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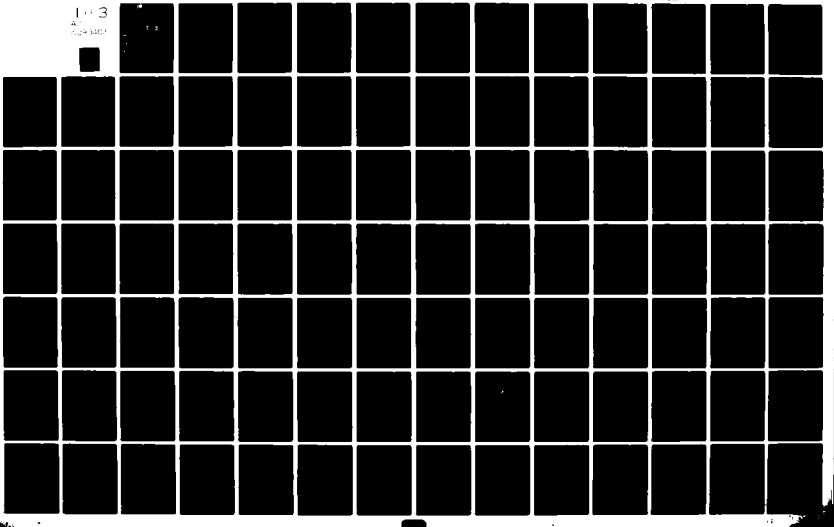
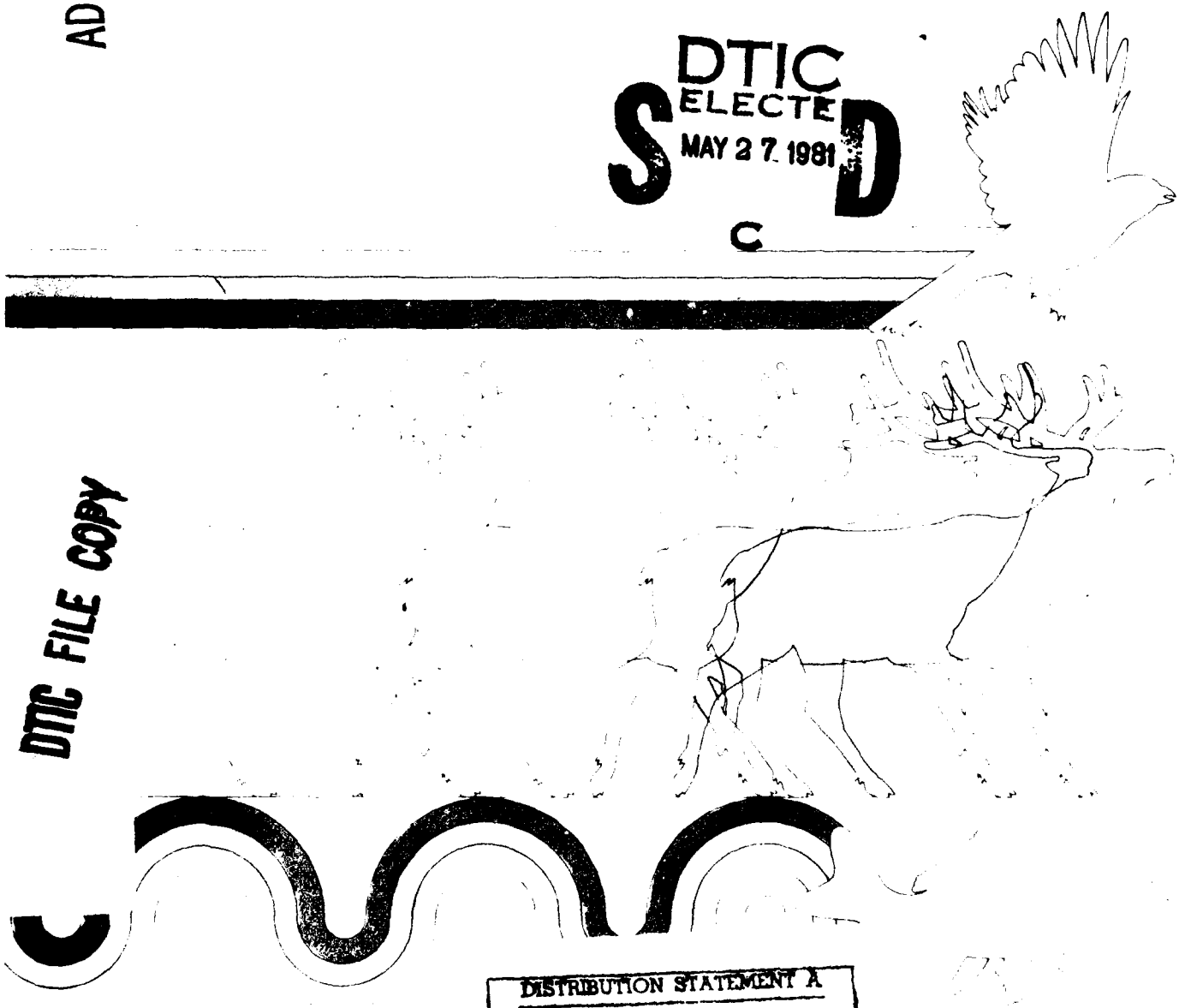


Evaluation of Planning for Fish & Wildlife

Dworshak Reservoir Project
February 1981



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Steelhead trout fishery
Resident river fisheries

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Dworshak project, located on the North Fork of the Clearwater River, in Clearwater County, Idaho, was authorized in Public Law 87-874, approved October 23, 1962. Navigation, power and recreation are contributors to the project purposes. Construction began on the 86.3 km (53.6 mi) long lake early in 1963, and the dam was closed on September 27, 1971. The project includes a 6,644 ha (16,417 ac) lake (at full pool) and 13,161 ha (32,521 ac) of fee lands located above the normal full pool.

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The project-associated wildlife habitat loss of 6,071 ha (15,000 ac) was expected to create serious losses to wildlife populations. Mitigation planning emphasized winter browse development primarily to benefit elk. An early recommendation for fee acquisition of 4,856 ha (12,000 ac) was later altered to a request for fee acquisition of only 1,059 ha (2,616 ac). All remaining elk mitigation needs were to be realized via management agreements. By 1966, the planners agreed that acquisition of at least a 2,024 ha (5,000 ac) "hard-core" area of elk winter range was required. The management agreements on approximately 14,165 ha (35,000 ac) proved unsatisfactory to the Idaho Department of Fish and Game (IDFG) and in 1972, the year the lake filled, the agency resubmitted a formerly proposed (1960) request for fee acquisition of lands located on Smith Ridge.

All agencies currently insist that the winter range carrying capacity under intensive development and management on the 2,072 ha (5,120 ac) of "hard-core", 809 ha (2,000 ac) of project lands and 1,821 ha (4,500 ac) on Smith Ridge (proposed but not acquired to date) is 915 elk. The "hard-core" area has been acquired and partially developed for winter browse.

Elk losses have not been as severe as the FWS's predicted loss of 2,700 animals. More elk are attracted to Smith Ridge during the spring calving season than during the winter and the majority of wintering elk on Smith Ridge and the "hard-core" lands are from the Little North Fork Clearwater Basin and not, as previously suspected, from the North Fork Clearwater drainage. Studies have not documented major migration problems. Some 1,000 white-tailed deer were eliminated by the project. Moose and mountain goats, as expected, were not harmed by the project. Losses of ruffed grouse, upland game and furbearers were expected but never quantified.

Although the IDFG preferred passage of wild steelhead, it eventually became necessary to accept a steelhead mitigation hatchery. Since reservoir impoundment, adult steelhead returns have fluctuated annually, averaging less than 14,000 fish or approximately 60 percent of average pre-project returns. However, given favorable passage conditions, the Dworshak Hatchery is capable of providing sufficient young fish to support adult runs at least equivalent to pre-project returns. In some years since project construction, the returning adult fish have supported twice the angler use projected for without-project conditions.

Intake gates were designed to provide temperature control for water releases. Before completion of the dam, however, the Clearwater River sport fishery shifted from smallmouth bass to rainbow and juvenile-steelhead. Shore angling on the river during both periods averaged just over 10,000 hours annually. The unimpounded section of the North Fork Clearwater River was expected to support less angler effort due to removal of the juvenile-steelhead population. However, the community of game fishes in the North Fork have declined only moderatly since closure of the dam.

The requested production of 300,000 resident fish has been possible at the Dworshak Hatchery. Since 1970, resident fish reared at the hatchery have been stocked into Dworshak Reservoir. Use and harvest at the reservoir greatly exceeded expectations expressed in 1962. Angler effort averaged 35,000 angler trips per year between 1973-76 or 5.4 times higher than the projected average life-time use of the lake. Harvest averaged 123,860 fish which was 9.5 times higher than the project-life prediction.

PREFACE

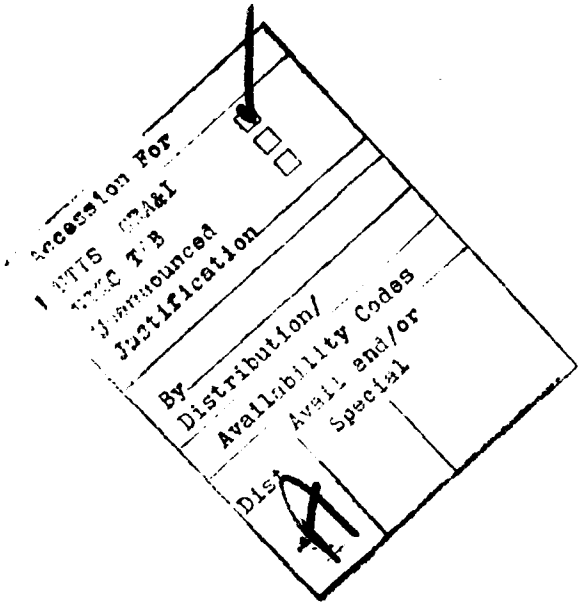
This document was prepared by staff of the Sport Fishing Institute for the U. S. Army Corps of Engineers (CE) under contract number DACW31-79-C-0005. The contract requires the compilation and comparison of pre- and post-construction data treating fish and wildlife for twenty separate CE water development projects. This report presents the findings for one of the twenty individual project evaluations.

Upon completion of the full series of twenty separate studies, a final report will be prepared which will contain an analysis of the validity of the predictive procedures used in fish and wildlife planning, and will contain recommendations for improving the planning process.

This evaluation of the adequacy and accuracy of fish and wildlife planning at the Dworshak Reservoir project in Idaho was aided significantly by the participation and active cooperation of many individuals. U. S. Army Corps of Engineers personnel John McKern, Dick Knowles and Jerry Berry participated in a tour of the Dworshak project and provided many helpful documents. Richard Fisher and George Harrington, U. S. Fish and Wildlife Service's Ecological Services Division, and Wayne Olson, manager of the Fish and Wildlife Service's Dworshak-Kooskia National Fish Hatchery, supplied many fish and wildlife-related planning reports and production data. Several members of the Idaho Department of Fish and Game supplied additional descriptive information regarding current conditions for fish and wildlife communities and dependent recreational [illegible] Dworshak Reservoir project. Among these individuals were

Lloyd Oldenburg, Walt Browne, Ted Meske and Stephen Pettit.

Bill Morse, Western Field Representative, Wildlife Management Institute, accompanied project personnel on a tour of the project and reviewed the draft manuscript.



