

WILDLIFE PROTECTION, MITIGATION AND ENHANCEMENT PLANNING
FOR
GRANDCOULEEDAM

FINAL REPORT

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ABSTRACT

The development and operation of Grand Coulee Dam inundated approximately 70,000 acres of wildlife habitat under the jurisdictions of the Colville Confederated Tribes, the Spokane Tribe, and the State of Washington. Under the provisions of the Pacific Northwest Electric Power Planning and Conservation Act of 1980, this study reviews losses to wildlife and habitat, and proposes mitigation for those losses. Wildlife loss estimates were developed from information available in the literature. Habitat losses and potential habitat gains through mitigation were estimated by a modified Habitat Evaluation Procedure. The mitigation plan proposes 1) acquisition of sufficient land or management rights to land to protect Habitat Units equivalent to those lost (approximately 73,000 acres of land would be required), 2) improvement and management of those lands to obtain and perpetuate target Habitat Units, and 3) protection and enhancement of suitable habitat for bald eagles. Mitigation is presented as four actions to be implemented over a 10-year period. A monitoring program is proposed to monitor mitigation success in terms of Habitat Units and wildlife population trends.

I. INTRODUCTION

I.1 Study Introduction

The Pacific Northwest Electric Power Planning and Conservation Act of 1980 prescribed that measures be implemented to protect, mitigate and enhance fish and wildlife affected by development and operation of hydropower projects on the Columbia River System. To this end, the Northwest Power Planning Council developed the Columbia Basin Fish and Wildlife Program, which established a process for reviewing hydropower projects, evaluating losses and developing and implementing mitigation plans. Hydropower projects are currently being reviewed according to this process on a project-by-project basis.

The Northwest Power Planning Council directed the parties reviewing Grand Coulee Dam project to move directly into the mitigation planning phase of the Wildlife Program (Section 1004(b)(3)). Representatives from the wildlife agencies, tribes, project operator, Bonneville Power Administration (BPA), Pacific Northwest Utilities Conference Committee (PNUCC) and Council staff met on April 2, 1985 to discuss the planning effort. Out of that meeting a working paper was drafted which outlined concerns and direction for planning. To avoid delay and potential disagreements due to absence of a loss statement and unresolved questions regarding crediting of losses, the working paper proposed mitigation concepts and a conceptual goal of acquisition of lands or management rights to lands totaling approximately 70,000 acres, and improvement and maintenance of those lands to increase and maintain carrying capacity for wildlife.

A Study Oversight Committee was formed with representatives of each of the above parties. This committee provided guidance and direction for all aspects of the study and approved each phase of the work.

I.2 Scope of Study

This study is intended to fulfill the requirements of Section 1004(b)(2) & (3) of the Columbia Basin Fish and Wildlife Program for Grand Coulee Dam on the Columbia River in the State of Washington. It considers impacts on wildlife from inundation by Franklin D. Roosevelt (FDR) Reservoir, and impacts of reservoir level fluctuations from project operation. Impacts due to downstream water fluctuations, recreational use, project facilities, roads, powerlines, etc. as well as the positive and negative effects of irrigation development of the Columbia Basin Project were not considered. Impacts on fish have been addressed in a separate study (Scholz et al. 1985).

Impacts on exotic wildlife such as pheasant, chukar, California quail and gray partridge were not considered in this study. Additionally, impacts on waterfowl other than Canada geese were not considered. The Study Oversight Committee decided that mitigation efforts were most needed for native wildlife, and that mitigation for Canada goose was more necessary than for other waterfowl.

II. DESCRIPTION OF STUDY AREA

II.1 Project History and Description

The completion of Grand Coulee Dam in 1941 impounded the Columbia River to form Franklin D. Roosevelt (FDR) Reservoir which is 151 miles long and averages 4,650 feet wide. In addition to the Columbia River, the reservoir includes nine miles of the Sanpoil River, 32 miles of the Spokane River, two miles of the Colville River, 11 miles of the Kettle River, and an estimated 20-30 miles of tributary streams (USBR 1976). At full pool level (elevation 1,290 feet) the reservoir is 385 feet deep near the dam, has a surface area of about 82,270 acres (USBR 1977), and holds approximately 5,000,000 acre feet of water or about 10% of the Columbia River's average annual flow at the Canadian border (USBR 1984). The reservoir level may vary a foot or more daily depending upon water withdrawals for power and irrigation needs. During spring, the pool level is drawn down 50-82 feet to store and maximize power production from spring runoff and to prevent flooding (Appendix 1.3).

II.2 Environment of the Study Area

The study area consisted of FDR Reservoir from Grand Coulee Dam to the Canadian Border, and the lands between the reservoir and surrounding ridges. FDR Reservoir overlaps two very different ecologic and physiographic zones. The northern portion of the reservoir, which runs southerly from the Canadian border to approximately Hawk Creek, lies within the Okanogan Highlands and is characterized by forest vegetation (Figures 1 & 2). The southern portion of the reservoir, running westerly from Hawk Creek to Grand Coulee Dam, lies within the Columbia Basin and is characterized by shrub-steppe vegetation. The environment and vegetation of the study area is further described in USBR (1976) and Rogers (1941). For the purposes of this study the reservoir was subdivided into eight reaches based upon vegetation, aspect, geology and tributary drainage (Figure 3).

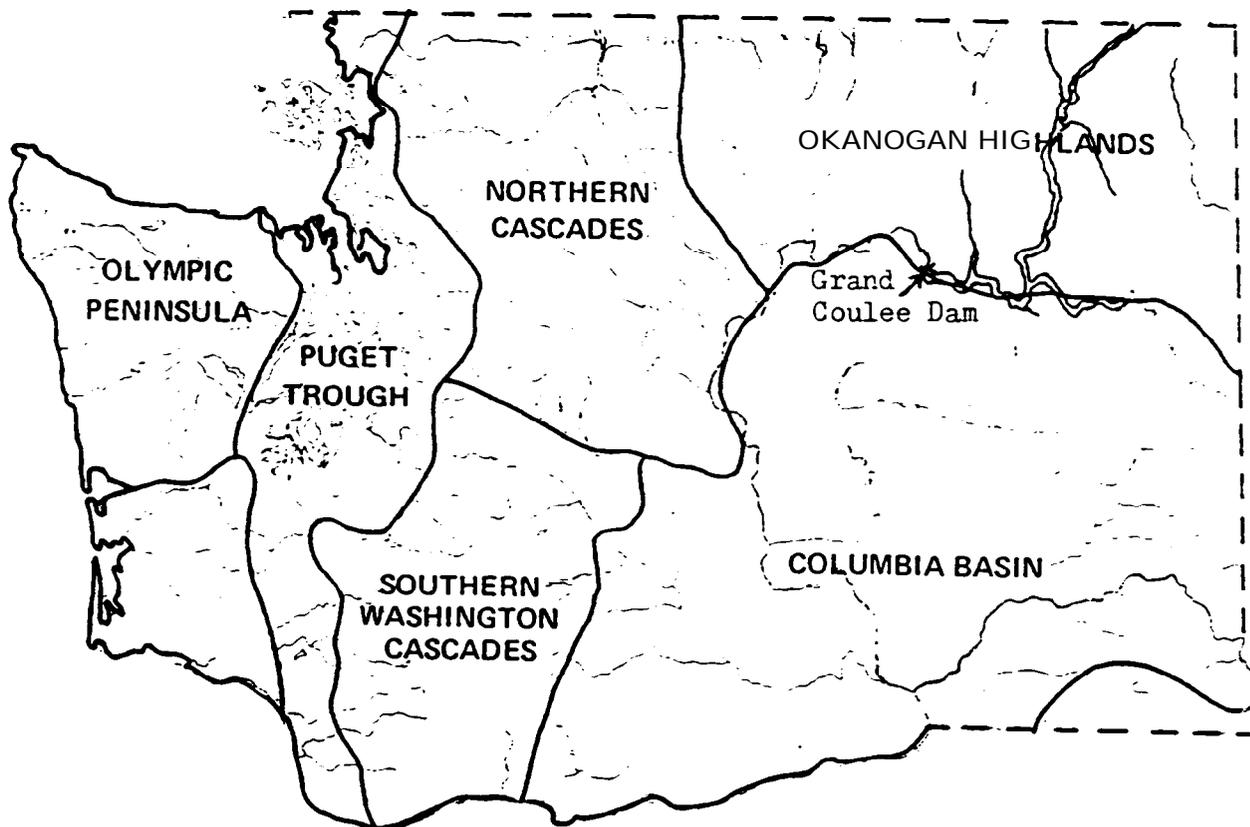


Figure 1. Physiographic regions in Washington (from Franklin & Dyrness 1973)

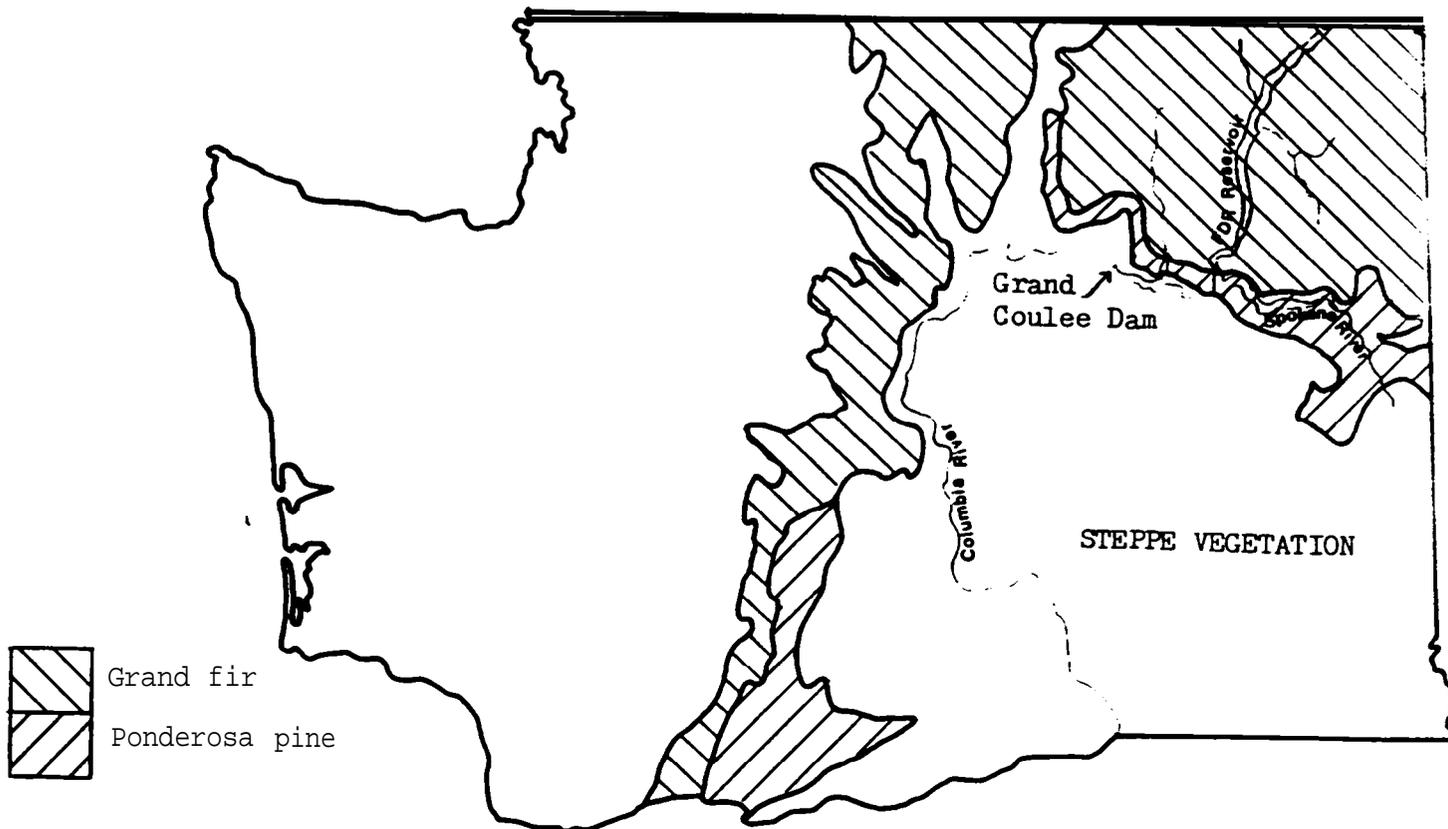


Figure 2. Major vegetation zones in Eastern Washington (adapted from Franklin and Dyrness 1973)

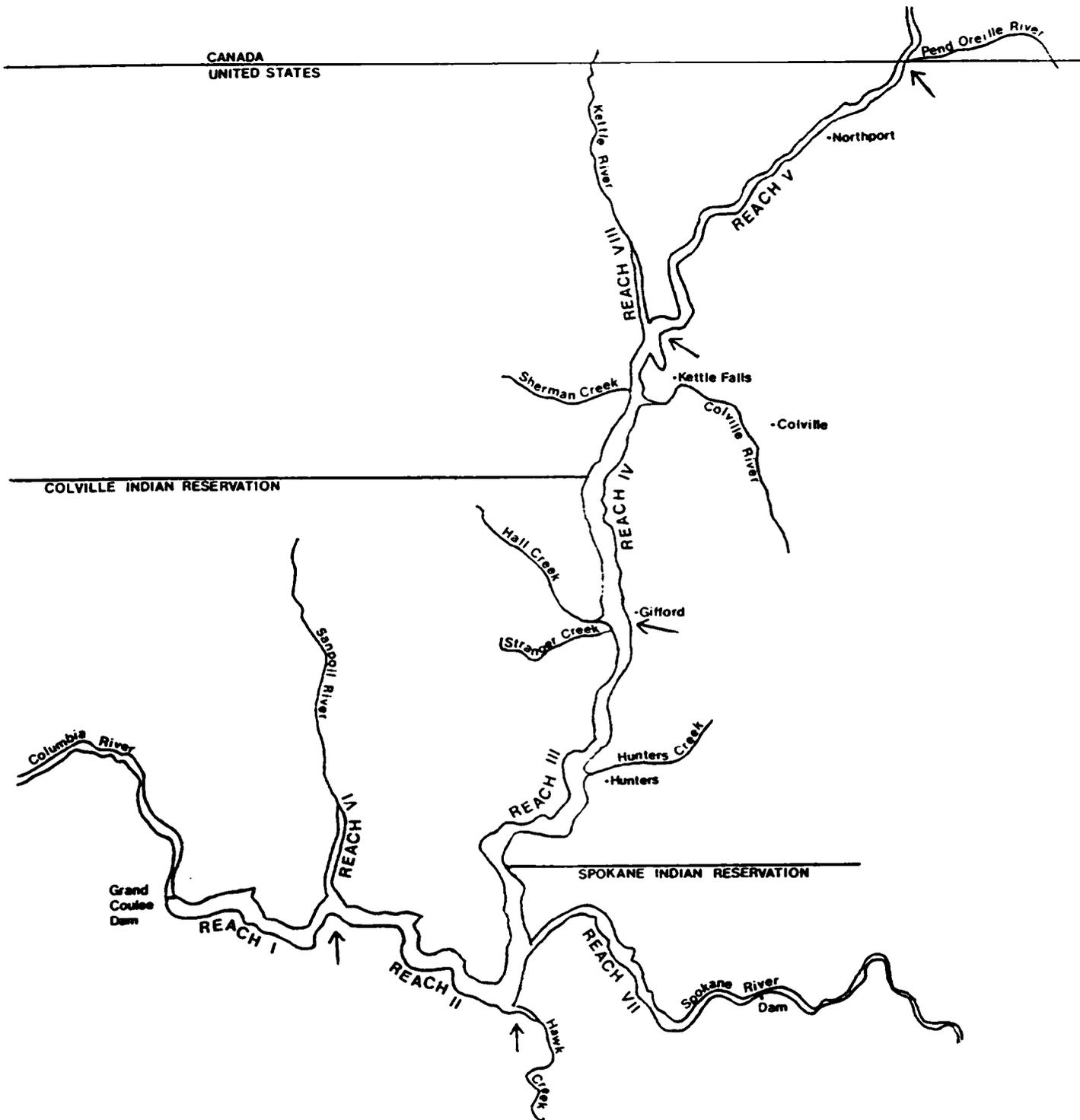


Figure 3. Eight river reaches on FDR Reservoir:

- I. Grand Coulee Dam to Sanpoil River
- II. Sanpoil River to Hawk Creek
- III. Hawk Creek to Gifford Ferry
- IV. Gifford Ferry to Kettle River
- V. Kettle River to Canadian Border
- VI. Sanpoil River
- VII. Spokane River
- VIII. Kettle River

III. METHODS AND MATERIALS

111.1 Assessment of Habitat Loss

Vegetation typing of inundated lands was based on 1930 U.S. Army Corps of Engineers (COE) (scale 1:22,500) and 1936 Soil Conservation Service (SCS) (scale 1:31,680) pre-project aerial photographs, and oblique photographs from the literature and U.S. Bureau of Reclamation (USBR) and National Park Service (NPS) archives. The aerial photographs were compared to 1974 aerial photography (showing the reservoir drawn down to 1,140') to draw the boundary of present-day FUR Reservoir onto mylar overlays. Vegetation types within the reservoir boundary were delineated and drawn onto the overlays with the aid of a mirror stereoscope. Vegetation types were classified after Payne et al (1976). Their vegetation typing and transects of lands above 1,290' maximum pool elevation were used as a check of our vegetation typing in lieu of ground truth information.

Aerial photographs were stratified by river reach, and one third of each reach was selected as a representative sample for planimetry of vegetation mapping. Planimetry was done with a mechanical, compensating polar planimeter. Results were summed for each vegetation type, but kept separate by river bank and river reach. Photographs of river segments not selected for detailed vegetation planimetry were planimetered to determine the area of each river bank inundated by FUR Reservoir. Acres of each vegetation type were then expressed as a percent of each river bank in each river reach, and as a percent of the total study area. Finally the percent of each vegetation type of the total study area was pro-rated to USBR figures for total acres of state and tribal lands inundated by the project.

III.2 Assessment of Wildlife Loss

A list of wildlife species known to occur within the project area was developed from the literature (Appendix 1.5). From this list, eleven indicator species were chosen to represent wildlife guilds affected by the project. Historical, ecological and population information was compiled for indicator species. Since only meagre pre-project wildlife data are available, project-related wildlife losses were estimated using population density figures from the literature with our data on inundated vegetation types (Appendix 3.2). Deer losses were estimated from information in WDG files on specific winter ranges above the 1,290' elevation and estimated maximum deer wintering densities at sustainable populations. These winter range boundaries and population densities were then projected to habitat which formerly existed below the reservoir level (Appendix 3.3).

III.3 Assessment of Habitat Unit Loss

A Habitat Unit is defined as one acre of optimum habitat for a given indicator species. Habitat Units lost as a result of the project were determined using a modification of the Habitat Evaluation Procedure developed by U.S. Fish and Wildlife Service (USFWS 1980a. and 1980b.) Habitat Unit calculations were based upon vegetation typing of pre-project aerial photographs coupled with

-- = no value
 F = food
 WF = winter food
 SF = spring-fall food
 C = cover
 WC = winter cover
 R = reproduction

	shrub-steppe	macrophyllous shrub	ponderosa pine savanna	mixed savanna	ponderosa pine forest	broadleaf forest	mixed forest	riparian	ag - forage (pasture & crops)	ag - grains	ag - orchard	sand/gravel/cobble	rock/bare ground/dunes
Canada goose	--	--	--	--	--	--	--	SF	SF	SF WF	--	F C	--
sage grouse	C F R	--	--	--	--	--	--	--	SF R	R	--	--	--
sharp-tailed grouse	F C R	WF C	F C R	F C R	--	--	--	WF C	F R	F R	WF	--	--
ruffed grouse	--	F C	--	F	F C R	F C R	F C R	F C R	--	--	--	--	--
mourning dove	--	R	--	--	--	--	--	R	--	F	C R	--	--
mule deer	F C R	F C	F C R	F C R	C	F C	F C	F C R	F	F	WF	--	--
white-tailed deer	--	F C	--	F	F C R	F C R	F C R	F C R	F	F	WF	--	--
riparian (composite model)	--	--	--	--	--	--	--	F C R	--	--	--	--	--

Figure 4 Indicator Species by Vegetation Type Matrix

Parcel vegetation types were mapped onto aerial photographs and orthophoto maps. For parcels on the Spokane Reservation, cover-type maps previously developed for the tribal forestry department were used (Zamora 1983). Acreages of each vegetation type were measured by planimetry with a mechanical, compensating polar planimeter. Present Habitat Units and potential gain in Units through management and improvement were determined as in Section III.3 above.

III.5 Mitigation Plan & Alternatives Considered

Losses due to the project and possible mitigation actions were reviewed. Actions were selected which provided the greatest benefits in terms of high-priority Habitat Units and cost effectiveness. Mitigation alternatives considered were as follows:

1) The proposed mitigation plan

This alternative is based on the goal of protecting the same number and kinds of Habitat Units as was lost due to inundation by the project. The mitigation goal and objectives benefit wildlife species affected by the project, provide a balance of mitigation benefits among the State and Tribes and are consistent with the study conceptual goal developed by the Study Oversight Committee. Details of the proposal are described in Section V, pages 32-47.

This alternative was selected because it is less costly over the life of the project than alternatives 2 and 3, and addresses important issues not addressed by alternatives 4 and 5,

2) Full redress of habitat losses - i.e. replacement of all Habitat Units lost due to inundation by the project.

Under this alternative, no mitigation credit would be awarded for simple protection of Habitat Units already in existence. Instead, new Habitat Units would be developed through habitat improvement efforts. Habitat Units would be replaced in kind and number for all USFWS "category 1 & 2" species and to the extent possible for other species. This alternative would provide the most benefits to wildlife and be consistent with the mitigation policies of state, federal and tribal wildlife agencies.

This alternative was not selected because: a) land acquisition requirements and total cost would be prohibitively high (refer to Section IV.7, page 30 and Appendix 4.1, page 91), b) the alternative exceeds the terms of the study conceptual goal, and c) in many cases Habitat Unit protection is an equally desirable and less costly goal than Habitat Unit replacement.

3) Full redress of habitat losses, but with all protection, mitigation and enhancement activities restricted to public or tribal lands.

This alternative is similar to alternative 2 above, except there would be no land management rights acquisition costs. Approximately

245,000 acres of public or tribal lands would be needed if habitat on these lands could be improved an average of 30%.

This alternative was not selected because: a) not enough public land could be identified within a reasonable proximity to the project to meet habitat needs and Habitat Unit targets, and b) although the initial cost would be low, annual operation, maintenance and monitoring costs would be high; over time this alternative would cost substantially more than the proposed mitigation plan.

- 4) Trade habitat improvement for waterfowl, furbearers and exotic upland game for lost native wildlife and habitat.

This alternative would allow maximum use of existing USBR lands for mitigation. Columbia Basin Project lands (including deferred and bypassed lands and lands used for project purposes) and federal and state lands currently managed for wildlife by WDG would be improved and intensively managed for wildlife. There would be minimal land acquisition costs, however development and annual operation and maintenance costs would be high.

Although there would be benefits to wildlife, this alternative was not selected because: a) it does not address any of the wildlife problems caused by Grand Coulee Dam nor the critical wildlife issues in the region today (i.e. big game winter range, prairie grouse, shrub-steppe species, habitat fragmentation and threatened species) b) wildlife gains occurring on these lands would be of little benefit to members of the Colville and Spokane Tribes and other residents of Northeastern Washington, and c) the alternative is not consistent with the Northwest Power Planning Act Section 4, (h)(5)&(6)(A) which states in part:

"... The (fish and wildlife) program shall consist of measures to protect, mitigate and enhance fish and wildlife affected by the development, operation and management of such **(hydropower)** facilities..." (emphasis added)

"... The Council shall include in the program measures which it determines on the basis set forth in paragraph (5), will complement the existing and future activities of the Federal and the region's State fish and wildlife agencies and appropriate Indian tribes; . . ."

- 5) Variations of the proposed mitigation plan where additional federal lands are considered first-priority target parcels.

To the extent possible, Bureau of Reclamation lands, Colville National Forest lands, etc. would be improved to provide targeted Habitat Units. The nature of these lands is such that Habitat Units cannot be gained efficiently. Additional Habitat Units needed beyond these would be obtained through protection and improvement of private lands.

These variations were not selected because only a relatively small

portion of targeted Habitat Units can be obtained on these public lands. Most Habitat Units still would need to be obtained from private lands so there appears to be no cost savings from these alternatives. Difficulties in finding public lands suitable for mitigation are described below.

In contrast to this alternative, the proposed plan puts high priority on lands where several different Habitat Unit types are obtained from each parcel. (the proposed plan does not rule out using additional public lands as mitigation, rather it places lands not selected as target parcels at a lower priority level, to be considered if more efficient means are not available.)

The Study Oversight Committee requested that to the extent practical, enhancement of existing federal, state and tribal lands be considered for mitigation needs. Accordingly 35% of the Colville and 70% of the Spokane mitigation options are on tribal lands. Approximately 12% of the mitigation options identified and rated for the State of Washington are on public lands. Other public lands were considered for achieving state mitigation goals but for various reasons were not selected for first priority and were therefore assigned to lower priority levels. Since Habitat Units were not evaluated on low priority lands, these lands are not included in Table 1 below. Identifying additional public lands for mitigation for the State has been difficult due to the following:

- 1) Most state lands managed by DNR near the project are isolated sections and cannot by themselves adequately address the needs of most of the indicator wildlife species.
- 2) Most large blocks of public land are far removed from the project area. (The exceptions to this are Sherman Creek and Banks Lake HMAs and the Colville National Forest. Their suitability is limited by factors discussed below.)
- 3) Deer winter range is a primary mitigation concern, and there is little available on large tracts of public land near the project. Most land in the Colville National Forest is too high in elevation to be reliable deer winter range. Although Banks Lake HMA supports some wintering deer, they are dependent upon adjacent winter wheat fields for forage. During heavy snow years, this forage is unavailable and the animals must move to lower elevation winter range or perish.
- 4) The habitat quality of some dedicated wildlife land is already high and offers little potential for improvement (e.g. Sherman Creek HMA). Further habitat improvement would have to come from intensive management with high annual costs, such as irrigated farming for wildlife.
- 5) Public lands managed for mitigation of other projects pose potential conflicts over jurisdiction, responsibility and mitigation credit if included as mitigation for Grand Coulee Dam.
- 6) Lands within the Columbia Basin Project owned by the Bureau of Reclamation but considered nonarable are not well suited to the needs of

most wildlife species affected by Grand Goulee Dam. These lands do not support sage grouse or sharp-tailed grouse, and do not provide winter range for big game. Since these lands receive less than seven inches of precipitation a year, they cannot support forests or forest wildlife species.

TABLE 1. OWNERSHIP SUMMARY OF LANDS EVALUATED FOR MITIGATION. All lands assumed to be enhanced for increased wildlife potential. All parcels in Appendix 4.3 included.

<u>Land Type</u>	<u>Acres of Land for Each Wildlife Jurisdiction</u>			
	<u>Golville</u>	<u>Spokane</u>	<u>State</u>	<u>Total</u>
Deeded or Allotted Lands	7,300	3,210	83,072	93,582
Public or Tribal Lands	4,000	7,380	11,060	22,440
Total	11,300	10,590	94,132	116,022

III.6 Mitigation Cost Estimates

Mitigation cost estimates are divided into six categories as follows: 1) Habitat Protection, 2) Advanced Design, 3) Development/Enhancement, 4) Annual Operation and Maintenance, 5) Bald Eagle Mitigation, and 6) Annual Monitoring.

Habitat protection: Costs were estimated based on fee title acquisition at the highest estimated cost. Actual costs may be less. If easements can be negotiated, habitat protection costs may also be reduced. Habitat protection costs include purchase or easement price of the land, title insurance, surveying, appraisal fees, site inspection and recording fees.

Cost estimates for state lands are based on local information provided by WDG Regional Lands Agents and two surveys: a) U.S. Farmland Values Study by USDA Agricultural Stabilization and Conservation Service, and b) Pacific Northwest Farmland Values Study by University of Washington. Cost estimates for surveys, appraisals and site inspections were provided by the WDG Engineering and Lands Division. Title insurance costs were calculated from tables provided to WDG by an insurance company.

Costs for easements on Spokane Tribal lands were estimated by the Spokane Tribal Council to be \$400/acre. Costs for deeded and allotted lands within the reservation were estimated to be \$1,000/acre by the Bureau of Indian Affairs, Wellpinit Agency. Costs of surveys, title insurance and site inspection were determined as above.

Costs for deeded and allotted lands within the Golville Reservation were estimated by the Tribal Real Estate Department at \$1,000/acre for irrigated cropland, \$500/acre for nonirrigated cropland, and \$250/acre for nonirrigated pasture. Costs of surveys, title insurance and site inspection were determined as above.

Advanced Design: Costs include field inventory necessary to finalize management plans, development of working drawings for all land management and improvements, siting of improvements, soliciting of bids and quotes, and negotiation of easements and management agreements. These cost estimates are based on advanced design cost estimates for the WDC Cowlitz project of \$12.50/acre.

Development and Enhancement: Costs include all one-time costs necessary to achieve the desired level of habitat quality on mitigation lands. These costs are tentative since actual mitigation parcels have not been secured and advanced design work has not been done. based on preliminary discussions of desired management for target mitigation parcels, we chose \$100/acre as the Development and Enhancement cost estimate for all lands.

Annual Operation and Maintenance (O&M): Includes all recurring costs associated with mitigation lands such as weed control, taxes, personnel and travel associated with management, costs of supervising forestry and agricultural practices contracts, etc. These costs are tentative since actual mitigation parcels have not been secured and advanced design work has not been done. O&M costs for Spokane Tribal lands are based on preliminary management plans. Costs for Colville Tribe and State lands are based on a flat \$20/acre estimate which is consistent with WDG experience with dedicated wildlife lands.

