to know there are significant potential sources currently available. As the Estuary Program moves into implementing the *Management Plan*, more specific implementation plans will be developed for each action and more will be known about the likelihood of receiving federal funding for a specific project.

In addition to federal sources of funding, there may be other government funding opportunities with the states of Oregon and Washington, regional entities, such as the Bonneville Power Administration, and with local officials. (See Chapter 6 for further discussion.)

Regulations Required: Identifies whether new or additional regulation is required to implement the action. Does not identify existing rules, laws, or ordinances.

Existing Agency Activities: Identifies some of the current and proposed activities of tribal, federal, state, and local governments. This list is not exhaustive, but illustrates that existing rules, statutes, and programs are currently addressing many of the actions, or aspects of actions, included in the *Management Plan*. The Management Committee incorporated these efforts to produce a comprehensive plan that encompasses the wide range of activities needed to achieve and maintain biological integrity for the lower Columbia River and estuary.

[3] Estimates for costs outside the Estuary Program were provided by Battelle Research Center.

Habitat and Land Use Actions

Actions 1 through 12 address habitat loss and modification, and the impacts of land use activities. In the comparative risk ranking conducted in 1997, all three participating groups (technical experts, focus groups, and the general public) ranked loss of habitat and wetlands as the number-one risk to public health, ecological health, and quality of life in the lower river and estuary. These 12 actions reflect that high level of concern. The Estuary Program will encourage and assist other entities in implementing these actions, and may implement some aspects of the actions itself.

ACTION 1: Inventory and prioritize habitat types and attributes needing protection and conservation. Identify habitats and environmentally sensitive lands that should not be altered.[4]

Environmental Significance: ***Well over 50 percent of the important fish and wildlife habitat in the lower river basin has been lost as a result of human activities. What is left needs to be identified, characterized, and protected if ecosystem functions are to be maintained and enhanced and if healthy populations of native species are to be sustained. Moreover, habitats such as riparian areas and wetlands also play important roles in improving water quality and reducing impacts of flooding. Completing an inventory of habitat types is the first step in a comprehensive effort to institutionalize the protection of important habitats in the lower river. It will result in a greatly improved knowledge base and provide a method to assess habitat health.***

How:

- Research and assess habitat types important to sensitive, threatened, and endangered species and other populations at risk, and identify factors that limit their proper functioning. Habitat types may include: tidal wetlands, riparian habitats, habitat corridors, and deep water and nearshore environments.
- Develop appropriate criteria and prioritize habitat types to be protected and restored.
- Map existing habitats and identify priority habitats.
- Identify possible protection and restoration projects, and designate habitats that should not be altered.
- Reach agreement on appropriate protection and restoration techniques and guidelines.
- Identify indicator species closely associated with particular habitat types, and monitor these species to evaluate the health and proper functioning of their habitats.

Priority Issues Addressed: *Habitat Loss and Modification, Institutional Constraints.*

Environmental Measurement: By 2005, specific habitats and environmentally sensitive lands are not altered.

Action Measurement: By 2001, existing habitat is mapped and a process and schedule is in place to prioritize habitats for protection, restoration, and conservation. By 2003, indicator species are identified, criteria for prioritizing and protecting habitat are in place, and a monitoring plan is in place.

Where: Study area.

Who: The Estuary Program coordinates with appropriate federal, state, and local governments and entities, and private landowners. Build on work completed by the Oregon Biodiversity Project and other existing inventories.

[4] Actions number 1-6 are somewhat cumulative. The assessment required in this action must be completed before components of subsequent actions can be implemented.

The Estuary Program Role:

CONSULT *(Minimum involvement)* | CONVENE | COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Progarm costs: Year 1: 0.6 FTE ($48,000) for oversight. Non-Estuary Program staffing costs need to be determined. Staff would be for program development, criteria selection, supervision of the assessment process, and development of appropriate protection and restoration techniques.

Other Costs: Riparian survey $1,000 to $15,000 per mile; habitat assessment $150 per mile. Costs to display data in GIS high resolution mapping format (1:24,000) would be approximately $13,000 for the mainstem Columbia River area only or approximately $87 per river mile.

Funding Source: Funding sources for non-Estuary Program staff need to be determined.

Regulations Required: This action will require legislation to designate habitats not to be altered.

Existing Agency Activities: Identification of habitats needing protection and sensitive lands that should be left undisturbed will require the attention of the full range of natural resource agencies and local land use planners. Federal, tribal and state fish and wildlife agencies have led past habitat protection efforts, and will play a lead role in developing the scope of such an analysis, establishing standards, restoring and preserving identified habitats, and monitoring the success of the program. The U.S. Army Corps of Engineers (Corps), and its ecosystem restoration authorities, may provide a vehicle for such natural resource agency and local government collaboration.

Environmental agencies such as Washington Department of Ecology (Ecology) and Oregon Department of Environmental Quality (DEQ) provide a focus on habitats at risk from contamination, or on fish recovery efforts where water quality issues are implicated.

Protection of wetlands and riparian areas relies in large measure on the work of local governments as they develop, update, and implement their land use plans.

The Division of State Lands (DSL) in Oregon and the Department of Natural Resources (DNR) in Washington have both a regulatory and an ownership interest in submerged and submersible lands.

The Natural Resource Conservation Service (NRCS) and conservation districts will continue to be involved in providing technical assistance to private landowners.

ACTION 2: Protect, conserve, and enhance identified habitats, particularly wetlands, on the mainstem of the lower Columbia River.

Environmental Significance: *The limited amount of habitat left on the mainstem of the Columbia River must be protected and enhanced to halt further deterioration and to maintain the possibility of preserving the ecosystem. Protection and restoration will begin by institutionalizing habitat protection and providing incentives and tools for landowners and government bodies to act. Currently, there are 64,200 acres of protected wetland habitat in the study area. The Oregon Wetlands Plan has identified an additional 10,000 acres of wetland habitat and 3,000 acres of upland habitat that should be protected.*[5]

How:

- Acquire and manage important wetland habitats and environmentally sensitive lands in perpetuity, using the information developed in the habitat assessment.
- Establish and maintain additional biological preserves in perpetuity.
- Where designated lands are already publicly owned, implement management practices that will ensure these lands are allowed to function naturally.
- Eliminate provisions in existing local, state, or federal rules that inhibit habitat restoration or enhancement by private landowners.
- Provide incentives (start-up grants, tax breaks, etc.) and technical assistance to encourage local landowners, businesses, corporations, and trustee agencies to improve and protect wetland and riparian areas. Include incentives for using best management practices (BMPs) to demonstrate appropriate techniques.
- Reclaim habitat by selectively using tools such as seasonally managing or breaching dikes, augmenting inadequate stream flows, decompacting wetland soil, lowering surface elevations of mainstream reservoirs, modifying dam operations, re-establishing sustained peak flows, installing fish-friendly tide gates, not disposing of dredge sediment in streams, restoring riparian floodplain connections, and removing or modifying structures that prevent natural flows.
- Support research on techniques for cost-effective revegetation of areas such as dredge spoil islands.
- Support the maintenance of effective enforcement programs.

Priority Issues Addressed: *Habitat Loss and Modification, Institutional Constraints, Public Awareness and Stewardship.*

Environmental Measurement: By 2010, 10,000 additional acres of wetland habitat and 3,000 acres of upland habitat are permanently enhanced, protected, or reclaimed. Other habitats types are enhanced, protected, or reclaimed.

Action Measurement: By 2005, a strategy with appropriate standards to protect and acquire habitats is established; incentives, including the U.S. Department of Agriculture Conservation Reserve and Enhancement Program, are in place. By 2005, provisions of rules, laws and ordinances that discourage environmentally sensitive development or allow loss of habitat have been

[5] The recommendation for 10,000 acres of wetland and 3,000 acres of upland habitat is contained in the Oregon Wetlands Plan prepared by the Oregon Department of Fish and Wildlife and the Oregon Wetland Joint Venture, which included parties in the states of Oregon and Washington.

identified. By 2008, rules, laws,and ordinances have been modified to encourage environmentally sensitive development and to protect habitat.

Where: Study area.

Who: The Estuary Program coordinates with appropriate federal, state, and local governments and entities, and private landowners.

The Estuary Program Role:

Preliminary Cost Estimates: Non-Estuary Program planning costs would be provided to help Estuary Program staff develop the plan for acquisition and maintenance. After assessment, staff would develop a plan for acquisition and maintenance of biological reserves, and incentives for private landowners to protect wetland and riparian areas.

Other Costs: Wetland restoration $50 to $95,000 per acre; wetland rental $63 to $121 per acre per year; pasture and grazing land purchase $75 to $4,000 per acre.

Funding Source: Funding sources for non-Estuary Program staff need to be determined.

Regulations Required: Rules and legislation may be needed to ensure appropriate habitat protection and enhancement and to modify rules, laws, and ordinances to encourage environmentally sensitive development.

Existing Agency Activities: Identification of habitats needing protection and sensitive lands that should be left undisturbed will require the attention of the full range of natural resource agencies and local land use planners. Federal, tribal, and state fish and wildlife agencies have led past habitat protection efforts, and will play a lead role in developing the scope of such an analysis, establishing standards, restoring and preserving identified habitats, and monitoring the success of the program. The Corps, and its ecosystem restoration authorities, may provide a vehicle for such natural resource agency and local collaboration.

Environmental agencies such as Ecology and DEQ provide a focus on habitats at risk from contamination, or on fish recovery efforts where water quality issues are implicated.

Protection of wetlands and riparian areas relies in large measure on the work of local governments as they develop, update, and implement their land use plans.

DSL in Oregon and DNR in Washington have both a regulatory and an ownership interest in submerged and submersible lands.

NRCS and conservation districts will continue to be involved in providing technical assistance to private landowners.

ACTION 3: Adopt and implement consistent wetland, riparian, and instream habitat protection standards to increase the quality and quantity of protected habitat to protect aquatic species.

Environmental Significance: *Currently, the application of wetland, riparian, and aquatic protection standards tends to vary between jurisdictions. If the ecosystem is to be effectively protected and enhanced, consistent standards throughout the study area are needed to ensure that balanced decisions can be made and to prevent future losses. Performance-based standards can enhance resource protection by focusing on important water quality and habitat functions, while allowing flexibility in practices. Consistent measures or standards will ensure that the habitat protection process is institutionalized throughout the study area, and that uniform protection and mitigation efforts are maintained into the future.*

How:

- Assess current habitat protection measures and implementation.
- Adopt habitat protection protocols, including standards for monitoring mitigation projects.
  - ✓ Assess the potential impacts of proposed development. Identify cumulative impacts and habitat attributes that might be lost. Present alternatives that minimize impacts.
  - ✓ The preferred alternative will have no adverse impacts.
  - ✓ If impacts are unavoidable, mitigation shall take one of five forms in order of preference:
    - a) Restoration: returning a damaged habitat as closely as possible to its condition prior to damage
    - b) Enhancement: making changes or improvements to habitat to replace functions or values lost or damaged
    - c) Preservation: protecting habitat in adjacent areas that are equivalent to the area damaged and that might otherwise be subject to unregulated activity
    - d) Creation: converting a non-functioning habitat area into one having all of the physical and biological characteristics of the area lost or damaged
    - e) Cash mitigation: providing cash compensation for lost habitat to be used for habitat protection and restoration

Priority Issues Addressed: *Habitat Loss and Modification, Institutional Constraints.*

Environmental Measurement: Development activity does not adversely affect or disturb existing habitat, or impacts are fully mitigated.

Action Measurement: All jurisdictions in the study area adopt consistent protection standards by 2007. Measures may include performance standards, rules, regulations, or laws.

Where: Study area.

Who: The Estuary Program works with federal and state natural resource agencies and local and regional governments to develop the standards, implement adoption procedures, and coordinate technical assistance.

The Estuary Program Role:

CONSULT *(Minimum involvement)* | CONVENE | COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: FY 1998: $25,000 to assess current standards and their implementation. Year 1 Implementation (1999): $25,000 to complete assessment and make recommendations and 0.05 FTE ($4,000) for oversight. Year 2: 0.05 FTE ($4,000) to coordinate the development of consistent standards. Staff would review and facilitate agency adoption of wetland, riparian, and aquatic standards, and agree on the consistent applications of standards, including mitigation standards where impacts are unavoidable. Resource agency staffing costs are determined by relevant agencies that are currently developing and implementing standards.

Other costs: Unit costs of protection standards: Fencing $1 to $4 per foot; tree planting $100 to $500 per acre; riparian area lease/rental rates $63 to $121 per acre per year; pasture and grazing land purchase $75 to $4,000 per acre.

Funding Source: Estuary Program staff and projects will come from base funds and a $50,000 U.S. EPA grant (received in 1998-1999). Funding sources for non-Estuary Program staff need to be determined.

Regulations Required: This action would require legislation to establish standards.

Existing Agency Activities: Identification of habitats needing protection and sensitive lands that should be left undisturbed will require the attention of the full range of natural resource agencies and local and regional land use planners. Federal, tribal, and state fish and wildlife agencies have led past habitat protection efforts, and will play a lead role in developing the scope of such an analysis, establishing standards, restoring and preserving identified habitats, and monitoring the success of the program. The Corps, and its ecosystem restoration authorities, may provide a vehicle for such natural resource agency and local collaboration.

Environmental agencies such as Ecology and DEQ provide a focus on habitats at risk from contamination, or on fish recovery efforts where water quality issues are implicated.

Protection of wetlands and riparian areas relies in large measure on the work of local governments as they develop, update, and implement their land use plans.

DSL in Oregon and DNR in Washington have both a regulatory and an ownership interest in submerged and submersible lands.

NRCS and conservation districts will continue to be involved in providing technical assistance to private landowners.

U.S. EPA has completed a Wildlife Criteria Risk Assessment, which has identified research needs and issues facing wildlife criteria development. It involves the need to integrate a spatial scale with an ecological perspective into wildlife risk assessments, developing toxicity data, improving species extrapolation and dose metrics, and integrating chemical and non-chemical stressors into wildlife risk assessments.

ACTION 4: Preserve and/or restore buffer areas in appropriate locations along tributaries and the Columbia River to a condition that is adequate to maintain a healthy, functioning riparian zone for the lower river and estuary.

Environmental Significance: ***Healthy riparian buffer zones are important for many reasons. They protect the spawning and rearing habitat critical to recover and sustain salmonids and other native threatened and endangered species of fish and wildlife. They reduce sediment intrusion and excessive runoff from human activities, such as development, construction, forestry, ranching, agriculture, farming, and road building practices. Healthy riparian buffers also provide shade to maintain stream temperature, habitat and food sources for fish and wildlife, woody debris for streams, and pollution attenuation. Additionally, they store water during high flows. To maintain these functions, it is critically important to identify key habitat for protection, and provide incentives and guidance to landowners and government bodies.***

How:

- Using the information developed during the habitat assessment (Action 1), identify possible buffer areas for protection and restoration. Characteristics such as slope, ground cover, and soil type should be addressed.
- Identify urban and rural techniques for restoration and preservation. Develop new techniques, such as 'daylighting' urban streams (opening up streams that have been submerged in conduits); exploring dike removal and alternatives to dewatering wetlands; and discouraging the use of riprap and other shoreline hardening. Ensure culverts encourage fish passage.
- Acquire and manage key riparian areas and open space preserves for permanent protection.
- Where designated lands identified in the habitat assessment are already publicly owned, implement management practices that ensure that those lands function naturally.
- Provide incentives such as start-up grants, tax breaks, density bonuses and fewer inspections, and technical assistance to encourage local landowners, businesses, corporations, and trustee agencies to undertake riparian area improvements and protection measures.
- Establish a vegetation protection program that includes planting and fencing. Provide acquisition, operations, and maintenance monies for planting or replanting native species along tributaries. Encourage volunteer efforts.

