Columbia River System Operation Review

Final Environmental Impact Statement

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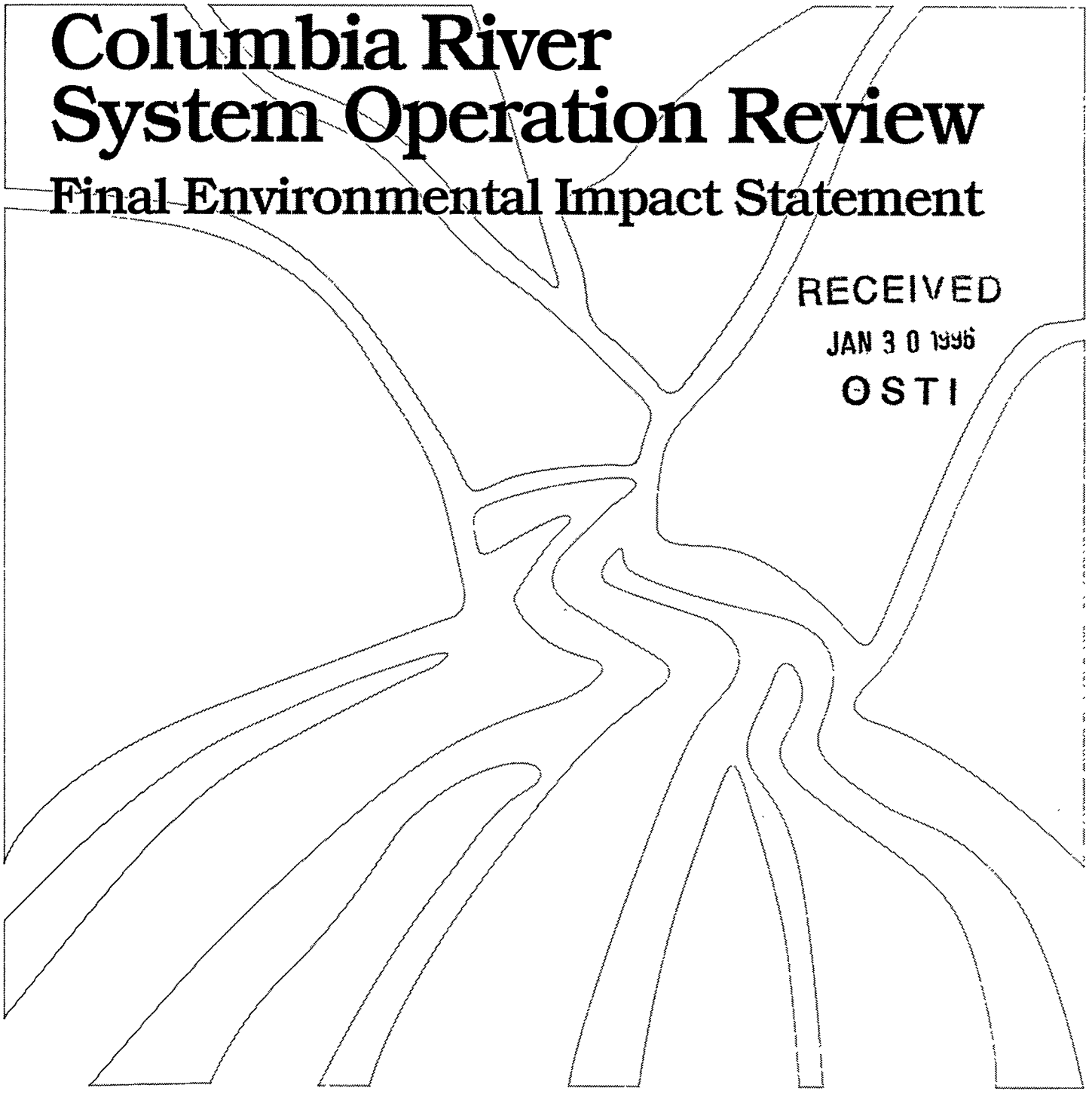

Appendix N

Wildlife

BONNEVILLE POWER ADMINISTRATION

US Army Corps of Engineers
North Pacific Division

MASTER

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

DOE/EIS-0170-app. N

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November 1995

PUBLIC INVOLVEMENT IN THE SOR PROCESS

The Bureau of Reclamation, Corps of Engineers, and Bonneville Power Administration wish to thank those who reviewed the Columbia River System Operation Review (SOR) Draft EIS and appendices for their comments. Your comments have provided valuable public, agency, and tribal input to the SOR NEPA process. Throughout the SOR, we have made a continuing effort to keep the public informed and involved.

Fourteen public scoping meetings were held in 1990. A series of public roundtables was conducted in November 1991 to provide an update on the status of SOR studies. The lead agencies went back to most of the 14 communities in 1992 with 10 initial system operating strategies developed from the screening process. From those meetings and other consultations, seven SOS alternatives (with options) were developed and subjected to full–scale analysis. The analysis results were presented in the Draft EIS released in July 1994. The lead agencies also developed alternatives for the other proposed SOR actions, including a Columbia River Regional Forum for assisting in the determination of future SOSs, Pacific Northwest Coordination Agreement alternatives for power coordination, and Canadian Entitlement Allocation Agreements alternatives. A series of nine public meetings was held in September and October 1994 to present the Draft EIS and appendices and solicit public input on the SOR. The lead agencies received 282 formal written comments. Your comments have been used to revise and shape the alternatives presented in the Final EIS.

Regular newsletters on the progress of the SOR have been issued. Since 1990, 20 issues of *Streamline* have been sent to individuals, agencies, organizations, and tribes in the region on a mailing list of over 5,000. Several special publications explaining various aspects of the study have also been prepared and mailed to those on the mailing list. Those include:

The Columbia River: A System Under Stress
The Columbia River System: The Inside Story
Screening Analysis: A Summary
Screening Analysis: Volumes 1 and 2
Power System Coordination: A Guide to the Pacific Northwest Coordination Agreement
Modeling the System: How Computers are Used in Columbia River Planning
Daily/Hourly Hydrosystem Operation: How the Columbia River System Responds to Short–Term Needs

Copies of these documents, the Final EIS, and other appendices can be obtained from any of the lead agencies, or from libraries in your area.

Your questions and comments on these documents should be addressed to:

SOR Interagency Team
P .O. Box 2988
Portland, OR 97208–2988

DOE/BP--2739

PREFACE: SETTING THE STAGE FOR THE SYSTEM OPERATION REVIEW

WHAT IS THE SOR AND WHY IS IT BEING CONDUCTED?

The Columbia River System is a vast and complex combination of Federal and non–Federal facilities used for many purposes including power production, irrigation, navigation, flood control, recreation, fish and wildlife habitat and municipal and industrial water supply. Each river use competes for the limited water resources in the Columbia River Basin.

To date, responsibility for managing these river uses has been shared by a number of Federal, state, and local agencies. Operation of the Federal Columbia River system is the responsibility of the Bureau of Reclamation (Reclamation), Corps of Engineers (Corps) and Bonneville Power Administration (BPA).

The System Operation Review (SOR) is a study and environmental compliance process being used by the three Federal agencies to analyze future operations of the system and river use issues. The goal of the SOR is to achieve a coordinated system operation strategy for the river that better meets the needs of all river users. The SOR began in early 1990, prior to the filing of petitions for endangered status for several salmon species under the Endangered Species Act.

The comprehensive review of Columbia River operations encompassed by the SOR was prompted by the need for Federal decisions to (1) develop a coordinated system operating strategy (SOS) for managing the multiple uses of the system into the 21st century; (2) provide interested parties with a continuing and increased long–term role in system planning (Columbia River Regional Forum); (3) renegotiate and renew the Pacific Northwest Coordination Agreement (PNCA), a contractual arrangement among the region's major hydroelectric–generating utilities and affected Federal agencies to provide for coordinated power generation on the Columbia River system; and (4) renew or develop new Canadian Entitlement Allocation Agreements (contracts that divide Canada's share of Columbia River Treaty downstream power benefits and obligations among three participating public utility districts and BPA). The review provides the environmental analysis required by the National Environmental Policy Act (NEPA).

This technical appendix addresses only the effects of alternative system operating strategies for managing the Columbia River system. The environmental impact statement (EIS) itself and some of the other appendices present analyses of the alternative approaches to the other three decisions considered as part of the SOR.

WHO IS CONDUCTING THE SOR?

The SOR is a joint project of Reclamation, the Corps, and BPA—the three agencies that share responsibility and legal authority for managing the Federal Columbia River System. The National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), and National Park Service (NPS), as agencies with both jurisdiction and expertise with regard to some aspects of the SOR, are cooperating agencies. They contribute information, analysis, and recommendations where appropriate. The U.S. Forest Service (USFS) was also a cooperating agency, but asked to be removed from that role in 1994 after assessing its role and the press of other activities.

HOW IS THE SOR BEING CONDUCTED?

The system operating strategies analyzed in the SOR could have significant environmental impacts. The study team developed a three–stage process—scoping, screening, and full–scale analysis of the strategies—to address the many issues relevant to the SOR.

At the core of the analysis are 10 work groups. The work groups include members of the lead and cooperating agencies, state and local government agencies, representatives of Indian tribes, and

members of the public. Each of these work groups has a single river use (resource) to consider.

Early in the process during the screening phase, the 10 work groups were asked to develop an alternative for project and system operations that would provide the greatest benefit to their river use, and one or more alternatives that, while not ideal, would provide an acceptable environment for their river use. Some groups responded with alternatives that were evaluated in this early phase and, to some extent, influenced the alternatives evaluated in the Draft and Final EIS. Additional alternatives came from scoping for the SOR and from other institutional sources within the region. The screening analysis studied 90 system operation alternatives.

Other work groups were subsequently formed to provide projectwide analysis, such as economics, river operation simulation, and public involvement.

The three–phase analysis process is described briefly below.

- **Scoping/Pilot Study**—After holding public meetings in 14 cities around the region, and coordinating with local, state, and Federal agencies and Indian tribes, the lead agencies established the geographic and jurisdictional scope of the study and defined the issues that would drive the EIS. The geographic area for the study is the Columbia River Basin (Figure P–1). The jurisdictional scope of the SOR encompasses the 14 Federal projects on the Columbia and lower Snake Rivers that are operated by the Corps and Reclamation and coordinated for hydropower under the PNCA. BPA markets the power produced at these facilities. A pilot study examining three alternatives in four river resource areas was completed to test the decision analysis method proposed for use in the SOR.

- **Screening**—Work groups, involving regional experts and Federal agency staff, were created for 10 resource areas and several support functions. The work groups developed computer screening models and applied them to the 90 alternatives identified during screening. They compared the impacts to a baseline operating year—1992—and ranked each alternative according to its impact on their resource or river use. The lead agencies reviewed the results with the public in a series of regional meetings in September 1992.

- **Full–Scale Analysis**—Based on public comment received on the screening results, the study team sorted, categorized, and blended the alternatives into seven basic types of operating strategies. These alternative strategies, which have multiple options, were then subjected to detailed impact analysis. Twenty–one possible options were evaluated. Results and tradeoffs for each resource or river use were discussed in separate technical appendices and summarized in the Draft EIS. Public review and comment on the Draft EIS was conducted during the summer and fall of 1994. The lead agencies adjusted the alternatives based on the comments, eliminating a few options and substituting new options, and reevaluated them during the past 8 months. Results are summarized in the Final EIS.

Alternatives for the Pacific Northwest Coordination Agreement (PNCA), the Columbia River Regional Forum (Forum), and the Canadian Entitlement Allocation Agreements (CEAA) did not use the three–stage process described above. The environmental impacts from the PNCA and CEAA were not significant and there were no anticipated impacts from the Regional Forum. The procedures used to analyze alternatives for these actions are described in their respective technical appendices.

For detailed information on alternatives presented in the Draft EIS, refer to that document and its appendices.

WHAT SOS ALTERNATIVES ARE CONSIDERED IN THE FINAL EIS?

Seven alternative System Operating Strategies (SOS) were considered in the Draft EIS. Each of the seven SOSs contained several options bringing the total number of alternatives considered to 21. Based on review of the Draft EIS and corresponding adjustments, the agencies have identified 7 operating strategies that are evaluated in this Final EIS. Accounting for options, a total of 13 alternatives is now under consideration. Six of the alternatives remain unchanged from the specific options considered in the Draft EIS. One is a revision to a previously considered alternative, and the rest represent replacement or new alternatives. The basic categories of SOSs and the numbering convention remains the same as was used in the Draft EIS. However, because some of the alternatives have been dropped, the numbering of the final SOSs are not consecutive. There is one new SOS category, Settlement Discussion Alternatives, which is labeled SOS 9 and replaces the SOS 7 category. This category of alternatives arose as a consequence of litigation on the 1993 Biological Opinion and ESA Consultation for 1995.

The 13 system operating strategies for the Federal Columbia River system that are analyzed for the Final EIS are:

SOS 1a Pre Salmon Summit Operation represents operations as they existed from around 1983 through the 1990–91 operating year, prior to the ESA listing of three species of salmon as endangered or threatened.

SOS 1b Optimum Load–Following Operation represents operations as they existed prior to changes resulting from the Regional Act. It attempts to optimize the load–following capability of the system within certain constraints of reservoir operation.

SOS 2c Current Operation/No–Action Alternative represents an operation consistent with that specified in the Corps of Engineers' 1993 Supplemental EIS. It is similar to system operation that occurred in 1992 after three species of salmon were listed under ESA.

SOS 2d [New] 1994–98 Biological Opinion represents the 1994–98 Biological Opinion operation that includes up to 4 MAF flow augmentation on the Columbia, flow targets at McNary and Lower Granite, specific volume releases from Dworshak, Brownlee, and the Upper Snake, meeting sturgeon flows 3 out of 10 years, and operating lower Snake projects at MOP and John Day at MIP.

SOS 4c [Rev.] Stable Storage Operation with Modified Grand Coulee Flood Control attempts to achieve specific monthly elevation targets year round that improve the environmental conditions at storage projects for recreation, resident fish, and wildlife. Integrated Rules Curves (IRCs) at Libby and Hungry Horse are applied.

SOS 5b Natural River Operation draws down the four lower Snake River projects to near river bed levels for four and one–half months during the spring and summer salmon migration period, by assuming new low level outlets are constructed at each project.

SOS 5c [New] Permanent Natural River Operation operates the four lower Snake River projects to near river bed levels year round.

SOS 6b Fixed Drawdown Operation draws down the four lower Snake River projects to near spillway crest levels for four and one–half months during the spring and summer salmon migration period.

SOS 6d Lower Granite Drawdown Operation draws down Lower Granite project only to near spillway crest level for four and one–half months.

SOS 9a [New] Detailed Fishery Operating Plan includes flow targets at The Dalles based on the previous year's end–of–year storage content, specific volumes of releases for the Snake River, the drawdown of Lower Snake River projects to near spillway crest level for four and one–half months, specified spill percentages, and no fish transportation.

SOS 9b [New] Adaptive Management establishes flow targets at McNary and Lower Granite based on runoff forecasts, with specific volumes of releases to meet Lower Granite flow targets and specific spill percentages at run–of–river projects.

SOS 9c [New] Balanced Impacts Operation draws down the four lower Snake River projects near spillway crest levels for two and one–half months during the spring salmon migration period. Refill begins after July 15. This alternative also provides 1994–98 Biological Opinion flow augmentation, integrated rule curve operation at Libby and Hungry Horse, a reduced flow target at Lower Granite due to drawdown, winter drawup at Albeni Falls, and spill to achieve no higher than 120 percent daily average for total dissolved gas.

SOS PA Preferred Alternative represents the operation proposed by NMFS and USFWS in their Biological Opinions for 1995 and future years; this SOS operates the storage projects to meet flood control rule curves in the fall and winter in order to meet spring and summer flow targets for Lower Granite and McNary, and includes summer draft limits for the storage projects.

WHAT DO THE TECHNICAL APPENDICES COVER?

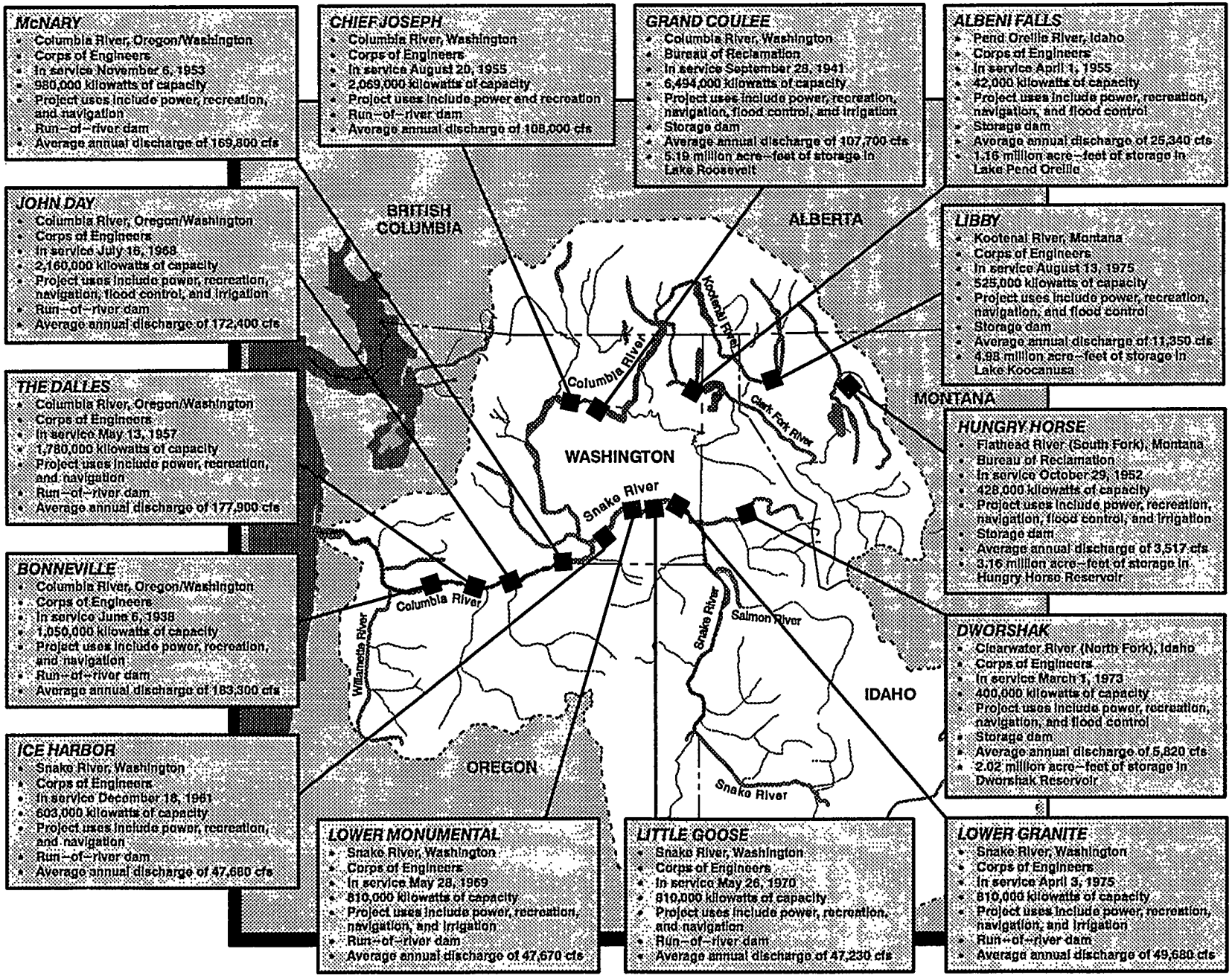
This technical appendix is 1 of 20 prepared for the SOR. They are:

A. River Operation Simulation
B. Air Quality
C. Anadromous Fish & Juvenile Fish Transportation
D. Cultural Resources
E. Flood Control
F. Irrigation/Municipal and Industrial Water Supply
G. Land Use and Development
H. Navigation
I. Power
J. Recreation
K. Resident Fish
L. Soils, Geology, and Groundwater
M. Water Quality
N. Wildlife
O. Economic and Social Impacts
P. Canadian Entitlement Allocation Agreements
Q. Columbia River Regional Forum
R. Pacific Northwest Coordination Agreement
S. U. S. Fish and Wildlife Service Coordination Act Report
T. Comments and Responses

Each appendix presents a detailed description of the work group's analysis of alternatives, from the scoping process through full–scale analysis. Several appendices address specific SOR functions (e.g., River Operation Simulation), rather than individual resources, or the institutional alternatives (e.g., PNCA) being considered within the SOR. The technical appendices provide the basis for developing and analyzing alternative system operating strategies in the EIS. The EIS presents an integrated review of the vast wealth of information contained in the appendices, with a focus on key issues and impacts. In addition, the three agencies have prepared a brief summary of the EIS to highlight issues critical to decision makers and the public.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.



1 million acre feet = 1.234 billion cubic meters
1 cubic foot per second = 0.028 cubic meters per second

Figure P–1. Projects in the System Operation Review.

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CHAPTER 1

SCOPE AND PROCESS

1.1 WORK GROUP FORMATION, AGENCY COORDINATION, AND PUBLIC INVOLVEMENT

The Wildlife Work Group (WWG) was formed in the summer of 1991, four months after the initial creation of technical work groups. Originally, wildlife and resident fish issues were handled by a single work group. However, as a result of comments received at public scoping meetings in August, 1991, and the realization that wildlife and resident fish have different concerns and priorities, the group was divided and a separate WWG was formed.

The WWG is composed of representatives from seven Federal agencies, three states, seven Tribes, public utilities, environmental groups, consulting firms, British Columbia Hydropower Authority (BC Hydro), Canadian Wildlife Service, and private individuals with regional and/or local wildlife expertise.

Throughout the SOR technical analysis, these groups and individuals have been divided into two categories: Tier 1 is composed of active participants and full working members; Tier 2 is composed of review–level participants who received all Work Group meeting notes and products. Members of the public who have expressed concern and given input but have not participated to the threshold of Tier 1 or Tier 2 are referred to as the 'general public.' Information is available to them on request.

Table 1–1 is the list of the Work Group Tier 1 and Tier 2 participants.

1.2 SUMMARY OF WILDLIFE PUBLIC ISSUES AND MANAGEMENT CONCERNS

Columbia River basin reservoir habitats of today are very different from the riverine habitats that existed before major dam development. Not surprisingly, current wildlife populations reflect this. Wildlife resources are significantly reduced from the historic levels that existed prior to hydroelectric development. The exceptions are those species that have typically adapted well to human activities, such as Canada geese, gulls, and mallards, or upland game species such as deer and elk that are closely managed due to their economic value.

While hydroelectric development is part of the reason for the declining wildlife resource, it is not the only reason. Increasing urban and rural growth have contributed to habitat conversion. Exotic plant and animal species introduced throughout the Columbia River basin over the past 50 years compete directly with native wildlife populations for decreasing habitat. Common examples of introduced species are cheat grass, Eurasian water milfoil, purple loosestrife, carp, house sparrows, and starlings. Once these introduced species become established, entire biospheres are permanently altered, leading to a significant loss of wildlife diversity.

The Columbia River System Operation Review presents an opportunity to address impacts to the wildlife resource that emerge from operation of the hydrosystem. During the formal scoping phase of SOR and informal discussions over the preceding four years, significant issues and management concerns have been identified by individuals and group representatives that eventually became the focus of the wildlife analysis. Local concerns centered on shorebird habitat on the lower Columbia River, cattle grazing impacts on the Snake River, big game impacts at Lake Roosevelt, non–game as well as game species impacts, and impacts to the wildlife refuges on the lower Columbia River.

Table 1–1. Wildlife Work Group Participants

Tier 1: Ken Brunner, COE
John Cannon, EBASCO
Geoff Dorsey, COE
Dick Giger, FWS, retired
Loren Kronemann, Nez Perce Tribe
Ron McKown, USBR
Don Treasure, USBR
Gary Bunn, COE
Carl Christianson, COE
Paul Fielder, Chelan Co. PUD
John Grettenberger, FWS
Rosy Mazaika
Bob Shank, BPA
Chris Thoms, BPA
Charlie Craig, BPA

Tier 2: Scott Ackerman, COE
Val Akana, Strategic Decisions Group
John Annear, FWS
Paul Ashley, Washington Dept. of Wildlife
Dale Becker, Confederated Salish and Kootenai Tribes
Joel Bich, Yakama Indian Nation
Bob Bradley, BC Hydro
Dan Casey, Kalispell, MT
Alan Christianson, USFS
Rich Clark, USBR
Mike Denny, Blue Mountain Audubon
Rick George, Confederated Tribes of the Umatilla Reservation
Dave Goeke, Columbia NWR
Tracy Hames, Yakama Indian Nation
Jerome Hansen, Idaho Dept. of Fish and Game
Steve Judd, Colville Confederated Tribe
Val Kitchen, The Wilderness Society
Bob Krein, Oregon Dept. Fish and Wildlife
Mike Kuttel, Washington Dept. of Wildlife
Rick Lamont, Audubon Society
Larry Lockard, FWS
Terry Luther, Confederated Tribes, Warm Springs Reservation
Diana MacDonald, PNUCC
Greg Mallette, Vancouver BC, Canada
Matt McCoy, Golden Eagle Audubon Society
Joseph L. McCrea, Spokane Tribal Wildlife Committee
Jack Melland, Oregon Dept. of Fish and Wildlife
Chris Merker, UCUT Fisheries and Wildlife Center
David Mevers, Idaho Power Company
Kathleen Moore, Canadian Wildlife Service
Lisa Norris, USFS
Harvey Nyherg, Cio Flathead National Forest, MT
Peter Paquet, NPPC
Julie Rogoski, BPA
Rich Shepard, Portland, OR
John Stevenson, PNUCC
Karen Taylor–Goodrich, NPS
Jim Torland, Oregon Dept. of Fish and Wildlife
Jeri Williams, FWS
Robin Witt, Western Area Power Administration

Not all input regarding wildlife concerns fell within the scope of the SOR process. Input such as phasing out all engineered restraints on the system (removing dams), extending endangered species protection to ecosystems, including the upper Snake River in the SOR, and halting mainstem irrigation diversions throughout the region were judged to be outside the scope.

For the SOR process, the WWG used different modeling and analytic techniques to evaluate strategies for operating the hydrosystem. The goal of the analysis was to assess impacts to wildlife from the strategies, both compared with present operations and compared with operations in the foreseeable future. Specifically, the WWG examined changes in the timing and magnitude of stream flows and reservoir elevations that would result from each strategy at the 14 Federal projects in the Columbia River system, as well as other projects and stream reaches affected by proposed changes. The concept underlying the analysis of streamflow and reservoir elevation is that these two results of hydrosystem operations largely determine the amount and quality of surrounding wildlife habitat. If hydrosystem operation negatively impacts habitat relative to the needs of its wildlife, the wildlife will decline.

A regional map of the Columbia River System provided in Figure 1–1.

1.3 SCREENING ANALYSIS

Following the Scoping process, 90 systemwide preliminary operating alternatives were submitted for the Screening Analysis by members of the public, by each of the technical work groups, and by various public and private groups. These preliminary alternatives represented a wide variety of operational possibilities ranging from current operations to those emphasizing single and multiple river uses.

The WWG developed two systemwide alternatives, entitled WLD – IDEAL, and WLD – REAL. Each alternative provided (in a slightly differing way) for stable reservoir elevations. The WWG next analyzed the 90 preliminary alternatives for their effect on wildlife resources in selected river reaches and hydroprojects, using quantitative and qualitative modeling techniques. (*See the Columbia River System Operation Review Screening Analysis, volume 1 & 2 for modeling techniques and results.*)

1.4 FULL–SCALE ANALYSIS

For Full–scale Analysis, the WWG revisited Screening Analysis methods and developed a matrix approach (*see Chapter Three, Study Methods*). The matrix evaluation was preferred because it has been effective in the past for identifying and comparing complex effects of proposed actions on wildlife habitats and populations. Early–on in the SOR process, the variability and lack of available data on a systemwide basis was identified as an issue affecting the wildlife analysis. Some parts of the system had considerable wildlife information, while others had little that was useful. For example, ample information might be available for Canada geese in one area, but little for shorebirds; or shorebird information might be available for a single reservoir, but not other project locations.

Compounding this problem, varying climatic zones, vegetative types, topography, and wildlife species greatly increased the complexity of the systemwide wildlife study.

A long–term benefit of the WWG's study methods has been the development of assessment techniques suitable for systemwide analysis that uniquely addresses public issues and management concerns identified in the scoping process.

1.4.1 Assumptions

Any analysis incorporates a number of basic assumptions. The methodological assumptions agreed to by the entire Work Group are noted in Chapter 3. Other assumptions by the Work Group about future activities in the region were necessary to estimate future conditions and impacts. Those assumptions concerning future trends include:

- The increasing growth in human population will continue;
- The Hanford Reach will remain undeveloped;

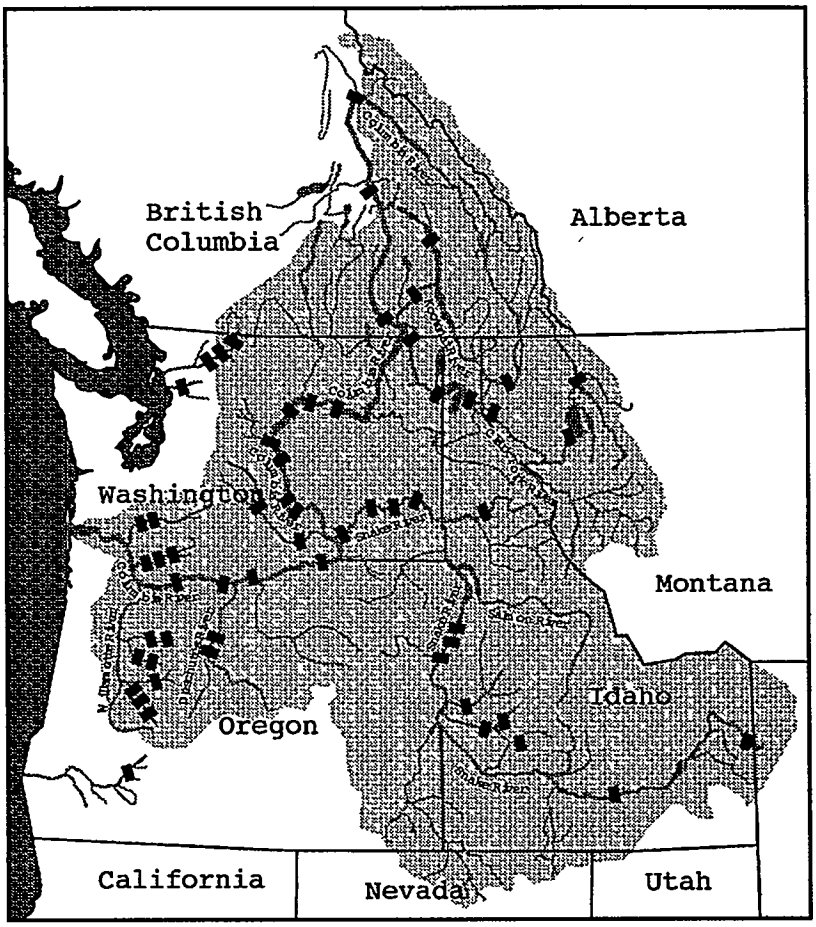

Figure 1–1. Columbia River Basin Major Dams

- No new dams will be added to the system;
- Normal weather patterns, based upon the existing 50 years of data, will continue;
- Existing Federal, state, and local laws/ordinances/ and regulations will remain in effect.

1.5 WILDLIFE RELATED LAWS AND REGULATIONS

Several Federal wildlife and other environmentally–related laws, as well as state, areawide, and local plans and programs, apply to the SOR. Federal laws specific to wildlife and associated shoreline habitat issues are shown in Table 1–2.

Table 1–2. Major Federal Acts Affecting the Wildlife Community

Endangered Species Act as amended	**16 USC 1531**	**1973**
Fish and Wildlife Coordination Act as amended	16 USC 661	1934
Fish and Wildlife Conservation Act	16 USC 2901	1980
Pacific Northwest Electric Power Planning and Conservation Act	16 USC 839	1980
Coastal Zone Management Act	16 USC 1451	1972
Marine Mammals Protection Act	16 USC 1361	1972
Clean Water Act as amended	33 USC 1251	1972
Wild and Scenic Rivers Act	16 USC 1271	1968
Compliance and other procedures are fully discussed in Technical Exhibit # B.		

CHAPTER 2

EXISTING AND AFFECTED ENVIRONMENT

2.1 OVERVIEW: WILDLIFE IN THE COLUMBIA BASIN TODAY

Wildlife resources vary widely over the Columbia River basin. Four different physiographic regions overlap the 14 coordinated hydroelectric projects and other areas which may be effected by the proposed actions of the System Operation Review (Bernard R.S. and Brown, K.F., 1978). Each of these physiographic regions have typical plant and animal communities that may be effected by proposed systemwide river operations in different ways. Several project reservoirs and/or stream reaches cross boundaries of the physiographic regions, including Lake Celilo behind the Dalles Dam, Franklin D. Roosevelt Lake behind Grand Coulee Dam, the Snake River through Hell's Canyon, and the Clearwater River in Idaho. The physiographic regions are the Northern Pacific Border Region, the Cascade Mountain Region, the Columbia Plateau Region, and the Northern Rocky Mountain Region.

The Northern Pacific Border Region includes the Columbia River segment below Bonneville Dam. This area of the Columbia River is typified by a spruce–hemlock–Douglas–fir upland forest. The area immediately adjacent to the river typically has riparian and wetland habitats containing cottonwoods, willows, cattails, and bulrushes. Some typical wildlife species include Canada geese, herons, gulls, sandpipers, warblers, bald eagle, osprey, beaver, deer, and increasing numbers of marine mammals such as harbor seals and sea lions.

The Cascade Mountain Region includes Bonneville Reservoir and the lower end of Lake Celilo. This region typically has a Douglas–fir/silver fir forest upland with some riparian and wetland habitat type developed adjacent to the reservoirs. The shorelines of the reservoirs in this region have been significantly affected by highway and railroad construction in the past and there is significant human activity (including residentially zoned and occupied areas). As a result, wetland and riparian wildlife habitats are limited. Typical wildlife of this region include Canada geese, ducks, herons, sandpipers, woodpeckers, eagles, osprey, and beaver.

The Columbia Plateau region contains the upper end of Lake Celilo, as well as other Federal projects including John Day, McNary, Chief Joseph, Grand Coulee (in part), Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams and reservoirs. Other facilities and reaches that occur within the Columbia Plateau physiographic region include: Brownlee and that downstream portion of the Snake River through Hell's Canyon to the upper end of the Lower Granite reservoir; the Public Utility District owned reservoirs on the mid–Columbia; and the Hanford Reach of the Columbia River. This region is dominated by a shrub–steppe environment, typified by fescue–wheatgrass, wheatgrass–bluegrass, sagebrush steppe, and wheatgrass–needlegrass shrub–steppe habitats in the uplands. Much of this upland habitat has been significantly altered by agricultural activity. Riparian and wetland communities are limited and in some cases are artificially developed and maintained as mitigation and licensing requirements for previous Federal and public utility actions. Typical wildlife include Canada geese, mallards, herons, terns, stilts, killdeer, swallows, warblers, bald and golden eagles, beavers, otter, mule deer, falcons, gopher snakes, and turtles.

Libby, Hungry Horse, Albeni Falls, and Dworshak projects are entirely within the Northern Rocky Mountains Region. The upper part of Franklin D. Roosevelt Lake, the Clearwater River, and part of the Snake River below Brownlee project are also in the physiographic region. As a region influenced by mountains, the various habitats are more diverse here than in the Columbia Plateau region. Primary

upland vegetation includes pine, fir, cedar, hemlock, wheatgrass, fescue, and needlegrass. Wetland and riparian areas are scattered but can be locally significant. Typical wildlife species include mergansers, sandpipers, waterfowl, osprey, bald eagles, beaver, otter, deer, elk, and bighorn sheep.

2.2 PROJECT BY PROJECT DISCUSSION

Each project and reach potentially impacted by proposed operational changes in the coordinated Columbia River system were examined individually. Local experts in wildlife management issues were contacted to assure the discussions were as accurate as possible. Beginning in the upstream areas of the Columbia River and working downstream to below Bonneville Dam, the existing wildlife resources are summarized by project and reach. In some cases, the resources are similar enough that several projects and/or reaches are combined in a single discussion.

The information presented on the following pages of this chapter was gathered from published and unpublished reports and discussions with local professional wildlife biologists, and unpublished information. The amount and quality of recent information available to the authors for each reach and reservoir varied and is reflected in this chapter.

In developing study methods, the Wildlife Work Group selected five habitats for impact analysis. These habitats were selected because they are sensitive to changes in reservoir elevations and operations, and because they effect a wide variety of wildlife. These habitats are:

Drawdown/Barren Zones: The drawdown/barren zone is a shoreline habitat devoid of vegetation. Lack of vegetation is generally associated with erosion and/or withdrawal of water due to reservoir operations. Increases in the drawdown/barren zone tend to negatively impact wildlife values, since the lack of vegetation and cover reduces availability of resources for most species. However, impacts can be duration–dependent. When the barren zone first makes its appearance, it acts as a barrier to wildlife migrating among quality habitats. The size of the barren zone is irrelevant at this stage, and a small barren zone is as effective a barrier as a larger barren zone. Should the barren zone persist, however, certain species may benefit, such as shorebirds, that would use the zone for feeding and nesting.

Riparian Zone: Riparian habitat is a special class of shoreline wetland habitat that is typified by development of woody shrubs and tree species. Riparian habitats are inundated part of the year, and species such as cottonwood that depend on regular groundwater and require scouring to establish new seedlings thrive in them. Riparian habitats contain an abundance and variety of wildlife. Some species such as mink spend entire life cycles in the riparian habitats, while other species complete critical life cycle activities in them such as nesting. Riparian habitats are dependent on available water, and therefore are sensitive to river operations which may increase or decrease stream flows.

Emergent Wetland Zone: Emergent wetland zones are classic wetlands. Marshy areas typified by cattails and bulrushes, these habitats are inundated with water most of the year, although they can tolerate some drying. Some species such as muskrats spend their entire life cycles in emergent wetlands, and could not exist elsewhere. Other species use emergent wetlands for incidental activities, such as white–tailed deer, which fawn in them. Wetlands typically depend on water depths and seasonal inundation patterns that are directly impacted by reservoir operations.

Submerged Aquatic Plant Zones: Submerged aquatic plant zones are areas of plants that spend their entire life cycle underwater. These submerged plants are a food source for several species of wildlife, including diving ducks. As with emergent wetlands, submerged aquatic plant beds depend on certain water depths and seasonal inundation patterns. Their existence is closely tied to river and reservoir operations.

Islands: Islands are bodies of land completely surrounded by water. Any individual island may contain one, several, or all of the habitats described above. As a result, they tend to support an abundance and variety of wildlife. Certain species, such as terns, exclusively use islands for nesting and

reproduction, while other species such as Canada geese use islands as preferred nesting sites. Islands are attractive to many species of wildlife because they provide security from mainland predators. Islands owe their existence to water elevations, and any changes in operations may directly effect their habitat profiles and their value to wildlife species.

The Wildlife Work Group also analyzed two categories that can only loosely be described as habitat zones for wildlife, although what takes place in the zones directly impacts wildlife values:

Primary Fish Productivity Zones are simply those areas within reservoirs and river reaches that produce fish populations. Many species of wildlife – bald eagles, osprey, bears, otter, etc. – feed on fish, and the work group evaluated how river operations may effect the capacity of these areas to produce food sources (known as 'prey base'). Should river operations significantly impact an area's capacity to produce fish, any variety of wildlife that feed primarily on fish are expected to decline.

Benthic Invertebrate Productivity Zones are those areas at the bottom (benthic zone) of reservoirs and river reaches that are producers of invertebrates. These invertebrates are valuable to wildlife as sources of food. Otters, for instance, feed on crayfish, and diving ducks feed on freshwater mussels.

Finally, the continuing effect of human activities on wildlife resources has been examined for each project/reach and alternative. Human effects range from incidental visits by recreationalists to the conversion of habitat through development of residential and/or industrial areas. All have critical effects on existing wildlife populations.

2.2.1 Lower Kootenai River

The Kootenai River is 485 miles long and approximately one–third of it lies in the United States. It originates in British Columbia and flows south though the Rocky Mountain Trench. The Kootenai River enters Montana near Eureka, and swings West at the confluence with the Fisher River. It then runs past Libby and Troy and enters Idaho, where it flows north into British Columbia once again and empties into Kootenay Lake, and eventually into the Columbia River. The area is characterized by high, rugged, forested northwest–trending mountain ranges separated by narrow linear valleys. The area downstream of Libby Dam is characterized by relatively flat terraces that lie at intervals between the riverbanks and steep mountain slopes. The meandering Kootenai River below Libby Dam has an average stream gradient of 0.1 percent, with the river dropping approximately five feet per mile. Elevations of the study area vary from 2,100 feet at the valley floor to over 5,000 feet on mountain ridges.

The Upper Columbia United Tribes, in particular the Kootenai Tribe of Idaho, have a strong interest in the resources of the Kootenai River, especially its bull trout, cutthroat trout, rainbow trout, whitefish, and burbot. The Confederated Salish and Kootenai Tribes of the Flathead Indian Reservation also have a strong interest in this region's resources.

2.2.1.1 Physical Habitat

Barren Zone

Gravel bars and some portions of the shoreline are intermittently exposed during low flows and comprise a majority of barren area acreage.

Operation of Libby Dam has been blamed for increased shoreline erosion of the Kootenai River, particularly in the Idaho reach upstream of Bonners Ferry. Erosion is caused by varying flows through the winter months. An important mechanism of bank erosion is high flows resulting in ice forming high on the banks. As the flows drop, the ice falls, taking bank soils with it.

Upland Zone

The upland zone vegetation occurring in the Kootenai River basin between Libby and Bonners Ferry may be broadly separated into three types: south–facing slope, north–facing slope, and bottomland.

South–facing slopes are generally characterized by scattered, open stands of ponderosa pine, and a limited amount of Douglas–fir. Understory species are bitterbrush, western serviceberry, and chokecherry. Other shrubs occurring include creeping Oregon

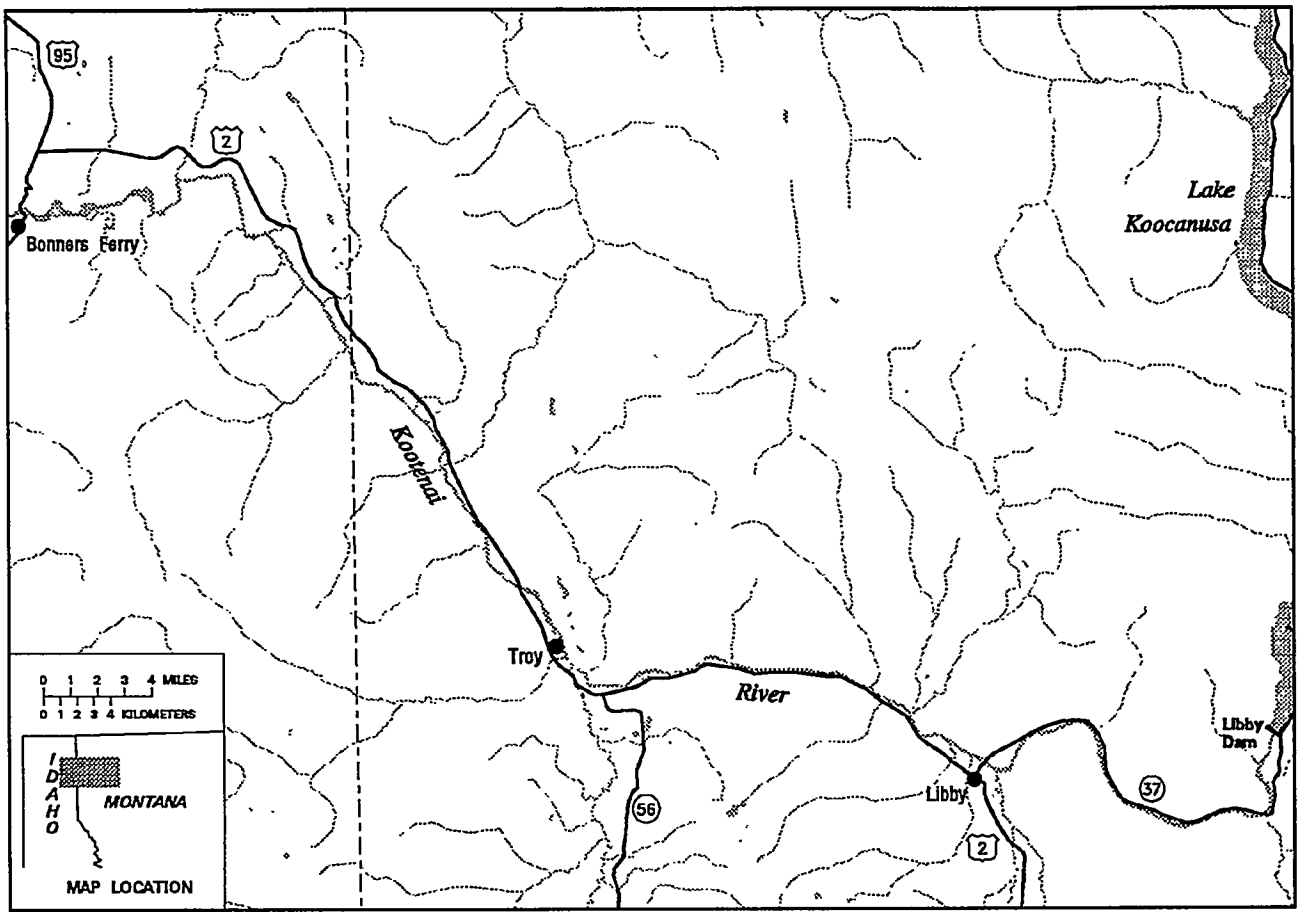

Figure 2–1. Lower Kootenai River

grape, and white spiraea. Major forbs found are yarrow, arrowleaf balsamroot, and dogbane. Dominant grasses include bluebunch wheatgrass, and rough fescue.

North–facing slopes south of the Kootenai River are usually densely timbered with mountain maple, Douglas–fir, western larch, and lodgepole pine. Understory shrubs consist of mock orange, ninebark, snowberry, and kinnikinnick. Forbs present include heartleaf arnica, Sego lily, as well as lupine and yarrow. The predominant grass is pine grass.

Meadows occur in several areas. Grasses include brome grasses, bluegrass, Junegrass, Idaho fescue, needlegrass, and bluebunch wheatgrass.

Riparian Zone

Riparian habitat is discontinuous along the river. Habitats (within the floodplain) can be divided into coniferous forests and deciduous forests. Coniferous forests consist of Douglas–fir, and western redcedar. Understory species include Oregon grape, Rocky Mountain juniper, and Canadian buffaloberry. Dominant deciduous overstory species include black cottonwood, alder and willow. Understory vegetation includes dogwood, gooseberry, chokecherry, ninebark, and serviceberry.

Total existing riparian area includes 1,775 acres from Libby Dam to the US border (Ebasco unpublished report).

Emergent Wetland Zone

Marsh areas support aquatic plants such as sedge, cattail, and pondweeds, though emergent wetlands are continuous and small in size. Total emergent acres: 1,574 (Ebasco, 1992).

Submerged Aquatic Plant Bed Zone

Filamentous algae and pond lily are common in the Kootenai River ecosystem, where flows are slack and water is shallow. Total acres: 553.

Island Habitat

Islands developed from the gravel bars on the Kootenai River are maintained in early successional stages through continued water level fluctuations. A variety of shrubs, forbs, and grasses do eventually colonize these areas and include willow, sweetclover, cocklebur and thistle. The bars and vegetated islands are vital habitat for numerous shorebirds, ducks, and geese. Total island acreage: 510.

Fish Productivity Zone

Introduced kokanee salmon entrained from Libby Dam provide food for eagles and osprey as well as some aquatic furbearers. Native whitefish also provide forage.

Benthic Invertebrate Productivity Zone

Benthic invertebrates in the Kootenai River are restricted in abundance by the fluctuating water levels that are the result of Libby Dam operations, as well as the generally cold water temperatures. Typical species include the larvae of mayflies and midges, and crayfish.

Human Effects

Three towns are situated along the lower Kootenai River: Libby, Troy, and Bonners Ferry. Highways 37 and 2 parallel the river for its entire length in this reach. Typical human uses include recreation (boating and fishing), and being repository to treated wastes.

2.2.1.2 Wildlife

Waterfowl

The Kootenai River Basin lies primarily within the Pacific Flyway. Mallards, harlequin ducks, pintail, American wigeon, teal, gadwall, goldeneye, American coot, common merganser, tundra swan, and Canada goose constitute the principal waterfowl species. The ten mile reach of the river below Libby Dam does not receive heavy use by waterfowl, although occasionally flocks of up to 30 waterfowl feed and rest on the slower moving backwater areas near the river islands. Harlequin ducks nest in smaller tributary streams, and possibly along the Kootenai River as well. Canada goose and duck nesting occurs on some of the river islands and among the grasses and/or dense vegetation growth associated with these habitats.

Colonial Nesting Birds

No colonial nesting birds are known to occur in this reach of the Kootenai River.

Shorebirds

Some shorebird species seasonally use the Kootenai River area for feeding and as a rest stop during southern migration. Species include the common snipe, spotted sandpiper, and lesser yellowlegs. Common snipe and spotted sandpiper may nest near the river.

Nongame Birds

The passerine bird life of the area is representative of northern coniferous forests including such species as the mountain chickadee, downy and pileated woodpeckers, common nighthawk, western tanager, cordilleran flycatcher, red–breasted nuthatch, common flicker, American robin, Swainson's thrush, northern flicker, house sparrow, red–eyed vireo, fox sparrow, pine siskin, dark–eyed junco, and Steller's jay. River habitats also supports the belted kingfisher, redwing blackbird, yellow warbler, and dipper.

Upland Game Birds

Upland game in Kootenai River basin include ruffed, blue and spruce grouse, ring–necked pheasants, and mourning doves. Chukar, sharp–tailed grouse and

Hungarian partridges also occur. Ruffed grouse are the most common species of grouse, occurring at lower elevations, while blue and spruce grouse prefer higher, more mountainous areas. Agricultural lands near Bonner's Ferry support moderate numbers of ring–necked pheasants and migrating mourning doves. The wild turkey can also be found along the river.

Raptors

Ospreys and bald eagles perch in tall bankside cottonwood and Douglas–fir trees along the riparian areas below the mouth of the Fisher River. Four pairs of bald eagles nest along the Fisher River, and six pairs nest along the Kootenai River in Montana. Migratory and wintering concentrations of bald eagles occur below Libby Dam. Great–horned owl, goshawk, red–tailed hawk, and short–eared owl are other common raptors that inhabit the area.

Aquatic Furbearers

Beaver, muskrat, mink, and river otter constitute the principal furbearers inhabiting the Kootenai River basin. Beaver colonies are found primarily along the Kootenai mainstem downstream of Bonners Ferry and along certain gradient tributaries. Diked agricultural lands near Bonners Ferry support the bulk of the muskrat populations. Small numbers of mink and river otters occur along main watercourses in the timbered areas of the basin.

Terrestrial Furbearers

Weasels, skunks, and raccoons are abundant in the area. Martens use heavily forested localities at higher elevations and wooded areas at lower elevations.

Big Game

Principal big game animals in Kootenai River basin are white–tailed deer, mule deer, elk, black bear, and moose. Less common species are grizzly bears, mountain goats, bighorn sheep, and woodland caribou. Grizzly bears inhabit the roadless backcountry of the extreme northeast and northwest corners of the basin. Black bears can be found from the Douglas–fir forests of the mountains to the wet meadow riparian areas by the river. White–tailed deer are abundant within the region with the largest concentration inhabiting the river basins and bottomlands.

Mule deer are less numerous and found at higher elevation in scattered herds. Elk herds are small, widely dispersed, and occur principally in the Moyie and Fisher rivers' drainages, and the Dunn Creek drainage. Elk also occur in the Boulder Creek and Alexander Creek drainages. Herds use the north and east facing slopes at higher elevations. Moose prefer the bottomlands along lakes and streams and early successional habitat.

Winter range is restricted to narrow areas along the Kootenai River and the lower reaches of lateral drainages on south and west facing slopes. Migrations to winter range generally occur during late October or early November. During normal winters, elk, and sometimes moose, are in direct competition with deer for food and cover on winter range. Common browse species used by big game include chokecherry, ceanothus, serviceberry, bitterbrush, mountain maple, red–osier dogwood, willow, aspen, and kinnikinnick. Mountain goat and Bighorn sheep inhabit rocky cliffs, benches and steep terrain in small bands. Bighorn sheep graze in meadows at lower elevations during winter.

Amphibians and Reptiles

Amphibians in this area include a few species of salamanders and frogs, and the western toad.

Reptiles include the painted turtle, garter snake, rubber boa, western skink, and the northern alligator lizard. Amphibians are closely tied to the river and its sloughs while reptiles can be found from upland coniferous forests to the mats of emergent plant bed in river sloughs.

Endangered, Threatened, and Sensitive Species

The USFWS has identified the following listed and candidate plant and wildlife species that may be found in the vicinity of the Kootenai River:

Idaho Portion of Kootenai River	
Grizzly bear, *Ursus arctos* Cabinet–Yaak Proposed Recovery Zone and Selkirk Proposed Recovery Habitat	threatened
Gray wolf, *Canis lupus*	endangered
Bald eagle, *Haliaeetus leucocephalus* 6 nest territories along the river; common winter resident	threatened
Northern goshawk, *Accipiter gentilis*	candidate 2
Wolverine, *Gulo gulo luscus*	candidate 2
Black tern, *Chlindonias niger*	candidate 2
Triangular–lobed moonwart, *Botrychium ascendens*	candidate 2
Montana Portion of Kootenai River	
Grizzly bear, *Ursus arctos*	threatened
Gray wolf, *Canis lupus*	endangered
Bald eagle, *Haliaeetus leucocephalus*	threatened
Peregrine falcon, *Falco peregrinus*	endangered
Water howellia, *Howellia aquatilis*	threatened

Bald eagles are common along the river throughout the year. Grizzly bears, gray wolves, and peregrine falcons are uncommon and rarely sighted near the river. At least one historic peregrine falcon eyrie is known from the cliffs adjacent to the Kootenai River. Black terns are found in scattered localities in quiet pond/marsh associations in northern Idaho, but are generally not associated with the Kootenai River. Northern goshawks and wolverines are both generally poorly known from the region, but are not likely to be closely associated with the Kootenai River. The triangular–lobed moonwart occurs near Lake Pend Oreille, but its status near the Kootenai River is unknown. Water howellia was listed in 1994, and its abundance and population status in Montana and Idaho are not well known.

2.2.2 Libby Dam and Lake Koocanusa

Short–term Operational Limits	
Lake Elevation	
Full Pool	2,459 ft
Minimum Pool	2,287 ft
Discharge	
Minimum instantaneous	2,000 cfs
Minimum daily flow	3,000 cfs
Rate of change of tailwater elevations	
May 1 – September 30 (1ft/hr)	4 ft/24 hrs
October 1 – April 30 (1ft/hr)	6 ft/24 hrs

Libby Dam was completed in 1976 (a fifth turbine was installed in 1984), and is located on the Kootenai River in Montana at river mile 221.9. The dam is located in the Kootenai River Valley of northwest Montana within the Kootenai National Forest. The area is characterized by high, forested northwest–oriented mountain ranges separated by narrow linear valleys. Downstream of Rexford, Montana, Lake Koocanusa occupies a narrow gorge, averaging one mile in width, between steep, coniferous forest–covered mountains with flat benches at the mouths of tributary streams. Above Rexford, extending a few miles north of the Canadian border, the reservoir is approximately two miles wide and the character of the shoreline changes to generally sloping, rolling terrain with extensive flat areas at or below pool level.

The Upper Columbia United Tribes, in particular the Kootenai Tribe of Idaho, are concerned with operation of Libby Dam and its effects on fish resources in the Kootenai River downstream of the dam. The Confederated Salish and Kootenai Tribes of the Flathead Indian Reservation also have a strong interest in the operation of Libby Dam.

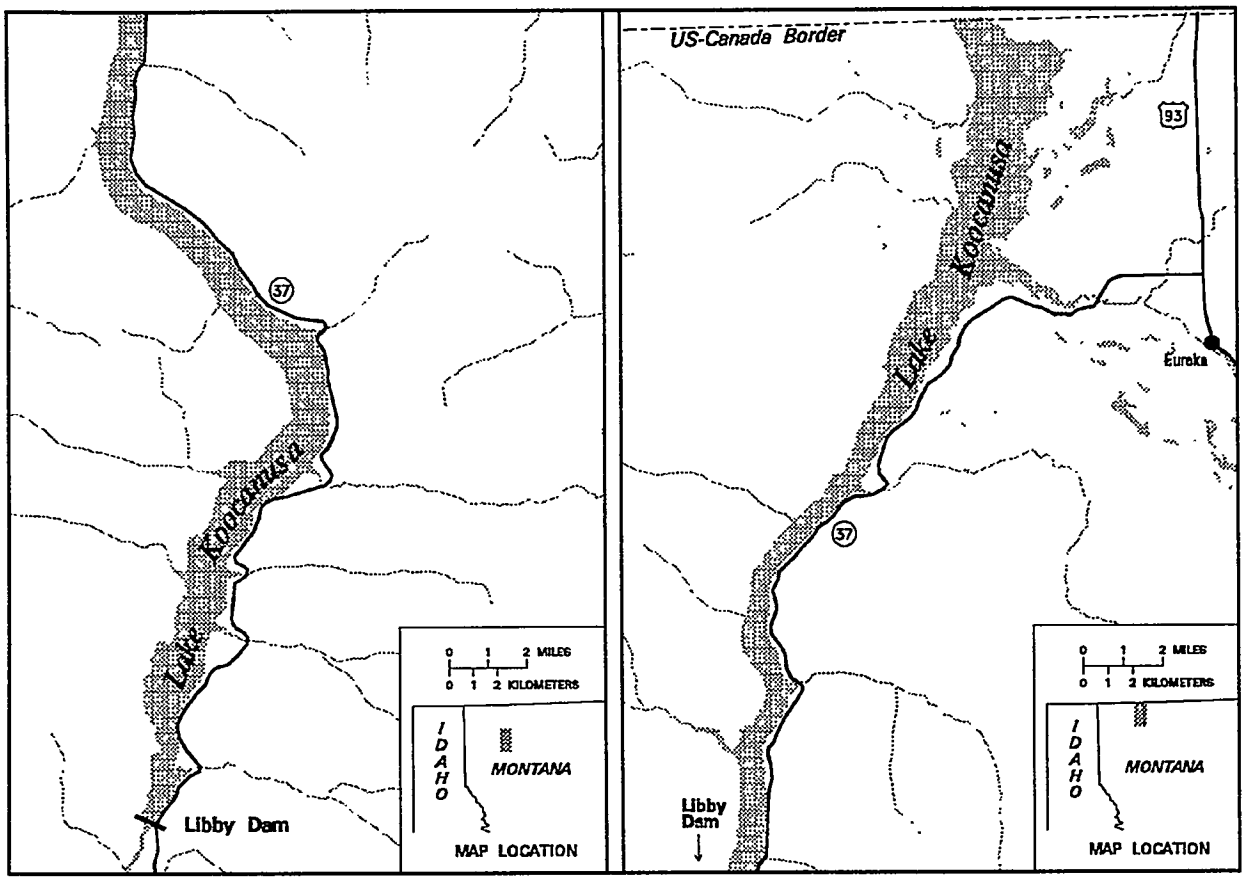

Figure 2–2. Libby Dam and Lake Koocanusa

2.2.2.1 Physical Habitat

Barren Zone

Bare sand and mud are exposed during the fall, winter, and spring drawdown, and during summers when the reservoir does not refill. Erosion can be a serious problem, particularly during winter wind storms when the substrate has dried out.

Upland Zone

Lake Koocanusa lies in a valley between two ranges that are north–south trending. Consequently, the forested slopes above the river are predominately east and west–facing slopes, with relatively few south– and north–facing slopes. The aspect of slopes at the Libby project area is an important factor in controlling vegetation colonizations in an area where the summers are hot and dry. Thus, south–facing slopes receive sun for a large portion of each day and consequently are the hottest and driest slopes. They are typified by a sparse growth of ponderosa pine and relatively few understory plants, including roses and ninebark. Ground cover is composed primarily of grasses and other herbaceous plants.

At the other extreme, north–facing slopes receive little to no direct sunlight, and tend to be cooler and steeper. These slopes do not become as dry, because they receive moisture from morning dew. Hence, vegetation is denser and more lush, usually showing a greater diversity of species. These slopes tend to be 85 percent Douglas–fir and 15 percent western larch, with a large number of understory plants including serviceberry and ocean spray.

The east– and west–facing slopes tend to show a gradation of community makeup encompassing a wide range of variability within the Douglas–fir/ western larch/ponderosa pine association. The west–facing slopes however, tend to be slightly drier than the east–facing slopes and are somewhat more open in structure. Vegetation communities include species common to both north and south–facing slopes and usually have the greatest diversity of vegetation and animal species. Understory plants consist of ninebark, snowberry, kinnikinnick, Oregon grape, ocean spray, mock azalea and serviceberry.

Riparian Zone

Plant species in riparian areas include cottonwood, willow, red–osier dogwood, mountain alder, birch, serviceberry, and ninebark. Riparian areas are important not only for the variety of food and cover they provide for wildlife, but also for their ready availability of water. Riparian areas provide an especially rich variety of foods including buds, twigs, catkins, seeds, and fruit. The riparian areas also provide tree perches for ospreys and bald eagles. Canada geese and other waterfowl nest among the grasses and/or dense vegetation growth associated with these habitats. Riparian habitats are restricted to only 24 acres, mostly associated with tributary streams.

Emergent Wetland Zone

There is only one significant emergent wetland near Lake Koocanusa. Total acreage of emergent wetlands is approximately 24 acres.

Submerged Aquatic Plant Bed Zone

There are no aquatic plant beds in Lake Koocanusa.

Island Habitat

One hundred and twenty acres of islands in the reservoir contain Douglas–fir, western larch, and western redcedar in the overstory. The understory consists of Rocky Mountain juniper, common juniper, birch, ninebark, snowberry, and Oregon grape. This vegetation complex supports a limited range of wildlife species.

Fish Productivity Zone

Salmonids provide prey for bald eagles. Other species of fish are prey for the osprey.

Benthic Invertebrate Productivity Zone

The benthic life within the reservoir is severely restricted by the wide seasonal drawdowns that occur. Populations of insect larvae exist along with some limited numbers of crayfish.

Human Effects

Recreation is restricted to boating and fishing during the summer months.

2.2.2.2 Wildlife

Waterfowl

The Kootenai River basin lies primarily within the Pacific Flyway. Mallard, pintail, American wigeon, teal, gadwall, goldeneye, wood duck, western grebe, common merganser, and tundra swan are seasonal migrants. Nesting is rare along this reservoir, and is limited to mallards and common mergansers.

Colonial Nesting Birds

No colonial nesting birds are known to occur in Lake Koocanusa.

Shorebirds

Some shorebird species seasonally inhabit the dam area for feeding and as a rest stop during southern migration. Species include the common snipe, spotted sandpiper, and lesser yellowlegs. The common snipe and spotted sandpiper may nest in the vicinity of Lake Koocanusa.

Nongame Birds

The bird life of the area is representative of coniferous forests including such species as the mountain chickadee, woodpeckers, swallows, wrens, bluebirds, finches, chickadees, wrens, red–breasted nuthatch, common flicker, American robin, hermit thrush, red–eyed vireo, fox sparrow, pine siskin, and dark–eyed junco. Island wildlife includes common flickers, belted kingfishers, and several other species of small birds.

Upland Game Birds

Upland game birds which might be found within the project area include ruffed and blue grouse. Ruffed grouse are the most common species of grouse occurring at lower elevations, while blue grouse prefer higher, more mountainous areas. The kinnikinnick fruit seems to be preferred by blue grouse.

Raptors

Great–horned owls, goshawks, and red–tailed hawks inhabit the forests surrounding the reservoir.

Aquatic Furbearers

Mink, river otter, and muskrat constitute the principal furbearers found along the shore of Lake Koocanusa. However, numbers near the reservoir are limited due to the extensive barren area between the water in the reservoir and shoreline vegetation during most of the year (i.e., when the reservoir is less than full).

Terrestrial Furbearers

Common furbearers include raccoon, cottontail rabbits, porcupine, shrews, marten, bobcat, weasel, coyote, mountain lion and black bear. Island furbearers include red and flying squirrels.

Big Game

Higher elevations of the slopes are the preferred summer range of deer, sheep, and elk, while the lower bottomland elevations provide winter habitat for big game. The north–facing slopes are generally used for escape and bedding cover by big game, primarily because of the lack of sunlight to the forest floor (due to the denser overstory vegetation). In addition, these slopes in the project area tend to be relatively steep, which likely discourages use by big game predators to some degree. The availability of grass on south–facing slopes makes them important seasonal feeding areas for mule deer and elk. White–tailed and mule deer favor the snowberry for its shoots and foliage, but also eat the shoots and foliage of Oregon grape, Ponderosa pine, and Douglas–fir. White–tailed deer also show an additional preference for kinnikinnick fruit. Moose seek the bottomlands for the twigs and foliage of the red–osier dogwood, willows, alder, and birch.

A moderate number of mountain lions, and black and grizzly bear are found throughout this region.

Amphibians and Reptiles

Amphibians in this area include a few species of salamanders, frogs, and the western toad. Reptiles include the painted turtle, garter snake, rubber boa, western skink, and the northern alligator lizard.

Endangered, Threatened, and Sensitive Species

The USFWS has indicated the following listed species may be found in the vicinity of Lake Kookanusa:

Lake Kookanusa.	
Grizzly bear, *Ursus arctos*	threatened
Gray wolf, *Canis lupus*	threatened
Bald eagle, *Haliaeetus leucocephalus*	threatened
Peregrine falcon, *Falco peregrinus*	endangered
Water howellia, *Howellia aquatilis*	threatened

Four pairs of bald eagles nest along the shores of Lake Koocanusa; 20 to 50 bald eagles may winter along the Kootenai River just below the dam. Grizzly bears, gray wolves, and peregrine falcons are uncommon near Lake Koocanusa and are rarely observed.

2.2.3 Hungry Horse Project

Short–term Operational Limits	
Lake Elevation	
Normal Full Pool	3,560 ft
Minimum Pool	3,336 ft
Discharge	
Minimum	400 cfs
Maximum (limit during flood control operations)	500 – 3,000 cfs

Hungry Horse Dam was completed by the Bureau of Reclamation in 1953 for flood control and hydropower generation on the Flathead River. The dam is located on the South Fork of the Flathead River five miles upstream of its confluence with the main stem of the Flathead River, seven miles southeast of Columbia Falls, and 11 miles south of the west entrance to Glacier National Park (BPA, 84). The Bureau attempts to maintain reservoir levels between 3,560 feet msl (full pool) and 3,475 feet, except under conditions of extreme runoff. In recent years, however, annual drawdown has ranged from 66 feet (1990) to 178 feet (1988), and has exceeded 85 feet in four out of six years. Between 1988 and 1993, the pool has refilled only twice.

Maximum power generation at full pool is achieved from Hungry Horse Dam at about 12,500 cfs. The Bureau typically releases about 10,000 cfs, and is required to maintain a minimum of 135 cfs in the South Fork and 3500 cfs in the main stem of the Flathead River to protect fish. In recent years, releases from the Dam have tended to range over a period of several days from a low near 135 cfs, to a high of about 10,000 cfs. The (ramping) rates at which releases are increased or decreased are modulated under agreement with Montana Department of Fish, Wildlife and Parks (Richard Clark, USBR, Hungry Horse Dam, personal correspondence). Because the channel capacity of the South Fork is approximately 20,000 cfs, the wide fluctuations in releases that occur over a several–day period tend to maintain at least the lower portion of the channel (that is, nearest the channel bottom) free of vegetation. Riparian vegetation growing along the channel's edges above the 20,000 cfs level is rarely inundated.

Existing Mitigation Program

The Montana Department of Fish, Wildlife and Parks (MDFWP) and US Forest Service are cooperatively implementing the Hungry Horse Habitat Enhancement Project and the Habitat Protection Project, which are designed to mitigate effects on wildlife habitat resulting from construction of Hungry Horse Dam. The two projects (as well as the Libby Habitat Enhancement Project) are funded by a trust account established as part of the Wildlife Mitigation Agreement for Libby and Hungry Horse Dams signed by the State of Montana and Bonneville Power Administration. The projects are described by Wood et al. (1995), from which the following was summarized.

The Hungry Horse Habitat Enhancement Project was designed "primarily to mitigate the loss of seral shrubfields used as elk winter range". Project activities include timber harvesting, slashing and burning on selected forest stands, and seeding with forage species. The project is a cooperative effort between MDFWP and Flathead National Forest. The areas selected are not influenced by water levels in Hungry Horse Reservoir.

The Habitat Protection Project was designed "primarily to protect riparian, wetland, palouse prairie [associated with Libby Dam], and mature/old growth forest habitats." Species expected to benefit include grizzly bear, waterfowl, terrestrial furbearers, numerous small mammals and birds associated with riparian and old growth habitats, mule deer, elk, white–tailed deer, aquatic furbearers, bald eagle and osprey. Goals include protection and/or enhancement of 4,564 acres of prime wetlands in the Flathead Valley, and protection of 8,590 acres of riparian habitat and travel corridors. The project is implemented by MDFWP in consultation with a Habitat Protection Committee comprising biologists from various agencies and conservation groups. Location of specific wetlands and riparian areas have not been finally identified, but some of the wetland areas will be dependent on Flathead River hydrology and would likely be influenced by Columbia River System operations.

Trust funds are also being used in a cooperative effort to mitigate the effects of the recent prolonged drawdown of Hungry Horse Reservoir. The three cooperating agencies are MDFWP, Flathead National Forest, and the US Bureau of Reclamation. The upper reaches of the Reservoir, in the vicinity of Spotted Bear, have been exposed year–long in seven of the last ten years, allowing eroded sediments and dust to degrade water quality. To miti-

gate the effects of prolonged drawdown, six objectives have been identified:

- improve water quality by decreasing wind and water erosion;
- promote insect nesting for fish prey;
- improve waterfowl habitat by vegetating low porosity swales and potholes;
- increase elk winter forage;
- improve aesthetics by decreasing bare soil;
- establish native vegetation to deter invasion by noxious weeds.

Initial efforts to meet these objectives have involved seeding approximately 50 acres of mud flats along the east and west shore of the upper reaches of the Reservoir. Seeding success and vegetation survival will be monitored in 1995. Additional efforts under consideration for 1995 include more seeding, transplanting of shrubs, and some form of weed control (letter from Carol Eckert, Flathead National Forest, to John Wachsmuth, MDFWP, dated March 6, 1995).

Relative to wildlife, significant physical features of this project include elevation above 4,000 ft, where there are several feet of snow every winter, and short growing seasons.

2.2.3.1 Physical Habitat

Barren Zone

Bare sand and mud are exposed during the fall, winter, and spring drawdown. Since 1988, Hungry Horse dam has failed to refill in the summer on several occasions (Reller and Collette, 93). Erosion can be a serious problem particularly during winter wind storms when the substrate has dried out and is susceptible to wind.

Upland Zone

The upland areas surrounding Hungry Horse Dam support many diverse habitats. Upland grasslands, meadows and floodplain terraces are dominated by bluebunch wheatgrass, rough fescue, Idaho fescue, and blue grass. Upland shrubland is dominated by the presence of several species including serviceberry, bitterbrush, Rocky Mountain maple, ceanothus, and snowberry (BPA, 84). Alpine forests dot the uppermost rims, along the side slopes and valley floors cool moist forests of Douglas–fir, larch, and ponderosa pine are interspersed with western hemlock and western redcedar. The understory is characterized by serviceberry, red–osier dogwood, and chokecherry.

Riparian Zone

The only riparian habitat (29 acres) is found along that portion of the South Fork just upstream of the reservoir. It consists of deciduous shrub and deciduous tree cover types. The deciduous shrub community consists of a shrub overstory with an understory composed of a variety of grasses, forbs and shrubs. Scattered deciduous or coniferous trees are occasionally found. Deciduous tree regions contain an overstory composed primarily of black cottonwood. A dense shrub and herbaceous understory is usually present. Scattered conifers are also found. The conifers are western hemlock, ponderosa pine, and western redcedar.

Emergent Wetland Zone

These are very limited around the reservoir. A total of 15 acres is found at the delta of the South Fork Flathead River.

Submerged Aquatic Plant Bed Zone

Communities of aquatic plants are similar to those found downstream at Flathead Lake. The species commonly found are elodea, knotweed, pondweed, parrotweed, duckweed, and milfoil. Aquatic plant beds cover 137 acres in the reservoir, nearly all of it at the delta of the South Fork Flathead River.

Island Habitat

Eleven coniferous islands remain in Hungry Horse Reservoir totaling 334 acres. The islands are surrounded by barren areas during drawdowns.

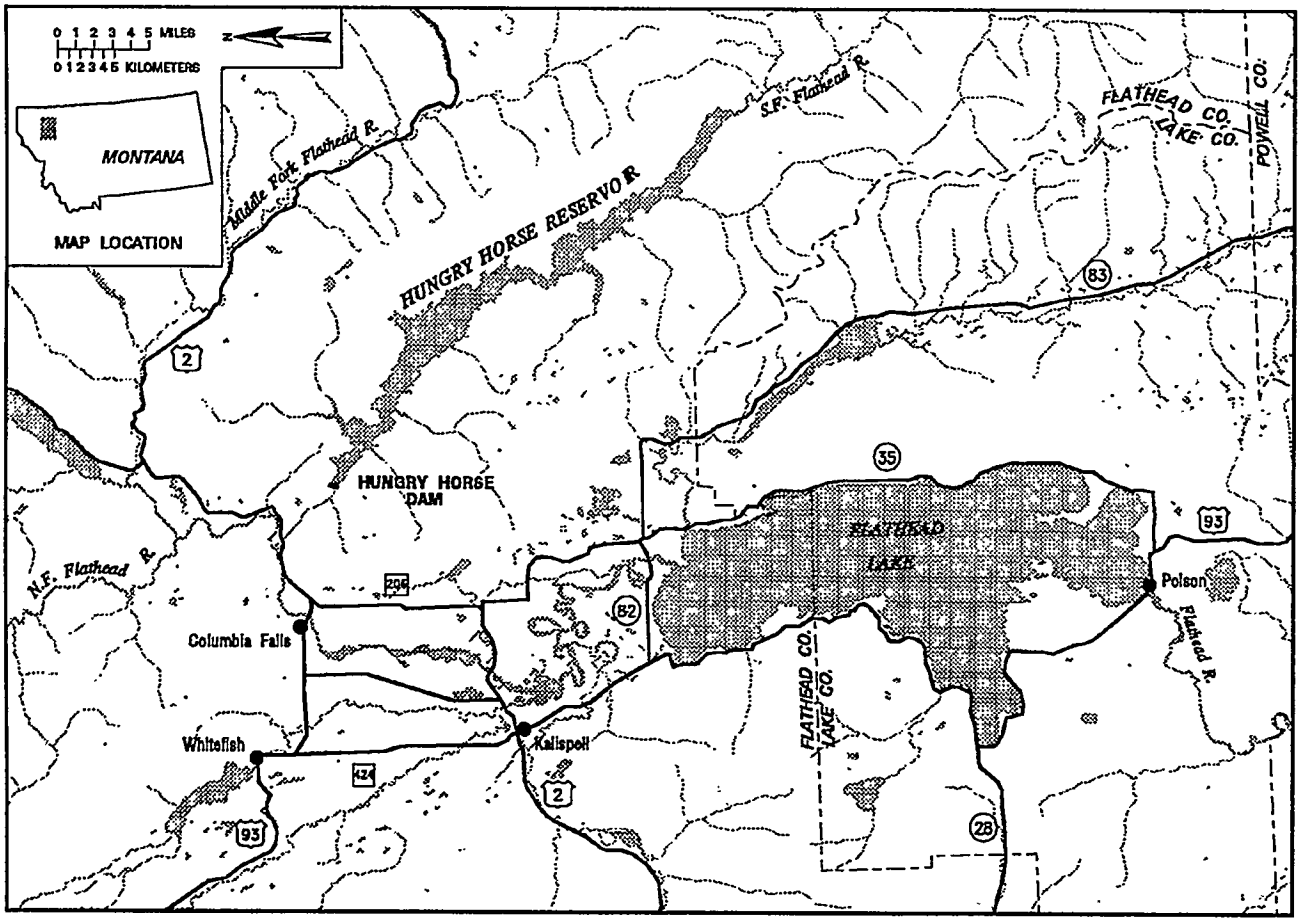

Figure 2–3. Hungry Horse Project, Flathead Lake, and Upper Flathead River

Fish Productivity Zone

The reservoir contains westslope cutthroat trout, bull trout, and kokanee. Bald eagles prey on these species, primarily on kokanee.

Benthic Invertebrate Productivity Zone

The benthic life within the reservoir is severely restricted by the wide seasonal drawdowns that occur. Populations of insect larva exist along with some limited numbers of crayfish.

Human Effects

Fishing, boating, and hunting are the principle recreation activities on and around the reservoir.

2.2.3.2 Wildlife

Waterfowl

Waterfowl seen at the project area include the Canada goose, mallard, wood duck, Barrow's goldeneye, common merganser, and a variety of other dabbling and diving duck species.

Colonial Nesting Birds

None.

Shorebirds

Some shorebird species seasonally inhabit the dam area for feeding and as a rest stop during southern migration. Species include the common snipe, spotted sandpiper, and lesser yellowlegs. The

spotted sandpiper may nest in the vicinity of Hungry Horse Reservoir.

Nongame Birds

The bird life of the area is representative of coniferous forests, including such species as the mountain chickadee, woodpeckers, swallows, wrens, blue birds, finches, chickadees, wrens, red–breasted nuthatch, common flicker, American robin, hermit thrush, red–eyed vireo, fox sparrow, pine siskin, and dark–eyed junco. Island wildlife includes common flickers, belted kingfishers, and several other species of small birds.

Upland Gamebirds

Ruffed grouse, spruce grouse, and blue grouse are all known to occur in the South Fork drainage. The ruffed grouse and blue grouse are common in the riparian areas, while spruce grouse are common in coniferous forests along the valley walls. Ruffed grouse prefer open hardwood stands with moderately dense herbaceous and sapling understory for courtship, nesting and broods (Landry, 80). Blue grouse typically breed in open stands of conifers interspersed with openings of herbaceous cover. Spruce grouse inhabit mixed coniferous forests, generally preferring subalpine spruce–fir and lodgepole pine. Spruce grouse also inhabit spruce–fir forests interspersed with fire induced serial stands of western larch and lodgepole pine.

Raptors

Great horned owls, goshawks, red–tailed hawks, ospreys, and bald eagles are represented near the reservoir. A single bald eagle nest is active on one island in the reservoir. Areas used for feeding and resting by eagles include portions of the river below the dam, and the upper end of the river valley above the reservoir.

At the time of the latest census, 18 osprey nest locations were known in the vicinity of Hungry Horse Reservoir (BPA, 1984). It is unknown how many active pairs used these nests during the 1993 breeding season.

Aquatic Furbearers

The most common aquatic furbearers of the area include beaver, muskrat, river otter, and mink. Beaver prefer riparian habitats along the South Fork and its tributaries, which has traditionally supported moderate populations of beaver. Optimal habitats for beaver are those areas where willow or poplars are available along permanent water courses (generally the larger tributaries). Muskrat probably use aquatic and streamside habitats along both the South Fork and its tributaries. Otters appear to be numerous along the river and use both the river and its tributaries. Backwater sloughs, streams, lakes, reservoirs, and beaver dens could also be important habitat for otters. Mink occur along the South Fork where they forage in riparian vegetation, overhanging banks, and log jams.

Terrestrial Furbearers

The pine marten inhabits mature coniferous timber with small openings. Bottomland and lower valley slopes of old growth with fire–caused openings, provide the most preferred of marten habitat. Lynx prefer the dense seral stands of lodgepole pine due to the high densities of showshoe hare, their preferred prey. Snowshoe hares reach their highest densities in these seral forests (Adams, 59). Other furbearers include weasel, skunk, and raccoon.

Big Game

Black bears are present along the riparian areas and lower benches. The large cottonwood trees located along the bottoms provide preferred type of denning sites (Jonkel and Cowan, 71). The riparian zones provide abundant lush vegetative forage during the spring, and an abundant late summer and fall food supply of berries and mast. Grizzly bears also reside in the project area. Grizzly bears select low level riparian areas after spring emergence because of the available succulent forage. In some areas big game carrion is an important source of spring food. During the summer period grizzly bears move up to higher elevations as the snow recedes. The fall period is spent in preparation for denning and the bears are forced back down to the lowland habitats for available food. The mountain lion is known to occur in a

variety of upland and bottomland areas (especially white–tailed deer habitat) where they feed on deer and elk. The bottomland and open shrubland slopes offer important winter range for prey species.

During the winter, elk require habitats that provide food, escape cover and thermal cover. Elk prefer habitats that support mountain maple, serviceberry, willow, chokecherry, dogwood, and ceanothus. Elk of the project area are not limited in the availability of summer range. A scattered population of mule deer exists around the project area. The deer are widely distributed in the summer with use in all the drainages. During the winter, the deer tend to concentrate on the open shrublands along south– and west–facing slopes where abundant forage is located. The white–tail deer population uses a wide variety of habitats throughout spring, summer, and fall. Winter ranges are in the south and west facing slopes along the east side of the drainage. Fires during the early portion of this century created extensive shrublands and conifer regeneration which, when combined with adjacent thermal cover, provide excellent winter range (BPA, 84). The further succession of thick lodgepole pine stands has caused a slight decline in white–tail deer numbers.

Reptiles and Amphibians

Amphibians typically associated with habitats found along the upper end of Hungry Horse Reservoir and South Fork of the Flathead River include spotted frog, tree frog, long–toed salamander and tiger salamander. Reptiles are generally scarce.

Endangered, Threatened, and Sensitive Species

The USFWS has identified five listed species that may be found in the vicinity of Hungry Horse Project (letter from R. Peterson, USFWS, to D. Treasure, USBR, dated March 29, 1995)

Grizzly bear, *Ursus arctos*	threatened
Gray wolf, *Canis lupus*	endangered
Bald eagle, *Haliaeetus leucocephalus*	threatened
Peregrine falcon, *Falco peregrinus*	endangered
Water howellia, *Howellia aquatilis*	threatened

No candidate species were included except for two fish species, which will be addressed in the Resident Fish and Anadromous Fish technical appendix (letter from R. Peterson, USFWS, to D. Treasure, USBR, dated March 29, 1995).

Grizzly bears roam the higher elevations around Hungry Horse Project. A single pair of bald eagles nests on an island (Clayton in Hungry Horse Reservoir). Gray wolves and peregrine falcons are seldom observed in the area. Water howellia has been reported from the Swan Valley, but not from anywhere along the Flathead River. It grows in "vernal glacial pothole ponds and former river oxbows" (USFS, 1994). Although some potential habitat occurs along the South Fork of the Flathead River below Hungry Horse Dam, the probability of water howellia occurring in the Flathead drainage is considered very low (M. Mantas, Forest Botanist, Flathead National Forest, personal communication, June 7, 1995).

2.2.4 Flathead Lake and Upper Flathead River

The Flathead Basin is located in a broad valley of northwestern Montana, between two ranges of the Rocky Mountains. The Flathead River is formed by three main tributaries originating along the west slope of the continental divide. These tributaries join before flowing into Flathead Lake.

Kerr Dam maintains lake elevations between 2,983 and 2,993 feet msl, and releases water at rates ranging from 1500 to 50,000 cfs (Matthews et al., 1986). At full pool (2,893 feet msl), Flathead Lake surface area is nearly 51,000 ha (126,000 ac), making it the largest natural freshwater lake in the western United States. Upland developments along the mostly rocky shoreline areas are dominated by mixed stands of ponderosa pine, Douglas–fir, western larch, and quaking aspen. Agricultural lands encompass 12,779 acres of the Flathead River basin above the lake. The shallow bays of the lake support limited emergent marshes.

2.2.4.1 Physical Habitat

Barren Zone

About one square kilometer of mudflats are exposed during winter drawdowns.

Upland Zone

Upland vegetation is dominated by extensive forests of Douglas–fir and ponderosa pine.

Riparian Zone

Coniferous forests and rangeland dominate much of the riparian areas (Mackey et al, 1984). The undeveloped portions of shoreline consists primarily of Douglas–fir, quaking aspen and paper birch. Scattered pockets of riparian shrub communities dominated by red–osier dogwood, Douglas hawthorn, and sandbar willow are found along much of the shoreline above the lake.

Emergent Wetland Zone

Communities of Cattail, flowering rush, and hardstem bulrush can be found in areas associated with the shallow mud–bottomed bays of the lake.

Submerged Aquatic Plant Bed Zone

Ponds and sloughs around Flathead Lake contain aquatic plants species such as elodea, knotweed, pondweed, parrotweed, duckweed, and milfoil.

Island Habitat

Islands in the upper Flathead basin below Hungry Horse are represented mainly by gravel bars. As the river gradient decreases, sloughs and numerous forested islands become typical.

Twenty–one islands covering 140ha occur in Flathead Lake. Vegetation typically consists of 33 percent ponderosa pine, Rocky mountain juniper, black cottonwood, and aspen. Shrub cover dominated by sandbar willow, red–osier dogwood, and chokecherry occupied 29.8 percent of the island area. The remaining area is dominated by herbaceous cover, including reed canarygrass, Columbia River mugwort, and compressed bluegrass (Mackey, D.L. 1984).

Fish Productivity Zone

A number of species inhabit Flathead Lake and the Flathead River. Trout (rainbow, westslope cutthroat, and bull), kokanee, suckers, and others all occur.

Benthic Invertebrate Productivity Zone

The benthic life of the Flathead River and of Flathead Lake include aquatic insect larvae. Crayfish and freshwater molluscs also occur.

Human Effects

Flathead Lake is used by boaters and fishermen, and there are numerous summer cabins located along the shoreline. The towns of Bigfork and Kalispell are located upstream of the lake and near the Flathead River. The area is known for the cherry orchards that occur around Flathead Lake.

2.2.4.2 Wildlife

Waterfowl

Mallard, pintail, teal, American wigeon, mergansers, and other waterfowl use the rivers, sloughs, and marshlands for nesting and rearing areas. Canada geese use Flathead Lake and its islands as important nesting and rearing areas.

During migration many species use the open water of the river and associated sloughs. Island, backwater sloughs, and gravel bars are used by Canada geese for nesting, brooding and loafing sites. Riparian and mixed forest, islands, bottomland meadows, and riparian shrubland in the project area offer suitable nesting habitat for a variety of duck species. Cavity nesting species use cottonwood and conifer trees in bottomland forest types. The mallard was the most common breeding waterfowl species using bottomland meadows, riparian shrublands, and beaver pond areas prior to the project, but is far less numerous now. The harlequin duck is known to nest along swift streams and rivers in northwestern Montana including the Flathead River.

Colonial Nesting Birds

Great blue heron commonly nest in the flat valley just above Flathead Lake.

Shorebirds

Many species of shorebirds use Flathead Lake and River as an important stopping point along their migration routes. Among them are the semipalmated

plover, long–billed curlew, solitary sandpiper, greater yellowlegs, long–billed dowitcher, northern phalarope, and sanderling.

Nongame Birds

The gray jay, cliff swallow, poorwill, rufous hummingbird, pileated woodpecker, dipper, western meadowlark, and northern oriole are a few of the many non–game birds that can be found in the Flathead region. Species such as the white–winged crossbill, northern shrike, and the common redpoll use the region during the winter.

Upland Game Birds

Wild turkey, ring–necked pheasant, and ruffed grouse are the principal game birds of the basin.

Raptors

Nesting species of raptors in the area are the turkey vulture, golden and bald eagle, and great–horned owl. The American peregrine falcon, and prairie falcon are also present along the river. Snags at Flathead Lake are used extensively for perching by osprey and bald eagle. During the winter, rough–legged hawks and pelicans are relatively common. Snowy owls appear during irruption years.

Aquatic Furbearers

Muskrat, river otter, beaver, and mink use habitats along the upper Flathead River and along the north shore of Flathead Lake. Muskrats prefer slough and pond habitats and avoid the braided river section. Muskrat use of the 93.1ha of marsh is restricted to periods of full pool (Bissell G N, 1987). Eighty–two beaver colonies were located and studied by Bissell. Eighty–five percent of the beavers were found to reside in braided, slough, and tributary habitats. River otter are found in slough, pond and river habitats. The otters feed primarily on two species of fish: the yellow perch is eaten in backwater sloughs, and the mountain whitefish is caught in the Flathead River. Mink prefer to use the food resources and bank cover of the main stem and braided aquatic habitats of the river.

Terrestrial Furbearers

Lynx, bobcat, and marten may be found within the upper Flathead River environment.

Big Game

The intermixture of forest, grassland, cropland and water in the Flathead River and valley provide excellent cover and forage for white–tailed deer; the main large animal of the valley. The white–tailed deer use a wide variety of habitats throughout the year. Elk and moose are also present in stable but smaller populations.

Black bears are present along the riparian areas and lower benches. The large cottonwood trees located along the bottoms provide preferred denning sites. The riparian zones provide abundant lush vegetative forage during the spring, and an abundant late summer and fall food supply of berries and mast. The mountain lion is known to occur in a variety of upland and bottomland areas, where they feed on deer and elk.

Reptiles and Amphibians

Spotted frogs and other amphibians occur in the Flathead basin. Resident reptiles include western painted turtles, garter snakes and northern alligator lizards.

Endangered, Threatened, and Sensitive Species

The USFWS has identified five listed species that may be found in the vicinity of Hungry Horse Project (letter from R. Peterson, USFWS, to D. Treasure, USBR, dated March 29, 1995).

Grizzly bear, *Ursus arctos*	threatened
Gray wolf, *Canis lupus*	endangered
Bald eagle, *Haliaeetus leucocephalus*	threatened
Peregrine falcon, *Falco peregrinus*	endangered
Water howellia, *Howellia aquatilis*	threatened

Riparian and lakeshore habitat are important to bald eagles year–round. Migrant eagles near Glacier National Part feed along stream reaches characterized by numerous shallow riffles, gravel bars, and deep pools. Preferred streamside perching snags of

large western larch and western redcedar are available. Gravel bars and large boulders in the riverbed are also used for feeding and resting (BPA, 84) 1,000 bald eagles may pass through the region each fall.

2.2.5 Albeni Falls

Short–term Operational Limits	
Lake Elevation (at Hope)	
Normal Full	2,062.5 ft
Normal Minimum	2,051.0 ft
Maximum daily lake elevation change	
Above Elevation 2,058 ft	0.4 ft
Below Elevation 2,058 ft	0.5 ft
Discharge	
Minimum instantaneous	4,000 cfs
Minimum daily flow	4,000 cfs
Maximum rate of change	
Normal 60–minute limit	5,000 cfs/hr
Maximum 60–minute increase or reduction	1.0 ft/hr
Maximum daily increase	10,000 cfs/ 24 hrs
Maximum daily reduction below 50,000 cfs	10,000 cfs/ 24 hrs
Minimum daily reduction – 50,000 to 75,000 cfs	2.0 ft/ 24 hrs
Minimum daily reduction above 75,000 cfs	1.0 ft/ 24 hrs
Special requirements	
Lake level is maintained at or near the observed November 20 elevation through December 31 to protect Kokanee spawning areas and prevent dewatering of nests	

Albeni Falls Dam was built across the Pend Oreille River in Idaho at river mile 86.9. The dam was completed in 1955.

The Clark Fork–Pend Oreille River Basin is a mountainous area dominated by conifer forests, situated mainly in western Montana but also in portions of northern Idaho, northeastern Washington, and two small areas in British Columbia, Canada. The basin comprises a total area of 25,960 square miles, of which 24,200 square miles are upstream of the Albeni Falls Dam site.

Lake Pend Oreille is a natural lake. Though construction of Albeni Falls Dam did not raise the level of the lake over natural elevations, operation of the dam have dramatically changed the natural environment of the lake. Prior to project operation, natural spring floods (usually May and June) brought the lake up to its highest elevations (often up to 2,070 ft); and then quickly (usually within two weeks) the lake levels would return to 'normal' levels – about 6 to 20 feet lower than the maximum. The average annual range in water levels for the 10–year period 1938 to 1947, inclusive, was nine feet, and the extreme annual fluctuation for the 33–year period 1914–47 was 21.4 feet. The maximum known water–surface elevation of Pend Oreille Lake, 2,076.08 ft, occurred in June 1894, and the minimum lake level, 2,046.47 ft, was recorded in February 1936 – a difference in elevation of 29.6 feet between the absolute maximum and absolute minimum lake levels of record.

In addition, at two locations (the deltas of the Pack River and the Clark Fork River), the topographic relief was quite flat and slightly higher than the summer lake levels. At the two delta areas the effect of the flat relief was the development of two vast wetland areas, consisting primarily of emergent marshes and forested swamps. Operation of the dam resulted in the lake levels remaining at maximum elevations throughout the summer, drowning the wetlands and resulting in the loss over time of in excess of 3,000 acres of wetlands and forested delta islands.

The Upper Columbia United Tribes, in particular the Kalispel Indian Tribe, and the Kootenai Tribe of Idaho, have more than passing interest in operations that affect Lake Pend Oreille and the Pend Oreille River, which are a part of their ceded lands. The tribes maintain their livelihoods near the lake and along the river, hunting and fishing the resources found there. The Salish and Kootenai Tribes of the Flathead Reservation also maintain active involvement with Corps activities in the vicinity.

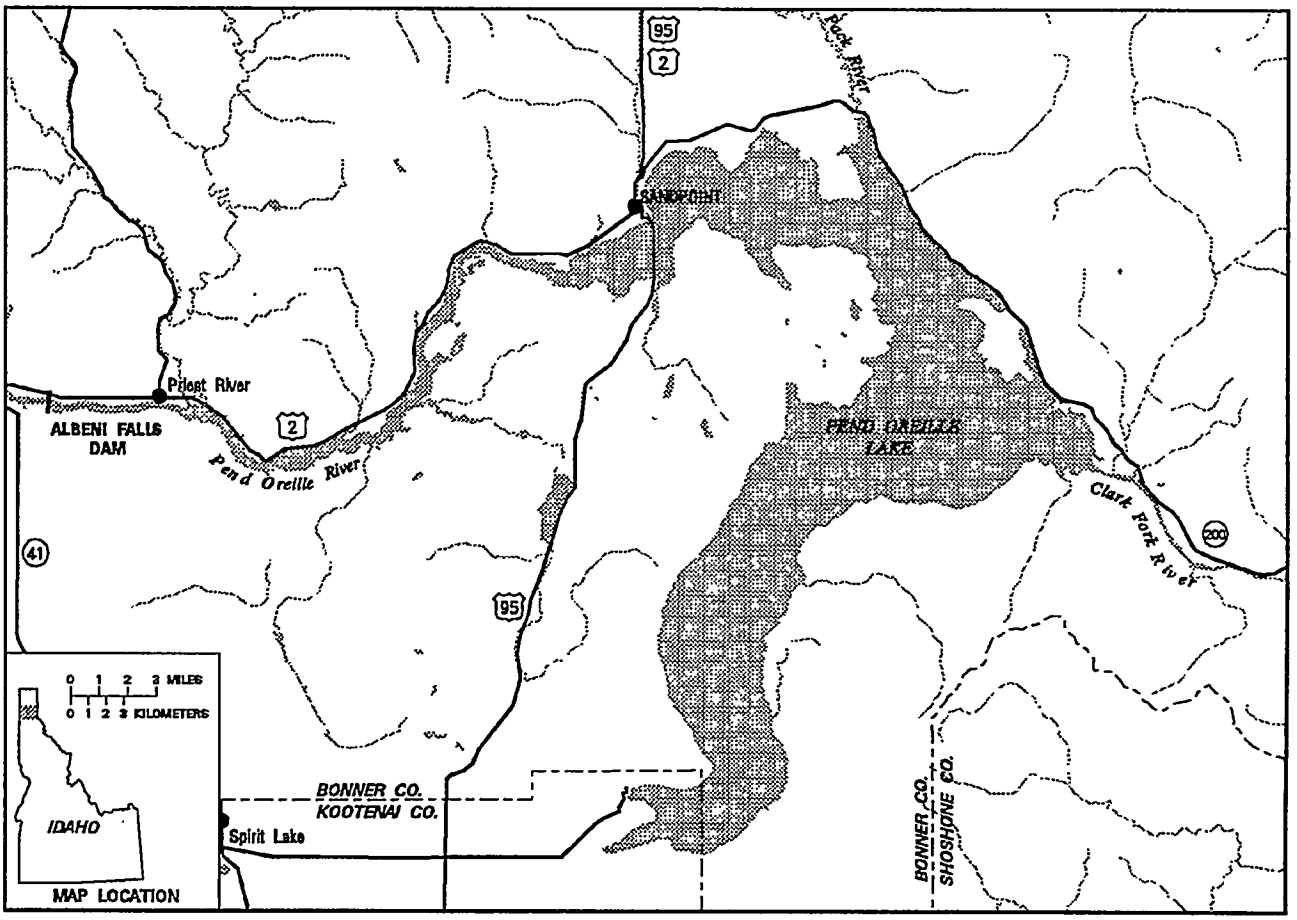

Figure 2–4. Albeni Falls

2.2.5.1 Physical Habitat

Barren Zone

Two major areas, the Pack River delta and the Clark Fork River delta, are barren during the winter drawdown period. In addition, much of the shoreline in the northern portion of the lake is exposed and barren during the drawdown. Soils of the Clark Fork delta are sandy. The remainder of the barren areas of the lake are primarily fine–textured.

Approximately 6,000 acres of wetlands have been lost to erosion since the project's construction. Wave and wind erosion have had dramatic effects, particularly in areas where shoreline vegetation has been lost. Seasonal fluctuations may be the greatest cause of erosion, resulting in sloughing of banks that become waterlogged in summer, then collapse under their own weight as the reservoir drops in elevation. Current drawdown rates have been reduced to lessen the effect.

Upland Zone

Approximately 80 percent of the basin area is covered by coniferous forests. At higher elevations (above 3,600 ft), mature forests are dominated by Douglas–fir, western redcedar, western hemlock, subalpine fir, grand fir, and western white pine. At lower elevations, ponderosa pine, lodgepole pine, and western larch dominate. Most of the forest in the study area is second growth. There is an old growth stand of western redcedar in the Albeni Cove recreation area in the 150 to 250–year age range. Most of the forested area is grazed by livestock, and

about one–fourth of the basin area is devoted to farming.

Riparian Zone

More moist conditions exist along the area surrounding the lake. Reflecting this, the composition of the surrounding forest shows areas with significant inclusions of deciduous trees. Common deciduous trees in these forests include paper birch, aspen, willow, black cottonwood, and red alder. Shrubs include various willows and red–osier dogwood. There are 1,341 acres of riparian habitat lining the shore of the lake.

Emergent Wetland Zone

The wetland communities that characterize approximately 69 percent of the 4,215–acre project land base provide valuable wildlife food, cover, and nest sites. Roughly 3,780 acres of the project lands are licensed for wildlife management to the Idaho Department of Fish and Game (IDFG). They consist primarily of wet meadows, shallow marsh, deep marsh, and submerged aquatic beds. Wetlands include wet meadows of sedge and rush, shallow marsh of cattail and reed canary grass, and deep marsh of water lily.

Submerged Aquatic Plant Bed Zone

Submerged aquatic beds cover roughly 8,000 acres in Lake Pend Oreille. The beds are dominated by Chara and stonewort (Nitella), and also include pondweed and arrowhead.

Island Habitat

Islands in the deeper parts of Lake Pend Oreille are all composed of rock, which, over geologic time, have become forested primarily by coniferous trees. They are characterized by having steep slopes rising abruptly out of the water. The forests are all rather small, generally less than a few acres with the exception of Warren Island, which is close to 80 acres in size. These support bald eagle and osprey nests, and are used by bald eagles in winter months for perching. By contrast, the delta areas (Clark Fork, Pack River, Priest River, et al) have relatively large, low–lying islands composed mainly of river sediments, and dominated by broad–leaved deciduous trees (for list of species see riparian vegetation, this section). These trees are used by nesting bald eagles, ospreys and great blue herons, as well as many other species of songbirds and raptors. In addition, these islands are rapidly being eroded by the high summer lake levels, due to seasonal fluctuations, and to wind and wave action along the island shorelines. Approximately 1,000 acres of islands occur in Lake Pend Oreille, including the Clark Fork delta.

Fish Productivity Zone

Kokanee salmon and whitefish provide the principal prey for bald eagles. Bullhead, perch, squawfish, suckers, peamouth chubs, shiners, and salmonids, including kokanee, provide prey for ospreys.

Benthic Invertebrate Productivity Zone

The benthic life of Lake Pend Oreille includes aquatic insect larvae. Crayfish and freshwater molluscs also occur.

Human Effects

Following project construction, many homes were built along the shoreline as a result of the lake levels being predictably high during the summer. Therefore, the lake is readily accessible from waterfront property. The high summer lake levels also prompted a recreation boom in the area, and in the past forty years human disturbance has increased drastically. Fifty–nine percent of the lake's shoreline is privately owned. The primary recreation activities on the lake are fishing and boating.

2.2.5.2 Wildlife

Waterfowl

Lake Pend Oreille supports large flocks of migratory and resident waterfowl. Twenty–three species of waterfowl, including Canada goose, tundra swan, mallard, pintail, redhead, three species of teal, American wigeon, and wood duck, are prominent. Lake Pend Oreille is a major spring and fall stop for migratory waterfowl of the Pacific Flyway. The fall and winter waterfowl surveys conducted by IDFG indicate numbers of duck and Canada geese peak

each year in November at an estimated 24,000 ducks and 2,200 geese. Concentrations of redhead ducks, which use (principally) Oden Bay through early winter, have numbered as many as 17,000 birds, estimated by IDFG to be almost 98 percent of the statewide count and approximately 20 percent of the total Pacific Flyway redhead population. The concentrations at Oden Bay are believed to be due to extensive stands of Chara and Nitella (benthic algae), on which they feed.

While most waterfowl species are migrants or winter residents only, several species of ducks (including mallard, American wigeon, and three species of teal), and the Canada goose nest on and around the lake. Permanent and summer resident waterfowl nest in marshes and adjacent riparian or upland habitats. Emergent vegetation, submerged vegetation, and shoreline habitats are also important for rearing activities and for food resources. The shallow water and abundant food supply make the principal areas at Morton Slough, Pack River, Oden Bay, Hoodoo Creek, Clark Fork River, Ellisport Bay, Sandpoint Bay, and the Pend Oreille River between the Highway 95 long bridge and Dover Peninsula particularly attractive for resting and feeding by both resident and migratory waterfowl.

Colonial Nesting Birds

Great blue herons are a resident species. A heronry of from 20 to 25 nests is located in a large riparian cottonwood grove in the Clark Fork Delta.

Several species of gulls have been reported in the area, but most are noted as migrants or uncommon summer residents.

Shorebirds

The largest shorebird populations occur during migration, with the greatest concentrations occurring in spring when the shoreline mudflats are most extensive and northward migrating shore birds pass through. Nesting species include killdeer and spotted sandpiper.

Upland Game Birds

Upland game birds generally prefer upland habitats for food, cover, and nesting, but may be found in riparian cover as well. Lake Pend Oreille upland game birds include ruffed grouse, mourning dove, and Merriam's turkey. Blue grouse are abundant at higher elevations.

Nongame Birds

Nesting species in riparian habitats and delta islands include downy woodpecker, warbling vireo, yellow warbler, common yellowthroat, thrushes, swallows, bobolink, and numerous others. Red–winged blackbirds, long–billed marsh wrens, American bitterns, and sora rails are the most common breeding passerine species in marsh areas. The mix of species in coniferous forests differs. Common species include red–breasted nuthatch, solitary vireo, yellow–rumped warbler, golden–crowned kinglet, western tanager, and many others. Wintering passerine species are less abundant and include ravens and dippers.

Raptors

Raptors using the area along the lake include numerous species of owls, hawks, osprey, and bald eagles. Owls and hawks nest in riparian trees and open woodlands, and hunt small birds and mammals in forested areas and open grasslands. Riparian cottonwood areas and nearby evergreen forests are important nesting habitats for the osprey, whereas shallow water habitats are of particular importance as foraging areas. The osprey is an area resident from mid–March through October.

Aquatic Furbearers

Aquatic mammals including beaver, river otter, muskrat, and mink can be found in project lands. The river otter is uncommon, and beaver, muskrat, and mink are not abundant. Beaver activity is higher in slough and river areas than in the lake. Muskrat are found primarily at the Pack River Delta. Mink den in riparian habitats and along tributary drainages, but forage chiefly in marsh areas.

Terrestrial Furbearers

The most common terrestrial furbearers are coyote, bobcat, raccoon and weasel.

Big Game

Large mammals in the vicinity include elk, moose, mule and white–tailed deer, mountain goat, and black bear. White–tailed deer spend both summer and winter seasons in deciduous and riparian habitats near the lake. Mountain goats winter in small numbers on the hills and bluffs bordering the lake near Bay View at the extreme southern end of the lake. A sparse population of grizzly bear and mountain lion is also present in the Lake Pend Oreille region.

Amphibians and Reptiles

The variety of aquatic, riparian and upland habitats supports many amphibians such as Pacific tree frog, bullfrog, leopard frog, Pacific giant salamander, tiger salamander, tailed frog, and long toed salamander. Populations of painted turtles, western skink and alligator lizard, rubber boa, gopher and garter snakes are present in numbers notably less than in warmer areas of the United States.

Endangered, Threatened, and Sensitive Species

The USFWS has provided three separate lists of listed and candidate species that may be found in the vicinity of Lake Pend Oreille (Albeni Falls project area):

Clark Fork Corridor	
Grizzly bear, *Ursus arctos*	threatened
Peregrine falcon, *Falco peregrinus*	endangered
Bald eagle, *Haliaeetus leucocephalus*	threatened
Gray wolf, *Canis lupus*	endangered
Wolverine, *Gulo gulo luscus*	candidate 2
Harlequin duck, *Histrionicus histrionicus*	candidate 2
Northern goshawk, *Accipiter gentilis*	candidate 2

Lake Pend Oreille Corridor	
Grizzly bear, *Ursus arctos*	threatened
Gray wolf, *Canis lupus*	endangered
Peregrine falcon, *Falco peregrinus*	endangered
Bald eagle, *Haliaeetus leucocephalus*	threatened
Northern goshawk, *Accipiter gentilis*	candidate 2
Harlequin duck, *Histrionicus histrionicus*	candidate 2
Pend Oreille Corridor	
Gray wolf, *Canis lupus*	endangered
Bald eagle, *Haliaeetus leucocephalus*	threatened
Wolverine, *Gulo gulo luscus*	candidate 2
Lynx, *Lynx lynx*	candidate 2

Grizzly bears are rare near Lake Pend Oreille, which is also not within a recovery zone for grizzly bears. Gray wolves have been identified within six miles of the lake. Northern goshawks nest in the dense forests just south of Lake Pend Oreille. Wolverines and lynx are found at higher elevations in the same vicinity as the goshawk. Harlequin ducks nest along tributary streams of lake Pend Oreille.

There are eight bald eagle nests around Lake Pend Oreille. They also winter in large numbers around the lake from October through March. Numbers of wintering bald eagles are shown in the table below. The high count was 286 on January 8, 1987. For the past three years, attempts have been made to reintroduce peregrine falcons, which formerly nested in the vicinity of Lake Pend Oreille.

Mean number of bald eagles observed on Pend Oreille Lake during the mid–winter inventory, 1971 – 1994

Time Period	Adults	Immatures	Total
1971 – 1975	38	3	41
1976 – 1980	58	7	65
1981 – 1985	74	9	83
1986 – 1990	165	31	196
1991 – 1993	84	14	98
1994	91	4	95

2.2.6 Grand Coulee Dam

Short–term Operational Limits	
Lake Elevation	
Normal Full Pool	1,290 ft
Normal Minimum Pool	1,208 ft
Maximum daily drawdown	1.5 ft
Maximum 6–hour drawdown	1.5 ft
Discharge	
Above tailwater elevation 957 ft	3.0 ft/hr
Below tailwater elevation 957 ft	2.0 ft/hr

Grand Coulee Dam formed Franklin D. Roosevelt Reservoir, a 151–mile long lake with 660 miles of shoreline and a surface area of more than 82,000 acres at full pool (elevation 1,290 feet) (USBR, 1977;1984). The reservoir inundated the Columbia River mainstem and lower reaches of the Sanpoil River (nine miles), Spokane River (32 miles), Colville River (two miles), Kettle River (11 miles), and about 20–30 miles of other tributary streams, (USBR, 1976). Approximately 70,000 acres of wildlife habitat was inundated by construction of the project.

Existing (post–project) wildlife and habitat have not been studied extensively, thus data are limited.

Payne, et al. (1976) provides the most detailed quantitative information on wildlife species, habitat types, and distribution, as well as discussion of effects of water regulation. Creveling and Renfrow (1986) present detailed estimates of habitat and species losses caused by project construction, but not of existing resources.

Roosevelt Lake is noteworthy for its history of landslide activity along many miles of reservoir shoreline (Jones and Peterson, undated; USBR,1984). The annual cycle of soil saturation, followed by extensive drawdown and lesser short–term fluctuations, has led to continued erosion and slumping of the soil mantle on steeper slopes prevalent in this major river canyon. The steep, unstable shoreline substantially limits habitat development and use by wildlife (Creveling and Renfrow, 1986).

2.2.6.1 Physical Habitat

Barren Zone

Acreage of exposed, unvegetated soil present at different drawdown levels can be calculated from an elevation/acreage model for the project. Under average water conditions, maximum seasonal drawdowns under the no action alternative result in exposure of approximately 23,200 acres of reservoir substrate.

The average inshore slope below full pool is approximately 8°, but varies substantially from site to site and decreases in an upstream direction. Near the dam areas as steep as 45° are found, while in upper reaches of the reservoir and in tributaries there are slopes of less than 5°.

During spring, the Roosevelt Lake water level is drawn down from 50 to 82 feet below full pool to store spring runoff and maximize power production, as well as to prevent flooding. Reservoir elevations may also fluctuate one or more feet daily depending on water withdrawals for power and irrigation needs (Creveling and Renfrow, 1986). Project operation essentially determines the degree of establishment and maintenance of wildlife and wildlife habitat on the reservoir shoreline.

Upland Zone

The extensive Roosevelt Lake environment overlaps two very different ecological and physiographic zones (Creveling and Renfrow, 1986). The southern reaches of the reservoir are in the Columbia Basin (Franklin and Dyrness, 1973) and are characterized by shrub–steppe vegetation. Northern reaches, which extend to the Canadian border, lie within the Okanogan Highlands and are characterized by forest vegetation. The area and vegetation are further described in USBR (1976), Rogers (1941), and Creveling and Renfrow (1986).

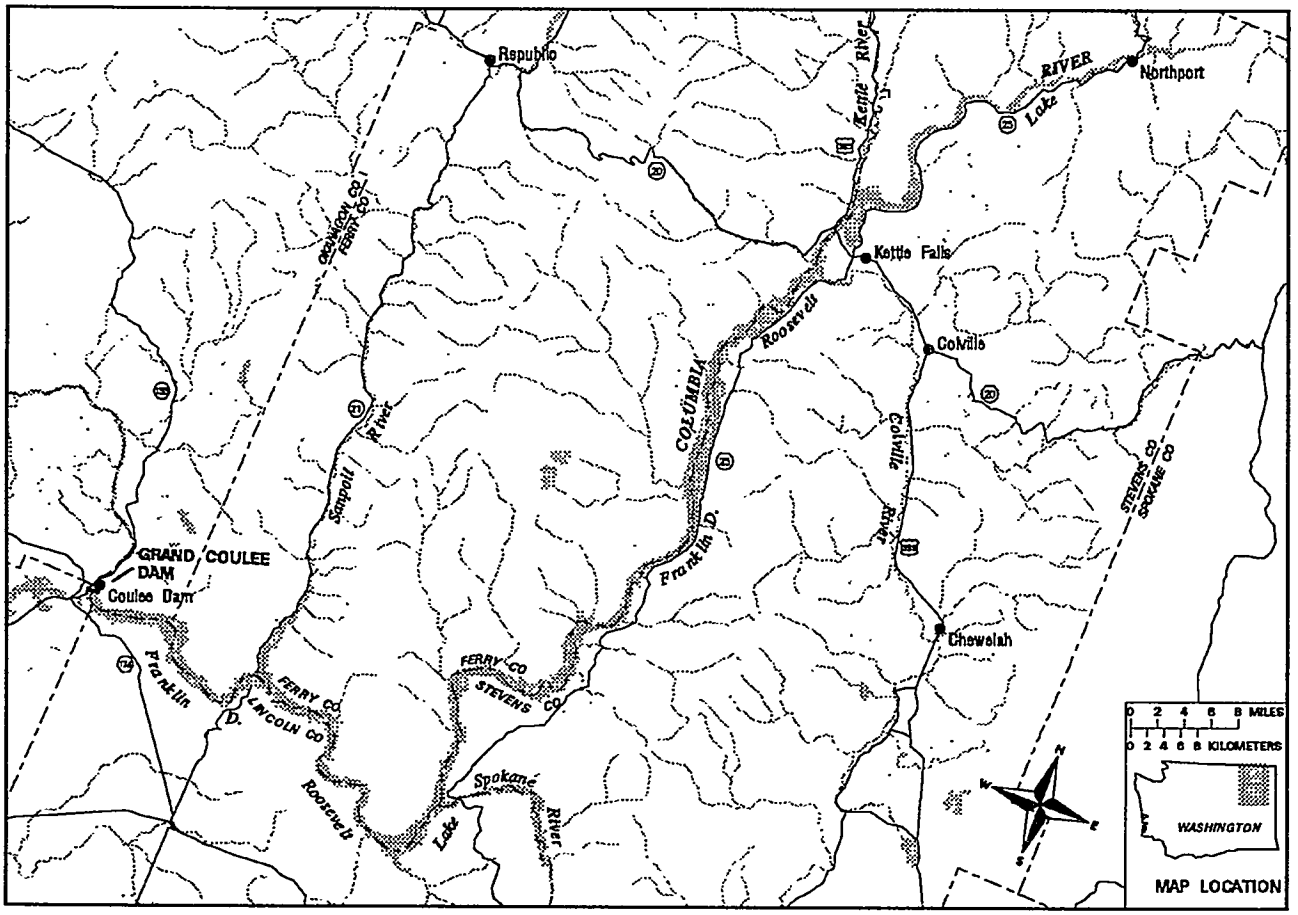

Figure 2–5. Grand Coulee Dam

The lower (southern) reach of Roosevelt Lake from the dam (RM 596) to RM 634 is shrub–steppe and runs east–west, generally with bitterbrush communities on north–facing slopes and sagebrush communities on south–facing slopes. Rabbitbrush is common in much of this area. Between RM 634 and 675, the reservoir runs north–south and ponderosa pine and bitterbrush are characteristic, with serviceberry on dry sites and redstem ceanothus in moist areas and on north–facing slopes. From RM 675 to 706, the vegetation can be characterized as open stands of ponderosa pine/pinegrass habitat, with Douglas–fir and ponderosa pine occurring on north–facing slopes. Bitterbrush occurs in the lower part of this reach, but not in the upriver portion. Canyon slopes are heavily vegetated with redstem and evergreen ceanothus and serviceberry. Rogers (1941) describes the upper reach (RM 706–745) forest as largely second growth ponderosa pine, Douglas–fir and western larch, with a grass shrub understory. Sumac is abundant in some sites. Nearer the Canadian border, there is a mixed forest of paper birch, aspen, lodgepole pine, and Douglas–fir.

Riparian Zone

Roosevelt Lake lacks extensive riparian habitat (Payne, et al., 1976). With few exceptions the pre–impoundment riparian vegetation at Grand Coulee, especially large–branched deciduous trees of high wildlife value, has not been re–established on the shoreline of the reservoir (Creveling and Renfrow, 1986). Payne, et al. (1976) reported that riparian habitat occupies less than 10 miles (1.5 percent) of the reservoir shoreline. Of an estimated total of only 25 acres of riparian habitat, virtually all was located in the northern (upper) portion of the reservoir.

Dry climate, spring reservoir drawdown, wave action, steep shoreline slopes and related erosion and landslide activity are principal factors preventing riparian re–establishment (Payne, et al., 1976; Creveling and Renfrow, 1986). Reservoir shoreline vegetation is perched well above the water level during the spring drawdown and the early portion of the growing season. As a consequence, despite a more moist climate in the northern reaches, riparian areas are typically associated with small streams and spring areas where the source of water is from precipitation, snow melt, or ground water discharge rather than reservoir. These areas are also typically more gently–sloping and protected from erosion forces, and are characterized by silt accumulation. According to Payne, et al. (1976), opportunities to establish further riparian zones at Lake Roosevelt appear limited.

The primary cottonwood riparian stands occurring in the northern portion of the reservoir are composed of an understory of birch, alder, red–osier dogwood, alder buckthorn, and lesser shrubs such as thimbleberry, poison ivy and rose (Payne, et al., 1976).

It is not known whether riparian establishment has increased this habitat since the survey in the mid–70's. Riparian development hinges on successful germination and establishment, which in turn are controlled mostly by soil conditions and moisture. The great scarcity of riparian habitat along Roosevelt lake is an indication of the lack of suitable sites and the detrimental effects of the water regime and soil conditions. Based on these problems and projections from the literature and current knowledge, riparian stands are probably in relatively stable condition at present, with no evidence of expansion.

Emergent Wetland Zone

Emergent wetlands are also limited in extent at Lake Roosevelt. They are restricted by the steep shorelines, seasonal drawdowns, and shorter–term fluctuations that also influence other habitat types. The National Wetlands Inventory (NWI) has classified approximately 230 acres as vegetated wetlands. These occur along the reservoir shoreline primarily in embayments, the mouths of small streams, and in the confluences of larger tributary streams. Areas containing significant wetland types include the mouths of the Colville River and Kettle River and nearby upper reservoir shallows. Most other wetlands are small and scattered in isolated areas such as Mill Creek (Spokane River arm), Big Sheep Creek, Fifteenmile Creek, Onion Creek, Spring Creek, and other sites. According to USACE (1992) the reservoir wetlands are dominated by *Calamagrostis* species.

Approximately 24 acres of Palustrine forested and 16 acres of Palustrine scrub–shrub wetlands are also delineated on NWI maps. These wetland classifications probably overlap somewhat with riparian areas identified by Payne, et al., (1976).

Roosevelt Lake wetlands are believed to be in a fairly static condition under the present water regime, since the project has been operating for about 50 years. Some continued growth of trees and other vegetation likely occurs where these have established.

Submergent Aquatic Plant Beds

According to Ball, et al. (1981) fluctuating reservoir levels in Lake Roosevelt essentially prevent growth of submergent vegetation. The steeply–sloping nearshore areas in much of the reservoir are another obvious limiting factor. Although some submergent plant beds are known to establish during extended high water elevations, these are very limited according to local experts. NWI maps of the reservoir do not include any identified aquatic bed delineations.

Approximately 46 acres of shallow water area is classified under NWI as Lacustrine (system), Littoral (subclass), unconsolidated bottom or shore. These are the types of sites where submergent plants such as water–weed (Elodea sp.) may develop to varying degrees.

Island Habitat

Only 28 islands are identified in Lake Roosevelt, compared to a pre–project river reach total of 114 (Creveling and Renfrow, 1986). These remaining islands total approximately 130 acres (Payne, et al.,1976). Much of the island acreage is classified under NWI as uplands. These areas are commonly the tops of hills or ridges that were isolated by water in the reservoir. According to Payne, et al. (1976) the islands support no riparian vegetation.

Islands were historically important in this area, receiving use by aquatic mammals, shorebirds, waterfowl, and other species. They were particularly important as secure nesting sites for Canada geese and as deer fawning areas. Islands are still important in the reservoir, but their value and use by wildlife is limited by the annual spring drawdown. Vegetation development is inhibited, the barren drawdown zone restricts wildlife use, and some islands become more accessible to predators. There evidently is little Canada goose nesting on remaining islands.

Fish Productivity Zone

A number of fish species inhabit Lake Roosevelt. Trout, kokanee, suckers, walleye, and others all occur.

Benthic Invertebrate Productivity Zone

The benthic life of the reservoir is severely restricted by the wide seasonal drawdowns that occur. The scarcity of emergent wetland vegetation adjacent to the reservoir restricts the production of microscopic crustaceans, such as Copepods and Ostracods that are in important food source for fish fry and hatchling amphibians. Populations of insect larvae occur along with some limited numbers of crayfish.

Human Effects

Although shoreline development is minimal at Lake Roosevelt, recreation is a major activity and boating, camping, picnicking, fishing, and related activities are seasonally intensive. These activities can disturb wildlife and reduce wildlife potential, especially because most campgrounds and picnic areas have been developed on nearshore islands, creek mouths, embayments, and flat benches that contain much of the best remaining habitat. There have recently been concerns raised about the level of contaminants entering Lake Roosevelt from the Canadian part of the Columbia River drainage. Data are not available concerning the effects of contaminants (heavy metals and dioxins) on fish, other aquatic forms or terrestrial wildlife in and around Roosevelt Lake.

Wildlife

About 350 species of wildlife are found in the vicinity of Roosevelt Lake (Creveling and Renfrow, 1986). Many of these use the riparian, wetland, and island habitats along the reservoir shoreline for part or all of their life requisites.

The overall wildlife values of Roosevelt Lake are limited because of the Lake's storage function and substantial seasonal drawdowns which adversely

affect shoreline habitat development and use. Important habitats generally are confined to tributary stream reaches, embayments and backwaters, and islands. Conditions are much less favorable on the main pool where steep, eroding banks are prevalent. Islands are important in part because only 28 remain from a pre–dam count of 114. In general, riparian and wetland habitats exist only as small, scarce units scattered throughout the reservoir.

The following wildlife resource areas are of note, starting from the dam and working upstream.

- On the State (south) side of the lower reservoir up to the Spokane River, several areas are identified. The Keller area includes bald and golden eagle nest sites, and osprey nesting occurs from Sterling Valley to Hawk Creek butte. Riparian stands exist at Welch Creek near Jones Bay, and at Hawk Creek. Bald eagle perching sites and waterfowl hunting are also present at Hawk Creek. The Lincoln area is notable for upland species that include Lewis' woodpecker and the introduced species, California bighorn sheep, and Merriam's turkey. There is significant raptor habitat in the vicinity of Whitestone Rock and Meeker Mountain.
- On the Colville Indian reservation side of the lower reservoir, as in some other reaches, lower elevation sites are important as deer winter range and portions as elk winter range. Between the dam and Sanpoil River there is significant use by geese in the fall and winter as a resting area. Significant waterfowl use of areas in this vicinity include the mouths of the Sanpoil River and Redford Creek. Between the Sanpoil River and reservation line further north, there are reported to be four bald eagle nest sites and four communal roost areas. Barnaby Island and Barnaby Creek areas near the reservation line are noted for shallows that provide habitat for waterfowl. This general area provides for some duck and goose nesting and grazing. Other shoreline species such as beaver, muskrat, and some otter use occurs in and near the mouths of tributary streams.
- The Spokane River arm is a notable wildlife resource area. It serves as an occasional resting area for as many as several thousand canada geese in the fall. A wetland area has been documented at Mill Creek, and Moccasin Cove near Squaw Creek that contains riparian habitat. Osprey nest sites occur on the lower river, and the Spokane Tribe has documented bald eagle communal roosting on their side of the river. Roosting sites for Thompson's big–eared bat are reported for this area. Porcupine Bay is a popular human use area.
- Upstream on the Columbia, an area just south of the Gifford Ferry near Inchelium is notable for shallows supporting a high waterfowl concentration. Osprey nests occur in this vicinity on both the state and reservation sides of the pool. The greatest concentration of eagles is said to occur between Kettle Falls and Hunters, and more particularly from Hunters to Gifford.
- The Colville River mouth near Kettle Falls is of significance as a wildlife and public use area. Colville flats (lower river) contains a wetland area, and the area supports significant osprey use. There is also a heron rookery farther upstream on the Colville.
- Across the reservoir, the Sherman Creek mouth exhibits wildlife values including use by great blue herons. The Washington Department of Wildlife Sherman Creek Habitat Management Area borders on the reservoir in this reach, but it is an upland management area.
- Marcus Island and the Evans Spit are potentially important areas for wildlife which are reduced in value by the presence of parks and campgrounds. As embayment areas protected somewhat from rough water conditions, they provide values such as waterfowl (duck) production. Wetland habitat occurs surrounding Evans Spit.
- The lower Kettle River between Barstow and the confluence near Kamloops is generally recognized as an important site for a variety of wildlife species. Its backwater areas and

bayous contain riparian stands and shallows with emergent wetland vegetation. It has waterfowl production values and is a bird concentration area. Osprey nest sites are present in this reach, and furbearers and other wildlife species also use the area.

Waterfowl

While waterfowl use of Roosevelt Lake is noteworthy, the reservoir is not generally considered by local biologists to be a major waterfowl resource management area. Production is substantially limited by the scarcity of islands, wetland habitat, and shoreline usable for waterfowl activities, as well as by the severe spring drawdowns. The most significant use appears to be in open water areas as a resting or wintering area for migrants, however density of wintering ducks is also considered low because of cold winter conditions and lack of adequate food supplies (USACE,1992).

Characteristic waterfowl species or groups identified for Grand Coulee are Canada goose, mallard, and diving ducks such as scaup. Nesting and feeding habitat for geese and mallards is said to be very limited (Creveling and Renfrow; 1986; Payne, et al., 1976). Riparian habitat used for duck nesting is in very short supply as are wetlands and other feeding areas. Islands, which are of particular importance as secure nest sites for geese, support little nesting because of their limited occurrence and the drawdown problems of land bridging and barren mudflat formation which lead to predation and restricted use. Shallower areas in upper reaches and tributaries support some seasonally flooded emergent wetlands that are potential nesting and grazing areas. However, drawdowns are particularly damaging to these areas since islands are more easily bridged and the more gently–sloping shoreline is separated from the vegetation by large expanses of barren soil. In other parts of the reservoir, steep and eroding banks are commonplace and are a barrier to shoreline use by geese with goslings or duck broods. Waterfowl use of the reservoir is mostly as a temporary stopover during migration periods.

Although riparian and wetland habitat has established slowly at Lake Roosevelt, the reservoir has been in place and under a similar operating regime long enough that these habitats have probably reached a certain degree of equilibrium. There is no information suggesting significant trends in waterfowl use.

Colonial Nesting Birds

Great Blue heron and bank swallow are representative colonial nesting birds at Grand Coulee. Reservoir creation eliminated most of the large riparian deciduous trees (such as cottonwoods), and they have not been replaced to any significant degree over the years (Creveling and Renfrow, 1986). These trees provided important nest sites for colonial waterbirds such as herons. Nevertheless, herons use a wide range of habitat types and are a familiar resident at Roosevelt Lake.

Bank swallows may have benefited from the creation of the reservoir and the increased insect foraging area over water. They may also derive benefit from shoreline erosion that creates vertical banks in some areas which are then colonized. Continuing erosion, may cause periodic slumping of the same vertical banks used for nesting.

Populations of these colonial species are also believed to be relatively stable in numbers, since the reservoir has been in place for many decades and habitats are not undergoing any significant year–to–year change.

Shorebirds

Shorebird use of Roosevelt Lake is limited and related mostly to the water level during spring and fall migration. Numbers of species may use the lake and surrounding barren zone at that time. Species likely to nest include killdeer and spotted sandpiper.

Nongame Birds

The downy woodpecker, red–winged blackbird, and yellow warbler are considered representative of nongame bird species at Roosevelt Lake. They primarily use riparian and emergent wetland habitats potentially impacted by changes in operational water regimes. Their nesting and feeding activities in relation to trees, shrubs, emergent aquatic vegeta-

tion, and other factors are important in determining their survival and density at the reservoir.