Bald Eagle Mitigation: Costs include compiling information, field investigations, selective habitat improvement on project lands, and protection of roosting and nesting sites. Cost estimates are based on 10 months salary for a biologist at \$2,083/month with 23% benefits and 40% overhead, \$4,000 for travel, aircraft time and expenses, \$5,000 for habitat enhancement, and \$465,300 for habitat protection. The habitat protection cost is based on fee title acquisition at \$1,100/acre of a 660 ft. radius around three separate nest sites, purchase of easements at \$550/acre on surrounding lands (94 acres/site) to establish a 1/4 mile radius buffer zone around each nest site and purchase of easements at \$550/acre on lands surrounding three winter roost sites (126 acres/site) to establish a 1/4 mile radius buffer zone around each site. The latter assumes a minimum size roost site core area. In actuality the size needed for buffer zones varies with site conditions. The sizes used for estimating costs are based on US Fish and Wildlife Service recommendations for nest and roost sites in other areas of Washington. Actual habitat protection costs may be less since landowners may agree to protect sites at lower costs and protection for sites on public lands would be done through management agreements at no cost.

Annual Monitoring: This includes the cost of collecting baseline biological data as well as periodic monitoring of all mitigation lands on a 3-year schedule. Baseline data are needed to assess the effectiveness of proposed mitigation measures. The \$.62/acre cost estimate for Colville Tribe and State lands was based on 10 months salary for a biologist at \$2,083/month with 23% benefits and 40% overhead, plus \$2,050 travel and \$3,000 of monitoring expenses. The \$4.46/acre cost estimate for the Spokane Tribe lands was based on 12 months salary for a biologist a \$2,083/month with 23% benefits and 40% overhead, plus \$5,025 travel and aircraft time and \$1,500 monitoring expenses.

IV. RESULTS AND DISCUSSION

IV.1 Habitat Losses

There are six categories of habitat losses resulting from the construction and operation of Grand Coulee Dam:

- 1) loss of land and vegetation due to inundation
- 2) loss of shoreline due to inundation and slope failure
- 3) loss of special habitats
- 4) loss of structure and diversity
- 5) loss of anadromous fish runs
- 6) loss of river (flowing water) environment

Each of these habitat losses has contributed to the loss of wildlife.

IV.1.1 Loss of Land and Vegetation

Approximately 70,000* acres of land were inundated by FDR Reservoir as follows:

Shrub-steppe uplands.....	14,000 acres
Forested uplands.....	25,000 acres
Agricultural lands.....	15,000 acres
Riparian lands.....	2,000 acres
Barren lands.....	13,000 acres
Islands.....	1,000 acres

Within these general land categories, 20 different vegetation types are discernible on pre-project aerial photographs. The loss of each vegetation type is summarized in Table 2. A description of each vegetation type is provided in Appendix 3.1. Due to time and resource constraints, we did not divide vegetation types into specific climax habitat types, although some extrapolation can be made from the literature (Daubenmire 1970, Daubenmire & Daubenmire 1968, Williams & Lillybridge 1985, Payne et al. 1976).

Although the total loss of riparian vegetation appears relatively small, the impact of this loss on wildlife is disproportionately large. Most wildlife use riparian habitat, and its availability at critical times of the year is a limiting factor in Eastern Washington for many species of public interest (Payne et al. 1976; Oliver 1974).

Riparian habitat typically occurred in narrow bands and was difficult to delineate and measure accurately on the scale of aerial photographs available for this study. Thus we believe the actual loss of riparian habitat is underrepresented by the vegetation figures.

*This includes the Rivers' shorelines between the high and low water levels. USBR has revised its figure for lands inundated by FDR Reservoir to include only lands above the mean high water level. This revised figure is approximately 56,000 acres.

TABLE 2. LAND AND VEGETATION TYPES INUNDATED BY GRAND COULEE DAM (percent of total by wildlife jurisdiction). Vegetation types are described in Appendix 3.1.

	Wildlife Jurisdiction			Total
	Colville	Spokane	State	
Total acres lost ¹	21,100	3,900	45,000	70,000
<u>% Vegetation Type</u>				
shrub-steppe	31.1%	16.3%	13.0%	18.6%
macrophyllous shrub	2.6	1.9	2.3	2.4
ponderosa pine savanna	18.6	26.1	11.6	14.5
mixed savanna	2.3	8.9	14.6	10.6
ponderosa pine forest	7.5	1.7	3.3	4.5
broadleaf forest	0.3	2.3	0.7	0.7
mixed forest	4.0	5.3	4.4	4.3
riparian draws	0.1	0	0.1	0.1
river-edge riparian	0.2	0.9	0.8	0.6
woody riparian	3.9	4.1	0.4	1.7
riparian shrub	0.1	0	0.03	0.1
herbaceous riparian	0.1	0	0.3	0.2
agricultural - forage	3.1	11.4	6.4	5.7
agricultural - grain	8.7	13.7	19.0	15.6
agricultural - orchard	0.02	0.4	4.5	2.9
sand/gravel/cobble	15.9	6.9	17.8	16.6
bare ground	0	0.1	0.2	0.1
rock	1.5	0.03	0.6	0.8
sand dunes	0	0	0.02	0.01
number of islands/bays	21	9	84	114
(net loss of islands ²)	(15)	(6)	(65)	(86)

¹ Acres as reported by USBR (1976) as measured from elevation 1,290' to the river during low water levels.

² Number of islands from pre-project aerial photographs less 3 present-day islands on the Spokane River shown on USGS 15 min. series maps, and less 25 present day islands on the Columbia River reported by Payne et al. (1976, Table 10).

IV.1.2 Loss of Shoreline Usable By Wildlife

We believe the loss of shoreline usable by wildlife is significant, however, the effort necessary to quantify shoreline loss is beyond the limits of this study. Shoreline is an important habitat component for furbearers, waterfowl,

shorebirds, mourning doves, etc. These animals use riparian vegetation and/or aquatic vegetation and organisms associated with the river's edge. The nature of the shoreline (gentle vs. steep) also affects its wildlife value. It appears that FDR Reservoir eliminated good quality shoreline from tributary rivers, and generally degraded shoreline quality along the Columbia River.

A direct loss of shoreline length is apparent on the Sanpoil, Kettle and Colville Rivers, as the creation of FDR Reservoir eliminated the river meanders and shoreline irregularities. On the Columbia and Spokane Rivers, the reservoir both eliminated shoreline by covering meanders and irregularities, and created new shoreline when it backed water into previously dry streambeds. The result appears to be a small net loss of shoreline length along the Spokane River and a large increase in shoreline length along the Columbia River.

Reservoir fluctuations and the annual drawdown have greatly reduced the value of the present-day shoreline by inhibiting the growth of riparian vegetation. For an approximately three-month period, the drawdown separates the terrestrial vegetation from the reservoir by a broad expanse of barren land. This barren zone has little habitat value. In addition, the reservoir's overall habitat value is reduced for species such as Canada goose and beaver which must travel between the water and terrestrial vegetation. Such species are vulnerable to predation while crossing this barren zone.

Wave action and reservoir fluctuations have created steep, eroded banks throughout the reservoir, and extensive areas of landslide activity (Jones and Peterson undated). As of 1984 there were 140 classified landslides along the reservoir rim, occupying approximately 129.3 miles of shoreline (USBR 1984). Steep, eroded banks, even when only a few feet high, are barriers to wildlife such as geese with goslings which need to move freely between the river and land. Slide areas have steep (often near vertical to oververtical) banks, resulting in a total loss of river-edge riparian habitat and shoreline usable by wildlife.

TABLE 3. LINEAR MILES OF SHORELINE LOST TO SLOPE FAILURE (from USBR 1984)

	<u>Jurisdiction</u>			<u>Total</u>
	<u>Colville</u>	<u>Spokane</u>	<u>State</u>	
Shoreline Lost to slides	37.2	11.5	80.6	129.3

FDR Reservoir has approximately 660 miles of shoreline (USBR 1984).

IV.1.3 Loss of Special Habitat Features

Vegetation and the physical environment combine to form some special habitat features not characteristic of the vegetation type alone. Along the Columbia River and its tributaries, these include islands and large-branched trees and snags.

Prior to inundation, 114 islands existed within the future boundaries of FDR Reservoir. Currently there are only 28 islands (Payne et al. 1976, Table 10;

USGS 15' topographic maps), which is a net loss of 86. Islands are used by aquatic mammals, mourning doves, shorebirds, and waterfowl, but are of particular importance as secure nesting sites for Canada geese (Payne et al. 1976; Ball et al. 1981). Payne et al. (1976) noted there appears to be little goose nesting on islands in F'DR Reservoir, and attributes this to the annual spring drawdown. At lower water levels, potentially suitable island nest sites are made accessible to mammalian predators, and nest sites are separated from the water by an expanse of barren mud flats.

Snags and large-branched trees (such as cottonwoods) are important perching, nesting and roosting sites for raptors, especially bald eagles (Fielder and Starkey 1980). Large-branched trees also provide important nest sites for colonial waterbirds such as herons, and are a habitat requirement of many other nongame species. FDR Reservoir inundated most of the snags and large-branched trees along the edge of the Columbia River downriver from Hawk Creek. Due to reservoir fluctuations, wave action and shoreline loss, such trees have not been replaced naturally along the reservoir shoreline. Although trees are common upriver from Hawk Creek, riparian deciduous trees (such as cottonwoods) were eliminated by the reservoir and, with few exceptions, have not been replaced naturally (Payne et al. 1976).

IV.1.4 Loss of Structure, Interspersion and Diversity

The arrangement of habitat components is a determining factor for the diversity of wildlife that can exist and its population potential (Teague & Decker 1979). The land lost to inundation by the reservoir provided much more ecological diversity and structure than is currently provided by remaining lands surrounding the project. This is attributed to the following:

FDR Reservoir inundated the river's floodplain and geologically recent terraces which were a mosaic of flat land, sand dunes, old river bends, channels and bars - all of which fostered differences in plant and animal communities.

Agricultural lands along the river generally consisted of small fields and orchards surrounded by brushy borders, windbreaks and drainage ways. This interspersion of small units of agricultural lands within native vegetation, and adjacent to water and riparian vegetation, resulted in many "edges" and unique combinations of food, water and cover which benefited many kinds of wildlife. Most of these agricultural lands were inundated by FDR Reservoir.

- Prior to inundation, river hydraulics and natural variations in flow created a great deal of structure along a "ragged" river shoreline. Bars of sand and gravel were exposed seasonally (some supported herbaceous plants) and provided feeding and loafing habitat for waterfowl, shorebirds and other animals. Bars and eddies captured floating debris and food material of use to wildlife. Additionally the seasonal rise and fall of the river level created temporary ponds along the shoreline, stranding fish and providing habitat for invertebrates and amphibians, all of which provided food for wildlife further up the food chain.

IV.1.5 Loss of Anadromous Fish Runs

Prior to the blocking of the Columbia River by Grand Coulee Dam, anadromous fish traveled up the river and its tributaries to spawn in significant quantities from May through October (USBR 1976). Migrating and spawned out fish are an important source of food for black bears, grizzly bears, bald eagles, and other carrion-eating mammals and birds. Fish carcasses also provided food for aquatic invertebrates such as crawfish, which would have been an important food source for otter, mink and raccoon. Weaver (1935) reported the young of Pacific lamprey were fed upon by "a great number of birds", and we suspect that smolts were similarly consumed. Completion of the project blocked an estimated 1,140 miles of spawning area (USBR 1976) with a minimum estimated run of between one and two million fish (Scholz et al. 1985). It is likely the loss of this food source had major impacts on the populations and distribution of wildlife.

IV.1.6 Loss of River Environment

Conversion of the rivers to a lake environment changed the species of aquatic organisms and plants. This change in food/prey base in turn has affected wildlife species connected in the food webs. We suspect that water birds associated with rivers and streams (e.g. harlequin ducks and dippers) have been replaced by those associated with deep water (e.g. diving ducks), furbearer populations have been altered, and birds that feed on river fish have been replaced by those which feed on lake fish. Prior to inundation, the rivers supported significant resident fisheries for trout, whitefish and suckers (Scholz et al. 1985). Spawning runs of these fish would have been an additional food resource for fish-eating wildlife. As a result of environmental changes created by FDR Reservoir, these fish populations have been largely replaced by species more adapted to the reservoir environment. These replacement species, such as walleye and brook trout, do not congregate in massive spawning runs, and therefore are not as available as prey for mammals and birds as were the original species (Scholz, pers. commun.).

IV.2 Wildlife Losses

Wildlife existing within the project area below the 1,290' elevation line perished with the pool rise or were displaced and perished soon thereafter. Such loss is usual with any project that eliminates habitat (Oliver and Barnett 1966: Kroodsma 1985). Since approximately 70,000 acres of habitat were permanently eliminated by the reservoir, both the base population (breeding population carried over from the previous year) and the annual wildlife production (young-of-the-year produced by the breeding population) dependent upon that habitat have been permanently lost. Much of the lost habitat was critical for wintering or breeding for wildlife with large home ranges such as deer. Loss of this critical habitat has additionally caused a reduction in wildlife populations on lands outside the inundation line.

IV.2.1 Indicator Species

Approximately 350 wildlife species occur within the study area. Therefore to evaluate losses the Study Oversight Committee selected 11 species as indicators

of general habitat types (Table 4). Basic habitat requirements of most wildlife in the project area correspond to those of one or more of the 11 indicator species.

TABLE 4. HABITAT INDICATOR SPECIES

CANADA GOOSE	(wildlife using the river as primary habitat but nesting on islands and feeding on land)
BALD EAGLE	(wildlife using river-edge riparian - river interface)
SAGE GROUSE	(wildlife dependent upon sagebrush communities)
SHARP-TAILED GROUSE	(wildlife dependent upon grasslands/shrub-steppe with riparian draws, and benefited by limited agriculture)
RUFFED GROUSE	(wildlife requiring forested habitat which includes hardwood trees)
MOURNING DOVE	(wildlife using riparian and agricultural land, particularly orchards and open ground)
LONGEARED OWL	(wildlife requiring grasslands and open agricultural lands adjacent to woody riparian habitat; also an indicator of the small mammal prey base)
FLICKER	(wildlife requiring riparian woodlands with trees large enough for cavity nests)
BEAVER	(wildlife dependent upon both riparian and aquatic habitat)
MULE DEER	(wildlife dependent upon shrub-steppe and river breaks)
WHITE-TAILED DEER	(wildlife dependent upon seral forest habitat with abundant shrubs and openings)

IV.2.2 Initial Losses

The initial wildlife loss due to inundation had two components. First, there was a loss of the breeding animals which maintained the population i.e. the base population or winter population. Second was the loss of the year's production from those breeding animals.

As an indication of the wildlife value of lands inundated by FDR Reservoir, estimates of the loss of wildlife potential were calculated for the 11 indicator species. For the purposes of this document, the ability of a parcel of land under reasonable management to support and produce wildlife is its "wildlife potential". Estimated wildlife potential losses for indicator species are presented in Table 5. Derivation of these estimates is presented in Appendices 3.2 and 3.3.

TABLE 5. ESTIMATED INITIAL LOSS OF POTENTIAL POPULATIONS FOR INDICATOR SPECIES BY JURISDICTION.*

<u>Indicator Species</u>	<u>Wildlife Jurisdiction</u>			<u>Total Project</u>
	<u>Colville</u>	<u>Spokane</u>	<u>State</u>	
Canada goose	59	119	262	440
Bald eagle	**	**	**	**
Sage grouse	767	76	691	1,534
Sharp-tailed grouse	818	194	1,820	2,832
Ruffed grouse	667	112	882	1,661
Mourning dove	4,157	1,444	81,704	87,305
Long-eared owl	34	12	78	124
Flicker	245	77	231	553
Heaver	299	107	688	1,094
Mule deer	619	44	496	1,159
White-tailed deer	570	133	972	1,675

* Derivation of estimates in Appendices 3.2 and 3.3.

** Insufficient historical data to estimate bald eagle losses

IV.2.3 Cumulative Losses

Since initial losses have not been mitigated to date, a loss of wildlife production has continued to occur since full pool level (1,290 ft. elevation) was reached in July of 1942. This cumulative loss is roughly equal to the lost annual production of the base breeding population of each species multiplied by the number of years without mitigation (currently 44 years). Annual production may be as high as 80% of the fall population for wildlife with high reproductive rates such as pheasant, or as low as 19% for wildlife with low reproductive rates such as the grizzly bear. This cumulative loss comprises the prey base in the food web, a host of nongame wildlife of interest to the public as well as the annual "harvestable surplus" of game species. The harvestable surplus loss represents a direct economic loss to the Indian tribes and the State.

IV.3 Habitat Unit Losses

A Habitat Unit is defined as one acre of optimum habitat for a given indicator species or indicator habitat. A secure island nest site is defined as an island site which provides optimum nesting conditions for Canada geese. Habitat Units lost for each indicator species/habitat and nest site losses for Canada geese are presented in Table 6. It is important to note that there is some overlap between Habitat Unit types. Therefore Habitat Units of different types cannot be added together, and great care must be exercised when comparing dissimilar Habitat Unit types.

TABLE 6. SUMMARY OF HABITAT UNITS AND NEST SITES LOST DUE TO PROJECT. One Habitat Unit equals one acre of optimum habitat for the specified indicator species or indicator habitat.

<u>Habitat Unit type</u>	<u>Habitat Units</u>			
	<u>Colville</u>	<u>Spokane</u>	<u>State</u>	<u>Total</u>
Sage grouse	893	0*	1,853	2,746
Sharp-tailed grouse	8,833	2,609	21,281	32,723
Ruffed grouse	4,152	974	11,376	16,502
Mourning dove	1,923	653	6,740	9,316
Mule deer	10,827	1,087	15,219	27,133
White-tailed deer	3,982	1,180	16,470	21,632
Riparian forest	780	176	676	1,632
Riparian shrub	14	0**	13	27
	<u>Secure Island Nest Sites</u>			
Canada goose	10	20	44	74

* Habitat Unit losses were minimal as little sagebrush-steppe is thought to have occurred on the Spokane Reservation.

** Losses likely occurred but could not be identified at the resolution level of this study.

Cumulative Habitat Unit and nest site losses are roughly equal to the initial losses annualized over the 100 year life of the project then multiplied by the number of years without mitigation (currently 44 years). One hundred years is the project life used by the Bureau of Reclamation for all projects with undetermined life expectancies such as Grand Coulee Dam. Annualized Habitat Unit losses are equal to the total of Habitat Units lost because of the project, for each of the 100 project years averaged over those 100 years. Consideration should be given to the likelihood that the number of Habitat Units within the project area might have declined to some extent even without the project.

IV.4 Project Benefits to Wildlife

Environmental change generally improves conditions for some wildlife while it degrades conditions for others. Therefore it is likely that some wildlife typically associated with reservoirs have benefited from this project. Wood et al. (1981) reported that bats likely benefit from the increased foraging area over reservoirs. This may also be true for swallows and other insect eaters. The deeper, slower moving water of a reservoir usually attracts more species and numbers of diving ducks (Wood et al., 1981, Oliver and Barnett 1966), grebes and coots. Because of the reservoir's size (approximately 80,000 acres), substantially more open water habitat is available to water birds than was the case before the project. FDR Reservoir serves as a resting area for both migrating waterfowl and a limited number of wintering waterfowl. An area of the Spokane River provides a resting area for several thousand Canada geese during October (Scholz, pers. commun.).

In spite of the reservoir's waterfowl benefits, the overall value of FDR Reservoir to waterfowl is relatively low. Payne et al. (1976) noted that the occurrence of ducks along the reservoir was limited almost exclusively to small coves and shallow waters around islands, but not all such areas held ducks. Except for diving waterfowl which feed on fish, aquatic vegetation and invertebrates, food for ducks and geese is limited and their abundance and distribution along FDR Reservoir is as much a function of events and conditions in the region's potholes and agricultural land as it is of the reservoir itself (Payne et al., 1976; Zender, pers. commun.). Fall 1974 waterfowl densities for FDR Reservoir averaged only 1.3 birds per 100 acres (Payne et al., 1976). For comparison, waterfowl densities on Wells Reservoir (51 miles downriver) averaged 43 birds/100 acres. Low fall and winter waterfowl densities on FDR Reservoir may be at least partly due to its northern location.

FDR reservoir appears to have little influence on waterfowl population levels in the region as there is low production from the reservoir. Payne et al. (1976) reported little evidence of nesting waterfowl on the pool and suggested that breeding habitat was limiting. Reservoir fluctuations and wave action limit the establishment of aquatic vegetation which provides food and cover for dabbling ducks and diving water birds which feed on aquatic vegetation. Because of these considerations and in light of the time and resources available for this study, the Study Oversight Committee decided that a more detailed analysis of waterfowl benefits and losses was not warranted, and except for Canada goose did not select indicator species to estimate the quantity of waterbird losses or gains in terms of population or Habitat Units.

The project resulted in no net benefits to any of the 11 indicator species chosen for this study. Since the combined needs of these indicator species are representative of the needs of most wildlife within the project area (with the exception of water birds other than Canada goose as discussed above), we conclude that there have been no significant net benefits for most species.

The project has resulted in some localized benefits to individual members of some indicator species, however these individual benefits are overshadowed by losses to the populations. For example wintering bald eagles scavenge in the tailwaters of Grand Coulee Dam for fish injured by passage through the turbines. This food source is a benefit to the individual eagles that use it, but the value of this benefit is outweighed by the loss to the eagle population as a whole of the anadromous fish runs on the Columbia River and tributaries.

IV.5 Management Goals Relevant to Project Area

According to the Columbia Basin Fish and Wildlife Program, Section 1004(b)(S), the development of mitigation plans is intended to provide a means for "addressing the effects of development and operation of the Columbia Basin hydroelectric system on wildlife". However, the Northwest Power Planning Council also recognizes that U.S. Fish & Wildlife Service, state fish and wildlife agencies, and affected Indian tribes have specific, ongoing wildlife programs in the Columbia River Basin.

Consideration of these programs in mitigation planning is intended to permit each entity to manage land in its jurisdiction in a voluntary fashion consistent with current practices and goals. The following management goals have been used as

guidelines in mitigation planning to meet the requirements of Sections 4(h)(5)&(6) of the Northwest Power Act which stipulates that mitigation measures must complement existing and future activities of the federal and state fish and wildlife agencies and tribes.

General Management Goals

COLVILLE CONFEDERATEDTRIBES

The overall goal of the Fish and Wildlife Management Program is to maintain and, where possible, to enhance fish and wildlife populations: 1) primarily for the use of tribal members, 2) secondarily for use by the non-member public (BIA 1984).

SPOKANE TRIBE

Mitigation policy and management goals are presently being developed by the tribe. The general philosophy of the tribe is to:

- 1) Protect existing wildlife habitat and maintain maximum diversity of species.
- 2) Increase, through direct management or habitat protection using principles of adaptive management, the abundance of species which has been adversely affected by development, including hydropower facility construction and operation.
- 3) Increase species which can be used by tribal members for subsistence hunting.
- 4) Maintain and manage species of important religious, cultural and economic significance to the Tribe.
- 5) Maintain viable populations of species which are currently threatened or endangered.
- 6) Coordinate wildlife goals with tribal range, forestry, fisheries, environmental quality and economic development plans. (Brittingham, pers. commun.).

STATE OF WASHINGTON

The Washington Game Commission, which oversees WDG, has directed that "...where habitat loss has already occurred, steps should be taken to compensate for it through enhancement efforts" (WDG 1986). Relevant Commission policies include the following:

- #5) The protection and enhancement of wildlife and its habitat is encouraged on all lands...
- #6)** Habitat suited and needed for wildlife winter use will be managed to provide optimum food supplies. Key winter habitat will be given high priority for acquisition.
- #7) Acquisition of habitat and recreation access through purchase of conservation easements, public hunting and fishing easements, long-term leases,

transfer of development rights, and other forms of less-than-fee title conveyance, along with outright purchase, will be sought.

WDG goals may result in increased local populations in order to achieve the broader goals of maintaining statewide populations. This is necessary to mitigate losses caused by past projects. The aim of the WDG Mitigation Program is to ensure adequate protection and mitigation/compensation is achieved through the Fish and Wildlife Coordination Act, FERC, and other state and federal legislation for all land and water development projects impacting wildlife and fish.

U.S. FISH & WILDLIFE SERVICE

"It is the policy of the U.S. Fish & Wildlife Service to seek to mitigate losses of fish, wildlife, their habitats, and uses thereof from land and water developments" (USFWS 1981). The mitigation planning goals and guidelines are divided into four Resource Categories for use in indicating levels of recommended mitigation. The primary focus is on recommendations related to habitat value losses.

USFWS has determined that sage grouse habitat is a Resource Category 1 habitat. This habitat is of high value to sage grouse and is unique within the ecoregion. The USFWS mitigation goal for all Resource Category 1 habitat is that there be no loss of existing habitat and thus impacts to the habitat must be avoided. However since impacts from Grand Coulee Dam have already occurred, the USFWS goal for the project is the same as for Resource Category 2 habitat. Sharp-tailed grouse habitat, deer winter range, Canada goose nesting habitat, and riparian habitat are Resource Category 2 habitats according to USFWS mitigation policy. The mitigation goal for this type habitat is "No Net Loss of In-kind Habitat Value". This means that the Service recommends these losses be compensated by replacement of the same kind of habitat value so that the total loss of such habitat will be eliminated.

Species-Specific Goals

WDG has further identified statewide objectives on a species-by-species basis. USFWS also has specific management goals for certain species. Relevant goals and objectives are listed for the indicator species.

MULEDEER:

STATE GOALS & OBJECTIVES

Maintain populations at 1970-79 levels. An increase in populations may be possible in some areas. Maintain 1970-79 mean harvest and hunter success rate (WDG 1982c).

Develop programs and agreements with landowners and/or managing agencies to preserve, protect and enhance mule deer range (WDG 1984).

* Populations for the years indicated are generally within the range of current population levels.

Identify and seek mitigation/compensation for impacts on mule deer range from ski resorts, logging, mining, road construction, etc., through review of environmental documents and resource permits (WDG 1984).

Acquire management rights on critical range which is privately owned and enhance range to increase carrying capacity (WDG 1984).

Improve habitat with emphasis on key winter range areas (WDG 1982b).

WHITE-TAILED DEER: STATEGOALS & OBJECTIVES

Maintain populations at 1970-79* levels. Increase harvest from 1970-79 levels by approximately 10% (WDG 1982c).

Identify and seek mitigation/compensation for impacts on white-tailed deer range, particularly riparian areas (WDG 1984).

Develop habitat improvement projects on key winter ranges on state, federal and private lands (WDG 1984).

RUFFED GROUSE: STATE GOALS & OBJECTIVES

Maintain populations at 1975-79 levels. Develop improved methods to monitor population levels. Increase harvest 10-15% above 1970-79 levels. Develop improved methods to monitor harvest success rate (WDG 1982c).

Maintain and improve habitat on WDG lands with forest grouse potential (WDG 1984).

Work with private and public landowners to preserve and maintain riparian habitat, e.g. increase water availability on arid habitat (WDG 1984).

Ensure adequate mitigation/compensation for detrimental development and practices (WDG 1984).

Reduce detrimental livestock grazing practices on nesting areas (WDG 1982b).

SHARP-TAILED GROUSE: STATEGOALS & OBJECTIVES

Maintain populations at or above 1975-79* levels. Develop improved methods to monitor population levels. Acquire critical habitats and develop a habitat restoration program. Maintain the five-year average

* Populations for the years indicated are generally within the range of current population levels.

harvest and success rate at 1970-79 levels. Develop improved methods to monitor harvest and success rate (WDG 1982c).

Develop habitat restoration program (WDG 1984).

Encourage landowners to retain budding trees and to plant water birch along waterways in areas where it has been depleted (WDG 1984).

Acquire critical habitat where it cannot otherwise be protected (WDG 1984).

Ensure adequate mitigation/compensation for detrimental developments and practices (WDG 1984).

Re-establish or expand populations into unoccupied or previously occupied areas where adequate habitat still exists. Identify areas where reintroduction/expansion has potential. Capture birds from stable populations for translocation to these areas (WDG 1984).

Insure continued opportunity for non-consumptive use (WDG 1982b).

SAGE GROUSE:

STATE GOALS & OBJECTIVES

Increase populations by 10% over 1981* levels. Acquire critical habitat. Develop a habitat restoration program. Maintain harvest and success rate at 1975-80 levels (WDG 1982c).

Protect critical habitat through agreements, leases, and/or purchase (i.e. sagebrush areas in close proximity to leks) (WDG 1984).

Ensure adequate mitigation/compensation for detrimental developments and practices (WDG 1984).

Re-establish or expand populations into unoccupied or previously occupied areas where adequate habitat still exists. Identify areas where reintroduction/expansion has potential. Capture birds from stable populations for translocation to these areas (WDG 1984).

Insure continued opportunity for non-consumptive use (WDG 1982b).

* Populations for the years indicated are generally within the range of current population levels.

MOURNING DOVE:

STATE GOALS & OBJECTIVES

Maintain populations at 1975-79* levels. Maintain average harvest and success rates at 1975-79 levels. Consider actions to increase average harvest and hunter success where feasible (WDG 1982c).

Provide nesting habitat on WDG lands and encourage same on other public and private lands (WDG 1984).

Work with landowners to preserve mature trees, especially along riparian areas (WDG 1982a & 1982b).

Plant and maintain suitable nesting trees. This could be in conjunction with planting for other upland game bird winter cover (WDG 1982b).

Insure adequate mitigation/compensation for developments detrimental to nesting habitat (WDG 1982b).

CANADA GOOSE:

STATE GOALS & OBJECTIVES

Maintain mid-winter populations. Manage for peak fall population at or above 1976-80* levels. Maintain harvest at 1973-82 levels. Maintain hunting opportunities at or above 1975-80 levels. Increase nonconsumptive use above current levels (WDG 1982c).

Attempt to establish agreements with local hydroelectric companies to moderate radical pool level fluctuations on Snake and Columbia Rivers, impacting key goose habitat, i.e. nesting islands, brooding areas, etc. Pursue mitigation if an agreement cannot be achieved (WDG 1984).