CONTENTS

LIST OF TABLES

LIST OF TABLES (CONTINUED)

LIST OF TABLES (CONTINUED)

LIST OF FIGURES

SPORT FISHING INSTITUTE

PROJECT PERSONNEL

Norville Prosser (Assistant Project Leader)

Robert Martin (Project Leader)

Richard Stroud (Contractor's Representative)

Debra Zambrano (Project Secretary)

CONSULTANT'S REVIEW

Professional terrestrial wildlife consultative services were provided by the staff of the Wildlife Management Institute (WMI). Project personnel were accompanied by a WMI staff specialist during field reconnaissance and on on-site discussions. The terrestrial wildlife portion of the prepared evaluative manuscript was reviewed and evaluated by WMI. All pertinent suggestions offered by the consultant are reflected in this report.

INDIVIDUAL RESERVOIR PROJECT EVALUATION REPORTS

DWORSHAK RESERVOIR PROJECT

INTRODUCTION

Location

The Dworshak Dam and Reservoir project is located on the North Fork of the Clearwater River, 3.1 km (1.9 mi) above the confluence with the Clearwater River. The dam and lower portion of the project are within the Nez Perce Indian Reservation and the entire project is located in Clearwater County, Idaho (Figure 1). In 1970 the population of Clearwater County was 10,871. This represents a 27.2 percent increase over the 1960 Census population figure of 8,548. Orofino, with a 1970 population of 3,893, is the largest town in Clearwater County. U. S. Highway 12, between Lewiston, Idaho, and Missoula, Montana, provides direct access to the Dworshak project. Lower Granite Dam and Reservoir, a U. S. Army Corps of Engineers project, located on the Lower Snake River in Washington, is the only other significant impoundment within 120 km (75 mi) of the Dworshak project (1).

Authorization

The Dworshak project is part of the comprehensive water resource development plan for the Columbia River and its tributaries. Authorized project purposes are for flood control and "other purposes." Navigation, power, and recreation are contributors to the project purposes.

During the early planning stages, the project was known as Bruce's Eddy. In 1963 the name was changed by Congressional action to honor

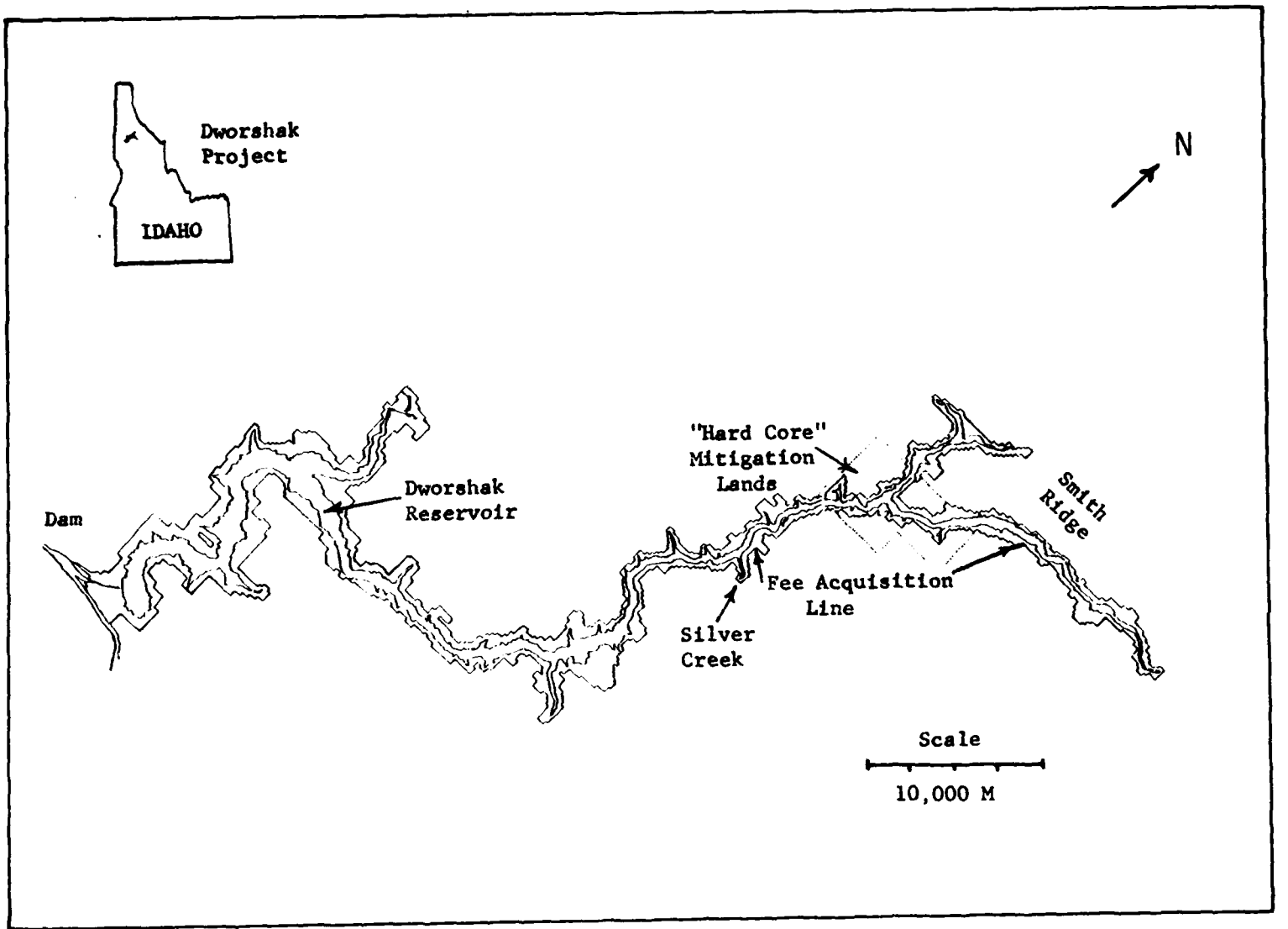


Figure 1. -- Map of Dworshak project.

Idaho Senator Henry C. Dworshak. The Bruces Eddy site was originally proposed as a potential dam site in House Document 531, 81st Congress, 2nd Session. Five years later, June 14, 1955, Senate Document 51, 84th Congress, 1st Session, recommended adoption of the Bruces Eddy project, and in 1958, Public Law 85-500, 85th Congress, 2nd Session, contained authorization and provided funding for detailed planning for the project. Authority for construction of the project was contained in Public Law 87-874, approved October 23, 1962, Section 201 of the 1962 Flood Control Act in accordance with House Document 403, 87th Congress, 2nd Session (op. cit.).

Construction funds were authorized by Public Law 87-880, approved on October 24, 1962, and construction began early in 1963. The dam was closed on September 27, 1971, and the first power was delivered on November 15, 1973. The Dworshak project is administered by the Walla Walla District of the North Pacific Division, U. S. Army Corps of Engineers.

Project Description

Dworshak Dam is a concrete gravity structure with a crest length of 1001.9 m (3,287 ft) and a total height of 218.5 m (717 ft). The spillway is located in the center face of the dam. Three generating units are incorporated into the project with a total generating capacity of 400,000 kilowatts. Space exists for the future installation of three additional units capable of generating 660,000 additional kilowatts. Water to turn the turbines is removed through an intake struc-

ture equipped with selector gates for selective withdrawal to provide temperature control of released water.

The dam was not provided with fish passage facilities. This effectively terminated migration of anadromous fish up the North Fork of the Clearwater River. To compensate for this loss, the world's largest steelhead hatchery was constructed downstream from the project at the confluence of the North Fork and the Clearwater Rivers.

The lake extends 86.3 km (53.6 mi) up the North Fork of the Clearwater River and covers 6,644 ha (16,417 ac) when at full pool elevation 487.7 m (1,600 ft) mean sea level (msl). At full pool the shoreline measures 282 km (175 mi) in length. At minimum pool elevation, 440 m (1,445 ft) msl, the lake covers 3,663 ha (9,050 ac). The 47 m (155 ft) vertical zone between full pool and minimum pool provides 2.47 x $10^9 m^3$ (2,000,000 ac-ft) of storage for power production and flood storage.

The maximum pool elevation is 489 m (1,605 ft) msl, which represents 1.5 m (5 ft) of surcharge storage over normal full pool elevation.

The Dworshak project includes 13,161 ha (32,521 ac) of fee lands located above the normal full pool. Of this total land area, 5,476 ha (13,531 ac) are allocated for wildlife management purposes (Table 1). Of this total, 2,081 ha (5,142 ac) were specifically acquired for wildlife management purposes. The remainder consists of project operational lands which are currently categorized for wildlife purposes.

The minimum instantaneous discharge currently permitted from the project

Table 1. -- Land use classification, Dworshak project fee land

Use category	Areas zoned	
	Ac	Ha
Project operation	660	267
Public recreation	11,294	4,571
Reserve forest (forest improvement areas)	5,637	2,281
Natural area (ecological and scenic areas)	1,399	566
Wildlife		
From operational lands	8,389	3,395
Mitigation lands	5,142	2,081
Total	32,521	13,161

Source: Walla Walla District. 1977. Dworshak master plan draft, a master plan for the management of all natural and manmade resources of Dworshak Reservoir. Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington.

is 305 m^3/sec (1,000 cfs). This discharge supplies the Dworshak Hatchery with water which is temperature controlled by multilevel outlet structures on the turbine intakes (2).

Dworshak Reservoir is long and narrow with a maximum width of 2,743 m (9,000 ft) and an average width of only 547 m (1,800 ft). For most of its length, the terrain surrounding the lake is steep and rugged and for the most part heavily timbered. The project is located in the Idaho white pine belt. The forest species vary widely depending upon slope orientation, gradient and proximity to the mountains. Protection of the project area from forest fires has created mixed stands of shade tolerant and less shade tolerant species. Ponderosa pine stands have become mixed with Douglas fir. Douglas fir has become mixed with grand fir and Western red cedar, and white pine stands are mixed with grand fir, Douglas fir, red cedar, and Englemann spruce. Stream bottoms have developed to an apparent climax stand of cedar and grand fir (1).

Mean annual precipitation ranges from 61 cm (24 in) per year near the mouth of the North Fork Clearwater River to 203 cm (80 in) near the extreme headwaters in the Bitterroot Mountains. Average precipitation over the entire watershed is 130 cm (51 in annually)(1). About 40 percent of the precipitation occurs November through January.

Mean annual temperatures range from less than 0 C (32 F) near the mountain summits to over 10 C (50 F) at the lowest elevations. Prevailing winds are from the west and southwest and are moderate in velocity, occasionally reaching 20 to 30 mph.

Acquisition of Descriptive Data

The U.S. Army Corps of Engineers (CE), the U.S. Fish and Wildlife Service (FWS) and the Idaho Department of Fish and Game (IDFG) are the three prime agencies that have been actively involved in fish and wildlife planning at the Dworshak project for over 30 years. This project's location on important big game winter and summer range as well as being located upon an anadromous fish-spawning river of major importance have resulted in an enormously complex planning effort.

Fish and wildlife-related negotiations have involved several other federal, state and private organizations, including the Bureau of Land Management (BLM), the U.S. Forest Service (USFS), the Idaho Land Board (ILB) and the Potlatch Forests, Inc. (PFI).

As a result of the enormously important natural resources being affected, and the number of agencies and organizations impacted by the Dworshak project, the planning record for the project is easily the most extensive and complex of any project encountered in this series of case history studies.