Upland Game Birds

Game birds such as chukar, Hungarian partridge, mourning dove, ring–necked pheasant, and California quail eat a variety of seeds, agricultural grasses (wheat, oats, corn) and insects. The pheasant and quail are found most commonly near agricultural lands and generally do not venture far into shrub–steppe areas. Upland game birds such as sharp–tailed grouse, ring–necked pheasant, and California quail may also harvest the catkins of willows, alders, and birches, and also eat the new buds. The upper (northern) end of Lake Roosevelt can also support some numbers of grouse such as blue, ruffed, and/or spruce.

Raptors

Bald eagles are an important reservoir area resource, with a recent wintering population estimate of about 250 birds, and as many as ten nests in the Roosevelt Lake area. Reservoir use appears to be increasing based on winter surveys and prior reports of little or no nesting. Although the bald eagle is well–known at the reservoir, other raptors such as golden eagle and prairie falcon commonly use cliff sites in the area. There is relatively low use of the shoreline by osprey for nesting.

Bald eagles and some other raptors are dependent on fish populations in the reservoir for food, and operational changes in the water regime could influence fish abundance and availability. Foraging success by raptors is potentially affected by system operation.

Snags and large–branched trees are important perching, nesting and roosting sites for raptors, especially the bald eagle. Operational changes could affect tree survival. The presence of large evergreens near the reservoir offsets the need for large riparian trees. However, shoreline conifers have been subject to cutting, snag removal, and landslide–induced loss. Riparian and other land–water interface habitats are important generally, however, as raptors use them regularly in their foraging activities.

Aquatic Furbearers

The beaver and otter are representative of the aquatic furbearers at Lake Roosevelt. This wildlife group must be able to travel between the water body and terrestrial vegetation, and thus can be significantly affected by reservoir operation. The shoreline interface is a critical component of aquatic furbearer habitat suitability. Islands are also of importance when present.

At present, most shoreline at Roosevelt Lake is of little value to aquatic furbearers because of its steepness and instability (erosion), and lack of vegetation. Additionally, drawdown of the reservoir in more gently–sloping areas creates large, barren mudflats which separate water and vegetated shoreline, increasing the animals' energy expenditure and vulnerability to predation, or even preventing use of an area. Otter can also be affected by loss of aquatic invertebrates such as crayfish, a primary food source.

Terrestrial Furbearers

Representative species of furbearers include the porcupine, least chipmunk, yellow pine chipmunk, striped skunk, bushy–tailed woodrat, deer mouse, sagebrush voles, cottontail rabbits, yellow–bellied marmots, bobcats, badgers, coyotes, cougar, and several species of mice, and bats. Most of these are resident in the conifers. Furbearers found in the shrub–steppe habitats of the project area (bobcat, badger, coyote) are predators, feeding primarily on rodents, as well as bird eggs and carrion. Rabbits and marmots eat grasses and herbaceous plants, and in winter may eat bark and twigs of woody plants as well. Marmots are restricted to rocky areas where they can find refuge among the many tunnels in the rocks. Small mammals such as the sagebrush vole and least chipmunk feed primarily on green vegetation.

Big Game

Prior to the construction of Grand Coulee Dam, lower elevation areas of the Columbia River corridor were critical winter range habitat for big game. Low elevation areas around the reservoir are important for deer wintering areas, and in some areas, for elk winter range. Riparian or shoreline areas containing deciduous or evergreen trees are used by big game

for feeding, fawning, summer and winter thermal cover, and as corridors.

Big game species are not as dependent as other wildlife species on habitats bordering the reservoir, but may still be significantly affected by habitat losses or changes in human use and disturbance patterns caused by reservoir operation. For these reasons, deer and elk foraging and wintering are considerations when reservoir operations change.

Amphibians and Reptiles

The spotted frog and long–toed salamander were selected to represent potential effects of reservoir operation modification on amphibians at Roosevelt Lake because these species have both an aquatic larval stage and a terrestrial adult stage. Very small seasonal ponds and pools can be used by long–toed salamanders and small permanent ponds can be used by spotted frog during breeding season. Increased drawdowns or fluctuations can remove these sources of water that provide oviposition and larval development sites for these and other amphibian species. Other species include western skink and Pacific chorus frog.

Endangered, Threatened, and Sensitive Species

State and Federally listed species of plants and animals that potentially occur in wetland and riparian habitats at Roosevelt Lake include the following (USACE, 1992):

Plants	
Giant helleborine	state sensitive
Nuttall's pussy toes	state sensitive
Palouse milk vetch	state sensitive
Least bladdery milk vetch	state sensitive
Columbia crazy weed	state sensitive
Pygmy–weed	state sensitive
Insects	
Immaculate green hairstreak	state monitor
Birds	
Great blue heron	state monitor
Golden eagle	state candidate
Bald eagle	Federal threatened
Osprey	state monitor
Peregrine falcon *Falco peregrinus anatum*	Federal endangered
Mammals	
Long–eared myotis	state monitor
Gray wolf	Federal endangered

2.2.7 Chief Joseph Dam

Short–term Operational Limits	
Lake Elevation	
Full Pool	956 ft
Minimum Pool	930 ft
Summer operating range	950–956 ft
Discharge	
Minimum instantaneous	No limit
Minimum daily flow	35,000 cfs
Maximum rate of change	No limit
Special Requirements	
Based on providing 36,000 cfs at Priest Rapids Dam, Chief Joseph outflow may be less if the 36,000 cfs at Priest Rapids is provided by tributary flow or from storage at another project.	

Chief Joseph Dam is on the Columbia River at river mile 545.1.; the reservoir is 51 miles long, ending at Grand Coulee Dam. The original structure was completed in 1961; an additional ten feet were added to the dam and reservoir in 1981.

Chief Joseph Dam and Rufus Woods Lake lie in a steep–sided canyon of the Columbia River valley which ranges in width from two to four miles. The north side of the valley rises sharply to the Okanogan Highlands, 1,000 feet or more above the Columbia River. The south side of the valley rises in a series of terraces and benches climbing to the Columbia Plateau surface. The majority of the shoreline is treeless with a dry land shrub–steppe cover and numerous canyons and deep draws supporting isolated stands of pine and deciduous trees and shrubs. Rangeland and irrigated orchards on upland benches and sixteen project wildlife mitigation sites along the lakeshore provide islands of greenery. Scenic areas include the badland–like area at RM 588, a resistant silt cliff at RM 574, and windcut sandy formations from RM 564 to RM 568.

2.2.7.1 Physical Habitat

Barren Zone

Barren areas are few along Rufus Woods Lake, due to only one to two foot daily fluctuations. Those barren areas that exist are on the steep slopes that are also the area of chronic erosion.

Erosion/Landslide Potential. Landslides and erosion are common on the steep canyon walls which are partially filled with thick deposits of fine–grain sediments. Glacial lake and old landslide deposits tend to slough more easily than other materials, but well–drained sands and gravels tend to be quite stable, even if of considerable height. Several major prehistoric and historic landslides have occurred in the project area. The post–glacial Bridgeport Slide occurred upstream of the project. It is presently administered by the Corps and is allocated for project operations to discourage public access to the area and allow for slide monitoring. Slides along the upstream portion of Rufus Woods Lake became active during the middle and late 1940's. They slowed after 1953, due to lesser tailwater fluctuations, probably as a result of the raised lake levels at Grand Coulee Dam. In 1970, construction for the third powerplant at Grand Coulee precipitated additional sliding and measures to control those slides are under study by the Bureau of Reclamation. Furthermore, impoundment of Rufus Woods Lake has caused slides near Bridgeport State Park and upstream of China Creek (RM 575) on the south bank. Reservoir operation and upland irrigation have resulted in a lesser degree of sloughing along the reservoir periphery. Riprapping to stabilize the slide area is currently being tested.

Upland Zone

Shrub–steppe. The major upland communities are the Big Sagebrush/Wheatgrass and Threetip Sagebrush/Fescue. These two communities are discussed together because their structural characteristics are very similar. Both the big sagebrush/wheatgrass community and the threetip sagebrush/fescue community are characteristic of the arid steppe province of the Columbia Basin. These two communities are distributed in response to total and seasonal distribution of precipitation, the threetip sagebrush/fescue community being established in somewhat moister areas. Franklin and Dyrness (1973) indicate that the north bank of the Columbia River supports the threetip sage/fescue community eastward from the Omak Trench into the Okanogan Highlands. These communities support several plant species important to wildlife. The cheatgrass, bitterbrush, serviceberry, black hawthorn, and snow eriogonum provide cover and food for both game and non–game species. Orchards are accelerating their expansion into Okanogan County, and hundreds of acres now line the shoreline of Rufus Woods Lake, displacing shrub–steppe habitat.

Coniferous Forest Habitat. Conifers are scarce along the majority of the shoreline of Rufus Woods Lake. Especially along the lower (downstream) half of the reservoir, trees are widely–spaced individuals instead of grouped in clusters. In a few areas, ponderosa pines grow in loose stands located on relatively steep hillsides suffused with seeps. On north–facing slopes, the pines become more densely packed and are mixed with Douglas–firs. The understory plants consist of some of the same species that grow in the riparian communities.

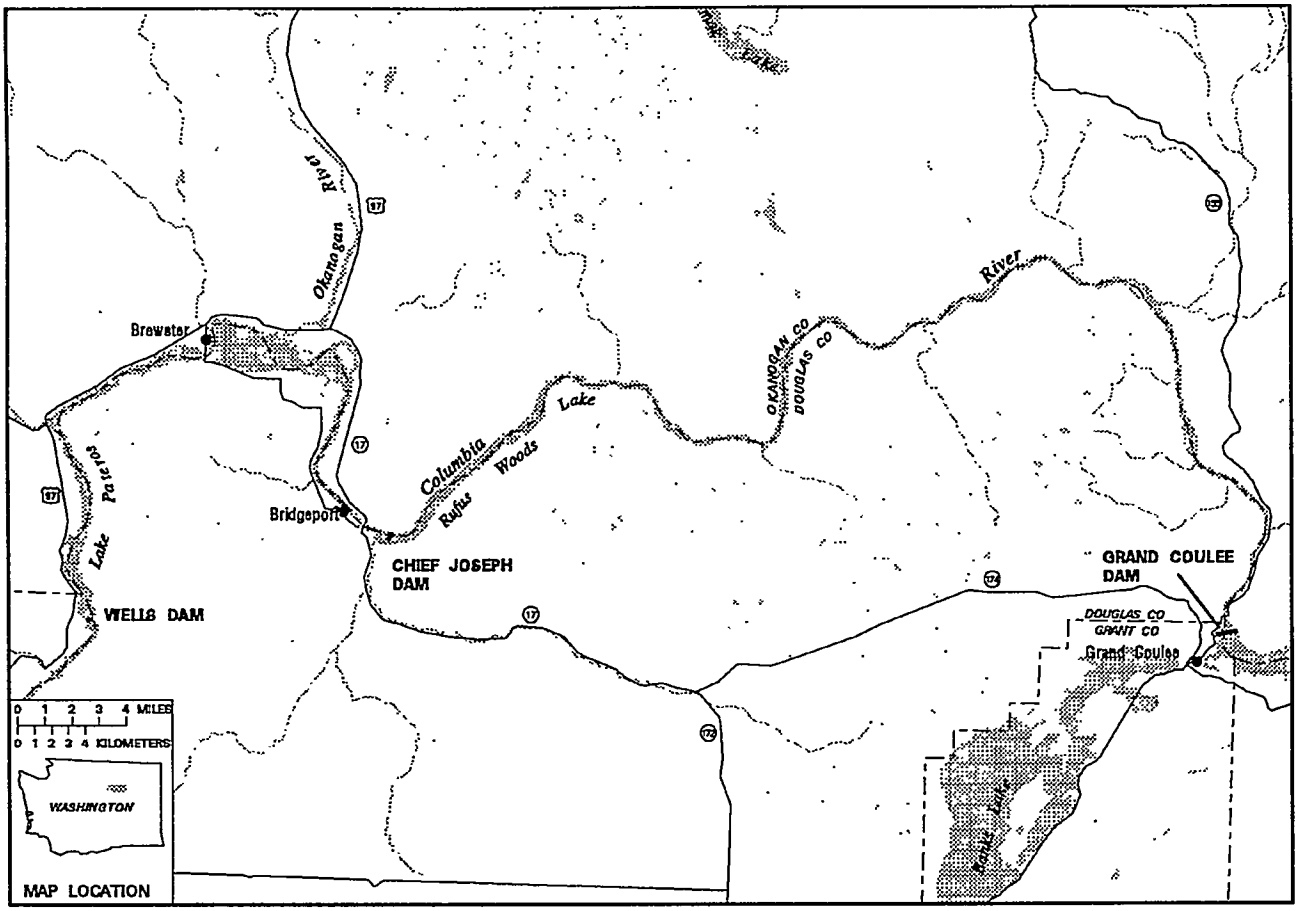

Figure 2–6. Chief Joesph Dam

Riparian Zone

Small streams running down the slopes into Rufus Woods Lake provide the best riparian habitats in the project area. The vegetation of these draws generally consists of serviceberry, squaw currant, golden currant, black hawthorn, mountain alder, Wood's rose, Bebb willow, and red–osier dogwood. Mock orange, mallow ninebark, oceanspray, chokecherry, smooth sumac, and quaking aspen are less common. Many of the same animals that use shrub–steppe communities also take advantage of the thermal and visual cover provided by the riparian vegetation, as well as the abundant and diverse food source.

Prior to construction of the additional power units and the 10–foot rise in reservoir elevation in February 1981, little riparian vegetation developed along the reservoir. The reasons for this are not clear, though it now appears that one reason may have been that the topography along the shoreline was too steep to allow plants to establish themselves. This is substantiated by the new shoreline which is generally of a much lower gradient than that of the original pool, and already has at least as much riparian vegetation as the original pool had after 22 years. Another reason for the sparse riparian vegetation may be that daily fluctuations of the reservoir prior to 1981 were usually 6 ft; since 1981 they are usually about one to two feet. Nevertheless, nowhere along the pool is the riparian vegetation on the shore established to the point where it represents a viable community. However, at the rate these plants are establishing, it should not be more than five years before small

communities of riparian vegetation of sufficient size and structure to support wildlife are established at several points along the lake.

Emergent Wetland Zone

Wetlands are scarce in the project area. At least two marshy areas have begun to develop since the pool raise: one at mitigation site 7 (RM 558) and one at mitigation site 3 (RM 549.5). These are areas of very shallow gradient at the high pool elevation. A small marsh/swamp/stream also exists on mitigation site 18 (RM 584.8), which is recovering from recent overgrazing by livestock. This wetland system is extremely valuable to many species of wildlife for the food, cover, and water it provides. Passerine birds find this type of habitat to be an oasis in the vastness of shrub–steppe and wheatlands that dominate the region.

Submerged Aquatic Plant Bed Zone

Aquatic vegetation in Rufus Woods Lake is not particularly abundant because the rocky shoreline, steep slopes in many areas, and the water level fluctuations effectively limit available habitat. A narrow band of aquatic vegetation is present along much of the shoreline of the reservoir. Five species of submerged aquatic vegetation have been observed in the lake, including elodea, Eurasian watermilfoil, sago pondweed, curly leaf pondweed, and watercress (though watercress is arguably not a true submerged aquatic). Excepting watercress, which has been observed only at mitigation site 16 (RM 575.2), these species have been observed the entire length of the lake, from RM 591 downstream. The most abundant aquatic plant in the lake is elodea, and Eurasian watermilfoil is more abundant than sago pondweed and curly leaf pondweed.

Island Habitat

There are several islands in Rufus Woods Lake. Two of them are man–made by the Corps as mitigation to replace goose nest sites lost to the pool raise. Most of the islands are small, and are often used by geese for nesting. Buckley Bar, near RM 587, is about 40 acres in size, and is wooded with small juniper trees, and used by Canada geese and other birds for nesting, and by mule deer for fawning.

Snags

The lake was not cleared at the time of the pool raise since so few trees were subject to inundation. The trees that died and became snags are important enough to constitute a habitat in themselves. Snags are a valuable source of food for many insectivorous birds and small mammals. They are used by many cavity–nesting birds and mammals, and are excellent perches for raptors.

Fish Productivity Zone

A number of fish species inhabit Rufus Wood Lake. Trout, kokanee, suckers, walleye, and others all occur.

Benthic Invertebrate Productivity Zone

The benthic life in the reservoir is severely restricted by the wide seasonal drawdowns that occur. Populations of insect larva exist along with some limited numbers of crayfish.

Human Effects

The principal human disturbance along the reservoir is from orchards and consequent erection of deer fences. This results not only in habitat losses but also restricts movements of deer and many other mammals. Cattle grazing also severely damages range condition and lowers carrying capacity for native animals. Hunting is a popular recreational activity in the vicinity of Rufus Woods Lake, although waterfowl hunting is restricted to the area between RM 582.5 and RM 590, as the rest of the reservoir is designated a waterfowl preserve by the WDFW.

2.2.7.2 Wildlife

Most resident species have declined from historic numbers due to their dependence, at least part of the year, on shoreline habitats that were lost when the reservoir was originally created. Because of the presence of food and the warming effect of these shoreline areas, the habitats have been extremely important during critically harsh winters. Following construction of the dam, grain acreage increased due

to the better accessibility of irrigation. The increase in grain acreage fortuitously benefited certain species of upland game birds and big game animals, though resulting in a loss of shrub–steppe habitat. In 1980, the Corps established six areas of riparian habitat totaling over 100 acres as mitigation for riparian habitat lost to a 10–foot increase in reservoir elevation. Orchards and overgrazing by livestock continue to lessen habitat quality in many areas.

Waterfowl

About 18,000 waterfowl of 33 species use the lake annually, primarily during fall and winter. Most of this number is comprised of mallards, Canada geese, and American coots. Canada goose is the only waterfowl species that nest in appreciable numbers – about 75 nests have been out each of the past two years. Brooding pastures are not abundant, but seem to be adequate for brood rearing. Mallards are common nesters, though riparian and emergent habitats are sparse. Wintering coots are an important source of prey for bald eagles along the reservoir. Lesser scaups are the second most common wintering waterfowl (after Canada goose) on the reservoir.

Colonial Nesting Birds

Great blue herons once had a nesting colony on the reservoir, but it was abandoned shortly before the 10–foot pool raise was initiated. No colonial nesting birds use Rufus Wood Lake to any significant extent. Gulls and herons may be seen occasionally but are not resident. No nesting activities have been recorded since 1981.

Shorebirds

Spotted sandpipers and killdeer commonly nest along the gravelly shoreline of Rufus Woods Lake. Potholes and wetlands in the vicinity of the project attract shorebirds, loons, grebes, and even white pelicans. As a result, many of these species have also been observed on Rufus Woods Lake, albeit only occasionally. The 10–foot pool raise inundated an excellent mudflat at the mouth of the Nespelem River which often had hundreds of shorebirds, occasionally including uncommon species such as solitary and Baird's sandpipers. However, with the disappearance of this mudflat, migrant shorebirds are seldom observed along the reservoir now.

Nongame Birds

The Columbia River is a migratory route for birds, which often follow the river's shoreline. Although shrub–steppe by itself supports relatively few species, the mix of riparian, tree/shrub, and wetland habitats are magnets to migrant songbirds. In one complex marsh/shrub–swamp, approximately three acres in size, on a cool August day, the author counted 39 species of birds in roughly two hours (this wetland is on one of the mitigation sites). The list from this one day included such species as sora rail, cedar waxwing, Nashville warbler, Wilson's warbler, MacGillivray's warbler, solitary vireo, warbling vireo, northern oriole, lazuli bunting, and western tanager. Red–winged blackbirds are found wherever there is an emergent marsh, no matter how small. Characteristic birds of ponderosa pine woodlands include downy and hairy woodpeckers, western wood pewee, mountain chickadee, red–breasted nuthatch, house wren, golden–crowned kinglet, solitary vireo, Townsend's warbler, western tanager, black–headed grosbeak, Cassin's finch, dark–eyed junco, and song sparrow.

Upland Game Birds

Game birds such as chukar, Hungarian partridge, mourning dove, ring–necked pheasant, and California quail eat a variety of seeds, agricultural grasses (wheat, oats, corn) and insects. The pheasant and quail are found most commonly near agricultural lands and generally do not venture far into shrub–steppe areas. Upland game birds such as sharp–tailed grouse, ring–necked pheasant, and California quail may also harvest the catkins of willows, alders, and birches, and also eat the new buds.

Raptors

Raptors using the area along the lake include two species of eagle, twelve species of hawks and falcons, and six species of owls. Of these, both species of eagle, four of hawks and falcons, and five of owls nest along the reservoir. The five most common nesting raptors are American kestrels, great horned

owls, red–tailed hawks, golden eagles, and long–eared owls. One nest each of bald eagle and osprey have been active the past two years. Most of the raptors are also present during the winter, although in lesser numbers. A few, such as the rough–legged hawk, are present during the winter months only.

Aquatic Furbearers

A few beaver and mink are found in the project area, nearly always in association with riparian communities. Likewise, the smaller mammals and furbearers such as mink and river otter find thermal cover and a wide variety of food in coniferous areas of the reservoir.

Terrestrial Furbearers

Representative species of furbearers include the porcupine, least chipmunk, yellow pine chipmunk, striped skunk, bushy–tailed woodrat, deer mouse, sagebrush voles, cottontail rabbits, yellow–bellied marmots, bobcats, badgers, coyotes, cougar, and several species of mice, and bats. Most of these are resident in the conifers. Furbearers found in the shrub–steppe habitats of the project area (bobcat, badger, coyote) are predators, feeding primarily on rodents, as well as bird eggs and carrion. Rabbits and marmots eat grasses and herbaceous plants, and in winter may eat bark and twigs of woody plants as well. Marmots are restricted to rocky areas where they can find refuge among the many tunnels in the rocks. Small mammals such as the sagebrush vole and least chipmunk feed primarily on green vegetation.

Big Game

The shrub–steppe habitat supports both resident and wintering mule deer. 1982 winter census counted 702 mule deer in the vicinity of Rufus Woods Lake. No other animal populations in these upland habitats have been estimated or extensively studied. However, food habits of some species are relatively well known. In early spring mule deer graze on the young shoots of cheatgrass, generally the first plant to 'green–up' in the spring. Later on, and generally throughout the summer, the deer prefer to feed on the young shoots of bitterbrush and to a lesser extent on the various sages and riparian shrubs such as serviceberry and black hawthorn. It appears from a recent study that, during the winter, mule deer may depend on snow eriogonum as a major source of food. Mule deer also make use of well–protected areas of shrub–steppe to give birth to their fawns, especially behind large rocks. Buckley Bar is important for fawning as well, as the junipers provide needed shade and visual cover. Wildlife in the coniferous areas also include cougar and black bear, and the black bear are often observed throughout the shrub–steppe habitats.

Amphibians and Reptiles

Amphibians attracted to the complex marsh/shrub–swamp habitats present in the project vicinity include tree frogs and spotted frogs. Great Basin spade–foot toads are also present. Reptiles are limited to four species of snakes, including rattlesnakes and gopher snakes.

Endangered, Threatened, and Sensitive Species

The USFWS has provided the following list of listed and candidate species that may be found in the vicinity of Rufus Woods Lake (Chief Joseph project area):

Rufus Woods Lake	
Bald eagle *Haliaeetus leucocephalus*	threatened
Peregrine falcon, *Falco peregrinus*	endangered
Harlequin duck, *Histrionicus histrionicus*	candidate 2
Black tern, *Chlidonias niger*	candidate 2
Columbian sharp–tailed grouse, *Tympanuchus phasianellus*	candidate 2
Western sage grouse, *Centrocercus urophasianus*	candidate 2
Ferruginous hawk, *Buteo regalis*	candidate 2
Northern goshawk, *Accipiter gentilis*	candidate 2
Western burrowing owl, *Athene cunicularis hypuges*	candidate 2
Olive–sided flycatcher, *Contopus borealis*	candidate 2

Loggerhead shrike, *Lanius ludovicianus*	candidate 2
Pale Townsend's big–eared bat, *Plecotus townsendii townsendii*	candidate 2
Small–footed myotis, *Myotis ciliolaburm*	candidate 2
Yuma myotis, *M. yumanensis*	candidate 2
Washington ground squirrel, *Spermophilus washingtoni*	candidate 2
Northern sagebrush lizard, *Sceloporus graciosus graciosus*	candidate 2
Spotted frog, *Rana pretiosa*	candidate 2
California floater, *Anodonta californiensis*	candidate 2
Columbia pebblesnail, *Fluminicola columbianus*	candidate 2

The peregrine falcon is an endangered species that has been seen on rare occasion flying overhead, but they do not appear to nest or winter in the area. The bald eagle, a threatened species, winters regularly along Rufus Woods Lake (October through April). Approximately 35 bald eagles are observed each winter using the snags along the reservoir. The eagles feed primarily on chukar, American coots, waterfowl, fish, and carrion. There are three successful bald eagle nests along the shoreline of Rufus Woods Lake. Part of the wildlife mitigation program is specifically aimed at bald eagles. This includes retaining snags for as long as possible, and the erection of 25 raptor poles for perching, five of which are equipped with artificial nesting platforms.

Of the candidate species, only the sharp–tailed grouse and loggerhead shrike have been observed near the project in recent years. Sage grouse were common early in this century, but may have been extirpated from the project area. Western burrowing owls nest near the project, but generally are well removed from the reservoir. Sagebrush lizards and the three species of bats may occur in the vicinity of the project, though inventories for these species have not been conducted. Sightings of black tern, harlequin duck, northern goshawk, olive–sided flycatcher, Washington ground squirrel, spotted frog, California floater, and Columbia pebblesnail are very rare in the project vicinity, as habitat for these species is wanting near the reservoir.

2.2.8 Mid–Columbia River Projects

2.2.8.1 Wells Reservoir

NOTE: *Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids are non–Federal Projects where impacts are expected to be minimal. As a result, the information presented is less detailed.*

Wells Dam is located on the Columbia River at RM 515.5. The dam is licensed by FERC and owned and operated by the Public Utility District No. 1 of Douglas County. The reservoir behind the dam extends for about 29 miles to the tailwater of Chief Joseph Dam. The reservoir also extends up the Okanogan Valley. The Colville Indian Reservation is borders the north shore of the upstream portion of the reservoir.

Precipitation averages about 8.5 inches. Annual temperatures vary markedly. Summer temperatures can exceed 100°F with average daily maximums of about 83°F. Winter temperatures can drop below 0°F, with average daily minimums of 25°F.

Most of Wells Reservoir (Lake Pateros) is in a broad valley. The reservoir is very wide, but shallow, with many shoals, mud banks, and low islands. The upstream four–mile portion is narrow.

2.2.8.1.1 Physical Habitat

Vegetation reflects the low level of precipitation in the area and the definitive shoreline edge of the reservoir. Riparian vegetation occurs along the margins of the reservoir. Riparian grass/forb, riparian shrub, and riparian deciduous trees are representative of vegetation within this typically narrow zone. Cottonwoods trees and stands of cattail and bulrush are the predominant components of the riparian plant community. Grassland and shrub–steppe are found along the upland margins of the shoreline. Much of the developed upland area adjacent to the reservoir supports fruit orchards and residences associated with the town of Bridgeport, Brewster, and Pateros. Highway and railroad right–of–ways

border portions of the shoreline. The Washington Department of Wildlife manages portions of the shoreline to provide wildlife habitat as part of a wildlife mitigation plan.

2.2.8.1.2 Wildlife

Waterfowl

The reservoir is used as a wintering area for ducks and geese. Wells Reservoir has typically supported many wintering diving ducks and coots. Ducks nest on islands and backwater areas along the reservoir. Canada geese nest on islands along the reservoir and in goose nesting structures maintained by the Washington Department of Wildlife. Shoreline orchards, residential lawns, and wildlife management areas offer abundant brooding and grazing areas.

Upland Game Birds

Ring–necked pheasants, California quail, chukar, and doves occur along the reservoir. The wildlife management areas typically support higher populations of upland game birds than do other non–managed portions of the Columbia River. The numbers of nesting doves are often highest near orchards. A wide variety of non–game birds occur along the reservoir, containing representatives of the wide variety of habitat types in the area.

Raptors

Raptors using the area include wintering bald eagles, resident golden eagles, nesting ospreys, kestrels, hawks, and owls.

Aquatic Furbearers

Beaver, muskrats, mink, and raccoon are common along the reservoir. River otters occur in the area also, but their numbers are relatively low compared to other furbearers. Beaver are abundant.

Big Game

Mule deer inhabit range adjacent to the reservoir. Highways and a railroad border a large portion of the reservoir shoreline. Because of the abundance of orchards and residential use along the shoreline, improvement of deer populations along the reservoir is not encouraged. Relatively few big game animals use the Wells Reservoir shoreline.

Endangered, Threatened, and Sensitive Species

Wintering bald eagles are the only Federally–listed T&E species along the reservoir. Bald eagles have also nested on a hillside overlooking the reservoir. As many as 50 bald eagles have been seen using two communal night roosts on hillsides overlooking the reservoir. The eagles usually arrive in the area in October, are most abundant in January and February, and most leave by the following April. Wintering bald eagles in eastern Washington are relatively transitory, moving about during the winter as local food availability changes. Waterfowl is the main item in the diet of bald eagles wintering in the area. Fish are not as available to wintering bald eagles along the mid–Columbia River as they are in other eagle wintering areas. Shoreline cottonwoods are the most used perch sites.

2.2.8.2 Rocky Reach Reservoir

NOTE: Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids are non–Federal Projects where impacts are expected to be minimal. As a result, the information presented is less detailed.

Rocky Reach Dam is located on the Columbia River at RM 474. The dam is licensed by FERC and owned and operated by the Public Utility District No. 1 of Chelan County. The dam was placed in service in 1961. The reservoir behind the dam extends for about 42 miles.

Precipitation averages about 8.5 inches. Annual temperatures vary markedly. Summer temperatures can exceed 100°F with average daily maximums of about 83° F. Winter temperatures can drop below 0°F, with average daily minimums of 25°F.

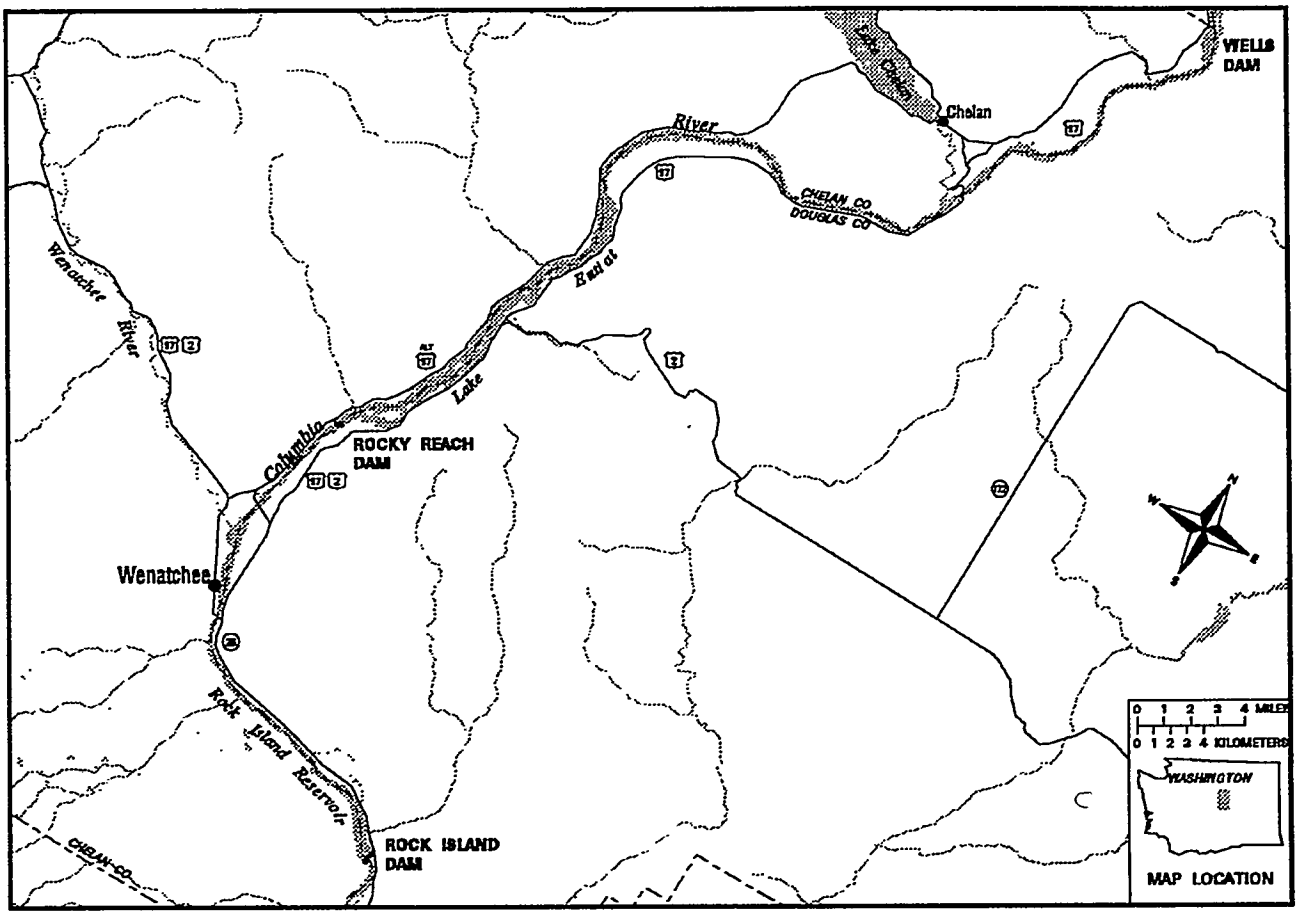

Figure 2–7. Wells, Rocky Reach and Rock Island Reservoirs

2.2.8.2.1 Physical Habitat

Vegetation reflects the low level of precipitation in the area and the definitive shoreline edge of the reservoir. Riparian vegetation occurs intermittently along the margins of the reservoir. Riparian grass/forb, riparian shrub, and riparian deciduous trees are representative of vegetation within this typically narrow zone. Cottonwoods trees are the predominant component of the riparian plant community. Grassland and shrub–steppe are found along the upland margins of the shoreline. Exposed rock of both fluvial and glacial origin is often mixed into the landscape. Much of the developed upland area adjacent to the reservoir supports fruit orchards and residences. Much of the shoreline is riprap along the highway and railroad right–of–ways. Ebasco Environmental (1991) completed a HEP analysis that extensively described the shoreline vegetation. These soils form extensive terraces and some small bars composed of soils ranging from clay to gravel and cobbles. Turtle Rock Island, consisting of approximately 175 acres, is located in the lower portion of the reservoir. Several other smaller, near shore islands and rocks are scattered along the reservoir.

2.2.8.2.2 Wildlife

Waterfowl

The reservoir is used as a wintering area for up to 17,000 ducks and geese. Few ducks, mostly mallards, nest along the reservoir. Goose nesting has doubled in the last 10 years from about 32 nests/year in the early 1980s to 78 nests in 1992. About 25 goose

nesting structures, maintained by Chelan PUD, have aided in this nesting increase. Prior to the nesting structures, nest destruction by predators often exceeded 50 percent. Shoreline parks, residential lawns, and orchards offer abundant brooding and grazing areas.

Upland Game Birds

Ring–necked pheasants, California quail, chukar, and doves occur along the reservoir. The numbers of nesting doves are often highest near orchards. A wide variety of non–game birds occur along the reservoir, containing representatives of the wide variety of habitat types in the area.

Raptors

Raptors using the area include wintering bald eagles, resident golden eagles, ospreys, kestrels, hawks, and owls.

Aquatic Furbearers

Beaver, muskrats, mink, and raccoon are common along the reservoir. River otters occur in the area, but their numbers are relatively low and their occurrence is sporadic. Beaver are abundant, and are a present and continuing threat to many shoreline cottonwood groves used by perching bald eagles.

Big Game

Mule deer and bighorn sheep are big game animals that inhabit range adjacent to the reservoir. Big game winter range adjacent to the west shore of the downstream half of the reservoir was purchased by Chelan PUD as partial wildlife mitigation for the original project. That range was turned over to the Washington Department of Wildlife for management. A deer fence, State Highway 97, and a railroad separate the winter range from the reservoir shoreline area, so the project area is not an important part of the habitat base of the big game herds. Relatively few big game animals use the Rocky Reach Reservoir shoreline.

Endangered, Threatened, and Sensitive Species

Wintering bald eagles are the only Federally–listed T&E species along the reservoir. Between 1975 and 1992, the maximum number of bald eagles seen along the reservoir was 37. A common mid–winter bald eagle survey count during January or February is about 25 to 30 bald eagles. They usually arrive in the area in October, are most abundant in January and February, and leave by the following April. Wintering bald eagles in eastern Washington are relatively transitory, moving about during the winter as local food availability changes. Waterfowl is the main item in the diet of bald eagles wintering in the area. Winter–killed, road–killed, railroad–killed big game and livestock also supplement the eagles' diet. Fish are not as available to wintering bald eagles along the mid–Columbia River as they are in other eagle wintering areas. Shoreline cottonwoods are the most used perch sites.

2.2.8.3 Rock Island Reservoir

NOTE: Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids are non–Federal Projects where impacts are expected to be minimal. As a result, the information presented is less detailed.

Rock Island Dam is located on the Columbia River at RM 453.5. The dam is licensed by FERC and owned and operated by the Public Utility District No. 1 of Chelan County. The dam was built in 1933. The reservoir behind the dam extends for about 20.5 miles.

Precipitation averages about 8.5 inches. Annual temperatures vary markedly. Summer temperatures can exceed 100°F with average daily maximums of about 83°F. Winter temperatures can drop below 0°F, with average daily minimums of 25°F.

2.2.8.3.1 Physical Habitat

Vegetation reflects the low level of precipitation in the area and the definitive shoreline edge of the reservoir. Riparian vegetation occurs intermittently along the margins of the reservoir. Riparian grass/forb, riparian shrub, and riparian deciduous trees are representative of vegetation within this typically narrow zone. Cottonwood trees are the predomi-

nant component of the riparian plant community. Grassland and shrub–steppe are found along the upland margins of the shoreline. Exposed rock of both fluvial and glacial origin is often mixed into the landscape. Much of the developed upland area adjacent to the reservoir supports fruit orchards. The residential and industrial development associated with the cities of Wenatchee and East Wenatchee also extend along the shores.

2.2.8.3.2 Wildlife

Waterfowl

The reservoir is used as a wintering area for 2,000 to 5,000 ducks and geese. Few ducks, mostly mallards and mergansers, nest naturally along the reservoir. As many as 25 wood duck nests have been attempted in a year along the reservoir, the result of a Chelan PUD wood duck nest box program. Goose nesting has been tripled in the last 15 years from 42 nests/year in the mid–1970s to 140 nests in 1992. Chelan PUD maintains about 25 goose nesting structures along the reservoir which have aided in this nesting increase. Shoreline parks, residential lawns, and orchards offer abundant brooding and grazing areas.

Upland Game Birds

Ring–necked pheasants, California quail, chukar, and doves occur along the reservoir. Their abundance and distribution is affected by human activities. The numbers of nesting doves are high in some orchards. Quail are especially abundant within the city limits because of abundant conifers for roosting and a very active bird feeding program by local residents. A wide variety of non–game birds occur along the reservoir, containing representatives of the wide variety of habitat types in the area.

Raptors

Raptors using the area include wintering bald eagles, resident golden eagles, nesting ospreys, kestrels, hawks, and owls.

Aquatic Furbearers

Beaver, muskrats, mink, and raccoon are common along the reservoir, especially in backwater areas. River otter occur in the area, but their numbers are relatively low and their occurrence is sporadic. Beaver are abundant and are a present and a continuing threat to many shoreline cottonwood groves used by perching bald eagles.

Big Game

Mule deer are the only big game animals that use the reservoir shoreline. Due to the abundance of orchards and residential and industrial use along the shoreline, improvement of deer populations along the reservoir is not encouraged.

Endangered, Threatened, and Sensitive Species

Wintering bald eagles are the only Federally–listed T&E species along the reservoir. Between 1975 and 1992, the maximum number of bald eagles seen along the reservoir was 12. A common mid–winter bald eagle survey count is four eagles. They usually arrive in the area in October, are most abundant in January and February, and leave by the following April. Wintering bald eagles in eastern Washington are relatively transitory, moving about during the winter as local food availability changes. Waterfowl are the main item in the diet of bald eagles wintering in the area. Fish are not as available to wintering bald eagles along the mid–Columbia River as they are in other eagle wintering areas. Shoreline cottonwoods and cliffs are the most used perch sites. No known communal night roosts occur along the reservoir.

2.2.8.4 Wanapum Reservoir

NOTE: Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids are non–Federal Projects where impacts are expected to be minimal. As a result, the information presented is less detailed.

Wanapum Dam is located on the Columbia River at RM 415.5. The dam is licensed by FERC and owned and operated by the Public Utility District No. 2 of Grant Co. The reservoir behind the dam extends for about 38 miles upstream to Rock Island Dam. Large portions of the reservoir are bordered by the Washington Department of Wildlife's Colockum and Quincy Wildlife Management Areas. The Crescent Bar recreation area is located on the east shore of the reservoir.

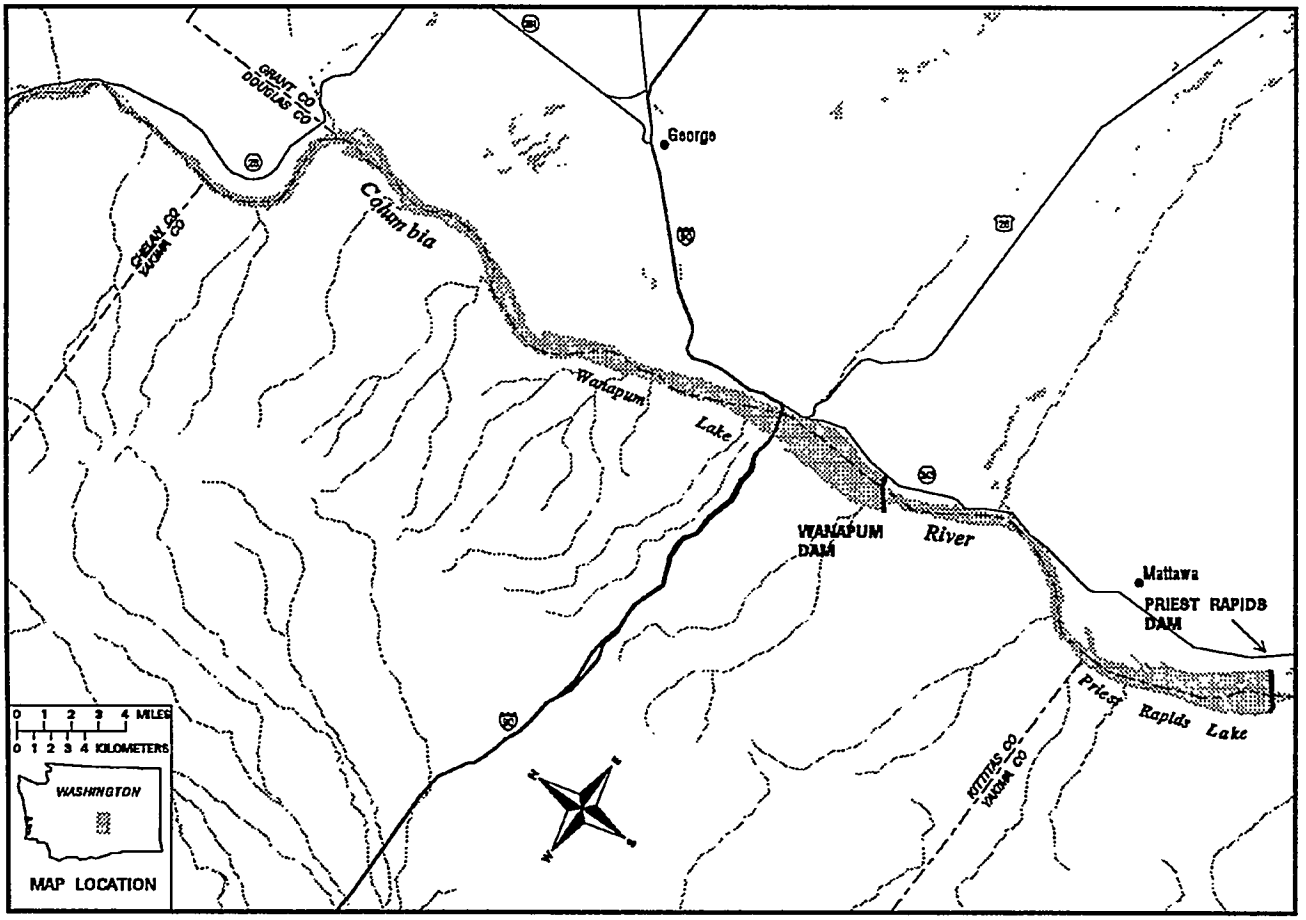

Figure 2–8. Wanapum and Priest Rapids Reservoirs

Annual precipitation averages less than 8.5 inches. Annual temperatures vary markedly. Summer temperatures can exceed 100°F with average daily maximums of about 83°F. Winter temperatures can drop below 0°F, with average daily minimums of 25°F.

2.2.8.4.1 Physical Habitat

Basalt cliffs reaching 400 feet are common. The downstream portion of the reservoir is broad with shallows near the shore. The middle portion is bordered by tall basalt cliffs on both shores with several small bays formed by the reservoir flooding creeks entering the river from the west. The upstream portion of the reservoir is narrow with several rock and gravel bar islands, and the cliffs give way to portions of more open shorelines.

Vegetation reflects the low level of precipitation in the area and the definitive shoreline edge of the reservoir. Intermittent strips of riparian vegetation occur along the margins of the reservoir and in backwater areas. Riparian grass/forb, riparian shrub, and cottonwood trees comprise the vegetation within this typically narrow zone. Shrub–steppe habitat comprised of sagebrush, rabbitbrush, and bluebunch wheatgrass is found along the upland portions of the shoreline.

2.2.8.4.2 Wildlife

Waterfowl

In the mid–1970s, the reservoir was used as a wintering area for as many as 100,000 ducks and geese, although that number is much lower now. Few ducks, mostly mallards, nest along the reservoir.

As many as 64 goose nests have been found along the reservoir. Geese nest on available shoreline islands and cliff ledges. Sunland Estates and the Crescent Bar recreation area and golf course provide grazing and brooding areas for geese.

Upland Game Birds

Ring–necked pheasants, California quail, chukar, and doves occur along the reservoir. A wide variety of non–game birds occur along the reservoir.

Raptors

Raptors using the area include wintering bald eagles, resident golden eagles, ospreys, kestrels, hawks, and owls. The area may also be used by prairie falcons.

Aquatic Furbearers

Beaver, muskrats, mink, and raccoon are common along the reservoir. River otters may occur along the reservoir but would be expected to be rare because of the absence of suitable tributaries. Beavers are relatively abundant along the reservoir, and are a present and continuing threat to the few shoreline trees along this reservoir, especially cottonwoods.

Big Game

Mule deer and Rocky Mountain elk are big game animals that inhabit range adjacent to the reservoir, especially the Colockum wildlife management area on the west shore. Quilomene Bar and West Bar are important elk and deer wintering areas along the west shore of the reservoir.

Endangered, Threatened, and Sensitive Species

Wintering bald eagles are the only listed T&E species along the reservoir. Between 1975 and 1992, a maximum of 25 bald eagles were counted along the reservoir. They usually arrive in the area in October, are most abundant in January and February, and leave by the following April. Wintering bald eagles in eastern Washington are relatively transitory, moving about during the winter as local food availability changes. Waterfowl are the main item in the diet of bald eagles wintering in the area. Winter–killed big game and livestock probably also supplement the eagles' diet. Fish are not as available to wintering bald eagles along the mid–Columbia River as they are in other eagle wintering areas. The tall basalt cliffs and shoreline cottonwoods are the most used perch sites. No known communal night roost used by bald eagles occur along the reservoir.

2.2.8.5 Priest Rapids Reservoir

NOTE: Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids are non–Federal Projects where impacts are expected to be minimal. As a result, the information presented is less detailed.

Priest Rapids Dam is located on the Columbia River at RM 397. The dam is licensed by FERC and owned and operated by the Public Utility District No. 2 of Grant Co. The reservoir behind the dam extends for about 19 miles upstream to Wanapum Dam. The west shore of the downstream portion of the shoreline is bordered by the US Army, Yakima Firing Center. The east shore of the center portion of the reservoir is bordered by the Washington Department of Wildlife Priest Rapids Wildlife Recreation Area.

The area is very dry with little annual precipitation. Annual temperatures vary markedly. Summer temperatures can exceed 100°F with average daily maximums of about 83° F. Winter temperatures can drop below 0° F, with average daily minimums of 25° F. The reservoir is subject to high winds, varying from zero to 80 m.p.h. in the fall with an average of five to 25 m.p.h.

2.2.8.5.1 Physical Habitat

The geology of the reach is typified by extensive basalt flows and extensive river terraces. Several gravel bar islands occur in the upstream portion of the reservoir and a large island (Cabin Island) lies just upstream of Priest Rapids Dam.

Vegetation reflects the low level of precipitation in the area and the definitive shoreline edge of the reservoir. Intermittent strips of riparian vegetation occur intermittently along the margins of the reservoir and in backwater areas. Riparian grass/forb, riparian shrub, and cottonwood trees comprise the vegetation within this typically narrow zone. Shrub–steppe habitat comprised of sagebrush, rabbitbrush, and bluebunch wheatgrass is found along the upland portions of the shoreline.

2.2.8.5.2 Wildlife

Waterfowl

Ducks and geese use the reservoir as a wintering area. Duck nesting along the reservoir is relatively low. Mallard is the most common species of duck nesting along the reservoir. Recent goose nesting surveys have located about 165 nests annually along the reservoir. Most of these nests (about 125) were found on Cabin Island, just upstream of Priest Rapids Dam. Most of the remainder of the nests (about 25) were found on Railroad Bridge Island at RM 412.5. The Priest Rapids wildlife management area provides most of the grazing and brooding area for geese along the reservoir.

Upland Game Birds

Ring–necked pheasants, California quail, chukar, and doves occur along the reservoir. Habitat for pheasants and quail is restricted to the immediate shoreline and the Priest Rapids wildlife recreation area. A wide variety of non–game birds occur along the reservoir.

Raptors

Raptors using the area include wintering bald eagles, resident golden eagles, hawks, and owls.

Aquatic Furbearers

Beaver, muskrats, mink, and raccoon probably occur along the reservoir in relatively low numbers. Aquatic furbearer habitat is scarce along the reservoir, except for the mouth of Crab Creek, which lies along the east shore of the reservoir.

Big Game

Mule deer inhabit range adjacent to the reservoir, but occur in limited numbers. The shores of Priest Rapids Reservoir are not an important wintering area for deer.

Endangered, Threatened, and Sensitive Species

Bald eagles are the only Federally–listed T&E species along the reservoir. No bald eagles nest along the reservoir and relatively few bald eagles winter along the reservoir. A high count of ten bald eagles was recorded during ten winters of surveys from 1975 to 1984. The eagles usually arrive in the area in October, are most abundant in January and February, and leave by the following April. Wintering bald eagles in eastern Washington are relatively transitory, moving about during the winter as local food availability changes. Most of the bald eagles that use Priest Rapids Reservoir probably move back and forth between the reservoir and the Hanford Reach, where food is more available. Waterfowl are the main item in the diet of bald eagles wintering in the area. Winter–killed big game and livestock probably also supplement the eagles' diet. Fish are not as available to wintering bald eagles along Priest Rapids Reservoir as they are in other eagle wintering areas. Shoreline cottonwoods, and especially cottonwoods on Cabin Island, are the perch sites most used by bald eagles along this reservoir. No known communal night roost used by bald eagles occur along the reservoir. Low availability of shoreline perches and available prey items probably limit bald eagle numbers along this reservoir.

2.2.9 Hanford Reach

The unimpounded area of the Hanford Reach of the Columbia River has experienced less alteration than any other reach. Unlike other stretches of the river, peak flows associated with winter rains or spring run–off still influence upland, riparian, and riverine vegetation along the approximately 50–mile reach.

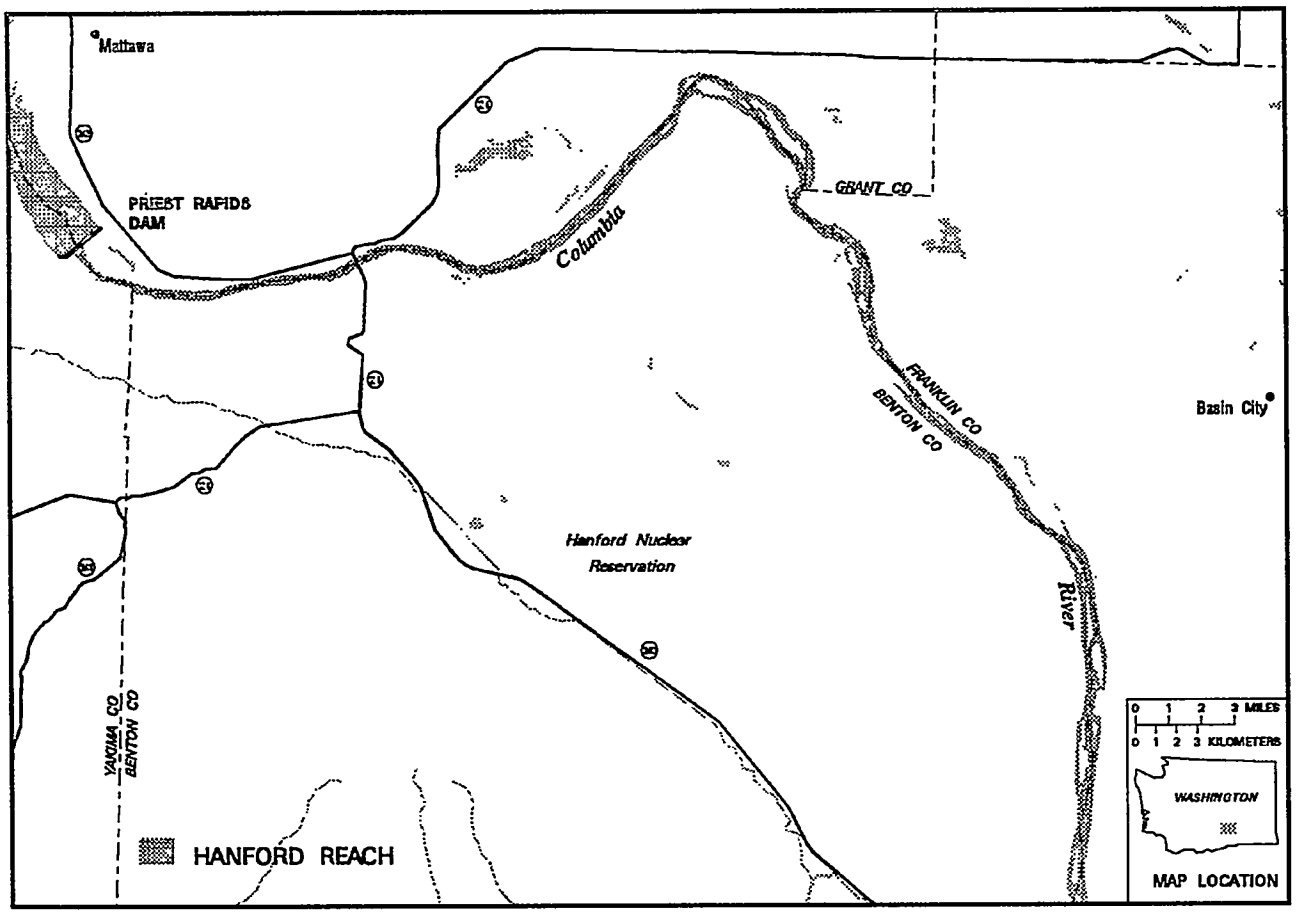

Figure 2–9. Hanford Reach

Riverine habitat includes the sloughs, backwaters, shorelines, islands, and palustrine forests that are associated with the river floodplain and are covered by water for the majority of the year. Artificial habitats include the ponds and ditches that drain irrigation water on the northern and eastern shores of the river. Riparian habitat includes the shoreline–river interface where species that are tolerant of fluctuating surface water elevations persist. Upland shrub–steppe habitat along the Hanford Reach is dominated by the sagebrush/cheatgrass/ Sandberg's bluegrass vegetation community. Unique areas include bluff, dune, island, cultivated (non–native), and spring stream habitats.

Sands and silt loams are the predominant soils on the Hanford site. Sands and loamy sands tend to cover low elevation areas central to the site, while silt–loams occur at higher elevations in the south, west, and north portions of the Hanford Site (Natl. Park Serv. 1992).

2.2.9.1 Physical Habitat

Barren Zone

Under current operations, a barren zone is not present along the Hanford Reach.

Upland Zone

Some of the last vestiges of sagebrush–steppe habitat occur along the Hanford Reach within the area surrounding the Hanford facilities. The area is botanically characterized as shrub–steppe, however, cheat grass is the dominant species occurring

throughout the eight major plant communities. The shrub–steppe habitat community is dominated by big sagebrush, antelope bitterbrush, grey rabbitbrush, and spiny hopsage. Remnant natives include bluebunch wheatgrass, Sandberg's bluegrass, needle–and–thread grass, Indian ricegrass, and prairie junegrass (Rickard and Poole 1989). The distribution and dominance of endemic species have been altered by human activities, which has resulted in the predominance of alien species, especially cheatgrass and tumble mustard. Although current river operations along the Hanford Reach have minimal affects on upland vegetation, competition from exotic species has precluded the proliferation of native vegetation within the shrub–steppe habitat (Rickard and Poole 1989).

Riparian Zone

Riverine and riparian habitat provides nesting, foraging, thermal, and travel cover for many wildlife species (Books 1984). Riverine vegetation includes willow, mulberry, Siberian elm, sedge, reed canarygrass, and bulbous bluegrass.

Shoreline riparian communities are seasonally important for a variety of species. Willows trap food for waterfowl (i.e., Canada geese) and shorebirds (i.e., killdeer, spotted sandpiper) and provide nesting habitat for passerines (i.e., mourning doves). Terrestrial and aquatic insects are abundant in emergent grasses and provide forage for fish, waterfowl, and shorebirds. Beaver and mule deer, and rely on shoreline habitat for foraging.

Emergent Wetland Zone

Emergent vegetation occurs within the riverine area (e.g., that area below mean high water) of the Hanford Reach that also includes riffles, gravel bars, oxbow ponds, backwater sloughs and the cobble shorelines that typified the Columbia River prior to inundation by dam development. These and emergent habitats that occur infrequently along the Hanford Reach, have acquired ecological significance due to the net loss of wetland habitat elsewhere within the region. The majority of emergent species include reed canarygrass, common witchgrass, and large barnyard grass.

The release of water used in industrial processes at the Hanford facilities created several artificial ponds that did not exist prior to industrial development. The ponds are ephemeral but have contributed to the establishment of cattail, reed canarygrass, willow, cottonwood, and Russian olive.

Submerged Aquatic Plant Bed Zone

The Columbia River and artificial ponds and ditches created as a result of Department of Energy facility operation comprise the aquatic habitat of the Hanford Reach. Diatoms represent 90 percent of the algae in the Hanford Reach. Species composition of plankton that persists within the reach is influenced by communities in upstream reservoirs (e.g., Priest Rapids). Although populations are largely transient, the peak concentration of phytoplankton develops in April and May (Cushing 1967).

Because currents within the main channel are generally strong, macrophytes that include *Lemna*, *Potamogeton*, *Elodea*, and *Myriophyllum* are generally limited. Rushes and sedges occur along the shorelines of several sloughs along the Reach at White Bluffs, below the 100–H area, downstream of 100–F, and the Hanford Slough (Cushing 1990).

Island Habitat

Approximately 18 islands, accounting for 39.9 miles of island shoreline (USACE 1976), occur within the main channel of the Hanford Reach. These islands range in size from one to five miles in length and afford a ratio of island shoreline to rivermiles of 0.77 to 1.0. Islands provide resting, nesting, and escape habitat for waterfowl, shorebirds, and small mammals. Shoreline riparian vegetation that characterizes the islands includes willow (*Salix* spp.), poplar, Russian olive, and mulberry. Species occurring within the island interior include buckwheat, lupine, mugwort, thickspike wheatgrass, giant wildrye, yarrow, and cheatgrass (Warren 1980). During 1993, purple loosestrife *(Lythrum salicaria),* a noxious plant species, was removed from the east side of Island 18 (USFWS, pers. comm.)

Fish Productivity Zone

Anadromous fish common within the Hanford Reach include chinook, coho, and sockeye salmon, and steelhead trout. Currently, approximately 2.5 million salmon and steelhead return to the Columbia River to spawn and rear, and include individuals of both species that spawn in the Hanford Reach. Activity of spring and summer chinook, coho, and sockeye salmon is limited to up– and downstream migration within the reach.

Approximately 60 percent of the fall chinook salmon passing the McNary Dam return to spawn in the Hanford Reach. The primary spawning areas include Vernita Bar, Locke Island, and White Bluffs. Although measures of steelhead spawning have not been recorded for the reach, the area is used for spawning and holding by adult fish.

Resident fish in the Hanford Reach include white sturgeon, mountain whitefish, and smallmouth bass which comprise a majority of the existing sport fishery. White sturgeon, which occur in isolated assemblages, spawn within vestigial habitat of the Hanford Reach. Smallmouth bass were introduced into the Yakima River and subsequently spread to the Columbia. Smallmouth bass contribute the sport fishery within the Hanford Reach. Mountain whitefish occur throughout the reach during the entire year and likely are afforded spawning habitat throughout the entire length of the Reach.

Mountain sucker, sandroller, paiute sculpin, and reticulate sculpin are state Species of Special Concern that also occur within the reach.

Benthic Invertebrate Productivity Zone

Benthic invertebrate productivity along Hanford Reach should not be affected significantly for any of the alternatives.

Unique Habitat

Bluffs. The White Bluffs on the north river bank and Umtanum Ridge on the south bank below Priest Rapids Dam provide nesting habitat for prairie falcons, cliff swallows, bank swallows, and rough–winged swallows. Canada geese also use the bluffs for nesting.

Dunes. The terrain of the Hanford Dunes rises and falls between 10 and 16 feet above ground, creating sandy habitats 2.5 to several hundred acres in size (Department of Army 1990). The dunes are vegetated by bitterbrush, scurfpea and thickspike wheatgrass. This community is ecologically important because of its unique vegetation which stabilizes the rivershore.

Orchards/Groves. Prior to 1943, the Hanford town site was inhabited by settlers who planted now remnant groves of black locust, Lombardy poplar, white poplar, Siberian elm, and white mulberry. Because many of these non–native specie are aggressive colonizers, they have become established within the riparian zone along the river and maintain a non–native vegetative component on the site. These trees that occur along the shoreline provide nesting habitat for great blue herons and roosting habitat for bald eagles.

Spring Streams. Rattlesnake and Snively springs are highly diverse biologic communities (Cushing and Wolf 1984). Watercress, which persists until flash floods decimate populations in the winter and early spring, is abundant. Other vegetation includes bulrush, spike rush, and cattail. These springs provide water for terrestrial vertebrates within the arid portion of the Hanford site (Cushing 1990).

Human Effects

The Hanford Reach, has received relatively minor disturbance since the 1940's when the Department of Energy acquired lands for the location of its facilities. Today only 6 percent of the landbase is used for Department of Energy operation facilities (Cushing 1990). Included in this area is 11 km^2 adjacent to the south shore of the Hanford Reach that accommodates the retired production reactors and the N reactor. The reach receives minimal disturbance from facility operation.

In 1977 the entire Hanford site was designated as a National Environmental Research Park (Cushing 1990). This is of significance in an region where the predominant adjoining land use is irrigated agricul-

ture, where tillage and grazing has converted a majority of former sagebrush–steppe to cultivated fields or pasture.

2.2.9.2 Wildlife

The Hanford Reach was ranked as the second most important area for fish and wildlife in the state, identifying the area as a regionally significant resource (USFWS 1992).

Waterfowl

Wintering waterfowl represent a primary resource of the Hanford Reach. Currently, 23 species use the reach for resting and feeding, although overall use has declined throughout the recent past (Fitzner 1991). Declines could be attributed to changes in management of downstream areas or changes in crop production in fields adjoining the reach. These factors, or intermittent occurrence of suitable foraging habitat (e.g., sloughs and backwater areas) may be responsible for the uneven distribution of waterfowl throughout the reach.

The Hanford Reach is off–limits to waterfowl hunting, from the powerline crossing upstream to the Vernita Bridge. This designation affords a refuge that accommodates resting and feeding activity of waterfowl. The primary nesting species along the reach are the mallard and Canada goose. However, gadwall, teal, and common merganser also take advantage of nesting habitat afforded along the river shorelines.

The Hanford Reach is a primary production site for Canada geese. Historic declines in nest numbers reflect the steady decrease in nest site availability. During 1980, 90 percent of goose nests were located on ten islands (Deward 1981). Site suitability for nest location is based on habitat as well as potential for nest success or failure. Previously, coyotes have been implicated in reducing nest success of Canada geese by predation on eggs and nestlings.

Colonial Nesting and Shorebirds

Colonial nesting species, including Forster's tern, California gull, ring–billed gull, and great blue heron, have established significant breeding populations within the Hanford Reach. Black–crowned night herons, and white pelicans, a state endangered species, are a desired species for management by the WDFW. During 1993, a night heron colony became established and was productive on Island 18 within the reach (USFWS, pers. comm.). Although white pelican numbers are increasing along the reach, currently no nesting has been recorded. The long–term management objective is to establish pelican nesting habitat along the reach. During 1993, spotted sandpipers nested on Island 14 within the reach.

Nongame Birds

Songbirds occur along the Hanford Reach, and nest within willow, cottonwood, and mulberry trees and shrubs along the shoreline. Common species include the western kingbird, horned lark, cliff swallow, barn swallow, black–billed magpie, common raven, American robin, European starling, yellow–rumped warbler, white crowned sparrow, dark–eyed junco, western meadowlark, red–winged blackbird, house finch, and house sparrow (WHC 1992).

Upland Game Birds

While several species are present in the area, including California quail and sharp–tailed grouse, none are expected to be effected by any of the alternatives.

Raptors

Raptor species occurring along the Hanford Reach are identified within designations for threatened, endangered, or sensitive (TES) species; or as species of special concern and are discussed below within the context of TES species.

Aquatic Furbearers

Furbearers occurring within backwater sloughs along the Hanford Reach include beaver, muskrat, and mink. Beaver distribution is generally limited by

fluctuations in water level, that affects forage supply and individuals susceptibility to predation.

Terrestrial Furbearers

Raccoons, skunks, long–tailed weasels, short–tailed weasels, and bobcat occur in the area.

Big Game

Mule deer, the most common big game species in the area, use the Hanford Reach to forage, rest, and fawn (Natl. Park Serv. 1992), relying primarily on riparian habitat and islands for fawning (Tabor et al. 1980). Fawn mortality has been attributed to coyote predation (Steiger et al. 1980) that limits overall population production. Occasionally, white–tailed deer are observed within the reach (Fickeisen 1980). The Hanford Site serves as a refuge for big game. Deer cannot be hunted on the site, and hunting is only permitted on the Wahluke State Wildlife Recreation Area in Franklin County.

Elk were first observed on the Hanford Site in 1972. The origin of the herd is suspected to be in the Cascade Mountains from where elk migrated to the Rattlesnake Hills. Recent surveys (1992) indicate that the population is increasing, and that approximately 170 Rocky Mountain elk are established on the Arid Lands Ecology Reserve (B. Tiller, Pers. comm.). Elk cannot be hunted on the site, and hunting is only permitted on the Wahluke State Wildlife Recreation Area or private lands adjoining the ALE.

Predatory Species

Coyotes are the most common predator occurring along the Hanford Reach. Primary prey of coyotes include small mammals, mule deer fawns, and goslings. Coyotes have been implicated in reducing nest success of waterfowl and contributing to mortality of deer fawns within the reach.

Amphibians and Reptiles

Reptiles and amphibians are distributed between characteristically very dry or moist sites on the Hanford Site. The Great Basin spadefoot toad, western painted turtles, and western terrestrial garter snakes are distributed near water. Pacific rattlesnakes, gopher snakes, short–horned lizards side–blocked lizards, and western skinks occur on drier sites.

The side–blotched lizard is the most abundant reptile that occurs on the Hanford Reach. Short–horned and sagebrush lizards are also common. The gopher snake, western yellow–bellied racer, and the Pacific rattlesnake are the most common snakes on the Hanford Site. In shallow water areas, tree frog and spotted frog occur in association with areas of aquatic vegetation. In more sparsely vegetated areas, long–toed salamanders would be expected to occur.

Endangered, Threatened, and Sensitive Species

Because of the protection afforded to vegetation and wildlife by the designation of the Hanford site as a NERP and the restrictions on hunting on site, unique biological resources are able to persist. A listing of Federal endangered, threatened, sensitive, and candidate species follows.

Plants	
Howelia aquatilis	Federal threatened
Golden Indian paintbrush	proposed threatened
Birds	
Bald eagle	Federal threatened
Western burrowing owl	Federal candidate–2; state candidate
Little willow flycatcher	Federal candidate–2
Olive–sided flycatcher	state candidate
Mammals	
Long eared myotis	Federal candidate–2
Fringed myotis	Federal candidate–2

Long–legged myotis	Federal candidate–2; state candidate
Washington ground squirrel	Federal candidate–2; state candidate
Yuma myotis	Federal candidate–2; state candidate
Pale Townsend's big–eared bat	state candidate
Small footed myotis	state candidate
Amphibians and Reptiles	
Tailed frog	Federal candidate–2
Northern sagebrush lizard	Federal candidate–2; state candidate
Spotted frog	Federal candidate–1
Fish	
Green sturgeon	Federal candidate–2
River lamprey	Federal candidate–2; state candidate
Westslope cutthroat trout	state candidate
Bull trout	Federal candidate–1
Pacific lamprey	Federal candidate–2; state candidate

A discussion of state sensitive species and species of special concern that occur on the Hanford Site are presented below. These species occur or have been recorded for the Hanford Site and are regarded as unique resources.

Fish. Washington State Species of Special Concern, that occur in the Hanford Reach include mountain sucker, sandroller, paiute sculpin, and reticulate sculpin.

Although its distribution is limited, the sandroller is endemic to the Columbia River system and has been found within the Hanford Reach (Dauble 1991).

Birds. The Hanford Reach provides habitat for bald eagles which are classified as a Federal threatened species. A wintering population of approximately 50 birds occurs along the Hanford Reach from the Umatilla National Wildlife Refuge to the Vernita Bridge. Bald eagles that occur along the Hanford Reach are reliant on waterfowl and spawned–out salmon carcasses for forage, and on groves of trees for roosting. Bald eagles generally initiate nesting along the Hanford Reach in April, but in the past have abandoned their nest sites. Currently, no nesting is reported for the reach.

The occurrence of peregrine falcons has not been reported for the Hanford Reach since 1987. The Aleutian Canada goose, sandhill crane, and black tern are reported for the Hanford Site. However, activity is limited to resting or foraging during migration and does not include nesting (WDFW, Pers. comm.).

In addition to bald eagles and ferruginous hawks, presence or absence of Swainson's hawk, long–billed curlew, western sage grouse, white pelican, loggerhead shrike, and great blue heron is recorded regularly for the Hanford Reach.

Swainson's hawks nest in trees along the Hanford Reach. Approximately 28 pairs nest within the area of the Saddle Mountain National Wildlife Refuge and the Wahluke Wildlife Recreation Area (Radke and Fitzner 1991).

The ferruginous hawk is presently listed as a state threatened species and is a candidate for Federal listing as threatened or endangered. Ferruginous hawks have declined in the recent past due to a reduced prey base and increased human disturbance in former nesting habitat. Approximately, one–sixth of the ferruginous hawks in the state of Washington occur along the Hanford Reach. Currently, there are 12 active nests on the site that occur in association with high voltage transmission towers.

The long billed curlew nests in isolated areas throughout the Hanford Site, Wahluke Slope, and on the Saddle Mountain National Wildlife Refuge. Approximately 300 birds occur throughout these areas (Allen 1980). The preferred habitat of long–billed curlews is grass covered uplands or islands that provide nesting, foraging, and loafing habitat for curlew. This species has been down–listed to a category three species, and is no longer being considered for listing as a threatened or endangered species.

Although white pelicans do not nest on the Hanford Site, breeding habitat is present along the reach. Future resource management objectives include establishing a breeding colony on the Hanford site.

Loggerhead shrikes, which are considered a candidate species for Federal and state listing rely on shrub–steppe habitat for nesting and foraging. The species tend to roost and nest in dense sagebrush and the Hanford Reach affords high quality habitat for shrike (Dobler 1992).

Mammals. The pygmy rabbit is a state threatened species and is a Federal candidate species. The species is endemic to the western states, and its historic range includes an isolated portion of the Columbia Plateau. Pygmy rabbits requires dense (50 percent cover) sagebrush and rabbitbrush (USFWS 1979).

Invertebrates. One aquatic mollusc that occurs in the Hanford Reach is a Federal candidate species. Reproductive populations of the Columbia pebblesnail occur throughout the reach and serve as food for goldeneye and mountain whitefish.

Amphibians and Reptiles. The spotted frog occurs in shallow waters of ponds and wet meadows or streams. The species occurs commonly with bull frogs, which are likely predators of this native species. Although reported for the site, individual observations or known locations have not been documented.

Plants. The persistantsepal yellowcress is a Federal candidate species and is considered endangered by the state. Persistentsepal yellowcress occurs along unimpounded stretches of the Columbia River from Vernita Bridge to RM 345 and below the Bonneville Dam near Beacon Rock State Park.

Columbia milkvetch is a Federal candidate species and is considered threatened by the state (WNHP 1990). Milkvetch occurs in an area near Wanapum Dam south to Vernita Bridge. The species occurs in the west (south) side of the Columbia.

Hoover's desert parsley is a Federal candidate species and is listed as threatened by the state of Washington. Its distribution is limited to basalt outcrops of Umtanum Ridge near Priest Rapids.

State sensitive species that occur along the Hanford Reach include dense sedge, shining flatsedge, bristly cryptantha, gray cryptantha, Piper's daisy, dwarf desert primrose, southern mudwort, and false pimpernel (WNHP 1990).

2.2.10 Brownlee Reservoir

Short–term Operational Limits	
Lake Elevation	
Freeboard	2,090 ft
Maximum pool	2,080 ft
Normal full pool	2,077 ft
Minimum pool	1,976 ft
Discharge	
Minimum	No limits
Tailwater	No limits

Brownlee Reservoir is a non–Federal hydroelectric facility located near Weiser, Idaho on the Snake River (RM 247). The dam is one of three hydroelectric facilities often referred to as the Hells Canyon Complex. The other two dams making up the 'Complex' include Oxbow (RM 273) and Hells Canyon (RM 247) dams.

Brownlee Reservoir, completed in 1958, is owned and operated by Idaho Power Company. The primary purpose of the dam is power generation. However, flood control and recreation are other important project functions.

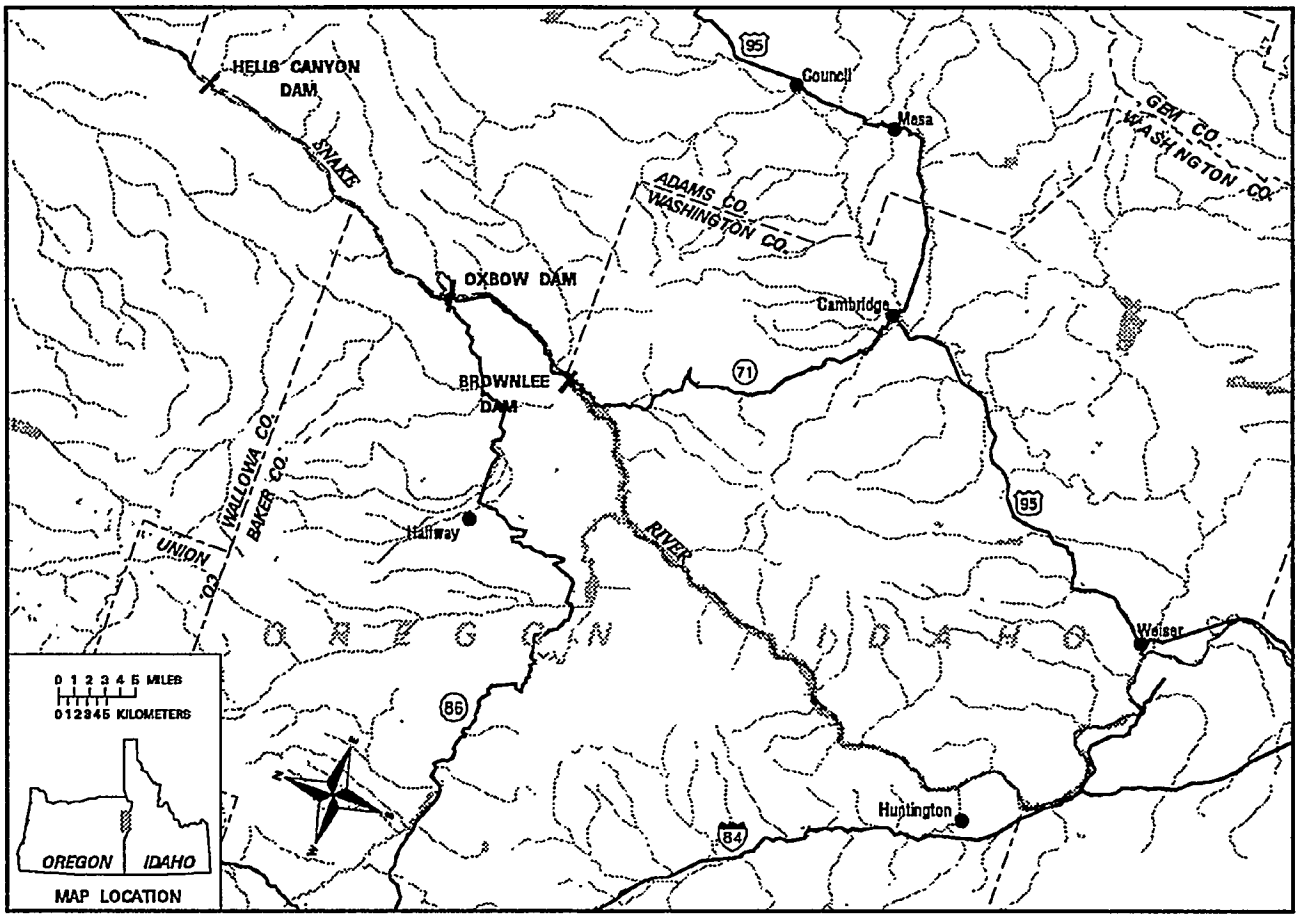

Figure 2–10. Brownlee, Oxbow, and Hells Canyon Dam Reservoirs

Full pool elevation at Brownlee is 2,077 msl. However, some FERC license requirements such as downstream flow releases, power generation, ramping, and flood control constraints may require the reservoir be drawn down during certain times of the year. For example, the FERC license requires Idaho Power to draw the reservoir down to 2,034 by March 1 of each year (subjected to forecast run–offs).

This area is typically hot and dry in the summer, with mild winters. Winter conditions tend to be milder than those of adjacent uplands. Precipitation falls most heavily in the late fall–winter and spring periods (Asherin and Claar, 1976).

2.2.10.1 Physical Habitat

Barren Zone

As is common in other reservoirs in mountainous terrain, numerous landslides are scattered around the perimeter of Brownlee Reservoir and several extend into the reservoir. Unstable slopes are possible candidates for rapid drawdown slope failures. Some of the more recent landslides may have resulted from rapid lowering of water levels. Such failures generally occur in saturated material which is not free–draining.

Because Brownlee is used for storage, barren soil along shorelines is exposed when the reservoir is drawn down. At reservoir level 2,067 ft, mud flats

begin to occur. At 2,064 ft, stumps and snags begin to appear. (CH2M Hill, 1984).

Upland and Riparian Zones

Brownlee Reservoir is enclosed by rolling grass–covered hills, giving a smooth textured appearance with scattered pockets of riparian vegetation. From the dam to the upper end of the reservoir, the predominant vegetation type is big sagebrush/bluebunch wheatgrass. Big sagebrush dominates the shrub layer, with small areas of Douglas hackberry and antelope bitterbrush scattered about the main body of the reservoir. Antelope bitterbrush is usually found around steep, rocky slopes. Bluebunch wheatgrass is the dominant understory. Cheatgrass, an annual invader, has replaced the wheatgrass in overgrazed areas. This vegetation type covers the majority of the shoreline in this segment of the reservoir (Asherin and Claar, 1976).

At the upper end of the reservoir, shrub/willow type vegetation occurs between the high and low water lines, and is flooded annually. This vegetation type consist of several species of willow which may include peachloaf willow, coyote willow, and red willow. The understory composition varies from dense grasses, mainly cheatgrass, to sparse forbs. A limited distribution of cattail and cottonwood vegetation types occurs around shallow bays in the upper reservoir.

Vegetation in the many small side canyons along the reservoir varies considerably from one to another, depending on the slope and the amount of time water is present. Narrow, steep canyons, usually have a dense tree and shrub association with a poorly developed herbaceous layer. Wider, gentle canyons have an equal mix of trees, shrubs, and herbaceous cover.

Many tributaries of the reservoir have vegetation associations that cannot be typed, as no one species is dominant. Several different tree species may occur, including white alder, black cottonwood, box elder, and water birch as well as the many exotics of apple, plum, apricot, walnut, and grape. A well–developed shrub layer is common, with the herbaceous layer usually comprised of grass species (McKern, 1976).

Island Habitat

Creeping wildrye is the dominant vegetative species on the 405 acres of islands at the upper end of the reservoir. Barren soils or shrub/willow type vegetation may be found between the high and low water zones (CH2M HILL, 1984). Upper reservoir islands may become part of the main shoreline through land–bridging if the reservoir is drawn down too far. This could have major impacts for island nesters such as Canada geese.

Emergent/Submergent Vegetation Zone

Brownlee Reservoir is known to have significant water quality problems, particularly in the summer months. High water temperatures and high nutrient input (from upstream irrigation returns and sewage sources) cause algal blooms and encourage the growth of emergents (112 acres) and submerged rooted plants (38 acres) along the shoreline and in bays created by tributary inflows. Decomposition of this organic matter contributes to nutrient cycling and oxygen depletion (Goodnight, 1971).

Fish Productivity Zone

Following the completion of the three dam complex (Hells Canyon, Oxbow, and Brownlee) and the elimination of attempts to pass migrating salmon through the system, two general types of fisheries were developed: warm–water and cold–water fisheries. These reservoirs favor the growth of warm–water fish species, but support cold–water fish as well. Smallmouth bass and channel catfish seem to dominate the warm–water fishery, while rainbow trout dominate the cold water fishery.

Benthic Invertebrate Productivity Zone

References on this topic were not found. Preliminary indications show the proposed strategies are unlikely to change the existing benthic environment.

Human Effects

Except for a few small communities, residences are widely scattered. According to a Baker County

survey, there are 34 summer residences along the reservoir from Huntington downstream to the dam on the Oregon side. At the upper end of the reservoir is the City of Weiser, Idaho. Recreation use is probably the greatest human effect on this area. Brownlee has the greatest number (5) of developed recreation sites of the three dam complex. The developed sites are located on the upper and lower end of the reservoir. The middle segment is accessible only on the Oregon side via an undeveloped dirt road (CH2M Hill, 1984).

2.2.10.2 Wildlife

Waterfowl

Asherin and Claar (1976) reported that at least 30 species of waterfowl use the Snake River between Asotin, WA and Weiser, ID during some time of the year. Of these, six species are known or suspected to be nesting in the area. These include Canada goose, mallard, pintail, American wigeon, green-winged teal, and common merganser. They also reported finding 191 Canada goose nests located on islands in the Brownlee pool during 1975. Aerial surveys of the Snake River from Walter's Ferry to Farewell Bend documented an increase from 289 nests in 1973 to 900 in 1981. This area includes the upper end of Brownlee pool where major nesting islands are located. These islands make up 20 to 25 percent of the total goose nesting of this stretch of the upper Snake River.

Colonial Nesting and Shorebirds

The most common colonial nesting/shorebirds found in the project area are the great blue heron, killdeer, spotted sandpiper, American avocet, and ring billed and California Gulls. No breeding colonies of gulls or terns were found in the area when Asherin and Claar completed their survey in 1975. However, ring billed, California, and herring gulls, and Caspian, common, and Forster's terns were sighted in the project area during the nesting season.

Nongame Birds

Approximately 76 species of passerines are found in and around the project. Some of the more common species include red–winged blackbird, house finch, American goldfinch, and song sparrow. Species of the goatsucker, swift, hummingbird, kingfisher, and woodpecker families are also found around the project. Many of these species are totally dependent on riparian vegetation for food, cover, and nesting. Others, such as the kingbirds, use riparian areas along with surrounding habitat types as well.

Upland Game Birds

Upland game birds occupying the reservoir area include chukar, California quail, ring–necked pheasant, gray partridge, ruffed grouse, and mourning dove. Of these, chukar and mourning dove are the most widely distributed. Chukars use a variety of habitats on a daily and seasonal basis, seeking out shady loafing areas during the hottest parts of the summer and depending on tree/shrub riparian habitats in the fall where water is available. Mourning doves are common during all seasons but winter. They occupy all brush/shrub/tree habitats as well as agricultural fields.

Raptors

McKern (1976) noted that Sharp–shinned and Cooper's hawks are commonly found in riparian zones where the small birds they prey on are plentiful. Red–tailed, Swainson's, rough–legged, and ferruginous hawks, while using riparian zones for roosting and perching, generally scour upland fields, meadows, and brush fields for rodents. The marsh hawk uses riparian marshes and meadows as well as uplands in foraging. Osprey and bald eagles, dependent on the reservoir for fish, perch and roost in riparian trees, and coniferous forest at higher elevations.

Prairie falcons use cliff ledges for nesting, and like the golden eagle and peregrine falcon, seek food along ridges and slopes above the river. The American kestrel, a tree cavity nester, is more dependent on the riparian zone than the larger cliff nesters.

The following excerpt from McKern (1976) describes the occurrence and habitats of owls found around the reservoir. "Barn, screech, great–horned, long–eared, short–eared, and saw–whet owls relied heavily on riparian trees and shrubs for perching and roosting. Screech and long–eared owls nest in trees

or tree cavities, while barn and great–horned owls often nest in cliff cavities. Short–eared owls are ground nesters. Burrowing owls were observed primarily in upland types. Pygmy owls were seen only where coniferous forest extended down to Brownlee Reservoir."

Aquatic Furbearers

Aquatic furbearers found in the area include the river otter, mink, and muskrat. Most mink and muskrat activity has been noted in the upper Brownlee pool. River otter sightings have been noted in the lower end of the reservoir near the dam.

Terrestrial Furbearers

Five terrestrial furbearers were found in the Brownlee Project study area. They include the coyote, striped skunk, raccoon, red fox, and badger. The coyote, striped skunk, and raccoon are the most widely distributed of the terrestrial furbearers, ranging over many distinct vegetation types. Badger and red fox were observed only on the upper end of the reservoir. Badger were found in areas where sagebrush was in close association with riparian habitat and red fox were observed around intensive agricultural activities.

Big Game

Mule deer are by far the most numerous of the big game species, followed in numbers by elk and white–tailed deer. Mule deer and elk tend to use the lower, open elevations of the project in winter and higher elevations the rest of the year. White–tailed deer, whose numbers are much smaller, tend to stay near permanent cover such as that provided by riparian vegetation along tributary streams rather than elevation.

Grover (1983) reported deer and elk numbers had been increasing in game management units for about the last 15 years. This was especially true of elk which, in Oregon at least, were increasing at the expense of mule deer due to competition for forage. In 1993 Oregon Department of Fish and Wildlife reported deer numbers were on the decline. Predation is felt to be the suspected cause of this decline (pers. comm. Jack Melland, 1993).

Black bear occur throughout the area and cougar have been reported to use the lower end of the reservoir. They are probably present along the reservoir in the highest numbers during the winter, when deer move to the lower elevations. They have also been reported using Douglas hackberry and riparian vegetation along tributary streams.

Amphibians and Reptiles

A literature search for amphibians and reptile information was incomplete for this river segment. However, the western toad (Bufo boreas) is a species that is believed to occur in this area. Documented breeding sites contain warm shallow edges of lakes. Toads appear to be declining in North America, especially in the west. Very little is known of life histories, habitat requirements or presence/absence. Another amphibian, the spotted frog (Rana pretiosa) is also suspected to occur. They are associated with warm, shallow water, the same habitats that are preferred by the introduced bullfrog which is commonly thought of as being an efficient predator of the native spotted frog. Very little field data are available for this species. Preliminary analysis indicates that the proposed strategies should not change their existing habitat.

Endangered, Threatened, and Sensitive Species

The bald eagle and the peregrine falcon are the only threatened or endangered species expected to occur on the Brownlee Project. The endangered peregrine falcon formerly nested in Hells Canyon and has been sighted in the Hells Canyon Dam area, where suitable nesting cliffs exist. However, no nesting is known to occur in the canyon at present. Efforts to augment the peregrine population through captive propagation continue.

Bald eagles are listed as endangered in Idaho and threatened in Washington and Oregon. The Brownlee/Oxbow/Hells Canyon Complex is an important wintering area for bald and golden eagles. Asherin and Claar (1976) found that wintering bald eagle use peaks in February. Isaacs (1991) reported 52 eagles counted in Oregon along

Brownlee during the 1991 Midwinter Bald Eagle Survey. Bald eagles usually leave the area by late April.

Table 2–1 on page 2–56 below was produced by the USFWS and provides additional ESA information for the Brownlee Reservoir area.

2.2.11 Oxbow and Hells Canyon Dam Reservoirs

Short–term Operational Limits	
Oxbow Dam and Lake	
Lake Elevation	
Normal full pool	1,805 ft
Minimum pool	1,795 ft
Active capacity	11,000 AF
Discharge	
Minimum	No limit
Tailwater	No limit
Hells Canyon Dam and Lake	
Lake Elevation	
Freeboard	1,695 ft
Maximum	1,693 ft
Normal full pool	1,688 ft
Minimum pool	1,678 ft
Discharge	
Minimum	5,000 cfs
Tailwater	3

Oxbow and Hells Canyon Reservoirs are hydroelectric facilities located along the Snake River near Halfway, Oregon. The dams are part of three hydroelectric facilities often referred to as the Hells Canyon Complex. The other dam making up the Complex is Brownlee.

Oxbow and Hells Canyon dams, completed in 1961 and 1964 respectively, are owned and operated by Idaho Power Company. The primary purpose of the dams is power generation. However, flood control and recreation are other project functions. Other uses of the projects and surrounding area include water budget releases to assist in anadromous fish runs, livestock and wildlife forage production, ranching, farming, and some dispersed residential development (Asherin and Claar, 1976).

Oxbow is located at Snake River RM 271, approximately 12 miles downstream of Brownlee and 22 miles northeast of Halfway, Oregon. The storage created by Oxbow Dam, which extends to the tailwater of Brownlee, is quite limited. As such, the generation at Oxbow is determined by current or expected generation levels at Brownlee. Hells Canyon Dam is located downstream of Oxbow (about 24 miles) at Snake River RM 247.6. It too has very limited storage, so the power plant is operated in conjunction with the other two plants. Brownlee serves as the principal storage system, while Oxbow and Hells Canyon function with shorter retention periods.

This area is typically hot and dry in the summer with mild winters. Winter conditions tend to be milder than those of adjacent uplands. Precipitation falls most heavily in the late fall–winter and spring periods (Asherin and Claar, 1976).

2.2.11.1 Physical Habitat

Barren Zone

Ten percent of the shoreline of Oxbow and over 40 percent of Hells Canyon Reservoir is roadfill material due to the close proximity of the road that runs the entire length of these two reservoirs. Hells Canyon and Oxbow undergo very little fluctuation. They are narrower, which probably reduces the amount of waves created by wind, and they have rocky shorelines. Shoreline erosion in these two reservoirs is negligible when compared to Brownlee Reservoir (Asherin and Claar, 1976).

Table 2–1. Federally Listed and Proposed Endangered and Threatened Species and Candidate Species: Snake River from Brownlee Dam to the Oregon/Washington Border (1–7–93–SP–383)

LISTED SPECIES			
Birds			
Peregrine falcon	*Falco peregrinus*	D	LE
Bald eagle	*Haliaetus leucocephalus*	D	LT
Fish			
Chinook salmon	*Oncorhynchus tshawytscha*	D	LT
Spring/summer/fall runs in the Snake River. (Petitioned June 7, 1990; proposed June 27, 1991 in SGFR 29542–29544; listed April 22, 1991 in 57 FR 14G53)			
Snake River sockeye salmon	*Oncorhynchus nerka*	D	LE
Salmon River Tributary to the Snake River, Idaho. (Petitioned Aprinl 2, 1990; proposed April 5, 1991 in 56 FR 14055; listed November 20, 1991 in 56 FR 5b619)			
Plants			
MacFarlanes' four o'clock	*Mirabilis macfarlanoi*	D	LE
PROPOSED SPECIES			
None			
CANDIDATE SPECIES			
Mammals			
North American lynx	*Felis lynx canadensis*	S	C2
California wolverine	*Gulo gulo luteus*	S	C2
Pacific fisher	*Martes pennanti pacifica*	S	C2
Pacific western big–eared bat	*Plecotus townsendii townsendii*	D	C2
Long–eared myotis (bat)	*Myotis evotis*	S	C2
Long–legged myotis (bat)	*Myotis volans*	S	C2
Yuma myotis (bat)	*Myotis yumanensis*	S	C2
Pale Townsend's big–eared bat	*Plecotus townsendii townsendii*	S	C2
Washington ground squirrel	*Spermophilus washingtoni*	D	C2
Birds			
Northern goshawk	*Accipiter gontilia*	S	C2
Ferruginous hawk	*Suteo regalis*	S	C2
Western burrowing owl	*Athene cunicularia hypugea*	D	C2
Plants			
Hazel's prickly–phlox	*Leptodactylon pungens ssp hazeliae*		C2
Amphibians and Reptiles			
Tailed frog	*Ascaphus truel*	S	C2
Spotted frog	*Rana pretiosa*	S	C1
Fish			
Bull trout	*Salvelinus confluentus*	S	C1

E – Endangered
T – Threatened
S – Suspected
D – Documented
C2 – Information indicated listing as T or E may be appropriate, but is inconclusive presently.

Upland and Riparian Zones

The predominant vegetation types along Oxbow Reservoir are antelope bitterbrush and Douglas hackberry. The antelope bitterbrush vegetation type forms an open shrub layer dominated by bitterbrush with smooth sumac and blue elderberry. Cheatgrass dominates the herbaceous layer, with other herbaceous species occurring in the area being common components. The Douglas hackberry vegetation type occurs primarily on the upper end of Oxbow Reservoir where the current pool level does not reach the old natural river high water mark. Narrow bands of this type line the riverbanks above the highwater mark. Blue elder is an important constituent of the overstory, which is dominated by hackberry. The understory is a grassland type community. Minor amounts of Ponderosa pine/bluebunch wheatgrass, blue elder, cheatgrass grassland, and shrub willow vegetation types occur throughout the area around the reservoir, depending on site specific conditions.

From Oxbow Dam to Hells Canyon Dam, the predominant vegetation type is bluebunch wheatgrass/ sandberg bluegrass. Much of Oxbow's shoreline is rightful and talus slopes. White sweetclover dominates on these previously disturbed areas. Foxtail barley, cheatgrass, yarrow, alfalfa, and curley dock are also common on these sites.

Emergent/Submergent Aquatic Plant Bed Zone

Emergent vegetation is limited by the steep topography in the area and the fluctuating water levels. High water temperatures and poor water quality at Brownlee Reservoir causes algal blooms and encourages the growth of emergent and submerged rooted plants along the shoreline and in bays created by tributary inflows (Goodnight, 1971). To what degree Oxbow and Hells Canyon reservoirs experience the problems of Brownlee is unknown. However, it is visually apparent that Oxbow and, to a certain degree, Hells Canyon, have lower levels of primary productivity. Water retention in these two reservoirs is much less than Brownlee, which means nutrients will be less available and more dilute, and thermal stratification may not occur (Asherin and Claar, 1976).

Island Habitat

Total island acreage is minimal for Oxbow Reservoir at .5 acres. Hells Canyon Reservoir has almost 28 acres, most of which is bluebunch wheatgrass–sanberg bluegrass type vegetation (Asherin and Claar, 1976).

Fish Productivity Zone

Following the completion of the three dam complex (Hells Canyon, Oxbow, and Brownlee) and the elimination of attempts to pass migrating salmon through, two general types of fisheries were developed: warm–water and cold–water fisheries. These reservoirs favor the growth of warm–water fish species, but support cold–water fish as well. Smallmouth bass and channel catfish seem to dominate the warm–water fishery, while rainbow trout dominate the cold water fishery.

Benthic Invertebrate Productivity Zone

Appropriate references were unavailable, although preliminary analysis indicates the proposed strategies are unlikely to change the existing benthic environment. Benthic life in Oxbow and Hells Canyon dams is restricted by annual drawdowns. Insect larvae and crayfish are present along with other species.

Human Effects

Except for a few small communities, residences are widely scattered. Growth of this area is slow and tourism/recreation seems to be the economic mainstay. Water–related recreation makes up the bulk of human activity on these reservoirs. Hells Canyon, Copperfield, and McCormack Parks are the developed sites. Several roadside pull–offs exist for day use and dispersed camping opportunities.

2.2.11.2 Wildlife

Waterfowl

Asherin and Claar (1976) reported that at least 30 species of waterfowl use the Snake River between Asotin, WA and Weiser, ID during some time of the year. Of these, six species are known or suspected to be nesting in the area. These include Canada

goose, mallard, pintail, American wigeon, green-winged teal, and common merganser. Surveys of the Hells Canyon and Oxbow reservoirs identified common mergansers brooding on these projects. A wintering waterfowl survey conducted in January of the same area showed grebes, mallards, goldeneyes, and mergansers using the reservoirs. Mergansers and goldeneyes were the most common.

Colonial Nesting and Shorebirds

The most common colonial nesting/shorebirds found in the project area are the great blue heron, killdeer, spotted sandpiper, American avocet, and ring billed and California Gulls. No breeding colonies of gulls or terns were found in the area when Asherin and Claar completed their survey in 1975. However, ring billed, California, and herring gulls, and Caspian, common, and Forster's terns were sighted in the project area during the nesting season.

Nongame Birds

Approximately 76 species of passerines are found in and around the project. Some of the more common species include red–winged blackbird, house finch, American goldfinch, and song sparrow. Species of the goatsucker, swift, hummingbird, kingfisher, and woodpecker families are also found around the project. Many of these species are totally dependent on riparian vegetation for food, cover, and nesting. Others, such as the kingbirds, use riparian areas along with surrounding habitat types as well.

Upland Game Birds

Upland game birds occupying all or parts of the reservoirs include chukar, California quail, ring–necked pheasant, gray partridge, ruffed grouse, and mourning dove. Of these, chukar and mourning dove are the most widely distributed. Chukars use a variety of habitats on a daily and seasonal basis, seeking out shady loafing areas during the hottest parts of the summer and depending on tree/shrub riparian habitats in the fall where water is available. Mourning doves are common during all seasons except winter. They occupy all brush/shrub/tree habitats as well as agricultural fields.

Raptors

McKern (1976) noted that Sharp–shinned and Cooper's hawks are commonly found in riparian zones where the small birds they prey on are plentiful. Red–tailed and Swainson's hawks, while using riparian zones for roosting and perching, generally scour upland fields, meadows, and brush fields for rodents. The marsh hawk uses riparian marshes and meadows as well as uplands in foraging. Osprey and bald eagles, dependent on the reservoir for fish, perch and roost in riparian trees. Prairie falcons use cliff ledges for nesting, and like the golden eagle and peregrine falcon, seek food along ridges and slopes above the river. The great–horned owl relies heavily on riparian trees and shrubs for perching and roosting, and on cliffs for nesting. The American kestrel, a tree cavity nester, is more dependent on the riparian zone than the larger cliff nesters.

Aquatic Furbearers

Aquatic furbearers found in the area include the river otter, beaver, and muskrat. Most river otter sightings were in close proximity of Oxbow Reservoir and most likely accounted for one family group.

Terrestrial Furbearers

At least three terrestrial furbearers were identified by Asherin and Claar (1976) to inhabit areas adjacent to the reservoirs. They include the coyote, striped skunk, and the raccoon. The badger, spotted skunk, and the bobcat also occur according to ODFW, but sightings were never made in any of their 1975 and 1976 surveys.

Big Game

Mule deer are by far the most numerous of the ungulates, followed in numbers by elk. White–tailed deer and bighorn sheep are also found, although their numbers are much smaller. Mule deer tend to use the lower, open elevations of the projects in winter and higher elevations the rest of the year (Grover, 1983). Elk winter in this segment usually at higher elevations and prefer the open bluebunch wheatgrass slopes and benches bordered by stands of ponderosa pine. Bighorn sheep were transplanted/released near Hells Canyon Dam in 1971 by Oregon Game Com-

mission (now ODFW). Some of these animals were observed on the Idaho side of the canyon since the transplant which meant they were swimming the river, crossing Hells Canyon Dam on the road, or both (Asherin and Claar, 1976). These sheep eventually disappeared by the 1980s and a second transplant was performed by the State of Oregon (pers. comm Jack Melland, 1993).

Black bear use was noted in the Douglas hackberry and riparian tributary vegetation types. Black bear are infrequently observed in early spring on the open bunchgrass slopes and in the ponderosa pine stands and in the late summer and fall when berry crops are abundant (Asherin and Claar, 1976). Cougar have been sighted in the area, but numbers are small. They are probably present along the reservoirs in the highest numbers when deer move to the lower elevations (CH2M Hill, 1984).

Amphibians and Reptiles

A literature search for amphibians and reptile information was incomplete for this river segment. However, the western toad (Bufo boreas) is a species that is believed to occur in this area. Documented breeding sites contain warm shallow edges of lakes. Toads appear to be declining in North America, especially in the west. Very little is known of life histories, habitat requirements or presence/absence. Another amphibian, the spotted frog (Rana pretiosa) is also suspected to occur. They are associated with warm, shallow water, the same habitats that are preferred by the introduced bullfrog which is commonly thought of as being an efficient predator of the native spotted frog. Very little field data are available for this species. Preliminary analysis indicates that the proposed strategies should not change their existing habitat.

Endangered, Threatened, and Sensitive Species

The bald eagle and the peregrine falcon are the only Federally–listed species expected to occur on the projects. The endangered peregrine falcon formerly nested in Hells Canyon and has been sighted in the Hells Canyon Dam area, where suitable nesting cliffs exist. Efforts to reintroduce the peregrine to this area continue. Since 1987, a cooperative effort between the Peregrine Fund and the states of Oregon and Idaho have released 62 young birds into this area. Although sightings have been limited, mating behavior was recorded in the 1992 breeding season (pers. comm. Phil Mattson, 1993).

Bald eagles are listed as endangered in Idaho and threatened in Washington and Oregon. The Brownlee/Oxbow/Hells Canyon Complex is an important wintering area for bald and golden eagles. Asherin and Claar (1976) found that wintering bald eagle use usually peaks in February. Isaacs (1991) conducted a midwinter bald eagle survey in 1991 along the Oregon side of Hells Canyon and Oxbow reservoirs. Eleven eagles were counted on Hells Canyon and eight were counted along Oxbow's. Bald eagles usually leave the area by late April but there have been summer sightings on Hells Canyon Reservoir. These birds may be summering and nesting in the high country adjacent to Hells Canyon Reservoir (Asherin and Claar, 1976).

Table 2–1, produced by the USFWS, provides additional ESA information for the Hells Canyon Complex area.

2.2.12 Hells Canyon, Snake River

Hells Canyon, or that portion of the Snake River below Hells Canyon Dam, was established as a Wild and Scenic River in 1975 by PL94–199. The river forms the northern portion of the boundary between the states of Oregon and Idaho. It runs north approximately 100 river miles from Hells Canyon Dam to the small Washington town of Asotin where this free flowing stretch of the Snake turns into the upper end of Lower Granite Reservoir. The upper 32 miles, or that portion between Hells Canyon Dam and Pittsburg Landing is designated as Wild River. The thirty six miles downstream of Pittsburg Landing is designated as Scenic River (US Army Corps of Engineers Navigation Charts, 1990).

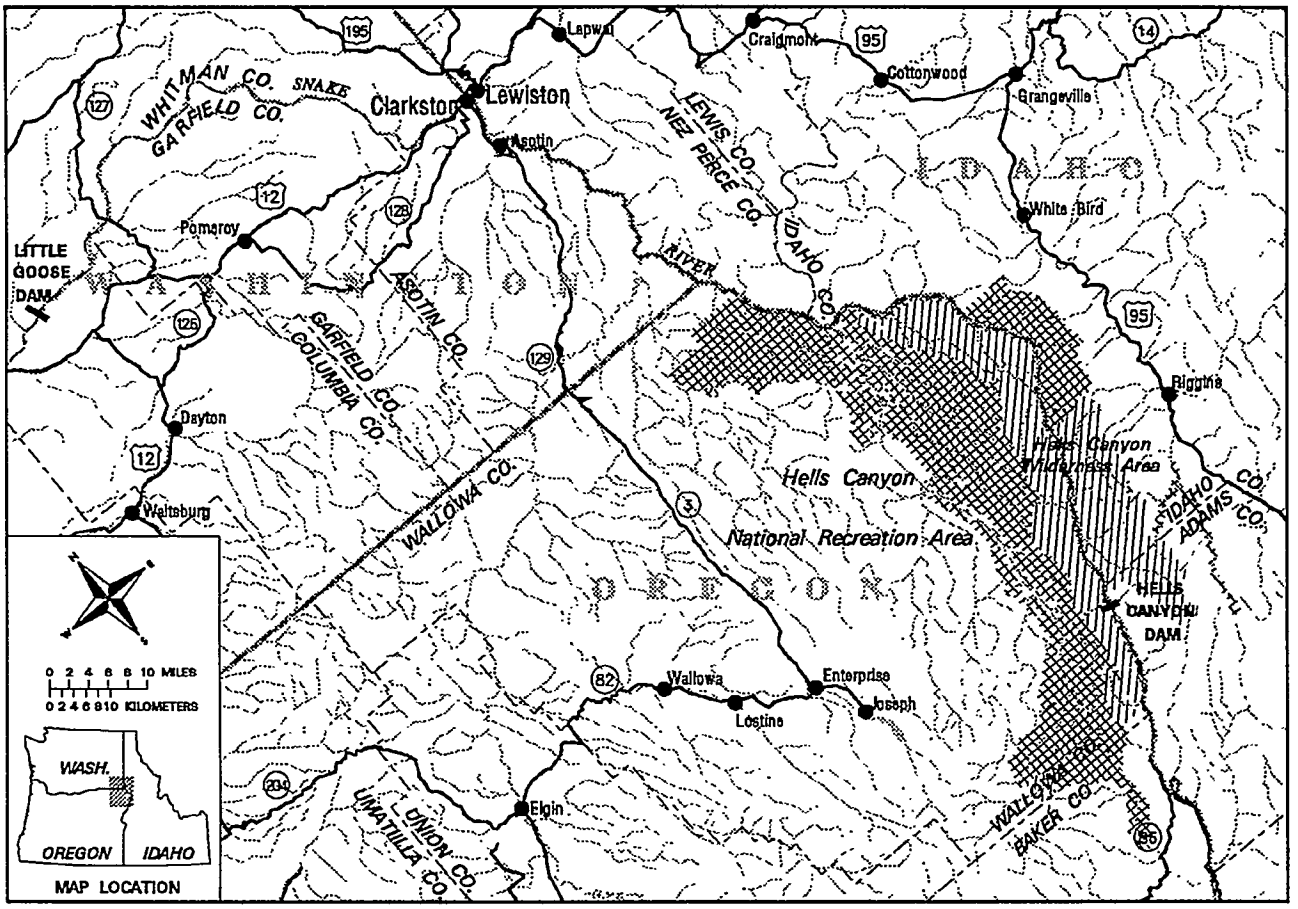

Figure 2–11. Hells Canyon, Snake River

Known as the deepest gorge in North America, this stretch of the Snake River averages about 10 miles from rim to rim and is over 5,000 feet deep in some places. Flows from Hell's Canyon Dam range from 5,000 to 30,000 cfs from the powerhouse. Additional flows are often provided via spill (pers. comm. Dan Sparks, Idaho Power, 1993). Numerous tributaries add additional flow as they enter the Snake River downstream of the dam.

Most of this portion of the Snake River is undeveloped and unroaded. There are two public access roads on the Oregon side and two on the Idaho side. Residences are widely scattered and usually depend on farming or ranching as an economic mainstay. Federal lands make up the majority of this area, and it is heavily used by recreationists.

This area is typically hot and dry in the summer with mild winters. Winter conditions tend to be milder than those of adjacent uplands. Precipitation falls most heavily in the late fall–winter and spring periods (Asherin and Claar, 1976).

2.2.12.1 Physical Habitat

Barren Zone

Layers of rock created by the Columbia River basalt flows have formed steep canyon walls. Several small sandy beaches add variety to the miles of rocky shorelines. These sand bars are decreasing in size and numbers as a result of erosion by the spring runoff, power peaking by the upstream dams, water budget releases, and power boating. In addition, the three upstream reservoirs are trapping sediments

and therefore not allowing new sand bars to form (Asherin and Claar, 1976).

Upland and Riparian Zones

The predominant shoreline vegetation type from Hells Canyon Dam to the mouth of the Salmon River is Douglas hackberry (McKern, 1976). Blue elderberry is found upstream near the Hells Canyon dam but is not found further downstream. Douglas hackberry types may range from an open savanna community to a closed thicket along the shoreline. The open, savanna type may have a serviceberry and mockorange understory, with cheat grass, sand dropseed, or bluebunch wheatgrass in the herbaceous layer (depending on moisture, topography, and grazing). The dense shoreline communities often contain mulberry and Pacific willow in the overstory, and a diverse herbaceous layer of starry cerastium, western scouringrush, American licorice, sunflower, hoarhound cocklebur, poison oak, sand dropseed, red threeawn, giant wildrye, and cheatgrass. These communities often represent an earlier successional stage, rather than open savannas, because of poorer soil development.

The Louisiana sagebrush vegetation type forms a minor component of the total shoreline. This type occurs below the high water line on cobblestone bars, reaching maximum development late in the year. Hairy goldenaster, willow, storkskill, sand dropseed, and red threeawn are the most common components of the type in addition to the dominant Louisiana sagebrush. In some areas, no shrub layer exist and the herbaceous layer is more diverse.

Ponderosa pine/Douglas hackberry vegetation type is another minor component of the shoreline miles. Bluebunch wheatgrass/sandberg bluegrass occurs frequently from Pittsburg Landing to the confluence of the Salmon–Snake Rivers. Minor patches of serviceberry–dominated shrub thickets occur downstream of Pittsburg Landing. Serviceberry usually occurs as scattered individuals in other shrub communities (CH2M Hill, 1984).

The only plant species Federally–listed for this area is McFarlane's four–o'clock. It is restricted to the Snake River canyon and its major tributaries (USFS, 1979).

Emergent Wetland Zone

Measurable quantities of emergent wetland habitat do not occur along this area of the Snake River.

Submerged Aquatic Plant Bed Zone

Aquatic vegetation has very limited distribution because of fluctuating water levels (McKern, 1976).

Island Habitat

Island habitat is minimal and is limited to the lower stretch between Pittsburg Landing and Asotin, WA. There is little difference between the vegetation found on these islands and that found above the high water mark along the adjacent shorelines.

Fish Productivity Zone

The Snake River in Hells Canyon supports populations of fish species that have regional, national, and even international importance. Of particular significance are the Snake River spring, summer, and fall chinook, which are Federally–listed as 'threatened,' and sockeye salmon which are Federally–listed as 'endangered' under the Endangered Species Act. The area supports both a warm water and cold water fishery for recreationists. Important fish species found in these two popular fisheries include steelhead, rainbow trout, white sturgeon, channel catfish, and smallmouth bass.

Benthic Invertebrate Productivity Zone

Benthic invertebrates should not be affected by any of the proposed alternatives.

Human Effects

Recreation in Hells Canyon is the primary human use potentially effecting the system. The Snake River corridor within the Hells Canyon National Recreation Area is designated as a Wild and Scenic River, which attracts increasing numbers of people on an annual basis.

2.2.12.2 Wildlife

Waterfowl

Canada geese, mallards, pintails, gadwalls, American wigeons, northern shovelers, green–winged teal,

blue–winged teal, cinnamon teal, wood ducks, redheads, canvasbacks, common and Barrow's goldeneye, ruddy ducks, common mergansers, and American coots are suspected to occur in Hells Canyon. Although Canada goose, mallard and common merganser broods were the only broods observed, pintails, American wigeon, and blue and green winged teal are suspected to nest in the canyon.

Canada goose nesting activity in Hells Canyon is widely scattered and erratic from year to year. Upper canyon nesting is usually always found to be on cliffs. This is mainly due to the lack of islands on the upper end of Hells Canyon and the numerous available cliffs in this stretch. The lower canyon does provide island nesting habitat, and geese take advantage of the islands available (Asherin and Claar, 1976).

Colonial Nesting and Shorebirds

The most common colonial nesting/shorebirds found in the project area consist of the great blue heron, killdeer, spotted sandpiper, American avocet, and ring billed and California Gulls. No breeding colonies of gulls or terns were found in the area when Asherin and Claar completed their survey in 1975. However, ring billed, California, and herring gulls, and Caspian, common, and Forster's terns were sighted in the project area during the nesting season.

Nongame Birds

Approximately 76 species of passerines are found in and around the project. Some of the more common species include red–winged blackbird, house finch, American goldfinch, and song sparrow. Species of the goatsucker, swift, hummingbird, kingfisher, and woodpecker families are also found around the project. Many of these species are totally dependent on riparian vegetation for food, cover, and nesting. Others, such as the kingbirds, use riparian areas along with surrounding habitat types as well.

Upland Game Birds

Chukar partridge is one of the most sought after small game birds in Hells Canyon. Abundance of cheatgrass brome, steep rocky brushfields, and Douglas hackberry contribute to excellent chukar and gray partridge (also called 'Huns') habitat. These habitats also contribute to the well being of both the California and mountain quail (USFS Hells Canyon NRA, Final EIS, 1979). Mourning doves are also common except during winter months when most migrate south for the winter months. Ring–necked pheasant and ruffed grouse are also found, though populations are generally smaller (McKern, 1976).

Raptors

The following birds of prey are known to occur in this free flowing stretch of the Snake River: Goshawk, Cooper's hawk, sharp–shinned hawk, northern harrier, rough–legged hawk, red–tailed hawk, Swainson's hawk, osprey, golden eagle, bald eagle, prairie falcon, American kestrel, long–eared owl, screech owl, and great–horned owl. A nesting survey completed by Asherin and Claar in 1974 and 1975 identified the American Kestrel as the most common nester in this group with 37 occupied territories. Eight occupied nesting territories of red–tailed hawk were also found as well as three golden eagle eyries, one prairie falcon eyrie and one suspected marsh hawk nesting territory. This data represents minimum numbers at best (Asherin and Claar, 1976). The peregrine falcon, a Federally–listed endangered species, has been known to nest in this area. Since 1987 the Peregrine Fund, the states of Idaho and Oregon, and the US Forest Service have cooperated in a successful release of 62 young peregrines in the canyon. Although observations have been limited, mating behavior was recorded during the 1992 breeding season (pers. comm. Phil Mattson, 1993).

Aquatic Furbearers

Aquatic furbearers consist of beaver and river otter. Neither are very common.

Terrestrial Furbearers

Five terrestrial furbearers were identified by Asherin and Claar (1976) to inhabit Hells Canyon. They include the bobcat, coyote, striped skunk, raccoon, and long–tailed weasel. Badger and spotted skunk are suspected to occur, but sightings were never

made in any of their surveys. Coyotes and raccoons seemed to be the most common.

Big Game

Mule deer are by far the most numerous of the big game species in Hells Canyon, followed by Rocky Mountain elk and white–tailed deer. Hells Canyon is a primary wintering area for these species. They will normally move up in elevation in the spring as green–up occurs. White tailed deer may be the exception. They seem to be found mostly north of Granite Creek and are more closely associated with riparian areas than are mule deer and elk. They do not tend to winter on the open, lower slopes, but rather stay near permanent cover types provided by riparian vegetation along tributary streams.

Bighorn sheep and mountain goats are also found in the Hells Canyon reach of the Snake River. These populations are the result of reintroduction efforts in Oregon, Idaho, and Washington. Sheep and goats often occupy the rock cliffs and bluebunch wheatgrass/sandberg wheatgrass vegetation types located above the river.

Black bear use was noted in the Douglas hackberry and riparian tributary vegetation types. Black bear are infrequently observed in early spring on the open bunchgrass slopes and in the ponderosa pine stands and in the late summer and fall when berry crops are abundant (Asherin and Claar, 1976). Cougar have been sighted in the area but numbers are small. They are probably present along the reservoirs in the highest numbers when deer move to the lower elevations (CH2M Hill, 1984).

Amphibians and Reptiles

A literature search for amphibians and reptile information was incomplete for this river segment. However, the western toad *(Bufo boreas)* is a species that is believed to occur in this area. Documented breeding sites contain warm shallow edges of lakes. Toads appear to be declining in North America, especially in the west. Very little is known of life histories, habitat requirements or presence/absence. Another amphibian, the spotted frog *(Rana pretiosa)* is also suspected to occur. They are associated with warm, shallow water, the same habitats that are preferred by the introduced bullfrog which is commonly thought of as being an efficient predator of the native spotted frog. Very little field data are available for this species. Preliminary analysis indicates that the proposed strategies should not change their existing habitat.

Endangered, Threatened, and Sensitive Species

Bald eagles, which are Federally–listed as threatened, winter along the Snake River. They may be observed roosting or feeding from October through May. Probable food items include fish, waterfowl, and carrion. Bald eagle numbers were estimated for this area in 1991 to be 76 birds (Isaacs, 1991).

The peregrine falcon is also a Federally–listed species. It is listed as endangered and was most likely no longer a resident of Hells Canyon at one point (USFS Hells Canyon NRA, Comp. Mgt. Plan, 1979). Efforts began in 1987 to reintroduce the peregrine into the area. More information is in the 'Raptors' discussion above.

Table 2–1, produced by the USFWS, provides additional ESA information for the Hells Canyon area.

2.2.13 Dworshak Project

Short–term Operational Limits	
Lake Elevation	
Full Pool	1,600 ft
Minimum Pool	1,445 ft
Discharge	
Minimum	1,000 cfs
Maximum weekly average (Oct. 1–Nov. 15	inflow + 1,300 cfs
Rate of change (Peck Gauge)	
Hourly	1 ft
24–hour (Oct.1–Nov. 15)	40 percent of previous weekly avg. outflow
Downstream flood control limit Clearwater River at Spalding	
Bank full	85,000 cfs
Flood stage	105,000 cfs
Lewiston levee capacity	150,000 cfs

The Dworshak Project is located on the north fork of the Clearwater River near Orofino, Idaho. The Nez Perce Tribe has particular interest in this project, as it is within their reservation. Also, the project controls a significant portion of the flows of the Clearwater River.

2.2.13.1 Physical Habitat

Barren Zone

Dworshak Project is a storage reservoir capable of a 155– foot drawdown. Rate and amount of drawdown and refill vary annually depending on environmental conditions. Typically the reservoir is managed to be full in July and drawn down during fall and winter reaching its lowest level by April. This operation pattern has caused Dworshak to exhibit typical characteristics for a storage reservoir: barren rocky slopes below high pool, devoid of soil and vegetation. Any significant erosion and landslide activity has already occurred from this repeated operation. Recent operations have included provision of additional flows for downstream fish passage, contributing to faster drawdown rates. However, this and future modifications of the like would not be expected to have any type of impact on existing conditions.

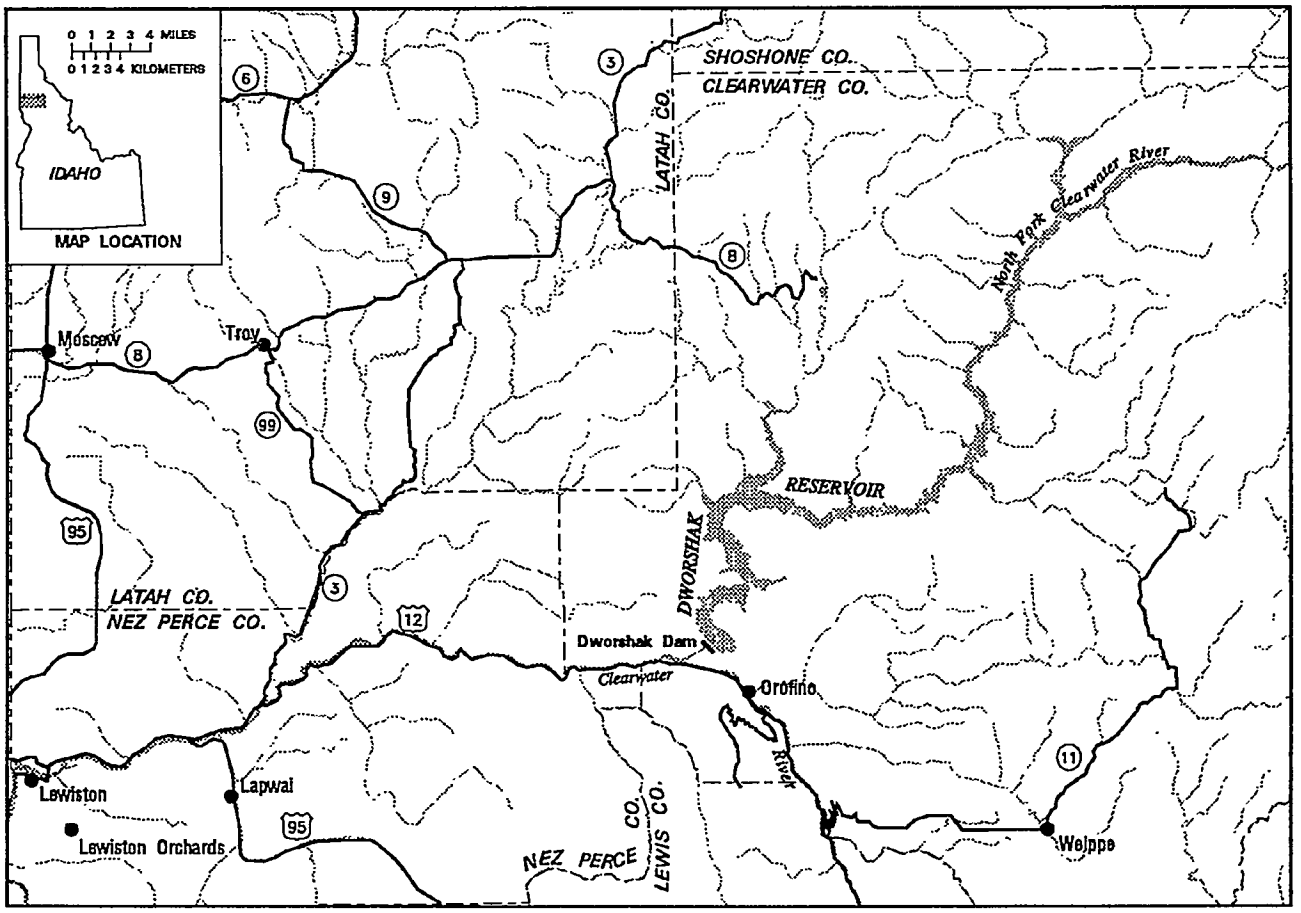

Figure 2–12. Dworshak Project and Lower Clearwater River

Upland Zone

The lands surrounding the reservoir are dominated by an open coniferous habitat type dominated by Douglas–fir and ponderosa pine associations along the lower end, transitioning to dense stands of Douglas–fir and cedar/hemlock toward the stream end of the pool. Generally, the more dense cover types characterize the north facing slopes while the south facing slopes contain open ponderosa pine stands, brush fields and meadows. Dominant shrubs include mallow ninebark, creambrush oceanspray, mockorange, common snowberry, serviceberry and thimbleberry. Grasses include bluebunch wheatgrass, cheatgrass brome, Kentucky bluegrass, orchardgrass and timothy. Maidenhair fern is a dominant and aggressive colonizer that occurs throughout the area, typically invading areas that have been disturbed sites.

According to cover mapping completed by an interagency team for a habitat loss assessment conducted on Dworshak, the following acreages of upland habitat types were determined: grass/forb (1,879); deciduous shrubland (6,882); evergreen forest open (570), dense (19,546), old growth (1,878); urban and developed (76); barren land (20). Approximately 3,795 acres have been clearcut and burned by the Corps of Engineers to create brushfields for wintering elk. Providing this browse for elk has been conducted under agreement with the Idaho Department of Fish and Game.

These habitat types have no dependence on the amount of water contained within the reservoir. Therefore, regardless of future operations, any changes in these habitats will be due to natural environmental influences, succession, and mitigation or timber management.

Riparian Zone

Very little riparian vegetation exists under current conditions. Deciduous scrub–shrub habitat that existed pre–project (104 acres) was inundated on completion of the project. Some deciduous forest is present (41 acres) associated with tributaries and springs. This habitat is dominated by red alder. Some relatively flat shelves, mostly associated with tributary deltas, support a 'green–up' of herbaceous vegetation in the spring. Riparian vegetation would not be expected to be affected by any type of drawdown regime.

Emergent Wetland Zone

Virtually no mappable emergent wetlands have existed, either pre–project or currently. This habitat type would not be expected to develop under future drawdown operations.

Submerged Aquatic Plant Bed Zone

No submergent aquatic plants of significance exist, nor would they be expected to develop under future drawdown operations.

Island Habitat

No islands exist or become exposed within the normal drawdown zone.

Fish Productivity Zone

The reservoir is presently populated with 18 species of fish, three of which were introduced into the drainage. Smallmouth bass were introduced, and kokanee have been heavily stocked since 1972. In 1979, some catches of northern pike were reported. Reservoir stocking of catchable and fingerling rainbow trout and kokanee is done on an annual basis. Cutthroat trout, steelhead, and smallmouth bass have been periodically released. The program for fishery mitigation includes stocking the reservoir annually with 100,000 pounds of fish. Future existing drawdown operations are not expected to impact the existing fishery.

Benthic Invertebrate Productivity Zone

Any benthic populations would be associated with tributaries and therefore not expected to be impacted by future drawdown operations.

Human Effects

Dworshak project and reservoir receives summer boating, fishing, and camping activity. Scattered campgrounds throughout the project are used in summer by recreationists and in the fall by hunters. Density of recreationists to water and land acreage

is relatively low. Future existing operations oriented toward achieving full pool during the summer recreation period would not change this use. Some additional use may be experienced in the future if this area experiences a general increase in human population. Fall use by hunters would remain unaffected.

2.2.13.2 Wildlife

Waterfowl

Some nesting wood duck, mallard and common merganser occurs on the reservoir in association with the tributaries at the upper end of the reservoir. The reservoir is used as a stop–over mainly during spring migration.

Colonial Nesting Birds

Great blue heron can be observed along the reservoir, occurring primarily in association with the tributaries and upper reservoir area.

Shorebirds

The following have been observed along the reservoir: common snipe, marbled godwit, solitary sandpiper, American avocet and killdeer. Killdeer is probably the only species that potentially nests on the project. Most shorebird use is confined to the tributaries and upper end of the reservoir.

Nongame Birds

Downy woodpeckers and black–capped chickadees nest and feed in the riparian forested areas. These and other species are dependent on creation of snags to provide suitable nest sites.

Raptors

Wintering Bald Eagle. These birds are know to winter along the reservoir, their highest concentration occurring immediately downstream of the dam. From 12 to 25 have been counted in the past. Raptors feed primarily on fish and also use ducks and carrion when available.

Osprey. These birds are common nesters along the reservoir. They feed exclusively on kokanee, trout and other available fish species.

Aquatic Furbearers

River otter and related species are confined to the upper reservoir and tributaries.

Terrestrial Furbearers

Due to the forested and more heavily vegetated nature of this project area, and given these species are not riparian–dependent, impacts due to future drawdown operations are probably nonexistent.