Expand goose production of western Canada goose in eastern Washington by expanding local goose brooding habitat and establishing artificial nesting structures (WDG 1984).

FEDERAL GOALS & OBJECTIVES (USFWS undated)

Maintain wintering waterfowl habitats to support the following mid-winter population in the Columbia Drainage of eastern Washington/Oregon:

- 100,000 - 150,000 lesser Canada geese
- 5,000 Great Basin Canada geese.

Maintain current amounts and quality of seasonal and permanent wetlands in the Basin as indicated by the National Wetland Inventory Project.

* Populations for the years indicated are generally within the range of current population levels.

Selectively acquire critically needed habitat.

Maintain current levels of nesting Great Basin Canada geese:

2,400 nesting pairs in the Columbia Basin of eastern Washington/Oregon.

Preserve and enhance island nesting habitat through statutory means, predator control and creation of artificial islands through judicious fills of dredge material.

Preserve and enhance brooding habitat through the use of localized sanctuaries, acceptable water levels and creation and maintenance of side channel impoundments.

BEAVER:

STATE GOALS & OBJECTIVES (Furbearers)

Maintain beaver populations at 1970-79* levels. Maintain harvest at 1970-79 levels (WDG 1982c).

Create permanent wetlands by diking and/or excavation, dredging and increasing beaver activity on WDG owned or controlled lands (WDG 1984).

Acquire control of critical habitat through fee purchase or less-than-fee title conveyance (WDG 1984).

Promote retention of wetlands (WDG 1982b).

Establish willow, poplar, or other trees or shrubs important to beaver on margins of streams, lakes and ponds where trees and shrubs do not exist (WDG 1982b).

Promote reduced livestock grazing on wetlands (WDG 1982b).

BALD EAGLE:

STATE GOALS & OBJECTIVES (Endangered & Threatened Species)

Arrest and if possible reverse factors responsible for decline of the species. Restore population to self-sustaining level (WDG 1982c).

For species having federal endangered and/or threatened designation, use management guidelines developed by federal recovery team (WDG 1984).

Identify and protect endangered and threatened species habitat (WDG 1984).

* Populations for the years indicated are generally within the range of current population levels.

Identify and seek mitigation/compensation for impacts to nongame special species habitat from logging, instream flows, mining, road construction, reservoirs, etc. through review of environmental documents and resource permits, and state and federal legislation (WDG 1984).

Inventory of critical habitats include bald eagle communal roosts along Spokane River and osprey nest sites along Kettle River, Kelly Hill and Lower Spokane River (WDG 1982a).

Management and preservation projects include consultation with USBR and creation of more perching snags for bald eagles along Lake Roosevelt. This would include planting cottonwood whips along shoreline at suitable sites so that trees will eventually provide additional perch sites and nesting trees for other species (WDG 1982a).

FEDERAL GOALS & OBJECTIVES (USFWS 1984)

Proposed management direction for Upper Columbia Basin (Zone 7): Locate nesting and feeding areas. Protect and enhance perching and roosting areas. Stabilize water fluctuations. Maintain and enhance prey populations, especially waterfowl and kokanee salmon. Regulate and monitor human disturbance. Seek landowner cooperation in habitat protection. Acquire threatened habitat, and call for moratorium on development in key eagle use area. Enforce existing laws. Spokane River, Kettle River, Colville River and FDR Lake identified as key areas. The habitat management goal for is for 59 additional territories to be established within zone 7, and the plan estimates three of those could be on FDR Reservoir.

Proposed management direction for Palouse Prairie (Zone 8): Protect and enhance roosting and perching areas. Stabilize water fluctuations. Enhance prey populations. Discourage human disturbance. Oppose dam construction. Banks Lake identified as key area.

LONG-EARED OWL & FLICKER:

STATE GOALS & OBJECTIVES (Nongame wildlife)

Preserve natural habitats to perpetuate these species in Washington. Preserve populations at a self-sustaining levels. Provide for public education and enjoyment of these species (WDG 1982c).

Identify and seek mitigation/compensation for impacts to nongame habitats from logging, instream flows, mining, road construction, reservoirs, etc. through review of environmental documents and resource permits and state and federal legislation (WDG 1984).

Coordinate with WDG programs and other agencies to accomplish habitat preservation (WDG 1984).

Acquire control of critical habitat (WDG 1984).

Inventory of sensitive areas include riparian habitat along Kettle River and Colville River (WDG 1982a).

Management and preservation projects include Northrup Canyon, Grand Coulee as a high priority natural area (WDG 1982b).

IV.6 Responsibility of Hydropower to Mitigate Losses

Grand Coulee Dam is a multipurpose project operated for power production, irrigation, flood control, navigation and recreation. As such it has been argued that the responsibility to fund mitigation of wildlife losses should be shared by all of the benefiting concerns. Several alternatives for allocating this responsibility have been proposed including the following:

- Allocation Based on Congressional Purposes. Examine the enabling legislation authorizing the construction of the dam to determine to what extent the project was to address each concern. However, it should be noted that the degree to which the project has addressed each concern has changed over time. Until 1952, the project was operated primarily for power production (COE 1948 cited in Scholz et al.)
- Allocation Based on Documentation Used to Justify Project. Examine Bureau of Reclamation and Army Corps of Engineers documents showing cost/benefit analyses of various aspects of the project. These documents clearly state that power revenues would be required to subsidize other project aspects for the project to be feasible.
- Congressional Repayment Allocation Formula. Examine how the cost of the project is being repaid in percent of total returnable dollars from plant investment. For the Columbia Basin Project the cost allocation is 74% to irrigation, 23% to hydropower, and 3% to other concerns (1984 statement cited in Scholz et al. 1985). It should be noted that under the Fish and Wildlife Coordination Act mitigation is part of a project's cost. Since project costs chargeable to irrigation are limited by Public Law 87-728 and excess charges reallocated to hydropower, in 1984 hydropower revenues were repaying 94% of irrigation costs. Thus the total hydropower responsibility for project repayment in 1984 was 94% of the entire payment (Scholz et al. 1985).

The above allocation methods place significant responsibility to mitigate wildlife losses on hydropower concerns, and the latter two methods imply hydropower has the primary responsibility to mitigate wildlife losses.

The greatest wildlife losses from development of Grand Coulee Dam are a direct result of the inundation of 70,000 acres of habitat by FDR Reservoir. This 151 mile long reservoir is necessary primarily for power production rather than other

project concerns. Of all project aspects, only hydropower requires a high pool level. The amount of power generated is a function of the volume of water flowing through the turbines, and the "head" (i.e. height of the column of water above the turbines). It is this head requirement that largely dictates the pool level of (and the amount of habitat inundated by) FUR Reservoir. The active storage (usable water stored behind the dam) resulting from the pool level is used specifically to firm up power operations at Grand Coulee and all other hydroelectric dams downriver. Management of this storage for hydropower causes large fluctuations of reservoir level which have major environmental impacts.

A high pool elevation is not necessary to pump irrigation water to Ranks Lake since from a purely engineering perspective water could have been pumped from elevations as low as the pre-project level of the Columbia River. The pump system as built will operate within a wide range of reservoir levels (COE 1948 cited in Scholz et al. 1985). (Note in Appendix 1.1 the pool level was first raised to its maximum authorized level of 1290 feet elevation in 1942, a full decade before the first irrigation water became available.) The storage capacity of the reservoir also is of primary benefit to power production rather than irrigation, as the supply of water is always adequate for irrigation (COE 1948 cited in Scholz et al. 1985). Flood control also requires a pool only a fraction of the size of FUR Reservoir.

Therefore, since reservoir storage and pool elevation (i.e. "head" or the dam's hydraulic height) resulted in most of the wildlife losses, and these factors are determined by power needs, hydropower concerns should be responsible for 100% of wildlife mitigation.

Hydropower provides the only net revenue from the project. Flood control, navigation, fish, wildlife and recreation are all nonreimbursable items - i.e. will not repay any of their project costs to the treasury. Irrigation (which accounts for the bulk of the project costs) is responsible for only partial repayment by law. Without the hydropower revenue, the project would have been economically infeasible (i.e. if proponents had intended that hydropower only pay for its 781 million dollar share of the estimated 2.8 billion dollar project, the project would have never been built.) Since there is a precedent that hydropower has paid other project costs, hydropower should similarly pay for wildlife mitigation. (See also Appendix 5, page 116.)

IV.7 Mitigation Necessary to Fully Redress Wildlife Losses

To completely redress habitat lost through inundation by the project, all 116,022 acres of evaluated lands (Appendix 4.3) would have to be protected and enhanced as well as 128,700 acres of additional lands. This assumes that a 30% improvement could be obtained on the additional lands. Although improvement greater than 30% may be obtainable on some parcels, 30% appears to be a reasonable average improvement rate overall. For parcels evaluated in this study (Appendix 4.3), the average estimated Habitat Unit increase obtainable through habitat enhancement was 33% (range 0 - 233%).

The distribution of lands needed is shown in Table 7. Additional lands have been identified for the State of Washington (Appendix 4.4) but their habitat quality and improvement potential have not been rated. Needed additional lands have yet to be identified for the Colville Tribe. Rough estimates of mitigation costs

have been generated for discussion purposes and are presented in Appendix 4.1. The total estimated initial cost for full redress of wildlife losses is approximately 107 million dollars.

TABLE 7. ESTIMATED LAND NEEDS FOR 100% REPLACEMENT OF LOST HABITAT UNITS

<u>Land Type</u>	<u>Acres of Land Needed for Each Wildlife Jurisdiction</u>			
	<u>Colville</u>	<u>Spokane</u>	<u>State</u>	<u>Total</u>
Lands Evaluated by Team				
Private or Allotted Lands	7,300	3,210	83,072	93,582
Public or Tribal Lands	4,000	7,380	11,060	22,440
Subtotal	11,300	10,590	94,132	116,022
Additional Lands Needed Assuming 30% Estimated Improvement Potential				
Government or Private	40,000	0*	88,700	128,700
Total Land Needs	51,300	10,590	182,832	244,722

* Although losses of all species are not redressed, a sizable net gain of white-tailed deer, as well as small gains of ruffed grouse, and riparian shrub Habitat Units exist.

V. MITIGATION PROPOSAL

INTRODUCTION

Grand Coulee Dam is the largest project on the Columbia River and has far-reaching impacts. In addressing mitigation of this enormous project 50 years after construction began, the Study Oversight Committee recognizes that this is a unique and unusual situation and warrants special considerations. The mitigation goals and objectives in this proposal must be viewed within this context. This proposal focuses more effort on protecting existing wildlife habitat than on replacing habitat lost as a result of the project. This trade-off appears to provide an acceptable level wildlife mitigation within project constraints.

V.1 MITIGATION GOAL

To protect through purchase, easement and/or enhancement, the same number of Habitat Units as was lost due to inundation by the project.

v.2 OBJECTIVES

Select land parcels to achieve greatest benefits for all indicator species and their associated species within the limitations of the mitigation goal.

Select mitigation consistent with current agency management goals for the wildlife resources (Section IV.5).

Provide an equitable distribution of mitigation to the three entities involved - the Colville Confederated Tribes, the Spokane Tribe, and the State of Washington.

Protect bald eagles in a manner consistent with the Pacific Northwest States Bald Eagle Recovery Plan (USFWS 1984).

V.3 PROPOSED MITIGATION PLAN

The proposed mitigation plan is composed of three main parts:

- 1) Acquisition of sufficient land or management rights to land to protect Habitat Units equivalent to those lost. (Approximately 73,000 acres of land would be required.)
- 2) Improvement and management of this land to obtain and perpetuate the target Habitat Units.
- 3) Protection and enhancement of identified bald eagle territories and communal roosts. Selected tree planting on project lands, and protection and enhancement of potential nesting habitat if warranted.

V.3.1 MITIGATION ACCOUNTING PROCEDURES

- Provide mitigation credit for Habitat Units gained through habitat enhancement of both new lands acquired by purchase or easement, and existing government and tribal lands.
- Provide mitigation credit for "base" (currently existing) Habitat Units for all new land acquisitions/easements. No credit for "base" Habitat Units on government and tribal lands where mitigation efforts are not directly responsible for maintenance and protection of those base Habitat Units.

V.3.2 RECOMMENDATIONS

- Within each action, land management rights acquisition will take precedence over habitat improvement so as to take advantage of current low land prices, low interest rates, and to ensure acquisition can be completed before lands are converted to uses incompatible with wildlife.
- Use of easements, management agreements, land trades, etc. to acquire land management rights will be considered. Where this proves uneconomical, fee title acquisition will be necessary.
- Annual operation and maintenance expenses of each mitigation parcel will be provided in perpetuity.
- The Habitat Unit protection goal is to be flexible so as to accommodate the need to acquire lands or easements in blocks acceptable to current property owners. Experience with other mitigation projects has shown that landowners are reluctant to fragment their holdings. Thus it may be necessary to acquire some nontarget lands and/or more or less Habitat Units than the goal. After consultation with the Study Oversight Committee, surplus or nontarget lands may be considered for disposal.
- It is recognized that as of this date, there is no certainty that proposed mitigation parcels will actually be available when funds are made available. Thus a priority scheme has been developed for land protection. The first priority will be protection of specific target parcels mentioned in the proposal. If some of these parcels should be unavailable, alternates will be selected from available parcels listed in Appendix 4.3. If a suitable alternative parcel from Appendix 4.3 is not available, a suitable alternative will be selected from available parcels listed in Appendix 4.4. Of the lands selected, those imminently threatened with destruction or development will have the highest priority for protection and management.
- In this proposal costs for bald eagle mitigation were not divided among wildlife agencies. Because of jurisdictional overlap bald eagle mitigation efforts should be coordinated by the U.S. Fish and Wildlife Service.

TABLE 9. COST ESTIMATE OF ACTION 1. All costs are in 1986 dollars and should be adjusted for inflation to the year of expenditure.

<u>COST ITEM</u>	<u>COLVILLE</u>	<u>SPOKANE</u>	<u>STATE</u>	<u>TOTAL</u>
Habitat Protection*	\$649,008	\$1,630,200	\$5,224,000	\$7,503,200
Advanced Design \$12.50/acre	37,508	50,000	251,250	338,750
Development/Enhancement 21,100 acres of private or allotted land at \$100/acre	100,000	0	2,010,000	2,110,000
Development/Enhancement 6,000 acres of public or tribal land at \$100/acre	200,000	400,000	0	600,000
Bald Eagle Mitigation				23,400
TOTAL INITIAL COSTS	\$986,508	\$2,080,200	\$7,485,250	\$10,575,350
Annual O & M**	\$60,033	\$14,625	\$402,008	

* Cost assumes fee title acquisition of lands for Colville Tribe and State. If easements negotiated, costs may be reduced. Cost assumes easements negotiated for Spokane Tribal lands. Refer to Methods, Section 111.6.

** Based on \$20/acre for Colville and State parcels and itemized budget for Spokane parcels.

Action #2: Acquire/protect priority 2 parcels identified for each entity or lands of comparable habitat value and improve habitat as prescribed. Negotiate habitat protection for confirmed nest or communal roost sites (purchase of easements may be necessary). Plant small clusters of trees that will grow to be suitable for use by bald eagles at selected locations along the treeless, southern portion of FDR Reservoir. Identify high quality, potential nest sites within the study area. Evaluate habitat protection needs for potential nest sites.

Target Parcels: Colville Parcel #2
 Spokane Parcel #4
 State Parcel #1
 State Parcel #15

Habitat Units Protected After Acquisition and Habitat Improvement:

Sage grouse	8,110
Sharp-tailed grouse	8,740
Mourning dove	851
Mule deer	4,000
White-tailed deer	1,628
Riparian shrub	123
Riparian forest	332

TABLE 10. LAND NEEDS (acres) FOR ACTION 2. Protection of private or allotted lands may be either through purchase or easement. Protection of public or tribal lands may be either through easement or management agreement.

<u>land Needs</u>	<u>Colville</u>	<u>Spokane</u>	<u>State</u>	<u>Total</u>
Private or Allotted Lands	3,500	0	9,732	13,232
Public or Tribal Lands	1,500	1,780	0	3,280
Total	5,000	1,780	9,732	16,512

TABLE 11. COST ESTIMATE OF ACTION 2. All costs are in 1986 dollars and should be adjusted for inflation to year of expenditure.

<u>COST ITEM</u>	<u>COLVILLE</u>	<u>SPOKANE</u>	<u>STATE</u>	<u>TOTAL</u>
Habitat Protection*	\$901,300	\$728,130	\$5,350,000	\$6,979,430
Advanced Design \$12.50/acre	62,500	22,250	121,650	206,400
Development/Enhancement 13,232 acres private or allotted land at \$100/acre	350,000	0	973,200	1,323,200
Development/Enhancement 3,280 acres public or tribal land at \$100/acre	150,000	178,000	0	328,000
Bald Eagle Mitigation+				174,700
TOTAL INITIAL COSTS	\$1,463,800	\$928,380	\$6,444,850	\$9,011,730
Annual O & M**	\$100,000	\$70,393	\$194,640	\$365,033

* Cost assumes fee title acquisition of lands for Colville Tribe and State. If easements negotiated, costs may be reduced. Cost assumes easements negotiated for Spokane Tribal lands. Refer to Methods, Section 111.6.

+ Cost includes \$155,100 to protect nest/roost sites on private or allotted land.

** Based on \$20/acre for Colville and State parcels and itemized budget for Spokane parcels.

Action #3 Acquire/protect priority 3 parcels identified for each entity or lands of comparable habitat value and improve habitat as prescribed. Negotiate habitat protection for confirmed nest or communal roost sites (purchase of easements or fee title purchase of land may be necessary). If warranted, protect habitat of high-quality potential nest sites to achieve habitat management goal of three territories on FDR Reservoir as outlined in the Recovery Plan.

Target Parcels: Colville Parcel #3
 Spokane Parcel #2
 State Parcel #5
 State Parcel #9
 State Parcel #10

Habitat Units Protected After Acquisition and Habitat Improvement:

Ruffed grouse	5,227
Turkey	815
Mourning dove	61
Mule deer	7,545
White-tailed deer	9,462
Riparian shrub	42
Riparian forest	364

TABLE 12. LAND NEEDS (acres) FOR ACTION 3. Protection of private or allotted lands may be either through purchase or easement. Protection of public or tribal lands may be either through easement or management agreement.

<u>Land Needs</u>	<u>Colville</u>	<u>Spokane</u>	<u>State</u>	<u>Total</u>
Private or Allotted Lands	1,500	1,290	9,000	11,790
Public or Tribal Lands	500	1,600	600	2,700
Total	2,000	2,890	9,600	14,490

TABLE 13. COST ESTIMATE OF ACTION 3. All costs are in 1986 dollars and should be adjusted for inflation to year of expenditure.

<u>COST ITEM</u>	<u>COLVILLE</u>	<u>SPOKANE</u>	<u>STATE</u>	<u>TOTAL</u>
Habitat Protection*	\$1,666,000	\$1,954,330	\$8,921,100	\$12,541,430
Advanced Design \$12.50/acre	25,000	36,125	120,000	181,125
Development/Enhancement 11,790 acres private or allotted land at \$100/acre	150,000	129,000	900,000	1,179,000
Development/Enhancement 2,700 acres public or tribal land at \$100/acre	50,000	160,000	60,000	270,000
Bald Eagle Mitigation+				311,200
TOTAL INITIAL COSTS	\$1,891,000	\$2,279,455	\$10,001,100	\$14,482,755
Annual O & M**	\$40,000	\$56,709	\$192,000	\$288,709

* Cost assumes fee title acquisition of lands for Colville Tribe and State, and of deeded lands on the Spokane Reservation. If easements negotiated, costs may be reduced. Cost assumes easements negotiated for Spokane Tribal lands. Refer to Methods, Section 111.6.

+ Cost includes \$310,000 to protect nest/roost sites on private or allotted land.

** Based on \$20/acre for Colville and State parcels and itemized budget for Spokane parcels.

Action #4 Acquire/protect priority 4 parcels identified for each entity or lands of comparable habitat value and improve habitat as prescribed.

Target Parcels: Colville Parcel #4
 Spokane Parcel #3
 State Parcel #7
 State Parcel #11

Habitat Units Protected After Acquisition and Habitat Improvement:

Ruffed grouse	5,216
Mule deer	2,921
White-tailed deer	6,927
Riparian forest	246

TABLE 14. LAND NEEDS (acres) FOR ACTION 4. Protection of private or allotted lands may be either through purchase or easement. Protection of public or tribal lands may be either through easement or management agreement.

<u>Land Needs</u>	<u>Colville</u>	<u>Spokane</u>	<u>State</u>	<u>Total</u>	--
Private or Allotted Lands	1,300	1,920	2,300	5,520	
Public or Tribal Lands	0	0	9,900	9,900	
Total	1,300	1,920	12,200	15,420	

TABLE 15. COST ESTIMATE OF ACTION 4. All costs are in 1986 dollars and should be adjusted for inflation to year of expenditure.

<u>COST ITEM</u>	<u>COLVILLE</u>	<u>SPOKANE</u>	<u>STATE</u>	<u>TOTAL</u>
Habitat Protection*	\$1,444,600	\$1,938,790	\$2,187,000	\$5,570,390
Advanced Design \$12.50/acre	16,250	24,000	152,500	192,750
Development/Enhancement 5,520 acres private or allotted land at \$100/acre	130,000	192,000	230,000	552,000
Development/Enhancement 9,900 acres public or tribal land at \$100/acre	0	0	990,000	990,000
TOTAL INITIAL COSTS	\$1,590,850	\$2,154,790	\$3,559,500	\$7,305,140
Annual 0 & M**	\$26,000	\$13,327	\$244,000	\$283,327

* Cost assumes fee title acquisition of all lands for Colville Tribe and State, and of deeded lands on the Spokane Reservation. If easements negotiated, costs may be reduced. Refer to Methods, Section 111.6.

** Based on \$20/acre for Colville and State parcels and itemized budget for Spokane parcels.

V.3.4 Summary of Proposed Actions

Proposed actions are summarized in the tables below.

TABLE 16. SUMMARY OF HABITAT UNITS **PROTECTED** BY PROPOSAL

<u>Habitat Unit Type</u>	<u>Units Lost</u>	<u>Units Protected</u>
Sage grouse	2,746	8,110
Sharp-tailed grouse	32,723	24,661
Turkey (trade for grouse)	0	815
Ruffed grouse	16,502	12,001
Mourning dove	9,316	3,471
Mule deer	27,133	34,291
White-tailed deer	21,632	21,187
Elk (trade for deer)	0	1,500
Riparian shrub	27	377
Riparian forest	1,632	1,458
Canada goose (nest sites)	74	42

TABLE 17. SUMMARY OF LAND NEEDS (acres) FOR PROPOSAL. Protection of private or allotted lands may be either through purchase or easement. Protection of public or tribal lands may be either through easement or management agreement.

<u>Land Needs</u>	<u>Colville</u>	<u>Spokane</u>	<u>State</u>	<u>Total</u>
Private or Allotted Lands	7,300	3,210	41,132	51,642
Public or Tribal Lands	4,000	7,380	10,500	21,880
Total	11,300	10,590	51,632	73,522

TARGET LAND PARCELS SELECTED FOR PROPOSAL. (Parcel descriptions in Appendix 4.3)

Colville parcel #1	Colville parcel #2
Colville parcel #3	Colville parcel #4
Spokane parcel #1	Spokane parcel #2
Spokane parcel #3	Spokane parcel #4
State parcel #1	State parcel #2
State parcel #5	Sherman Cr. HMA improvement (state #7)
State parcel #9	State parcel #10
State parcel #11	State parcel #15

TABLE 18. SUMMARY OF COST ESTIMATES FOR PROPOSAL. All costs are in 1986 dollars and should be adjusted for inflation to year of expenditure.

<u>COST ITEM</u>	<u>COLVILLE</u>	<u>SPOKANE</u>	<u>STATE</u>	<u>TOTAL</u>
Habitat Protection*	\$4,660,900	\$6,251,450	\$21,682,100	\$32,594,450
Advanced Design \$12,50/acre	141,250	132,375	645,400	919,025
Development/Enhancement 51,642 acres of private or allotted land at \$100/acre	730,000	321,000	4,113,200	5,164,200
Development/Enhancement 21,880 acres of public or tribal land at \$100/acre	400,000	738,000	1,050,000	2,188,000
Bald Eagle Mitigation+				509,300
TOTAL INITIAL COSTS	\$5,932,150	\$7,442,825	\$27,490,700	\$41,374,975
Annual O & M**	\$226,000	\$155,054	\$1,032,640	\$1,413,694
Annual Monitoring*	\$7,006	\$45,775	\$32,012	\$84,793
TOTAL ANNUAL COSTS	\$233,006	\$200,829	\$1,064,652	\$1,498,487

* Cost assumes fee title acquisition of lands for Colville Tribe and State, and of deeded lands on the Spokane Reservation. If easements negotiated, costs may be reduced. Cost assumes easements negotiated for Spokane Tribal lands. **Refer** to Methods, Section 111.6.

+ Includes \$465,300 for protection of bald eagle nest and roost sites on nonpublic lands. Cost is contingent on nest/roost sites being discovered on nonpublic lands and the inability to negotiate protection for these sites through less costly means.

** Based on \$20/acre for Colville and State parcels and itemized budget for Spokane parcels.

++ Based on \$.62/acre for Colville and State parcels and itemized budget for Spokane parcels.

TABLE 19. SUMMARY OF COST ESTIMATES BY PROPOSED ACTIONS. The category "Other" refers to funds for bald eagle mitigation which have not been divided between agencies. All costs are in 1986 dollars and should be adjusted for inflation to year of expenditure.

<u>Action</u>	<u>Colville</u>	<u>Spokane</u>	<u>State</u>	<u>Other</u>	<u>Total</u>
#1 Initial Costs	\$986,500	\$2,080,200	\$7,485,250	\$23,400	\$10,575,350
#1 Annual O&M	60,000	14,625	402,000	0	476,625
#2 Initial Costs	1,463,800	928,380	6,444,850	174,700*	9,011,730
#2 Annual O&M	100,000	70,393	194,640	0	365,033
#3 Initial Costs	1,891,000	2,279,455	10,001,100	311,200*	14,482,755
#3 Annual O&M	40,000	56,709	192,000	0	288,709
#4 Initial Costs	1,590,850	2,154,790	3,559,500	0	7,305,140
#4 Annual O&M	26,000	13,327	244,000	0	283,327
TOTALS					
INITIAL COSTS	\$5,932,150	\$7,442,825	\$27,490,700	\$509,300*	\$41,374,975
ANNUAL O&M	\$226,000	\$155,054	\$1,032,640	0	\$1,413,694
ANNUAL MONITORING	\$7,006	\$45,775	\$32,012	0	\$84,793

* Includes costs of protecting bald eagle nest and roost sites on nonpublic lands. Costs contingent on sites being discovered on these lands and the inability to negotiate protection for these sites through means other than purchase of land and easements (see Section 111.6, page 12). Action #2 includes \$155,100; Action #3 includes \$310,000; total costs \$465,300.

V.3.5 Wildlife to Benefit from Actions

Because mitigation is based on protecting Habitat Units of indicator species, a wide range of wildlife will benefit from the mitigation proposal. The protection and enhancement of native plant communities will benefit most of the approximately 350 wildlife species occurring within the study area. Significant benefits would occur for shrub-steppe species such as sage grouse and sharp-tailed grouse. Shrub-steppe wildlife and particularly that associated with sagebrush, is rapidly disappearing from Washington due to the conversion of shrub-steppe lands. Mule deer and white-tailed deer will benefit greatly from the protection and enhancement of critical winter range. Winter range is a major limiting factor for big game in the project area. Actions protecting critical riparian lands, including some mature cottonwood stands, will benefit game species and furbearers as well a great number of nongame species including bald eagles, other raptors and cavity nesters. The proposed actions will further the recovery of the bald eagle by protecting nest and roost sites along FDR Reservoir.

V.3.6 Proposed Time Schedule

The time schedule proposed for implementation is as follows:

Year 1	1988 - Action 1
Year 3	1990 - Action 2
Year 6	1993 - Action 3
Year 8	1995 - Action 4

V.3.7 Evaluation and Monitoring

Lands acquired/protected/managed as a result of the four mitigation actions will be monitored on a three year schedule. Baseline data will be collected as soon as possible after acquisition/protection/management agreements are in place. Routine monitoring will occur every third year thereafter.

The monitoring program will consist of two parts: a) habitat quality monitoring and b) wildlife population trend monitoring. Habitat quality monitoring will consist of monitoring the parameters identified in the Habitat Suitability Models used in this study to estimate habitat quality. Population trend monitoring will consist of appropriate trend counts for each of the indicator species identified in this study. Trend counts on comparable lands will serve as a control for trends on mitigation lands.

v.4 Discussion

Desirable known habitat for sage grouse is not available on project or adjacent lands therefore it is necessary to protect habitat outside of the study area. Mitigation is difficult for sage grouse because they require large blocks of fairly continuous sagebrush-steppe habitat. Shrub-steppe habitat is becoming increasingly fragmented in Eastern Washington, and acquiring lands for mitigation will do little for sage grouse unless lands can be preserved in a fairly continuous block. Thus, in order to provide effective mitigation for sage grouse and sage-steppe dependent species, it is necessary to focus a greater level of mitigation effort toward replacement of sage grouse Habitat Units than would otherwise be warranted.

There is insufficient information available to prescribe specific protection and enhancement measures for bald eagles within the study area. Currently there appears to be some recovery occurring in wintering bald eagle populations in the Upper Columbia Basin, but the reasons for this are not understood. Information is available regarding winter population size and age structure for the upper Columbia River from 1975-1986, and the activities of wintering bald eagles in the vicinity of Banks Lake and Grand Coulee Dam. However information regarding food habits, key feeding areas, locations of communal roosts upriver from Grand Coulee Dam and distribution of bald eagles along the reservoir is limited. Also little is known about bald eagle use of the project area during the nesting period. It is possible that active bald eagle nesting territories exist within the study area. Communal roosts, key feeding areas, food resources and nesting territories should be identified and protected.