To acquire the key reports and most important informal support documentation, and to discuss project planning in detail with knowledgeable local personnel, Sport Fishing Institute staff visited major administrative, research and management offices of the three agencies with primary planning responsibilities for the Dworshak project. CE files were reviewed at both the North Pacific Division offices in Portland, Oregon, and at the Walla Walla, Washington, District offices. In addition,

Corps field staff accompanied Institute personnel during a two-day tour of project facilities. Pertinent records maintained by the FWS, including the major planning instruments prepared under authority of the Fish and Wildlife Coordination Act (P.L. 85-624) were acquired during visits to the Regional Office in Portland, Oregon, and at the Field Office in Boise, Idaho. Institute personnel also visited the Dworshak Hatchery, a FWS operated steelhead production facility constructed by the CE at the Dworshak project.

Most of the information relating to the fish and wildlife communities of the Dworshak project area were obtained from the Idaho Department of Fish and Game (IDFG). Discussions were held with appropriate IDFG staff at both the State Office in Boise, Idaho, and the Regional Office in Lewiston, Idaho.

The last major source of historical information, as in all preceeding studies, was the files of the National Archives in Washington, D.C. The Washington offices of the BLM and FWS also provided select documents during the preparation of this report.

WILDLIFE RESULTS AND DISCUSSION

General Discussion

This report assesses the accuracy of fish and wildlife-related impact predictions which were developed by affected conservation agencies to guide design, construction and operational decisions at the Dworshak Reservoir project. The evaluation also examines the adequacy of those mitigation and compensation recommendations which were formulated by the conservation agencies and implemented by the construction agency.

Several characteristics make the Dworshak project unique among those projects which have been studies under the current investigation. The lake was not fully impounded until the spring of 1973, making Dworshak [illegible] among the youngest projects studied.

Plan formulation and impact assessment began in 1954 and is still under way. This lengthy planning period, combined with the degree of losses anticipated as a result of the project have produced an enormous record of written documentation. The record, though voluminous, was widely scattered and not available at any single location prior to this effort.

Because of the volume and planning complexities involved over a long period of time and among many concerned agencies, the following discussion of plan formulation is presented chronologically, beginning with the public hearing in 1953. A tabular summarization of the major actions presented in the following lengthy discussion is provided in

Table 18 (pg 122) of this report. Reference to this table may help the reader follow the complex planning history of the Dworshak project.

Wildlife Resources-Planning History

Active planning for a water development project at the Dworshak site, known in the earlier years as the Bruces Eddy project, was publicly unveiled by the CE at a meeting held in Orofino, Idaho, on November 20, 1953. At the meeting the CE announced their intention to recommend two projects, i.e., Bruces Eddy (Dworshak) and Penny Cliffs. A dam with a hydraulic height of 174 m (570 ft) was proposed for the Dworshak site to provide flood control and hydropower production. The Fish and Wildlife Service's initial comments, submitted to the CE by letter dated November 25, 1953 (3), cautioned that creation of these impoundments would have serious impacts on wildlife, viz:

> The North Fork area is second only to the Middle Fork Selway-Lochsa area in production of big game. The impoundment formed by the proposed dam at Bruces Eddy would not only inundate some winter habitat but also obstruct a portion of the winter migration routes. The effect of the impoundment would vary from year to year depending on the severity of the winter and the depth of the snow. Obviously it would have its most detrimental effects in severe winters, when game are forced by heavy snows to seek relatively low elevations. It is estimated that during critical winters over 15 percent of the existing elk and deer herds in the North Fork would be affected by the impoundment. This effect could only result in a diminution of the size of the populations, as little or no restitution could be provided for the partial loss of winter habitat and routes of migration.

With regard to relative impacts of the two projects, i.e., Penny Cliffs and Bruces Eddy, the 1953 FWS report stated:

> The Middle Fork-Selway-Lochsa area is the major big-game-producing area in the Clearwater drainage. Consequently, the impoundment formed by the proposed dam at the Penny Cliffs site would have a much greater effect on the big-game populations than would the proposed dam at Bruces Eddy, owing to the larger big-game herds involved and the larger extents of winter habitat affected.

In summary, the FWS opposed the construction of both projects (op.cit.):

> While it is true that the impoundments produced by these dams would inundate only a portion of the big-game winter habitat, adequate restitution could not be provided for this loss. The end result would be a reduction in the big-game productivity of the area and the State as a whole.
>
> In conclusion, the Fish and Wildlife Service is of the opinion that the ill effects to both fish and wildlife resulting from the construction of Bruces Eddy and Penny Cliffs Dams are of sufficient magnitude to warrant a delay in the authorization and construction of these projects. Such a delay would allow time for the Fisheries Research Engineering Program, sponsored by the Corps of Engineers and now in progress, to produce answers to the problems of better fish passage at dams and would also permit time for further determination of the extent of loss of big-game habitat and methods of improving the residual winter range. The results of these studies, if they are available prior to construction, should greatly minimize the ill effects of the project. At the present time, therefore, the Fish and Wildlife Service is opposed to the construction of these high dams in the Clearwater watershed, and particularly to a dam at the Penny Cliffs site.

This initial FWS response contained no quantitative data. Studies necessary to document the importance of the project area to the game resources of Idaho had not been conducted.

Several unsuccessful attempts were made by project supporters to gain Congressional authorization and construction appropriations for the Dworshak project in the early 1950s. The first attempt in 1954 died in committee.

In 1955 and 1956 public opposition blocked funding of planning within the Public Works appropriation bills.

During the 1956 session of the 84th Congress (2nd Session), Senator Henry E. Dworshak of Idaho made a strong attempt to obtain Congressional

authorization by amending the Omnibus Rivers and Harbors Bill to include planning authorization for the project. He noted that engineering as well as studies of fish and wildlife impact could proceed after project authorization, viz (4):

> At the hearing before the Subcommittee on Public Works last week, I testified that about 2 years would be required for the Army Engineers, after the authorization of this project, to complete the studies and the design; and that it would be about 2 years from now before a report could be submitted by the Army engineers on Bruces Eddy project, at which time Congress would have an opportunity to make a determination as to the desirability of constructing that project.
>
> So far as the fish and wildlife values are concerned, I testified also that I desired to cooperate in every way with the great wildlife organizations, even though they reflect the thinking of people in the States several thousand, or at least many hundred, miles distant from Idaho.
>
> *****
>
> I want to stress that it will require 2 years to complete the fish and wildlife study. So, 2 years hence, Congress will have an opportunity to make an evaluation of the various aspects from an engineering standpoint and from a flood control and power standpoint, and make an appraisal of the fish and wildlife benefits involved in the proposed Clearwater project development.

The amendment to include the Dworshak project in the Omnibus Bill met strong opposition from leading conservationists in Congress but was eventually included in the legislation. However, the entire bill was vetoed by President Eisenhower on the basis that many of the development projects contained in the legislation had not been adequately studied.

In this regard, relative to testimony at the 1956 Omnibus Bill hearings, Senator Dworshak introduced a letter from the Department of the Army's

Assistant Chief of Engineers (op.cit.), viz:

> Both of the above dams [Bruces Eddy and Penny Cliffs] and particularly Bruces Eddy, are within the winter range used by the elk herd of the region, although only a very small percentage of that winter range lies within the proposed reservoirs. The portion of the river to be inundated by the reservoirs has very steep sides with little forage for animal life in the bottom of the valleys. Most of the browse is located on benches practically all of which are above the pool elevation. The major winter feeding areas are situated on side draws of the river system upstream from the reservoir areas. A cooperative big-game census by the United States Forest Service and the Idaho Department of Fish and Game during the most critical winter in recent years (1948-49) indicated that about 100 elk were within the 9.5-mile length of the upper reaches of the Bruces Eddy Reservoir area. Construction of the dams should be accompanied by a concerted effort on the part of the responsible agencies to regulate the elk and to improve the supply of available winter feed.

To help resolve the obvious differences of opinion relative to the project's possible impacts on big game, intensive studies were initiated by the Idaho Department of Fish and Game to more comprehensively document the project area's importance to wintering game populations. These investigations covered 16,640 km^2 (6,400 mi^2) and included both the Dworshak and Penny Cliffs sites. The studies covered a three-year period and were concluded on September 30, 1957. The collected information was released in 1958 (5).

As indicated, this investigation focused upon critical winter range, which was defined as the portion of the big game winter range in which the game population would cause a progressive seasonal depletion of the plant cover if confined to this area for a series of winter periods.

Specific areas of investigation included big game aerial census and

ground observations during the winter of 1955-56; mapping of winter range, burned-over and logged areas; and big game movement data. Summer reconnaissance was also made within the proposed pool area to identify and quantify vegetation, with particular emphasis on browse species. Topographic features, particularly those that could affect big game movements, were identified and finally, big game harvest data were obtained from check station records and hunter interviews.

The Clearwater Management Unit was one of three management units included in the Department's big game range study area. The Clearwater Unit covered an area of 7,540 km^2 (2,900 mi^2) and contained the entire North Fork of the Clearwater River drainage, including the Dworshak project site.

Among the findings of this investigation, as reported in the 1958 report, were the following elk population data:

> The approximate annual fall pre-hunting season elk population in the project area [three management units] is estimated between 25 and 38 thousand animals, with an average of 31 thousand. Based on this average, the approximate fall pre-hunting season elk populations in the Clearwater, Lochsa and Selway Management Units are estimated at 10, 8, and 13 thousand animals, respectively. The approximate numbers of mule deer and white-tailed deer in the project area are unknown. The elk wintering population approximates 26 thousand animals.

During the 1955-56 census of the North Fork Clearwater drainage, 5,329 elk were counted. Persons involved with the census estimated that they had counted about 80% of the wintering elk. The entire drainage was divided into nine distinct sections (Figure 2) and separate counts were maintained for these areas to better describe the winter elk distribu-

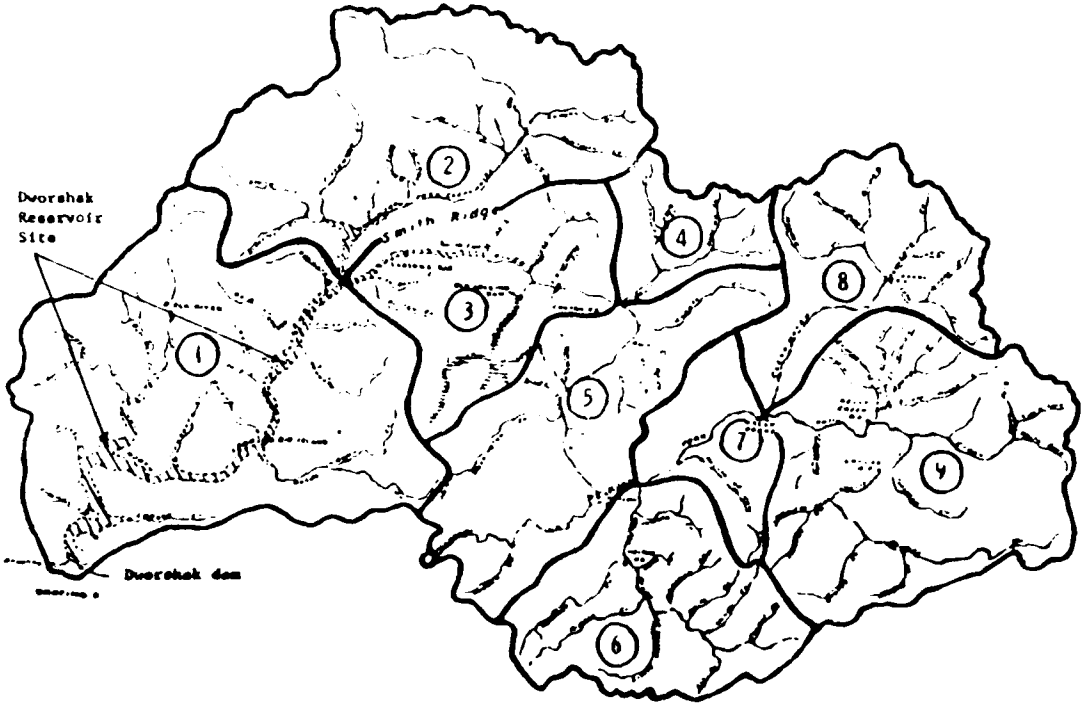


Figure 2. -- Nine study areas selected for 1955-56 elk winter range census conducted by the Idaho Fish and Game Department.

tion (Table 2). These data indicate that 1,491 elk were counted within the three (out of nine) count areas within which the Dworshak Reservoir project ultimately inundated portions of the available winter range.