Priority Issues Addressed: *Habitat Loss and Modification, Institutional Constraints, Public Awareness and Stewardship.*

Environmental Measurement: Streams meet water quality standards. Indices and measurements are established by 2002 to evaluate habitat and riparian corridors.

Action Measurement: Specific areas and miles for buffer restoration have been identified by 2005 and a plan for preservation and restoration is in place.

Where: Study area.

Who: The Estuary Program coordinates with the appropriate federal, state, and local governments and agencies, watershed councils, and private landowners.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: 0.25 FTE ($20,000) annually for coordination. Non-Estuary Program staffing costs need to be determined. Staff would identify areas for protection and restoration, and develop preservation and restoration techniques.

Other Costs: Unit costs for riparian protection/restoration: Fencing $1 to $4 per foot; tree planting $100 to $500 per acre; dike removal estimated at $2 to $5 per cubic yard; riparian area lease/rental rates $63 to $121 per acre per year; pasture and grazing land purchase $75 to $4,000 per acre.

Funding Source: Estuary Program base funds will support Estuary Program staff. Funding sources for non-Estuary Program staff need to be determined.

Regulations Required: Regulations may be needed to ensure that adequate and appropriate buffer areas are maintained and restored.

Existing Agency Activities: Identification of habitats needing protection and sensitive lands that should be left undisturbed will require the attention of the full range of natural resource agencies and local land use planners. Federal, tribal, and state fish and wildlife agencies have led past habitat protection efforts, and will play a lead role in developing the scope of such an analysis, establishing standards, restoring and preserving identified habitats, and monitoring the success of the program. The Corps, and its ecosystem restoration authorities, may provide a vehicle for such natural resource agency and local collaboration.

Environmental agencies such as Ecology and DEQ provide a focus on habitats at risk from contamination, or on fish recovery efforts where water quality issues are implicated.

Protection of wetlands and riparian areas relies in large measure on the work of local governments as they develop, update, and implement their land use plans.

DSL in Oregon and DNR in Washington have both a regulatory and an ownership interest in submerged and submersible lands.

NRCS and conservation districts will continue to be involved in providing technical assistance to private landowners.

ACTION 5: Restore 3,000 acres of tidal wetlands along the lower 46 river miles to return tidal wetlands to 50 percent of the 1948 level.

Environmental Significance: ***Tidal wetlands are one of the most critical habitats of the estuary, providing nursery and feeding grounds for numerous species, including threatened and endangered species (steelhead, chinook salmon, bald eagles, etc.). Much of this key habitat has been lost through the actions of humans. Restoring lost tidal wetlands is a key to the health of the ecosystem of the lower river. Restoring 3,000 acres will ensure that significant progress is made toward returning the lower river, specifically the estuary itself, to a more natural condition. Restoring this critical habitat will have top priority in habitat protection efforts.***

How:

- Using the information developed during the habitat assessment (Action 1), identify specific tidal wetlands areas that could be restored.
- Acquire, where possible, identified wetland areas and manage them to restore their natural functioning.
- Work with land owners and local diking districts to undertake tidal wetland improvement projects on private lands. These efforts could include removing tide gates or replacing tide gates with ones that allow greater water exchange, and breaching dikes.

Priority Issues Addressed: *Habitat Loss and Modification, Institutional Constraints, Public Awareness and Stewardship.*

Environmental Measurement: 1,500 acres are restored by 2010; 3,000 acres are restored by 2020.

Action Measurement: Identify tidal wetlands to be restored; work with land owners and diking districts.

Where: The lower 46 miles of the study area.

Who: The Estuary Program coordinates with federal, state, and local governments and agencies, and private landowners.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: 0.25 FTE (Biologist) ($20,000) annually for oversight. Staffing costs for other agencies need to be determined. Staff would identify potential locations for tidal wetland restoration.

Other Costs: Unit costs for tidal wetland restoration: dike removal estimated at $2 to $5 per cubic yard; culvert replacement $80,000 to $243,000 “project cost” to re-establish fish passage; pasture and grazing land purchase $75 to $4,000 per acre; tidal fresh-water wetland restoration $43,000 to $78,000 per acre; salt marsh restoration $18,000 to $49,000 per acre.

Funding Source: Estuary Program base funds will support Estuary Program staff. Funding sources for non-Estuary Program staff need to be determined. Potential Source: National Coastal Wetland Conservation grants for restoration and acquisition in partnership with U.S. Fish and Wildlife Service.

Regulations Required: None.

Existing Agency Activities: Identification of habitats needing protection and sensitive lands that should be left undisturbed will require the attention of the full range of natural resource agencies and local land use planners. Federal, tribal, and state fish and wildlife agencies have led past habitat protection efforts, and will play a lead role in developing the scope of such an analysis, establishing standards, restoring and preserving identified habitats, and monitoring the success of the program. The Corps, and its ecosystem restoration authorities, may provide a vehicle for such natural resource agency and local collaboration.

Environmental agencies such as Ecology and DEQ provide a focus on habitats at risk from contamination, or on fish recovery efforts where water quality issues are implicated.

Protection of wetlands and riparian areas relies in large measure on the work of local governments as they develop, update, and implement their land use plans.

DSL in Oregon and DNR in Washington have both a regulatory and an ownership interest in submerged and submersible lands.

NRCS and conservation districts will continue to be involved in providing technical assistance to private landowners.

ACTION 6: Monitor the effectiveness of habitat protection, restoration, and mitigation projects.

Environmental Significance: ***Currently, there is no consistent oversight of habitat protection, restoration, and mitigation projects. These projects must be maintained and evaluated if they are to be successful over the long run.***

How:

- Establish a team responsible for ensuring that habitat projects are monitored for effectiveness and adequately maintained for long-term viability.
- Develop criteria (including indicator species and best assessment tools) for evaluating the effectiveness of habitat protection, restoration, and mitigation projects.
- Where mitigation has been required, establish a team to work with regulatory agencies to ensure that any failed projects are corrected. At a minimum, require developers using mitigation to provide financial security for a prescribed period of time to ensure successful operation and long-term maintenance of their mitigation.
- Link habitat monitoring to the Estuary Program long-term monitoring plan.

Priority Issues Addressed: *Habitat Loss and Modification, Institutional Constraints.*

Environmental Measurement: By the year 2007, mitigation for developments is required and habitat protection and restoration goals are fully met.

Action Measurement: After the mitigation program is in place, the team will be established in 2001.

Where: Study area.

Who: The Estuary Program convenes a group of qualified individuals who could monitor habitat projects to ensure their proper functioning over time.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: 0.25 FTE (Biologist) ($20,000) annually for oversight.

Funding Source: Estuary Program base funds.

Regulations Required: None.

Existing Agency Activities: Identification of habitats needing protection and sensitive lands that should be left undisturbed will require the attention of the full range of natural resource agencies and local land use planners. Federal, tribal, and state fish and wildlife agencies have led past habitat protection efforts, and will play a lead role in developing the scope of such an analysis, establishing standards, restoring and preserving identified habitats, and monitoring the success of the program. The Corps of Engineers, and its ecosystem restoration authorities, may provide a vehicle for such natural resource agency and local collaboration.

Environmental agencies such as Ecology and DEQ provide a focus on habitats at risk from contamination, or on fish recovery efforts where water quality issues are implicated.

Protection of wetlands and riparian areas relies in large measure on the work of local governments as they develop, update, and implement their land use plans.

DSL in Oregon and DNR in Washington have both a regulatory and an ownership interest in submerged and submersible lands.

NRCS and conservation districts will continue to be involved in providing technical assistance to private landowners.

ACTION 7: Develop floodplain management and shoreland zoning protection programs.

Environmental Significance: ***The floodplain and the floodway serve important functions in the natural system, such as accommodating natural flooding and filtering some pollutants. When flooding does occur, the water takes the course nature provided. What is built in the water's path is flooded. The long-term cost to society of rebuilding structures in the floodway is high and unnecessary. In addition to property loss and cost of replacement, floodplain development increases pollutant discharges and runoff volume. Limiting floodplain development allows the river and riparian area to perform vital functions, such as providing habitat for endangered species, filtering pollution, and attenuating flood flows, and allows floodwaters to create new aquatic and riparian habitats.***

How:

- Discourage building in the floodway and the 100-year floodplain.
- Prohibit new building of non-water-dependent structures or activities and expansions of existing structures in the floodway.
- Phase out existing non-water-dependent structures in the floodway by 2020.
- Encourage and augment efforts, such as those of the Federal Emergency Management Agency (FEMA), to buy out existing structures.
- Promote alternatives to armored shorelines to restore and protect habitat.
- Establish appropriate setback requirements to protect the shorelines of streams and rivers.
- Increase home buyers' knowledge of the risk to flooding and the adverse effects of placing homes in the floodplain and floodway.

Priority Issues Addressed: *Impacts of Human Activity and Growth, Institutional Constraints, Habitat Loss and Modification.*

Environmental Measurement: Floodway is functioning without impairment of structures. More shoreline is stabilized with natural vegetation than with riprap or structures.

Action Measurement: In 1999, assemble existing model ordinance language that prohibits and phases out non-water-dependent floodway development, and establishes standards and best management practices for riparian buffers. In 2000, augment existing language for specific use in the lower river and estuary; prepare or supplement and disseminate education materials on impacts of floodplain development and alternatives. By 2002, initiate a buy-out fund to augment similar programs.

Where: The study area with later expansion to the Columbia River Basin.

Who: The Estuary Program works with appropriate parties to develop model language and define goals. Local and state jurisdictions implement.

The Estuary Program Role:

CONSULT *(Minimum involvement)* | CONVENE | COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: Year 1: 0.5 FTE (Land Use Planner) ($40,000) to collect and analyze model ordinances. Year 2: 0.25 FTE (Land Use Planner) ($20,000) to develop or refine models, with $100,000 for contract work to assist in developing model language for floodplain regulations. Year 3 onward: 0.25 FTE (Land Use Planner) ($20,000) to assist in implementing.

Other Costs: FEMA buy-out programs for homes that have suffered serious damage (losses greater than 50 percent of the value) and flood-prone properties at fair market value under the Hazard Mitigation Grant Program. Use of rock barbs to divert flow rather than riprap for shoreline protection. Tillamook Soil and Water Conservation District proposes 90 barbs in 18 miles of eroding streambank, at a cost of $50,000 per mile.

Funding Source: Estuary Program base funds for staff.

Regulations Required: This action would require legislation to prohibit building and floodplain development and to phase out existing buildings.

Existing Agency Activities: Local governments, through their land use planning and zoning activities, are primary implementers of floodplain and shoreland protection programs. At the state level, DSL in Oregon and DNR in Washington exercise both a regulatory and an ownership interest in activities that affect the beds and banks of navigable waterways.

ACTION 8: Reduce the volume and velocity and improve the water quality of stormwater runoff in developed areas.

Environmental Significance: ***The roofs, driveways, and roads associated with residential and non-residential development reduce the ability of the land to absorb and filter rainwater, increasing runoff and erosion. Development significantly increases stormwater volume, velocity, and sediment load. Stormwater can carry heavy metals and toxic contaminants (such as pesticides and PAHs) collected from lawns, nurseries, farms, roadways and emissions from vehicles. Volume and velocity affect the receiving waters by causing increased erosion and sedimentation. The cumulative effects of increased volume and velocity and impaired water quality significantly harm habitat and water quality. Decreasing volume and velocity and improving the water quality of runoff will significantly benefit fish and wildlife and the aquatic ecosystem while reducing flooding.***

How:

- Reduce stormwater from developed sites by such means as disconnecting downspouts and utilizing onsite retention. Support or initiate incentive programs for downspout disconnection.
- Require stormwater runoff from new development or redevelopment to meet pre-development rates of runoff, using techniques such as onsite holding, pretreatment or bioretention.
- Reduce the amount of impervious surface, using techniques such as reducing the ratio of parking spaces per floor area, developing narrower streets, using porous concrete and pavement, or creating gravel parking areas.
- Identify model developments and development practices; disseminate information on these techniques to local governments, developers, builders, and real estate professionals.
- Identify and eliminate planning techniques and requirements that inhibit onsite stormwater retention and treatment.
- Plan for treatment of runoff from impervious surfaces, including roads.
- Educate homeowners about "native" landscaping options that lessen runoff.
- Fully implement the Clean Water Act urban stormwater program.

Priority Issues Addressed: *Impacts of Human Activity and Growth, Toxic Contaminants, Conventional Pollutants.*

Environmental Measurement: The quality of receiving waters following storm events is improved. Impervious surface to open space ratios are decreased. Sedimentation and erosion are reduced.

Action Measurement: By 2000, identify and recognize development practices that reduce stormwater runoff. Collect, assemble, and disseminate examples of model developments and development practices to local governments, developers, builders, and real estate professionals.

By 2002, review stormwater management ordinances from five cities or towns in the study area to assess conflicts with stormwater management control goals. By 2003, remove ordinance provisions that do not advance control of stormwater. By 2005, review five additional ordinances. Achieve new development rates of runoff that meet pre-development rates.

Where: Study area.

Who: The Estuary Program works with state agencies and local governments. The Estuary Program might exchange information, and draft model ordinance language and best management practices guidelines.

The Estuary Program Role:

Preliminary Cost Estimates: Estuary Program costs: Year 1: 0.25 FTE (Land Use Planner) ($20,000) to assemble and analyze model plans and ordinances. Year 2: 0.25 FTE (Land Use Planner) ($20,000) to develop or modify models. Year 3: 0.25 FTE (Land Use Planner) ($20,000) to review existing ordinances and make recommendations for improved stormwater management control. Year 4 onward: 0.25 FTE (Land Use Planner) ($20,000) to assist in implementation.

Other Costs: Constructed wetlands to slow runoff and provide treatment $1,000 to $3,000 per acre; operations and maintenance costs $25 to $100 an acre.

Funding Source: Estuary Program base funds for staff.

Regulations Required: Local ordinances would need to reflect local strategies.

Existing Agency Activities: Ecology and DEQ both issue discharge permits for large municipalities, industrial facilities and certain construction activities. As Phase II stormwater regulations are promulgated by U.S. EPA, these permit activities will extend to smaller municipalities. Ecology and DEQ are developing stormwater pollution prevention best management practices (BMPs). Stormwater ordinances are currently under joint development by Ecology and Clark County.

Local jurisdictions on both sides of the river continue to develop stormwater control and treatment programs and ordinances. The City of Portland anticipates adoption of a new stormwater ordinance in spring 1999. The City of Troutdale, Oregon, is also developing a stormwater ordinance.

U.S. EPA is continuing to evaluate stormwater best management practices sampling data collected in 1998, and is preparing BMPs for pollutant removal.

ACTION 9: Use tools and incentives in local planning ordinances and state laws to ensure that development is environmentally sensitive.