Project operations have precluded the natural re-establishment of riparian trees formerly used by bald eagles for perching, roosting and nesting. Opportunities

exist to re-establish trees at selected locations along the treeless, southern portion of the reservoir. At maturity these trees would provide roosting, nesting and perching opportunities for bald eagles.

The Bureau of Reclamation in consultation with interested wildlife agencies is currently developing a bald eagle management plan for the vicinity of Grand Coulee Dam and Banks lake. Mitigation efforts should be coordinated with this planning effort.

Because of limited information available, the proposal recommends protection and enhancement for bald eagles be implemented gradually, beginning with background investigations. The information collected would determine the type and level of mitigation needed. To the extent practical, the proposal seeks to further the goals of the Draft Pacific States Bald Eagle Recovery Plan which include protection of key habitat and establishment of three nesting territories along FUR Reservoir.

Cost estimates for bald eagle mitigation include amounts sufficient to protect nest and roost sites should they occur only on private or allotted lands and efforts to ensure protection through means other than purchase of lands and easements (see Section 111.6, page 12) are unsuccessful. It should be noted that sites occurring on public land would be protected through management agreements at no cost. Also nest and roost sites may occur on target parcels identified in the proposed actions (Section V.3.3, pages 34-39) and would be protected in conjunction with those parcels at little or no additional cost. Information about bald eagles in the vicinity of FUR Reservoir (proposed in Action 1), is needed before cost estimates can be further refined.

As part of the proposal, the Colville Tribe has decided to protect 1500 elk Habitat Units in lieu of 1500 deer Habitat Units, and the Spokane Tribe has decided to protect 815 turkey Habitat Units in lieu of 815 sharp-tailed grouse Habitat Units.

It is proposed that less-than-fee title acquisition be used for habitat protection wherever economically feasible. Conservation easements can sometimes reduce land acquisition costs. However, because of the needs for restricting land management and allowing public access to the land for hunting and recreation purposes, preliminary information suggests that cost savings of easements over fee title purchase will be low. The use of easements would not reduce estimated monitoring, operation and maintenance costs as the agencies must protect rights purchased through easements. In some instances monitoring, operation and maintenance costs for easements may be greater than such costs for the same land if purchased in fee title.

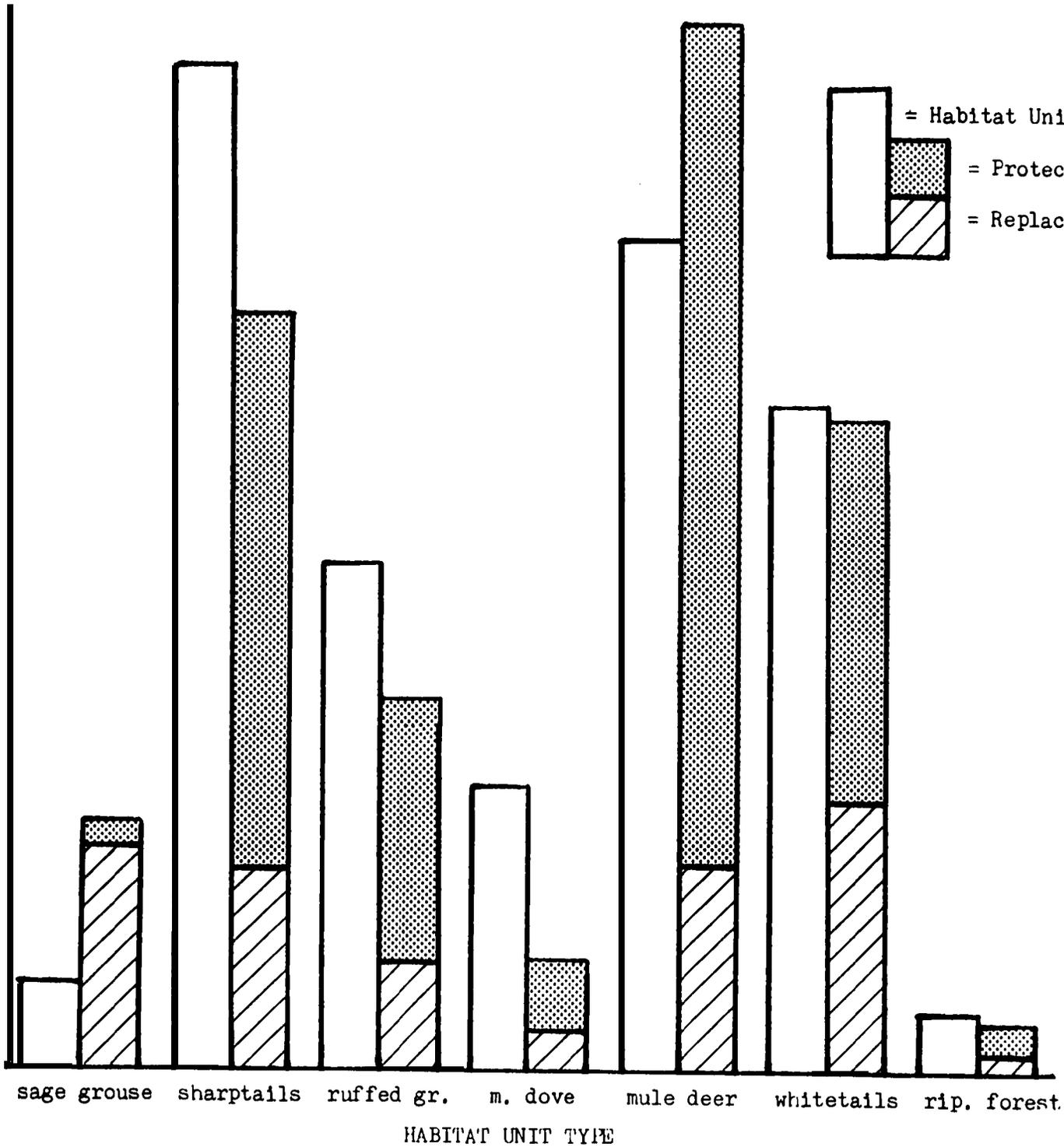
WDG policy precludes use of condemnation to acquire lands. Any lands or management rights acquired by WDG would be from willing sellers.

It is important to note that with this proposal, less than one third of the wildlife Habitat Units inundated by the project will be REPLACED. The net effects of the proposal on Habitat Units for each indicator species is illustrated in Figure 5. The total effect on Habitat Units in the study area is illustrated in Figures 6-8. Although the proposal protects Habitat Units equal to 68% of losses, these protected Habitat Units already exist today. Thus

HABITAT UNITS

34,000
 33,000
 32,000
 31,000
 30,000
 29,000
 28,000
 27,000
 26,000
 25,000
 24,000
 23,000
 22,000
 21,000
 20,000
 19,000
 18,000
 17,000
 16,000
 15,000
 14,000
 13,000
 12,000
 11,000
 10,000
 9,000
 8,000
 7,000
 6,000
 5,000
 4,000
 3,000
 2,000
 1,000

= Habitat Units Lost
 = Protected Base Habitat Units
 = Replaced Habitat Units



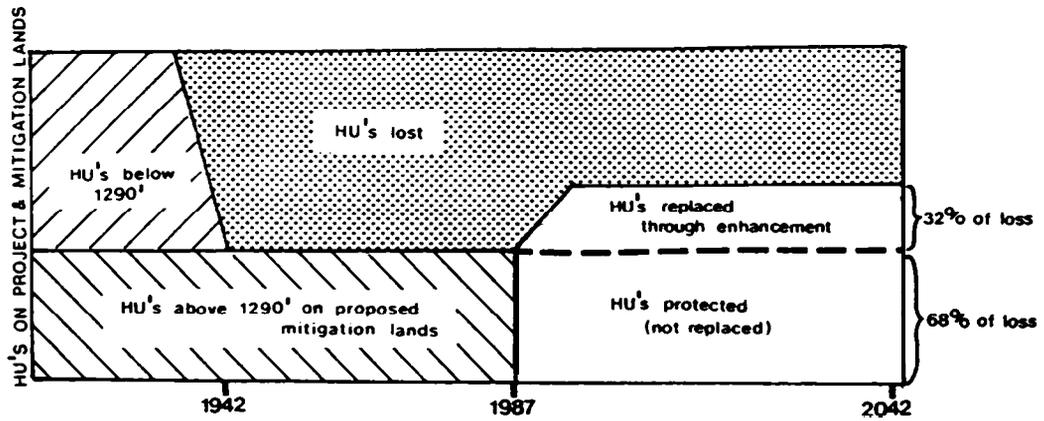


Figure 6. Habitat Unit changes with proposed mitigation. Total HU's protected & replaced = HU's lost. Only 32% actually replaced, Life of project is assumed to be 100 years. Habitat Units on both project lands and mitigation lands are shown.
 1942 - Most Habitat Units eliminated from project lands with pool rise; Habitat Units on mitigation lands remain relatively unchanged.
 1987 - Mitigation implemented over 10-year period.

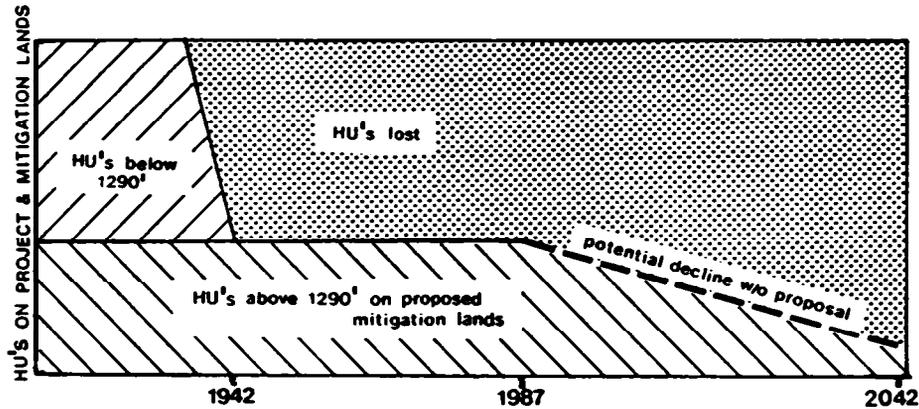


Figure 7. Habitat Unit changes without proposed mitigation. Unprotected HU's potentially will decline due to development and losses will increase.

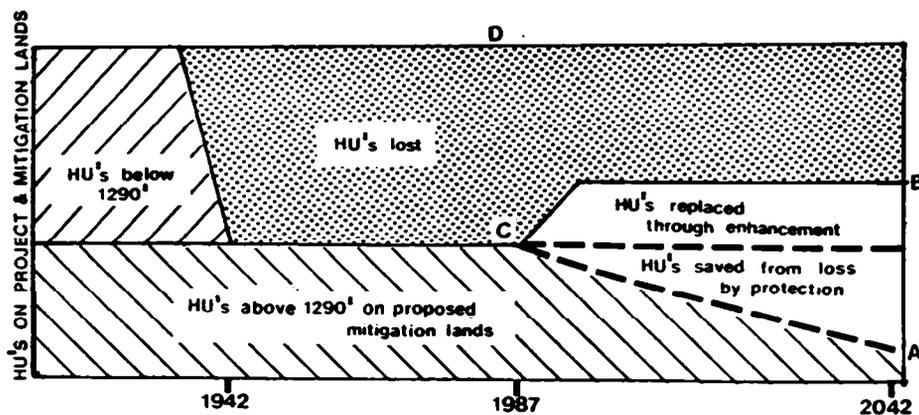


Figure 8. Habitat Unit net gains with proposed mitigation. Since protection prevents future decline of habitat value, net gain of HU's may be considered to increase over time. Mitigation could reach 100% sometime in the future (i.e. when line AB = line CD).

Habitat Units existing after mitigation will reflect only a moderate increase over the amount existing before mitigation.

If the proposal is not implemented it is likely that the number of remaining Habitat Units will decline over time due to development (Figure 7). Since the proposal prevents this potential future loss, the value of the proposed mitigation would increase over time (Figure 8). At a point in the future the sum of the Habitat Units gained through enhancement and the Habitat Units saved from loss may equal the total Habitat Units lost due to the project. The primary mitigation action will be the protection of remaining habitat rather than replacement of lost habitat. Full replacement of lost habitat would require approximately 244,700 acres; the proposal seeks to protect 73,522 acres.

This is not keeping within the policies of the agencies and tribes, which require 100% mitigation in kind and number, nor does this meet the conditions of the Northwest Power Act (which seeks full redress of fish and wildlife losses to the extent affected by hydropower and insofar as it can be done without jeopardizing the Pacific Northwest power supply). However, the Study Oversight Committee recommends this proposal be accepted as REASONABLE mitigation in light of the considerations listed below:

- Wildlife habitat within the study area and in the Columbia Basin is being developed or converted to uses incompatible with the needs of the indicator species and other species of interest to the public. Protection of portions of remaining habitat is an important action needed to ensure a future for wildlife.
- As a condition of mitigation planning, to avoid delay and potential disagreement associated with determining hydropower responsibility for losses and establishing losses in the absence of a detailed loss statement, the Study Oversight Committee agreed to a conceptual mitigation goal of acquisition of land or management rights of approximately 70,000 acres.
- The Northwest Power Act requires redress of fish and wildlife losses while providing for an adequate, efficient, economical and reliable power supply. Mitigation must achieve a balance in these concerns.

This plan is consistent with the land acquisition guidelines of the Columbia Basin Fish and Wildlife Program. Section 1003 states that the Council has included measures for off-site enhancement which "call for acquisition of wildlife range lands to compensate for the loss of such lands when the projects were developed". Acquisition of suitable off-site winter range near Grand Coulee project is indicated in Section 1004, Table 5. Section 1004(d)(1)(A)-(D) indicates the criteria to be used by the Council in reviewing recommendations for land acquisition. These criteria include: a) determination of the need for and level of mitigation, b) development of a plan for implementing the project, c) consultation and coordination according to the Council's Fish and Wildlife Program, and d) submission of a detailed management plan for the proposed mitigation. This mitigation proposal provides the information necessary for this process.

VI. SUMMARY AND CONCLUSIONS

In 1942, completion of the Grand Coulee Dam project inundated approximately 70,080 acres of wildlife habitat. According to the U.S. Bureau of Reclamation (1976), approximately 21,100 acres were lands of the Colville Confederated Tribes, 3,900 acres were lands of the Spokane Indian Tribe and 45,000 acres were lands under the jurisdiction of the State of Washington. The Pacific Northwest Electric Power Planning & Conservation Act of 1980 prescribed that measures be implemented to protect, mitigate and enhance fish and wildlife affected by development and operation of Grand Coulee Dam and other hydropower projects on the Columbia River System.

This study estimated losses of wildlife and habitat due to inundation and reservoir level fluctuations resulting from development and operation of Grand Coulee Dam for hydropower production. Habitat/vegetation losses were determined from interpretation of pre-project aerial photographs. Eleven indicator species were chosen to represent wildlife known to occur within the study area. These were Canada goose, bald eagle, sage grouse, sharp-tailed grouse, ruffed grouse, mourning dove, long-eared owl, flicker, beaver, mule deer and white-tailed deer. Project-related losses of these species were estimated using population densities reported in the literature for other locations and vegetation data determined for the study area.

Losses in terms of Habitat Units were determined for eight indicator species/habitats using a modification of USFWS Habitat Evaluation Procedures. Indicator species/habitats were sage grouse, sharp-tailed grouse, ruffed grouse, mourning dove, mule deer, white-tailed deer, riparian forest habitat and riparian shrub habitat. Habitat Unit losses are shown in Table 20. Project benefits to wildlife are poorly documented and appear minimal.

TABLE 20. SUMMARY OF HABITAT UNITS AND NEST SITES LOST DUE TO PROJECT. One Habitat Unit equals one acre of optimum habitat for the specified indicator species or indicator habitat.

<u>Habitat Unit type</u>	<u>Habitat Units</u>			
	<u>Colville</u>	<u>Spokane</u>	<u>State</u>	<u>Total</u>
Sage grouse	893	0	1,853	2,746
Sharp-tailed grouse	8,833	2,609	21,281	32,723
Ruffed grouse	4,152	974	11,376	16,502
Mourning dove	1,923	653	6,740	9,316
Mule deer	10,827	1,087	15,219	27,133
White-tailed deer	3,982	1,180	16,470	21,632
Riparian forest	780	176	676	1,632
Riparian shrub	14	0	13	27
	<u>Secure Island Nest Sites</u>			
Canada goose	10	20	44	74

Potential mitigation lands were identified, their habitat quality and improvement potential rated, and prioritized by wildlife value. Deer winter range, riparian habitat and shrub-steppe lands were the highest priorities.

To fully replace the Habitat Unit losses due to the project, it was estimated that 244,722 acres of land would need to be protected and improved for wildlife. This would cost approximately \$107,000,000 for land protection and development, and approximately \$4,900,000 for annual operation and maintenance.

Rather than full redress of losses, the goal of the proposed mitigation plan is to protect through purchase, easement and/or enhancement, the same number of Habitat Units as was lost due to inundation by the project. Additionally it is proposed that key sites within the study area be identified, protected and enhanced for bald eagles. This goal is substantially smaller and less costly than full redress of losses. 73,522 acres of potentially available lands have been targeted to meet this goal.

Estimated costs for the mitigation proposal are \$41,374,975 for protection and enhancement of habitat, and protection for bald eagles. These are high estimates based on fee title acquisition of lands. If easements can be negotiated, costs may be reduced. Estimated annual operation and maintenance costs are \$1,413,694 and annual monitoring costs are estimated at \$84,793. The basis for these cost estimates is described in Section III.6 on pages 11-12.

Lands included in the proposal are a mix of government, tribal and private ownership. Mitigation credit is provided for Habitat Units gained through improvement for all lands considered and for protection of currently existing Habitat Units on all new acquisitions and/or easements. The plan is divided into four actions implemented sequentially over a 10-year period. Each action protects a portion of the targeted habitat and provides for habitat development and improvement. Actions were selected which provide the greatest benefits in terms of high-priority Habitat Units and cost-effectiveness. Cost estimates for each action are presented on pages 35-39 and 42.

Mitigation lands are equitably distributed between the Colville Confederated Tribes, the Spokane Tribe and the State of Washington. In the event that a given target parcel is not available, alternative land parcels have also been listed which could be substituted to provide similar Habitat Unit values. Habitat Units protected by this plan are shown in Table 21,

TABLE 21. SUMMARY OF HABITAT UNITS PROTECTED BY PROPOSAL

<u>Habitat Unit Type</u>	<u>Units Lost</u>	<u>Units Protected</u>
Sage grouse	2,746	8,110
Sharp-tailed grouse	32,723	24,661
Turkey (trade for grouse)	0	815
Ruffed grouse	16,502	12,001
Mourning dove	9,316	3,471
Muledeer	27,133	34,291
White-tailed deer	21,632	21,187
Elk (trade for deer)	0	1,500
Riparian shrub	27	377
Riparian forest	1,632	1,458
Canada goose (nest sites)	74	42

Funds for operation and maintenance would be required for the life of the project. Monitoring of mitigation success would be accomplished by periodic sampling of habitat quality and wildlife population trends.

Because the proposal seeks to protect a variety of habitat, some degree of protection will be provided for all of the approximately 350 wildlife species occurring within the study area. The proposal would provide significant benefits to shrub-steppe wildlife such as sage grouse and sharp-tailed grouse. These species are rapidly disappearing from Washington because of continued conversion of shrub-steppe lands. Habitat for bald eagles would be protected and enhanced under the proposal, and nesting along FUR Reservoir would be encouraged. Critical big game winter range would be protected for elk, mule deer and white-tailed deer. The proposal would also protect critical riparian lands including some mature cottonwood stands. Riparian lands are important to many species, and mature stands are especially valuable for bald eagles, other raptors and cavity nesters.

This mitigation plan replaces less than one third of the estimated wildlife and habitat losses caused by Grand Coulee Dam. However because of habitat degradation occurring in Washington, the value of the proposed mitigation actions to wildlife is expected to increase significantly over time. It is proposed that the plan be accepted as reasonable and fair mitigation because of the size and particular circumstances surrounding the project. The plan is consistent with the Northwest Power Planning Council's land acquisition criteria and the Study Oversight Committee's conceptual goal.

VII. GLOSSARY

Terms are defined as used in this report.

Advanced Design Work required to finalize management plans for specific mitigation parcels; may include field inventory, development of maps and working drawings, siting plans, solicitation of bids and quotes, and negotiation of easements and management agreements.

Allotted land Lands within an Indian reservation, belonging to a tribal member but with the title to the land held in trust for that member by the tribe.

Base **Habitat** Units Habitat Units that currently exist before any mitigation actions take place.

Carrion Dead and decaying fish or animals, such as spawned-out salmon or road-killed wildlife, used for food by other fish and wildlife.

Clutch Number of eggs a pair of birds produces and incubates at one time.

Cover Type Land classifications used in mapping aerial photographs; can be vegetation types such as grassland or forest, or other land uses such as industrial, commercial, etc.

Deeded Land Land within an Indian reservation belonging to an individual who holds the land in fee title. These lands were sold in accordance with the Indian Allotment Act and may belong to persons or corporations not affiliated with the tribes.

Drawdown Lowering the water level of the reservoir. FDR Reservoir is generally lowered 50-82 feet from April to July to provide storage for spring runoff, maximize power production and prevent flooding.

Easement Acquisition of limited use or rights to another party's property; ownership is not transferred.

Enhance To increase the habitat value/quality of a piece of land. This usually involves manipulating the plant communities to provide for greater numbers of selected species or an increase in species diversity; see habitat improvement.

Fledge The event of a young bird achieving flight for the first time. Used in the context of number of young fledged/nest, it serves as an indication of reproductive success.

Fledgling A young bird which has just acquired feathers necessary to fly.

Food Web A group of organisms involved in a complex pattern of transferring energy between different levels of a community; the relationships by which certain species prey on and are preyed upon by other species.

Habitat Improvement To change plant communities on a particular land parcel to provide better conditions for certain types of wildlife. May include burning, fencing, logging, thinning, planting, grazing management, irrigation, etc.

Habitat Improvement Potential The difference between the present condition of a specific land parcel and its projected condition after development and management for wildlife. Expressed in terms of increase in Habitat Suitability Index (HSI).

Habitat Protection Used in proposal to mean acquisition of management rights to specific mitigation lands. Includes conservation easements, public hunting and fishing easements, long-term leases, transfer of development rights, fee title purchase, or any other means available to obtain rights to manage wildlife.

Habitat Quality Rating A number between 0 and 1 used to indicate the overall capability of a land parcel to provide habitat for a specific type of wildlife. The rating represents the estimated percent of optimum habitat, with 1 being optimum.

Habitat Suitability Index (HSI) A number between 0 and 1 which represents the habitat condition of the area in question as compared to optimum habitat conditions; same as "habitat quality rating" above.

Habitat Unit One acre of optimum habitat for a given species.

Indicator Species Species chosen to represent general habitat types and habitat requirements of most wildlife affected by the project.

Land Management Rights Legal privilege to control the use of certain property. May be obtained a variety of ways, i.e. through easement, purchase or other agreement.

Lek Communal breeding ground used by grouse during spring courtship.

Macrophyllous Shrubs Shrubs having relatively large, broad leaflets or leaves. These include serviceberry, snowberry, oceanspray, chokecherry, etc. as opposed to bitterbrush, sagebrush or rabbitbrush.

Mesic Characterized by moderately moist conditions; neither overly moist nor overly dry.

Mitigate To alleviate or make less severe. When damage to habitat is unavoidable or has already occurred, it is the action needed to reduce and/or compensate for losses to wildlife and habitat.

Mitigation Credit Number of Habitat Units/parcel which will be counted toward meeting the goal of protecting the same number of Habitat Units as was lost due to the project. Mitigation credit is provided for Habitat Units gained through improvement for all lands in the proposal and for protection of currently existing Habitat Units on all new acquisitions and/or easements.

Monitoring Periodic evaluation of mitigation lands to assess the effectiveness of mitigation measures. Initial collection of baseline data with routine monitoring of habitat quality and wildlife populations trends every three years is proposed.

operation and Maintenance Work, investments and expenditures required to hold and manage land and keep habitat in desired condition. This includes weed control, range and forest management, agricultural practices, payments in lieu of taxes, etc.

Planimetry Technique used to measure mapped areas on aerial photographs using an instrument that measures the area of a plane figure as a mechanically coupled pointer traverses the figure's perimeter.

Prey Base Those animals available as food for another species; see also "food web".

Private land Land belonging to a private individual. The State has jurisdiction for wildlife on private lands.

Project Grand Goulee Dam, associated hydropower facilities and FDR Reservoir, Irrigation aspects and facilities of the Columbia Basin Project are not considered in this report.

Project Area The area in the vicinity of Grand Goulee Dam and FDR Reservoir and extending to the ridge crests on either side of the reservoir.

Protect To prevent destruction of currently existing habitat; usually accomplished by acquiring ownership or management rights to those lands; see also "Habitat Protection".

Public Land Land owned by the state or federal government.

Raptor Bird of prey such as a hawk or owl.

Riparian **Habitat** Areas influenced by surface or ground water at a frequency and duration sufficient to support a prevalence of vegetation typically adapted to moist or saturated soil conditions. These plant communities typically provide food, cover, water and reproductive habitat for many species and are considered key or critical, especially in dry environments.

Shrub-steppe Grass and shrub vegetation typical of the arid Columbia Basin or rain shadow east of the Cascades. Shrubs include bitterbrush, sagebrush and rabbitbrush; grasses include Idaho fescue, bluebunch wheatgrass, needle-and-thread and cheatgrass.

Target Parcel Specific parcels of land proposed for the mitigation plan, i.e. the first priority lands for which management rights are sought to obtain the mitigation goal. Alternate parcels are also listed and described.

Tribal Land Land owned by an Indian Tribe and managed for the collective benefit of its members.

Vegetation Typing Delineation of plant communities on aerial photographs. Relatively homogeneous areas are mapped on mylar overlays and given a designation from a specific classification system.

Wildlife Guild A group of species which uses a common resource in the environment; guilds may be defined at any level of detail.

Wildlife Population Trend The direction of changes in a wildlife population i.e. increasing or decreasing; a parameter to be measured in monitoring effectiveness of mitigation in specific areas.

Wildlife Potential The ability of a specific parcel of land to support and produce wildlife.

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APPENDIX 1.1. GRAND COULEE DAM PROJECT SPECIFICATIONS

PROJECT CHRONOLOGY:

- 1913 State/Federal irrigation feasibility study
- 1918 Grand Coulee High Dam/irrigation project proposed
- 1932 official Bureau of Reclamation proposal of project
- 1933 (July 16) project authorized (low dam) and clearing begins
- 1935 left coffer dam in place; construction of high dam authorized
- 1936 both coffer dams in place
- 1937 dam foundation extends across the river
- 1939 water began to back up behind partially completed dam
- 1941 generators rushed into service for war effort. First water spilled over top of dam.
- 1942 (July 15) FDR pool level first reaches 1290 ft.
- 1943 (May 8) work begins on irrigation system
- 1946 construction begins on pumping plant (for Banks Lake)
- 1951 last of generating units completed
- 1952 irrigation water first available
- 1967 beginning of construction of 3rd powerhouse
- 1973 2 pump-generator units installed
- 1974 reservoir lowered to 1160' to allow construction
- 1981 reversible pump-generators completed
- 1983 3rd powerhouse dedicated

FDR RESERVOIR:

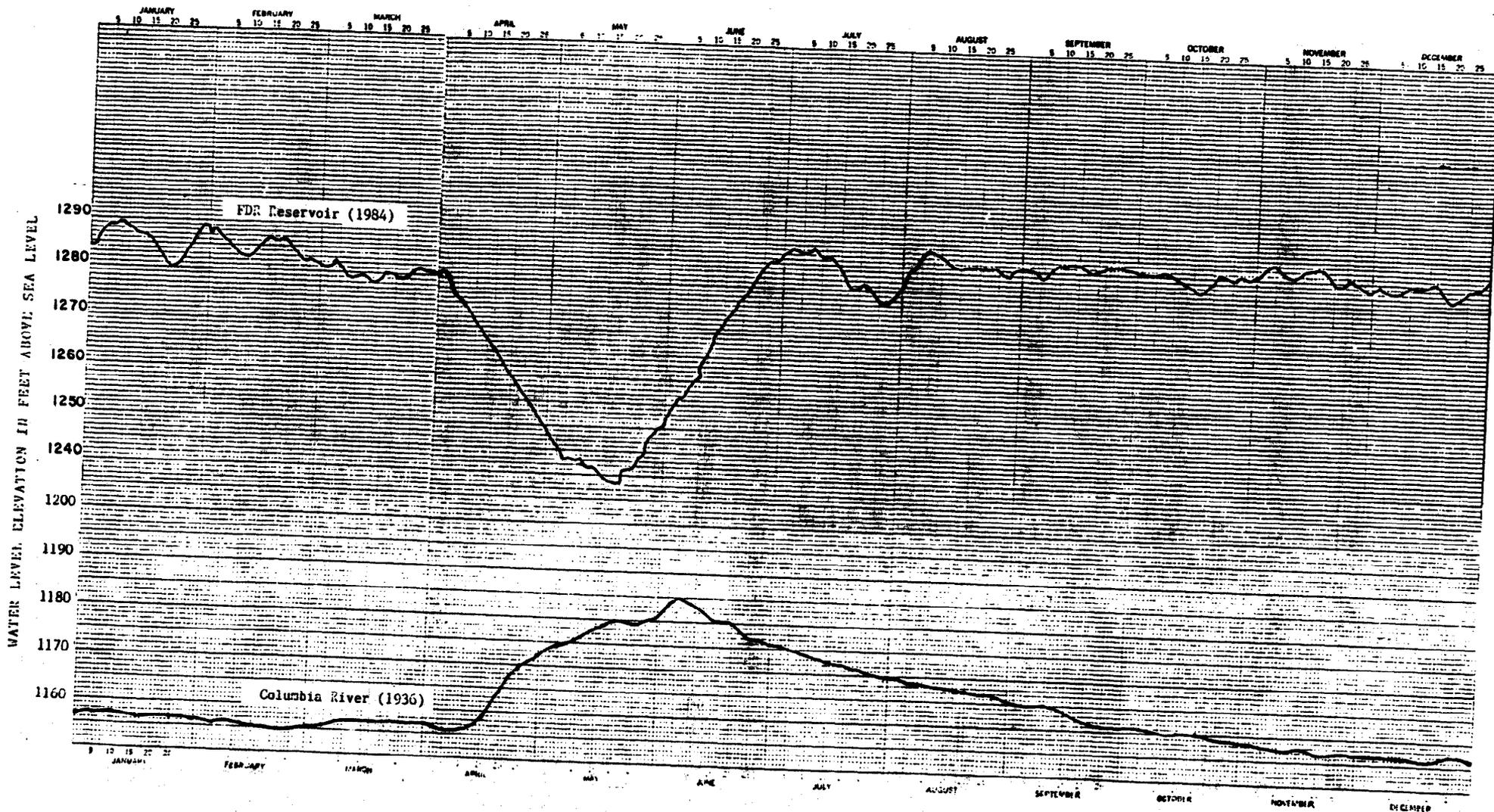
- reservoir length = 151 miles to the Canadian border (Note: RM745 - RM596.7 = 148.8 miles on USGS maps. The 1290' pool level crosses the reservoir at RM740.8 and therefore can be interpreted as the end of the reservoir for a total length of 144.1 miles)
- reservoir elevation = 1290' (max pool)
- annual drawdown = 50 - 82 feet
- operating extremes = 1290' max pool - 1208' min pool (1974 construction pool level reduced to 1170' - 1160')
- depth of reservoir behind dam = 345 feet (1290' max pool - 945' min tailwaters; measured depth near dam is 385 feet (USBR 1976))
- Hydraulic height of dam = 355 feet (USBR 1976)
- length of shoreline = 660 miles (USBR 1984)
- surface area of reservoir at 1290 feet = 82,270 acres
- active water storage = 5,232,000 acre feet or about 10% of the average annual flow of Columbia River water entering the U.S.