Big Game

Rocky mountain elk. Over 1000 elk have been observed wintering on project lands. Mitigation actions have been taken to assure sufficient browse is available to sustain them. While not dependent on the reservoir or riparian areas, the reservoir creates a hazard due to formation of ice. Depending on environmental conditions, it is not unusual to observe animals having broken through the ice and drowned.

White–tailed deer. Significant numbers of white–tailed deer also winter along the reservoir. Ice poses a hazard to these ungulates as well. Coyotes have been known to chase deer onto the ice facilitating their predation.

Amphibians and Reptiles

Several amphibian and reptile species occur in the area in association with shallow water areas, pools, shallow lake edges, or upstream tributaries. Bull frog, tree frog, and spotted frog occur in association with submerged aquatic vegetation or seasonal emergent wetlands and ponds. Long–toed salamander and western toad occur in seasonal wetlands or scrub–shrub wetlands. At higher elevations, tailed frogs occur in riffles and pools of tributary streams. The Coeur d' Alene salamander is a state species of special concern and occurs in the upper reaches of the Dworshak reservoir (S. Stephens, ICDC, pers. comm.).

Benthic Invertebrates

Due to the magnitude of drawdown, the reservoir is likely devoid of benthic fauna. However, some benthics are associated with the tributary areas and uppermost portion of the reservoir. Their occurrence would not change under future drawdown operations.

Endangered, Threatened, and Sensitive Species

Plants	
Broad–fruited mariposa	federal candidate 1
Jessica's aster	federal candidate 2
Birds	
Bald eagle	federal endangered
Mammals	
Gray wolf	federal endangered
Amphibians and Reptiles	
Coeur d' Alene salamander	Idaho state species of concern
Western toad	Idaho state species of concern
Spotted frog	Idaho state species of concern
Fish	
Chinook salmon	federal endangered
Bull trout	federal candidate 1

2.2.14 Lower Clearwater River

The Lower Clearwater River extends from the junction of the north and main forks of the Clearwater River to its junction with the Snake River at Lewiston, Idaho. The Nez Perce Tribe have a major interest in this reach of the river as it flows through their reservation and is a resource for the tribe.

2.2.14.1 Physical Habitat

Barren Zone

Water level fluctuations along the lower Clearwater River are regulated by outflow from Dworshak Dam. Peak flows occur in May with the spring freshet. Although this was also the case prior to operation of Dworshak Dam, the magnitude of the freshet was greater, causing bank and island scouring. These same islands are more stable today as is the riparian growth along the banks.

Average seasonal stage height fluctuation is about seven feet as measured at the Spalding gauge. Lowest flows are observed in August when Dworshak is still maintained for recreation. While the difference between highest and lowest flows is less today, an increase in daily fluctuations during releases from Dworshak have been observed. The water temperature regime has also been affected as cooler water than would normally be experienced is released from the lower depths of the reservoir upstream.

Upland Zone

The river is bounded by a road on one side and a railroad on the other. In many places there is only rock riprap between these transportation corridors and the river. Most of the upland vegetation consists of grasslands dominated by cheatgrass brome and perhaps some native bunchgrasses in places such as bluebunch wheatgrass. Ponderosa pine commonly occurs in association with the grassland.

Riparian Zone

Approximately 37 percent of the river bank is occupied by coyote willow (859 acres). Mixed deciduous shrub (26 acres) and deciduous forested wetland (97 acres) typical of that described for the lower Snake River also occur. These latter types were not nearly as predominant prior to construction of Dworshak Dam when high flood flows and ice scouring maintained vegetation in early successional stages.

Emergent Wetland Zone

Some emergents occur in small backwater pockets and narrow bands too small to be mappable.

Submerged Aquatic Plant Bed Zone

Little if any of this plant type is associated with a free–flowing river.

Island Habitat

Numerous islands totaling 243 acres are present. These islands are more stable since operation of Dworshak Dam. Many support deciduous forested

wetland (11 acres total). They are used by waterfowl, deer, furbearers, raptors, songbirds and any other wildlife that can reach them.

Fish Productivity Zone

Changes in relative abundance of game and rough fish have been observed since the operation of Dworshak Dam. Gordon, et. al. (1970) predicted the demise of the resident smallmouth bass population based on the decline in summer water temperature induced by regulated hydroelectric flows released from Dworshak Dam. Petit (1976) reported that by 1975 the sizable smallmouth bass population in the Clearwater River was reduced to a remnant of the pre–impoundment (1969) population. Further surveys of the river revealed a greater number of rough fish, much greater than the number of smallmouth bass and trout (Fleck et.al., 1978).

Benthic Invertebrate Productivity Zone

The composition and ecology of the benthic community is in question. The increased velocities and the sharp temperature and flow fluctuations resulting from operation of Dworshak Dam might affect the resident insect populations with subsequent adverse effects on resident fish (Fleck et.al., 1978). A study by MacPhee and Brusven (1973) indicated that hydroelectric peaking–induced flow fluctuations could change community structure to a less stable community marked by fewer species, changes in dominance, relationships among species, and changes in the available energy for higher trophic levels. However Brusven et. al. (1975), reported no major shifts in community structure during the pre– and post–impoundment period at several sites on the Clearwater River and below the confluence of the North Fork of the Clearwater River.

Human Effects

Aside from the occurrence of the road and railroad, there are several dwellings and homesteads scattered along the river. Some prominent beach areas are heavily used by recreationists, and fishing and boating are common along its entire length.

2.2.14.2 Wildlife

Waterfowl

Canada Goose

(1) Nesting: The number of nesting geese on downstream islands of the lower Clearwater has tripled since 1981. As many as 82 nesting structures have been erected in recent years to protect geese from high flows and predation. Approximately 50 percent of the structures are used. In addition, an average of 25 ground nesters have been successful.

(2) Brooding: Most brooding likely occurs within the lower reach under reservoir influence on a combination of managed and naturally vegetated sites. The Corps maintains and irrigates two pastures in this and other agricultural areas.

(3) Wintering: Some geese may winter along the reservoir–influenced portion of the river, but the vast majority of goose wintering occurs on Lower Granite Reservoir below Clarkston.

Common Merganser

(1) Nesting: A minimal amount of nesting occurs on the islands.

(2) Wintering: Prior to operation of Dworshak, much of this stretch froze in winter. However, this reach now remains ice free and harbors hundreds of wintering ducks.

Colonial Nesting Birds

Great Blue Heron

(1) Nesting: There are no known rookeries along this reach.

(2) Foraging: Great blue herons frequent the shallow water shorelines. It is not understood how or if changes in temperature and flow regimes have altered the potential forage base if any, but adequate forage is still available.

Shorebirds

Spotted Sandpiper

(1) Nesting: Some nesting may occur along limited beach areas and islands.

(2) Foraging: The seven foot annual fluctuation provides many suitable foraging sites for sandpipers along the shoreline.

Nongame birds

Downy Woodpecker

(1) Nesting: Some nesting cavity sites are available in snags amongst clumps of mature cottonwood and willow stands along this reach. Regeneration of this habitat type is limited though, due to attenuation of periodic flood flows. There are 86 acres of this habitat type along the river, and 11 acres on islands within the river.

(2) Feeding: Feeding for this and other gleanor species occurs in this habitat type that provides the highest habitat diversity within this arid ecotype. Most of the species found in this region are dependent on this habitat type for at least a part, if not all, of their life cycle.

Yellow Warbler. This species nests and feeds in the riparian shrub component, primarily associated with the scrub–shrub willow association. This habitat type occurs in small pockets along the river, many too small to be mapped but still having significant food and cover value for many species of wildlife. Approximately 725 acres of scrub–shrub are known to occur along the shorelines and another 134 acres along the periphery of the islands.

Raptors

Wintering bald eagle. Bald eagles winter along the entire reach feeding on fish, waterfowl, and carrion. They tend to concentrate just below the Dworshak Dam site, feeding largely on kokanee that pass through the turbines. Good perch sites are furnished by mature trees, and releases from Dworshak keep the lower Clearwater ice–free throughout the winter.

Aquatic Furbearers

Beaver. Beaver are known to occur throughout the reach, as are mink, muskrat and river otter. No lodges have been constructed in this environment with bank denning being exclusively used. Den sites usually occur in association with well developed riparian habitat. Beaver feed on abundant scrub–shrub willow and the bark of saplings.

River Otter. Otters occur in association with dense riparian, boulder and flood detritus/logjam cover types. Otter feed in the associated shallow water areas and den in previously excavated sites near the water, or within boulder piles, rock outcrops or dense logjam–type litter.

Terrestrial Furbearers

Raccoon. Raccoon are intimately tied to riparian habitat, especially for denning, which includes use of snags, rotted logs, and dense debris. The vast majority of prey items are obtained along the interface of shallow water shorelines and riparian vegetation.

Big Game

Deer. White–tailed deer are more prevalent in this area than mule deer. Most occurrence and use, however, occurs in the side canyons. Asherin and Orme (1978) found very minimal evidence of deer occurrence in either the riparian corridor or on the islands. They suspected this was due to the abundance of water in the side canyons, and the very minimal security cover afforded by narrow bands of riparian vegetation in the riparian corridor.

Amphibians and Reptiles

The Western toad is one of the most abundant amphibians encountered by Asherin and Orme (1978). As is the case with most amphibians, they are closely associated with permanent ponds, usually within forested wetland vegetation adjacent to the river. Long–toed salamanders also occur in these habitats. Bull frog, tree frog, and spotted frog occur in association with submerged aquatic vegetation of seasonal emergent wetlands and ponds. At higher elevations, tailed frogs may occur in pool or riffle habitats. The Western garter snake and ring neck snake (S. Stephens, ICDC, pers. comm.) are reptile species noted to occur in riparian habitats or permanent ponds associated with the river (Asherin and Orme 1978).

Endangered, Threatened, and Sensitive Species

Plants	
Broad–fruited mariposa	federal candidate 1
Jessica's aster	federal candidate 2
Birds	
Bald eagle	federal endangered
Mammals	
Gray wolf	federal endangered
Amphibians and Reptiles	
Ring neck snake	Idaho state species of concern
Western toad	Idaho state species of concern
Spotted frog	Idaho state species of concern
Fish	
Chinook salmon	federal endangered
Bull trout	federal candidate 1

2.2.15 Lower Snake River Projects

Short–term Operational Limits	
Lower Granite Dam and Lake	
Lake Elevation	
Full Pool	738 ft
Minimum Pool	733 ft
Discharge	
Minimum	
December–February	None
March–November	11,500 cfs
Maximum rate of change per hour	70,000 cfs
Little Goose Dam and Lake Bryant	
Lake Elevation	
Full Pool	638 ft
Minimum Pool	633 ft
Discharge	
Minimum	
December–February	None
March–November	11,500 cfs
Maximum rate of change per hour	70,000 cfs
Lower Monumental Dam and Lake Herbert G. West	
Lake Elevation	
Full Pool	540 ft
Minimum Pool	537 ft
Discharge	
Minimum	
December–February	None
March–November	11,500 cfs
Maximum rate of change per hour	70,000 cfs
Ice Harbor Dam and Lake Sacajawea	
Lake Elevation	
Full Pool	440 ft
Minimum Pool	437 ft
Discharge	
Minimum	
December–February	None
March–July	9,500 cfs
August–November	7,500 cfs
Maximum rate of change per hour	20,000 cfs

2.2.15.1 Physical Habitat

Barren Zone

Lower Granite and Little Goose dams operate within a five–foot range; Ice Harbor and Lower Monumental operate within a three–foot range. This has created a small band (primarily within the upper two feet of the operating range) that is periodically and irregularly inundated. The vast majority of this river stretch exhibits relatively steep topography with very few expanses of mudflats. There are only three areas of significant mudflat development at the mouths of tributaries: the Palouse River (RM 59.5), Tucannon River (RM 62) and Deadman Slough (RM 83). One other major tributary, the Clearwater River (RM 140), contributes a significant sediment load, however flows are high in this area and deposition is far enough downstream as to not form mudflats. Erosion, landslides and bank sloughing are accentuated by wind and wave action, and to a certain extent by towboat wakes. Although this is a continual dynamic action, it has been on–going for approximately 20 years and has therefore reached relative stability. Erosion and sloughing occurs, primarily along lower lying benches, and deposition of silts continues at the mouths of the tributaries.

A recent change in operations has included operation of the four reservoirs to within one foot of minimum operating pool (MOP) from April through October. Affects to the physical aspects of the drawdown zone are minimal. Advantages to vegetation are discussed below.

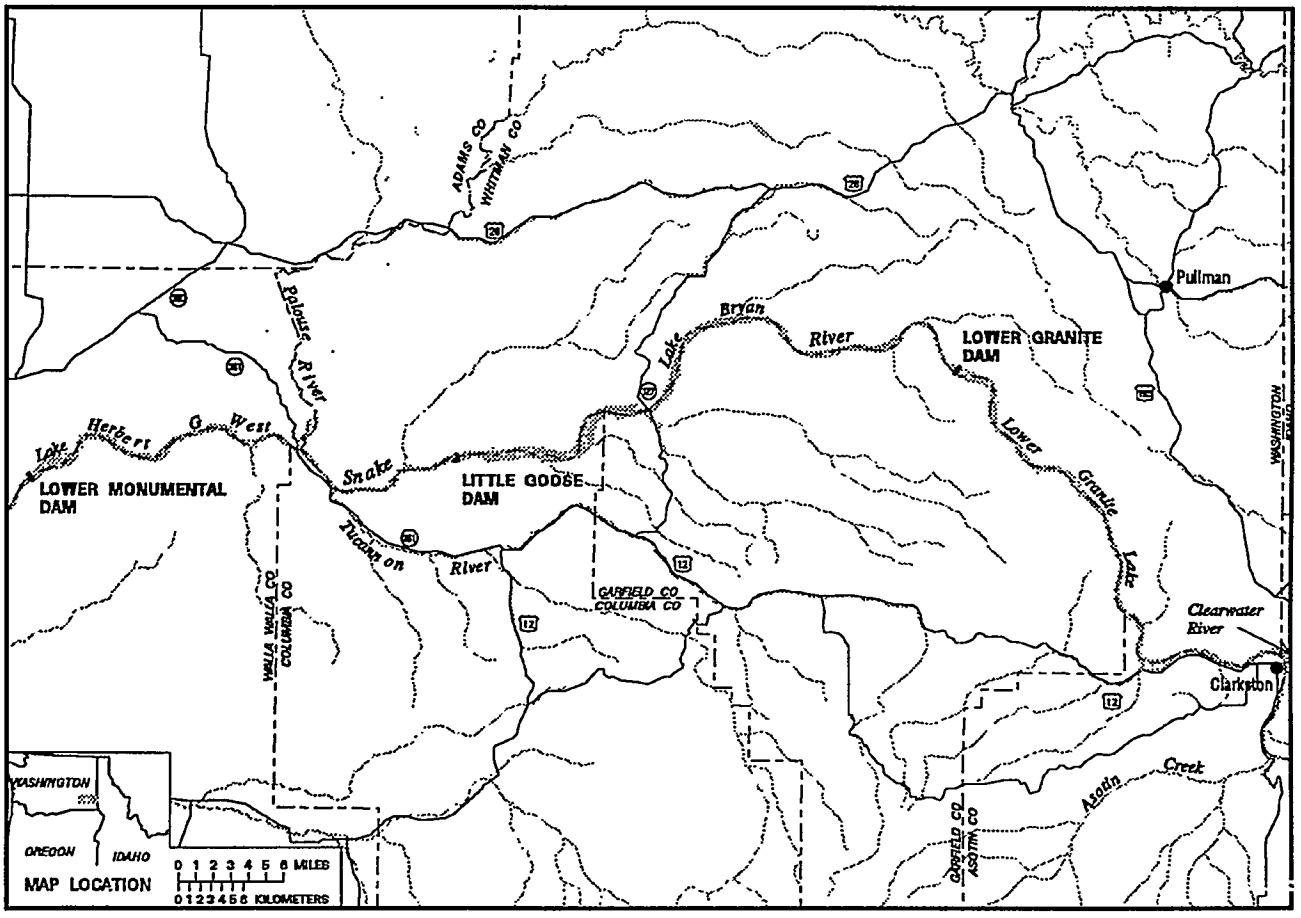

Figure 2–13. Lower Snake River Projects

A 34–foot drawdown of Lower Granite Reservoir, and 13–foot drawdown of Little Goose Reservoir were conducted in March 1992 to test physical impacts and feasibility in attempts to improve flows for juvenile outmigrating salmonids. As expected, significant sloughing of previously submerged sediments and banks was observed. It is almost certain that additional tests of this nature will be undertaken on the same two reservoirs and very possibly on all four lower Snake River reservoirs. Additional significant sloughing and erosion can be expected.

Upland Zone

The upland areas surrounding the projects are typical of the semi–arid Intermountain ecotype which is dominated here by rabbitbrush, cheatgrass and remnant bunchgrasses and forbs. Topographic relief increases from the lower to upper end of this reach reflecting increasing proportions of rock cliff and talus slopes. This upland community is the dominant vegetation type throughout the reach. Fencing of project lands has eliminated cattle grazing on this plant community thus encouraging re– establishment of some of the native plants. There are 13,497 acres of this vegetation type within project boundaries. Approximately 7,436 acres were inundated by the projects. (Above acreages do not include intermingled cliff and talus).

Continued historic operation of the projects would have little if any influence on this vegetation community. If the expected additional testing of drawdowns leads to annual drawdowns throughout the majority of the growing season, this community can be expected to replace some bands and pockets of riparian vegetation that is presently dependent on existing reservoir levels to provide subirrigation.

Riparian Zone

The extent and type of riparian vegetation occurring along this reach is totally dependent on water availability. Prior to construction of the dams, there were approximately 5,201 acres of riparian vegetation. This type included forb areas composed of species such as teasel, curly dock, and water hemlock; shrubland represented by hawthorn, chokecherry, currant and blackberry; scrub–shrub dominated by coyote and other willows; and forested areas dominated by black cottonwood and white alder. Much of this vegetation was found in discontinuous stringers along the main river at the bottom of the canyon. However, much of this habitat type also occurred in the side canyons associated with seeps and springs. Along with an increase in topographic relief from the downstream to the upstream end, there exists a corresponding gradient in precipitation that ranges from approximately nine to 15 inches. Increased precipitation in the upstream reaches affords a higher occurrence of riparian vegetation in the side draws and shallow pockets across the canyon slopes not found further downstream. This change in vegetation frequency becomes evident around RM 85.

Today, approximately 2,123 acres of similar habitat types occur in varying proportions. Species composition has also changed somewhat reflecting intrusion of invader species such as Canada thistle, false indigo, black locust, and Russian olive. The following percent losses have been estimated: Forb – 42 percent; shrub – 29 percent; scrub–shrub – 84 percent; forest – 82 percent. In addition to riparian vegetation that remained relatively undisturbed above the newly established water line, 1,050 acres are supported or have been artificially recreated through the use of irrigation on 10 habitat management units (HMU's) scattered throughout this reach. These areas were developed as part of the Lower Snake River Fish and Wildlife Compensation Plan (LSRFWCP). The following percentages represent the contribution of these habitat types to the total currently existing on all project lands: forb – 69 percent; shrub – 25 percent; scrub–shrub – 33 percent; forest – 28 percent.

An additional 3,434 acres of adjacent lands have recently been acquired under the LSRFWCP and will be developed and managed to support additional riparian vegetation. Under historic operation practices, some additional riparian vegetation, or at least changes in proportion of riparian types, can be expected through natural succession or to additional sediment deposition. The recent operation of the

reservoirs near MOP has shown significant benefits for riparian vegetation, particularly scrub–shrub which has naturally invaded the exposed band of rich sediment and can endure inundation from November through March. Continuance of this operational strategy would reflect additional development of this habitat type. Introduction of additional drawdowns, particularly any of significant length (e.g., April through June) could be devastating to existing riparian vegetation. Removal of water that presently infiltrates the root zone along the existing shoreline would likely cause that vegetation to desiccate and die and likely be replaced by upland vegetation types above high pool. In addition, modifications would have to be made to existing water intakes for irrigation systems presently supporting riparian–type vegetation on the HMU's.

Emergent Wetland Zone

Amount and occurrence of wetland vegetation has increased since project construction. From mapping that was performed in 1989 using 1/2 acre minimum mapping units (from which all acreages were derived for this reach), 44 acres of wetland vegetation now exist. Numerous small pockets of wetland vegetation less than 1/2 acre in size exist in small impoundments behind roads and railroads and small embayments. Vegetation is dominated by cattail with some rushes and sedges.

Little if any change in amount of wetland vegetation would be expected under historic operating conditions. With future operation at MOP during the growing season, a slight increase may be observed, or perhaps just a shift in location of existing wetland areas to slightly closer to MOP elevation with development of more riparian–type vegetation landward. Future operations implementing extended drawdowns would likely exhibit similar effects to those incurred on riparian–types. Long periods of desiccation during the growing season would eliminate this habitat type.

Submerged Aquatic Plant Bed Zone

Extent of this vegetation type has never been quantified for this reach but is assumed to be limited, correlated with the amount of shallow water present. Future operation at MOP could potentially influence an increase in this type since a more stable pool would be more conducive to these plants' survival. Future operations based on drawdowns would likely eliminate all of this vegetation type.

Island Habitat

Prior to project construction, there were over 50 islands of greater than 5 acres in size scattered throughout the 140 mile stretch of river. This component has been reduced to two islands of significant size (48 and 123 acres), the latter having become a recreation area connected to the mainland by a causeway. About 20 additional islands, some as small as 0.1 acre are also present. At least four have been created from dredged material disposal.

All of these islands maintain their integrity under existing operating conditions, i.e. no land–bridging occurs, even at MOP. However, if future operations incorporate drawdowns, most or all of these islands will exhibit land bridging, depending on the magnitude of the drawdown.

Fish Productivity Zone

Reference the Corps' 1992 Options Analysis EIS for a good discussion of resident fish productivity.

With continuance of historic operating conditions, resident fish productivity should remain unaffected. Continued operations at MOP could possibly enhance spawning conditions for some species. Future operations incorporating drawdowns could have devastating effects on many or most of these same species depending on timing, duration and magnitude.

Benthic Invertebrate Productivity Zone

Benthic diversity in the lower Snake projects is relatively low, and is dominated by chironomids and oligochaetes. The density of other taxa such as amphipods (*Corophium sp.*) and nematodes is low. Total biomass is highly influenced by oligochaetes and ranges from 2 g/m^2 to 20 g/m^2 in Lower Granite reservoir (Bennett et al. 1990).

Mollusc diversity has been greatly reduced by the impoundment of the Snake River, and molluscs

populations are presently dominated by the introduced Asian clam (*Corbicula fluminea*). In Lower Granite reservoir, *Gonidea angulata* is the most frequently observed large bivalve. Two species of floaters, (*Anodonta kennerlyi)* and (*A. californiensis)*, Federal candidates for listing as threatened and endangered species, are present. All molluscs in Lower Granite reservoir were severely impacted by the 1992 drawdown (Frest and Johannes 1992).

Densities of crayfish in the lower Snake reservoirs have not been quantified, except for limited evaluations in Lower Granite reservoir. Bennett et al. (1983) found the highest densities of crayfish at upstream sites in Lower Granite reservoir, with numbers being greater in the main channels compared to benches. Mortality during the 1992 drawdown would also indicate that large numbers of crayfish are associated with riprapped shorelines.

Benthic invertebrate densities in the drawdown zone would likely be reduced with the drawdown alternatives, as benthic organisms do not tolerate prolonged desiccation. Recolonization after refill would occur to some extent, dependent on duration and depth of dewatering, and would likely be greater in the upper pools where benthic drift from free–flowing stretches of the Snake River enters the lower Snake River projects. Recolonization by chironomids is likely to be most rapid because of their short life cycle and mobility of the adults.

Elimination of the mollusc fauna would be expected within the drawdown zone. Certain species that are already rare, such as the floaters, would probably be eliminated. The Asian clam, which is presently abundant and is an important white sturgeon food item, is likely to be substantially reduced (Bennett 1991).

Crayfish numbers would be greatly reduced by the drawdown alternatives. Based on observations during the 1992 drawdown, crayfish are very susceptible to stranding mortality because they seek refuge in nearby cover such as riprap, rather than following the receding water line.

Human Effects

Human activity and use of the reservoirs, primarily associated with recreation, i.e. boating, has increased relative to recreational use prior to creation of the reservoirs. This use is likely to increase under existing operations given general trends in increased 'leisure time' and observed and expected influx of retirees into the general area. Future operations incorporating MOP would likely seriously impact this recreational use.

Shoreline activity has increased locally, associated with dams and recreation areas, marinas and ports. Farming and grazing activities have almost been eliminated except for scattered cattle watering corridors, where cattle have direct access to the river. The fenced project lands created a buffer zone between the shoreline and all existing agricultural activities. The amount of this activity would remain unchanged under future conditions with perhaps some increase in 'curiosity seekers' under future drawdown operations. Drawdowns would also make islands accessible to people on foot.

2.2.15.2 Wildlife

Waterfowl

Canada Goose

(1) Nesting: Geese nest in the cliffs bordering the reservoirs along this reach with production corresponding to the occurrence and frequency of this habitat type which increases upriver. This component would be relatively unaffected by alternative strategies. New York Island, the sole remaining island of significance, produces an average of 64 successful nests annually. The other smaller islands that produce any successful nests average 0.3 – 2.4 annually. The Corps also maintains 75 goose nesting tubs located in various shallow water areas in association with HMU's. Use of these tubs by geese has increased over the years with the greatest use observed at the upper end of this reach. Highest use for all four reservoirs for which data is available was 15 successful nests in 1987.

(2) Brooding: An abundance of brooding pastures, both natural and artificially managed on HMU's, are present along this reach. This would not be expected to change under continued existing operating conditions. Continued operation at MOP could possibly provide some benefit in availability of sprouting herbaceous growth immediately adjacent to the water's edge. However, much of this zone is being invaded by woody species, creating conditions conducive to predation. Such growth could also hinder access and cause increased predation associated with existing landward pastures.

(3) Wintering: Most goose wintering occurs at the lower end of this reach, associated with the availability of irrigated agricultural lands providing a food source. The reservoirs are used primarily for roosting.

Mallard

(1) Nesting: Very little mallard nesting has been observed along the lower Snake River, most likely due to very limited occurrence of suitable dense nesting cover.

(2) Brooding: What little brooding that may occur is associated with the shallow backwaters and embayments.

(3) Wintering: Significant numbers of mallards winter on the reservoirs. As with geese, their primary use is roosting.

Colonial Nesting Birds

Great Blue Heron

(1) Nesting: There are no known rookeries along the lower Snake River.

(2) Foraging: Great blue herons are frequently observed along this reach. They forage along shallow shorelines, backwaters and embayments.

Shorebirds

Spotted Sandpiper. Shorebird occurrence along this reach is limited due most likely to limited availability of mudflats. The area is most likely used as a stop–over during migration. Although future operations incorporating drawdown would increase availability of mudflats, the expected durations would most likely eliminate desirable prey items.

Nongame Birds

Downy Woodpecker

(1) Nesting: Availability of nesting cavities associated with snags and decaying riparian hardwoods is an extremely limited habitat component along this reach. This is a necessary requirement for several species of neo–tropical cavity nesting birds. Present–day mitigation activities focus on replacement of this component which was prevalent along the original free–flowing river and associated canyon bottoms that have since been inundated. This is a difficult habitat type to replace for a variety of reasons, primarily due to lack of suitable areas to attempt re–establishment, and competing uses by other animals such as deer and beaver in earlier life stages of the tree.

(2) Feeding: Feeding for this and other gleanor species takes place in the same habitat type. This riparian forest habitat provides the highest habitat diversity within any single type found in this region and therefore provides necessary habitat components and life requisites for an abundance of species. Due to inundation from dams as well as poor grazing practices and increased frequency of fire in adjoining lands, this habitat type has become severely limited in extent.

Red–winged Blackbird

(1) Nesting: This species is totally dependent on cattail for nesting. This very common species can be found occupying almost all wetland areas supporting cattail throughout the reach. Continued operations similar to historic would not affect this habitat. Incorporation of MOP annually could possibly increase this habitat type slightly. Incorporation of annual

drawdown would likely eliminate this habitat type.

(2) Feeding: Although not necessarily dependent on wetlands for feeding, this species is rarely found in the absence of cattail.

Yellow Warbler

(1) Nesting/Feeding: This species exclusively occupies scrub–shrub habitat provided by shrub–type willow growth. Many small pockets of this habitat type occur along backwaters, embayments and tributary deltas. This habitat type provides food and cover for a variety of other animals as well.

Raptors

Wintering Bald Eagle

(1) Foraging: A few bald eagles winter along the lower Snake River, feeding primarily on waterfowl and, to a lesser extent, on upland game, salmonid carcasses and other wildlife carcasses.

Aquatic Furbearers

Beaver

(1) Denning: Beaver are quite common along the lower Snake River. Lodges are rare, with most denning occurring in banks and in association with at least sapling size trees.

(2) Feeding: Beaver are dependent on woody riparian growth as a food source.

Otter

(1) Denning: Requirements for this species are not as stringent as for beaver. Otter use dens previously excavated by other species, although always in close proximity to water.

(2) Feeding: Otters depend on prey found in shallow water and are also dependent on relatively dense bank cover that can be supplied by vegetation, woody debris and/or rocks. Heavy riparian vegetation cover provides the best environment for both the cover and feeding requirements of this species.

Terrestrial Furbearers

Raccoon. Raccoon foraging and denning requirements are largely dependent on prey items found in riparian–type habitats and associated shallow water.

Big Game

Deer

(1) Fawning: The primary species along this reach is mule deer. Whitetail deer are found along Lower Granite reservoir (the uppermost project) in association with dense shrub and tree cover. Although some island fawning may occur, mule deer are not dependent on islands for this. Primary use of the Snake River Canyon is for wintering with deer moving up and down the canyon draws and into the rolling wheatfields above on a daily basis. The HMU's, vegetated draws and other pockets of riparian vegetation provide good conditions for fawning. Impacts to these habitats would force deer to find suitable areas further from the projects and could possibly reduce overall populations because of this. Other suitable areas would already likely be used by other deer.

(2) Foraging: Although deer are found year–round on the projects and particularly on the HMU's, the primary dependency on the area would be for provision of winter browse.

Amphibians and Reptiles

Amphibian occurrence and use along the lower Snake River is limited. This could be due to a lack of suitable breeding habitat and/or lack of colonizing species post–inundation and low populations in the region in general.

As is the case with most amphibians, long–toed salamander, tiger salamander, Woodhouse's toad, a state monitor species, and Western toad are closely associated with permanent ponds, usually within forested wetland vegetation adjacent to rivers. Tree frog and spotted frog occur in association with

submerged aquatic vegetation of seasonal emergent wetlands and ponds.

Reptile occurrence and use is limited although some snake species are dependent on a well–developed riparian zone for availability of prey, cover and over–wintering requirements.

Endangered, Threatened, and Sensitive Species

Plants	
McFarlane's four–o'clock	Federal threatened
Northwest raspberry	Federal candidate 2
Jessica's aster	Federal candidate 2
Broad–fruited mariposa	Federal candidate 1
Snake River goldenweed	Federal candidate 2
Palouse goldenweed	Federal candidate 2
Cusick's lupine	Federal candidate 2
Spalding's silene	Federal candidate 2
Hazel's prickly phlox	Federal candidate 2
Bartonberry	Federal candidate 2
Insects	
Columbia River Tiger beetle	Federal candidate 2
Shepard's parnassian	Federal candidate 2
Birds	
Bald eagle	Federal endangered
Peregrine falcon	Federal endangered
Northern goshawk	Federal candidate 2
Western burrowing owl	Federal candidate 2
Harlequin duck	Federal candidate 2
Loggerhead shrike	Federal candidate 2
Western sage grouse	Federal candidate 2
Black tern	Federal candidate 2
Ferruginous hawk	Federal candidate 2; Washington State threatened
Olive sided flycatcher	Federal candidate 2
Mammals	
Gray wolf	Federal endangered
Preeble's shrew	Federal candidate 2
Long–eared myotis	Federal candidate 2
Long–legged myotis	Federal candidate 2
Yuma myotis	Federal candidate 2
Small–footed myotis	Federal candidate 2
Pale Townsend's big eared bat	Federal candidate 2
Washington ground squirrel	Federal candidate 2
Amphibians and Reptiles	
Tailed frog	Federal candidate 2
Spotted frog	Federal candidate 2; Washington State candidate
Northern sagebrush lizard	Federal candidate 2
Molluscs	
Columbia pebble snail	Federal candidate 2
California floater	Federal candidate 2
Fish	
Chinook salmon	Federal endangered
Sockeye salmon	Federal endangered
Bull trout	Federal candidate 1
Pacific lamprey	Federal candidate 2
Westslope cutthroat trout	Federal candidate 2
Interior redband trout	Federal candidate 2

2.2.16 McNary Project

Short–term Operational Limits	
McNary Dam and Lake Wallula	
Lake Elevation	
Normal Full Pool	340 ft
Minimum Pool	335 ft
Discharge	
Minimum	
December–February	12,500 cfs
March–November	50,000 cfs
Maximum change per hour	150,000 cfs

2.2.16.1 Physical Habitat

Barren Zone

The McNary reservoir typically operates within a five foot range. Much of the lower half of the reservoir is bordered by steep topography and rip rap protecting a road on the east side and railroad on the west side. The shorelines bordering the upper half of the reservoir are relatively flat, especially on the east side between the mouths of the Snake and Walla Walla Rivers. This provides for the creation of extensive mudflats when the pool is operated at or near its minimum. Erosion and landslide potential is minimal throughout the reservoir, however significant influx of sediment is contributed via the Walla Walla River which has formed an extensive delta at its mouth. Continual formation of this delta would be expected in the future. Little to no change would be expected regarding the extent of mudflats.

A recent change in operations has restricted water levels to within one–foot of MOP from April through October. This could have a minor effect on the shape and location of delta formation at the mouth of the Walla Walla River. While this operation would maximize the amount of mudflats exposed, it would concurrently promote desiccation.

Upland Zone

Upland areas surrounding the project are typical of shrub–steppe in the area. Gray and green rabbitbrush have replaced big sagebrush for the most part. Limited associations of sagebrush and bitterbrush can still be found within project boundaries, mostly on flat benches. Cheatgrass has replaced most of the native bunch grasses. There are presently 8,672 acres of upland habitat within the project. There would be very little if any affect on this plant community regardless of future operations.

Riparian Zone

Riparian vegetation is found in association with the reservoir shoreline, backwaters, sloughs and along tributaries. This vegetation is dependent on subirrigated conditions and represents three communities; forest or hardwood, shrub, and herb or forb. The habitat provided by this vegetation is very limited in extent and provides critical cover and food for the majority of wildlife species found in the area for at least part of the year.

The forest type is dominated by black cottonwood. The most extensive stand of cottonwood on the project is located at the mouth of the Walla Walla River. Willow is commonly found in association with cottonwood. The Yakima River delta, another major tributary, is composed mostly of Russian olive. Other common tree species include white alder, red alder, hackberry, and black locust. There are 1,255 acres of this habitat type on the project.

The shrub component is comprised of a scrub–shrub community of willow and an exotic, false indigo, usually found adjacent to the high water line along protected backwater areas. A more mesic shrub community is typified by species such as black hawthorn, chokecherry, golden currant and red–osier dogwood. Wood's rose and smooth sumac can withstand somewhat drier conditions. There are 365 acres of riparian shrub within the project.

The riparian herbaceous vegetation type is found chiefly on sandbars, mudflats and other riparian substrates as well as areas adjacent to the reservoir supporting subirrigated conditions. It is a very

limited habitat type occupying only 14 acres. Representative species include mustards, docks, pigweeds, composites, thistles, and Russian thistle. Grasses include foxtail, squirreltail and reed canarygrass.

Recent operation at MOP has encouraged development of scrub–shrub. This habitat type would be expected to mature under future similar operation. Other riparian types would be expected to remain relatively unaffected.

Emergent Wetland Zone

Approximately 354 acres of emergent wetlands occur, the majority located just below the mouth of the Snake River and in McNary Refuge which occupies McCormack Slough. Typical wetland taxa for the region are present including cattail, bulrush and sedge.

Continued operation at MOP could encourage expansion or minor displacement of this habitat type, i.e. replacement by scrub– shrub and development closer to the "new" water line. MOP operation would also increase the ratio of vegetation to water in the wetland ponds of McNary Refuge.

Submerged Aquatic Plant Bed Zone

This vegetation type has not been quantified. The most extensive beds likely occur in ponds within the refuge. Future operations at MOP could negatively impact these beds but could possibly be offset by establishment of beds in a more stable environment within the reservoir proper.

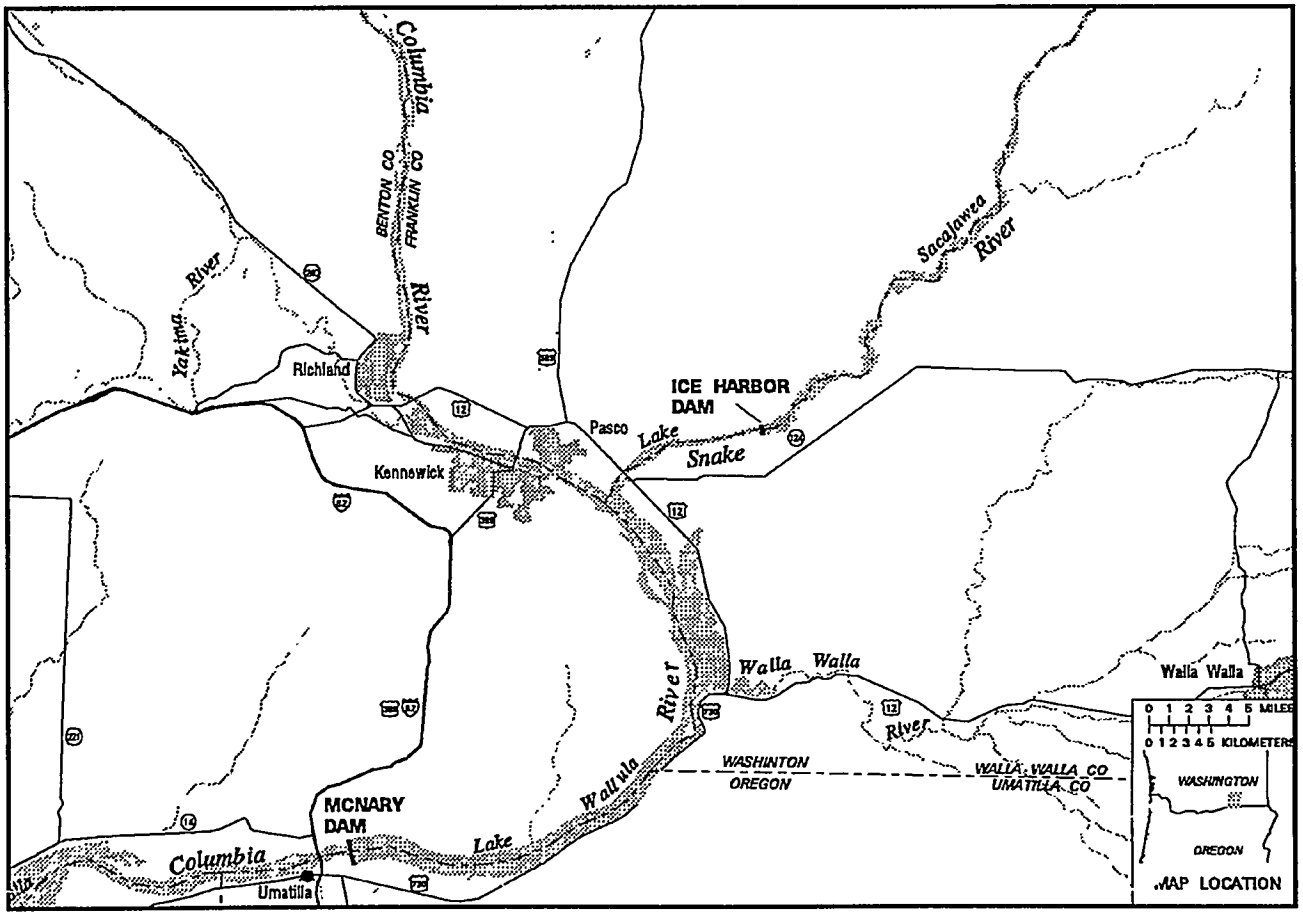

Figure 2–14. McNary and Ice Harbor Projects

Island Habitat

Dozens of islands were inundated by the project and replaced by relatively few new ones. The inundated islands were probably similar to those existing in the Hanford Reach and the Strawberry Islands located below Ice Harbor Dam. The 20 "new" islands are a result of partially submerged sand hills and bluffs. Other islands have been constructed using dredged material. Boise Cascade built a dredge island in 1985 composed of silt and cobble. Three islands were created from shot–rock dredged material below the mouth of the Snake River between 1978 and 82. Two of these islands were reshaped in January, 1992 to lower their profiles, and dredged silt from local port access sites were deposited on top of the original material and vegetated with grasses. The islands support the entire range of habitats found on the project from bare sand and gravel to riparian forest.

Future operations, whether at MOP or fluctuating within the normal range, should not affect the integrity of the islands nor cause a land–bridging concern. Past "normal" operation has included "soft constraints" between 1 March – May 15 operating within the upper three feet to inhibit goose nesting below maximum pool.

Fish Productivity Zone

Reference the Corps' 1992 Options Analysis EIS for a good discussion of physical parameters associated with resident fish productivity.

Future operations incorporating MOP could possibly enhance spawning conditions for some species. Otherwise, resident fish productivity is expected to remain unaffected.

Benthic Invertebrate Productivity Zone

Certain benthic invertebrates have been able to exist under existing operations. Future operations at MOP could possibly enhance their existence. Many wildlife and fish species rely on benthics as prey items.

Human Effects

The upper end of the Columbia River portion of the project flows through the Tri–Cities of Richland, Pasco and Kennewick, Washington. This populous, urbanized area supports many parks, beaches, boat launches and marinas. Most of the shorelines through this reach are rip rapped levees. Other similar recreation facilities are located toward the lower end of the project near Umatilla, Oregon. Hunting, fishing, water skiing and other boating– related activities are probably the most common sources of disturbance to wildlife. The more productive nesting islands are posted in an attempt to minimize human use during the nesting season. There are 3 port facilities scattered along the reservoir.

Human recreation and use will likely increase in the future following nationwide trends. The Hanford Nuclear Reservation is located at the uppermost end of the project along the free– flowing Hanford Reach. This facility is a major employer and has gone through several boom and bust periods. Employment has been increasing there associated with environmental cleanup efforts.

2.2.16.2 Wildlife

Waterfowl

Canada Goose

(1) Nesting: McNary pool supports a large population of nesting Canada geese. The 25 islands, together with the McNary Wildlife Refuge produced up to 675 goslings in 1991. Most goose nesting occurs on seven islands, with the greatest numbers of successful goose nests (73) occurring on Badger Island. Total number of successful nests for all island nesting averages 130. In 1974, the U.S. Fish and Wildlife Service erected 30 nesting baskets on the Strawberry Islands (part of the refuge complex) to eliminate predation by raccoons that had become established there. These baskets receive about 20 percent use. The refuge maintains 19 goose nesting platforms. Some ground nesting has also been observed

within the refuge but is very susceptible to both avian and ground predators.

Under continued existing operations, including operating at MOP, goose nesting would not be expected to be impacted. Operation at MOP would actually maximize the island acreage available for potential nesting.

(2) Brooding: Adequate habitat for brooding pastures is thought to exist along McNary Reservoir. Almost all of this habitat is naturally occurring. This condition would not change under continued existing operations. Future operations at MOP could provide additional herbaceous forage within the drawdown. Development of woody vegetation within this zone however, could create cover conducive to predators.

(3) Wintering: Number of wintering Canada geese on McNary Refuge have been known to peak at about 50,000 with as many as 20,000 additional geese utilizing other areas of the reservoir. These birds use abundant corn and wheat fields provided on the refuge and surrounding agricultural lands. Annual use is highly dependent on weather conditions. The U.S. Fish and Wildlife Service conducts aerial censuses of a large portion of the Columbia Basin on a monthly basis during November–January. Future use of this area is not expected to change under existing operating conditions.

Mallard

(1) Nesting: Little data is available on mallard nesting. In 1990, 104 mallard pairs were counted on McNary Refuge. Other pairs observed in 1990 included: gadwall (62), shoveler (203), wigeon (58), cinnamon/blue–wing teal (86), green–wing teal (58), and pintail (36). Nine boxes were added to goose structures for mallard use as well as 12 plastic nesting tubs in 1990. Some additional nesting likely occurs on the more heavily vegetated islands within the reservoir.

(2) Brooding: A few mallard broods are usually observed on McNary Refuge but high predation rates are assumed due to the abundance of skunk, magpie and feral cats. Teal, pintail and wood duck broods have also been observed. Very limited brooding may also occur associated with the islands or along shallow backwaters along the reservoir. An attractive brooding area consisting of a complex of backwater ponds and wetlands occurs immediately below the mouth of the Snake River.

(3) Wintering: Roughly 80,000 mallards used grain fields on the refuge in 1990. Approximately 172,000 were observed throughout the reservoir in December, 1993. As with Canada goose, these numbers vary dramatically from year to year depending on weather and other factors. Future use is not expected to change under existing operations.

Diving Ducks

(1) Nesting: Actual nesting data is not available but the following pair counts were observed on McNary Refuge in 1990: Redhead (76); Canvasback (6); Lesser Scaup (68); Ruddy (104); Ring–neck (45); Bufflehead (6); and common goldeneye (2). Future existing operations would not likely have any effect on potentially nesting divers.

(2) Brooding: No diving duck broods were mentioned as being observed on the refuge in 1990. If any brooding of diving ducks occurs within McNary Reservoir, it would not be expected to be effected by future existing operations.

(3) Wintering: Between 1,000–2,000 divers have been counted during December and January from aerial censuses over McNary Reservoir. These include redhead, canvasback, greater and lesser scaup, ringneck, common and Barrow's goldeneye, bufflehead, hooded and common merganser, and ruddy duck. Future existing operations would not be expected to have any effect on this usage by diving ducks.

Colonial Nesting Birds

Great Blue Heron

(1) Nesting: A substantial rookery is located on Foundation Island. This rookery also contains black–crowned night herons.

(2) Foraging: Herons are commonly observed foraging along shallow shorelines, backwaters and embayments. Their use of these areas would not be impacted by future existing operations.

Forsters Tern

(1) Nesting: Forsters (as well as Caspian) terns have been known to nest on the artificially–created Crescent Island. Vegetation development, combined with competition from California gulls is limiting this opportunity. Future operations incorporating MOP could possibly create favorable conditions for this species.

Shorebirds

Black–necked stilt. Little is known about the occurrence of nesting along McNary Reservoir. Data obtained from the Blue Mountain Chapter of the Audobon Society lists the following species that have been observed at the Walla Walla River Delta: American coot, black– bellied plover, lesser golden plover, snowy plover, semipalmated plover, killdeer, black–necked stilt, American avocet, greater and lesser yellowlegs, spotted sandpiper, whimbrel, long–billed curlew, marbled godwit, sanderling, semipalmated sandpiper, western sandpiper, least sandpiper, Baird's sandpiper, pectoral sandpiper, dunlin, stilt sandpiper, short–billed dowitcher, long– billed dowithcer, common snipe, Wilson's phalarope, and red– necked phalarope. A Virginia rail call was heard on the McNary Refuge in 1990 but never observed. Other water birds observed include pied–billed, red–necked and western grebe, white pelican (about 100 in 1990) and double–crested cormorant.

Nongame birds

Downy Woodpecker

(1) Nesting: Suitable habitat in the form of mature cottonwoods is present near the mouth of the Walla Walla River and pockets along the shoreline up to and above the mouth of the Snake River. There is also some suitable habitat along this same stretch along the western shoreline up to the mouth of the Yakima River although most "forested" areas along this shoreline are dominated by Russian olive. Regeneration of cottonwood is a concern since it normally requires a situation characterized by periodic flooding. Future existing operations are not expected to affect this habitat type. Future operations at MOP could possibly create conditions for some limited development of cottonwood.

(2) Feeding: Feeding is conducted within the same habitat type however, the areas dominated by Russian olive may be more heavily used for this activity.

Red–winged blackbird. All nesting and most feeding occurs within wetlands dominated by cattail. Small pockets of cattail occur throughout the backwaters along the reservoir. Continued existing operations would not affect this habitat type. Future operations at MOP could possibly encourage development of cattail.

Yellow Warbler. This species exclusively occupies scrub–shrub habitat provided by shrub–type willow growth. Many pockets of this habitat type occur along backwaters, embayments and tributary deltas. Continued existing operations should have no impact on this habitat type. Continued operation at MOP would encourage additional development of this habitat within the drawdown zone.

Raptors

Wintering Bald Eagles. A few bald eagles winter along McNary Reservoir feeding primarily on waterfowl and to a lesser extent on upland game, salmonid carcasses and other wildlife. Future existing operations are not anticipated to impact prey species nor mature trees which offer perch and roost sites.

Aquatic Furbearers

Beaver. Beaver are found in association with the riparian forested and scrub–shrub areas containing a high proportion of young trees and suitable banks for denning. Future existing operations are not expected to impact woody riparian habitat however regeneration of forested areas must take place. Future operations at MOP could potentially benefit this habitat type.

River Otter

(1) Denning: Otter use dens excavated by other species in close proximity to water. They have been known to use rip rap of suitable size for this purpose as well. Future existing operations are not likely to impact the occurrence of suitable den sites.

(2) Feeding: Otters depend on prey found in shallow water habitats and are also dependent on relatively dense bank cover provided by vegetation, woody debris and large rocks. Future existing operations are not expected to impact this requirement and future MOP operations could encourage development of additional cover.

Terrestrial Furbearers

Raccoon. Raccoon foraging and denning requirements are largely dependent on prey items found in riparian–type habitats and associated shallow water. Future operations are not expected to negatively impact these habitats.

Big Game

Deer

(1) Fawning: Mule deer occur throughout the project area. Islands are used to some extent for fawning. Otherwise, fawning is associated with heavy cover associated with riparian vegetation. Future operations are not expected to impact riparian vegetation.

(2) Foraging: Mule deer are only partially dependent on project lands and riparian areas for food, that dependence increasing during winter for sources of browse. Future existing operations are not expected to negatively impact riparian vegetation.

Amphibians and Reptiles

Amphibian occurrence and use of habitats along the reservoir are very low, probably due to existing fluctuations. Although recent operations at MOP have helped stabilize water levels, it has not yet allowed suitable wetland–type vegetation to establish immediately adjacent to the water line.

Riparian areas along the reservoir are used to some extent by garter and gopher snakes. These areas provide sources of prey, cover, and over–wintering habitat.

2.2.17 John Day, the Dalles, and Bonneville Dams

Short–term Operational Limits	
John Day Dam and Lake Umatilla	
Lake Elevation	
Full Pool	268 ft
Minimum Pool	257 ft
Discharge	
Minimum	
December–February	12,500 cfs
March––November	50,000 cfs
Maximum change per hour	200,000 cfs
Special Requirements: Normal minimum elevation in spring is 262 feet for protection of geese during nesting period March 1 – May 15.	
Reservoir is to be operated between elevation 264–265 once every three days during the goose nesting period, March 1 – May 15.	
Reservoir is to be operated between elevation 262.5–264 during juvenile fish outmigration period from May 1 – August 31 unless higher levels are required for irrigation withdrawals.	

The Dalles Dam and Lake Celilo	
Lake Elevation	
Full Pool	160 ft
Minimum Pool	155 ft
Discharge	
Minimum	
December–February	12,500 cfs
March–November	50,000 cfs
Maximum rate of change per hour	150,000 cfs
Bonneville Dam and Lake	
Lake Elevation	
Full Pool	77.0 ft
Minimum Pool	70.0 ft
Normal forebay operating range	71.5 – 76.5 ft
Maximum 24–hr fluctuation at Stevenson gauge	4.0 ft
Tailwater Elevation	
Rate of change	
Summer (April 1–September 30 (60–min limit	1.5 ft
Normal – 24 hr limit	4.0 ft
Maximum – 24 hr limit (no more than 10 times per season)	5.0 ft
Winter (October 1 – March 31) 60–min limit	3.0 ft
Normal – 24 hr	7.0 ft
Maximum – 24 hr limit (no more than 18 times per season)	10.0 ft
Discharge	
Minimum instantaneous	80,000 cfs
Minimum daily average	100,000 cfs
Special requirements: Normal operating range will not be exceeded more than 18 days per year.	
When average 7–day inflow is below 125,000 cfs, the minimum instantaneous outflow limit is 70,000 cfs and the minimum daily average discharge limit is 80 percent of the 7–day average inflow.	

Bonneville (RM 145), The Dalles (RM 216), and John Day (RM 292) dams are the most downstream of the Federal projects on the Columbia River. All three projects are operated by the USACE. These projects are run–of–river, with John Day Dam having flood storage capability. Significant wildlife habitat is prevalent in the area around John Day Dam.

2.2.17.1 Physical Habitat

Barren Zone and Shallow Water Zone

Shallow water habitat occurs along the shoreline of the Columbia River and around islands within the various pools. Typically the substrate for Bonneville, The Dalles, and John Day pools is comprised of rock, gravel, sand, and silt with rocky shorelines predominating in many locations. Gravel shorelines are prevalent in the upper John Day pool. Sand and silt deposits are most evident in backwaters, inlets, and embayments or at the mouths of rivers. A substantial delta formed from silts exists at the mouth of the Klickitat River in Bonneville pool. Sand/silt deposits are also evident just downstream of the Deschutes River mouth. The occurrence of wetland plants has been noted for the Klickitat River delta where elevational increase from sediment deposition has been sufficient for wetland plants to become established. Greater coverage of wetland plants is anticipated with additional elevation increase from sediment settling.

Shallow water areas can be very productive of submergent, emergent and aquatic vegetation in addition to benthic invertebrate populations. However, this productivity is somewhat tempered in Bonneville, The Dalles, and John Day pools by fluctuating pool levels. Still, aquatic plant beds are evident in some locations; their areal extent and species composition have not been formally documented, however. Neither has areas of importance for benthic invertebrates nor detailed work on their density and species composition been determined. There are indications of large beds of *Corbicula manilensis*, based on shorelines with dense layers of shells on the beach and observations of diving duck concentrations.

Bonneville pool normal operation range is from 71.5 to 76.5 ft msl. although typically fluctuations occur within the upper three feet of this range. Aquatic plant beds are present in the pool and are expected to be most prevalent below 73.5 msl. Location, extent and nature of these aquatic plant beds is unknown.

The normal operational range for The Dalles pool is 155.0 to 160.0 ft msl with the forebay normally fluctuating 1 to 3 feet. Thus, much of the shallow water habitat (el. 155.0–160.0) is periodically exposed. Development of aquatic plant beds would be most likely around elevation 155 ft. msl or slightly lower.

John Day pool is normally operated between elevations 262 and 265 ft msl. Location, extent, and nature of aquatic plant beds is unknown, although the relatively gentle topography and extensive shallow areas suggest their presence would be more substantial than in either The Dalles or Bonneville pools. The presence of suitable substrate within these shallow water areas for aquatic plants has not been established and would also significantly influence their presence, density, and possibly species composition.

Upland Zone

Upland areas abutting Bonneville, The Dalles and John Day pools exhibit a considerable variation in plant communities from west to east. This is attributable to a graduation from a mild, wet marine west coast climate to a dry, cold winter–hot summer continental climate. Pool levels typically only influence a very narrow region immediately abutting the reservoirs. This zone of influence includes riparian habitat but does not extend into the upland habitats. Thus, the upland zone is not considered an area subject to impacts from implementation of various operational strategies.

Riparian Zone

Riparian habitats determined by the USFWS (BPA 1990) are broken into three sub–categories: hardwood, shrub, and herb. Riparian hardwood is principally comprised of cottonwood trees, although red alder, Russian olive, large willows and a few other tree species might also be present. Riparian shrub habitat is comprised of willows, young hardwoods, false indigo, and other shrubby species. Riparian herb communities are chiefly herbaceous, low–growing forb–grass communities occupying sand, mud, or gravel bars. Herbaceous plants are generally weeds such as mustards, docks, pigweed, and Russian thistle. Grasses are also common. This category also includes seeding willows, cottonwoods, and other trees and shrubs.

Riparian plant communities are dependent on subirrigation for water and are typically in immediate juxtaposition to a stream. This is particularly true in The Dalles and John Day pools where very dry conditions and dryland plant communities occur at slight elevations above full pool.

Approximately 1,089 acres of riparian shrub and riparian hardwood occur adjacent to Bonneville pool or on islands within its bounds. Black cottonwood is the principal tree species in riparian hardwood stands along Bonneville pool. Large willows, red alder, western redcedar, and Douglas–fir are other species present (BPA 1990).

Riparian plant communities comprise only 377 acres adjacent to The Dalles pool. The reduction in acreage is a result of the arid environment, shorter pool, and the immediate juxtaposition of highways and railroads to the river. Riparian shrub habitat comprises 299 acres of the total. Riparian shrub communities occur primarily along inlets and embayments or on sandbars (BPA 1990). False indigo, an introduced shrub, is the most abundant shrub species (BPA 1990).

John Day pool supports an estimated 571 ac of riparian habitat based on 1994 aerial photo interpretation. Photo interpretation was not conducted downstream of RM 257.8 because of generally unsuitable conditions for riparian habitat development. Black cottonwood is the dominant tree species, with willow, Russian olive, alder and hackberry representing other members of the riparian forest community. Willows and young riparian hardwood species comprise the riparian shrub community. Much of this habitat occurs within the Umatilla NWR and Irrigon Wildlife Management Area.

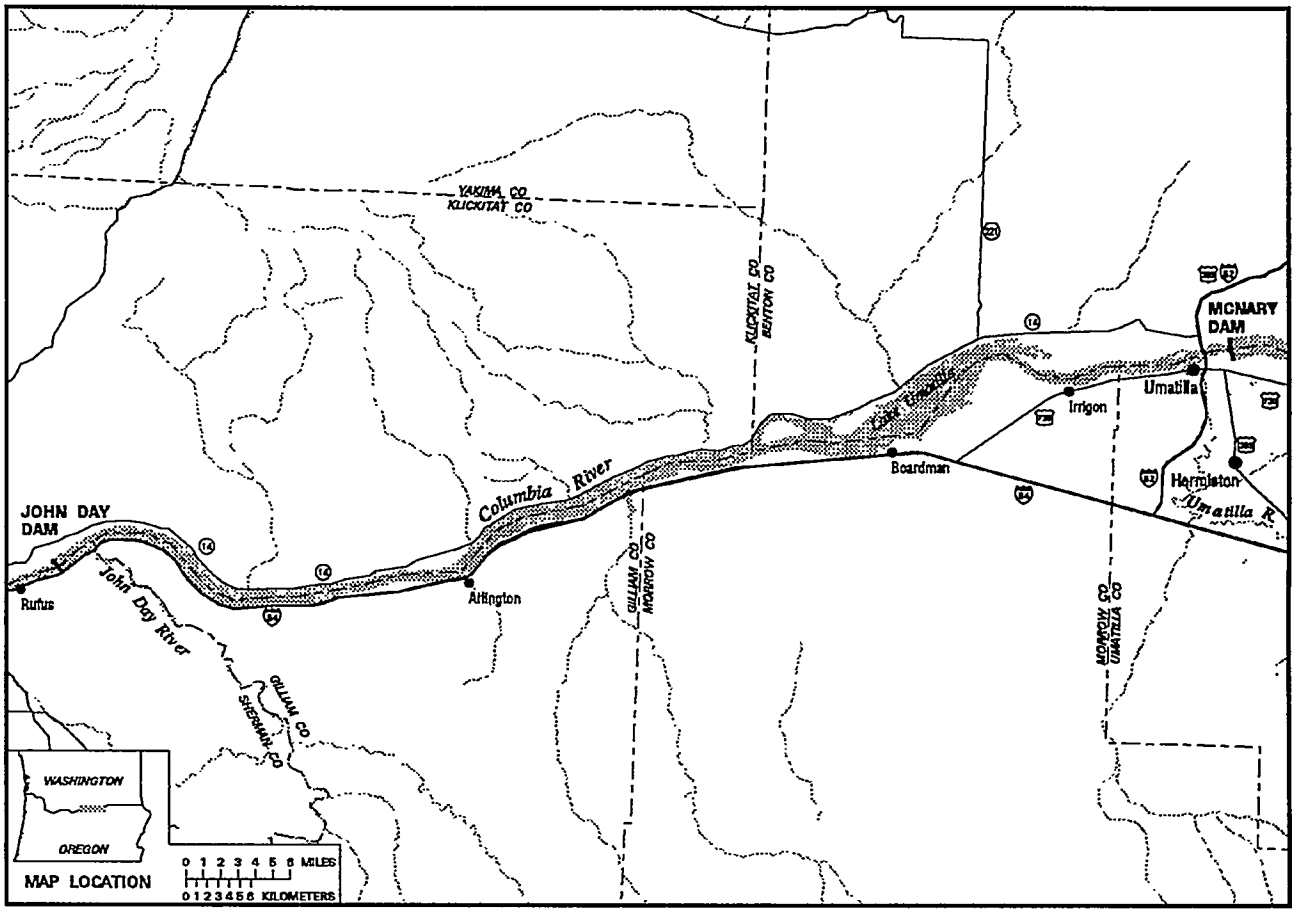

Figure 2–15. John Day Pool

Emergent Wetland Zone

Information on wetland habitat acreage associated with Bonneville and The Dalles, projects is derived from vegetative mapping efforts performed by Judith Glad, private consultant to the USFWS's for input into Bonneville Power Administration's (BPA) Wildlife Impact Assessments (1990) for these three projects. Mapping effort for Bonneville Project is based on 1975 aerial photography; 1979 photography is used for vegetation analysis on the other projects.

Very limited acreage (15 ac) of emergent wetlands is associated with Bonneville Project. The USFWS (BPA 1990) characterizes emergent wetlands as wet soil areas supporting rushes, sedges and/or cattails. Emergent wetlands generally occurs where drainage from adjoining slopes is interrupted by railroad or highway embankments or agricultural activities.

Emergent wetlands in The Dalles pool are also typically formed in this manner. Approximately 52 acres of emergent wetlands adjoin The Dalles pool, although not necessarily directly impacted by pool fluctuations.

An estimated 2,283 acres of emergent wetlands are associated with John Day pool according to 1994 aerial photo interpretation. Interpretation was only for lands upstream of RM 257.8 as rocky, steep slopes downstream result in minimal habitat presence. The USFWS (BPA 1990) note that emergent wetlands usually occupies sites where seepage from

upslope or subirrigation maintains wetland plant species. They note that emergent vegetation communities are more prevalent in Patterson and McCormack Slough Units in 1989 than indicated by interpretation of 1979 photography. They also note that numerous ponds appear to be undergoing natural succession from emergent wetlands to uplands.

Submergent plant communities are present in Paterson and McCormach Sloughs, Irrigon Wildlife Management Area and other slackwater areas.

Embayments

Embayments, adjacent ponds, and associated tributaries provide an important habitat feature for fish and wildlife resources on these projects. These embayments are relatively unique to the three projects and provide special wildlife values. They provide protected loafing and roosting areas for waterfowl and other waterbirds, in addition to food resources. Embayments are considered bodies of water cut off from the main river by highway or railroad causeways, or other features and are typically connected to the Columbia River via culverts or small channels. Associated tributaries reflect slack–water conditions that extend up tributaries. Adjacent ponds encompass bodies of water adjacent to the river; the source of the water in these sites may arise from subirrigation and/or drainage from adjoining lands.

Thirty–two embayments encompassing 548 acres occur in Bonneville pool. Sixteen of these embayments are less than five acres in extent; only six sites exceed 40 acres in extent. There are 13 adjoining ponds encompassing 46 acres. Four associated tributaries provide 339 acres of slack–water. Drano Lake at the mouth of the Little White Salmon River constitutes 236 acres.

Embayments and adjacent ponds provide 284 acres of backwater habitat in The Dalles pool. No associated tributaries constituting significant slack–water acreage occur.

Eleven embayments are less than five acres in extent; only one site exceeds 40 acres in extent.

Slack–water sites in John Day pool comprise substantially more acreage than comparable areas for either downstream project. There are approximately 17 embayments in John Day pool. Paterson Slough in Umatilla NWR refuge is the largest embayment, with 1,043 acres. McCormack Slough represents another major embayment, with 494 acres. An embayment behind Crow Butte Island represents an additional 165 acres of the total embayment acreage. Other significant embayments occur at Three Mile Island and Willow Creek. Adjacent ponds represent 212 acres with ponds in Paterson Unit, Umatilla NWR and those just downstream of McNary Dam constituting the bulk of the acreage. Slack–water areas of tributaries provide 1,391 acres of backwater habitat with John Day River arm and Willow Creek encompassing 1,272 acres of the total.

Fish Productivity Zone

This measure is not used to address operational impacts for Bonneville, The Dalles or John Day pools. Loss of other habitats, particularly the emergent marsh/riparian zone is considered of more importance.

Submerged Aquatic Plant Bed Zone

The extent and location of submerged aquatic plant beds has not been documented for either Bonneville, The Dalles, or John Day pools. Some backwater areas of these pools are known to support submerged aquatic plant communities. McCormack Slough and Patterson Slough, plus ponds in the Irrigon Wildlife Management Area on John Day pool, contain submerged aquatic plant communities. Observations of foraging concentrations of American coots and American wigeon at other embayments along these pools are strong indicators of the presence of submerged aquatic plant communities. The presence of submerged aquatic plant communities in open water habitat is suspected but not adequately documented.

Benthic Invertebrate Productivity Zone

Benthic invertebrates, principally **Corbicula manilensis**, appear to form an important prey base for diving ducks in Bonneville pool, although sufficient documentation is lacking.

Human Effects

Recreational users are the primary human effect of concern to wildlife resources for below Bonneville Dam, and for Bonneville, the Dalles and John Day dams.

Specific activities of concern include fishing, windsurfing, and boating/picnicking that occur in areas important to wildlife (i.e., nesting islands/locations and brooding/rearing areas). The demand for recreation facilities results in development and loss of wildlife habitat.

Highways and railroads are an existing and significant human effect. Increased urban and residential development is significant in many locations.

2.2.17.2 Wildlife

Waterfowl

Wintering waterfowl probably constitute the most abundant wildlife resource on Bonneville, The Dalles, and John Day projects, with John Day Project supporting very significant numbers of wintering waterfowl. Resident, breeding waterfowl numbers are generally low except for Canada geese (Great Basin Canada geese), which occur throughout all three projects and various duck species in and around the Umatilla NWR.

Bonneville pool supports lesser numbers (estimated 2,500 to 3,000 birds) of wintering waterfowl than either The Dalles or John Day pools. This is substantially attributable to the lack of agricultural lands in the Columbia River Gorge. Wintering concentrations of diving ducks, primarily scaup spp. occur upstream of Home Valley on the Washington shore, at Hegewald Pond in Stevenson, in Government Cove, at Mayer State Park embayment, and along the Oregon shoreline just upstream of Mayer State Park.

Wintering mallards, pintails, American wigeon and American coots occur in fair numbers at Government Cove, Hegewald Pond, Wells Island, Mayer State Park Embayment, and nearshore areas just upstream of Mayer State Park. Adjacent lakes, marshes and backwaters are also important habitats for foraging and loafing. Aquatic vegetation appears to be an important food resource for these species. Breeding ducks are minimal in number.

Canada geese are represented by a substantial nesting population on Bonneville pool. The 1991 nesting survey indicated that 168 goose nests are present on Bonneville pool, with the majority of goose nests associated with islands. Wells Island at Hood River supported 74 nests alone. Islands in Rock Creek embayment at Stevenson (Hegewald Pond) support the next largest nesting concentration. Nearshore areas supporting grass/forb communities are important foraging areas for geese with broods. Lawns at Rock Creek Park and pastures at Bonneville Dam provide significant foraging habitat for geese with broods. Wintering geese are distributed throughout the pool. Concentrations of loafing/roosting Canada geese do occur just below The Dalles Dam.

Waterfowl use in The Dalles pool is primarily associated with islands which are used extensively by nesting Canada geese and also by wintering ducks and geese. Nesting by ducks is minimal which is probably attributable to the lack of marsh/wetland habitat for rearing young.

A total of 117 Canada goose nests were recorded from The Dalles pool during the 1991 survey. Brown's, Little Miller, and Rufus Islands support the majority of nests. Low tailwater elevations in early April 1991 at John Day Dam were required to facilitate repair of the lock. This resulted in substantial land–bridging at Rufus Islands and incidences of predation by dogs (eight) were evident. Vehicular access to the site from the freeway and nearby Rufus contribute to disturbance by man and his pets. Forage resources for geese with broods may be limiting in the pool. Tabor (1976) reported geese with broods using park lawns at Horsethief Lake and Deschutes River State Parks. Grass–forb communities adjacent to the river, embayments, and backwaters are important foraging/loafing areas for geese with broods.

Rufus Islands also represent a high use area for wintering waterfowl. Mallards and Canada geese (2,000 to 3,000 geese) use these islands in significant numbers for loafing and roosting. The presence of shallow backwater, gravel bars, islands

and protection from the wind contribute to the attractiveness of this location for waterfowl. Foraging by most wintering waterfowl occurs in agricultural lands located north and south of the ridgeline above the Columbia River. Miller Island supported grazing geese in the recent past when commercial haying and grazing operations were ongoing. Presently, the pasture appears in a degraded condition and less use by Canada geese would be expected. Minimal forage resources occur within The Dalles pool (i.e. aquatic plant beds) and therefore waterfowl concentrations are less likely to develop. Concentrations of diving ducks, primarily scaup spp. and ring–neck ducks, occur at RM 202 (Oregon shore) and at the Biggs grain terminal. Approximately 1600 diving ducks occur at RM 202 comprised primarily of scaup spp. and ring–necked ducks. The Biggs grain terminal supports approximately 1,500 diving ducks. It is presumed that diving ducks are utilizing benthic invertebrate resources at the RM 202 and spilt grain at Biggs grain terminal.

The John Day pool supports one of the most significant wintering concentrations of waterfowl – particularly Canada geese and mallards – in Oregon and Washington. Backwater areas on John Day pool provide protected areas for wintering waterfowl to escape storms and roost. The USFWS censuses in 1995 documented a maximum of 131,000 ducks wintering on John Day pool upstream of RM 250 for winter 1994/'95. An estimated 20,500 to 58,400 (average 33,550, USFWS surveys 1987–'92) Canada geese also winter on this portion of the pool. Waterfowl resources in the area of major regional significance (25 percent of wintering mallard population, i.e., 131,000 in 1995 for Oregon and Washington.) A peak population of 600,000 ducks, primarily mallards, has occurred in the South Columbia Basin. Approximately 20,000 northern pintails are present in this concentration (J. Annear, Umatilla NWR, pers. comm. 1991). Most of these birds will occur in the vicinity of the Umatilla NWR. Wintering Canada geese number approximately 100,000. Wintering waterfowl are strongly dependent on agricultural crops grown in the region, particularly field corn and winter wheat for forage resources. The Columbia River and its islands provide protected, relatively undisturbed loafing, resting, and roosting habitat for these waterfowl.

Ducks begin arriving in the Umatilla NWR/John Day pool area in August when 30,000 to 50,000 birds, principally northern pintails and green–winged teal, are present (J. Annear, Umatilla NWR, pers. comm. 1991). Mallards begin arriving in substantial numbers in September. A population of 100,000 ducks can be attained by the end of September. These early arriving waterfowl appear to focus on aquatic, emergent, and moist–soil vegetation resources rather than field–feeding. Foraging in agricultural fields is prevalent during winter. Foraging in shallow backwaters, ponds, and wetlands is prevalent therefore in late–summer and early fall.

Geese do not begin arriving in significant numbers until November. Most wintering geese will occur in the vicinity of Umatilla NWR but significant numbers of geese can be located loafing and roosting on the Columbia River throughout the John Day pool and major arms such as the John Day River and Willow Creek backwaters. Protected bays and backwaters are important loafing/roosting areas for wintering birds during high winds and storm events.

Substantially more Canada geese nest in John Day pool (1991: 323 nests) than either Bonneville or The Dalles pool. The majority of nests are located on islands in the Umatilla NWR although McCredie and Three Mile Islands also support substantial number of nests. Most islands are well offshore and therefore protected from mammalian predation. McCredie and Three Mile Islands are relatively nearshore and susceptible to land–bridging.

Brood rearing areas in the John Day pool occur primarily on the Umatilla NWR, particularly at Whitcomb Island, Crow Butte Island backwater, Longwalk Island, McCormack Slough, and Paterson Slough (Tabor 1976). The Oregon shoreline between RM 260 and 265, and Willow Creek Wildlife Management Area, are other important foraging areas for Canada geese with broods. Gently sloping shorelines with grass–forb communities are used by foraging geese (Tabor 1976). Tabor (1976) noted that low water–levels increased the distance geese with broods had to travel to access shoreline forage

from open water. This increase in escape distance could have a significant positive bearing on predator efficiency and a negative effect on percent brood survival.

Waterfowl nesting other than Canada geese is also centered on the Umatilla NWR. The Willow Creek and Irrigon Wildlife Management Areas and McNary Wildlife Park also provide important nesting and brood rearing areas for ducks. Tabor (1976) considered that portion of John Day pool downstream of RM 250 as unproductive waterfowl habitat due to the lack of islands and rocky, steep shorelines. Upstream of RM 250, gently sloping shorelines with adjacent grass–forb communities are more prevalent and provide appropriate habitat conditions for waterfowl. Fourteen–plus species of ducks with an annual production of 2,000 to 2,500 young occur in John Day pool (Tabor 1976, Annear 1983).

Colonial Nesting Birds

Species comprising this complex include herons, gulls, terns, and cormorants. Individual species present at the three Portland District projects include great blue heron, black–crowned night heron, double–crested cormorant, Caspian tern, Forster's tern, and California, glaucous–winged, and ring–billed gulls. These species are primarily dependent on fisheries resources associated with the Columbia River although reptiles, amphibians, small mammals, and invertebrates may provide important forage resources at times. Scavenging and field–feeding by gulls is also common.

Great blue herons are the only colonial nesting waterbird known to nest on Bonneville pool. Wells Island near Hood River, Oregon supported 24 active and 38 total nests in early May 1991 (Torland, ODFW, unpubl. notes). Shallow water, embayments, shorelines and wetlands represent foraging areas for this species. Double–crested cormorants and various gull species occur throughout the project area, typically foraging throughout the pool. Concentrations of gulls are particularly noticeable at The Dalles tailrace where they forage on juvenile salmonids and other fish injured when passing through the ice/trash sluiceway. Gulls loaf on rocks below The Dalles Dam and at Boat Rock just upstream of Bonneville Dam.

Nesting by California gulls and great blue herons occurs in The Dalles pool. Great blue herons nest at Brown's Island (2–plus nests) and Miller Island. Torland (ODFW, pers. comm. 1991) reported 23 heron nests at Miller Island in 1991. The number of active nests is not determined. He noted that there are 12 active of 20 total nests in 1990. California gulls nest on rocky islands upstream of Miller Island (RM 206) and on Little Memaloose Island (RM 195). Tabor (1976) reported 213 nests on rock islands upstream of Miller Island and approximately 275 nests on Little Memaloose Island. Ackerman (USACE, 1991) reported approximately 300 gull nests on the rocky islands just upstream of Miller Island. Torland (ODFW, 1991, pers. comm.) reported that approximately 1,500 nests occurred on these rock islands upstream of Miller Island during a 1983 census. Ring–billed (95 percent) and California gulls (5 percent) are the species present. Torland also reported substantial gull presence at Little Memaloose Island although nesting numbers are unknown. Tabor (1976) reported the presence of a few adult glaucous–winged gulls at the aforementioned gull colonies and considered them probable breeders at these locations. He also reported occasional nesting Caspian and Forster's terns at Rufus Islands.

Concentrations of gulls occur in The Dalles pool immediately downstream of John Day Dam, apparently foraging for juvenile salmonids and other fish injured or stunned during passage through John Day Dam.

The John Day pool supports substantially more colonial nesting species and number of breeding birds than either Bonneville or The Dalles pools. Three Mile Island at RM 256 supports black–crowned night herons, California gulls, ring–billed gulls, and Caspian terns. Tabor (1976) reported Forster's terns as having nested at Three Mile Island. An estimated 35 black–crowned night heron nests occur at this location. The breeding population of California and ring–billed gulls is estimated at 7,000 to 10,000 birds. Approximately 12 Caspian tern nests are located at this site. Sand

Dune Island (RM 274) supports approximately 50 nests each of black–crowned night herons and great blue herons.

Gulls congregate below McNary Dam in order to capture fish injured or stunned passing through the dam; foraging may occur the length of the pool. Foraging by gulls in agricultural fields, freeway rest stops, and garbage dumps is also common. Foraging by herons would primarily occur along shorelines, in wetlands, and throughout shallow backwaters.

Shorebirds

Shorebird use in Bonneville pool is relatively minor. Minor concentrations have been observed on exposed shoreline at Hegewald Pond, Stevenson, and Washington. Mudflats, when exposed, at the mouth of the White Salmon River (delta), Wells Island, Mayer State Park, embayments, and Taylor Lake would provide foraging, loafing, and potentially roosting habitat for migrant shorebirds. Killdeer and spotted sandpipers are the principal nesting shorebirds, nesting just upslope from the high pool line and foraging along the shoreline.

Nongame Birds

Many species of nongame birds occur in the vicinity of the three Portland District projects. Most species are associated with upland habitats adjacent to the project. Riparian and wetland habitats directly influenced by waters of the Columbia River are important to many nongame species as well as the ecotone to upland habitats. The pool areas also support a number of species.

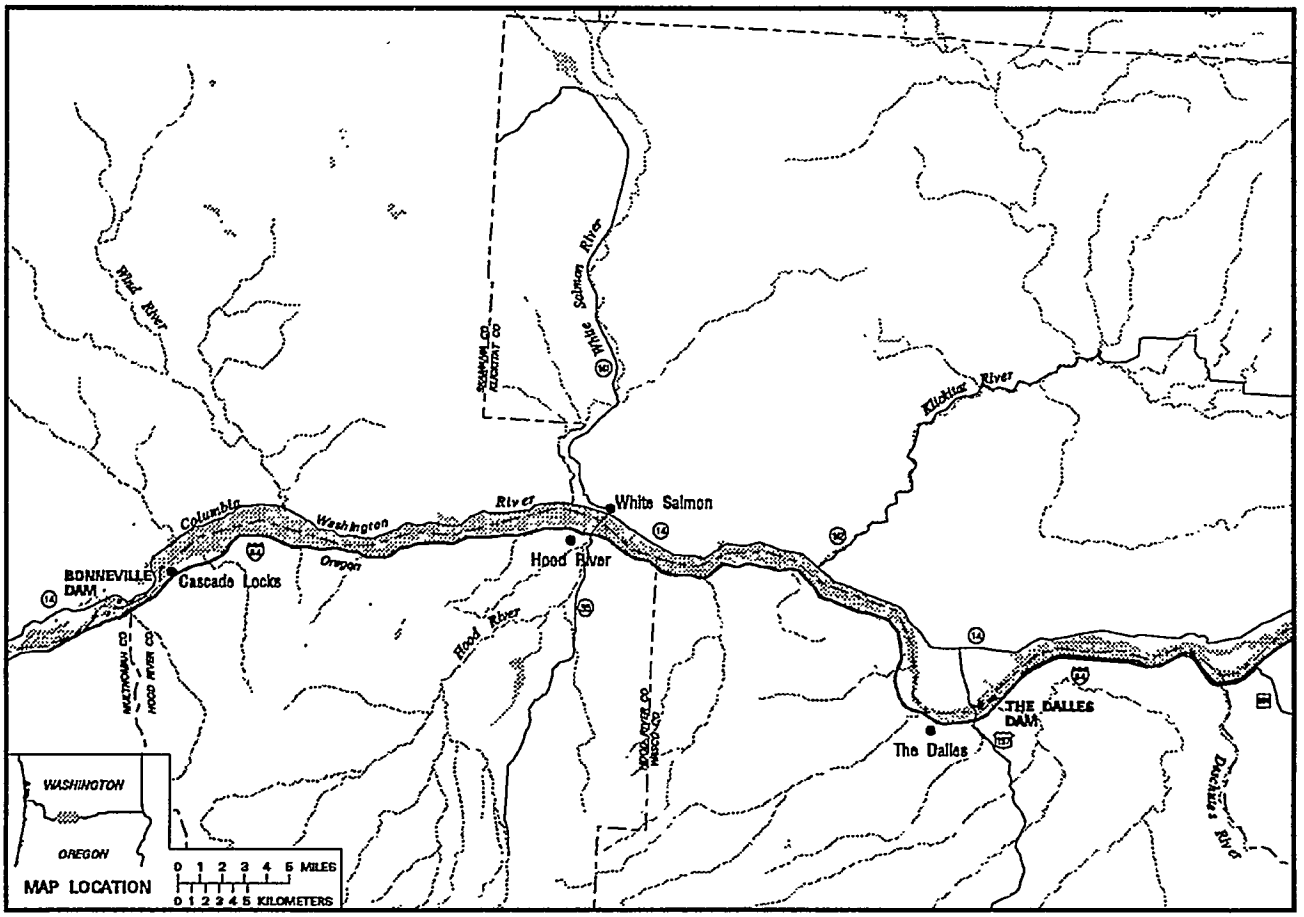

Figure 2–16. Bonneville and the Dalles Projects

Migrant and wintering western grebes occur on Bonneville pool in minor numbers. Presence of pied–billed grebes is generally associated with embayments, backwaters, and ponds along the river. Rail occurrence in the Bonneville pool area would be associated with emergent vegetation occurring in wetlands and embayments.

Bird species that forage for insects in the airspace over the pools are present in substantial numbers. Approximately 1,000 to 2,000 cliff swallow nests are estimated to occur on the powerhouses, spillway, and other structures at Bonneville Dam. Highway bridges, structures, and rock cliffs adjacent to Bonneville pool support many more nesting cliff swallows. Nesting barn swallows are also numerous at these locations. Violet–green and tree swallows use cavities in snags, live trees, cliffs, structures, and

pilings for nesting and are abundant in the pool area. Insect production in riparian, wetland, embayment, and backwater areas are important for these species. Common nighthawks and Vaux's swifts would also benefit from insect production from these habitats; riparian habitats also provide roost and perch locations for common nighthawks.

Riparian habitats provide nesting and foraging requisites for several species of woodpeckers, flycatchers, and chickadees plus warblers, kinglets, orioles, and grosbeaks, among other species. Marsh habitats are important to several species of sparrows, warblers, rails, blackbirds plus marsh wrens and common yellowthroats in addition to other species.

Many species of birds would use the Columbia River or associated backwaters for a water source. Typically, riparian/marsh/wetland habitats and the ecotones to upland habitats will support a higher density and diversity of bird life than dryland shrub–steppe, talus, cliff, and/or grassland habitat which is prevalent along the Columbia River. Habitats associated with the river generally support trees or dense grass–forb cover offering more structural diversity and better forage resources than adjacent upland habitats.

Upland Gamebirds

Ruffed grouse, ring–necked pheasant, California quail, turkey, mourning dove, band–tailed pigeon, and common snipe occur along the Bonneville pool. None of these species would be considered abundant.

Chukar would be the most abundant species in The Dalles project vicinity (BPA 1984). They occur primarily on the adjacent slopes in habitat comprised of upland grasses and cliffs/rimrock.

Similar to other species present along John Day pool, upland gamebirds are also more abundant in the upper reaches of the pool, particularly in the Umatilla NWR. This is a reflection of suitable habitat occurrence.

Raptors

Osprey represent the most abundant nesting raptor whose foraging requirements are dependent on the fisheries resources of the Columbia River. Nesting is principally confined to the Bonneville pool area where substantial forested habitat occurs adjacent to the river. Approximately ten to 12 osprey nests occur along the Oregon and Washington shores of Bonneville pool (Anderson, WDFW and Torland, ODFW, pers. comm., 1991). Members of these pairs would be expected to forage extensively in Bonneville pool and associated backwaters. Additional pairs of osprey occur in the Columbia River Gorge, but are associated with lakes.

Discussion on occurrence and use of the Portland District projects by bald eagles and peregrine falcons will be discussed under threatened and endangered species.

Raptor use along Bonneville, The Dalles, and John Day pools is primarily associated with upland habitats, wherein their principal prey base would occur. Riparian forest habitats provide nesting opportunities for some species, particularly red–tailed hawks, Swainson's hawks, and American kestrels. Swainson's hawks, on the USFWS's (1982) Sensitive Species List for Region One, occur in riparian stands within the Umatilla NWR, John Day pool. Use of riparian habitats during migration would be expected by sharp–shinned and Cooper's hawks. Northern harri-

ers would make use of grassland, marsh, and wetland communities. Golden eagles would occur along the upper end of Bonneville pool and throughout The Dalles and John Day pools. Their use would be primarily associated with cliffs, shrub–steppe, and other upland habitats. Great–horned and western screech–owls would represent the principal owl species in riparian habitats associated with the projects. Short–eared owls would by present in wetland and marsh plant communities, principally during migration and winter.

Aquatic Furbearers

Aquatic furbearers occurring at each project would include muskrat, beaver, river otter, and mink. Tabor (1976) notes that density of these species, as a group, is higher for the Bonneville pool area than for The Dalles and John Day pools. Beaver use in Bonneville pool is strongly associated with riparian habitats and protected areas, including embayments, inlets, ponds, and sloughs (Tabor 1976). Mink are more abundant in Bonneville pool than in the other two pools. They exhibit high use of riprap, particularly where it occurs in conjunction with embayments (Tabor 1976). Muskrats occur primarily in embayments and sloughs where wetland plant communities are present. Densities are low in Bonneville pool (Tabor 1976).

Density of aquatic furbearers are low in The Dalles pool and reflect the lack of riparian habitat available (Tabor 1976). Beaver is present where riparian shrub or hardwoods occur.

Aquatic furbearer density is also low in the John Day pool (Tabor 1976). The lack of riparian habitat between RM 216 and 263 significantly contributes to the lack of these species. Most aquatic furbearers occur upstream of RM 263 where more suitable habitat is present than for downstream locations (Tabor 1976). Riparian forest, principally cottonwoods, are an important habitat feature for beaver. Muskrats are associated with cattail–bulrush marshes. Otter are common in John Day pool with most observations upstream of RM 263 (Tabor 1976).

Terrestrial Furbearers

Terrestrial furbearers occurring in riparian habitats associated with Bonneville pool include raccoon, coyote, bobcat, porcupine, striped skunk and opossum (Tabor 1976). Red fox are also present in project area (BPA 1984). Raccoon use of riparian habitats is generally greater than for other terrestrial habitats (Tabor 1976). Raccoons are also the most abundant terrestrial furbearer. Striped skunks are next highest in abundance (Tabor 1976).

Terrestrial furbearers occurring in riparian habitats associated with The Dalles pool include raccoon, coyote, bobcat, porcupine, and striped skunk (Tabor 1976). Shrub–willow habitat is the most important habitat for raccoons (Tabor 1976). Striped skunks and raccoons are the most abundant species along The Dalles pool.

John Day pool riparian habitats support coyotes, badgers, striped skunks, and raccoons (Tabor 1976). Coyotes are the most abundant species, though they exhibited a preference for sagebrush habitat. Raccoons, the next most abundant species, are most prevalent in riparian habitats (Tabor 1976).

Big Game

Black–tailed deer occur in terrestrial habitats adjacent to Bonneville and The Dalles pools with this species most prevalent adjacent to Bonneville Project. Tabor (1976) notes that they are most commonly observed in habitats south of I–84 which forms a relatively effective barrier to deer movement. He further noted that density of black–tailed deer is low adjacent to Bonneville pool. Density of mule and black–tailed deer adjacent to The Dalles pool is also low. Use on the Oregon shore is more restricted to the canyon walls due to the Interstate highway abutting the shoreline whereas in Washington deer use occurs in areas adjacent to the river as Highway 14 is located high on the canyon wall (Tabor 1976). Mule deer are the only species of big game observed in habitats adjacent to John Day pool (Tabor 1976). Bitterbrush habitat appears as the most important habitat for mule deer in the John Day pool area although Tabor (1976) believes that cottonwood/willow and marsh habitats are more important to deer

than their surveys indicate. He notes that islands in the John Day pool, particularly those on Umatilla NWR, appear to be important fawning areas for mule deer. The lack of predators on these islands is cited as a probable factor for the high use observed during the spring and summer.

Reptiles and Amphibians

Tabor (1976) reports six species of reptiles and amphibians associated with riparian/water habitats in the Bonneville pool area. A number of other species are expected to occur in the Bonneville pool area but are not detected. Pacific chorus frog concentrations are noted in large willow habitat. The author states that large willow habitat in the Bonneville pool area do not appear to be of great importance to amphibians or reptiles.

Seven species are reported in riparian/wetland habitats along The Dalles pool; other species not recorded are expected to occur (Tabor 1976). He notes that most habitats censused in this area are sparsely populated with reptiles and amphibians with Pacific chorus frogs being most abundant. Large willow habitat have the highest diversity of species although number of individuals encountered is low. Shrub willow habitat, which is subject to periodic inundation receives little use by this species complex (Tabor 1976).

Marsh/riparian habitat along the John Day pool support seven species; other species may occur (Tabor 1976). Woodhouse's toad is abundant in marsh habitat. The ecotone between marsh and upland habitats is most important to lizards and snakes (Tabor 1976). Prey populations/availability in and near marsh habitat are probable attractants to lizards and snakes. The Great Basin spadefoot toad and Woodhouse's toads are the major species associated with marsh cottonwood–willow habitats (Tabor 1976). These two species use marshes for breeding habitat.

Western painted turtles are abundant in the Irrigon Wildlife Management Area of John Day pool. The complex of emergent marsh, open water with abundant submerged aquatic plants, and associated sparsely vegetated uplands support this population.

Benthic Invertebrates

Specific information for benthic populations in Bonneville and the Dalles areas is limited.

The extensive shallow water habitat on the upper John Day pool probably supports good benthic invertebrate populations, since physical conditions appear conducive to these species. However, the nature and composition of benthic invertebrates in John Day pool is not well known.

Endangered, Threatened, and Sensitive Species

Bald eagles and peregrine falcons are the principle Federally–listed threatened and endangered species potentially affected by the proposed alternatives. A number of state (Oregon and/or Washington) listed species occur in the project area but are not generally considered to be affected by proposed actions.

One bald eagle nesting territory is associated with Bonneville pool; another territory occurs near the mouth of the Sandy River. Since impacts from operational alternatives are not considered to extend below the mouth of the Willamette River, the numerous nesting and wintering bald eagles downstream of the Willamette River are not expected to be impacted.

Wintering bald eagles are most common (40 birds) on John Day pool and are associated with the large concentration of wintering waterfowl. Fewer birds (10 to 15 each) are associated with The Dalles, Bonneville, and below Bonneville areas.

Peregrine hacking operations and natural nesting occur in the Columbia River Gorge. Approximately six nest sites are currently known.

2.2.18 Columbia River Below Bonneville Dam to the Willamette River Mouth

2.2.18.1 Physical Habitat

The area below Bonneville Dam is a free flowing stretch of the Columbia River. The Columbia River from Bonneville Dam (RM 145) to the mouth of the Willamette River (RM 101) encompasses 44 miles of river. Tidal fluctuations, although minor in magnitude, occur in this reach of the river. Peak river

flows, typically occurring during May and June, still impact the riparian areas along the river. Low flows occur during late summer and early fall and result in the exposure of extensive mudflats.

Riverine habitats present include sloughs, backwaters, shorelines, islands, mudflats and riparian zones. Railroads and highways usurp a substantial portion of the riparian zone in this reach. Human development of adjacent shorelands is prevalent below the Interstate 205 bridge. Agricultural areas encompass a substantial amount of the flood plain in this reach. A number of relatively large islands are also present. Three National Wildlife Refuges, i.e. Pierce, Franz, and Steigerwald, are present along the Washington shore.

Beaches below Bonneville are sandy. Deep, sandy loam prevails in adjacent riparian and agrarian lands. An accumulation of organic material is present in the riparian zones. Shoreline erosion, particularly in areas with sandy soils is prevalent. Erosive areas include the shoreline along Franz NWR and Sand Island at RM 132. Gravel/cobble bars are present on the upstream portions of Ives and Pierce Islands.

Barren Zone

Each year, lowering water levels expose sand and silt that is barren for part of the year.

Riparian Habitat

Black cottonwood and various species of willows are the dominant tree species for riparian areas in this reach of the Columbia River. Mature black cottonwoods are the dominant tree species in terms of height. Willows range in size from invasive stands on sand bars and beaches to mature stands comprising a major component of the overstory vegetation. Tree species comprising lesser components of the riparian zone include Oregon ash and black hawthorn.

Shrub willows, red osier dogwood, young cottonwoods and Himalaya blackberry are predominant shrub components. A dense shrub layer is often present. Reed canarygrass, nightshade, trailing blackberry, and stinging nettles are common groundcover components of the vegetation. Reed canarygrass can dominate ground cover in many locations.

Mature riparian forests provide perch and nesting habitat for bald eagles and osprey in this reach. Many species of passerines, including yellow warblers and Swainson's thrushes, use the riparian forest and shrub habitat for foraging and nesting. Decadent trees, either a result of maturity or from wind/ice snappage provide opportunities for cavity nesters such as downy woodpeckers. Great blue herons also use the riparian stands for nesting. Canada geese will nest within the riparian forest, generally along the edge, on islands. Beaver use shrub willow and cottonwood stands for foraging; denning occurs in the bankline.

Emergent Wetlands

Emergent wetlands below Bonneville Dam are primarily limited to backwater sloughs and ponded areas away from the main Columbia River. Franz Lake at Franz NWR contains an extensive stand of wapato. Old slough channels, embayments and ponded areas on Government Island, Sandy River Delta, Steigerwald Lake, Ainsworth State Park (RM 138 to 139) and other riverine areas support emergent wetlands. Often, these areas are dominated by reed canarygrass.

These habitats provide forage, loafing, and night roost locations for waterfowl. The extensive wapato stand at Franz Lake supports a substantial (1,000–plus) population of wintering tundra swan in addition to other waterfowl species. These sites also provide foraging areas for various species of waterfowl, great blue herons, rails, passerines such as red–winged blackbirds, swallows, and marsh wrens, and other species of birds, mammals and amphibians.

Submerged Aquatic Plant Beds

Emergent wetlands are expected to occur in sloughs. embayments and ponded areas where water depth is sufficient to support submergent plants. The substantial fluctuation in flows and elevations of the Columbia River below Bonneville limits the development of submergent aquatic plant beds.

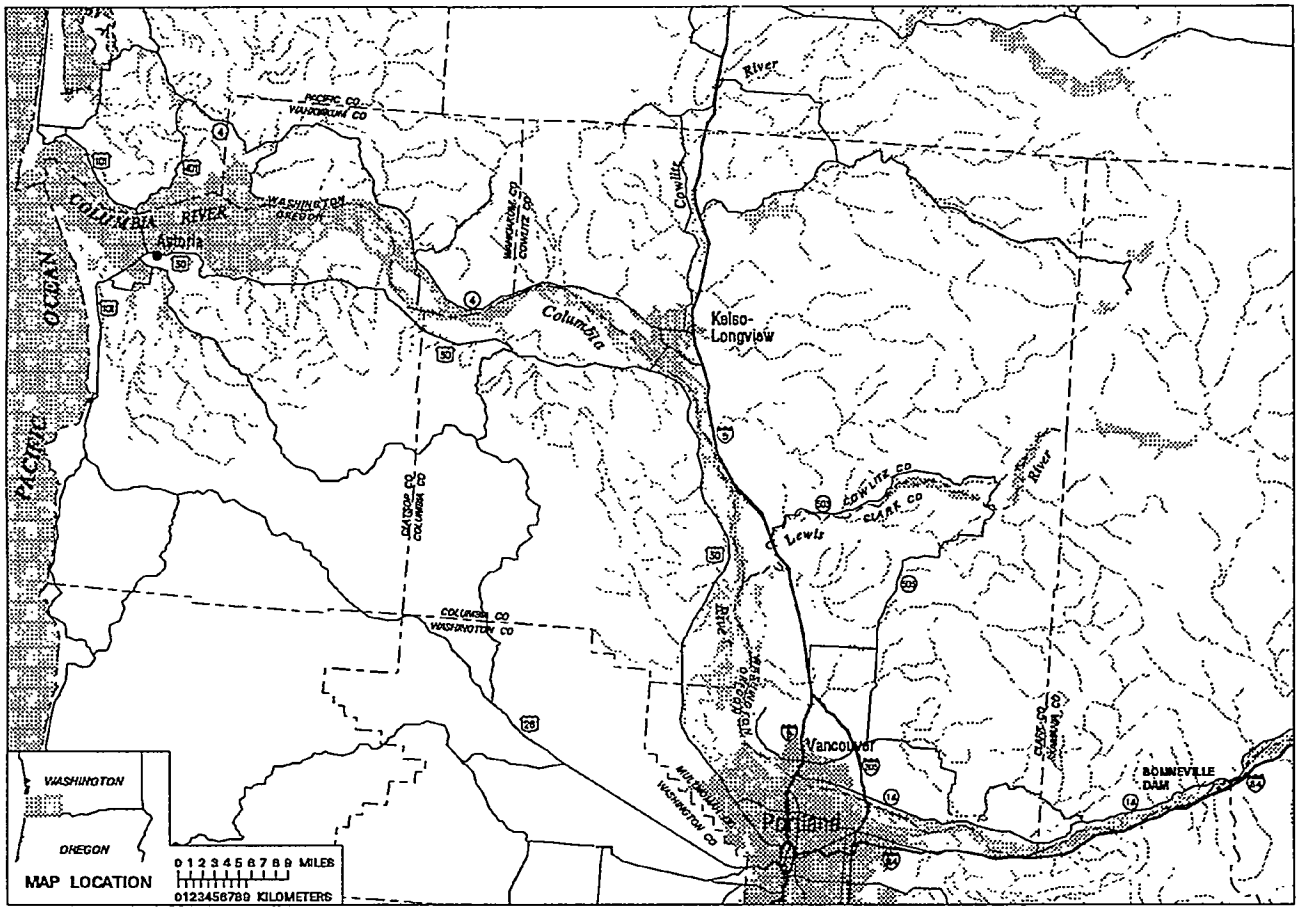

Figure 2–17. Columbia River Below Bonneville Dam to the Willamette River Mouth

Upland Habitat

Upland habitat varies by location and extent of human activities/development that have occurred over time. Extensive grass/forb habitat occurring along this reach is typically associated with agricultural or former agricultural operations (livestock), such as at Pierce NWR, Steigerwald Lake, Government Island, and Sandy River delta. Placement of construction–borrow material for Bonneville Second Powerhouse has resulted in the development of a large grass–forb upland site at Hamilton Island immediately below Bonneville Dam.

Upland forests are typically Douglas–fir in composition. Red alder and big leaf maple are common understory/early successional stage tree species. Oregon white oak occurs on more xeric sites.

Island Habitat

This reach of the Columbia River is dominated by a number of large islands. Hayden Island occurs just upstream of the mouth of the Willamette River. This island is heavily developed on its upstream end while the lower half contains riparian forest and grass/forb uplands. Interstate 5 and the railroad bisect Hayden Island. Lemon, Sand, McGuire and Government Islands form a large island complex at RM 112 to 117. Government Island is bisected by Interstate 205. These islands contain grass–forb uplands, riparian forest, sloughs, and small lake habitats. Gary and Flagg Islands are riparian forest dominated islands off the Sandy River delta. Reed Island at RM 124 to 127 is comprised of riparian forest and grass–forb upland. Another Sand Island

occurs at RM 131 to 132. Riparian forest and a large, erosive sand bluff on the northeast shoreline dominate this island. Pierce and Ives Islands are located just downstream of Bonneville Dam. A number of these islands are grazed. Others remain in their natural state.

Human Disturbance Zone

Human disturbance is prevalent along this reach of the Columbia River because of the large urban population centers of Portland and Vancouver, the presence of major highways and railroads along both shores, and the recreational draw presented by the Columbia River. A number of major state parks are located along this reach of the Columbia River.

Primary Fish Production Zone

Major migrations of anadromous fish species, including spring, summer and fall chinook, chum, sockeye, and coho salmon, winter and summer steelhead, shad, and white sturgeon pass through this reach of the Columbia River. Natural production of these anadromous fish is generally limited in tributary streams because of run declines associated with habitat degradation, harvest, and presence of a large component of hatchery fish in the runs. The Washougal and Sandy Rivers are the principal tributary streams providing production of anadromous fish. Hardy and Hamilton Creeks support remnant runs of chum salmon. White sturgeon spawn in the Columbia River below Bonneville Dam. Massive numbers of shad migrate through this reach of the Columbia River. Angling for these species is an important draw for recreationists in the Columbia River below Bonneville Dam.

Resident fish present – many of them arising from introductions – include smallmouth and largemouth bass, walleye, and various sun fish. Sport fishing, particularly for bass and walleye occurs in this reach. The bounty program for squawfish has encouraged anglers to fish for this species.

2.2.18.2 Wildlife

Waterfowl

Wintering waterfowl account for the majority of waterfowl use in this reach. Steigerwald and Franz National Wildlife Refuges along with the Government Island area represent the major wintering waterfowl sites. The dense stand of wapato at Franz NWR supports 1,000–plus tundra swans at peak periods during the winter.

Nesting by Canada geese along this reach is not as significant as for Bonneville pool or for the Columbia River downstream of Portland. Production of ducks is minor and generally associated with sloughs, ponds and backwater areas.

Colonial Nesting and Shorebirds

A great blue heron colony is located at Reed Island. Cliff swallows have substantial nesting colonies on the powerhouses and spillway structures at Bonneville Dam. Purple martins nest in old pilings at Skamania Landing and in the Vancouver area. Spotted sandpipers and killdeer nest along exposed beaches in this reach. Few migrant shorebirds use the Columbia River between Bonneville Dam and the city of Portland, although they occur downstream of Portland.

Songbirds

The riparian forest supports numerous passerine species including Swainson's thrushes, song sparrows, western wood peewees and robins. Barn, tree, violet–green and cliff swallows are abundant in this reach.

Raptors

Red–tailed hawks and osprey are probably the most abundant nesting raptors in this reach. Osprey are very dependent on the river for foraging and associated riparian and coniferous forest habitats for nest sites. Two bald eagle nests and two peregrine

eyries are associated with the area below Bonneville Dam. Wintering bald eagles are also present.

Furbearers

The array of terrestrial furbearers present along this reach of the Columbia River is typical for western Oregon and Washington. Tabor (1976) did note gray fox on both shores. The Washington observations are of special note because the species had not been documented previously in Washington. Beaver, river otter and mink are probably the most abundant aquatic furbearers. Muskrat would be expected to occur in backwaters, sloughs and ponded areas which support emergent marsh habitat.

Big Game

Black–tailed deer represent the principal big game species along the Columbia River in this reach. Roosevelt elk may occasionally occur in habitats adjacent to the river, but generally occur upslope from the highways and railroads.

Small Mammals

Tabor (1976) recorded 16 species of small mammals along this reach of the Columbia River. He noted that riparian habitat – specifically ash/cottonwood/willow – had the highest diversity of small mammals. Deer mice, vagrant shrew, and Townsend's vole are the most abundant small mammal in his study for this reach.

Tabor (1976), based on a literature survey effort, reported that seven species of bats had been collected near this reach of the Columbia River and that ten species could be expected to occur in the area. Bats are observed during his study foraging over riparian stands and adjacent open water habitats. Roosting in riparian forest stands is suspected although not confirmed. He observed that bats appear most abundant in the ash/willow/cottonwood stands.

Reptiles and Amphibians

Tabor (1976) observed ten species of reptiles and amphibians along the Columbia River below Bonneville Dam. He reported that 23 species may occur in the general area. Tabor (1976) reported that the presence of permanent ponds greatly enhanced the likelihood of the presence of these species. Western painted turtles occur in Columbia Slough, a former attached side channel of the Columbia River in the Portland area of this reach.

Endangered, Threatened and Sensitive Species

For the Columbia River from its mouth to McNary Dam, the USFWS has listed Columbian white–tailed deer, peregrine falcon and bald eagle. Columbian white–tailed deer occur in the lower Columbia River in the vicinity of Cathlamet–Skamokawa, Washington, but not in the project area. Peregrine falcons have established nesting territories along Bonneville and The Dalles pools. Wintering peregrines would be expected along John Day pool given the large prey base available. Bald eagles have established nesting territories along Bonneville pool and downstream of Bonneville Dam. Wintering birds occur along all pools but are prevalent along John Day pool. The large waterfowl concentration on John Day pool serves to attract bald eagles to the location.

One proposed plant species, *Howellia*, is listed by the USFWS as occurring in the project area.

The USFWS has also identified 25 sensitive or candidate species along these three projects. These include three mammals, five birds, three amphibians or reptiles, one fish, five invertebrates and eight plant species.

2.3 SCIENTIFIC NAMES

2.3.1 Plant

alder – *Alnus* spp.

alder buckthorn – *Rhamnus alnifolia*

antelope bitterbrush – *Purshia tridentata*

arrowleaf balsamroot – *Balsamorhiza sagittata*

bank monkeyflower – *Mimulus clivicola*

Barrett's breadtongue – *Penstemon barrettiae*

Bebb willow – *Salix bebbi*

black cottonwood – *Populus trichocarpa*

black hawthorn – *Crataegus douglasii*
black locust – *Robinia pseudo–acacia*
blue grass – *Poa* spp.
bluebunch wheatgrass – *Agropyron spicatum*
box elder – *acer negundo*
bristly cryptantha – *Cryptantha interrupta*
broad–fruit mariposa – *Calochortus nitidus*
brome grasses – *Bromus* spp.
buckwheat – *Eriogonum* spp.
bulrush – *Scirpus* spp.
Canadian buffaloberry – *Sheperdia canadensis*
cattail – *Typha latifolia*
ceanothus – *Ceanothus* spp.
cedar – *Thuja plicata*
Ceratophyllum demersum
cheatgrass – *Bromus tectorum*
chokecherry – *Prunus virginiana*
cocklebur – *Xanthium strumarium*
Columbia milk–vetch – *Astragulus columbianus*
Columbia River mugwort – *Artemisia lindleyana*
Columbia yellow – cress – *Rorippa columbiae*
compressed bluegrass – *Poa compressa*
creeping Oregon grape – *Berberis repens*
curly leaf pondweed – *Potamogeton crispus*
Cusick's lupine – *Lupinus cusickii*
dense sedge – *Carex densa*
dogbane – *Apocynum* spp.
Douglas fir – *Pseudotsuga menziesii*
Douglas' constricted onion – *Allium constrictum*
duckweed – *Lemma* spp
elodea – *Elodea* spp.
Eurasian watermilfoil – *Myriophyllum spicatum*
flowering rush – *Butomus umbellatus*
giant helleborine – *Epipactis gigantea*
giant wildrye – *Elymus giganteus*
golden currant – *Ribes aureum*
gooseberry – *Ribes* spp.
Grand fir – *Abies grandis*
gray cryptantha – *Cryptantha leucophaea*
hardstem bulrush – *Scirpus acutus*
Hazel's prickly phlox – *Leptodactylon pungens hazeliae*
heartleaf arnica – *Arnica cordifolia*
Howell's fleabane – *Erigeron howellii*
Idaho fescue – *Festuca idahoensis*
Jessica's aster – *Aster jessicae*
kinnikinnick – *Arctostaphylos uva–ursi*
lodgepole pine – *Pinus contorta*
Lombardy poplar – *Populus nigra*
lupine – *Lupinus* spp.
Macfarlane's four–o–clock – *Mirabilis macfarlanei*
mallow ninebark – *Physocarpus malvacea*
mock azalea – *Menziesia ferruginea*
mock orange – *Philadelphus lewisii*
mountain alder – *Alnus incana*
needlegrass – *Stipa veridula*
northern wormwood – *Artemesia campestris*
northwest raspberry – *Rubus nigerrimus*
obscure buttercup – *Ranunculus reconditis*
oceanspray – *Holodiscus discolor*
Palouse goldenweed – *Haplopappus liatriformis*
paper birch – *Betula papyifera*
pine – *Pinus monticola*
Pinegrass – *Calamagrostis rubescens*
Piper's daisy – *Erigeron peperianus*
poison ivy – *Rhus radicans*
Polygonum amphibium
pond lily – *Nuphar* spp.
Ponderosa pine – *Pinus ponderosa*
pondweed – *Potamogeton* spp.
prairie Junegrass – *Koeleria cristata*

pygmy–weed – *Tillaea aquatica*
quaking aspen – *Populus tremuloides*
rabbitbrush – *Chrysothamnus* spp.
redosier dogwood – *Cornus stolonifera*
reed canarygrass – *Phalaris arundinaceae*
reedgrass – *Calamagrostis* spp.
Rocky Mountain juniper – *Juniperus scopulorum*
Rocky Mountain maple – *Acer glabrum*
rose – *Rosa* spp.
rough fescue – *Festuca scabrella*
rushes – *Juncus* spp.
Russian olive – *Elaeagnus angustifolia*
sagebrush – *Artemisia* spp.
sago pondweed – *Potamogeton pectinatus*
sandbar willow – *Salix exigua*
Saskatoon serviceberry – *Amelanchier alnifolia*
scurfpea – *Psoralea laceolata*
sego lily – *Calochortus apiculatus*
shining flatsedge – *Cyperus rivularis*
Siberian elm – *Elmus pumila****(spelling?)
silver fir – *Abies alba*
Sitka alder – *Alnus sinuata*
smooth desert parsley – *Lomatium laevigatum*
smooth sumac – *Rhus glabra*
Snake River goldenweed – *Haplopappus radiatus*
snow eriogonum – *Eriogonum niveum*
snowberry – *Symphoricarpos* spp.
Spaulding's silene – *Silene spauldingii*
spike rush – *Eleocharis* spp.
spruce – *Picea* spp.
squaw currant – *Ribes cereum*
Suksdorf's desert parsley – *Lomatium suksdorfii*
sweetclover – *Melilotus officinalis*
thickspike wheatgrass – *Agropyron dasytachyum*
thimbleberry – *Rubus parviflorus*
thistle – *Circium* spp.
triangular–lobed moonwart – *Botrychium ascendens*
tumble mustard – *Sisymbrium altissimum*
watercress – *Rorippa nasturtium–aquaticum*
western hemlock – *Tsuga heterophylla*
western larch – *Larix occidentalis*
white mulberry – *Morus alba*
white poplar – *Populus alba*
white spiraea – *Spiraea betulifolia*
willow – *Salix* spp.
Wood's rose – *Rosa woodsii*
yarrow – *Achillea millefolium*

2.3.2 Birds

American avocet – *Recurvirostera americana*
American coot – *Fulica americana*
American kestrel – *Falco sparverius*
American robin – *Turdus migratorius*
Baird's sandpiper – *Calidris bairdii*
bald eagle – *Haliaeetus leucocephalus*
bank swallow – *Raparia riparia*
Barrow;s golden–eye – *Bucephala clangula*
belted kingfisher – *Ceryle alcyon*
black–headed grosbeak – *Pheucticus melanocephalus*
black tern – *Chlidonias niger*
black–billed magpie – *Pica pica*
black–crowned night heron – *Nycticorax nycticorax*
black–necked stilt – *Himantopus mexicanus*
blue bird – *Sialia* spp.
blue grouse – *Dendrogapus obscurus*
burrowing owl – *Athene canicularia*
California gull – *Larus californicus*
California quail – *Callipepla californica*
Canada geese – *Branta canadensis*
Caspian tern – *Sterna caspia*
Cassin's finch – *Carpodacus cassinii*

chukar – *Alectoris chukar*
Clark's grebe – *Aechmophorus clarkii*
cliff swallow – *Hirundo pyrrhonota*
Columbian sharp–tailed grouse – *Typanuchus phasianellus columbianus*
common flicker –*Colaptes auratus*
common goldeneye – *Bucephala clangula*
common loon – *Gavia immer*
common merganser – *Mergus merganser*
common nighthawk – *Chordeiles minor*
common raven – *Corvus corax*
common redpoll – *Carduelis flammea*
common snipe – *Gallinago gallinago*
cordilleran flycatcher – *Empidonax occidentalis*
dark–eyed junco – *Junco hyemalis*
dipper – *Cinclus mexicanus*
downy woodpecker – *Picoides pubescens*
European starling – *Sturnus vulgaris*
ferruginous hawk – *Buto regalis*
flammulated owl – *Otus flammeolus*
Forsters tern – *Sterna forsteri*
fox sparrow –*Passerella iliaca*
gadwall – *Anas strepera*
golden–crowned kinglet – *Regulus satrapa*
golden eagle – *Aquila chrysaetos*
goshawk – *Accipiter gentilis*
grasshopper sparrow – *Ammodramus savannarum*
gray jay – *Perisoreus canadensis*
great egret – *Casmerodius albus*
great horned owl – *Bubo virginianus*
Great blue heron – *Ardea herodias*
greater yellowlegs – *Tringa melanoleuca*
gyrfalcon – *Falco rusticolis*
hairy woodpecker – *Picoides villosus*
harlequin duck – *Histrionicus histrionicus*
hermit thrush – *Catharus guttatus*
horned grebe – *Podiceps auritus*
horned lark – *Eremophila alpestris*
house finch – *Carpodacus mexicanus*
house sparrow – *Passer domesticus*
house wren – *Trooglodytes aedon*
Hungarian partridge – *Perdix perdix*
killdeer – *Charadrius vociferus*
lesser yellowlegs – *Tringa flavipes*
Lewis' woodpecker – *Melanerpes lewis*
loggerhead shrike – *Lanius ludovicianus*
long–billed curlew – *Numenius americanus*
long–billed dowitcher – *Limnodromus scolopaceus*
long–eared owl – *Asio otus*
mallard – *Anas platyrhynchos*
merlin – *Falco columbarius*
mountain chickadee – *Parus gambeli*
mountain quail – *Oreotyx pictus*
mourning dove – *Zenaida macroura*
northern goshawk – *Accipiter gentilis*
northern oriole – *Icterus glabula*
northern phalarope – *Phalaropus lobatus*
northern shrike – *Lanius excubitor*
osprey – *Pandion haliaetus*
peregrine falcon – *Falco peregrinus anatum*
pileated woodpecker – *Dryocopus pileatus*
pine siskin – *Carduelis spinus*
pintail – *Anas acuta*
poorwill – *Phalaenoptilus nuttallii*
prairie falcon – *Falco mexicanus*
red–breasted nuthatch – *Sitta canadensis*
red–eyed vireo – *Vireo olivaceus*
red–necked grebe – *Podiceps grisegena*
red–tailed hawk – *Buteo jamaicensis*
red–wing blackbird – *Agelaius phoeniceus*
ring–billed gull – *Larus delawarensis*

ring–necked pheasant – *Phasianus colchicus*
rough–legged hawk – *Buteo lagopus*
rough–winged swallow – *Stelgidopteryx serripennis*
ruffed grouse – *Bonasa umbellus*
rufous hummingbird – *Selasphorus rufus*
sage sparrow – *Amphispiza belli*
sanderling – *Calidris alba*
sandhill crane – *Grus canadensis*
scaup – *Aythya* spp.
semipalmated plover – *Charadrius semipalmatus*
short eared owl – *Asio flammeus*
snowy owl – *Nyctea scandiaca*
solitary sandpiper – *Tringa solitaria*
solitary vireo – *Vireo solitarius*
song sparrow – *Melospiza melodia*
spotted sandpiper – *Actitis macularia*
spruce grouse – *Dendrogapus canadensis*
Steller's jay – *Cyanocitta stelleri*
Swainson's hawk – *Buteo swainsoni*
Swainson's thrush – *Catharus ustulatus*
teal – *Anas* spp.
Townsend's warbler – *Dendroica townsendi*
tundra, whistling swan – *Cygnus columbianus*
turkey – *Meleagris gallopavo*
turkey vulture – *Cathartes aura*
turkey vulture – *Cathartes aura*
western grebe – *Aechmophorus occidentalis*
western kingbird – *Tyrannus verticalis*
western meadowlark – *Sturnella neglecta*
western sage grouse – *Centrocercus urophasianus*
western tanager – *Piranga ludoviciana*
western wood pewee – *Contopus sordidulus*
white pelican – *Pelecanus erythrorhynchus*
white–crowned sparrow – *Zonotrichia leucophrys*
white–winged crossbill – *Loxia leucoptera*
wigeon – *Anas americana*
wood duck – *Aix sponsa*
yellow warbler – *Dendroica petechia*
yellow–rumped warbler – *Dendroica coronata*

2.3.3 Mammals

badger – *Taxidea taxus*
beaver – *Castor canadensis*
bighorn sheep – *Ovis canadensis*
black bear – *Ursus americanus*
black–tailed jackrabbit – *Lepus californicus*
bobcat – *Lynx rufus*
bushy–tailed woodrat – *Neotoma cinerea*
cottontail rabbit – *Sylvilagus nuttalli*
cougar – *Felis concolor*
coyote – *Canis latrans*
deer mouse – *Peromyscus maniculatus*
elk – *Cervus canadensis*
grasshopper mouse – *Onochomys leucogaster*
gray wolf – *Canis lupis*
Great Basin pocket mouse – *Perognathus parvus*
grizzly bear – *Ursus arctos*
house mouse – *Mus musculus*
least chipmunk – *Eutamias minimus*
long–legged myotis – *Myotis volans*
long–tailed weasel – *Mustela frenata*
lynx – *Lynx canadensis*
Merriam's shrew – *Sorex merriami*
mink – *Mustela vison*
moose – *Alces alces*
mountain goat – *Oreamnos americanus*
mule deer – *Odocoileus hemionus*
Muskrat – *Ondatra zibethica*
northern pocket gopher – *Thomomys talpoides*
Norway rat – *Rattus norvegicus*
Pacific fisher – *Martes pennanti pacifica*

Pacific western big–eared bat – *Plecotus townsendii townsendii*

pallid bat – *Antrozous pallidus*

pine marten – *Martes americana*

porcupine – *Erithizon dorsatum*

Preble'shrew – *Sorex preblei*

pygmy rabbit – *Brachylagus idahoensis*

river otter – *Lutra canadensis*

sagebrush vole – *Lagurus curtatus*

short–tailed weasel – *Mustela erminea*

snowshoe hare – *Lepus americanus*

striped skunk – *Mephitis mephitis*

Thompson's big–eared bat – *Corynorhinus rafinesquei*

Townsend's ground squirrel – *Spermophilus townsendii*

western harvest mouse – *Reithrodontomys megalotis*

white–tailed deer – *Odocoileus virginianus*

wolverine – *Gulo gulo luscus*

woodland caribou – *Rangifer tarandus*

yellow–bellied marmot – *Marmota flaviventris*

yellow pine chipmunk – *Eutamias amoenus*

2.3.4 Reptiles and Amphibians

garter snake – *Thamnophis elegans*

gopher snake – *Pituophis melanoleucus*

Great Basin spadefoot toad – *Spea intermontanus*

Larch Mountain salamander – *Plethodon larselli*

long–toed salamander – *Ambystoma macrodactylum*

northern alligator lizard – *Gerrhonotus coeruleus*

northern red–legged frog – *Rana aurora aurora*

Pacific rattlesnake – *Crotalus viridis*

Pacific treefrog – *Pseudacris regilla*

painted turtle – *Chrysemys picta*

rubber boa – *Charina bottae*

sagebrush lizard – *Sceloporus graciosus*

short–horned lizard – *Phrynosoma douglassii*

side–blotched lizard – *Uta stansburiana*

Spotted frog – *Rana pretiosa*

western pond turtle – *Clemmys marmorata marmorata*

western skink – *Eumeces skiltonianus*

western toad – *Bufo boreas*

Woodhouse's toad – *Bufo woodhouseii*

western yellow–bellied racer – *Coluber constrictor*

2.3.5 Fish

chinook salmon – *Oncorhynchus tshawytscha*

coho salmon – *Oncorhynchus kisutch*

mountain sucker – *Catostomus platyrhynchus*

mountain whitefish – *Prosopium williamsoni*

paiute sculpin – *Cottus beldingi*

reticulate sculpin – *Cottus perplexus*

sandroller – *Percopsis transmintana*

sockeye – *Oncorhynchus nerka*

steelhead trout – *Oncorhynchus mykiss*

white sturgeon – *Acipenser transmontanus*

smallmouth bass – *Micropterus dolomieui*

2.3.6 Invertebrates

California floater – *Andonta californiensis*

Columbia pebblesnail – *Fluminicola columbianus*

Columbia River limpet –

Columbia River spire snail – *Lithoglyphus columbiana*

immaculate green hairstreak – *Callophrys affinis affinis*

shortface lanx – *Lanx nuttalli*

CHAPTER 3

STUDY METHODS

3.1 INTRODUCTION

Significant adverse wildlife impacts in both the short and long term will result as a consequence of implementing any of the proposed System Operating Strategies. This is due to the significant ecological effects that are caused when systemwide changes are made in the Columbia and Snake river reservoir elevations and instream flows. The proposed annual and seasonal changes as projected in the System Operating Strategies' hydroregulation models could impact several shoreline habitat types along the length of the entire Columbia and Snake rivers, and produce a variety of adverse effects on local wildlife species.

As described in this chapter, the SOR wildlife evaluation was carried out after an extensive public scoping process in two steps: the Screening and Full–scale Analyses. The initial public scoping process was essential to involve Tribal, State, and Federal wildlife managers, and the public, in the identification of issues, concerns, and alternatives. The Screening Analysis was used for prioritizing and synthesizing a large number of preliminary alternatives, and to select a smaller number of feasible alternatives for Full–scale Analysis. The Full–scale Analysis required the development of a comprehensive evaluation methodology capable of assessing the full range of potential (direct, indirect, and cumulative) effects on the wildlife community.

The WWG conducted an extensive review process throughout the Pacific Northwest Region. After gaining information from the Tribal, state, and Federal wildlife managers, and other interested organizations with authority or interest in the mainstem river system, the Full–scale methodology was developed. The long–term benefit of the wildlife review process was the development of an analytic methodology that better addressed systemwide public issues and interagency management concerns, and provided the capability for assessing both local and systemwide effects. For example, measures of discrete physical effects were added to the evaluation – such as the drying and flooding of riparian and wetland habitats – which capture differences in a variety of wildlife productivity factors.

3.2 SCREENING ANALYSIS

The WWG was formed as an independent committee during the first phases of the Screening Analysis. The first objective was to bring together field biologists and other technical experts from throughout the Columbia River basin with knowledge of Federal power operation impacts to wildlife resources. The WWG's second priority was to identify at least two single purpose systemwide operational alternatives designed to enhance or maintain wildlife values, and to reach consensus on wildlife models. The final task was to complete the evaluation and prioritize the large number of preliminary screening alternatives from good to bad in terms of wildlife value.

The Screening Analysis process was facilitated by Strategic Decision Group consultants and a formal Decision Analysis method.

3.2.1 Goals and Methodology

The WWG Screening alternatives, value measures, models, and methodologies, as well as the Work Group's conclusions, are presented in the Columbia River System Operation Review, Results of Screening, volumes 1 & 2 (1993).

3.3 FULL–SCALE METHODOLOGY

3.3.1 Alternatives

For Full–scale Analysis, each of the 13 final strategies was simulated as system wide hydrological data by HYDROSIM. Hydrological data produced for

each strategy presents a variety of water–year conditions. These included: average monthly streamflows, and end–of–month elevations for a fifty–year period of record.

Streamflow and elevation changes at all projects and reaches for each strategy were depicted graphically or in tabular format for comparison purposes.

For analysis purposes, the WWG determined that three water–year conditions reflect the full range of wildlife impacts. The first is the average water year, generated from the 50–year average from the hydroregulation run of each SOS alternative. The second is a year reflecting "dry" conditions. The dry period was determined by the lowest five–year sequential outflow records at Bonneville Dam. The last year of the dry sequence (1941) was the year used to represent systemwide dry conditions. The third year reflects the systemwide effects of a series of "wet" conditions. The last year in the sequence (1976) was used to represent systemwide wet conditions.

3.3.2 Full–scale Analysis Techniques

As previously noted, some parts of the SOR study area had considerable wildlife information, while others had little. Because of the wide range of adverse ecological effects of changing system operations, systemwide data gaps, and the broad geographic scope of the study area, the Work Group was unable to develop or adapt existing quantitative modeling techniques in time to meet the SOR schedule. For these reasons, the WWG selected a qualitative matrix approach as its analytic methodology.

In this approach a rating is recorded that measures the magnitude of wildlife impacts for each alternative.

Each project expert completed site analysis in two steps including assessments of impacts to both wildlife habitat and populations. Results were then reviewed with local experts. More specifically the Project Physical Effects Matrix documents the direct impacts of hydrological changes of each project/reach on the surrounding wildlife habitat. In each of the physical environment categories, existing habitat acres were reported for the No–Action alternative. Potential changes in habitat acreages for each of the action alternatives were estimated and recorded. The change in habitat acreages, and other measures outlined in the physical habitats matrix, was used to focus and guide input into a second wildlife population assessment.

The Project Wildlife Matrix displays the range of potential responses of wildlife indicator species as a result of proposed changes by SOS on the physical environment. Specifically, the productivity of selected indicator species is effected by changes in the physical environment; therefore, the second matrix attempts to capture the severity of the indirect impacts on wildlife populations as produced by potential changes to habitat conditions. Each alternative was processed through the Project Wildlife Matrix to document severity of specific impacts to localized wildlife species.

As noted above, the technique presented here is a general one to guide analysis consistency. Individual project evaluators made modifications as needed to better reflect site–specific conditions prior to analysis. These modifications and a full discussion of individual assumptions are included in Chapter 5.0.

The site–specific results of each of the project matrices were finally accumulated into a pair of basinwide (summary) matrices and used as the basis for documenting systemwide effects of the SOS alternatives.

3.3.3 Data Elements of Project and Summary Matrices

As shown in Table 3–2, the change in the hydrological conditions are assessed by a number of physical habitat components and measures as identified by the WWG, and the public at large during the scoping period. Habitat components include: drawdown/barren zone, upland zone, riparian zone, emergent wetland zone, submerged aquatic plant bed, and island habitat productivity; fish and benthic invertebrate productivity, and potential human effects.

Vegetative habitats were primarily evaluated in terms of acreage change. Island habitats were evaluated in terms of acreage changes, and land bridging potential. Primary fish, and benthic invertebrate productivity factors were measured in terms of the percentage of increase or decrease in indices reported by the Resident Fish work-group. Human activities include an estimate of the increase or decrease in boating and shoreline use.

In the wildlife matrix evaluation, important habitat features were associated with a list of wildlife categories and life requisites of selected indicator species. Wildlife categories that are potentially effected by project habitat changes resulting from proposed changes in operations include: waterfowl; colonial nesting birds; shorebirds; nongame birds; raptors; aquatic furbearers; terrestrial furbearers; big game; amphibians; reptiles; and Federally–listed endangered, threatened, and sensitive species.

One or more indicator species of these categories were selected at each reservoir/reach to measure impacts to the representatives grouping. The activities most important for each indicator species, relative to a particular physical change, were measured by project evaluators in terms of percent increase or decrease in activity levels. Species activities such as nesting or denning, feeding or foraging, brooding, and wintering or winter range factors were evaluated.

Table 3–2. Direct Physical Effects by Project or Reach

Public Issue/Mngt Concern	Value	Measure	wet	avg	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres			
Upland Zone Productivity:	Upland Zone Extent	# of acres			
Riparian Zone Productivity:	Riparian Zone Extent	# of acres			
Emergent Wetland Zone Productivity	Emergent Wetland Extent	# acres			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres			
Island Habitat Productivity:	Island Extent	# of acres			
	Land Bridging Potential	percent increase/ decrease			
Fish Productivity	Resident Fish Species index	percent increase/ decrease			
Benthic Invertebrate Productivity	Resident Fish benthic index	percent increase/ decrease			
Human Effects	Boating Activity	percent increase/ decrease			
	Shoreline Activities	percent increase/ decrease			

Table 3–3. Project Wildlife Matrix

Public Issue/ Mngt Concern	Indic Spp	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	C. Geese	Nesting								
		Brooding								
		Wintering								
	Mallard	Nesting								
		Brooding								
		Wintering								
	Diving Ducks	Nesting								
		Brooding								
		Wintering								
Colonial Nesting Birds	G.B. Heron	Nesting								
		Foraging								
	Gulls	Nesting								
		Foraging								
Shorebirds	Bl. Neck Stilt	Nesting								
		Foraging								
	Spotted Sandpiper	Nesting								
		Foraging								
Non Game Birds	Downy Woodpek.	Nesting								
		Feeding								
	R.W. Blk Bird	Nesting								
		Feeding								
	Yellow Warbler	Nesting								
		Feeding								
Raptors:	Bald Eagle	Foraging								
	Osprey	Nesting								
		Foraging								

Table 3–3. Project Wildlife Matrix – CONT

Public Issue/ Mngt Concern	Indic Spp	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Aquatic Furbearers:	Beaver	Denning								
		Feeding								
	Otter	Denning								
		Feeding								
Terrestrial Furbearers:	Raccoon	Foraging								
Big Game:	Deer	Fawning								
		Foraging								
	Elk	Wnt. Range								
	B.H. Sheep	Wnt. Range								
Amphibians:										
Reptiles:	Painted Turtle	Foraging								
End.,Threat., Sens. Spp.										