Environmental Significance: *Population of the study area will increase in the foreseeable future. Managing that growth to minimize its adverse impact will help sustain the area and its natural resources. Some land use practices contribute to the degradation of water quality and habitat. The significant increase in population expected in the Portland-Vancouver metropolitan area will place new demands on our land and how we use it. A number of existing tools and incentives can be incorporated into land development planning processes to protect habitat and the environment and reduce impacts on adjacent properties. Conserving land for use in agriculture, forestry, and open space is critical for the continued health of all species. Concentrating development where infrastructure and services already exist is cost effective and protects natural resources from unnecessary degradation. Maintaining a responsible growth boundary will ensure that population growth and development in urban areas will occur in an environmentally responsible manner. This also ensures that suburban land, agricultural land and forested land will not be compromised unnecessarily.*

How:

- Establish and maintain urban growth boundaries.
- Promote clustered development with dedicated open space that protects environmentally sensitive land, such as critical habitat, wetlands, and steep slopes. Hold open space in perpetuity.
- Develop minimum habitat and ecosystem protection standards for development proposals.
- Encourage redevelopment of abandoned or under-utilized sites before development of undisturbed sites as a priority.
- Require vegetative buffers along riparian corridors.
- In urban areas, provide planning assistance for infill design options that maintain neighborhood integrity while increasing units; provide information on the development and application of design guidelines for neighborhoods.
- Require that infrastructure ensuring compliance with water quality standards is in place before development can occur, or require that it be provided by the developer. Such infrastructure could include adequate capacity at collectors or waste water treatment facilities, stormwater management, and permanent erosion control.
- Monitor the impacts of new developments to better define how land use, habitat condition, and fish and wildlife survival interrelate.
- Incorporate the review of mapped sensitive areas, critical habitats, and data on projected growth into local planning and development processes.
- Assess current local ordinance provisions to identify requirements that do not encourage environmentally sensitive development. Work to remove them. Develop model ordinance language.

Priority Issues Addressed: *Impacts of Human Activity and Growth, Habitat Loss and Modification.*

Environmental Measurement: Quantity and quality of waters in receiving streams is maintained or improved. The number of developments using innovative techniques increases.

Action Measurement: Using results from the habitat assessment, by 2001 develop and disseminate model habitat protection performance standards for local governments. By 2001, develop and disseminate, using interactive means, model ordinances or performance standards for clustered development and vegetative riparian buffers and information on conservation easements, including operations and maintenance, examples of success, and contact persons. By 2001, develop model ordinance language to encourage redevelopment of already serviced sites; develop the infill design guidelines program. By 2004, 50 percent of jurisdictions will have adopted ordinances or standards. By 2009, 100 percent of jurisdictions will have adopted ordinances or standards.

Where: Study area.

Who: Local jurisdictions; the Estuary Program develops model ordinances or alternatives, and assesses current language or ordinance provisions that do not promote environmentally sensitive design.

The Estuary Program Role:

CONSULT *(Minimum involvement)* | CONVENE | COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: Year 1 and 2: 0.5 FTE (Planner) ($40,000) to assemble model ordinances. Year 3: 0.25 FTE ($20,000) to develop and assist in implementing and using; $100,000 for contract work on model ordinances. Year 4 -10: 0.25 FTE to assist in implementing and using.

Funding Source: Estuary Program base funds.

Regulations Required: Regulations are an option for local government if it wishes to achieve this action through non-voluntary or incentive programs. Regulations could be implemented to establish urban growth boundaries, promote clustered development, achieve habitat protection, establish vegetative buffers, design guidelines for infill development, or require infrastructure prior to development.

Existing Agency Activities: Local governments, through their land use planning and zoning ordinances, make judgements about the nature and location of development. Both states, through their respective land use statutes, play a role in land use decisions.

ACTION 10: Establish or modify minimum flows (including Columbia River flows) to meet instream fish and wildlife needs. Evaluate the cumulative impact of all proposed water withdrawals, diversions, or instream structures to ensure that established minimum flows are maintained.

Environmental Significance: ***Modification of flows in the Columbia River and its tributaries has contributed to elevated temperature and diminished water quality. Establishing appropriate levels will restore river flows to more natural levels, minimizing high temperature problems during critical times of the year and restoring lost habitat.***

How:

- Identify and maintain flows needed to support beneficial uses and treaty obligations.
- Request flows to support fish and wildlife, water quality, and recreational needs.
- Review water withdrawal applications and recommend appropriate conditions or limitations on permits to protect flows.
- Initiate water conservation and acquisition of water rights to improve flows where needed.
- Restore the natural high flow regime in late spring.

Priority Issues Addressed: *Conventional Pollutants, Habitat Loss and Modification.*

Environmental Measurement: Minimum flows that are adequate for beneficial uses are requested and established by 2003. Over time, there is a measured increase in the amount of water dedicated to meeting minimum flow requirements.

Action Measurement: Identify flows. Applications are approved with flow conditions and/or limitations.

Where: The Columbia River Basin.

Who: The Estuary Program monitors implementation and facilitates discussions with the appropriate provincial, federal, and state (basin-wide) governments and agencies.

The Estuary Program Role:

CONSULT *(Minimum involvement)* | CONVENE | COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Non-Estuary Program staffing costs need to be determined. Staff would analyze minimum flow needs, request and process minimum flow requests, and review proposed withdrawals to protect necessary flows.

Other costs: Cost of acquiring water to meet minimum flows. Example: Oregon Water Trust lease prices range from $7 to $58 annually per acre foot of water. Purchase prices range from $67 to $367 per acre foot. Example: The annual cost of "fish spill" at Bonneville Dam to meet the 1995 NMFS Biological Opinion was $70 to $80 million of foregone power production.

Resource agencies already are committing significant time and money to developing and permitting for instream rights.

Funding Source: Funding sources for non-Estuary Program staff need to be determined.

Regulations Required: Rules or legislation would be required to establish minimum flows.

Existing Agency Activities: Oregon DEQ, the Oregon Department of Fish and Wildlife (ODF&W), and Oregon Department of Parks & Recreation (ODP&R) are authorized to request instream water rights to support their statutory obligations. The Oregon Water Resources Department and Commission review these requests and establish instream water rights. Oregon currently has established more that 1,300 instream water rights.

Ecology also establishes instream flows and provides grants and technical support to the Lower Columbia Fish Recovery Board to address instream flow issues.

NRCS provides technical assistance to farmers and ranchers for conserving on-farm use of water.

U.S. EPA maintains a water quality standards program evaluation.

ACTION 11: Avoid the introduction of unwanted exotic species and control the deliberate introduction of desirable exotic species in the lower Columbia River and estuary.

Environmental Significance: *Non-native species in the lower Columbia River threaten the survival of many native species through competition for food, alteration of the habitat, predation, and domination. To date, efforts to control the introduction of non-native species have been largely ineffective. More resources must be directed at this problem for effective control strategies to be developed.*

How:

- Regularly inventory existing populations of non-indigenous species and maintain a current list of all identified species.
- Research the relationship between native species, exotic species, primary production, and the food chain, since native species may now be dependent on non-native species.
- Develop and implement consistent control programs for introduced species. Manage native species experiencing population explosions where necessary to protect other native species and prevent harm to the existing ecosystem.
- Provide information on invasive and harmful exotic species to the public. Target nurseries, anglers, shipping companies, and the pet trade.
- Require pumping of ballast water at sea instead of in the estuary or the river, and/or require the treatment of ballast water consistent with international conventions.
- Promote the use of native plant species through education programs.

Priority Issues Addressed: *Habitat Loss and Modification, Public Awareness and Stewardship, Institutional Constraints.*

Environmental Measurement: Desired and native species are not compromised by the presence of exotic species.

Action Measurement: By 2000, establish a baseline inventory and monitoring plan and a public education strategy. By 2005, strategies are in place to both effectively prevent the introduction of unwanted exotic species and effectively manage those already introduced.

Where: Study area.

Who: The Estuary Program monitors implementation and coordinates the development of a consistent control program with the appropriate federal and state agencies.

The Estuary Program Role:

Preliminary Cost Estimates: Estuary Program costs: $150,000 for research; 0.10 FTE ($8,000) for coordination. Non-Estuary Program staffing costs need to be determined. Staff would develop strategies to avoid the introduction of unwanted exotic species and manage the deliberate introduction of desirable exotic species.

Other costs: Example: Trap line management (one person) for the green or Chinese mitten crab is $50,000 annually. Potential costs for shippers if ballast water treatment or controlled pump-out is required.

Funding Source: Estuary Program base funds will pay for Estuary Program staff. Research funds would come from grants. Funding sources for non-Estuary Program staff need to be determined.

Regulations Required: Control strategies for managing species and ballast pumping could require legislation.

Existing Agency Activities: Oregon and Washington fish and wildlife departments have management responsibilities for fish and wildlife including the control of non-indigenous species. Washington Department of Fish and Wildlife (WDF&W) is currently developing an Aquatic Non-indigenous Species Management Plan. The Pacific States Marine Fisheries Commission currently administers a project to promote interstate communication and facilitate the coordination of aquatic non-indigenous species activities on the west coast. Oregon and Washington Sea Grant Programs have combined to form the NW Marine Invasive Species Team to raise the level of awareness about the threats of invasive species. More recently, the Invasive Alien Species Executive Order at the federal level has created the Invasive Species Council and directed development of an Invasive Species Management Plan.

ACTION 12: Require human-caused changes in the river morphology and sediment distribution within the river channel and estuary to be managed so that native and desired species are not harmed.

Environmental Significance: *Human-caused changes in the river morphology and sediment distribution within the river channel and estuary can harm populations of native and desired species. River morphology includes the river's physical structure, banks, channel, and channel bottom. Human-caused changes include such activities as channel alteration and dredging. Identifying these changes, monitoring impacts, and advocating for the interests of native and desired species will help ensure that changes will not harm existing populations. Changes in sediment, caused by such activities as dredging, result in negative impacts to aquatic vegetation, salmon, crab, and other species.*

How:

- Identify proposed and current activities that will cause significant changes in Columbia River morphology and sediment distribution within the river channel and estuary.
- Coordinate with other agencies and governments to ensure compliance with existing goals, rules, and regulations.
- In conjunction with the long-term monitoring plan, monitor the impacts of changes in the river's morphology and sediment distribution on native and desired species.
- Review existing laws, regulations, and enforcement for adequacy in protecting species.

Priority Issues Addressed: *Habitat Loss and Modification, Institutional Constraints.*

Environmental Measurement: Native and desired species associated with the Columbia River and estuary are not harmed by changes to river morphology and sediment distribution.

Action Measurement: Identify activities that cause change. Monitor impacts for consistency and coordination.

Where: Study area.

Who: U.S. Army Corps of Engineers and other federal, state, and local agencies and industries. The Estuary Program will coordinate, comment on, and monitor such projects.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: 0.25 FTE ($20,000) annually to coordinate.

Funding Source: Estuary Program base funds.

Regulations Required: Rules and regulations may need to be altered or added.

Existing Agency Activities: Alterations to river structure and form (morphology) from removals, fills and dredging are regulated by specific sections of the federal Clean Water Act, or state statute, or both. These laws are exercised by federal (Corps, U.S. EPA) or state agencies (DEQ, DSL, Ecology, DNR, Department of Land Conservation and Development). Alterations to river banks, depending on the activity and location, may be regulated by these agencies, or by local jurisdictions through land use codes.

U.S. EPA has established existing sediment guidelines and expects those to be finalized in 1999.

Education and Management Actions

Actions 13 through 28 call for increased education, and improved consistency and coordination among government agencies with responsibility for the lower river and estuary. These actions are seen as paramount for fostering public stewardship and protecting the resource. The Estuary Program will take the lead in implementing these actions.

ACTION 13: Create an entity that serves as an advocate for the lower Columbia River and estuary and carries out the goals of the *Management Plan*.

Environmental Significance: ***There is a need for an entity that advocates for the lower Columbia River and estuary and that ensures implementation of the Management Plan. Until the Estuary Program and endangered species listings, most efforts were focused above Bonneville Dam. Minimal emphasis was placed on the downriver and estuary effects of basin-wide activities. A single entity that focuses on the lower Columbia River and estuary can provide a framework for the purposes of protecting the ecosystem. Fish, wildlife, and humans benefit from a healthy, functioning river ecosystem.***

How:

- Establish the Estuary Program Implementation Committee; meld existing Policy and Management Committees into one Implementation Committee. Members would be policy-level directors of agencies, etc., and stakeholders.
- Develop a private non-profit foundation to assist in implementing the *Management Plan* and advocating for the river.
- Monitor and evaluate implementation of the *Management Plan* and evaluate environmental progress.
- Implement education and management actions of the *Management Plan*.
- Convene collaborative partnerships among appropriate parties.
- Develop consistency between the environmental programs of Oregon and Washington that affect the lower river and estuary.
- Advocate for the interests of the ecosystem, its habitats, water quality, and species (including human) of the lower river and estuary.
- Foster stewardship for the lower Columbia River and estuary.

Priority Issues Addressed: *Public Awareness and Stewardship, Institutional Constraints*.

Environmental Measurement: Not applicable.

Action Measurement: The Estuary Program and the Foundation will begin implementation of the *Management Plan* in July 1999. The Columbia River Foundation, a non-profit arm of the Estuary Program, was incorporated in 1998.

Where: Study area, with a program office based in the Portland metropolitan area. There may eventually be a small regional office downriver.

Who: The Estuary Program.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: FY 1998: $45,000 contract for fund-raising strategy. Year 1: 1 FTE (Director) ($95,000); 1 FTE (Office Support) ($45,000). Year 2 and annually thereafter: 1 FTE (Director) ($95,000); 1 FTE (Office Support) ($45,000); 0.75 FTE (Development Director) ($60,000); $40,000 for development projects.

Funding Source: The Estuary Program, with support from individual, foundation, corporate, and government sources.

Regulations Required: None.

Existing Agency Activities: The Estuary Program and the Columbia River Foundation are currently establishing the *Management Plan* implementation strategy. Local, state, tribal, and federal agencies helped develop the *Management Plan*, and their continued involvement is anticipated as implementation of the plan gets underway.

ACTION 14: Establish a common vision for and unified commitment to the health of the river.

Environmental Significance: *Currently, a wide range of laws exist that govern the river. The river provides low-cost electric power, serves as a major barge and shipping corridor, irrigates the eastern sections of Oregon and Washington, provides commercial fishing and recreational opportunities for tens of thousands, and is home to over 2 million people. Sometimes, these different uses compete. Over the last 100 years, the cumulative impacts of human activities have degraded water quality and left some species threatened and endangered. By defining a common vision for the river and a comprehensive approach to managing the river's resources, further degradation can be stopped, and existing resources can be enhanced for fish and wildlife and future generations.*

How:

- Host a forum to discuss current programs' goals: convene agencies, governors, legislators, federal agency leaders, state agency directors. Review existing missions and efforts (using the work of the Base Program Inventory and Analysis, and the institutional framework analysis as the basis). Develop the Estuary Program *Management Plan* to support and supplement existing efforts.
- Hold a summit with stakeholders, interested parties, and agencies to shape the vision and help build a unified commitment to the health of the river. Define a unified approach to water quality, habitat protection, and threatened and endangered species recovery that includes both states.

Priority Issues Addressed: *Public Awareness and Stewardship, Impacts of Human Activity and Growth, Institutional Constraints.*

Environmental Measurement: Not applicable.

Action Measurement: A comprehensive review of existing laws and programs will be completed; parties will be convened and a process for continued dialogue will be established. First step (January 1999): begin with a forum with federal, state, tribal, and local officials focused on consistency regarding environmental protection. A second forum will be held one year later (year 2000) to focus on the vision.

Where: Begin with study area, although issues will impact entire Columbia River Basin.

Who: The Estuary Program coordinates.

The Estuary Program Role:

Preliminary Cost Estimates: Estuary Program costs: FY 1998 initial forum, $5,000. Year 1 follow-up forum, $5,000.