DAM OPERATION:

- output = 497 - 2305 megawatts
- flow = 27 - 299 kcfs
- flow change rate = 31 kcfs/hr increase, 30 kcfs/hr decrease

APPENDIX 1.2 RIVERBANK MILES BY JURISDICTION. (Riverbank miles = river miles taken from USGS topographic maps and USBR (1976) x 2 banks per mile of river. NOTE: total riverbank miles are less than would be indicated by the USBR river-length figure, and are less than actual shoreline measurements which would include natural shoreline irregularities.)

River	Colville Tribe	Spokane Tribe	State
Columbia	92.7	7.5	196.8
Sanpoil	18		
Spokane		32	32
Colville			4
Kettle			22
TOTAL	110.7	39.5	254.8



APPENDIX 1.3 WATER LEVEL FLUCTUATIONS OF FDR RESERVOIR AND PRE-PROJECT COLUMBIA RIVER. Comparison of 1984 reservoir forebay elevations with pre-project Columbia River elevations at the Kettle Falls Gaging Station in 1936. Total reservoir fluctuation was 52 feet. Total river fluctuation was 30.5 feet.

APPENDIX 1.4. COLUMBIA RIVER LOG (Based on USGS miles from topographic maps)

REACH I. GRAND COULEE DAM TO SANPOIL RIVER (RM596.5 - RM615.8 = 19.3 miles)

<u>River Mile</u>	<u>Landmark</u>
596.5	Grand Coulee Dam site
599	Seaton Ferry
608	town of Plum
615.5	Clark Ferry (now Keller Ferry)
615.8	Sanpoil River

REACH II. SANPOIL RIVER TO HAWK CREEK (RM615.8 - RM634 = 18.2 miles)

<u>River Mile</u>	<u>Landmark</u>
619	Hell Gate (river feature)
623.5	1000 ft. river elevation
624	Whitestone Rock
627	Halverson Mill
634	town of Peach
634	Hawk Creek

REACH III. HAWK CREEK TO GIFFORD FERRY (RM634 - RM674.7 = 40.7 miles)

<u>River Mile</u>	<u>Landmark</u>
635	China Camp Rapids
639	confluence with Spokane River
646.5	Spokane Reservation northern boundary
655	old town of Gerome
657.3	town of Fruitland
659	town of Hunters
661.3	old Hunters Ferry
664	town of Cedonia

REACH IV. GIFFORD FERRY TO KETTLE RIVER (RM674.7 - RM706 = 31.3 miles)

<u>River Mile</u>	<u>Landmark</u>
674.7	Gifford Ferry
675	old Gifford Ferry
675	old and new towns of Inchelium and Gifford
679.5	old and new towns of Daisy
684.3	town of Rice
686	old town of Harvey
689.2	Colville Reservation northern boundary
696.5	Rickey Rapids
699.7	Colville River

700.3	old town of Kettle Falls
703.3	Kettle Fall Bridge
704	Kettle Falls
706	Kettle River

REACH v. KETTLE RIVER TO CANADIAN BORDER (RM706 - RM745 = 39 miles)

<u>River Mile</u>	<u>Landmark</u>
706	old town of Marcus
708	new town of Marcus
712	town of Powell
712.5	town of Evens
716	old Bossburg ferry
715.5	town of Bossburg
722.2	Ryan (old railroad siding?)
723	China Bend
726.7	town of Marble
729	Little Dalles
729.6	end of national recreation area (NPS)
734.2	old Northport bridge
734.5	town of Northport
735.1	new Northport bridge
737	Steaaboat Rock
740.8	1,290' FDR Reservoir contour
743.7	town of Boundary
745	Canadian Border

APPENDIX 1.5 WILDLIFE OF THE STUDY AREA

LONG-TAILED SALAMANDER	GREEN-WINGED TEAL	VIRGINIA RAIL
LONG-TOED SALAMANDER	BLUE-WINGED TEAL	SORA
TIGER SALAMANDER	CINNAMON TEAL	AMERICAN COOT
WESTERN TOAD	AMERICANWIDGEON	
WOODHOUSE'S TOAD	SHOVELER	KILLDEER
GREAT BASIN SPADEFOOT	WOOD DUCK	BLACK-BELLIED PLOVER
PACIFIC TREEFROG	REDHEAD	SAMIPALMATED PLOVER
LEOPARD FROG	RING-NECKED DUCK	COMMON SNIPE
GREEN FROG	CANVASBACK	LONG-BILLED CURLEW
BULLFROG	GREATER SCAUP	SPOTTED SANDPIPER
SPOTTED FROG	LESSER SCAUP	SOLITARY SANDPIPER
	COMMON GOLDENEYE	GREATER YELLOWLEGS
PAINTED TURTLE	BARROW'S GOLDENEYE	LESSER YELLOWLEGS
SAGEBRUSH LIZARD	BUFFLEHEAD	PECTURAL SANDPIPER
WESTERN FENCE LIZARD	HARLEQUIN DUCK	BAIRD'S SANDPIPER
SIDE-BLOTCHED LIZARD	OLDSQUAW	LEAST SANDPIPER
SHORT-HORNED LIZARD	WHITE-WINGED SCOTER	DUNLIN
N. ALLIGATOR LIZARD	RUDDY DUCK	LONGBILLED DOWITCHER
WESTERN SKNIK	HOODED MERGANSER	STILT SANDPIPER
RUBBER BOA	COMMON MERGANSER	SAMIPALMATED SANDPIPER
YELLOW BELLIED RACE	RED-BREASTED MERGANSER	WESTERN SANDPIPER
GOPHER SNARE		SANDERLING
WANDERING GARTER (ELEGANS)	TURKEY VULTURE	AMERICAN AVOCET
COMMON GARTER (SIRTALIS)	GOSHAWK	WILSON'S PHALAROPE
WESTERN GARTER SNAKE	SHARP-SHINNED HAWK	NORTHERN PHALAROPE
NIGHT SNARE	COOPER'S HAWK	HERRING GULL
WESTERN RATTLESNAKE	RED-TAILED HAWK	CALIFORNIAGULL
	SWAINSON'S HAWK	RING-BILLED GULL
COMMON LOON	ROUGH-LEGGED HAWK	BONAPARTE'S GULL
ARCTIC LOON	FERRUGINOUS HAWK	GLAUCOUS-WINGED GULL
RED-NECKED GREBE	GOLDEN EAGLE	FORSTER'S TERN
HORNED GREBE	BALDEAGLE	BLACK TERN
EARNED GREBE	NORTHERN HARRIER	COMMON TERN
WESTERNGREBE	OSPREY	
PIED-BILLEDGREBE	PRAIRIE FALCON	BAND-TAILED PIGEON
WHITE PELICAN	PERGRINE FALCON	ROCK DOVE
GREAT BLUE HERON	MERLIN	MOURNING DOVE
B-C NIGHT HERON	KESTREL	
COMMON EGRET		BURROWING OWL
AMERICAN BITTERN	SHARP-TAILED GROUSE	BARRED OWL
	SAGE GROUSE	BARN OWL
WHISTLING SWAN	BLUE GROUSE	SCREECH OWL
CANADAGOOSE	SPRUCE GROUSE	GREAT HORNED OWL
ALASKAN CACKLING GOOSE	RUFFED GROUSE	BOREAL OWL
WHITE-FRONTED GOOSE	CALIFORNIA QUAIL	SNOWY OWL
ROSS GOOSE	RING-NECKED PHEASANT	PYGMY OWL
SNOW GOOSE	CHUKAR	BARREDOWL
	GRAY PARTRIDGE	GREAT GRAY OWL
MALLARD	TURKEY	LONGEARED OWL
GADWALL		SHORT-EARED OWL
PINTAIL	SANDHILL CRANE	SAW-WHET OWL

FLAMMULATED OWL
HAWK OWL

COMMON POORWILL
COMMON NIGHTHAWK

VAUX'S SWIFT
WHITE-THROATED SWIFT

BLACK-CHINNED HUMMINGBIRD
RUFIOUS HUMMINGBIRD
CALLIOPE HUMMINGBIRD

BELTED KINGFISHER
COMMON FLICKER
PILEATED WOODPECKER
LEWIS' WOODPECKER
YELLOW-BELLIED SAPSUCKER
WILLIAMSON'S SAPSUCKER
HAIRY WOODPECKER
DOWNY WOODPECKER
WHITE-HEADED WOODPECKER
BLACK-BACKED WOODPECKER
THREE-TOED WOODPECKER

EASTERN KINGBIRD
WESTERN KINGBIRD
SAY'S PHOEBE
WILLOW FLYCATCHER
AHS-THROATED FLYCATCHER
LEAST FLYCATCHER
HAMMOND'S FLYCATCHER
DUSKY FLYCATCHER
WESTERN FLYCATCHER
WESTERN WOOD PEEWEE
OLIVE-SIDED FLYCATCHER

HORNED LARK

VIOLET GREEN SWALLOW
TREE SWALLOW
BANK SWALLOW
ROUGH-WINGED SWALLOW
BARN SWALLOW
CLIFF SWALLOW

GRAY JAY
BLUE JAY
STELLER'S JAY
BLACK-BILLED MAGPIE
COMMON RAVEN

COMMON CROW
CLARK'S NUTCRACKER

BLACK-CAPPED CHICKADEE
MTN. CHICKADEE
BOREAL CHICKADEE
CHESTNUT-BACKED CHICKADEE
WHITE-BREASTED NUTHATCH
RED-BREASTED NUTHATCH
PYGMY NUTHATCH
BROWN CREEPER

DIPPER

HOUSE WREN
WINTER WREN
LONG-BILLED MARSH WREN
CANYON WREN
ROCK WREN

GRAY CATBIRD
ROBIN
VARIED THRUSH
HERMIT THRUSH
WAINSONS'S THRUSH
VEERY
WESTERN BLUEBIRD
MOUNTAIN BLUEBIRD
TOWNSEND'S SOLITAIRE
GOLDEN CROWNED KINGLET
RUBY-CROWNED KINGLET
WATER PIPIT
HOHEMIAN WAXWING
CEDAR WAXWING
NORTHERN SHRIKE
LOGGERHEAD SHRIKE
STARLING

SOLITARY VIREO
RED-EYED VIREO
WARBLING VIREO

TENNESSEE WARBLER
ORANGE-CROWNED WARBLER
NASHVILLE WARBLER
YELLOW-RUMPED WARBLER
TOWNSEND'S WARBLER
NORTHERN WATERTHRUSH
YELLOW WARBLER
MACGILLIVRAY'S WARBLER
COMMON YELLOWTHROAT

YELLOW-BREASTED CHAT
WILSON'S WARBLER

AMERICAN REDSTART
HOUSE SPARROW
BOBOLINK
WESTERN MEADOWLARK
YELLOW-HEAD, BLACKBIRD
BREWER'S BLACKBIRD
RED-WINGED BLACKBIRD
RUSTY BLACKBIRD

NORTHERN ORIOLE
BULLOCK'S ORIOLE
BROWN-HEADED COWBIRD
WESTERN Tanager
SNOW BUNTING
NDIGOBUNTING
LAZULI BUNTING
PINE GROSBEEK
BLACK-HEADED GROSBEEK
EVENING GROSBEEK-

CASSIN'S FINCH
PURPLE FINCH
HOUSE FINCH
GRAY-CROWN. ROSY FINCH
HOARY REDPOLL
COMMON REDPOLL
PNE SISKIN
AMERICNA GOLDFINCH
RED CROSSBILL
WHITE-WINGED CROSSBILL

RUFIOUS-SIDED TOWHEE
DARK-EYED JUNCO
SAVANNAH SPARROW
GRASSHOPPER SPARROW
VESPER SPARROW
LARK SPARROW
TREE SPARROW
CHIPPING SPARROW
CLAY-COLORED SPARROW
BREWER'S SPARROW
HARRIS' SPARROW
WHITE-CROWNED SPARROW
GOLDEN-CROWNED SPARROW
WHITE-THROATED SPARROW
FOX SPARROW
LINCOLN'S SPARROW
SONG SPARROW

MERRIAM SHREW
MASKED SHREW
VAGRANT SHREW
DUSKY SHREW
N. WATER SHREW
PYGMY SHREW
PACIFIC WATER SHREW
TROWBRIDGE'S SHREW
MERRIAM'S SHREW
SHREW MOLE
TOWNSEND'S MOLE
COAST MOLE
3LG BROWN BAT
SILVER-HAIRED BAT
RED BAT
HOARY BAT
TOWNSENDS'S BIG-EARNED BAT
CALIFORNIA MYOTIS
LONG-EARED MYOTIS
LITTLE BROWN MYOTIS
SMALL-FOOTED MYOTIS
FRINGED MYOTIS
LONG-LEGGED MYOTIS
YUMA MYOTIS
WESTERN BIG-EARED BAT
PALLID BAT

SNOWSHOE HARE
WHITE-TAIL JACKRABBIT
MOUNTAIN COTTONTAIL
PYGMY RABBIT
NUTTALL'S COTTONTAIL
PIKA

WASHINGTON GROUND SQUIRREL
COLUMBIAN GR. SQUIRREL
CALIFORNIA GR. SQUIRREL
GOLD MANTLED GR. SQUIRREL
LEAST CHIPMUNK
TOWNSEND'S CHIPMUNK
RED-TAILED CHIPMUNK
YELLOWPINE CHIPMUNK

RED SQUIRREL
DOUGLAS SQUIRREL
W. GRAY SQUIRREL
FOX SQUIRREL
N. FLYING SQUIRREL

N. POCKET GOPHER

W. POCKET GOPHER
WESTERN JUMPING MOUSE
WESTERN HARVEST MOUSE
GR. BASIN POCKET MOUSE
DEERMOUSE
HOUSE MOUSE
BUSHY-TAILED WOODRAT
NORWAY RAT

BEAVER
PORCUPINE
MUSKRAT
YELLOW-BELLIED MARMOT
s. RED-BACKED VOLE
W. RED-BACKED VOLE
HEATHER VOLE (PHENACOMYS)
MEADOW VOLE
MOUNTAIN VOLE
TOWNSEND'S VOLE
LONGTAILED VOLE
CREEPING VOLE
WATER VOLE
SAGEBRUSH VOLE

COYOTE
RED FOX
BLACK BEAR
GRIZZLY BEAR
RACCOON
SHORT-TAILED WEASEL
LONG-TAILED WEASEL
MINK
MARTEN
FISHER
WOLVERINE
BADGER
STRIPED SKUNK
w. SPOTTED SKUNK
RIVER OTTER
MOUNTAIN LION
CANADA LYNX
BOBCAT

ROCKY MOUNTAIN ELK
WHITE-TAILED DEER
MULE DEER
MOOSE

APPEENDIX 1.6 OVERVIEW OF COLUMBIA RIVER REACHES

A brief description of each river reach is provided, along with a list of perennial tributaries for each bank and a figure depicting generalized vegetation distribution.

OVERVIEW of Reach I. Grand Coulee Dam to Sanpoil River. (RM596.5-RM615.8=19.3 miles)

In this reach the Columbia River runs generally East-West. The land is rocky and open, and the vegetation is predominately shrub-steppe. Zender (pers. commun.) describes the present vegetation as being generally bitterbrush communities on the left bank (north-facing slopes) and sagebrush communities on the right bank (south-facing slopes). Rogers (1941) characterized the land between the dam and the Spokane River as being largely disturbed, with "cheatgrass sagebrush and other weedy plants prevailing in many places". He notes that bitterbrush appears intermittently along the Columbia to a few miles above the mouth of the Spokane River, and that rabbitbrush also occurs to the mouth of the Spokane, with a somewhat spotty distribution.

Left Bank

Aspect: generally North-facing
slopes rise to 2600'

Surface rocks: Basalt

Perennial Tributaries from W to E

none

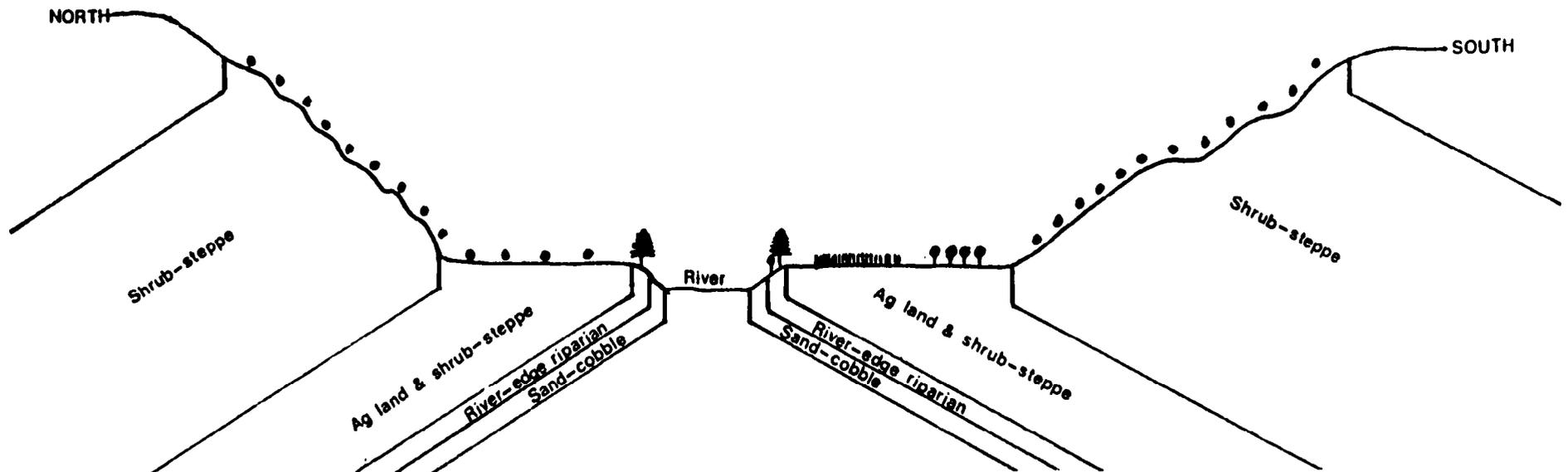
Right Bank

Aspect: generally South-facing
slopes rise to 2600'

Surface rocks: Basalt

Perennial Tributaries from W to E

none



OVERVIEW of Reach II. Sanpoil River to Hawk Creek. (RM615.8-RM634=18.2 miles)

In this reach the Columbia River runs generally East-West. Vegetation is predominately shrub-steppe. Zender (pers. commun.) describes the present vegetation as being generally bitterbrush communities on the left bank (north-facing slopes) and sagebrush communities on the right bank (south-facing slopes). Rogers (1941) characterized the land between the dam and the Spokane River as being largely disturbed, with “cheatgrass, sagebrush and other weedy plants prevailing in many places”. He notes that bitterbrush appears intermittently along the Columbia to a few miles above the mouth of the Spokane River, and that rabbitbrush also occurs to the mouth of the Spokane, with a somewhat spotty distribution.

Left Bank

Aspect: generally North-facing slopes rise to 2600'

Surface rocks: Basalt

Perennial Tributaries from W to E

Owl Canyon ?

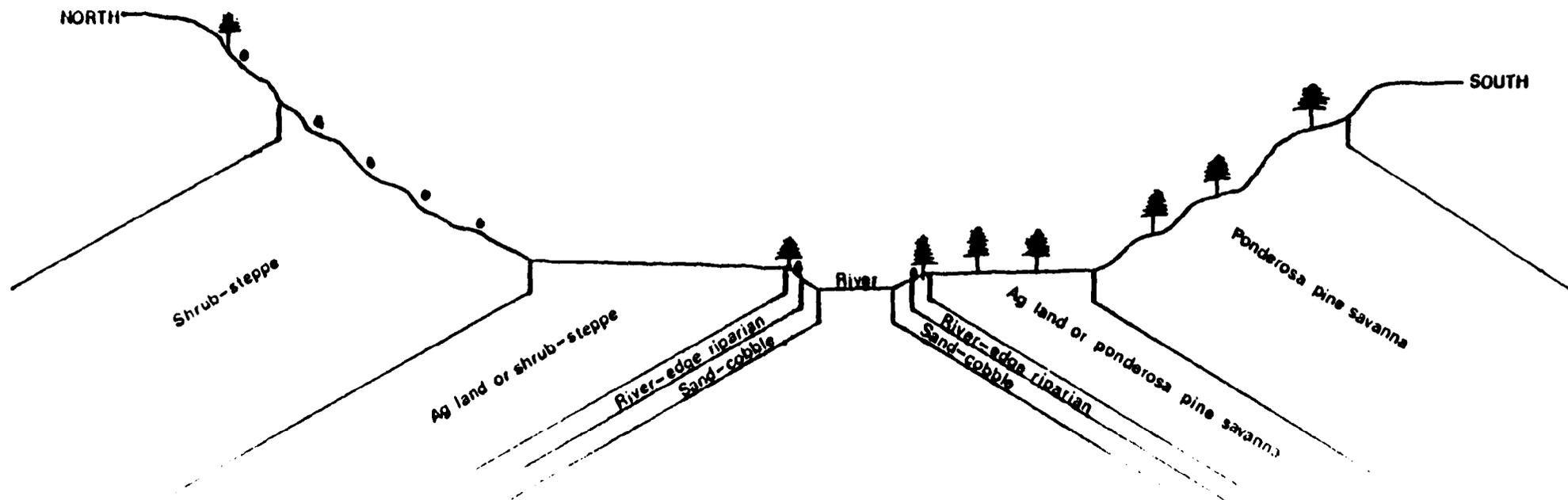
Right Bank

Aspect: generally South-facing slopes rise to 3000'

Surface rocks: Basalt Changing to granite

Perennial Tributaries from W to E

Sanpoil River RM615.8



OVERVIEW of Reach III. Hawk Creek to Gif ford Ferry. (RM634-RM674.7=40.7 mi lcs)

In this reach the Columbia River runs generally North-South, Rogers (1941) described the area along the Columbia River's east bank as sandy flats of ponderosa pine savanna, most of which had been cleared and "overrun by weeds, particularly cheatgrass". He reports the west bank as being relatively undisturbed open ponderosn pine forest. Zender (pers. commun.) describes the present left hank vegetaton as ponderosa pine and bitter-brush with serviceberry on dry sites and redstem ceanothus occurring in moist areas and on north-facing slopes. Bitterbrush is less prevalent up-river from Cedonia.

LEFT BANK

Aspect: West facing
slopes rise to 1800' then to 4200'

RIGHT BANK

Aspect: East facing
slopes rise to 3500'

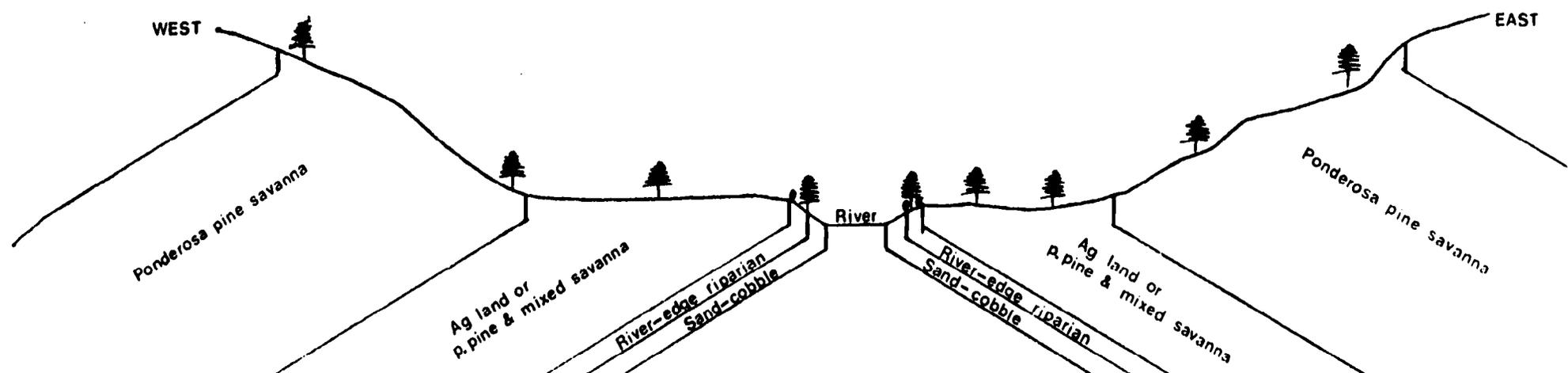
Perennial Tributaries from S to N

- Hawk Creek RM634
- Spokane Rtver RM639
- Spokane Reservation Boundary RM646.5__
- Glasgow Creek RM654
- 0-ra-pak-en Creek RM656
- Alder Creek (Fruitland) RM658
- Hunters Creek (Hunters) RM659
- Harvey Creek (Cedonia) RM664
- Clark Lake Creek RM669
- Deer Creek RM673

Perennial Tributaries from S to N

- Threemile Creek RM642
- Sixmile Creek RM644
- Ninemile Creek RM648
- Wilmont Creek RM654
- Monoghan Creek RM658
- Coyote Creek RM660
- Falls Creek RM660.5
- Nez Perce Creek RM661
- Stray Dog Creek RM668

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OVERVIEW of Reach IV, Gifford Ferry to Kettle River. (RM674-RM706=31.3 mile)

In this reach the Columbia River runs generally North-South. Up-river from Daisy the area can be generally characterized as old growth, open stands of ponderosa pine/pinegrass habitat type, with Douglas fir and ponderosa pine occurring on north-facing slopes (Zender, pers. commun.). Bitterbrush occurs in the lower portion of this reach (down-river from Daisy) but is not abundant. Rogers (1941) did not report its occurrence in this reach at all. It is absent from the up-river portion of this reach, and thus Ceanothus spy. provide the most important browse, During the period of 1926-1934, large forest fires occurred in the vicinity of Barnaby Island and north of Kettle falls. Thus canyon slopes in these areas are currently heavily vegetated with redstem and evergreen ceanothus, and servicecherry (Zender , pers. commun.). McComb (pers. commun.) suggested that following a burn in this area, browse species comprise the greatest percent canopy cover after 5 years Thereafter the burned area is steadily invaded by trees. Rogers (1941) reported that Rocky Mountain juniper occurred commonly on stony river bars.

LEFTBANK

Aspect: West facing
slopes rise to 2800' then to 4200'
(Huckleberry Mts.)

Surface Rocks: sedimentary rocks and
glacial outwash

Perennial Tributaries from S to N

- Stranger Creek (Gifford) RM675
- Magee Creek(Daisy) RM679. 5
- Jennings Creek RM680
- Cheweka Creek RM684
- Quil 11 isascut Creek RM688
- Rickey Creek 696
- Hal lam Creek 699
- Colville River 700

RIGIT BANK

Aspect: East facing
slopes rise to 3500'
(Kettle Mts.)

Surface Rocks: sedimentary rocks and
glacial outwash

Perennial Tributaries from S to N

- Stranger Creek (Inchelium) RM675
- Hall Creek RM675.5
- Cobbs Creek RM676
- Colville Reservation Boundary ----- RM689.3
- La Fleur Creek RM688
- Martin Creek RM693
- Roper Creek RM695
- Sherum Creek Rm700.3



OVERVIEW of Reach V. Kettle River to Canadian Border. (RM706-RM745=39 miles)

In this reach the Columbia River runs generally Northeast-Southwest. Rogers (1941) reports the forest consisted largely of second growth ponderosa pine, Douglas fir and western larch, speculating that the original forest was destroyed by fire. Sparse stands of young ponderosa pine, with a grass/macrophyllous **shrub** understory, prevailed on the hills along the west side of the river to near the Canadian **border, and** on the east side of the river to a few miles north of Evans. Zender (pers. commun.) reports that **currently** sumac is particularly abundant in the vicinity of China Bend. From a few miles above Evans to **the** Canadian border, Rogers (1941) reported a mixed forest with species including paper birch, aspen, lodgepole **pine, and** Douglas fir, with an understory of macrophyllous shrubs. Rocky Mountain juniper occurred commonly on **stony** river bars, and cottonwoods leaned over the river in many places.