The adverse impacts and the number of animals subject to direct impact by the project were identified in subsequent passages from the 1958 report, viz:

> The reservoir created by the construction of the proposed Bruces Eddy dam in the lower North Fork of the Clearwater River drainage will cause excessive big game population fluctuations, resulting in average population levels below that which this area would normally support. The degree of fluctuation, as well as the level at which these populations could be maintained, would depend upon the frequency of severe winters, the time and frequency of changes in reservoir levels, and future cultural activities.
>
> The Bruces Eddy dam would be located in a specific area where elk numbers, based on the available information, are increasing and, if constructed, approximately 10.8 percent of the elk, or 720 animals, will be directly affected at the present time. Known minimums of 50 mule deer and 403 white-tailed deer will also be directly affected at the present time. It is believed that these minimum figures, particularly for white-tailed deer, represent only a small proportion of the deer populations in that area. The reservoir will flood land required as emergency winter range for elk, mule deer and white-tailed deer. During emergency periods, portions of these populations will be forced to winter on the remaining portion of the winter range. This range may be further reduced by future cultural activities. Additional animals, which normally winter upstream, may also move into this area, particularly during emergency periods when the remaining winter range would be least able to support them. Big game animals attempting to cross or travel on the ice-covered reservoir may be lost.
>
> Under these conditions the big game populations in this area would have to be managed at a level below that which could be maintained during the intervals between the years causing these fluctuations.

By way of summary, the authors stated - - - "the value of this range

Table 2 . -- Number and percentage distribution of 1955 harvest and 1955-56 wintering utilization for North Fork Clearwater elk population

Area		Number harvested	% of total harvest	Number counted	% of total census
No.*	Geographical identification				
1	Ahsahka to mouth of Little North Fork	40	5.4	329	6.2
2	Little North Fork	72	9.6	575	10.8
3	South Little North Fork to Skull Creek	84	11.3	586	11.0
4	Skull Creek	9	1.2	370	7.0
5	Skull Creek to Weitas Creek	91	12.2	1,035	18.4
6	Weitas Creek	206	27.6	880	16.5
7	Weitas Creek to Kelly Forks Guard Sta.	50	6.7	565	10.6
8	Kelly Forks Guard Sta. to headwaters	75	10.0	285	5.4
9	Kelly Creek	119	16.0	704	13.2
	Totals	746	100.0	5,329	100.0

* For identification on Figure 2

Source: Norberg, Elmer R. and Lester Trout. 1958. Clearwater game and range study, Pittman-Robertson Proj., W-112-R final report, Idaho Fish and Game Department.

(Bruces Eddy) cannot be measured in terms of square miles or even in terms of total amount of available food. Its greatest value is its ability to keep animals alive during short emergency periods. Loss of this range would mean a beginning of excessive big-game population fluctuations."

The 1958 IDFG report concluded with the following recommendations:

1. That, because of the serious and adverse affects the proposed Bruces Eddy and Penny Cliffs dams would have on big game populations in the drainage areas directly affected by these dams and their relationship to big game populations in the surrounding areas, it is recommended that these dams not be built.

2. That, in the event either, or both, of these dams is authorized for construction, the enabling act or license authorizing construction include provisions for mitigating the loss to the big game resources, as follows:

    a. That the construction agencies acquire all private lands for the projects in fee simple title by the least legal sub-division.

    b. That all lands in the dam construction areas, consistent with the primary cause for purchase, be licensed to the State of Idaho, Department of Fish and Game, for administration as being of primary economic importance to wildlife.

    c. The purchase of adjacent key big game winter range lands, by the construction agency or agencies, comparable in amount to those inundated by construction of the dams at maximum pool elevation; the winter range lands to be selected and managed by the State of Idaho, Department of Fish and Game as being of primary economic importance to wildlife.

    d. That funds to finance studies of big game management problems arising as the result of one or both of the reservoirs created by the construction of the proposed Bruces Eddy and Penny Cliffs dams be provided by the construction agency or agencies.

Attempts to obtain Congressional authorization for the project continued during the 1957, 85th Congress, First Session. The conference committee report on the Public Works appropriation bill included a Senate inserted half-million dollars for the Dworshak project. The $500,000 for the unauthorized project had been included in the Senate bill under a suspension-of-the-rules motion by Senator Dworshak. House conferees passed the bill after vigorous pleas by Senator Dworshak and Congressman Hamer H. Budge (ID), both members of the conference committee. However, the House of Representatives overwhelmingly defeated the conference report with the inclusion of Dworshak project funding.

The next year, shortly after release of the state's winter range study, the Corps was authorized by Congress to proceed with detailed studies of the project by Public Law 85-500, 85th Congress, 2nd Session, July 3, 1958. The enabling language was as follows:

> The preparation of detailed plans for the Bruces Eddy Dam and Reservoir on the North Fork of the Clearwater River, Idaho, substantially in accordance with the recommendations of the Chief of Engineers in Senate Document Numbered 51, 84th Congress, is hereby authorized at an estimated cost of $1,200,000.

During this same general period (1955-1958) the FWS, with IDFG assistance, was assembling materials and preparing their report under authority of the Fish and Wildlife Coordination Act. This report, which was published in 1960, relied upon the project design features as described in 1955 in Senate Document 51, 84th Congress, 1st Session. The proposed project included a dam 174 m (570 ft) high forming a lake 79 km (49 mi) long, and covering 4,371 ha (10,800 ac) at summer pool. Including nec-

essary flowage rights, the reservoir was expected to include about 4,662 ha (11,520 ac): 1,004 ha (2,480 ac) in scattered tracts of National Forest lands; 1,595 ha (3,940 ac) of other public lands and 2,064 ha (5,100 ac) of private and state-owned lands (6).

Although updated in 1962 to reflect project design changes (52 percent enlargement of lake surface area), the 1960 FWS report was the prime Federal planning document for fish and wildlife considerations during most of the project plan formulation period. In fact, Congress authorized construction of the project only 65 days after the FWS released the updated 1962 report.

Actually, a preliminary draft of the FWS's 1960 report was completed in May of 1957 but, according to a FWS memorandum dated August 31, 1962 (7), release of the report was delayed by the Office of the Secretary of the Interior until June, 1960.

The 1960 report predicted severe losses of big game and upland game, viz:

> Losses of big game in the North Fork Clearwater Basin with the Bruces Eddy project would vary from moderate to extreme depending upon the severity of the weather and the species most affected. The elk herd would be reduced about 8 percent, the mule deer herd about 17 percent, and the white-tailed deer herd about 58 percent. Inundation of about 10,000 acres of winter range would adversely affect deer and elk. Upland game, notably grouse, would suffer significant losses.
>
> Most winter range in the lower North Fork is already receiving moderate to heavy use by big game. If the remaining range were forced to support the displaced animals from the inundated area in addition to its usual herds, it would soon be badly damaged from over-use. Habitat improvement is the only practical means of compensating for these losses and

preserving both the game and the range.

The projected losses to big game herds over the 50 year period of project analysis are presented in Table 3. To offset these losses, the FWS's 1960 report recommended acquisition of 9,713 ha (24,000 ac) located in three separate areas, viz:

> Development of approximately 4,000 acres between Elk Creek and Cranberry Creek would partially compensate for these losses.
>
> *****
>
> Another important big-game wintering area is located in the vicinity of Big Island and Swamp Creek, between North Fork River miles 26 and 33. Improvement of about 16,000 acres close to the reservoir site would absorb much of the influx of animals from nearby inundated winter range.
>
> A third area which could be improved, the Smith burn area, is located near the upper end of the proposed reservoir site. During the early 1930s, a fire devastated about 10,000 acres of forest land along the south slope of Smith Ridge between the north side of the river and elevation 3,500 feet. Much of the burned area lies within the boundaries of Clearwater National Forest. This large burn area was soon vegetated with shrub species which now provide important winter range for elk and deer. About 4,000 acres adjacent to the national forest boundary could be developed by timber thinning or renovation of over-aged brush stands to improve the carrying capacity of this winter range.

In addition to these land acquisition actions, certain land treatment recommendations were provided in the 1960 report, viz:

> Since it would be difficult for only three development areas to support all the big-game animals which would be displaced, other ways of improving this game range should also be considered. Blocks of 50 or 100 acres of timber could be cleared below elevation 2,500 feet. Such clearings, located within timbered tracts, would be especially attractive to big-game once the openings reverted to brush. Losses to upland game would be partially compensated by such a program.

A summarization of the recommended acquisition program stated, (op.cit):

Table 3. -- Summary of estimated average annual big-game populations and harvests, North Fork Clearwater drainage, with and without Bruces Eddy project

Big-game species	Without the project[1/]		With the project[1/]		Difference		Percent loss	
	Estimated population	Annual harvest	Estimated population	Annual harvest	Population	Harvest	Population	Harvest
Elk	18,000	3,200	16,500	2,900	-1,500	-300	8.3	9.4
Mule deer	3,000	750	2,500	625	- 500	-125	16.7	16.7
White-tailed deer	3,600	900	1,500	375	-2,100	-525	58.3	58.3

1/ 50-year period of analysis

Source: Tunnison, A. V. and D. L. McKernan. 1960. Bruces Eddy Dam and Reservoir, North Fork Clearwater River, Idaho. A report on the fish and wildlife resources. Report of the directors of the Bureau of Sport Fisheries and Wildlife and the Bureau of Commercial Fisheries. U. S. Fish and Wildlife Service, Washington, D. C. June 1960.

> In summary, preservation of the wildlife resource would require an intensive range improvement program. The State of Idaho would be confronted with new problems in managing its game herds. The project plan should include budgetary items for acquisition and improvement of big-game winter range. Annual operation and maintenance costs would be incurred once a wildlife management program was instituted. These costs should be included as part of the annual appropriation for operation and maintenance of Bruces Eddy project.
>
> The foregoing range improvement program would require an estimated $800,000 for land acquisition, and $1,100,000 for initial development. Average annual operation and maintenance charges, including continuing costs of developing these areas, are estimated at $70,000.