3.3.4 Matrix Ranking Process

The WWG agreed that an actual numerical value would be assigned to each matrix measure and the following ranking standards were adopted:

3 equals a >66 percent increase in the measure (i.e. acres, goose broods)

2 equals a 3 percent to 66 percent increase in the measure

1 equals a 6 percent to 33 percent increase in the measure

0 equals a 5 percent to −5 percent no measurable change

−1 equals a 6 percent to 33 percent decrease in the measure

−2 equals a 34 percent to 66 percent decrease in the measure

−3 equals a >6 percent decrease in the measure

When an actual numerical value is used in the project matrix (not a relative value or subjective ranking), a superscript may be added.

(1) accurate with some reservations

(2) an estimate based on professional judgment

(3) an estimate based on the best available information

If rating estimates could not be reached they were left blank.

The ten categories of wildlife and five habitat/land use categories were identified and used to represent wildlife resources throughout the system. Additionally, Federal Threatened and Endangered Species were examined for potential impacts. In the system-wide analysis, the WWG totaled the values for each category by project/reach. These values provided a relative index of the effects of the alternatives on wildlife values. The accuracy of these estimates vary by category, with more information available for

game species and wetland acres, and less information available for nongame species and submerged plant beds. A more complete discussion of the development of these values for each individual site is presented in Chapters 2.0 and 5.0.

The systemwide discussion of impacts (Chapter 6.0) is based on this relative ranking of alternatives and the comparison of estimated acre changes to the various wildlife category values.

3.3.5 General Assumptions/Parameters/ Uncertainties

3.3.5.1 Analysis Assumptions

The following are basic procedural assumptions or standards documented by the Work Group for analytic purposes:

- The critical wildlife period is March through August. While winter habitat can also be critical, it is generally not affected by SOR actions.
- The drawdown zone is defined as that area below the high water level for the water year (1941, 50 yr. average, 1976). The wildlife impacts of the drawdown vary with the extent and pattern of the drawdown that occurs during the critical wildlife period.
- Areas between maximum pool and a year's high water level will generally be captured in increased upland/riparian/wetland acreage. The WWG recognizes there are exceptions that may occur. In those instances, such exceptions will be explained in the text of the individual project analysis.
- Average water year conditions do not reflect any particular water year and are included for comparison purposes. Typically, the entire 50 years of record are scanned to identify a maximum summer pool elevation. If the pattern and frequency of past full pool elevations are similar to today, there is no change from existing conditions. The 50 year mean given in the hydroregulations is not reflective of typical conditions if the mode is significantly different. When or if differences occur they are discussed in the text of the individual project/reach.
- The Physical Effects Matrix will show the greatest change in a measure (generally elevation/acres) during the wildlife critical period.
- Those biological effects for any species/activity documented in project Wildlife Matrices are based on physical effects (recorded in the project Physical Effects Matrix) most relevant to that species/activity.
- The individual project methodology and result discussions will document any change from standard methods/analysis technique.
- The base analysis will use 1941 as the dry year, 1976 as the wet year, and the mean of the 50 years of record as the average condition.
- Years more extreme than 1941 and 1976 will be discussed on an individual project basis, if impacts are significantly different.
- Upland acreage figures in the No–Action alternatives are unnecessary for the Physical Effects Matrix, but may be developed as needed. Alternative analysis will emphasize changes in acres.
- No significant change in irrigated acreage is assumed, pending information from the irrigation work group.
- The accuracy/source of data for each individual project/reach will be documented in the individual project analysis. National Wetland Inventory/United States Geological Survey quad data reflects the minimum acres of wetland habitat because of scale.
- The drawdown zone represents an annual effect. Vegetative zones are more reflective of longer–term effects (5 year period).
- System short term (power peaking) operations will continue in the future and result in daily fluctuations which are the same as

today or no greater than the historic record for each project.

- The Work Group believes that the specific effects of different operations below Flathead Lake on the Flathead River in Montana will be attenuated by the operations of Kerr Dam and the size of Flathead Lake, to the point that specific effects can not be evaluated. The same assumption applies to the Kootenai and Columbia rivers below Corra Linn Dam and Lake Kootenay in British Columbia. This assumption has been confirmed by the analysis, which generally shows insignificant impacts below Federal facilities in the United States. Canadian members and officials were responsible for reporting significant wildlife impacts at stream reaches and reservoirs in their portion of the basin. Based on the scope of the EIS, Brownlee Reservoir was the upstream terminus of the Snake River analysis. Wildlife effects were not analyzed above the Brownlee Project on the Snake River.
- Submerged soils will retain the capacity to revegetate.

Each of the individual project evaluators is responsible for documenting site–specific methodologies/assumptions, which are the basis for project analysis (See Chapter 5.0). This also includes discussion of general, alternative, and analysis–specific exceptions or anomalies in the above standards.

3.3.5.2 Study Parameters

- Hydroregulation output reflects end of month reservoir elevations and monthly average streamflows.
- The width of the study area is 1/4 mile on either side of the mainstem river system.
- The study applies to the entire Columbia System Operation Review study area.
- Site–specific assumptions/methodologies are documented in individual project analysis.

3.3.5.3 Uncertainties/Data Gaps

Uncertainties and data gaps include:

- System data gaps (existing wildlife populations): population statistics/Canadian/daily fluctuations
- Use of Averages (end of month elevations/ monthly streamflows)
- Magnitude of impacts (Large percentage breakouts or thresholds used for broad categories or measuring effects)
- Flow relationships (near and long–term)
- Long term plant and animal response to operational changes
- Cumulative effects
- Mitigation measures, effectiveness and costs – w/o adequate baseline data
- Impacts of mitigation itself
- Short Term Operations (elevation range of fluctuations is assumed the same as historic)
- An objective value measure for individual habitat acres was not available for the entire system and this increases the uncertainty of the impacts.
- The ability of soils long inundated to support wetland/riparian vegetation is uncertain because of possible chemical and physical damage.

CHAPTER 4

ALTERNATIVES

4.1 GENERAL DESCRIPTION OF ALTERNATIVES

Seven alternative System Operating Strategies (SOS) were considered in the Draft EIS. Each of the 7 SOSs contained several options, bringing the total number of alternatives considered to 21. This Final EIS also evaluates 7 operating strategies, with a total of 13 alternatives now under consideration when accounting for options. Section 4.1 of this chapter describes the 13 alternatives and provides the rationale for including these alternatives in the Final EIS. Operating elements for each alternative are summarized in Table 4–1. Later sections of this chapter describe the effects of these alternatives on wildlife.

The 13 final alternatives represent the results of the third analysis and review phase completed since SOR began. In 1992, the agencies completed an initial effort, known as "Screening" which identified 90 possible alternatives. Simulated operation for each alternative was completed for five water year conditions ranging from dry to wet years, impacts to each river use area were estimated using simplified analysis techniques, and the results were compared to develop 10 "candidate SOSs." The candidate SOSs were the subject of a series of public meetings held throughout the Pacific Northwest in September 1992. After reviewing public comment on the candidate strategies, the SOR agencies further reduced the number of SOSs to seven. These seven SOSs were evaluated in more detail by performing 50–year hydroregulation model simulations and by determining river use impacts. The impact analysis was completed by the SOR workgroups. Each SOS had several options so, in total, 21 alternatives were evaluated and compared. The results were presented in the Draft EIS, published in July, 1994. As was done after Screening, broad public review and comment was sought on the Draft EIS. A series of nine public meetings was held in September and October 1994, and a formal comment period on the Draft EIS was held open for over 4 1/2 months. Following this last process, the SOR agencies have again reviewed the list of alternatives and have selected 13 alternatives for consideration and presentation in the Final EIS.

Six options for the alternatives remain unchanged from the specific options considered in the Draft EIS. One option (SOS 4c) is a revision to a previously considered alternative, and the rest represent replacement or new alternatives. The basic categories of SOSs and the numbering convention remains the same as was used in the Draft EIS. However, because some of the alternatives have been dropped, the final SOSs are not numbered consecutively. There is one new SOS category, Settlement Discussion Alternatives, which is labeled SOS 9 (see Section 4.1.6 for discussion).

The 13 alternatives have been evaluated through the use of a computerized model known as HYDROSIM. Developed by BPA, HYDROSIM is a hydroregulation model that simulates the coordinated operation of all projects in the Columbia River system. It is a monthly model with 14 total time periods. April and August are split into two periods each, because major changes can occur in streamflows in the first and second half of each of these months. The model is based on hydrologic data for a 50–year period of record from 1928 through 1978. For a given set of operating rule inputs and other project operating requirements, HYDROSIM will simulate elevations, flows, spill, storage content and power generation for each project or river control point for the 50–year period. For more detailed information, please refer to Appendix A, River Operation Simulation.

The following section describes the final alternatives and reviews the rationale for their inclusion in the Final EIS.

Table 4–1. SOS Alternative–1

Summary of SOS

SOS 1 Pre-ESA Operation	SOS 2 Current Operations	SOS 4 Stable Storage Project Operation
SOS 1 represents system operations before changes were made as a result of the ESA listing of three Snake River salmon stocks. SOS 1a represents operations from 1983 through the 1990–91 operating year, influenced by Northwest Power Act; SOS 1b represents how the system would operate without the Water Budget and related operations to benefit anadromous fish. Short-term operations would be conducted to meet power demands while satisfying nonpower requirements.	SOS 2 reflects operation of the system with interim flow improvement measures in response to the ESA salmon listings. It is consistent with the 1992–93 operations described in the Corps' 1993 Interim Columbia and Snake River Flow Improvement Measures Supplemental EIS. SOS 2c represents the operating decision made as a result of the 1993 Supplemental EIS and is the no action alternative for the SOS. Relative to SOS 1a, primary changes are additional flow augmentation in the Columbia and Snake Rivers and modified pool levels at lower Snake and John Day reservoirs during juvenile salmon migration. SOS 2d represents operations of the 1994-98 Biological Opinion issued by NMFS, with additional flow aumentation measures compared to SOS 2c.	SOS 4 would coordinate operation of storage reservoirs to benefit recreation, resident fish, wildlife, and anadromous fish, while minimizing impacts to power and flood control. Reservoirs would be managed to specific elevations on a monthly basis; they would be kept full longer, while still providing spring flows for fish and space for flood control. The goal is to minimize reservoir fluctuations while moving closer to natural flow conditions. SOS 4c attempts to accommodate anadromous fish needs by shaping mainstem flows to benefit migrations and would modify the flood control operations at Grand Coulee.

Actions by Project

	SOS 1	SOS 2	SOS 4
LIBBY	**SOS 1a** Normal 1983–1991 storage project operations	**SOS 2c** Operate on system proportional draft as in SOS 1a	**SOS 4c** • Meet specific elevation targets as indicated by Integrated Rule Curves (IRCs); IRCs are based on storage content at the end of the previous year, determination of the appropriate year within the critical period, and runoff forecasts beginning in January • IRCs seek to keep reservoir full (2,459 feet) June-Sept; minimum annual elevation ranges from 2,399 to 2,327 feet, depending on critical year determination • Meet variable sturgeon flow targets at Bonners Ferry during May 25-August 16 period; flow targets peak as high as 35 kcfs in the wettest years
	SOS 1b • Minimum project flow 3 kcfs • No refill targets • Summer draft limit of 5–10 feet	**SOS 2d** • Provide flow augmentation for salmon and sturgeon when Jan. to July forecast is greater than 6.5 MAF • Meet sturgeon flows of 15, 20, and 12.5 kcfs in May, June, and July, respectively, in at least 3 out of 10 years	

KAF = 1.234 million cubic meters

MAF = 1.234 billion cubic meters

Table 4–1. SOS Alternative–1

SOS 5 Natural River Operation	SOS 6 Fixed Drawdown	SOS 9 Settlement Discussion Alternatives	SOS PA
SOS 5 would aid juvenile salmon by increasing river velocity. The four lower Snake River projects would have new outlets installed, allowing the reservoirs to be drawn down to near the original river elevation. The "natural river" operation would be done for 4 1/2 months in SOS 5b and year-round in SOS 5c. John Day would also be operated at MOP for 4 months, and flow augmentation measures on the Columbia River portion of the basin would continue as in SOS 2c.	SOS 6 involves drawing down lower Snake River projects to fixed elevations below MOP to aid anadromous fish. SOS 6b provides for fixed drawdowns for all four lower Snake projects for 4 1/2 months; SOS 6d draws down Lower Granite only for 4 1/2 months. John Day would also be operated at MOP for 4 months, and flow augmentation measures on the Columbia River portion of the basin would continue as in SOS 2c.	SOS 9 represents operations suggested by the USFWS, NMFS, the state fisheries agencies, Native American tribes, and the Federal operating agencies during the settlement discussions in response to the *IDFG v. NMFS* court proceedings. This alternative has three options, SOSs 9a, 9b, and 9c, that represent different scenarios to provide increased river velocities for anadromous fish by establishing flow targets during migration and to carry out other actions to benefit ESA-listed species. The three options are termed the Detailed Fishery Operating Plan (9a), Adoptive Management (9b), and the Balanced Impacts Operation (9c).	SOS PA represents the operation recommended by NMFS and the USFWS Biological Opinions issued March 1, 1995. This SOS supports recovery of ESA-listed species by storing water during the fall and winter to meet spring and summer flow targets, and protects other resources by setting summer draft limits to manage negative effects, by providing flood protection, and by providing for reasonable power generation.

SOS 5	SOS 6	SOS 9	SOS PA
SOS 5b Operate on system proportional draft as in SOS 1a	**SOS 6b** Operate on system proportional draft as in SOS 1a	**SOS 9a** • Operate on minimum flow up to flood control rule curves year-round, except during flow augmentation period • Provide sturgeon flow releases April-Aug. to achieve up to 35 kcfs at Bonner's Ferry with appropriate ramp up and ramp down rates	**SOS PA** • Operate on minimum flow up to flood control rule curves beginning in Jan., except during flow augmentation period • Strive to achieve flood control elevations in Dec. in all years and by April 15 in 75 percent of years • Provide sturgeon flows of 25 kcfs 42 days in June and July • Provide sufficient flows to achieve 11 kcfs flow at Bonner's Ferry for 21 days after maximum flow period • Draft to meet flow targets, to a minimum end of Aug. elevation of 2,439 feet, unless deeper drafts needed to meet sturgeon flows
SOS 5c Operate on system proportional draft as in SOS 1a	**SOS 6d** Operate on system proportional draft as in SOS 1a	**SOS 9b** • Operate on minimum flow up to flood control rule curves year-round, except during flow augmentation • Provide sturgeon flow releases similar to SOS 2d • Can draft to elevation 2,435 by end of July to meet flow targets	
		SOS 9c • Operate to the Integrated Rule Curves and provide sturgeon flow releases as in SOS 4c	

1 kcfs = 28 cms

1 ft = 0.3048 meter

Table 4–1. SOS Alternative–2

Actions by Project

	SOS 1	SOS 2	SOS 4
HUNGRY HORSE	SOS 1a Normal 1983–1991 storage project operations	SOS 2c Operate on system proportional draft as in SOS 1a	SOS 4c • Meet specific elevation targets as indicated by Integrated Rule Curves (IRCs), similar to operation for Libby • IRCs seek to keep reservoir full (3,560 feet) June-Sept.; minimum annual elevation ranges from 3,520 to 3,450 feet, depending on critical year
	SOS 1b • No maximum flow restriction from mid-Oct. to mid-Nov. • No draft limit; no refill target	SOS 2d Operate on system proportional draft as in SOS 1a	
ALBENI FALLS	SOS 1a Normal 1983–1991 storage project operations	SOS 2c Operate on system proportional draft as in SOS 1a	SOS 4c Elevation targets established for each month, generally 2,056 feet Oct.–March, 2,058 to 2,062.5 feet April–May, 2,062.5 feet (full) June, 2,060 feet July–Sept. (but higher if runoff high); Oct.–March drawdown to 2,051 feet every 6th year
	SOS 1b No refill target	SOS 2d Operate on system proportional draft as in SOS 1a	

KAF = 1.234 million cubic meters MAF = 1.234 billion cubic meters

Table 4–1. SOS Alternative–2

SOS 5	SOS 6	SOS 9	SOS PA
SOS 5b Operate on system proportional draft as in SOS 1a	**SOS 6b** Operate on system proportional draft as in SOS 1a	**SOS 9a** • Operate on minimum flow up to flood control rule curves year-round, except during flow augmentation period	**SOS PA** • Operate on minimum flow up to flood control rule curves year-round, except during flow augmentation period • Strive to achieve flood control elevations by April 15 in 75 percent of the years • Draft to meet flow targets, to a minimum end-of-August elevation of 3,540 feet
SOS 5c Operate on system proportional draft as in SOS 1a	**SOS 6d** Operate on system proportional draft as in SOS 1a	**SOS 9b** • Operate on minimum flow up to flood control rule curves year-round, except during flow augmentation • Can draft to meet flow targets, to a minimum end-of-July elevation of 3,535 feet	
		SOS 9c • Operate to the Integrated Rule Curves as in SOS 4c	

SOS 5	SOS 6	SOS 9	SOS PA
SOS 5b Operate on system proportional draft as in SOS 1a	**SOS 6b** Operate on system proportional draft as in SOS 1a	**SOS 9a** Operate on minimum flow up to flood control rule curves year-round, except during flow augmentation period	**SOS PA** • Operate to flood control elevations by April 15 in 90 percent of the years • Operate to help meet flow targets, but do not draft below full pool through Aug.
SOS 5c Operate on system proportional draft as in SOS 1a	**SOS 6d** Operate on system proportional draft as in SOS 1a	**SOS 9b** • Operate on minimum flow up to flood control rule curves year-round, except during flow augmentation period • Can draft to meet target flows, to a minimum end-of-July elevation of 2,060 feet	
		SOS 9c • Elevation targets established for each month, generally no lower than 2,056 feet Dec.—April, no lower than 2,057 feet end of May, full (2,062.5 feet) June—Aug., 2,056 feet Sept.—Nov.	

1 kcfs = 28 cms

1 ft = 0.3048 meter

Table 4–1. SOS Alternative–3
Actions by Project

GRAND COULEE

SOS 1	SOS 2	SOS 4
SOS 1a • Operate to meet Water Budget target flows of 134 kcfs at Priest Rapids in May 1/ • Meet minimum elevation of 1,240 feet in May	**SOS 2c** • Storage of water for flow augmentation from January through April • Supplemental releases (in conjunction with upstream projects) to provide up to 3 MAF additional (above Water Budget) flow augmentation in May and June, based on sliding scale for runoff forecasts • System flood control space shifted from Brownlee, Dworshak	**SOS 4c** • Operate to end-of-month elevation targets, as follows: 1,288 Sept.-Nov 1,287 Dec. 1,270 Jan. 1,260 Feb. 1,270 Mar. 1,272 Apr. 15 1,275 Apr. 30 1,280 May 1,288 Jun.-Aug. • Meet flood control rule curves only when Jan.-June runoff forecast exceeds 68 MAF
SOS 1b • No refill target of 1,240 feet in May • Maintain 1,285 feet June–Sept.; minimum 1,220 feet rest of year • No May–June flow target	**SOS 2d** • Contribute, in conjunction with upstream storage projects, up to 4 MAF for additional flow augmentation • Operate in summer to provide flow augmentation water and meet downstream flow targets, but draft no lower than 1,280 feet	

PRIEST RAPIDS

SOS 1	SOS 2	SOS 4
SOS 1a • Meet May-June flow targets 1/ • Maintain minimum flows to meet Vernita Bar Agreement 2/	**SOS 2c** Operate as in SOS 1a **SOS 2d** Operate as in SOS 1a	**SOS 4c** Operate as in SOS 1a
SOS 1b • No May flow target • Meet Vernita Bar Agreement		

1/ Flow targets are weekly averages with weekend and holiday flows no less than 80 percent of flows over previous 5 days.
2/ 55 kcfs during heavy load hours October 15 to November 30; minimum instantaneous flow 70 kcfs December to April
KAF = 1.234 million cubic meters MAF = 1.234 billion cubic meters

Table 4–1. SOS Alternative–3

SOS 5	SOS 6	SOS 9	SOS PA
SOS 5b Operate on system proportional draft and provide flow augmentation as in SOS 2c	**SOS 6b** Operate on system proportional draft and provide flow augmentation as in SOS 2c	**SOS 9a** • Operate to meet flood control requirements and Vernita Bar agreement • Provide flow augmentation releases to help meet targets at The Dalles of 220-300 kcfs April 16-June 15, 200 kcfs June 16-July 31, and 160 kcfs Aug. 1-Aug.31, based on appropriate critical year determination • In above average runoff years, provide 40% of the additional runoff volume as flow augmentation	**SOS PA** • Operate to achieve flood control elevations by April 15 in 85% of years • Draft to meet flow targets, down to minimum end-of-Aug. elevation of 1,280 feet • Provide flow augmentation releases to meet Columbia River flow targets at McNary of 220-260 kcfs April 20-June 30, based on runoff forecast, and 200 kcfs July-Aug.
SOS 5c Operate on system proportional draft and provide flow augmentation as in SOS 2c	**SOS 6d** Operate on system proportional draft and provide flow augmentation as in SOS 2c	**SOS 9b** • Operate on minimum flow up to flood control rule curves year-round, except during flow augmentation period • Can draft to meet flow targets, bounded by SOS 9a and 9c targets, to a minimum end-of-July elevation of 1,265 feet	
		SOS 9c • Operate to meet McNary flow targets of 200 kcfs April 16-June 30 and 160 kcfs in July • Can draft to meet flow targets, to a minimum end-of-July elevation of 1,280 feet • Contribute up to 4 MAF for additional flow augmentation, based on sliding scale for runoff forecasts, in conjunction with other upstream projects • System flood control shifted to this project	

SOS 5	SOS 6	SOS 9	SOS PA
SOS 5b Operate as in SOS 1a	**SOS 6b** Operate as in SOS 1a	**SOS 9a** Operate as in SOS 1a	**SOS PA** Operate as in SOS 1a
SOS 5c Operate as in SOS 1a	**SOS 6d** Operate as in SOS 1a	**SOS 9b** Operate as in SOS 1a	
		SOS 9c Operate as in SOS 1a	

1 kcfs = 28 cms

1 ft = 0.3048 meter

Table 4–1. SOS Alternative–4

Actions by Project

	SOS 1	SOS 2	SOS 4
SNAKE RIVER ABOVE BROWNLEE	**SOS 1a** Normal 1990—91 operations; no Water Budget flows	**SOS 2c** Release up to 427 KAF (190 KAF April 16—June 15; 137 KAF Aug.; 100 KAF Sept.) for flow augmentation	**SOS 4c** Same as SOS 1a
	SOS 1b Same as SOS 1a	**SOS 2d** • Release up to 427 KAF, as in SOS 2c • Release additional water obtained by purchase or other means and shaped per Reclamation releases and Brownlee draft requirements; simulation assumed 927 KAF available	

	SOS 1	SOS 2	SOS 4
BROWNLEE	**SOS 1a** • Draft as needed (up to 110 KAF in May) for Water Budget, based on target flows of 85 kcfs at Lower Granite • Operate per FERC license • Provide system flood control storage space	**SOS 2c** Same as SOS 1a except for additional flow augmentation as follows: • Draft up to 137 KAF in July, but not drafting below 2,067 feet; refill from the Snake River above Brownlee in August • Draft up to 100 KAF in Sept. • Shift system flood control to Grand Coulee • Provide 9 kcfs or less in November; fill project by end of month • Maintain November monthly average flow December through April	**SOS 4c** Same as SOS 1a except slightly different flood control rule curves
	SOS 1b • No maximum flow restriction from mid-Oct. to mid-Nov. • No draft limit; no refill target	**SOS 2d** Same as SOS 2c, plus pass additional flow augmentation releases from upstream projects	

KAF = 1.234 million cubic meters

MAF = 1.234 billion cubic meters

Table 4–1. SOS Alternative–4

SOS 5	SOS 6	SOS 9	SOS PA
SOS 5b Same as SOS 1a	**SOS 6b** Same as SOS 1a	**SOS 9a** Provide up to 1.927 MAF through Brownlee for flow augmentation, as determined by Reclamation	**SOS PA** Provide 427 KAF through Brownlee for flow augmentation, as determined by Reclamation
SOS 5c Same as SOS 1a	**SOS 6d** Same as SOS 1a	**SOS 9b** Provide up to 927 KAF through Brownlee as determined by Reclamation	
		SOS 9c Provide up to 927 KAF through Brownlee as determined by Reclamation	

SOS 5	SOS 6	SOS 9	SOS PA
SOS 5b Same as SOS 4c	**SOS 6b** Same as SOS 4c	**SOS 9a** • Draft up to 110 KAF in May, 137 KAF in July, 140 KAF in Aug., 100 KAF in Sept. for flow augmentation • Shift system flood control to Grand Coulee	**SOS PA** Draft to elevation 2,069 feet in May, 2,067 feet in July, and 2,059 feet in Sept., passing inflow after May and July drafts
SOS 5c Same as SOS 4c	**SOS 6d** Same as SOS 4c	**SOS 9b** • Draft up to 190 KAF April-May, 137 KAF in July, 100 KAF in Sept. for flow augmentation • Shift system flood control to Grand Coulee • Provide an additional 110 KAF in May if elevation is above 2,068 feet and 110 KAF in Sept. if elevation is above 2,043.3 feet	
		SOS 9c Same as SOS 9b	

1 kcfs = 28 cms

1 ft = 0.3048 meter

Table 4–1. SOS Alternative–5

Actions by Project

	SOS 1	SOS 2	SOS 4
DWORSHAK	**SOS 1a** • Draft up to 600 KAF in May to meet Water Budget target flows of 85 kcfs at Lower Granite • Provide system flood control storage space **SOS 1b** • Meet minimum project flows (2 kcfs, except for 1 kcfs in August); summer draft limits; maximum discharge requirement Oct. to Nov. (1.3 kcfs plus inflow) • No Water Budget releases	**SOS 2c** Same as SOS 1a, plus the following supplemental releases: • 900 KAF or more from April 16 to June 15, depending on runoff forecast at Lower Granite • Up to 470 KAF above 1.2 kcfs minimum release from June 16 to Aug. 31 • Maintain 1.2 kcfs discharge from Oct. through April, unless higher required • Shift system flood control to Grand Coulee April–July if runoff forecasts at Dworshak are 3.0 MAF or less **SOS 2d** • Operate on 1.2 kcfs minimum discharge up to flood control rule curve, except when providing flow augmentation (April 10 to July 31) • Provide flow augmentation of 1.0 MAF plus 1.2 kcfs minimum discharge, or 927 KAF and 1.2 kcfs, from April 10-June 20, based on runoff forecasts, to meet Lower Granite flow target of 85 kcfs • Provide 470 KAF from June 21 to July 31 to meet Lower Granite flow target of 50 kcfs • Draft to 1,520 feet after volume is expended, if Lower Granite flow target is not met; if volume is not expended, draft below 1,520 feet until volume is expended	**SOS 4c** Elevation targets established for each month: 1,599 feet Sept.-Oct.; flood control rule curves Nov.-April; 1,595 feet May; 1,599 feet June-Aug.;

KAF = 1.234 million cubic meters

MAF = 1.234 billion cubic meters

Table 4–1. SOS Alternative–5

SOS 5	SOS 6	SOS 9	SOS PA
SOS 5b • Operate to local flood control rule curve • No proportional draft for power • Shift system flood control to lower Snake projects • Provide Water Budget flow augmentation as in SOS 1a • Draft to refill lower Snake projects if natural inflow is inadequate **SOS 5c** • Operate to flood control during spring • Refill in June or July and maintain through August • Draft for power production during fall	**SOS 6b** Same as SOS 5b **SOS 6d** Same as SOS 5b	**SOS 9a** • Remove from proportional draft for power • Operate to local flood control rule curves, with system flood control shifted to Grand Coulee • Maintain flow at 1.2 kcfs minimum discharge, except for flood control or flow augmentation discharges • Operate to meet Lower Granite flow targets (at spillway crest) of 74 kcfs April 16-June 30, 45 kcfs July, 32 kcfs August **SOS 9b** • Similar to SOS 9a, except operate to meet flow targets at Lower Granite ranging from 85 to 140 kcfs April 16-June 30 and 50-55 kcfs in July • Can draft to meet flow targets to a min. end-of-July elevation of 1,490 feet **SOS 9c** • Similar to SOS 9a, except operate to meet Lower Granite flow target (at spillway crest) of 63 kcfs April-June • Can draft to meet flow targets to a min. end-of-July elevation of 1,520 feet	**SOS PA** • Operate on minimum flow-up to flood control rule curve year-round, except during flow augmentation period • Draft to meet flow targets, down to min. end-of-Aug. elevation of 1,520 feet • Sliding-scale Snake River flow targets at Lower Granite of 85 to 100 kcfs April 10-June 20 and 50 to 55 kcfs June 21-Aug. 31, based on runoff forecasts

1 kcfs = 28 cms

1 ft = 0.3048 meter

Table 4–1. SOS Alternative–6

Actions by Project

	SOS 1	SOS 2	SOS 4
LOWER SNAKE	**SOS 1a** • Normal operations at 4 lower Snake River projects (within 3 to 5 feet of full pool, daily and weekly fluctuations) • Provide maximum peaking capacity of 20 kcfs over daily average flow in May	**SOS 2c** • Operate reservoirs within 1 foot above MOP from April 16 to July 31 • Same as SOS 1a for rest of year	**SOS 4c** Same as SOS 2c
	SOS 1b Same as 1a, except: • No minimum flow limit (11,500 cfs) during fall and winter • No fish-related rate of change in flows in May	**SOS 2d** Same as SOS 2c	

	SOS 1	SOS 2	SOS 4
LOWER COLUMBIA	**SOS 1a** • Normal operations at 4 lower Columbia projects (generally within 3 to 5 feet of full pool, daily and weekly fluctuations) • Restricted operation of Bonneville second powerhouse	**SOS 2c** Same as SOS 1a except: lower John Day to minimum irrigation pool (approx. 262.5 feet) from April 15 to Aug. 31; operate within 1.5 feet of forebay range, unless need to raise to avoid irrigation impacts	**SOS 4c** Same as SOS 2c, except operate John Day within 2 feet of elevation 263.5 feet Nov. 1 through June 30
	SOS 1b Same as 1a, except no restrictions on Bonneville second powerhouse	**SOS 2d** Same as SOS 2c	

KAF = 1.234 million cubic meters MAF = 1.234 billion cubic meters

Table 4–1. SOS Alternative–6

SOS 5	SOS 6	SOS 9	SOS PA
SOS 5b • Draft 2 feet per day starting Feb. 18 • Operate at natural river level, approx. 95 to 115 ft below full pool, April 16-Aug. 31; drawdown levels by project as follows, in feet: Lower Granite 623 Little Goose 524 L. Monumental 432 Ice Harbor 343 • Operate within 3 to 5 ft of full pool rest of year • Refill from natural flows and storage releases **SOS 5c** Same as SOS 5b, except drawdowns are permanent once natural river levels reached; no refill	**SOS 6b** • Draft 2 feet per day starting April 1 • Operate 33 feet below full pool April 16-Aug. 31; drawdown levels by project as follows, in feet: Lower Granite 705 Little Goose 605 L. Monumental 507 Ice Harbor 407 • Operate over 5-foot forebay range once drawdown elevation reached • Refill from natural flows and storage releases • Same as SOS 1a rest of year **SOS 6d** • Draft Lower Granite 2 feet per day starting April 1 • Operate Lower Granite near 705 ft for 4 1/2 months, April 16-Aug. 31	**SOS 9a** • Operate 33 feet below full pool (see SOS 6b) April 1-Aug. 31 to meet L. Granite flow targets (see Dworshak); same as SOS 1a rest of year • Spill to achieve 80/80 FPE up to total dissolved gas cap of 120% daily average; spill cap 60 kcfs at all projects **SOS 9b** • Operate at MOP, with 1 foot flexibility April 1-Aug. 31; same as SOS 1a rest of year • Spill to achieve 80/80 FPE up to total dissolved gas cap of 120% daily average; spill caps range from 18 kcfs at L. Monumental to 30 kcfs at L. Granite **SOS 9c** • Operate 35 to 45 feet below full pool April 1-June 15 to meet L. Granite flow targets (see Dworshak), refill by June 30; same as SOS 1a rest of year • Spill to achieve 80/80 FPE, as in SOS 9b	**SOS PA** • Operate at MOP with 1 foot flexibility between April 10 - Aug. 31 • Refill three lower Snake River pools after Aug. 31, Lower Granite after Nov. 15 • Spill to achieve 80% FPE up to total dissolved gas cap of 115% 12-hour average; spill caps range from 7.5 kcfs at L. Monumental to 25 kcfs at Ice Harbor

SOS 5	SOS 6	SOS 9	SOS PA
SOS 5b Same as SOS 2, except operate John Day within 1.5 feet above elevation 257 feet (MOP) from May 1 through Aug. 31; same as SOS 2c rest of year **SOS 5c** Same as SOS 5b	**SOS 6b** Same as SOS 5 **SOS 6d** Same as SOS 5	**SOS 9a** • Same as SOS 5, except operate John Day within 1 foot above elevation 257 feet April 15-Aug. 31 • McNary flow targets as described for Grand Coulee • Spill to achieve 80/80 FPE, up to total dissolved gas cap of 120% daily average, as derived by agencies **SOS 9b** • Same as SOS 2, except operate John Day at minimum irrigation pool or 262.5 feet with 1 foot of flexibility from April 16-Aug. 31 • McNary flow targets as described for Grand Coulee • Spill to achieve 80/80 FPE, up to total dissolved gas cap of 120% daily average, as derived by Corps **SOS 9c** Same as SOS 9b, except operate John Day at minimum operating pool	**SOS PA** • Pool operations same as SOS 2c, except operate John Day at 257 feet (MOP) year-round, with 3 feet of flexibility March-Oct. and 5 feet of flexibility Nov.-Feb. • Spill to achieve 80% FPE up to total dissolved gas cap of 115% 12-hour average; spill caps range from 9 kcfs at John Day to 90 kcfs at The Dalles

1 kcfs = 28 cms

1 ft = 0.3048 meter

4.1.1 SOS 1-Pre–ESA Operation

This alternative represents one end of the range of the SOR strategies in terms of their similarity to historical system operations. This strategy reflects Columbia River system operations before changes were made as a result of the ESA listing of three Snake River salmon stocks. This SOS has two options:

- **SOS 1a (Pre–Salmon Summit Operation)** represents operations as they existed from 1983 through the 1990–91 operating year, including Northwest Power Act provisions to restore and protect fish populations in the basin. Specific volumes for the Water Budget would be provided from Dworshak and Brownlee reservoirs to attempt to meet a target flow of 85 kcfs (2,380 cms) at Lower Granite Dam in May. Sufficient flows would be provided on the Columbia River to meet a target flow of 134 kcfs (3,752 cms) at Priest Rapids Dam in May. Lower Snake River projects would operate within 3 to 5 feet (0.9 to 1.5 m) of full pool. Other projects would operate as they did in 1990–91, with no additional water provided from the Snake River above Brownlee Dam.

- **SOS 1b (Optimum Load–Following Operation)** represents operations as they existed prior to changes resulting from the Northwest Power Act. It is designed to demonstrate how much power could be produced if most flow–related operations to benefit anadromous fish were eliminated including: the Water Budget; fish spill requirements; restrictions on operation of Bonneville's second powerhouse; and refill targets for Libby, Hungry Horse, Grand Coulee, Dworshak, and Albeni Falls. It assumes that transportation would be used to the maximum to aid juvenile fish migration.

4.1.2 SOS 2-Current Operations

This alternative reflects operation of the Columbia River system with interim flow improvement measures made in response to ESA listings of Snake River salmon. It is very similar to the way the system operated in 1992 and reflects the results of ESA Section 7 consultation with NMFS then. The strategy is consistent with the 1992–93 operations described in the Corps' *1993 Interim Columbia and Snake Rivers Flow Improvement Measures Supplemental EIS* (SEIS). SOS 2 also most closely represents the recommendations issued by the NMFS Snake River Salmon Recovery Team in May 1994. Compared to SOS 1, the primary changes are additional flow augmentation in the Columbia and Snake Rivers and modified pool levels at lower Snake and John Day reservoirs during juvenile salmon migration. This strategy has two options:

- **SOS 2c (Final SEIS Operation- No Action Alternative)** matches exactly the decision made as a result of the 1993 SEIS. Flow augmentation water of up to 3.0 MAF (3.7 billion m^3) on the Columbia River (in addition to the existing Water Budget) would be stored during the winter and released in the spring in low–runoff years. Dworshak would provide at least an additional 300 KAF (370 million m^3) in the spring and 470 KAF (580 million m^3) in the summer for flow augmentation. System flood control shifts from Dworshak and Brownlee to Grand Coulee would occur through April as needed. It also provides up to 427 KAF (527 million m^3) of additional water from the Snake River above Brownlee Dam.

- **SOS 2d (1994–98 Biological Opinion)** matches the hydro operations contained in the 1994–98 Biological Opinion issued by NMFS in mid–1994. This alternative provides water for the existing Water Budget as well as additional water, up to 4 MAF, for flow augmentation to benefit the anadromous fish migration. The additional water of up to 4 MAF would be stored in Grand Coulee, Libby and Arrow, and provided on a sliding scale tied to runoff forecasts. Flow targets are established at Lower Granite and McNary.

In cases such as the SOR, where the proposed action is a new management plan, the No Action Alterna-

tive means continuing with the present course of action until that action is changed (46 FR 13027). Among all of the strategies and options, SOS 2c best meets this definition for the No Action Alternative.

4.1.3 SOS 4-Stable Storage Project Operation

This alternative is intended to operate the storage reservoirs to benefit recreation, resident fish, wildlife, and anadromous fish while minimizing impacts of such operation to power and flood control. Reservoirs would be kept full longer, but still provide spring flows for fish and space for flood control. The goal is to minimize reservoir fluctuations while moving closer to natural flow conditions. For the Final EIS, this alternative has one option:

- **SOS 4c (Stable Storage Operation with Modified Grand Coulee Flood Control)** applies year–round Integrated Rule Curves (IRCs) developed by the State of Montana for Libby and Hungry Horse. Other reservoirs would be managed to specific elevations on a monthly basis; they would be kept full longer, while still providing spring flows for fish and space for flood control. The goal is to minimize reservoir fluctuations while moving closer to natural flow conditions. Grand Coulee would meet elevation targets year–round to provide acceptable water retention times; however, upper rule curves would apply at Grand Coulee if the January to July runoff forecast at the project is greater than 68 MAF (84 billion m^3).

4.1.4 SOS 5-Natural River Operation

This alternative is designed to aid juvenile salmon migration by drawing down reservoirs (to increase the velocity of water) at four lower Snake River projects. SOS 5 reflects operations after the installation of new outlets in the lower Snake River dams, permitting the lowering of reservoirs approximately 100 feet (30 m) to near original riverbed levels. This operation could not be implemented for a number of years, because it requires major structural modifications to the dams. Elevations would be: Lower Granite – 623 feet (190 m); Little Goose – 524 feet (160 m); Lower Monumental – 432 feet (132 m); and Ice Harbor – 343 feet (105 m). Drafting would be at the rate of 2 feet (0.6 m) per day beginning February 18. The reservoirs would refill again with natural inflows and storage releases from upriver projects, if needed. John Day would be lowered as much as 11 feet (3.3 m) to minimum pool, elevation 257 feet (78.3 m), from May through August. All other projects would operate essentially the same as in SOS 1a, except that up to 3 MAF (3.7 billion m^3) of water (in addition to the Water Budget) would be provided to augment flows on the Columbia River in May and June. System flood control would shift from Brownlee and Dworshak to the lower Snake River projects. Also, Dworshak would operate for local flood control. This alternative has two options:

- **SOS 5b (Four and One–half Month Natural River Operation)** provides for a lower Snake River drawdown lasting 4.5 months, beginning April 16 and ending August 31. Dworshak would be drafted to refill the lower Snake River projects if natural inflow were inadequate for timely refill.
- **SOS 5c (Permanent Natural River Operation)** provides for a year–round drawdown, and projects would not be refilled after each migration season.

4.1.5 SOS 6-Fixed Drawdown

This alternative is designed to aid juvenile anadromous fish by drawing down one or all four lower Snake River projects to fixed elevations approximately 30 to 35 feet (9 to 10 m) below minimum operating pool. As with SOS 5, fixed drawdowns depend on prior structural modifications and could not be instituted for a number of years. Draft would be at the rate of 2 feet (0.6 m) per day beginning April 1. John Day would be lowered to elevation 257 feet (78.3 m) from May through August. All other projects would operate essentially the same as under SOS 1a, except that up to 3 MAF (3.7 billion m^3) of water would be provided to augment flows on the Columbia River in May and June. System flood control would shift from Brownlee and Dworshak to the lower Snake projects. Also, Dwor-

shak would operate for local flood control. This alternative has two options:

- **SOS 6b (Four and One–half Month Fixed Drawdown)** provides for a 4.5–month drawdown at all four lower Snake River projects beginning April 16 and ending August 31. Elevations would be: Lower Granite – 705 feet (215 m); Little Goose – 605 feet (184 m); Lower Monumental – 507 feet (155 m); and Ice Harbor – 407 feet (124 m).
- **SOS 6d (Four and One–half Month Lower Granite Fixed Drawdown)** provides for a 4.5–month drawdown to elevation 705 feet at Lower Granite beginning April 16 and ending August 31.

4.1.6 SOS 9-Settlement Discussion Alternatives

This SOS represents operations suggested by USFWS and NMFS (as SOR cooperating agencies), the State fisheries agencies, Native American tribes, and the Federal operating agencies during the settlement discussions in response to a court ruling in the *IDFG v. NMFS* lawsuit. The objective of SOS 9 is to provide increased velocities for anadromous fish by establishing flow targets during the migration period and by carrying out other actions that benefit ESA–listed species. The specific options were developed by a group of technical staff representing the parties in the lawsuit. The group was known as the Reasonable and Prudent Alternatives Workgroup. They developed three possible operations in addition to the 1994–98 Biological Opinion. This strategy has three options:

- **SOS 9a (Detailed Fishery Operating Plan [DFOP])** establishes flow targets at The Dalles based on the previous year's end–of–year storage content, similar to how PNCA selects operating rule curves. Grand Coulee and other storage projects are used to meet The Dalles flow targets. Specific volumes of releases are made from Dworshak, Brownlee, and upper Snake River to try to meet Lower Granite flow targets. Lower Snake River projects are drawn down to near spillway crest level for 4 1/2 months. Specific spill percentages are established at run–of–river projects to achieve no higher than 120 percent daily average total dissolved gas. Fish transportation is assumed to be eliminated.
- **SOS 9b (Adaptive Management)** establishes flow targets at McNary and Lower Granite based on runoff forecasts. Grand Coulee and other storage projects are used to meet the McNary flow targets. Specific volumes of releases are made from Dworshak, Brownlee, and the upper Snake River to try to meet Lower Granite flow targets. Lower Snake River projects are drawn down to minimum operating pool levels and John Day is at minimum irrigation pool level. Specific spill percentages are established at run–of–river projects to achieve no higher than 120 percent daily average for total dissolved gas.
- **SOS 9c (Balanced Impacts Operation)** draws down the four lower Snake River projects to near spillway crest levels for 2 1/2 months during the spring salmon migration period. Full drawdown level is achieved on April 1. Refill begins after June 15. This alternative also provides 1994–98 Biological Opinion flow augmentation (as in SOS 2d), IRC operation at Libby and Hungry Horse, a reduced flow target at Lower Granite due to drawdown, limits on winter drafting at Albeni Falls, and spill to achieve no higher than 120 percent daily average for total dissolved gas.

4.1.7 SOS PA-Preferred Alternative

This SOS represents the operation recommended by NMFS and USFWS in their respective Biological Opinions issued on March 1, 1995. SOS PA is intended to support recovery of ESA–listed species by storing water during the fall and winter to meet spring and summer flow targets, and to protect other resources by managing detrimental effects through maximum summer draft limits, by providing public safety through flood protection, and by providing for reasonable power generation. This SOS would operate the system during the fall and winter to achieve a high confidence of

refill to flood control elevations by April 15 of each year, and use this stored water for fish flow augmentation. It establishes spring flow targets at McNary and Lower Granite based on runoff forecasts, and a similar sliding scale flow target at Lower Granite and a fixed flow target at McNary for the summer. It establishes summer draft limits at Hungry Horse, Libby, Grand Coulee, and Dworshak. Libby is also operated to provide flows for Kootenai River white sturgeon. Lower Snake River projects are drawn down to minimum operating pool levels during the spring and summer. John Day is operated at minimum operating pool level year–round. Specific spill percentages are established at run–of–river projects to achieve 80–percent FPE, with no higher than 115–percent 12–hour daily average for total dissolved gas measured at the forebay of the next downstream project.

4.1.8 Rationale for Selection of the Final SOSs

Table 4–2 summarizes the changes to the set alternatives from the Draft EIS to the Final EIS. SOS 1a and 1b are unchanged from the Draft EIS. SOS 1a represents a base case condition and reflects system operation during the period from passage of the Northwest Power Planning and Conservation Act until ESA listings. It provides a baseline alternative that allows for comparison of the more recent alternatives and shows the recent historical operation. SOS 1b represents a limit for system operation directed at maximizing benefits from development–oriented uses, such as power generation, flood control, irrigation and navigation and away from natural resources protection. It serves as one end of the range of alternatives and provides a basis for comparison of the impacts to power generation from all other alternatives. Public comment did not recommend elimination of this alternative because it serves as a useful milepost. However, the SOR agencies recognize it is unlikely that decisions would be made to move operations toward this alternative.

In the Draft EIS, SOS 2 represented current operation. Three options were considered. Two of these options have been eliminated for the Final EIS and one new option has been added. SOS 2c continues as the No Action Alternative. Maintaining this option as the No Action Alternative allows for consistent comparisons in the Final EIS to those made in the Draft EIS. However, within the current practice category, new operations have been developed since the original identification of SOS 2c. In 1994, the SOR agencies, in consultation with the NMFS and USFWS, agreed to an operation, which was reflected in the 1994–98 Biological Opinion. This operation (SOS 2d) has been modeled for the Final EIS and represents the most "current" practice. SOS 2d also provides a good baseline comparison for the other, more unique alternatives. SOS 2a and 2b from the Draft EIS were eliminated because they are so similar to SOS 2c. SOS 2a is identical to SOS 2c except for the lack of an assumed additional 427 KAF of water from the upper Snake River Basin. This additional water did not cause significant changes to the effects between SOS 2a and 2c. There is no reason to continue to consider an alternative that has impacts essentially equal to another alternative. SOS 2b is also similar to SOS 2c, except it modified operation at Libby for Kootenai River white sturgeon. Such modifications are included in several other alternatives, namely SOS 2d, 9a, 9c, and the Preferred Alternative.

SOS 3a and 3b, included in the Draft EIS, have been dropped from consideration in the Final EIS. Both of these alternatives involved anadromous fish flow augmentation by establishing flow targets based on runoff forecast on the Columbia and Snake Rivers. SOS 3b included additional water from the upper Snake River Basin over what was assumed for SOS 3a. This operation is now incorporated in several new alternatives, including SOS 9a and 9b. Public comment also did not support continued consideration of the SOS 3 alternatives.

Table 4–2. Summary of Alternatives in the Draft and Final EIS

Draft EIS Alternatives	Final EIS Alternatives
SOS 1 Pre–ESA Operation SOS 1a Pre–Salmon Summit Operation SOS 1b Optimum Load Following Operation	SOS 1 Pre–ESA Operation SOS 1a Pre–Salmon Summit Operation SOS 1b Optimum Load Following Operation
SOS 2 Current Practice SOS 2a Final Supplemental EIS Operation SOS 2b Final Supplemental EIS with Sturgeon Operations at Libby SOS2c Final Supplemental EIS Operation – No–Action Alternative	SOS 2 Current Practice SOS2c Final Supplemental EIS Operation – No–Action Alternative **SOS 2d 1994–98 Biological Opinion Operation**
SOS 3 Flow Augmentation SOS 3a Monthly Flow Targets SOS 3b Monthly Flow Targets with additional Snake River Water	
SOS 4 Stable Storage Project Operation SOS 4a1 Enhanced Storage Level Operation SOS 4a3 Enhanced Storage Level Operation SOS 4b1 Compromise Storage Level Operation SOS 4b3 Compromise Storage Level Operation SOS 4c Enhanced Operation with modified Grand Coulee Flood Control	SOS 4 Stable Storage Project Operation **SOS 4c Enhanced Operation with modified Grand Coulee Flood Control**
SOS 5 Natural River Operation SOS 5a Two Month Natural River Operation SOS 5b Four and One Half Month Natural River Operation	SOS 5 Natural River Operation SOS 5b Four and One Half Month Natural River Operation **SOS 5c Permanent Natural River Operation**
SOS 6 Fixed Drawdown SOS 6a Two Month Fixed Drawdown Operation SOS 6b Four and One Half Month Fixed Drawdown Operation SOS 6c Two Month Lower Granite Drawdown Operation SOS 6d Four and One Half Month Lower Granite Drawdown Operation	SOS 6 Fixed Drawdown SOS 6b Four and One Half Month Fixed Drawdown Operation SOS 6d Four and One Half Month Lower Granite Drawdown Operation
SOS 7 Federal Resource Agency Operations SOS 7a Coordination Act Report Operation SOS 7b Incidental Take Statement Flow Targets SOS 7c NMFS Conservation Recommendations	**SOS 9 Settlement Discussion Alternatives** **SOS 9a Detailed Fishery Operating Plan** **SOS 9b Adaptive Management** **SOS 9c Balance Impacts Operation** **SOS Preferred Alternative**

Bold indicates a new or revised SOS alternative

SOS 4 originally included 5 options in the Draft EIS. They were similar in operation and impact. In SOS 4a and 4b, the primary feature was the use of Biological Rule Curves for Libby and Hungry Horse reservoirs. SOS 4c also included these rule curves but went further by optimizing the operation of the other storage projects, particularly Grand Coulee and Dworshak. For the Final EIS, the SOR agencies have decided to update the alternative by substituting the IRC for the Biological Rule Curves and by eliminating SOS 4a and 4b. The IRCs are a more recent, acceptable version of minimum elevations for Libby and Hungry Horse. Significant public comment in support of this alternative with IRCs was received. Similar to SOS 2 above, SOS 4a and 4b were not different enough in operation or impacts to warrant continued consideration.

The Natural River (SOS 5) and the Spillway Crest Drawdown (SOS 6) alternatives in the Draft EIS originally included options for 2 months of drawdown to the appropriate pool level and 4 1/2 months of drawdown. The practicality of 2–month drawdowns was questioned during public review, particularly for the natural river. It did not appear that the time involved in drawing down the reservoirs and later refilling them provided the needed consideration for other uses. Flows are restricted to refill the reservoirs at a time when juvenile fall chinook are migrating downstream and various adult species are returning upstream. The 2 1/2 month drawdown strategies (SOS 5a, 6a, and 6c) have been dropped from the Final EIS. However, 2 1/2 month spillway crest drawdown at all four lower Snake projects is still an element in SOS 9c, so the impacts associated with this type of operation are assessed in the Final EIS.

A new option was added to SOS 5, namely SOS 5c. This option includes natural river drawdown of the lower Snake River projects on a permanent, year–round basis. The Corps received comment on this type of alternative during the review of Phase I of the SCS, a reconnaissance assessment of potential physical modifications for the system to enhance fish passage. Many believe the cost for such modification would be less than that required for periodic, temporary drawdowns, which would require specialized facilities to enable the projects to refill and operate at two different pool elevations.

SOS 7 Federal Resource Agencies Operations, which included 3 options in the Draft EIS, has been dropped from the Final EIS and replaced with an alternative now labeled as SOS 9 that also has 3 options. SOS 7a was suggested by the USFWS and represented the State fishery agencies and tribes' recommended operation. Since the issuance of the Draft EIS, this particular operation has been revised and replaced by the DFOP (SOS 9a). The SOR agencies received comment that the DFOP was not evaluated, but should be. Therefore, we have included this alternative exactly as proposed by these agencies; it is SOS 9a. SOS 7b and 7c were suggested by NMFS through the 1993 Biological Opinion. This opinion suggested two sets of flow targets as a way of increasing flow augmentation levels for anadromous fish. The flow targets came from the Incidental Take Statement and the Conservation Recommendation sections of that Biological Opinion. The opinion was judged as arbitrary and capricious as a result of legal action, and these operational alternatives have been replaced with other alternatives that were developed through settlement discussions among the parties to this lawsuit. SOS 7b and 7c have been dropped, but SOS 9b and 9c have been added to represent operations stemming from NMFS or other fishery agencies. In particular, SOS 9b is like DFOP but has reduced flow levels and forgoes drawdowns. It is a modification to DFOP. SOS 9c incorporates elements of operation supported by the State of Idaho in its "Idaho Plan." It includes a 2 1/2–month spillway crest drawdown on the lower Snake River projects and several other elements that attempt to strike a balance among the needs of anadromous fish, resident fish, wildlife and recreation.

Shortly after the alternatives for the Draft EIS were identified, the Nez Perce Tribe suggested an operation that involved drawdown of Lower Granite, significant additional amounts of upper Snake River water, and full pool operation at Dworshak (i.e., Dworshak remains full year round). It was labeled as SOS 8a. Hydroregulation of that operation was completed and provided to the Nez Perce Tribe. No technical response has been received from the Nez

Perce Tribe regarding the features or results of this alternative. However, the elements of this operation are generally incorporated in one or more of the other alternatives, or impose requirements on the system or specific projects that are outside the range considered reasonable. Therefore, this alternative has not been carried forward into the Final EIS.

The Preferred Alternative represents operating requirements contained in the 1995 Biological Opinions issued by NMFS and USFWS on operation of the FCRPS. These opinions resulted from ESA consultation conducted during late 1994 and early 1995, which were a direct consequence of the lawsuit and subsequent judgement in *Idaho v. NMFS*. The SOR agencies are now implementing this operating strategy and have concluded that it represents an appropriate balance among the multiple uses of the river. This strategy recognizes the importance of anadromous fish and the need to adjust river flows to benefit the migration of all salmon stocks, as well as the needs of resident fish and wildlife species at storage projects.

CHAPTER 5

IMPACT ANALYSIS

5.1 INTRODUCTION

Chapter 5 is a narrative description of the Wildlife Work Group's analysis of the impacts to physical habitat and wildlife values from the 13 operating strategies. The analysis is presented on a project–by–project basis, with analysis first for the impacts to physical habitat values at each project, followed by an analysis of impacts to wildlife values. In presenting results, the project evaluators have grouped alternatives that produce similar results into general categories, and then compared those results to the base case alternative (2c).

Because individual projects respond differently to the alternatives, the groupings of alternatives into categories may differ. For instance, the groupings for Libby Reservoir may include different alternatives than the groupings for lower Bonneville, because alternatives that effect Libby similarly may not similarly effect lower Bonneville.

The impacts to physical habitat and wildlife categories were assigned numerical values (*see Chapter 3.0, Study Methods*) and entered into matrices for each project. For detailed results of the analysis, refer to the project matrices in the technical exhibits.

5.2 PROJECT–BY–PROJECT RESULTS

5.2.1 Libby Project

5.2.1.1 Project–Specific Species List

The indicator species listed in Table 3–3 (Project Wildlife Matrix) has been modified to better represent local conditions. The modifications include:

Deleted	*Because*		
1. Colonial nesting birds 2. Black–necked stilt 3. Non–game birds 4. Mule–deer 5. Elk	1. None affected by reservoir operations 2. Do not occur along Lake Koocanusa 3. Do not occur in Kootenai Basin 4. To avoid confusion with white–tailed deer 5. Do not occur		
Selected or Added	***To Represent Category***	***Instead of***	***Because***
1. Common merganser 2. Wood frog 3. Bald eagle 4. White–tailed deer	1. Waterfowl 2. Amphibians 3. T&E raptors 4. Big Game/ Deer	1. Canada goose	1. More common

5.2.1.2 Project–Specific Assumptions/ Parameters

- The barren zone is based on the winter period draft, since this is the season when the barren zone is largest.
- **Barren zones estimation formula:** With each alternative, the evaluator finds the lowest Libby Dam reservoir elevation during any month for the wet, dry and average years. The evaluator then uses a topographic map to calculate average width of the reservoir for selected elevation. That width is multiplied by 253,440 ft (the reservoir length in the US, in ft). The result is divided 43,560 square ft (the number of square ft in an acre), which gives the area of the reservoir at the selected elevation in acres. Finally, that figure is subtracted from 25,000 acres (the area at full pool) to arrive at an estimate of the drawdown acreage at the selected elevation.

5.2.1.3 Evaluation Results

A consistently stable summer reservoir elevation is necessary before wildlife benefits can be realized, as stable water levels allow vegetation to establish. Water levels must be stable not only during the summer of a single year, but they must be attained consistently from year–to–year to sustain the vegetation community. Year–to–year fluctuations in water levels would not result in any improvement over the existing condition, even if the summer elevation was stable during each summer. With increasing vegetation communities, habitat is enlarged and animal populations can expand.

Based on topographic maps, the wildlife working group felt that a summer elevation of about 2400 ft would provide the greatest opportunity for habitat establishment (though the group also recognized a summer reservoir at this elevation would greatly impact recreation and power generation). At 2400 ft some of the Tobacco River area islands and riparian areas could be re–established, and vegetation may be restored to the Tobacco Plains 'dust bowl.' However, the original topsoil has been lost from these areas and it may be necessary to haul in significant volumes of soil before restoration of vegetation could be started. Coincidentally, Alternative 9a results in an average end–of–month summer elevation of about 2390 ft. Unfortunately, the year–to–year elevations vary greatly, and vegetation restoration would likely fail due to inconsistent water elevations. The other alternatives all have 50–year average end–of–month elevations approximately between 2440 ft and 2450 ft (with a few exceptions), but other factors cause them to sort out into four groups As follows: 1a, 1b, 2c, 2d, 5b, 5c, 6b, and 6d all have similar spring through summer elevations; 4c and 9c are virtually identical; 9b and the Preferred Alternative (Alt. PA) are quite similar; and 9a stands alone. It should be noted that the 50–year average month–end elevations do not tell the whole story, as some alternatives may consistently result in summer pool elevations close to full, but with enough years of significantly lower elevations to bring down the average. Therefore, while grouped alternatives may produce similar 50–year month–end averages, not all alternatives in the group arrive there in the same way. Some may fluctuate around the average, while others stay consistently at the average. This is discussed in more detail in the paragraphs that follow.

Matrix Discussion

Physical Habitat Matrix. The habitat acreages that would result from the various alternatives are displayed on four matrices:

The first Physical Habitat Matrix shows those alternatives that reflect roughly similar effects to the existing condition. These alternatives include 1a (wet and average years), 1b (wet and average), 2c 2d, 5b, 5c, 6b, 6d, 9a, 9b, (wet and dry), and PA (wet and dry). The drawdown acreage is roughly 9600 to 9700 acres in wet and dry years, and about 9170 to 9280 acres on average. Wetland and riparian extent is 24 acres for each, while there are no aquatic beds in Lake Koocanusa, and 120 acres of islands. The acreage for wetlands, riparian habitats, and islands are calculated from aerial photography.

The second Physical Habitat Matrix shows 1a (dry) and 1b (dry), which differ only in drawdown acreage

from the first group. During dry years the drawdown is less (i.e., the winter elevation is higher) so the drawdown acreage is 9410 acres, about 290 acres less than the others in the first matrix.

The third matrix shows alternatives 4c and 9c which have significantly higher winter reservoirs (and thus smaller barren areas) than all other alternatives. The acreages are 9015 to 9230 acres for wet years, 8640 for average, and 9131 to 9175 for dry years. In addition, these two alternatives produce relatively stable summer reservoirs, resulting in a projected increase in vegetation communities. The wetlands are expected to increase to 30, while riparian habitat is expected to increase to 28 acres.

The fourth matrix shows the acreage of barren zone for 9b (average) and PA (average), which is 8993 acres, slightly less than the current operation.

Wildlife Impacts Matrix. The wildlife impacts are shown on three matrices. The first matrix is existing condition and shows no change. Any effect that is less than 6 percent is considered too small to measure and is given a zero. The alternatives included on the first matrix are 1a, 1b, 2c, 2d, 5a, 5c, 6b, and 6d.

The second wildlife matrix shows the effects from alternatives 4c and 9c, which have very similar effects on wildlife −− nearly all positive. Since wetland and riparian habitats are expected to increase in acreage, nesting and brooding habitat would be improved. The change is relatively small (about 17 percent), and the matrix reflects the change with the numeral 1. The other animal species would also benefit from these habitat increases, and this benefit is reflected by a 1 in the appropriate boxes. There would be no change in aquatic beds or islands, so these boxes show zeroes for all species except spotted sandpiper. This species may find the barren zone exposed around the islands attractive to nesting, and a 1 is placed in the nesting and foraging boxes. The drawdown zone does not support very many animals, so only spotted sandpiper is expected to benefit from a slightly larger, consistent summer barren area. The benefit is relatively small, so, once again, a 1 is placed in the appropriate boxes for nesting and foraging. Because the reservoir would be slightly lower in the summer than under the current operation, human use may be somewhat reduced, which would lessen human/wildlife contact and improve production of all species.

The third wildlife matrix shows the effects of alternatives 9a, 9b, and PA. Although alternative 9a is quite different from the other alternatives, it is included with 9b and PA because the effects on wildlife are roughly the same. These alternatives have negative effects on wildlife because the summer reservoir will be fluctuating from year−to−year, thereby not allowing any vegetation to establish. The effect is considered to be worse than existing operation due to a predicted long−term loss in fish production, and the fluctuating summer reservoir. However, as the impact is somewhat difficult to measure, and is considered small, most boxes still have zeroes. For drawdown zone, all but the spotted sandpiper would suffer negative effects due to the fluctuating shoreline. The spotted sandpiper may benefit due to an increased shoreline, not only around the reservoir, but around islands as well. However, spotted sandpipers would be adversely affected by an expected drop in benthic invertebrate production; aquatic and terrestrial furbearers and amphibians and reptiles would also be negatively impacted by the expected decline in benthic invertebrates. This decline in invertebrates would further be expected to reduce the fish population, negatively affecting wildlife that prey on fish. Thus, −1 is placed in the boxes for fish−eating wildlife. One possible benefit is an expected decrease in human use, which would result in fewer interactions between humans and animals, and should result in increased productivity of most animals.

Physical Habitat Impacts

General. Alternatives are sorted on the basis of the 50 year average end−of−month reservoir elevation (see Table 5−2). This results in a fairly clean grouping of four sets: 1) Alternatives 1a, 1b, 2c, 2d, 5b, 5c, 6b, and 6d; 2) Alts. 4c and 9c; 3) Alt. 9a; and 4) Alts. 9b and PA.

a. Group 1: The average summer pool elevation for this group is about 2050, tied for the highest average with group 2. Group 1 includes the No Action alternative (2c), the Pre−salmon Summit Operation (1a), as well as

the Natural River and fixed drawdown alternatives (5 and 6). All of these except 2d result in a full reservoir in July in at least 33 out of 50 years (2d has a full pool only 28 out of 50 years). Alternative 1a results in the most full pool years of any alternative: 37.

b. Group 2: This group differs from group 1 in having a higher winter pool (about 40 ft higher on average than group 1). This probably does not result in any noticeable immediate wildlife benefits, since the reservoir is usually frozen over during the winter months. However, resident fish will benefit from a higher winter reservoir, which ultimately would provide a greater prey base for fish–eating wildlife, and improve the overall health of the Lake Koocanusa ecosystem (see Appendix K, Resident Fish, for more discussion on this issue). The summer reservoir elevations average somewhat higher than current operations. The reservoir is also held at a relatively stable elevation, thus promoting restoration of habitat (though opportunities are limited due to the relative steepness of the shoreline at this elevation).

c. Group 3: Alternative 9a has only 2 years in 50 with a full pool. The 50–year average for summer pool elevation is about 2390, about 70 ft below normal full pool. Definitely not desirable in the short term for wildlife or for most other uses (especially recreation and power production), in the long term this alternative – based on the 50–year average, at least – seems to show promise for habitat restoration. However, a closer look at the end–of–month elevations for each year shows that there is no consistent pattern to the summer elevations. Following is a sampling of one five year period, showing the elevations at the end of July in each year:

1929 — 2362.6
1930 — 2330.1
1931 — 2287.0
1932 — 2402.9
1933 — 2429.3

The remaining 45 years show no consistent summertime pool elevation as well. With this kind of operation, there is no hope of restoring habitat to the reservoir shoreline, as no species of plant could tolerate the extremes in fluctuations demonstrated by this alternative. Wind–blown dust from the Tobacco Plains would be more of a problem than under the existing operation, and would further erode the soil from the bed of the reservoir, further reducing the productivity of the reservoir.. The only reason this alternative would not be worse than described is that the riparian and emergent vegetation communities are dependent on the flow of tributary streams. As the tributaries are not affected by these alternatives (except that river–spawning fish may have difficulty migrating up stream in the lower elevations of the tributaries that must flow through the drawdown zone [see Resident Fish appendix, K), the riparian and emergent communities are not expected to decline as a result of this alternative.

d. Group 4: Alternatives 9b and PA are similar, though not identical in their 50–year average end–of–month elevations. Alternative 9b elevations are slightly higher, and continue to get higher even in October, while the PA starts lowering the reservoir by the end of August. Both of these alternatives also result in higher winter reservoirs (about 2348 ft) than either Group 1 or Group 3, though the difference is small and would not result in any measurable benefit compared to the existing condition. On the other hand, the lower summer elevation (the reservoir only reaches full pool twice under 9b and 9 times under PA), with fluctuations similar to alternative 9a, result in impacts similar to those described for alternative 9a. Further, restoration of riparian and emergent vegetation communities along the reservoir shoreline does not seem feasible.

Wildlife Impacts

Alternatives Analysis

Group 1 alternatives will not result in any changes to wildlife populations, as this group of alternatives reflects the current operation.

Group 2 alternatives should result in improved conditions for resident fish and aquatic invertebrates, leading to an enlarged prey base for wildlife species dependent on aquatic resources such as ospreys and aquatic furbearers. As the reservoir would remain stable through each summer and be relatively consistent year–to–year, some shoreline habitat development (up to four acres of wetlands and six acres of riparian) would result in benefits to waterfowl and small mammals.

Group 3 alternatives would result in the highest degree of impact to wildlife, yet the impact is relatively small compared to the effects of the current operation of the reservoir. Benthic invertebrate and fish production are both expected to decline, resulting in long–term declines of wildlife populations associated with the reservoir. The enlarged and fluctuating drawdown zone would negatively affect shoreline nesters and denning animals, as well as any animals that utilize both the reservoir and the adjacent terrestrial habitats.

Group 4 (including the PA) alternatives would negatively affect wildlife populations in comparison to current operations, though not to the degree of group 3, since the summer reservoir elevation would be about ten to 12 ft below current full pool, rather than 50 to 70 ft lower.

Threatened and Endangered Species

Bald eagles may be adversely affected by implementation of either group 3 or group 4 alternatives, which result in lower reservoir elevations in the summer. In the long term, resident fish populations may decline, eroding the prey base for the nesting eagles. Group 1 would not affect bald eagles, and group 2 may have long–term beneficial effects if the operations result in an increased prey base, and newly established riparian habitat results in perches and nest sites close to shore. No other listed species are expected to be affected, as they are not dependent upon reservoir operations.

5.2.1.4 Data Gaps

A thorough analysis of lake bathymetry would provide more accurate estimates of drawdown acreage. The estimates on projected expansions of riparian and emergent habitats would also be more accurate with a more thorough analysis of topography and soils. Use of the drawdown zone and islands by wildlife in Lake Koocanusa is lacking. Presence of both the wood frog and painted turtle is based on known occurrences in the region, and are assumed to occur in the vicinity of Lake Koocanusa. No data was found regarding submerged aquatic beds in Lake Koocanusa, though some may occur. If present, the areal extent is expected to be quite small (less than 10 acres).

5.2.1.5 Conclusions

Group 1 would continue current operations and would not result in any noticeable changes to wildlife or their habitats at Libby Project. Group 2 may result in long–term benefits to wildlife and is preferred over the other groups. Group 3 (Alternative 9a) would clearly have the most serious negative effects on wildlife and their habitats of all the alternatives. Group 4 would further reduce habitat quality and result in losses of wildlife as compared to the existing operation.

5.2.1.6 Mitigation for Preferred Alternative

Mitigation for lost reservoir values would likely need to be accomplished off–site, due to the nature of the reservoir operation under the Preferred Alternative. This operation would not allow for establishment of shoreline vegetation, and would preclude other types of restoration efforts within the limits of the reservoir. The level of mitigation is based on acreage of impact, and a 3:1 replacement ratio. The loss is based on the summer reservoir operation, which results in a rough average of 12 ft lower than normal elevation (see Table 5–2). This computes to a lost reservoir area of 144 acres. A replacement at 3:1 means a target of 432 acres. The impact extends to all users of the reservoir, so that mitigation should endeavor to include habitat for nesting waterfowl, aquatic and

terrestrial furbearers, bald eagles and ospreys, big game, and reptiles and amphibians. As yet, specific mitigation has not been identified. A search for feasible mitigation sites and measures will be conducted with the State Department of Fish, Wildlife, and Parks and the US Fish and Wildlife Service.

5.2.2 Kootenai River

5.2.2.1 Project-specific Species List

The indicator species listed in Table 3–3 (Project Wildlife Matrix) has been modified to better represent local conditions. The modifications include:

Deleted	*Because*		
1. Colonial nesting birds 2. Black–necked stilt 3. Mule–deer	1. Not common along the Kootenai River 2. None occur 3. To avoid confusion with white–tailed deer		
Selected or Added	*To Represent Category*	*Instead of*	*Because*
1. Common merganser 2. harlequin duck 3. Wood frog 4. Bald eagle 5. White–tailed deer	1. Waterfowl 2. Waterfowl 3. Amphibian 4. T&E raptors 5. Big Game/Deer	1. Canada goose 2. Mallard	1. More common 2. Harlequin duck nests along the Kootenai River, usually in a concealed nest under thick cover of moss, or overhanging bank. They sometimes nest under bridges. Harlequin ducks forage on aquatic insects and larvae, as well as small fish and fish eggs, and various other aquatic organisms.

5.2.2.2 Project-specific Assumptions/ Parameters

- For the purposes of this evaluation, only the US portion of the Kootenai River is considered, which starts at Libby Dam and flows through Montana into northern Idaho.
- Flows are the analytic measure used to evaluate effects to the Kootenai River environment, since elevations are not listed in the hydroregulations. However, there is a major difficulty in attempting to relate flows to elevations, even in a general sense. This analysis simply compares the current operations flows with one another, and attempts to relate the flows resulting from the alternatives to the existing environment in and along the river. Monthly outflow from Libby Dam are the main source of data.
- All acreage figures were derived directly from aerial photos, although the flows in the river at the time of the photography is not known. Acreage could vary.
- Because of fluctuating flows and uncertainty with regard to the flows that existed at the time of the photography, acreage indicated below are assumed to be the same for wet, average, and dry years.

- The total calculated as:

Acres	Habitat type
121.2	Barren Zone (including 87.5 on islands)
1775	Riparian Zone
298.5	Islands
1574	Emergent Wetlands (including 58.9 on islands)
553	Submergent Plant Beds
65.3	Upland Vegetation

5.2.2.3 Evaluation Results

Irregular flow releases from Libby Dam have been blamed for causing accelerated bank erosion in the Idaho portion of the Kootenai River above Bonners Ferry. In addition, flows that are consistent in spring and continuing through summer are the best for promoting wildlife use along the river. Nesting waterfowl, shorebirds, denning furbearers all need stable water elevations to improve their chances of successfully raising their progeny. Stable elevations also promote the establishment and growth of shoreline vegetation. Thus, the following analysis focuses on the consistency of outflows from Libby Dam. Table 5–3 shows the 50–year average monthly outflows from Libby Dam for each of the alternatives, and Table 5–4 shows the 50–year average monthly flows at Bonners Ferry for each of the alternatives. Note that the difference in flows between these two tables is a result of tributary streams that enter the Kootenai River between Libby Dam and Bonners Ferry. These streams include the Fisher River, Yaak River, and Moyie River. Also note that during the spring freshet months (April, May and June), the contribution of the tributaries is greater than that of Libby Dam outflows under nearly every alternative.

The alternatives sort into four groups, based on the similarity of average monthly flows (incidentally, these groupings are identical to those for Libby Dam). Group 1 includes alternatives 1a, 1b, 2c, 2d, 5b, 5c, 6b, and 6d. Group 2 includes alternatives 4c and 9c. Group 3 is alternative 9a, and Group 4 includes alternatives 9b and PA.

Matrix Discussion

Matrices for river reaches were not prepared, as analyses for these non–impounded reaches do not cleanly fit the matrix formula used for the project areas.

Physical Habitat Impacts

Group 1 includes the "No Action" alternative (2c), and thus all alternatives in this group reflect virtually no change from current operations. However, within group 1, there are inconsistencies. For example, in January, alternatives 1b and 2d differ from the rest in having flows between 1700 and 3000 cfs less than the other alternatives in the group, giving them slightly more consistency than the others, month–to–month. In addition, flows for alternative 1b are much higher in October than the others in the group, which again adds to the consistency of flows under that alternative. Since consistency in flows are important in regard to erosion effects, wildlife breeding, and habitat development, alternative 1b comes closest to achieving this goal, while 2d would represent an improvement over existing operation. However, it should be pointed out that daily flow fluctuations are critical to this analysis, and the data provided is in terms of monthly averages. So, even though 1b and 2d appear to be preferable, without knowledge of daily flow fluctuations, a great deal of uncertainty exists as to their impacts. We assume that the existing rates of erosion, and current trends in wildlife breeding and habitat development along the river's edge would continue with any alternative of this group.

Group 2 simply exacerbates an already bad situation by greatly increasing the inconsistency in flows from month–to–month. This is most obvious in December, when the average flow is roughly 1 1/2 times greater than for November, and over twice that in January. This flow regime would greatly increase bank erosion along the Kootenai River. The spring and summer flows are similarly inconsistent and would cause problems for shoreline wildlife. The flow regime might also result in a long term loss of riparian vegetation.

Group 3 (alternative 9a) provides for relatively consistent – and generally lower – flows during the winter than all the other alternatives. Flows in spring, however, are exceedingly high (though attempting to replicate historic spring freshet flows before Libby Dam was built). The flow regime in spring and summer would appear to disrupt breeding activities by wildlife and may result in the loss of riparian vegetation.

Group 4 is inconsistent in the winter as well as in the spring and summer, and would result in impacts similar to that resulting from group 2.

Wildlife Impacts

Wildlife impacts can only be generalized, but it would appear that the best scenario is found in group 1, which merely maintains the current operation. Alternative 1b may have the least impact in this group, as described under physical habitat impacts above.

Impacts to wildlife resulting from implementation of any of the other alternatives would be more severe than under current operations. It is likely that denning sites would be lost, cavity–bearing trees would be swept away, and gravel bars would be very unstable.

Threatened and Endangered Species

Species dependent on the river would be adversely affected by implementation of any of the alternatives, although those alternatives in group 1 would be merely maintaining the current operation. Bald eagles and northern goshawks may lose nest trees; harlequin ducks may lose nest sites associated with overhanging banks; habitat for Coeur d'Alene salamander could be lost or adversely affected by high flows; and areas of triangular lobed moonwart and water howellia may be affected by inconsistent flow regimes.

5.2.2.4 Data Gaps

Maximum daily flows and fluctuations are needed to better analyze effects of alternatives on wildlife use of the Kootenai River below Libby Dam. One species in particular, the Coeur d'Alene salamander (a state–sensitive species), may be influenced by daily changes in river flows, especially during the fall foraging season. Without daily flow data, however, the effects cannot be determined.

5.2.2.5 Conclusions

Group 1 alternatives result in essentially no change from current operations and would result in the least impact to wildlife. Alternatives 1b and 2d appear to have the most consistent flow regimes and thus would have the smallest effect on wildlife. All the other alternatives would result in increased negative impacts to all wildlife species associated with the Kootenai River between Libby Dam and Bonners Ferry.

5.2.2.6 Mitigation for Preferred Alternative

Mitigation would be necessary with implementation of the Preferred Alternative. Mitigation may best take the form of a four–season inventory of resources found along the entire US portion of the Kootenai River, and would include an assessment of potential impacts from implementation of the preferred alternative. The study should also include an assessment of the severity, nature, and location of erosive processes. The inventory and assessment would then form the basis for development of mitigation measures and identification of mitigation sites.

5.2.3 Hungry Horse Project

5.2.3.1 Project–specific Species List

The indicator species listed in Table 3–3 (Project Wildlife Matrix) has been modified to better represent local conditions. The modifications include:

Deleted	*Because*		
1. Black–necked stilt 2. Big–horn sheep 3. Canada geese 4. Gulls 5. Painted turtle	1. Absent project area 2. Absent in project area 3. Not an important management concern 4. Not an important management concern 5. Limited Occurrence		
Selected or Added	*To Represent Category*	*Instead of*	*Because*
1. Grizzly bear 2. Spotted frog	1. Big Game; Listed Species 2. Amphibians	N/A	1. Important management concern 2. Believed present in project area and sensitive to water level changes

5.2.3.2 Project–specific Assumptions/ Parameters

As an additional consideration when evaluating impacts to wildlife associated with riparian habitat at Hungry Horse project, changes in upland habitat were considered by estimating acreage of newly established riparian/upland transition, and including this acreage.

Areas of vegetated habitat considered sensitive to changes in reservoir level were estimated from inspection of 1986 aerial photography (D. Sirucek, personal communication; Ebasco Services, 1993). Current (1986) wetland habitat at Hungry Horse is generally restricted to the upper reaches of the reservoir–river interface. These wetlands are referred to as 'headwater' types, to distinguish them from wetland habitats currently absent but possibly developing on reservoir shoreline as a consequence of changed operating strategy. Approximately 29 acres of riparian (scrub–shrub) vegetation, 15 acres of emergent marsh, and 137 acres of aquatic plant bed have been identified in the headwater area, and half of one mapping category (marsh/wet meadow/ shrub) was arbitrarily assigned to emergent marsh and half to riparian. (These assignments are not precise, and are not intended to serve as baseline for monitoring or mitigation assessment purposes.)

Two somewhat different processes are likely to affect amount of wetland habitat at Hungry Horse, and so two sets of criteria were developed for projecting changes in acreage as a function of EOM reservoir levels, see Table 5–1. One set of criteria deals with conditions required to allow establishment of new wetland on exposed shoreline, and the second set of criteria deals with maintenance of existing headwaters wetlands. (Expansion of headwaters wetland acreage was not estimated, as it is assumed that increased duration of elevated water levels in the headwaters would mostly increase wetness of existing wetland habitats rather than inundating/saturating additional substrate.)

The criteria adopted for establishment of new wetland reflect two general assumptions: (1) water levels must not fluctuate by more than three ft, because wetland plants can be easily desiccated by prolonged exposure; and (2) wetland types are restricted to shallow water or to sites at least periodically saturated.

Table 5–1. Criteria for Determining Changes in Vegetation Hungry Horse Reservoir

Establishment of New Wetlands Along Shoreline or on Exposed Sediments

If EOM elevations for June, July and August of a particular year (such as 1937, 1938, etc.) fluctuate less than 3 feet, assume all substrate within indicated bands converts to indicated vegetation type(1):

−6 to −2 feet below pool(2):	.. **aquatic bed**
−2 to full pool:	.. **newly established emergent marsh**
full pool to +2 feet:	.. **newly established riparian**

If EOM elevations for June, July and August fluctuate more than 3 feet:

(1) convert area occurring below full pool, but not inundated during water year, to: ..... **year−long drawdown zone**

(2) convert portion of previous year's year−long drawdown zone that remains uninundated for a second year, to: ..... **upland/riparian transition**

Maintenance of Headwaters Wetlands

headwaters emergent wetland is maintained if July or August EOM elevations attain full pool at least once during current or either of the previous two years

headwaters riparian vegetation is maintained if July or August EOM elevations attain full pool at least once during 5−year sequence

headwaters aquatic bed is maintained any year when maximum fluctuation among June, July and August EOM elevations is within 10 feet of full pool

(1) This over estimates actual acreage, as much of the substrate would probably not provide adequate structure for vegetation establishment. Substrate conditions were not investigated, but as little as 10 percent of substrate may contain sufficient fine materials and organic matter to support vegetation (H. Nyberg, personal communication). To account for substrate conditions, ten percent of the aquatic bed, emergent marsh and riparian habitat acreages calculated on the worksheets were transferred to the direct physical effects matrices. (2) In certain alternative strategies, 3559 was treated as full pool (3560) because of high frequency of occurrence.

Criteria developed for determining changes in headwater wetlands are based on inspection of EOM water levels in Hungry Horse reservoir occurring five years prior to the aerial photography taken in July of 1986 (US Geological Survey Water Data Reports, "Hungry Horse Reservoir near Hungry Horse, Montana") During the critical growing season months of May, June, July, and August, water levels were relatively consistent; in May, levels approached or slightly exceeded 3540 ft; for the rest of the season, levels in the reservoir were 20 ft higher, at or near full pool. This suggests that the June through August full pools back up elevations in the headwaters area sufficiently to support the wetlands occurring there. May elevations in the reservoir, however, appear too low to appreciably affect the moisture regime in the headwaters wetlands. Selection of required frequency of occurrences (every three years for emergent wetlands, and every five years for riparian) is based strictly on judgment, reflecting the tendency of woody plants characterizing riparian habitat to tolerate longer periods of dry conditions.

Hungry Horse reservoir includes approximately 334 acres of island habitat, distributed among three major islands. Due to the small amount of island habitat and the assumed absence of associated wetlands, island acreage were not projected for evaluating wildlife impacts. One island, however, supports an active bald eagle nest. This island (Clayton) becomes land–bridged when drawdowns exceed approximately 70 ft (R. Clark, USBR, Hungry Horse Dam, personal communication). Analysis of the SOS impacts to eagle nesting habitat was conducted by tallying the number of years out of the sequence of five in which reservoir EOM elevations for April, May, or June dropped 70 ft below full pool.

Increase in acreage of drawdown zone is assumed to be detrimental to mallards and diving ducks as it exposes immature and adult ducks to predation as they cross the zone from nesting sites to open water.

Increase in drawdown zone acreage is also assumed to be detrimental to amphibians, as it indirectly reflects early spring conditions in the headwater areas, where amphibians would use ephemeral pools for breeding. Higher March reservoir levels translate into greater likelihood of backing up water levels in the headwaters at the time amphibians utilize the river and standing water.

5.2.3.3 Evaluation Results

Inspection of 50–year average elevations (Figure 5–1) and 1941 elevations (Figure 5–2) indicates that the thirteen alternatives sort into five groups of similar lake elevations:

a. 1a, 2c (identical to 2d), 5b (identical to 5c, 6b and 6d)

b. 1b

c. Preferred Alternative (PA), 9b

d. 4c (identical to 9c)

e. 9a

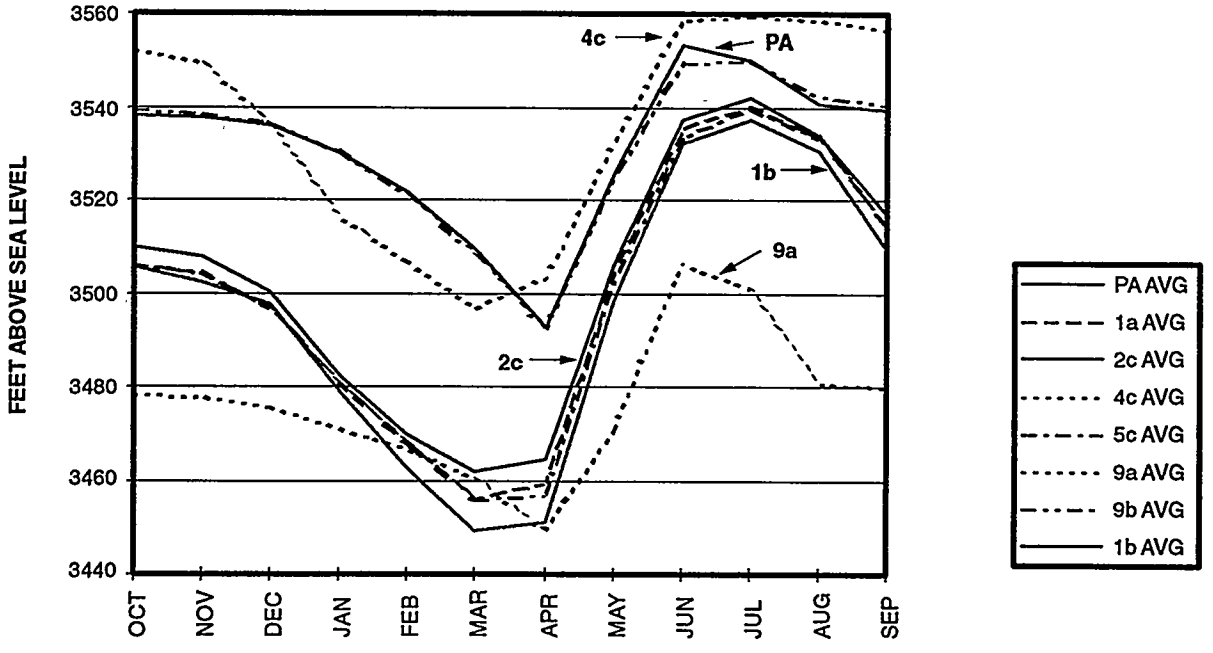

Figure 5–1. EOM Average Elevations Hungry Horse Reservoir

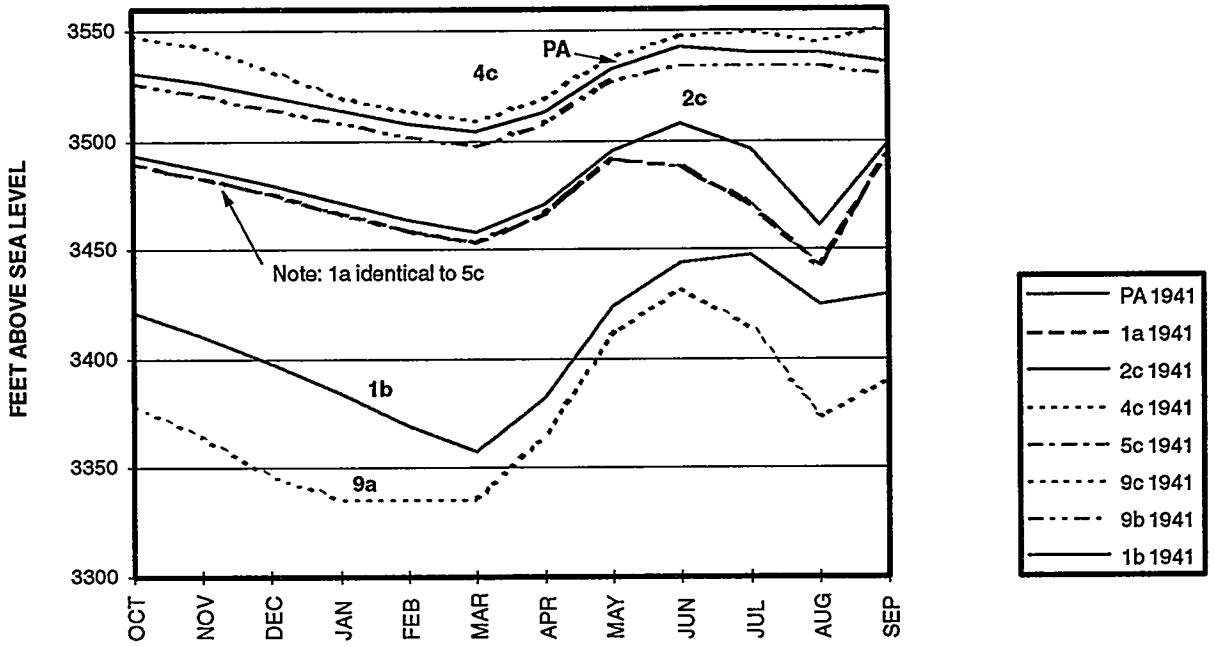

Figure 5–2. 1941 EOM Elevations Hungry Horse Reservoir

The 50–year average monthly elevations tend to follow the same pattern: reservoir elevation drops to lowest levels in March and April, rises relatively rapidly to full pool or maximum elevation in June or July, and starts to fall either immediately (alternative 9a and the Preferred Alternative) or as late as October (stable storage). The stable storage strategy (option 4c) and alternative 9c differ from others at Hungry Horse by maintaining full pool during June, July and August in most years.

Physical Habitat Impacts

Group 1

1a

1a produces two general patterns of reservoir levels. A typical pattern exemplified by the wet years 1937–1941, and a dry period pattern restricted to the 1930's drought. In normal or wet years, full pool (3560 ft above msl) is attained in June and July, and minimum elevations about 100 ft lower are produced in March or April. In many years, August elevations drop slightly, allowing some late season growth in the upper drawdown zone of low densities of ephemeral plants including horse–tails, sedges and weedy forbs. The entire drawdown zone may extend 1,000 ft from the wooded shoreline (very approximately estimated). Frequent yearly occurrence of full pool in summer maintains small areas of riparian and emergent headwaters wetlands. June elevations tend to fall more than ten ft below July and August (full pool). In 1976, however, June elevation is 3552, which according to the adopted assumptions, allows growth of aquatic plants in the headwaters area. In four out of the five wet years, June elevations differ by more than ten ft from July and August. The severe annual drawdowns essentially preclude establishment of shoreline wetland habitat.

During major droughts such as occurred in the 1930's, full pool is not achieved for six consecutive years, allowing establishment of some perennial vegetation in exposed sediments. As much as a thousand acres of reservoir sediments may be continually exposed for five consecutive years, allowing growth in areas with suitable substrate of woody plants such as alder, willow and dogwoods, as well as herbaceous species. Although the drawdown zone estimated for 1941 comprises about half the acreage

estimated for 1976, the actual area exposed below full pool under dry conditions would be somewhat larger, as can be seen from comparison of the 1941 and 1976 winter drawdown zone estimated acres. Both wet and dry years tend to land–bridge Clayton Island.

2c (identical to 2d) Vs 1a

A Physical Effects matrix was developed for the 2c strategy, as well as a separate matrix comparing 2c with 1a. The 2c strategy and 1a differ very little. Alternative 2c fails to refill Hungry Horse Reservoir to full pool 23 years out of the 50 simulated, compared to 19 years resulting from 1a. The 2c strategy produces slightly higher June elevations as indicated by comparison of its average of 3537 ft with the 1a average of 3535 ft. Higher June elevations may increase early season wetness in the headwaters wetland habitats, and possibly favor slightly greater frequency of annual aquatic beds. In three of the five wet sequence years examined (1972–1976), 2c would provide conditions assumed adequate for growth of aquatic beds in the headwaters, compared to one year for 1a. Because both 2c and 1a met the assumed condition in 1976, no difference between these two alternatives is inferable from the direct physical effects matrix.

Between 1972 and 1976, 2c land–bridged Clayton Island all five years compared to four years associated with 1a. Similar acreage of drawdown habitat are estimated for 2c and 1a. During a major drought, 2c may create less upland/riparian transition vegetation in the zone below full pool.

Differences between 2c DRY and 1a DRY are considered negligible. Differences between 2c WET and 1a WET also appear slight, but a wildlife impact matrix was developed comparing 2c with 1a to confirm absence of significant differential effects.

5b (identical to 5c, 6b and 6d) Vs 1a

Comparison of the direct physical effects of 5b with those projected for 1a indicates essentially no difference.

5b (and other identical alternatives) Vs 2c

The 5b strategy draws Hungry Horse Reservoir down to 3476 ft in 1976, compared to 3483 for strategy 2c, and consequentially creates 9170 acres of drawdown/barren zone compared to the 8400 acres produced by 2c. During dry years and during the winter season of most years, however, acreage of drawdown/barren zone projected for 5b fall slightly below acreage projected for 2c. Six hundred and sixty more acres (36 percent) of upland/riparian transition vegetation are projected for 1941 as a result of 5b, reflecting the slightly lower maximum elevations produced by 5b during the 1937–1941 sequence. The differences in projected acres of drawdown/barren zone and upland/riparian transition appear too small to affect wildlife populations differently.

Group 2

1b Vs 1a

In wet years and most years, 1b would likely cause the same kinds of effects on wildlife habitats at Hungry Horse, as would the 1a strategy. During a major drought, 1b would likely cause substantially greater acreage of upland/riparian transition vegetation on exposed shorelines. Although 1b produces a slightly higher maximum elevation in 1937 compared to 1a, it produces lower maxima from 1938 through 1941. Alternative 1b elevations range no higher than 3447 ft in 1941, compared to 3495 ft for 1a. The consistently lower elevations associated with 1b create greater drawdown habitat, much of which is exposed for two or more consecutive years.

1b Vs 2c

Inspection of the direct physical habitat matrix comparing 1b with 2c indicates that relative effects on habitat are essentially the same as those derived from comparing 1b with 1a.

Group 3

Preferred Alternative (PA) and 9b

End–of–month elevations simulated for Hungry Horse Reservoir under alternative 9b are similar to those simulated for the Preferred Alternative. Impacts on habitat and wildlife resulting from these

two alternatives would therefore be essentially the same. The Preferred Alternative was selected for more detailed analysis.

The Preferred Alternative produces higher average reservoir levels in all months compared to the no–action alternative (2c), but fewer years in which July or August levels attain full pool (3560 ft amsl). In August, the Preferred Alternative maintains the reservoir at 3539 ft in 49 of the 50 years simulated, compared to the No Action alternative, which fluctuates widely, achieving full pool in 15 years but producing reservoir elevations less than 3539 ft in 18 years. Although the Preferred Alternative increases (compared to No Action) the frequency of years with June reservoir levels at full pool, in most of these years July levels drop about 20 ft to 3539 ft amsl.

Extent and quality of physical habitat would be about the same under the Preferred Alternative as under the No Action alternative. In most years, the somewhat higher reservoir levels occurring in March under the Preferred Alternative would expose less barren area. But the acreage of barren substrate exposed would still be large. When March reservoir level drops to 3509 ft (the 50–year average), approximately 5560 acres of substrate would be exposed, which very roughly translates into a band (between water level and upland) 700 ft wide. Under the No Action alternative, mean March elevation (3462) exposes approximately 10690 acres which would be roughly 1340 ft wide. In 1976, a year of particular interest because it follows a sequence of relatively wet years, the Preferred Alternative and alternative 2c produce the same acreage of barren substrate because they produce the same minimum (March) and maximum (summer) elevations (Appendix A).

Frequency of occurrence of full pool during June, July, or August under the Preferred Alternative would probably continue to support marsh and riparian habitats established in the headwaters of the reservoir. The consistent drop in reservoir elevation from June–July levels to 3540 ft in August, would probably reduce, compared to 2c, opportunity for establishment and survival of aquatic bed or productive shallow water habitat in the headwaters area. The acreage of aquatic bed vegetation under No Action, however, is believed relatively small. Similar to No Action and Current Conditions, the fluctuating reservoir elevations during the growing season would tend to prohibit establishment of wetland or riparian vegetation along the reservoir shoreline.

Group 4

4c (identical to 9c) Vs 1a

The 4c alternative maintains higher reservoir levels than does the Base Case 1a, with the most pronounced differences occurring during dry years. The 4c alternative also tends to reduce month–to–month fluctuations. Both factors favor greater amounts of wetland habitat, as shown in the completed matrix (Table D–4, pg. D–21). Under the Stable Storage hydrologic regime, an estimated 650 acres of substrate would lie under shallow water or experience intermittent shallow inundation. Much of this acreage (roughly 90 percent) comprises stony substrate which would not support emergent or submergent vegetation, but may support greater densities of benthic organisms due to more stable water levels during a significant portion of the growing season. A small portion of the acreage would be colonized by submergent and emergent plants.

The much higher minimum annual elevations reduce the acreage of drawdown barren zone associated with Stable Storage, compared to the Base Case. During late spring and summer months the Stable Storage alternative and alternative 9c almost always achieve full pool or near full pool, unlike any of the other strategies. Comparison of 50–year average EOM elevations simulated for the four summer months shows the marked difference:

	June	July	August	September
Stable Storage	3558.9	3559.5	3558.7	3556.6
Base Case	3535.4	3540.3	3533.8	3514.2

The Stable Storage strategy and alternative 9c cause land–bridging (April, May and June) of Clayton

Island during two years of the wet year sequence and during none of the dry years. The 1a alternative would be expected to bridge Clayton Island in four out of five wet years and five out of five dry years.

4c (and 9c) Vs 2c

Comparison of 4c with 2c yields differences comparable to those derived from comparison of 4c with 1a.

Group 5

9a

Alternative 9a achieves full pool during the growing season less frequently than other alternatives, and generally keeps Hungry Horse Reservoir at lower levels (Figures 5–1 and 5–2). Winter drawdowns would be greater under 9a. In times of drought drawdowns would persist for five or more years producing extensive acreage of exposed sediments, which would be temporarily colonized by upland and riparian plants.

Although the effects of 9a on physical habitat would be similar to No Action, over an extended time habitat established in the headwaters of the reservoir would tend to degrade. Under the 9a alternative, full pool occurs relatively infrequently and rarely persists for more than one month. The infrequent occurrence of full pool, coupled with relatively wide fluctuations in water level during average growing seasons, would likely degrade marsh and aquatic vegetation currently established in the headwaters of the reservoir.

Wildlife Impacts

Based on the above analysis, three alternatives would affect physical habitat sufficient to potentially affect abundance and occurrence of indicator wildlife species: 1b (Pre–ESA, Optimum Load), 4c (Stable Storage), and 9a (Settlement Discussion, Detailed Fishery Operating Plan). The 2c strategy (No Action) was also compared to 1a (Existing Baseline) to confirm similarity.

2c (identical to 2d) Vs 1a

The relatively small differences between 2c (No Action) and 1a (Base Case) regarding estimated acreage of drawdown/barren zone, upland/riparian transition and island bridging, were found insignificant for wildlife. From 1972 to 1976 (the wet year sequence), EOM elevations projected for 2c would land–bridge Clayton island in all years, whereas 1a would exceed 3490 ft in only four. Because eagles currently nest on the island and tolerate frequent land–bridging, this difference is not considered sufficient to warrant distinguishing the 2c strategy from 1a.

1b Vs 1a

The results of comparing 1b with 1a were identical to the results of comparing 1b with 2c.

The 1b strategy favors substantially greater (150 percent) acreage of substrate that remains uninundated throughout the 1937–1941 interval. The dry sequence of years, however, is not typical of the entire 50–year simulation, which is best represented by the wet year sequence. During the drought years, the 1b alternative would promote greater development of upland/riparian transition vegetation on the continuously exposed sediments. After two to several years, colonized vegetation may approach shrub stature. The developing shrub zone would occupy the landward edge of the shoreline, removed a considerable distance (very approximately 500 to 700 ft depending on time of year) from open water. Wildlife that could benefit from increased acreage of low shrub habitat in proximity with, but not adjacent to, water, include waterfowl and some non–game bird species such as red–winged blackbird, and yellow warbler. These species were assigned impact ratings of +1 to represent an estimated increase in numbers. Increases were judged not likely to exceed 33 percent because non–wetland shrub habitat is not likely a major factor limiting current populations, and because the difference between 1b and 1c is restricted to periods of major drought. A 0 rating for riparian habitat was assigned to the downy woodpecker, also a non–game species, as populations of this species responds more to mature woodlands than low shrub.

Diving duck and colonial nesting bird (great blue heron) categories were assigned 0 ratings with respect to riparian habitat, representing changes in wildlife densities ranging from − five to + five percent. These species more closely associate with shrub vegetation adjacent to shallow water. Both of the compared alternatives create upland/riparian transition vegetation relatively far removed from water.

Big game such as mule deer and wintering elk could benefit from increased woody vegetation, which provides both food and cover. Grizzly bear could benefit from increased berry production and deer. Any such increased benefit accrued from 1b would be restricted to drought years.

The 1b alternative does not appear to differ from the Base Case with regard to land−bridging of islands, benthic invertebrate productivity, or human effects. 1b may produce EOM elevations sufficient to isolate Clayton Island from the mainland slightly more frequently than the 2c alternative, but this difference is not judged significant for nesting eagles.

Stable Storage Strategy (identical to 9c) Vs Base Case (1a)

The results of comparing 4c with 1a were identical to the results of comparing 4c with 2c.

The higher, more stable, elevations produced by the stable pool strategy should favor wetland habitats, which would likely increase densities of species benefiting from wetland cover and food materials. All of the selected indicator species except aquatic furbearers would increase with increased acreage of emergent and submergent wetland. Aquatic furbearers, which are presently absent from the reservoir and shoreline, are limited by extensive annual drawdowns which result from all alternatives under consideration.

Waterfowl are currently limited at Hungry Horse by sparse emergent and emergent wetland habitat; mallards are consequently assigned impact ratings of +3, indicating possible increases in densities ranging from 67 to 100 percent (or greater). This reflects the current, almost complete absence of marsh habitat associated with the reservoir as it has recently been operated or would be operated under the No Action alternative. Note, however, that the actual numbers of waterfowl that occur are quite small. Even a doubling results in only a small number of birds. Other species are assigned ratings of either +2 or +1 for emergent and submergent wetland, depending on importance of these habitat types for each species. Big game and downy woodpeckers, for example, feed in a variety of habitats including marsh. The spotted frog is restricted to a +1 rating because it would still be greatly limited by extensive spring drawdowns, when this species is breeding. The Stable Storage strategy primarily benefits amphibians by enhancing headwater wetlands utilized during the non−breeding portion of the year.

The Stable Storage strategy produces considerably less drawdown/barren zone than the Base Case and No Action alternatives, but still produces extensive acreage of exposed substrate. For example, area of exposed drawdown roughly estimated for 1976 is 5780 acres, 3390 acres less than that projected for alternative 1a but still averaging (roughly estimated) 700 ft in width. Consequently, no significant differences are recognized for this habitat element.

Effects of changes in riparian habitat appear more variable, as two general kinds of changes are projected. Some increased acreage of riparian wetland shrub would likely result from 4c, establishing along the reservoir's edge where the mix of water and cover could benefit waterfowl, colonial nesting birds and amphibians and reptiles. The higher levels resulting from Stable Storage would also tend, however, to create less upland/riparian transition vegetation compared to 1a, particularly during dry periods. To some extent, relatively less acreage of riparian vegetation more upland in composition may offset effects of increased acreage of wetter plant communities. Species more dependent on early successional woody vegetation types, such as nongame birds and terrestrial furbearers, may experience little significant gain.

The Stable Storage strategy markedly reduces the frequency of island land−bridging, which could

benefit bald eagle nesting and foraging with respect to successful reproduction. Density of breeding eagles would not likely change with a decreased frequency of island bridging, as only three suitable islands occur in the reservoir and only one (Clayton) may be suitable for nesting.

The Stable Storage strategy and alternative 9c would enhance recreational opportunities on Hungry Horse Reservoir. Projected visitor days over an average season exceed projections for other alternatives by about 20 percent (SOR Recreation Work Group Appendix). Anticipated effects of human activity on wildlife are difficult to quantify, but greater human activity would probably perturb most indicator species of wildlife except nongame birds and amphibians. The latter two categories of wildlife associate more exclusively with marsh and dense shrub habitat, where human contact (boating, fishing and picnicking) would likely be minimal. Whereas projected recreational usage of Hungry Horse Reservoir would likely decrease wildlife populations to some extent, compared to a situation without human activity, the recreational factor does not appear likely to offset the wildlife advantages of Stable Storage relative to other operational strategies.

The Stable Storage strategy and alternative 9c would favor fish productivity (westslope cutthroat trout) relative to Base Case and other options, but the magnitude or effect is uncertain (Resident Fish Work Group Appendix). Increased fish productivity would probably benefit many waterfowl, colonial nesting birds, raptors – including eagles, raccoons, bear and amphibians/reptiles.

9a Vs No Action (2c)

Alternative 9a would tend to create extensive early–growth riparian vegetation during extended drought, and continue to cause relatively wide water level fluctuations during the growing season in non–drought years. As with 1b, occurrence of early growth low shrub and forbs within the reservoir drawdown zone would favor nongame birds, terrestrial furbearers and big game, which utilize woody habitats for feeding and nesting. Benefits of increased habitat would be restricted to drought periods. Over the long term, however, the adverse effects of reduced marsh and aquatic plants in the headwaters area would out–weigh any increase in wildlife populations associated with drought and vegetation encroachment into the drawdown zone. The marsh and submerged aquatic plants in the headwaters area currently represent most of the wetland habitat associated with Hungry Horse Reservoir. Reduction of this remaining habitat would likely reduce densities of waterfowl, great blue herons, nongame birds, terrestrial fur–bearers, big game and amphibians. The magnitude of population declines would probably be small, as some portion of wetland habitat would survive where tributaries enter the South Fork and most species utilize non–wetland habitats in addition to marsh and aquatic beds.

Threatened and Endangered Species

The gray wolf, bald eagle and peregrine falcon are Federally–listed as endangered in Montana. The grizzly bear and aquatic plant, water howellia, are listed as threatened. No candidate species for listing have been identified as potentially occurring in the area affected by system operation (US Fish and Wildlife Service Letter from R.D. Peterson to D. Treasure , dated March 29, 1995). The bald eagle and grizzly bear were included in the impact evaluation matrices as representative raptor and big game species that occur in the Hungry Horse Reservoir area. The Stable Storage strategy would increase wetland habitats at Hungry Horse, and favor increased reproductive success of bald eagles and perhaps grizzly bears. The Stable Storage strategy might benefit peregrine falcons should any establish a territory in the vicinity of Hungry Horse Reservoir. Stable Storage would tend to improve habitat for waterfowl, which can provide prey for the peregrine falcon. The threatened plant, water howellia, occurs in the Swan River drainage and has not been reported from the Flathead River. It typically grows in wetlands associated with former river oxbows and ephemeral glacial pothole ponds (Federal Register 59:35860–35864, July 14, 1994). The hydrology of the Swan River drainage will not be affected by any of the System Operation Strategies.

5.2.3.4 Data Gaps

Analyses of impacts at Hungry Horse Reservoir are limited by available data. Most important unknowns are area and composition (silt, sand, etc.) of substrate exposed at different lake levels, and magnitude of changes in fish populations resulting from alternative options. More accurate estimates of wetland distribution would also improve analytical confidence. More generally, analyses are limited by uncertainties of plant responses to fluctuating water levels, and wildlife responses to annual and longer–term fluctuations in habitat abundance.

5.2.3.5 Conclusions

Effects of alternative system operations on habitat and wildlife at Hungry Horse Reservoir are summarized in table 5–2.

Table 5–2. Comparison of Alternatives – Hungry Horse Reservoir

Comparison of Alternatives	
Alternatives Providing Significant Improvement Compared to No Action:	4c, 9c
Alternatives Providing Slight Improvement Compared to No Action:	1b
Alternatives Causing Slight Reductions in Habitat and Wildlife Populations:	9a
Alternatives Causing No significant Change from Current Operations:	1a, 2c, 2d, 5b, 5c, 6c, 6d, 9b, Preferred

The Stable Storage alternative and 9c are substantially different from all other alternatives. Alternatives 4c and 9c would tend to increase wetland and shallow water habitat, although still producing extensive annual drawdowns. Most of the wildlife species selected as indicators of reservoir resource would increase. Estimated increases range from six to greater than 100 percent, largely because densities associated with the Base Case and no–action alternative are low.

Alternative 1b would provide more upland/riparian transition habitat during extended droughts than other alternatives. This could benefit nongame birds, big game and terrestrial furbearers, but increases would probably not be large as this habitat is not generally as limiting for wildlife populations as wetland types. Also, any increases in wildlife would not likely persist beyond the drought period, once newly created habitat reverted back to open water and/or barren drawdown zone.

Alternative 9a would tend to improve early–growth non–wetland habitat during extended drought, but over the long–term degrade wetland habitats in the reservoir headwaters. The net effect would likely be small reductions in wildlife populations dependent on wetland and shallow water habitats.

5.2.3.6 Mitigation for the Preferred Alternative

The Preferred Alternative is not expected to affect wildlife or wildlife habitat significantly differently than the No Action alternative. This conclusion, however, is based on assumptions necessitated by data gaps and incomplete understanding of plant and animal responses to fluctuating water levels. These assumptions require corroboration with field investigation and periodic monitoring. The monitoring should focus on selected species and habitat parameters that serve as sensitive indicators of ecosystem health. Monitoring is particularly important because the Hungry Horse ecosystem is currently stressed by fluctuating reservoir levels which will continue to fluctuate under the Preferred Alternative. In addition, the repeated drawdown of reservoir elevation to 3539 ft amsl in August, a unique feature of the Preferred Alternative, might over time cause unpredictable effects on habitat and wildlife associated with the headwaters area near Spotted Bear.

The principal data gaps that need to be addressed are effects of fluctuating water levels on wetland plants, and quality of the headwaters area as wildlife habitat. Plant responses to fluctuating water levels can be investigated as part of a monitoring program, described below. Habitat quality currently existing in the upper reaches of the reservoir needs to be investigated to determine occurrence of species sensitive to drawdown, as well as general wildlife productivity. Surveys

should be performed in the headwaters area to determine current abundance of nesting waterfowl and amphibians, and their seasonal use of reservoir–related habitats. Information on amphibians is important because species in this taxon are likely sensitive to slight changes in timing and magnitude of water level fluctuations, but life histories are poorly documented. Diversity (number of species) of waterfowl and amphibia serves as a good indicator of ecosystem health where hydrologic factors play an important role in ecosystem function. The information collected on these taxa could provide part of the basis for long–term monitoring of the reservoir ecosystem.

Monitoring needs to be conducted to assess whether the reservoir ecosystem is degrading further or improving as a result of the Preferred Alternative. Baseline information is also needed concerning plant responses to fluctuating water levels over a gradient of sediment types and water depths. Wetland mapping currently being performed by Flathead National Forest should be facilitated with mitigation funds, and repeated at least at five–year intervals to detect changes in acreage of lacustrine wetland habitats. Changes in occurrence and abundance of hydrophytic plant species should be correlated with weekly water levels to better understand plant sensitivity to inundation, saturation and desiccation. Mitigation funds should be used to facilitate the on–going efforts to re–vegetate exposed mudflats in the vicinity of Spotted Bear. This will require continued coordination among USBR, USFS and Montana FWP.

5.2.4 South Fork Flathead River Below Hungry Horse Dam and Mainstem Flathead River

5.2.4.1 Project–specific Species List

No habitat or impact matrices were completed for the affected environment as hydrologic evaluation indicates no significant differences among the alternatives.

5.2.4.2 Project–specific Assumptions/ Parameters

Due to the extreme daily and monthly fluctuations in flows in the South Fork of the Flathead River below Hungry Horse Dam, analysis of the impacts from the SOS's focuses on numerical comparison of releases from Hungry Horse Dam. Historic data were obtained for the USGS gauge ("near Columbia Falls") located approximately 1.7 miles (2.7 km) downstream of the dam (USGS Water Data Reports, Montana, various years). Flows recorded at this gauge would presumably fluctuate somewhat less than releases at the dam, but are assumed to be a good basis for estimating significance of the alternative simulated releases. Flow fluctuations caused by Hungry Horse Dam dissipate below the confluence of the South Fork with the mainstem, but Clancey and Fraley (1986) report that daily vertical water level fluctuations in the mainstem vary up to 4.6 ft (1.4 km) as a result of Hungry Horse operations.

5.2.4.3 Evaluation Results

A number of the alternatives will produce identical flows. When options with identical flows are grouped together, eight groups can be distinguished:

1a	1b	2c	4c	5b	9a	9b	PA
		2d	9c	5c			
				6b			
				6d			

References to alternatives 2c, 4c (Stable Storage strategy) and 5b therefore refer to the entire group of identical (with regard to effects on flows in the Flathead River below Hungry Horse Dam) alternatives.

Selected historic data recorded from the South Fork of the Flathead River and simulated releases from Hungry Horse Dam are presented in Table 5–3. Average, maximum, and minimum mean flows recorded at the South Fork of the Flathead River for the period 1978–1986 are graphed in Figure 5–3. For the month of June, mean flow ranged from 932 cfs in 1983 to 10,312 cfs in 1981, and averaged over the nine years at 3658 cfs. Although the nine–year average suggests a seasonal pattern, inspection of (1982–1986) yearly data graphed in Figure 5–4 indicate little if any consistent seasonal trend.

Table 5–3. Mean Daily Flows and Mean Daily Releases

Mean Flows (CFS) in South Fork Flathead River, Near Columbia Falls, 1978–1986 (USGS)												
YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1978	5259	4810	532	3847	3393	2664	350	539	2726	2677	1625	1317
1979	2561	7683	7862	4770	371	2151	1289	4637	2934	4125	5863	2392
1980	5657	7381	2886	723	477	237	183	272	4574	2242	2135	3954
1981	2267	3482	5436	1983	2568	3604	4432	3589	10312	3787	1010	3454
1982	6609	3316	3071	4264	2644	4244	7567	3171	2527	5657	1348	836
1983	1211	2147	2854	3712	5016	3695	6615	3980	932	4329	1829	5834
1984	5099	1094	5438	3403	5757	3635	1535	2478	1191	512	3326	4361
1985	3205	1871	4803	6403	6081	4169	741	262	2485	4775	7218	6275
1986	3648	613	5655	5025	2095	595	2098	2917	5242	1783	2852	6507
AVG	3946	3600	4282	3792	3156	2777	2757	2427	3658	3321	3023	3881
78–86 MAX	6609	7683	7862	6403	6081	4244	7567	4637	10312	5657	7218	6507
78–86 MIN	1211	613	532	723	371	237	183	262	932	512	1010	836

Mean Releases (CFS) From Hungry Horse Dam Projected For Various Options												
ALTER.	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
PA 1941	1991	2316	2418	2516	2639	2251	145	145	145	2365	450	2018
PA 1976	1014	145	145	5855	7445	7839	11310	1692	2500	3408	1526	349
PA AVG	1444	1443	1802	3027	4227	5079	10731	2834	2633	5089	1905	1446
1a 1941	1992	2316	2418	2516	2640	2251	145	145	4805	5940	6800	6358
1a 1976	2478	978	5934	8634	8107	4878	3597	2276	2447	1837	1526	7576
1a AVG	3664	1683	3341	5563	4611	4197	4643	1394	2147	1877	3095	7620
1b 1941	1991	2316	2418	2516	2639	2251	145	145	145	474	6800	6275
1b 1976	2014	978	145	11821	11070	5173	3597	2276	2447	1837	1526	7576
1b AVG	2134	2026	2430	6346	5597	4368	5048	1239	1552	1889	3089	8235
2c 1941	1991	2316	2418	2516	2639	2251	145	145	145	4877	7401	4989
2c 1976	4446	978	5883	6728	7134	3556	5870	1692	2500	3408	1526	8859
2c AVG	3432	1801	3520	6006	4522	3168	5465	1962	2095	1946	3676	7050
4c 1941	1991	2316	4333	4891	2639	2251	145	145	145	474	2229	2018
4c 1976	4285	978	6010	11248	5752	4801	145	6869	243	5040	1526	1276
4c AVG	2918	2268	6175	7465	4359	4112	1809	3426	2685	3655	1374	1650

Table 5–3. Mean Daily Flows and Mean Daily Releases – CONT

Mean Releases (CFS) From Hungry Horse Dam Projected For Various Options												
ALTER.	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5c 1941	1992	2316	2418	2516	2640	2251	145	145	4805	5940	6800	6358
5c 1976	2478	978	5934	8634	8107	4878	3597	2276	2447	1837	1526	7576
5c AVG	3664	1683	3341	5563	4611	4197	6135	1328	2245	1361	2977	7504
9a 1941	1991	2316	2418	1523	497	953	145	145	145	4167	6800	2018
9a 1976	1014	145	145	1388	1877	2949	11310	1692	2500	3408	1526	349
9a AVG	1382	1428	1684	2306	2399	3145	12054	7395	2673	4995	6311	1358
9b 1941	1991	2316	2418	2516	2639	2251	145	145	1377	1172	450	2018
9b 1976	1014	145	1219	7365	7445	7839	11310	1692	6800	145	1292	349
9b AVG	1488	1620	1901	3133	4392	5350	10445	2960	3774	3668	4158	1464

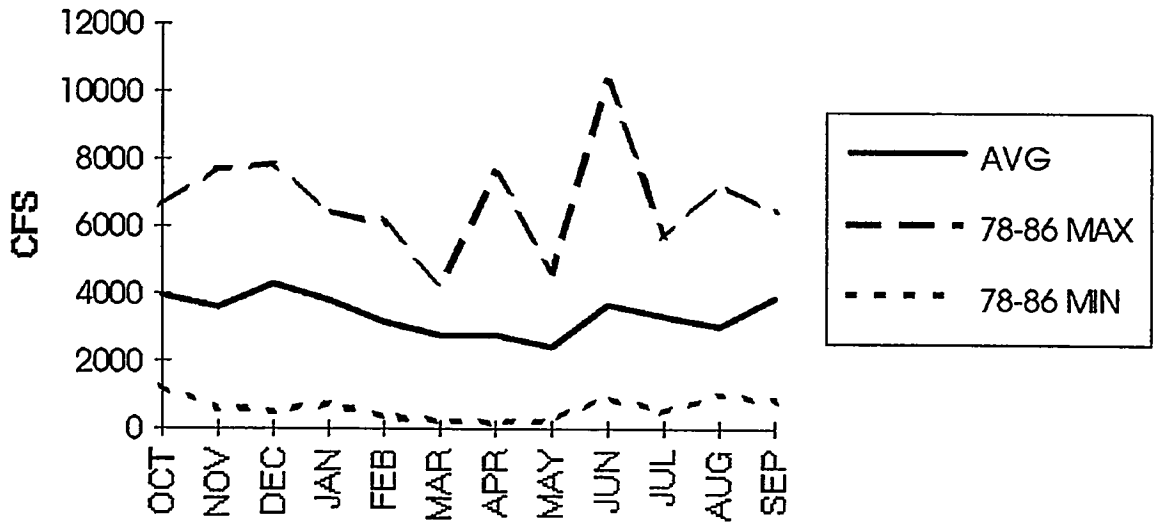

Figure 5–3. Average, Maximum and Minimum Historic Flows (CFS) in South Fork Flathead River, 1978–1986

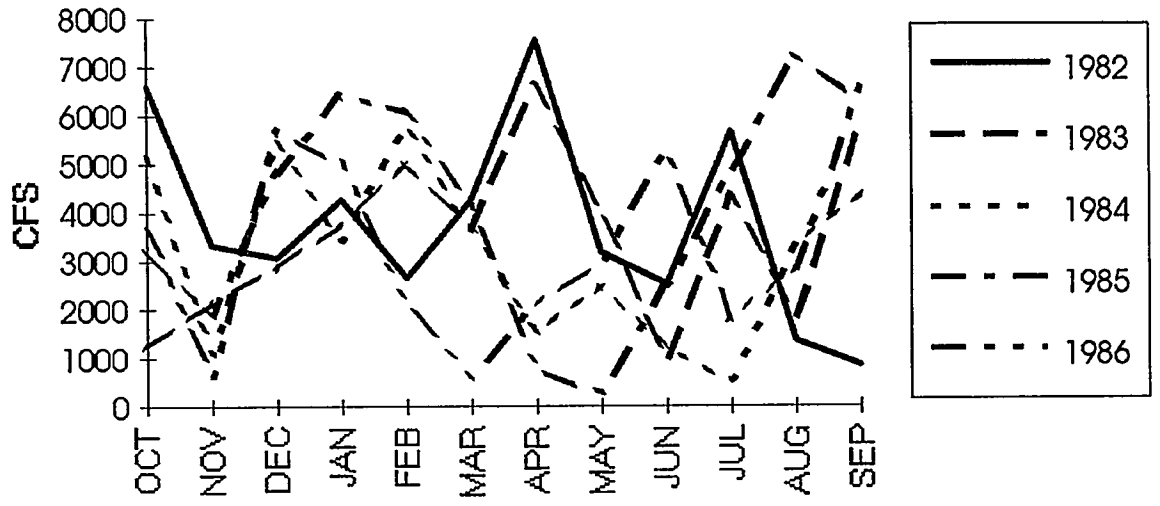

Figure 5–4. Average, Daily Historic Flows (CFS) in South Fork Flathead River, for Month and Year, 1982–1986

During June, 1981, mean daily flows ranged from 100–200 cfs, to greater than 15,000 cfs., fluctuating markedly from day–to–day.

In more recent years, daily fluctuations have lessened, but flows in the south Fork during the course of one–to–several days still typically range from 145 cfs up to about 10,000 cfs. The channel capacity of the South Fork below Hungry Horse Dam is approximately 20,000 cfs, which is rarely if ever achieved (Richard Clark, USBR, personal correspondence). Effects of alternative strategies on wildlife resources in this stretch of the South Fork and on the main branch of the Flathead River depend on frequency of flows greater than 10,000 cfs, rather than changes in monthly averages.

Comparison of 50–year Average Mean Monthly Flows

Fifty–year average mean monthly releases simulated for each of the eight options (some representing groups of identical options) fall into two general patterns. The Preferred Alternative, and alternatives 9a and 9b, exhibit similar 50–year mean flows (Figure 5–5). Under these three alternatives, mean flows peak in April between 10,000 and 12,000 cfs, and drop precipitously in May. All other alternatives produce much lower mean flows in April and (excepting 4c) much higher flows in September (Figure 5–6). Effects of greater April flows on wildlife habitat are discussed further below.

Comparison of 1941 and 1976 Mean Monthly Flows

1941 and 1976 were selected by the Wildlife Work Group as indicators of dry and wet conditions when extremes in flows may most likely occur. In general, 1941 monthly releases from Hungry Horse Dam simulated for all alternatives tend to be substantially less than the 50–year average but no less than the recent historical (1978–1986) ranges for particular months. Releases simulated for 1976, however, do not much exceed the 50–year averages; evidently, high releases from Hungry Horse Dam, regardless of the SOS, would not necessarily correspond to years of unusual wetness (as determined for the entire

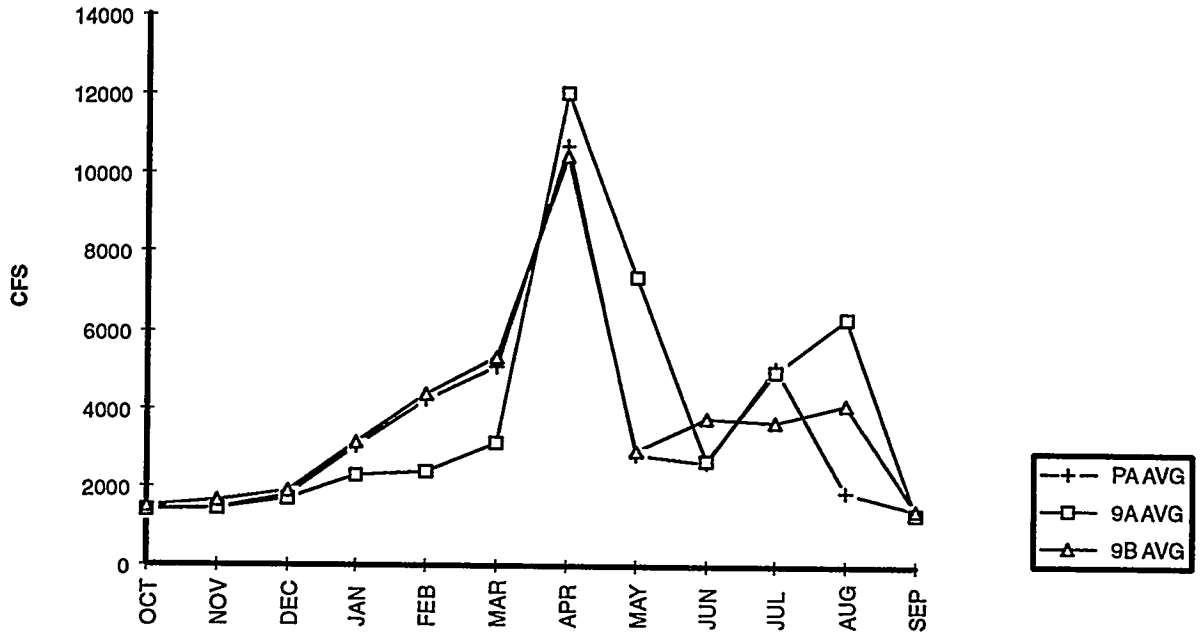

Figure 5–5. Comparison of Average Releases (1929 – 1978) from Hungry Horse Dam, Options PA, 9a, and 9b

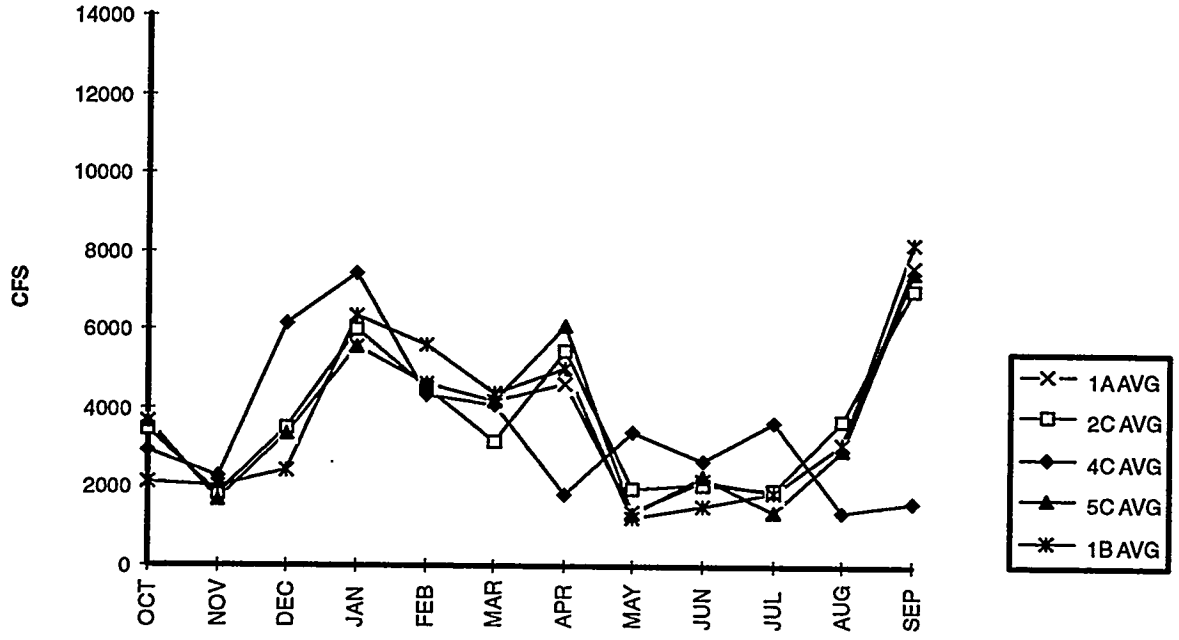

Figure 5–6. Comparison of Average Releases (1929 – 1978) from Hungry Horse Dam, Options 1a, 1b, 2c, 4c, and 5c

Columbia River basin). Nevertheless, even the 50–year average releases simulated for the Preferred Alternative and alternatives 9a and 9b, exceed the recent (1978–1986) maximum April releases. The Preferred Alternative, for example, would release an average of 10,731 cfs in April over the 50–year simulation period, compared to the maximum April release between 1978 and 1986 of 7,567 cfs (occurring in 1982).