Funding Source: Estuary Program base funds.

Regulations Required: The outcome of this action may affect current statutory language.

Existing Agency Activities: Oregon and Washington, with financial support from ports and Northwest Pulp and Paper Association began work in 1990, through the Bi-State Water Quality Program, to assess the health of the river. This effort evolved into the Estuary Program developing the *Management Plan*. This action is addressed by the completion of this and the commitment to implementation from the participating constituents.

ACTION 15: Provide public information and education efforts about the lower river and estuary that focus on endangered species, habitat loss and restoration, biological diversity, and lifestyle practices and connections to the river.

Environmental Significance: *Increasingly, the pollution of our waterways results from the cumulative impacts of a wide range of activities: the use of fertilizers and pesticides by homeowners, and the agricultural and nursery industries; the automobiles and miles we drive; the installation of impervious surfaces, creating runoff that carries various contaminants; and certain agricultural, forestry, and land development practices. Yet, few of us understand that many of our everyday choices affect the river. We all need to make adjustments in our practices in order to reduce the pollution we create and our impacts on the river. Maintaining an effective education effort will help the public make informed decisions about the management of river resources.*

How:

- Develop educational materials and programs to bridge the gap between public perception of river problems and technical information.
- Work with individual residential property owners. Focus on alternatives and practices that reduce non-point pollution from fertilizers, pesticides, harmful detergents and other household and garden products, landscaping, construction and land use, and impacts of flooding.
- Develop hands-on opportunities: conduct on-river classroom trips for adults and school children, including classroom preparation materials as appropriate; develop an environmental camp for school children; train young adults to work as counselors with the adult educators; develop opportunities for hands-on field work.
- Coordinate, or develop where appropriate, educational opportunities utilizing existing programs to build their capacity.
- Provide regular reporting to the public on trends in the lower river and estuary. Use existing data and collect new data on river conditions; monitor water quality and land use trends; evaluate data; define environmental indicators to measure trends.
- Assess which methods of public information yield effective results.
- Periodically survey the public to assess changes in their values, behavior, or practices.
- Disseminate information using various means, such as developing and maintaining a Web site, regularly updated reports from long-term monitoring, and newsletters.

Priority Issues Addressed: *Public Awareness and Stewardship, Impacts of Human Activity and Growth, Habitat Loss and Modification, Conventional Pollutants, Toxic Contaminants.*

Environmental Measurement: Not applicable.

Action Measurement: By 2000, develop and begin implementing education efforts. Identify and develop a strategy that coordinates existing education efforts directed at the lower river and estuary. By 2000, organize five annual on-river trips. By 2002, organize eight annual on-river trips.

Where: Study area.

Who: The Estuary Program.

The Estuary Program Role:

CONSULT
(Minimum involvement)

CONVENE

COORDINATE
(Maximum involvement)

Preliminary Cost Estimates: Estuary Program costs: $130,000 annually for producing educational programs and materials, maintaining the Web site, and reporting trends. 1 FTE ($70,000) annually for education/public information staff. Survey - Year 1: $25,000 to establish baseline and $10,000 every 2 years for update. River tours: $50,000 annually.

Funding Source: Estuary Program base funds and grants.

Regulations Required: None.

Existing Agency Activities: Information on the lower river and estuary has been provided to the public by a variety of agencies, including the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and the U.S. Army Corps Corps of Engineers (Corps) at the federal level. At the state level, the Sea Grant extension service, state environmental agencies, Marine and Environmental Research and Training Station (MERTS), and Columbia River Estuary Study Taskforce (CREST) provide information. This information, however, has been somewhat episodic in nature, and focused on specific activities and areas of interest.

ACTION 16: Use best management practices to reduce non-point source pollution.

Environmental Significance: *Pollution enters the mainstem Columbia River and its tributaries primarily from non-point sources. Runoff from farms, forestry, construction sites, and residential and non-residential development can contribute significant amounts of pollution. In addition, impervious surfaces collect fertilizers, pesticides, and automobile-related pollutants that are then carried into streams. Development in floodways and wetlands encroaches on natural systems and limits natural pollution attenuation. The impacts are increasing and adverse: sedimentation affects salmonid spawning and rearing areas, habitat is lost or modified, bacteria levels increase, the nutrient balance is altered, there is less land surface for pollution attenuation, and toxic contaminants enter the water and sediment. Best management practices (BMPs) help minimize and/or eliminate non-point source pollution. This in turn results in more efficient, less costly, and more environmentally benign methods of managing natural resources.*

How:

- Focus on both pollution-generating and resource protection activities. Pollution-generating activities might include industrial, manufacturing, construction and other development activities producing runoff, forestry, nursery, agriculture, and ranching operations. Resource protection activities might include improving urban and suburban land use, improving stormwater management, limiting floodplain development, increasing flood storage capacity, enforcing water quality standards, and protecting and creating wetlands habitat.
- Assemble and maintain a library of model ordinances and BMPs for topics such as wetland protection, habitat protection, land use activities, stormwater management, and floodplain development. Assemble existing material, evaluate it for effectiveness and applicability to Pacific Northwest conditions, identify gaps, and fill gaps with additional or tailored BMPs and model ordinances. BMPs should also address operation and maintenance procedures and cost. Disseminate manuals/library of BMPs, including on the Internet.
- Assemble and maintain model farm plans, forest practices, and stormwater management plans that are protective of habitat and water quality. Share that information with involved land managers and government agencies.
- Establish and fund pilot programs or demonstration projects for successful farm, forestry, and roadway activities to provide hands-on examples of effective practices. Use model farm and feedlot BMPs and demonstration projects to show how to improve water quality and decrease pollutant loads in nearby water bodies.
- Use direct contact with local officials to provide assistance, including workshops, seminars, and peer-to-peer exchanges.
- Use incentives to encourage agencies and individuals to adopt or implement BMPs.
- Develop strategies that ensure that BMPs are consistent and that implementation of minimum BMPs for all non-point sources is consistent.

Priority Issues Addressed: *Toxic Contaminants, Conventional Pollutants, Public Awareness and Stewardship, Habitat Loss and Modification, Impacts of Human Activity and Growth.*

Environmental Measurement: Non-point source pollution is reduced.

Action Measurement: By 2000, the BMP library is assembled. By 2001, gaps and inadequacies are identified. By 2002, additional BMPs are developed to fill the gaps. By 2003, model ordinances are collected and assessed. From 2003 forward, the program will work with local jurisdictions to adopt and implement BMPs.

Where: Study area.

Who: The Estuary Program coordinates with federal and state natural resource and agricultural agencies, extension offices, local governments, and watershed councils.

The Estuary Program Role:

CONSULT *(Minimum involvement)* | CONVENE | COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: Year 1: 0.25 FTE ($20,000) to assemble and assess BMPs. Year 2: $100,000 for contract to develop or augment BMPs. Year 2 and annually: 0.25 FTE ($20,000) to assist implementation.

Funding Source: Estuary Program base funds.

Regulations Required: Legislation would be required to adopt BMPs into regulation.

Existing Agency Activities: Both Washington and Oregon, through their environmental agencies, are developing best management practices (BMPs) manuals to address specific non-point sources. Ecology is developing a stormwater BMP manual for statewide application, and implementing the Dairy Nutrient Management Act to assure implementation of BMPs at dairy facilities. In Oregon, as load allocations are identified through the total maximum daily load (TMDL) process, the Department of Agriculture (through Senate Bill 1010 authorities) is developing plans to assure appropriate practices on agricultural lands.

DEQ completed the TMDL for the Columbia Slough in November 1998, and other TMDLs are underway.

The Washington DNR, Oregon Department of Forestry (Forestry), USFWS, NMFS, Bureau of Land Management (BLM), and NRCS are all actively involved in addressing impacts of non-point pollution.

Some local governments in both states are developing BMPs and ordinance language to reduce the impacts of development. An example of this activity is the work done by Metro, the regional government in the Portland metropolitan area, on streambank and wetland setbacks to protect water quality and address flooding. Additional work is now underway in the Portland metropolitan area to develop protections for fish and wildlife under Goal 5 of Oregon's land use planning law.

Much of the work being done on non-point sources of pollution in both states is being coordinated with other activities related to threatened and endangered species recovery.

ACTION 17: Help local governments implement federal, state, and local environmental and land use laws.

Environmental Significance: *Local government representatives have consistently asked for a program that helps them implement various laws. Providing compliance tools and information will help local governments improve their ability to comply with laws addressing habitat loss and modification, human activities, and conventional and toxic pollutants. Greater compliance means better resource protection.*

How:

- Provide technical assistance to local governments.
- Establish contact points enabling the public to report observed conditions in waterways that may reflect environmental concerns.
- Develop reporting mechanisms enabling agencies to advise the public regarding levels of permitted discharge and dischargers' performance.
- Provide an exchange of technical assistance among federal, state, and local governments to improve implementation of and compliance with environmental and land use laws. Keep current information on environmental laws, programs, etc. in a clearinghouse for local officials.
- Ensure that municipal and industrial wastewater treatment plants are operated to meet or exceed water quality standards in effect at the time of permitting or permit renewal.

Priority Issue Addressed: *Institutional Constraints.*

Environmental Measurement: There will be fewer violations of environmental and land use laws and better resource protection.

Action Measurement: A survey measuring local officials' knowledge and experience regarding land use and environmental law is completed. A reporting mechanism by which regulating agencies measure and report on performance in meeting regulatory standards is established. A planner is hired by the Estuary Program to assist municipalities. An increased number of municipalities are receiving Estuary Program assistance or information.

Where: Study area.

Who: The Estuary Program implements aspects of the action related to information and conducts an assessment of local compliance. State agencies continue their technical assistance efforts.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: 0.20 FTE (Land Use Planner) ($16,000) annually to coordinate. Grants to local governments.

Funding Source: Estuary Program base funds. As funds become available, the Estuary Program would provide financial assistance to local governments.

Regulations Required: None.

Existing Agency Activities: Ecology and DEQ currently provide assistance to local governments to help them meet environmental standards. Ecology provides technical assistance and some funds to local governments on request and as resources allow. DEQ maintains a full-time complaints coordinator and provides permit information to any interested party on its Web site. DEQ provides assistance specifically to local governments by participating in the Environmental Partnership for Oregon Communities (EPOC), the Community Solutions Team, and through the Healthy Streams Partnership.

The Department of Land Conservation and Development (DLCD) in Oregon and Ecology in Washington provide a state perspective on local land use regulations.

ACTION 18: Coordinate federal and state threatened and endangered species recovery activities in the lower Columbia River and estuary, and help local communities meet species recovery requirements.

Environmental Significance: *Several species in the lower Columbia River and estuary are listed under the Endangered Species Act (ESA) as threatened or endangered. Most notable are the recent listings of the Lower Columbia River chinook and chum salmon; more are expected to be added in the near future. Threatened or endangered species indicate significant degradation to the ecosystem. A number of factors lead to species loss: modification or loss of habitat, elevated temperatures or levels of total dissolved gas, and presence of toxic or conventional contaminants. Bringing local codes and review processes up to NMFS and USFWS requirements may allow NMFS and USFWS to grant program approval, which would be more efficient than having a federal project-by-project review. This will improve efficiencies, heighten consistency in resource protection, and retain local control over most development decisions.*

How:

- Work with NMFS and other appropriate agencies to identify the components necessary for species recovery.
- Identify and convene appropriate parties to set priorities and develop specific actions to implement components of species recovery.
- Identify review procedures and standards necessary to meet ESA listing requirements with NMFS, USFWS, and other federal and state agencies.
- Help local communities coordinate threatened and endangered species recovery efforts with federal and state agencies.
- Provide assistance to local communities to develop, adopt, and implement review procedures and standards that meet ESA listing requirements. Review existing efforts by local governments, evaluate local development review processes and standards, and develop model language and review procedures, as appropriate.

Priority Issues Addressed: *Habitat Loss and Modification, Institutional Constraints.*

Environmental Measurement: Not applicable.

Action Measurement: By 2000, convene federal and state agencies and identify components and set priorities. By 2001, review local efforts. By 2003, develop model ordinances and standards to assist local communities.

Where: Study area.

Who: The Estuary Program will coordinate with National Marine Fisheries Service, U.S. Fish and Wildlife Service and other state and federal agencies and local government.

The Estuary Program Role:

CONSULT *(Minimum involvement)* | CONVENE | COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Years 1-4: 0.5 FTE ($40,000) annually for Estuary Program staff. Year 3: $60,000 to assemble and disseminate information to local communities.

Funding Source: Estuary Program base funds or grants.

Regulations Required: Local communities may need to modify or adopt standards.

Existing Agency Activities: Listings of species as threatened and endangered are relatively new to urban areas. NMFS continues to work on the development of a rule for steelhead in the lower Columbia and Willamette systems. With additional species being listed, agencies in both states will need to develop supplements to existing fish recovery plans and activities, including identifying the role that local governments will need to play in improving the habitat for identified species.

U.S. EPA, USFWS, NMFS, NRCS, and the states are co-signers of a Salmon Memorandum of Understanding that defines their involvement in species recovery.

ACTION 19: Enforce existing environmental and land use laws.

Environmental Significance: *Among the most persistent comments received from the public is the observation that there is already a substantial body of laws on the books. If these laws were fully implemented and their requirements met, fewer new regulatory approaches would be necessary. A strong enforcement program helps reduce pollution. Helping ensure that existing laws are enforced in an effective and timely manner by facilitating communication, building trust, and providing technical assistance improves resource protection.*

How:

- Increase the capacity and ability of agencies to enforce environmental and land use laws.
- Raise awareness for the need to increase enforcement.
- Develop a program to assess compliance with local and state land use laws, and use the results to provide specific remedy options.
- Use environmental fines for supplemental environmental projects instead of depositing them into a "general" fund.
- Educate the public about the reasons for laws and compliance with laws. Discuss the harm to the public good caused by violations.
- Develop measures of success to track environmental improvement and effective enforcement that reflect environmental goals.

Priority Issue Addressed: *Institutional Constraints.*

Environmental Measurement: Land uses comply with environmental and land use laws; compliance is increased.

Action Measurement: Program to assess compliance is in place by 2000.

Where: Study area.

Who: Local governments, and federal and state environmental agencies. The Estuary Program provides technical assistance.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: 0.4 FTE ($32,000) annually for technical assistance and to assess compliance. Non-Estuary Program staffing costs need to be determined. Staff would improve compliance by conducting additional inspections, public education efforts, and program audits to evaluate effectiveness.

Funding Source: Estuary Program base funds will support Estuary Program staff. Funding

sources for non-Estuary Program staff need to be determined.

Regulations Required: Rules or laws may be needed to direct environmental fines to environmental improvement projects.

Existing Agency Activities: Ecology has programs to educate the public and local government on laws and regulations, and their purposes. It has an initiative in place to increase its presence in local businesses, and to provide education on hazardous waste, toxics, air pollution, pollution prevention, stormwater, and water quality requirements.

DEQ has revised its Enforcement Procedure and Civil Penalties rule which broadens the scope of water quality violations likely to be referred for civil penalty, clarifies the seriousness of water quality violations, and increases civil penalties for water quality violations. It also allows civil penalties to be mitigated through "supplemental environmental projects," which directs penalty money to specific environmental enhancement projects. It maintains an active education program to help the public and regulated community to better understand the laws and rules, and the environmental harm resulting from violations. It also publishes an annual enforcement report documenting the number and types of formal enforcement actions.

Both Washington (Ecology) and Oregon (DLCD) have statutes describing the state interest and expectations for local land use planning. Once land use plans are in place, compliance is enforced at the local level.