In conclusion, the 1960 FWS report recommended against authorization of the project, viz:

> We are opposed to the authorization of the Bruces Eddy project at this time because of the serious impact it would have on fish and wildlife resources. If the project were to be constructed we have no assurance that the runs of anadromous fish could be maintained at even present levels. If, however, the project is authorized, notwithstanding these objections, conservation and development of fish and wildlife resources should be included as an authorized project purpose.
>
> Following authorization, additional fish and wildlife investigations would be made and mitigation measures for preservation of these resources fully developed. Modification of the plan of development to provide for the following recommendations would partially compensate for the anticipated adverse effects the project would have on fish and wildlife resources.

A related report which evaluated the expenditures of big game hunters in 1956 within the Clearwater Basin of Idaho was released by the FWS at about the same time (8). According to this report a total of $2,100,000 were expended by the 12,575 resident hunters and the 3,225 non-resident hunters (Table 4). Unfortunately, these data did not allow analysis by individual drainages within the Clearwater Basin.

Table 4. -- Expenses of big-game hunters and percentage distribution in Clearwater Basin, Idaho, 1956, numbers of hunters in parentheses

Expenditures	Resident hunters (12,575)		Nonresident hunters (3,225)		Total hunters (15,800)	
	Expenses	Percent	Expenses	Percent	Expenses	Percent of total
Transportation	$ 173,500	14.9	$133,100	14.6	$ 306,600	14.8
Food and lodging	204,200	17.6	134,400	14.7	338,600	16.3
Alcoholic beverages	47,900	4.1	23,300	2.6	71,200	3.4
Packers' fees	121,600	10.5	164,000	18.0	285,600	13.8
Horse use	176,700	15.2	37,900	4.2	214,600	10.3
Ammunition	12,200	1.0	3,600	0.4	15,800	0.8
Merchandise	341,700	29.4	168,700	18.5	510,400	24.6
Meat processing	34,900	3.0	20,100	2.2	55,000	2.7
License fees and tags	50,600	4.3	226,400	24.8	277,000	13.3
Totals	$1,163,300	100.0	$911,500	100.0	$2,074,800	100.0

Source: U. S. Department of Interior. 1960. Sportsmen expenditures associated with big-game hunting, Clearwater Basin, Idaho. Fish and Wildlife Service, Portland, Oregon.

One month after release of the June, 1960, FWS report, the CE released Design Memorandum No. 2, type and height of dam. Significantly, this document recommended an increase in the normal pool elevation from 469 m to 488 m (1,540 ft to 1,600 ft). This additional storage increased the surface area of summer pool from 4,371 ha (10,800 ac) to 6,644 ha (16,417 ac).

The CE released their general design memorandum for the Dworshak project on September 15, 1961 (9). At that point the FWS's 1960 report had been available for 15 months and construction of the project had not yet been authorized by Congress.

The mitigation philosophy adopted by the CE for the Dworshak project, as reflected in general design memorandum materials, was embraced in the following quote from the Chief of Engineers, General E. C. Itschner (op.cit.):

> All planning by the Corps of Engineers to date has included fish passage facilities and range replacement as a part of the project. Should the project be authorized and undertaken prior to development of successful means for downstream passage of young fish, alternative hatcheries and artificial spawning areas may be substituted to compensate for the natural run of fish. Similarly, the feeding capability of big game winter range inundated by the project would be replaced by equivalent feeding areas and improved feeding measures. Beyond this, any program to increase production of fish from the gravel beds of the North Fork area which are not used for spawning purposes by the existing natural run, or for expansion of big game winter range, are considered to be development and enhancement purposes which should stand on their own merits (Emphasis added).

The CE's 1961 general design memorandum discussed the big-game situation as follows:

> Wildlife, General. The principal wildlife asset of the Clearwater Basin is big game. In winter these animals migrate to lower benches and valleys where feed is more plentiful and climate less severe. The pool will cover some river valley bottoms of the North Fork and its tributaries but will not cover the bench areas and southerly slopes which contain the most heavily utilized winter range.
>
> It is difficult to evaluate project effects on big game, since basic data and actual survey results are not given in the report prepared by the U. S. Fish and Wildlife Service [refers to 1960 report]. Their report estimates a total of 12,000 elk in the North Fork Drainage. The number of animals that utilize the immediate drainage area of the reservoir has a wide annual variance, depending upon the weather. As a severe winter has not been experienced since studies were initiated, data are not available relative to use of the immediate drainage area during such conditions. In addition to the elk, there are considerable populations of both mule and white-tailed deer that inhabit the reservoir and adjacent area. The white-tailed deer feed at the lower elevations. Census figures indicate that a high percentage of the deer population in the North Fork Basin would be in the immediate drainage area of the reservoir.

The 12,000 figure for the North Fork drainage elk herd relates to the figure reported by the FWS for 1956 conditions. It should be noted that the FWS indicated the herd was increasing and that over the 50-year period of analysis, the North Fork elk herd was expected to average 18,000 head as shown in Table 3.

To compensate for the lost winter range, the CE accepted the FWS's 1960 recommendation to provide 9,712 ha (24,000 ac), as reflected in the following language from the 1961 general design memorandum, viz:

> Land Replacement. The Fish and Wildlife Service has recommended that 24,000 acres be acquired as project lands and made available for wildlife management and habitat improvement. The reservoir will inundate approximately 17,000 acres. The increase in the area recommended by the Service for acquisition over that being inundated by the reservoir is based on the premise that the area to be acquired is now supporting deer and elk close to its present capacity and the forage

> loss experienced on the 17,000 acres to be inundated will have to be replaced by habitat improvement on the acquired land. Considering feasible improvement, 24,000 acres of land now supporting a population of big game will be required. Approximately 12,000 acres of land above the pool level and exclusive of relocation requirements will be acquired for flowage and other project purposes. The project needs are such that these lands can be improved and used as big-game winter range. These lands will be augmented by purchase of an additional 12,000 acres of the most suitable land available, and an allowance of $1,000,000 for the cost thereof has been included in the project cost estimate. A study is now being made by the Idaho Department of Fish and Game to locate land areas and to determine the most suitable species of plants for habitat improvement. The Fish and Wildlife Service estimated $70,000 as an annual operation and maintenance cost for these wildlife areas and this amount has been included in annual costs shown in these report. It is believed that a more economical maintenance program can be developed after the lands are designated and improvement completed.

There was no reference to species other than deer and elk in the CE's design memorandum.

It should be noted that the CE's general design memorandum references the larger 6,880 ha (17,000 ac) lake while using the FWS's 9,713 ha (24,000 ac) mitigation recommendation from the 1960 report, which was based upon the previously planned project with a permanent pool of only 4,391 ha (10,800 ac). According to a General Accounting Office report (10) use of the 1960 FWS report was authorized by the Secretary of Interior.

In response to the altered project design, the FWS prepared an updated report under authority of the Fish and Wildlife Coordination Act. This report was released in August, 1962 (11). As noted before, this updated analysis of project impacts was released some two months before Congress

authorized construction of the project. The 1962 FWS report described the new project design as follows:

> This report supersedes our report of June 1960, which was based on data obtained from Senate Document No. 51, 84th Congress, 1st Session, 1955. The current plan of development, as did the former, proposes construction of a dam at river mile 1.9 on North Fork Clearwater River. However, the new plan proposes a dam with a 61 foot increase in hydraulic height, and a reservoir which would extend 4 miles farther upstream. Based on the current proposal, the dam would be 631 feet in hydraulic height, and at crest elevation, would be 3,170 feet in length. At normal pool elevation, 1,600 feet, the reservoir would extend 53 miles upstream. The project would be operated for flood control, power, recreation, and log transportation. Fish-passage facilities would be provided for passage of both upstream and downstream migrating fish during project construction and during project operation.
>
> Depending on runoff forecasts, the reservoir level would reach maximum drawdown about April 1 each year. Storage evacuation would normally begin in early August and continue to February in a manner that would satisfy power requirements. Additional drawdown would vary depending on forecasted runoff. Between April and mid-June, the water level would be raised to normal pool elevation, 1,600 feet, and would be maintained at that level until the latter part of July. In dry years the reservoir would not be completely filled. Surface area of the reservoir would be 16,970 acres at normal pool and 9,000 acres at minimum pool elevation 1,445. Minimum pool will be reached infrequently.

The 1962 letter report, as distinct from the more comprehensive substantiating report which was attached, did not specifically identify the wildlife resource losses which were anticipated but alluded to substantial reductions in elk and deer populations and significant losses to upland game, viz:

> The wild areas of the Clearwater basin are well suited to meet the increasing public demand for big-game hunting. The Clearwater River elk herd is one of the largest in the United States and includes an estimated 35,000 to 45,000 animals. About one-third of this herd occupies the North Fork drainage. Many of these elk are dependent upon winter range located along the

river bottoms. Several thousand white-tailed deer, and lesser numbers of mule deer, also use these bottomlands during winter months.

Elk in the Bruces Eddy big-game range, which includes the reservoir site and adjacent drainages to their headwaters, would be substantially reduced in numbers if the project were constructed. With the project, the number of deer on this range would undergo a 40 percent reduction. The proposed impoundment would flood about 15,000 acres of elk and deer winter range. The habitat which would be inundated is situated along 69 miles of streams at low elevations which experience the least snowfall in the North Fork watershed. Elimination of this large acreage in the heart of heavily used wintering area would displace many big-game animals and force them onto higher and less desirable range. Before readjustment of big-game populations could occur, heavy use of these areas would cause extensive damage to the vegetation and carrying capacity of the habitat would be seriously reduced. Many years would be required for recovery of vegetation on such overgrazed range. The summary effect of the project on big-game herds in the North Fork Clearwater River drainage would be highly adverse. The project also would add materially to elk and deer management problems.

There would be significant losses of upland game, particularly grouse, with the project.

The substantiating report presented an interesting historical perspective for elk in the North Fork drainage, (op.cit.), i.e.:

There are few records to indicate that elk used the North Fork drainage prior to 1910, but these animals have greatly increased in the drainage since that time. The increase in elk numbers was first noticed in the upper North Fork, and is attributed to the vast brush fields which developed following forest fires that devastated over 40 percent of the area. Two large fires swept through most of the upper North Fork watershed upstream from Skull Creek in 1910 and 1919 and burned about 1,180 square miles of forested lands. Soon after these fires, elk began a rapid build-up in numbers and eventually became numerous throughout the upper basin. In total, approximately 180 square miles (84 percent) of elk winter range was burned prior to 1950 in the upper North Fork Clearwater drainage. In contrast, only about 57 square miles (37 percent) of elk winter range was burned in the lower North Fork within the Bruces Eddy area of influence. Consequently, elk numbers in the lower area did not attain the proportions of herds farther upstream. Only in recent years, mainly be-

> cause of logging operations at lower elevations, have elk numbers in the lower North Fork begun to increase.

In the substantiating report, the FWS pointed out that the North Fork of the Clearwater drainage supported the second largest of the three elk herds wihch constituted the nationally famous Clearwater basin herd. This total basin herd which was estimated at 40,000 animals supported an estimated harvest of 6,650 head and 183,000 man-days of hunting annually between 1956 and 1960.

Over the same period the average deer harvest in the basin was estimated at 5,000 animals in some 37,500 man-days of hunting.

Existing big-game conditions within the North Fork drainage were presented in the FWS's 1962 report in terms of numbers, harvest and man-days of recreational hunting supported, viz:

> In 1956, the elk population of North Fork drainage had reached about 12,000 animals, and it has been increasing since that time. The increase is expected to continue. The average annual harvest of elk in North Fork drainage during the period from 1956 to 1960 was about 2,400 animals. Approximately 64,500 man-days of hunting were expended by hunters annually in harvesting these animals.