The Stable Storage alternative would also release greater amounts of water down the South Fork of the Flathead River during a spring month, but would not increase flows as much as the Preferred Alternative, or alternatives 9a and 9b. The May 1976 release simulated for the Stable Storage alternative, 6869 cfs, exceeds the recent maximum release in May, 4,637 cfs (1979).

Comparison of Average Releases (1929–1978) from Hungry Horse Dam, Options 4a1, 4c, 7b and 7c

Effects of High Mean Monthly Flows

Summary of occurrences of mean flows greater than 10,000 cfs projected for April (either mid–month or entire month), May, June and September from 1929 to 1978 for each alternative grouping;

SOS	10,000–15,000[1]	15,000–20,000	>20,000	Maximum
PA	16(0)	11	2	23,510
1a	18(8)	1	0	18,933
1b	27(14)	1	0	18,933
2c	15(2)	3	2	23,510
4c	6(0)	0	0	14,077
5c	20(8)	3	1	23,510
9a	5(0)	9	27	24,274
9b	13(0)	12	2	23,510

[1]Numbers in parentheses are occurrences in September.

The spring months and September were selected for analysis because most of the mean monthly flows greater than 10,000 cfs occur in these periods, and they represent important times for wildlife. Three sets of alternatives can be distinguished from inspection of occurrences of releases greater than 10,000 cfs: one set consists of alternative 9a; a second set comprises the Preferred Alternative and 9b; all other alternatives comprise the third set.

Alternative 9a would release mean monthly flows greater than 20,000 cfs in 27 growing–season months over the 50–year simulation period. These flows would probably scour vegetation established within the active channel, and inundate riparian vegetation along the channel edge. Overbank flooding might not be extensive, as the maximum release is 24,274 cfs. Over time, alternative 9a would tend to increase the area of exposed sands and cobble and perhaps early successional herbaceous growth.

The Preferred Alternative and alternative 9b would also tend to scour successional vegetation growing within the channel of the South Fork, but would not release flows (greater than 20,000 cfs) that would cause overbank flooding. Thus, the effects on vegetation would be similar to alternative 9a but not as great.

The frequencies of high mean releases resulting from other alternatives would not differ significantly from the Base Case (1a) or No Action (2c). Areas of the channel occurring above the 15,000 cfs zone of inundation would continue to support successional scrub–shrub habitat. Although the Stable Storage alternative produces fewer spring or September months with releases between 10,000 and 15,000 cfs, it produces January flows in this range in nine years. Other alternatives do not produce January releases in this range. The January releases greater than 10,000 cfs produced by the Stable Storage alternative (and 9c) would tend to scour successional vegetation growing within the channel, resulting in about the same habitat mix expected from alternatives 1a, 1b, 2c (including 2d), and 5c (including 5b, 6b and 6d).

5.2.4.4 Data Gaps

Two kinds of information restrict analysis of impact on the South Fork below Hungry Horse Dam. Daily fluctuations in releases from the dam associated with each option compose one important set of needed data. Also important, is information relating river stage with flooded area, as well as characterization of current floodplain habitat.

5.2.4.5 Conclusions

The greater spring releases associated with alternative 9a would tend to scour riparian vegetation along a greater portion of the floodplain compared to other options. Greater area of disturbed floodplain habitat characterized by annual plants and bare substrate could result. The Preferred Alternative and alternative 9b would cause similar effects but not as great. Current daily fluctuations in river flow probably cause similar effects. The over–riding impact of releases from Hungry Horse Dam may result from these relatively extreme daily fluctuations in flow and river stage. If daily fluctuations are similar among alternatives, and remain similar to current practices, none of the alternatives would likely substantively alter wildlife resources of the South Fork below the dam.

5.2.4.6 Mitigation for the Preferred Alternative

The Preferred Alternative is not expected to affect wildlife or wildlife habitat significantly differently than the No Action alternative. As discussed in Section 5.2.3.6, however, this conclusion is based on various assumptions and in the absence of a detailed inventory of wildlife resources associated with the South Fork. The general approach to mitigation described for Hungry Horse Reservoir (Section 5.2.3.6) should also be applied to the South Fork. This involves survey of existing use of the wetland and riparian habitat downstream of the dam, with particular focus on effects of short–term (daily or weekly) fluctuations in river stage. Long–term effects of fluctuating releases (short–term and long–term) on habitat quality need to be monitored. The monitoring program should focus on the effects of higher April releases resulting from the Preferred Alternative as well as continued daily fluctuations. Greater frequency of releases between 15,000 and 20,000 cfs in April may scour successional vegetation more frequently, and interfere with nesting and denning along the higher portion of the river channel. Vegetation and wildlife abundance along the South Fork should be periodically inventoried, using a combination of habitat mapping and density estimates for indicator species such as waterfowl and aquatic furbearers.

5.2.5 Flathead Lake

5.2.5.1 Project–specific Species List

No habitat or impact matrices were completed for Flathead Lake, as hydrologic evaluation indicates no significant differences among the alternatives.

5.2.5.2 Project–specific Assumptions/ Parameters

The analysis assumes that water levels in the extensive lower reaches of the Flathead River (headwaters), where water is backed up by Kerr Dam, are controlled by Kerr Dam and not directly influenced by river flows or releases from Hungry Horse Dam.

5.2.5.3 Evaluation Results

A number of the alternatives will produce identical EOM elevations in Flathead Lake. When alternatives with identical projected elevations are lumped together, seven groups can be distinguished:

PA	1a	2c	4c	5b	9a	9c
9b	1b	2d		5c		
				6b		
				6d		

References to the Preferred Alternative (PA), for example, refer to alternative 9b as well.

The critical portion of the year for wildlife is from April through September. The fifty–year mean EOM elevations projected for these months differ very little among alternatives (Table 5–4). The greatest difference is projected for April, when the Preferred Alternative (including alternative 9b) and alternative 9a provide as much as 1.2 ft higher elevations than other alternatives. This is a small difference in light of the fact that all of the alternatives provide mean lake levels substantially below full pool (2893 ft). In May, alternatives 4c and 9a produce 50–year mean EOM elevations as much as 0.5 ft higher than other alternatives. For the other critical months, June through September, mean elevations differ by less than 0.2 ft. Based on comparison of 50–year mean EOM elevations, the alternatives do not appear to differ significantly from one another or from recent historic operations.

Maximum and minimum EOM elevations projected for a 5–year sequence of dry years (1937–1941) and a 5–year sequence of wet years (1972–1976) are also included in Table 5–4. End–of–month elevations simulated for wet years differ very little among alternatives. Simulations for dry years differ appreciably in only one of the five years, 1941. In 1941, the Preferred Alternative and alternative 9c would not allow Flathead Lake to rise much above 2889 ft, whereas other alternatives would bring the lake up to 2890 (2c and 9a) or full pool (1a, 4c and 5b). This is the only year out of the 50 simulated in which the Preferred Alternative and alternative 9c produce July and August lake elevations appreciably lower than other alternatives.

Inspection of Table 5–4 also indicates that, compared to No Action, alternatives 4c and 1a provide slightly higher lake elevations in May and June during a dry sequence of years. This difference could be minor because 50–year average lake elevations for May and June differ only slightly among all alternatives. To further examine effects of each alternative on spring season lake levels, number of years (out of 50) with end–of–month elevations less than 2890 ft are shown below. Lake levels greater than three ft (elevation 2890) below full pool might adversely affect moisture conditions in wetland environments.

	PA	1a	2c	4c	5b	9a	9c
April	47	49	48	48	48	47	49
May	7	5	7	5	7	3	7
June	0	0	1	0	0	1	1

Alternative 9a produces fewer years with May lake levels greater than three ft below full pool. End–of–May lake levels simulated for all other alternatives would be less than 2890 ft in five or seven years out of fifty, four of which occur between 1955 and 1962.

5.2.5.4 Data Gaps

Analyses were limited by uncertainties concerning effects of occasional years with low spring seasonal lake levels on wetland plants and wildlife dependent on riparian/shallow water habitat.

5.2.5.5 Conclusions

Analysis of 50–year mean end–of–month elevations as well as elevations simulated for dry and wet years indicates little difference among the seven groups of alternatives. Alternative 9a produces three years out of 50 in which end–of–May simulated lake elevations fall more than three ft below full pool. Other alternatives produce five or seven years with low end–of–May lake levels, with four of the

Table 5–4. Comparison of Maximum and Minimum EOM Elevations (Feet) of Flathead Lake During Growing Season

	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER
1978–1986:[1]	2884.4–2886.8(2.4)	2889.2–2892.1(2.9)	892.5–2893.0(0.5)	2892.6–2893.0(0.4)	2892.8–2893.1(0.3)	2891.9–2892.8(0.9)
PA:						
DRY[2]	2883.6–2888.3(4.7)	2887.7–2891.5(3.8)	2888.4–2893.0(4.6)	2889.4–2893.0(3.6)	2888.6–2893.0(4.4)	2892.4–2893.0(0.6)
WET[3]	2884.9–2888.6(3.7)	2890.0–2890.8(0.8)	2893.0(0)	2893.0(0)	2892.7–2893.0(0.3)	2892.8–2893.0(0.2)
50–YR AVG	2887.0	2890.6	2892.8	2892.9	2892.8	2892.8
1a:						
DRY	2883.6–2885.5(1.9)	2889.9–2891.5(1.6)	2893.0(0)	2893.0(0)	2892.7–2892.9(0.2)	2892.7–2893.0(0.3)
WET	2884.9–2888.7(3.8)	2890.0–2890.8(0.8)	2893.0(0)	2893.0(0)	2892.8–2893.0(0.2)	2892.7–2893.0(0.3)
50–YR AVG	2886.0	2890.6	2893.0	2893.0	2892.9	2892.8
2c:						
DRY	2883.6–2886.6(3.0)	2887.7–2891.5(3.8)	2888.4–2893.0(4.6)	2890.7–2893.0(2.3)	2892.9–2893.0(0.1)	2892.4–2893.0(0.6)
WET	2884.0–2888.6(4.6)	2890.0–2890.8(0.8)	2893.0(0)	2893.0(0)	2893.0(0)	2893.0(0)
50–YR AVG	2886.2	2890.6	2892.9	2893.0	2893.0	2893.0
4c:						
DRY	2883.6–2886.4(2.8)	2889.9–2891.5(1.6)	2892.7–2893.0(0.3)	2892.7–2893.0(0.3)	2892.8–2893.0(0.2)	2892.7–2892.9(0.2)
WET	2884.0–2886.5(2.5)	2890.1–2893.0(2.9)	2893.0(0)	2893.0(0)	2892.8–2893.0(0.2)	2892.7–2893.0(0.3)
50–YR AVG	2885.9	2890.9	2893.0	2893.0	2892.9	2892.8
5b:						
DRY	2883.6–2885.5(1.9)	2887.7–2891.5(3.8)	2890.7–2893.0(2.3)	2893.0(0)	2893.0(0)	2893.0(0)
WET	2884.9–2887.1(2.2)	2890.0–2890.8(0.8)	2893.0(0)	2893.0(0)	2893.0(0)	2893.0(0)
50–YR AVG	2886.1	2890.5	2892.9	2893.0	2893.0	2893.0

Table 5–4. Comparison of Maximum and Minimum EOM Elevations (Feet) of Flathead Lake During Growing Season – CONT

	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER
9a						
DRY	2884.7–2888.1(3.4)	2887.7–2891.5(3.8)	2888.4–2893.0(0.2)	2890.4–2893.0(2.6)	2892.7–2893.0(4.3)	2892.4–2893.0(0.6)
WET	2884.0–2887.9(3.9)	2890.1–2893.0(2.9)	2893.0(0)	2893.0(0)	2893.0(0)	2893.0(0)
50–YR AVG	2887.1	2891.0	2892.9	2892.9	2893.0	2893.0

(1) HISTORIC END–OF–MONTH ELEVATION

years occurring relatively close together, between 1955 and 1962. The effects on wetland vegetation resulting from occasional years with May lake levels below 2890 ft, are difficult to predict. The effects would probably not be great because June levels almost always exceed 2890 ft, and intervening years occur with higher May levels. If wildlife were adversely affected in these years, changes in population numbers of affected species would not likely exceed 5 percent. The possible benefit derived from alternative 9a, which produces fewer years with May lake elevations below 2890 ft, is therefore considered insignificant.

5.2.5.6 Mitigation for the Preferred Alternative

The Preferred Alternative is not expected to affect wildlife or wildlife habitat significantly differently than the No Action alternative. No mitigation measures are recommended for this area other than those associated with Hungry Horse Dam (Sections 5.2.3.4 and 5.2.4.4).

5.2.6 Flathead River Below Kerr Dam

5.2.6.1 Project-specific Species List

No habitat or wildlife matrices were developed.

5.2.6.2 Project-specific Assumptions/ Parameters

The analysis was restricted to inspection of simulated releases from Kerr Dam and assumes that higher releases tend to inundate a greater portion of the river channel and flood plain.

5.2.6.3 Evaluation Results

A number of the options will produce identical or essentially identical flows. When options with identical releases are lumped together, nine groups can be distinguished:

PA	1a	1b	2c	4c	5b	9a	9b	9c
			2d		5c			
					6b			
					6d			

Inspection of 50-year averages graphed in Figures 5-7 and 5-8 indicates that although the options are very similar, essentially two sets can be distinguished: one comprising the preferred alternative (PA) and two of the settlement discussion alternatives (9a and 9b); the second comprising all other alternatives. The first set produces lower releases in December and January compared to the second set, and then comparatively higher releases in April and May.

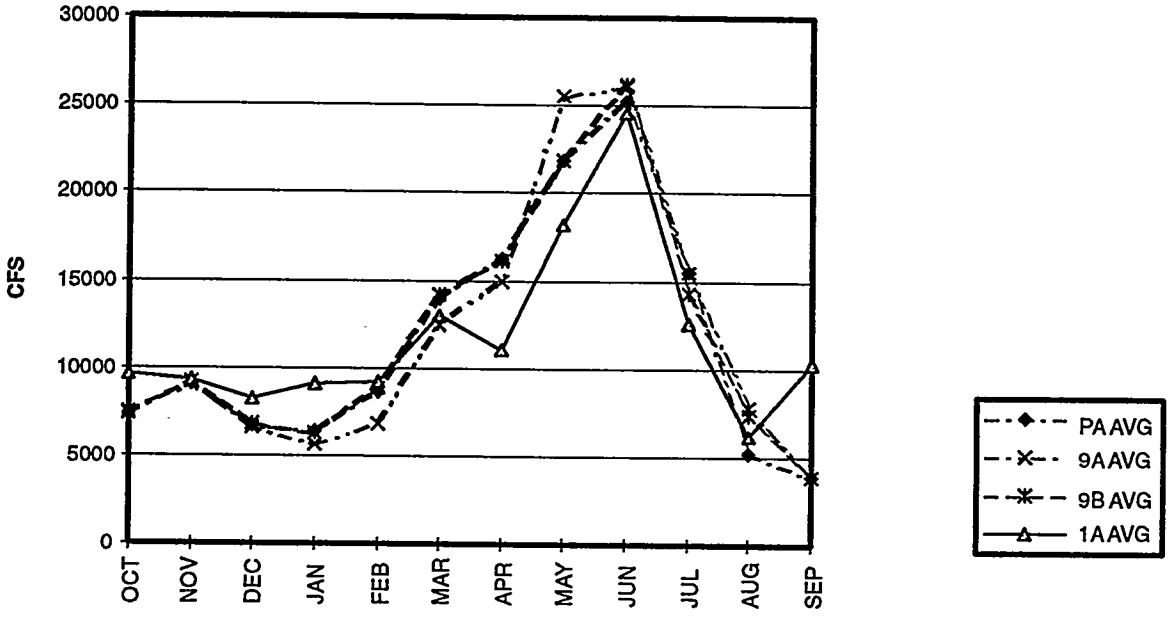

Figure 5-7. Releases from Kerr Dam Simulated for Options PA, 9a, 9b and 1a

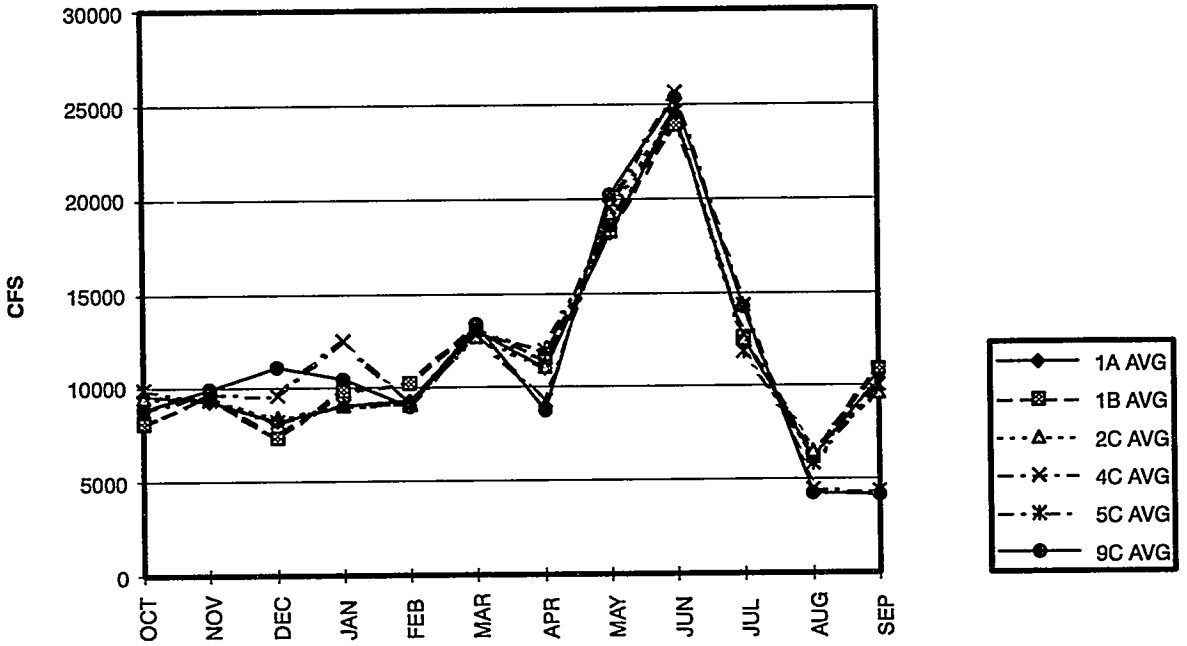

Figure 5–8. Releases from Kerr Dam: Options 1a, 1b, 2c, 4c, 5c and 9c

Spring flows resulting from the Preferred Alternative and alternatives 9a and 9b will inundate a larger cross–section of the channel in April and May compared to existing operations (1a). The mean June releases from all alternatives do not differ much from existing operations. The markedly higher May flows resulting from alternative 9b approach the magnitude of June releases, and would therefore tend to prolong the period of wetness in shoreline habitats. Increased duration of inundation or soil saturation would favor a wetter mix of vegetation types. The April and May flows resulting from the Preferred Alternative and alternative 9a would be greater than existing operations, but still tend to remain lower than June flows. These two alternatives might also increase wetness of riparian habitats but affected areas might consist principally of exposed gravel bars and shoreline sediments.

The higher April and May flows resulting from the Preferred Alternative and alternatives 9a and 9b would affect acreage of gravel bars which are used by Canada geese for brooding. Matthews et al. (1986) reported that "high flows" of about 29,000 cfs inundated 99 and 96 percent of the gravel bar–herbaceous and gravel bar–shrub habitat available at "moderate" flows (12,900 cfs). Their studies were conducted at Buffalo Bridge, located roughly twelve miles downstream of Kerr Dam.

The effects of higher spring flows on nests and dens located near the water line are difficult to predict because flooding and land–bridging impacts result from flows that may last for only a few hours or days. At high levels, flow in the lower Flathead River can fluctuate markedly over a period of several days. In June 1991, for example, releases from Kerr Dam dropped from 38,400 cfs to 10,600 cfs over a period of seven days. This magnitude of fluctuation may largely control the effects of releases from the dam on wildlife habitat. If the short–term fluctuations are not affected by SOR, as is assumed, then the effects of each alternative System Operation Strategy on wildlife may not differ significantly.

Mean monthly releases from the second set of alternatives (1a, 1b, 4c, 5c, 9c and 2c) differ very little from existing operations (1a) and No Action (2c) (Figure 5–8).

No apparent patterns are exhibited among alternatives in wet (1976) and dry years (1940 and 1941). Under all alternatives, mean monthly flows vary from year to year, although wet years generally produce higher flows than the dry years in the critical months of April through September.

5.2.6.4 Data Gaps

Lack of information restricts analyses of impacts on wildlife resources associated with the Flathead River below Kerr Dam. Of principal importance are means to estimate area of inundated floodplain as a function of river flow, and quality of existing riparian habitat.

5.2.6.5 Conclusions

The Preferred Alternative and alternatives 9a and 9b will increase releases from Kerr Dam in April and May, compared to existing conditions and no action. The increased early spring releases resulting from alternative 9b may favor gradual conversion of riparian habitat to wetter vegetation types. The Preferred Alternative and alternative 9a would also tend to increase wetness of riparian habitat but possibly with no change in vegetative composition. The magnitude of any benefits or impacts would depend on a number of factors including morphology of the river shore and frequency and magnitude of daily flows. Magnitude of impacts cannot be estimated without additional information. No significant differences were identified among the basecase (1a), No Action (2c), and remaining options (1b, 2d, 4c, 5b, 5c, 6b, 6d and 9c.

5.2.6.6 Mitigation for the Preferred Alternative

Assumptions and uncertainties associated with assessment of impacts of the Preferred Alternative on the Flathead River ecosystem below Kerr Dam require acquisition of additional information and monitoring. The general approach of recommended studies and monitoring would be similar to that described for the South Fork of the Flathead River (5.2.4.6).

5.2.7 Albeni Falls Project

5.2.7.1 Project-specific Species List

The indicator species listed in Table 3–3 (Project Wildlife Matrix) has been modified to better represent local conditions. The modifications include:

Deleted	*Because*		
1. Black–necked stilt 2. Elk 3. Big–horn sheep	1. Do not occur in project area 2. Do not occur in project area 3. Do not occur in project area		
Selected or Added	***To Represent Category***	***Instead of***	***Because***
1. Bank swallow 2. White–tailed deer 3. Bald eagle	1. Colonial Nesting Birds 2. Big Game/Deer 3. T&E/Raptors	1. Gulls	1. Occur more frequently

5.2.7.2 Project-specific Assumptions/ Parameters

- The barren zone for most alternatives is based on the winter low elevation of 2049, which was the normal summer elevation prior to construction of Albeni Falls Dam. Construction of Albeni Falls Dam drowned all vegetation between elevations 2049 and 2062.5 – a total of 6617 acres. This zone is mostly barren when exposed (although some aquatic plant beds are uncovered as lake levels drop), and includes about 300 acres that were above elevation 2062.5, which have eroded away since the project has been in operation. The shoreline continues to erode at a rate of about 15 percent per year.

- Acreage figures include:

riparian*	1,341 acres
emergent*	2,196 acres
submergent*	8,245 acres
island**	1,000 acres

* 1988 Albeni Falls Wildlife Mitigation and Enhancement Plan prepared for Bonneville Power Administration by the Idaho Department of Fish and Game.

**Estimated based on aerial photography.

5.2.7.3 Evaluation Results

Under the current operation of Albeni Falls Dam, the reservoir is held at a summer elevation of 2062.5 ft. As explained in chapter 2.2.5, this is much higher than the natural lake elevation during the summer months, and this higher summer level drowned over 3000 acres of wetlands. Under this current operation, lands continue to erode and wetlands continue to be lost. Thus, the WWG feels that a summer reservoir elevation somewhat less than 2062.5 is desirable to allow restoration of lost habitats. Higher winter reservoir elevations would benefit fish resources, as well as aquatic beds, which would benefit wildlife in the long term. Alternatives which would result in unstable reservoir elevations in either the winter or summer, or lower winter elevations, would adversely affect wildlife.

Alternatives are grouped based on 50–year average end–of–month reservoir elevations. This results in six different groups: group 1 includes alternatives 1a, 1b, 2c, 2d, 5b, 5c, 6b, and 6d. The other "groups" are all individual alternatives, and are referred to by their numbers. Table 5–9 shows the 50–year average end–of–month elevations at Albeni Falls for each alternative.

Matrix Discussion

Physical Habitat Matrix. The drawdown zone acreage is based on the lowest winter elevation achieved for each alternative. According to the authorizing document, there is a difference of 6300 acres between the elevations of 2049 and 2062.5. Therefore, the drawdown acreage at 2049 ft is 6300 acres. To simplify calculations, we assume a reservoir with perfectly sloped sides, so that for each foot of elevation gain there will be an equal number of acres. Thus, we divide 6300 by 13.5 ft to find that there would be a gain of 466.7 acres for every foot of elevation gain. Alternatives 1a, 1b, 2c, 2d, 5b, 5d, 6b, 6d, and PA all achieve a low winter pool elevation of 2051 ft. To calculate the drawdown acreage at elevation 2051 we multiply 466.7 acres by 2 ft elevation gain to find a gain of 933.4 acres. This is subtracted from 6300 acres (since the barren zone is smaller at the higher elevation), to arrive at a barren zone acreage of 5367 at elevation 2051'. The same method is used to calculate the barren zone acreage for the other alternatives. Alternative 4c has a winter minimum of 2055.3 ft, resulting in 4293 acres of barren zone. Alternatives 9a, 9b, and 9c each have winter drawdowns to 2056, resulting in a barren zone of 3967 acres.

Under current operations (Group 1 alternatives, which include the Preferred Alternative), riparian habitat covers 1341 acres, emergent wetlands cover 2196 acres, aquatic plant beds cover 8245 acres, and islands cover 1000 acres. These figures were obtained by measuring from aerial photographs

Under alternative 4c, all of the plant communities are expected to expand (see detailed discussion under the impact section following): The riparian com-

munity would be expected to increase to 1959 acres; the emergent wetlands would be 2744 acres; and aquatic plant beds would be 8300 acres. Island area too would grow to 1185 acres, based on the assumption that with a stable and lower summer reservoir, the plant communities would also expand down around the base of the islands (currently inundated during summer by the reservoir), and stabilize their shorelines. This would further enhance the ability of the delta islands to collect sediment.

Under alternative 9a, the summer pool ramps down and expands the barren zone earlier in the year than any other alternative. This is not considered to be a negative effect on existing wetland communities, though in the long–term it may contribute to accelerated erosion of lake bed sediments. Because of the continual dropping of the reservoir during the growing season, wetland (riparian and emergent) communities are not expected to expand. Thus the acreages shown in the matrix are the same as for group 1 alternatives.

Aquatic plant beds may expand due to the higher winter reservoir elevations, and the acreage shown in the matrix (8325) reflects this positive effect. The expansion of islands shown in the matrix is artificial growth, based mainly on the summer drawdown, which causes an expansion around the base of the island.

Alternative 9b has the identical winter operation as 9a. This is reflected in the expanded area of aquatic plant beds. The alternative also results in lower summer reservoir elevations that would be slightly higher than alternative 4c. Thus an expansion in riparian, emergent, and island communities is expected, similar to the 4c expansions.

Alternative 9c has the identical minimum winter pool as 9a and 9b, and thus also has the expansion in aquatic plant beds to 8325 acres. This alternative has a consistent, fairly high summer reservoir – .5 lower than the group 1 alternatives. In the long–term, this slightly lower summer elevation is expected to result in a slight expansion of riparian, emergent, and island communities as compared to current acreages.

Wildlife Impacts Matrix. The alternatives are grouped in three groups based on expected impacts to wildlife. Alternatives 1a, 1b, 2c, 2d, 5b, 5c, 6b, 6d, and PA all represent current operations and would not result in either impacts or benefits to wildlife. Thus the matrix shows zeroes in all boxes.

Alternatives 4c, 9b, and 9c each have positive effects, because of the expected expansion of all habitat types. In all cases, the expansion is less than 33 percent, so the score is 1 in most cases. The scores given for the drawdown zone are based on an expectation that the drawdown area may actually be smaller in the long term, and thus would be a negative effect on animals that feed in the drawdown zone. Benthic invertebrate and fish productivity are expected to improve under these operations, and thus would benefit animals that prey on these resources. Human use of the reservoir may drop with a lower summer reservoir elevation, thus lowering the encounters between humans and animals. Thus, animal productivity should be improved, if only slightly.

Alternative 9a would expand the aquatic plant beds, but little else. Thus benefits would accrue to those species that depend on the aquatic plant beds, including benthic invertebrates and fish, and predators on those resources. Human use would decline with the much lower summer pool, and human encounters with animals would also decline.

Physical Habitat Impacts

Group 1 maintains the current operation and would not change the effect on wildlife or wildlife habitats as compared to existing operations. However, the current operations do result in continued loss of habitats, particularly of marshes and swamps in the Clark Fork and Pack River deltas.

Alternative 4c would implement a "ramping down" of the summer pool, from a high of 2062.5 in June, to 2061.4 in July, and 2060 in August and September. This operation would more closely mimic the natural lake condition, and should arrest the erosion currently on–going in the delta areas. This operation should also allow restoration of wetland habitats all around the reservoir (in appropriate places), as the ramping is slight, and certain species of plants would be tolerant of these changing water conditions. In addition, the winter elevation is about four ft higher than under current operation, which will benefit resident fish (see appendix K for more detailed discussion) and aquatic

plant beds, further benefiting wildlife in the long run. Aquatic plant beds would benefit by having a smaller area exposed to winter ice and desiccation, and thus more of the beds would remain underwater, and would be somewhat protected from desiccation.

Alternative 9a would lower the summer elevation to a greater extent than 4c, similarly ramping down, all the way to 2055.5 in August. This would aid wetland habitat restoration, though it is unclear what effect the ramping would have on restoration efforts. The continual, fairly severe dropping of reservoir elevation might make establishment of plants an impossibility, as plants at a higher elevation would soon be high–and–dry, and plants at lower elevations would be inundated early, and left to dry out later. This alternative would also result in higher winter elevations, but would fluctuate between month–to–month. This wintertime operation would adversely affect resident fish, but its effect on aquatic plants is positive, though the extent is unknown. On the one hand plants would be protected from desiccation by the higher pool but, because of the fluctuations, the protected areas would be exposed from time–to–time, thus negating the positive effects. On the whole, it appears that the lowest winter elevation is still higher than that in alternative 4c and may actually result in a greater expansion of plant beds than in 4c.

Alternative 9b could be likened to a hybrid of 4c and 9a, differing from 4c in having an inconsistent but slightly higher winter pool (as with 9a). The alternative has the fairly consistent, but slightly higher summer operation of 4c, and therefore differs from 9a in that regard. As a result, this alternative is better for habitat development and wildlife than 9a, but the winter operation, as with 9a, is difficult to accurately assess due to the fluctuations, which likely would have negative effects. Yet, the fact that even the lowest winter elevation under these operating strategies are higher than that under 4c may mean that these would result in slightly improved conditions for aquatic plant beds.

Alternative 9c is similar to 4c, in providing for a consistent, high winter pool, but differs by dropping pool elevation slightly in April. Pool elevation then nearly reaches the high pool, represented by Group 1 alternatives during the summer (but stays at 2062 in July and August instead of 2062.5). Thus this alternative is an improvement over Group 1 alternatives, with improved conditions for aquatic plant survival during the winter, and slightly better conditions for wetlands during the summer. However, this alternative is not as good as 4c or 9b during the summer.

Alternative PA: This alternative closely mimics Group 1, with one minor exception: the pool is raised from 2051.5 in February to 2056 in March. This difference probably has no bearing on habitats or wildlife around Lake Pend Oreille and, for purposes of impact analysis, is considered to have no impacts, as with Group 1.

Wildlife Impacts

Group 1 and the PA are considered to have no impacts to wildlife. Alternatives 4c, 9b, and 9c should all result in benefits to wildlife in the long–term through expansion of aquatic plant beds, and a projected increase in wetland and riparian habitats around the lakeshore. Of these, Alternative 4c would have the greatest wetland benefits, while the increase in aquatic plant beds may be approximately the same with all three alternatives. Wildlife species benefiting from the enlarged plant beds include redhead ducks and tundra swans, among other species of waterfowl. Many animals would benefit from an increased acreage of emergent and riparian habitats, including muskrats and other aquatic furbearers, Canada geese, mallards, bald eagles, blackbirds, rails, and other songbirds.

Alternative 9a would result in an expansion of aquatic plant beds, and improved conditions for redhead ducks and tundra swans. However, the continuous drawdown during the summer months would likely result in the loss of additional acreage of emergent, riparian, and delta island habitats, thus adversely affecting wildlife populations that depend on these habitats (all those mentioned in the above paragraph, as well as white–tailed deer, and other terrestrial animals). Ospreys, bald eagles, other hawks, and great blue herons may all be adversely affected if existing and potential nest trees are lost to erosion.

Threatened and Endangered Species

Only one of the species listed in Chapter 2 for Albeni Falls Project (bald eagle) is somewhat dependent on the habitats in an around Lake Pend Oreille, and thus may be affected by changes in reservoir elevations. Some of the other species may occasionally be found around the lake, but are rarely resident and are not expected to be affected by changes in the reservoir. The triangular–lobed moonwart is found in a wetland not associated with Lake Pend Oreille, and thus would not be affected by changes in lake elevations.

Group 1 and the PA will not affect threatened or endangered species. The other alternatives (except for 9a) would all increase wetland and aquatic habitats, and should benefit those threatened and endangered species found near the shore of Lake Pend Oreille. Alternative 9a would negatively affect riparian, emergent and island habitats, and thus could have an adverse effect on bald eagles, through diminution of prey base and potential loss of nest trees.

5.2.7.4 Data Gaps

Lack of Lake Pend Oreille bathymetry prevents analysis of the effects of various reservoir elevations on the extent of aquatic plant beds. It is expected that a higher winter reservoir elevation would result in an expansion of aquatic plant beds; on the other hand, it is possible that lower summer reservoir elevations may result in a shrinking of the aquatic plant beds. The magnitude of the effects of these various changes is unknown. For emergent and riparian habitats, predictions on projected expansion of these areas is based on the knowledge that prior to construction of Albeni Falls Dam these habitats were far more extensive. This appendix therefore assumes that a lower summer reservoir elevation would allow restoration of some of the lost habitats. However, the loss of topsoils through erosion makes restoration an uncertainty. Further, the extent of restoration potential is unknown, given the uncertainties involved (although the maximum that could be restored under various alternatives with ideal circumstances can be and is predicted in the matrices).

5.2.7.5 Conclusions

Alternative 4c would result in the greatest benefits to habitats and wildlife, by providing an opportunity for expansion of wetland plant communities. Alternatives 9b and 9c would also result in benefits. Group 1 alternatives and the Preferred Alternative would result in no effect on wildlife, while alternative 9a would adversely affect emergent and riparian habitats, but may result in improved conditions for aquatic plant beds.

5.2.7.6 Mitigation for Preferred Alternative

As the preferred alternative is virtually identical in operation to the existing operation, no mitigation is necessary or proposed for this project.

5.2.8 Grand Coulee Project

5.2.8.1 Project–specific Species List

The indicator species listed in Table 3–3 (Project Wildlife Matrix) has been modified to better represent local conditions. The modifications include:

Deleted	*Because*		
1. Shorebirds 2. Terrestrial furbearers 3. Reptiles 4. Big–horn sheep	1. Not essential to adequate evaluation 2. Not essential to adequate evaluation 3. Not essential to adequate evaluation 4. Do not occur		
Selected or Added	***To Represent Category***	***Instead of***	***Because***
1. Bank swallows 2. Bald eagle	1. Colonial Nesting Bird 2. T&E/Raptors	1. Gulls	1. Occur more frequently, and are more affected by landslide erosion from hydrosystem operations

5.2.8.2 Project-specific Assumptions/ Parameters

- Inspection of dry year data suggests that 1941 elevations for Grand Coulee Project were not typical. Thus, the end year for the dry–year cycle was not used. To estimate drawdown impacts dry periods were based on the lowest monthly elevation within the total five year dry cycle (between 1937 and 1941). The lowest elevation in the wet year (1976) was used to estimate impacts of dry years. Because Grand Coulee refills each year, there appears to be no cumulative effect of a period of dry years on reservoir elevations.

- Drafting at Roosevelt Lake under the No Action alternative (2c) conditions can be seasonally distinct and severe between 30 and 50 feet between December and May.

- Beyond a certain minimal level of drawdown in storage reservoirs, additional drafting has little added impact because habitats and dependent wildlife are already substantially separate from the benefits of the water body. It was assumed that any drafting greater than 7 feet of elevation from full pool would cause significant adverse effects.

- Computer models showed that under some alternatives drawdowns would occur twice in one year, sometimes as frequently as once in every 3 years. Frequency of double drawdowns were considered in the impact rating.

- Time of year of drawdowns was considered because March to August drawdowns would impact plant growth along reservoir edges and some riparian areas more than drawdown in winter.

5.2.8.3 Evaluation Results

Physical Impacts

A comparison for drawdown conditions for all alternatives is presented in Table 5–5.

Impact considerations focus on 1) the overlap between drawdown occurrences with spring and summer habitat use by wildlife and 2) the occurrence of double drawdowns. Under existing conditions, drawdowns create a substantial barren zone that distinctly separates water habitats from upland habitats. The barren zone can be a barrier to many species of wildlife that must cross it to get to water. It can also impact the growth of many plant species that are commonly associated with the moist land–water interface. Drawdowns also contribute to landslide erosion on the banks of Roosevelt Lake by wetting the soil which accelerates soil movements as water levels lower. Double drawdowns exacerbate land sliding by rewetting soils that have dried after drawdowns. Rapid drawdowns are also considered in physical impacts in relation to slope stability. Temporary development of vegetation could occur in portions of the drawdown zone during periods of extended drafting but are not expected to recover to vigorous growth within the year, leaving opportunities for weedy or habitat altering species.

At Roosevelt Lake, the scarce riparian and wetland habitat is generally concentrated in shallow, gently sloping, upper reservoir areas such as those of tributary streams and embayments characterized by silt accumulation. When water level changes occur over a 4 or 5 month period, succeeding stages of drawdown pull the water line away from these gently sloping wetland habitats. This can happen so slowly on these gently sloping sites that no impacts would be experienced. Greater stress on vegetation would occur from water level that remains low during drier summer and fall months, than during spring months, and from rapid water level withdrawals.

Emergent wetlands are more dependent on reservoir related water levels than riparian areas. Emergent wetlands are generally found in embayments that are directly dependent for hydrology on the reservoir. These areas are estimated to decrease by 5 to 10 acres from a total of 230 acres under some alternatives. A decrease in extent of emergent wetlands could occur under alternatives with extended periods of drawdowns, double drawdowns and rapid water level drops.

Table 5–5. Drawdown Conditions Under Seven Columbia River Operation Options, Grand Coulee Dam (Lake Roosevelt)

System Operation Option	Average Yearly Drawdown/ Months	March to August Drawdown Months	50 - Year Drawdown Frequency (% of Years)				Frequency of Double Drawdowns (% of years)
			Spring (April)	Summer (July - August)	Fall (Oct - Nov)	Winter (January)	
SOS 2c (1a, 1b) (No Action)	4.5	3.0	100	0	0	74	0
SOS 2d	4.2	3.5	100	19	0	4	10
SOS 4c (Stable Storage Operation)	5.1	3.1	100	0	0	100	0
SOS 5b	4.5	2.9	100	0	0	74	0
SOS 5c, (6b), 6d	4.5, 4.6	3.9	100	0	0	76	0
SOS 9a	7.0	4.4	93	70	57	18	38
SOS 9b	5.8	4.0	90	58	37	6	10
SOS 9c	5.5	7.5	2	60	0	1	10
SOS PA	5.8	4.7	98	66	2	10	12

A late summer drawdown during August that follows the vegetative growth period would have little impact on vegetation. Water level drops in fall that follow a return to full pool constitutes a second yearly drawdown. A double drawdown will increase the incidence of landslides and erosion on more steeply sloping shoreline areas by resaturating banks, followed by lowering water levels. Increased landslide activity would reduce bank habitat used by bank nesting birds. An annual early spring drawdown from March to May could adversely impact early spring vegetation by slowing growth. Impacts to later successional vegetation are not known and may be detrimental.

Riparian areas are more dependent on water from precipitation, snow melt and ground water discharge. Soil moisture recharge from tributary streams supports riparian habitat in some areas and could offset drawdown effects. Riparian areas adjacent to Roosevelt Lake are expected to decrease by as little as 5 acres under all water year conditions, from a total of 25 acres, as a result of the extended drawdowns. The impact would be greater if the riparian stands were directly dependent on reservoir water levels.

SOS 2c, 1a, 1b, 5b, 5c, 6b, 6d

SOS 2c represents the Current Operation, there are six alternative operation strategies that are similar to it. Under these alternatives the extent of the barren zone, seasons of drafting, rates of drafting and a single drawdown occurrence per year are identical.

Under existing conditions and under the six similar alternatives, the maximum drawdown period would be 6 months. Full pool elevation is 1,290 feet and drafting depth is approximately 52 to 70 feet. The rate at which water is lowered occurs within a 3 month period.

Drawdown occurs between January and May and is seldom evident in changes of extent of the barren zone. Existing daily drawdown is approximately 1.5 feet, water flows out almost as fast as it flows in once drafting has occurred The daily water level fluctuations are not expected to change with any alternative.

No double drawdown occurs.

Under these alternatives the extent of the barren zone and other aquatic habitats were estimated to remain the same with no difference in impact or extent.

SOS 2d

The extent of the barren zone is similar to existing during wet, dry and average years. Full pool elevation remains at 1,290 feet during the summer months and 1,288 feet during the winter months.

Drawdown occurs primarily between February to May. With less frequent drawdowns during wet years. A 46 foot drop in water level occurs within a 4 month's time between January to April.

Double drawdowns would occur more frequently (once in seven years) during dry regimes and once in twenty years during a wet regime.

Under this alternative the barren zone and other aquatic habitats are not expected to change substantially. Limited widening of the barren zone would occur after the years that experienced a double drawdown. Impacts to emergent and submerged habitats would be expected over the short term.

Submerged vegetation beds would be negatively impacted by the double drawdown and those areas could experience reduced vegetation growth.

SOS 4c

Under this alternative the full pool elevation is lowered to 1,288 feet, 2 feet lower than existing full pool elevation of 1,290 feet. With seasonal drafting the extent of the barren zone is reduced by half during average and dry years but remains near the existing acreage during wet years.

Drawdown occurs between Jan and May returning to full pool in June. Lowest elevations are 2 feet higher than existing. Average yearly pool elevations would be between 1,256 and 1,288 feet and would drawdown 32 feet in elevation. Spring drawdown levels are predicted to be 10 to 20 feet higher than currently established.

Although average difference in water level equals 32 feet, the absolute difference can be as great as 60 feet. All years would experience an average 32 foot drop in water level that would occur over a period of 3 months during February to April.

There are no double drawdowns predicted under this alternative.

Short term impacts would be experienced by most aquatic habitats during the first year with a lower full pool.

Overall, the barren zone is expected to decrease by 40 percent under this alternative during average and dry years. The barren zone would remain the same during wet years.

Landslide activity would decrease with higher, stable water levels.

Emergent wetland acreage is estimated to increase as the barren zone is reduced. Emergent wetlands are generally located in areas with shallow gradients. Because water levels would recede slowly, over four months, and because the shallow gradient would retard receding ground water levels, there is not expected to be an adverse impact to emergent wetlands.

Riparian habitats are not expected to be influenced by water level changes, and should benefit from higher water levels during dry and average years. They would remain unchanged during wet years because the primary source of water for these riparian areas is precipitation.

Submerged beds would also increase because water levels would be higher than existing.

SOS 9a

Under this alternative full pool elevation would remain at 1,290. Drawdowns would be maintained for 7 months out the year. Land bridging during this time is expected. The barren zone would increase during wet years and remain near normal during average and dry years. Yearly average pool elevations would be between 1,236 and 1,285 feet.

During December, Jan, Feb. and June the reservoir would experience full pool conditions, the other

months would experience drawdown conditions. Some years would experience 49 foot drop in water level within one month's time.

A double drawdown would occur 38 percent of the time (approximately once in three years).

Landslide activity would be increased by the double drawdown. Higher water levels during many years are lower than existing and drawdown is estimated to occur rapidly, within a one month time period.

The barren zone extent is estimated to be approximately the same as existing with small decreases during average and dry years that are interspersed evenly throughout the fifty years of modeling.

Emergent wetlands, submerged beds and riparian areas are expected to be adversely impacted by the double drawdown that occurs approximately every three years. The drawdowns would also occur rapidly, within one month's time during some years, resulting in a rapid removal of water resulting in a negative impact to soil stability and vegetation.

SOS 9b and 9c

These two alternatives are similar in conditions. Full pool elevation would remain at 1,290 feet. A difference in elevation of 49 to 50 feet would occur over a period of 1 to 3 months.

On average the months of March to May and July to October would experience drawdowns under 9b while the months of February to May and Aug. to Sept. would experience drawdowns under SOS 9c. Drawdowns would occur rapidly over the spring (within 1 month) and they would occur over 3 month's time during the fall.

Drawdowns would remain on average 6 months out of the year and double drawdowns would occur at a frequency of once in ten years.

Barren zone extent for these alternatives would remain the same for most years.

Vegetation in submerged and emergent areas would be negatively impacted by the double and rapid spring drawdown.

Riparian areas are estimated to remain unchanged.

Preferred Alternative

Full pool elevation would remain at 1,290 feet. The lowered water level, of 50 feet, would remain for a period of 1 to 3 months over the spring. During some years water level drops approximately 60 feet in 2 months.

On average the months of March to May would experience drawdowns that occur over a 2 month time period, with additional drawdowns during August to September in some years. The double drawdown is predicted to occur once in seven years during dry climatic conditions and once in ten years during wetter regimes.

Drawdowns would remain, on average, 7 months out of the year during dry years and 4 months out of the year for wetter years. Double drawdowns would occur at a frequency of 8 percent.

The extent of the barren zone is not expected to change.

Emergent, submerged and riparian areas are expected to experience negative impacts from the rapid withdrawal of water from those habitats. Years with rapid water level changes are sporadic and recovery to these areas would be slow if these water changes are repeated in consecutive years.

Wildlife Impacts and Alternatives

When the barren zone is extended from increased drawdowns a negative impact to many wildlife species would be experienced. Vegetative cover provides security from predators and for animals that are thermally–sensitive like amphibians and reptiles.

Waterfowl

Low water levels not only increase the extent of the barren zone but also can produce land bridging to once isolated islands. Changes from these alternatives are not expected to significantly affect important habitat types, since islands are essentially uplands, but may affect wildlife use of islands. Approximately 98 percent of all Canada Goose nests are on the ground on islands. Easy access by preda-

tors can be detrimental to these goose populations as well as other waterfowl that use islands for nesting and rearing young. Waterfowl abundance and production at Roosevelt Lake is already constrained by substantial spring drawdowns.

Colonial Nesting Birds

Riparian habitats that provide nesting sites for colonial bird species such as the Great Blue Heron are not expected to be impacted.

Vertical banks along the shore of Roosevelt Lake are used by bank swallows for nesting sites that are 4 to 20 feet above the High Water Level. Water levels that impact these nesting sites be causing erosion or slumping of the banks can be detrimental to these species of bank–nesting birds.

Nongame Birds

Non–game birds can be negatively impacted by water levels that affect emergent and riparian vegetation during the growing season because these habitats provide food, cover and nesting sites for many of these species. A long term decline of emergent wetlands and riparian areas would impact red wing blackbirds and yellow warbler that use these areas for nesting and fledging.

Raptors

Impacts to fish production in turn impacts food supplies for raptors.

Big Game

Big game species are less impacted by lower water levels. However deer fawning often takes place on islands during the summer. Introducing access to species that prey upon deer would be a negative impact.

Amphibians

Amphibians with aquatic larval stages can be substantially impacted by water level changes that occur during early spring and summer. They would be directly impacted by water level changes that not only strand egg masses but also have a negative impact on small crustaceans that are a primary food source for salamander hatchlings.

Benthic Organisms

Because emergent wetlands are more dependent on reservoir water than riparian areas and are found frequently in embayments that lack another water source, adverse impacts are more likely to occur to these areas than riparian areas. Emergent wetlands, aquatic beds and the land–water interface is an important habitat for planktonic and benthic organisms. Many species inhabit temporary or still water and are often associated with silt bottoms and rooted vegetation. Crustaceans that range in size from 1mm to 5 mm are an important source of food for many small fresh water aquatic species. Isopods, amphipods, ostracods and especially copepods are a critical source of food for many larval stages of fish and salamanders. These crustaceans are closely tied to emergent vegetation that occurs in vegetated shallows and wetlands. When these habitats are adversely impacted these sources of food are reduced.

Threatened and Endangered Species

Threatened and Endangered Species represented by the bald eagle occur near Roosevelt Lake and may forage in the vicinity.

SOS 2c, 1a, 1b, 5b, 5c, 6b, 6d

Wildlife impacts would not be altered for current conditions.

SOS 2d

Critical drawdowns remain between February and May. Increased island accessibility to predators would impact waterfowl nesting and brooding that generally occurs between March and June. Impacts to this group are not expected to be adverse. Big game such as deer would be moderately adversely impacted. Fawning that occurs during May would be negatively impacted by increased access to predators.

During years with double drawdowns increased bank erosion would impact the nesting sites of bank swallows. Emergent wetlands and riparian sites are

not expected to be impacted. Sites that are used by colonial nesting birds and nongame birds for nesting are also not expected to be impacted.

Submerged beds are estimated to be adversely impacted by this alternative. Wildlife associated with this habitat such as amphibians would also be impacted not only by lower food production but also by fewer oviposition options. Raptors may experience reduced hunting potential from fewer fish that survive on benthic organisms during their early stages.

Moderate over all impacts to wildlife would be experienced by this alternative.

SOS 4c

Most wildlife groups analyzed would benefit from this alternative. Initial impact from lower water levels would be slightly experienced by habitats that are influenced by reservoir water. Full pool elevation is lower than that which currently occurs. The difference in drafting would decrease the size of the barren zone by half allowing a potential for colonization of new vegetation along the upper portion of the barren zone. Because spring drawdown level $ are estimated to be 10 to 20 feet higher than existing new emergent wetland should establish along the upper portion of the barren zone. An increase in total emergent wetland is expected. Those years that experience a deeper than normal draft are estimated to occur during wetter regimes and it is expected that areas adjacent to the reservoir would be moderately impacted for a short time.

Waterfowl and other groups using islands for nesting, brooding and fawning would benefit from maintenance of isolated island habitats. Bank nesting birds would benefit from this alternative from increased stability to banks.

Nongame birds, colonial tree nesting and big game are expected to benefit from this alternative as emergent wetlands would increase, and riparian areas would remain stable during wet and dry years.

Benthic organisms are expected to increase production from increased extent of submerged aquatic beds and emergent wetlands. These are critical in the food chain that affect larger fish and amphibians. Both fish production and amphibian production would benefit from this food source. Indirectly, raptors would benefit from the increase in food source.

Overall impacts from this alternative are expected to be beneficial.

SOS 9a, 9b, 9c, PA

Summer drawdowns would occur with a frequency of between 58 and 70 percent with these alternatives. Drawdowns and associated increases in barren zone under these alternatives would affect animals directly through increased vulnerability to predation, increased energy expenditure and potential for other physiological stresses. Indirect effects include longer–term decline of habitat suitability by change in vegetation and food production. An initial benefit to predatory species would be offset by the reduced numbers of prey over the long term.

The loss in production and habitat use for all water fowl groups is estimated to be at least 6 to 33 percent.

Waterfowl abundance and production at Roosevelt Lake, which is already constrained by substantial spring drawdowns, would experience additional adverse effects under these alternatives. Island habitat suitability for Canada goose, mallards and deer would decline, impacting these groups. Canada goose nesting and brooding would be affected by a decline of emergent wetlands and riparian areas, and by the substitution of shoreline habitat with barren zone conditions. Extended barren zone reduces suitable sites for forage, cover, nesting and brooding. It increases animal movement and the risk of predation. Lower water levels would decrease the value of existing riparian habitat by separating the main water body from the cover provided at the riparian sites. Riparian habitat is used for nesting and is limited in supply, a decline in this habitat suitability could affect nesting and brooding. Diving duck (scaup) wintering would also by adversely affected, particularly if benthic food supplies are impoverished by frequent and rapid drawdowns.

Great blue heron are expected to be adversely affected the summer drawdown through a reduction in their food supply, (e.g., tadpoles). Dewatering shallow water habitats and emergent wetlands is expected from double drawdowns in the spring and summer and would reduce benthic fauna production eliminating productive nearshore foraging areas.

Colonial and bank–nesting birds would be impacted by degradation of riparian habitats and by bank erosion. Loss of colonial bird habitat is expected to be adversely impacted by 6 to 33 percent. The potential for bank sloughing through rapid drawdowns, resaturation, and bank erosion resulting from double drawdowns would increase, reducing available nesting sites for bank swallows.

Effects on raptors are more difficult to assess. They are expected to experience a loss of food production from degradation of emergent wetlands and submerged habitats. Raptors are likely to be affected by these alternatives through drawdown frequency and the potential adverse effects these changes could have on resident fish food sources. Bald eagles may also be adversely affected by loss of shoreline nesting trees due to increased landslide and erosion resulting from the double drawdown in many years. Bald eagles would also be affected by impacts on waterfowl, another important food source at the reservoir. These affects are potentially significant but their extent is difficult to quantify without further data on resident fish population and results of these alternatives.

Beaver and other aquatic furbearers are estimated to experience a 6 to 33 percent loss of suitable habitat under these alternatives. Aquatic furbearers, otter and beaver, which are dependent on shoreline habitats, would be adversely affected by rapid drawdown and double drawdowns. Lowering of the water table near emergent wetlands would desiccate wetland vegetation. Alteration of habitats during July and August, which are important months for adults and developing young would be a negative impact to these species. Increased barren zone increases energy expenditure and susceptibility to predation. Feeding is adversely affected by projected decline and loss of food plants from long term erosion, plant stress and mortality. Otter feeding on benthic organisms such as crayfish would be adversely impacted by altering wetland areas.

It is difficult to assess the potential impact of these alternatives on big game (elk, deer) which are less dependent on shoreline habitats than other animal groups. Under alternative 9a predation of young on islands could be impacted by increased land bridging from rapid drawdowns.

Amphibians would be impacted by the season, length and depth of drawdown under alternative 9a. Loss of habitat suitable for amphibians is expected to range from 6 to 33 percent. Amphibians such as spotted frog and long–toed salamander which are dependent on emergent wetlands and vegetated shallow water edges would be adversely impacted by rapid drawdowns and double drawdowns that would impair habitat suitability for oviposition and benthic food sources for hatchlings.

All wildlife groups analyzed, except non–game birds that can use upland habitats, are expected to be adversely affected by these alternatives.

Impacts to Wildlife Management Programs

Management entities for the Roosevelt Lake area include the Confederated Tribes of the Colville Reservation, Spokane Tribe of Indians, Washington Department of Wildlife, and the National Park Service which administers the waters and shore lands of Lake Roosevelt outside the Colville and Spokane Indian Reservations.

The historic large spring drawdown in combination with area topography has severely limited wildlife habitat development and wildlife management opportunities at Roosevelt Lake. As a result there are presently no substantial wildlife development activities tied to the reservoir, and interest in mitigation for past inundation impacts (Chapter 2) under the Northwest Power Planning and Conservation Act

(P.L.96–501) has focused almost totally on areas away from the reservoir.

The National Park Service has two mitigation projects, one underway and one under consideration, for the Lake Roosevelt area. A peregrine falcon reintroduction effort has begun, and investigation of habitat development potential on the lower Kettle River (Kettle River arm) is proposed. The latter study could be jeopardized by implementation of 9a, 9b, 9c and PA alternatives. The Spokane Tribe would also be adversely affected through impacts to Spokane arm habitats and resources. The Colville Tribe does not have substantial habitat areas or management activities which focus on shoreline areas, and would be less affected by operational changes. The Washington Department of Wildlife also does not have noteworthy management activities tied to reservoir habitats.

Threatened and Endangered Species

Potential impacts to Federally listed species will be assessed. Potential impacts to candidate and state listed species will also be considered.

5.2.8.4 Data Gaps

There is a need for more quantitative information on wildlife than now exists for the Lake Roosevelt area. Wildlife studies should include the effects of seasonal drawdowns on distribution, movements and use of shoreline habitats by various types of wildlife associated with these areas. Surveys to confirm extent and distribution of emergent wetland and submergent aquatic plant beds are needed. Bathymetric data correlated to wildlife and habitat concentration areas would be valuable. Further study of bald eagle ecology at the reservoir is needed, particularly dependence on various food sources, to help protect this valuable resource. Also, impacts are more difficult to estimate when resident fish response to various options is unclear.

5.2.8.5 Conclusions

Relative impacts of the proposed system operation options were summarized from data on drawdown frequency and estimated habitat and wildlife response. The comparisons were aided by judging and weighing the relative importance to wildlife of dewatered conditions in different seasons and for varying frequencies of occurrence.

Options 2c (No Action) and 4c were comparable and best for wildlife. Option 4c might result in limited positive benefits to most wildlife categories.

Option 9a has moderate adverse impact in comparison to all options evaluated. Although it is more adverse than 2c or 4c, it is less adverse than others because there are fewer double drawdowns and fewer total months of drawdown within a year, on average.

Options 9b, 9c and the Preferred Alternative have the most serious adverse effects on wildlife. The Preferred Alternative has less impact because of the relative advantages in fewer summer drawdowns, fall drawdowns, or double drawdowns depending on comparisons with other options. Options 9c and 9b are slightly more adverse than 9a.

5.2.8.6 Mitigation for the Preferred Alternative

Surveys and inventories of existing wildlife populations and determination of habitat suitability are recommended. Because wildlife species are often constrained to use habitats that are less than optimal, data gathering that focuses on identifying suitable habitats is recommended.

Habitat improvement at a ratio of 3 acres of restoration for every acre lost would provide replacement for lost habitat if determined by monitoring and studies. On–site mitigation is preferable to off–site, especially for wildlife species that apparently return to their "homeland" to reproduce i.e. many amphibian species. Off site mitigation could be provided by entering into partnering agreements, such as a mitigation bank.

5.2.9 Chief Joseph Project

5.2.9.1 Project–specific Species List

The indicator species listed in Table 3–3 (Project Wildlife Matrix) has been modified to better represent local conditions. The modifications include:

Deleted	*Because*		
1. Black–necked stilt 2. Terrestrial fur-bearers 3. Big–horn sheep 4. Reptiles	1. Do not occur 2. None for the evaluation that depend of the shoreline of Lake Rufus Woods 3. Do not occur 4. None for the evaluation dependent on the shoreline of Lake Rufus Woods		
Selected or Added	*To Represent Category*	*Instead of*	*Because*
1. Bank swallows 2. Spotted frog 3. Bald eagle	1. Colonial Nesting Birds 2. Amphibians 3. T&E/Raptors	1. great blue herons or gulls	1. Occur more frequently 2. Occur more frequently 3. Occur more frequently

5.2.9.2 Project–specific Assumptions/ Parameters

- The reservoir fluctuates daily as much as four ft (951 to 955 ft). However, based on discussion with hydrologists, the assumption is made that 953.2 ft elevation reflects a year–round average elevation for the reservoir and reflects current operating conditions.
- Chief Joseph Dam is operated largely as a reregulating dam for Grand Coulee outflows. Given this, alternatives have been examined with respect to Grand Coulee outflows. Outflows were examined not only with respect to monthly flows (i.e., to check whether monthly flows were 'out of line' with 'normal' flows for the month), but also with respect to whether certain extreme flows were out of line with historic extreme flows, at any time of the year. The intent is to ascertain whether there may be potential for increased erosion/sloughing of banks along Rufus Woods Lake, as well as inundation or desiccation of shoreline habitats.

5.2.9.3 Evaluation of Results

Month–end elevations of Chief Joseph Reservoir (Rufus Woods Lake) never change under any alternative: the elevation stays at 953.2 ft every month for 50 years in all alternatives. This occurs despite wildly fluctuating outflows from Grand Coulee Dam (Rufus Woods Lake receives Grand Coulee outflows). The inconsistent outflows from Grand Coulee Dam have resulted in fairly large–scale erosion of certain unstable banks along Rufus Woods Lake. This has been a persistent problem, but one which cannot really be solved without stabilizing the outflows from Grand Coulee Dam. On the other hand, because of the large volume of water held by Rufus Woods Lake, the varying Grand Coulee outflows are somewhat successfully absorbed with small daily fluctuations in Rufus Woods Lake elevations––only about 3 ft/day on average. It has been observed over the history of Rufus Woods Lake since construction of Chief Joseph Dam in 1958 that daily fluctuations of more than 3 ft are generally destructive of shoreline vegetation. Between 1958 and 1981, daily fluctuations in Rufus Woods Lake averaged about 6 ft; during those years virtually no shoreline vegetation established itself. In 1981 the reservoir elevation was raised 10 ft and the operation was changed to the 3–foot (or less) daily fluctuation. Establishment of shoreline vegetation has been tremendous, now totaling about 166 acres. Thus, the key to analyses is to identify daily fluctuations. Unfortunately, this data is unavailable, and analyses are dependent upon average monthly outflows from Grand Coulee Dam.

Matrix Discussion

Physical Habitat Matrix. All alternatives are identical so all are shown on one matrix. The drawdown acreage is simply a calculation of the acres between the authorized high reservoir of 956' and the 'normal' operating elevation of 953'. This results in a barren zone of 154 acres. Because of persistent and

continual erosive forces, this acreage is expanding at the rate of about 2 acres/year. The riparian zone is 54 acres, and is expanding at the rate of 4 acres/year; emergent marsh covers 72 acres and is expanding at the rate of 6 acres/year; aquatic plant bed is found over 40 acres and expands at the rate of 1 acre/year; and islands cover 38 acres. Primary fish productivity is improving, as is benthic productivity, while human use is also going up.

Wildlife Impacts Matrix. Again, all alternatives are the same and result in no change from current operations. Thus, no effects to wildlife are expected, and all blocks have zeroes.

Physical Habitat Impacts

Alternatives Analysis

The alternatives sort into 2 groups: Group 1 consists of alternatives 1a, 1b, 2c, 2d, 4c, 5b, 5c, 6b, and 6d. Group 2 consists of Alternatives 9a, 9b, 9c, and PA. See Table 5–6. It should be pointed out that though the 50–year averages shown in the table are between 49,000 cfs and 158,000 cfs., outflows from Grand Coulee Dam of 200,000 cfs are not uncommon.

Group 1 includes the No Action alternative and thus reflects the current operations. Alternative 2d varies from the others in January (much lower average than the others), March, June and July (the latter three months with higher averages than the other alternatives) The much lower average in January, on paper at least, suggests that erosive forces during the winter would be moderated. However, the numbers in Table 5–6 reflect 50–year averages, and a closer examination of year–by–year outflows reveals that there is no consistency in outflows in January from year–to–year, nor any consistency from December– January–February in any given year. Similarly, alternative 4c is somewhat different from the rest in September, December, April, June, and July. But again, a closer examination of the monthly averages during each year reveal that fluctuations in outflows are erratic with no defined pattern, and are not outside normal operating limits. Thus the numbers in Table 5–6 are really an illusion, and great caution must be used in interpreting this data, again emphasizing the need for daily fluctuation data. Only generic statements can be made regarding effects on physical habitats based on a 50–year average.

Group 2: Alternatives 9a, 9b, 9c, and PA differ from Group 1 in the extremely low outflows during September, October, and November (as low as 49,000 cfs.). Flows for December, January, and February are similar to those of Group 1, while flows for March through August are somewhat higher than those in Group 1. Alternative 9a is the most extreme of these alternatives, but even so, does not result in any monthly average outflows higher than those that occur under existing operations (i.e., around 200,000 cfs). Once again, a closer look at the individual years shown in the hydroregs reveal that there is no discernible pattern from year–to–year, or from month–to–month, within years, that would allow any prediction as to impacts beyond those that already occur under the existing operation. When combined with the fact that the elevation of Rufus Woods Lake is predicted to be perfectly stable (though remembering that daily fluctuation data is lacking), there is no reason to predict any adverse or beneficial impacts resulting from the operation of Group 2 alternatives.

Wildlife Impacts

As no effects are predicted to physical habitats, no effects to wildlife are expected.

Threatened and Endangered Species

There are now (1995) three active bald eagle nests, and another non–nesting pair, along the shores of Rufus Woods Lake. The active nests are all placed in dead trees, which are located either on unstable banks or in the inundation zone of the reservoir. Thus, all are susceptible to falling due to wave action, or freezing/thawing cycles, or wind. However, as indicated in the discussion of physical habitat impacts, it is impossible to predict that banks will be more susceptible to sloughing, or that fluctuations would be more dramatic, based on the hydroregs. Thus, though it is predictable that any or all of the nest trees may soon fall victim to rotten roots and unstable substrates, it is not reasonable to implicate any operating strategy as the cause, nor even as an agent toward their demise, given the lack of data provided in the hydroregs.

Table 5–6. Average Month–end Columbia River Flow Releases at Grand Coulee Dam

Alternative	Months											
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
1a	75115	77115	79860	97363	156493	129461	114397	117638	148031	116189	108901	83284
1b	75755	80931	81811	99180	157386	131479	105945	111882	141783	120635	114082	84575
2c	75242	74544	85013	97952	153222	129426	102711	109256	150772	131006	106596	85396
2d	75612	74795	84515	97178	115131	124583	125942	105785	138537	144817	124661	84452
4c	57342	71420	72957	105659	147224	124543	98149	121071	148104	150449	123831	80217
5b	74756	74713	84776	98823	154231	129454	103048	115073	150382	130564	105355	84732
5c	74756	74713	84776	98823	154231	129454	103048	115073	150382	130564	105355	84663
6b	74756	74713	84776	98823	154231	129454	103048	115073	150382	130564	105355	84700
6d	74756	74713	84776	98823	154231	129454	103048	115073	150382	130564	105355	84665
9a	49058	50650	57700	82746	112405	115142	114735	159455	170940	150546	144598	117620
9b	49500	52412	62532	100043	99962	108295	135737	177162	149033	157758	133294	100842
9c	51231	62946	83072	108648	112763	122829	125592	129754	139252	143306	137041	89578
PA	59323	61438	74542	98179	115784	111076	120794	142716	145594	152164	130742	92382

Peregrine falcon is the only other listed species found in the vicinity of Rufus Woods Lake. This species is seen only occasionally in the project area, and does not nest nearby. Changes in operation of the reservoir are not expected to affect peregrines.

Though numerous candidate species may occur in the vicinity of Rufus Woods Lake, only the harlequin duck, black tern, California floater, and Columbia pebblesnail are water–dependent. Harlequin ducks nest along fast–flowing streams, under mossy banks. There is no habitat like this in the vicinity of Rufus Woods Lake. Black terns are birds of relatively small, marsh–lined ponds; though they may occasionally be seen near Rufus Woods Lake, it does not provide habitat for this species, and any potential change in operation would not affect it. The floater is a type of mussel. Its occurrence in Rufus Woods Lake, as well as that of the pebblesnail, is unknown. Presumably the habitat for these species is fast–flowing, cold water, with a cobble substrate. This habitat does not occur in the Chief Joseph Dam project area.

5.2.9.4 Data Gaps

Knowledge of daily flows is necessary to perform an adequate in–depth analysis of operational effects.

5.2.9.5 Conclusions

End of month average elevations do not change over the 50–year period of analysis, which suggests no impacts to habitats or wildlife from any of the alternative operating strategies. Although monthly average outflows from Grand Coulee fluctuate dramatically from month–to–month under several alternatives, this condition is not much different from existing operations. A true picture of effects cannot be painted until daily fluctuations under each operating strategy are known.

5.2.9.6 Mitigation for Preferred Alternative

As the preferred alternative is identical to the existing operation, no mitigation is required.

5.2.10 Mid–Columbia Projects

5.2.10.1 Wells Reservoir

Because reservoir elevations do not vary for any of the 21 options of the 7 System Operating Strategies, no change from existing conditions is predicted for wildlife resources at the Wells reservoir.

5.2.10.2 Rocky Reach Reservoir

Because reservoir elevations do not vary for any of the 13 options of the 7 System Operating Strategies, no change from existing conditions is predicted for wildlife resources at the Wells reservoir.

5.2.10.3 Rock Island Reservoir

Because reservoir elevations do not vary for any of the 13 options of the 7 System Operating Strategies, no change from existing conditions is predicted for wildlife resources at the Wells reservoir.

5.2.10.4 Wanapum Reservoir

Because reservoir elevations do not vary for any of the 13 options of the 7 System Operating Strategies, no change from existing conditions is predicted for wildlife resources at the Wells reservoir.

5.2.10.5 Priest Rapids Reservoir

Because reservoir elevations do not vary for any of the 13 options of the 7 System Operating Strategies, no change from existing conditions is predicted for wildlife resources at the Wells reservoir.

5.2.11 Hanford Reach

5.2.11.1 Project–specific Species List

The indicator species listed in Table 3–3 (Project Wildlife Matrix) has been modified to better represent local conditions. The modifications include:

Deleted	*Because*		
N/A	N/A		
Selected or Added	***To Represent Category***	***Instead of***	***Because***
1. Forster's tern 2. Rorippa columbiae 3. Canada goose	1. Colonial Nesting Birds 2. T&E Species 3. Waterfowl	N/A	1. Unique to Hanford Reach 2. Unique to Hanford Reach 3. Represent 20 percent of Canada goose production in the Columbia Basin

5.2.11.2 Project–specific Assumptions/ Parameters

- The impact analysis accounts for significant habitat–based impacts to wildlife associated with broad variations in outflows from the Priest Rapids pool. Surface water elevations within the Hanford Reach respond in approximately five to six hours to changes in outflow from Priest Rapids. Daily fluctuations in downstream surface water elevation range from eight to 12 ft. It is assumed that daily fluctuations in downstream surface water elevation would not vary significantly from current conditions for any of the proposed drawdown alternatives.

- Hydrosystem operations may impact factors that affect wildlife values within the Hanford

Reach, although these impacts are not accounted for directly within the analysis:

(1) **Predation**: Primary predators of island and riparian nesting species include ravens, magpies, gulls, and coyotes. Coyotes have been identified as primary predators of nesting Canada geese in the Hanford Reach, and in previous years (e.g. 1977 to 1985) coyote control has been implemented on the Hanford Site in order to reduce effects of predation. As a part of the program, hunting was implemented on downstream islands that are managed by the USFWS. The affect hunting has on coyote control is largely related to the increased presence of humans. Coyote access to islands is likely facilitated by, and increases with, low flows within the Hanford Reach. During low flow periods, islands that are peninsulas of the mainland are exposed as a result of land bridging. High flows that reduce the incidence of land–bridging are recommended for spring (e.g. early in the breeding season).

(2) **Human Disturbance**: The Hanford Reach provides year–round recreation for sportfishing, boating, and waterfowl hunting. The greatest recreation use occurs during September and October in conjunction with peak waterfowl hunting and salmon fishing seasons. Management for extreme low and/or high flows should limit disturbance to shoreline and island habitats and associated wildlife species by reducing the number of boat users with the reach during these periods.

5.2.11.3 Evaluation Results

The following analysis is based on average flows calculated for; 1) a period representing prolonged "dry" atmospheric conditions; 2) a period representing prolonged "wet" atmospheric conditions; and 3) a period representing average atmospheric conditions. For each of the proposed alternatives, flows are presented from mean wet, mean dry, and average years between March and August. These flows were examined for similarities and differences in; 1) flow in cubic ft per second (cfs); 2) timing of period when flow exceeded 120,000 cfs; and 3) rate of increase of flow to beyond 120,000 cfs (Table 5–7).

The flow of 120,000 cfs was chosen as a critical flow for Hanford Reach analyses because it represents an outflow that, with corresponding changes in downstream surface water flow and elevation, has significant effects on habitat and results in direct losses to wildlife species production (e.g., Canada goose, Forster's tern).

The rate of increase of flow to beyond 120,000 cfs was selected as a discriminating criteria, because of the potential for mitigating effects of hydroregulation. Consideration of individual species behaviors during varying periods of their reproductive cycle and flows projected for these periods will allow for seasonal impact analysis and thus facilitate mitigation planning.

Assessment of impact was based on flows exceeding approximately 120,000 cfs and the month in which flows resulted in the most significant change to downstream flow rates and surface water elevations.

Physical Habitat Impacts

Alternatives 1a, 1b, 2c (No Action), 5c, 6b, 6d,

Alternatives 1a, 1b, 2c, 5c, 6b, and 6d will, on the average, maintain flows at or below those which have been observed to create significant changes in island and shoreline substrates (e.g., 120,000 cfs) and emergent and submergent habitats. (Figure 5–9) Significant increases during May, however, may have a negative affect on shoreline and island substrates.

Table 5–7. Proposed Flows for Average, Wet, and Dry Conditions for System Operating Strategies, Hanford Reach Analysis

	PA	1a	1b	2c	2d	4c	5c, 6b, 6d	9a	9b	9c	9d
Dry											
Mar	99898	95260	92760	99961	105454	74978	99195	97122	113405	106047	51197
Apr 1–15	97069	116627	97695	90157	88339	107016	83909	93210	94080	92061	105613
Apr 15–30	147641	116079	110350	102748	110996	109661	107534	153763	154331	139206	107359
May	146023	148370	141928	152945	132089	133451	150939	126676	136878	136237	196530
Jun	128655	90340	94859	104769	131698	120358	106599	139732	149569	128237	234879
Jul	97083	78202	81381	75687	86106	94725	74711	148193	112029	92088	157705
Aug 1–15	77482	76742	77559	82099	82063	72126	67646	111637	91378	79710	105430
Aug 15–30	73174	75154	81030	80545	78056	69038	79105	108735	88287	58500	75367
Wet											
Mar	148680	131426	124422	129337	182657	131660	127615	153409	631410	150246	127719
Apr 1–15	142236	132918	132308	129037	125957	135470	126706	138056	141652	132932	141231
Apr 15–30	157179	140295	137254	129016	127872	137521	132096	166208	180373	144958	156021
May	189732	187541	185032	185670	186966	177489	187456	209098	193588	180350	280182
Jun	209664	194649	193192	206981	206530	217585	206956	223630	210448	200664	322377
Jul	191154	192637	197507	182294	185971	205202	179116	195883	188283	92088	216313
Aug 1–15	137707	129678	128657	129753	128763	141433	129519	151129	135341	79710	143268
Aug 15–30	126510	115249	113386	112607	110603	113319	112302	143969	121916	73417	98256
Average											
Mar	126533	120136	111684	108450	131681	103888	108788	120474	141477	150246	82215
Apr 1–15	135687	115713	108296	114007	119535	116008	110267	126861	131675	132932	123329
Apr 15–30	152458	127379	121623	118998	115527	130812	124814	169196	186093	144958	142312
May	165700	168111	161863	170878	158643	168184	170488	191046	169139	180350	259233
Jun	182028	146037	150483	160870	174680	180297	160428	180409	187622	200664	305648
Jul	147358	125516	130697	123212	141277	140445	121971	161125	149910	203903	195339
Aug 1–15	117600	102337	102516	104005	104471	108139	103426	124693	118566	140567	124220
Aug 15–30	98040	88948	90239	91033	90089	85882	90300	123258	106495	114090	80804

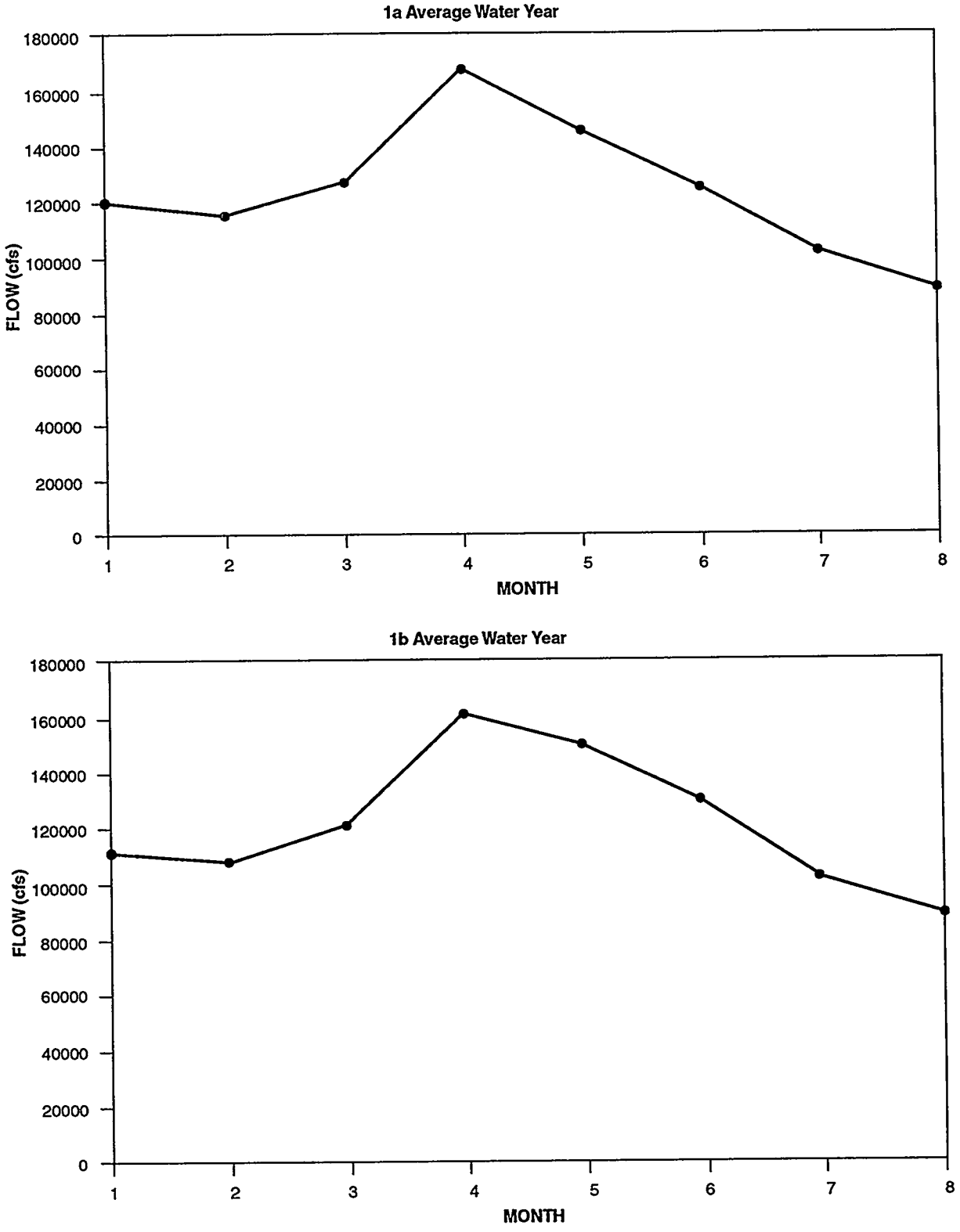

Figure 5–9. Hanford Reach 1a, 1b, 2c, 5c, 6b, and 6d Average Water Year

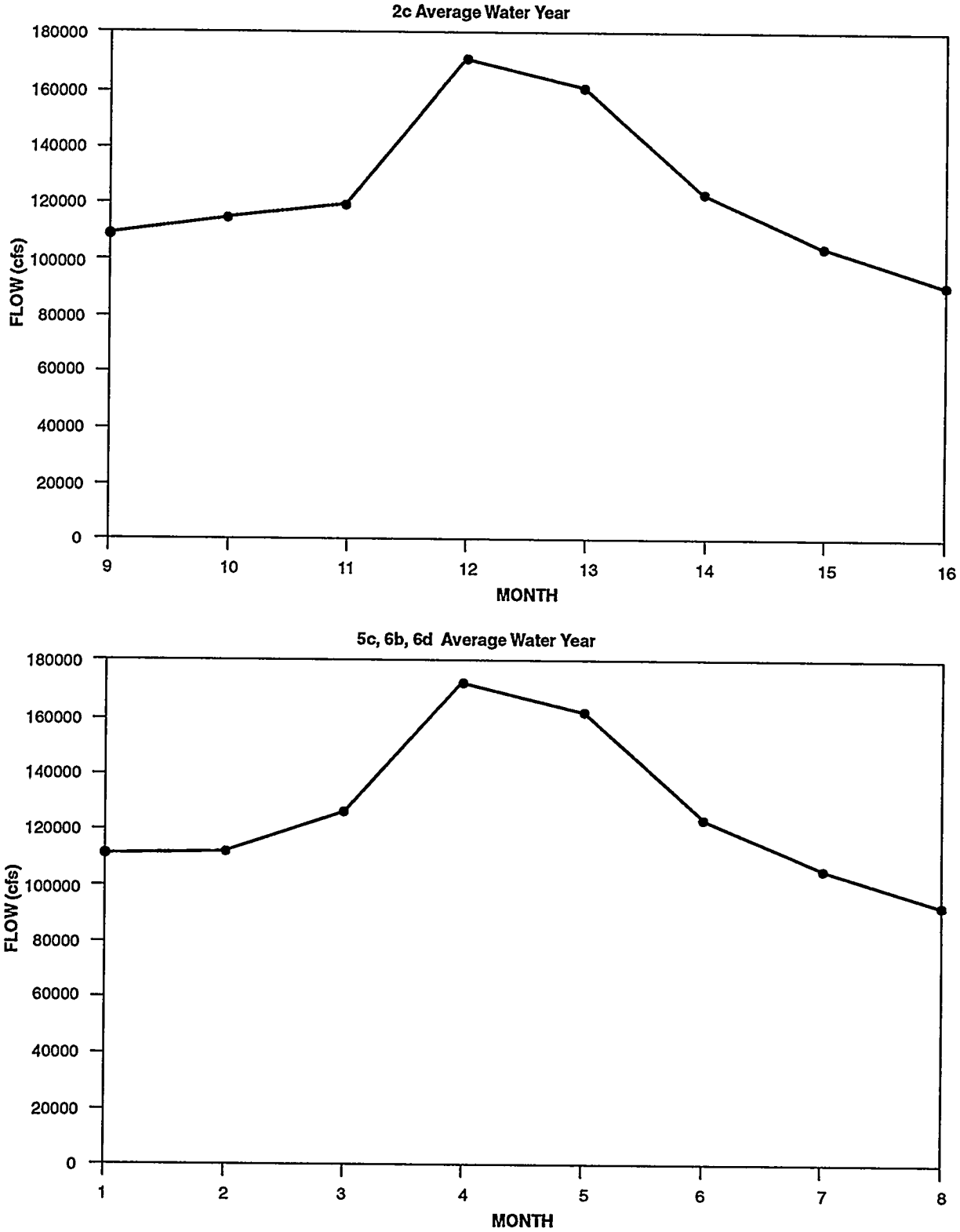

Figure 5–9. Hanford Reach 1a, 1b, 2c, 5c, 6b, and 6d Average Water Year – CONT

Increases in palustrine shrub and emergent habitat should result from flows in excess of 120,000 cfs. In addition, proposed outflows should maintain elevated pool levels in downstream sloughs and backwaters. However, prolonged high flows may have a cumulative affect of reducing riparian habitat in the long–term.

Alternatives PA, 2d, 4c (Group 1)

Alternatives PA, 2d, and 4c will maintain flows at or above those which have been observed to create significant changes in island and shoreline substrates and emergent and backwater habitats (e.g., 120,000 cfs). (Figure 5–10) Significant increases in flow during June, may have a negative affect on shoreline and island substrates but would increase flows in slough and backwater habitats, enhancing palustrine shrub and emergent vegetation.

Periods of high flow may have a cumulative impact of reducing riparian habitat in the long–term.

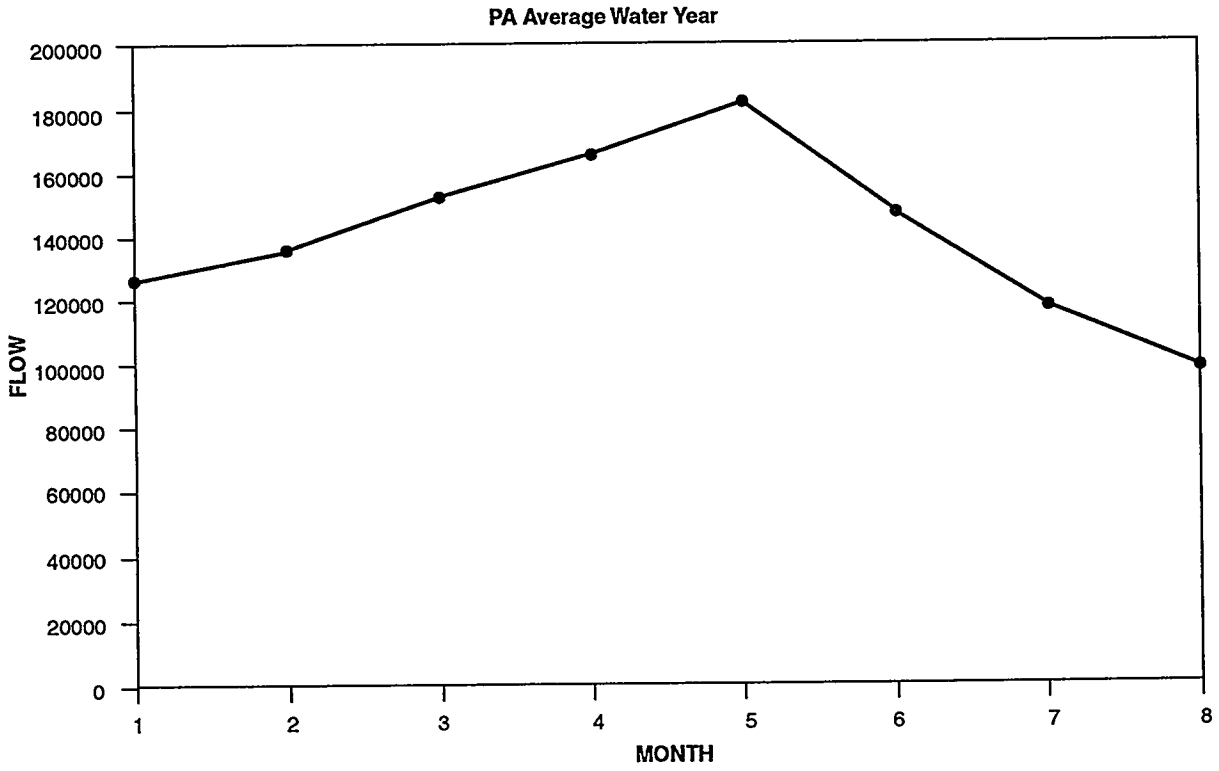

Figure 5–10. Hanford Reach PA, 2d, 4c Average Water Year

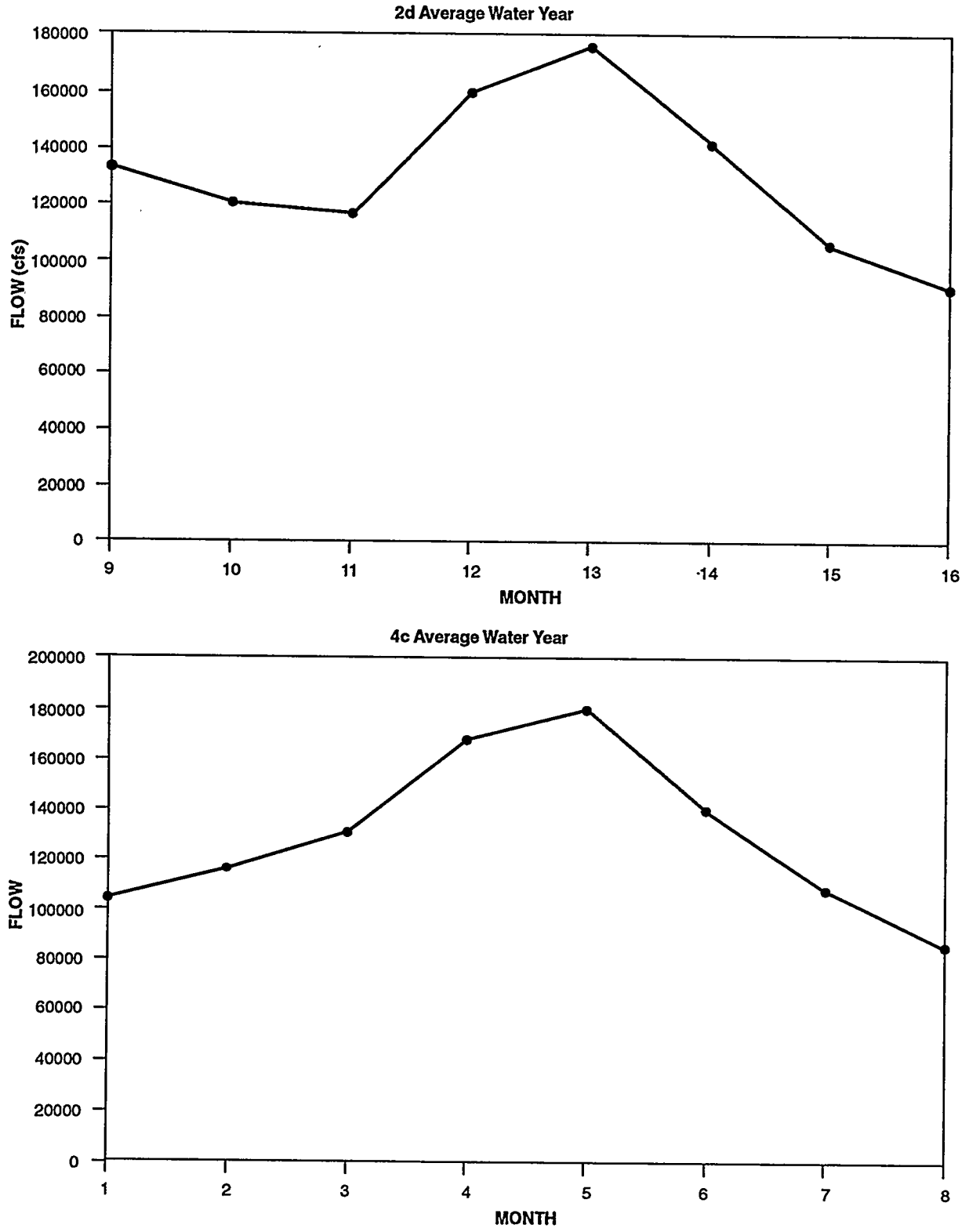

Figure 5–10. Hanford Reach PA, 2d, 4c Average Water Year – CONT

Alternative 9a (Group 2)

Alternative 9a maintains elevated flows projected for the system over the longest period of time. The alternatives will maintain flows above those that have been observed to create significant changes in island and shoreline substrate and emergent and backwater habitats (e.g., 120,000 cfs). (Figure 5–11)

Prolonged periods at high flows would facilitate creation of backwater and slough habitat, however, the prolonged period of high flow may have a cumulative impact of reducing riparian habitat in the long–term. This would have consequences for species that exhibit a high degree of site fidelity, and that are reliant on mature riparian vegetation.

Alternative 9b (Group 3)

Affects of this alternative should be reduced in comparison to other proposed alternatives because regulated flows would increase during spring and be maintained at elevated levels through July. (Figure 5–12)

Alternative 9b will maintain flows above those which have been observed to create significant changes to island and shoreline substrates and emergent and backwater habitats (e.g., 120,000 cfs). Significant increases in flow may have a negative affect on shoreline and island substrates however flows may increase palustrine shrub and emergent habitat in slough and backwater areas.

Although the alternatives propose high flows, prolonged periods of elevated surface waters and early season regulation of flows would impact habitat and associated dependent wildlife species less severely than if system regulation was more dramatic.

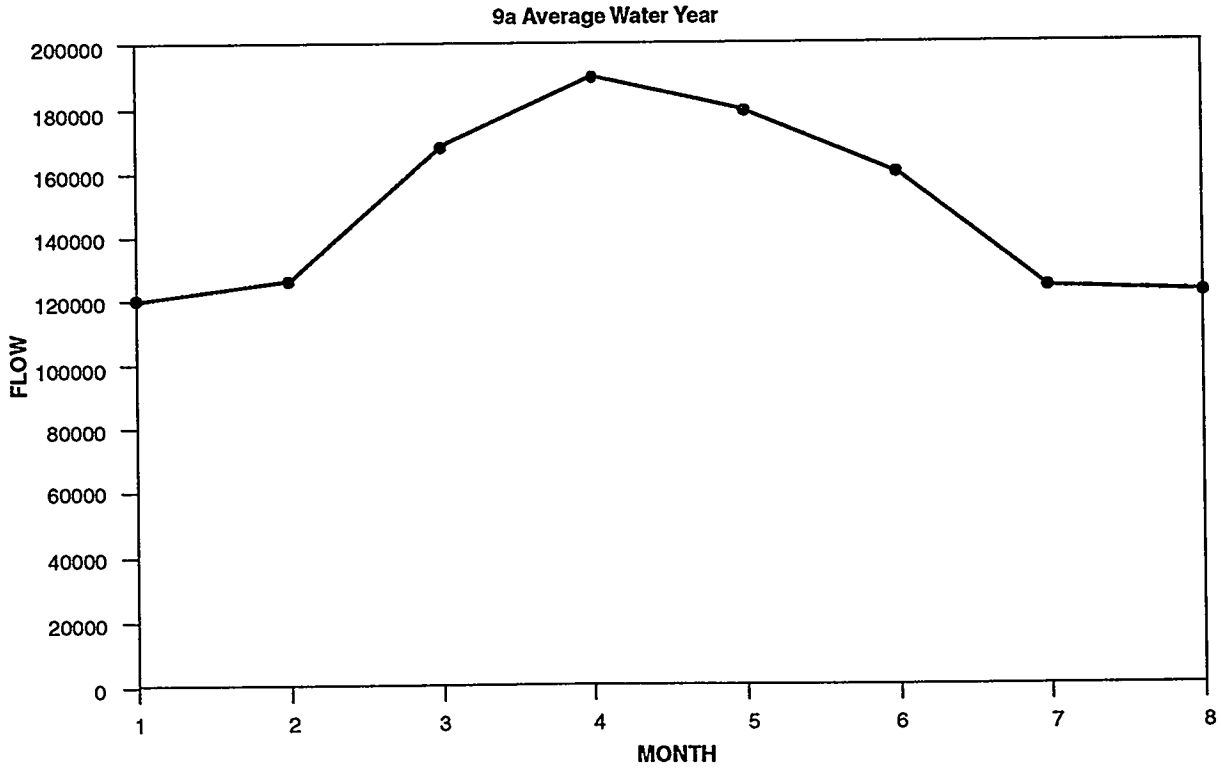

Figure 5–11. Hanford Reach 9a Average Water Year

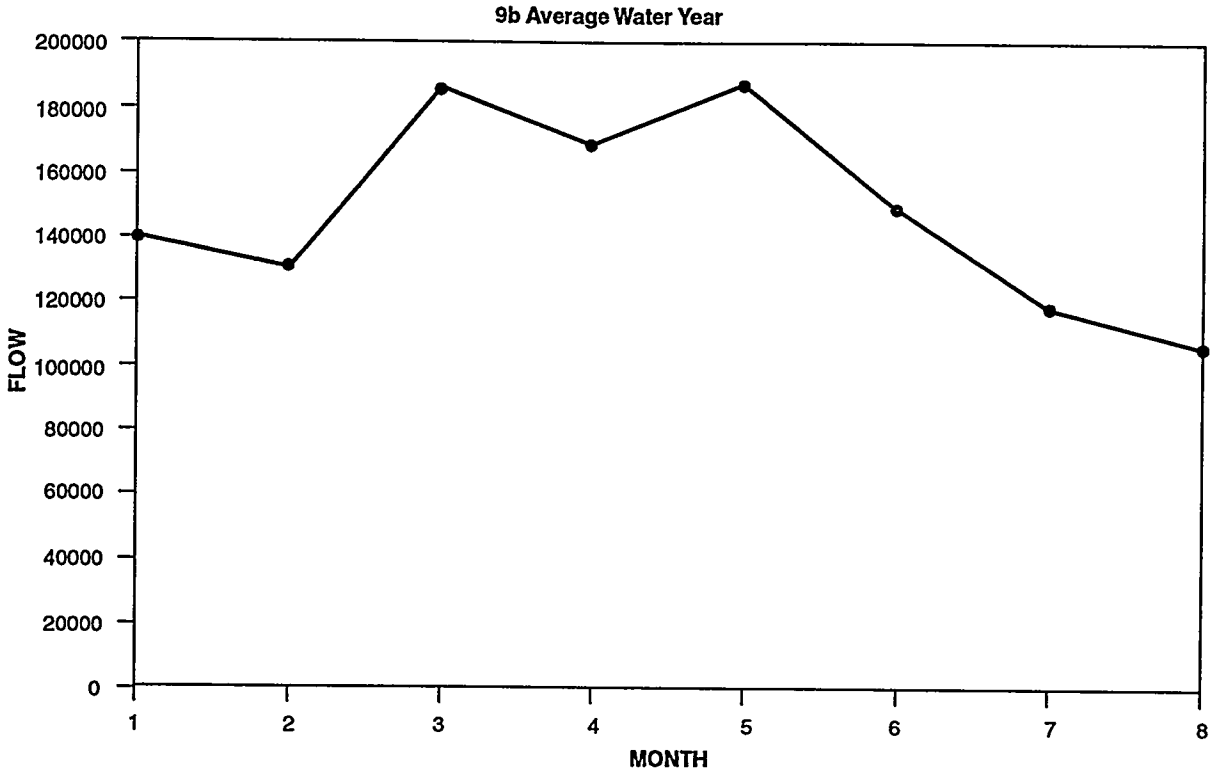

Figure 5–12. Hanford Reach 9b Average Water Year

Alternative 9c (Group 4)

Alternative 9c is similar in timing, elevation, and duration of flows to alternatives 9a and 9b. Like the 9a and 9b alternative strategies, Alternative 9c projects the maximum flows of any of the alternatives. This alternative will maintain flows well above those that have been observed to create significant changes in island and shoreline substrate and emergent and backwater habitats (e.g., 120,000 cfs). (Figure 5–13)

Prolonged periods at high flows would facilitate an increase in palustrine shrub and emergent vegetation in backwater and slough habitat, however, the prolonged period of high flow may have a cumulative impact of reducing riparian habitat in the long–term.

Affects of this group of alternatives should be reduced in comparison to other proposed alternatives because regulated flows would increase during spring and be maintained at elevated levels throughout the growing season.

Wildlife Impacts

Alternatives 1a, 1b, 2c, 5c, 6b, 6d

Significant increases in flow (e.g., 120,000 cfs) during May, may negatively affect shoreline and island substrates and associated nested waterfowl, colonial nesting, and shorebird species.

Species reliant on emergent and submergent habitats would benefit from sustained flows in excess of 120,000 cfs that would facilitate creation of backwater and slough habitat during that period. Increases in palustrine shrub and emergent habitat should also result in slight to moderate increases in nesting and foraging habitat for nongame bird species. In addition, proposed outflows should maintain elevated pool levels in downstream sloughs and backwaters and should not impact aquatic furbearers.

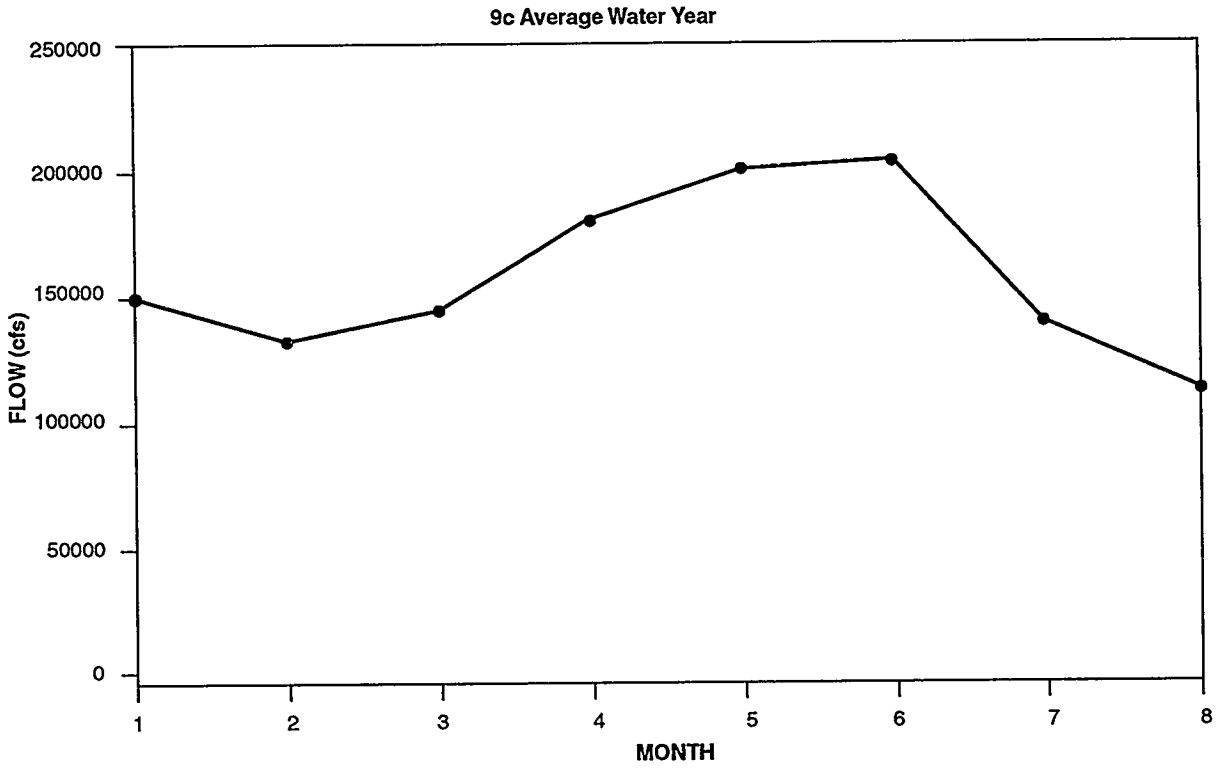

Figure 5–13. Hanford Reach 9c Average Water Year

Reduced early season flows may facilitate early establishment of *Rorippa columbiae*, as was observed in 1993 (J. Downes, Battelle–Pacific Northwest Laboratory, pers. comm.). However, significant increases in flow during May would inundate reproductive individuals. *Rorippa* may recover effectively from inundation in July and August when flows are again reduced. Alternately, *Rorippa* may be limited in its period of reproduction to a window between August and September, which typifies current species behavior (W. Rickard, Battelle – Pacific Northwest Laboratory, pers. comm.).

Foraging and breeding habitats for terrestrial wildlife will be reduced during a period between May through July when increased outflows will inundate emergent, submergent, and riparian habitats. This, however, should not negatively affect these species.

Changes in outflows should not affect or could potentially increase habitat potential for amphibian species that are reliant on emergent and riparian habitats.

Alternatives PA, 2d, 4c

Significant increases in flow prior to nest initiation should limit the potential negative affect on waterfowl, colonial nesting, and shorebird species. Increases in flow through June May benefit these species from increased brooding and foraging habitat as higher flows increase slough and backwater habitat.

Species reliant on emergent and submergent habitats would benefit from sustained flows in excess of 120,000 cfs that would facilitate creation of backwater and slough habitat. Elevated flows that reduce riparian habitat over the long–term could affect species that exhibit a high degree of site fidelity and that are reliant on mature riparian vegetation (e.g., great blue heron) for life requisites.

Increases in palustrine shrub and emergent habitat should result in slight to moderate increases in nesting and foraging habitat for nongame bird species.

Proposed outflows should maintain elevated pool levels in downstream sloughs and backwaters and should not impact aquatic furbearers.

Foraging and breeding habitats for terrestrial wildlife will be reduced during a period between May through July when increased outflows will inundate emergent, submergent, and riparian habitats. However, this should not negatively affect these species.

Changes in outflows should not affect or could potentially increase habitat potential for amphibian species that are reliant on emergent and riparian habitats.

Alternative 9a

Flows in excess of 120,000 cfs that become established prior to nest initiation should not impact waterfowl, colonial nesting, and shorebird species. Elevated flows of the magnitude proposed in alternative 9a will reduce nesting habitat availability on islands. On the other hand, elevated flows will increase waterfowl brood rearing habitat as higher flows increase slough and backwater habitat.

Species reliant on emergent and submergent habitats would benefit from elevated flows that would facilitate creation of backwater and slough habitat. However, the prolonged period of high flow may have a cumulative impact of reducing riparian habitat in the long–term. This would have consequences for species that exhibit a high degree of site fidelity and that are reliant on mature riparian vegetation (e.g., great blue heron).

Increases in palustrine shrub and emergent habitat should result in slight to moderate increases in nesting and foraging habitat for nongame bird species. Proposed outflows should maintain elevated pool levels in downstream sloughs and backwaters and should not impact terrestrial furbearers.

Foraging and breeding habitats for terrestrial wildlife will be reduced during a period between March through August when increased outflows will inundate emergent, submergent, and riparian habitats. However, this should not negatively affect these species.

Changes in outflows should not affect or could potentially increase habitat potential for amphibian species that are reliant on emergent and riparian habitats.

Alternative 9b

Affects of this alternative should be significantly reduced in comparison to other proposed alternatives because regulated flows are increased during spring; and are maintained at elevated levels throughout the nesting and brood rearing period for many species. Gradual increases and decreases throughout the period of reregulation should reduce overall affects to habitat and subsequently wildlife species.

Significant increases in flow may negatively affect shoreline and island substrates. However, flows that are regulated during early March should not significantly impact species. Species that would be impacted by overall nesting habitat availability would benefit from increased brooding and foraging habitat as higher flows increase slough and backwater habitat. Species reliant on emergent and submergent habitats would benefit from sustained flows in excess of 120,000 cfs that would facilitate creation of backwater and slough habitat during periods of high flow.

Reductions in riparian habitat would have consequences for species that exhibit a high degree of site fidelity and that are reliant on mature riparian vegetation (e.g., great blue heron) for life requisites. This situation may, however, benefit species which under normal flow conditions have a reduced competitive advantage. *Rorippa columbiae*, that would suffer a reduced reproductive period during the high flows, may gain an increased competitive advantage over other riparian competitors due to excessive high flows that will be held constant over a prolonged period, thus reducing the competitively superior species period of reproduction.

Increases in palustrine shrub and emergent habitat should result in slight to moderate increases in nesting and foraging habitat for nongame bird species. In addition, proposed outflows should maintain elevated pool levels in downstream sloughs and backwater areas and should not impact aquatic furbearers.

Foraging and breeding habitats for terrestrial wildlife will be reduced during a period between May through July when increased outflows will inundate emergent, submergent, and riparian habitats. This should not negatively affect these species.

Changes in outflows should not affect or could potentially increase habitat potential for amphibian species that are reliant on emergent and riparian habitats.

Alternative 9c

Alternative 9c behaves similarly to alternative strategies 9a and 9b. Therefore, impacts to wildlife species are expected to be similar. Affects of this alternative should be significantly reduced in comparison to other proposed alternatives because regulated flows are increased during spring; and are maintained at elevated levels throughout the nesting and brood rearing period for many species. Gradual increases and decreases throughout the period of reregulation should reduce overall affects to habitat and subsequently wildlife species.

Flows in excess of 120,000 cfs that become established prior to nest initiation should not impact waterfowl, colonial nesting, and shorebird species. However, elevated flows will reduce nesting habitat availability on islands. On the other hand, elevated flows will increase waterfowl foraging habitat as higher flows increase slough and backwater habitat.

Species reliant on emergent and submergent habitats would benefit from elevated flows that would facilitate creation of backwater and slough habitat. However, the prolonged period of high flow may have a cumulative impact of reducing riparian habitat in the long–term. Reductions in riparian habitat would have consequences for species that exhibit a high degree of site fidelity and that are reliant on mature riparian vegetation (e.g., great blue heron) for life requisites.

Increases in palustrine shrub and emergent habitat should result in slight to moderate increases in nesting and foraging habitat for nongame bird species.

In addition, proposed outflows should maintain elevated pool levels in downstream sloughs and backwater areas and should not impact aquatic furbearers.

Foraging and breeding habitats for terrestrial wildlife will be reduced during a period between March through July when increased outflows will inundate emergent, submergent, and riparian habitats. However, this should not negatively affect these species.

Changes in outflows should not affect or could potentially increase habitat potential for amphibian species that are reliant on emergent and riparian habitats.

Periods of elevated flow may benefit species which under normal flow conditions have a reduced competitive advantage. *Rorippa columbiae*, that would suffer a reduced reproductive period during the high flows, may gain an increased competitive advantage over other riparian competitors due to excessive high flows that will be held constant over a prolonged period, thus reducing the competitively superior species period of reproduction.

Threatened, Endangered, and Sensitive Species

No impacts to threatened and endangered species are reported for the Hanford Reach.

Current management of flows that affect an eight to 12 foot change in surface water elevation in the Hanford Reach has resulted in a decrease in the period of time that Rorippa can germinate and reproduce due to scouring and elevated water levels. Under current flow regulation, Rorippa reproduces during August and September (W. Rickard, Battelle–Pacific Northwest Laboratory, pers. comm.). During 1993, however, when spring and early summer flows were greatly reduced, Rorippa germinated during May and June. It was not determined whether these individuals were reproductive. If this species is capable of reproducing during the early season, management of flows between 70,000 cfs. and 90,000 cfs. during spring and early summer could contribute to enhancing Rorippa populations viability along the reach.

5.2.11.4 Data Gaps

A majority of data for the Hanford Reach was compiled for analysis specific to Hanford Site monitoring activities. Information regarding habitat acreage for upland, emergent, and submergent vegetation are lacking. Therefore, estimates of impact may reflect inaccuracies in assumptions. Compilation of this information would compliment the long–term database that has been maintained for wildlife species that occur within or use the Reach.

The present analysis assumes a general lack of information on riparian vegetation and subsequently, a negligible effect of hydroregulation on riparian vegetation is anticipated. Similar assumptions are applied to impact assessment for palustrine shrub and emergent habitat.

During 1993, surveys for *Rorippa columbiae* were conducted throughout the Reach. The status of *Rorippa* and its decline in the face of hydropower development warrants examination of the effect of hourly, daily, and seasonal water level fluctuations on the species ecology. Currently, these data are lacking.

5.2.11.5 Conclusions

Benefits and negative effects to wildlife from systems operation will be balanced over the period of most significant consequence to wildlife (e.g., Mar–Aug). All proposed alternatives increase outflow to a point where the bottom substrate in the main channel is affected. Although the No Action and Group 1 alternatives are characterized by elevated flows, that length of time that flows are elevated is one to two months. Impacts from this group of alternatives would result largely from dramatic increases and decreases (e.g., rate of change) of flows within the system.

Group 2, Group 3, and Group 4 alternatives increase and maintain elevated flows similarly. It is anticipated that impacts from implementation of any of the alternatives would be relatively simiiar. The magnitude of flows is generally consistent between these alternatives and the rate of increase of flows and initiation of drawdown (e.g. March) should have a reduced impact on wildlife. These alternatives would reduce nesting habitat for some species, conversely, these alternatives would increase brooding and foraging habitat for other species. Alternative 9c differs from the 9a and 9b alternatives with respect to period of peaking high flows (e.g., July) and ramping the rate. Under all these scenarios the changes to habitat availability and/or distribution would occur early in the reproductive cycle and should not impact nested or reproductive wildlife species. Sustained high flows should contribute to increased submergent and emergent habitat and reduced water levels during late summer (e.g., August) should preclude a significant loss of the riparian component.

Rates of increase of flow and period of initiation of drawdown are the primary factors influencing the character of habitat within the Hanford Reach and ultimately the distribution of wildlife species. Not only do gradual increases and decreases in the system maintain system integrity, they accommodate short–term behavioral adaptation to a dynamic system.

5.2.11.6 Mitigation for the Preferred Alternative

Lack of information regarding the extend of distribution of riparian vegetation warrants further analysis. Currently, hydroregulation that affects the Hanford Reach is a result of operation of Priest Rapids Dam to meet requirements of the Vernita Bar Agreement. If requirements of this agreement are upheld through implementation of the Preferred Alternative, affects in the Hanford Reach should be minimal, and mitigation action should target characterization of existing riparian habitats.

5.2.12 Brownlee Project

5.2.12.1 Project–specific Species List

The indicator species listed in Table 3–3 (Project Wildlife Matrix) has been modified to better represent local conditions. The modifications include:

Deleted	*Because*		
N/A	N/A		
Selected or Added	*To Represent Category*	*Instead of*	*Because*
1. Golden eagle 2. Killdeer 3. Prairie falcon	1. Raptors 2. Shorebirds 3. T&E/Raptors	N/A	1. Significance to the area

5.2.12.2 Project-specific Assumptions/ Parameters

None

5.2.12.3 Evaluation Results

When comparing the monthly elevations of the different alternatives, it was discovered that many were identical and could be placed in groups to save time in the evaluation process. The following groupings were possible because of their similar reservoir elevations: 1) 2c, 2d, 5b, 6b and 6d are the same; 2) 4c; 3) 1a and 1b are the same: 4) 9b and 9c are the same; 5) 9a; 6) Preferred Alternative. Only one alternative was evaluated from each of the six groups.

Alternative 1a

Reservoir elevations in 'dry' years would be much higher in March when many island nesters are selecting sites. This would reduce the possibility of land bridging on islands and therefore enhance island nesting habitat. However, lower water elevations in May, July, August, and September may negatively impact riparian, emergents, submergents, and the wildlife that depend on these type of habitats. 'Wet' years keep the reservoir steady during July and August, but the benefits from this probably do not exceed 5 percent (as the water is down only 45 days at a maximum of ten ft). 'Average' years still increase the barren zone extent due to pool fluctuations.

Alternative 4c

Reservoir elevations for 4c 'wet' years are identical when compared to 2c 'wet,' so there are no impacts identified. 4c 'dry,' years are also identical, except for a raise in pool elevation in February and March. This increase in elevation will reduce land-bridging on islands as nesting sites are selected, and therefore show a positive impact. 4c 'average' years are similar to 2c 'average' as well, but it too will produce positive impacts on island nesters.

Alternative 9a

Reservoir elevations for 9a are similar in 'wet' and 'average' years, but vary significantly in 'dry' years. Because these 'dry' years may be the limiting factor for healthy vegetation, wildlife habitat is expected to be negatively impacted. Wildlife species relying on riparian vegetation would be impacted the most. Aquatic furbearer foraging may also be impacted from the fluctuating late summer elevations. A drawdown in late April may also impact island nesters.

Alternative 9b

The same negative impacts discussed in 9a would be experienced under this alternative with one exception: there is no April drawdown, so island nesting should not be impacted.

Preferred Alternative

Although the reservoir elevations in the Preferred Alternative are somewhat different when compared to 2c, the critical period elevations are very close. Reservoir elevations are actually more stable and land-bridging for islands is minimally reduced. Although some benefits are recognized from the preferred alternative, they are estimated to be minimal (5 percent or less).

Threatened and Endangered Species

From the Threatened/Endangered plant and wildlife species list shown in Table 5–8, no negative impacts are expected. However, this is only a preliminary evaluation. Biological assessments will be prepared for all Federally listed species to determine what impacts, if any, may occur. Impacts on candidate species will also be considered.

5.2.12.4 Data Gaps

Lack of sound habitat type acreages makes it very difficult to evaluate impacts to the wildlife that use these habitats. The habitat sizes have been estimated using the best available data. Much of the literature/data used in calculating impacts to existing habitats should be verified, as much of it was performed many years ago and might be considered outdated.

5.2.12.5 Conclusions

Reservoir elevations for 2c and 4c alternatives are identical in 'wet' years. Therefore impacts to wildlife are the same. However 'dry' and 'average' years are different so impacts to wildlife vary.

However, alternative 4c shows the most benefits to wildlife.

The Preferred Alternative is not expected to impact the existing habitat.

Table 5–8. Federally–Listed and Proposed Endangered and Threatened Species and Candidate Species: Snake River from Brownlee Dam to the Oregon/Washington Border (1–7–93–SP–383) (revised 3–25–95)

LISTED SPECIES			
Birds			
Peregrine falcon	*Falco peregrinus*	D	LE
Bald eagle	*Haliaetus leucocephalus*	D	LT
Fish			
Chinook salmon	*Oncorhynchus tshawytscha*	D	LT
Spring/summer/fall runs in the Snake River. (Petitioned June 7, 1990; proposed June 27, 1991 in SGFR 29542–29544; listed April 22, 1991 in 57 FR 14G53)			
Snake River sockeye salmon	*Oncorhynchus nerka*	D	LE
Salmon River Tributary to the Snake River, Idaho. (Petitioned April 2, 1990; proposed April 5, 1991 in 56 FR 14055; listed November 20, 1991 in 56 FR 5b619)			
Plants			
MacFarlanes' four o'clock	*Mirabilis macfarlanoi*	D	LE
PROPOSED SPECIES			
None			
CANDIDATE SPECIES			
Mammals			
North American lynx	*Felis lynx canadensis*	S	C2
California wolverine	*Gulo gulo luteus*	S	C2
Pacific fisher	*Martes pennanti pacifica*	S	C2
Pacific western big–eared bat	*Plecotus townsendii townsendii*	D	C2

Table 5–8. Federally–Listed and Proposed Endangered and Threatened Species and Candidate Species: Snake River from Brownlee Dam to the Oregon/Washington Border (1–7–93–SP–383) (revised 3–25–95) – CONT

CANDIDATE SPECIES – CONT			
Mammals – CONT			
Long–eared myotis (bat)	*Myotis evotis*	S	C2
Long–legged myotis (bat)	*Myotis volans*	S	C2
Yuma myotis (bat)	*Myotis yumanensis*	S	C2
Pale Townsend's big–eared bat	*Plecotus townsendii townsendii*	S	C2
Washington ground squirrel	*Spermophilus washingtoni*	D	C2
Birds			
Northern goshawk	*Accipiter gontilia*	S	C2
Ferruginous hawk	*Buteo regalis*	S	C2
Western burrowing owl	*Athene cunicularia hypugea*	D	C2
Plants			
Hazel's prickly–phlox	*Leptodactylon pungens ssp hazeliae*		C2
Amphibians and Reptiles			
Tailed frog	*Ascaphus truei*	S	C2
Spotted frog	*Rana pretiosa*	S	C1
Fish			
Bull trout	*Salvelinus confluentus*	S	C1
LE – Listed Endangered **LT** – Listed Threatened	**S** – Suspected **D** – Documented	**C2** – Information indicated listing as T or E may be appropriate, but is inconclusive presently.	

5.2.12.6 Mitigation for the Preferred Alternative

Since the Preferred Alternative is not expected to impact the existing habitat, no mitigation is required.

5.2.13 Oxbow and Hells Canyon Projects

5.2.13.1 Evaluation Results and Conclusions

Oxbow and Hells Canyon reservoirs are expected to be operated as 'run of the river' projects, and therefore should not experience significant affects. There will be some flow variations, but impacts to wildlife are expected to be less than 5 percent, as the flow changes are not considered significant (i.e. these range of flows are already being experienced).

5.2.13.2 Data Gaps

Lack of sound habitat type acreages makes it very difficult to evaluate impacts to the wildlife that use these habitats. The habitat sizes have been estimated using the best available data. Much of the literature/data used in calculating impacts to existing habitats should be verified, as much of it was performed many years ago and might be considered outdated.

Dworshak Reservoir			
Deleted	*Because*		
N/A	N/A		
Selected or Added	*To Represent Category*	*Instead of*	*Because*
1. Golden eagle 2. Killdeer 3. Prairie falcon 4. Common merganser	1. Raptors 2. Shorebirds 3. T&E/Raptors 4. Waterfowl	N/A	1. Significance to the area

5.2.13.3 Mitigation for the Preferred Alternative

Since the Preferred Alternative is not expected to impact the existing habitat, no mitigation is required.

5.2.14 Hells Canyon, Snake River

5.2.14.1 Project-specific Species List

The indicator species listed in Table 3–3 (Project Wildlife Matrix) has been modified to better represent local conditions. The modifications include:

5.2.14.2 Project-specific Assumptions/ Parameters

- To evaluate the different alternatives for Hells Canyon, reservoir releases (or total outflow) from Hells Canyon Dam were used. Although differences in flows were noted by month for the entire year, the 'critical period' was defined as March through September.
- An increase in outflow from Hells Canyon Dam would increase water elevation with Hells Canyon. However, an increase of less than 5,000 cfs is considered for the analysis to be non–significant to wildlife habitat along the river (i.e., the habitat already experiences these type of flows). Therefore, such increases would not impact wildlife.

5.2.14.3 Evaluation Results

When comparing the monthly outflows of the different alternatives, it was discovered that many were identical or similar enough to be placed in groups to save time in the evaluation process. The following groupings were made: 1) 1a, 1b, 2c, 2d, 4c, 5b, 5c, 6b, 6d and the preferred alternative are similar; 2) 9a; 3) 9b and 9c are similar. Only one alternative was evaluated from each of the three groups.

Using 2c as Base

Alternative 9a

Flows are much higher for this alternative during June, July, and August. The increased flows range from 5,200 to nearly 13,000 cfs above those experienced in 2c. These higher flows will likely increase the barren zone and decrease other habitat types. Island habitat, emergent wetlands, and riparian areas will most likely experience negative impacts. Wildlife species using these habitats will also experience a negative impact.

Alternative 9b

Alternatives 9b and 9c also experience much higher flows than 2c (but not as high as 9a). Increased flows of around 6,000 cfs during the 'critical period' would be experienced. The same type of impacts will likely be seen here as are discussed in alternative 9a. However, these higher flows are not expected to impact wildlife or their habitat more than an estimated 5 percent.

All other alternatives

All of the remaining alternatives have similar flows to 2c and should result in little change of existing habitat.

Threatened and Endangered Species

From the Threatened/Endangered plant and wildlife species list shown in Table 5–8, no negative impacts are expected. However, this is only a preliminary evaluation. Biological assessments will be prepared for all Federally listed species to determine what impacts, if any, may occur. Impacts on candidate species will also be considered.

5.2.14.4 Data Gaps

Flows are used instead of elevations for this reach (since elevations were unavailable). Vegetation along this stretch of the Snake River is currently subject to flooding from time to time, so existing habitat is somewhat tolerant. Timing and duration are major factors which may effect this tolerance. The hydroregs used for evaluation show wet, dry, and average flow years, which at times are quite different. Without having more exact information on timing and duration of such flows, assumptions have to be made.

Lack of sound habitat type acreages makes it very difficult to evaluate impacts to the wildlife that use the habitats. The habitat sizes have been estimated using the best available data. Much of the literature/data used in calculating impacts to existing habitats should be verified, since much of it was performed many years ago, and might be outdated.

5.2.14.5 Conclusion

The only alternative showing a measurable impact to wildlife would be 9a. This alternative would create substantially higher flows than 2c during the 'critical period.' Higher flows at this time of year negatively impact adjacent vegetation, and therefore negatively impact wildlife. The Preferred Alternative is similar to the No Action alternative. Therefore, if adopted, there should be no impacts to wildlife or it's habitat from what currently exists.

5.2.14.6 Mitigation for the Preferred Alternative

Since the Preferred Alternative is not expected to impact the existing habitat, no mitigation is required.

5.2.15 Dworshak Project

5.2.15.1 Project–specific Species List

The indicator species list in Table 3–3 has been modified to better represent local conditions. Modifications include:

Clearwater River			
Deleted	*Because*		
1. Diving ducks	1. Not common		
2. Gulls	2. Not common		
3. Black–necked stilt	3. None occur		
4. Elk	4. None occur		
5. Bighorn sheep	5. None occur		
6. Painted turtle	6. None occur		
Selected or Added	*To Represent*	*Instead of*	*Because*
1. Pacific tree frog	Amphibian		Occur commonly
2. N. alligator lizard	Reptile	Painted turtle	Occur commonly

5.2.15.2 Project–specific Assumptions/ Parameters

- Dworshak Dam is a storage reservoir. Therefore, impacts to wildlife and habitat that will result from drawdown do not account for original impacts of project development. Steep, rugged topography and lack of major tributaries provide a very limited area for vegetation development along the shoreline. Precipitation is not limiting generally, so riparian type vegetation may develop independent of changes in reservoir elevation. Few, if any, wildlife species are dependent on changes in reservoir elevation.
- Existing acreage of riparian and wetland vegetation was derived from Hansen and Martin (1989). There is no mappable scrub–shrub, emergent, or submergent vegetation that exists under current conditions. It is assumed that 6,862 acres of deciduous shrubland occurring in an early seral stage is not limited by water level fluctuations of the reservoir. Similarly, it is assumed that 41 acres of deciduous forest is not dependent on the reservoir but on tributaries at the extreme upper end of the reservoir.
- Approximately 1,879 acres of grass/forb presently occur within the project boundaries. Since this is the most likely vegetation type to become established under a given drawdown condition, it is assumed that perhaps 1 percent (19 acres) of this type is dependent on the reservoir for sustenance.

5.2.15.3 Evaluation Results

Alternatives 1a and 1b vary with respect to the number of times full pool (e.g., 1600 ft elevation) is attained during the 50–year hydroregulation period (e.g., 84 vs. 104 respectively); however they are similar with respect to maximum pool averages (Table 5–9). Alternatives 4c and 5c vary from 1a and 1b with respect to the number of times full pool is attained; however all the above alternatives have the greatest maximum pool averages over the 50–year hydroregulation period. Alternatives 5c, 5b, 6b, and 6d differ in regard to the rate at which full pool is restored following drawdown. For purposes of impact assessment these alternatives are grouped with Alternative 1a.

Alternative 9c is similar to alternative 9a with respect to maximum pool averages; however Alternative 9c approaches 1600 ft 27 times during the hydroregulation period. In terms of number of times maximum pool (e.g., 1600 ft) is attained, Alternative 9c is most similar to the Preferred Alternative. Alternative 2d is also similar to the Preferred Alternative approaching 1600 ft 15 times during the hydroregulation period and achieving maximum pool average elevations slightly less than those under the Preferred Alternative.

Alternative 9b is distinct from the above grouping of alternatives and exhibits increased potential for impact associated with the lowest average maximum pool elevation (e.g., 1470) for the 50–year hydroregulation period (Table 5–9).

Physical Habitat Impacts

Alternatives 1a, 1b, 4c, 5b, 5c, 6b, 6d

Derivation of the extent of the drawdown zone affected by each alternative is presented in section 5.2.15.2. Drawdown of Dworkshak Reservoir occurs during the winter, therefore physical impact to habitat should be minimal. No erosion or landslide potential is predicted since these conditions have primarily been exhausted by historic operation, and it is assumed that erosive forces no longer affect the reservoir shoreline. The majority of the reservoir area is vegetated by coniferous forest or shrubs on steep slopes ascending from the full pool elevation upland with bare rock occurring below.

No upland colonization would be expected to take place except under the dry condition (Table D–17). Dry year operations usually result in higher reservoir elevations, resulting in increased potential for plant colonization. Twenty–five acres of riparian habitat would develop as a result of exposure during the fifth year of a dry cycle that creates conditions suitable for vegetation colonization. Based on the five–year dry cycle, it is estimated that existing riparian acreage (e.g., 19 ac) primarily associated with tributaries,

Table 5–9. Maximum Pool Averages Derived From 50–Year Period of Record for Alternative March through June, Dworshak Reservoir

SOS Alternatives	Maximum Pool Averages (ft)				
	Mar	Apr (15)	Apr (30)	May	Jun
SOS 1a	1493.2	1493.1	1506.6	1556.6	1588.9
SOS 1b	1490.1	1489.6	1503.7	1562.5	1592.6
SOS PA	1511.3	1512.7	1506.7	1557.1	1589
SOS 2d	1510.8	1511.6	1501.6	1548.5	1575.5
SOS 4c	1519.4	1519.9	1527.8	1570.2	1597.4
SOS 5c	1514.9	1516.9	1525.6	1571.1	1598.2
SOS 5b	1515.1	1517.1	1525.8	1571.1	1598.2
SOS 6b	1515.8	1517.3	1525.9	1571.1	1598.2
SOS 6d	1515.8	1517.3	1525.9	1571.1	1598.2
SOS 9a	1505.3	1503.4	1498.4	1558.4	1584.3
SOS 9b	1503.8	1486.4	1470.2	1509	1545.5
SOS 9c	1508.6	1506.1	1505	1563.1	1583.1
SOS 9d	1506.5	1499.9	1502.9	1514.1	1520.3

would increase 25 percent (e.g., 5 ac) (Table D–17). Any changes in habitat would result from natural influences, succession, or mitigation and should not result from variation in the drawdown regime.