Tribes can exercise authority similar to that discussed above for the states on tribal reservation lands.

ACTION 20: Improve coordination among government agencies.

Environmental Significance: *Currently, over 160 parties have some jurisdiction or interest in management of the lower Columbia River, which creates significant challenges to effective management. One of the difficulties in managing a complex system like the Columbia River is the lack of information about which agencies are involved in a given issue. Identifying agencies and contact points within agencies provides interested entities with valuable information that can reduce confusion and loss of time. Improving inter-governmental coordination and responsiveness will facilitate the dissemination of information to interested parties in a timely manner, ultimately improving resource protection of the lower river and estuary.*

How:

- Convene agency leaders and/or technical staff teams regularly to focus on the lower river and estuary.
- Provide mechanisms for information flow and exchange among agencies and to the public.
- Develop and maintain a catalog of permit-issuing agencies to enable project proponents and other interested parties to contact agencies with permit-reviewing responsibility. Develop a list of other permits (federal, state, regional, or local) required for the activity in question. Make the list available at the local permitting agency. Create and maintain a system that identifies a point of contact in agencies involved in natural resource management. Make the system available at the local level.
- Develop and maintain processes that encourage and rely on local jurisdictions as the first contact for any developments that are planned. Assure that information about other agencies of interest is provided in written and electronic form to developers and interested parties.
- Develop a clearinghouse for information about the river and the federal, state and local regulatory review processes.
- Provide Internet hardware and software to local government officials in every municipality in the study area that does not possess it. Maintain a Web site that links data about the river, provides updates on laws, rules, etc., and provides technical assistance and information.

Priority Issues Addressed: *Institutional Constraints, Public Awareness and Stewardship.*

Environmental Measurement: Not applicable.

Action Measurement: The initial forum was convened January 1999. Create and maintain a catalog of agencies and contact points for use by developers, agencies, and interest groups by 2002. Have the clearinghouse in place by 2002. Provide Internet access by 2002.

Where: Study area.

Who: The Estuary Program.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: 0.10 FTE ($8,000) annually for assistance; $700,000 to provide hardware and software for Internet connection.

Funding Source: Funding for the Internet service would be sought from a corporation or foundation grant. Estuary Program base funds for staff support.

Regulations Required: None.

Existing Agency Activities: Washington, through use of a cabinet structure for natural resource agencies, provides an opportunity for agencies to be aware of programs and initiatives of the other agencies. Oregon, through regular meetings of natural resource agency directors with the governor's natural resource advisor, provides a similar opportunity for information exchange. On some issues of importance that multiple resource agencies are reviewing for comment, the comments are coordinated through the governors' offices to provide a single voice for agency comments.

Programs such as the Healthy Streams Initiative in Oregon and the Extinction Is Not An Option plan in Washington are intended to develop a concerted effort among agencies of each state to address fish recovery and water quality improvements.

ACTION 21: Design, support, and agree to use dispute resolution processes leading to resolution of institutional conflicts that affect the river.

Environmental Significance: *One of the most important elements to an orderly resolution of conflicts is predictability. That predictability derives from an agreement among involved agencies to develop and use a dispute resolution process. Dispute resolution may prompt quicker action. Providing an avenue for resolving resource management conflicts could result in more effective and efficient management of the river.*

How:

- Define the dispute resolution program, users, process, and goals.
- Assess existing conflict resolution programs in Oregon, Washington, and elsewhere. Augment, support or build additional processes to address institutional conflicts specifically relating to lower Columbia River disputes or conflicts.
- Provide grants for training.

Priority Issue Addressed: *Institutional Constraints.*

Environmental Measurement: Not applicable.

Action Measurement: The process is established by 2000. The time to resolve conflicts decreases. The willingness of parties to use the process increases.

Where: Study area.

Who: The Estuary Program implements the dispute resolution process with support from federal, state, and local parties with jurisdiction over river management.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: 0.10 FTE ($8,000) annually, plus grants for entities to participate.

Funding Source: Estuary Program base funds will support staff and grants. Fees for service from able-to-pay parties will also support the program.

Regulations Required: None.

Existing Agency Activities: The Dispute Resolution Commission, established in 1989, is responsible for administering Oregon's Dispute Resolution Act. The commission establishes program standards, qualifications, and training for mediators, and methods for evaluating dispute resolution programs. The commission operates the Public Policy Program to encourage use of dispute resolution in disputes that affect public interest and/or involve public decision making at local, state, and federal levels.

ACTION 22: Develop and implement consistent water quality-related activities, laws, rules, and standards. Focus on function and performance of ecosystems.

Environmental Significance: *Currently, the states of Washington and Oregon have water quality standards and land use laws that are not always consistent, nor do they adequately address certain resource issues. This results in confusion for those who must comply on both sides of the river. It also can result in inconsistent and inadequate resource protection. Eliminating or minimizing confusion as to what the standards are, and providing an agreed-upon level of protection by developing consistent standards and testing methods, should facilitate compliance.*

How:

- Review existing local, regional, state, and federal water quality and land use activities, standards, rules, and laws; discuss their effectiveness, their consistency, and how they are administered. (Activities include such things as assessing maximum pollutant load allocations for rivers and streams.) Assess the effect each state's laws, rules, etc. have on the other state. Discuss the impact of any identified inconsistencies on natural resource protection. Strengthen compatibility. Release information to users. For specific issues (e.g., water quality, habitat protection, and data management and monitoring), convene appropriate agencies to address issues raised.
- Develop and implement consistent standards for water quality and habitat protection as warranted by the review and analysis.
- Incorporate the principles found in best management practices into local and state regulations.
- Monitor compliance with established regulations.

Priority Issues Addressed: *Institutional Constraints, Conventional Pollutants, Toxic Contaminants.*

Environmental Measurement: Not applicable.

Action Measurement: Work began in 1998 by reviewing the legal and institutional framework. By 2005, consistent water quality standards for the lower Columbia River will be in place.

Where: Study area.

Who: The Estuary Program does the analysis (with state environmental and natural resource agencies) and leads and convenes appropriate parties to develop rules.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: $25,000 for initial analysis of legal and institutional framework. Year 1: 0.20 FTE ($16,000) to convene parties.

Funding Source: Estuary Program base funds.

Regulations Required: This action may require rules or legislation.

Existing Agency Activities: In 1999, Oregon will initiate the next triennial standards review. Parameters under consideration for review include: anti-degradation, outstanding resource waters, sedimentation/turbidity, selected toxics, temperature for bull trout, wetlands, healthy streams criteria, biologic criteria, bacteria/shellfish, and sediment quality.

As best management practices are incorporated into local and state regulation and agricultural lands are included, NRCS, conservation districts, and state agricultural agencies will be involved.

ACTION 23: Establish an award program to promote successful stewardship and pollution prevention activities.

Environmental Significance: ***Many excellent examples of stewardship and pollution prevention occur but go unnoticed. Recognizing and celebrating the positive efforts of individuals, municipalities, industries, and others encourages stewardship activities and practices and sharing good ideas. Parties that demonstrate innovation and leadership in resource protection should be rewarded and used as models for others.***

How:

- Define objectives and procedures of such a program, including developing a marketing strategy, identifying a selection team, and soliciting and reviewing nominations.
- Make awards annually to individuals, business and industry, municipalities, non-government organizations, and schools.
- Promote successes through information dissemination.

Priority Issues Addressed: *Public Awareness and Stewardship, Toxic Contaminants, Conventional Pollutants, Impacts of Human Activity and Growth, Habitat Loss and Modification*.

Environmental Measurement: Not applicable.

Action Measurement: The program will be established and the first round of awards given by June 30, 2000.

Where: Study area.

Who: The Estuary Program convenes a committee to define and implement the program.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: 0.10 FTE ($8,000) annually to cover planning, program development and implementation, and coordinate the volunteer team; $2,500 annually for awards and ceremony.

Funding Source: Estuary Program base funds.

Regulations Required: None.

Existing Agency Activities: Ecology has recently identified and publicly recognized three dairies for protecting water quality. The dairies singled out for recognition were among the 50 dairies inspected in the upper Chehalis River Basin during the previous year.

There are a number of environmental awards, both public and private, given in Oregon. Public awards include the City of Portland's BEST (Businesses for an Environmentally Sustainable Tomorrow) award; awards given to land owners and managers by the Department of Agriculture and jointly by ODF&W and the Department of Forestry; and a Green Permit program being developed by DEQ.

U.S. EPA Region X gives an Evergreen Award for environmental leaders who demonstrate that pollution prevention is also good business.

ACTION 24: Administer grant programs to assist users with *Management Plan* implementation and to assist school children in educational efforts that focus on endangered species and habitat loss.

Environmental Significance: ***Implementing the Management Plan and encouraging young citizens to participate as stewards of the river are two important goals of the Estuary Program. One direct way to accomplish those goals is to provide resources to expand stewardship opportunities. Providing funds to implement this Management Plan will help ensure ongoing public involvement.***

How:

- Develop the grants program, including securing funds, identifying target audiences, establishing criteria and objectives, establishing an award process, soliciting or identifying potential recipients, and evaluating the effectiveness of the program.
- Provide educational materials and technical assistance, including facilitation, coordination, and collaboration to support the grants program.

Priority Issues Addressed: *Public Awareness and Stewardship, Habitat Loss and Modification.*

Environmental Measurement: Not applicable.

Action Measurement: By 2001, secure funds and establish dollar amount to be awarded; define criteria; make solicitation; make the first round of awards.

Where: Study area.

Who: The Estuary Program administers the program.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: 0.25 FTE ($20,000) annually to administer, plus grants.

Funding Source: Estuary Program base funds.

Regulations Required: None.

Existing Agency Activities: This action is specific to the Estuary Program when it enters implementation. Other agencies may have programs from their own resources that could help address *Management Plan* actions.

ACTION 25: Coordinate volunteer monitoring programs and create or coordinate volunteer opportunities on the lower river.

Environmental Significance: *Volunteer opportunities provide information and education. Giving volunteers a direct opportunity to participate in resource protection fosters stewardship and can help reduce the level of financial support needed. Volunteers also can monitor environmental progress and help citizens see the results of their efforts.*

How:

- Assess existing volunteer monitoring efforts on both sides of the river to identify gaps and needs.
- Ensure that consistent procedures and protocols are being used and that identified needs for training, technical assistance, and equipment are being met.
- Target and prioritize feasible projects to fill in data gaps.
- Recruit additional organizations to participate in the volunteer monitoring program, and establish a clearinghouse for matching volunteers with program needs.
- Develop an oversight mechanism for all volunteer monitoring efforts to ensure coordination and delivery of training and technical assistance, and to provide a liaison between the volunteer groups and participating agencies.
- Develop a data reporting, storage, and retrieval system.
- Link to central information management and long-term monitoring plans adopted by the Estuary Program.
- Identify possible volunteer activities.
- Recruit interested volunteers and coordinate linking interested volunteers to appropriate projects.

Priority Issues Addressed: *Public Awareness and Stewardship, Toxic Contaminants, Conventional Pollutants, Habitat Loss and Modification*.

Environmental Measurement: Not applicable.

Action Measurement: By 2000: 60 people are involved in volunteer efforts and the clearinghouse is established. By 2002: 120 people are volunteering. By 2004: 240 people are volunteering. Volunteer hours are tracked and increased. Data from volunteer monitoring is being used for program decision making.

Where: Study area.

Who: The Estuary Program manages the program.

The Estuary Program Role:

CONSULT *(Minimum involvement)* | CONVENE | COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: FY 1998: $49,000 to identify existing volunteer monitoring efforts, coordinate those efforts, and augment them; 0.10 FTE ($8,000) annually to maintain the program.

Funding Source: Estuary Program Action Planning Demonstration Project Fund; Estuary Program base funds for staff support.

Regulations Required: None.

Existing Agency Activities: Washington Ecology supports an extensive statewide network of volunteer monitors by providing training, technical assistance, common standards and protocols, and a Web site.

DEQ provides water quality monitoring equipment for watershed councils; Oregon Plan for Salmon and Watersheds volunteers monitoring protocols and training for watershed groups, data management, and technical assistance in the development of sampling projects and quality assurance plans.

CREST is currently developing an assessment of volunteer monitoring opportunities.

ACTION 26: Identify and improve points of public access to the river. Ensure that access does not cause further loss or degradation of habitat, increased erosion, loss of riparian vegetation, or degradation of water quality.

Environmental Significance: *There should be places where, with minimal damage or degradation, citizens can access the river both physically and visually. Providing increased opportunities to use and appreciate the river encourages good stewardship. While public access is important, we must ensure that increased access does not further degrade water quality or habitat.*

How:

- Create and distribute a map showing existing public access to the Columbia River in the study area. Research, survey, and map existing sites.
- Assess adequacies of existing sites and trails, and identify additional sites and trails where the environmental or cultural impacts are neutral or positive. Solicit public input regarding the siting, restoration, and development of access points.
- Provide assistance to enhance responsible public access to the river, including visual access. Prohibit vandalism and dumping of waste.
- Acquire sites through purchase, easement, etc.
- Develop interpretive sites throughout the area. Develop a connection between the history of the region and the effect of human activity on water quality. Assess appropriate locations with high public access potential; develop and construct interpretive materials; acquire permission and install. Coordinate information at the interpretative sites with the Lewis and Clark Bicentennial.
- Prepare a companion habitat map with location and habitat attributes as a field guide.

Priority Issue Addressed: *Public Awareness and Stewardship.*

Environmental Measurement: Not applicable.

Action Measurement: By 2001, produce the map, complete the assessment of the adequacy of existing points of access (areas and people served), and identify locations and types of needed additional access. By 2002, secure funds and establish the grant program. By 2004, develop interpretative sites. By 2006, provide additional points of access as identified in the assessment.

Where: Study area.

Who: The Estuary Program works with federal, state, and local governements and agencies, and landowners.

The Estuary Program Role:

Preliminary Cost Estimates: Estuary Program costs: Year 2: develop and produce map, $20,000. Year 3: develop interpretative sites, $50,000. Year 1 and annually: 0.05 FTE ($4,000) for staff oversight. Acquisition costs to be determined.

Funding Source: Estuary Program base funds.

Regulations Required: None.

Existing Agency Activities: Access to the river is currently provided through the acquisition and development of lands adjacent to the river by federal, state, and local resource agencies. Access to the river and associated islands or river banks by boat is also provided in some areas. There is currently no systematic process for assessing the adequacy of such access in the study area.

ACTION 27: Implement the Estuary Program information management plan.

Environmental Significance: *Data and information on the Columbia River are spread among many agencies and data bases. To effectively manage the river, the data need to be easily accessible to all who are interested. Ready access to data will assist scientists, managers, and decision makers in understanding the complexities of the river, its current condition, and apparent trends over time. This in turn will allow for more effective decision making and resource management.*

How:

- Seek agreement among the data collecting agencies on: (1) consistent methods and protocols for collecting, analyzing, and storing data, and (2) common data elements and names, standards for metadata, and widely used indicators.
- Work with the various agencies that collect and store information to develop a Web site (clearinghouse) that can provide easy access to all the data.
- Build data management capability to show trends, analyze trends, and develop reports for customers.

Priority Issues Addressed: *Toxic Contaminants, Conventional Pollutants, Habitat Loss and Modification, Institutional Constraints, Public Awareness and Stewardship.*

Environmental Measurement: Not applicable.

Action Measurement: An effective information strategy has been developed and implemented, and agreements on common data elements, names, etc., are in place. By the end of year 2000, the Estuary Program Web site contains data and/or links from multiple sources.