LEFT BANK

Aspect: Northwest facing
slopes rise to 3500'

Surface Rocks: sedimentary rocks and mudstone, volcanic sandstones & tuff

Perennial Tributaries from S to N

- Pingston Creek RM706
- China Creek RM712.5
- Onion Creek RM730
- 5 Mile Creek RM733
- Deep Creek RM737
- Scriver Creek RM739.5

RIGHT BANK

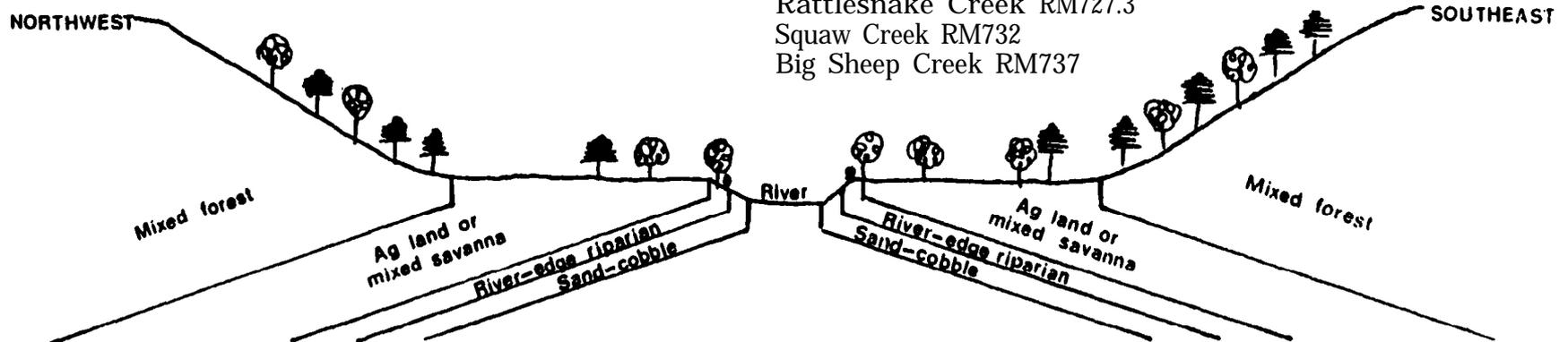
Aspect: Southeast facing
slopes rise to 3200'

Surface Rocks: sedimentary rocks and mudstone, volcanic sandstone & tuff

Perennial Tributaries from S to N

- Kettle River RM706
- unnamed creek RM715.5
- Lodgepole Creek RM720.3
- 15 mile creek RM721.3
- Flat Creek RM721.5
- Crown Creek RM726.7
- Rattlesnake Creek RM727.3
- Squaw Creek RM732
- Big Sheep Creek RM737

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Agency/OrganizationRepresentatives

Bonneville Power Administration

James Meyer

Colville Confederated Tribes

Steve Judd

Pacific Northwest Electric Power and
conservation Planning council

Martin Montgomery

Pacific Northwest Utilities Conference Committee

Paul Fielder
Kathryn Kostow

Spokane Tribe

Margaret Brittingham
Allan Scholz

U.S. Bureau of Reclamation

Robert Adair

U.S. Fish and Wildlife Service

Steve Lannoy

Washington Department of Game

Duane Eldred
Ted Gruenwald
Jack Howerton
Tracy Lloyd

The Oversight Cttee provided guidance and direction for the study, approved goals and objectives, provided background information, and reviewed findings and recommendation

APPENDH2.2 STUDY TEAM

Jennifer Creveling

Washington Department of Game

Brent Renfrow

Washington Department of Game

APPENDIX 2.3 HABITAT EVALUATION (Modified HEP used for this study)

The objective was to rate the quality of the habitat for both lands inundated by the project, and lands being considered for acquisition and/or management as mitigation. The various quality ratings (Habitat Suitability Indices or HSI's) multiplied by the actual acres of each vegetation type yield "Habitat Units" for a given species. A Habitat Unit is equal to one acre of optimum habitat for that species.

A habitat evaluation team was selected, comprised of personnel from agencies involved with the study. To the extent possible, personnel were selected who had knowledge of field conditions of the sites to be evaluated.

The team was provided with:

- A) A "habitat suitability model" for each indicator species or target habitat. Each model described basic "life requisites" or key parameters, and included graphs illustrating the relationship of parameters and life requisite variables to habitat quality.
- B) A brief written description of inundated lands and each proposed mitigation land parcel.
- C) Maps and aerial photographs of 1) the project area before inundation, and 2) potential mitigation lands. Vegetation typing and acreage figures were available for each site.

Using this information, group discussion, personal knowledge of the area, and professional judgment, the team rated the quality of each land parcel for the eight indicator species/indicator habitats. The following procedures were used:

- 1) The baseline habitat evaluation considered two points in time a) 1936 for inundated lands, and b) 1986 for potential mitigation lands. Habitat was considered as it was/is at those times with no adjustments made for management or succession.
- 2) The habitat ratings considered only the key vegetation types within a parcel for each indicator species/habitat. The types considered for each are presented in Figure 4.
- 3) The ability of the parcel to provide for each life requisite, including the variables for each life requisite as described in the species models, were considered in assigning the habitat rating.
- 4) The team rated the overall habitat suitability of the vegetation type from 0 to 1. This numerical rating is the Habitat Suitability Index (HSI). The HSI for a given parcel was based on the concept

of "limiting factors". Where limiting factors could be identified, the HSI equaled the lowest value of any limiting factor.

- 5) Team members discussed the rationale for rating each parcel, and collectively decided the final rating.

APPENDIX 2.4. HABITAT EVALUATION TEAM

<u>Name</u>	<u>Affiliation/(representing)</u>
Robert Adair	U.S. Bureau of Reclamation
Margaret Brittingham	Upper Columbia United Tribes (Spokane Tribe)
Paul Fielder	Chelan County Public Utilities District (Pacific Northwest Utilities Conference Committee)
Ron Friesz	Washington Department of Game
Ted Gruenwald	Washington Department of Game
Steve Judd	Coville Confederated Tribes
Steve Lannoy	U.S. Fish and Wildlife Service
Steve Zender	Washington Department of Game

APPENDIX 2.5 LIST OF HABITAT SUITABILITY MODELS USED

Sage Grouse. USFWS. undated. Sage grouse model, Ecoregion 3111 and 3112, US Fish and Wildlife Service. Ft. Collins, CO.

Sharp-tailed Grouse. USFWS. undated. Sharp-tailed grouse model, Ecoregion 3131. US Fish and Wildlife Service. Boise, ID.

Ruffed Grouse. Cade, B. S., P. J. Sousa. Habitat suitability index models: ruffed grouse. Biological Report 82(10.86). Western Energy and Land Use Team. US Fish & Wildlife Service. Fort Collins, CO. 31pp.

Mourning Dove. USFWS. 1978. Draft mourning dove habitat suitability model, Ecoregion 2410. US Fish & Wildlife Service. Olympia, WA.

Yule Deer. Sathé-Blari, S., S. Preston. 1985. Habitat suitability index model for the mule deer IN Wildlife Impact Assessment, Palisades Project, Idaho. US Fish & Wildlife Service. Boise, ID.

White-tailed Deer. Kaumbeimer D. undated. White-tailed deer **model** modified from SCS Pine Creek HEP. Unpubl. report in files of US Fish & Wildlife Service. Olympia, WA.

Riparian Forest. Lannoy, S. 1986. Forested riparian **habitat** composite model. Unpubl. report in files of US Fish & Wildlife Service. Olympia, WA.

Riparian Shrub. Lannoy, S. 1986. Riparian shrub habitat composite model. Unpubl. report in files of US Fish & Wildlife Service. Olympia, WA.

APPENDIX 3.1. DESCRIPTION OF VEGETATION TYPES INUNDATED BY PROJECT

SHRUB-STEPPE

Description: Occurs on dry sites and consists of grasses and shrubs. Dominant overstory species include bitterbrush, three-tipped sage and rabbitbrush with understory dominants including Idaho fescue, bluebunch wheatgrass, needle-and-thread and cheatgrass. Daubenmire (1970) described shrub-steppe habitat types in detail.

Wildlife Value: Key habitat for steppe-dependent species such as sage grouse, sharp-tailed grouse and pygmy rabbit. The type also includes winter range for mule deer and white-tailed deer and hunting areas for raptors and other predators. Zeigler (1977) noted that mourning dove nesting occurs within shrub-steppe as well riparian and orchard types.

MACROPHYLLOUS SHRUB

Description: Occurs on mesic sites such as north slopes, field edges and bottomland. Shrub species associated with the type include serviceberry, snowberry, meanspray, chokecherry, ceanothus, mockorange, wax current, rose and elderberry.

Wildlife Value: Forage for deer and sharp-tailed grouse, and provides winter cover for upland game.

PONDEROSAPINESAVANNA

Description: Grassland or shrubland vegetation with a park-like scattering of open-grown ponderosa pine. Various macrophyllous shrubs may also be present.

Wildlife Value: Forage for deer and sharp-tailed grouse.

MIXED SAVANNA

Description: Grassland or shrubland vegetation with a scattering of open-grown ponderosa pine and black cottonwood. Various macrophyllous shrubs may be present. The type usually occurs along river terraces.

Wildlife Value: Forage for deer and sharp-tailed grouse. The mixture of deciduous and evergreen trees provides perch sites and cover for raptors, magpies and other birds.

PONDEROSA PINE FOREST

Description: A closed canopy (or nearly so) forest type with ponderosa pine as the dominant tree. On mesic sites such as north slopes, Douglas fir is codominant with ponderosa pine, and larch and grand fir may be present. Understory species include ninebark, snowberry and wheatgrass. Serviceberry, Prunus spp., Rosa spp., evergreen ceanothus, sumac, oceanspray and spirea may also be present.

Wildlife Value: Cover and forage for forest grouse, white-tailed deer, and forest birds. The type also provides cover for large carnivores.

BROADLEAF FOREST

Description: Occurs on river terraces adjacent to the Columbia and tributaries. The type is commonly adjacent to agricultural lands. Overstory trees include black cottonwood and hawthorn. Various macrophyllous shrubs are present in the understory.

Wildlife Value: Food and cover for wildlife that use deciduous forest and riparian habitats; winter cover for white-tailed deer and upland game; and reproductive cover for various nongame and furbearer species.

MIXED FOREST

Description: Type is common north of Kettle Falls. South of Kettle Falls it is restricted to north slopes and river terraces. Overstory species include black cottonwood, aspen, paper birch, ponderosa pine and Douglas fir. Serviceberry and snowberry are present in the understory.

Wildlife Value: Food and cover for forest-dwelling wildlife such as bear, forest grouse, whittaileddeer, etc.

RIPARIAN DRAWS

Description: Occurs in a narrow strip along streams and seasonal watercourses. The overstory may or may not consist of trees, depending upon the amount of moisture available. The understory consists of macrophyllous shrubs.

Wildlife Value: Cover for a wide variety of wildlife. The type is a key habitat component in dry environments.

RIVER-EDGE RIPARIAN

Description: A distinctive, discontinuous, narrow band of vegetation growing along the high water line of the Columbia and Spokane Rivers. In the lower reaches it consists of riparian species (willow, hawthorn, cottonwood) interspersed in an overstory of scattered, large ponderosa pine. In upper reaches the overstory is a mixture of hardwoods and coniferous trees. Willow tends to occur at the edge of the high water mark where it is subject to periodic flooding, whereas cottonwood tends to occur at a slightly higher elevation in a zone where silt deposits are present and flooding is infrequent (Payne et al. 1976).

Wildlife Value: Cover and perching sites for raptors, forage for furbearers, and resting cover for a variety of birds.

WOODY RIPARIAN

Description: Riparian forest vegetation adjacent to open water and subject to occasional flooding. Typically found along the Sanpoil River and tributaries and high water channels of the reaches of the Columbia upriver from Hawk Creek. Overstory includes black cottonwood and willow; understory includes macrophyllous shrubs.

It was difficult to delineate and measure this type where it occurred in narrow bands along tributaries. Also, pre-project photographs of Hawk Creek above its mouth were not available. Therefore we believe this type is underrepresented in loss estimates.

Wildlife Value: Food, cover and reproductive habitat for a wide variety of species.

SHRUBBY RIPARIAN

Description: Macrophyllous shrubs growing adjacent to water courses and and influenced by high ground moisture and/or subject to occasional flooding.

Wildlife Value: Food, cover and reproductive habitat for a wide variety of species.

HERBACEOUS RIPARIAN

Description: Herbaceous vegetation growing in wet areas adjacent to open water. Typically occurs on islands and is subject to occasional flooding. Plant species include horsetail, rushes and sedges. The type is difficult to discern using available photos and ground truth information, however it appears to be uncommon.

Wildlife Value: Source of plant and invertebrate foods for waterfowl.

AGRICULTURAL LAND- FORAGE

Description: Lands used for forage production (timothy, native hay, alfalfa, seeded pasture or irrigated pasture).

Wildlife Value: Food and cover for sharp-tailed grouse and pheasant, hunting area for raptors, brooding habitat for Canada geese.

AGRICULTURAL LAND-GRAIN

Description: Lands used for production of row crops or small grains.

Wildlife Values: Food for sharp-tailed grouse, pheasant, California quail, and geese. Hunting area for raptors.

AGRICULTURAL LAND - ORCHARD

Description: Orchards and associated windbreaks.

Wildlife Value: Nesting cover for mourning doves and other passerines. Food for deer and bear.

SAND/GRAVEL/COBBLE

Description: Any area below the high water mark without vegetation obvious on photographs. Photo resolution and lack of ground truth information precluded further classification. Sparse cover of herbaceous vegetation was likely present on many of these sites.

Wildlife Value: Resting/loafing area for waterfowl and river otter, foraging area for mourning doves.

BARE GROUND

Description: Areas where landslide activity has limited vegetation to a scattering of grasses and shrubs.

Wildlife Value: Habitat for small mammals; possible nesting sites for raptors and cliff-nesting birds such as swallows.

ROCK

Description: Rock outcrops

Wildlife Value: Nesting sites for raptors and Canada geese.

SAND DUNES

Description: Active sand dunes. Typically occurs along old river floodplain.

Wildlife Value: Habitat for wildlife adapted to dunes such as kangaroo rats and tiger beetles. Hunting area for raptors.

ISLANDS/BARS

Description: Land surrounded by water at flows of 50,000 cfs. Generally composed of rock, **cobbles**, gravel and sand. Vegetation on islands was predominately shrubby or herbaceous.

Wildlife Value: Key nesting sites for Canada geese. Also resting and loafing areas for waterfowl and aquatic mammals, and foraging areas for mourning doves and shorebirds. Depending on size and vegetation type, islands may provide food and cover for many kinds of wildlife.

APPENDIX 3.2 CALCULATION OF UPLAND GAME, FURHEARER, GOOSE AND NONGAME LOSSES.

Calculation of losses is based upon multiplying the estimated population density of each species by the number of lost acres of the appropriate vegetation type(s). The vegetation types chosen for calculations were those with which the species are primarily associated. However it should be understood that all the species will use other vegetation types to some extent, and some of these other vegetation types may play important roles during certain times in a species' life cycle. Calculations reflect losses of fall population since this includes the harvestable surplus of wildlife.

INDICATOR SPECIES

CANADA GOOSE

Quantitative pre-project data on Canada goose are lacking. However Suckley (1860) reported them as being abundant on the Columbia River, and Lorraine (1924) implied they were not uncommon.

Knight (1978) reported that the nesting period on Rufus Wood Reservoir during 1975 was from March 20 to June 12. Nests were initiated from March 20 to May 9. Fielder (pers. commun.) noted the majority of goose nesting on the Upper Columbia River is completed by May 5th. Hanson and Eberhardt (1971) reported an 18 year average nesting period extending from early March to late May, and contended that goose behavior is synchronized to complete nesting before arrival of normal flood levels. On their study area they noted flooding and nest losses at flow rates above 137,000 cfs. Since 1936 data from the Kettle Falls gaging station (300 miles upriver from Hanson and Eberhardt's study area) showed flows greater than that beginning April 28, we concluded that prior to Grand Coulee Dam, geese nested during the early flood period and used only the higher islands for nesting.

We chose a conservative approach to estimating Canada goose losses by considering production only from secure island nest sites. The number of secure island nest sites was estimated by inspection of aerial photographs of each pre-project island in the Columbia and Spokane Rivers. Island size, shape, vegetation, distance from shore, topography and susceptibility to flooding were considered.

Photographs used for determining the number of pre-project islands were taken during low water levels (22,000-75,000cfs) and 114 islands/bars were visible within the boundary of present-day FDR Reservoir. However, we could not determine for certain if exposed gravel bars were normally above mean high water levels expected during nesting. Therefore only islands having woody vegetation, pronounced relief or those composed of rock where the high water line could be distinguished were evaluated for potential nest sites.

Hanson and Eberhardt (1971) recorded an average of 12.65 nesting pairs of geese/island during a 20 year study of the free flowing Hanford Reach of the Columbia River. Based upon the literature and two to three years of annual counts, Ball et al. (1981) reported that 338 pairs of geese nested on the 58 islands between Grand Coulee Dam and McNary Pool, which is an average of 5.8 pairs/island. The mean

clutch size for Washington was reported as 5.8. Knight (1978) reported an 84% nest success rate on islands on Rufus Wood Reservoir, Fletcher (1979) documented a total loss of goslings between hatching and fledging of 19%. Ball et al. (1981) estimated that more than 80% of nesting geese on the Columbia River nest on islands, therefore an estimate of non-island goose production loss was not developed.

(net loss of 74 secure **island** nest sites to Inundation) x (1 pair/site) x (2 birds/pair +(5.8 clutch size x .84 nesting success x .81 fledging success)) = lost birds/year

Canada Goose			
COLVILLE	SPOKANE	STATE	PROJECT TOTAL
59	119	262	440

BALD EAGLE

Few pre-project references to bald eagles have been located. Cooper (1860) reported the bald eagle as one of the most abundant raptors in Washington, particularly along the Columbia River, and an 1891 newspaper article (Anonymous 1891) reported bald eagles were frequently seen "...along the creeks looking for where the salmon spawn" We have found no documentation of nesting bald eagles within the project areas, however we have no reason to believe they did not do so. The fact that bald eagles currently nest nearby (Marr. Pers. commun.) suggests that they nested in the project areas prior to inundation.

Fielder (pers. commun.) indicated that the wintering eagle population in Eastern Washington appears to be increasing (winter counts have doubled over past 10 years). Much of the increase ~~was~~ noted to have occurred along FDR Reservoir. During the winter of 1975-76 the maximum number of bald eagles observed on FDR Reservoir was 20 (Fielder, pers. cr.). Preliminary information from the 1986 mid-winter bald eagle survey indicates 176 bald eagles were counted in the vicinity of FDR Reservoir

SAGE GROUSE

Rogers (cited in Johnsgard, 1973) reports population densities in Colorado ranging from 1-10 birds/sq. mile to 10-30 birds/sq. mile. However, the citation does not make clear the habitat condition nor season associated with these density figures. Based upon Patterson's work in Wyoming Edminster (1954) estimated that spring populations on good range in Wyoming were 30-50 birds/sq, mile. From the life table presented by Edminster, it can be determined that fall populations should be 161% of spring populations or 48-80 birds/sq. mile (0.08-0.12 bird/acre).

Writing in 1827, explorer/botanist David Douglas (cited in Yocum, 1956) indicated that sage grouse congregated in large flocks along the Columbia River between its confluences with the Spokane and Walla Walla Rivers from October to April. His remarks suggest that lands along the Columbia River served as wintering and breeding areas, and that the birds dispersed away from the river during the summer. Since lands inundated by FDR Reservoir served as winter range with high densities of birds during winter we selected the 0.12 bird/acre density derived from Edminster (1954) for calculating losses.

(shrub-steppe) x 0.12 bird/acre = birds lost/year

		Sage Grouse		
COLVILLE	SPOKANE	STATE	PROJECT TOTAL	
767	76	691	1,534	

SHARP-TAILED GROUSE

Early descriptive historical accounts suggest high sharp-tailed grouse populations along the Columbia River. Botanist/explorer David Douglas wrote in 1826 that the Kettle Falls area was "...abounding with game... Tetrao Richardsonii (blue grouse) and T. urophasianellus (sharp-tailed grouse) were so plentiful that they formed a principle part of the food." (cited in Buechner, 1953).

Amman (cited by Johnsgard, 1973) reported average fall densities of one bird/18 acres on 13 square miles of prime, occupied range in Michigan over a seven year period. These figures were considered unusually high for the area by Johnsgard. Grange (cited by Johnsgard, 1973) estimated an average spring density of one bird/138 acres on occupied range in Wisconsin. Edminster (cited by Johnsgard, 1973) summarized a variety of other fall density estimates from various states which indicate densities of one bird/27-125 acres are probably typical. Symington and Harper (cited by Johnsgard, 1973) estimated late summer populations in Saskatchewan to be one bird/16-25.6 acres in the Sand Bills area "where an ideal combination of native grasses, shrubs and small trees occur".

Habitat requirements for the prairie race of sharp-tailed grouse in Michigan, Wisconsin, etc., are not strongly applicable to the requirements of the Columbian race in Washington (Johnsgard, 1973). The former race uses habitat with 20-50% woody cover (aspen and mixed hardwood and conifer stands) (Grange, Amman, cited in Johnsgard, 1973) whereas the latter race occupies semi-desert scrub and uses shrubs and small trees only during the late fall and winter. The arid habitat along FDR Reservoir is most analogous to the sand hill habitat of Symington and Harper's study. Since the land inundated by the reservoir likely served as winter range with high densities of birds during winter, we chose one bird/16 acres (.06 bird/acre) reported by Symington and Harper as the density for calculating the loss estimate.

((shrub-steppe) + (agriculture - forage) + (agriculture - grain) + (macrophyllous shrub) + (riparian) + (ponderosa pine savanna) + (mixed savanna)) x .06 bird/acre = birds lost/year

		Sharp-tailed Grouse		
COLVILLE	SPOKANE	STATE	PROJECT TOTAL	
818	194	1,820	2,832	

RUFFED GROUSE

A three-year study of ruffed grouse in western Washington by Brewer (1980) indicated spring densities of one bird/19-23 acres varying with year. His estimates of fall densities based on modeling were one bird/8.2-9.9 acres. Zender (pers. commun.)

noted that "drumming counts" in Stevens County averaged 27 males per 20 stop route, where Brewer's study only averaged approximately four males per route. Ruffed grouse densities in Ferry County, WA. are believed to be the highest densities anywhere in the state (Gruenwald, pers. commun.). Bump et al. (cited by Johnsgard, 1973) reported breeding densities near Ithaca, NY of one bird/8-22 acres, in the Adirondacks of one bird/21-38 acres, and maximum fall densities ranging from one bird/5-20 acres. Gullion (cited in Johnsgard, 1973) from work in Minnesota estimated the maximum breeding density allowed by territorial behavior as 1 pair/8-10 acres. Porath (cited by Johnsgard 1973) from work in northeastern Iowa estimated the late summer population density to be 90-135 birds/sq. mile (one bird/5-7 acres). We presumed Porath's study area to be most analogous to habitat conditions occurring along FDR Reservoir and thus chose the median density from his study of one bird/6 acres (0.2 bird/acre) for calculation of losses

Keith (cited in Johnsgard 1973) after an intensive study of population fluctuations in birds and mammals of North America concluded that ruffed grouse populations vary according to ten-year cycles. The average ratios between peak-year densities and subsequent low densities varied from 3:1 to up to 15 :1. Population cycles were not considered in calculations of ruffed grouse losses.

((ponderosa pine forest) + (broadleaf forest) + (mixed forest) + (all riparian)) x 0.2 bird/acre =lost birds/year

	Ruffed Grouse			
COLVILLE	SPOKANE	STATE	PROJECT TOTAL	
667	112	882	1,661	

MOURNING DOVE

The Bureau of Reclamation (1976) estimated that the creation of FDR Reservoir resulted in a loss of about 100,000 doves. This was based on unpublished information from Oliver and Riley which indicated mourning dove densities in orchards of 8.4 breeding pairs/acre (Oliver & Riley, pers. COMMUN.), Oliver and Riley also postulated 4.4 fledged birds/pair based upon their review of the literature which revealed a range of 3.2 - 6.2. From work in the area of Wells pool, Oliver and Barnett (1966) reported a total orchard population (young and adults) of 51.3 doves/acre. Kessler (1980) reported breeding population densities of mourning doves in orchards of 0.2 birds/ha. Fichtner (1959) working in orchards in southeastern Idaho reported 7.46 pair/orchard acre, with a production of 3.2 fledglings/pair. Mourning doves may produce several clutches per year and may reuse nests. Taking this into account, Fichtner reported approximately .44 breeding pair/nest. Zeigler (1977a) reported great differences exist between individual orchards, and that studies in Washington have found from 0.3 to 70.0 nests per acre of orchard. The maximum density found during Zeigler's 1977 studies was 18 nests/acre.

Orchards appear to be the primary nesting habitat of mourning doves in Central Washington (Zeigler 1977b). but it should be understood that doves nest in other places as well Dobler (1978) from work in the Rocky Reach pool area report 2.3 nests/acre in riparian vegetation with .99 fledglings/nest, and 1.3 nests/acre in shrub-steppe vegetation.

Because we believe the greatest loss of doves occurred through the inundation of orchards and riparian land, we have used only those two vegetation types in loss calculations. Since there is a wide range of nesting density reported in the literature, we chose to use Fichtner's and Dobler's moderate densities of 7.46 nests/acre for orchard nesting birds and 2.3 nests/acre for riparian nesting birds respectively.

$$((\text{agriculture-orchard}) \times (7.46 \text{ breeding pair/acre}) \times (2 \text{ birds/pair} + 3.2 \text{ fledged birds/pair})) + ((\text{riparian}) \times (2.3 \text{ nest/acre}) \times (-99 \text{ fledglings/nest} + (2 \text{ birds/pair} \times .44 \text{ pair/nest}))) = \text{lost birds/year}$$

Mourning Dove			
COLVILLE	SPOKANE	STATE	PROJECT TOTAL
4,157	1,444	81,704	87,305

LONG-EARED OWL

Knight and Erickson (1977) in studies conducted immediately downriver from Grand Goulee Dam (i.e. Rufus Woods Reservoir) reported an average linear density of long-eared owls as one pair/12 river km. or about 0.13 pair/river mile. Unlike the area inundated by FDR Reservoir, the study area was not a mixture of agricultural lands and native plant communities but rather shrub-steppe with infrequent stands of trees. The authors reported that the study area had a low prey base for supporting raptors. Knight et al. (1982) in describing the same study area reported that the downriver half of the area was devoid of trees and supported only 1/2 of the raptor population that was supported by the upriver half which had many linear stands of trees.

Knight and Erickson (1977) reported that of three pair, two pair nested and fledged four young apiece, and the third pair did not nest. The average number of fledged young for this limited sample is 2.7 young/pair.

For calculation of losses we chose Knight and Erickson's figures of 0.13 pair/river mile. It appears, however, that the inundated lands upriver of Grand Goulee Dam constituted better habitat for long-eared owls than Knight and Erickson's study area. Thus the loss estimates based on Knight and Erickson (1977) should be conservative.

$$((\text{riverbank miles of jurisdiction}) \times (0.065 \text{ pair/riverbank mile}) \times (2 \text{ adults/pair} + 2.7 \text{ young/pair})) = \text{long-eared owls lost/year.}$$

Long-eared Owl			
COLVILLE	SPOKANE	STATE	PROJECT TOTAL
34	12	78	124

FLICKER

Short (1982) reported that where dense woods border good feeding habitat, pairs may nest within 50 meters of each other. We believe this condition would have existed adjacent to riparian lands, farmsteads and windbreaks in the project area. Short

reports a clutch size of 3-12 eggs (19 maximum) but does not indicate fledging success. Dobler et al. (1978) estimated fall flicker density within 30 feet of Rock Island pool as one bird/3.7 acres (0.27 bird/acre) based upon five years of data from S parallel transects perpendicular to the shoreline. Using this figure, loss estimates were calculated as follows:

$((\text{broadleaf forest}) + (\text{riverside riparian}) + (\text{woody riparian})) \times 0.27 \text{ bird/acre} = \text{flickers lost/year}$

Flicker			
COLVILLB	SPOKANE	STATE	PROJECT TOTAL
245	77	231	553

BEAVER

No references were located regarding beaver population densities for large rivers such as the Columbia. The estimated pre-project beaver population on 140 miles of the lower Snake River was 1,100 or 7.8 beaver/river mile (COE 1975). Tabor (pers. commun.) estimated that one to two colonies existed per river mile on the lower gradient tributaries such as the Kettle and Sanpoil Rivers, and one colony per river mile on the Spokane and Columbia Rivers. Tabor estimated that presently FDR Reservoir supports about one colony/10 river miles which is a 90% loss of pre-project levels. He also noted that reservoir fluctuations adversely impact beaver production. Zender (pers. commun.) suggested that beaver losses may be even greater since steep banks and slides restrict beaver use from much of the shoreline of FUR Reservoir.

A typical beaver colony consists of two parents, the young of the year (2-4), plus the young from the previous year (yearlings) (Maser et al. 1981). We arbitrarily chose six beaver as the average colony size. One colony or six beaver per river mile would be 3 beaver per riverbank mile (6 beaver / (left bank mile + right bank mile)). Riverbank miles were calculated from USGS river miles on current topographic maps and USBR figures for the Kettle, Sanpoil and Spokane rivers (USBR 1976). Losses due to inundation of tributary streams were not taken into account.

$((\text{riverbank miles of jurisdiction}) \times (3 \text{ beaver / pre-project riverbank mile})) \times (9 \text{ population loss}) = \text{net beaver Loss/year}$

Beaver			
COLVILLE	SPOKANE	STATE	PROJECT TOTAL
299	107	688	1,094

APPENDIX 3.3 CALCULATION OF DEER LOSSES

Loss determinations were adapted from unpublished data developed by WDG in 1965 (Oliver and Riley, pers. commun.) Oliver and Riley estimated losses by examining current deer wintering areas, and then projecting current wintering area boundaries down to the pre-project river edge. Population densities were presumed to be equal to current densities. Current winter densities were determined as follows: $((\text{population of deer management unit}) \times (\text{percent of deer expected to winter in given wintering area})) / (\text{acres in wintering area})$. Oliver and Riley's management unit densities ranged from 5.5-13 deer/sq. mi. and wintering area densities ranged from 14.8-67.7 deer/sq. mi. Zender (pers. commun.) noted that winter areas other than those adjacent to FDR Reservoir exist within Oliver and Riley's deer management units. Therefore where noted, estimated population densities of inundated winter ranges evaluated were reduced to levels suggested by Zender. Losses were estimated to be equal to the inundated wintering area multiplied by the population density. Calculations for each wintering area are described below.