Alternatives PA, 2c, 2d, 9a, 9b, 9c

No erosion is expected under the alternatives because the area within the fluctuation zone is within that of the normal operation range. Upland colonization potential will range between three and ten acres for Alternative 9b, and 18 to 48 acres for alternatives PA, 2d, 9a, and 9c (Table D–17). These estimates are derived by determining the acreage exposed at an elevation midway between elevation 1,600 ft and the mean high pool, and high pool at the end of the 5–year wet/dry sequence. Years that full pool is achieved, vegetation cannot establish in the barren zone, since the barren zone is inundated at full pool. Only 1 percent of this acreage is assumed suitable for vegetation colonization.

Riparian colonization reflects the same acreage potential as upland colonization, since the assumption is made that colonizing vegetation has a 50 percent chance of becoming either upland or riparian. In any event, the increase would be minor and would have small benefit to wildlife in the area.

Boating activity would decrease significantly because access would be precluded by lower maximum pool levels. Reduced boating activity is not likely to affect wildlife.

Wildlife Impacts

Alternatives 1a, 1b, 4c, 5b, 5c, 6b, 6d

There is no impact anticipated for wildlife because most species are not dependent on the reservoir for life requisites (Table D–17). This conclusion further assumes that the fishery would not be impacted, which would further negate any impact to species reliant on resident and migratory fish populations.

Alternatives PA, 2C, 2d, 9a, 9b, 9c

Few wildlife species that occur in this area depend on reservoir level or habitat supported by the reservoir for life requisites (Table D–17). Many species' use of the area is restricted to tributaries and the upper end of the reservoir that receives water from the North Fork Clearwater River.

Mallard wintering would not be affected because mallard use the reservoir as a stop–over during migration and for resting and roosting during early winter when the water is still ice free.

Use of the area by great blue heron, raccoon, and Pacific tree frog would be concentrated around tributaries. The indicator species presented in Table D–17 – downy woodpecker, bald eagle, osprey, white–tailed deer, elk, and alligator lizard – are not dependent on habitats that are influenced by the reservoir. Of all species occurring in the area, osprey are the most dependent on the reservoir and would be impacted if an alternative significantly impacted the kokanee fishery or eliminated potential nest trees.

A reduction in fish productivity may occur because full pool is not realized under average conditions for this group of alternatives. Impacts would include a decrease in productivity because water levels would preclude fish from reaching traditional spawning beds, and ultimately influence osprey forage

Threatened and Endangered Species

No impacts are anticipated to threatened or endangered species for this project, since the alternatives produce no significant change in flows or elevations from current operations.

5.2.15.4 Data Gaps

Because the majority of wildlife species are not dependent on the reservoir, the primary impact to habitat and subsequently wildlife species will result along tributaries at the upper end of the reservoir. A major assumption of the analysis is that seral shrub, deciduous forest, and open grassland vegetation is not influenced by the reservoir. The extent that water level fluctuations impact upland and riparian habitat at the mouth of tributaries is undetermined. The reservoir and adjoining landscape are generally steep and gradient may limit the extent of any effect that drawdown may have at the mouth of upstream tributaries. To date these data have not been assembled.

5.2.15.5 Conclusions

Because topography limits the potential for development of additional habitat, historic operations of Dworshak Reservoir dominate landscape response, and precipitation as opposed to the reservoir, supports vegetation. Osprey, bald eagle, and mallard, however, do derive some benefit from the reservoir, but should not be affected by any alternative. Therefore, none of the alternatives are expected to impact wildlife differently, or in addition to impacts that occurred from original construction and continued operation of Dworshak Reservoir.

5.2.15.6 Mitigation for the Preferred Alternative

A loss assessment for original construction was performed using Habitat Evaluation Procedures (HEP) under the Northwest Power Planning Council (NPPC) Fish and Wildlife Program. Under this program, efforts between the Nez Perce Tribe and the Idaho Fish and Game are intended to enhance habitat for big game species (e.g., elk) and acquire lands to contribute toward fulfilling mitigation obligations. The losses identified for six species are the primary mitigation goals for the Dworshak Reservoir (Table 5–10). SOR operational goals should not impact species and mitigation developed with respect to the intent of the original NPPC program.

5.2.16 Clearwater River

5.2.16.1 Project–specific Species List

The indicator species list in Table 3–3 has been modified to better represent local conditions. Modifications include:

Deleted	*Because*
1. Mallard	1. Not common
2. Gulls	2. Not common
3. Black–necked stilt	3. None occur
4. Red–winged blackbird	4. Not common
5. Osprey	5. None occur
6. Raccoon	6. Raccoon
7. Elk	7. None occur
8. Bighorn sheep	8. None occur
9. Painted turtle	9. None occur

Selected or Added	*To Represent*	*Instead of*	*Because*
1. Common merganser	Diving duck		Occur commonly
2. Belted kingfisher	Nongame birds	Red–winged blackbird	Occur commonly
3. Pacific tree frog	Amphibian		Occur commonly
4. Gopher snake	Reptile	Painted turtle	Occur commonly

5.2.16.2 Project–specific Assumptions/ Parameters

- Elevations were obtained from a River Gaging Station Rating Table for the Clearwater River at Spalding, Idaho, provided by the Walla Walla District Corps (Table 5–11).
- Acreage was obtained from Hansen and Martin (1989). Presently, 1,174 acres of riparian vegetation are estimated, including vegetated islands consisting of deciduous scrub–shrub wetland, deciduous forested wetland, deciduous shrubland, and grass/ forbs. This acreage is assumed to be dependent on a soil moisture regime influenced by the river.
- Existing riparian acreage is assumed to be representative of alternative 2c at an average elevation of 11.0 ft. Riparian acreage is also assumed to gain or lose in direct proportion to river elevation.

5.2.16.3 Evaluation Results

Major flow events are defined relative to flows that exceed 50,000 cfs and are recorded at a stage of 12 ft at the Spalding gage. The significance of these events is related to an affected change of one foot in stage per 10,000 cfs of flow between 50,000 and 70,000 cfs (12 to 14 ft stage height). Average maximum elevation for Alternatives 1a and 1b differ slightly (e.g., 10.7 vs. 10.4 ft). However, their maximum elevation for major events are virtually identical (Figure 5–14).

Table 5–10. Mitigation Objectives for Dworshak, Lower Clearwater, and Lower Snake Projects — Net of Pre-/Post-Project Totals

	Bald Eagle	Canadian Goose		Osprey	Yellow Warbler	Chickadee	River Otter	Pilieated Woodpecker	Elk	Deer
		Breeding	Wintering							
	HUs ±	HUs ±	HUs ±	HUs ±	HUs ±	HUs ±	HUs ±	HUs ±	HUs ±	HUs ±
Dworshak	1627	NA	NA	1674	−77	−95	−4475	−3524	−11603	−8606
Lower Clearwater	1051	−16	323	0	196	4	163	NA	NA	−300
Net	2678	−16	323	1674	119	−91	−4312	−3524	−11603	−8906
Potential	maintain	restore	maintain	maintain	restore	restore	restore	restore	restore	restore
Mitigating	increase		increase	increase	maintain	maintain	maintain			
Activity					increase	increase	increase			

Table 5–11. Gage Height (Feet) and Discharge (x 1,000) for Clearwater River and Spalding, Idaho

Gage Height (ft)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	Discharge (x 1000 cfs)									
2				1.8	2	2.1	2.3	2.4	2.6	2.7
3	2.9	3.1	3.3	3.5	3.7	3.9	4.2	4.4	4.7	4.9
4	5.2	5.4	5.7	6	6.3	6.6	6.9	7.2	7.6	7.9
5	8.2	8.5	8.9	9.3	9.6	10	10.4	10.8	11.2	11.7
6	12.1	12.5	12.9	13.3	13.8	14.2	14.7	15.1	15.6	16.1
7	16.6	17.1	17.6	18.1	18.7	19.2	19.7	20.2	20.7	21.3
8	21.8	22.4	22.9	23.5	24.1	24.7	25.3	25.9	26.5	27.2
9	27.8	28.4	29.1	29.7	30.4	31.1	31.7	32.4	33.1	33.8
10	34.5	35.2	35.9	36.7	37.4	38.2	38.9	39.7	40.4	41.2
11	42	42.8	43.6	44.5	45.3	46.2	47	47.9	48.7	49.6
12	50.5	51.3	52.2	53	53.9	54.8	55.6	56.5	57.4	58.3
13	59.2	60.1	61	61.9	62.8	63.8	64.7	65.6	66.6	67.5
14	68.5	69.5	70.4	71.4	72.4	73.4	74.4	75.4	76.4	77.4
15	78.5	79.5	80.5	81.6	82.6	83.7	84.7	85.8	86.9	88
16	89	90.1	91.2	92.3	93.4	94.6	95.7	96.8	97.9	99.1
17	100.2	102.5	102.5	103.7	104.9	106	107.2	108.4	109.6	110.8
18	112	114.4	114.4	115.6	116.8	118	119.3	120.5	121.7	123
19	124.2	126.7	126.7	128	129.3	130.5	131.8	133.1	134.4	135.7
20	137									

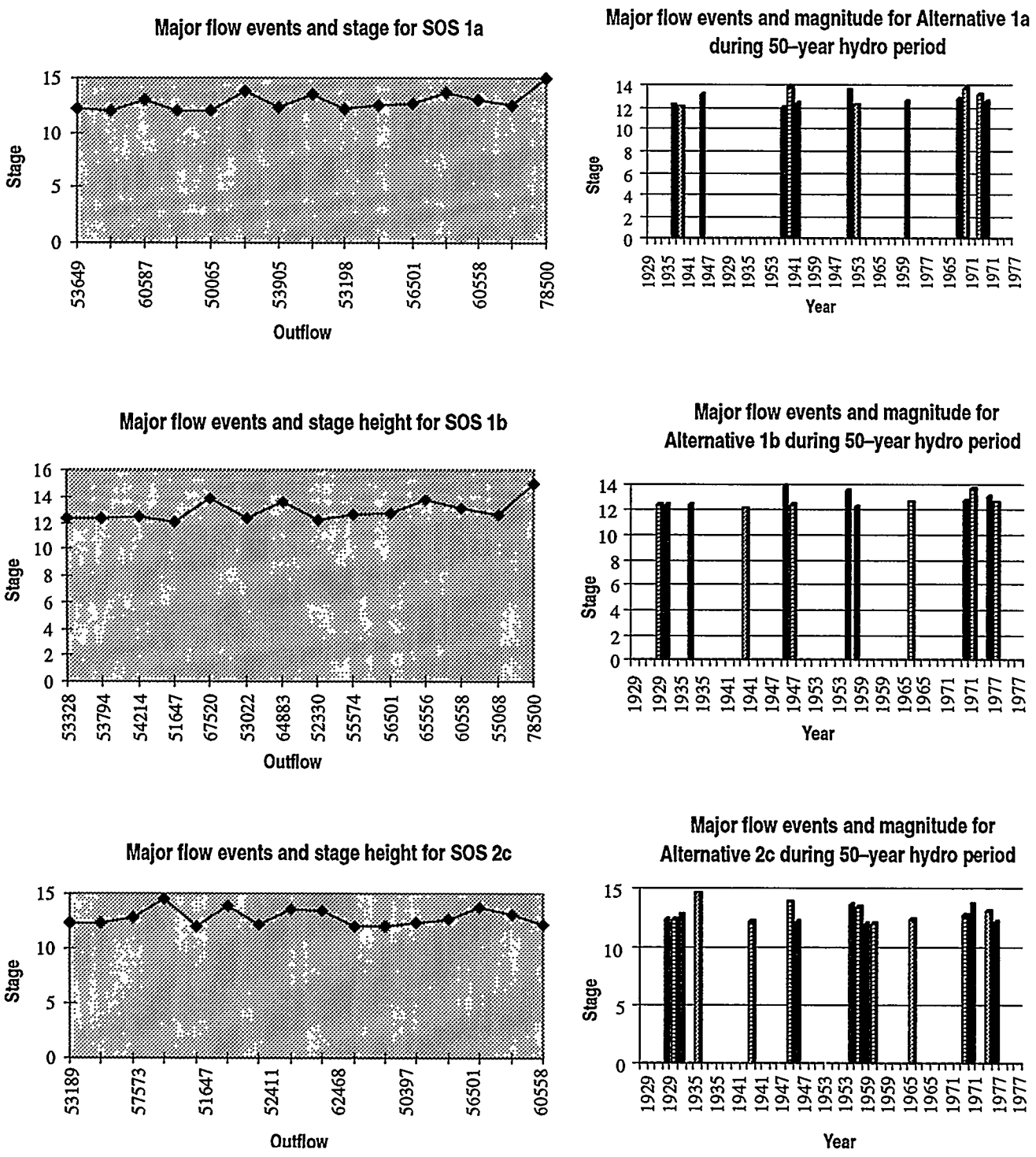

Figure 5–14. Maximum Elevation and Discharge for Major Water Events Derived for Alternate Operating Strategies, Clearwater River (Sheet 1 of 4)

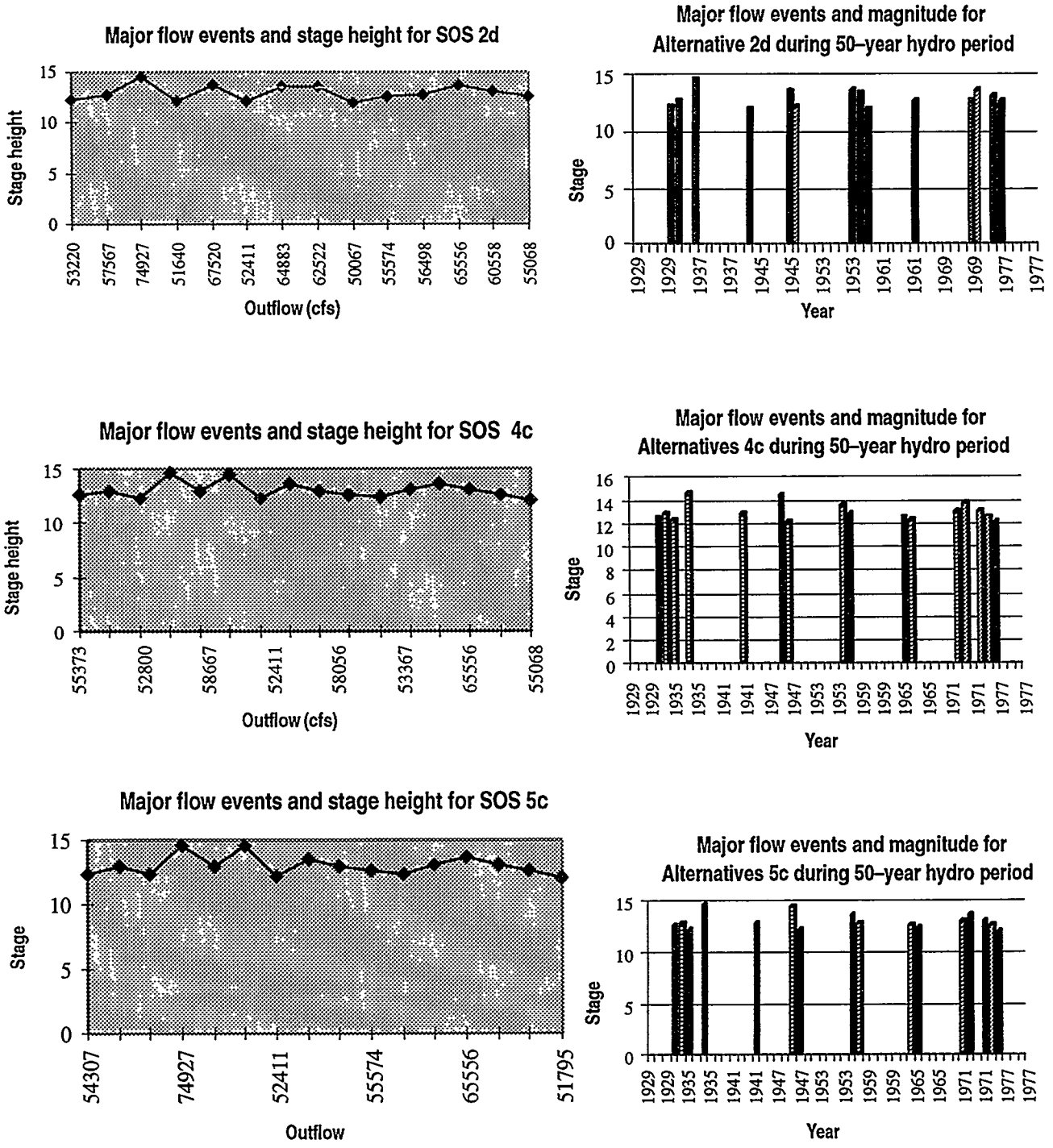

Figure 5–14. Maximum Elevation and Discharge for Major Water Events Derived for Alternate Operating Strategic, Clearwater River (Sheet 2 of 4)

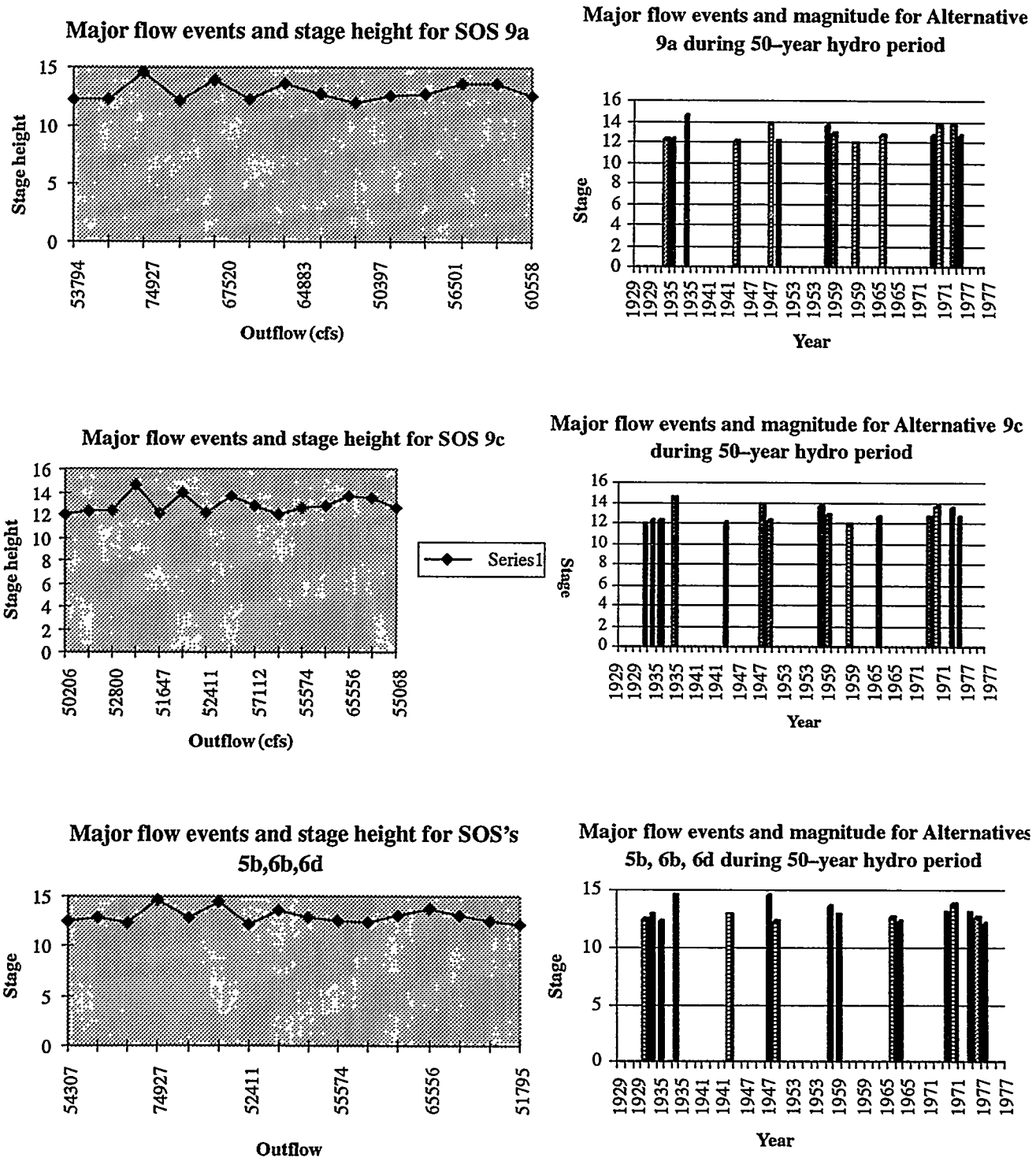

Figure 5–14. Maximum Elevation and Discharge for Major Water Events Derived for Alternate Operating Strategies, Clearwater River (Sheet 3 of 4)

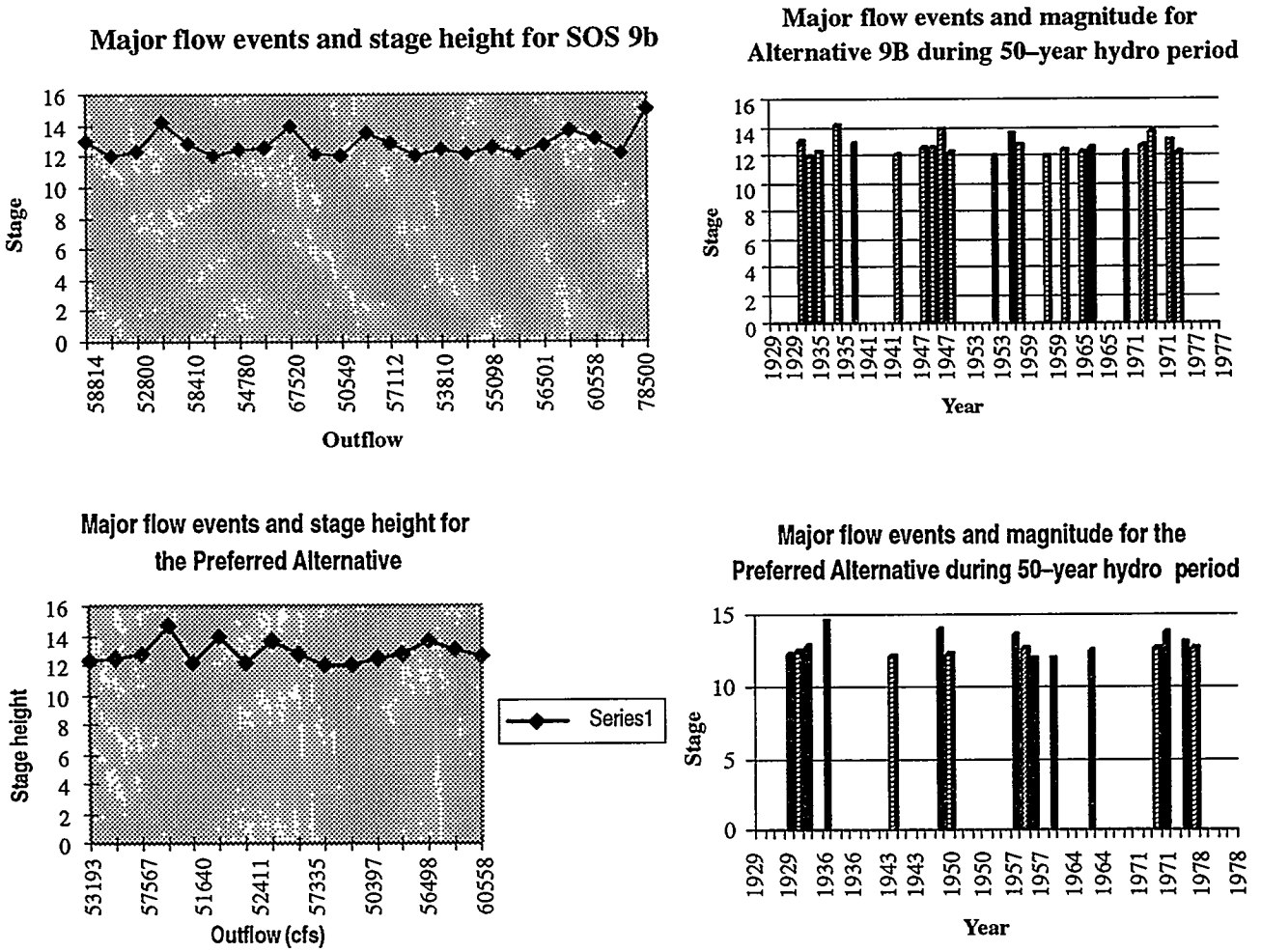

Figure 5–14. Maximum Elevation and Discharge for Major Water Events Derived for Alternate Operating Strategies, Clearwater River (Sheet 4 of 4)

Similarly, the maximum elevation for major events under the Preferred Alternative, duplicates alternatives 1a and 1b with exception for one event where the stage height at Spalding gage is 14.6 ft.

Alternatives 4c and 5c are largely identical and resemble the Preferred Alternative (Figure 5–14), as do alternatives 2c, 2d, 9a, and 9c (Figure 5–14).

Alternative 9b deviates from the other alternatives with respect to the magnitude of one major flow event that was 14.2 ft and the number of times the stage exceeds 12 ft (e.g., 25). Although this alternative captures the same range of flows as the other alternatives, the number of major events recorded for the hydroperiod is greater than those for the other alternatives. The degree of variability of major flow events distinguishes this alternative from the others for the 50–year hydroperiod (Figure 5–14).

Physical Habitat Impacts

Alternatives 1a, 1b, PA, 2c, 2d, 4c, 5c, 9a, 9c

Any gain or loss in vegetation between the wet and dry condition would be reflected as riparian vegetation. Although differences in elevations between the three conditions reflect variations in acreage, it is assumed that these differences will be temporary since the occurrence of vegetation is dictated by the major flow events. The stage height elevations derived for the fifth year of the wet condition are of lesser magnitude than the first and third years of that same period.

There are not mappable expanses of emergent vegetation or submerged aquatic plants beds along the river. Land–bridging of islands could potentially increase by approximately 25 percent (Table D–19).

Alternative 5b, 6b, 6d, 9b

The adaptive management Alternative 9b consistently maintains the maximum average flows in comparison to other alternatives during the period of April through May. Any difference between alternatives will be demonstrated by Alternative 9b. We may conclude that distinct variation in physical habitat parameters associated with this alternative would be observed during this period.

Greater average flows during the March to May period may have a scouring effect on the banks and island shoreline and may result in less riparian vegetation. Mature riparian vegetation should persist under dry conditions of Alternative 9b. Conversely, elevated flows of the wet condition may inundate root systems and negatively affect mature riparian vegetation, depending on duration.

Land–bridging of islands should be of less concern than elevated flows under these alternatives.

Wildlife Impacts

Alternatives 1a, 1b, PA, 2c, 2d, 4c, 5c, 9a, 9c

Impact to wildlife are not expected under these alternatives because the differences in extent of riparian vegetation will be temporary, as dictated by recurring major flow events (Table D–20).

Alternatives 5b, 6b, 6d, 9b

Ground nesting Canada geese could be impacted depending on the timing of major flow events (Table D–20). The majority of goose nesting occurs on elevated platforms on the islands. However some ground nesting has been recorded. Significant increases in flow during April and May, after nest initiation, could result in inundation of nests. Brooding could be impacted by reduced availability of herbaceous vegetation for grazing.

Common merganser, being primarily cavity nesters, could benefit from a long–lived riparian forested community. Great blue heron, downy woodpecker, and belted kingfisher would also benefit. The potential for establishment of a heron rookery would remain; nesting and feeding requirements for woodpecker would be perpetuated, and perch sites for kingfisher would remain available. Wintering bald eagles may realize some benefit from perch site availability as well.

Opportunities for spotted sandpiper nesting would likely be reduced over the long–term due to higher flows that would inundate sandy shorelines. Foraging could also be affected, at least during periods of high flow.

Yellow warbler nesting and feeding could be impacted from effects on scrub–shrub habitat from elevated flows.

Beaver denning may be impacted by increased fluctuations of water levels. Foraging could also be impacted by effects on the scrub–shrub. Otter may adapt more readily and may not be limited by impacts to denning for foraging habitat. Dynamics within the riparian and littoral zones could reduce feeding opportunities for these species as well as raccoons that are reliant on riparian habitat.

Deer utilizing the islands and riparian areas for fawning could potentially be impacted by the elevated surface water flows. Desirable succulent grasses and forbs may be reduced in acreage, slightly impacting foraging opportunities.

Threatened and Endangered Species

No impacts are anticipated to threatened or endangered species for this reach, since the alternatives produce no significant change in flows or elevations from current operations.

5.2.16.4 Data Gaps

The primary assumption in analysis is that all island and shoreline vegetation within the Lower Clearwater River is dependent on the existing soil moisture regime that is influenced by flow events. Therefore, the primary impact of each group of alternatives is the temporary loss or conversion of riparian habitat. Lack of site–specific or area–specific data for riparian habitat for the Lower Clearwater River requires several assumptions for analysis. Uncertainties relative to these assumptions compound inaccuracies in determining affect of each of the alternatives.

In early seral development of riparian vegetation, flooding occurs annually and plants develop, tolerant of variations in flow regime. Vegetation along the Lower Clearwater has developed in areas subject to seasonal variations in flow. The timing and duration of major flow events will dictate which species will persist and those that will recolonize a site after waters recede.

A final data gap regards interaction between wildlife species and habitat. Species that are dependent on wetland or riparian habitat for any of their life requisites may be affected by implementation of any of the alternative strategies. Displacement and recolonization rates specific to the Lower Clearwater River have not been assessed.

5.2.16.5 Conclusions

Alternative 9b maintains consistently higher average flows through April and May, which is why it becomes the basis for comparison of other alternatives. Although Alternative 5c is characterized as having two major flow events (>70,000 cfs), like the other alternatives, 5c is characterized by lower average flows for April and May of the 50–year hydroperiod than Alternative 9b. It is the magnitude of these highest flows, and their frequency and timing that would have the most lasting impact in regard to vegetation composition.

Riparian vegetation communities along free–flowing rivers are dynamic systems with one type of vegetation often replacing another type. Because the adjoining sideslope and occurrence of a road or railroad on either bank of the Clearwater River, the wetted width of the river is generally confined, especially in certain reaches. Therefore, alternatives with higher average flows would tend to result in overall less riparian vegetation; this is determined to be less desirable when considering the abundance and diversity of wildlife species inhabiting riparian habitat. However, impacts through implementation of Alternative 9b are anticipated to have only marginal effects on local wildlife.

5.2.16.6 Mitigation for the Preferred Alternative

The Army Corps of Engineers is not responsible for operational impacts below its storage projects. Loss assessment for this free–flowing reach was performed under the Northwest Power Planning Council (NPPC) Fish and Wildlife Program, and mitigation was developed consistent with mitigation for the Dworshak project. A Habitat Evaluation Procedures (HEP) analysis similar to that applied to reservoir loss assessments, was used to compare pre– and

post–project conditions. The losses identified for two species are the primary mitigation goals for the Clearwater River (Table 5–10) and should not be impacted by implementation of SOR operational goals.

Mitigation for riparian habitat loss/conversion upstream of the project should be addressed relative to operational impacts of SOR implementation. Riparian habitat is listed as a 'high' priority habitat for managing target species within the Lower Columbia Basin Wildlife Mitigation Plan. Given an 8 to 1 maximum replacement ratio for habitat loss/conversion with implementation of various alternatives, the following are estimates for riparian habitat mitigation in tributaries upstream of the Clearwater project.

Alternatives	Habitat	Acres
PA, 1a, 1b, 2c, 2d, 4c, 5c, 9a, 9c	Riparian	690
5b, 6b, 6d, 9b	Riparian	1792

5.2.17 Lower Snake River Projects, including McNary Project

5.2.17.1 Project–specific Species List

The indicator species list in Table 3–3 has been modified to better represent local conditions. Modifications include:

Lower Snake			
Deleted	***Because***		
1. Diving duck	1. Not common		
2. Gull	2. Not common		
3. Black–necked stilt	3. None occur		
4. Osprey	4. None occur		
5. Elk	5. Not common		
6. Bighorn sheep	6. None occur		
7. Painted turtle	7. None occur		
Selected or Added	***To Represent***	***Instead of***	***Because***
1. Pacific tree frog	Amphibian		Occur commonly
2. Gopher snake	Reptile	Painted turtle	Occur commonly

5.2.17.2 Project–specific Assumptions/ Parameters

- Because reservoir elevations do not vary for any of the 13 SOS's, no change from existing conditions is predicted for wildlife resources at the McNary reservoir.
- The four lower Snake River reservoirs (Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams) can be evaluated as a system or as single projects. Any alternative affecting one reservoir affects each reservoir simultaneously in the same manner. This in turn creates similar impacts to wildlife utilizing these reservoirs and adjacent shorelines. Therefore, indicator wildlife species used to evaluate impacts are the same for each reservoir.
- There are approximately 750 acres of habitat on nine Habitat Management Units (HMUs) scattered along the entire length of these four reservoirs. These habitats are not included within the impact assessment because they are not directly supported or affected by the reservoir levels.

- It is assumed that irrigation system intakes will be modified or wells drilled in order to continue irrigation of the HMUs under alternatives that lower water levels below the existing intakes. Otherwise, these habitats will have to be replaced, and included as part of mitigation under those alternatives.
- Ice Harbor and Lower Monumental reservoirs are normally operated within three ft of maximum pool, while Little Goose and Lower Granite reservoirs normally operate within five ft of maximum pool. For alternatives displaying the mean elevation within these respective ranges in the hydroregulation models, it is assumed that the reservoir elevations will fluctuate within their normal operating range.
- There is no variation between wet, dry, and average classification values for any of the alternatives for these four reservoirs.
- Wetland and riparian acreage are derived from a HEP analysis performed on the lower Snake River reservoirs from 1989 to 1991 (Sather–Blair et al. 1991). In that analysis, acreage data was lumped for the lower two reservoirs (Ice Harbor and Lower Monumental) and the upper two reservoirs (Little Goose and Lower Granite) because of environmental and habitat similarities. For the purpose of this analysis, habitat attributed to reservoir pairs has been divided in half to represent a single reservoirs' acreage. Vegetative cover mapping extended to the edge of project boundaries, accounting for riparian–type habitats in canyon draws, associated with seeps and springs, and along tributaries not necessarily dependent on reservoir elevations for sustenance.
- Riparian vegetation was classified as palustrine scrub–shrub, palustrine forest, mesic shrub, and perennial forb/grass. For the purpose of this analysis, it is assumed that the occurrence of all scrub–shrub vegetation is reservoir–elevation–dependent.
- It is assumed that only 15 percent of the other riparian vegetative types are reservoir dependent.
- It is assumed that all palustrine emergent vegetation is reservoir–dependent.
- It is assumed that all areas suitable for wetland or riparian establishment have been colonized.

5.2.17.3 Evaluation Results

The baseline alternatives 1a and 1b are identical, reflecting operation within the normal ranges of the four reservoirs throughout the entire year, including the critical period. Alternative 2c varies from alternatives 1a and 1b in that the alternative is held at minimum pool during April through July. Alternatives 2d and 4c are operated similarly to Alternative 2c, so for purposes of analysis these alternatives are grouped. The Adaptive Management Alternative (9b) and the Preferred Alternative strategies correspond with the April drawdown of alternatives 2d and 4c but extend that period beyond July to August in the case of the Adaptive Management Alternative 9b, and October in the case of the Preferred Alternative. These alternatives have also been group with alternatives 2d and 4c for analysis.

Alternative 9c draws on the reservoirs during March through May. Drawdown ranges between 33 and 43 ft for Ice Harbor (33 ft), Lower Granite (40 ft), Little Goose (41 ft), and Lower Monumental (43 ft) projects. Alternative 6b and 9a extend the period of drawdown from April through August. The drawdown magnitude varies from Alternative 9c to 28 ft at Little Goose and Lower Granite projects, and 30 ft at Ice Harbor and Lower Monumental projects under Alternative 9a; and 33 ft at all four projects under Alternative 6b. Similarly, Alternative 6d draws down Lower Granite project 25 ft between April and June, restoring the reservoir to within normal operating range by August 15 (Table 5–12).

Alternatives 5b and 5c represent drawdown to the 'natural river' elevation at each reservoir for April to August, and January through December, respectively. This represents drawdowns of 97 ft at Ice Harbor, 108 ft at Lower Monumental, 114 ft at Little

Goose, and 115 ft at Lower Granite. The magnitude of the drawdown distinguishes this alternative from the others.

Physical Habitat Impacts

Alternatives 1a, 1b, PA, 2d, 4c, 9b

Erosion/landslide potential is not assumed because the alternatives reflect operation within the normal range for each reservoir. These alternatives reflect historic operations, therefore no further colonization of upland vegetation is expected (Table D–21). With exception for alternatives 1a and 1b, the upper three ft of the normal operating zone for Lower Granite and Little Goose, and the upper one foot of the same zone for Lower Monumental and Ice Harbor are assumed to have potential to support colonizing vegetation. Due to topography, and availability of sediments able to support vegetation, colonization of emergent and riparian vegetation is anticipated.

Extent of submerged aquatic plant beds is expected to increase with a more stable pool during the growing season. There is not data available on the present extent of this vegetation type.

The limited island acreage available is not expected to be impacted. Silcott Island in Lower Granite Reservoir is not included in the analysis since it is linked to the mainland by a causeway and for all intents and purposes is a recreational island. Because the alternatives are within the normal operating range of each reservoir, it is not expected that impacts to islands through land–bridging would result.

Alternative 9c

Although alternatives 9a and 9c are similar in that they largely extend the drawdown zone beyond normal operational pool, the timing and duration of drawdown under Alternative 9c (March to May) versus Alternative 9a (April to August) may result in variation in the magnitude of affects and therefore the alternatives will be discussed separately.

The work group believes that most of the riparian vegetation dependent on the reservoir can endure a drawdown between March and May, because during the remainder of the year the reservoir would be operated at full pool. More importantly, under this alternative the reservoirs are returned to their normal levels during the hottest part of the growing season when rainfall is least and evaporation very high.

Alternative 9c would likely deter recruitment (regeneration) of riparian vegetation and in the long–term have detrimental impacts. Due to the anticipated impact and relative uncertainty regarding actual effects, a 20 percent replacement of riparian vegetation is predicted. The existing riparian vegetation would be replaced by an equal amount of upland vegetation (grassland or shrub steppe) since the area of impact would all be above high pool.

Similar to riparian habitat, emergent vegetation is also expected to persist under Alternative 9c although no regeneration is anticipated. Submerged aquatic vegetation, however, would not endure exposure from even 'short–term' drawdowns. Virtually all islands would be land–bridged during some period under Alternative 9c.

Table 5–12. Project Operation and Maximum Drawdown Elevation Associated with Alternative SOS's for the Lower Snake River

Alternative	Project	Period (Month–Month)	Elevation (Ft)
PA	L. Granite	Apr–Aug	733
	L. Goose	Apr–Aug	633
	L. Monumental	Apr–Aug	537
	Ice Harbor	Apr–Aug	437

Table 5–12. Project Operation and Maximum Drawdown Elevation Associated with Alternative SOS's for the Lower Snake River – CONT

Alternative	Project	Period (Month–Month)	Elevation (Ft)
1a,1b	L. Granite	Aug–Sep	735
	L. Goose	Aug–Sep	636
	L. Monumental	Aug–Sep	538
	Ice Harbor	Aug–Sep	438
2c,2d	L. Granite	Apr–Jul	733
4c	L. Goose	Apr–Jul	633
	L. Monumental	Apr–Jul	537
	Ice Harbor	Apr–Jul	437
5c	L. Granite	Aug–Sep	623
	L. Goose	Aug–Sep	524
	L. Monumental	Aug–Sep	432
	Ice Harbor	Aug–Sep	343
5b	L. Granite	Apr–Aug	623
	L. Goose	Apr–Aug	524
	L. Monumental	Apr–Aug	432
	Ice Harbor	Apr–Aug	343
6b	L. Granite	Apr–Aug	705
9a	L. Goose	Apr–Aug	605
	L. Monumental	Apr–Aug	507
	Ice Harbor	Apr–Aug	407
6d	L. Granite	Apr–Aug	705
	L. Goose	Apr–Jul	633
	L. Monumental	Apr–Jul	537
	Ice Harbor	Apr–Jul	437
9b	L. Granite	Apr–Aug	733
	L. Goose	Apr–Aug	633
	L. Monumental	Apr–Aug	537
	Ice Harbor	Apr–Aug	437
9c	L. Granite	Mar–May	695
	L. Goose	Mar–May	595
	L. Monumental	Mar–May	495
	Ice Harbor	Mar–May	405

Alternative 6b, 6d, 9a

Alternative 9a differs from alternative 9c in magnitude and timing/duration of drawdown. The affects of the magnitude of drawdown are addressed in the discussion of Alternative 9c. Under alternatives 6b, 6d, and 9a, the timing and duration of drawdown, that spans the growing season and continues through the summer, is expected to eliminate much of the riparian vegetation that might otherwise persist. Selected individuals or species would persist and some vegetation would be sustained around tributaries. No riparian regeneration would occur. Therefore, an 80 percent reduction in riparian vegetation is predicted (Table D–21). The riparian vegetation lost would be replaced by upland vegetation, and assuming pumping and irrigation equipment is not rendered ineffective, vegetation of the Habitat Management Units (HMU's) may colonize shoreward of the upland margin. Affects associated with Alternative 6d would be expected only to affect the Lower Granite reservoir.

Virtually all islands would be land–bridged during some period under this alternative.

Alternative 5b, 5c

The natural river operation, Alternative 5c would eliminate riparian habitat and deter recruitment of riparian vegetation. Assuming some replacement of riparian vegetation by upland vegetation, and assuming pumping and irrigation equipment is operational and reaches that vegetation, vegetation of the HMU's may colonize shoreward of the upland margin and extend into the barren zone. Colonization potential is estimated to be less than 1 percent. All islands would be land–bridged under these alternatives.

Wildlife Impacts

Alternatives 1a, 1b, 2c, 2d, 4c, 9b

The alternatives should provide minimal benefit to nesting Canada geese (Table D–22). Presently, very few geese nest along the river banks, exclusive of islands and cliffs, and operation at MOP could encourage nesting in the future. Goose broods could exhibit both positive and negative responses under this group of alternatives. Operations at MOP will encourage herbaceous vegetation to sprout within the drawdown zone possibly enhancing grazing habitat. However, in other areas, birds may need to travel across extensive barren zones to reach grazing pastures, potentially exposing goslings to increased predation. Development of additional riparian vegetation will increase hiding cover for predators, particularly if riparian vegetation separates the reservoir from landward grazing pastures.

Mallards may also benefit from operation at MOP. Presently, few mallards nest along the lower Snake River. An increase in the percent of submerged aquatic plant beds and increased riparian habitat may benefit mallards, although the increase would likely be less than 5 percent of the current population.

Great blue heron could benefit from an increased, mature riparian zone. Currently, there are no rookeries located along the lower Snake River. However, development of mature trees along this stretch could encourage formation of a rookery. Herons would benefit from an expected increase in fish and benthic invertebrate production and potential increase in amphibian production resulting from a more stable pool.

Opportunities for nesting by spotted sandpiper would increase with development of barren zones along shores and islands. Foraging habitat and invertebrate prey abundance would also increase.

Potential long–term benefits for nesting and feeding for downy woodpecker could result from development of mature riparian vegetation. Wintering bald eagles could also benefit from additional perch and roost sites. Red–winged blackbird and yellow warbler would benefit from an increase in riparian vegetation, that is essential for nesting and feeding. The latter two species would also benefit from an increase in emergent wetland vegetation. Red–winged blackbird would benefit from increased nesting habitat under this scenario.

Operating at a lowered pool during only part of the year could expose beaver bank dens and lodges. A lowered pool could also induce beaver to construct lodges or dens at the lowered level only to be later flooded and rendered unusable.

Raccoon would benefit from the lowered pool through increased foraging opportunities in the barren zone immediately following drawdown, and from expected increased prey abundance in expanded wetland areas, the edge of shallow water areas (e.g., submergent wetland zone) and increased riparian zone.

White–tail and mule deer may benefit from the expanded riparian areas along shorelines and islands that will increase habitat for fawning. The expanded wetland and riparian areas and growth of seasonal annuals in the drawdown zone would provide more grazing and browsing opportunities.

The Pacific tree frog should benefit from a stable pool elevation. This condition should provide habitat for egg–laying and development in backwater sloughs and ponds. Foraging and hiding cover would increase with the expansion of the riparian and wetland zones. The Great Basin gopher snake would benefit from increased foraging opportunities in wetland and riparian zones, as well as from increased breeding opportunities in riparian zones.

Human effects are not expected to change and may increase slightly with stable pool elevations.

Alternative 9c

Canada goose nesting would be impacted significantly because all nesting islands would become land–bridged and rendered accessible to predators and people. It is doubtful that any successful island nesting would be achieved after several years under these alternatives. There would be significant production from cliff nesting geese. However, these broods would be negatively impacted from the extensive drawdown zone that goslings would need to traverse en route to brooding pastures. This impact may be offset somewhat from development of annuals, that may provide forage within this zone.

Presently, mallard nesting activity is limited along the lower Snake River, which is the reason for the determination of no impact. However, eventual loss of riparian habitats through lack of regeneration would reduce potential of nesting in suitable habitat even more. Any mallard broods produced would be impacted by increased barren zone and the withdrawal of water from emergent and riparian habitats, the loss of submergent aquatic vegetation, the loss of island habitats, and an increase in human disturbance. Wintering mallards, that occur in significant numbers, could be impacted by a loss of submerged aquatics although they are likely much more reliant on off–site grains during this period.

There are no known great blue heron rookeries along the lower Snake River reservoirs, therefore these alternatives should have no impact other than precluding the establishment of a rookery in the future, through loss of woody riparian habitats. The greatest impact to herons would likely result from desiccation of shallow water areas along shorelines and around islands and resultant detrimental impacts to fish and benthic invertebrate prey. Spotted sandpiper could experience increased nesting opportunities through creation of mud flats along shorelines and around islands. This benefit could be limited however by increased human use of these areas. Foraging opportunities however, would be significantly impacted through loss of a stable shallow water/mud flat complex that supports the benthic invertebrates on which these birds rely.

Long–term impacts to nongame songbirds would be negative, associated with a loss of riparian habitat that supports nesting and feeding activity and to a lesser extent, by increased human use of shorelines and islands. Wintering bald eagles would be impacted by eventual loss of perch sites and roost trees in a declining riparian zone.

Beaver would be impacted significantly through exposure of dens and lodges or inducement to construct dens in areas that would later be flooded. Eventually, food supply could be reduced due to a loss of woody riparian vegetation. Subsequently, river otter denning opportunities would be negatively impacted as well, although otter tend to be more opportunistic than beaver. Of greater significance would be impacts to otter feeding associated with impacts to benthic invertebrates and fish, related to desiccation of shallow water areas. Increased risk of predation through exposure in the barren zone may also impact otter.

Raccoon would be affected similarly, as a result of impacts to prey availability/accessibility.

Mule deer would likely only be impacted slightly since fawning and foraging are not dependent on habitats supported by the reservoir. Some individuals utilizing islands or riparian vegetation for fawning would have to relocate that activity and some foraging opportunity, mostly browse that would be utilized in the winter, would be lost.

Opportunity for reproduction by the Pacific tree frog would be virtually eliminated. The drawdown would desiccate any usable backwater areas that could potentially support eggs and subsequent tadpole development. Foraging opportunities would be lessened through eventual loss of riparian habitat. Similarly, the gopher snake would be impacted both reproductively and by limited availability of foraging habitat associated with loss of riparian and emergent vegetation.

Primary fish productivity would be expected to decrease dramatically from the fluctuating water levels during critical spawning periods. Benthic invertebrates, unable to withstand exposure, would suffer as well. Boating activity could be expected to decrease significantly, with a decline of the resident sport fishery.

Alternatives 6b, 6d, 9a

Impact of Alternative 9a is similar to Alternative 9c. Canada goose nesting would be disrupted if land–bridging of islands occurs, affording access to predators and humans and resulting in a loss of riparian vegetation. Brooding by cliff nesters would be negatively affected by the increased expanse of barren zone between nesting sites and brood pastures. Some traditional pastures may revert to upland vegetation. This effect would probably be outweighed by emergence of annuals in the drawdown zone at least during the early brooding period. Wintering geese would not be impacted.

Almost all potential for mallard nesting would be lost due to reduction of riparian vegetation and land–bridging of islands. Any brooding would be severely impacted by drawdown that would desiccate most, if not all, feeding areas. Wintering ducks would be dependent entirely on off–site grains since no submergent vegetation would be available.

Great blue heron would lose any potential nesting habitat through loss of riparian vegetation. Foraging would be severely impacted by desiccation of shallow water feeding areas and loss of prey species.

Spotted sandpiper could benefit from increased nesting opportunities in the barren zone, however this would be negated by a loss of foraging opportunities through desiccation of mud flats.

Downy woodpecker, red–winged blackbird, and yellow warbler would all be affected by a loss of riparian and emergent habitat which they depend on for nesting and feeding. The number of bald eagle perch and roost trees would decline over the long term although usable snags would remain for some time.

Occurrence of beaver and river otter would be eliminated adjacent to the reservoirs through loss of denning opportunities and loss of riparian vegetation that supplies food and/or cover. Otter and raccoon foraging opportunities would be eliminated through desiccation of shallow water areas and loss of prey species.

Mule deer fawning habitat would be reduced along the reservoir or along island shorelines. Similarly, winter browse and riparian grasses and forbs would be eliminated.

Reproductive potential of Pacific tree frog would be eliminated through desiccation of shallow water sloughs and ponds. In addition, riparian habitat necessary for foraging and cover would be eliminated. Similarly, elimination of riparian vegetation would significantly reduce, if not eliminate, gopher snake reproduction.

Primary fish productivity would be expected to be severely impacted, as would boating activity. Shoreline activity may increase slightly.

Alternative 5b, 5c

Drawdown to natural river would impact wildlife in a similar manner to Alternatives 6b, 6d, 9a, and 9c. Further, implementation of this alternative would preclude establishment of riparian vegetation, create

extensive barren zones, land–bridge islands, desiccate waterfowl foraging areas, and eliminate shallow water and mud flat foraging and denning areas. Managed habitat production similar to that employed for existing HMU programs may accommodate site restoration or enhancement for impacted wildlife species in the long–term.

Threatened and Endangered Species

Bald Eagle would be impacted by any of the drawdown alternatives that would impact persistence of the riparian zone through loss of perch and roost trees.

5.2.17.4 Data Gaps

The primary impact of each alternative is the loss or conversion of palustrine emergent or riparian habitat to upland or barren zones. Lack of site–specific or area–specific data for wetland and riparian habitat and submerged aquatic plant beds for each of the lower Snake River reservoirs requires several assumptions for analysis. Uncertainties relative to these assumptions compound inaccuracies in determining affect of each of the alternatives.

In early seral development of riparian vegetation, flooding occurs annually and plants develop that are tolerant of variations in flow regime. Although vegetation along the lower Snake River has developed in areas subject to daily fluctuations in surface water elevation (e.g., 3–5 ft.), drawdown would be expected to affect vegetation production. Timing and duration of drawdown may affect regeneration if seeds are dispersed on densely vegetated or dry substrates or on substrates that dry too rapidly (USFWS 1992). These data have not been assembled for the Lower Snake River projects. It was noted, as a result of the March 1992 drawdown of Lower Granite and Little Goose reservoirs, that exposed gravel and mud substrates within the normal water fluctuation zone were colonized by an abundance and diversity of plant species (Philips 1992). Changes in species composition was also noted; however, it was not demonstrated that the change in vegetative composition of the shoreline was not based on the species annual productive cycle.

Drawdown may favor production of undesirable or weed species in riparian habitat, thus reducing habitat quality. Evidence suggests that reservoir drawdown zones are avenues for dispersal of weeds, and that drawdown may contribute to the spread of noxious weeds that outcompete native vegetation (Ebasco 1992). A result of the March 1992 drawdown was colonization by noxious weed species between the ordinary high water mark and MOP. It is not known whether this condition would persist over the long term.

A final data gap regards interaction between wildlife species and habitat. Species that are dependent on wetland or riparian habitat for any of their life requisites may be affected by implementation of any of the alternative strategies. Displacement and recolonization rates specific to each of the Lower Snake River reservoirs has not been assessed, although preliminary analysis of vegetation response was conducted during the March 1992 drawdown. Quantifiable results that can be expressed in terms of impact to food webs have not been generated.

5.2.17.5 Conclusions

Alternatives 1a, 1b, PA, 2c, 2d, 9b

The alternatives would enhance the food chain from aquatic invertebrates and submerged plants through top carnivores such as raptors and coyotes. Species representing each category would derive some benefit from this group of alternatives with only two species exhibiting a negative response (e.g., Canada goose goslings and beaver). Noting this exception, the working group concludes that the potential benefits from this group of alternatives far outweigh negative effects.

Alternative 9c

Each category of wildlife would be impacted to some degree with implementation of Alternative 9c. The majority of species would be impacted due to loss of riparian habitat, and due to lack of

regeneration over the long–term. The species that would be impacted to a greater extent would be locally reproducing mallard, great blue heron, spotted sandpiper, beaver, river otter, raccoon, and Pacific tree frog. Resident Canada geese would be impacted by a lack of suitable nesting habitat on islands.

Alternative 6b, 6d, 9a

Implementation of this alternative would eliminate or significantly reduce use of the reservoir and adjacent habitat for most species with a dependence on riparian or aquatic habitat. Downy woodpecker, raccoon, mule deer, and gopher snake could use adjacent draws that provide riparian habitat. However it is assumed that these areas would be limited and niches occupied by other individuals; thus enhancing intraspecies competition.

Alternative 5b, 5c

This alternative would produce the greatest impact on the Lower Snake River reservoirs, eliminating, or at least significantly reducing use of the reservoir and adjacent habitats for nearly all species with any dependency on riparian or aquatic habitat during any or all of their life stages. It is conceivable that displaced species could use adjacent draws that provide riparian habitat, however it is assumed that these areas would be limited and niches occupied by other individuals, thus enhancing intraspecies competition.

5.2.17.6 Mitigation for the Preferred Alternative

Mitigation goals for construction of the Lower Snake River projects have been addressed in the Lower Snake River Compensation Plan. Mitigation goals were established using the HEP analysis and habitat unit losses for nine species (Table 5–13). Mitigation is being accomplished through a combination of management of existing project lands and acquisition of off–project lands. The original mitigation proposal has been modified and is being satisfied in part by the Army Corps of Engineers. Mitigation achieved to date could be affected by drawdown alternatives not only because of dependency of habitat on the reservoir but also on existing irrigation operation.

Riparian forest and scrub–shrub wetlands that were not compensated under the initial mitigation program for the lower Snake River should be a focus of mitigation for implementation of SOR alternatives. Riparian and wetland habitats are also listed as 'High' priority habitats for managing target species within the Lower Columbia Basin Wildlife Mitigation Plan. Given a three to one minimum replacement ratio for habitat loss or conversion associated with implementation of the alternatives the following estimates should be considered for mitigation.

Alternatives	Habitat	Acres
PA, 1a, 1b,	Riparian	429
2d, 4c, 9b	Emergent	51
9c	Riparian	605
6b, 9a	Riparian	605
6d	Riparian	605
5b, 5c	Riparian	605

5.2.18 John Day Project

5.2.18.1 Project–specific Species List

The indicator species listed in Table 3–3 (Project Wildlife Matrix) has been modified to better represent local conditions. The modifications include:

Deleted	*Because*		
1. Spotted sandpipers	1. Either negligible presence, or impacts addressed by other species		
2. Osprey	2. same as above		
3. Raccoon	3. same as above		
4. Deer	4. same as above		
5. Big horn sheep	5. same as above		
Selected or Added	*To Represent Category*	*Instead of*	*Because*
N/A	N/A	N/A	N/A

Table 5–13. Summary of Pre–Project and Current Habitat Conditions (Habitat Units – HUs) for Each Evaluation Species for the Lower Snake River

Habitat/Species Group (Evaluation Species)	Pre–Project Habitat Conditions	Current Habitat Conditions	Habitat Loss	
			HU's	Percent
Riparian Forest (downy woodpecker)	710.8	48.5	662.3	93.2
Riparian Forest understory (song sparrow)	685.4	126.0	559.4	81.6
Scrub–shrub Wetland (yellow warbler)	1,164.2	196.4	967.8	83.1
Emergent Wetland (marsh wren)	1.1	13.4	0.0	0.0
Mesic Shrubland (song sparrow)	830.1	554.7	275.4	33.2
Shrubsteppe/Grass Land (western meadowlark)	7,879.1	6,092.9	1,786.2	22.7
Furbearers (river otter)	3,174.9	3,903.3	0.0	0.0
Big Game (mule deer)	8,243.7	5,468.1	2,775.6	33.7
Upland Gamebird (California quail)	28,029.5	4,040.2	23,989.3	85.6
Upland Gamebird (ring–necked pheasant)	7,505.4	2,879.6	4,625.8	61.6
Upland Gamebird (chukar)	9,919.8	6,649.1	3,270.7	33.0
Waterfowl (mallard)	89.9	117.7	0.0	0.0
Waterfowl (Canada goose)	3,870.6	1,810.6	2,060.0	53.2

5.2.18.2 Project–specific Assumptions/ Parameters

- Acreage numbers displayed in Table 5–14 for shallow water habitat were derived from 1992 and 1994 hydrographic surveys of John Day pool, for pool areas upstream of RM 257.8. Lands downstream of RM 257.8 are typically steep, sloped and rocky, thereby providing minimal habitat.
- Water supply concerns for hatcheries at Irrigon, Oregon precluded implementation of a test drawdown to elevation 257 ft and concurrent aerial photography to determine the actual acreage impacted.
- Information on emergent marsh/riparian habitat acreage was derived from interpretation of 1992 and 1994 aerial photography. Information developed for these habitats was only for area upstream of RM 257.8. Below RM 257.8, these habitats are very limited in extend due to steeper topography on the banklines.
- Modifications to irrigation pump stations on Lake Umatilla to curtail irrigation impacts at elevation 262.5 ft have not been enacted yet, and thus it is difficult to predict current operation impacts for Group 2 SOS operations. This analysis assumes that operation for Group 2 would be at elevation 262.5 without deviation.
- Analysis of physical effects is for average year conditions as the hydroregulations indicate no difference between wet, dry, and average years in pool elevations by month for John Day reservoir.

Table 5–14. Projected Acreage to Shallow Water and Emergent Marsh–Riparian Habitat Associated with Seasonal Drawdown of John Day Pool

Elevation (John Day Forebay)	Acres of Shallow Water Habitat Dewatered
268	0**
267	530
266	1060
265	1590
264	2532
263	3474
262	4002
261	4699
260	5396
259	6108
258	6820
257	7532

** An estimated 1,845 acres of emergent marsh/riparian habitat occurs above elevation 268 ft, but is directly linked to pool elevation.

- The lake (pool) elevations referenced throughout the text are forebay readings at John Day Dam (RM 216). Actual elevations of habitats upstream of RM 250 are slightly higher. At 100,000 cfs discharge from John Day Dam and at MOP (257 ft) at that location, the water surface elevation at RM 280 is 258 ft. RM 280 is upstream of Umatilla NWR where the largest block of wildlife habitat occurs. Development of plant communities is assumed to be directly related to forebay elevations, thus those elevations are referenced in the text when analyzing habitat acreage and impacts of elevational changes.

- There are an estimated 2,854 acres of emergent marsh/riparian habitat present in and adjacent to John Day Pool directly associated with the pool operation level. These two habitats are grouped together due to their intermingling and the difficulty in accurately separating these habitats via aerial photo interpretation. For analytic purposes, it is assumed that 80 percent of the 2,854 acres (i.e., 2,283 acres) is emergent marsh and the balance (571 acres) is riparian habitat. An estimated 1,009 acres of riparian emergent marsh occurs within the pool (i.e., below elevation 268 ft) and 1,845 acres occurs above elevation 268 ft.

- Emergent marsh habitat presently occurs above elevation 263 ft. There is an estimated 3,737 acres of emergent marsh, riparian, and shallow water habitat above elevation 262.5 ft.

- Riparian forest and emergent marsh occur to elevations slightly above full pool and riparian/emergent marsh habitat is also associated with ponds/wetlands above full pool elevation that are hydrologically linked to the pool.

- The acreage of emergent marsh surviving various pool operations is based on operation of Lake Umatilla at elevations below those currently experienced for the period of May through August 31. Further, it is assumed that Lake Umatilla will be operated at these elevation levels, and that the pool elevation will not be adjusted higher to mitigate irrigation withdrawal concerns.

- The acreage of shallow water habitat impacted is based upon the total estimated acreage between pool elevations 257–268 ft upstream of RM 257.8. For locations downstream of this river mile, banks are typically abrupt rock faces and provide little wildlife habitat. John Day Pool is seldom operated at elevation 268'; more typically the pool is operated around elevation 265'. Thus, impacts to shallow water habitat and associated wildlife are more pronounced once the pool drops below elevation 265'. Presently, the pool is to be operated per strategy 2c (existing condition), although in reality it is operated in the 263.5–264 foot elevation range, particularly during the growing season, to mitigate impacts to irrigation.

- An additional area of concern is the possible impacts to wildlife habitat and/or populations that are strongly associated with irrigated agricultural lands, e.g. waterfowl, upland game birds, big game. Retro–fitting irrigation pump stations should ensure no impacts to wildlife arising form loss of irrigated agriculture. If this assumption is not met, then wildlife impacts associated with drawdown of John Day Pool would be substantially greater than that reported above for this operational change.

5.2.18.3 Evaluation Results

The first SOS group contains 1a, 1b, and 4c. These strategies have similar operational elevations in most months (Table 5–15). The elevational differences among SOS's for these months are not considered significant to wildlife populations or their habitat, therefore the SOS's are combined as one group. A substantial elevation difference is present for May through August 31 for this SOS group, when compared to SOS groups three and four.

Three SOS's comprise the second group: 2c, 2d, and 9b. These strategies have identical pool elevations

Table 5–15. Average Monthly Elevational Data for John Day pool for Each System Operations Strategy. Group Assignment Indicates Similarity of SOS's

Month	Group One	Group Two	Group Three	Group Four
	1a, 1b, 4c	2c, 2d, 9b	5a, 5b, 6a, 6b, 6c, 6d	Biological Opinion
Sept	266.5/265	266.5	266.9/266.5	257
Oct	265	265	265	257
Nov	263.5	263.5	265/263.5	257
Dec	263.5	263.5	265/263.5	257
Jan	263.5	263.5	265/263.5	257
Feb	263.5	263.5	265/263.5	257
Mar	263.5	263.5	265/263.5	257
Apr 15	263.5	262.5	265/262.5/257	257
Apr 30	263.5	262.5	257.5/262.5/257	257
May	263.5	262.5	257.5/257	257
June	263.5	262.5	257.5/257	257
July	266.5/265	262.5	257.5/257	257
Aug 15	266.5/265	262.5	257.5/257	257
Aug 31	266.5/265	262.5	257.5/257	257

each month (Table 5–15). The operation of John Day pool per these SOS's at elevation 262.5 ft from April 15 through August differs from all other SOS's.

Six SOS's comprise SOS group three: 5b, 5c, 6b, 6d, 9a, and 9c. These SOS's are different from the other groupings due to the seasonal operation of John Day pool at elevation 257 ft, e.g., May through August 31 (Table 5–15).

The Preferred Alternative is the single SOS in the fourth group. The pool would be operated at elevation 257 ft for the entire year under this strategy. Pool levels would be allowed to fluctuate 3 ft (e.g. 257–260 ft) from March through October and 5 ft (e.g. 257–262 ft) from November through February.

Physical Habitat Impacts

SOS Group 1 (1a, 1b and 4c) comparison to SOS Group 2 (2c, 2d, and 9b)

Currently, emergent marsh ends at approximately elevation 263 ft. Development of emergent marsh habitat to this elevational level is predicated on historical operations of John Day pool under 1a in Group 1 SOS's. Group 2 SOS's represent a slightly lower pool elevation for a longer period of time than the previous operational strategy. Operation (Group 2 SOS's) at elevation 262.5 during the growing season will impact riparian, emergent marsh, open water and submerged aquatic plant habitats.

Group 2 operational strategies would result in an operational pool level approximately one foot lower from April 15 through August 31 than Group 1

operational strategies. This decreased pool elevation would dewater approximately 735 acres of shallow water habitat.

The current operational strategy (Group 2, 2c; and 2d and 9b) should result in an expansion outward of the emergent marsh habitat as it follows the water level. This expansion of marsh habitat outward may not be substantial as pool operations for September to March will mimic Group 1 SOS's operational levels. This should inhibit emergent marsh expansion beyond elevation 262 ft. Concurrently, a reduction in marsh habitat would be expected at the upper elevational limits and for hydrologically–linked areas of this habitat due to desiccation from decreasing the pool operation level during the growing season. Emergent marsh habitat may be lost between elevations 267 and 268 ft and for hydrologically–linked areas above full pool with implementation of this strategy. This loss may be comparable to the amount of emergent marsh expansion between elevations 262 and 263, thus no substantial net loss in emergent marsh habitat is expected.

Riparian herb and riparian shrub/forest habitat would probably replace the emergent marsh habitat lost at the upper elevational limits of the pool. This presumes that germination of riparian tree/shrub species will occur in densely vegetated, former emergent marsh habitat. For willows and cottonwoods, which require barren, moist substrate for germination, substrate conditions would probably not be suitable for habitat expansion. Russian olive may be the dominant species occurring in the former upper elevational zone of emergent marsh habitat with operations under SOS's in Group 2.

The riparian habitat currently present adjacent to Lake Umatilla would remain under implementation of Group 2 SOS's. The–one foot decrease in pool elevation during the growing season would not be expected to impact established trees and shrubs. Their root systems should be sufficiently well established to reach soil moisture during the drawdown period and survive. Recruitment of new trees and shrubs into the population may be compromised as root structure of seedlings may be insufficient to reach water and survive during the drawdown period. However, the dense vegetation currently in the riparian zone and the lack of scouring flows to provide the barren, moist soils required by seedlings probably precludes most recruitment now. Advancement of seedlings into the drawdown zone is not likely as high water levels and wave action later in the year would destroy them.

An increment of open water habitat supportive of submerged aquatic plants would be lost due to implementation of SOS's in Group 2. This impact would be most noticeable at Paterson Slough, McCormack Slough, and the State Wildlife Management Areas at Willow Creek and Irrigon. It is difficult to assign an acreage to the loss of submerged aquatic plants from these strategies. The actual acreage of submerged aquatic plant beds is unknown. Further, the presence of carp has a strong influence on the presence and abundance of submerged aquatic plants.

Drawdown associated with implementation of SOS's in Group 2 will result in an additional 735 acres of currently shallow water habitat being exposed between elevation 262.5 to 263.5 ft from April 15 to August 31. Loss of benthic invertebrates, particularly macrobenthos (mussels), would be most evident. The length of the drawdown period and its annual occurrence would probably preclude repopulation by macrobenthos. Response of chironomids and oligochaetes is unknown. Bennett (pers. comm., 1993) noted a significant increase in chironomids in Lower Granite pool, Snake River, six months post–drawdown. However, he noted that the drawdown on Lower Granite occurred earlier in the year for a shorter period of time and is not an annual event. Annual drawdowns for long periods of time may generate different responses by chironomid and other benthic invertebrate populations.

SOS Group 1 (1a, 1b, and 4c) and SOS Group 2 (2c, 2d and 9b) comparison to SOS Group 3 (5b, 5c, 6b, 6d, 9a and 9c).

To avoid repetitiousness of comparisons, Group 1 and Group 2 were compared to Group 3 concurrently. Further, the difference between Group 1 and 3 and Group 2 and 3 are quite comparable given the

severe impacts associated with implementation of strategies in Group 3.

The proposed drawdown of John Day Project (Lake Umatilla) under Group 3 strategies to elevation 257 ft to 257.5 ft from a proposed operational level of elevation 262.5 (Group 2 SOS) during the growing season poses serious concerns for wildlife populations and wildlife habitat. Lowering the pool level by 5–plus ft will result in lowered ground water levels in areas adjacent to the river, withdrawal of water from established marsh and riparian habitats, and exposure of presently shallow water habitat. High summer temperatures and negligible rainfall would combine with the decrease in pool elevation associated with implementation of Group 3 Strategies to eliminate emergent marsh and riparian habitat. Operation of the pool at 263.5 ft to 266.9 ft during the remainder of the year would eliminate the potential for these habitats to establish in the drawdown zone exposed during the spring and summer growing season. Riparian habitat, particularly mature trees with deeper root systems, would be expected to survive for a longer period of time than emergent marsh plants. Recruitment of riparian trees and shrubs would be foregone with flooding of seedlings each fall. Ultimately, the net result would be a "bathtub ring" around the perimeter of John Day pool which would be exposed annually with drawdown.

An estimated 7,531 acres of backwater sloughs, marshes, riparian habitat and shallow water areas would be exposed by drawdown of John Day pool to elevation 257 ft (USACE 1992). Habitat development within these 7,531 acres is predicated on SOS Group 1 operational levels, although most habitat acreage would be maintained under SOS Group 2 strategies. The estimate of 7,531 acres is based on the acreage between the full pool contour (elevation 268) and the elevation 257 contour as derived from 1992 and 1994 hydrographic surveys. An estimated 2,854 acres of emergent marsh/riparian habitat, based on interpretation of 1992 aerial photography, would be impacted by implementation of SOS Group 3 strategies. These impacts will be most noticeable in the upper portion of John Day pool (RM 250 upstream).

Terrain in the upper portion of the pool adjacent to the river is relatively flat with numerous shallow depressions that hold water during pool operation (i.e. elevation 262.5–plus ft). Post–impoundment (1968), these low areas along John Day pool developed into riparian, emergent marsh, and shallow water habitats with submergent aquatic plant beds where surface elevations were near (riparian) or below full pool elevation. These habitats also developed at elevations above 268 ft in areas hydrologically linked to the pool. Emergent marsh/riparian units are highly intermixed and range in size from 0.2 to 172 acres in size. Submerged aquatic plant beds occur in shallow backwaters and ponds fed by the Columbia River.

The impact level of Group 3 SOS's on these 2,854 acres of emergent marsh/riparian habitat is expected to be total loss of emergent marsh habitat and gradual loss of riparian habitat. The duration of the drawdown (i.e. May 1 – August 31) coupled with the extreme high temperatures and aridity of the region will desiccate and destroy the plants comprising these habitats.

A substantial decrease in emergent aquatic plant beds would occur via dewatering of ponds and backwaters during the growing season.

High soil permeability rates further intensify drawdown impacts on backwater, emergent marsh, submerged aquatic plant and riparian habitats. Soil permeability tests conducted for Portland District on Umatilla National Wildlife Refuge indicated soil permeability rates ranging from 4 to 29 inches of water/hour. The average permeability rate is 15.9 inches/hour. Due to these high soil permeability rates, emergent marsh, open water and riparian habitats would experience a very rapid loss of standing and/or near–surface water on drawdown. The subsurface water table would fall to a level commensurate with the pool elevation. Some delay between pool drawdown and decrease in water elevation for diked/ponded open water and marsh habitats adjacent to John Day pool would occur. This time frame may be from several days to several weeks but,

would be significantly shorter than the projected drawdown period of May 1 – August 31. The high soil permeability will thus compound the impacts of pool drawdown to elevation 257 ft under Group 3 strategies.

Drawdown from May 1 – August 31 each year corresponds to the hottest, driest period of the year. Thus, loss of water to riparian and marsh habitats would occur at the most disadvantageous time frame for plant growth, survival and recruitment. Riparian, submerged aquatic plant and marsh vegetation communities are expected to incur substantial acreage losses due to mortality from desiccation and lowered or lack of seedling recruitment. Additionally, decreases in biomass and seed production, and reduced plant density, height, and cover attributes are expected to occur. Marsh habitats are expected to have no standing water with substantial mud flats separating them from open water. Seedling and/or vegetative establishment of emergent marsh plants on mud flats exposed when John Day pool is operated to elevation 263 ft is observed in 1992 and survival of these plants is expected under present (SOS Group 2) operating conditions. Although this demonstrates emergent marsh advancement onto mud flats, an expected event in a wetland ecosystem, this vegetative advancement is not expected to be successful with implementation of Group 3 strategies. The magnitude of the drawdown (5.5–plus ft; 4 month duration) coupled with high soil permeability will preclude moist soil conditions and near surface water levels. Thus all emergent marsh habitat (i.e. 2,283 acres) is expected to be lost with implementation of strategies in Group 3.

Open water habitats will either be eliminated or greatly reduced in shallow, backwater areas. An additional 4,198 and 4,962 acres of shallow water habitat would become dry land when compared to Groups 1 and 2 respectively. Thus, implementation of Group 3 SOS's will significantly reduce or eliminate submergent aquatic plant communities within John Day pool. The depth of drawdown (5.5–plus ft) exceeds the depth of much of these shallow backwaters. Aquatic plants, such as **Potamogeton spp.**, occur in the 2 to 3 foot depth range in open water habitat. Thus these aquatic plants, which are an important forage resource for many wildlife species, would be lost. Aquatic benthic invertebrate productivity in these dewatered areas would be lost via this operation. Species dependent on these forage resources would be compromised on resumption of higher pool operational levels.

Riparian plants will fair poorly from the drawdown also. Poplar seedlings are intolerant of drought (Rood and Mahoney 1990); saplings over two years old are more drought tolerant as they have larger root systems (Pezeshki and Hinckley 1988 in Rood and Mahoney 1990). Mahoney and Rood (1991) concluded that activities that increase the rate of riparian water table decline during the seedling establishment period would increase poplar seedling mortality. They noted several factors which could modify the effect of water table decline on plants, including fine textured substrate and timely precipitation. Neither of these factors would be expected to occur along John Day pool.

Drought stress also influences mortality rates for mature poplars; Albertson and Weaver 1945 (in Rood and Mahoney 1990) noted extensive mortality in western poplars during the 1930's drought. Abrupt reduction in streamflows preclude drought hardening in poplars that would occur in streams subject to natural variations in streamflow (Rood and Mahoney 1990). Albertson and Weaver (1945; in Rood and Mahoney 1990) observed mortality in riparian trees within a few months where rapid declines in the water table occurred. McNatt et al. (1980) reported 60 to 84 percent mortality in cottonwood trees in an area influenced by groundwater withdrawal by the City of Phoenix. Reduction of groundwater levels up to 10–plus ft were attributed to this pumping operation and were considered a likely factor in the high observed mortality rate.

These drought related impacts to poplar trees and seedlings would be magnified over time by annual drawdowns. Normal (not necessarily natural) conditions for marsh and riparian plant communities would prevail during the initial period of the growing season; drawdown would then impose an instantaneous and severe annual drought condition on

these communities. Drought hardening of riparian species could not occur in such a short time frame. Return of normal water conditions post–drawdown would occur too late for recovery and/or survival of many wetland/riparian species. Large trees with well established root systems would be expected to survive significantly better than younger trees or seedlings with poorly established root systems. Albertson and Weaver (1945; in Rood and Mahoney 1990) noted increasing susceptibility to drought in poplars greater than 30 years old. Poplars on Umatilla NWR are approximately 24 years of age currently. However, various mortality factors (disease, windthrow, insects) coupled with severe annual drought stress would reduce the number of these mature trees over time with recruitment of new trees precluded by annual drawdowns. The ability of plant communities to 'follow' the change in water elevation is precluded by the return to normal pool operation levels post–drawdown. Thus, the eventual (1 to 20 years) creation of a more extensive barren zone around the project would be expected. The fluctuation zone would be vegetated annually by annual forbs (i.e. smartweed) and grasses with extent of cover determined by seed source and/or availability, soil moisture levels and elevation.

SOS Group 4 (Preferred Alternative) comparison to SOS Group 1 (1a, 1b, and 4c), SOS Group 2 (2c, 2d and 9b) and SOS Group 3 (5b, 5c, 6b, 6d, 9a and 9c).

Habitat losses associated with Preferred Alternative operation would be very similar to that outlined for the comparison of SOS Groups 1 and 2 to SOS Group 3. Operation at elevation 257 ft would destroy the existing emergent marsh, riparian, shallow water and submerged aquatic plant bed habitats. The extent and pace of habitat loss would be the same as identified for Group 3, except that riparian forest habitat loss would be faster under the Preferred Alternative as operation at elevation 257 ft is year–around.

The Preferred Alternative operation does allow for post–implementation habitat development to occur in the drawdown zone. The seasonal increase/decrease in water levels associated with Group 3 strategies precludes habitat development in the drawdown zone.

Several factors influence the level of habitat recovery that may occur under Preferred Alternative implementation. Nature of the exposed soils will be a key factor; sandy or silty soils would provide a better substrate for vegetation than cobble. Drawdown areas exposed to wind and wave action, and associated erosion, would also be less likely to have vegetation establish. Additionally, the Preferred Alternative allows for pool elevations to fluctuate, e.g.: 257 to 260 ft from March to October and 257 to 262 ft from November to February. These fluctuations will influence type, acreage and location of vegetation that becomes established. Pool fluctuations also influence the nature and extent of physical measures that can be implemented to mitigate habitat losses. Potential on–site mitigation is discussed more fully in the section on Wildlife Mitigation.

Wildlife Impacts

SOS Group 1 (1a, 1b and 4c) comparison to SOS Group 2 (2c,2d, and 9b)

Canada goose nesting would only be minimally affected by operation of John Day pool under Group 2. Drawdown to elevation 262.5 ft would occur approximately April 1 each year; few nests have hatched by early April. Although the drawdown will not land–bridge any islands, shallower water associated with SOS Group 2 at McCredie Islands and Willow Peninsula would provide for easier mammalian access to these islands. These islands are not major nesting areas for Canada geese. A minor impact on nesting Canada geese may result from easier mammalian access at these locations.

Brood rearing for Canada geese may be slightly enhanced at some locations where green–up of drawdown areas occur. For other locations where geese and their broods are dependent on upland forage resources, brood rearing may be compromised slightly because of the greater travel distances to water for escape. Overall, the impact is not expected to be significant.

Wintering Canada geese are not expected to be impacted by operations under Group 2. Water levels should have no bearing on the presence of wintering Canada geese. Agricultural crops used by wintering Canada geese are not expected to be impacted by the strategies comprising Group 2, thus the forage base for these birds should not be impacted.

Nesting mallards may be slightly impacted by operation under Group 2 strategies. Some nests formerly over water or protected by expanses of water will be slightly more vulnerable to mammalian predators. Provided dense nesting cover is present, these nests should be no more vulnerable than terrestrial nesting mallards.

Brood escape cover for mallards would probably be more distant in the initial years of operation under Group 2 strategies. This would be attributed to the greater distance to emergent cover for ducklings. The expansion outward of emergent marsh over the first few years of operation under Group 2 strategies would likely lessen the distance to escape cover and preclude any significant increase in predation on ducklings. Some ponds in the Irrigon Wildlife Management Area would dry up and be unavailable for brood rearing under Group 2 strategies.

Wintering mallards, comparable to wintering Canada geese would not be impacted by implementation of Group 2 operation strategies.

Nesting diving ducks would be impacted to a moderate extent by implementation of Group 2 strategies as these species tend to nest over water. Drawdown to elevation 262.5 during the summer months would withdraw water from the existing emergent marsh stands. Although the number of diving ducks present is not overly significant, a reduction in production by these species would be expected. The expansion of emergent marsh habitat outward during the first few years of implementation would lessen the impact in some areas. Desiccation of ponds at the Irrigon Wildlife Management Area would reduce the amount of nesting habitat annually.

Brood rearing areas would be compromised by implementation of Group 2 strategies. In addition to the lessening of shallow water habitat available for foraging and escape cover for ducklings (i.e. emergent wetlands) would be dried up, thus lessening survival.

Wintering diving ducks should not be impacted significantly by the implementation of Group 2 strategies. A slight decrease in benthic invertebrate (i.e. macrobenthos) would be expected, on which diving ducks forage.

Colonial nesting birds, primarily gulls and great blue herons are not expected to be significantly impacted by implementation of Group 2 strategies. The principal nesting area at Three Mile Island would not be land–bridged by Group 2 strategies. Water separating the island from the Oregon mainland would be shallower than under Group 1 strategies, but should still be of sufficient depth to deter predators.

Foraging by great blue herons may be accentuated as ponds and backwaters shrink and pools become isolated, trapping and exposing fish to a greater extent than Group 1 strategies.

Black–necked stilts should benefit from implementation of Group 2 strategies. As observed in May 1992, this species and American avocets, killdeer and probably spotted sandpipers take advantage of exposed areas in the drawdown zone to nest. Further, the formation of shallow water and isolation of pools provide excellent foraging opportunities for these species.

The nongame bird species considered at John Day Project, i.e. downy woodpecker, red–winged blackbird and yellow warbler, are not expected to incur significant impacts from implementation of Group 2 strategies. The riparian zone, on which downy woodpeckers and yellow warblers are dependent is expected to remain. Long–term, the recruitment of willows and cottonwoods may be compromised by the Group 2 strategies. However, it would be difficult to determine if riparian recruitment is compromised by implementation of Group 2 strategies or by dense emergent wetland and riparian herb vegetation, precluding establishment of seedlings of these species.

Bald eagles are not expected to be impacted by operation under Group 2 strategies. The wintering eagles present on the project key on wintering waterfowl for prey. As wintering waterfowl numbers are not expected to be impacted by implementation of Group 2 strategies, bald eagle numbers should not be impacted either. Perch sites would remain provided that the existing riparian zone is not affected.

Beaver are expected to incur some impacts from implementation of Group 2 strategies. Operation of John Day pool at comparable levels to Group 2 strategies in May 1992 revealed that beaver den sites and access channels are substantially exposed by this minor drawdown. Further, beaver have to travel farther, and over exposed lands, to reach foraging areas. Thus, implementation of Group 2 strategies will result in increased predation on this species.

Otter denning sites would be expected to be more exposed, particularly in areas above RM 250 where submerged lands are more extensive, which is attributable to the flat nature of the land in this area. Lands adjacent to the river below RM 250 are much steeper and the impact of the drawdown under Group 2 strategies would be barely noticeable. The drawdown associated with implementation of Group 2 strategies is not expected to significantly impact river otter.

River otter foraging may be slightly enhanced as fish trapped in shallow pools or more exposed due to the slight drawdown associated with the Group 2 strategy will be available. Fish production should not decline significantly with the drawdown and fish availability in John Day pool is probably very high. Some loss of benthic invertebrates (macrobenthos) may result but probably will not be significant, given the minimal nature of the drawdown.

Painted turtles are primarily present in ponds located within the Irrigon Wildlife Management Area. A loss of some ponds and reduction in size of others is expected with implementation of Group 2 strategies. Mark Frisch (ODFW, pers. comm., 1993) reported that most ponds within Irrigon Wildlife Management Area went dry in August 1992 under a temporary Group 2–type operation. A similar response was anticipated in 1993 under Group 2 SOS's. These impacts, on an annual basis and over the course of the project life, should result in a net reduction in the painted turtle population at this location. Neonate survival and recruitment of individuals into the population would be less given the reduction in habitat.

Other species complexes, such as big game, terrestrial furbearers, small mammals, raptors, and upland gamebirds generally are not expected to be affected by implementation of Group 2 strategies.

SOS Group 1 (1a, 1b, and 4c) and SOS Group 2 (2c, 2d and 9b) comparison to SOS Group 3 (5b, 5c, 6b, 6d, 9a and 9c)

To avoid repetitiousness of comparisons, Group 1 and Group 2 were compared to Group 3 concurrently. Although minor differences exist between Group 1 and Group 2 strategies, they are both similarly disparate when compared to Group 3 strategies. Further, the difference between Group 1 and 3 and Group 2 and 3 are quite comparable, given the severe impacts associated with implementation of strategies in Group 3.

Canada goose nesting will be impacted by implementation of Group 3 strategies. Although, the majority of Canada goose nests will generally have hatched by May 1, the start date for drawdown to elevation 257 ft, some nests will still be in the incubation phase. Operation of Lake Umatilla at elevation 257 ft will land–bridge McCredie Island, Willow Peninsula and Three Mile Island. Unhatched Canada goose nests on these islands will be jeopardized as mammalian predator access to these islands will have been enhanced by drawdown. Level of impact is estimated at loss of 10 to 20 percent of total nests or approximately 30 to 60 Canada goose nests.

Brood rearing by Canada geese is expected to be compromised by implementation of Group 3 strategies. Brood rearing areas in the John Day pool occur primarily on the Umatilla NWR, particularly at Whitcomb Island, Crow Butte Island backwater, Longwalk Slough, McCormack Slough, and Paterson Slough (Tabor 1976). The Oregon shoreline between RM 260 and 265 and Willow Creek Wildlife

Management Area are other important foraging areas for Canada geese with broods. Crow Butte Island backwater, much of Longwalk Slough, McCormack Slough and substantial areas of Paterson Slough will be dewatered by implementation of Group 3 strategies.

Gently sloping shorelines with grass–forb communities are used by foraging geese (Tabor 1976). He noted that low water–levels increased the distance geese with broods had to travel to access shoreline forage from open water. This increase in escape distance could have a significant positive bearing on predator efficiency and a negative effect on percent brood survival. A flush of moist soil plants in the drawdown zone may provide additional forage resources for geese and their broods. However, in those areas where geese and broods are dependent on shoreline forage resources, escape distance from feeding grounds to water will be increased, and predation success for coyotes, domestic dogs, and other predators will be increased. Distance to forage and predation success rate will be site dependent.

The dewatering of habitats currently used for brood rearing coupled with increased predation rates are estimated to reduce recruitment of Canada geese by 50 percent. Currently, 500 to 600 goslings are recruited into the population (M. Frisch, ODFW, pers. comm. 1993; 60 percent nest success with three goslings per nest recruited into the population). A net reduction in the nesting population would be expected over time.

Wintering Canada geese, excluding the resident population, are not expected to be impacted by the proposed operational change. Water levels during the period when wintering geese are present are expected to be comparable to current conditions. Further, no impact to agricultural crops preferred by wintering geese for forage are anticipated.

Nesting mallards and other duck species, which are typically dependent on wetland and associated upland vegetation for nesting cover and backwater areas for brood rearing, will incur substantial net losses in the local nesting population. A reduction in marsh habitat will markedly reduce available nesting habitat. McCormack Slough, Patterson Slough, Irrigon Wildlife Management Area and other sites important for waterfowl nesting will be dewatered by implementation of Group 3 strategy. Attainment of elevation 257 ft for Lake Umatilla by May 1 each year would occur prior to the completion of most nesting efforts. Consequently, abandonment of the area by ducks prior to nesting and increased predation by mammalian predators should reduce the nesting population. Currently, total duck brood production on Umatilla NWR is approximately 2,000 ducklings. Implementation of Group 3 operation strategies would probably decrease duck production 50 to 80 percent.

Those ducklings that hatch prior to implementation of the strategies in Group 3 (i.e. prior to 1 May) will be subject to loss of water in open water and emergent marsh habitats. This will reduce available foraging and escape habitat. Consequently, mortality rates for ducklings remaining in the impact area would increase compared to current operational strategies. Population recruitment would thus be reduced and a substantial net loss in the nesting population would occur within a couple years of strategy implementation.

Wintering mallard population levels are not expected to be impacted by implementation of Group 3 strategies provided there are no changes in agricultural operations. Backwaters and sloughs would contain water during their residence period and would be expected to receive use. Loss of marsh habitat may have a slight impact but it is not expected to be discernible from population fluctuations associated with other factors. The development of moist soil/grass/forb plants in drawdown zones could provide additional forage/seeds for early fall migrants plus resident ducks, post–drawdown. Currently, these species take advantage of seeds produced by these plants in the very upper pool/immediate shoreline habitat when they arrive.

Nesting by diving ducks, which typically occurs in emergent wetland plant communities over water, would be severely compromised by implementation of SOS Group 3 strategies. Nesting habitat would

be dewatered, which would lead to nest abandonment, increased predation, and decreased production. Further, brood rearing habitat (i.e. open water with submerged aquatic plant beds) adjacent to emergent marsh nesting habitat would be substantially reduced by operation under Group 3 strategies. A virtually complete loss of the diving duck nesting population would be expected.

Wintering diving duck population levels would probably decrease under Group 3 operations strategies. Dewatering of shallow water habitat is anticipated to deplete the population of benthic invertebrates and submerged aquatic plants utilized by diving ducks. Diving ducks would either have to utilize populations of benthic invertebrates in deeper water or seed produced by moist soil/invasive plants in the drawdown zone to maintain population levels. A net movement to other areas would be expected by wintering diving ducks.

Great blue herons nest at Sand Dune Island within Umatilla NWR. This nesting location is situated in mid–pool and should not become land–bridged with drawdown. Provided the weeping willow trees that support this nesting colony are not lost because of drawdown associated impacts (i.e. annually imposed drought), there should be no impacts to nesting habitat for this species. Recruitment of trees is needed at this location to maintain nesting habitat for great blue herons and black–crowned night herons. Group 3 will probably preclude recruitment of trees at this location, and may result in loss of existing trees.

Foraging conditions for great blue herons may improve early in the drawdown period each year with implementation of Group 3 SOS strategies. Drawdown will result in fish entrapment in pools and lower water conditions in other foraging areas. High forage availability may be ephemeral. Long–term impacts on prey resources of annual drawdowns are unknown but some decline is anticipated. Productivity of herons could thus decline in the long–term if prey resources are reduced.

Presently, a nesting population of 7,000 to 10,000 California and ring–billed gulls occurs at Three Mile Island within Lake Umatilla. Three Mile Island is expected to be land–bridged, or nearly so, with implementation of Group 3 strategies. Gulls arrive at this nesting location in early March; egg–laying and incubation begin in the latter half of April (Thompson and Tabor 1981). Thus, implementation of Group 3 operation strategies, i.e. operating Lake Umatilla at elevation 257 ft, comes at a most inopportune time for gulls. Most members of the colony will have made a virtually irretrievable commitment (i.e. pair bonding, territory establishment, nest construction, egg–laying and incubation initiation) prior to drawdown. Cues used by gulls to determine suitability of Three Mile Island for nesting will be obscured by a drawdown initiated well after pairs have made a commitment to nest there. Thus, Three Mile Island would serve as a population sink under Group 3 strategies as operation at elevation 257 ft would land–lock the site and bring an influx of mammalian predators to the location. Loss of this colony would occur during the project life with implementation of Group 3 strategies. Relocation of the colony may occur provided late–nesters in the population can and will relocate to another island location. Loss of recruitment to this population are roughly estimated to result in net population losses of 50 to 75 percent of the population in three to five years. Population recovery is contingent on establishment of a new colony on a secure site.

Black–necked stilts and American avocets apparently took advantage of areas exposed by the temporary drawdown to elevation 263 in May 1992 by nesting and foraging on exposed lands. Expansion of the emergent marsh habitat outward during that event apparently has precluded, at least in McCormack Slough, Umatilla NWR, a similar response by these species in 1993. Implementation of Group 3 strategies may provide conditions suitable for these species (i.e. large expanses of drawdown zones, shallow ponds).

Impacts associated with implementation of Group 3 strategies are expected to be adverse for the three nongame bird species considered. Downy woodpeckers and yellow warblers have strong ties to riparian habitat, which will be substantially degraded

in the short–term and lost over the project life under Group 3 SOS's. Consequently, these two species are expected to decline substantially in presence at Lake Umatilla. Similarly, red–winged blackbirds are strongly dependent on emergent marsh habitat for nesting and foraging habitat. Operation under Group 3 SOS's results in the loss of much of their habitat and a consequent decline in their presence.

Prey populations for bald eagles, principally wintering waterfowl, are not expected to be impacted, therefore wintering bald eagles are not expected to decline with implementation of Group 3 SOS's. Perch and roosting habitat, primarily cottonwoods occurring in the riparian zones will be lost over the course of the project life. A shift to alternate locations (i.e. Cold Springs Reservoir, Umatilla River, etc.) would be expected for roosting birds. Foraging birds are expected to use alternative perches, including ground perches, in lieu of cottonwood trees, as the riparian zone declines. Foraging, post–implementation of Group 3 SOS's, would then be comparable to situations in the Klamath and Harney Basins and certain areas of the lower Columbia River estuary with respect to availability of perch sites. No decline in bald eagle use of Lake Umatilla is anticipated.

Beavers would incur a substantial population loss with implementation of Group 3 SOS's. All den sites would be dry. Loss of riparian habitat would remove a key forage component for this species. The population would be expected to crash in response to loss of denning and foraging habitat.

River otters would experience a distancing of their den sites from the water in the upper portions of Lake Umatilla. Prey resources may be concentrated during the initial phase of each annual drawdown. Impacts to benthic invertebrates, particularly macrobenthos, will reduce prey availability for otters. A net decline in the otter population is forecast although the level of decline can not be ascertained.

Western painted turtles, which occur at the Irrigon Wildlife Management Area and McCormack Slough, Umatilla NWR, are expected to incur severe population reductions with implementation of SOS's comprising Group 3. The majority of ponds at Irrigon WMA and McCormack Slough would dry up under Group 3 SOS's in May of each year. Neonate survival and thus recruitment into the population may be entirely compromised by loss of these backwater areas and their emergent and submergent plant communities on which neonates are dependent for foraging and cover. Further, adults in the population would have to relocate to either the few ponds retaining water or to the Columbia River. Turtles entering the Columbia River are not expected to find comparable foraging, escape and basking cover that they presently enjoy in the ponds and slough. Attrition of adults over the course of the project life would be substantial with few members of the populations associated with Irrigon WMA and McCormack Slough expected to be surviving at the end of the project life.

Big game and terrestrial furbearer species are not expected to be impacted substantially by implementation of Group 3 SOS's. Small mammals associated with riparian and emergent marsh habitat will be adversely impacted. Loss of riparian habitat over the course of the project life will impact nesting by Swainson's hawks and other raptors dependent on riparian zones for nesting sites, including cavities. Nongame birds associated with riparian and emergent marsh habitat also would be expected to decline with the loss of these habitats. Species such as pied–billed grebes, which are dependent on shallow, protected waters for foraging and nesting habitat, would decline. Other species, such as killdeer and spotted sandpipers, which prefer drawdown zones would be expected to prosper. Rails, which are strongly associated with emergent wetlands would decline.

SOS Group 4 (Preferred Alternative) comparison to SOS Group 1 (1a, 1b, and 4c), SOS Group 2 (2c, 2d and 9b) and SOS Group 3 (5b, 5c, 6b, 6d, 9a and 9c)

Implementation of the Preferred Alternative will result in similar impacts initially to wildlife as described for the comparison of SOS Group 3 to Groups 1 and 2. However, some habitat recovery is forecast to occur over time under the Preferred

Alternative strategy, because the pool will be held at elevation 257 ft with 3 to 5 foot fluctuations for the entire year. This habitat recovery, coupled with the permanent exposure of greater acreage of island habitat compared to other strategies, will lessen the extent of wildlife impacts over time. A conceptual estimate of impacts is provided in the subsequent text.

Canada goose nesting efforts will be initially detrimentally impacted to an extent similar to that described for Group 3 strategies. However, with the development of vegetation and accumulation of debris on new and enlarged islands in the pool, an increase in number of nesting Canada geese may occur. Many other factors, including harvest level on these resident geese, will have an influence on the nesting population level that will be attained. Previous analysis has demonstrated that islands in John Day pool are subject to severe erosion losses. This can be anticipated also for new and enlarged islands that will emerge with implementation of this strategy.

New brood rearing areas are expected to establish under the Preferred Alternative operational strategy. It is unknown if these areas will be comparable in acreage to those currently present. An initial decline in brood survival could be expected with implementation of the Preferred Alternative.

Wintering Canada geese are not expected to be impacted by implementation of the Preferred Alternative provided there are no impacts to irrigated agriculture from the Preferred Alternative. There will be sufficient water in the pool and island habitat for roosting and loafing activities by wintering geese.

Ducks nesting on John Day pool will incur a substantial initial loss of nesting habitat, particularly for those species that nest over water in emergent marsh vegetation, with implementation of the Preferred Alternative. The drying up of emergent marsh habitat and subsequent loss of this plant community where it currently exists will result in adverse nesting conditions for many duck species, particularly diving ducks. Typically, emergent marsh habitat is associated with shallow backwater areas, which provide forage, loafing, and roosting habitat for ducks. Much of this backwater habitat will be lost with implementation of the Preferred Alternative. Post–implementation, some recovery of emergent marsh habitat is anticipated. This recovery of emergent marsh habitat will probably occur within five years of implementation of the Preferred Alternative. The extent that these habitats can be recovered will greatly influence the number of nesting ducks that will occur in the future. Whether these backwater habitats can be managed to preclude carp comparable to the existing situation at McCormack Slough will also have a bearing on the future number of nesting ducks to occur on John Day pool.

Brood rearing habitat for ducks is also contingent on the extent and nature of backwater habitats post–implementation of the Preferred Alternative. Compared to Group 3 strategies, the Preferred Alternative should result in the eventual re–establishment of emergent marsh habitat. Thus, there will be an initial, and substantial, detrimental impact on brood rearing habitat with some habitat recovery one to five years post–implementation. A net loss in brood rearing capability for ducks is anticipated even after all on–site habitat re–establishment has occurred, as there will be fewer backwaters in number and extent as compared to the present situation.

The most noticeable impact of the Preferred Alternative to wintering waterfowl, principally mallards, as compared to other alternatives, will be in the loss of protected backwater habitat areas. Weekly censuses of wintering waterfowl in 1994/95 by the USFWS determined that the three most important use areas were Paterson Slough, Long Walk embayment, and the islands from RM 270 to 276. Paterson Slough and Long Walk embayment, with implementation of the Preferred Alternative, are substantially reduced in acreage when compared to other alternatives. There is however a substantial increase in island acreage with the Preferred Alternative, which may provide adequate area for these wintering mallards. Island habitats in John Day pool are subject to severe erosion because they are principally sand islands. Thus, loss of island habitat is expected over time under the Preferred Alternative strategy,

which will decrease protected winter loafing and roosting habitat for waterfowl. The net result long–term for waterfowl is unknown.

It has been assumed that the current irrigation pumping stations will be retro–fitted to ensure their continuous operation under the Preferred Alternative. This assumes that crops waterfowl are dependent on for winter forage will not be lost and no effect to waterfowl relative to winter food would be realized. Violation of this assumption – i.e. no mitigation of irrigation impacts associated with the Preferred Alternative – would have a detrimental impact on wintering waterfowl.

Wintering diving duck populations under the Preferred Alternative would probably incur an initial loss in foraging resources with dewatering of present shallow water habitat. Recovery of benthic invertebrate resources in the new shallow water habitat would be expected in one to five years. Thus, wintering diving duck populations may be reduced for the same period of time. Species comprising this duck population are not numerous in the project area.

Great blue and black–crowned night herons that nest at Sand Dune Island within the Umatilla NWR can be expected to lose the grove of weeping willow trees in which they currently nest under the Preferred Alternative. Drawing down the pool is anticipated to lower the water table on which these trees are dependent, causing their mortality. Alternative nesting sites may be available at Long Walk Island or in riparian areas of Paterson Slough. These riparian areas are also subject to mortality from implementation of the Preferred Alternative. The outlook for this nesting colony is thus questionable.

A reduction in the extent of foraging habitat for great blue herons is forecast with implementation of the Preferred Alternative. McCormack Slough will dry up. Much of the Paterson Slough area will also dry up, although ponded shallow areas will remain. There will be a reduction in the shallow water habitat available at Long Walk embayment, and other areas such as Irrigon Wildlife Management Area will be adversely affected. Substantial areas of foraging habitat will remain for this species and may be sufficient to maintain the current population level.

Colonial nesting birds at Three Mile Island are also jeopardized by implementation of the Preferred Alternative. Operation of the pool will nearly land–bridge this island to the mainland and thus make it easier for mammalian predators – e.g., coyotes – to gain access to the colony. These birds may be able to take up residence at another island upstream that emerges with drawdown, provided that adequate vegetation develops to support them. Alternatively, dredging of the shallow water areas that are to occur with implementation of the Preferred Alternative could preclude mammalian access to the island and maintain the colonial nesting site.

Black–necked stilts and American avocets can be expected to take advantage of the areas exposed by implementation of the Preferred Alternative. These favorable habitat conditions for foraging and nesting are expected to be short–term and may last no longer than one to three years before establishment of emergent marsh, riparian, and upland vegetation precludes their further use by stilts and avocets.

Nongame bird species such as downy woodpeckers, yellow warblers and red–winged blackbirds will incur substantial losses of habitat with implementation of the Preferred Alternative. Loss of riparian habitat will affect downy woodpeckers and yellow warblers. As mature riparian trees are expected to survive longer than seedlings and saplings (although with increased levels of annual mortality), downy woodpeckers would be expected to gradually declines. Loss of yellow warblers would be expected to occur at a faster rate with loss of the younger components of the existing riparian habitat. Re–establishment of riparian stands at the new Preferred Alternative pool level will be initially beneficial to species such as the yellow warbler. Fifteen to 20–plus years will be required before trees in the new riparian zone begin to attain size adequate for nest cavities for species such as the downy woodpecker. Loss of the emergent marsh habitat with implementation of the Preferred Alternative will impact red–winged blackbirds significantly through loss of their nesting and foraging habitat. Re–establishment of emergent

marsh habitat post–implementation of the Preferred Alternative will occur although the extent is unknown and there will be a one to five year lag. A reduction in the acreage of this habitat post–implementation is expected, although the extent is unknown.

Wintering bald eagle numbers on John Day pool are not expected to decline substantially with implementation of the Preferred Alternative, provided their principal prey resource (wintering waterfowl) do not decrease significantly in numbers. Loss of riparian forest stands will decrease the number and extent of preferred perch and roost sites for bald eagles. A shift to alternate locations for roosting habitat would be expected, e.g.: Cold Springs NWR, Umatilla River. Foraging bald eagles would be expected to use alternate perches, including ground perches, with loss of riparian trees.

Beavers would incur a substantial population loss with implementation of the Preferred Alternative as denning and foraging habitat would both be lost. Dens would be dewatered and the riparian forest stands would be lost. The new shoreline would be substantially removed from that which currently exists, exposing those beavers present to increased predation. Riparian forest re–establishment would occur with time as would recovery of beaver populations. Recovery may require 15 to 25 years, however.

A decline in the small otter population present can be expected with implementation of the Preferred Alternative, as there will be a substantial decrease in backwater habitat area for this species. This will decrease prey availability, both macrobenthos and fish. Recovery of macrobenthos will occur with time at the new pool level.

Western painted turtles, which occur at the Irrigon Wildlife Management Area and McCormack Slough, Umatilla NWR are expected to incur severe population reductions with implementation of the Preferred Alternative. The ponds inhabited by turtles at Irrigon WMA and McCormack Slough would dry up permanently under the Preferred Alternative. Neonate survival and thus recruitment into the population would be entirely compromised by loss of these backwater areas and their emergent and submergent plant communities, on which neonates are dependent for foraging and cover. Further, adults in the population would have to relocate to the Columbia River. Turtles entering the Columbia River are not expected to find comparable foraging, escape, and basking cover that they presently enjoy in the ponds and slough. Attrition of adults would probably be substantial under the Preferred Alternative. Some turtles would be expected to pioneer into newly formed ponds and/or backwaters. However, the net result of implementation of the Preferred Alternative should be a significant reduction in the population of western painted turtles on John Day pool.

Big game and terrestrial furbearer species are not expected to be impacted substantially by implementation of the Preferred Alternative. Small mammals associated with riparian and emergent marsh habitat will be adversely impacted. Loss of riparian habitat over the course of the project life will impact nesting by Swainson's hawks and other raptors dependent on riparian zones for nesting sites, including cavities. Nongame birds associated with riparian and emergent marsh habitat also would be expected to decline with the loss of these habitats. Species such as pied–billed grebes, which are dependent on shallow, protected waters for foraging and nesting habitat would decline. Other species, such as killdeer and spotted sandpipers, which prefer drawdown zones, would be expected to prosper. Rails, which are strongly associated with emergent wetlands would decline.

Threatened and Endangered Species

The USFWS, in their letter of October 4, 1993, provided a list of threatened, endangered, proposed and candidate species for the Columbia River from the mouth to above McNary Dam. Listed species which will be addressed by the Wildlife Work Group for this reach include Columbian white–tailed deer, peregrine falcon, bald eagle. *Howellia Aquatalis* is a proposed plant species. Listed salmonids will be addressed by the Anadromous Fish Work Group. The USFWS also provided a list of 25 candidate species: three mammal, five bird, three amphibians

and reptiles, one fish, five invertebrates, and eight plant species.

5.2.18.4 Data Gaps

The location, species composition and acreage of submerged aquatic plant beds represent a significant data gap for John Day Project. Impacts to wildlife species that utilize riparian and emergent marsh habitat needs better documentation. Impacts to benthic invertebrates from drawdown is also a requirement. The extent that riparian and emergent marsh habitat will reestablish with Preferred Alternative needs to be determined.

5.2.18.5 Conclusions

System Operation Strategies under Group 1 will maintain existing conditions for wildlife and their habitat. Operation of the project under Group 2 strategies will result in slight to moderate adverse impacts to most wildlife species and their habitat. A few species will respond positively to Group 2 SOS's (i.e. shorebirds). Group 3 SOS's and the Preferred Alternative represent a severe impact to most wildlife species and wildlife habitat considered in this analysis. Habitat losses under Group 3 would be long–term, and necessitate substantial mitigation efforts.

5.2.18.6 Mitigation for the Preferred Alternative

The wildlife mitigation requirements reported in this section pertain specifically to implementation of the Preferred Alternative. System operation strategies assigned to either Group 1 or 2 would not require mitigation as they represent or closely represent existing operations on John Day pool. Group 3 strategies, which entail a seasonal drawdown of John Day pool to elevation 257 to 257.5, would require mitigation actions comparable to the acreage identified for the Preferred Alternative. A seasonal drawdown would preclude most, if not all, mitigation actions on–project.

Initial estimates of wildlife mitigation acreage required for John Day drawdown to MOP are predicated on a minimal recovery of emergent marsh/riparian habitat post–drawdown in and adjacent to John Day pool. Minimal recovery is attributed to the operational scenario, i.e.: a three foot fluctuation from March to October, and up to a five foot fluctuation from November through February, identified in the Preferred Alternative. These conditions are thought to present adverse conditions for establishment of emergent marsh and riparian vegetation. These concerns were identified and discussed by the Interagency Wildlife Mitigation Team (IWMT) at their April 5 and May 19, 1995 meetings.

The range of mitigation ratios acceptable to the IWMT is 4:1 to 8:1, i.e.: four acres to eight acres of mitigation lands for each acre of loss attributable to the drawdown. Thus, mitigation acreage required would range from 11,416 to 22,832 acres for the 2,854 acres of emergent marsh/riparian habitat complex anticipated to be lost on John Day pool.

The value of emergent marsh/riparian habitat is considered higher at John Day pool than for other areas because it represents a large block of a unique habitat in an otherwise desert environment. Riparian/emergent marsh habitat is a very important and limited habitat type on the east side of the Cascades. In addition, this habitat complex along John Day pool is associated with a large body of water, which makes the association even more unique. Large waterfowl concentrations are associated with this habitat complex contributing to its high wildlife value. These factors, based upon the IWMT discussion, result in a requirement for a high mitigation ratio.

A preliminary estimate of 4,932 acres of lost shallow water habitat is derived after some adjustment for emergent marsh/riparian habitat acreage included in the total for shallow water. Therefore, at the identified mitigation ratios, 19,728 to 39,456 acres would be required for mitigation.

For both habitats, 31,144 to 62,288 acres of mitigation lands would be required. This represents the probable worst case scenario for mitigation. These mitigation acreages would represent permanently protected lands with full development and full

Operations and Maintenance expenses as described by group consensus.

However, subsequent analysis indicates that the mitigation requirement for shallow water habitat can be reduced. An adjustment for emergent marsh included in the shallow water habitat acreage total reduces the acreage impact to 5,538 acres. And, accounting for recovery of shallow water habitat associated with the new pool elevation – e.g., 4,972 acres between elevation 249–257 ft – the net loss is reduced to 566 acres of shallow water habitat. Thus, mitigation acreage requirements for the 4:1 to 8:1 mitigation ratios would equal 2,264 to 4,528 acres. The revised mitigation total would thus be 13,680 to 27,360 acres.

The estimates of mitigation acreage requirements are preliminary in nature. The level of impacts to wildlife and wildlife habitats requires verification. Some recovery of emergent marsh and riparian habitat in and adjacent to John Day pool can be expected as historical fluctuations were somewhat similar to those expected with the Preferred Alternative.

Potential on–project mitigation actions include construction of dikes to form protected backwaters and control carp, pumping to maintain existing backwater areas, and dredging and/or deposition of dredged materials to form emergent marsh, riparian, and shallow water habitat. These proposed actions could significantly reduce the off–project requirement for mitigation lands if they are feasible and cost–efficient.

The mitigation acreage requirements presented should represent the 'worst case scenario' for wildlife mitigation. Please note that impacts to wildlife and wildlife habitat associated with loss of irrigated agriculture are not evaluated in this assessment. It has been assumed that modification of irrigation pump stations will be accomplished and that there will be no change in acreage or crop practices associated with irrigated agriculture. Nor will there be a loss of wetlands and riparian areas associated with irrigation drainwater. Should this assumption not be met, then impacts to wildlife and their habitat will be substantially greater than that presented in this analysis. The mitigation acreages identified would represent permanently protected lands with full development and full Operations and Maintenance expenses as described by group consensus.

5.2.19 The Dalles Project

5.2.19.1 Evaluation Results and Conclusions

Because reservoir elevations do not vary for any of the alternatives proposed, no change from existing conditions is predicted for wildlife resources at The Dalles pool.

Threatened and Endangered Species

The USFWS, in their letter of October 4, 1993, provided a list of threatened, endangered, proposed and candidate species for the Columbia River from the mouth to above McNary Dam. Listed species that are addressed by the Wildlife Work Group for this reach include Columbian white–tailed deer, peregrine falcon, bald eagle. Howellia Aquatilis is a proposed plant species. Listed salmonids will be addressed by the Anadromous Fish Work Group. The USFWS also provided a list of 25 candidate species: three mammal, five bird, three amphibians and reptiles, one fish, five invertebrates, and eight plant species.

Biological assessments will be prepared for listed species. A determination will be made as to whether the proposed actions will jeopardize the continued existence of species. No action to address candidate species is required. Impacts on candidate species will be considered. A preliminary review of candidate species indicates that the proposed actions would have no impact on most of them.

5.2.19.2 Data Gaps

The proposed operation of The Dalles Dam would be unchanged under alternatives proposed. Thus, no impacts to listed species are anticipated. Sufficient information currently exists to develop the biological assessment, thus no information needs to be collected.

5.2.20 Bonneville Project

5.2.20.1 Project-specific Species List

The indicator species listed in Table 3–3 (Project Wildlife Matrix) has been modified to better represent local conditions. The modifications include:

Deleted	*Because*
1. Mallard	1. Either negligible presence, or impacts addressed by other species
2. Gulls	2. same as above
3. Black–necked stilts	3. same as above
4. Red–winged blackbirds	4. same as above
5. River otter	5. same as above
6. Raccoon	6. same as above
7. Deer	7. same as above
8. Big–horn sheep	8. same as above
9. Painted turtle	9. same as above

Selected or Added	*To Represent Category*	*Instead of*	*Because*
N/A	N/A	N/A	N/A

5.2.20.2 Evaluation Results and Conclusions

Because reservoir elevations do not vary for any of the alternatives, no change from existing conditions is predicted for wildlife resources at Bonneville pool.

Threatened and Endangered Species

The USFWS, in their letter of October 4, 1993, provided a list of threatened, endangered, proposed and candidate species for the Columbia River from the mouth to above McNary Dam. Listed species that are addressed by the Wildlife Work Group for this reach include Columbian white–tailed deer, peregrine falcon, bald eagle. Howellia Aquatalis is a proposed plant species. Listed salmonids will be addressed by the Anadromous Fish Work Group. The USFWS also provided a list of 25 candidate species: three mammal, five bird, three amphibians and reptiles, one fish, five invertebrates, and eight plant species.

Biological assessments will be prepared for listed species. A determination will be made on whether the proposed actions will jeopardize the continued existence of species. No action to address candidate species is required. Impacts on candidate species will be considered. A preliminary review of candidate species indicates that the proposed actions would have no impact on most of them.

5.2.21 Lower Columbia River below Bonneville Dam

5.2.21.1 Project-specific Assumptions/ Parameters

- Separation of the alternatives into distinct groups with similar flow characteristics is accomplished by assessing the number of occurrences wherein average monthly flows of 300,000 cfs. to 500,000 cfs. were exceeded (see Table 5–16). Selection of 300,000 cfs. or greater outflows is on the basis that these flow levels resulted in significant flooding of the riparian zones along the lower Columbia River.
- Specific acreage of the various habitat types were undetermined for this reach of the Columbia River. Vegetation communities within the inundation zone are generally adapted to inundation impacts; plant communities in the higher zone would contain some species that are less tolerant of substantial inundation. It is assumed that changes in plant communities associated with physical impacts of these alternatives will be minimal. The average monthly discharges evaluated under the alternatives seldom exceed 500,000 cfs (515,000 cfs represents a 10–year flood event).

Table 5–16. Number of occurrences wherein Bonneville Dam discharges (average monthly) exceed 300,000 to 500,000–plus cfs during the spring freshet period, i.e. April 30 – July timeframe; n=200 (50 years of record x 4 months). Strategies are grouped by similarity in discharge level occurrences.

SOS	Group	>300	>350	>400	>450	>500
1a	1	45	19	5	2	0
1b	1	47	16	5	2	0
2c	1	50	21	5	2	1
Biol. Opin.	2	51	30	11	2	2
2d	2	53	37	7	2	1
4c	2	57	31	9	2	1
5b	1	49	21	7	2	0
5c	1	49	21	7	2	0
6b	1	49	21	7	2	0
6d	1	49	21	7	2	0
9a	3	69	31	11	2	2
9b	3	73	35	12	2	2
9c	1	42	21	7	2	1

5.2.21.2 Evaluation Results

The first SOS group contains 1a, 1b, 2c, 5b, 5c, 6b, 6d and 9c. Alternative 1a represents the pre–ESA operations scenario while 2c represents the current operation scenario. These SOS's generally have the fewest instances in which 300,000 cfs are exceeded, i.e.: 21 to 25 percent occurrence. This group displays only a slight difference from other SOS's for flows in excess of 400,000 cfs.

Three strategies, Preferred Alternative, 2d, and 4c comprise Group 2. These strategies attain 300,000 cfs 25.5 to 28.58 percent of the time, and also have higher incidence of attaining 350,000 cfs and 400,000 cfs than Group 1. These differences range from 7 to 9.5 percent and are below the 10–year flood level, thus they are not significant.

Group 3 is comprised of 2 SOS's; 9a and 9b. Strategies in this group have a greater percentage of flows in excess of 300,000 to 400,000 cfs than the other groups. The maximum difference displayed is 15.5 percent in a comparison with 9c of Group 1 for 300,000 cfs events. >Excedence of 300,000 cfs occurred in 34.5 to 36.5 percent of potential incidences during spring freshet.

Physical Habitat Impacts

The physical impacts associated with these three groups of SOS's is probably minimal, as 500,000 cfs events are rare and a 10–yr flood event would require 515,000 cfs past Bonnefville.

It is unlikely that any noticeable changes in the plant communities will occur, because the operation strategy of the Preferred Alternative is only minimally different than the present operational strategy.

The most recent relatively high flow event in May 1993 (i.e. to 415,000 cfs) did not initiate any significant changes in vegetation composition at the mouth of the Sandy River, based on preliminary observations. Ponding of water in low spots may have contributed to loss of some reed canarygrass, but impacts did not appear widespread. Substantial coverage of riparian zones for a maximum of two weeks is observed during that event. Holm (USFWS, pers. comm., 1993) reported that wapato at Franz Lake NWR is emerging above the water surface post–May inundation. Although emergence is later than normal he could detect no deleterious impact from inundation. Fall 1993 observations also indicate no deleterious impacts from spring 1993 inundation. The substantial introduction of carp may yet play a role at Franz Lake although they were present prior to inundation.

Additional erosion to vulnerable shorelines, as projected by Tabor (1976), may result from the higher incidence of 300,000 cfs and greater flows. Bank erosion is a concern at both Pierce Ranch and Franz Lake NWR's. The 1993 high flows (May) did not overtop the bank at Franz Lake, but nearly did so. Overtopping could lead to a much more serious level of erosion. However, flows that overtop the bank at Franz Lake would be only slightly more frequent under the Preferred Alternative than the current strategy. Slumping of banks at Franz Lake and Pierce Ranch NWRs would increase at a rate probably commensurate with the increase in flows above 300,000 cfs.

The higher incidence of scouring flows may benefit species such as **Columbia Cress.** which require scoured gravel/cobble bars. This plant is present below Bonneville Dam, primarily at Pierce Island.

Wildlife Impacts

Comparable to the physical analyses, minimal impacts to wildlife are foreseen with any of the proposed strategies. Only Group 3, which has the most incidences of higher flows when compared to all other groups, will be evaluated. The striking similarity of flows among the other strategies indicates that impacts are unlikely to be significant.

It is unlikely that Canada goose nesting efforts below Bonneville will be impacted significantly by the implementation of Group 3 alternatives. Nesting has essentially been completed by the time flows exceeding 300,000 cfs generally occur (i.e. May and June). These flow levels will occur occasionally in April, however, and flooding of some nests can be expected. Canada goose nesting between Bonneville Dam and the mouth of the Willamette River is not as substantial as either above or below those locations.

Brood rearing by Canada geese will probably not be significantly impacted by higher water levels. Broods are expected to move into flooded areas to take advantage of flooded grasslands and expanded ponds and lakes. Wintering Canada geese are not expected to be impacted as no changes in overall habitat conditions are predicted.

Wintering diving ducks should not be impacted by a slight percent increase in spring freshet levels.

Great blue heron nest locations should be secure from alteration attributable to increased discharges from Bonneville Dam. Foraging by this species would be altered more frequently with the increase in higher water levels. During freshet events, this species would be expected to exploit the leading edge of the water, newly formed ponds and backwaters, and possibly make more use of upland locations for foraging. The return to 'normal' water levels may provide a slight increase in forage availability given the entrapment of fish in ponds and shallow water areas.

The slight increase in inundation events would increase the number of spotted sandpiper nests lost due to flooding. However, this increase in flood events should contribute to the maintenance of habitat conditions required by this species (i.e., rather open, sparsely vegetated banklines). This species also appears to be a persistent nester and renesting should offset losses due to increased high water associated with Group 3 SOS's.

The two nongame species of birds considered in this analysis – downy woodpeckers and yellow warblers – should be minimally impacted by increased flows associated with SOS Group 3. A temporary loss of a minor portion of their foraging habitat may occur.

No substantial loss of riparian habitat, particularly willows, is anticipated, thus these species should not be adversely impacted. Very low nests of these species could be impacted but this would be considered exceptional. Scouring associated with high water levels leads to regeneration of riparian tree and shrub habitat which would be beneficial to these species in the long term.

Neither bald eagles nor osprey are anticipated to incur impacts from implementation of Group 3 strategies. Higher water levels may result in changes in their foraging strategy. It is anticipated that these species would take advantage of carp and other species advancing with the leading edge of the water to spawn and/or forage.

Tabor (1976) considered power–peaking operations to be detrimental to the beaver population, particularly if extreme and frequent in nature during April to August. Young are typically born between April and July, he reported, which would coincide with the freshet period. He observed that beaver bank den entrances are slightly below the normal water level with the den situated slightly higher. Loss of young too immature to swim or from increased exposure to elements and predation would increase with higher water levels (Tabor 1976).

The impact to other species or species groups from a slight increase in spring freshet water levels associated with implementation of Group 3 SOS is expected to vary. Big game are not substantially represented along this stretch. Black–tailed deer would be expected to move to high ground during high flows.

Nesting ducks would incur additional losses in nests via flooding as the timeframe for their nesting coincides with the spring freshet period. This would be most pronounced for mallards and other ground nesters that place their nests in the riparian zone. Increased water to ponds and backwater areas could provide additional foraging areas for ducks and their broods. Duck nesting is not of major proportions below Bonneville Dam (Tabor 1976).

Tabor (1976) indicates that impacts to muskrats would be comparable to beaver and for similar reasons. River otter and mink would be expected to incur loss of den sites and young, although he reports observations of dens above the high water mark. He notes that otter are most abundant along the Columbia River just below Bonneville Dam. Tabor (1976) notes that some loss of prey organisms could occur from power peaking impacts to fish, other aquatic organisms, and some terrestrial species for mink and river otter. Terrestrial species are more commonly a dietary item of mink than otter. These two predators may also take advantage of prey resources made more vulnerable by high water (Tabor 1976).

Terrestrial furbearers would be impacted by increased high flows through flooding of dens, loss of habitat and reductions in prey populations (Tabor 1976). These species would have to shift to alternative areas during high flows, which will increase their vulnerability to loss. Availability of alternative areas has been compromised by human development in the area.

Many species of nongame birds and small mammals will lose their habitat base during high flow levels. Losses could be either direct mortalities, delay and/or abandonment of nesting attempts, and loss or reduction in foraging areas. Many bird species would be expected to attempt renests. Small mammals would have to recolonize impacted areas. The incidence level of these events would increase slightly with advent of SOS Group 3.

Threatened and Endangered Species

The USFWS, in their letter of October 4, 1993, provided a list of threatened, endangered, proposed and candidate species for the Columbia River from the mouth to above McNary Dam. Listed species that are addressed by the Wildlife Work Group for this reach include Columbian white–tailed deer, peregrine falcon, and bald eagle. Howellia Aquatilis is a proposed plant species. Listed salmonids will be addressed by the Anadromous Fish Work Group. The USFWS also provided a list of 25 candidate species: three mammal, five bird, three amphibians and reptiles, one fish, five invertebrates, and eight plant species.

Biological assessments will be prepared for listed species. A determination will be made on whether the proposed actions will jeopardize the continued existence of species. No action to address candidate species is required. Impacts on candidate species will be considered. A preliminary review of candidate species would indicate that the proposed actions would have no impact on most of them.

5.2.21.3 Data Gaps

Acres of habitat types adjacent to the Columbia River and within the floodplain remain unquantified. The extent to which these habitats are flooded by different cfs release levels from Bonneville Dam are unidentified. The response of vegetation communities and wildlife has not been specifically quantified, i.e.: it is uncertain whether species simply move in and out of habitat, or whether recolonization is required.

Completion of surveys to accurately determine actual acreage inundated during high spring flows, the duration habitats are inundated, and the effects of inundation on vegetation and wildlife need more thorough documentation.

5.2.21.4 Conclusion

The implementation of SOS Group 3 would result in a slight increase in the number of high flow events during the spring freshet period. For many species that reside, den, nest and/or forage in the riparian areas impacted by implementation of Group 3 SOS's, an increase in den/nest loss, reduction in foraging areas, or greater susceptibility to predation and other mortality factors can be expected. Loss of these populations is not anticipated, rather fluctuations in their numbers will be slightly more pronounced over the project life. These impacts are not considered significant. The other SOS's, including the Preferred Alternative, will have negligible impact on wildlife and their habitat occurring below Bonneville Dam.

5.2.21.5 Mitigation for the Preferred Alternative

Mitigation for the impacts associated with implementation of the Preferred Alternative is not considered necessary. Any impacts that will occur will be slight in nature and brief in extent.

CHAPTER 6

SYSTEMWIDE IMPACTS TO WILDLIFE

6.1 HABITAT ACRES

Each of the 13 alternatives affects wildlife habitat differently. However, an examination of the changes in total acres of various habitat types and land forms reveals certain patterns.

There are no evident changes in acres for any habitat or land form evaluated for several projects/reaches. These are the Kootenai River, Chief Joseph reservoir, mid–Columbia PUD reservoirs, the Flathead River, Hell's Canyon, McNary reservoir, The Dalles reservoir, Bonneville reservoir, and the Columbia River below Bonneville Dam. As a result, these are not addressed in this discussion of acreage changes related to SOR. For most of these, information on existing acres of habitat was not collected, since none of the alternatives change existing operations. Therefore, the total acres used to calculate the systemwide percent change in habitat acres does not include acres from the mid–Columbia PUDs, the Flathead River, McNary reservoir, the Dalles reservoir, Bonneville reservoir, and the Columbia River below Bonneville Dam.

Each of five habitat types/land forms are evaluated and an estimated acreage determined under each of the alternatives as part of the site–specific analysis (see the individual sections for a discussion of how the acreage values were derived). The five habitats are drawdown/barren zone, riparian, emergent wetland, submergent aquatic plant beds, and islands. The acreage figures for the drawdown/barren zones are generally the most accurate, while the acreage figures for submergent plant beds are believed to be the least accurate. Additional information on all habitat types would be useful, but especially for submergent plant beds, as the existing data is fragmentary at best.

6.1.1 Drawdown/Barren Zone (TABLE 6–1)

Existing conditions – 2c and 1a. The amount of drawdown/barren zone varies by water–year and operation. The No Action alternative (2c) and the Base Case alternative (1a) have different estimated acreage in areas potentially affected by these alternatives. Under Alternative 2c (No Action), in a 'typical' year there is estimated to be 63,649 acres of drawdown/barren zone in the system. Under alternative 1a (Base Case), however, there is an estimated 67,344 acres of drawdown/barren zone in the system. Given the accuracy of the figures used to derive these totals and the variable acres that will exist in any given water–year, the difference between these two figures is considered insignificant. However, when discussing the drawdown/barren zone, comparisons will be made to the Base Case alternative (1a), to present the greatest potential change in drawdown/barren acres.

Systemwide, the change in acres of drawdown/barren zone ranges from an estimated increase of 30,217 acres for alternatives 5b and 5c (45 percent when compared to the Base Case alternative [1a]), to an estimated decrease of 12,278 acres for alternative 4c (minus 18 percent when compared to the Base Case alternative [1a]) (Table 6–1).

Increases in the drawdown/barren zone are generally considered to have a negative impact to wildlife values as a whole. The variability of submersion, the lack of vegetation, and the monotypic habitat form all reduce the values of this zone to wildlife. While certain species may benefit (e.g., shorebirds use such areas for feeding and nesting), the diversity and numbers of wildlife are typically reduced in such areas.

For the entire system, the alternative that would result in the greatest decrease in drawdown/barren zone acres is 4c. The decrease in drawdown/barren acres is not distributed evenly throughout the system.

Table 6–1. Total Acreage Changes – Systemwide

	1a	1b	2c	2d	4c	5b	5c	6b	6d	9a	9b	9c	PA
Drawdown/Barren	3695	63	63649	−496	−12278	30217	30217	10632	10632	9526	−2966	28930	3465
Riparian	0	0	5811	5	576	−772	−772	−772	−772	−728	544	−570	−285
Emergent Wetland	0	0	6589	0	574	−2290	−2354	−2293	−2354	−2370	528	−994	−607
Submergent Aquatic Plant Beds	132	132	9891	0	220	−829	−829	−829	−829	−886	80	−716	−348
Islands	0	0	3158	189	374	−60	−60	−60	−60	510	374	20	330

NOTE: 2C IS THE ACRES AND IS UDED TO DETERMINE THE EFFECT OF EACH OF THE OTHER ALTERNATIVES

The results for the Libby, Hungry Horse, Albeni Falls, Grand Coulee, Brownlee, and John Day projects/reaches show decreases in these acres. The greatest decrease occurs at Grand Coulee, with a decrease of 8,770 in most years for alternative 4c. One facility (Dworshak) showed an increase in drawdown/barren acres of 315 acres for alternative 4c. Also, the extent of barren zone on the Hanford Reach is estimated to increase under alternative 4c by 189 acres.

The other extreme is represented by alternative strategy 5 (both options). There is an increase in drawdown/barren zone acres of 26,522 when compared to the Base Case alternative (1a). The lower Snake River facilities (Lower Granite, Little Goose, Lower Monumental, and Ice Harbor) and John Day all show very large increases. Hungry Horse and Dworshak show more modest increases in drawdown/barren zone acres.

The Preferred Alternative increases the acres of drawdown/barren zone by 3,465 when compared to the No Action alternative and decreases the number of acres of barren/drawdown zone by 230 when compared to the Base Case. The most significant changes are at John Day, where the acres of barren/drawdown zone more than doubles.