Where: The study area is the primary focus; other parts of the basin may also be included.

Who: The Estuary Program develops the information plan with federal and state natural resource agencies.

The Estuary Program Role:

CONSULT *(Minimum involvement)* | CONVENE | COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: Year 1: 0.5 FTE ($40,000) to initiate development of the information management system.

Funding Source: Estuary Program base funds.

Regulations Required: None.

Existing Agency Activities: Ecology maintains a database for storing all environmental data. Ambient water quality data is available on the Ecology Web site. DEQ lab operates two databases for the storage of analytical results for water, sediments, and fish tissue, as well as biological population, biological index, and habitat data.

Both DEQ and Ecology store water quality data on STORET, the national water quality database run by U.S. EPA.

ACTION 28: Implement the Estuary Program long-term monitoring plan.

Environmental Significance: *The Bi-State Water Quality Program of the lower Columbia River identified a number of water quality problems in the lower river and noted many gaps in the information base. As the Management Plan for the lower river and estuary is implemented, a long-term monitoring effort needs to be in place to assess the evolving health of the river, identify problem areas, and assess the effectiveness of management actions. Collecting, monitoring, and evaluating data over the long term will measure whether programs and efforts in place are realizing environmental improvement. The monitoring plan will help ensure that information about the condition of the river is available for decision makers and the public, and that trends can be detected and addressed in a timely manner.*

How:

- Fund the long-term monitoring plan.
- Reach agreement with the participating agencies regarding: (1) roles and responsibilities, including a coordination mechanism, (2) consistent collection and analysis protocols, techniques, and information storage format, and (3) expansion of existing ambient monitoring program.
- Review and support ongoing research and data collection activities to further refine the long-term monitoring plan.
- Build in regular evaluation mechanisms and flexibility to allow for changes as the knowledge base grows.
- Establish monitoring priorities based on the recommendations of the long-term monitoring plan.

Priority Issues Addressed: *Toxic Contaminants, Conventional Pollutants, Habitat Loss and Modification, Public Awareness and Stewardship, Institutional Constraints.*

Environmental Measurement: Trends are identified and tracked, and adjustments are made in environmental actions to improve the health of the lower river and estuary.

Action Measurement: By 2000, initial funding is in place, monitoring plan is implemented, and special studies are conducted as identified.

Where: Study area.

Who: The Estuary Program coordinates the monitoring plan with natural resource agencies and contractors.

The Estuary Program Role:

CONSULT *(Minimum involvement)* | CONVENE | COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: 0.75 FTE ($40,000) annually to coordinate, plus $450,000 annually for data collection.

Funding Source: Estuary Program base funds and additional federal, state, or foundation assistance. U.S. Geological Survey maintains a strong interest in this action and may be able to cost share (50/50) with non-federal agencies.

Regulations Required: None.

Existing Agency Activities: DEQ dedicates 32 permanent FTE to monitoring and analysis. DEQ maintains an ambient water quality monitoring network with 1 site on the Columbia, 37 sites in the Willamette Basin, and 1 site each on the Sandy, Clatskanie, Klaskanine, Youngs, and Lewis and Clark Rivers. Sites are monitored 6 or 12 times a year and analyzed annually for trends and water quality standard exceedances. Nutrients, bacteria, and other conventional pollutants are monitored. The Oregon Plan for Salmon and Watersheds has led to the development and implementation of a long-term monitoring plan to measure success of the plan. DEQ also conducts studies each year as it develops TMDLs, and studies toxic contaminants and mixing zone impacts.

Ecology maintains an extensive ambient monitoring program and water quality monitoring program. The Lower Columbia TMDL scoping activity will identify ambient monitoring stations for the year 1999-2000. Current monitoring does not include any sites on the mainstem Columbia River; the major tributaries have monitoring. Ten random sites a year will be monitored in the lower Columbia evolutionary significant unit (ESU) for fish, macro-invertebrates, water quality and habitat as part of the Oregon Plan long-term monitoring.

Federal Agencies such as the U.S. Geological Survey (USGS) are also involved in data collection and management, and have participated in the development of the long-term monitoring plan.

Conventional and Toxic Pollutants Actions

Actions 29 through 43 address conventional and toxic pollutants. These actions involve the regulatory authority of a variety of federal, state, and local agencies. In some cases, the actions reflect existing activities, and in other cases call for increased regulatory activity. The Estuary Program's primary role will be to monitor the progress of the responsible entities to ensure the actions are implemented and the goals are met. This involves watching, encouraging, assisting where possible, and motivating where needed. In a few cases, the Estuary Program may initiate minor aspects of these actions, such as conducting additional studies.

ACTION 29: Monitor and evaluate potential effects of pollutants on human health and fish and wildlife.

Environmental Significance: *At present, it is often difficult to relate measured levels of contaminants in sediments to environmental impacts and health effects. The lack of agreement on protocols at both the national and regional levels hinders the effective collection, interpretation, and sharing of data. Likewise for fish and wildlife, there are still many compounds for which the toxic effects are unknown. More research is needed to understand these complex relationships. Monitoring and evaluating potential effects of pollutants will help provide a better understanding of the impacts.*

How:

- Conduct a comprehensive survey of fish and shellfish consumption for the lower Columbia and Willamette rivers, Multnomah Channel, and Columbia Slough. Health risk evaluations should be based on the results of this survey, and should focus on both cancer and non-cancer endpoints, including the endocrine, immune, and reproductive systems and developmental processes. Ensure that the public, specifically those groups or individuals facing the highest risk, is informed of the findings and understands the potential risks.
- Actively promote fish consumption safety programs.
- Continue regional and national scientific efforts to develop, test, and implement protocols for evaluating and monitoring sediment, water, and tissue samples.
- Develop and adopt reference levels or standards for trace metals, PAHs, dioxins, furans, pesticides, radionuclides, and tributyltin in sediments, fish, and wildlife.
- Implement the long-term monitoring plan to help develop the data needed to evaluate program effectiveness.
- Continue scientific studies into the effects on aquatic life of toxic contaminants in sediments to ensure that all toxic contaminants of concern are addressed. Use the results to develop standards specific to regional or local areas.

Priority Issues Addressed: *Toxic Contaminants, Public Awareness and Stewardship, Institutional Constraints.*

Environmental Measurement: Human and wildlife health is not impaired by pollutants.

Action Measurement: By 2010, standards for concentrations of toxic contaminants in sediments and fish tissue are developed and adopted. Agreements between monitoring agencies are in place.

Where: Study area.

Who: Scientific community, health agencies, and federal and state environmental agencies. The Estuary Program provides funding for the fish consumption survey and coordinates its implementation.

The Estuary Program Role:

CONSULT *(Minimum involvement)* | CONVENE | COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: Year 1 and 2: $200,000 for the study. Year 3: 0.05 FTE ($4,000) to support the development of standards.

Funding Source: Estuary Program Base funds and grant monies will be used for the fish consumption survey. Continued efforts and funds from the federal government will be used to address standards.

Regulations Required: This action would require state rules or legislation if standards are to be adopted.

Existing Agency Activities: Annually DEQ develops a toxics monitoring strategy that typically focuses on a particular toxic concern. Special studies involving toxics, mixing zone studies, and total maximum daily pollutant load (TMDL) assessments are conducted. Current work includes mercury assessments on the Willamette and a Willamette harbor toxics study. TMDL assessments are scheduled for the lower Columbia and tributaries.

Ecology, in addition to the ambient monitoring listed in Action 28, is developing fresh-water sediment standards.

U.S. EPA is administering a national study of chemical residues in lake fish tissue that is sampling and analyzing data between 1999-2003 in over 800 lakes. The agency maintains a fish advisory program and database and a shellfish liaison with coastal states.

ACTION 30: Develop a basin-wide strategy for identified toxic and conventional pollutants that defines their sources, fate, and effects and reduces their discharge.

Environmental Significance: *Studies indicate that toxic pollutants exist throughout the Columbia River system at low levels. Some toxic contaminants, such as certain pesticides, are bioaccumulative. These can best be controlled by eliminating or minimizing the problem at its source. By identifying sources of pollutants, processes to eliminate them can be initiated. Decreasing the impacts of toxic and conventional pollutants on the ecosystem will benefit fish, wildlife, and humans.*

How:

- Analyze and evaluate existing water quality data on toxic and conventional pollutants throughout the basin. Focus on bioaccumulative toxic contaminants.
- Develop and implement total maximum daily loads (TMDLs) for temperature and total dissolved gas (see Action 34).
- Identify existing gaps in knowledge and devise studies to improve the knowledge base. Chemically "fingerprint" congener-specific PCBs, dioxins, and furans in tissue or other samples collected from the Columbia River to identify patterns associated with specific point sources. In cooperation with permit holders, work to improve the usefulness of monitoring data required by permits—e.g., uniform analytical methods. Evaluate priority pollutants analyses from individual permitees to track the cumulative impact of those pollutants at levels of concern in the Columbia River. Identify the sources of Bis (2-ethyl hexyl) phthalate, arsenic, and other toxics in the lower Columbia River and take immediate actions to reduce current human-caused inputs.
- Establish a pesticide and fertilizer use tracking system. Develop a protocol for setting up, operating, funding, and evaluating a tracking system that originates at point of sale and follows through to application. Develop a bar code for tracking. Seek resources and/or support to implement the tracking system. Publish the data on a regular basis to inform the public and interested parties about the use and effects of pesticides and fertilizers, and the success of efforts to reduce both usage and impact.
- Provide technical assistance, fund model projects, and promote alternative solutions that are environmentally benign.

Priority Issues Addressed: *Toxic Contaminants, Conventional Pollutants.*

Environmental Measurement: Demonstrate decreases in the levels of toxic contaminants in the sediments, water column and biota throughout the study area.

Action Measurement: Regular information will be provided to the public to facilitate discussions of the fate and effects of toxic pollutants and the use of monitoring data. By 2005, a pesticide tracking system will be in place. By 2010, a use reduction strategy will be in place.

Where: The Columbia River Basin.

Who: The Estuary Program develops the strategy, working with federal and state environmental agencies, U.S. Geological Survey, agriculture, industry, watershed councils, and other interested parties.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: $400,000 to conduct a study to identify the sources; 0.05 FTE ($4,000) to coordinate the study.

Funding Source: Special federal funds or foundation grant to the Estuary Program.

Regulations Required: Regulations may be required to reduce discharges.

Existing Agency Activities: Ecology maintains a hazardous waste inspection program for businesses that discharge point or non-point pollutants to the Columbia River. This program includes pollution prevention and technical assistance visits, with suggestions for behavior and business changes to reduce loading.

DEQ and Ecology issue National Pollutant Discharge Elimination System (NPDES) permits that do not allow the discharge of toxics in toxic amounts. Permitees monitor effluent for any toxic contaminant and conduct bioassays of potentially toxic effluents. A TMDL has been established for dioxin on the Columbia and Willamette Rivers.

The federal Resource Conservation Recovery Act hazardous and solid waste requirements prohibit the discharge of toxics and establish a cradle-to-grave tracking system for toxic substances. DEQ's hazardous waste program provides incentives and technical assistance and promotes hazardous waste reduction through recycling, non-hazardous alternatives, and reduction in use of hazardous substances. State and federal Superfund programs identify, prioritize, and oversee the cleanup of sites contaminated with hazardous substances.

Initial work on identifying the sources of pollutants to the lower Columbia River was completed as part of the Lower Columbia River Bi-State Program.

NRCS is in the process of developing a pest management policy, with emphasis on integrated pest management principles.

ACTION 31: Use pollution prevention to reduce or eliminate toxic and conventional pollution generated during manufacturing and industrial processes.

Environmental Significance: *Reducing or eliminating toxic pollution during production processes provides significant benefits: pollution is reduced or not created at all; there is no cost for handling or cleaning up toxic waste; workers and handlers are not exposed; and the environment is less harmed or not harmed at all. Decreasing impacts of toxic and conventional pollutants on the river ecosystem will benefit fish, wildlife, and humans. People who work directly with production systems often have ideas that reduce or eliminate pollution or use of toxic contaminants. In many cases, this has led to a significant reduction in pollutants and reduced production costs.*

How:

- Emphasize the pollution prevention hierarchy of prevent, reduce, re-use and recycle.
- Promote closed-loop systems that use materials and products efficiently within and/or between industries.
- Provide incentives that significantly reduce pollution through appropriate prevention strategies. Incentives may include reducing the number of inspections, the number of reports, or the discharge fees.
- Create a recycling information center (waste exchange) that identifies recycled products and matches them with interested users.
- Explore the implications of using pollution discharge fees or taxes on certain processing materials to discourage the discharge of toxic contaminants in the environment.
- Develop pollution prevention teams to devise alternative processes that eliminate or reduce waste. Technical experts from the pulp and paper industry, aluminum industry, and other major water dischargers in the study area should meet regularly with federal, state, and local government staff to identify process or product alternatives. This discussion should include a review of potential incentives for bleached kraft mills, including effluent recovery. Their goal should be continuous improvement and removal of toxic contaminants from processes.
- Identify markets for recycled materials while supporting existing efforts to link products and markets. Identify "environmentally friendly" products and industries and promote their positive impact on the environment and the economy.

Priority Issues Addressed: *Toxic Contaminants, Conventional Pollutants.*

Environmental Measurement: By 2010, discharges show a documented reduction in contaminants and there are documented decreases in the levels of toxic contaminants in organisms and sediments.

Action Measurement: Selected incentives will be developed, in place, and in effect by 2000. Disincentives will be evaluated by 2002.

Where: Study area.

Who: Federal and state environmental agencies, industries, and municipalities continue their efforts. The Estuary Program works with all the parties to study the implications of discharge fees and other incentives.

The Estuary Program Role:

CONSULT
(Minimum involvement)

CONVENE

COORDINATE
(Maximum involvement)

Preliminary Cost Estimates: Estuary Program costs: 0.25 FTE ($20,000) annually to coordinate; continued investment by Ecology, DEQ, U.S. EPA, and local governments.

Funding Source: Estuary Program base funds.

Regulations Required: There are no immediate regulatory issues, but the imposition of fees or taxes could require legislation and/or regulations at some date in the future.

Existing Agency Activities: Both Ecology and DEQ have programs to encourage pollution prevention. Both agencies are participants in a three-state recycling information system already in place, called the Industrial Materials Exchange (IMEX). Both agencies use a team approach to encourage pollution prevention: DEQ in the auto industry, and Ecology to reduce toxic contaminants use or water use.

Many local governments are also involved in pollution prevention efforts, both for city-run activities and for encouraging pollution prevention by residents and industry.

U.S. EPA maintains effluent guidelines for industry.

ACTION 32: Reduce and maintain temperature and total dissolved gas in the mainstem Columbia River and tributaries to help sustain native species.

Environmental Significance: *Temperatures at critical locations in the Columbia River system are often at elevated levels injurious to anandromous fish and other native species. Levels of total dissolved gas in the river are sometimes above levels protective of fish, particularly juveniles. Taking measures to maintain appropriate temperature and total dissolved gas levels will help ensure the survival of juvenile fish, particularly salmonids as they migrate downstream. It will also encourage more responsible management of the river for fish passage and survival.*

How:

- Re-establish appropriate vegetative cover along tributaries (see Action 4).
- Make physical and operational alterations to dams in the Columbia River system to avoid exceeding water quality standards for temperature and total dissolved gas, thus enhancing fish survival.
- Increase river velocity or flows during warm weather or low flow to assist in maintaining temperatures that sustain native species.
- Draft water from reservoirs with sufficient thermal gradient to cool the downstream waters.
- Develop and implement total maximum daily loads (TMDLs) for temperature and total dissolved gas (see Action 34).
- Develop a temperature model that identifies controlling factors for the Columbia River mainstem, including from Bonneville Dam to the mouth. Use the model to set priorities for action.