According to the same report, the projected big-game associated losses were to result from inundation of 6,070 ha (15,000 ac) of winter range, viz:

> Construction of Bruces Eddy Dam would have a highly adverse effect on big-game populations of the North Fork drainage. The proposed impoundment would destroy about 15,000 acres of elk and deer winter range. This habitat, which is situated along 69 miles of river and major tributaries, has the least snowfall occurring in the North Fork basin. Loss of this key winter range would complicate management problems of the Idaho Department of Fish and Game. In the publication, Clearwater Game and Range Study, released in 1958 by that

> department, Norberg and Trout discussed the expected effects of Bruces Eddy dam and reservoir on big game. It is stated, "The value of this range (Bruces Eddy) cannot be measured in terms of square miles or even in terms of total amount of available food. Its greatest value is its ability to keep animals alive during short emergency periods. Loss of this range would mean the beginning of excessive big-game population fluctuations."
>
> Elimination of this large acreage would, during severe winters, force elk and deer onto adjacent areas that are now being used at or near their carrying capacity. Additional feeding in these concentration areas would result in extensive damage to vegetation. Consequently, with less winter range available and greatly reduced carrying capacity, mortality of big-game animals would be much higher during periodic severe winters. The elk and mule deer herds in Bruces Eddy big-game range would undergo substantial reductions. The white-tailed deer population would be drastically reduced.

The 6,071 ha (15,000 ac) of elk and deer winter range expected to be destroyed by the project were identified by major vegetative cover types in the 1962 report. As the 6,071 ha (15,000 ac) figure was used extensively during subsequent negotiations, primarily relating to replacement of critical winter browse habitat for elk, the FWS's table of cover types is reproduced herein as Table 5.

Other adversities mentioned in the 1962 FWS report were expected to be created by construction of the lake, including blockage of travel routes and drownings:

> In addition to the inundation of winter range, major impediments to big-game utilization of the remaining habitat would arise. In some locations the reservoir would reduce access to range by blocking well-established crossings. Drowning losses in the reservoir would greatly exceed similar losses which now occur in the river.

As indicated in the preceeding paragraph, the North Fork Clearwater drainage elk herd was increasing when the 1962 report was written and

Table 5. Principal cover types within Dworshak (Bruces Eddy) Reservoir site in 1962*

Cover Type	Acreage	Percent
Open coniferous timber	7,300	43
Dense coniferous timber	6,100	36
Brush	1,190	7
Grass	510	3
Agricultural crops	170	1
Sub-total	15,270	90
Water and wasteland (streambed)	1,700	10
Total	16,970	100

*Below normal pool elevation

Source: Quick, Paul T. and Samuel J. Hutchinson. 1962. A detailed report on fish and wildlife resources affected by Bruces Eddy Dam and Reservoir Project, North Fork Clearwater River, Idaho. U. S. Fish and Wildlife Service, Portland, Oregon. August 20, 1962.

the report anticipated continued expansion. Future with and without project projections, as presented in the report, are contained in Table 6.

Impact of the project on other wildlife species was discussed only briefly. Black bear were hunted within the project area and supported an estimated 1,300 man-days of hunting. Although moose, mountain lions, coyotes, lynxes and bobcats were identified as being present along the North Fork Clearwater within the project area, no data were available with regard to numbers or use of these species.

Predicted project impacts on these species were described very briefly by the FWS in their report of 1962, viz:

> It is unlikely that black bear, mountain goats or moose would suffer any reduction in numbers due to the project.

Upland game animals of significance were primarily grouse species. The pre-project conditions for these animals were presented as follows:

> Ruffed grouse are the principal upland game in the North Fork drainage. These birds nest, rear their young and winter throughout the Bruces Eddy reservoir site. The Big Island-Swamp Creek section of the river probably contains the heaviest populations of grouse in the project area. Blue and spruce grouse are also present, principally at higher elevations, although blue grouse usually nest and rear their young at lower elevations near water. Both blue and spruce grouse have been observed in the Big Island area during spring and summer. About 5,000 man-days of grouse hunting occur in North Fork drainage annually. A few quail and Hungarian partridges are present in Bruces Eddy project area.

The 1962 FWS report continued with descriptions of post-impoundment conditions for upland game. Following project construction, conditions for upland game were expected to vary depending upon each species' habitat preference, viz:

Table 6 . -- Estimates of average big-game populations, harvests, and man-days of hunting, North Fork Clearwater Drainage, with and without Dworshak project

Species	Without the project 1/			With the project 1/			Expected losses		
	Estimated population	Harvest	Man-days	Estimated population	Harvest	Man-days	Estimated population	Harvest	Man-days
Elk	18,000	3,250	89,350	15,300	2,750	75,600	2,700	500	13,750
Mule deer	3,500	700	5,250	3,000	600	4,500	500	100	750
White-tailed deer	5,000	1,250	9,350	2,100	525	3,950	2,900	725	5,400

1/ 50-year period of analysis

Source: Quick, Paul T. and Samuel J. Hutchinson. 1962. A detailed report on fish and wildlife resources affected by Bruces Eddy Dam and Reservoir Project. North Fork Clearwater River, Idaho. U. S. Fish and Wildlife Service, Portland, Oregon. August 20, 1962.

> Populations of ruffed grouse in the vicinity of the reservoir would be greatly reduced. Blue grouse would be less affected. There would be little effect on other upland game.

No quantitative values for post-impoundment conditions for these species were supplied by the 1962 report.

Similarly, limited pre-impoundment data and no post-impoundment projections were provided for fur bearer species in the 1962 evaluation. The full discussions for pre- and post-impoundment conditions for fur bearers are presented below, respectively, viz:

> Fur animals along the North Fork include beaver, minks, river otters, raccoons, and weasels. Martens are present in fair numbers at higher elevations. Fur harvest in this area is small due to low fur prices and difficult access during the trapping season. Since 1955, approximately $3,000 worth of furs have been harvested annually in North Fork drainage.

*****

> Fur animals, including beavers, minks, martens, river otters, and weasels would be adversely affected by the impoundment.

Waterfowl were not of major importance in the project area before project construction. The 1962 FWS report contained qualitative descriptions only for waterfowl, viz:

> North Fork Clearwater River is not located on a major waterfowl flyway, and the area contributes relatively little to this wildlife group. Limited waterfowl use occurs along some stream sections, however, and several species of ducks have been seen in the area. Small numbers of American mergansers, mallards, American and Barrow's goldeneyes, canvasbacks, American widgeons, wood ducks, gadwalls, green-winged teals, and Canada geese have all been observed.

Location and proposed operational schedules were expected to minimize any potential value for migratory waterfowl (11), viz:

> Because of its location and proposed operation, Bruces Eddy Reservoir would have limited usefulness to waterfowl. The

> project would not be located on a major flyway, and extensive reservoir fluctuations would prevent establishment of waterfowl food plants. Waterfowl use of the reservoir would be chiefly for resting. Waterfowl, as a group, would be relatively unaffected.

In the discussion section of the 1962 FWS report, winter range acquisition and management were recommended to mitigate for the losses anticipated to occur as a result of project construction. Two areas were identified as possessing the greatest potential, viz: (1) 6,475 ha (16,000 ac) located above both sides of the project in the Big Island-Swamp Creek area, and (2) 4,047 ha (10,000 ac) on Smith Ridge adjacent to the Clearwater National Forest. These tracts totalled 10,522 ha (26,000 ac) and were privately owned in part with the majority held by the State of Idaho. The FWS pointed out that for ease of management, a larger single block approximating 10,522 ha could be acquired and managed at either the Big Island-Swamp Creek or Smith Ridge locations.

In addition, the FWS recommended clearing of 20-40 ha (50-100 ac) tracts along the projedt downstream from the Little North Fork River. These smaller tracts were to be located below 762 m (2,500 ft) elevation. These small clearings, when covered with brushy plants, were expected to offer winter feed for big game, particularly white-tailed deer. This habitat was also expected to receive significant use by grouse.

The cost of such a land acquisition and development program to mitigate wildlife damages at the Dworshak was projected by the FWS at just under $2,200,000, viz:

> In summary, preservation of wildlife resources would require an intensive range improvement program. The State of Idaho

would be confronted with new problems in managing its game herds. The project plan should include budgetary items for acquisition and improvement of big-game winter range.

Annual operation and maintenance costs would be incurred once a wildlife management program is instituted, and these costs should be included as part of the annual appropriation for operation and maintenance of Bruces Eddy project.

The foregoing range improvement program would require an estimated $980,000 for land acquisition and $1,200,000 for initial development. Operation and maintenance costs to be borne by the project are estimated to be $75,000 annually for the first 5 years of project operation and $35,000 annually thereafter.

In contrast to the FWS's 1960 report which opposed construction of the project, the 1962 updated report contained no such stated opposition. This omission was explained in the memorandum (from the Regional Directors of the two FWS Bureaus) which accompanied transmittal of the 1962 report to the Commissioner of the FWS (7), viz:

In our report of June 1960 to Commissioner Suomela we indicated that we were opposed to the authorization of the Bruces Eddy project at that time because of the serious impact it would have on fish and wildlife resources. We pointed out that if the project were to be constructed we had no assurance that the runs of anadromous fish would be maintained even at present levels. We recommended a number of measures for the conservation and development of fish and wildlife resources, to be included in the project plan in the event that the project were authorized, notwithstanding our objections.

As you know, in a letter of March 14, 1962 commenting on the Corps of Engineers' revised 308 report for the Columbia River and Tributaries, Secretary Udall recommended that the Bruces Eddy project be authorized for construction. Secretary Udall also recommended authorization of the Bruces Eddy project in an agreement of the same date with the Secretary of the Army. Consequently, the revised report by our Regional Directors on this project no longer expresses opposition to authorization of the project.

Construction of the dam for flood control and other purposes was autho-

rized in Section 201 of the Flood Control Act of 1962, Public Law 87-874, approved 23 October 1962 (12). As noted previously the date of passage was only 65 days after release of the updated FWS report.

Two million dollars were appropriated for the project in the 1962 Flood Control Act and construction began in April 1963. Clearing of the dam site and reservoir basin began in April 1964.

The conference report for the authorizing law (87-874) specifically spelled out Congressional intent regarding mitigation of fish and wildlife resources (13), viz:

> In taking its action authorizing Bruces Eddy Reservoir, North Fork Clearwater River, Idaho, the conferees were aware of the objections which have been made to this project by numerous groups interested in fish and wildlife conservation. It is the intention of the conferees that the Secretary of the Army shall adopt appropriate measures to insure the preservation and propagation of fish and wildlife affected by this project, and shall allocate to the preservation and propagation of fish and wildlife, as provided in the Act of August 14, 1946, (60 Stat. 1080), an appropriate share of the cost of constructing this project and of operating and maintaining the same (emphasis added).

A small step back in the chronological sequence of events is necessary to review efforts which were continuing to develop rational wildlife mitigation recommendations. On November 1, 1960, the IDFG began collecting additional data to quantify the Dworshak project site's importance to wintering big game populations. Specific objectives of these CE-funded contractual investigations were:

(1) Determine what browse species could be utilized for game food plantings.

(2) Determine the location and areas of land suitable to revegetate with

browse species.

(3) Determine big game winter migration routes, extent and nature of movements in project area, and determining favorite big game wintering areas.