6.1.2 Riparian Zone (TABLE 6–1)

Existing conditions – 2c and 1a. The amount of riparian habitat that exists is a result of long term conditions and (except for extreme conditions) is little affected by water–year type (i.e., individual low or high water–years). The No Action alternative (2c) and the Base Case alternative (1a) are estimated to both support about 5,811 acres of riparian habitat in areas potentially affected by these alternatives. The changes identified here are an estimate of what would exist 20 to 30 years into the operations identified by the various alternatives and options. These changes will not occur immediately, but should gradually occur over time until the acreage of riparian habitat approached the estimates here. Monitoring changes in riparian habitats would be useful for confirming these estimates and for improving the accuracy of future projections.

Increases in acres of riparian habitat generally increase populations and diversity of wildlife species present in an area, and are thus considered to positively affect wildlife. Based on estimated changes in riparian acres, the alternatives fall into three categories. For alternative strategies 1a and 2d, the estimated changes are small (less than 3 percent of the existing conditions). Alternatives 5b, 5c, 6b, 6d, 9a, 9c, and the Preferred Alternative reduce the estimated acres of riparian habitat systemwide by between 5 percent and 13 percent, a loss of 285 to 772 acres, respectively. Last, alternatives 4c and 9b increase the amount of riparian habitat in the system by about 10 percent, gaining 576 or 544 acres, respectively.

The impacts to riparian habitats are not evenly distributed throughout the system. No alternatives are expected to impact the existing acres of riparian hab-

itat on the Hanford Reach, at Brownlee, or at Chief Joseph.

The greatest decrease in riparian acres occurs with alternatives 5b, 5c, 6b, and 6d (772 acres). These losses occur on the Lower Clearwater River, at Lower Granite, Little Goose, Lower Monumental, and John Day reservoirs. No part of the system gains riparian habitat under these alternatives. Alternative 9a is similar, with a lesser total impact (estimated loss of 728 acres) as a result of reduced losses on the Lower Clearwater and at Dworshak.

Alternatives 1a, 1b, 2c, and 2d have little overall effects on riparian habitats.

The largest increases in riparian acres occurs with alternative strategy 4c. The amount of estimated gain is 646 acres. The gains occur at Libby, Hungry Horse, and Albeni Falls. Alternative 9b also shows a substantial gain of 544 acres of riparian habitat.

The Preferred Alternative is estimated to result in a net decrease in riparian habitat in the system. The total decrease is 285 acres, with changes occurring at John Day only. This concentrates the entire habitat reduction for this alternative at one location.

6.1.3 Submerged Aquatic Plant Beds (TABLE 6–1)

The No Action alternative (2c) and Base Case alternative (1a) are different in their impacts to submerged aquatic plant beds. When compared to the No Action alternative, the Base Case shows an increase of 132 acres at John Day reservoir. However, as noted above, the acreage figures for submerged aquatic plant beds reflect a low degree of accuracy, due to a lack of information and the difficulty in measurement. Only at three sites (Hungry Horse, Albeni Falls, and John Day) were enough data available to estimate changes for any of the alternatives.

Submerged aquatic plant beds are important to a number of wildlife species. Their absence would generally result in reduced species diversity and numbers. As a result, decrease in submerged aquatic plant beds is considered to negatively affect wildlife in the system.

Alternative 1a and 1b show an increase of 132 acres at John Day, with no change elsewhere in the system. Alternative 4c (all options) shows a similar increase at John Day as well as a 55 acre increase at Albeni Falls. Alternatives 5b, 5c, 6b, and 6d show a 962 acre loss of existing submerged aquatic plant beds.

The Preferred Alternative shows declines in aquatic plant bed acreage when compared to either the No Action (2c, 348 acres) or the Base Case (1a, 480 acres) alternatives. As for the riparian habitat losses, these losses in aquatic plant beds all occur at John Day.

Because of the high degree of uncertainty associated with submerged aquatic plant bed acreage, the monitoring and evaluation of management impacts to these plant beds would be a useful program throughout the system.

6.1.4 Emergent Wetlands (TABLE 6–1).

The No Action alternative and the Base Case alternative are identical in their estimated emergent wetland acres, so the discussion will compare results to the No Action alternative. Existing acres of emergent wetlands in areas potentially affected by SOR alternatives are estimated to total about 6,589 acres.

The establishment of emergent wetlands (typically cattail and bulrush species) is generally the result of more than one year of operations. While one year of either excessively high or excessively low water may destroy an existing emergent wetland, more than one year of fairly stable water conditions is generally necessary to fully establish or reestablish an emergent wetland. So, while emergent wetlands are more responsive than riparian habitats, the acres estimated here are believed to represent a 'typical' condition that will vary somewhat from year to year.

Emergent wetlands are highly productive habitats that support a variety of wildlife species. Any decrease in the availability to this habitat is generally considered to be negative to the existing wildlife resources.

Potential impacts to systemwide emergent wetland acres range from a loss of an estimated 2,370 acres under alternative 9a to an estimated gain of 574 acres under alternative 4c. Most alternatives (except 4c and 9b) show losses to existing emergent wetland acres. Alternatives 4c and 9b have an estimated increase in emergent acres of 574 and 528 acres, respectively.

The Preferred Alternative will result in a net loss of about 607 acres. These losses are located at John Day. No other reach or facility shows losses or gains. This is significant as the emergent wetlands involved include high quality habitat within the Umatilla National Wildlife Refuge.

An accurate, periodic survey of emergent wetland acres would supply useful data on the existence, the trends, and the effects of existing operations.

6.1.5 Islands (TABLE 6–1).

The No Action Alternative (2c) and the Base Case Alternative (1a) do not differ in the total acres of islands estimated to exist in the areas potentially affected by SOR. Therefore, they will be compared together by presenting only the No Action alternative (2c) in this discussion. The No Action alternative identifies 3,233 acres of islands.

The time of year when islands are present, the types and density of vegetative cover present, and if and when land bridging to the mainland occurs affect the value of islands to wildlife resources. The acreage resented here does not reveal this and may be misleading. The discussion of wildlife values is likely to more accurately reflect the value of island habitat. For this discussion, it is important to understand that, while more island acreage is generally considered better for wildlife, acres alone can be misleading.

None of the alternatives appear to decrease island acres significantly. The greatest decrease is for alternatives 5b, 5c, 6b, and 6d, with a loss of 60 acres. This loss occurs at the 4 Lower Snake River dams.

The largest gain in island acres occurs with alternatives 4c and 9b, which both add 374 acres. The Preferred Alternative would result in a net gain in island acres of about 330 acres, located on the Hanford Reach and at John Day. However, as indicated above, gross acreage changes do not accurately reflect values to and effects on wildlife.

6.1.6 Conclusions

The alternatives analyzed have a variety of impacts to habitat/land form acres. However, based on acres alone, the alternatives with the greatest potential positive impact to wildlife habitat are 4c and 9b. This conclusion is based on the forecasted gains in acres for emergent wetlands, riparian, and submergent aquatic plant beds that occur under these alternatives.

The alternatives with the greatest negative impacts to wildlife habitat acres are 5b, 5c, 6b and 6d. The single most important factor supporting this conclusion is the large loss of riparian, emergent wetland, and submergent aquatic plant bed acreage. Impacts are also, at least locally, significant at the lower Snake River reservoirs.

The Preferred Alternative has very concentrated negative effects on wildlife habitat at John Day, with little significant change from current acreage occurring throughout the rest of the system.

6.2 WILDLIFE EFFECTS

Each of the 13 alternative strategies impact wildlife differently. However, an examination of the changes in effects caused by the different alternatives reveals patterns that are similar to the patterns observed for habitat acreage changes.

There are no significant effects on wildlife values at the Kootenai River, Chief Joseph reservoir, Dworshak, mid–Columbia PUD reservoirs, the Flathead River, McNary reservoir, The Dalles reservoir, Bonneville reservoir, and the Columbia River below Bonneville Dam. As a result, these projects/reaches are not further addressed in this discussion of wildlife values related to SOR, and are not displayed in the following tables.

Although there are acreage changes in habitats at Dworshak, no effects on wildlife values are expected. The reasons for this are discussed in Chapter 5 for the individual projects. Basically, at Dworshak, while the drawdown acres increase under several of the alternatives, the existing drawdown is so large that the additional increment should have minimal effect on wildlife.

Ten categories of wildlife are identified and used to represent wildlife resources throughout the system. Additionally, Federal Threatened and Endangered Species are examined for potential impacts. The ten categories of wildlife have been discussed previously for each of the projects/reaches examined (Chapter 5). In this systemwide analysis, wildlife values are summarized for each category and each project/ reach. These values are presented here and totaled for a relative index of the effects of the alternatives on wildlife values. The accuracy of these estimates varies by category, with there generally being more information available for game species and less available for nongame species. For each category, an estimated effect level or value ranging from −3 to +3 was developed. A more complete discussion of the development of these values is presented in Chapters 2 and 5.

The total wildlife values recorded in the summary tables for each wildlife component are nothing more than a summation of the relative indices of the estimated impact. The values are a guide to the effects of the various alternatives but do not, and are not meant to, translate into population numbers for any species.

6.2.1 Waterfowl (Table 6–2)

Waterfowl species generally benefit from stable water conditions and the establishment of riparian and wetland vegetation. Consistent with the changes in acres for these habitats, alternative strategy 4c seems to be most advantageous for waterfowl, while alternative strategies 5b, 5c, 6b, and 6d have the greatest negative effects.

Positive effects of alternative strategy 4c are distributed throughout much of the system, with level 3 effects at Hungry Horse and level 2 effects at the Hanford Reach. The negative effects of alternative strategies 5b, 5c, 6b, and 6d occur on the Lower Clearwater River, and at the 4 Lower Snake River dams and John Day.

The Preferred Alternative has a small positive cumulative total (+1). But there are two areas where the impact will be severely negative. Grand Coulee has a −2 rating, and John Day has a −3 rating. The negative rating at John Day is especially significant, as there are nationally recognized waterfowl resources located at Umatilla National Wildlife Refuge, which would be significantly damaged by this alternative. Potential mitigation for the site specific impacts are discussed in Chapter 4.

6.2.2 Colonial Nesting Birds (Table 6–2)

Colonial nesting birds are generally heavily dependent on islands for nesting activities (exceptions include species such as bank swallows, used for impact analysis at Grand Coulee). The usefulness of any particular island depends on the vegetation and the seasonal occurrence of land−bridging. As a result, as discussed above, the acres of island habitat do not indicate the value of that habitat to colonial nesting birds.

Despite this, the estimated effects on colonial nesting birds of the various alternative strategies displays a similar pattern to other species effects and to the acres of island habitat. Alternative strategy 4c has the greatest positive effect, while alternative strategies 9a, 5b, 5c, 6b, and 6d have negative effects.

The Preferred Alternative has negative effects on colonial nesting birds at two locations − Grand Coulee and John Day. Positive effects are forecast at Hanford, and the four lower Snake River dams. The systemwide effect is slightly positive (+2), but the effects on the large colonies on John Day are particularly significant.

Table 6–2. Total Effects on Wildlife – Systemwide

Total Effects	1a	1b	2c	2d	4c	5b	5c	6b	6d	9a	9b	9c	PA
Waterfowl	6	6	4	4	11	−15	−15	−15	−16	−13	4	−10	0
Colonial Nesting Birds	6	6	5	5	11	−13	−13	−13	−13	−15	7	−10	1
Shore Birds	3	3	3	2	5	−13	−13	−13	−13	−11	2	−10	2
Nongame Birds	4	5	5	4	7	3	3	3	3	−17	4	−5	0
Raptors	5	5	5	5	8	−4	−4	−4	−4	−2	6	−2	3
Aqu. Furbearers	4	4	5	5	6	−13	−13	−13	−13	−14	5	−12	3
Terr. Furbearers	3	4	3	3	9	−12	−12	−12	−12	−13	6	−7	2
Big Game	3	4	3	3	4	−1	−15	−7	−15	−15	6	−1	2
Amphibians	5	5	5	4	6	−15	−15	−15	−15	−18	5	−12	1
Reptile	4	4	4	4	6	−2	−16	−8	−16	−15	4	−5	1
Change From Current (w/out T&Es)	43	46	43	39	73	−85	−113	−97	−114	−133	49	−74	16
Change From 2c	0	3	0	−4	30	−128	−156	−140	−157	−176	6	−117	−27
T&E SPP*	1	1	1	1	1	6	6	6	6	6	0	5	2

*T&E species are handled differently in that any negative identified in the analysis is recorded but not included in the total. The number recorded in this row is simply the number of areas where negative values for T&E species are expected. See the individual project/reach discussions for more information on potential effects on T&E species.

6.2.3 Shorebirds (Table 6–2)

Shorebirds of the Pacific Northwest typically use habitats with little vegetative cover. The numbers of species and densities are highest during migration, when large concentrations can be present in appropriate habitats.

Alternative strategy 4c has the most positive values for wildlife. Alternatives 5b, 5c, 6b, and 6d have equally severe negative effects on shorebirds.

The Preferred Alternative will have a slightly positive effect, systemwide, on shorebirds. While the effect on the Hanford Reach is significantly negative (−2), each of the four lower Snake dams are estimated to be somewhat better (+1) that the No Action.

6.2.4 Nongame Birds (Table 6–2)

Nongame birds include a variety of species with a diverse range of habitat needs. However, the habitats most likely to be affected by changes in operations are riparian and emergent wetlands.

Alternative strategy 4c has higher positive values for nongame birds than for any others. The benefits to nongame birds are distributed fairly evenly, with the highest values estimated on the Hanford Reach and at Hungry Horse. Positive effects are also expected at Albeni Falls and the lower Snake River projects.

One alternative (9a) has significantly greater negative values for nongame birds than any of the other alternatives. These negative effects are concentrated at the lower Snake River projects and at John Day, with additional negative effects expected on the Hanford Reach, at Brownlee, Hell's Canyon, Grand Coulee, and Hungry Horse.

The Preferred Alternative has negative effects on nongame birds at Grand Coulee and especially severe negative effects at John Day (−3). These are countered by slightly positive effects (+1) on the

Hanford Reach and at the lower Snake River projects.

6.2.5 Raptors (Table 6–2)

The raptors commonly associated with the Columbia River habitats include the bald eagle, the osprey, and the peregrine falcon. Two of these are listed under the Federal Endangered Species Act and will be addressed in the Biological Assessment when a preferred alternative is selected. These species are often (but not always) associated with riparian forests for perching. However, the extent of human disturbance and density of prey species are also highly significant factors in determining total effects.

Alternatives 5b, 5c, 6b, and 6d have the greatest systemwide negative effects on raptors (−4). The negative effects for these alternatives are estimated to occur on the lower Snake River reservoirs and at John Day.

Alternative 4c has no negative effects at any individual projects and have the highest total value for systemwide effects (+9). These positive effects are well distributed throughout the system, but the only individual location where values exceed level 1 is on the Hanford Reach (level 2).

The Preferred Alternative has an overall positive rating (+4) for raptors. The only area where negative impacts are expected are at John Day, with positive impacts forecast at Hanford and the lower Snake River projects.

6.2.6 Aquatic Furbearers (Table 6–2)

Aquatic furbearers, including beaver, mink, muskrat, and otter, generally occur in riparian and emergent wetland habitats. As such, they respond to the alternative strategies in a manner that is similar to most of the other wildlife components examined.

The alternatives with the greatest benefit to aquatic furbearers are 4c and 9b. The only area where the effect is greater than 1 is the Hanford Reach, where the value is 2. No negatives occur under alternative 4c, but alternative 9b has a −1 at Brownlee (the reason 9b is not quite as positive as 4c).

Alternatives 5b, 5c, 6b, 6d, and 9a have the greatest total negative values for aquatic furbearers. These negative effects occur primarily at the lower Snake River projects and at John Day.

The Preferred Alternative has a systemwide total of +4, with negative impacts to aquatic furbearers at John Day and positive impacts at Hanford and the lower Snake River projects.

6.2.7 Terrestrial Furbearers (Table 6–2)

Terrestrial furbearers, including fox and raccoon, often use riparian habitats and the shoreline of reservoirs and free−flowing reaches.

The alternative with the most positive effects is 4c. These gains are most evident at Hungry Horse and on the Hanford Reach, the only projects/reaches where the values are at level 2.

The alternative strategies with the greatest negative effects values for terrestrial furbearers are 5b, 5c, 6b, 6d, and 9a. These negative effects are concentrated in the lower Snake River projects.

The Preferred Alternative has a systemwide total rating of +3. A negative rating at Hanford is more than balanced by positive ratings at the Lower Snake Projects.

6.2.8 Big Game (Table 6–2)

Typical big game species include elk and deer. Other species may be locally important (such as big horn sheep at Libby). The riparian areas can be significantly important to big game species for winter habitat and birthing. Islands can also be important fawning areas.

Alternative strategy 9b has the greatest positive effects to big game. These benefits occur most clearly on the Hanford Reach. Additional positive impacts are expected at the lower Snake River projects and Albeni Falls. Systemwide, there are no negative effects with this alternative.

The alternatives with the greatest negative effects are 5c, 6d, and 9a. Negative effects occur on the Hanford Reach, on the lower Clearwater River, John Day, and at the lower Snake River projects, and are

especially severe at the lower Snake River projects (level 3).

The Preferred Alternative has a small positive total (+3), systemwide. Repeating a pattern that has been seen other wildlife groups, the negative impacts at Hanford are offset by positive ratings at the four lower Snake River projects.

6.2.9 Amphibians and Reptiles (Table 6–2)

Amphibians and reptiles use a variety of habitats in the Pacific Northwest. Some species of reptile, such as turtles, are closely related to water habitats. Most amphibians are required to use water–related habitats for breeding activities. Riparian areas and emergent wetlands are especially important.

The alternative with the most positive effect value is 4c. The effects values are not much higher for these alternative than for the others with positive values, especially for reptiles. Given the lack of information on these species and the lack of dependence of most types of reptiles on water habitats, this is not surprising. Other alternatives with positive systemwide effects on amphibians and/or reptiles include 1b, 2d, 9b, and the Preferred Alternative.

The alternatives with the greatest negative effect values for reptiles and/or amphibians are 5b, 5c, 6b, 6d, and 9a. Repeating the general pattern observed for other wildlife components, these negative values are highest at the lower Snake River project and John Day.

The Preferred Alternative, as stated above, has positive systemwide impacts. Positive effects at Hanford, and the lower Snake River projects outnumber the negative effects at Grand Coulee and John Day. However, the negative impact at John Day is at level 2, and thus likely to be significant.

6.3 SYSTEMWIDE EFFECTS

All of the alternatives have the potential to have negative effects to some wildlife values at some projects. However, certain alternatives also appear to have potentially significant effects for wildlife values throughout the entire system. To present these potentially significant effects – positive and negative, the wildlife values for each category of wildlife were simply totaled. This results in a relative wildlife value for each alternative. However, it is important to point out that this is simply a sum of a number of indices and that the results just approximate the relative effects of each alternative on wildlife. They are not precise and should not be used for more than an approximate ranking of all the alternatives.

The alternative with significantly higher total value is 4c (Table 6–2). Not surprisingly, this is also the alternative with the greatest decreases in barren/drawdown acres and the greatest increases in riparian and emergent wetland acres (Table 6–1).

Alternatives 5c, 6d, and 9a have significantly greater negative wildlife effects than any other alternatives (Table 6–2). The expected relationship between acres of habitats and wildlife values continues to be seen here, with alternatives 5c, 6C, and 9a having the large increases in drawdown acres and the large decreases in riparian and emergent wetland acres (Table 6–1). As has been pointed out for various individual wildlife components, these negative effects are concentrated on the lower Snake River project and at John Day. All wildlife components are negatively affected by these alternatives, and amounts of those habitats most directly related to wildlife populations (riparian and emergent wetland acres) are consistently reduced by these alternatives.

The analysis of the Preferred Alternative indicates a positive change in wildlife values when compared the current situation, but a negative change when compared to the No Action. Neither change is large when compared to the effect of alternatives 5c, 6d, or 9a (Table 6–2), but the negative effects should not be ignored. The negative effects of the Preferred Alternative occur most often at John Day, with negative effects also occurring on the Hanford Reach for shorebirds and at Grand Coulee for a number of wildlife groups.

Any ranking effort for all the alternatives leads to the conclusion that alternative strategy 4c is the best for wildlife and alternative strategies 5b, 5c, 6b, 6d, and 9a are the worst, with the other alternative strategies in between.

The most significant factors supporting this conclusion are the large impacts associated with the drawdown alternative strategies 5b, 5c, 6b, 6d, and 9a at the lower Snake River reservoirs and especially at John Day. The relatively positive ranking for alternative strategy 4c is mostly the result of gains at Hungry Horse, Albeni Falls, and the Hanford Reach, with gains also occurring at Libby, and the lower Snake River reservoirs.

Endangered species are not included in these totals of wildlife effects (Table 6–2). Alternative strategy 4c negatively effects Rorippa, a Washington State special status species as well as a Federal Candidate species. Alternatives 5b, 5D, 6b, 6d, and 9a have the largest number of projects/reaches where negative effects to special status species, including state, and federal candidate species, are expected.

The Preferred Alternative has potentially negative impacts to Rorippa on the Hanford Reach and to the bald eagle at John Day. However, the impacts to the bald eagle are fully considered in the Biological Opinion that the Preferred Alternative implements and considered by the US Fish and Wildlife Service to not jeopardize the continued existence of the bald eagle.

6.4 MITIGATION AND MONITORING

6.4.1 System–Wide Mitigation Common to all Alternatives

a. Develop an effective quantitative modeling technique that more accurately predicts the degree of impact in systemwide wildlife populations and wildlife habitats as a result of changes in systemwide river operations. The monitoring effort and comprehensive studies necessary to acquire adequate data include:

- Conduct joint US/Canadian systemwide inventories as necessary to establish baseline plant and animal population levels and long–term population trends in each of the physiographic regions affected by systemwide river operations.
- Evaluate the effects of short term operations on systemwide wildlife and wildlife habitats. This would include identifying, monitoring and evaluating the effects of the actual range of daily fluctuations at each SOR Project and Reach.
- Identify, monitor, and evaluate the effect of systemwide streamflows on wildlife and wildlife habitat both in the near– and long–term. This would include identifying monitoring and evaluating the actual habitat vs. flow and population vs. flow relationships specific to each SOR Project and Reach.
- Conduct systemwide bathymetric analysis to determine underwater contours of the Columbia and Snake rivers. This is necessary for improving predictions of drawdown effects at each Project and Reach.

b. Monitor and evaluate Project and Systemwide analysis assumptions as necessary for completing the quantitative modeling technique. The monitoring effort and comprehensive studies necessary to resolve uncertainties with the current analytic methodology include:

- Identifying and developing quantitative evaluation measure(s) that more accurately display the magnitude of systemwide impacts on wildlife values. At this time, large analysis (percentage) breakouts and thresholds are utilized in a qualitative technique that is useful only for predicting very broad trendline effects for specific wildlife habitats and populations.
- Monitoring of actual systemwide streamflow and reservoir elevation data is necessary to assess the accuracy of results that are now based on (SOS hydroregulation) average end of month

reservoir elevations and monthly streamflow averages.

- Monitoring of long–term plant and animal responses to systemwide operational changes through use of photopoints, air photos, satellite (LandSat etc.) data and documentation of data on regional GIS and other available Environmental Data Base digital information systems, as necessary to facilitate evaluation and understanding of long–term physical changes to habitats and population indicator species.

- Identifying and evaluating cumulative effects of river operations including the rate of wetland and riparian habitat conversions, recreation effects, benthic invertebrate effects, and resident and anadromous fish effects, on wildlife resources.

- Monitoring the effectiveness and costs of site–specific mitigation measures.

- Evaluating the impacts of mitigation itself. Coordinate the development of site specific mitigation projects through the NWPPCs existing Fish and Wildlife Program.

6.4.2 Project by Project Mitigation Specific to the Preferred Alternative

For site–specific mitigation, the Wildlife Work Group determined a general ratio of 3:1 for systemwide habitat acreage replacement purposes. This ratio will increase, however, in areas with special circumstances that are significant to wildlife, and for locations identified through public comment as pertaining to regional importance for wildlife. The most significant example of this exception is at the John Day pool. Existing wildlife values at the John Day pool are considered among the highest in the Pacific Northwest because of the great extent of wetland habitats that are supported in an otherwise desert environment. Significant concentrations of waterfowl associated with the nationally important "Pacific Flyway" use this area primarily for wintering purposes. Because the Preferred Alternative would result in significant wetland habitat losses and critically impact existing migratory waterfowl populations, the John Day Project interagency team recommends a range of 4:1 to 8:1 or as necessary to replace existing habitat conditions.

6.4.2.1 Libby Project Mitigation for Preferred Alternative

Identify and acquire 432 acres of off–site wetland/riparian cover types including habitats for: nesting waterfowl, aquatic and terrestrial furbearers, bald eagles and ospreys, big game, reptiles, and amphibians.

Establish a program to monitor:

- Project analysis assumptions and uncertainties involving long–term plant and animal response to fluctuating water levels and flows.

6.4.2.2 Kootenai River Mitigation for Preferred Alternative

Establish a program to gather baseline data and monitor:

- Existing year–round wildlife habitat and population conditions.

- Severity, nature, and location of streambank erosion along entire US portion of the Kootenai River.

- Development of site–specific mitigation measures as data is gathered and/or identification of suitable wildlife mitigation sites.

6.4.2.3 Hungry Horse Project Mitigation for the Preferred Alternative

Establish a program to gather baseline data and monitor:

- Assumptions and uncertainties associated with assessment of impacts of the Preferred Alternative at the Hungry Horse reservoir.

- Baseline information is needed concerning long–term plant response to fluctuating water levels over a gradient of sediment types and water depths.

- Wetland mapping currently being performed by Flathead National Forest should be facilitated with mitigation funds, and repeated at least at five–year intervals to detect changes in acreage of lacustrine wetland habitats.

- Changes in occurrence and abundance of hydrophytic plant species should be correlated with weekly water levels to better understand plant sensitivity to inundation, saturation and desiccation.

- Mitigation funds should be used to facilitate the ongoing efforts to re–vegetate exposed mudflats in the vicinity of Spotted Bear. This will require continued coordination among USBR, USFS and Montana FWP.

The principal uncertainties that need to be addressed are the effects of fluctuating water levels on wetland plants, and quality of the headwaters area as wildlife habitat.

- Habitat quality currently existing in the upper reaches of the reservoir needs to be investigated to determine occurrence of species sensitive to drawdown, as well as baseline wildlife productivity levels.

- Field surveys should be performed in the headwaters area to determine current abundance of nesting waterfowl and amphibians, and their seasonal use of reservoir–related habitats. Information on amphibians is required because species in this taxon are likely sensitive to slight changes in timing and magnitude of water level fluctuations, but life histories are poorly documented. Diversity (number of species) of waterfowl and amphibian would serves as a good indicator of ecosystem health where hydrologic factors play an important role in ecosystem function. The information collected on these taxa would provide part of the basis for long–term monitoring of the reservoir ecosystem.

6.4.2.4 South Fork Flathead River below Hungry Horse Dam and Mainstem Flathead River Mitigation for the Preferred Alternative

Establish program to monitor:

- Long–term effects of fluctuating releases with focus on the effects of higher April releases as well as effects of ongoing daily fluctuations

- Greater frequency of releases between 15,000 and 20,000 cfs in April may scour successional vegetation more frequently, and interfere with nesting and denning along the higher portion of the river channel. Vegetation and wildlife abundance along the South Fork should be periodically inventoried, using a combination of habitat mapping and density estimates for indicator species such as waterfowl and aquatic furbearers.

6.4.2.5 Flathead Lake Mitigation for the Preferred Alternative

No mitigation measures are recommended for this area.

6.4.2.6 Flathead River below Kerr Dam Mitigation for the Preferred Alternative

Establish program to monitor:

- Assumptions and uncertainties associated with assessment of impacts of the Preferred Alternative on the Flathead River ecosystem below Kerr Dam.

- Long–term effects of fluctuating releases with focus on the effects of higher April releases as well as effects of ongoing daily fluctuations

- Greater frequency of releases between 15,000 and 20,000 cfs in April may scour successional vegetation more frequently, and interfere with nesting and denning along the higher

portion of the river channel. Vegetation and wildlife abundance along the Flathead River should be periodically inventoried, using a combination of habitat mapping and density estimates for indicator species such as waterfowl and aquatic furbearers.

6.4.2.7 Albeni Falls Project Mitigation for Preferred Alternative

No mitigation measures are recommended for this Project.

6.4.2.8 Grand Coulee Project Mitigation for the Preferred Alternative

Establish a program to monitor:

- Long–term effects of fluctuating releases with focus on the effects of higher seasonal drawdowns as well as effects of daily fluctuations.
- Vegetation and wildlife abundance and use along Roosevelt Lake should be periodically inventoried, using a combination of habitat mapping and population density estimates, field surveys and inventories, to identify existing wildlife population levels and better determine changes in habitat suitability.
- Results of long–term monitoring of acre losses shall be used to calculate future habitat restoration at a 3:1 ratio.

6.4.2.9 Chief Joseph Project Mitigation for Preferred Alternative

No mitigation measures are recommended for this Project.

6.4.2.10 Hanford Reach Mitigation for the Preferred Alternative

Establish a program to monitor:

- Project analysis assumptions and acquire information as necessary to resolve uncertainty surrounding data gaps i.e. extent of distribution of riparian vegetation and the long–term streamflow effects on riparian vegetation.

6.4.2.11 Brownlee Project Mitigation for the Preferred Alternative

No mitigation measures are recommended for this Project.

6.4.2.12 Oxbow and Hells Canyon Projects Mitigation for the Preferred Alternative

No mitigation measures are recommended for this Project.

6.4.2.13 Hells Canyon, Snake River Mitigation for the Preferred Alternative

No mitigation measures are recommended for this Project.

6.4.2.14 Dworshak Project Mitigation for the Preferred Alternative

No mitigation measures are recommended for this Project.

6.4.2.15 Clearwater River Mitigation for the Preferred Alternative

Because the Preferred Alternative affects existing high priority riparian habitats and target species presently managed under the Lower Columbia Basin Wildlife Mitigation Plan, up to 690 riparian acres are recommended for habitat replacement upstream of the Clearwater project.

6.4.2.16 Lower Snake River Projects, including McNary Project Mitigation for the Preferred Alternative

Because the Preferred Alternative results in changes to existing irrigation practices and affects high priority riparian and wetland habitat areas and target species currently managed under the Lower Columbia Basin Wildlife Mitigation Plan, up to 1,288 acres of riparian and 152 acres of emergent wetlands are recommended for habitat replacement.

Riparian forest and scrub–shrub wetlands that were not compensated under the initial mitigation pro-

gram for the lower Snake River should be the focus of mitigation acquisitions.

6.4.2.17 John Day Project Mitigation for the Preferred Alternative

Wildlife values at the John Day pool are considered among the highest in the Pacific Northwest because of the great extent of wetland habitats that are supported in an otherwise desert environment. Significant waterfowl concentrations associated with the nationally important "Pacific Flyway" use this area primarily for wintering. The Preferred Alternative results in changes to existing irrigation practices and significantly impacts water availability for existing emergent marsh/riparian habitats. The following mitigation recommendations are recommended:

a. Habitat Replacement.

Mitigation Summary:	4:1	8:1
Emergent Marsh/Riparian	11,416	22,832
Shallow Water	2,264	4,528
Total	13,680	27,360

Mitigation acreage acquired must be provided permanent protection, full restoration of habitat quality – to the level that was lost as a result of the Preferred Alternative, and long–term Operations and Maintenance budgets.

b. ON–SITE Mitigation.

Willow Creek:

- Dredge silted areas
- Levee creek on both sides to eliminate silt deposits
- Fill embayment with dredge material to elevation that encourages riparian/emergent marsh development.
- Pump required water to maintain pond levels within the wetland

Additional mitigation actions immediately adjacent to John Day pool include:

- Construction of dikes to form protected backwaters and control carp, pumping to maintain existing backwater areas, and dredging and/or deposition of dredged materials to form emergent marsh, riparian, and shallow water habitat. The feasibility of these actions is presently being determined. These proposed actions could significantly reduce the off–project requirement for mitigation lands if they are feasible and cost–efficient.

McCormack Slough:

Option #1

- Pump to maintain water levels within slough
- Add silt liner to hold water as practical and dependent on economic feasibility

Option #2

- Dredge to elevation 256 to 254 (approximately 4 to 6 feet depth). This action would generate approximately 2.5 million cubic yards of dredged material. Where this material can be placed without further impacting environment, costs, and cultural resources are outstanding questions. The estimated dredge material far exceeds levee material requirements.

Long Walk

Option #1 Standard Design Levees

- Construct levees of standard design, riprap to elevation 265.
- Construct inlet upstream at elevation 263.5. The inlet would be placed at this elevation to allow for gradual filling during flood events and to prevent overtopping and introduction of carp and to decrease erosion of existing levees.

Option #2 Sheet Pile Dikes

- Construct inlet upstream at elevation 263.5. The inlet would be placed at this elevation to allow for gradual filling during flood events and to prevent overtopping and introduction of carp and to decrease erosion of existing levees.

No pumping required

Option #3 Combination of Options 1 and 2.

Paterson Slough

- Construct standard levees, riprap to elevation 265.
- Excavate to provide levee materials.
- Construct inlet upstream at elevation 263.5

Irrigon

Option #1

- Pump to maintain water levels

Option #2

- Dredge and excavate to increase water depth

Crow Butte

No mitigation actions recommended

Reservoir Drawdown Area

- Re–establish native shrubs and grasses

Three Mile Island

- Dredge an area between the east tip of the island and the mainland to maintain present level of access difficulty for mammalian predators and protection for the colonial nesting bird colonies on the island

c. OFF SITE Mitigation

Identification of potential mitigation areas and specific wetland, riparian, and shallow water habitats for restoration purposes should begin prior to implementation of the Preferred Alternative.

Potential areas identified to date include:

Yakama Nation Sites
South Lateral A
Satus Creek Wildlife Area
Wapato Wildlife Area
Lower Satus Creek
The Mouth of Toppenish Creek
Yakima River Northwest of Granger
Horseshoe Lake Area
Yakima River North of Toppenish
Satus Valley Wetlands
Mosebar Ponds
East Toppenish Creek Refuge
West Toppenish Creek Refuge
Plank Road Wetlands
Medicine Creek
Yost Road Unit
WDFW Sites
Lewis and Clark Ranch
Wallula Gap (Kennewick Hospital)
USFWS Sites
Toppenish NWR
Peninsula, Two Rivers
Wallula HMU's
Barker Ranch
Echo Meadows
Walla Walla River Floodplain
Glade Creek
ODFW Sites
McNary Potholes
Cold Springs/Hat Rock Drain
Umatilla/Echo Meadows
Ladd Marsh

Because of the assumptions and uncertainties associated with assessment of impacts of the Preferred Alternative, it is necessary to establish a program to monitor, investigate, and further evaluate:

- The assumption that a three–foot and five–foot fluctuation would be adverse to emergent marsh/riparian vegetation establishment.

- The extent of habitat recovery after implementation of the Preferred Alternative. As knowledge is gained a firmer estimate of mitigation acreage requirements can be assessed. A long–term analysis is required to provide ongoing information on shallow water habitat conditions and extent. Some level of emergent marsh and riparian habitat recovery in and adjacent to John Day pool can be expected as historical fluctuations were somewhat similar to those expected with the Preferred Alternative. It is recommended that percolation testing continue at McCormack Slough, Irrigon WMA, and Paterson Slough to determine soil percolation capacity to better predict recovery levels.

- Impacts to wildlife and wildlife habitat associated with loss of irrigated agriculture was not evaluated in this assessment. It was assumed that retro–fitting of irrigation pump stations would be accomplished and that irrigated acreage and cropping practices would not change. It was assumed there would be no net loss of wetlands and riparian areas associated with irrigation drainwater. Should these assumptions not be met, then impacts to wildlife and their habitat will be substantially greater requiring identification and implementation of additional mitigation measures.

6.4.2.18 The Dalles and Bonneville Projects and below Bonneville Dam Mitigation for the Preferred Alternative

No mitigation measures are recommended for these projects.

TECHNICAL EXHIBIT A

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TECHNICAL EXHIBIT B

CONSULTATION, REVIEW, AND PERMIT REQUIREMENTS

In addition to their responsibilities under NEPA, the Federal SOR agencies are required to carry out the provisions of other Federal environmental laws, as well as compliance with state, areawide and local plans and programs. Laws and procedures pertaining to the Wildlife Appendix include:

Endangered and Threatened Species and Critical Habitat

The Endangered Species Act of 1973, as amended, (16 USC 1536) requires Federal agencies to ensure that their actions do not jeopardize endangered or threatened species or their critical habitats. In May, 1993, formal discussion with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) was initiated to determine how and when to best address the requirements of the Act. In compliance with Section 7, the SOR lead agencies requested a list of endangered and threatened plant, fish, and animal species in the affected environment. Plant and animal species relevant to the Wildlife Appendix was provided by the appropriate USFWS Field Offices in Idaho, Montana, Oregon, and Washington, and is presented in Technical Exhibit #2. Biological Assessments analyzing effects on the various species will be prepared by the SOR lead agencies when a preferred alternative is identified. Biological Assessments will be forwarded to the USFWS and NMFS for concurrence and included in the SOR NEPA documentation.

Fish and Wildlife Conservation

The Fish and Wildlife Coordination Act (16 USC 661 et seq.) requires Federal agencies undertaking projects affecting water resources to consult with the USFWS in order to conserve or improve wildlife resources. Recommendations from the USFWS are provided in a Coordination Act Report. The USFWS mitigation recommendations identified in the report will either be implemented by the SOR lead agencies or discussed in the NEPA documentation with reasons explaining why the recommendations would not be undertaken.

The Fish and Wildlife Conservation Act of 1980 (16 USC 2901 et seq.) encourages Federal agencies to conserve and to promote conservation of nongame fish and wildlife species and their habitats. The SOR lead agencies are working closely with the USFWS in evaluating the potential impact to nongame species and associated habitats.

The Pacific Northwest Electric Power Planning and Conservation Act (16 USC 839 et seq.) contains provisions intended to protect, mitigate, and enhance the fish and wildlife (including spawning grounds and habitat) of the Columbia River and its tributaries. In implementing its mandate to assure an adequate, efficient, economical, and reliable power supply, BPA must give due consideration to the protection, mitigation, and enhancement of the region's fish and wildlife resources. SOR actions, therefore,must be consistent with the Regional Electric Power and Conservation Plan including its fish and wildlife components, unless an exemption is granted by Act of Congress.

State, Area–wide, and Local Plan and Program Consistency

In accordance with Executive Order 12372, the SOR EIS will be circulated to the appropriate state clearinghouses to satisfy review and consultation requirements. In addition to the ongoing peer review process which was initiated at the start of the wildlife study, draft versions of the Wildlife Technical Appendix will be circulated to appropriate state and tribal (Wildlife Work Group) members to ensure maximum consistency practicable with regional, state, and local permitting and planning processes.

Coastal Zone Management Act

The Coastal Zone Management Act of 1972 requires that Federal actions be consistent, to the maximum extent practicable, with approved state Coastal Zone Management Programs. If specific SOR actions affect the coastal zone or estuarine sanctuaries, the SOR lead agencies will consult with the appropriate state(s) to ensure consistency with the state programs.

Floodplains Management

Executive Order 11988 (Floodplain Management) and Department of Energy regulations implementing the Executive Order (10 CFR part 1022) direct BPA to avoid, to the extent possible modification of floodplains and to avoid activities or programs affecting land use which takes place in or has impact on a floodplain. Because all proposed System Operating Strategies will affect shoreline wildlife habitat and other existing land uses to various degrees, changes to the Columbia River system floodplains will be extensively analyzed in the SOR EIS.

Wetlands Protection

Executive Order 11990 (Protection of Wetlands) and Department of Energy regulations implementing the Executive Order (10 CFR Part 1022) direct BPA to minimize the destruction, loss, or degradation of wetlands; and to preserve and enhance the natural and beneficial values of wetlands. All SOR alternatives will be evaluated to determine how wetlands are affected or if proposed System Operating Strategies will result in a net loss of wetlands. If wetlands will be affected, a finding must be made that there is no practicable alternative to affecting the wetland and that all practicable measures have been taken to minimize harm to wetlands.

Additional Legislation

In addition to their responsibilities under NEPA, the SOR lead agencies are required to carry out the provisions of other Federal environmental laws. To the extent applicable to broader programmatic decisions being analyzed in the SOR, the following environmental laws are cited as appropriate to the Wildlife Appendix. While specific responses are more linked to site specific proposals and alternatives, compliance with the standards contained in the following legislation is mandatory.

- Title 16 U.S.C. 1361, et seq., The Marine Mammals Protection Act, as amended
- Title 33 U.S.C. 1251, et seq., The Clean Water Act, as amended
- Title 16 U.S.C. 1271, et seq., The Wild and Scenic Rivers Act, as amended

TECHNICAL EXHIBIT C

ANALYTICAL RESULTS FOR THE LOWER KOOTENAY DRAINAGE

The Lower Kootenai Drainage begins at Bonner's Ferry, ID, and includes Kootenay Lake and Corra Lynn Dam in Canada.

Methods and Assumptions of Analysis

The analysis for impacts to the Canada reach of the Kootenai (Kootenay) River was done at a more general level than site within the United States. The hydroregulation data for outflows at Bonner's Ferry, outflows at Corra Lynn, and elevations at Corra Lynn were compared to identify potentially significant changes. A significant data gap exists in the lack of information on Kootenay Lake, a natural lake, entirely within Canada, between Bonner's Ferry and Corra Lynn.

The Creston Valley Wildlife Management Area is a significant wildlife area located between the Canada/ United States border and Kootenay Lake, on the Kootenay (Kootenai) River. Changes in outflows at Bonner's Ferry would likely impact this wildlife area.

It was assumed that a flow pattern that most closely reflected an unregulated hydrology, with highest flows in June, declining through the summer, would be most beneficial to wildlife.

It was assumed that higher flows during the critical period for wildlife were generally beneficial for wildlife.

It was assumed that the system had adapted to the existing pattern of maximum flows and that flows significantly higher than historic would have negative impacts.

It was assumed that changes in flows of less that 1 percent were always insignificant and changes in flows of less than 6 percent were generally insignificant.

It was assumed that maximum flows would not significantly impact wildlife values unless the maximum increased by greater than 10 percent during the critical wildlife period.

It was assumed that changes in elevations equal to or less than 3 feet were insignificant and changes up to 5 feet were generally insignificant if not in the critical period or if irregular in occurrence.

The first step was to examine the base case (SOS 1a) and the no action alternative (SOS 2c) to determine if the respective hydroregulation data was significantly different.

If different, the best one for wildlife values was compared to each of the 17 action alternatives. The most positive one for wildlife was selected so any negative impacts would be maximized and positive impacts minimized. This approach was used because of the subjective nature of the analysis and because of the lack of on the ground information at these sites.

All of the action alternatives were compared to determine if groups with similar effects existed. If so, one representative of each group was compared to the base case or no action alternative. Based upon the assumptions identified above, a general conclusion was made identifying potential impacts from each action alternative or representative alternative.

Base Case and No Action Comparisons

Bonner's Ferry – Mean Monthly Outflows

The Baseline Alternative (1a) and the No Action Alternative (2c) are different for outflows at Bonner's Ferry, outflows at Corra Lynn, and end of month elevations at Corra Lynn.

At Bonner's Ferry, the differences between 1a and 2c in mean outflow for 1941, the mean, and 1976 are:

ALT	YEAR	MAR	APR15	APR30	MAY	JUN
1a	1941	5442	7763	7958	9732	17664
2c	1941	8250	7763	12289	9732	7170
	DIF	−2808	0	−4331	0	10494
1a	MEAN	9645	11651	16525	20892	18517
2c	MEAN	9714	11496	16884	20815	17458
	DIF	−69	155	−359	77	1059
1a	1976	13269	14294	12201	23504	10849
2c	1976	14424	14721	12201	26166	10849
	DIF	−1155	−427	0	−2662	0

ALT	YEAR	JUL	AUG15	AUG31	SEP	OCT
1a	1941	10358	14546	7514	9335	6247
2c	1941	12436	13342	6469	13878	6247
	DIF	−2078	1204	1045	−4543	0
1a	MEAN	15158	12668	10256	13400	10948
2c	MEAN	15404	11951	9962	14329	11126
	DIF	−246	717	294	−929	−178
1a	1976	9845	22511	18728	15534	11324
2c	1976	17003	22511	18728	17194	10888
	DIF	−7158	0	0	−1660	436

The differences between the mean flows are not large, but the greatest difference (1059 CFS) occurs in June, a period generally considered critical for wildlife values. Higher flows in June would generally mimic the natural hydrograph, so an assumption is made that higher flows in June would generally be beneficial to wildlife. As a result, it would appear, on average, that Alternative 1a is somewhat better for wildlife values than Alternative 2c. This should be most evident in wetland and especially riparian development and maintenance.

To examine the worst reasonably foreseeable impacts, all other alternatives will be compared to Alternative 1a at Bonner's Ferry.

Corra Lynn – Mean Monthly Outflows

The Baseline Alternative (1a) and the No Action Alternative (2c) are different for outflows at Bonner's Ferry, outflows at Corra Lynn, and end of month elevations at Corra Lynn.

I assumed that the most critical time for high flows was June, as most similar to the historic pattern. High flows in May would also be beneficial. The value of high flows in July would depend upon the flows in June – flows higher than June in July would have a negative impact, by not allowing wetland/riparian waterfowl nesting and by interfering with riparian/wetland development and maintenance. Alternatively, too great a drop in flows between June and July would also be negative, resulting in extensive scouring and a barren flood plain zone where the establishment of riparian vegetation would be difficult.

At Corra Lynn, the differences between 1a and 2c in mean outflow for 1941, the mean, and 1976 are:

ALT	YEAR	MAR	APR15	APR30	MAY	JUN
1a	1941	16163	17899	20545	23387	40237
2c	1941	18972	17899	22125	27490	29852
	DIF	−2089	0	−1580	−4103	10385
1a	MEAN	19317	17358	22905	37627	51810
2c	MEAN	19597	16795	23635	39525	51661
	DIF	−280	563	−730	−1898	149
	%2C	−1	3	−3	−5	0.2
1a	1976	20370	22309	26654	38919	62947
2c	1976	21712	19943	21007	44454	52891
	DIF	−1342	2366	5647	−5535	10056

ALT	YEAR	JUL	AUG15	AUG31	SEP	OCT
1a	1941	25612	27587	15335	14008	14387
2c	1941	24813	26380	14290	18550	14387
	DIF	799	1207	1045	−4542	0
1a	MEAN	42267	26989	20763	16485	17581
2c	MEAN	38603	27411	20544	17419	17758
	DIF	3664	−422	219	−934	−177
	%2C	9	−2	1	−5	−1
1a	1976	40048	41743	43089	27162	14536
2c	1976	42295	47198	44099	28937	14100
	DIF	−2247	−5455	−1010	−1775	436

The greatest difference between mean flows (3664 CFS, 9 percent of 1a) occurs in July, a period generally considered critical for wildlife values. Additionally, the highest flows of the year are generally in June, recreating the historic pattern. Higher flows in June and July (especially June) should support existing wetland and riparian habitats more effectively, and perhaps allow the development of additional habitats. This would generally be beneficial to wildlife. The variable flows in August (down and then up again) in high flow years would are not beneficial to wildlife resources, however, the changes are fairly small. As a result, it would appear, on average, that Alternatives 2c and 1a are not significantly different for wildlife values relative to outflow at Corra Lynn.

To examine impacts, all other alternatives for outflows at Corra Lynn will be compared to Alternative 2c.

Corra Lynn – End of Month Elevations

IMPACTS – END ELEVATIONS AT CORRA LYNN

ALT	YEAR	MAR	APR15	APR30	MAY	JUN
1a	1941	1739	=	1740	1743	1745
2c	1941	1739	=	1741	1742	1743
DIFF		0	0	+1	1	2
1a	MEAN	1739	=	1741	1748	=
2c	MEAN	1739	1740	1741	1746	=
DIFF		0	+1	0	2	2
1a	1976	1739	1741	=	1755	1744
2c	1976	1739	1740	=	1750	1743
DIFF		0	1	1	5	1
1a	MIN	1739	=	=	1743	=
	MAX	1740	1743	1750	1757	1763
RANGE		1	4	11	14	20
2c	MIN	1739	=	=	1741	1743
	MAX	1740	1744	1750	1751	1754
RANGE		1	5	11	10	11

JUL	AUG15	AUG31	SEP	OCT
1743	=	=	1745	=
=	=	=	1745	1745
0	0	0	0	0
1744	1743	1743	1745	=
1744	1743	=	1745	=
0	0	0	0	0
=	1745	=	=	=
1746	1745	=	=	=
−2	0	0	0	0
=	=	1742	1743	1744
1750	1745	=	=	=
7	2	3	2	1
=	1742	=	1743	1744
1752	1745	=	=	=
9	3	3	2	1

All differences in elevations are less than 3 feet except for in June of a high water year. The changes in maximum high flows was well less than 10 percent. These differences should not have a significant effect upon wildlife resources.

Differences are not significant for any of the alternatives. No significant impacts from end of month elevations at Corra Lynn can be determined.

Comparison of Alternatives and Groups of Similar Alternatives at Bonner's Ferry

1A is the base line alternative and will be used for impact comparison at Bonner's Ferry as a result of it's somewhat more positive effects on wildlife, when compared to 2c. No alternatives where different from 1A by 1 percent or less.

2c is the no action alternative. Several other alternatives have identical or very similar hydroregulation results when compared to 2c. Therefore, these are grouped and assumed to have no impacts when compared to 2c. Alternatives where the differences in mean outflows for each month were 1 percent or less were assumed to be effectively equal in impacts. These alternatives are:

2a is similar to 2c except that sturgeon flows have been added at Libby. Naturally, this has changed the hydroregulation data for Bonner's Ferry. Within the definition of similar hydroregulation data (difference of less than 1 percent in mean CFS for each month), 2b is grouped with Alternatives 3a, 3b, 4a1, and 4b1.

Alternative 4a3 and Alternative 4b3 is unique. They are most similar to each other, with the only potentially significant differences occurring in the months of June, July, and August.

Alternatives 5a, 5b, 6a, 6b, 6c, and 6d are all similar and are grouped together.

There are therefore 4 additional groups of alternative that are similar in effects at Bonner's Ferry. These 4 groups will be compared to 1a to determine the effects to wildlife resources.

ALT	YEAR	MAR	APR15	APR30	MAY	JUN
1a	1941	5442	7763	7958	9732	17664
	MEAN	9645	11651	16525	20892	18517
	1976	13269	14294	12201	23504	10849
	MIN	4905	6327	5937	8142	9109
	MAX	16011	31456	40116	37182	41066
1b	1941	6718	6763	6958	8732	6170
	MEAN	9374	11558	16568	20266	17019
	1976	13268	14261	11201	24004	9849
	MIN	3898	5327	6544	7142	5742
	MAX	16010	31459	40113	37181	41067

ALT	YEAR	JUL	AUG15	AUG31	SEP	OCT
1a	1941	10358	14546	7514	9335	6247
	MEAN	15158	12668	10256	13400	10948
	1976	9845	22511	18728	15534	11324
	MIN	5319	4830	4754	7532	5248
	MAX	37456	22511	18728	22419	20045
1b	1941	12530	14504	6089	13667	5247
	MEAN	16044	12441	10516	14073	13979
	1976	10813	22511	18728	15534	14814
	MIN	4387	4075	6089	7732	5247
	MAX	37456	22511	18728	26180	21684

DIFFERENCE IN MEAN (1b MINUS 1a)

	MAR	APR 15	APR 30	MAY	JUN	JUL	AUG 15	AUG 31	SEP	OCT
DIF	−271	−93	43	−626	−1498	886	−227	260	673	3031
%1a	−3	−1	0.2	−3	−8	6	−2	3	5	28

The effects of 1b are difficult to determine when compared to alternative 1a. Flows decrease significantly from May to June, but are then more stable through July. The maximum flood flows are effectively identical. The pattern may result in some change in the species composition of the riparian habitats, but should not have an overall significant effect upon the wildlife resource.

ALT	YEAR	MAR	APR15	APR30	MAY	JUN
1a	1941	5442	7763	7958	9732	17664
	MEAN	9645	11651	16525	20892	18517
	1976	13269	14294	12201	23504	10849
	MIN	4905	6327	5937	8142	9109
	MAX	16011	31456	40116	37182	41066

ALT	YEAR	JUL	AUG15	AUG31	SEP	OCT
1a	1941	10358	14546	7514	9335	6247
	MEAN	15158	12668	10256	13400	10948
	1976	9845	22511	18728	15534	11324
	MIN	5319	4830	4754	7532	5248
	MAX	37456	22511	18728	22419	20045

ALTERNATIVES 2b, 3a, 3b, 4a1, 4b1

ALT	YEAR	MAR	APR15	APR30	MAY	JUN
2b	1941	7554	11474	12516	10342	7170
	MEAN	8976	11885	17486	25817	21462
	1976	12734	16208	12204	34042	11336
	MIN	4749	5398	5942	8142	5089
	MAX	19201	31551	43167	47773	52541

ALT	YEAR	JUL	AUG15	AUG31	SEP	OCT
2b	1941	5184	4559	4524	5293	23185
	MEAN	20232	12007	8710	7076	16841
	1976	29971	24051	18728	10361	15585
	MIN	5103	4531	4524	4490	13141
	MAX	37534	24051	18728	16994	24684

DIFFERENCES IN MEAN (2b minus 1a)

	MAR	APR 15	APR 30	MAY	JUN	JUL	AUG 15	AUG 31	SEP	OCT
DIF	−669	234	961	4925	2945	5074	−661	−1546	−6324	5893
%1a	−7	2	6	24	16	33	−5	−15	−47	54

Flows for Alternative 2b are higher in May, June, July, and October, with the highest flows generally occurring in June – except in high flow periods (1976) where they occur in July. Under the assumption that more water on a regular basis is beneficial for wildlife and that the pattern follows the natural hydrograph, Alternative 2b (and others similar to it) is somewhat better for wildlife values than the base case.

ALTERNATIVE 4a3

4a3	1941	7555	11474	12513	10345	7170	5182	4559	4524	5295	13253
	Mean	9436	12514	19699	28319	27192	20805	12107	8755	7080	9976
	1976	8276	19949	17524	38138	15247	29970	24052	18728	10361	10931
	MIN	4749	5398	5937	8142	5089	5103	4531	4524	4490	5650
	MAX	19202	31459	48577	51617	52538	37534	24052	18728	16994	20030

ALT	YEAR	MAR	APR15	APR30	MAY	JUN
1a	1941	5442	7763	7958	9732	17664
	MEAN	9645	11651	16525	20892	18517
	1976	13269	14294	12201	23504	10849
	MIN	4905	6327	5937	8142	9109
	MAX	16011	31456	40116	37182	41066

ALT	YEAR	JUL	AUG15	AUG31	SEP	OCT
1a	1941	10358	14546	7514	9335	6247
	MEAN	15158	12668	10256	13400	10948
	1976	9845	22511	18728	15534	11324
	MIN	5319	4830	4754	7532	5248
	MAX	37456	22511	18728	22419	20045

DIFFERENCES IN MEAN (4a3 minus 1a)

	MAR	APR 15	APR 30	MAY	JUN	JUL	AUG 15	AUG 31	SEP	OCT
DIF	−209	863	3174	7427	8675	5647	−561	−1501	−6320	−972
%1a	−2	7	19	36	47	37	−4	−15	−47	−9

Through the entire spring/mid−summer period (end of April to end of July), alternative 4a3 has significantly higher flows than 1a flows decline rapidly after that, with significantly lower flows by the end of August through October. The maximum flows are more than 10% higher for 4a3, increasing the chance of excessive flows damaging existing habitats. As a result, the net impacts should be about equal to the impacts of 1a.

ALTERNATIVE 4b3

ALT	YEAR	MAR	APR15	APR30	MAY	JUN
4b3	1941	7554	11474	12516	10342	7170
	MEAN	9436	12514	19699	28319	24828
	1976	8276	19949	17524	38138	15247
	MIN	4749	5398	5937	8142	5089
	MAX	19202	31459	48577	51617	52538
1a	1941	5442	7763	7958	9732	17664
	MEAN	9645	11651	16525	20892	18517
	1976	13269	14294	12201	23504	10849
	MIN	4905	6327	5937	8142	9109
	MAX	16011	31456	40116	37182	41066

ALT	YEAR	JUL	AUG15	AUG31	SEP	OCT
4b3	1941	5184	4559	4524	5293	13253
	MEAN	23003	12293	8755	7080	9976
	1976	29970	24052	18728	10361	10931
	MIN	5103	4531	4524	4490	5650
	MAX	48778	24052	18728	16994	20030
1a	1941	10358	14546	7514	9335	6247
	MEAN	15158	12668	10256	13400	10948
	1976	9845	22511	18728	15534	11324
	MIN	5319	4830	4754	7532	5248
	MAX	37456	22511	18728	22419	20045

DIFFERENCES IN MEAN (4b3 minus 1a)

	MAR	APR 15	APR 30	MAY	JUN	JUL	AUG 15	AUG 30	SEP	OCT
DIF	−209	863	3174	7427	6311	7845	−375	−1501	−6320	−972
%1a	−2	7	19	36	34	52	−3	−15	−47	−9

The pattern for 4b3 is similar to the pattern for 4a3 and should have similar wildlife effects.

ALTERNATIVES 5a, 5b, 6a, 6b, 6c, and 6d

ALT	YEAR	MAR	APR15	APR30	MAY	JUN
5a	MEAN	10328	11652	16342	20108	17997
	1976	13293	14294	12201	23504	10849
	MIN	4905	6327	5937	8142	9109
	MAX	18947	31459	41619	37181	41067
1a	1941	5442	7763	7958	9732	17664
	MEAN	9645	11651	16525	20892	18517
	1976	13269	14294	12201	23504	10849
	MIN	4905	6327	5937	8142	9109
	MAX	16011	31456	40116	37182	41066

ALT	YEAR	JUL	AUG15	AUG31	SEP	OCT
5a	MEAN	14396	12059	9981	13384	10948
	1976	9845	22511	18728	15534	11324
	MIN	5319	4779	4754	7532	5248
	MAX	37456	22511	18728	22419	20045
1a	1941	10358	14546	7514	9335	6247
	MEAN	15158	12668	10256	13400	10948
	1976	9845	22511	18728	15534	11324
	MIN	5319	4830	4754	7532	5248
	MAX	37456	22511	18728	22419	20045

DIFFERENCES IN MEAN (5a minus 1a)

	MAR	APR 15	APR 30	MAY	JUN	JUL	AUG 15	AUG 31	SEP	OCT
DIF	683	1	−4550	−785	−520	−762	−609	−275	−16	0
%1a	7	0	−28	−4	−3	−5	−5	−3	−0.1	0

The differences in flow are not significant except for in March (+7 percent) and at the end of April (−28 percent). These periods are not generally critical for wildlife in this area and the impacts should be less than significant.

Corra Lynn Outflows

COMPARISON OF ALL ALTERNATIVES AND GROUPS OF SIMILAR ALTERNATIVES FOR OUTFLOWS AT CORRA LYNN.

2c is the no action alternative and will be used for impact comparison of outflows at Corra Lynn. Several other alternatives have identical or very similar hydroregulation results when compared to 2c. Therefore, these are grouped and assumed to have no impacts when compared to 2c. Alternatives where the differences in mean outflows for each month were 1 percent or less were assumed to be effectively equal in impacts. The only alternative that is similar to 2c by this criteria is 2a.

1a, the baseline alternative, is unique but, as discussed above, not considered significantly different from 2c. No other alternatives are similar to 1a.

1b is also unique.

2b is similar to 3a and 3b.

4a1 is similar to 4b1.

4a3 is unique.

4b3 is unique.

5a is similar to 5b, 6a, 6b, 6c, and 6d.

Six groups of alternatives, in addition to the baseline alternative, are compared to the no action alternative.

ALT	YEAR	MAR	APR15	APR30	MAY	JUN
2c	1941	18972	17899	22125	27490	29852
	MEAN	19597	16795	23635	39525	51661
	1976	21712	19943	21007	44454	52891
	MIN	13041	8137	14947	21261	26773
	MAX	27617	29202	53284	74829	93286
1b	1941	17440	16899	19545	22386	28743
	MEAN	19013	17083	22411	36681	50286
	1976	20369	22309	24912	33425	61947
	MIN	12139	7137	10309	17109	28743
	MAX	25299	27201	37626	78178	78927

ALT	YEAR	JUL	AUG15	AUG31	SEP	OCT
2c	1941	24813	26380	14290	18550	14387
	MEAN	38603	27411	20544	17419	17758
	1976	42295	47198	44099	28937	14100
	MIN	20784	14362	13774	8947	11652
	MAX	71847	64184	44099	36083	32715
1b	1941	27784	27545	13910	18340	13387
	MEAN	43047	27077	21026	17158	20611
	1976	40610	42411	43219	27179	18026
	MIN	17253	14647	12639	6854	13582
	MAX	89795	56732	43219	34417	31667

DIFFERENCES IN MEAN (1b MINUS 2c)

	MAR	APR 15	APR 30	MAY	JUN	JUL	AUG 15	AUG 31	SEP	OCT
DIF	−584	288	−1224	−2844	−1375	4444	−334	482	−261	2853
%2c	3	2	−5	−7	−3	12	−1	2	−1	16

1b has insignificant flow changes in March, April, June, August, and September. In July and October, flows are higher by 12 and 16 percent respectively. In May, flows are 7 percent lower. Little wildlife activity or habitat growth is occurring in this area in May, so the 7 percent decrease in flows then should be insignificant. The increased flows in October are also unlike to have a significant effect on wildlife resources for the same reason. However, the higher flows in July could effect wildlife resources in a significant way. Higher flows in July could negatively impact waterfowl production and riparian regeneration by nest flooding and scouring newly established riparian vegetation. This alternative should be slightly negative when compared to 2c.

CORRA LYNN OUTFLOWS 2c Vs 2b (INCLUDING 3a AND 3b)

ALT	YEAR	MAR	APR15	APR30	MAY	JUN
2c	1941	18972	17899	22125	27490	29852
	MEAN	19597	16795	23635	39525	51661
	1976	21712	19943	21007	44454	52891
	MIN	13041	8137	14947	21261	26773
	MAX	27617	29202	53284	74829	93286
2b	1941	18275	19743	23436	25429	28933
	MEAN	19347	16726	22477	41235	55222
	1976	20025	20500	16875	43409	62723
	MIN	11891	8554	11153	16446	28933
	MAX	25299	29199	37627	81782	89367

ALT	YEAR	JUL	AUG15	AUG31	SEP	OCT
2c	1941	24813	26380	14290	18550	14387
	MEAN	38603	27411	20544	17419	17758
	1976	42295	47198	44099	28937	14100
	1976	52551	56793	45971	22283	18797
	MIN	20784	14362	13774	8947	11652
	MAX	71847	64184	44099	36083	32715
2b	1941	19547	17793	12226	9966	31325
	MEAN	46960	28091	19018	10085	23370
	MIN	18596	14700	10696	5002	17669
	MAX	90227	57811	45971	29243	37527

DIFFERENCES IN MEAN (2b MINUS 2c)

	MAR	APR 15	APR 30	MAY	JUN	JUL	AUG 15	AUG 31	SEP	OCT
DIF	−250	−69	−1158	1710	3561	8357	680	−1526	−7334	5612
%2c	−1	−0.4	−5	4	7	22	2	−7	−42	32

2b has potentially significant flow differences only in June (7 percent), July (22), the end of August (minus 7 percent), September (minus 42 percent), and October (32 percent). The timing of the high flows, as in 1b, is a concern for wildlife. Additionally, the wide range of flows in September and October is also a concern. Additional scouring is possible, impacting wetland and riparian habitats.

CORRA LYNN OUTFLOWS 2c Vs 4a1 (INCLUDING 4b1)

ALT	YEAR	MAR	APR15	APR30	MAY	JUN
2c	1941	18972	17899	22125	27490	29852
	MEAN	19597	16795	23635	39525	51661
	1976	21712	19943	21007	44454	52891
	MIN	13041	8137	14947	21261	26773
	MAX	27617	29202	53284	74829	93286
4a1	1941	18276	19744	23523	25665	29743
	MEAN	19271	16761	22408	41345	55024
	1976	20024	20500	16872	43411	63434
	MIN	11933	8521	11213	16447	29743
	MAX	25299	29202	54049	81783	90070

ALT	YEAR	JUL	AUG15	AUG31	SEP	OCT
2c	1941	24813	26380	14290	18550	14387
	MEAN	38603	27411	20544	17419	17758
	1976	42295	47198	44099	28937	14100
	MIN	20784	14362	13774	8947	11652
	MAX	71847	64184	44099	36083	32715
4a1	1941	20436	17600	2345	9967	31324
	MEAN	47340	28146	19308	10181	23702
	1976	51912	56702	45963	22285	8796
	MIN	19073	14756	0377	5000	17953
	MAX	89846	7453	45963	29243	37410

DIFFERENCES IN MEAN (4a1 MINUS 2c)

	MAR	APR 15	APR 30	MAY	JUN	JUL	AUG 15	AUG 31	SEP	OCT
DIF	−326	−34	−1227	1820	3363	8737	735	−1236	−7238	5944
%2c	−2	−0.2	−5	5	7	23	3	−6	−42	33

4a1 appears to be slightly better for wildlife resources than 2c. The flows in June are generally higher (mean increase 7 percent) and the flows in July are generally closer to the June flow, while still declining somewhat. The maximum flows are slightly lower for 4a1, reducing the chance of large flows significantly disruption riparian and wetland habitats. This pattern should work to assist the establishment and maintenance of riparian and wetland habitats.

CORRA LYNN OUTFLOWS 2c Vs 4a3

ALT	YEAR	MAR	APR15	APR30	MAY	JUN
2c	1941	18972	17899	22125	27490	29852
	MEAN	19597	16795	23635	39525	51661
	1976	21712	19943	21007	44454	52891
	MIN	13041	8137	14947	21261	26773
	MAX	27617	29202	53284	74829	93286
4a3	1941	18276	19744	23523	25665	29743
	MEAN	18983	17112	24017	42655	60604
	1976	15566	21902	24535	47506	67345
	MIN	11891	8521	11213	16447	29743
	MAX	27617	29202	53515	81125	103855

ALT	YEAR	JUL	AUG15	AUG31	SEP	OCT
2c	1941	24813	26380	14290	18550	14387
	MEAN	38603	27411	20544	17419	17758
	1976	42295	47198	44099	28937	14100
	MIN	20784	14362	13774	8947	11652
	MAX	71847	64184	44099	36083	32715
4a3	1941	20436	17600	12345	9967	21393
	MEAN	48987	28003	19352	10185	16594
	1976	51912	56702	45963	22285	14143
	MIN	19073	15012	10377	5000	8022
	MAX	89846	7453	45963	29243	32757

DIFFERENCES IN MEANS (4a3 MINUS 2c)

	MAR	APR 15	APR 30	MAY	JUN	JUL	AUG 15	AUG 31	SEP	OCT
DIF	−614	317	382	3130	8943	10384	592	−1192	−7234	1164
%2c	−3	2	2	8	17	27	2	−6	−42	−7

This pattern should be beneficial to wildlife values. Increased water flows throughout the period of April through mid−August, with highest flows in June and a steady decline after that. Increased wildlife benefits over 2c, but, because of the higher maximum flows (greater than 10 percent, compared to 4a1), this alternative is not as beneficial as 4a1.

CORRA LYNN OUTFLOWS 2c Vs 5a (including 5b, 6a, 6b, 6c, and 6d).

ALT	YEAR	MAR	APR15	APR30	MAY	JUN
2c	1941	18972	17899	22125	27490	29852
	MEAN	19597	16795	23635	39525	51661
	1976	21712	19943	21007	44454	52891
	MIN	13041	8137	14947	21261	26773
	MAX	27617	29202	53284	74829	93286
5a	1941	16163	17899	20545	26014	37178
	MEAN	19947	17429	23369	39214	51739
	1976	20393	22309	26318	45584	51301
	MIN	13042	8137	11300	21262	30980
	MAX	27617	29202	54041	78237	94478

ALT	YEAR	JUL	AUG15	AUG31	SEP	OCT
2c	1941	24813	26380	14290	18550	14387
	MEAN	38603	27411	20544	17419	17758
	1976	42295	47198	44099	28937	14100
	MIN	20784	14362	13774	8947	11652
	MAX	71847	64184	44099	36083	32715
5a	1941	25946	27587	15335	14008	14387
	MEAN	37927	27239	20528	16469	17581
	1976	38250	42113	43161	27173	14536
	MIN	13157	14481	10046	8183	9686
	MAX	71850	64190	43161	34417	32772

DIFFERENCES IN MEANS (5a MINUS 2c)

	MAR	APR 15	APR 30	MAY	JUN	JUL	AUG 15	AUG 31	SEP	OCT
DIF	350	634	−266	−311	78	−676	−172	−16	−950	−177
%2c	2	4	−1	−1	0.1	−2	−1	0	−5	−1

These differences in flows are not expected to have a significant effect on wildlife values.

Conclusion

None of the alternatives would appear to have major significant impacts (positive or negative) to wildlife resources.

Bonner's Ferry

The Alternative with the greatest impacts to wildlife is 2c, the No Action Alternative. Alternatives 1a, 1b, 4a3, 4b3, and 5a are similar in magnitude of effects, although some differences exist between them. Alternatives 2b, 3a, 3b, 4a1, and 4b1 are all similar and likely to be beneficial for wildlife when compared to either 1a or 2c.

Corra Lynn

Outflows at Corra Lynn fall into four groups of effects. The no action and base case alternatives (2c and 1a) are similar. Alternatives 5a, 5b, 6a, 6b, 6c, and 6d are all similar to 2c and 1a in wildlife effects.

Alternatives 1b, 2b, 3a, and 3b will have somewhat greater negative effects upon wildlife when compared to the no action and the base case.

Alternative 4a3 is somewhat better for wildlife resource than either the base case or the no action alternative. However, it is not as good as Alternatives 4a1 and 4b1, which are the best at Corra Lynn when considering outflows.

Elevations changes at Corra Lynn do not appear to be significant with regard to wildlife effects.

TECHNICAL EXIBIT D

INDIVIDUAL PROJECT MATRIX RESULTS

Table D–1. 30 Year Physical Effects of SOS Strategy for Libby Dam

System Operation Strategy Title: 1a wet avg; 1b wet avg; 2c; 2d; 5b; 5c; 6b; 6d; 9a; 9b wet and dry; PA wet and dry.

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	9600–9200	9170–9280	9700
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres	0	0	0
	Upland Colonization Potential	# of acres	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Riparian Zone Productivity	Riparian Zone Extent	# of acres	24	24	24
	Riparian Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	24	24	24
	Emergent Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	0	0	0
	Submerged Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Island Habitat Productivity:					
	Island Extent	# of acres	120	120	120
	Land Bridging Potential	% increase/decrease	0	0	0
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

Table D–1. 30 Year Physical Effects of SOS Strategy for Libby Dam – CONT

System Operation Strategy Title: 1a dry; 1b dry

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	0	0	9410
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres	0	0	0
	Upland Colonization Potential	# of acres	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Riparian Zone Productivity	Riparian Zone Extent	# of acres	0	0	24
	Riparian Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	0	0	24
	Emergent Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	0	0	0
	Submerged Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Island Habitat Productivity:	Island Extent	# of acres	0	0	120
	Land Bridging Potential	% increase/decrease	0	0	0
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

Table D–1. 30 Year Physical Effects of SOS Strategy for Libby Dam – CONT

System Operation Strategy Title: 4c; 9c

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	9015–9230	8640	9131–9175
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres	0	0	0
	Upland Colonization Potential	# of acres	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Riparian Zone Productivity	Riparian Zone Extent	# of acres	30	30	30
	Riparian Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	28	28	28
	Emergent Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	0	0	0
	Submerged Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Island Habitat Productivity:	Island Extent	# of acres	120	120	120
	Land Bridging Potential	% increase/decrease	0	0	0
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

Table D–1. 30 Year Physical Effects of SOS Strategy for Libby Dam – CONT

System Operation Strategy Title: 9a avg; PA avg

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres		8993	
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres			
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres		24	
	Riparian Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres		24	4
	Emergent Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	0	0	0
	Submerged Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Island Habitat Productivity:	Island Extent	# of acres		120	
	Land Bridging Potential	% increase/decrease	0	0	0
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

Table D–2. Wildlife Impacts for Libby Dam

Description of SOS Strategy: Group 1 (1a; 1b; 2c; 2d; 5b; 5c; 6b; and 6d)

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Common Merganser	Nesting				0	0	0	0	0
		Brooding	0	0	0			0	0	0
		Wintering								
	Mallard	Nesting	0	0		0	0	0		0
		Brooding	0	0	0		0	0		0
		Wintering								
	Diving Ducks	Nesting		0	0	0		0	0	0
		Brooding	0	0	0			0	0	0
		Wintering								
Shorebirds	Spotted Sandpiper	Nesting	0				0		0	
		Foraging	0				0	0	0	
Raptors:	Bald Eagle	Foraging	0			0	0		0	0
	Osprey	Nesting				0			0	
		Foraging	0	0	0	0			0	0
Aquatic Furbearers:	Beaver	Denning	0	0		0			0	
		Feeding	0	0	0	0			0	
	Otter	Denning	0			0	0		0	
		Feeding	0	0	0	0		0	0	0
Terrestrial Furbearers:	Raccoon	Foraging	0	0	0	0		0	0	0
Big Game:	Deer	Fawning	0			0	0		0	
		Foraging	0	0		0	0		0	
	B.H. Sheep	Winter range	0			0			0	
Amphibians:	Wood Frog	Life Cycle	0	0	0	0	0	0	0	0
Reptiles:	Painted Turtle	Foraging	0	0	0				0	0

Table D–2. Wildlife Impacts for Libby Dam – CONT

Description of SOS Strategy: Group 2 (4c and 9c)

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Common Merganser	Nesting				1	0	0	1	1
		Brooding	0	1	0			0	1	1
		Wintering								
	Mallard	Nesting	0	+1		1	0	0		0
		Brooding	0	1	0		0	0		0
		Wintering								
	Diving Ducks	Nesting		1	0	1		0	1	1
		Brooding	0	1	0			0	1	1
		Wintering								
Shorebirds	Spotted Sandpiper	Nesting	+1				1		1	
		Foraging	+1				1	1	1	
Raptors:	Bald Eagle	Foraging	0			0	0		1	1
	Osprey	Nesting				0			1	
		Foraging	0	1	0	1			1	1
Aquatic Furbearers:	Beaver	Denning	0	1		1			1	
		Feeding	0	1	0	1			1	
	Otter	Denning	0			1	0		1	
		Feeding	0	1	0	1		0	1	1
Terrestrial Furbearers:	Raccoon	Foraging	0	1	0	1		0	1	1
Big Game:	Deer	Fawning				1	0		1	
		Foraging	0	1		1	0		1	
	B.H. Sheep	Winter range	0			1			1	
Amphibians:	Wood Frog	Life Cycle	0	1	0	1		0	1	0
Reptiles:	Painted Turtle	Foraging	0	1	0			0	1	0

Table D–2. Wildlife Impacts for Libby Dam – CONT

Description of SOS Strategy: Group 3 (9a) and Group 4 (9b and PA)

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Common Merganser	Nesting				0	0	0	+1	–1
		Brooding	–1	0	0			0	+1	–1
		Wintering								
	Mallard	Nesting	–1	0		0	0	0		0
		Brooding	–1	0	0		0	0		0
		Wintering								
	Diving Ducks	Nesting		0	0	0		0	+1	–1
		Brooding	–1	0	0			0	+1	–1
		Wintering								
Shorebirds	Spotted Sandpiper	Nesting	+1				+1		+1	
		Foraging	+1				+1	–1	+1	
Raptors:	Bald Eagle	Foraging	–1			0	–1		+1	–1
	Osprey	Nesting				0			+1	
		Foraging	–1	0	0	0			+1	–1
Aquatic Furbearers:	Beaver	Denning	–1	0		1			+1	
		Feeding	–1	0	0	0			+1	
	Otter	Denning	–1			0	–1		+1	
		Feeding	–1	0	0	0		–1	+1	–1
Terrestrial Furbearers:	Raccoon	Foraging	–1	0	0	0		–1	+1	–1
Big Game:	Deer	Fawning	–1			0	–1		+1	
		Foraging	–1	0		0	–1		+1	
	B.H. Sheep	Winter range	–1			0			+1	
Amphibians:	Wood Frog	Life Cycle	–1	0	0	0	0	–1	+1	0
Reptiles:	Painted Turtle	Foraging	–1	0	0			–1	+1	0

Table D–3. Direct Physical Effects for Hungry Horse Reservoir

System Operation Strategy Title: 1a

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	9170	8960	4880
	Erosion/Landslide Potential	acres/year			
Winter (Dec – Mar) Upland Zone Productivity:	Upland Zone Extent	# of acres	8840	–	11,270
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	29	0	0
	Riparian Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Upland/Rip Trans.			0	–	2510
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	15	0	0
	Emergent Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	137	137	0
	Submerged Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity:	Island Extent = 334a		4	1	5
	Land Bridging Potential				
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
BenthicInvertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

Table D–3. Direct Physical Effects for Hungry Horse Reservoir – CONT

System Operation Strategy Title: 1b compared to 1a

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	0	190	730
	Erosion/Landslide Potential	acres/year			
Winter Upland Zone Productivity:	Upland Zone Extent	# of acres	0	–	6100
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	29–29=0		
	Riparian Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Upland/Rip Trans.				–	2510
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres		0	
	Emergent Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres			
	Submerged Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity:	Island Extent = 334a				
	Land Bridging Potential	yrs brd	4–4=0	1–1=0	5–5=0
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

Table D–3. Direct Physical Effects for Hungry Horse Reservoir – CONT

System Operation Strategy Title: 1b compared to 2c

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	770	420	430
	Erosion/Landslide Potential	acres/year			
Winter Upland Zone Productivity:	Upland Zone Extent	# of acres	440	–	6420
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	29–29=0		
	Riparian Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Upland/Rip Trans.				–	4480
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres		0	
	Emergent Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres			
	Submerged Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity:	Island Extent = 334a				
	Land Bridging Potential		4–5=–1	1–1=0	5–4=+1
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

Table D–3. Direct Physical Effects for Hungry Horse Reservoir – CONT

System Operation Strategy Title: 2c Compared to 1a

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	–770	–230	400
	Erosion/Landslide Potential	acres/year			
Winter (Dec – Mar) Upland Zone Productivity:	Upland Zone Extent	# of acres	–440		–320
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres			
	Riparian Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Upland/Rip Trans. Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres			–660
	Emergent Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres			
	Submerged Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity:	Island Extent = 334a	No yrs out of 5 that island is bridged			
	Land Bridging Potential		5–4=1	1–1=0	5–5=0
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

Table D–3. Direct Physical Effects for Hungry Horse Reservoir – CONT

System Operation Strategy Title: 2c (= 2a, 2b, 3a, 3b)

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	8400	8730	5280
	Erosion/Landslide Potential	acres/year			
Winter (Dec – Mar)			8400	–	10,950
Upland Zone Productivity:	Upland Zone Extent	# of acres			
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	29	29	
	Riparian Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Upland/Rip Trans.			0	0	1850
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	15	0	
	Emergent Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	137	137	0
	Submerged Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity:	Island Extent = 334a	No yrs out of 5 that island is bridged			
	Land Bridging Potential		5	1	4
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

Table D–3. Direct Physical Effects for Hungry Horse Reservoir – CONT

System Operation Strategy Title: 4a1 (= 4b1) Compared to 2c

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	−2620=5780	−3490=5240	−1240=4040
	Erosion/Landslide Potential	acres/year			
Winter (Dec – Mar) Upland Zone Productivity:	Upland Zone Extent	# of acres	−3710	–	−6800
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	51−29=22	22	51−0=51
	Riparian Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Upland/Rip Trans. Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	37−15=22	– 37−0=37	−1740 37−9=37
	Emergent Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	181−137=44	44	159−0=159
	Submerged Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity:	Island Extent = 334a	No yrs out of 5 that island is bridged			
	Land Bridging Potential		2−5=−3	0−1=−1	0−4=−4
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
BenthicInvertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

Table D–3. Direct Physical Effects for Hungry Horse Reservoir – CONT

System Operation Strategy Title: 5a (= 5b, 6a–d) Compared to 1a

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	0	0	10
	Erosion/Landslide Potential	acres/year			
Winter (Dec – Mar) Upland Zone Productivity:	Upland Zone Extent	# of acres			–1200
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres			
	Riparian Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	0	0	0
	Emergent Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	0	0	0
	Submerged Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity:	Island Extent = 334a				
	Land Bridging Potential		0	0	0
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

Table D–3. Direct Physical Effects for Hungry Horse Reservoir – CONT

System Operation Strategy Title: 5a (= 5b, 6a–d) Compared to 2c

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	770	230	–390
	Erosion/Landslide Potential	acres/year			
Winter (Dec – Mar) Upland Zone Productivity:	Upland Zone Extent	# of acres	–440	–	–880
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres			
	Riparian Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Upland/Rip Trans. Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres		–	–660
	Emergent Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres			
	Submerged Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity:	Island Extent = 334a	# of acres			
	Land Bridging Potential	% increase/decrease	–1	0	–1
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

Table D–3. Direct Physical Effects for Hungry Horse Reservoir – CONT

System Operation Strategy Title: 4a.3 Compared to 4a1

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	−540	−1530	0
	Erosion/Landslide Potential	acres/year			
Winter (Dec – Mar) Upland Zone Productivity:	Upland Zone Extent	# of acres	−870		0
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	0		0
	Riparian Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Upland/Rip Trans. Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	0		0
	Emergent Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	0		0
	Submerged Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity:	Island Extent = 334a	# of acres			
	Land Bridging Potential	% increase/decrease			
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
BenthicInvertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

Table D–3. Direct Physical Effects for Hungry Horse Reservoir – CONT

System Operation Strategy Title: 4a1 (=4b1) Compared to 1a

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	−3390	−3830	−840
	Erosion/Landslide Potential	acres/year			
Winter (Dec – Mar) Upland Zone Productivity:	Upland Zone Extent	# of acres	−4150		
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	51−29=22	51	51
	Riparian Colonization Potential	acres/year		51−0=	
	Net Growth/Regeneration	%increase/decrease			−2900
Upland/Rip Trans. Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	22−0=22	37−0=37	37−0=37
	Emergent Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	44−0=44	44	159−0=159
	Submerged Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity:	Island Extent = 334a	No yrs out of 5 that island is bridged			
	Land Bridging Potential		2−4=−2		0−5=−5
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

Table D–4. Wildlife Impacts for Hungry Horse Project

Description of SOS Strategy: 2c Compared to 1a

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Mallard	Nesting	0	0		0	0			
		Brooding	0	0	0		0			
	Diving Ducks	Nesting		0	0	0				
		Brooding	0	0	0		0			
Colonial Nesting Birds:	G.B. Heron	Nesting				0	0			
		Foraging		0	0		0			
Shorebirds	Spotted Sandpiper	Nesting	0				0			
		Foraging	0		0		0			
Nongame Birds:	Downy Woodpeck.	Nesting				0				
		Feeding		0		0				
	Red–winged Blackbird	Nesting		0		0				
		Feeding	0	0		0				
	Yellow Warbler	Nesting				0				
		Feeding		0		0				
Raptors:	Bald Eagle	Nesting	0	0	0	0	0			
		Foraging	0	0	0	0	0			
	Osprey	Nesting				0	0			
		Foraging		0	0	0				
Aquatic Furbearers:	Beaver	Denning	0	0		0				
		Feeding	0	0	0	0				
	Otter	Denning	0			0	0			
		Feeding	0	0	0	0				
Terrestrial Furbearers:	Raccoon	Foraging	0	0	0	0	0			
							0			
Big Game:	Deer, Mule	Fawning	0			0	0			
		Foraging	0	0		0	0			
	Elk	Winter range	0	0		0				
	Grizzly Bear	Foraging	0	0		0				
Amphibians:	Spotted Frog	Life Cycle	0	0	0	0				

Table D–4. Wildlife Impacts for Hungry Horse Project – CONT

Description of SOS Strategy: 1b Compared to 1a to comparison of 1b with (2c)

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Mallard	Nesting	0	0		1	0			
		Brooding	0	0	0		0			
	Diving Ducks	Nesting		0	0	0				
		Brooding	0	0	0		0			
Colonial Nesting Birds:	G.B. Heron	Nesting				0	0			
		Foraging		0	0		0			
Shorebirds	Spotted Sandpiper	Nesting	0				0			
		Foraging	0		0		0			
Nongame Birds:	Downy Woodpeck.	Nesting				0				
		Feeding		0		1				
	Red–winged Blackbird	Nesting		0		1				
		Feeding	0			1				
	Yellow Warbler	Nesting				1				
		Feeding		0		1				
Raptors:	Bald Eagle	Nesting	0	0	0	0	0			
		Foraging	0	0	0	0	0			
	Osprey	Nesting				0	0			
		Foraging		0	0	0				
Aquatic Furbearers:	Beaver	Denning	0	0		0				
		Feeding	0	0	0	0				
	Otter	Denning	0			0	0			
		Feeding	0	0	0	0				
Terrestrial Furbearers:	Raccoon	Foraging	0	0	0	1	0			
Big Game:	Deer, Mule	Fawning	0			1	0			
		Foraging	0	0		1	0			
	Elk	Winter range	0	0		1				
	Grizzly Bear	Foraging	0	0		1				
Amphibians:	Spotted Frog	Life Cycle	0	0	0	0				

Table D–4. Wildlife Impacts for Hungry Horse Project – CONT

Description of SOS Strategy: 1b Compared to 2c

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Mallard	Nesting	0	0		1	0			
		Brooding	0	0	0		0			
	Diving Ducks	Nesting		0	0	0				
		Brooding	0	0	0		0			
Colonial Nesting Birds:	G.B. Heron	Nesting				0	0			
		Foraging		0	0		0			
Shorebirds	Spotted Sandpiper	Nesting	0				0			
		Foraging	0		0		0			
Nongame Birds:	Downy Woodpeck.	Nesting				0				
		Feeding		0		1				
	Red–winged Blackbird	Nesting		0		1				
		Feeding	0	0		1				
	Yellow Warbler	Nesting				1				
		Feeding		0		1				
Raptors:	Bald Eagle	Nesting	0	0	0	0	0			
		Foraging	0	0	0	0	0			
	Osprey	Nesting				0	0			
		Foraging		0	0	0				
Aquatic Furbearers:	Beaver	Denning	0	0		0				
		Feeding	0	0	0	0				
	Otter	Denning	0			0	0			
		Feeding	0	0	0	0				
Terrestrial Furbearers:	Raccoon	Foraging	0	0	0	1	0			
Big Game:	Deer, Mule	Fawning	0			1	0			
		Foraging	0	0		1	0			
	Elk	Winter range	0	0		1				
	Grizzly Bear	Foraging	0	0		1				
Amphibians:	Spotted Frog	Life Cycle	0	0	0	0				

Table D–4. Wildlife Impacts for Hungry Horse Project – CONT

Description of SOS Strategy: 4a Compared to 1a

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Mallard	Nesting	0	3		1	2			
		Brooding	0	3	3		2			
	Diving Ducks	Nesting		2	3	1				
		Brooding	0	2	3		2			
Colonial Nesting Birds:	G.B. Heron	Nesting				1	1			
		Foraging		2	2		1			
Shorebirds	Spotted Sandpiper	Nesting	0				1			
		Foraging	0		2		1			
Nongame Birds:	Downy Woodpeck.	Nesting				0				
		Feeding		1		0				
	Red–winged Blackbird	Nesting		2		0				
		Feeding	0	2		0				
	Yellow Warbler	Nesting				0				
		Feeding		2		0				
Raptors:	Bald Eagle	Nesting	0	1	1		1			
		Foraging	0	1	1		1			
	Osprey	Nesting				0	0			
		Foraging		1	1	0				
Aquatic Furbearers:	Beaver	Denning	0	0		0				
		Feeding	0	0	0	0				
	Otter	Denning	0			0	0			
		Feeding	0	0	0					
Terrestrial Furbearers:	Raccoon	Foraging	0	2	2	0	0			
Big Game:	Deer, Mule	Fawning	0			0	1			
		Foraging	0	1		1	0			
	Elk	Winter range	0	1		1				
	Grizzly Bear	Foraging	0	1		1				
Amphibians:	Spotted Frog	Life Cycle	0	1	1	1				

Table D–5. 30 Year Physical Effects of SOS Strategy for Albeni Falls

System Operation Strategy Title: Group 1 (1a, 1b, 2c, 2d, 5b, 5c, 6b, and 6d); and PA

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	5367	5367	5367
	Erosion/Landslide Potential	acres/year			
Winter (Dec – Mar) Upland Zone Productivity:	Upland Zone Extent	# of acres	0	0	0
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	1341	1341	1341
	Riparian Colonization Potential	acres/year	−15	−15	−15
	Net Growth/Regeneration	%increase/decrease			
Upland/Rip Trans. Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	2196	2196	2196
	Emergent Colonization Potential	acres/year	−15	−15	−15
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	8245	8245	8245
	Submerged Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Island Habitat Productivity:	Island Extent = 334a	# of acres	1000	1000	1000
	Land Bridging Potential	% increase/decrease	0	0	0
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
BenthicInvertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

Table D–5. 30 Year Physical Effects of SOS Strategy for Albeni Falls – CONT

System Operation Strategy Title: 4c

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	4293	4293	4293
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres	0	0	0
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	1959	1959	1959
	Riparian Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	2744	2744	2744
	Emergent Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	8300	8300	8300
	Submerged Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Island Habitat Productivity:	Island Extent = 334a	# of acres	1185	1185	1185
	Land Bridging Potential	% increase/decrease	0	0	0
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

* Assumes lake shore was fully vegetated at time of project construction. Since then 6617 acres of vegetated land have been lost to erosion.

Table D–5. 30 Year Physical Effects of SOS Strategy for Albeni Falls – CONT

System Operation Strategy Title: 9a

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	3967	3967	3967
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres	0	0	0
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	1341	1341	1341
	Riparian Colonization Potential	acres/year	−5	−5	−5
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	2196	2196	2196
	Emergent Colonization Potential	acres/year	−5	−5	−5
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	8325	8325	8325
	Submerged Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Island Habitat Productivity:	Island Extent = 334a	# of acres	1385	1385	1385
	Land Bridging Potential	% increase/decrease	0	0	0
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

Table D–5. 30 Year Physical Effects of SOS Strategy for Albeni Falls – CONT

System Operation Strategy Title: 9b

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	3967	3967	3967
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres	0	0	0
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	1949	1949	1949
	Riparian Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	2729	2729	2729
	Emergent Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	8325	8325	8325
	Submerged Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity:	Island Extent = 334a	# of acres	1185	1185	1185
	Land Bridging Potential	% increase/decrease			
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

Table D–5. 30 Year Physical Effects of SOS Strategy for Albeni Falls – CONT

System Operation Strategy Title: 9c

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	3967	3967	3967
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres	0	0	0
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	1441	1441	1441
	Riparian Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	2329	2329	2329
	Emergent Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	8325	8325	8325
	Submerged Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity:	Island Extent = 334a	# of acres	1050	1050	1050
	Land Bridging Potential	% increase/decrease			
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

Table D–6. Wildlife Impacts for Albeni Falls

Description of SOS Strategy: 1a, 1b, 2c, 2d, 2d, 5b, 5c, 6b, 6d, and PA

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting		0		0	0		0	
		Brooding		0		0		0	0	
		Wintering	0		0	0	0	0	0	
	Mallard	Nesting		0		0	0	0	0	
		Brooding		0	0		0	0	0	
		Wintering	0	0	0		0	0	0	
	Diving Ducks	Nesting		0	0	0		0	0	0
		Brooding		0	0			0	0	0
		Wintering	0	0	0		0	0	0	0
Colonial Nesting Birds:	G.B. Heron	Nesting				0	0		0	
		Foraging	0	0	0		0	0	0	0
	B. Swallow	Nesting	0						0	
		Foraging	0	0	0	0		0	0	
Shorebirds	Spotted Sandpiper	Nesting					0	0		
		Foraging	0		0			0		
Nongame Birds:	Downy Woodpeck.	Nesting		0		0			0	
		Feeding	0	0		0			0	
	Red–winged Blackbird	Nesting		0		0			0	
		Feeding	0	0		0		0	0	
	Yellow Warbler	Nesting				0			0	
		Feeding		0		0			0	
Raptors:	Bald Eagle	Foraging	0			0	0		0	0
		Nesting				0	0		0	
	Osprey	Nesting				0				
		Foraging		0	0	0				0
Aquatic Furbearers:	Beaver	Denning		0		0			0	
		Feeding	0	0	0	0			0	
	Otter	Denning				0	0		0	
		Feeding	0	0	0	0		0	0	0
Terrestrial Furbearers:	Raccoon	Foraging	0	0	0	0		0	0	0
Big Game:	Mule Deer	Fawning				0	0		0	
		Foraging	0	0		0	0		0	
	W–t. Deer	Winter range	0	0		0	0		0	
Amphibians:	Pacific Tree Frog	Life Cycle	0	0	0	0		0		
Reptiles:	Painted Turtle	Foraging	0	0	0			0	0	0
		Reprod.					0		0	

Table D–6. Wildlife Impacts for Albeni Falls – CONT

Description of SOS Strategy: 4c, 9b, and 9c

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting		1		1	1		1	
		Brooding		1		1		1	1	
		Wintering	0		1	1	1	1	0	
	Mallard	Nesting		1		1	1	1	1	
		Brooding		1	1		1	1	1	
		Wintering	0	1	1		1	1	0	
	Diving Ducks	Nesting		1	1	1		1	1	1
		Brooding		1	1			1	1	1
		Wintering	0	1	1		1	1	0	1
Colonial Nesting Birds:	G.B. Heron	Nesting				1	1		1	
		Foraging	−1	1	1		1	1	1	1
	B. Swallow	Nesting	0						0	
		Foraging	0	1	1	1		1	0	
Shorebirds	Spotted Sandpiper	Nesting					1	1		
		Foraging	−1		0			1		
Nongame Birds:	Downy Woodpeck.	Nesting		1		1			0	
		Feeding	0	1		1			0	
	Red–winged Blackbird	Nesting		1		1			1	
		Feeding	−1	1		1		1	0	
	Yellow Warbler	Nesting				1			1	
		Feeding		1		1			1	
Raptors:	Bald Eagle	Foraging	−1			1	1		1	1
		Nesting				1	0		1	
	Osprey	Nesting				1				
		Foraging	−1	1	1	1				1
Aquatic Furbearers:	Beaver	Denning		1		1			1	
		Feeding	−1	1	1	1			1	
	Otter	Denning				1	1		1	
		Feeding	−1	1	1	1		1	1	1
Terrestrial Furbearers:	Raccoon	Foraging	−1	1	0	1		1	1	1
Big Game:	Mule Deer	Fawning				1	1		1	
		Foraging	0	1		1	1		1	
	W–t. Deer	Winter range	0	1		1	1		0	
Amphibians:	Pacific Tree Frog	Life Cycle	0	1	0	1		1		
Reptiles:	Painted Turtle	Foraging	0	1	1			1	1	1
		Reprod.					1		1	

Table D–6. Wildlife Impacts for Albeni Falls – CONT

Description of SOS Strategy: 9a

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting		0		0	0		1	
		Brooding		0		0		1	1	
		Wintering	0		1	0	0	0	0	
	Mallard	Nesting		0		0	0	1	1	
		Brooding		0	1		0	1	1	
		Wintering	0	0	1		0	1	0	
	Diving Ducks	Nesting		0	1	0		1	1	1
		Brooding		0	1			1	1	0
		Wintering	0	0	1		0	1	0	1
Colonial Nesting Birds:	G.B. Heron	Nesting				0	0		1	
		Foraging	0	0	1		0	1	1	1
	B. Swallow	Nesting	0						0	
		Foraging	0	0	1	0		1	0	
Shorebirds	Spotted Sandpiper	Nesting					0	1		
		Foraging	0		0			1		
Nongame Birds:	Downy Woodpeck.	Nesting		0		0			0	
		Feeding	0	0		0			0	
	Red–winged Blackbird	Nesting		0		0			1	
		Feeding	0	0		0		1	0	
	Yellow Warbler	Nesting				0			1	
		Feeding		0		0			1	
Raptors:	Bald Eagle	Foraging	0			0	0		1	1
		Nesting				0	0		1	
	Osprey	Nesting				0				
		Foraging		0	1	0				1
Aquatic Furbearers:	Beaver	Denning		0		0			1	
		Feeding	0	0	1	0			1	
	Otter	Denning				0	0		1	
		Feeding	0	0	0	0		0	1	1
Terrestrial Furbearers:	Raccoon	Foraging	0	0	0	0		0	1	1
Big Game:	Mule Deer	Fawning				0	0		1	
		Foraging	0	0		0	0		1	
	W–t. Deer	Winter range	0	0		0	0		0	
Amphibians:	Pacific Tree Frog	Life Cycle	0	0	0	0		1		
Reptiles:	Painted Turtle	Foraging	0	0	1			1	1	1
		Reprod.					0		1	

Table D–7. 30 Year Physical Effects of SOS Strategy for Grand Coulee – Lake Roosevelt

System Operation Strategy Title: 2c, 1a, 1b, 5b, 5c, 6b, 6d

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	32,270	23,270	32,270
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres	–	–	–
	Upland Colonization Potential	# of acres	–	–	–
	Net Growth/Regeneration	%increase/decrease	0	0	0
Riparian Zone Productivity	Riparian Zone Extent	# of acres	25	25	25
	Riparian Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	230	235	230
	Emergent Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	46	46	46
	Submerged Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Island Habitat Productivity:	Island Extent	# of acres	130	130	130
	Land Bridging Potential	% increase/decrease	0	0	0
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease	0	0	0
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease	0	+1	0
Human Effects:	Boating Activity	% increase/decrease	0	0	0
	Shoreline Activities	% increase/decrease	0	0	0

Table D–7. 30 Year Physical Effects of SOS Strategy for Grand Coulee – Lake Roosevelt – CONT

System Operation Strategy Title: 4c

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	30,700	14,500	12,400
	Erosion/Landslide Potential	acres/year	0	0	0
Upland Zone Productivity:	Upland Zone Extent	# of acres			
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	25	25	25
	Riparian Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	230	235	235
	Emergent Colonization Potential	acres/year	0	0	+1
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	46	46	46
	Submerged Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Island Habitat Productivity:	Island Extent	# of acres	130	130	130
	Land Bridging Potential	% increase/decrease	0	0	0
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease	0	0	0
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease	0	+1	−1
Human Effects:	Boating Activity	% increase/decrease	0	0	0
	Shoreline Activities	% increase/decrease	0	0	0

Table D–7. 30 Year Physical Effects of SOS Strategy for Grand Coulee – Lake Roosevelt – CONT

System Operation Strategy Title: 9a

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	36,100	22,900	32,900
	Erosion/Landslide Potential	acres/year	–	–	–
Upland Zone Productivity:	Upland Zone Extent	# of acres	–	–	–
	Upland Colonization Potential	# of acres	–	–	–
	Net Growth/Regeneration	%increase/decrease	0	0	0
Riparian Zone Productivity	Riparian Zone Extent	# of acres	25	25	25
	Riparian Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	230	235	235
	Emergent Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	–1	–1	–1
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	46	46	46
	Submerged Colonization Potential	acres/year	–	–	–
	Net Growth/Regeneration	%increase/decrease	0	0	0
Island Habitat Productivity:	Island Extent	# of acres	130	130	130
	Land Bridging Potential	% increase/decrease	+1	+1	+1
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease	–1	–1	–1
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease	–1	–1	–1
Human Effects:	Boating Activity	% increase/decrease	0	0	0
	Shoreline Activities	% increase/decrease	0	0	0

Table D–7. 30 Year Physical Effects of SOS Strategy for Grand Coulee – Lake Roosevelt – CONT

System Operation Strategy Title: 9b

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	32,270	21,270	32,270
	Erosion/Landslide Potential	acres/year	0	0	0
Upland Zone Productivity:	Upland Zone Extent	# of acres	–	–	–
	Upland Colonization Potential	# of acres	–	–	–
	Net Growth/Regeneration	%increase/decrease	0	0	0
Riparian Zone Productivity	Riparian Zone Extent	# of acres	25	25	25
	Riparian Colonization Potential	acres/year	–	–	–
	Net Growth/Regeneration	%increase/decrease	0	0	0
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	230	230	230
	Emergent Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	46	46	46
	Submerged Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	−1	−1	−1
Island Habitat Productivity:	Island Extent	# of acres	130	130	130
	Land Bridging Potential	% increase/decrease	0	0	0
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease	0	0	0
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease	−1	−1	−1
Human Effects:	Boating Activity	% increase/decrease	0	0	0
	Shoreline Activities	% increase/decrease	0	0	0

Table D–7. 30 Year Physical Effects of SOS Strategy for Grand Coulee – Lake Roosevelt – CONT

System Operation Strategy Title: 9c

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	36,170	25,270	36,570
	Erosion/Landslide Potential	acres/year	+1	+1	+1
Upland Zone Productivity:	Upland Zone Extent	# of acres	–	–	–
	Upland Colonization Potential	# of acres	–	–	–
	Net Growth/Regeneration	%increase/decrease	–	–	–
Riparian Zone Productivity	Riparian Zone Extent	# of acres	25	25	25
	Riparian Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	230	230	230
	Emergent Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	−1	−1	−1
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	46	46	46
	Submerged Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Island Habitat Productivity:	Island Extent	# of acres	130	130	130
	Land Bridging Potential	% increase/decrease	+1	+1	+1
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease	0	0	0
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease	−1	−1	−1
Human Effects:	Boating Activity	% increase/decrease	0	0	0
	Shoreline Activities	% increase/decrease	0	0	0

Table D–7. 30 Year Physical Effects of SOS Strategy for Grand Coulee – Lake Roosevelt – CONT

System Operation Strategy Title: PA

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	32,270	23,170	32,270
	Erosion/Landslide Potential	acres/year	0	0	0
Upland Zone Productivity:	Upland Zone Extent	# of acres	–	–	–
	Upland Colonization Potential	# of acres	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Riparian Zone Productivity	Riparian Zone Extent	# of acres	25	25	25
	Riparian Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	230	235	230
	Emergent Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	46	46	46
	Submerged Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Island Habitat Productivity:	Island Extent	# of acres	130	130	130
	Land Bridging Potential	% increase/decrease			
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease	0	0	0
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease	0	–1	0
Human Effects:	Boating Activity	% increase/decrease	0	0	0
	Shoreline Activities	% increase/decrease	0	0	0

Table D–7. 30 Year Physical Effects of SOS Strategy for Grand Coulee – Lake Roosevelt – CONT

System Operation Strategy Title: 2d

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	32,270	22,270	32,270
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres	?	?	?
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease	–		–
Riparian Zone Productivity	Riparian Zone Extent	# of acres	25	25	25
	Riparian Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	–	0	–
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	230	235	230
	Emergent Colonization Potential	acres/year		5	
	Net Growth/Regeneration	%increase/decrease	–	0	–
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	46	46	46
	Submerged Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	–	0	–
Island Habitat Productivity:	Island Extent = 334a	# of acres	130	130	130
	Land Bridging Potential	% increase/decrease	–	0	–
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease	–	0	–
BenthicInvertebrate Productivity:	Annual lbs/acre	% increase/decrease	–	–1	–
Human Effects:	Boating Activity	% increase/decrease	–	0	–
	Shoreline Activities	% increase/decrease	–	10	–

Table D–8. Wildlife Impacts for Grand Coulee

Description of SOS Strategy: 2c, 1a, 1b, 5b, 5c, 6b, 6d

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting				0	0			
		Brooding	−1	+1		0				
		Wintering	0		0	0	0			
	Mallard	Nesting	−1	+1		0	0			
		Brooding	−1	+1	0		0			
		Wintering	0	−1	+1		0			
	Diving Ducks	Nesting		0	0	0				
		Brooding	−1	+1	0					
		Wintering	0	+1	0		0			
Colonial Nesting Birds:	G.B. Heron	Nesting				0	0			
		Foraging	0	+1	0		0			
	Bank Swallow	Nesting	−1				0			
		Foraging	+1	+1	0	0				
Nongame Birds:	Downy Woodpeck.	Nesting	−1	0		0				
		Feeding	−1	0		0				
	Red–winged Blackbird	Nesting		+1		0				
		Feeding	0	+1		0				
	Yellow Warbler	Nesting				0				
		Feeding		−1		0				
Raptors:	Bald Eagle	Foraging	0			0	0			−1
		Nesting	0	0	0	0	0			
Aquatic Furbearers:	Beaver	Denning	−1	−1		0				
		Feeding	−1	−1	0	0				
	Otter	Denning	−1			0	0			
		Feeding	−1	−1	−1	0				
Big Game:	Deer	Foraging	0	+1		0	0			
	Elk	Winter range	0	0		0				
	B.H. Sheep	Winter range								
Amphibians:	Spotted Frog	Oviposition	0	+1	0	0				–
	Frog	Larval cycle	−3	+1	0	0		+		–

Table D–8. Wildlife Impacts for Grand Coulee – CONT

Description of SOS Strategy: 4c

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting				0	0		0	
		Brooding	+1	0		0		0	0	
		Wintering	0		0	0	0	0	0	
	Mallard	Nesting	0	0		0	0	0	0	
		Brooding	–1	0	0		0	0	0	
		Wintering	0	0	0		0	0	0	
	Diving Ducks	Nesting		0	0	0		0	0	
		Brooding	0	0	0			+1	0	+1
		Wintering	0	0	+1		0	+1	0	0
Colonial Nesting Birds:	G.B. Heron	Nesting				0	0		0	
		Foraging	0	0	+1		0	0	0	+1
	Bank Swallow	Nesting	0				0		0	
		Foraging	+1	0	0	0		0	0	
Nongame Birds:	Downy Woodpeck.	Nesting	0	0		0			0	
		Feeding	0	0		0			0	
	Red–winged Blackbird	Nesting		0		0			0	
		Feeding	0	0		0		0	0	
	Yellow Warbler	Nesting				0			0	
		Feeding		0		0			0	
Raptors:	Bald Eagle	Foraging	+1			0	0		0	+1
Aquatic Furbearers:	Beaver	Denning	0	0		0			0	
		Feeding	0	0	0	0			0	
	Otter	Denning	0			0	0		0	
		Feeding	+1	0	+1	0		0	0	+1
Big Game:	Deer	Foraging	0	0		0	0		0	
	Elk	Winter range	0	0		0			0	
	B.H. Sheep	Winter range	0			0			0	
Amphibians:	Spotted Frog	Life Cycle	0	0	+1	0		+1		0
	Frog									

Table D–8. Wildlife Impacts for Grand Coulee – CONT

Description of SOS Strategy: 9a

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting				0	0		0	
		Brooding	−1	−1		−1			+1	
		Wintering	0		0	0	0		0	
	Mallard	Nesting	−1	0		−1	0		0	
		Brooding	−1	−1	−1		0		+1	
		Wintering	0	0	0		0		0	
	Diving Ducks	Nesting		0	0	−1			0	
		Brooding	−1	−1	0				0	
		Wintering	0	0	−1		0		0	
Colonial Nesting Birds:	G.B. Heron	Nesting				0	0		0	
		Foraging	0	−1	0		0		0	
	Bank Swallow	Nesting	−1				0		+1	
		Foraging	0	−1	0	0			0	
Nongame Birds:	Downy Woodpeck.	Nesting	0	0		0			0	
		Feeding	0	0		0			0	
	Red–winged Blackbird	Nesting		−1		−1			+1	
		Feeding	0	−1		−1			0	
	Yellow Warbler	Nesting				0			+1	
		Feeding		−1		−1			0	
Raptors:	Bald Eagle	Foraging	0			0	0		+1	−1
		Nesting								
Aquatic Furbearers:	Beaver	Denning	0	−1		0			0	
		Feeding	−1	−1	0	−1			+1	
	Otter	Denning	0			0	0		0	
		Feeding	−1	−1	−1	0			+1	
Big Game:	Deer	Foraging	0	−1		0	0		0	
	Elk	Winter range	0	0		0			0	
	B.H. Sheep	Winter range	0			0			0	
Amphibians:	Spotted Frog	Life Cycle	0	−1	0	0				
	Frog									

Table D–8. Wildlife Impacts for Grand Coulee – CONT

Description of SOS Strategy: 9b

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting				0	0			
		Brooding	−1	−1		−1				
		Wintering	0		−1	0	0			
	Mallard	Nesting	0	0		−1	0			
		Brooding	−1	−1	0		0			
		Wintering	−1	0	0		0			
	Diving Ducks	Nesting		0	0	−1				
		Brooding	−1	−1	0					
		Wintering	0	0	−1		0			
Colonial Nesting Birds:	G.B. Heron	Nesting				0	0			
		Foraging	0	−1	0		0			
	Bank Swallow	Nesting	0				0			
		Foraging	0	−1	0	0				
Nongame Birds:	Downy Woodpeck.	Nesting	0	0		0				
		Feeding	0	0		0				
	Red–winged Blackbird	Nesting		−1		−1				
		Feeding	0	−1		−1				
	Yellow Warbler	Nesting				0				
		Feeding		−1		−1				
Raptors:	Bald Eagle	Foraging	0			0	0			−1
		Nesting								
Aquatic Furbearers:	Beaver	Denning	0	−1		0				
		Feeding	−1	−1	−1	−1				
	Otter	Denning	0			0	0			
		Feeding	−1	−1	−1	0				
Big Game:	Deer	Foraging	0	−1		0	0			
	Elk	Winter range	0	0		0				
	B.H. Sheep	Winter range	0			0				
Amphibians:	Spotted Frog	Life Cycle	0	−1	−1	0				
	Frog									

Table D–8. Wildlife Impacts for Grand Coulee – CONT

Description of SOS Strategy: 9c

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting					−1		0	
		Brooding	−2	−1		0			+1	
		Wintering	0		−2	0	0		0	
	Mallard	Nesting	−1	−1		−1	−1		0	
		Brooding	−2	−1	−1		−1		+1	
		Wintering	0	−1	−1		0		0	
	Diving Ducks	Nesting		−1	0	−1			0	
		Brooding	−1	−1	−1				0	
		Wintering	0	−2	−2		0		0	
Colonial Nesting Birds:	G.B. Heron	Nesting				−1	0		0	
		Foraging	−1	−1	0		0		0	
	Bank Swallow	Nesting	−1				0		+1	
		Foraging	−1	−1	0	0			0	
Nongame Birds:	Downy Woodpeck.	Nesting	0	0		0			0	
		Feeding	0	0		0			0	
	Red–winged Blackbird	Nesting		−1		−1			+1	
		Feeding	−1	−1		−2			0	
	Yellow Warbler	Nesting				−1			+1	
		Feeding		−1		−1			0	
Raptors:	Bald Eagle	Foraging	0			0	0		+1	−1
		Nesting								
Aquatic Furbearers:	Beaver	Denning	−2	−1		−1			0	
		Feeding	−2	−1	0	−2			+1	
	Otter	Denning	−2			−1	0		0	
		Feeding	−1	−1	−1	0			+1	
Big Game:	Deer	Foraging	−1	−1		0	0		0	
	Elk	Winter range	0	−1		0			0	
	B.H. Sheep	Winter range	0			0			0	
Amphibians:	Spotted Frog	Life Cycle	−1	−1	−1	−1				
	Frog									

Table D–8. Wildlife Impacts for Grand Coulee – CONT

Description of SOS Strategy: PA

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting					−1		0	
		Brooding	−2	−1		0			+1	
		Wintering	0		−2	0	0		0	
	Mallard	Nesting	−1	−1		−1	−1		0	
		Brooding	−2	−1	−1		−1		+1	
		Wintering	0	−1	−1		0		0	
	Diving Ducks	Nesting		−1	0	−1			0	
		Brooding	−1	−1	−1				0	
		Wintering	0	−2	−2		0		0	
Colonial Nesting Birds:	G.B. Heron	Nesting				−1	0		0	
		Foraging	−1	−1	0		0		0	
	Bank Swallow	Nesting	−1				0		+1	
		Foraging	−1	−1	0	0			0	
Nongame Birds:	Downy Woodpeck.	Nesting	0	0		0			0	
		Feeding	0	0		0			0	
	Red–winged Blackbird	Nesting		−1		−1			+1	
		Feeding	−1	−1		−2			0	
	Yellow Warbler	Nesting				−1			+1	
		Feeding		−1		−1			0	
Raptors:	Bald Eagle	Foraging	0			0	0		+1	−1
		Nesting								
Aquatic Furbearers:	Beaver	Denning	−2	−1		−1			0	
		Feeding	−2	−1	0	−2			+1	
	Otter	Denning	−2			−1	0		0	
		Feeding	−1	−1	−1	0			+1	
Big Game:	Deer	Foraging	−1	−1		0	0		0	
	Elk	Winter range	0	−1		0			0	
	B.H. Sheep	Winter range	0			0			0	
Amphibians:	Spotted Frog	Life Cycle	−1	−1	−1	−1				
	Frog									

Table D–8. Wildlife Impacts for Grand Coulee – CONT

Description of SOS Strategy: 2d

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting				0	−1		0	
		Brooding	+1	−1		0		−1	0	
		Wintering	0		+1	0	−1	−1	0	
	Mallard	Nesting	0	−1		0	0	−1	0	
		Brooding	0	−1	0		0	−1	0	
		Wintering	0	0	0		0	0	0	
	Diving Ducks	Nesting		0	0	0		−1	0	−1
		Brooding	−1	0	0			−1	0	−1
		Wintering	+1	0	0		−1	−1	0	−1
Colonial Nesting Birds:	G.B. Heron	Nesting				0	0		0	
		Foraging	+1	0	0		−1	−1	0	−1
	Bank Swallow	Nesting	0						0	
		Foraging	0	0	0	0			0	
Nongame Birds:	Downy Woodpeck.	Nesting	0	0		0			0	
		Feeding	0	0		0			0	
	Red–winged Blackbird	Nesting		−1		0			0	
		Feeding	0	−1		0		0	0	
	Yellow Warbler	Nesting				0			0	
		Feeding		−1		0			0	
Raptors:	Bald Eagle	Foraging	0			0	0		0	−1
		Nesting								
Aquatic Furbearers:	Beaver	Denning	0	0		0			0	
		Feeding	0	0	0	0			0	
	Otter	Denning	0			0	0		0	
		Feeding	0	0	0	0		0	0	0
Big Game:	Deer	Foraging	0	0		0	0		0	
	Elk	Winter range	0	0		0			0	
	B.H. Sheep	Winter range				0			0	
Amphibians:	Spotted Frog	Oviposition	0	−1	0	0		0		−1
	Frog	Larval Stage	−1	−1	0	0	0	−1	0	−1
	Long toed Salamander	Larval Stage	0	−1	0	0	0	−1	0	−1
		Larval Stage	−1	−1	0	0	0	0	0	−1

Table D–9. 30 Year Physical Effects of SOS Strategy for Chief Joseph

System Operation Strategy Title: All

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	154	154	154
	Erosion/Landslide Potential	acres/year	2	2	2
Upland Zone Productivity:	Upland Zone Extent	# of acres	0	0	0
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	54	54	54
	Riparian Colonization Potential	acres/year	4	4	4
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	72	72	72
	Emergent Colonization Potential	acres/year	6	6	6
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	40	40	40
	Submerged Colonization Potential	acres/year	1	1	1
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity:	Island Extent = 334a	# of acres	38	38	38
	Land Bridging Potential	% increase/decrease	0[3]	0	0
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease	+3	+3	+3
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease	−1	−1	−1
Human Effects:	Boating Activity	% increase/decrease	+1	+1	+1
	Shoreline Activities	% increase/decrease	+5	+5	+5

Table D–10. Wildlife Impacts for Chief Joseph

Description of SOS Strategy: All

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting				0	0			0
		Brooding	0	0		0		0		0
		Wintering	0		0	0	0	0		0
	Mallard	Nesting	0	0		0	0	0		0
		Brooding	0	0		0	0	0		0
		Wintering	0	0	0		0	0		0
	Diving Ducks	Nesting		0	0	0		0	0	0
		Brooding	0	0	0			0	0	0
		Wintering	0	0	0		0	0	0	0
Colonial Nesting Birds:	Bank Swallow	Nesting	0						0	
		Foraging	0	0	0	0			0	
	Spotted Sandpiper	Nesting	0				0	0	0	
		Foraging	0				0	0	0	
Nongame Birds:	Downy Woodpeck.	Nesting	0	0		0			0	
		Feeding	0	0		0			0	
	Red–winged Blackbird	Nesting		0		0			0	
		Feeding	0	0		0		0	0	
	Yellow Warbler	Nesting				0			0	
		Feeding		0		0			0	
Raptors:	Bald Eagle	Foraging	0			0	0		0	0
		Nesting				0	0		0	
	Osprey	Nesting				0			0	
		Foraging	0	0	0	0			0	0
Aquatic Furbearers:	Beaver	Denning	0	0		0			0	
		Feeding	0	0	0	0			0	
	Otter	Denning	0			0	0		0	
		Feeding	0	0	0	0		0	0	0
Big Game:	Mule Deer	Winter range	0	0		0			0	
	Elk	Winter range	0	0		0			0	
Amphibians:	Spotted Frog	Life Cycle	0	0	0	0		0	0	

Table D–11. 30 Year Physical Effects of SOS Strategy for Hanford

System Operation Strategy Title: Group 1 PA, 2d, 4c

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone	# of acres	37 to 204	0	37 to 204
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres			
	Upland Colonization	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres			
	Riparian Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres			
	Emergent Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres			
	Submerged Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity:	Island Extent	# of acres	37 to 204	0	37 to 204
	Land Bridging Potential	% increase/decrease	0	inc 25 %	0
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease	inc 6 to 33 %	inc 6 to 33 %	inc 6 to 33 %
Benthic Invertebrates Productivity:	Annual lbs/acre	% increase/decrease	inc 6 to 33 %	inc 6 to 33 %	inc 6 to 33 %
Human Effects:	Boating Activity	% increase/decrease	inc 6 to 33 %	inc 6 to 33 %	inc 6 to 33 %
	Shoreline Activities	% increase/decrease	inc 6 to 33 %	inc 6 to 33 %	inc 6 to 33 %

Table D–11. 30 Year Physical Effects of SOS Strategy for Hanford – CONT

System Operation Strategy Title: No–Action 1a, 1b, 2c, 5c, 6b, 6d

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone	# of acres	37 to 204	37 to 204	0
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres			
	Upland Colonization	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres			
	Riparian Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres			
	Emergent Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres			
	Submerged Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity:	Island Extent	# of acres	37 to 204	37 to 204	0
	Land Bridging Potential	% increase/dec	0	0	inc 25 %
Primary Fish Productivity:	Annual lbs/acre	% increase/dec	inc 6 to 33 %	inc 6 to 33 %	5 to–5%
Benthic Invertebrates Productivity:	Annual lbs/acre	% increase/dec	inc 6 to 33 %	inc 6 to 33 %	5 to–5%
Human Effects:	Boating Activity	% increase/de	dec 6 to 33 %	dec 6 to 33 %	dec 6 to 33 %
	Shoreline Activities	% increase/de	dec 6 to 33 %	dec 6 to 33 %	dec 6 to 33 %

Table D–11. 30 Year Physical Effects of SOS Strategy for Hanford – CONT

System Operation Strategy Title: Group 2 9a

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone	# of acres	210 to 409	37 to 204	0
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres			
	Upland Colonization	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres			
	Riparian Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres			
	Emergent Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres			
	Submerged Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity:	Island Extent	# of acres	210 to 409	210 to 409	210 to 409
	Land Bridging Potential	% increase/dec	0	0	0
Primary Fish Productivity:	Annual lbs/acre	% increase/dec	inc 6 to 33 %	inc 6 to 33 %	inc 6 to 33 %
Benthic Invertebrates Productivity:	Annual lbs/acre	% increase/dec	inc 34 to 66 %	inc 34 to 66 %	inc 34 to 66 %
Human Effects:	Boating Activity	% increase/dec	inc 34 to 66 %	inc 34 to 66 %	inc 34 to 66 %
	Shoreline Activities	% increase/dec	inc 34 to 66 %	inc 34 to 66 %	inc 34 to 66 %

Table D–11. 30 Year Physical Effects of SOS Strategy for Hanford – CONT

System Operation Strategy Title: Group 3 9b, Group 4 9c

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone	# of acres	210 to 409	210 to 409	210 to 409
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres			
	Upland Colonization	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres			
	Riparian Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres			
	Emergent Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres			
	Submerged Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity:	Island Extent	# of acres	210 to 409	210 to 409	210 to 409
	Land Bridging Potential	% increase/dec	0	0	0
Primary Fish Productivity:	Annual lbs/acre	% increase/dec	inc 34 to 66 %	inc 34 to 66 %	inc 34 to 66 %
Benthic Invertebrates Productivity:	Annual lbs/acre	% increase/dec	inc 34 to 66 %	inc 34 to 66 %	inc 34 to 66 %
Human Effects:	Boating Activity	% increase/dec	inc 34 to 66 %	inc 34 to 66 %	inc 34 to 66 %
	Shoreline Activities	% increase/dec	inc 34 to 66 %	inc 34 to 66 %	inc 34 to 66 %

Table D–12. Wildlife Impacts for Hanford

Description of SOS Strategy: No–Action 1a, 1b, 2c, 5c, 6b, 6d

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	CanadaGeese	Nesting					−1		−1	
		Brooding	−1	−1		−1		−1	−1	
		Wintering					−1	−1	−1	
	Mallard	Nesting	−1	−1		−1	−1	−1	0	
		Brooding	−1	−1	−1			−1	0	
		Wintering	−1	−1	−1			−1	0	
Colonial Nesting Species	Great blue heron	Nesting				−1	0			
		Foraging	1	1	1		1	0	0	1
	Forster's tern	Nesting	−1				−1		−1	−1
Shorebirds	Spotted sandpiper	Nesting	1	0	0		1		−1	
		Nesting	−1	0	0		1	−1	−1	
Nongame Birds:	Red–wing blackbirds	Nesting		1		1			0	
		Feeding	1	1		1			0	
	Yellow Warbler	Nesting				1			0	
		Feeding		1		1			0	
Raptors:	Bald Eagle	Wintering	1			0	1		0	1
Aquatic Furbearers:	Beaver	Denning	−1	−1		−1				
		Feeding	−1	−1	−1	−1				
Terrestrial Furbearer	Raccoon	Denning				−1	0			
		Foraging	0	−1	−1	−1				−1
Big Game:	Deer	Fawning	−1			−1	−1		−1	
		Foraging		−1		−1	−1			
Amphibians:	Pacific Tree Frog	Feeding		1	1	1				
		Breeding		1	1	1				
Threaten Sensitive Endanger	Rorippa columblae		1	0		1	0		0	

Table D–12. Wildlife Impacts for Hanford – CONT

Description of SOS Strategy: Group 1 PA, 2d, 4c

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting					−1		−1	
		Brooding	−1	−1		−1		−1	−1	
		Wintering					−1	−1	0	
	Mallard	Nesting	0	0		−1	0	1	1	
		Brooding	1	1	1			1	1	
		Wintering	0	0	0		−1	−1	0	
Colonial Nesting Species	Great blue heron	Nesting				0	0		1	
		Foraging	1	1	1		1	1	1	1
	Forster's tern	Nesting	−1				−1		1	1
Shorebirds	Spotted sandpiper	Nesting	−1	−1	−1		−1		1	
		Nesting	−1	−1	−1		−1	1	1	
Nongame Birds:	Red–wing blackbirds	Nesting		1		1			1	
		Feeding	1	1		1			1	
	Yellow Warbler	Nesting				1			1	
		Feeding		1		1			1	
Raptors:	Bald Eagle	Wintering	0			0	0		1	1
Aquatic Furbearers:	Beaver	Denning	1	1		1				
		Feeding	1	1	1	1				
Terrestrial Furbearer	Raccoon	Denning				−1	0			
		Foraging	−1	−1	−1	−1				1
Big Game:	Deer	Fawning	0			−1	0		1	
		Foraging		−1		−1	0			
Amphibians:	Pacific Tree Frog	Feeding		1	1	1				
		Breeding		1	1	1				
Threaten Sensitive Endanger	Rorippa columblae		−1	0		−1	−1		1	

Table D–12. Wildlife Impacts for Hanford – CONT

Description of SOS Strategy: Group 2 9a

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting					–2		2	
		Brooding	–2	–2		–2		2	2	
		Wintering					1	1	0	
	Mallard	Nesting	0	0		2	0	2	2	
		Brooding	2	2	2			2	2	
		Wintering	0	0	0		–1	–1	0	
Colonial Nesting Species	Great blue heron	Nesting				0	0		2	
		Foraging	2	2	2		2	1	2	1
	Forster's tern	Nesting	–2				–2		2	1
Shorebirds	Spotted sandpiper	Nesting	–2	–2	–2		–2		2	
		Nesting	–2	–2	–2		–2	1	2	
Nongame Birds:	Red–wing blackbirds	Nesting		2		2			2	
		Feeding	2	2		2			2	
	Yellow Warbler	Nesting				1			1	
		Feeding		1		1			1	
Raptors:	Bald Eagle	Wintering	0			0	0		1	1
Aquatic Furbearers:	Beaver	Denning	2	2		2				
		Feeding	2	2	2	2				
Terrestrial Furbearer	Raccoon	Denning				2	0			
		Foraging	2	2	2	2				2
Big Game:	Deer	Fawning	0			–2	0			
		Foraging		–1		–2	0			
Amphibians:	Pacific Tree Frog	Feeding		1	1	1				
		Breeding		1	1	1				
Threaten Sensitive Endanger	Rorippa columblae		–2	0		–2	–2		2	

Table D–12. Wildlife Impacts for Hanford – CONT

Description of SOS Strategy: Group 3 9b, Group 4 9c

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting					2		2	
		Brooding	2	2		0		2	2	
		Wintering					0	0	2	
	Mallard	Nesting	0	0		2	0	2	2	
		Brooding	0	0	0		0	2	2	
		Wintering	0	0	0		−1	−1	0	
Colonial Nesting Species	Great blue heron	Nesting				0	0		2	
		Foraging	2	2	2		2	2	2	2
	Forster's tern	Nesting	2				2		2	2
Shorebirds	Spotted sandpiper	Nesting	1	0	0		1		2	
		Nesting	1	0	0		1	1	2	
Nongame Birds:	Red–wing blackbirds	Nesting		2		2			2	
		Feeding	0	2		2			2	
	Yellow Warbler	Nesting				−1			2	
		Feeding		0		−1			2	
Raptors:	Bald Eagle	Wintering	0			0	0		2	2
Aquatic Furbearers:	Beaver	Denning	2	2		2				
		Feeding	2	2	2	2				
Terrestrial Furbearer	Raccoon	Denning				2	0			
		Foraging	2	2	2	2				2
Big Game:	Deer	Fawning	0			2	2		2	
		Foraging		2		2	2			
Amphibians:	Pacific Tree Frog	Feeding		2	2	2				
		Breeding		2	2	2				
Threaten Sensitive Endanger	Rorippa columblae		2	0		2	2		2	

Table D–13. 30 Year Physical Effects of SOS Strategy for Brownlee

System Operation Strategy Title: 2c, 2d, 5b, 5c, 5d, 6b, 6d

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone	# of acres	8210	5270	3755
	Erosion/Landslide Potential	acres/year (– = dec)	0	0	0
Upland Zone Productivity:	Upland Zone Extent	# of acres (?)			
	Upland Colonization	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres (140)	140	140	140
	Riparian Colonization	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres (112)	112	112	112
	Emergent Colonization	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres (38)	38	38	38
	Submerged Colonization	acres/year	0	o	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Island Habitat Productivity:	Island Extent	# of acres (405)	405	405	405
	Land Bridging Potential	% increase/decrease	0	0	0
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrates Productivity:	Annual lbs/acre	% increase/decrease	0	0	0
Human Effects:	Boating Activity	% increase/decrease	0	0	0
	Shoreline Activities	% increase/decrease	0	0	0

Table D–13. 30 Year Physical Effects of SOS Strategy for Brownlee – CONT

System Operation Strategy Title: 1a, 1b

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone	# of acres	8210	4910	3710
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres			
	Upland Colonization	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres (140)	140	140	126[3]
	Riparian Colonization	acres/year	0	0	decrease
	Net Growth/Regeneration	%increase/decrease	0	0	decrease
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres (112)	112	112	101[3]
	Emergent Colonization	acres/year	0	0	decrease
	Net Growth/Regeneration	%increase/decrease	0	0	decrease
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres (38)	38	38	34[3]
	Submerged Colonization	acres/year	0	o	decrease
	Net Growth/Regeneration	%increase/decrease	0	0	decrease
Island Habitat Productivity:	Island Extent	# of acres (405)	405	405	405
	Land Bridging Potential	% increase/decrease	no change	decrease 33%	decrease 67%
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrates Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease	0	0	0
	Shoreline Activities	% increase/decrease	0	0	0

Table D–13. 30 Year Physical Effects of SOS Strategy for Brownlee – CONT

System Operation Strategy Title: 4c

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone	# of acres	8210	4790	4040
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres			
	Upland Colonization	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres (140)	140	140	140
	Riparian Colonization	acres/year	0	>5% decrease	
	Net Growth/Regeneration	%increase/decrease	0	0	0
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres (112)	112	112	112
	Emergent Colonization	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres (38)	38	38	38
	Submerged Colonization	acres/year	0	o	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Island Habitat Productivity:	Island Extent	# of acres (405)	405	405	405
	Land Bridging Potential	% increase/decrease	0	decrease 33%	decrease 67%
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
BenthicInvertebrates Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease	0	0	0
	Shoreline Activities	% increase/decrease	0	0	0

Table D–13. 30 Year Physical Effects of SOS Strategy for Brownlee – CONT

System Operation Strategy Title: 9a

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone	# of acres	8210	5490	1230
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres			
	Upland Colonization	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	140	154[3]	126[3]
	Riparian Colonization	acres/year	0	increase	decrease
	Net Growth/Regeneration	%increase/decrease	0	0	0
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	112	112	102
	Emergent Colonization	acres/year	0	0	decrease
	Net Growth/Regeneration	%increase/decrease	0	0	0
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	38	38	38
	Submerged Colonization	acres/year	0	o	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Island Habitat Productivity:	Island Extent	# of acres	0	0	0
	Land Bridging Potential	% increase/decrease	0	0	0
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrates Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease	0	0	0
	Shoreline Activities	% increase/decrease	0	0	0

Table D–13. 30 Year Physical Effects of SOS Strategy for Brownlee – CONT

System Operation Strategy Title: 9b, 9c

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone	# of acres	8210	5030	3755
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres			
	Upland Colonization	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	140	140	126[3]
	Riparian Colonization	acres/year	0	0	decrease
	Net Growth/Regeneration	%increase/decrease	0	0	decrease
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	112	112	101
	Emergent Colonization	acres/year	0	0	decrease
	Net Growth/Regeneration	%increase/decrease	0	0	decrease
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	38	38	38
	Submerged Colonization	acres/year	0	o	0
	Net Growth/Regeneration	%increase/decrease	0	0	0
Island Habitat Productivity:	Island Extent	# of acres	0	0	0
	Land Bridging Potential	% increase/decrease	0	0	0
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrates Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease	0	0	0
	Shoreline Activities	% increase/decrease	0	0	0

Table D–13. 30 Year Physical Effects of SOS Strategy for Brownlee – CONT

System Operation Strategy Title: Preferred Alt.