Priority Issues Addressed: *Conventional Pollutants, Institutional Constraints.*

Environmental Measurement: Temperature and total dissolved gas are at levels that maintain native species.

Action Measurement: TMDL schedules as set by the environmental agencies are met, and effective modification has been made to structures or operations of mainstem Columbia River dams. TMDLs are established throughout the basin by 2007 for those contaminants listed as of 1998, as agreed to by the environmental agencies.

Where: The Columbia River Basin.

Who: Federal and state environmental agencies, Corps, Bureau of Reclamation, and public utility dam managers have primary responsibility. The Estuary Program monitors implementation and convenes parties.

The Estuary Program Role:

Preliminary Cost Estimates: Non-Estuary Program staffing costs need to be determined. Staff would develop TMDL schedules and dissolved gas abatement programs.

Funding Source: Funding sources for non-Estuary Program staff need to be determined. Restoration costs: $20,000 per mile for 100-foot buffers on both sides of a stream for vegetation restoration ($120 to $500 per acre for tree planting; $1 to $4 per linear foot for fencing). $20,000,000 for spill flow deflectors (flip lips) at 19 Bonneville Dam bays.

Regulations Required: Regulations may be required if current levels are not adequate.

Existing Agency Activities: U.S. EPA is leading an effort to evaluate the temperature regime in the Columbia River. Ecology, DEQ, the Corps, USGS, and NMFS are participants. The same agencies are involved with the analysis of dissolved gas, with NMFS/Corps leadership.

ACTION 33: Reduce the bacterial contamination sometimes found in the Columbia River and its tributaries to limit human exposure to contaminated water.

Environmental Significance: ***Sources of bacterial contamination contribute to elevated levels of bacteria in specific locations and periodically require limiting human contact with the water, particularly during and immediately following storm events. Reducing the impacts of bacterial contamination by controlling and reducing the discharge of bacteria will reduce the health risk from water contact activities.***

How:

- Use available data to conduct risk analysis and identify gaps in knowledge base.
- Control and continue to reduce sanitary and combined sewer overflows.
- Reduce discharge of animal waste to surface waters.
- Develop programs to assure continued operation and maintenance of onsite sewage disposal systems.
- Monitor trends.

Priority Issue Addressed: *Conventional Pollutants.*

Environmental Measurement: By 2020, the study area will comply with bacteria standards.

Action Measurement: The incidence and severity of combined sewer overflows is reduced. Discharge from farm operations is controlled.

Where: Study area.

Who: State environmental agencies, state and local health agencies, and local governments are responsible for reducing exposure.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Communities throughout the basin are on schedules to reduce or eliminate sanitary sewer overflows. The City of Portland is currently working to reduce pollution from combined sewer overflows and is scheduled to meet DEQ pollution reduction levels by 2011 in a program that will cost over $1 billion. The City of Astoria is scheduled to meet DEQ standards and eliminate prohibited overflows in a phased program by 2022 at a cost of $22 million.

Funding Source: Funding sources for non-Estuary Program staff need to be determined.

Regulations Required: This action will require regulations for onsite disposal systems. Regulations may be used to achieve further reductions in combined overflows, implement stormwater programs, and reduce animal waste to augment voluntary programs.

Existing Agency Activities: Ecology, through the National Pollutant Discharge Elimination System (NPDES) permit program, regulates discharges from wastewater treatment plants, dairies, and animal feeding operations. Untreated discharge is not permitted to waters of the state.

In Oregon, raw sewage is prohibited from being discharged (except for one in 10-year, 24-hour duration summer storm, and one in 5-year, 24-hour duration winter storm). Facilities experiencing overflows due to inflow and infiltration must be in compliance by January 1, 2010.

Combined sewer overflow (CSO) discharges from Astoria and Portland are the subject of a Stipulated and Final Order requiring Astoria (by 2022) and Portland (by 2011) to significantly reduce current volumes of overflow. Overflows in Astoria will be reduced by 96 percent. In Portland, overflows in the Columbia Slough will be reduced by 99 percent and in the Willamette River by 94 percent. In committing to these schedules, both communities are anticipating substantial costs and management responsibility.

Bacteria in stormwater is addressed by best management practices and through TMDL requirements. A TMDL for bacteria has been established for the Columbia Slough in Portland.

Discharge of untreated or partially treated sewage from onsite systems is prohibited; implementation is by complaint or by TMDL analysis. Large systems (greater than 2,500 gallons per day) have operation and maintenance as part of their permit.

The Oregon Department of Agriculture oversees state permits regulating confined animal feeding operations.

U.S. EPA has established a workgroup to look at problems associated with monitoring recreational waters to determine the microbiological risks associated with indicator levels and determining the need for public health controls at recreational waters. The workgroup will develop a testing protocol. Guidance will be issued to public health officials on when, where, and how to set up and conduct monitoring.

ACTION 34: Develop maximum pollutant loads for streams that do not meet water quality standards.

Environmental Significance: *Currently, there are many water bodies and segments of water bodies in Oregon and Washington that do not meet water quality standards for protecting beneficial uses. The Clean Water Act requires that streams be assessed to determine if they meet standards. Water bodies that do not meet standards are listed on what is known as the "303(d) list," which refers to the section of the Clean Water Act that requires listing of streams that do not meet standards. The Clean Water Act further requires that for those listed streams, standards be developed that establish a maximum daily pollutant load to reduce pollutant levels in the stream. The lower Columbia River does not meet standards for temperature, total dissolved gas, dissolved oxygen, bacteria, DDE, DDT, and PCBs. By developing total maximum daily loads (TMDLs) for these pollutants and implementing waste load allocations, beneficial uses such as fisheries and aquatic life will be protected.*

How:

- Update 303(d) lists on a biennial basis by April of even-numbered years.
- Prioritize waters on the 303(d) lists and schedule waters for TMDL development. Prioritize bioaccumulative chemicals for immediate action.
- Develop water quality assessments that identify the extent of water quality problems and the sources, fate, and transport of pollutants.
- Develop TMDLs for pollutants that affect the lower Columbia River and estuary to ensure compliance with water quality standards. Develop waste load allocations and load allocations for point and non-point sources of pollution, respectively.
- Implement waste load allocations through permit-related activity and load allocation through implementation plans and appropriate agreements/action of designated management agencies.

Priority Issues Addressed: *Toxic Contaminants, Conventional Pollutants.*

Environmental Measurement: Not applicable.

Action Measurement: Oregon will complete TMDLs, including implementation plans with load allocations, on the following schedule: Lower Columbia sub-basins by 2001; Columbia River mainstem by 2001; lower Willamette River by 2005; and Sandy River sub-basin by 2007. Washington will complete TMDLs for the lower Columbia River sub-basin and the mainstem Columbia River by 2010.

Where: The Columbia River Basin.

Who: Federal and state environmental agencies, industry, and other interested parties will implement TMDLs. The Estuary Program monitors progress and assists where appropriate.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Oregon DEQ, Washington Ecology, and U.S. EPA are currently devoting significant resources to developing TMDLs for streams that do not meet water quality standards.

Funding Source: Both DEQ and Ecology have committed to meet the schedules shown in the action measurements.

Regulations Required: This action may require rules or regulations, unless industries voluntarily adopt the TMDLs.

Existing Agency Activities: In Washington, all TMDLs associated with the 1996 303(d) list will be completed by 2013. Scoping is now underway to prioritize and schedule TMDLs in the lower Columbia River Basin.

DEQ will develop TMDLs for Oregon by 2007. The schedule for sub-basins in the lower Columbia area is: lower Columbia sub-basins by 2001; lower Willamette River by 2005; Sandy River sub-basin by 2007.

ACTION 35: Eliminate new sources of persistent, bioaccumulative and toxic chemicals; eliminate existing point source discharges of persistent, bioaccumulative and toxic chemicals; and control persistent, bioaccumulative and toxic discharges from contaminated sites.

Environmental Significance: *Persistent, bioaccumulative and toxic chemicals are particularly harmful to fish and wildlife because they persist in the environment for long periods of time and tend to be magnified up the food chain. The Bi-State studies have indicated that organisms at the top of the food chain, such as bald eagles, otters, and mink, are suffering possible reproductive problems from the ingestion of persistent, bioaccumulative and toxic chemicals. Furthermore, in the case of dioxin, which is a probable carcinogen, there may be a health risk for the consumers of contaminated fish. Eliminating persistent, bioaccumulative and toxic chemicals in the ecosystem removes these threats.*

How:

- Identify and list all persistent, bioaccumulative and toxic chemicals of concern and develop a process to regularly update the list.
- Develop regulatory processes and rules for addressing listed chemicals.
- Using the data developed from the basin-wide survey of toxic pollutants, target specific bioaccumulative, toxic chemical discharges for phase-out.
- Develop chemical and biological indicators to monitor the effectiveness of efforts to reduce bioaccumulative chemical emissions and discharges.
- Work with appropriate regulatory agencies to ensure implementation of standards.
- Ensure that all pulp and paper industry dischargers of dioxin meet the U.S. EPA cluster rule requirement that they be elemental chlorine free. Facilitate interstate cooperation in the implementation of the provisions of the cluster rules.
- Require all other industrial and manufacturing dischargers of dioxin to use alternative processes that eliminate production of dioxin by 2020.
- Develop a strategy to address water quality concerns regarding dioxin inputs from wood-treating facilities, other major industrial National Pollutant Discharge Elimination System (NPDES) dischargers, and major municipal NPDES facilities with formal pretreatment programs.
- Develop incentives for those organizations to meet the requirements before the mandated deadlines. Incentives may include public recognition and/or discharge fee reduction.

Priority Issue Addressed: *Toxic Contaminants.*

Environmental Measurement: Demonstrate decreases in the levels of persistent, bioaccumulative and toxic chemicals in the lower Columbia River. By 2005, eliminate bioaccumulative chemicals in new sources. By 2020, eliminate persistent, bioaccumulative and toxic chemicals in existing sources. By 2025 control discharges of persistent, bioaccumulative and toxic chemicals from contaminated sites.

Action Measurement: Regulatory processes are in place by 2000.

Where: The Columbia River Basin.

Who: Federal and state environmental agencies and industry. The Estuary Program convenes parties to ensure that the action is implemented.

The Estuary Program Role:

CONSULT
(Minimum involvement)

CONVENE

COORDINATE
(Maximum involvement)

Preliminary Cost Estimates: Non-Estuary Program staffing costs need to be determined.

Funding Source: Funding sources for non-Estuary Program staff need to be determined.

Regulations Required: This action will likely require legislation and rule development.

Existing Agency Activities: Pulp and paper mills in Oregon are meeting the cluster rule on the schedule required in the rule.

In Washington, the Persistent Bioaccumulative and Toxic Chemical (PBT) initiative is being implemented statewide. Public scoping meetings were held in early 1999.

U.S. EPA has established an agency-wide multi-media strategy to reduce risks from persistent, bioaccumulative and toxic chemicals. The strategy currently targets the 12 substances included in the Canada/United States Bi-National Toxics Strategy Level 1 list for immediate attention. Action plans to reduce emissions and exposure are currently under development. Additional chemicals of concern will be selected.

ACTION 36: Require all permitted discharges to surface water to use alternatives to chlorine to protect aquatic life where such alternatives provide equivalent removal and treatment of bacteria.

Environmental Significance: ***Chlorine is highly toxic to aquatic life in its elemental form and can form toxic chlorinated hydrocarbons in water. Eliminating the toxic impacts of chlorine on aquatic life and promoting the development of alternative disinfection practices could be cost effective as well as environmentally benign.***

How:

- Test and develop alternatives, which are financially acceptable and protect public health, to the use of chlorine for disinfection.
- Provide grants to help facilities identify and employ alternatives to chlorine.
- Phase out the use of chlorine for disinfection as alternatives are proven practicable for both the protection of aquatic life and the treatment of bacteria. Develop timelines and rules for phase-out.

Priority Issue Addressed: *Toxic Contaminants.*

Environmental Measurement: By 2020, the use of chlorine for wastewater effluent has been replaced by equally effective, environmentally benign alternatives.

Action Measurement: Research and development of alternatives.

Where: Study area.

Who: State environmental agencies and local government will develop and implement rules. The Estuary Program provides grants.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: 0.05 FTE ($4,000) annually to coordinate granting program. Non-Estuary Program staffing costs need to be determined. Staff would develop rules and conduct compliance monitoring. Installation estimates range from $50,000 to $140,000 per million gallons per day capacity ultraviolet radiation treatment facilities. Operating costs range from $10 to $30 per million gallons per day for treatment.

Funding Source: When funding sources are secured, grants would be made by or facilitated by the Estuary Program. Funding sources for non-Estuary Program staff need to be determined.

Regulations Required: This action will require rules or legislation, unless facilities voluntarily eliminate or reduce chlorine.

Existing Agency Activities: In both states, effluent discharges containing chlorine are regulated by NPDES permits, and sources are encouraged to seek alternative methods of treatment.

Ecology reports that chlorine discharges have been significantly reduced.

DEQ has developed best management practices guidance on chlorinated water discharge, and provides tax credits to encourage use of alternative technologies.

ACTION 37: Require that industrial wastewater that is discharged to municipal wastewater treatment facilities does not contain materials that exhibit chronic toxicity or that interact with other chemicals to cause toxic effects.

Environmental Significance: *Current laws require pretreatment for acutely toxic chemicals. However, some chemicals are chronically toxic to aquatic organisms at low levels and may not be detected under the present regulatory structure. Chronic toxicity can cause effects other than acute mortality, such as lowered birth rates or lowered resistance to disease. Some chemicals are "synergistically" toxic, becoming toxic as they mix with other chemicals. Increasing treatment plant surveillance of these chemicals and requiring more pretreatment processes to be implemented by industry will provide a better understanding of the effects of the pollutants. Reducing levels of toxic chemicals discharged to the river will remove the toxic threat to fish and wildlife.*

How:

- Provide technical and monetary assistance so small municipal wastewater treatment facilities can test for toxic contaminants entering their facilities.
- Provide technical assistance so industrial facilities can develop pollution prevention strategies.
- Require larger industrial facilities to step up their pretreatment testing and compliance efforts.
- Reward proactive programs and innovative approaches.
- Develop information regarding alternative methods and technologies.

Priority Issue Addressed: *Toxic Contaminants.*

Environmental Measurement: Not applicable.

Action Measurement: By 2005, all industrial dischargers to municipal wastewater treatment facilities in the study area are required to monitor their effluent.

Where: Study area.

Who: State environmental agencies and local governments are responsible for regulating discharges. The Estuary Program provides technical assistance and grants awards.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Estuary Program costs: 0.10 FTE ($8,000) annually for coordination and technical assistance. Grant awards. Non-Estuary Program staffing costs need to be determined.

Other costs: Current annual local government cost examples for pretreatment: City of Portland $1,000,000; City of Vancouver $200,000.

Funding Source: Estuary Program base funds for staff support and grant awards. Funding sources for non-Estuary Program staff need to be determined.

Regulations Required: This action could require local ordinance changes, and state agency rules would be necessary to address pretreatment and compliance efforts.