Payne et al. (1976) observed that mule deer comprised 25% of the deer population north of the Spokane River and 100% of the population south of the Spokane River. This proportion is assumed to be correct for all lands except for lands in the Colville Reservation and lands where otherwise noted. Aerial trend counts flown on the Colville Reservation indicate that white-tailed deer comprise an average of 53% of the deer wintering along the Columbia River and 20% of the deer wintering along the Sanpoil River south of Bridge Creek (Judd, pers. commun.). These proportions were used in determining deer losses on the Colville Reservation.

WINTERING AREA I. Left Bank. river mile 602-637

Description: The area from 8 miles upriver from Grand Coulee Dam to Hawk Creek. Deer winter within 1/2 mile of the water's edge. Payne et al. (1976) reported seeing only mule deer in this area. Oliver and Riley estimated the wintering deer population density to be 67.6 deer/sq. mile. Zender (pers. commun.) reported that 15 deer/sq. mile is a better estimate based on current information.

Wildlife Jurisdiction: State
Wintering Population Density: 15 deer/sq.mile
Area Inundated: 10.8 sq. miles
Potential Deer Wintering Loss: 162 mule deer

WINTERING AREA II. Left Bank, river mile 637-641 + Spokane

Description: A 4 mile wide winter range area from Hawk Creek to and including the south bank of the Spokane River. Payne et al. (1976) reported seeing only mule deer in this area. Oliver and Riley estimated the wintering deer population density to be 14.8 deer/sq. mile. Zender (pers. commun.) reported that 12 deer/sq. mile is a better estimate based on current information.

Wildlife Jurisdiction: State

Wintering Population Density: 12 deer/ sq. mile
Area Inundated: 9.2 sq. miles
Potential Deer Wintering Loss: 83 mule deer and 27 white-tailed deer

WINTERING AREA III. Left Bank, river mile 641-668+Spokane

Description: A 4 mile wide range from and including the north bank of the Spokane River to Hunters, WA. Oliver and Riley estimated the wintering deer population density to be 41.6 deer/sq. mile. Zender (pers. comm.) reported that 25 deer/sq. mile is a better estimate based on current information. Payne et al. (1976) noted that 75% of the deer he observed north of the Spokane River were white-tailed deer. Zender's estimated 15% mule deer was used for calculations.

Wildlife Jurisdiction: 21.5 river miles = State
7.5 river miles = Spokane Tribes
27 Spokane river miles = Spokane Tribes
Wintering Population Density: 25 deer/sq. mile
Area Inundated: 11.8 sq. miles (40% State, 60% Spokane)
Potential Deer wintering Loss: 295 deer or 74 mule deer and 221 white-tailed deer (State=30 mule deer + 88 white-tailed deer, Spokane Tribes = 44 mule deer+133 white-tailed deer)

WINTERING AREA IV. Left Bank. river mile 668-682

Description: A 1/2 mile wide area from Hunters, WA to Gifford, WA. A very high density of wintering animals occurs in this area. Oliver and Riley estimated the wintering deer population density to be 41.6 deer/sq. mile. Zender (pers. comm.) reported that 30 deer/sq. mile is a better estimate based on current information. Zender estimated mule deer make up 10% of the population.

Wildlife Jurisdiction: State
Wintering Population Density: 30 deer/sq. mile
Area Inundated: 3 sq. miles
Potential Deer Wintering Loss: 90 deer (9 mule deer + 89 white-tailed deer)

WINTERING AREA V. Left Bank, river mile 682-710

Description: A 3 1/2 mile wide area from Gifford, WA to Marcus, WA, and the Colville River Drainage exclusive of Mill Creek and Hutch Lake. Oliver and Riley estimated the wintering deer population density to be 41.6 deer/sq. mile. Zender (pers. comm.) reported that 25 deer/sq. mile is a better estimate based on current information.

Wildlife Jurisdiction: State
Wintering Population Density: 25 deer/sq. mile
Area Inundated: 20.8 sq. miles
Potential Deer Wintering Loss: 520 deer (130 mule deer + 390 white-tailed deer)

WINTERING AREA VI. Left Rank, river mile 710-745

Description: A 1/4 mile wide area from Marcus, WA to the Canadian Border, and the Colville River drainage in the vicinity of Hutch Lake, Chugston Creek, Mill Creek, etc. Oliver and Riley estimated the wintering deer population density to be 71 deer/sq. mile. Zender (pers. commun.) reported that 20 deer/sq. mile is a better estimate based on current information.

Wildlife Jurisdiction: State

Wintering Population Density: 20 deer/sq.mile

Area Inundated: 2.5 sq. miles

Potential Deer Wintering Loss: 50 deer (12 mule deer + 38 white-tailed deer)

WINTERING AREA VII. Right Rank, river mile 745-715

Description: A 1/4 mile wide area from the Canadian Border south to a point opposite Evans, WA. Oliver and Riley estimated the wintering deer population density to be 51.1 deer/sq. mile. Zender (pers. commun.) reported that 25 deer/sq. mile is a better estimate based on current information. Zender reported mule deer make up 10% of the population.

Wildlife Jurisdiction: State

Wintering Population Density: 25 deer/ sq. mile

Area Inundated: 2.8 sq. miles

Potential Deer Wintering Loss: 70 deer (7 mule deer + 63 white-tailed deer)

WINTERING AREA VIII. Right Bank. river mile 715-709

Description: A 3 mile wide area from a point opposite Evans, WA to the mouth of the Kettle River. Oliver and Riley estimated the wintering deer population density to be 51.1 deer/sq. mile. Zender (pers. commun.) reported that 25 deer/sq. mile is a better estimate based on current information. Zender reported there are no mule deer wintering in the area.

Wildlife Jurisdiction: State

Wintering Population Density: 25 deer/sq.mile

Area Inundated: 3.1 sq. miles

Potential Deer Wintering Loss: 78 white-tailed deer

WINTERING AREA IX. Kettle River Drainage

Description: A 3 mile wide area along the north shore of the Kettle River. (Lost land area has been reduced by 50% to compensate for intensive agricultural use of area.) Oliver and Riley estimated the wintering deer population density to be 51.1 deer/sq. mile. Zender (pers. commun.) reported that 20 deer/sq. mile is a better estimate based on current information. Zender reported the wintering population is about 10% mule deer.

Wildlife Jurisdiction: State
Wintering Population Density: 20 deer/ per sq. mile
Area Inundated: 0.7 sq. miles (adjusted figure)
Potential Deer Wintering Loss: 14 deer (1 mule deer + 13 white-tailed deer)

WINTERING AREA X. Kettle River & Sherman Creek

Description: A 3 mile wide area along the south shore of the Kettle River and in the Sherman Creek drainage. Oliver and Riley estimated the wintering deer population density to be 43.7 deer/sq. mile. Zender (pers. comun.) reported that 25 deer/sq. mile is a better estimate based on current information.

Jurisdiction: State
Wintering Population Density: 25 deer/sq. mile
Ares Inundated: 0.8 sq.miles
Potential Deer Wintering Loss: 20 deer(5 mule deer + 15 white-tailed deer)

WINTERING AREA XI. Right Bank. river mile 709-602

Description: A 3 mile wide area from the mouth of the Kettle River to a point approximately S miles upriver from Grand Coulee Dam. Oliver and Riley estimated the wintering deer population density to be 43.7 deer/sq. mile. Zender (pers. commun.) reported that 30 deer/sq. mile is a better estimate based on current information.

Wildlife Jurisdiction: 19.8 river miles = state
87.2 river miles = Colville Tribes
Wintering Population density: 30 deer/sq. mile
Area Inundated: 41.1 sq. miles
Potential Deer Wintering Loss: 1233 deer (State - 57 mule deer + 171 white-tailed deer. Colville Tribes = 472 mule deer + 533 white-tailed deer)

WINTERING AREA XII. Sanpoil River

Description: An area extending 3 miles beck from either side of the Sanpoil River (6 miles wide total). Oliver and Riley estimated the wintering deer population density to be 43.7 deer/sq. mile,

Yildlife Jurisdiction: Colville Tribes
Wintering Population Density: 43.7 deer/sq. mile
Area Inundated: 4.2 sq. miles
Potential Deer Wintering Loss: 184 deer (147 mule deer + 37 white-tailed deer)

APPENDIX 4.1. SCOPE AND COST OF FULL REDRESS OF WILDLIFE LOSSES

If all 116,022 acres of land evaluated and rated by the team (Appendix 4.3) were acquired and improved for wildlife production, only a portion of the habitat loss would be redressed. The net gain/(loss) of Habitat Units due to the project after mitigation would be as shown in Table 22. Complete replacement of lost habitat would occur only for sage grouse and riparian shrub on state land and ruffed grouse, white-tailed deer, and riparian shrub on the Spokane Reservation.

TABLE 22. SUMMARY OF NET GAIN/(LOSS) OF HABITAT UNITS FROM PROJECT WITH ALL EVALUATED LANDS ACQUIRED AND ENHANCED AS MITIGATION. Summary includes all parcels in Appendix 4.3

<u>Habitat Unit type</u>	<u>Habitat Units</u>		
	<u>Colville</u>	<u>Spokane</u>	<u>State</u>
Sage grouse	(893)	0	10,083
Sharp-tailed grouse	(8,036)	(2,609)	(15,545)
Ruffed grouse	(3,276)	189	(8,838)
Mourning dove	(1,303)	(156)	(6,651)
Mule deer	(7,977)	(798)	(7,832)
White-tailed deer	(3,316)	3,112	(10,856)
Riparian forest	(756)	(176)	(158)
Riparian shrub	(9)	171	17
Elk (trade for deer units)	900	N.A.	N.A.
Turkey (trade for sharp-tail units)	N.A.	233	N.A.
		<u>Secure Island Nesting Sites</u>	
Canada goose (preliminary results)	(10)	(20)	(32)

To completely redress habitat lost through inundation by the project, the entire 116,022 acres of currently evaluated lands (Appendix 4.3) would have to be enhanced as well as 128,700 acres of additional lands (assuming that a 30% improvement could be obtained on the additional lands). The distribution of lands needed is shown in Table 23. Additional lands have been identified for the State of Washington (Appendix 4.4) but their habitat quality and improvement potential have not been rated. Needed additional lands have yet to be identified for the Colville Tribe. Rough estimates of mitigation costs have been generated for discussion purposes and are presented in Table 24.

TABLE 23. ESTIMATED LAND NEEDS FOR 100% REPLACEMENT OF LOST HABITAT UNITS

<u>Land Type</u>	<u>Acres of Land Needed for Each Wildlife Jurisdiction</u>		
	<u>Colville</u>	Spokane	<u>State</u>
Lands Evaluated by Team			
Private or Allotted Lands	7,300	3,210	83,072
Public or Tribal Lands	4,000	7,380	11,060
Subtotal	11,300	10,590	94,132
Additional suming 30% Estimated		Improvement Potential	
Government or Private	40,000	0*	88,700
Total	51,300	10,590	182,832
Total land needs			244,722 acres

*Although losses of all species are not redressed, a sizable net gain of white-tailed deer, as well as small gains of ruffed grouse, and riparian shrub Habitat units exist.

TABLE 24. ESTIMATES OF MITIGATION COSTS FOR 100% REPLACEMENT OF LOST HABITAT UNITS

<u>COST ITEM</u>	<u>COLVILLE</u>	<u>SPOKANE</u>	<u>STATE</u>	TOTAL
Habitat Protection+	\$17,431,000*	\$3,243,100	\$58,767,000**	\$79,441,100
Advanced Design \$12,50/acre	641,250	132,375	2,285,400	3,059,025
Development/Enhancement \$100/acres	5,130,000	1,059,000	18,283,200	24,472,200
TOTAL INITIAL COSTS	\$23,202,250	\$4,434,475	\$79,335,600	\$106,972,325
Annual O & M \$20/acre	\$1,026,000	\$211,800	\$3,656,640	\$4,894,440

- * Assume additional lands needed include 20,000 acres of deeded &/or allotted land.
- ** Assume additional lands needed include 21,800 acres of private land.
- + Assume fee title acquisition. Less than fee acquisition may reduce costs.

APPENDIX 4.2. HABITAT UNIT GAINS/(LOSSES) IN PROPOSAL

Base is the habitat value of parcels in 1986 before habitat improvement. (No base is figured for existing dedicated wildlife lands i.e. Sherman Creek HMA.0
 Gain is the increase in Habitat Units expected from habitat enhancement.
 Total credit is the Habitat Unit credited toward the mitigation proposal.
 Total project loss is the estimated loss of Habitat Units due to the project.
 Net credit is the total credit minus the estimated loss due to the project.
 Net gain or loss is the difference between the gain from enhancement and the total loss due to the project - i.e. number of Habitat Units created/(lost) due to project after mitigation.

<u>Habitat Unit type</u>	<u>Colville</u>	<u>Spokane</u>	<u>State</u>	<u>Total</u>
Canada goose				
base secure nest sites	0	0	30	30
gain thru enhancement	0	0	12	12
total credit (base+gain)	0	0	42	42
total project loss	10	20	44	74
net credit (credit - loss)	(10)	(20)	(2)	(32)
net gain /(loss)	(10)	(20)	(32)	(62)
Sage grouse				
base Habitat Units	0	0	901	901
-gain thru enhancement	0	0	7,209	7,209
total credit (base+gain)	0	0	8,110	8,110
total project loss	a93	0	1,853	2,746
net credit (credit - loss)	(893)	0	6,257	5,364
net gain /(loss)	(893)	0	5,356	4,463

APPENDIX 4.2 CONTINUED

<u>Habitat Unit Type</u>	<u>Colville</u>	<u>Spokane</u>	<u>State</u>	<u>Total</u>
Sharp-tailed grouse				
base Habitat Units	0	0	18,128	18,120
gain thru enhancement	797	0	5,736	6,533
total credit (base+gain)	797	0	23,864	24,661
total project loss	8,833	2,609	21,281	32,723
net credit (credit - loss)	(8,036)	(2,609)	2,583	(8,062)
net gain /(loss)	(8,036)	(2,609)	(15,545)	(26,190)
Buffed grouse				
base Habitat Units	403*	2,123*	6,073*	8,599*
gain thru enhancement	876	1,163	1,363	3,402
total credit (base+gain)	1,279	3,286	7,436	12,001
total project loss	4,152	974	11,376	16,502
net credit (credit - loss)	(2,873)	2,312	(3,940)	(4,501)
net gain /(loss)	(3,276)	189	(10,013)	(13,100)
Mourning dove				
base Habitat Units	931*	331*	1,092	2,354
gain thru enhancement	620	497	0	1,117
total credit (base+gain)	1,551	828	1,092	3,471
total project loss	1,923	653	6,740	9,316
net credit (credit - loss)	(372)	(175)	(5,648)	(5,845)
net gain /(loss)	(1,303)	(156)	(6,740)	(8,199)
Mule deer				
base Habitat Units	3,800*	867*	22,956*	27,623*
gain thru enhancement	2,850	289	3,529	6,668
total credit (base+gain)	6,650	1,156	26,485	34,291
total project loss	10,827	1,087	15,219	27,133
net credit (credit - loss)	(4,177)	69	11,266	7,158
net gain /(loss)	(7,977)	(798)	(11,690)	(20,465)
White-tailed deer				
base Habitat Units	1,466*	4,060*	6,872*	12,398
gain thru enhancement	666	4,292	3,831	3,739
total credit (base+gain)	2,132	8,352	10,703	21,187
total project Loss	3,982	1,180	16,470	21,632
net credit (credit - loss)	(1,850)	7,172	(5,767)	(445)
net gain /(loss)	(3,316)	3,112	(12,639)	(12,843)

APPENDIX 4.2 CONTINUED

<u>Habitat Unit type</u>	<u>Colville</u>	<u>Spokane</u>	<u>State</u>	<u>Total</u>
Riparian forest				
base Habitat Units	10*	155*	873*	1,038*
gain thru enhancement	24	0	396	420
total credit (base+gain)	34	155	1,269	1,458
total project loss	780	176	676	1,632
net credit (credit - loss) (746)		(21)	593	(174)
net gain /(loss)	(756)	(176)	(280)	(1,212)
Riparian shrub				
base Habitat Units	0	83	88	124
gain thru enhancement	5	171	30	171
total credit (base+gain)	5	254	118	377
total project loss	14	0	13	27
net credit (credit - loss) (9)	(9)	254	105	350
net gain /(loss)	(9)	171	17	179
Elk (trade for deer units)				
base Habitat Units	600	NA	NA	600
gain thru enhancement	900	NA	NA	900
total credit (base+gain)	1500	NA	NA	1500
total project loss	0	0	0	0
net credit (credit - loss) 1500	1500	NA	NA	1500
net gain/(loss)	900	0	0	900
Turkey (trade for sharp-tailed grouse units)				
base Habitat Units	NA	582*	NA	582
gain thru enhancement	NA	233	NA	233
total credit (base+gain)	NA	815	NA	815
total project loss	0	0	0	0
net credit (credit - loss) NA	NA	815	NA	815
net gain/(loss)	0	233	0	233

* Mitigation credit will not be awarded for all of these units. These base Habitat Units include some on government or tribal lands, which will be subtracted from base credit once specific parcel boundaries have been delineated.

APPENDIX 4.3 CATALOG OF POTENTIAL MITIGATION PARCELS FOR HABITAT QUALITY

COLVILLE TRIBE

COLVILLE PARCEL #1
 (3,000 acres: **2,000 tribal**; 1,000 deeded)

Description: Deer and elk winter range. Badly damaged shrub steppe from cattle winter use. Some dryland and irrigated lands. Upland game birds are abundant, especially chukars, gray partridge, pheasants, quail and sharp-tailed grouse. Canada geese reported to nest here. Very little riparian, only a few draws and springs. Adjacent to 4,700 acre parcel of which 400 acres are managed for wildlife rest is used for cattle.

Proposed management/improvement: Improve winter range with grazing management. Plant winter wheat and leave standing to benefit doves and attract geese. Some sharp-tailed grouse potential. Shrub plantings could be beneficial. Tribe would trade some deer Habitat Units for elk.

Habitat ratings:	Resent	With Improvement
Sharp-tailed grouse	0	.1
Mourning dove	.3	.5
Mule deer	.2	.75
Elk (trade for deer units)	.2	.5

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>NOW PRESENT</u>	<u>WITH IMPROVEMENT</u>	<u>NET INCREASE</u>
Sharp-tailed grouse	0	299	299
Mourning dove	880	1,467	587
Mule deer	600	2,250	1,650
Elk (trade for lost deer units)	600	1,500	900

COLVILLE PARCEL #2
 (5,000 acres: 1,500 tribal: 3,500 deeded-includes 100 acres USBR)

Description: Sage steppe lands used by deer and elk. Prime wintering area next to river. Some erosion problems. Upland game birds abundant, especially sharp-tailed grouse, chukar and quail. Evidence of bald eagle nesting activity in area.

Proposed management/improvement: Manage grazing for deer habitat, mourning doves and Buns; may also help sharp-tailed grouse. Pump and trickle irrigation system (possibly windmill powered) could add riparian habitat. This would be experimental and evaluated later for benefits.

Habitat ratings:	Present	With Improvement
Sharp-tailed grouse	0	.1
Mourning dove	.3	
Mule deer	.6	.8
White-tailed deer	.2	.4
Riparian shrub	0	.1

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>NOW PRESENT</u>	<u>WITH IMPROVEMENT</u>	<u>NET INCREASE</u>
Sharp-tailed grouse	0	498	498
Mourning dove	14	23	9
Mule deer	3,000	4,000	1,000
Whit-tailed deer	13	26	13
Riparian shrub	0	5	5

COLVILLE PARCEL #3

(2,000 acres: 500 tribal; 1,500 deeded-including 100 acres USBR)

Description: Mostly forested. Primarily a white-tailed deer area, some mule deer also. Tribe recently introduced herd of elk. Quail abundant, blue grouse present. Bald eagles and nesting Canada geese have been reported in area.

Proposed management/improvement: Manage grazing as main objective. Improve riparian areas.

Babitat ratings:	Present	With Improvement
Ruffed grouse	.2	.4
Mourning dove	.1	.5
Mule deer	.8	.2
White-tailed deer		1.0
Riparian forest	.3	1.0

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>NOW PRESENT</u>	<u>WITH IMPROVEMENT</u>	<u>NET INCREASE</u>
Ruffed grouse	214	428	214
Mourning dove	37	61	24
Mule deer	200	400	200
Whit-tailed deer	926	1,158	232
Riparian forest	10	34	24

COLVILLE PARCEL #4

(1,300 acres deeded-includes some private timber; adjacent to some tribal lands)

Description: Key concentration area for white-tailed deer. Forested with meadows. Many bald eagles winter in general area. Recent logging has decreased whitetail

habitat and reduced drumming sites for ruffed grouse but may be beneficial over long term. Also supports mule deer, blue grouse, black bear and **turkeys**. Ospreys and other raptors nest in area.

Proposed management/improvement: Manage grazing as main objective. Protect forage as it comes back into logged area.

Habitat ratings:	Resent	With Improvement
Ruffed grouse	.2	.9
White-tailed deer	.5	.9

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>NOW PRESENT</u>	<u>WITH IMPROVEMENT</u>	<u>NET INCREASE</u>
Ruffed grouse	189	851	662
White-tailed deer	527	948	421

POTENTIAL MITIGATION LANDS - SPOKANE INDIANS

SPOKANE PARCEL #1
(4,000 acres tribal land)

Description: White-tailed deer winter range. Ponderosa pine with snowberry, bluebunch wheatgrass and bitterbrush; some Douglas fir. One active beaver dam on site. Area is very overgrazed.

Proposed management/improvement: Improve winter range with managed grazing including fencing, cattle guards and alternative water supplies. Establish burning program followed by reseeding with native grasses. Protect creek bottoms from **grazing**. Tribe has grazing management plan which has not yet been implemented.

Habitat ratings:	Resent	With Improvement
Ruffed grouse	.2	.4
White-tailed deer	.2	.a
Riparian shrub	.2	.9

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>NOW PRESENT</u>	<u>WITH IMPROVEMENT</u>	<u>NET INCREASE</u>
Ruffed grouse	779	1,558	779
White-tailed deer	793	3,170	2,377
Riparian shrub	47	212	165

SPOKANE PARCEL #2

(2,890 acres: 1,600 tribal; 520 allotted; 520 private ownership; 250 deeded; NPS/USBR lands)

Description: Primarily a wild turkey area. Ponderosa pine with bitterbrush, bluebunch wheatgrass and some open land. Some good quality riparian on site.

Proposed management/improvement: Manage for turkeys. Reduce grazing pressure with fencing, cattle guards and alternative water supplies. Restrict logging. Plant wheat fields and possibly provide supplemental feeding. Tribe would like to trade lost sharp-tailed grouse Units for turkeys.

Habitat ratings:	Resent	With Improvement
Turkey (trade for sharptail units)	.5	.7
Mule deer	.3	.4
White-tailed deer	.6	.8
Riparian shrub	.7	.8

<u>BABITATUNITTYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>N W PRESENT</u>	<u>WITH IMPROVEMENT</u>	<u>NET INCREASE</u>
Turkey (trade for sharptail units)	582	815	233
Mule deer	867	1,156	289
White-tailed deer	1,389	1,852	463
Riparian shrub	36	42	6

SPOKANE PARCEL #3

(1,920 acres: 1,740 allotted; 180 deeded)

Description: Deer fawning area. Forested with perennial creeks and well-developed riparian areas. Several beaver ponds and heron rookery may be on site.

Proposed management/improvement: Protect fawning and riparian areas. Eliminate disturbance to and enhance habitat by closing logging roads, restricting hunting and managing logging. Could plant clover on roads for ruffed grouse.

Habitat ratings:	Resent	With Improvement
Ruffed grouse	.7	.9
White-tailed deer	.7	.9
Riparian forested	.9	.9

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>N W PRESENT</u>	<u>WITH IMPROVEMENT</u>	<u>NET INCREASE</u>
Ruffed grouse	1,344	1,728	384
Whit-tailed deer	1,344	1,728	384
Riparian forest	155	155	0

SPOKANE PARCEL #4
 (1,780 acres tribal)

Description: Irrigated agricultural land near Spokane River (alfalfa and corn).
 Deer use edges nov.

Proposed management/improvement; General wildlife improvement especially for
 upland game birds, white-tailed deer, wintering waterfowl and nongame birds.
 Plant winter wheat and corn. Improve cover by planting hedgerows and leaving
 crops standing. Improve water supplies. Provide nest boxes for western blue-
 birds.

Habitat ratings:	Resent	With Improvement
Mourning dove	.2	.5
White-tailed deer	.3	.9

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>NOW</u> <u>PRESENT</u>	<u>WITH</u> <u>IMPROVEMENT</u>	<u>NET</u> <u>INCREASE</u>
Mourning dove	331	828	497
White-tailed deer	534	1,602	1,068

POTENTIAL MITIGATION LANDS - STATE PRIORITIES

STATE PARCEL #1
 (9,400 acres private ownership)

Description: Sagebrush habitat. One sage grouse lek and 4-5 sharptail leks on
 property; 6 other sharptail leks within a few miles. Presently grazed and burned.
 May be only remaining habitat for sage grouse in Lincoln County but numbers have
 declined recently. Rime sharp-tailed grouse area although lacks optimum winter
 food plants. Many small lakes with well-developed cattail shorelines. Used by
 waterfowl and furbearers.

Proposed management/improvement: Reserve and rejuvenate sagebrush habitat-stop
 burning, manage grazing, plant sagebrush, transplant sage grouse, plant birch and
 apple trees for sharptail winter food. May also be able to improve lek sites.
 Improve riparian vegetation with cuttings, etc.

Habitat ratings:	Resent	With Improvement
Sage grouse	.1	.9
Sharp-tailed grouse	.7	.9
Riparian shrub	.6	.8

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>N W PRESENT</u>	<u>WITH IMPROVEMENT</u>	<u>NET INCREASE</u>
Sage grouse	901	8,110	7,209
Sharp-tailed grouse	6,411	8,242	1,831
Riparian shrub	88	118	30

STATE PARCEL #2
(20,100 acres private ownership)

Description: 19 miles of riverfront downstream from Grand Coulee Dam. Mosaic of different habitats; most is severely overgrazed with weed problems. Includes Buckley Bar, an important goose nesting island (20-30 nest sites). Well-developed woody riparian. Mule deer wintering range. Also used by sharptails, some bear, ruffed grouse, chukars, quail, pheasants, Huns, a few beaver and river otters, some muskrats. Includes wintering bald eagle roost and golden eagle nest areas. Lewis woodpecker habitat throughout. Good habitat for bobcats and coyotes. Mourning doves are common. Likely supports long-eared owls.

Proposed management/improvement: Grazing management and improvement/protection of riparian areas would improve habitat for most species, especially sharp-tailed grouse. Could be managed as cattle ranch/wildlife improvement project. Could use trickle irrigation with solar pumping to increase riparian areas. Irrigate old alfalfa fields for deer use. Plant small patches of dryland grain to improve upland bird habitat. Maintain goose habitat and improve to accommodate 12 additional nesting pairs. Provide vehicle control.

Habitat ratings:	Resent	With Improvement
Sharp-tailed grouse	.6	.8
Mourning dove	.8	.8
Mule deer	.8	.9
Riparian forest	.6	1.0

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>N W PRESENT</u>	<u>WITH IMPROVEMENT</u>	<u>NET INCREASE</u>
Canada goose (nest sites)	30	42	12
Sharp-tailed grouse	11,717	15,622	3,905
Mourning dove	15,022	17,098	2,076
Riparian forest	310	516	206

STATE PARCEL #3
(24,200 acres private ownership)

Description: All sagelands surrounded by wheat fields. Size of block makes it especially valuable for sage grouse habitat. Four known leks on site. Spring

and fall deer habitat. Also supports sage sparrows, sage thrashers, Brewer's sparrows and pygmy rabbits. Some habitat plots were put in by WDG in 1950s.

Proposed management/improvement: Stop sagebrush control. Maintain current grazing practices. Plant alfalfa and create wet meadows.

Habitat ratings:	Resent	With Improvement
Sage grouse	.6	.8
Mule deer	.5	.6

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>N W PRESENT</u>	<u>WITH IMPROVEMENT</u>	<u>NET INCREASE</u>
Sage grouse	14,181	18,908	4,727
Mule deer	12,013	14,415	2,402

STATE PARCEL #4
(900 acres private ownership)

Description: Primarily a sharp-tailed grouse area including nesting, broodrearing and wintering for SO+ birds. Lek on site. Also spring and summer deer use. Grainfields and nesting cover for mourning doves. Also used by quail, pheasants and Huns; breeding area for blue grouse. Well developed riparian habitat. Popular hunting area.

Proposed management/improvement: Protection.

Habitat ratings:	Resent	With Improvement
Sharp-tailed grouse	.8	.8
Mourning dove	.7	.7
Mule deer	.5	.5
Riparian shrub	.7	.7

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>N W PRESENT</u>	<u>WITH IMPROVEMENT</u>	<u>NET INCREASE</u>
Sharp-tailed grouse	717	717	0
Mourning dove	618	618	0
Mule deer	448	448	0
Riparian shrub	4	4	0

STATE PARCEL #5
(2,700 acres private ownership)

Description: Borders FDR reservoir. Mule deer and white-tailed deer wintering **area**. **Timbered** with thick ceanothus and serviceberry. Some is heavily grazed. **Good ruffed** grouse habitat. Year-round creeks on property. Thick forested riparian with some ponds. County landfill on site.