During March of 1963 the IDFG supplied the CE with a completion report covering these wildlife studies (14). This report unveiled the "Heezen Block" concept of acquiring one large contiguous block of land located at the junction of the Little North Fork and the North Fork of the Clearwater River.

A description of the proposed block and a statement of the IDFG's rationale for acquisition of these lands for mitigation were as follows (op.cit.):

> The area is contiguous with lands administered by the U. S. Forest Service. This contiguity would enhance the value of the proposed big game management area. The elk could move from winter to summer range in at least one direction without interfering with private interests and with a minimum of human interference. Major range and migration problems are anticipated to be present here when water is impounded.
>
> State-owned lands account for approximately 34,700 acres and are the predominant land ownerships in the area. Approximately 13,400 acres of land in the area are under private ownership. The remaining lands, approximately 2,700 acres, are under federal ownership. The land included in the area totals approximately 50,800 acres.
>
> The location of the area, at the confluence of the two rivers, provides a maximum number of slopes which could be developed into big game wintering areas by the proper manipulation of the vegetative cover. The north-facing slopes on the area could be used by big game during portions of each winter and continually during less severe winters. By developing higher-elevated areas in conjunction with nearby critical areas, a better distribution of game animals can be achieved.

Figure 3 is a map of the project area showing the location of the "Heezen Block."

Shortly after release of the IDFG report, the CE requested (on August 20, 1963) more detailed information to be supplied jointly by the FWS and the IDFG pursuant to the wildlife lands necessary for mitigation purposes. In response, in March 1964 the FWS recommended acquisition of a detailed list of privately-owned lots identified by location and owner (15). The proposed acquisitions totalled 1,059 ha (2,616 ac). Wildlife management agreements were sought for an additional 3,885 ha (9,600 ac) of private lands. The relevant passage from this 1964 FWS document is as follows:

> Our 1962 Service report recommended that about 26,000 acres be acquired at project cost and made available for wildlife management and habitat improvement to mitigate wildlife losses. We still conclude that this acreage would be necessary for optimum big-game reparation. However, due to (1) the difficulty in locating such a large acreage suitable for big-game winter-range management, (2) the expense involved in acquiring valuable timber stands in areas near the reservoir, and (3) conflicts with management programs of other agencies, the acreage recommended for acquisition has been reduced to about 2,616 acres. In addition, it will be necessary to obtain wildlife management agreements on about 9,600 acres of private land in the vicinity. If satisfactory agreements cannot be negotiated on these tracts, it will be necessary to acquire them in fee title. Consummation of fee acquisition of this minimum land area and negotiation of acceptable management agreements on private tracts will achieve an estimated 50 percent reduction in elk losses. This procedure will also appreciably reduce the modest reductions forcast for mule deer populations and harvest but would have no significant mitigating affect on white-tailed deer or grouse losses. The estimated acquisition cost of approximately 2,616 acres is $[illegible]. These lands should be acquired by condemnation if not available by negotiation.

Locations of the fee acquisition and management agreement lands within

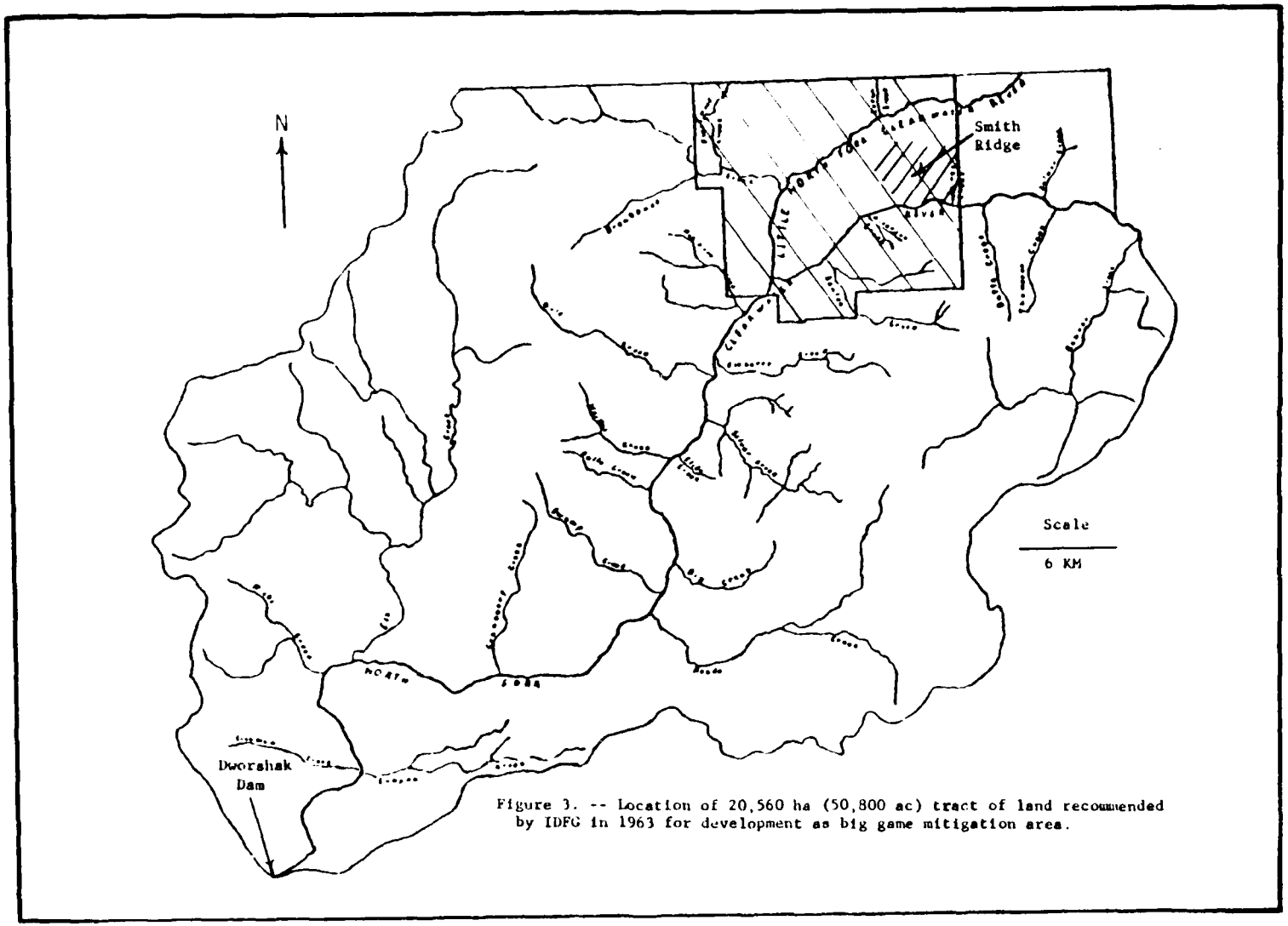


Figure 3. -- Location of 20,560 ha (50,800 ac) tract of land recommended by IDFG in 1963 for development as big game mitigation area.

the total block are shown in Figure 4. Notably, 45 percent was owned by Potlatch Forests, Inc. (PFI).

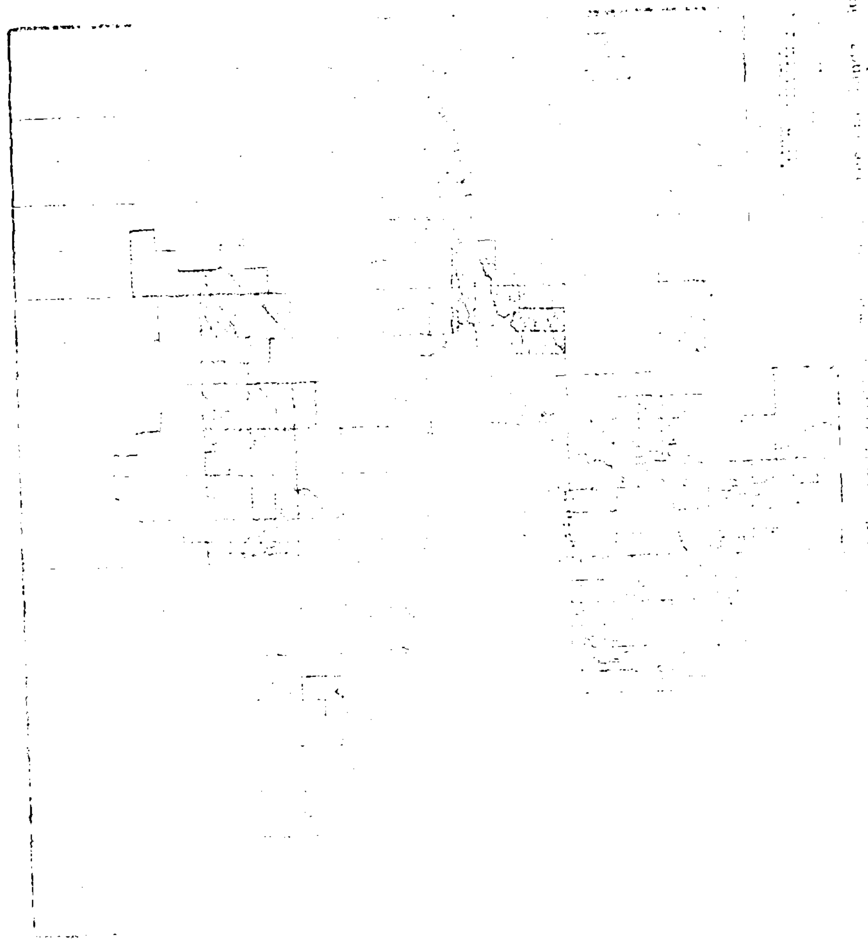
Management objectives for the lands suggested for acquisition in fee were to provide critical winter range for elk and deer, while the lands under management agreements were considered necessary for the provision of intermediate range.

Although not specifically discussed in the letter, the FWS anticipated obtaining management agreement on the remaining 14,043 ha (34,700 ac) of the 20,235 ha (50,000 ac) "Heezen Block." These lands were owned by the State of Idaho.

On May 8, 1964, less than two months after presentation by the FWS of the "Heezen Block" proposal, PFI officials ruled out any wildlife management agreement for the company's 3,885 ha (9,600 ac) area which had been suggested for this management procedure. The Company spokesman preferred fee-acquisition of their lands.

According to the FWS (16), when informed of PFI's rejection of the management agreement, the CE firmly rejected any notion they would be amenable to acquiring the full 4,944 ha (12,216 ac) comprised of the earlier suggested 1,054 ha (2,616 ac) in fee plus the 3,885 ha (9,600 ac) in management agreement. This position seems to have contradicted the CE's stated land acquisition responsibilities contained in their 1961 general design memorandum (9).

The CE in turn stressed that agreements should be obtained from the



State for the remaining State-owned lands within the "Heezen Block." The conservation agencies proceeded to acquire such an agreement with the Idaho Land Board (ILB) under whose control the State lands were operated under Constitutional mandate to maximize financial return via logging, agricultural and grazing leases and other heavy industrial uses. Money generated by the Land Board is used to fund public education in Idaho.

A Memorandum of Understanding between the two Idaho agencies was formally signed on August 12, 1965. The document contained two basic requirements,

> the key requirement being Item No. 1, which indicates that lands described would be managed with "special attention" given to fish and wildlife and especially to meet winter range requirements for big-game animals compatible with management for timber production and other multiple uses. It further specifies that timber cutting methods be planned to provide as much palatable browse and useful cover for big-game animals and upland-game birds as practicable. It calls for the establishment of a technical committee, consisting of a minimum of two persons appointed by the Idaho Fish and Game Department and two persons appointed by the Land Board, which would be responsible for "reviewing management plans" for the State lands.