Existing Agency Activities: The Federal Wastewater Pretreatment Program is being implemented in both Washington and Oregon. In or near the Estuary Program study area, the following Oregon entities have pretreatment programs: Oak Lodge, Portland, St. Helens, Unified Sewerage Agency (Durham, Forest Grove, Hillsboro, Rock Creek plants), Gresham, Hood River, and Clackamas. Ecology's South West Regional Office pretreatment coordinator is also responsible for NPDES permitting in the Columbia Basin.

U.S. EPA publishes laboratory analytical methods that are used by industries and municipalities to analyze the chemical and biological components of wastewater, drinking water, sediment, and other environmental samples required by U.S. EPA regulations under the authority of the Clean Water Act. Most are published in the Code of Federal Regulations.

ACTION 38: Reduce hydrocarbon (PAHs) and heavy metal discharges associated with petroleum-powered vehicles and equipment that contaminate runoff with toxic chemicals.

Environmental Significance: *Gases and particulates produced during the combustion of fossil fuels can precipitate and settle out on impervious surfaces. From here, they may be washed into streams or rivers or settle directly on the water surface. Water-cooled 2-cycle engines flush contaminants, including fuel and oil, directly into the water. Once in the water, they become toxic to aquatic life. By reducing the emissions and number of vehicles on the road, toxic contaminants entering the ecosystem can be reduced and better managed. Encouraging more efficient use of autos and small gasoline engines and reducing auto usage and consumption of fossil fuels will collectively reduce the amount of PAHs and other toxic contaminants found in deposition or leakage from petroleum-powered vehicles or equipment. Additionally, certain metals, including copper, used in brake pads are a source of metal contamination of runoff.*

How:

For vehicles:

- Encourage mass transit and other alternative transportation use.
- Implement strict air pollution control checks with vehicle re-registration or re-licensing.
- Develop a rebate program for purchases of environmentally friendly vehicles.
- Institute a buy-back program for non-complying vehicles in the Portland-Vancouver metropolitan area.
- Institute a registration fee based on miles driven.
- Remove exemptions from mileage performance standards for certain types of vehicles.
- Encourage use of alternatives to metals, including copper, in brakepads where alternatives are available.
- Encourage use of low-sulfur fuels in all petroleum-powered vehicles.

For smaller engines:

- Phase out 2-cycle engines for outboard motors, leaf blowers, and lawn mowers.
- Minimize the use of petroleum-powered engines with incentives and rewards for innovative approaches (e.g., PGE and DEQ's buy-back program for gas lawnmowers).

Priority Issue Addressed: *Toxic Contaminants.*

Environmental Measurement: By 2020, concentrations of PAHs, metals, and other contaminants in the sediments and biota of the river resulting from fossil fuel combustion will be reduced.

Action Measurement: By 2000, the Estuary Program will have contacted the Congressional delegation requesting removal of the exception for sports utility vehicles from mileage performance standards. By 2005, 2-cycle engines will not be in use or available. By 2008, vehicle registration in Oregon and Washington will be based on miles driven.

Where: Focus on urban areas in the study area.

Who: State environmental agencies, local governments, and industry are responsible for air emission compliance; local governments can encourage mass transit; U.S. Congress has responsibility for exemptions from miles-per-gallon requirements. The Estuary Program promotes alternatives to gas-powered vehicles.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Non-Estuary Program staffing costs need to be determined. Staff would evaluate buy-back programs, develop 2-cycle engine reduction programs, and evaluate transportation alternatives.

Other costs: Higher costs for more frequent emissions testing or a more comprehensive test; additional costs for buy-back programs if established.

Funding Source: Funding sources for non-Estuary Program staff need to be determined.

Regulations Required: This action would require changes to state license registration programs, legislation for 2-cycle engines, and Congressional removal of exemptions.

Existing Agency Activities: Ecology has an extensive air quality program to reduce the amounts of emissions from petroleum-powered engines. They are also working to develop and implement BMPs for stormwater runoff, and are working with Clark County to establish a stormwater ordinance.

DEQ operates a vehicle inspection program in the Portland metropolitan area, and co-sponsors a gas-powered lawnmower buy-back program with Portland General Electric. DEQ has several programs to encourage alternative transportation use, including employee commute options, voluntary parking rations, and public education. At the national level, DEQ is working to establish sulfur limits in fuel.

ACTION 39: Clean up hazardous waste sites.

Environmental Significance: ***Runoff and seepage from hazardous waste sites contribute significantly to surface water and groundwater pollution. Cleanup of hazardous waste sites would improve surface and groundwater quality and benefit fish, wildlife, and humans who use the water and/or who live or work near hazardous waste sites.***

How:

- Encourage and help enforcement authorities trace landowners of abandoned sites, identify responsible parties, and use existing enforcement authority to facilitate cleanup.
- Secure funds for cleanup of sites where responsible parties are unknown or unable to fund cleanup.
- Provide incentives for agencies and responsible parties to avoid litigation and to speed cleanup and restoration of hazardous waste sites.
- Develop a ranking system to prioritize sites for cleanup.
- Promote successful programs through newsletters and outreach programs.
- Monitor and publish information about cleanup of hazardous sites.

Priority Issue Addressed: *Toxic Contaminants.*

Environmental Measurement: Hazardous sites no longer harm fish, wildlife, or humans.

Action Measurement: All hazardous waste sites in the study area are cleaned up or contained and rendered harmless.

Where: Study area.

Who: Federal and state environmental agencies and local governments continue their efforts to clean up hazardous waste sites. The Estuary Program monitors implementation of the action.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Oregon DEQ, Washington Ecology, and U.S. EPA are currently devoting significant resources to cleaning up hazardous waste sites. Existing staff would continue to monitor and manage cleanup efforts.

Other costs: Cleanup costs range from $1,350 to $400,000 per acre.

Funding Source: Funding sources for non-Estuary Program staff need to be determined.

Regulations Required: None.

Existing Agency Activities: In Washington, the activities mentioned in this action are currently being done under the Washington Ranking Method (WARM).

Oregon has a fully developed hazardous waste program. In the lower Columbia River area, there are over 400 suspected sites and 150 sites with confirmed contamination. Oregon's program includes emergency spill response, site ranking and development of strategy recommendations, cleanup options (voluntary or enforcement program), orphan site account for financially unable or unwilling responsible parties, and various public involvement and outreach programs, including listings of sites with confirmed releases and needing further action.

ACTION 40: Regulate and track the use of hazardous materials to prevent re-uses that contaminate surface water or groundwater.

Environmental Significance: ***The use of recycled hazardous materials is not tracked closely. Current tracking of products labeled "recycled" is not consistent. Improper use of these materials may release toxic substances that contaminate surface water and groundwater, and bioaccumulate in the ecosystem. Regulating and tracking the use of recycled hazardous materials will help eliminate the risk of contamination from improper use and disposal.***

How:

- Develop and enforce strict hazardous materials recycling regulations that ensure appropriate re-use and prevent the contamination of surface water and groundwater.
- Develop an incentive program to encourage the proper re-use of recycled hazardous materials.
- Set up a database/information system (waste exchange) that would connect potential users and suppliers of recycled materials.
- Determine appropriate methods to monitor re-use.

Priority Issues Addressed: *Toxic Contaminants, Institutional Constraints.*

Environmental Measurement: There is no release of toxic residue from "recycled" materials.

Action Measurement: By 2005, toxic contaminants of concern are identified and their waste streams are characterized; environmental goals and programs are defined; and regulations for tracking are developed and implemented.

Where: Study area.

Who: State environmental and transportation agencies and industry will develop the tracking system. The Estuary Program convenes a collaborative process to help develop the system.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Non-Estuary Program staffing costs need to be determined. Staff would evaluate present uses of hazardous materials.

Other costs: IMEX (Industrial Materials Exchange), based in King County and jointly funded by Washington, Oregon and Idaho, is already in place.

Funding Source: Funding sources for non-Estuary Program staff need to be determined.

Regulations Required: Regulations will be required.

Existing Agency Activities: Ecology is implementing a Hazardous Waste Regulations tracking of waste generation, and a toxics release inventory.

DEQ has adopted the federal regulations that regulate recycling of hazardous materials. It has also established fees for generating hazardous waste that have an incentive for recycling built into them. DEQ includes reporting of recycling in its annual hazardous waste report.

ACTION 41: Provide subsidized hazardous material disposal opportunities for small-volume users and generators.[6]

Environmental Significance: ***In some areas, there are few opportunities for citizens to properly dispose of unwanted hazardous materials. These unwanted materials can end up in the environment as a result of improper storage or disposal. Providing regular sites and opportunities for households and other users to properly dispose of small volumes of hazardous material will help prevent contamination of water bodies, fish, and wildlife.***

How:

- Develop hazardous materials collection opportunities, particularly in rural areas, that are user friendly.
- Actively promote new and existing collection opportunities though newsletters, newspapers, radio, etc., and develop incentives to encourage homeowners and other small-volume users to participate.
- Work to facilitate cooperative recycling agreements with communities on both sides of the river.
- Identify possible funding sources to provide annual recycling opportunities.

Priority Issues Addressed: *Toxic Contaminants, Institutional Constraints, Public Awareness and Stewardship.*

Environmental Measurement: Not applicable.

Action Measurement: By 2002, annual disposal opportunities will be provided in all communities.

Where: Rural communities in the study area.

Who: The Estuary Program establishes a task force to develop possible ways to fund hazardous waste disposal programs in rural areas. The Estuary Program monitors implementation.

The Estuary Program Role:

CONSULT *(Minimum involvement)* — CONVENE — COORDINATE *(Maximum involvement)*

Preliminary Cost Estimates: Non-Estuary Program staffing costs need to be determined. Staff would manage current programs and develop new ones.

Other costs: An average hazardous materials collection day costs $9,000 and averages $60 to $65 per customer. $10,000 annually to publicize.

[6] Small volume is defined by DEQ to be households and small businesses that generate less than 220 pounds per month or 2,200 pounds per year.

Funding Source: Funding sources for non-Estuary Program staff need to be determined. Partnerships with targeted industries, such as chemical, paint, fertilizer, and pesticide manufacturers, would be pursued.

Regulations Required: None.

Existing Agency Activities: DEQ participated in a household hazardous waste and "conditionally exempt generator" collection held in Clatskanie in September 1998.

Metro sponsors and provides staff for periodic hazardous waste collection events.

ACTION 42: Require all marine facilities to have safety, spill prevention, and cleanup plans in place, and to have sewage and bilge pump-out facilities and treatment procedures.

Environmental Significance: *The refueling and transfer of fuel to vessels, bilge pumping, and sewage discharge can result in spills that contaminate water and wildlife. Larger commercial vessels and most fuel facilities are covered by existing regulations, but smaller facilities, small commercial and private vessels are not. Responsible handling of boat fuels and waste will eliminate or minimize the impacts of contaminant spills on the ecosystem, including fuel and other vessel discharges..*

How:

- Expand existing oil spill prevention and response regulations to cover all currently uncovered marinas and ports that handle petroleum products.
- Require all facilities that handle fuel to have approved spill prevention plans and spill response plans in place, including signed agreements with approved spill response contractors.
- Require the regular updating and testing of spill response plans.
- Require all commercial vessels to pump bilge water into approved facilities.
- Require all boats and ships to contain sewage on board.
- Provide approved and accessible sewage and bilge pump-out facilities to minimize possible exposure.

Priority Issues Addressed: *Toxic Contaminants, Conventional Pollutants, Institutional Constraints.*

Environmental Measurement: No discharge of sewage or bilge water occurs in the study area.

Action Measurement: By 2003, identify the existing number of sewage and bilge pump-out facilities, and increase that number so all facilities have pump-out accommodations. The number of spills is reduced and the amount of spillage is reduced. By 2005, requirements are in place for all facilities handling fuel and for all commercial vessels.

Where: All marine facilities and all commercial vessels in the study area.

Who: State environmental agencies and U.S. Coast Guard. The Estuary Program monitors implementation.

The Estuary Program Role:

Preliminary Cost Estimates: Non-Estuary Program staffing costs need to be determined. Staff would develop rules, monitor compliance, and encourage pump-out facilities.

Other costs: Costs to develop bilge and sewage pump-out facilities. Examples: $30,000 for a 3,500-gallon pump-out barge; $58,000 for floating pump-out/dump station/restroom with $3,000 yearly operating costs. Additional costs for boat owners to pump out bilges and sewage tanks.

Funding Source: Funding sources for non-Estuary Program staff need to be determined.

Regulations Required: Legislation will be necessary for bilge water requirements.

Existing Agency Activities: In Washington, contingency plan and prevention plan approval and implementation is required for all onshore and offshore facilities that receive oil from vessels or pipelines and all tank vessels over 300 gross tons. Cargo and passenger vessels require contingency plans and practice drills, and structural integrity inspections are required for all vessels that transit the Columbia River.

In Oregon, contingency plans must be approved and implemented prior to operation of any tank, cargo or passenger vessel, or any onshore or offshore facility with over 10,000 gallons of oil. Approved plans must be renewed every 5 years. In addition, there are required training and practice drills to evaluate the effectiveness of the contingency plans.

Oregon and Washington prohibit the discharge of any sewage from marine toilets on all freshwater lakes, impoundments, and reservoirs. Approved marine sanitation devices are required on the Willamette and Columbia Rivers out to the 3-mile limit. Vessels without approved sanitation devices must use holding tanks or porta-potties. In Oregon, the Clean Vessel Program is administered by the State Marine Board.

ACTION 43: Pursue safe deposition and timely cleanup of nuclear wastes stored at the Trojan and Hanford nuclear facilities.

Environmental Significance: ***The Bi-State Program measured radionuclides in the lower Columbia River at levels similar to concentrations above the Hanford military reservation, which are believed to reflect background levels. However, the public is concerned about the potential for contamination. Encouraging responsible government and industry surveillance of nuclear waste cleanup and disposal activities will give the public current information to address its concerns.***

How:

- Encourage and support efforts to identify safe disposal procedures; actively promote timely removal and cleanup of all nuclear wastes at Trojan and Hanford.
- Develop an agreement with the appropriate responsible parties to keep the public regularly apprised of the current status of stored nuclear wastes and cleanup efforts.
- Provide information about the risks and the cleanup of nuclear processes.
- Include monitoring of radionuclides in the long-term monitoring plan.

Priority Issues Addressed: *Toxic Contaminants, Public Awareness and Stewardship.*

Environmental Measurement: Not applicable.

Action Measurement: Cleanup schedules and budgets are in place by 2001.

Where: Nuclear sites.

Who: U.S. Department of Energy, federal and state environmental agencies, and Hanford Waste Board are responsible for cleanup. The Estuary Program monitors the river and the cleanup progress and provides information to the public.

The Estuary Program Role:

Preliminary Cost Estimates: 0.05 FTE ($4,000) annually for Public Information Specialist; $5,000 annually to assemble and disseminate information.

Funding Source: Estuary Program Base funds.

Regulations Required: None.

Existing Agency Activities: Ecology and the U.S. EPA are both parties to the cleanup agreement at the Hanford Nuclear Reservation. Both parties continue to work to get full cleanup of the site. The State of Oregon has an interest in cleanup activities both as a downstream state and as a state through which transportation of wastes is likely to occur. Oregon's interests in both the Hanford and the Trojan sites are expressed by the Office of Energy in the Department of Consumer Affairs and Services.

There is something . . . thrilling about a river . . .

—Wallace Stegner

Look deep, deep into nature, and then you will understand everything better. . .

—Albert Einstein

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.

Tributylitin: An organic compound used as an additive in many marine anti-foulant plants to prevent algal and barnacle growth. Tributylitin 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.

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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.