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone	# of acres	8210	5030	3755
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres			
	Upland Colonization	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	154[3]	154[3]	154[3]
	Riparian Colonization	acres/year	increase	increase	increase
	Net Growth/Regeneration	%increase/decrease	increase	increase	increase
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	112	112	112
	Emergent Colonization	acres/year	>5% increase	>5% increase	>5% increase
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres	38	38	38
	Submerged Colonization	acres/year	>5% increase	>5% increase	>5% increase
	Net Growth/Regeneration	%increase/decrease	0	0	0
Island Habitat Productivity:	Island Extent	# of acres	405	405	405
	Land Bridging Potential	% increase/decrease	no change	no change	no change
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrates Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease	0	0	0
	Shoreline Activities	% increase/decrease	0	0	0

Table D–14. Wildlife Impacts for Brownlee

Description of SOS Strategy: 2c (Base) Compared to 1a, 1b

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting					+1		0	
		Brooding	0	0				0	0	
		Wintering	0				0	0	0	
	Mallard	Nesting		0		−1	+1		0	
		Brooding	0	0		0	0	0	0	
		Wintering	0	0	0		0	0	0	
	Diving Ducks	Nesting		0		−1		0	0	
		Brooding	0	0	0			0	0	0
		Wintering	0	0	0			0	0	0
Colonial Nesting Birds:	G.B. Heron	Nesting				0	+1		0	
		Foraging	0	0	0		0	0	0	−1
	Gull spp.	Nesting					+1		0	
		Foraging	0	0	0			0	0	−1
Shorebirds	Killdeer	Nesting	0	0					0	
		Foraging	0	0		−1			0	0
Nongame Birds:	Downy Woodpeck.	Nesting				−1			0	
		Foraging		−1		−1			0	
	Red–winged Blackbird	Nesting		−1		−1			0	
		Foraging		−1		−1		0	0	
	Yellow Warbler	Nesting				−1			0	
		Foraging		−1		−1			0	
Raptors:	Bald Eagle	Foraging	0	0	0	0			0	−1
	G. Eagle	Foraging	0	0		0		0	0	0
Aquatic Furbearers:	River Otter	Denning	−1	0					0	
		Foraging	0	0	0			−1	0	−1
Terrestrial Furbearers:	Raccoon cont'd	Foraging	0	0					0	0
		Foraging				0				
Big Game:	Mule Deer	Wintering	0			0			0	0
Threat., End. Sens. Spp.	P. Falcon (Peregrine)	Foraging				0		0	0	

Table D–14. Wildlife Impacts for Brownlee – CONT

Description of SOS Strategy: 2c (Base) Compared to 4c

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting					+1		0	
		Brooding	0	0				0	0	
		Wintering	0				0	0	0	
	Mallard	Nesting		0		0	+1		0	
		Brooding	0	0		0	0	0	0	
		Wintering	0	0	0		0	0	0	
	Diving Ducks	Nesting		0		0		0	0	
		Brooding	0	0	0			0	0	0
		Wintering	0	0	0		0	0	0	0
Colonial Nesting Birds:	G.B. Heron	Nesting					+1		0	
		Foraging	0	0	0		0	0	0	0
	Gull spp.	Nesting					+1		0	
		Foraging	0	0	0			0	0	0
Shorebirds	Killdeer	Nesting	0	0					0	
		Foraging	0	0		0			0	0
Nongame Birds:	Downy Woodpeck.	Nesting				0			0	
		Foraging		0		0			0	
	Red–winged Blackbird	Nesting		0		0			0	
		Foraging		0		0		0	0	
	Yellow Warbler	Nesting				0			0	
		Foraging		0		0			0	
Raptors:	Bald Eagle	Foraging	0	0	0	0			0	+1
	G. Eagle	Foraging	0	0		0		0	0	0
Aquatic Furbearers:	River Otter	Denning	0	0					0	
		Foraging	0	0	0			0	0	+1
Terrestrial Furbearers:	Raccoon cont'd	Foraging	0	0					0	0
		Foraging				0				
Big Game:	Mule Deer	Wintering	0			0			0	0
Threat., End. Sens. Spp.	P. Falcon (Peregrine)	Foraging				0		0	0	

Table D–14. Wildlife Impacts for Brownlee – CONT

Description of SOS Strategy: 2c (Base) Compared to Preferred Alt.

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting					0		0	
		Brooding	0	0				0	0	
		Wintering	0					0	0	
	Mallard	Nesting		0		0	0		0	
		Brooding	0	0		0	0	0	0	
		Wintering	0	0	0		0	0	0	
	Diving Ducks	Nesting		0		0			0	
		Brooding	0	0	0			0	0	0
		Wintering	0	0	0		0	0	0	0
Colonial Nesting Birds:	G.B. Heron	Nesting				0	0		0	
		Foraging	0	0	0		0	0	0	0
	Gull spp.	Nesting					0		0	
		Foraging	0	0	0			0	0	0
Shorebirds	Killdeer	Nesting	0	0					0	
		Foraging	0	0		0			0	0
Nongame Birds:	Downy Woodpeck.	Nesting				0			0	
		Foraging		0		0			0	
	Red–winged Blackbird	Nesting		0		0			0	
		Foraging		0		0		0	0	
	Yellow Warbler	Nesting				0			0	
		Foraging		0		0			0	
Raptors:	Bald Eagle	Foraging	0	0	0	0			0	0
	G. Eagle	Foraging	0	0		0		0	0	0
Aquatic Furbearers:	River Otter	Denning	0	0					0	
		Foraging	0	0	0			0	0	0
Terrestrial Furbearers:	Raccoon cont'd	Foraging	0	0					0	0
		Foraging				0				
Big Game:	Mule Deer	Wintering	0			0			0	0
Threat., End. Sens. Spp.	P. Falcon (Peregrine)	Foraging				0		0	0	

Table D–14. Wildlife Impacts for Brownlee – CONT

Description of SOS Strategy: 2c (Base) Compared to 9a

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting					–1		0	
		Brooding	0	0				0	0	
		Wintering	0				0	0	0	
	Mallard	Nesting		–1		–1	–1		0	
		Brooding	0	0		0	0	0	0	
		Wintering	0	0	0		0	0	0	
	Diving Ducks	Nesting		–1		–1		0		
		Brooding	0	0	0			0	0	0
		Wintering	0	0	0		0	0	0	0
Colonial Nesting Birds:	G.B. Heron	Nesting				0	0		0	
		Foraging	0	0	0		0	0	0	0
	Gull spp.	Nesting					–1		0	
		Foraging	0	0	0			0	0	0
Shorebirds	Killdeer	Nesting	0	0					0	
		Foraging	0	0		0			0	0
Nongame Birds:	Downy Woodpeck.	Nesting				–1			0	
		Foraging		0		–1			0	
	Red–winged Blackbird	Nesting		0		–1			0	
		Foraging		0		–1		0	0	
	Yellow Warbler	Nesting				–1			0	
		Foraging		0		–1			0	
Raptors:	Bald Eagle	Foraging	0	0	0	0			0	0
Raptors:	G. Eagle	Foraging	0	0		–1		0	0	0
Aquatic Furbearers:	River Otter	Denning	–1	–1					0	
		Foraging	0	0	0			0	0	0
Terrestrial Furbearers:	Raccoon cont'd	Foraging	0	0					0	0
		Foraging				0				
Big Game:	Mule Deer	Wintering	0			0			0	0
Threat., End. Sens. Spp.	P. Falcon	Foraging				0		0	0	

Table D–14. Wildlife Impacts for Brownlee – CONT

Description of SOS Strategy: 2c (Base) Compared to 9b, 9c

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting					0		0	
		Brooding	0	0				0	0	
		Wintering	0				0	0	0	
	Mallard	Nesting		0		−1	0		0	
		Brooding	0	0		0	0	0	0	
		Wintering	0	0	0		0	0	0	
	Diving Ducks	Nesting		0		−1		0	0	
		Brooding	0	0	0			0	0	0
		Wintering	0	0	0		0	0	0	0
Colonial Nesting Birds:	G.B. Heron	Nesting				0	0		0	
		Foraging	0	0	0		0	0	0	0
	Gull spp.	Nesting					0		0	
		Foraging	0	0	0			0	0	0
Shorebirds	Killdeer	Nesting	0	0					0	
		Foraging	0	0		0			0	0
Nongame Birds:	Downy Woodpeck.	Nesting				−1			0	
		Foraging		0		−1			0	
	Red–winged Blackbird	Nesting		0		−1			0	
		Foraging		0		−1		0	0	
	Yellow Warbler	Nesting				−1			0	
		Foraging		0		−1			0	
Raptors:	Bald Eagle	Foraging	0	0	0	0			0	0
	G. Eagle	Foraging	0	0		−1		0	0	0
Aquatic Furbearers:	River Otter	Denning	−1	0					0	
		Foraging	0	0	0			−1	0	−1
Terrestrial Furbearers:	Raccoon cont'd	Foraging	0	0					0	0
						0				
Big Game:	Mule Deer	Wintering	0			0			0	0
Threat., End. Sens. Spp.	P. Falcon (Peregrine)	Foraging				0		0	0	

Table D–15. 30 Year Physical Effects of SOS Strategy for Hells Canyon

System Operation Strategy Title: 9b

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres		431	
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres			
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres		9	
	Riparian Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres		7	
	Emergent Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres		3	
	Submerged Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity:	Island Extent	# of acres		42	
	Land Bridging Potential	% increase/decrease			
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

Table D–15. 30 Year Physical Effects of SOS Strategy for Hells Canyon – CONT

System Operation Strategy Title: 9a

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres		475	
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres		—	
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres		8	
	Riparian Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres		6	
	Emergent Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres		3	
	Submerged Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity:	Island Extent	# of acres		38	
	Land Bridging Potential	% increase/decrease			
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/decrease		same	
	Shoreline Activities	% increase/decrease			

Table D–15. 30 Year Physical Effects of SOS Strategy for Hells Canyon – CONT

System Operation Strategy Title: 2c

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres		431	
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres		—	
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres		9	
	Riparian Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres		7	
	Emergent Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres		3	
	Submerged Colonization Potential	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity:	Island Extent	# of acres		42	
	Land Bridging Potential	% increase/decrease			
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease		same	
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease		same	
Human Effects:	Boating Activity	% increase/decrease		same	
	Shoreline Activities	% increase/decrease			

Table D–16. Wildlife Impacts for Hells Canyon

Description of SOS Strategy: 9b

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting					0		0	
		Brooding	0	0				0	0	
		Wintering	0			0	0	0	0	
	Common Merganser	Nesting				0	0		0	
		Brooding	0	0	0			0	0	0
		Wintering	0	0	0			0	0	
Colonial Nesting Birds:	G.B. Heron	Nesting				0	0		0	
		Foraging	0	0	0		0	0	0	0
Shorebirds	Killdeer	Nesting	0	0					0	
		Foraging	0	0			0	0	0	
Nongame Birds:	Downy Woodpeck.	Nesting				0			0	
		Foraging		0		0			0	
	Red–winged Blackbird	Nesting		0		0			0	
		Foraging	0	0		0		0	0	
	Yellow Warbler	Nesting				0			0	
		Foraging		0		0			0	
Raptors:	Bald Eagle	Foraging	0			0			0	0
		Foraging	0	0	0	0			0	0
	G. Eagle	Nesting				0			0	
		Foraging	0	0		0			0	
Aquatic Furbearers:	River Otter	Denning	0						0	
		Foraging	0	0	0			0	0	0
Terrestrial Furbearers:	Raccoon	Foraging	0	0		0		0	0	0
			0	0		0	0	0	0	0
Big Game:	Mule Deer	Wintering	0			0			0	0
Threat., End.	P. Falcon	Foraging				0			0	
Sens. Spp.										
Amphibians				0	0					

Table D–16. Wildlife Impacts for Hells Canyon – CONT

Description of SOS Strategy: 9a

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting					0		0	
		Brooding	0	0				0	0	
		Wintering	0			0	0	0	0	
	Common Merganser	Nesting				0	0		0	
		Brooding	0	0	0			0	0	0
		Wintering	0	0	0			0	0	0
Colonial Nesting Birds:	G.B. Heron	Nesting				−1	−1		0	
		Foraging	0	0	0		0	0	0	0
Shorebirds	Killdeer	Nesting	0	0					0	
		Foraging	0	0			0	0	0	
Nongame Birds:	Downy Woodpeck.	Nesting				−1			0	
		Feeding		0		−1			0	
	Red–winged Blackbird	Nesting		−1		−1			0	
		Feeding	0	−1		−1		0	0	
	Yellow Warbler	Nesting				−1			0	
		Feeding		−1		−1			0	
Raptors:	Bald Eagle	Foraging	0			0			0	0
		Foraging	0	0	0	0			0	0
	G. Eagle	Nesting				0			0	
		Foraging	0	0		0			0	
Aquatic Furbearers:	River Otter	Denning	−1						0	
		Foraging	0	−1	−1			0	0	0
Terrestrial Furbearers:	Raccoon	Foraging	0	0		0		0	0	0
								0		0
Big Game:	Mule Deer	Wintering	0			0			0	
								0		0
Threat., End.	P. Falcon	Foraging				0			0	
Sens. Spp.										
Amphibians				−1	−1					

Table D–17. 30 Year Physical Effects of SOS Strategy for Dworshak

System Operation Strategy Title: Alternatives 1a, 1b, 4c, 5b, 5c, 6b, 6d

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	8038	5293	3590
	Erosion/Landslide Potential	acres/year	0	0	0
Upland Zone Productivity:	Upland Zone Extent	# of acres			
	Upland Colonization Potential	# of acres	0	0	20
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	19	19	19
	Riparian Colonization Potential	acres/year	0	0	5
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	0	0	0
	Emergent Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres		0	
	Submerged Colonization Potential	acres/year		0	
	Net Growth/Regeneration	%increase/decrease		0	
Island Habitat Productivity:	Island Extent	# of acres		0	
	Land Bridging Potential	% increase/decrease		0	
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease		0	–5 TO 5%
Benthic Invertebrate				0	
Productivity:	Annual lbs/acre	% increase/decrease		0	
Human Effects:	Boating Activity	% increase/decrease		0	
	Shoreline Activities	% increase/decrease		0	

Table D–17. 30 Year Physical Effects of SOS Strategy for Dworshak – CONT

System Operation Strategy Title: Alternative 9b

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	8038	4978	3153
	Erosion/Landslide Potential	acres/year	0	0	0
Upland Zone Productivity:	Upland Zone Extent	# of acres			
	Upland Colonization Potential	# of acres	3	4	10
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	19	19	19
	Riparian Colonization Potential	acres/year	3	4	10
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	0	0	0
	Emergent Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres		0	
	Submerged Colonization Potential	acres/year		0	
	Net Growth/Regeneration	%increase/decrease		0	
Island Habitat Productivity:	Island Extent	# of acres		0	
	Land Bridging Potential	% increase/decrease		0	
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease	–5 to 5%	–5 to 5%	
Benthic Invertebrate				0	
Productivity:	Annual lbs/acre	% increase/decrease		0	
Human Effects:	Boating Activity	% increase/decrease			
	Shoreline Activities	% increase/decrease			

Table D–17. 30 Year Physical Effects of SOS Strategy for Dworshak – CONT

System Operation Strategy Title: Alternatives PA, 2c, 2d, 9a, 9c

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres	8038	5313	4781
	Erosion/Landslide Potential	acres/year	0	0	0
Upland Zone Productivity:	Upland Zone Extent	# of acres			
	Upland Colonization Potential	# of acres	24	14	9
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	19	19	19
	Riparian Colonization Potential	acres/year	24	14	9
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres	0	0	0
	Emergent Colonization Potential	acres/year	0	0	0
	Net Growth/Regeneration	%increase/decrease			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres		0	
	Submerged Colonization Potential	acres/year		0	
	Net Growth/Regeneration	%increase/decrease		0	
Island Habitat Productivity:	Island Extent	# of acres		0	
	Land Bridging Potential	% increase/decrease		0	
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease	-5 to 5%	-5 to 5%	
Benthic Invertebrate				0	
Productivity:	Annual lbs/acre	% increase/decrease		0	
Human Effects:	Boating Activity	% increase/decrease	dec 67 to 99 %	dec 67 to 99 %	dec 67 to 99 %
	Shoreline Activities	% increase/decrease			

Table D–18. Wildlife Impacts for Dworshak

Description of SOS Strategy: All

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting								
		Brooding								
		Wintering								
	Mallard	Nesting								
		Brooding								
		Wintering	0	0	0			0	0	
Colonial Nesting Species	Great blue heron	Nesting				0			0	
		Foraging	0	0	0			0	0	0
Shorebirds	Spotted Sandpiper	Nesting								
		Foraging								
Nongame Birds:	Downy Woodpeck.	Nesting	0	0		0			0	
		Feeding	0	0		0			0	
	Red–winged Blackbird	Nesting								
		Feeding								
	Yellow Warbler	Nesting								
		Feeding				0			0	
Raptors:	Bald Eagle	Wintering	0			0			0	
	Osprey	Feeding	0	0	0	0	0	0	0	–1
Aquatic Furbearers:	Beaver	Denning								
		Feeding								
	Otter	Denning								
		Feeding								
Terrestrial Furbearer	Raccoon	Foraging	0			0		0	0	0
Big Game:	Deer	Fawning	0			0			0	
		Foraging	0			0			0	
Amphibian	Pacific Tree Frog	Feeding	0		1	0				
		Breeding	0		1					
Reptiles	N.Alligator	Foraging	0			0			0	
	Lizard	Reprod.	0			0			0	

Table D–19. 30 Year Physical Effects of SOS Strategy for Lower Clearwater

System Operation Strategy Title: Alternatives PA, 1a, 1b, 2c, 2d, 4c, 5c, 9a, 9c

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown/Barren Zone:	Drawdown Zone Extent	# of acres			
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity:	Upland Zone Extent	# of acres			
	Upland Colonization Potential	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	1089	1174	1504
	Riparian Colonization Potential	acres/year	–85	19	330
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres		0	
	Emergent Colonization Potential	acres/year		0	
	Net Growth/Regeneration	%increase/decrease		0	
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres		0	
	Submerged Colonization Potential	acres/year		0	
	Net Growth/Regeneration	%increase/decrease		0	
Island Habitat Productivity:	Island Extent	# of acres	243	243	182
	Land Bridging Potential	% increase/decrease			inc to 33 %
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease	0	0	0
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease	0	0	0
Human Effects:	Boating Activity	% increase/decrease	0	0	0
	Shoreline Activities	% increase/decrease	0	0	0

Table D–19. 30 Year Physical Effects of SOS Strategy for Lower Clearwater – CONT

System Operation Strategy Title: 5b, 6b, 6d, 9b

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown Barren Zone:	Drawdown Zone	# of acres			
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity	Upland Zone Extent	# of acres			
	Upland Colonization	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres	950	1110	1334
	Riparian Colonization	acres/year	−224	−64	160
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres			
	Emergent Colonization	acres/year			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres		0	
	Submerged Colonization	acres/year		0	
Island Habitat Productivity	Island Extent	# of acres	243	243	182
	Land Bridging Potential	% increase/decrease		0	
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease	0	0	0
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease	0	0	0
Human Effects:	Boating Activity	% increase/dec	0	0	0
	Shoreline Activities	% increase/dec	0	0	0

Table D–20. Wildlife Impacts for Lower Clearwater

Description of SOS Strategy: All

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting				0	−1		0	
		Brooding				−1	−1		0	
		Wintering				0	0		0	
	Common Merganser	Nesting				1	1	0	0	
		Brooding						0	0	
		Wintering						0	0	
Colonial Nesting Species	Great blue heron	Nesting				1	1		0	
		Foraging					0	0	0	0
Shorebirds	Spotted Sandpiper	Nesting				−1	−1		0	
		Foraging				−1	0	0	0	
Nongame Birds:	Downy Woodpeck	Nesting				1			0	
		Feeding				1			0	
	Belted Kingfisher	Nesting				0			0	
		Feeding				1		0	0	
	Yellow Warbler	Nesting				−1			0	
		Feeding				−1			0	
Raptors:	Bald Eagle	Wintering				1			0	
Aquatic Furbearer	Beaver	Denning				−1			0	
		Feeding				−1			0	
	Otter	Denning				0			0	
		Feeding				0		0	0	
Big Game:	Deer	Fawning				−1			0	
		Foraging				−1			0	
Amphibian	Pacific Tree Frog	Feeding				0	0		0	
		Breeding				−1	0		0	
Reptiles	Gopher	Foraging				−1			0	
	Snake	Reprod.				−1			0	

Table D–21. 30 Year Physical Effects of SOS Strategy for Lower Snake River

System Operation Strategy Title: 1a, 1b, PA, 2d, 4c, 9b

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown	Drawdown Zone	# of acres		1380	
Barren Zone:	Erosion/Landslide Potential	acres/year		0	
Upland Zone Productivity	Upland Zone Extent Upland Colonization	# of acres # of acres		0	
	Net Growth/Regeneration	%increase/decrease		0	
Riparian Zone Productivity	Riparian Zone Extent Riparian Colonization	# of acres acres/year		632	
	Net Growth/Regeneration	%increase/decrease		161	
Emergent Wetland Zone Productivity:	Emergent Wetland Extent Emergent Colonization	# of acres acres/year		170	
	Net Growth/Regeneration	%increase/decreases		19	
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent Submerged Colonization	# of acres acres/year			
	Net Growth/Regeneration	%increase/decrease		inc 6 to 33%	
Island Habitat	Island Extent	# of acres		60	
Productivity	Land Bridging Potential	% increase/decrease		0	
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease		inc 6 to 33%	
BenthicInvertebrate Productivity:	Annual lbs/acre	% increase/decrease		inc 6 to 33%	
Human Effects:	Boating Activity	% increase/dec		inc 6 to 33%	
	Shoreline Activities	% increase/dec		0	

Table D–21. 30 Year Physical Effects of SOS Strategy for Lower Snake River – CONT

System Operation Strategy Title: 5b, 5c

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown Barren Zone:	Drawdown Zone	# of acres		26610	
	Erosion/Landslide Potential	acres/year		25230	
Upland Zone Productivity	Upland Zone Extent	# of acres			
	Upland Colonization	# of acres			
	Net Growth/Regeneration	%increase/decrease		505	
Riparian Zone Productivity	Riparian Zone Extent	# of acres		127	
	Riparian Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease		0	
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres		0	
	Emergent Colonization	acres/year			
	Net Growth/Regeneration	%increase/decreases		0	
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres		0	
	Submerged Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease		0	
Island Habitat Productivity	Island Extent	# of acres		0	
	Land Bridging Potential	% increase/decrease		inc 67 to 99%	
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease		dec 67 to 99%	
BenthicInvertebrate Productivity:	Annual lbs/acre	% increase/decrease		dec 67 to 99%	
Human Effects:	Boating Activity	% increase/dec		dec 67 to 99%	
	Shoreline Activities	% increase/dec		inc 6 to 33%	

Table D–21. 30 Year Physical Effects of SOS Strategy for Lower Snake River – CONT

System Operation Strategy Title: 6b, 9a

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown Barren Zone:	Drawdown Zone	# of acres		7025	
	Erosion/Landslide Potential	acres/year		5874	
Upland Zone Productivity	Upland Zone Extent	# of acres			
	Upland Colonization	# of acres			
	Net Growth/Regeneration	%increase/decrease		505	
Riparian Zone Productivity	Riparian Zone Extent	# of acres		127	
	Riparian Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease		0	
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres		0	
	Emergent Colonization	acres/year			
	Net Growth/Regeneration	%increase/decreases		0	
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres		0	
	Submerged Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease		0	
Island Habitat Productivity	Island Extent	# of acres		0	
	Land Bridging Potential	% increase/decrease		inc 67 to 99%	
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease		dec 67 to 99%	
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease		dec 67 to 99%	
Human Effects:	Boating Activity	% increase/dec		dec 67 to 99%	
	Shoreline Activities	% increase/dec		inc 6 to 33%	

Table D–21. 30 Year Physical Effects of SOS Strategy for Lower Snake River – CONT

System Operation Strategy Title: 6d

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown Barren Zone:	Drawdown Zone	# of acres		1925	
	Erosion/Landslide Potential	acres/year		1582	
Upland Zone Productivity	Upland Zone Extent	# of acres			
	Upland Colonization	# of acres			
	Net Growth/Regeneration	%increase/decrease		131	
Riparian Zone Productivity	Riparian Zone Extent	# of acres		127	
	Riparian Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease		0	
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres		0	
	Emergent Colonization	acres/year			
	Net Growth/Regeneration	%increase/decreases		0	
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres		0	
	Submerged Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease		0	
Island Habitat Productivity	Island Extent	# of acres		0	
	Land Bridging Potential	% increase/decrease		inc 67 to 99%	
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease		dec 6 to 33%	
Benthic Invertebrate Productivity:	Annual lbs/acre	% increase/decrease		dec 6 to 33%	
Human Effects:	Boating Activity	% increase/dec		dec 6 to 33%	
	Shoreline Activities	% increase/dec		inc 6 to 33%	

Table D–21. 30 Year Physical Effects of SOS Strategy for Lower Snake River – CONT

System Operation Strategy Title: 9c

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown	Drawdown Zone	# of acres		26610	
Barren Zone:	Erosion/Landslide Potential	acres/year		25230	
Upland Zone	Upland Zone Extent	# of acres			
Productivity	Upland Colonization	# of acres			
	Net Growth/Regeneration	%increase/decrease		127	
Riparian Zone	Riparian Zone Extent	# of acres		505	
Productivity	Riparian Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease		0	
Emergent Wetland Zone	Emergent Wetland Extent	# of acres		64	
Productivity:	Emergent Colonization	acres/year			
	Net Growth/Regeneration	%increase/decreases		0	
Submerged Aquatic Plant	Plant Bed Extent	# of acres		0	
Bed Productivity:	Submerged Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease		0	
Island Habitat	Island Extent	# of acres		0	
Productivity	Land Bridging Potential	% increase/decrease		inc 67 to 99%	
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease		dec 67 to 99%	
BenthicInvertebrate Productivity:	Annual lbs/acre	% increase/decrease		dec 67 to 99%	
Human Effects:	Boating Activity	% increase/dec		inc 67 to 99%	
	Shoreline Activities	% increase/dec		inc 6 to 33%	

Table D–22. Wildlife Impacts for Lower Snake River

Description of SOS Strategy: 1a, 1b, PA, 2d, 4c, 9b

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting				1	0		0	
		Brooding	−1	1		0		0	0	
		Wintering	0		0	0	0	0	0	
	Mallard	Nesting	0	0		0	0	0	0	
		Brooding	0	0	0			0	0	
		Wintering	0	0	0			0	0	
Colonial Nesting Species	Great blue heron	Nesting				1	1		0	
		Foraging	0	1	1		1	1	0	
Shorebirds	Spotted Sandpiper	Nesting	1				1		0	
		Foraging	1		1		1	1	0	
Nongame Birds:	Downy Woodpeck.	Nesting	0	0		1			0	
		Feeding	0	0		1			0	
	Red–winged Blackbirds	Nesting		1		1			0	
		Feeding		1		1			0	
	Yellow Warbler	Nesting				1			0	
		Feeding		1		1			0	
Raptors:	Bald Eagle	Wintering	0			1	0		0	0
Aquatic Furbearers:	Beaver	Denning	−1	0		0			0	
		Feeding	0	0	0	1			0	
	Otter	Denning	0			1	1		0	
		Feeding	0	1	1	1		1	0	1
Terrestrial Furbearer	Raccoon	Foraging	1	1	1	1		1	0	1
Big Game:	Deer	Fawning	0			1	1		0	
		Foraging	1	1		1	0		0	
Amphibian	Pacific Tree Frog	Feeding	0	1	1	1	0	0	0	0
		Beeding	0	0	0	0	0	0	0	0
Reptiles	Gopher Snake	Foraging	0	1		1			0	
		Reprod.				1			0	

Table D–22. Wildlife Impacts for Lower Snake River – CONT

Description of SOS Strategy: 5b, 5c

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting				−1	−3		−1	
		Brooding	−3	0		−1		0	0	
		Wintering	0		0	0	0	0	0	
	Mallard	Nesting	0	0		−3	−3		−1	
		Brooding	−3	−3	−2	−1	0	0	−1	
		Wintering	0	−1	−2	0	0	0	0	
Colonial Nesting Species	Great blue heron	Nesting				−3	−1		−1	
		Foraging	−2	−3	−2		−1	−3	0	−3
Shorebirds	Spotted Sandpiper	Nesting	2				2		−1	
		Foraging	−2		0		−2	−3	0	
Nongame Birds:	Downy Woodpeck	Nesting	0			−3			0	
		Feeding	0			−3			0	
	Red–wing Blackbirds	Nesting		−3		−3			−1	
		Feeding		−3		−3			−1	
	Yellow Warbler	Nesting				−3			−1	
		Feeding		−3		−3			−1	
Raptors:	Bald Eagle	Wintering	0			−1	0		0	0
Aquatic Furbearer	Beaver	Denning	−3	−3		−3			−1	
		Feeding	−3	−3		−3			−1	
	Otter	Denning	−3			−3	−3		−1	
		Feeding	−3	−3	−3	−3		−3	−1	−3
Terrestrial Furbearer	Raccoon	Foraging	−3	−3		−3		−3	0	−3
Big Game:	Deer	Fawning	0			−3	−3		−2	
		Foraging	0	−3		−3	−3		−1	
Amphibian	Pacific Tree Frog	Feeding	0	0	0	−3	−3	0	−1	0
		Breeding	−3	−3	−3	−3	−3	0	−1	0
Reptiles	Gopher Snake	Foraging	0	−3		−3			−1	
		Reprod.				−3			−1	

Table D–22. Wildlife Impacts for Lower Snake River – CONT

Description of SOS Strategy: 6b, 6d, 9a

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting				−1	−3		−1	
		Brooding	−3	0		−1		0	0	
		Wintering	0		0	0	0	0	0	
	Mallard	Nesting	0	0		−3	−3		−1	
		Brooding	−3	−3	−2	−1	0	0	−1	
		Wintering	0	−1	−2	0	0	0	0	
Colonial Nesting Species	Great blue heron	Nesting				−3	−1		−1	
		Foraging	−2	−3	−2		−1	−3	0	−3
Shorebirds	Spotted Sandpiper	Nesting	2				2		−1	
		Foraging	−2		0		−2	−3	0	
Nongame Birds:	Downy Woodpeck	Nesting	0			−3			0	
		Feeding	0			−3			0	
	Red–wing Blackbirds	Nesting		−3		−3			−1	
		Feeding		−3		−3			−1	
	Yellow Warbler	Nesting				−3			−1	
		Feeding		−3		−3			−1	
Raptors:	Bald Eagle	Wintering	0			−1	0		0	0
Aquatic Furbearer	Beaver	Denning	−3	−3		−3			−1	
		Feeding	−3	−3		−3			−1	
	Otter	Denning	−3			−3	−3		−1	
		Feeding	−3	−3	−3	−3		−3	−1	−3
Terrestrial Furbearer	Raccoon	Foraging	−3	−3		−3		−3	0	−3
Big Game:	Deer	Fawning	0			−3	−3		−2	
		Foraging	0	−3		−3	−3		−1	
Amphibian	Pacific Tree Frog	Feeding	0	0	0	−3	−3	0	−1	0
		Breeding	−3	−3	−3	−3	−3	0	−1	0
Reptiles	Gopher Snake	Foraging	0	−3		−3			−1	
		Reprod.				−3			−1	

Table D–22. Wildlife Impacts for Lower Snake River – CONT

Description of SOS Strategy: 9c

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting				0	–3		–3	
		Brooding	–2	0		0		0	–1	
		Wintering	0		0	0	0	0	0	
	Mallard	Nesting	0	0		0	0		0	
		Brooding	0	0	0	0	0	0	0	
		Wintering	0	0	0	0	0	0	0	
Colonial Nesting Species	Great blue heron	Nesting				0	0		0	
		Foraging	–3	0	–2		–1	–3	0	–3
Shorebirds	Spotted Sandpiper	Nesting	2				3		–1	
		Foraging	–2		0		–3	–3	0	
Nongame Birds:	Downy Woodpeck	Nesting	0			–1			0	
		Feeding	0			–1			0	
	Red–winged Blackbirds	Nesting		0		–1			–1	
		Feeding		0		–1			–1	
	Yellow Warbler	Nesting				–1			–1	
		Feeding		0		–1			–1	
Raptors:	Bald Eagle	Wintering	0			–1	0		0	0
Aquatic Furbearer	Beaver	Denning	–3	–3		–1			–2	
		Feeding	0	0	0	–1			–1	
	Otter	Denning	–2			–1	–3		–1	
		Feeding	–3	–1	–3	–1		–3	–1	–3
Terrestrial Furbearer	Raccoon	Foraging	–3	–1	–3	–1		–3	0	–3
Big Game:	Deer	Fawning	0			–1	–1		–1	
		Foraging	0	–1		–1	–1		0	
			0			0			0	
Amphibian	Pacific Tree Frog	Feeding	0	0	0	–1	–1	0	–1	0
		Breeding	–3	–3	–3	–1	–1	0	–1	0
Reptiles	Gopher Snake	Foraging	0	–1		–1			–1	
		Reprod.				–1			–1	

Table D–23. 30 Year Physical Effects of SOS Strategy for John Day Project

System Operation Strategy Title: Group 3 = 5b, 5c, 6b, 6d, 9a, 9c
Group 4 = PA

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown	Drawdown Zone	# of acres		7531	7531
Barren Zone:	Erosion/Landslide Potential	acres/year		0	
Upland Zone	Upland Zone Extent	# of acres			
Productivity	Upland Colonization	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone	Riparian Zone Extent	# of acres		−571	−571
Productivity	Riparian Colonization	acres/year		0	202
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone	Emergent Wetland Extent	# of acres		−2283	−2283
Productivity:	Emergent Colonization	acres/year		0	807
	Net Growth/Regeneration	%increase/decreases		0	
Submerged Aquatic Plant	Plant Bed Extent	# of acres		0	
Bed Productivity:	Submerged Colonization	acres/year		0	0
	Net Growth/Regeneration	%increase/decrease		0	
Island Habitat	Island Extent	# of acres		260 (No net change)	1,195
Productivity	Land Bridging Potential	% increase/decrease		0	
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease		198	
BenthicInvertebrate	Annual lbs/acre	% increase/decrease			
Productivity:					
Human Effects:	Boating Activity	% increase/dec			
	Shoreline Activities	% increase/dec			

Table D–23. 30 Year Physical Effects of SOS Strategy for John Day Project – CONT

System Operation Strategy Title: Group 1= 1a, 1b, 4c

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown Barren Zone:	Drawdown Zone	# of acres		3,003	
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity	Upland Zone Extent	# of acres			
	Upland Colonization	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres		571	
	Riparian Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres		2283	
	Emergent Colonization	acres/year			
	Net Growth/Regeneration	%increase/decreases			
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres		961	
	Submerged Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat Productivity	Island Extent	# of acres		156	
	Land Bridging Potential	% increase/decrease		198	
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
BenthicInvertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/dec			
	Shoreline Activities	% increase/dec			

Table D–23. 30 Year Physical Effects of SOS Strategy for John Day Project – CONT

System Operation Strategy Title: Group 2= 2c, 2d & 9b

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown Barren Zone:	Drawdown Zone	# of acres		3738	
	Erosion/Landslide Potential	acres/year			
Upland Zone Productivity	Upland Zone Extent	# of acres			
	Upland Colonization	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone Productivity	Riparian Zone Extent	# of acres		571	
	Riparian Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Emergent Wetland Zone Productivity:	Emergent Wetland Extent	# of acres		2283	
	Emergent Colonization	acres/year			
	Net Growth/Regeneration	%increase/decreases		–	
Submerged Aquatic Plant Bed Productivity:	Plant Bed Extent	# of acres		829	
	Submerged Colonization	acres/year			
	Net Growth/Regeneration	%increase/decrease			
Island Habitat	Island Extent	# of acres		198	
Productivity	Land Bridging Potential	% increase/decrease		0	
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease			
BenthicInvertebrate Productivity:	Annual lbs/acre	% increase/decrease			
Human Effects:	Boating Activity	% increase/dec		0	
	Shoreline Activities	% increase/dec		0	

Table D–24. Wildlife Impacts for John Day

Description of SOS Strategy: Group 1 & 2 vs Group 3 (See Text)

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting					–2			
		Brooding	–2	–2				X		
		Wintering	0			0	0	X		
	Mallard	Nesting	–2	–3		–2	0	–3		
		Brooding	–2	–3	–3		0	–3		
		Wintering	0	–3	–3		0	0		
	Diving Ducks	Nesting		–3	–3	X		–3		X
		Brooding	X	–3	–3			–3		X
		Wintering	0	0	–2		0	–3		X
Colonial Nesting Birds:	G.B. Heron	Nesting				–1	0			
		Foraging	0	–2	–2		0	–2		–2
	Gulls	Nesting					–3			
Shorebirds	BI. Neck Stilt	Nesting	+2					–1		
		Foraging	+2	+1	X	X	0	–1		X
Nongame Birds:	Downy Woodpeck.	Nesting	X	X		–3				
		Feeding	X	X		–3				
	Red–winged Blackbird	Nesting		–3		–2				
		Feeding	–2	–3		–2		–3		
	Yellow Warbler	Nesting				–3				
		Feeding		–3		–3				
Raptors:	Bald Eagle	Foraging	0			–2	0			
		Nesting								
Aquatic Furbearers:	Beaver	Denning	0	–2		–3				
		Feeding	X	–2	–2	–3				
	Otter	Denning	X			–2	0			
		Feeding	–2	–3	–3	–1		–2		–2
Reptiles	Painted Turtle	Foraging	–2	–3	–3			–2		X

Table D–24. Wildlife Impacts for John Day – CONT

Description of SOS Strategy: Group 1 vs Group 2

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting				0	0			
		Brooding	0	0		0		X	X	
		Wintering	0		0	0	0	X	X	
	Mallard	Nesting	0	–		0	0	–	X	
		Brooding	–	–	–		0	–	X	
		Wintering	0	0	0		0	0	0	
	Diving Ducks	Nesting		–	–	X		–	X	0
		Brooding	X	–	–			–	X	0
		Wintering	0	0	0		0	0	X	0
Colonial Nesting Birds:	G.B. Heron	Nesting				0	0		X	
		Foraging	+	+	+		0	0	X	0
	Gulls	Nesting					0		X	
Shorebirds	BI. Neck Stilt	Nesting	+							
		Foraging	+	+	X	X	+	+	X	X
Nongame Birds:	Downy Woodpeck.	Nesting	X	X		0			X	
		Feeding	X	X		0			X	
	Red–winged Blackbird	Nesting		0		0			X	
		Feeding	0	0		0		0	X	
	Yellow Warbler	Nesting				0			X	
		Feeding		0		0			X	
Raptors:	Bald Eagle	Foraging	0			0			X	
									X	
Aquatic Furbearers:	Beaver	Denning	–	–		0			X	
		Feeding	X	–	0	0			X	
	Otter	Denning	X			–	–		X	
		Feeding	–	0	0	0		0	X	
Reptiles	Painted Turtle	Foraging	–	–	–			–	X	

Table D–25. 30 Year Physical Effects of SOS Strategy for Below Bonneville

System Operation Strategy Title: Group 4= 3b, 4a1, 4a3, 4ba, 4b3, 4c
Group 4 vs. Group 1, 2, 3, 5

Public Issue/ Mngt Concern	Value	Measure	wet	average	dry
Drawdown	Drawdown Zone	# of acres		0	
Barren Zone:	Erosion/Landslide Potential	acres/year		–	
Upland Zone	Upland Zone Extent	# of acres			
Productivity	Upland Colonization	# of acres			
	Net Growth/Regeneration	%increase/decrease			
Riparian Zone	Riparian Zone Extent	# of acres		–	
Productivity	Riparian Colonization	acres/year		0	
	Net Growth/Regeneration	%increase/decrease		0	
Emergent Wetland Zone	Emergent Wetland Extent	# of acres		0	
Productivity:	Emergent Colonization	acres/year		0	
	Net Growth/Regeneration	%increase/decreases		0	
Submerged Aquatic Plant	Plant Bed Extent	# of acres		0	
Bed Productivity:	Submerged Colonization	acres/year		0	
	Net Growth/Regeneration	%increase/decrease		0	
Island Habitat	Island Extent	# of acres		0	
Productivity	Land Bridging Potential	% increase/decrease		0	
Primary Fish Productivity:	Annual lbs/acre	% increase/decrease		0	
Benthic Invertebrate	Annual lbs/acre	% increase/decrease		0	
Productivity:					
Human Effects:	Boating Activity	% increase/dec		0	
	Shoreline Activities	% increase/dec		0	

Table D–26. Wildlife impacts for Below Bonneville

Description of SOS Strategy: Groups 1, 2 & 3 versus Group 4 (See Text)

Category	Species	Activity	Drw–dwn	Emr Wet	Sub Wet	Rip	Isld	Bnth Inver	Hum Eff	Fish Prod
Waterfowl:	Canada Geese	Nesting				0	0		X	
		Brooding	0	0		0		X	X	
		Wintering	0			0	0	X	X	
	Diving Ducks	Wintering	0	0			X	0	X	0
Colonial Nesting Birds:	G.B. Heron	Nesting				0	0		X	
		Foraging	0	+			0	0	X	0
Shorebirds	Spotted Sandpiper	Nesting	–				–		X	
		Foraging	–				0		X	
Nongame Birds:	Downy Woodpeck.	Nesting	0	0		0			X	
		Feeding	0	0		–			X	
	Yellow Warbler	Nesting				0			X	
		Feeding		–		–			X	
Raptors:	Bald Eagle	Foraging	0			0	0		X	
									X	
	Osprey	Foraging				0			X	
									X	
Aquatic Furbearers:	Beaver	Denning	0	0		–			X	
		Feeding	0	0	0	0			X	

TECHNICAL EXHIBIT E

ESA SPECIES LISTS

Original ESA Species Lists (6/93)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
911 N. E. 11th Avenue
Portland, Oregon 97232-4181

TAKE PRIDE IN AMERICA

RECEIVED BY BPA
PUBLIC INVOLVEMENT
LOG #: SOR-07-390
RECEIPT DATE: 6/22/93
AREA: DISTRICT

JUN 17 1993

Mr. Witt Anderson
Interagency Team
Columbia River System Operation Review
P.O. Box 2988
Portland, Oregon 97208-2988

Dear Mr. Anderson:

This is in response to your letter, dated ~~May 3, 1993, requesting~~ a list of endangered and threatened species that may occur within the area affected by the Columbia River System Operation Review. Fish and Wildlife Service (Service) Field Offices in Idaho, Montana, Oregon, and Washington have each prepared a list which corresponds to their area of territorial jurisdiction. The enclosed species lists fulfill the requirement of the Service under Section 7(c) of the Endangered Species Act of 1973, as amended (Act). The lists are submitted for your review as follows:

Species List Enclosure No.	Program Area (by state)	FWS Field Office responsible for list
1.0 - 1.4	Idaho	Boise, ID
2.0	Montana	Kalispell, MT
3.0 - 3.2	Oregon	Portland, OR
4.0 - 4.4	Washington	Olympia, WA

Also included on the lists, are candidate species presently under review by the Service and which may occur in the project areas. Candidate species have no protection under the Act, and are not subject to any of its provisions, including section 7, until they are formally proposed or listed as endangered or threatened. We are including these species for the purpose of giving you advance notification. If you determine that your projects may affect candidate species, you are not required to perform an assessment of impacts to these species or to consult with the Service about them. However, if early evaluation of your projects indicates that a project is likely to adversely impact a candidate species, you may wish to request technical assistance from the Service. We would appreciate anything you might do to avoid impacting such species.

Please note that Category 1 (C1) candidate species are taxa for which the Service currently has substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species. Proposed rules have not been issued, but development and publication of such rules are anticipated. Category 2 (C2) species are taxa for which information now in possession of the Service indicates that proposing to list these species as endangered or threatened is possibly appropriate. However, conclusive data on biological vulnerability and threat are not currently available to support proposed rules. Additional biological research and field study may be needed to ascertain the status of taxa in the C2 category.

Original ESA Species Lists (6/93) – CONT

If you have specific questions about the biology, habits, or life requirements of any species, you should contact the Field Offices directly. Please contact Laura Todd at 503/231-6179 if you have any specific questions regarding species occurring in Oregon; for species in Idaho, contact Ted Koch at 208/334-1931; for species in Washington, contact John Grettenberger at 206/753-9440; for species in Montana, contact Larry Lockard at 406/755-7870.

Please be advised, you will need to contact the National Marine Fisheries Service concerning endangered and threatened anadromous fish species (e.g., Snake River sockeye salmon *Oncorhynchus nerka*, and the spring/summer and fall runs of chinook salmon *Oncorhynchus tshawytscha* in the Snake River), to assure your compliance with section 7 of the Act. Contact the U.S. Department of Commerce, National Marine Fisheries Service, Endangered Species Branch, 911 NE 11th Avenue, Portland, Oregon 97232, telephone 503/230-5400.

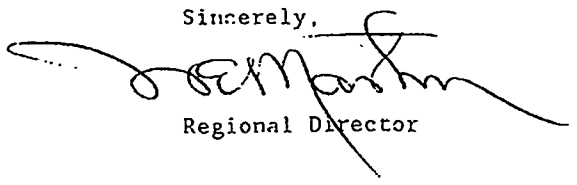
Refer to "Enclosure 5.0" for a discussion of the responsibilities Federal agencies have under section 7(c) of the Act and the conditions under which a biological assessment must be prepared by the lead Federal action agency or its designated non-Federal representative.

It is important to note that if a biological assessment is prepared, a concise determination of effects to endangered and threatened species should be made. Each narrative description of impacts to listed species should conclude with one of the following explicit determinations of effect: 1) "no effect", 2) "may affect, but not likely to adversely affect", 3) "may affect, and likely to adversely affect", or 4) "likely to affect, beneficially."

Formal consultation, pursuant to 50 CFR § 402.14, should be initiated if you determine that a listed species may be affected by a proposed action. If you determine that a species proposed for listing as endangered or threatened may be adversely affected, you should consider requesting a conference with the Service pursuant to 50 CFR § 402.10. Informal consultation may be utilized prior to a written request for formal consultation to exchange information and resolve conflicts with respect to a listed species. If a biological assessment is required, and it is not initiated within 90 days of your receipt of this letter, you should informally verify the accuracy of the species list with the Service.

If you initiate consultation with us, our Olympia, Washington, Field Office will serve as the Service's lead field office for coordinating with your staff and completing the consultation. Your interest and concern for sensitive fish and wildlife resources is appreciated. If you have any questions about this subject, please contact, Chief, Division of Recovery, at (503) 231-6241 or letterhead address. We look forward to working with you on the Columbia River System Operation Review.

Sincerely,



Regional Director

Enclosures

Original ESA Species Lists (6/93) – CONT

Enclosure 1.0

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Boise Field Station
4696 Overland Road, Room 576
Boise, Idaho 83705

June 2, 1993

Memorandum

To: Assistant Regional Director, Fish and Wildlife Enhancement, Portland

From: Field Supervisor, Boise Field Office, Boise

Subject: Species List for Columbia River System Operation Review (1-4-93-SP-376/501.2400)

Attached please find a list of species known to occur in the System Operation Review project area within Idaho. If you have any questions please contact Ted Koch of my staff at 208/334-1931.

Charles H. Lobdell

Attachments

Original ESA Species Lists (6/93) – CONT

Enclosure 1.1

AS REQUESTED
LISTED AND PROPOSED ENDANGERED
AND THREATENED SPECIES, AND CANDIDATE
SPECIES, THAT OCCUR WITHIN THE COLUMBIA RIVER SYSTEM

PROJECT NAME: Columbia River system from western Montana to below Bonneville Dam
SPECIES LIST NO. FWS 1-4-93-SP-376 (501.2400)

SNAKE RIVER

T/E SPECIES	CANDIDATE SPECIES	OTHER SPECIES
Chinook Salmon (LT) (Oncorhynchus tschawytscha)	Goshawk (C2) (Accipiter gentilis)	None
Sockeye Salmon (LE) (Oncorhynchus nerka)	Mountain Quail (C2) (Oreotyx pictus)	
Bald Eagle (LE) (Haliaeetus leucocephalus)	Idaho Ground Squirrel (C1/C2) (Spermophilus brunneus)	
Peregrine Falcon (LE) (Falco peregrinus)	Snake River Goldenweed (C1) (Haplopappus radiatus)	
Gray Wolf (LE) (Canis lupus)	Hazel's prickly phlox (C2) (Leptodactylon pungens spp. hazeliae)	
Macfarlane's four-o'clock (LE) (Mirabilis macfarlanei)		

CLEARWATER RIVER

T/E SPECIES	CANDIDATE SPECIES	OTHER SPECIES
Bald Eagle (LE) (Haliaeetus leucocephalus)	Bull Trout (C2) (Salvelinus confluentus)	None
Gray Wolf (LE) (Canis lupus)	Mountain Quail (C2) (Oreotyx pictus)	
	Goshawk (C2) (Accipiter gentilis)	
	Jessica's Aster (C2) (Aster jessicae)	
	Broad-fruit Mariposa (C1) (Calochortus nitidus)	
	Bank Monkeyflower (C2) (Mimulus clivicola)	

Original ESA Species Lists (6/93) – CONT

Enclosure 1.2

CLARK FORK

T/E SPECIES	CANDIDATE SPECIES	OTHER SPECIES
Grizzly Bear (Ursus arctos)	Goshawk (C2) (Accipiter gentilis)	None
Peregrine Falcon (LE) (Falco peregrinus)	Wolverine (C2) (Gulo gulo luscus)	
Bald Eagle (LE) (Haliaeetus leucocephalus)	Bull Trout (C2) (Salvelinus confluentus)	

LAKE PEND ORIELLE

T/E SPECIES	CANDIDATE SPECIES	OTHER SPECIES
Grizzly Bear (Ursus arctos)	Goshawk (C2) (Accipiter gentilis)	None
Gray Wolf (LE) (Canis lupus)	Harlequin Duck (C2) (Histrionicus histrionicus)	
Peregrine Falcon (LE) (Falco peregrinus)	Wolverine (C2) (Gulo gulo luscus)	
Bald Eagle (LE) (Haliaeetus leucocephalus)	Bull Trout (C2) (Salvelinus confluentus)	
	Triangular-lobed Moonwart (C2) (Botrychium ascendens)	

PEND OREILLE RIVER

T/E SPECIES	CANDIDATE SPECIES	OTHER SPECIES
Gray Wolf (LE) (Canis lupus)	Goshawk (C2) (Accipiter gentilis)	None
Bald Eagle (LE) (Haliaeetus leucocephalus)	Bull Trout (C2) (Salvelinus confluentus)	
	Wolverine (C2) (Gulo gulo luscus)	

KOOTENAI RIVER

T/E SPECIES	CANDIDATE SPECIES	OTHER SPECIES
Grizzly Bear (Ursus arctos)	Goshawk (C2) (Accipiter gentilis)	None

Original ESA Species Lists (6/93) – CONT

Enclosure 1.3

Gray Wolf (LE)
(Canis lupus)

Woodland Caribou (LE)
(Rangifer tarandus caribou)

Bald Eagle (LE)
(Haliaeetus leucocephalus)

Harlequin Duck (C2)
(Histrionicus histrionicus)

White Sturgeon (C1)
(Acipenser transmontanus)

Bull Trout (C2)
(Salvelinus confluentus)

Triangular-lobed Moonwart (C2)
(Botrychium ascendens)

Wolverine (C2)
(Gulo gulo luscus)

GENERAL COMMENTS:

A) Listed Species:

1) Bald Eagle -- a) Snake River: Wintering Area, Captain John Creek/Snake River Historic Nest, Lone Pine Nest, Dry Gulch Nest; b) Clearwater: Wintering Area; c) Clark Fork: Wintering Area, Colby Nest, Sheepherder Point/Lake Pend Oreille Nest, Delta Nest; d) Lake Pend Oreille: Wintering Area, Eaton Lake Nest, Fisherman Island Nest, Delta Nest, Sheepherder Point/Lake Pend Oreille Nest; e) Pend Oreille River: Wintering Area, Pend Oreille River Nest; f) Kootenai River: Trout Creek Nest, Kootenai NWR Nest, Moyie Nest, Bonners Ferry Nest, Jerome Slough Nest, Wintering Area.

2) Peregrine Falcon -- a) Snake River: Sheep Creek Historic Eyrie; b) Clark Fork: Clark Fork River Canyon, Clark Fork Delta Hack Site; c) Lake Pend Oreille: Pend Oreille Lake Historic Eyrie

3) Grizzly Bear -- a) Clark Fork, Lake Pend Oreille and Kootenai River: Cabinet Proposed Grizzly Bear Recovery Habitat

B) Candidate Species:

a) C1 = Category 1 Taxa for which the U.S. Fish and Wildlife Service currently has substantial information on hand to support the biological appropriateness of proposing to list as endangered or threatened. Proposed rules have not been issued, but development and publication of such rules are anticipated.

b) C2 = Category 2 Taxa for which information now in possession of the U.S. Fish and Wildlife Service indicates that proposing to list as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threat are not currently available to support proposed rules. Further biological research and field study may be needed to ascertain the status of taxa in this category.

c) NORTHERN GOSHAWK -- To determine the most likely areas for goshawk nest territories, identify all mature and old growth stands over 25 acres that

Original ESA Species Lists (6/93) – CONT

Enclosure 1.4

have a canopy closure of 60% or more, and contain Douglas fir, aspen, and western larch. Areas that will NOT need to be surveyed include stands less than mature, spruce, alpine fir or mountain hemlock forest types, and stands that are less than 50% canopy closure.

Original ESA Species Lists (6/93) – CONT

Enclosure 2.0

United States Department of the Interior

FISH AND WILDLIFE SERVICE
911 N. E. 11th Avenue
Portland, Oregon 97232-4181

MEMORANDUM

Date: May 20, 1993

To File: Division of Recovery
Ecological Services, Portland, Oregon

From: John Nuss, Fish and Wildlife Biologist
Division of Recovery
Ecological Services, Portland, Oregon

Subject: Species List Request for Columbia River System Operation Review/Section 7 Consultation

This office received response by FAX transmittal, dated May 20, 1993, from Larry Lockard, Fish and Wildlife Service, Ecological Services, Kalispell Field Office: Kalispell, Montana. The Kalispell Field Office staff provided the following list of federally listed endangered and threatened species, and candidate (status review) species, that may occur within the Columbia River System Operation Review action area in Montana.

Mammals	Status
Grizzly bear (*Urus arctos*)	Threatened
Gray wolf (*Canis lupus*)	Endangered
Birds	
Bald eagle (*Haliaeetus leucocephalus*)	Endangered
Peregrine falcon (*Falco peregrinus*)	Endangered
Fish	
Bull trout (*Salvelinus confluentus*)	C2, candidate
White sturgeon (*Acipenser transmontanus*)	C1, candidate

If additional information about the biology, habits or life requirements of these species is needed, contact the Kalispell Field Office, Ecological Services, Fish and Wildlife Service, 780 Creston Hatchery Road, Kalispell, Montana 59901, telephone 406-755-7870.

Original ESA Species Lists (6/93) – CONT

Enclosure 3.0

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Portland Field Office
2600 SE 98th Avenue, Suite 100
Portland, Oregon 97266

June 8, 1993

To: Assistant Regional Director/Deputy Assistant Regional Director
Ecological Services, Portland, Oregon

From: Acting Field Supervisor, Ecological Services
Portland, Oregon

Subject: Initiation of Section 7 Consultation for the Columbia River System Operation Review - Request for Species List

Per discussion with John Nuss we are sending (EM) a species list for preparation of a response to the subject request from Witt Anderson.

Roger E. Tabor

cc:
Assoc. Mgr. Endangered Species
John Nuss

Original ESA Species Lists (6/93) – CONT

3.1

Enclosure 3.1

ATTACHMENT A, page 3

FEDERALLY LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN THE AREA OF THE COLUMBIA RIVER SYSTEM OPREATION REVIEW: SNAKE RIVER FROM BROWNLEE DAM TO THE OREGON/WASHINGTON BORDER
1-7-93-SP-383

LISTED SPECIES[i/]

Birds			
Peregrine falcon	*Falco peregrinus*	(D)	LE
Bald eagle	*Haliaeetus leucocephalus*	(D)	LT
Fish			
Chinook salmon	*Oncorhynchus tshawytscha*	(D)	**LT
Spring/salmon and fall runs in the Snake River. (petitioned June 7, 1990; proposed June 27, 1991 in 56 FR 29542-29544; listed April 22, 1991 in 57 FR 14653)			
Snake River Sockeye salmon	*Oncorhynchus nerka*	(D)	**LE
Salmon River tributary to the Snake River, Idaho. (petitioned April 2, 1990; proposed April 5, 1991 in 56 FR 14055; listed November 20, 1991 in 56 FR 58619)			
Plants			
MacFarlane's four o'clock	*Mirabilis macfarlanei*	(D)	LE

PROPOSED SPECIES[ii/]

None

CANDIDATE SPECIES[iii/iv/]

Mammals			
North American lynx	*Felis lynx canadensis*	(S)	C2
California wolverine	*Gulo gulo luteus*	(S)	C2
Pacific fisher	*Martes pennanti pacifica*	(S)	C2
Pacific western big-eared bat	*Plecotus townsendii townsendii*	(D)	C2
Birds			
Northern goshawk	*Accipiter gentilis*	(S)	C2
Ferruginous hawk	*Buteo regalis*	(S)	C2
Plants			
Hazel's prickly-phlox	*Leptodactylon pungens* ssp. *hazeliae*		C2

(E) - Endangered (T) - Threatened (CH) - Critical Habitat
(S) - Suspected (D) - Documented

Original ESA Species Lists (6/93) – CONT

3.2

Enclosure 3.2

ATTACHMENT A

FEDERALLY LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN THE AREA OF THE COLUMBIA RIVER SYSTEM OPREATION REVIEW: SNAKE RIVER FROM BROWNLEE DAM TO THE OREGON/WASHINGTON BORDER

~~1-7-93-SP-381~~

LISTED SPECIES[1/]			
Birds			
Peregrine falcon	*Falco peregrinus*	(D)	LE
Bald eagle	*Haliaeetus leucocephalus*	(D)	LT
Fish			
Chinook salmon	*Oncorhynchus tshawytscha*	(D)	**LT
Spring/salmon and fall runs in the Snake River. (petitioned June 7, 1990; proposed June 27, 1991 in 56 FR 29542-29544; listed April 22, 1991 in 57 FR 14653)			
Snake River Sockeye salmon	*Oncorhynchus nerka*	(D)	**LE
Salmon River tributary to the Snake River, Idaho. (petitioned April 2, 1990; proposed April 5, 1991 in 56 FR 14055; listed November 20, 1991 in 56 FR 58619)			
Plants			
MacFarlane's four o'clock	*Mirabilis macfarlanei*	(D)	LE
PROPOSED SPECIES[1/]			
None			
CANDIDATE SPECIES[2/]			
Mammals			
North American lynx	*Felis lynx canadensis*	(S)	C2
California wolverine	*Gulo gulo luteus*	(S)	C2
Pacific fisher	*Martes pennanti pacifica*	(S)	C2
Pacific western big-eared bat	*Plecotus townsendii townsendii*	(D)	C2
Birds			
Northern goshawk	*Accipiter gentilis*	(S)	C2
Ferruginous hawk	*Buteo regalis*	(S)	C2
Plants			
Hazel's prickly-phlox	*Leptodactylon pungens* ssp. *hazeliae*		C2

(E) - Endangered (T) - Threatened (CH) - Critical Habitat
(S) - Suspected (D) Documented

Original ESA Species Lists (6/93) – CONT

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Portland Field Office
2600 SE 98th Avenue, Suite 100
Portland, Oregon 97266

October 4, 1993

Ref: 1-7-93-SP-383

Jeff Dorsey
Department of the Army
Portland District Corps of Engineers
P.O. Box 2946
Portland, Oregon 97208-2946

Dear Mr. Dorsey:

The enclosed species list replaces the list previously sent to your office. The list addresses the Oregon portion of the Columbia River System Operation Review. For further questions, please contact Josh Millman at the Oregon State Office 503-231-6179.

Sincerely,

Roger E. Anderstrasse

for Russell D. Peterson
State Supervisor

Enclosures

JM/np/SP383.jd

Original ESA Species Lists (6/93) – CONT

RECEIVED
OCT 0 1993
REG & ENV. AFFAIRS

ATTACHMENT A

FEDERALLY LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN THE AREA OF THE COLUMBIA RIVER SYSTEM OPERATION REVIEW: COLUMBIA RIVER FROM THE MOUTH TO ABOVE MCNARY DAM
1-7-93-SP-383

LISTED SPECIES[1/]			
Mammals			
Columbian white-tailed deer	*Odocoileus virginianus leucurus*	(D)	LE
Birds			
Peregrine falcon	*Falco peregrinus*	(D)	LE
Bald eagle	*Haliaeetus leucocephalus*	(D)	LT
Fish			
Chinook salmon	*Oncorhynchus tshawytscha*	(D)	**LT
Spring/salmon and fall runs in the Snake River. (petitioned June 7, 1990; proposed June 27, 1991 in 56 FR 29542-29544; listed April 22, 1991 in 57 FR 14653)			
Snake River Sockeye salmon	*Oncorhynchus nerka*	(D)	**LE
Salmon River tributary to the Snake River, Idaho. (petitioned April 2, 1990; proposed April 5, 1991 in 56 FR 14055; listed November 20, 1991 in 56 FR 58619)			
PROPOSED SPECIES[2/]			
Plants			
Howellia	*Howellia aquatalis*	(D)	PT
CANDIDATE SPECIES[3/4/]			
Mammals			
White-footed vole	*Arborimus albipes*	(D)	C2
Pacific fisher	*Martes pennanti pacifica*	(S)	C2
Pacific western big-eared bat	*Plecotus townsendi townsendi*	(D)	C2
Birds			
Tricolored blackbird	*Agelaius tricolor*	(D)	C2
Ferruginous hawk	*Buteo regalis*	(D)	C2
Western sage grouse	*Centrocercus urophasianus phaios*	(S)	C2
Long-billed curlew	*Numenius americanus*	(D)	3C
Columbia sharptailed grouse	*Tympanuchus phasianellus columbianus*	(D)	C2
Amphibians and Reptiles			
Northwestern pond turtle	*Clemmys marmorata marmorata*	(D)	C2
Larch Mountain salamander	*Plethodon larselli*	(D)	C2
Northern red-legged frog	*Rana aurora aurora*	(D)	C2
Fish			
Bull trout	*Salvelinus confluentus*	(D)	C2

Original ESA Species Lists (6/93) – CONT

ATTACHMENT A, page 2

Invertebrates			
Shortface lanx (Giant Columbia River limpet)	*Fisherola nuttallii*	(D)	3C
Great Columbia River spire snail	*Fluminicola columbianus*	(D)	C2
Minor Pacific sideband (snail)	*Monadenia fidelis minor*	(D)	C2
Columbia Gorge neothremman	*Neothremma andersoni*	(D)	C2
Wahkeena Falls flightless stonefly	*Zapada (=Nemoura) wahkeena*	(D)	C2
Plants			
Northern wormwood	*Artemisia campestris var. wormskioldii*	(D)	C1
Golden Indian-paintbrush	*Castilleja levisecta*	(D)	C1
Howell's fleabane	*Erigeron howellii*	(D)	C2
Smooth desert-parsley	*Lomatium laevigatum*	(D)	C2
Howell's montia	*Montia howellii*	(D)	C2
Barrett's penstemon	*Penstemon barrettiae*	(D)	C2
Columbia cress	*Rorippa columbiae*	(D)	C2
Oregon sullivantia	*Sullivantia oregana*	(D)	C2

(E) - Endangered *(T) - Threatened* *(CH) - Critical Habitat*
(S) - Suspected *(D) - Documented*
(L) - Listed *(P) - Proposed*

(C1)- Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.

(C2)- Category 2: Taxa for which existing information indicates may warrant listing, but for which substantial biological information to support a proposed rule is lacking.

(3A)- Category 3A: Taxa for which the Service has persuasive evidence of extinction.

(3B)- Category 3B: Names that on the basis of current taxonomic understanding do not represent taxa meeting the Act's definition of "species."

(3C)- Category 3C: Taxa that have proven to be more abundant or widespread than was previously believed and/or those that are not subject to any identifiable threat.

* *If a vertebrate or plant, a single asterisk indicates taxon is possibly extinct. If an invertebrate, a single asterisk indicates a lack of information for the taxon since 1963.*

** *Consultation with National Marine Fisheries Service required.*

1/ U. S. Department of Interior, Fish and Wildlife Service, July 15, 1991, Endangered and Threatened Wildlife and Plants, 50 CFR 17.11 and 17.12.

2/ Federal Register Vol. 58, No. 72, April 16, 1993, Proposed Rule-Howellia aquatalis

3/ Federal Register Vol. 56, No. 225, November 21, 1991, Notice of Review-Animals

4/ Federal Register Vol. 55, No. 38, February 21, 1990, Notice of Review-Plants

Original ESA Species Lists (6/93) – CONT

ATTACHMENT A, page 3

FEDERALLY LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES
CANDIDATE SPECIES THAT MAY OCCUR IN THE AREA OF THE
COLUMBIA RIVER SYSTEM OPREATION REVIEW: SNAKE RIVER FROM
BROWNLEE DAM TO THE OREGON/WASHINGTON BORDER
1-7-93-SP-383

LISTED SPECIES[1/]

Birds			
Peregrine falcon	*Falco peregrinus*	(D)	LE
Bald eagle	*Haliaeetus leucocephalus*	(D)	LT
Fish			
Chinook salmon	*Oncorhynchus tshawytscha*	(D)	**LT
Spring/salmon and fall runs in the Snake River. (petitioned June 7, 1990; proposed June 27, 1991 in 56 FR 29542-29544; listed April 22, 1991 in 57 FR 14653)			
Snake River Sockeye salmon	*Oncorhynchus nerka*	(D)	**LE
Salmon River tributary to the Snake River, Idaho. (petitioned April 2, 1990; proposed April 5, 1991 in 56 FR 14055; listed November 20, 1991 in 56 FR 58619)			
Plants			
MacFarlane's four o'clock	*Mirabilis macfarlanei*	(D)	LE

PROPOSED SPECIES[1/]

None

CANDIDATE SPECIES[2/3/]

Mammals			
North American lynx	*Felis lynx canadensis*	(S)	C2
California wolverine	*Gulo gulo luteus*	(S)	C2
Pacific fisher	*Martes pennanti pacifica*	(S)	C2
Pacific western big-eared bat	*Plecotus townsendii townsendii*	(D)	C2
Birds			
Northern goshawk	*Accipiter gentilis*	(S)	C2
Ferruginous hawk	*Buteo regalis*	(S)	C2
Plants			
Hazel's prickly-phlox	*Leptodactylon pungens* ssp. *hazeliae*		C2

Original ESA Species Lists (6/93) – CONT

ATTACHMENT A, page 4

(E) - Endangered *(T) - Threatened* *(CH) - Critical Habitat*
(S) - Suspected *(D) - Documented*
(L) - Listed *(P) - Proposed*

(C1)- Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.

(C2)- Category 2: Taxa for which existing information indicates may warrant listing, but for which substantial biological information to support a proposed rule is lacking.

(3A)- Category 3A: Taxa for which the Service has persuasive evidence of extinction.

(3B)- Category 3B: Names that on the basis of current taxonomic understanding do not represent taxa meeting the Act's definition of "species."

(3C)- Category 3C: Taxa that have proven to be more abundant or widespread than was previously believed and/or those that are not subject to any identifiable threat.

- *If a vertebrate or plant, a single asterisk indicates taxon is possibly extinct. If an invertebrate, a single asterisk indicates a lack of information for the taxon since 1963.*

•• *Consultation with National Marine Fisheries Service required.*

1/ U. S. Department of Interior, Fish and Wildlife Service, July 15, 1991, Endangered and Threatened Wildlife and Plants, 50 CFR 17.11 and 17.12.

2/ Federal Register Vol. 56, No. 225, November 21, 1991, Notice of Review-Animals

3/ Federal Register Vol. 55, No. 38, February 21, 1990, Notice of Review-Plants

Original ESA Species Lists (6/93) – CONT

ATTACHMENT B

FEDERAL AGENCIES RESPONSIBILITIES UNDER SECTIONS 7(a) and (c)
OF THE ENDANGERED SPECIES ACT

SECTION 7(a) - Consultation/Conference

Requires: 1) Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species;

2) Consultation with FWS when a Federal action may affect a listed endangered or threatened species to insure that any action authorized, funded or carried out by a Federal agency is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of Critical Habitat. The process is initiated by the Federal agency after they have determined if their action may affect (adversely or beneficially) a listed species; and

3) Conference with FWS when a Federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or adverse modification of proposed Critical Habitat.

SECTION 7(c) - Biological Assessment for Major Construction Projects 1/

Requires Federal agencies or their designees to prepare a Biological Assessment (BA) for construction projects only. The purpose of the BA is to identify any proposed and/or listed species which are/is likely to be affected by a construction project. The process is initiated by a Federal agency in requesting a list of proposed and listed threatened and endangered species (list attached). The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). If the BA is not initiated within 90 days of receipt of the species list, the accuracy of the species list should be informally verified with our Service. No irreversible commitment of resources is to be made during the BA process which would foreclose reasonable and prudent alternatives to protect endangered species. Planning, design, and administrative actions may be taken; however, no construction may begin.

To complete the BA, your agency or its designee should: (1) conduct an on-site inspection of the area to be affected by the proposal which may include a detailed survey of the area to determine if the species is present and whether suitable habitat exists for either expanding the existing population or for potential reintroduction of the species; (2) review literature and scientific data to determine species distribution, habitat needs, and other biological requirements; (3) interview experts including those within FWS, National Marine Fisheries Service, State conservation departments, universities, and others who may have data not yet published in scientific literature; (4) review and analyze the effects of the proposal on the species in terms of individuals and populations, including consideration of cumulative effects of the proposal on the species and its habitat; (5) analyze alternative actions that may provide conservation measures and (6) prepare a report documenting the results, including a discussion of study methods used, any problems encountered, and other relevant information. The BA should conclude whether or not a listed or proposed species will be affected. Upon completion, the report should be forwarded to our Portland Office.

1/ A construction project (or other undertaking having similar physical impacts) which is a major Federal action significantly affecting the quality of the human environment as referred to in NEPA (42 U.S.C. 4332.(2)c). On projects other than construction, it is suggested that a biological evaluation similar to the biological assessment be undertaken to conserve species influenced by the Endangered Species Act.

Original ESA Species Lists (6/93) – CONT

Enclosure 4.0

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
3704 Griffin Lane SE, Suite 102
Olympia, Washington 98501-2192
(206) 753-9440 FAX: (206) 753-9008

TAKE PRIDE IN AMERICA

Memorandum

May 17, 1993

TO: Assistant Regional Director, Ecological Services, Region 1, Portland, Oregon (Attn: John Nuss)

FROM: State Supervisor, Ecological Services, Olympia State Office, Olympia, Washington

SUBJECT: State of Washington Species List for the Columbia River System Operation Review (1-3-93-SP-520)

Attached, as requested, is the Washington portion of the species list for the Columbia River System Operation Review. The list has been prepared on a project and reach basis. A list of abbreviations for the projects is as follows:

Grand Coulee	GC
Chief Joseph	CJ
Mid Columbia (includes Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids Dams)	MC
Hanford Reach	HA
McNary	MN
John Day	JD
The Dalles	TD
Bonneville	BO
Ice Harbor	IH
Lower Monumental	LM
Little Goose	LIG
Lower Granite	LOG

If you have any questions, please contact John Grettenberger of this office at the letterhead phone/address.

Original ESA Species Lists (6/93) – CONT

Enclosure 4.1

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES WHICH MAY OCCUR WITHIN THE AREA OF THE PROPOSED COLUMBIA RIVER SYSTEM OPERATION REVIEW ON THE COLUMBIA AND SNAKE RIVERS IN ASOTIN, BENTON, CHELAN, COLUMBIA, DOUGLAS, FERRY, FRANKLIN, GARFIELD, GRANT, KITTITAS, KLICKITAT, LINCOLN, OKANOGAN, SKAMANIA, STEVENS, WALLA WALLA, WHITMAN AND YAKIMA COUNTIES, WASHINGTON.

1-3-93-SP-520

LISTED

Bald eagle *(Haliaeetus leucocephalus)* - wintering bald eagles may occur in the vicinity of the project from about October 31 through March 31 (All projects).

There are bald eagle communal winter night roosts located in the vicinity of the Grand Coulee project at T31N R29E S36, T29N R31E S16, T28N R30E S32/33, T28N R31E S07, and T27N R30E S5; Chief Joseph project at T29N R27E S02; Wells project at T30N R30E S06, T30N R25E S29 and T30N R25E S30; Hanford Reach at T14N R26E S11/14/18/29, T13N R27E S23/24/25/26 and T13N R26E S06; Rocky Reach project at T26N R21E S29; and John Day project at T05N R26E S09.

There are bald eagle wintering concentrations located at Grand Coulee, Chief Joseph, Wells and John Day projects and along the Hanford Reach.

There are eight bald eagle nesting territories located in the vicinity of the Grand Coulee project at: T29N R33E S9; T29N R36E S5; T32N R35E S22; T32N R37E S16; T34N R36E S14; T36N R37E S22; T37N R37E S27; and T39N R38E S36; one nesting territory in the vicinity of Chief Joe Project at T30N R30E S4; and two nesting territories on the Hanford Reach at T13N R27E S09 and T14N R27E S29. Nesting activities occur from about January 1 through August 15.

Gray wolf *(Canis lupus)* - may occur in the vicinity of the project (GC).

Peregrine falcon *(Falco peregrinus)* - Hack sites/aeries are present along the Bonneville and The Dalles projects. Spring and fall migrant falcons may occur in the vicinity of all of the projects.

Major concerns that should be addressed in your biological assessment of project impacts to listed species are:

1. Level of use of the project area by listed species.

2. Effect of the project on listed species' primary food stocks, prey species, and foraging areas in all areas influenced by the project.

   Impacts from project implementation (e.g., increased noise levels, increased human activity and/or access, loss or degradation of habitat) which may result in disturbance to listed species and/or their avoidance of the project area.

Original ESA Species Lists (6/93) – CONT

Enclosure 4.2

CANDIDATE SPECIES IN WASHINGTON

Mammals

North American lynx (*Felis lynx canadensis*) C2 - may occur in the vicinity of the project (GC)

Pacific fisher (*Martes pennanti pacifica*) C2 - may occur in the vicinity of the project (GC)

Preble's shrew (*Sorex preblei*) C2 - may occur in the vicinity of the project (LIG, LOG)

Birds

Black tern (*Chlidonias niger*) C2 - may occur in the vicinity of the project (LM, IH, LIG, LOG, GC, CJ, MC, HA, MN, JD, TD, BO)

Columbian sharp-tailed grouse (*Typanuchus phasianellus columbianus*) C2 - may occur in the vicinity of the project (GC, CJ, MC)

Ferruginous hawk (*Buteo regalis*) C2 - may occur in the vicinity of the project (LM, IH, LIG, LOG, GC, CJ, MC, HA, MN, JD)

Harlequin duck (*Histrionicus histrionicus*) C2 - may occur in the vicinity of the project (LM, IH, LIG, LOG, GC, CJ, MC, BO)

Loggerhead shrike (*Lanius ludoviciianus*) C2 - may occur in the vicinity of the project (LM, IH, LIG, LOG, GC, CJ, MC, HA, MN, JD, TD, BO)

Mountain quail (*Oreortyx pictus*) C2 - may occur in the vicinity of the project (BO)

Northern goshawk (*Accipiter gentilis*) C2 - may occur in the vicinity of the project (GC, CJ, BO)

Western sage grouse (*Centrocercus urophasianus phaios*) C2 - may occur in the vicinity of the project (LM, IH, LIG, LOG, GC, CJ, MC, HA)

Reptiles

Northwestern pond turtle (*Clemmys marmorata marmorata*) C2 - may occur in the vicinity of the project (BO)

Amphibians

Larch Mountain salamander (*Plethodon larselli*) C2 - may occur in the vicinity of the project (BO)

Northern red-legged frog (*Rana aurora aurora*) C2 - may occur in the vicinity of the project (BO)

Spotted frog (*Rana pretiosa*) C2 - may occur in the vicinity of the project (LM, IH, LIG, LOG, GC, CJ, MC, HA, MN, JD, TD, BC)

Original ESA Species Lists (6/93) – CONT

Enclosure 4.3

CANDIDATE SPECIES IN WASHINGTON (cont)

Fish

Bull trout (*Salvelinus confluentus*) C2 - may occur in the vicinity of the project (LM, IH, LIG, LOG, GC, CJ, MC, HA, MN, JD, TD, BO)

Invertebrates

California floater (mussel) (*Andonta californiensis* [Lea, 1852]) C2 - may occur in the vicinity of the project (LM, IH, LIG, LOG, GC, CJ, MC, HA, MN, JD, TD, BO)

Columbia pebblesnail (= Great Columbia River spire snail) (*Fluminicola (=Lithoglyphus) columbianus* [Hemphill in Pilsbury, 1899]) C2 - May occur in the vicinity of the project (LM, IH, LIG, LOG, GC, CJ, MC, HA, MN, JD, TD, BO)

Plants

Allium constrictum (Douglas' constricted onion) C2 - May occur in the vicinity of the project (GC)

Artemesia campestris var.*workskoldii* (northern wormwood) C1 - May occur in the vicinity of the project (TD)

Aster jessicae (Jessica's aster) C2 - May occur in the vicinity of the project (LIG, LOG)

Astragulus columbianus (Columbia milk-vetch) C2 - May occur in the vicinity of the project (HA)

Calochortus nitidus (broad-fruit mariposa) C1 - May occur in the vicinity of the project (LIG, LOG)

Erigeron howellii (Howell's fleabane) C2 - May occur in the vicinity of the project (BO)

Haplopappus liatriformis (Palouse goldenweed) C2 - May occur in the vicinity of the project (LIG, LOG, JD)

Lomatium laevigatum (smooth desert parsley) C2 - May occur in the vicinity of the project (TD)

Lomatium suksdorfii (Suksdorf's desert-parsley) C2 - May occur in the vicinity of the project (BO)

Lupinus cusickii (Cusick's lupine) C2 - May occur in the vicinity of the project (LIG, LOG)

Penstemon barrettiae (Barrett's breadtongue) C2 - May occur in the vicinity of the project (BO, TD)

Ranunculus reconditis (obscure buttercup) C1 - May occur in the vicinity of the project (TD)

Original ESA Species Lists (6/93) – CONT

Enclosure 4.4

CANDIDATE SPECIES IN WASHINGTON (cont)

Rorippa columbiae (Columbia yellow-cress) C2 - May occur in the vicinity of the project (BO,HA)

Rubus nigerrimus (northwest raspberry) C1 - May occur in the vicinity of the project (LIG, LOG)

Silene spaldingii (Spalding's silene) C2 - May occur in the vicinity of the project (LIG, LOG)

Original ESA Species Lists (6/93) – CONT

Enclosure 5.0
Federal Agencies' Responsibilities Under
Sections 7(a) and (c) of the Endangered Species Act

Section 7(a) Consultation/Conference
Requires: 1) Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species; 2) Consultation with the Fish and Wildlife Service when a Federal action may affect a listed endangered or threatened species to insure that any action authorized, funded or carried out by a Federal agency is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The process is initiated by the Federal agency after determining the action may affect a listed species; and 3) Conference with the Fish and Wildlife Service when a Federal action is likely to jeopardize the continued existence of a proposed species or result in the destruction or adverse modification of proposed critical habitat.

Section 7(c) Biological Assessment -- Major Construction Activity *
Requires Federal agencies or their designees to prepare a Biological Assessment (BA) for major construction activities. The BA analyzes the effects of the action** on listed and proposed species. The process begins with a Federal agency requesting from the Fish and Wildlife Service a list of proposed and listed threatened and endangered species. The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). If the BA is not initiated within 90 days of receipt of the list, the accuracy of the species list should be informally verified with the Fish and Wildlife Service. No irreversible commitment of resources is to be made during the BA process which would foreclose reasonable and prudent alternatives to protect endangered species. Planning, design, and administrative actions may proceed; however, no construction may begin.

We recommend the following for inclusion in the BA: An onsite inspection of the area affected by the proposal which may include a detailed survey of the area to determine if the species or suitable habitat are present; a review of literature and scientific data to determine species' distribution, habitat needs, and other biological requirements; interviews with experts, including those with the Fish and Wildlife Service, State conservation departments, universities and others who may have data not yet published in scientific literature; an analysis of the effects of the proposal on the species in terms of individuals and populations, including consideration of indirect effects of the proposal on the species and its habitat; an analysis of alternative actions considered. The BA should document results, including a discussion of study methods used, any problems encountered, and other relevant information. The BA should conclude whether or not a listed or proposed species would be affected. Upon completion, the BA should be forwarded to the Fish and Wildlife Service's lead office for the consultation.

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* A construction project (or other undertaking having similar physical impacts) which is a major Federal action significantly affecting the quality of the human environment as referred to in NEPA (42 USC 4332(2)C).

** "Effects of the action" refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action.

Original ESA Species Lists (6/93) – CONT

State of Montana

OFFICE OF THE GOVERNOR
NORTHWEST POWER PLANNING COUNCIL

MARC RACICOT
GOVERNOR

STAN GRACE
Council Member

JOHN N. ETCHART
Council Member

November 5, 1993

Don Treasure, D-5120
Coordinator, SOR Wildlife Work Group
US Bureau of Reclamation
PO Box 25007
Denver, CO 80225-0007

Dear Mr. Treasure:

I am seeking information on the status of the SOR Wildlife Work Group. My assigned task is to gather this information, and garner from it potential impacts to Montana. Has the group drafted a preliminary document, workscope review or any other product (such as meeting minutes) that would educate me on your activities?

Please send me any information that might enlighten me and add my name to your list for future mailings. I would also appreciate the schedule of upcoming work group meetings.

If you have additional information concerning the activities of the group that you could share with me on the phone, please call me at (406) 444-3952.

Thank you for your help.

Sincerely,

Ti Dahlseide

Ti Dahlseide
Public Involvement Director

PO BOX 200805 HELENA, MT 59620-0805 (406) 444-3952 FAX-(406) 444-4339

Updated Species Lists (3/95)

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Portland Field Office
2600 S.E. 98th Avenue, Suite 100
Portland, Oregon 97266
(503) 231-6179 Fax: (503)-231-6195

In Reply Refer to: 1-7-95-SP-198

Don Treasure
Bureau of Reclamation
PO Box 25007, D-5100
Denver, CO 80225

Dear Mr. Treasure:

This is in response to your letter, dated 6 February 1995, requesting concurrence on your list of endangered, threatened, and candidate species for consideration in the Columbia River Systems Operations Review in Oregon. The U.S. Fish and Wildlife Service (Service) received your letter on 15 March 1995.

We have coordinated the concurrence letters from the Boise, Kalispell, and Moses Lake field offices for the affected areas in their respective states. Their responses are included in the attatchments.

We have reviewed your list and have the following changes to recommend for the Columbia River, from the mouth to above McNary Dam:

Mammals				
Add	Long-eared myotis (bat)	*Myotis evotis*	(S)	C2
Add	Fringed myotis (bat)	*Myotis thysanodes*	(S)	C2
Add	Long-legged myotis (bat)	*Myotis volans*	(S)	C2
Add	Yuma myotis (bat)	*Myotis yumanensis*	(S)	C2
Add	Washington ground squirrel	*Spermophilus washingtoni*	(D)	C2
Birds				
Add	Western burrowing owl	*Athene cunicularia hypugea*	(D)	C2
Drop	Western sagegrouse	*Centrocercus urophasianus phaios*		
Add	Little willow flycatcher	*Empidonax traillii brewsteri*	(S)	C2
Drop	Long-billed curlew	*Numenius americanus*		
Amphibians and Reptiles				
Add	Tailed frog	*Ascaphus truei*	(S)	C2
Add	Northern sagebrush lizard	*Sceloporus graciosus graciosus*	(S)	C2
Fish				
Add	Green sturgeon	*Acipenser medirostris*	(S)	C2
Add	River lamprey	*Lampetra ayresi*	(S)	C2

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Updated Species Lists (3/95) – CONT

Add	Pacific lamprey	*Lampetra tridentata*	(S)	C2

Invertebrates

Drop	Shortface lanx	*Fisherola nutallii*		

Plants

Change PT to LT	Howellia	*Howellia aquatalis*		
Change C2 to PT	Golden Indian paintbrush	*Castilleja levisecta*		
Drop	Smooth desert parsely	*Lomatium laevigatum*		

We have the following changes to recommend for the Snake River, from Brownlee Reservoir to the Oregon/Washington border:

Mammals

Add	Long-eared myotis (bat)	*Myotis evotis*	(S)	C2
Add	Long-legged myotis (bat)	*Myotis volans*	(S)	C2
Add	Yuma myotis (bat)	*Myotis yumanensis*	(S)	C2
Add	Pale Townsend's big-eared bat	*Plecotus townsendii pallescens*	(S)	C2
Add	Washington ground squirrel	*Spermophilus washingtoni*	(D)	C2

Birds

Add	Western burrowing owl	*Athene cunicularia hypugea*	(D)	C2

Amphibians and Reptiles

Add	Tailed frog	*Ascaphus truei*	(S)	C2
Add	Spotted frog	*Rana pretiosa*	(S)	C1

Fish

Add	Bull trout	*Salvelinus confluentus*	(S)	C1

With these changes, your current list fulfills the requirement of the Service under Section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 USC 1531 et seq.). Your requirements under the Act are outlined in Attachment B.

If Bureau of Reclamation (BR) determines, based on the Biological Assessment or evaluation, that threatened and endangered species and/or critical habitat may be affected by the project, BR is required to consult with the Service following the requirements of 50 CFR 402 which implement the Act.

The list provided by you includes candidate species presently under review by this Service. Candidate species have no protection under the Act but it is possible candidates could become formal proposals and be listed prior to project completion. If BR determines your project may affect candidate species, you are not required to perform a biological assessment or to consult with the Service. However, if early evaluation of your project indicates that it is likely to adversely impact a candidate species, BR may wish to request technical assistance from this office.

Updated Species Lists (3/95) – CONT

If you have questions regarding your responsibilities under the Act, please contact Laura Todd at (503) 231-6179. For questions regarding anadromous fish, please contact National Marine Fisheries Service, 911 N.E. 11th Ave., Room 620, Portland, Oregon (503) 230-5420. All correspondence should include the above referenced case number. Your interest in endangered species is appreciated.

Sincerely,

for Russell D. Peterson
State Supervisor

Attachments
Oregon SP-198
Concurrence letters:
Washington
Idaho
Montana
cc: PFO-ES
BFO-SE
ODFW (Nongame)
RO

Updated Species Lists (3/95) – CONT

ATTACHMENT 1

WASHINGTON

Below, please find updated changes to the original species list provided to the USBR in June, 1993, for Washington state. I've included common names, scientific names, and the reaches of river of concern for the SOR, as identified in the original memorandum.

New Candidate Species	Reach of River
Fringed Myotis (*Myotis thysanodes*)	BO, TD, JD, MN
Green Sturgeon (*Acipenser medirostris*)	BO
Little Willow Flycatcher (*Empidonax traillii brewsteri*)	BO, TD, JD
Long-eared Myotis (*Myotis evotis*)	BO
Long-legged Myotis (*Myotis volans*)	BO, JD, MN, HA, IH, LM, LIG, LOG
Margined Sculpin (*Cottus marginatus*)	JD, MN
Northern Sagebrush Lizard (*Sceloporus graciosus graciosus*)	JD, MN, HA, MC, CJ, GC, IH, LM, LIG, LOG
Olive-sided Flycatcher (*Contopus borealis*)	All
Pacific Lamprey (*Lampetra tridentata*)	All
Pale Townsend's Big-eared Bat (*Plecotus townsendii townsendii*)	JD, MN, HA, MC, CJ, GC, IH, LOG
River Lamprey (*Lampetra ayresi*)	BO
Small-footed Myotis (*Myotis ciliolaburm*)	JD, MN, HA, MC, CJ, GC, IH, LM, LIG, LOG
Washington Ground Squirrel (*Spermophilus washingtoni*)	JD, MN, HA, MC, CJ, GC, IH, LM, LIG, LOG
Western Burrowing Owl (*Athene cunicularia hypugea*)	MN, HA, MC, CJ, GC, IH, LM, LIG, LOG
Westslope Cutthroat Trout (*Oncorhynchus clarki lewisi*)	All
Yuma Myotis (*Myotis yumanensis*)	All

Species Upgraded from C2 to C1
Bull Trout (*Salvelinus confluentus*)
Spotted Frog, west coast population (*Rana pretiosa*)

Species Removed from Candidate List
Mountain Quail (*Oreortyx pictus*)

Updated Species Lists (3/95) – CONT

IDAHO

AS REQUESTED
LISTED AND PROPOSED ENDANGERED
AND THREATENED SPECIES, AND CANDIDATE
SPECIES, THAT OCCUR WITHIN THE COLUMBIA RIVER SYSTEMS
IN IDAHO OPERATION REVIEW PROJECT AREAS

PROJECT NAME: **Columbia River system from western Montana to below Bonneville Dam**
SPECIES LIST NO. FWS 1-4-95-SP-158 (501.2400)

SNAKE RIVER CORRIDOR FROM BROWNLEE RESERVOIR DOWNSTREAM

THREATENED AND ENDANGERED SPECIES

Chinook Salmon (LE)
(*Oncorhynchus tschawytscha*)

Sockeye Salmon (LE)
(*Oncorhynchus nerka*)

Bald Eagle (LE)
(*Haliaeetus leucocephalus*)

Peregrine Falcon (LE)
(*Falco peregrinus*)

Gray Wolf (LE)
(*Canis lupus*)

Macfarlane's four-o'clock (LT)
(*Mirabilis macfarlanei*)

CANDIDATE SPECIES

Northern Goshawk (C2)
(*Accipiter gentilis*)

Snake River Goldenweed (C1)
(*Haplopappus radiatus*)

Hazel's prickly phlox (C2)
(*Leptodactylon pungens* spp. *hazeliae*)

Yuma Myotis (C2)
(*Myotis yumanensis*)

Columbia Pebblesnail (C2)
(*Fluminicola columbianus*)

Updated Species Lists (3/95) – CONT

Bartonberry (C2)
(Rubus bartonianus)

Palouse Goldenweed (C2)
(Haplopapppus liatriformis)

Interior Redband Trout (C2)
(Oncorhynchus mykiss ssp.)

CLEARWATER RIVER CORRIDOR

THREATENED AND ENDANGERED SPECIES

Bald Eagle (LE)
(Haliaeetus leucocephalus)

Gray Wolf (LE)
(Canis lupus)

Chinook Salmon (LE)
(Oncorhynchus tschawytscha)

CANDIDATE SPECIES

Broad-fruit Mariposa (C1)
(Calochortus nitidus)

Bull Trout (C1)
(Salvelinus confluentus)

Jessica's Aster (C2)
(Aster jessicae)

CLARK FORK CORRIDOR

THREATENED AND ENDANGERED SPECIES

Grizzly Bear (LT)
(Ursus arctos)

Peregrine Falcon (LE)
(Falco peregrinus)

Bald Eagle (LE)
(Haliaeetus leucocephalus)

Gray Wolf (LE)
(Canis lupus)

Updated Species Lists (3/95) – CONT

CANDIDATE SPECIES

Wolverine (C2)
(Gulo gulo luscus)

Bull Trout (C1)
(Salvelinus confluentus)

Harlequin Duck (C2)
(Histrionicus histrionicus)

Northern Goshawk (C2)
(Accipiter gentilis)

LAKE PEND ORIELLE CORRIDOR

THREATENED AND ENDANGERED SPECIES

Grizzly Bear (LT)
(Ursus arctos)

Gray Wolf (LE)
(Canis lupus)

Peregrine Falcon (LE)
(Falco peregrinus)

Bald Eagle (LE)
(Haliaeetus leucocephalus)

CANDIDATE SPECIES

Northern Goshawk (C2)
(Accipiter gentilis)

Harlequin Duck (C2)
(Histrionicus histrionicus)

Bull Trout (C1)
(Salvelinus confluentus)

PEND OREILLE RIVER CORRIDOR

THREATENED AND ENDANGERED SPECIES

Updated Species Lists (3/95) – CONT

Gray Wolf (LE)
(Canis lupus)

Bald Eagle (LE)
(Haliaeetus leucocephalus)

CANDIDATE SPECIES

Bull Trout (C1)
(Salvelinus confluentus)

Wolverine (C2)
(Gulo gulo luscus)

Lynx (C2)
(Lynx lynx)

KOOTENAI RIVER CORRIDOR

THREATENED AND ENDANGERED SPECIES

Grizzly Bear (LT)
(Ursus arctos)

Gray Wolf (LE)
(Canis lupus)

Bald Eagle (LE)
(Haliaeetus leucocephalus)

White Sturgeon (LE)
(Acipenser transmontanus)

CANDIDATE SPECIES

Triangular-lobed Moonwart (C2)
(Botrychium ascendens)

Wolverine (C2)
(Gulo gulo luscus)

Bull Trout (C1)
(Salvelinus confluentus)

Northern Goshawk (C2)
(Accipiter gentilis)

Black Tern (C2)
(Chlindonias niger)

Updated Species Lists (3/95) – CONT

(Chlindonias niger)

GENERAL COMMENTS:

A) **Listed Species:**

1) Bald Eagle -- a) Snake River: Wintering Area, 3 nesting territories; b) Clearwater: Wintering Area; c) Clark Fork: Wintering Area, 3 nesting territories; d) Lake Pend Oreille: Wintering Area, 4 nesting territories; e) Pend Oreille River: Wintering Area, 1 nesting territory; f) Kootenai River: 6 nesting territories, Wintering Area.

2) Peregrine Falcon -- a) Snake River: Sheep Creek Historic Eyrie, Grave Point Lookout Hack Site; b) Clark Fork: Clark Fork River Canyon Historic Eyrie, Clark Fork Delta Hack Site; c) Lake Pend Oreille: Pend Oreille Lake Historic Eyrie

3) Grizzly Bear -- a) Clark Fork, Lake Pend Oreille and Kootenai River: Cabinet-Yaak Proposed Grizzly Bear Recovery Zone; b) Kootenai River: Selkirk Proposed Grizzly Bear Recovery Habitat.

4) Since the translocation of gray wolves from Canada, gray wolves are considered experimental and non-essential south of Interstate 90, north of I-90 they retain their status as endangered.

5) Bull Trout -- a) Kootenai River - 9 locations in creeks; b) Clearwater - 1 river and Dworshak Reservoir; c) Clark Fork - 4 creeks/rivers; d) Lake Pend Oreille - 6 creeks/rivers, plus the Lake; e) Pend Oreille River - 2 rivers.

Updated Species Lists (3/95) – CONT

ATTCHMENT 3

MONTANA

FEDREALLY LISTED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR WITHIN THE COLUMBIA RIVER SYSTEMS OPERATION REVIEW ACTION AREA IN MONTANA

	Status
Mammals	
Grizzly bear (Ursus arctos)	Threatened
Gray Wolf (Conis lupus)	Endangered
Birds	
Bald eagle (Haliaeetus leucocephalus	Endangered
Peregrine falcon (Falco peregrinus)	Endangered
Fish	
Bull trout (Salvelinus confluentus)	C1 candidate
White sturgeon (Acipenser transmontanus)	Endangered
Plants	
Water howellia (Howellia aquatilus)	Threatened

TECHNICAL EXHIBIT F

NATURAL HERITAGE DATA STATE PROTECTED SPECIES DEFINITIONS

Abbreviation	Description
Montana	
E	Endangered
P	Protected
GA	Game Animal
GF	Game Fish
FB	Fur-bearer
MB	Migratory Bird
UB	Upland Bird
NG	Non-Game Wildlife
CD	Closed Season
RH	Restricted Harvest
Idaho	
Animals	
T	Threatened
E	Endangered
G	Game Animal
P	Protected
SC	Species of Special Concern
ESC	Endangered/Species of Special Concern
GSC	Game Animal/Species of Special Concern
PSC	Protected/Species of Special Concern
Plants	
1	State Priority 1. Taxa in danger of becoming extinct or extirpated from Idaho in the foreseeable future.
2	State Priority 2. Taxa likely to be classified as Priority 1 within the foreseeable future in Idaho.

Abbreviation	Description
Plants – CONT	
S	Sensitive
M	Monitor
R	Review
X	Historical/Extirpated
Oregon	
LT	Listed Threatened
LE	Listed Endangered
C	Candidate for listing
SC	Sensitive/Critical
SV	Sensitive/Vulnerable
SP	Sensitive/Peripheral
SU	Sensitive/Unknown
Washington	
Animals	
ST	State Threatened
SE	State Endangered
SS	State Sensitive
SC	State Candidate
SM	State Monitor
Plants	
T	Threatened
E	State Endangered
S	State Sensitive
M	State Monitor
X	Possibly Extinct or Extirpated

STATE PROTECTED PLANTS AND ANIMALS

COMMON NAME	SCIENTIFIC NAME	STATE STATUS
Montana Natural Heritage Data for Animals		
Bald Eagle	*Haliaeetus Leucocephalus*	P
Coeur D'Alene Salamander	*Plethodon Idahoensis*	NG
Common Loon	*Gavia Immer*	P
Great Blue Heron	*Ardea Herodias*	P
Harlequin Duck	*Histrionicus Histrionicus*	MB
Montana Arctic Grayling	*Thymallus Arcticus Montanus*	GFRH
Peregrine Falcon	*Falco Peregrinus*	E
Shorthead Sculpin	*Cottus Confusus*	NG
Tailed Frog	*Ascaphus Truei*	NG
Westslope Cutthroat Trout	*Oncorhynchus Clarki Lewisi*	GF
White Sturgeon	*Acipenser Transmontanus*	GFRH
Montana Natural Heritage Data for Plants		
Adder's-Tongue	*Ophioglossum Vulgatum*	S
Bristly Sedge	*Carex Comosa*	E
Columbia Water-Meal	*Wolffia Columbiana*	S
Deer Indian-Paintbrush	*Castilleja Cervina*	S
Giant Helleborine	*Epipactis Gigantea*	T
Guadalupe Water-Nymph	*Najas Guadalupensis*	S
Maidenhair Spleenwort	*Asplenium Trichomanes*	S
Mountain Holly-Fern	*Polystichum Scopulinum*	S
Mountain Moonwort	*Botrych Ium Montanum*	WL
Pygmy Water-Lily	*Nymphaea Tetragona*	T
Pyramidal Spiraea	*Spiraea X Pyramidata*	S
Shinyleaf Gooseberry	*Ribes Cognatum*	S

Note: All individual or community sightings listed here occurred within 1/4 mile of the river system being evaluated in this SOR.

STATE PROTECTED PLANTS AND ANIMALS – CONT

COMMON NAME	SCIENTIFIC NAME	STATE STATUS
	Montana Natural Heritage Data for Plants – CONT	
Short-Pointed Flatsedge	*Cyperus Acuminatus*	S
Sreddby Willow-Herb	*Epildbium Suffrut Icosum*	WL
Slender Sedge	*Carex Tincta*	U
Slender Wintergreen	*Gaultheria Gvatifolia*	WL
Small Yellow Lady's-Slipper	*Cypripedium Calceolus Var Parviflor*	S
Spalding Campion	*Silene Spaldinoii*	T
Spurred Gentian	*Halenia Deflexa SSP Deflexa*	
Twin Clover	*Trifolium Latifolium*	S
Water Star-Grass	*Heteranthera Dubia*	S
Wedge-Leaved Saltbush	*Atriplex Truncata*	S
Western Witchgrass	*Panicum Occidentale*	WL
Yerba Buena	*Satureja Douglas II*	WL
	Lomatium Geyeri	
	Idaho Natural Heritage Data for Animals	
Bald Eagle	*Haliaeetus Leucocephalus*	E
Gray Wolf	*Canis Lupus*	E
Northern Alligator Lizard	*Elgaria Coerulea*	
Peregrine Falcon	*Falco Peregrinus Anatum*	E
White Sturgeon	*Acipenser Transmontanus*	
Wood Frog	*Rana Sylvatica*	
Yuma Myotis	*Myotis Yumanensis*	

Note: All individual or community sightings listed here occurred within 1/4 mile of the river system being evaluated in this SOR.

STATE PROTECTED PLANTS AND ANIMALS – CONT

COMMON NAME	SCIENTIFIC NAME	STATE STATUS
	Idaho Natural Heritage Data for Plants	
Arrowleaf Coltsfoot	*Petasites Sagittatus*	M
Bank Monkeyflower	*Mimulus Clivicola*	2
Bartonberry	*Rubus Bartonianus*	M
Black Snake-Root	*Sanicula Marilandi*	S
Bristle-Stalked Sedge	*Carex Leptalea*	S
Cusick's Capmas	*Camassia Cusickii*	S
Giant Helleborine	*Epipactis Gigantea*	2
Hazel's Prickly Phlox	*Leptodactylon Pungsp Hazeliae*	
High-Bush Cranberry	*Virumum Trilobum Opulus Var Americanum*	X
Macfarlane's Four-o'clock	*Mirabilis Macfarlanei*	
Nalheur Cryptantha	*Cryptantha Propria*	R
Purple Meadow-Rue	*Thalictrum Dasycarpum*	R
Salmon-Flower Desert-Parsley	*Lomatium Salmoni Florum*	S
Snake Canyon Milkvetch	*Astragalus Vallaris*	M
Wool-Grass	*Scirpus Cyperinus*	M
	Astragalus Microcystis	1
	Cicuta Bulbifera	2
	Crepis Bakeri SSP Idahoensis	2
	Cuscuta Denticulata	1
	Hypericum Majus	2
	Lycopodiella Inundatum	1
	Pentagramma Triangularis SSP Triangulars	1
	Tellima Grandiflora	1

Note: All individual or community sightings listed here occurred within 1/4 mile of the river system being evaluated in this SOR.

STATE PROTECTED PLANTS AND ANIMALS – CONT

COMMON NAME	SCIENTIFIC NAME	STATE STATUS
	Idaho Natural Heritage Data for Plants – CONT	
	Teucrium Canadense Var Occidentale	1
	Thelypodium Laciniatum Var Streptanthoides	S
	Oregon Natural Heritage Data for Animals	
Bald Eagle	*Haliaeetus Leucocephalus*	LT
Bull Trout	*Salvelinus Confluentus*	
Columbia Gorge Hesperian	*Vespericola Columbianus*	
Columbia Pebblesnail or Spire Snail	*Fluminicola Columbiana*	
Columbian White-Tailed Deer	*Odocoileus Virginianus Leucurus*	LE
Commom Loon	*Gavia Immer*	
Dalles Mountain Snail	*Oreohelix Variabilis*	
Giant Columbia River Limpet	*Fisherola Nuttalli*	
Gray Wolf	*Canis Lupus*	LE
Larch Mountain Salamander	*Plethodon Larselli*	SV
Lesser Scaup	*Aythya Affints*	
Long-Billed Curlew	*Numenius Americans*	
Oregon Slender Salamander	*Batrachoseps Wrighti*	SC
Oregon Snail	*Monadenia Fidelis Minor*	
Pacific Fringe-Tailed Bat	*Myotis Thysanodes Ssp*	SV
Pacific Western Big-Eared Bat	*Plecotus Townsendii Townsendii*	SG
Painted Turtle	*Chrysemys Pigta*	SC
Peregrine Falcon	*Falco Peregrinus*	LE
Peregrine Falcon	*Falco Peregrinus Anatum*	LE
Purple Martin	*Progne Subis*	SC
Swainson's Hawk	*Buteo Swainsoni*	SV
Tricolored Blackbird	*Agelaius Tricolor*	SP

Note: All individual or community sightings listed here occurred within 1/4 mile of the river system being evaluated in this SOR.

STATE PROTECTED PLANTS AND ANIMALS – CONT

COMMON NAME	SCIENTIFIC NAME	STATE STATUS
	Oregon Natural Heritage Data for Animals – CONT	
Washington Ground Squirrel	*Spermophilus Washingtoni*	SC
White-Footed Vole	*Arborimus (=Phenacomys) Albipes*	SP
Yellow-Billed Cuckoo	*Coccyzus Americas*	SC
	Oregon Natural Heritage Data for Plants	
Barrett's Penstemon	*Penstemon Barrettiae*	C
Bartonberry	*Rubus Bartonianus*	C
Brandegee's Onion	*Allium Brandegei*	
Columbia Press	*Rorippa Columbiae*	C
Diffuse Stickseed	*Hackelia Diffusa Var Diffusa*	C
Fee Lipfern	*Cheilanthes Feei*	
Gray Cryptantha	*Cryptantha Leucophaea*	
Hazel's Prickly-Phlox	*Leptodactylon Pungens Ssp Hazeliae*	C
Hepatip Monkeyflower	*Mimulus Jungermannioides*	C
Hood River Milk-Vetch	*Astragalus Hoodianus*	3C
Howell's Bentgrass	*Agrostis Howellii*	C
Macfarlane's Four-o'clock	*Mirabilis Macfarlanei*	LE
Northern Wormwood	*Artemisia Campestris Var Wormskiold*	PE
Oregon Bolandra	*Bolandra Oregana*	C
Oregon Daisy	*Erigeron Oreganus*	
Oregon Sullivantia	*Sullivantia Oregana*	C
Robinson's Onion	Allidm Robinsonii	3C
Rosy Lewisia	*Lewisia Columbiana Var Columbiana*	

Note: All individual or community sightings listed here occurred within 1/4 mile of the river system being evaluated in this SOR.

STATE PROTECTED PLANTS AND ANIMALS – CONT

COMMON NAME	SCIENTIFIC NAME	STATE STATUS
Oregon Natural Heritage Data for Plants – CONT		
Silky Lupine	*Lupinus Sericeus Var Egglestonianus*	
Snake River Goldenweed	*Haplopappus Radiatus*	LE
Tall Bugbane	*Cimicifuga Elata*	C
Thompson's Sandwort	*Arenaria Franklinii Var Thompsonii*	C
Violet Suksdorfia	*Suksdorfia Violacea*	
Watson Desert-Parsley	*Lomatium Watsonii*	
White Meconella	*Meconella Oregana*	C
	Erigeron Howellii	C
Washington Natural Heritage Data for Animals		
American White Pelican	*Pelecanus Erythorhynchos*	SE
Ash-Throated Flycatcher	*Myiarchus Cinerascens*	SM
Bald Eagle	*Haliaeetus Leucocephalus*	ST
Black-Crowned Night-Heron	*Nycticorax Nycticorax*	SM
Brandt'b Cormorant	*Phalacrocorax Penicillatus*	SC
Burrowing Owl	*Athene Cunicularia*	SC
California Mountain Kingsnake	*Lampropeltis Zonata*	SC
Caspian Tern	*Sterna Caspia*	SM
Columbia River Tiger Beetle	*Cicindela Columbica*	SC
Columbian White-Tailed Deer	*Odocoileus Virginianus Leucurus*	SE
Common Loon	*Gavia Immer*	SC
Compton Tortoiseshell	*Nymphalis Vau-Album Watsoni*	SM
Dunn's Salamander	*Plethodon Dunni*	SC
Ferruginous Hawk	*Buteo Recalis*	ST

Note: All individual or community sightings listed here occurred within 1/4 mile of the river system being evaluated in this SOR.

STATE PROTECTED PLANTS AND ANIMALS – CONT

COMMON NAME	SCIENTIFIC NAME	STATE STATUS
Washington Natural Heritage Data for Animals – CONT		
Forster's Tern	*Sterna Forsteri*	SM
Giant Columbia River Limpet	*Fisherola Nuttalli*	SC
Giant Columbia River Spire Snail	*Fluminicola Columbiana*	SC
Golden Eagle	*Aquila Chrysaetos*	SC
Grasshopper Sparrow	*Ammodramus Savannarum*	SM
Gray-Tailed Vole	*Microtus Canicaudus*	SM
Great Blue Heron	*Ardea Herodias*	SM
Great Egret	*Casmerodius Albus*	SM
Immaculate Green Hairstreak	*Callophrys Affinus Affinis*	SM
Juniper Hairstreak	*Mitoura Siva Ssp.*	SC
Larch Mountain Salamander	*Plethodon Larselli*	SC
Lewis' Woodpecker	*Melanerpes Lewis*	SC
Long-Billed Curlew	*Numenius Americanus*	SM
Long-Legged Myotis	*Myotis Volans*	SM
Merlin	*Falco Columbarius*	SM
Merriam's Shrew	*Sorex Merriami*	SC
Mountain Sucker	*Catostomus Platyrhynchus*	SM
Night Snake	*Hypsiglena Torquata*	SM
Northern Grasshopper Mouse	*Onychomys Leucogaster*	SM
Olympic Salamander	*Rhyacotriton Olympicus*	SM
Ord's Kangaroo Rat	*Dipodomys Ordii*	SM
Oreas Anglewing	*Polygonia Orpas*	SM
Osprey	*Pandion Haliaetus*	SM
Pale Crescent	*Phyciodes Pallidus Barnesi*	SM
Pallid Bat	*Antrozous Pallidus*	SM

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STATE PROTECTED PLANTS AND ANIMALS – CONT

COMMON NAME	SCIENTIFIC NAME	STATE STATUS
Washington Natural Heritage Data for Animals – CONT		
Peregrine Falcon	*Falco Peregrinus*	SE
Prairie Falcon	*Falco Mexicanus*	SM
Purple Martin	*Progne Subis*	SC
Pygmy Rabbit	*Brachylagus Idahoensis*	SE
Ring-Necked Snake	*Diadophis Punctatus*	SM
Sage Sparrow	*Amphispiza Belli*	SC
Sagebrush Vole	*Lagurus Curtatus*	SM
Sand Roller	*Percopsis Transmontana*	SM
Sharp-Tailed Snake	*Contia Tetnuis*	SM
Shepard's Parnassian	*Parnassius Clodius Shepardi*	SC
Silver-Bordered Bog Fritillary	*Boloria Selene Atrocostalis*	SC
Small-Footed Myotis	*Myotis Leibii*	SM
Southern Alligator Lizard	*Elgaria Multicarinata*	SM
Striped Whipsnake	*Masticophis Taeniatus*	SC
Swainson's Hawk	*Buteo Swainsoni*	SC
Sylvan Hairstreak	*Satyrium Sylvinum Sylvinum*	SM
Tawny-Edged Skipper	*Polites Themistocles*	SM
Tiger Salamander	*Ambystoma Tigrinum*	SM
Turkey Vulture	*Cathartes Aura*	SM
Viceroy	*Limenitis Archippus Lahontani*	SM
Western Gray Squirrel	*Sciurus Griseus*	ST
Western Pipistrelle	*Pipistrellus Hesperus*	SM
Western Pond Turtle	*Clemmys Marmorata*	SE
White Salmon Pocket Gopher	*Thomomys Talpoides Limobus*	SM
Woodhouse's Toad	*Bufo Woodhousei*	SM

Note: All individual or community sightings listed here occurred within 1/4 mile of the river system being evaluated in this SOR.

STATE PROTECTED PLANTS AND ANIMALS – CONT

COMMON NAME	SCIENTIFIC NAME	STATE STATUS
Washington Natural Heritage Data for Plants		
Alaska Plantain	*Plantago Macrocarpa*	S
Arthur's Milk-Vetch	*Astragalus Arthuri*	S
Barrett's Penstemon	*Penstemon Barrettiae*	T
Bear's-Foot Sanicle	*Sanicula Arctopoides*	S
Bog Clubmoss	*Lycopodium Inundatum*	S
Bolandra	*Bolandra Oregana*	S
Boreal Bedstraw	*Galiun Kamtschaticum*	
Bristly Cryptantha	*Cryptantha Interrupta*	S
Canadian Single-Spike Sedge	*Carex Scirpoidea Var Scirpoidea*	S
Clackanas Corydalis	*Corydalis Aquae-Gelidae*	T
Clustered Lady's-Slipper	*Cypripedium Fasciculatum*	T
Columbia Milk-Vetch	*Astragalus Columbianus*	T
Cusick's Desert-Parsley	*Lomatium Cusickii*	X
False-Pimpernel	*Lindernia Anagallidea*	S
Fee Lipfern	*Cheilanthes Feei*	S
Few-Flowered Sedge	*Carex Pauciflora*	S
Fringed Pinesap	*Pleuricospora Fimbriolata*	S
Giant Helleborine	*Epipactis Gigantea*	S
Gray Cryptantha	*Cryptantha Leucophaea*	S
Great Polemonium	*Polemonium Carneum*	S
Green-Fruited Sedge	*Carex Interrupta*	S
Hoover's Tauschia	*Tauschia Hooveri*	T
Howellia	*Howellia Aquatilis*	E
Idaho Gooseberry	*Ribes Oxyacanthoides Ssp Irriguum*	S
Large-Awn Sedge	*Carex Macrochaeta*	S

Note: All individual or community sightings listed here occurred within 1/4 mile of the river system being evaluated in this SOR.

STATE PROTECTED PLANTS AND ANIMALS – CONT

COMMON NAME	SCIENTIFIC NAME	STATE STATUS
Washington Natural Heritage Data for Plants – CONT		
Leiberg's Tauschia	*Tauschia Tenuissima*	X
Longsepal Globemallow	*Iliamna Longisepala*	S
MacCall's Willow	*Salix Maccalliana*	S
Mt. Rainier Lousewort	*Pedicularis Rainierensis*	S
Northern Grass-of-Parnassus	*Parnassia Palustris Var Neogaea*	S
Northern Microseris	*Microseris Borealis*	S
Oregon Coyote-Thistle	*Eryngium Petiolatum*	T
Oregon Daisy	*Erigeron Oreganus*	S
Pacific Lanceleaved Springbeauty	*Claytonia Lanceolata Var Pacifica*	S
Pale Blue-Eyed Grass	*Sisyrinchium Sarmentosum*	T
Palouse Goldenweed	*Haplopappus Liatriformis*	T
Palouse Milk-Vetch	*Astragalus Arrectus*	S
Persistentsepal Yellowcress	*Rorippa Columbiae*	E
Pine Broomrape	*Orobanche Pinorum*	S
Pink Fawn-Lily	*Erythronium Revolutum*	S
Piper's Daisy	*Erigeron Piperianus*	S
Poor Sedge	*Carex Paupercula*	S
Prairie Lupine	*Lupinus Cusickii*	S
Pulsifer's Monkey-Flower	*Mimulus Pulsiferae*	S
Purple Meadowrue	*Thalictrum Dasycarpum*	S
Pygmy Saxifrage	*Saxifraga Debilis*	S
Queen-of-the-Forest	*Filipendula Occidentalis*	S
Rollins' Desert-Parsley	*Lomatium Rollinsii*	T
Ross' Avens	*Geum Rossii Var Depressum*	S
Sagebrush Stickseed	*Hackelia Hispida Var Disjuncta*	S

Note: All individual or community sightings listed here occurred within 1/4 mile of the river system being evaluated in this SOR.

STATE PROTECTED PLANTS AND ANIMALS – CONT

COMMON NAME	SCIENTIFIC NAME	STATE STATUS
Washington Natural Heritage Data for Plants – CONT		
Saw-Leaved Sedge	*Carex Scopulorum Var Prionophylla*	S
Scandinavian Sedge	*Carex Norvegica*	S
Several-Flowered Sedge	*Carex Pluriflora*	S
Showy Stickseed	*Hackelia Venusta*	E
Siskiyou False-Hellebore	*Veratrum Insolitum*	S
Skunk Polemonium	*Polemonium Viscosum*	S
Small Northern Bog-Orchid	*Platanthera Obtusata*	S
Small-Flowered Trillium	*Trillium Parviflorun*	S
Smoky Mountain Sedge	*Carex Proposita*	S
Smooth Desert-Parsley	*Lomatium Laevigatum*	S
Snake Canyon Desert-Parsley	*Lomatium Serpentinum*	S
Soft-Leaved Willow	*Salix Sessilifolia*	S
Subalpine Spiraea	*Spiraea Densiflora Var Splendens*	S
Tall Agoseris	*Agoseris Elata*	S
Tall Bugbane	*Cimicifuga Elata*	S
Thompson's Chaenactis	*Chaenactis Thompsonii*	S
Thompson's Clover	*Trifolium Thompsonii*	T
Torrey's Peavine	*Lathyrus Torreyi*	X
Tweedy's Willow	*Salix Tweedyi*	S
Umatilla Gooseberry	*Ribes Oxyacanthoides Ssp Cognatum*	S
Umtanum Desert-Parsley	*Lomatium Quintuplex*	S
Washington Polemonium	*Polemonium Pectinatum*	E
Water (Purple) Avens	*Geum Rivale*	S
Water Lobelia	*Lobelia Dortmanna*	S

Note: All individual or community sightings listed here occurred within 1/4 mile of the river system being evaluated in this SOR.

STATE PROTECTED PLANTS AND ANIMALS – CONT

COMMON NAME	SCIENTIFIC NAME	STATE STATUS
Washington Natural Heritage Data for Plants – CONT		
Western Ladies-Tresses	*Spiranthes Romanzoffiana Var Porrifolia*	S
White Meconella	*Meconella Oregana*	S
Woodsage	*Teucrium Canadense Ssp Viscidum*	S
Yellow Mountain-Avens	*Dryas Drummondii*	S
	Antennaria Parvifolia	S
	Arabis Crucisetosa	S
	Artemisia Campestris Var Wormskioldii	E
	Aster Curtus	S
	Astragalus Geyeri	S
	Astragalus Riparius	S
	Astragalus Microcystis	S
	Carex Hystricina	S
	Carex Densa	S
	Collinsia Sparsiflora Var Bruciae	S
	Cyperus Rivularis	S
	Eleocharis Rostellata	S
	Githopsis Specularioides	S
	Hackella Diffusa Var Diffusa	S
	Heuchera Grossulariifolia Var Tenuifolia	S
	Isoetes Nuttallii	S
	Juncus Kelloggii	S
	Limosella Acaulis	S
	Linanthus Bakeri	S

Note: All individual or community sightings listed here occurred within 1/4 mile of the river system being evaluated in this SOR.

STATE PROTECTED PLANTS AND ANIMALS – CONT

COMMON NAME	SCIENTIFIC NAME	STATE STATUS
Washington Natural Heritage Data for Plants – CONT		
	Lobelia Kalmii	T
	Lomatium Suksdorfii	S
	Machaerocarpus Californicus	S
	Mimulus Suksdorfii	S
	Montia Diffusa	S
	Navarretia Tagetina	T
	Nicotiana Attenuata	S
	Oenothera Pygmaea	S
	Oxalis Suksdorfii	S
	Oxytropis Campestris Var Columbiana	S
	Petrophytum Cinerascens	T
	Poa Nervosa Var Nervosa	S
	Poa Gracillima Var Multnoma	S
	Poa Unilateralis	T
	Rubus Nigerrimus	T
	Samolus Parviflorus	S
	Spartina Pectinata	S
	Tillaea Aquatica	S

Note: All individual or community sightings listed here occurred within 1/4 mile of the river system being evaluated in this SOR.

TECHNICAL EXHIBIT G

LIST OF PREPARER'S

KEN BRUNNER – B.S. Wildlife Biology, University of Washington, 1976. Sixteen years experience as a Wildlife Biologist with U.S. Army Corps of Engineers. Prepared parts of the affected environment and wildlife impacts for Chief Joseph Dam, Albeni Falls Dam, Libby Dam, Hungry Horse Dam, Flathead Lake, Flathead River between Hungry Horse Dam and Kerr Dam, Kootenai River between Libby Dam and Canada.

GARY BUNN – B.S. Wildlife Management, Texas Tech University, 1976 16 years experience as a Wildlife Biologist with U.S. Army Corps of Engineers. Prepared parts of the affected environment and wildlife impacts for the Brownlee Project and Hells Canyon of the Snake River sections.

JOHN CANNON – B.A., Biology, Williams College, Williamstown, MA, 1971. M.F.S. Yale, New Haven, Conn., 1973. 20 years terrestrial ecology and field investigations with Ebasco Services. Prepared parts of the Wildlife Technical Appendix dealing with vegetation impacts.

CARL CHRISTIANSON – M.S. Wildlife Management, University of Maryland 7 years of experience as a Wildlife Biologist with the U.S. Army Corps of Engineers.Prepared parts of the affected environment and wildlife impacts section for the McNary, Ice Harbor, Lower Monumental, Little Goose, Lower Granite, and Dworshak Projects and the Lower Clearwater River.

GEOFF DORSEY – B.S. Wildlife Science, Oregon State University, 1977 M.S. Wildlife Science, Oregon State University, 1982 12 years of experience as a Wildlife Biologist with the U.S. Army Corps of Engineers. Prepared parts of the affected environment and wildlife impacts for the Lower Columbia River Projects (Bonneville, The Dalles, John Day)

DICK GIGER – B.S. and M.S. in Wildlife Management, Oregon State University, 1962–65. 29 years experience with State/Federal agencies. Prepared parts of the affected environment and wildlife impacts section for Grand Coulee and parts of the methodology discussion.

ROSY MAZAIKA – B.S. Ecology from Unity College, Maine, 1986 M.S. Wildlife Ecology from University of Arizona, Tucson, 1989 3 years Environmental Consultant, 1 year Research Scientist. Prepared parts of the affected environment and wildlife impacts section for the Hanford Reach of the Columbia River.

BOB SHANK – B.S. Biology from Eastern Washington University, 1975 M.R.P. Environmental Science Regional Planning from Washington State University, 1983 10 years experience as a Resource Planner, with Federal, State, and Regional Agencies. Prepared parts of the methods and scope sections of the wildlife analysis.

DON TREASURE – B.S. Wildlife Management, Humboldt State University, CA, 1974 16 years of experience with Federal Agencies. Chaired Wildlife Work Group, prepared parts of the methods and scope and the system wide effects discussion for the wildlife analysis.

TECHNICAL EXHIBIT H

PREFERRED ALTERNATIVE BELOW BONNER'S FERRY

The Kootenai River between Bonner's Ferry, ID, and the US – Canadian border is constrained by levees for its entire length. Just downstream of Bonner's Ferry, north and east of the river and outside of the levees, is Kootenai National Wildlife Refuge, which is not expected to be directly affected by the Preferred Alternative. However, the low flows present in the fall will make it more difficult to pump water into refuge ponds and may require relocation of the pump intakes.

Within the leveed channel, several forested areas exist. The areas around RM 138 and RM 135, and the island at RM 143, appear to be the most extensive (estimated at 1,000 acres or more). These areas likely support riparian vegetation similar to the Hideaway Islands, a BLM Research Natural Area located at RM 158. The Hideaway Islands support three species of cottonwood (black, *Populus trichocarpa,* narrowleaf, *P. angustifolia*, and eastern, *P. deltoides*). The dominant understory is red–osier dogwood (*Cornus stolonifera*). Willow (*Salix sp.*) is common in some areas. Typical grass cover includes *Poa pratensis* and *Calamagiostis sp.*. This habitat supports white–tail deer, furbearers, waterfowl, nongame birds, ruffed grouse, and possibly wood frogs (a sensitive species). This habitat has been fairly stable since Libby Dam was completed in 1972. Libby Dam controlled the flooding that historically determined riparian vegetative cover.

The Preferred Alternative will increase the flows in June and reduce them in September and October by substantial amounts (Table H–1). This more closely duplicates the uncontrolled flow regime. This will have the effect of moving the vegetative complex within the levees to an earlier successional stage, changing the composition of vegetation present. The numbers of mature cottonwood trees will likely decline somewhat over time, and the amount of cobble exposed will increase in the fall. The riparian habitat will show more diversity of structure as various flood events affect scour and new plant establishment in species–specific ways.

This will affect wildlife populations and species composition. Species that prefer climax riparian forests (cavity nesting species of birds, for example) will likely decline in these areas, while species that prefer earlier successional stages (white–tail deer, for example) will likely show some local increase. None of these changes are expected to be significant, as these habitats are not limiting, and substantial acreage of forested areas are available in the area.

These changes in flow will continue northward into Canada and may effect the Canadian reach of the Kootenay River (above Kootenay Lake). Of particular concern is potential impacts to the Crestone Valley Wildlife Area, located just north of the Idaho/Canadian border. However, personnel from Crestone Valley Wildlife Area were instructed by their superiors not to comment on the effects of changing flows relative to the Preferred Alternative. As a result, the Wildlife Work Group cannot determine the effects of the preferred alternative on wildlife values in the Canadian Reach of the Kootenay River, but believe they would be similar to the effects within the United States.

Table H–1. Bonner's Ferry Flows – Average of Period of Record

	BASE CASE (1a)	NO ACTION (2c)	PREFERRED ALT.
MARCH	9645	9714	10457
APRIL 15	11651	11496	11459
APRIL 30	16525	16884	16651
MAY	20892	20815	25867
JUNE	18517	17458	30249
JULY	15158	15404	13899
AUG. 15	12668	11951	12294
AUG. 31	10256	9962	12118
SEPT.	13400	14329	7478
OCT.	10948	11126	5974