Proposed management/improvement: Create small openings and replant desirable species. Improve ceanothus with burning. Manage grazing. Create beaver ponds. Burning and logging management would encourage mule deer habitat, which is WDG preference for this area.

Habitat ratings:	Resent	With Improvement
Ruffed grouse	.9	.9
Mule deer	.6	.9
White-tailed deer	.6	.9
Riparian forest	.7	.8

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>N W PRESENT</u>	<u>WITH IMPROVEMENT</u>	<u>NET INCREASE</u>
Ruffed grouse	2,216	2,216	0
Mule deer	1,610	2,415	805
White-tailed deer	1,610	2,415	805
Riparian forest	149	170	21

STATE PARCEL #6
(2,100 acres: 80 acres BLM: 480 acres USFS; 1,540 acres private ownership)

Description: Adjacent to Kettle River. Important mule deer wintering area but in poor condition. Also habitat for some white-tailed deer and ruffed grouse. Forested with intermittent fields and steep slopes. Cattle presently winter on redstem and evergreen ceanothus and serviceberry.

Proposed management/improvement: Manage grazing. Burn to rejuvenate shrubs. Small spring could be improved. Improve alfalfa fields and add borders to reduce sight distance.

Habitat ratings:	Resent	With Improvement
Ruffed grouse	.4	.6
Mule deer	.3	1.0

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>N W PRESENT</u>	<u>WITH IMPROVEMENT</u>	<u>NET INCREASE</u>
Ruffed grouse	704	1,055	351
Mule deer	624	2,080	1,456

STATE PARCEL #7

Sherman Creek HMA Improvement (9,000 acrs WDG land)

Description: Borders FDR reservoir. Whitetail and mule deer winter range. Also used by ruffed grouse and some quail. Presently logged and burned. Not grazed. Good riparian habitat.

Proposed management/improvement Could use O&H funds for fields. Plant alfalfa and/or grains and leave for wildlife. Plant cover along roads and fields for sight distance Improvement. Sherman Crack HMA could be used as headquarters. Contract with local farmer to manage land.

Habitat ratings:	Resent	With Improvement
Ruffed grouse	.8	.8
Mule deer	.9	.9
White-tailed deer	.8	1.0
Riparian shrub and forest	.9	.9

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>NOW PRESENT</u>	<u>WITH IMPROVEMENT</u>	<u>NET INCREASE</u>
Ruffed grouse	5,040	5,040	0
Mule deer	8,100	8,100	0
White-tailed deer	5,321	6,651	1,330
Riparian shrub and forest	405	405	0

STATE PARCEL #8

(1,100 acres private ownership)

Description: Grassland and forested areas. Small portion is orchard. Same wildlife value as above.

Proposed management/improvement: Block up these sections with HMA. Protect from subdividing and orchard expansion. Expand HMA management to these areas.

Habitat ratings:	Resent	With Improvement
Ruffed grouse	.8	.8
White-tailed deer	.8	1.0
Riparian shrub and forest	.9	.9

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>N W PRESENT</u>	<u>WITH IMPROVEMENT</u>	<u>NET INCREASE</u>
Ruffed grouse	620	620	0
White-tailed deer	806	1,008	202
Riparian shrub and forest	23	23	0

STATE PARCEL #9
 (2,400 acres private ownership)

Description: Borders FDR reservoir. Extremely heavy white-tailed deer use-classic winter range although some is heavily grazed. Much of area is being converted to orchard. Thick ceanothus needs rejuvenation. Alfalfa ranch in west portion.

Proposed management/improvement: Burn for great improvement of shrubs. Divide fields into smaller sections. Reduce sight distance. Plant alfalfa for summer range. Too dry to improve for ruffed grouse. Reserve existing riparian and improve with planting along creek.

Habitat ratings:	Resent	With Improvement
Ruffed grouse	.4	.4
White-tailed deer	.7	1.0
Riparian forest	.2	.5

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>N W</u> <u>PRESENT</u>	<u>WITH</u> <u>IMPROVEMENT</u>	<u>NET</u> <u>INCREASE</u>
Ruffed grouse	710	710	0
White-tailed deer	1,679	2,398	719
Riparian forest	8	21	13

STATE PARCEL #10
 (4,500 acres: 600 acres in current WDG easement; 3,900 acres private ownership)

Description: Primarily mule deer and ruffed grouse area. Also some whitetails, turkeys, quail, a few sharp-tailed grouse and pheasants. Popular hunting area. Riparian areas overgrazed with erosion problems. Least milk-vetch (Astragalus microcvstis), a proposed state sensitive plant, has been found in the area.

Proposed management/improvement: Extend current management to larger block and manage timber for turkeys. Manage grazing. Convert some grain fields to alfalfa to improve spring and fall deer habitat. Improve riparian areas. Potential for good beaver habitat (presently not allowed by farmers).

Habitat ratings:	Resent	With Improvement
Ruffed grouse	.3	.7
Mule deer	.7	.8
White-tailed deer	.4	.5
Riparian forest	.3	.9

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>NOW PRESENT</u>	<u>WITH IMPROVEMENT</u>	<u>NET INCREASE</u>
Buffed grouse	803	1,873	1,070
Mule deer	3,127	3,574	447
White-tailed deer	1,311	1,639	328
Riparian forest	46	139	93

STATE PARCEL #11

(3,200 acres: 900 acres BLM; 2,300 acres private ownership)

Description: Borders FDR reservoir Important whitetail and mule deer wintering area. Open ponderosa pine with ceanothus. Springs with cottonwood and aspen borders. Good ruffed grouse habitat.

Proposed management/improvement: Logging and burning. Manage grazing, especially in riparian areas. Improve aspen thickets.

Habitat ratings:	Resent	With Improvement
Ruffed grouse	.8	.9
Mule deer	.8	.9
White-tailed deer	.7	.9
Riparian forest	.4	.6

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>NOW PRESENT</u>	<u>WITH IMPROVEMENT</u>	<u>NET INCREASE</u>
Buffed grouse	2,344	2,637	293
Mule deer	2,597	2,921	324
White-tailed deer	2,272	2,921	649
Riparian forest	61	91	30

STATE PARCEL #12

(3,500 acres private ownership)

Description: Borders FDR reservoir. White-tailed deer area. Good ruffed grouse habitat. Also mourning doves, turkeys and other upland birds. Geese feed in wheat fields during fall and winter. Some thick, well-developed riparian, Least milk-vetch (astragalus microcystis) and Idaho gooseberry (Ribes irriguum), both proposed state sensitive plants, have been found in area.

Proposed management/improvement: Manage grazing. Increase grain plantings. Sharecrop or P.I.K. to raise wheat and not cultivate. Improve riparian,

Habitat ratings:	Present	With Improvement
Ruffed grouse	.7	.8
Mourning dove	.3	.4
White-tailed deer	.8	.9
Riparian forest	.4	.9

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>N W</u> <u>PRESENT</u>	<u>WITH</u> <u>IMPROVEMENT</u>	<u>NET</u> <u>INCREASE</u>
Ruffed grouse	1,394	1,593	199
Mourning dove	267	356	89
White-tailed deer	2,223	2,501	278
Riparian forest	40	91	51

STATE PARCEL #13
(8,300 acres private ownership)

Description: Borders FDR reservoir. Excellent white-tailed deer area. Some turkeys, ruffed grouse, quail, doves, rabbits and coyotes. Many small fields with brushy draws. Generally overgrazed. Much of area is being converted to orchards. Nuttall's pussy-toes (Antennaria parvifolia), a proposed state sensitive plant, has been found in area,

Proposed management/improvement: Negotiate agreements with ranchers to raise alfalfa and leave some for wildlife. Reduce size and manage edges of grain fields. Obtain logging agreements and manage grazing. Manage some fields for geese. Improve riparian areas.

Habitat ratings:	Resent	With Improvement
Ruffed grouse	.7	.8
White-tailed deer	.8	.9
Riparian forest	.6	.8

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>N W</u> <u>PRESENT</u>	<u>WITH</u> <u>IMPROVEMENT</u>	<u>I N & E</u>
Ruffed grouse	4,369	4,994	625
White-tailed deer	6,614	7,440	826
Riparian forest	176	234	58

STATE PARCEL #14
(2,400 acres private ownership)

Description: Borders FDR reservoir. Valuable white-tailed deer wintering area. Also habitat for some quail, other upland birds and nongame species. Open south-facing slopes with grasslands and good brush which needs rejuvenation. Could be combined with state parcel #5.

Proposed management/improvement: Grazing management, timber management, burn-
ing. Intensively farm alfalfa and grains for summer range. Improve riparian.

Habitat ratings:	Resent	With Improvement
Ruffed grouse	.8	.8
White-tailed deer	.7	.9
Riparian forest	.7	.9

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>NOW PRESENT</u>	<u>WITH IMPROVEMENT</u>	<u>NET INCREASE</u>
Buffed grouse	1,647	1,647	0
White-tailed deer	1,671	2,148	477
Riparian forest	47	60	13

STATE PARCEL #15
(332 acres private ownership)

Description: Adjacent to slow meandering river with old-age cottonwood groves **up** 1/2 mile wide. Excellent example of forested riparian habitat, and of particular value because of its width on either side of the **river**. Flows through agricultural areas. Lots of beaver dam and log jams. Northern water thrushes in area. Bald eagles frequent the parcel.

Proposed management/improvement: Mainly protection. Some potential for. geese. Could improve a previously farmed section.

Habitat ratings:	Resent	With Improvement
Riparian forest	.9	1.0

<u>HABITAT UNIT TYPE</u>	<u>HABITAT UNITS (acres)</u>		
	<u>N W PRESENT</u>	<u>WITH IMPROVEMENT</u>	<u>NET INCREASE</u>
Riparian forest	299	332	33

APPENDIX 4.4 CATALOG OF ALTERNATIVE POTENTIAL MITIGATION PARCELS

STATE ALTERNATIVES

STATE PARCEL #16
(3,500 acres private ownership)

Description: Shrub steppe and grasslands, mostly grazed. Borders FDR reservoir. Mule deer and whitetail wintering area, also used by resident population. Habitat for quail, pheasants and chukars. Some springs with thickets on site. Palouse milk-vetch (Astragalus arrectus), a proposed state sensitive plant, has been found in the area.

Proposed management/improvement: Manage grazing. Restrict cattle from draws and allow native vegetation to take over. Could create goose pasture.

STATE PARCEL #17
(7,500 acres private ownership)

Description: Shrub steppe, timbered canyons and some agriculture. Primarily a mule deer area. Ruffed grouse in canyons. Some sharp-tailed grouse in southern part. Some riparian development. Area is heavily grazed.

Proposed management/improvement: Protect and improve riparian zones. Plant for sharptails along streams. Prescribed fire. Sharecrop grain and alfalfa and manage for deer.

STATE PARCEL #18
(2,500 acres private ownership, DNR inholdings along creek)

Description: Timbered canyons and draws with good brush. Crops in uplands. Habitat for mule deer, some white-tailed deer, ruffed grouse, quail and a few pheasants. Raptor nesting in area. Not roaded. Some is heavily grazed.

Proposed management/improvement: Protect riparian zones. Manage grazing. Burn grasslands and woody vegetation. Establish alfalfa fields along creeks. Widen brush borders.

STATE PARCEL #19
(1,200 acres private ownership adjacent to BLM land)

Description: Borders FDR reservoir. Lightly forested. Golden eagle nest on BLM land.

Proposed management/improvement: Protection would be main goal.

STATE PARCEL #20
(900 acres private ownership)

Description: Borders FDR reservoir. Timbered with some grassland. Golden eagle nest.

Proposed management/improvement: Protection would be main goal.

STATE PARCEL #21
(1,000 acres private ownership adjacent to-DNR Land)

Description: Borders river, Not heavily timbered, but has good brush fields. Steep, not grazed. Mule deer and ruffed grouse habitat.

Proposed management/improvement : Prescribed fire and managed grazing.

STATE PARCEL #22
(17,600 acres USBR owned lands around lake)

Description: Federal lands surrounding Banks Lake. Resident deer concentrate along shorelines. Winter forage is limiting; deer rely heavily on winter wheat.

Proposed management/improvement: Banks lake Enhancement Plan outlines possible projects to improve habitat for 12 management units in area. Includes plans for waterfowl, upland birds, mule deer, furbearers, bald eagles and ospreys,

STATE PARCEL #23 (2 portions)
(9,000 acres including 50-60 percent DNR land)
(6,000 acres private ownership)

Description: **Sagelands** adjacent to state parcel #3. Three known leks on site.

Proposed management/improvement: Protection would be main goal. Also manage grazing for some habitat gains.

STATE PARCEL #24
(11,000 acres including USBR 8 BLM inholdings)

Description: Pocket potholes and spring-fed streams with well-developed riparian. Grainfields interspersed. Unusually good sharp-tailed grouse habitat. Also sage grouse, mule deer, chukars and quail. Year-round deer habitat,

Proposed management/improvement: Improve riparian habitat. Improve range management. Rehabilitate abandoned grain fields. Establish grain plots and feeders. Good recreational opportunities.

STATE PARCEL #25

(3,060 acres: 1,860 private ownership; 1,000 state and federal; 200 county)

Description: Borders Rufus Woods Pool. Bitterbrush flats, some draws and a few potholes. Presently in good condition. Year-round mule deer habitat. Golden eagle and bald eagle nests on site. Also some sharptails, quail and chukars. Goose brooding pasture and some waterfowl production.

Proposed management improvement: Protection would be main goal. Could also improve riparian habitat along pool and improve goose brooding area.

STATE PARCEL, #26

(2,500 acres private ownership)

Description: Near Chief Joseph Dam. Alkali flats, riparian areas and springs. Some erosion problems and destroyed vegetation from ORV use. Garbage dump in draw. Mule deer winter range. Also habitat for sharptails, quail and some pheasants.

Proposed management/improvement: Improve riparian draws. Remove ORV use. Eliminate dump. Manage grazing.

STATE PARCEL #27

(6,400 acres private ownership)

Description: Borders river (Lake Pateros). Well developed riparian areas on site. Portions are overgrazed, especially Bonita Plats. Year-round deer habitat with sharp-tailed grouse, chukars and some quail. Beaver population in Bonita Canyon. Potholes in Cold Springs Basin support muskrats and waterfowl.

Proposed management/improvement: Improve riparian in Bonita Canyon and along reservoir. Improve deer habitat to reduce damage in local orchards. Manage grazing. Plant aspen and birch in spring areas.

STATE PARCEL #28

(4,000 acres including DNR inholdings)

Description: Edge between wheat and scrubland. Presently there are alfalfa fields with sprinkle irrigation from creek. Area is sink for wintering wildlife including chukars, quail, deer and nongame species. Migrant geese also use area. Portions are heavily grazed.

Proposed management/improvement: Manage grazing. Move crops back 50 feet from creek to reestablish riparian vegetation.

STATE PARCEL #29
(9,000 acres private ownership)

Description: Borders Rufus Woods Pool near Chief Joseph Dam. Critical mule deer winter range. Also provides nesting habitat for red-tailed hawks. Chukars and sharptails use area in winter and spring. East Foster Creek severely eroded. Much of area is being converted to orchard.

Proposed management/improvement: Main goal would be protection of tinter range and maintenance of wildlife numbers. Also improve riparian areas and correct erosion problems.

STATE PARCEL #30
(8,300 acres private ownership)

Description: Mixture of timber and sage. Principally a white-tailed deer area-critical winter range in good to excellent condition. Also used by quail, pheasants, chukars, Huns, a few mule deer, ruffed grouse, doves, partors, black bear and long-billed curlews. Grazed in winter only. Little access. Surrounding area is being subdivided.

Proposed management/improvement: Maintain in present condition. Fence to prevent damage to adjacent orchards. Consider planting alfalfa on property. Weed contro and vehicle access control. Especially good for non-consumptive use.

STATE PARCEL #31
(1,500+ acres private ownership)

Description: Riparian corridor and adjacent shrub steppe. Riparian habitat is badly damaged from overgrazing and carp invasion. No woody vegetation left, only grasses and rushes. Siltation is also a problem. Waterfowl, furbearers and curlew habitat. Heavily used by raptors. Some sandhill cranes. Historic value; pre-irrigation surface flow.

Proposed management/improvement: Fence and control weeds. Proposed carp control program also allows for wildlife improvements. Construct wing and check dams to direct and funnel stream flows. Plant shrubs in riparian corridor.

STATE PARCEL #32
(private and public ownership)

Description: Many small ponds with grassy borders and lots of invertebrates. Extremely productive waterfowl area for almost all species of Washington ducks. Limiting factor is nesting cover. Wheat farming extends to edge of ponds in places.

Proposed management/improvement: Could be greatly improved with small expenditure. Improve nesting habitat. Create additional potholes with dikes and water impoundment. Exclude cattle along sections of pothole shorelines to create 100-200 foot buffers. Establish grazing and burning program.

APPENDIX 5.1 STUDY OVERSIGHT COMMITTEE MEETINGS

<u>Meeting Date</u>	<u>Location</u>	<u>Agencies Respresented</u>
10/31/85	Wenatchee	Colville Confederated Tribes Oregon Dept. of Fish and Wildlife PNUCC Spokane Tribe U.S. Bureau of Reclamation U. S. Fish and Wildlife Service Washington Dept. of Game
12/18/85	Spokane	BPA Colville Coafederated Tribes PNUCC Spokane Tribe U.S. Bureau of Reclamation U.S. Fish and Wildlife Service Washington Dept. of Game
3/4/86	Spokane	BPA Colville Confederated Tribes Northwest Power Planning Council PNUCC Spokane Tribe U.S. Bureau of Reclamation U.S. Fish and Wildlife Service Washington Dept. of Game
5/22/86	Spokane	BPA Colville Confederated Tribes Northwest Power Planning Council PNUCC Spokane Tribe U.S. Bureau of Reclamation U.S. Fish and Uildlife Service Washington Dept. of Game
8/13/86	Spokane	BPA Colville Coafederated Tribes Northwest Power Planning Council Spokane Tribe U.S. Bureau of Reclamation U.S. Fish and Wildlife Service Washington Dept. of Game

APPENDIX 5.2 SUMMARY OF COMMENTS RECEIVED ON DRAFT REPORT AND STUDY TEAM RESPONSE.

Project Benefits to Wildlife

Comments: The Bureau of Reclamation and PNUCC commented that the report did not adequately address project benefits to wildlife either on- or off-site.

Response: Additional information addressing benefits to wildlife occurring from development and operation of the hydroelectric facility has been added to the final report, Section IV.4, pages 20-21.

Comment: The Bureau and PNUCC requested that benefits resulting from irrigation development in the Columbia Basin be included in the analysis and discussion in addition to benefits associated with Grand Coulee Dam and FDR Reservoir. In that way, credit for those benefits could be weighed against losses due to inundation and project operations.

Response: The purpose of this study is to examine losses and propose actions to mitigate losses resulting from hydroelectric operations of the facility and/or the hydroelectric system. Examination and analysis of benefits and losses resulting from irrigation and the development and operation of irrigation facilities is beyond the scope of the contract under which the study has been done. The scope of the study is described in Section 1.2. page 1.

It should be noted that irrigation and irrigation facilities have produced both positive and negative impacts in the Columbia Basin. It would be inappropriate to consider irrigation benefits to wildlife without also considering the adverse impacts on wildlife.

Comment: PNUCC commented that substantial protection, enhancement and mitigation has already taken place since project construction and noted the many wildlife areas established in the Columbia Basin.

Response: In order to take full advantage of wetlands habitat created incidental to irrigation development, a memorandum of understanding was signed by U.S. Fish and Wildlife Service and Bureau of Reclamation which determined that the Fish and Wildlife Coordination Act applies to the Columbia Basin Project. Wildlife enhancement areas referenced by PNUCC are not considered mitigation for losses resulting from hydropower because:

- a) Wildlife benefits on all these lands are incidental to irrigation and irrigation facilities.
- b) Purpose for establishing the Columbia National Wildlife Refuge was not hydropower mitigation but rather 1) to provide a nesting and breeding ground for migratory birds and 2) to grow crops and reduce depredation of surrounding agricultural lands.

c) Other fish and wildlife enhancement has been done under the authority of the Fish and Wildlife Coordination Act. Costs were allocated to wildlife purposes of the project not hydropower.

Hydropower Allocation

Comment: The Bureau of Reclamation and PNUCC commented that the hydroelectric share of wildlife losses should be allocated based on its proportion of project costs.

Response: Comment noted. Refer to Section IV.6, pages 29-30.

The proposal is a compromise which seeks to replace approximately 32% of the losses due to inundation. Since the Bureau of Reclamation assigns 43% of project costs to the hydroelectric function, the issue of hydropower responsibility is moot.

Comment: PNUCC commented that the large size of FDR Reservoir is required for irrigation in addition to the production of hydropower. Quotations from Bureau of Reclamation publications are provided as support of this position.

Response: Although the report quotation implies that a high dam was needed to support the Columbia Basin irrigation plan, it does not explain the reason it was needed. The reason for the choice of the high dam and large pool involved economics as well as engineering. The additional hydropower production and revenue (a function of "head") obtainable from a high dam was necessary to adequately pay for construction costs and provide electricity for pumping water to Banks Lake.

Irrigation purposes do not need water storage because the natural flow in the Columbia River exceeds irrigation requirements. Neither do irrigation purposes need a high pool elevation.

The report included in the PNUCC letter as attachment 4 addresses the "as built" aspects of the project's design and indicates that the pump-generator units used to lift water to Banks Lake are engineered to take advantage of the high pool level used for hydropower production. This does not mean that irrigation water could not have been pumped to the Columbia Basin lands without a pool level above 1,240 ft. elevation. From a purely engineering perspective it is possible to pump irrigation water to Banks Lake directly from the Columbia River (pre-project elevation 945 ft.). Neither a high dam nor large reservoir are needed. It is the economic perspective (i.e. hydropower production) that requires the high dam and large pool size.

Comment: The Bureau of Reclamation commented that the report incorrectly implies that hydropower revenues subsidize nonreimbursable project purposes.

Response: The wording in Section IV.6, page 30 has been corrected.

Full Redress of Wildlife Losses

Comment: PNUCC commented that discussion of full redress of wildlife losses is not appropriate in the report since full redress is not required by the Act.

Response: While the Act does not require full redress of hydropower-related wildlife losses, it is clear that it seeks full redress to the extent that it does not preclude an adequate, efficient, economical and reliable power supply for the Pacific Northwest. Therefore a discussion of full redress of wildlife losses resulting from Grand Coulee Dam is necessary so that the Council will have adequate information on which to base decisions.

Commentz; PNUCC expressed concern that the proposal does not provide full credit for lands protected as mitigation.

Responsez; It is the intent of the proposal to provide such credit. Language has been added to Section V and the glossary to clarify this matter.

The Habitat Unit Concept

Comment: PNUCC commented that when trading Habitat Units as mitigation, consideration should be given to the relative economic value of the individual species. For example the draft proposal recommends that some elk Habitat Units be taken in trade for an equivalent number of deer Habitat Units. Since elk are more valuable than deer, PNUCC suggests three deer units should be considered equal to two elk units.

Response: When trading Habitat Units we are not trading individual animals but rather units of habitat. Trading one mule deer Habitat Unit for one Elk Habitat Unit should be interpreted by the reader as:

"Trading the equivalent of one acre of land which has optimum habitat for mule deer and all other wildlife species associated with mule deer habitat

for

the equivalent of one acre of land which has optimum habitat for elk and all other wildlife species associated with elk habitat."

A Habitat Unit is essentially an acre of land. What makes a deer Habitat Unit different from an elk Habitat Unit is the habitat on that acre (i.e. the type and structure of vegetation, topography, relative location of water sources, climate, etc.).

Assigning a relative value to Habitat Units has many pitfalls. Since Habitat Units are acres of land, do we consider the real value of the land or just the value of the indicator species? Should the other species represented by the indicator species be figured into the valuation? What about differences in carrying capacity? It requires more land to produce one elk than it does to produce one deer. Unless the Habitat Units in question are grossly dissimilar, assignment of relative values adds unnecessary complexity.

With regard to the current proposal, there are only two Habitat Unit trades proposed, they involve only a small number of habitat units, and the trades involve wildlife and land types that are generally similar. In light of these and the above considerations, we do not believe it advisable to assign relative values to Habitat Units for the purposes of this proposal.

Land Acquisition

Comment: PNUCC commented that the proposal emphasizes fee title acquisition of lands as a first priority, and that the draft report inadequately addresses cost-effectiveness of alternatives considered. Priorities for providing Land for wildlife were suggested.

Response: The proposal stipulates that the most cost effective approach be used to acquire management rights whether it be through management agreement, easement or fee title purchase. The suggested priorities for providing wildlife lands are consistent with the proposal. Language has been added to the final report, Section V, page 33 and 44 to clarify these matters.

Cost estimates for the proposal are expressed in terms of fee title acquisition at the highest estimated land prices only so that the Council may anticipate potential costs of the proposal. Less-than-fee acquisition remain an option. Regardless of land management rights acquisition methods chosen, actual costs may be less if negotiations with land owners are favorable and actions are expedited to take advantage of cost saving opportunities.

Additional information regarding alternatives considered has been added to the final report, Section III.5

Operation and Maintenance

Comment: PNUCC commented that annual operation and maintenance expenses on mitigation lands should be the responsibility of the wildlife management agencies (unless title to the mitigation lands was retained by the project operator).

Response: With the proposal, approximately 32% of mitigation credit would result from habitat enhancement. Much of this involves artificially increasing the habitat value of the land beyond what exists naturally. If O&M monies are not available to maintain this artificial increase, the mitigation value of this habitat would revert to zero within a few years. Approximately 68% of the proposal's mitigation credit would result from habitat protection. Maintaining this protection requires some continuing costs (such as weed control required by law or required payments in lieu of taxes). If O&M monies are not available to meet these costs, the management rights to the land would be lost as would habitat protection and its value as mitigation.

In summary operation and maintenance funds are needed for mitigation facilities just as for any other project facilities.

Monitoring

Comment: PNUCC commented that establishing reasonable population ranges and monitoring population levels would provide a more appropriate measure of enhancement success than trend counts. The concern was raised that population trends are influenced by factors not related to mitigation efforts. PNUCC recommends that additional parameters be selected and monitored as well.

Response: Trend counts are proposed to supplement monitoring of habitat variables. Since mitigation is based upon protection and enhancement of habitat, monitoring habitat variables would provide the best information as to how well mitigation measures have been implemented and maintained. However it is also desirable to have an indication that wildlife populations are responding to the mitigation measures as planned. Trend counts would provide an indication of relative population changes. Since trend counts are also routinely conducted by wildlife management personnel on lands other than proposed mitigation lands, these routine trend counts can serve as a control against which trend counts on mitigation lands can be compared. Such comparisons would help filter out factors not related to mitigation efforts such as over-harvest and disease.

Establishing reasonable population ranges and then monitoring population levels to see if they fall within those ranges would also serve to verify that wildlife populations are responding to mitigation measures as planned. However, the level of effort required to ascertain the population of mobile wildlife such as deer can be quite high. The use of trend counts is proposed as a potentially less expensive alternative.

Wildlife Needs and Priorities

Comment:PNUCC commented that the draft report does not demonstrate needs for wildlife protection, mitigation and enhancement. Concern was expressed that the report emphasized replacement of acreage rather than meeting wildlife needs.

Response: Wildlife needs are identified in the report in Section IV and expressed in terms of population losses for indicator species, losses of Habitat Units for indicator species and agency management goals for indicator species on a reservation, region and statewide basis. Further demonstration of need is beyond the scope of this study and is not warranted since the Act and the Program recognize that the needs exist.

Since wildlife is a product of the land (habitat), replacement of land (habitat) is an inescapable requirement of any effort to enhance, mitigate or protect wildlife affected by hydropower.

Comments: The Bureau of Reclamation and PNUCC commented that wintering populations of bald eagles are increasing in the FDR Reservoir/Hanks Lake area and question whether mitigation efforts are feasible or warranted. Additionally the Bureau of Reclamation noted that 486 bald eagles were counted on FDR Reservoir by the National Park Service.

Response: Proposed bald eagle mitigation is discussed in Section V.4, pages 39 and 40. Additional information has been added to clarify the scope and objectives of the proposed mitigation.

We have been unable to substantiate the reported large number of bald eagles wintering along FDR Reservoir in ~~1926~~. The 1986 mid-winter count of bald eagles along the reservoir was 176.

Comment: PNUCC commented that present deer management in areas adjacent to FDR Reservoir is designed to limit deer numbers. This is considered an indication that mitigation designed to increase the number of deer is not justified,

Response: Current deer management is intended to keep the population within the carrying capacity of the current habitat. The population cannot be allowed to increase unchecked because there is insufficient winter range for a larger population. (Much of the former winter range was inundated by FDR Reservoir.) If the population- allowed to increase beyond the carrying capacity of the habitat, depredation, habitat destruction and mass die-offs would eventually result. Proposed mitigation would increase the carrying capacity of the habitat and thus allow an increase in the deer population.

General Comments

Comment: The Bureau of Reclamation commented that the correct figure for the total amount of land inundated by Grand Coulee Dam is 56,000 acres.

Response: The 14,000 acre difference between this new figure and the figure of 70,000 acres used in the report is a matter of whether the inundated land was measured from the high or low water line. The amount of river shoreline (sand/gravel/cobble vegetation type) is approximately equal to the difference noted.

Since the river bank below the high water line was used by wildlife, we have decided to continue using the 70,000 acre figure for the purposes of the report. The use of either the 70,000 or 56,000 acre figure for inundated lands will not affect the mitigation alternatives considered nor the proposed mitigation since the sand/gravel/cobble vegetation type was not a factor considered for mitigation purposes.

Comment: The Colville Confederated Tribes, Washington Department of Game, U.S. Fish and Wildlife Service and Inland Empire Big Game Council commented that they support the study and proposed mitigation.

Comment: The Inland Empire Public Lands Council and Mike Shane, an individual, commented that the proposal did not adequately mitigate for wildlife losses. noted that full redress of losses was warranted.

APPENDIX 5.3 COMMENT LETTERS RECEIVED