Upon reviewing the Memorandum of Understanding signed by the IDFG and the ILB, PFI expressed rekindled interest in consumating a similar agreement on their lands located within the "Heezen Block." Direct negotiations for such an agreement was planned between the CE and PFI. However the FWS expressed reservation that certain stipulations between two state agencies incorporated into the previous Memorandum were inappropriate for a similar document involving a private concern. Specifically, the FWS was concerned about the stipulation permitting cancella-

tion of the agreement by either party. It was believed that implicit to the intrastate agreement was some arbitration mechanism that would not prevail between state and a private company. The FWS also desired inclusion of a purchase option for the State, should PFI decide to sell any or all of the lands under agreement.

This entire management agreement concept between government and private concerns became a moot question when the CE questioned their authority to consumate such an agreement. The CE suggested consideration of a perpetual easement document which would permit wildlife management by the State on PFI lands.

On January 31, 1966, a meeting of the FWS, IDFG, and CE representatives was convened to discuss the perpetual easement concept. After lengthy discussion the whole idea of easements, etc., was abandoned and a decision was reached to acquire the necessary lands in fee title. After embracing this "new" approach, the conservation agencies once again agreed to review land requirements to mitigate wildlife losses at the Dworshak project.

After cooperative field studies within the overall "Heezen Block" by the IDFG and the FWS, a new plan of action was prepared. This proposal was incorporated in a FWS letter to the District Engineer dated June 28, 1966 (17).

In summary, the letter recommended the total area be reduced from 20,883 ha (51,600 ac) to 18,616 ha (46,000 ac). Further, instead of buying

1,059 ha (2,616 ac) of private land and negotiating management agreements or acquiring perpetual easements on 3,895 ha (9,624 ac) of additional private lands, that 2,851 ha (7,045 ac) be purchased in fee. No management agreements on private land were requested. The 1,607 ha (3,970 ac) of private lands formerly requested for management that were deleted from this proposal were primarily north-facing slopes. Some parcels of private lands were left within the total "Heezen Block" as well.

Some 800± ha (2,000± ac) of the full 2,851 ha (7,045 ac) were located at the extreme upper end of the Little North Fork Clearwater River arm of the reservoir in an area known as Gobbler's Knob. This higher elevation acreage was sought by the conservation agencies to allow creation of intermediate range to attract and hold elk during early or mild winters, thereby reducing feeding activity on the critical range to periods of truly severe winter conditions.

The CE unilaterally eliminated the Gobbler's Knob tract from further consideration. This decision was not accepted by the conservation agencies as indicated in November 16, 1966 correspondence from the Director of the IDFG to members of the Idaho Congressional delegation (18), viz:

> District Engineer Frank McElwee, in his reply to Regional Director Quick of August 10, 1966, questioned the need for high-elevation habitat development on private land when large areas of State-owned land are available. Although he did not spell this out specifically in his letter, we later learned through telephone conversations with Corps personnel that he had recommended to "higher authority" in the Corps that a tract of some 2,060 acres surrounding Gobbler's Knob in the northern half of our proposed Heezen Block management area <u>not be acquired</u>.

> We believe that the tract which the Corps apparently has eliminated, the Gobbler's Knob area, is essential to our mitigation plan. Actually the area is not higher to a significant degree than other important areas in the southern portion of the Heezen Block and it has favorable slope and exposure which make it of special value in our plan for mitigation. We expect heavy concentrations of elk to congregate at the confluence of the Little North Fork and the North Fork of the Clearwater River during severe winter weather conditions, and we would like to develop areas to the north which would attract these animals from the concentration points as much as possible.

In May of 1967 the CE notified the FWS that they had been authorized to acquire 2,024 ha (5,000 ac) of lands for wildlife mitigation purposes at the juncture of the Little North Fork and North Fork Clearwater Rivers (19). This correspondence also referenced the Gobbler's Knob acquisition denial (op.cit.), viz:

> The need for habitat development at higher elevations for proper management is not questioned, but we believe such needs are beyond and above necessary project mitigation measures. We also believe there are extensive areas in the 34,700 acres of state-owned land already under management agreement that meet all the requirements for high elevation habitat development land.
>
> We have been authorized, subject to agreement thereto by your office, to initiate action to purchase in fee title all private lands in Sections 1, 2, 3, 10, 11, 12, 13, 14, and 15, Township 40N, Range 4E, and Sections 5, 6, 7, and 8, Township 40N, Range 5E. However, if you wish to consider further the land in the Gobbler's Knob area, it will be necessary to submit a supplemental report including additional justification for these lands. This justification should include a detailed explanation of why the desired development cannot be accomplished on land already in state ownership and covered by management agreement, specific data to show that a major portion of the elk which normally winter in the reservoir area do utilize the Gobbler's Knob land, why the lands already provided do not suffice for mitigation measures, and evidence to support the concept that big game could be held in the Gobbler's Knob area later than is now experienced for comparable weather conditions.

[illegible] your position on this
[illegible] jurisdiction on big-game lands
[illegible] extent of [illegible] has been determined.

[illegible] potential legal activities regarding land acqui-

[illegible] addressed in the same 1967 letter, viz:

> [illegible] that condemnation action will be required to [illegible] lands described in the preceding paragraphs, both [illegible] adjacent to project lands and particularly for any [illegible] those in the Gobbler's Knob area. We will expect [illegible] organization to furnish expert witnesses for trials in the Federal Court in those instances where condemnation action is required.

In the meantime, events of a serious nature occurred on the 11,951 ha (29,531 ac) area under management agreement between the ILB and the [illegible]. Coal prospecting leases for bauxite clay extraction were granted [illegible] on 2,024 ha (5,000 ac) of excellent winter range on the [illegible] Mountain Ridge (10). The ILB pointed out that mineral leases were not precluded by the Memorandum of Understanding between the state agencies.

[illegible] 1967 the FWS provided additional justification for acquisition [illegible] Gobbler's Knob area (10). This four-page letter described [illegible] proposed to optimize the habitat management on lands under [illegible] agreement, again described the purpose of the Gobbler's [illegible] developed as a winter browse area, explained that the [illegible] (3,000 ac) tract was not capable of offsetting the loss of [illegible] (16,000 ac) of habitat, and discussed the manner in which elk [illegible] attracted and held in the Gobbler's Knob tract if it were pro-[illegible]

The Walla Walla District indicated by phone that they would indeed initiate land acquisition, including the requested Gobbler's Knob area.

Shortly thereafter, PFI, owners of most of the lands to be acquired for the 2,839 ha (7,045 ac) mitigation area, began an active campaign of opposition to the acquisition plan. On July 24, 1967, Commissioner Pautzke of the FWS met with representatives of PFI, in Washington, D.C. Informative paragraphs from a FWS internal memorandum reporting this meeting (21) are presented below:

> Mr. Cancell [PFI President] expressed his concern over effects on company operations of the plan of the Federal Government to acquire a total of 16,000 acres of company land at the project including the 7,000 acres for elk management. He disclaimed any previous knowledge of the proposed acquisition for elk management until his recent meeting with the Department of Justice.
>
> *****
>
> Mr. Pautzke and I briefly reviewed the past history of the project including the recommendations by the two Regional Directors of the Service that the project not be authorized. We indicated that the Bureau of Sport Fisheries and Wildlife and the Idaho Fish and Game Department had originally recommended that 26,000 acres of private lands be acquired for the purpose. We pointed out that the matter had been studied for a number of years and that the present proposal represented the absolute minimum amount of private land which was needed in combination with 35,000 acres of State forest land and 8,000 acres of other Corps lands at the project to provide effective elk management. We said that proposed cutting and burning operations for elk management porposes on the 7,000 acres would require Federal ownership.
>
> Mr. Cancell requested an opportunity to meet once again with representatives of our Regional Office and the Idaho Fish and Game Department to explore opportunities for managing company lands in such a way as to eliminate the need for Federal land acquisition. We said that the opportunity for an acceptable alternative did not appear promising but that we would not object to an exploratory meeting among representatives of our region, the State Fish and Game Department, and

the Potlatch Lumber Company.

During the latter part of 1967, strong political efforts were made in Idaho to dissuade the IDFG from seeking the desired mitigation lands via acquisition in fee. Governor Samuelson directly urged the Department to accept a management agreement as offered by PFI representatives in lieu of acquisition. The Department resisted but took the agreement, which was already signed by PFI officers, under advisement (16).

After formally indicating full support for the acquisition of the 2,839 ha (7,045 ac) mitigation area by letter dated August 1, 1967, the CE backed away one week later and withdrew the August 1, 1967, letter. Once again, the conservation agencies were asked by the CE to prepare a justification report to clearly demonstrate why the requested lands were essential to wildlife communities and further to provide information showing that the big-game resource was of sufficient value to justify the acquisition package (op.cit.).

Approximately six months later, on February 27, 1968, the FWS released the requested report (22). In the interim, the FWS and IDFG agreed that in view of Governor Samuelson's position they would accept a management agreement to the PFI lands on Gobbler's Knob. A suitable agreement for these lands was signed by IDFG and PFI on October 27, 1967.

Two other notable activities occurred prior to release of the FWS report. Idaho's Senator Jordon strongly opposed acquisition of any lands at the Dworshak project for wildlife purposes and so stated in several letters to CE and Department of Interior officials in Washington, D.C.

PFI officials continued to pressure the IDFG to accept a plan to manage for wildlife purposes on the remaining acreage under management agreements similar to those signed between the two orgainzations for the Gobbler's Knob tract.

As noted, the requested FWS justification report appeared February 27, 1968. The report contained the same project-associated loss projection materials that appeared in the August 1962 report, as summarized in Table 6 of this report.

The total mitigation plan was summarized in the FWS's 1968 report as follows:

> In essence, the wildlife mitigation plan entails the establishment of a 46,000-acre block of land (Heezen Block) which would be developed and managed to provide winter range for elk and mule deer at the upper limits of *Dworshak Reservoir*. About 4,850 acres of private land within this block, or a little over 10 percent of the total area, have been designated for purchase in fee title to permit full control and intensive development by fish and game agencies on this tract. About 3,150 acres of private land will be managed under terms of an agreement with the landowners. Most of the remaining land within the 46,000-acre block is presently under the management of the State Land Department, and a memorandum of understanding has been executed with the State Land Board which gives the Idaho Fish and Game Department certain wildlife management priviliges on this land. Acreages of the various categories of land within the Heezen Block are listed in Table 2. While the wildlife management activities on the State lands and private lands under <u>agreement</u> must be compatible with timber production and other uses, improved wildlife habitat can be attained on these acres in that special attention will be given to the production of browse for big game. However, the greatest effort would be made on the 4,850-acre "hard-core" area <u>acquired</u> specifically for wildlife management. On this acreage, continuous browse production following a rotation plan would be the primary objective.

[<u>NB</u>: The table referenced in the paragraph above was used to prepare

Table 7 herein].

The 1968 FWS report went on to describe the results expected from habitat development under the different types of treatments allowable. The management results with respect to carrying capacity during winter periods of undetermined duration were:

> Studies show that the 46,000-acre area proposed for management now supports about one elk per 30 acres. Lands acquired and intensively developed for big game could be made to support 1 elk per 8 acres. In other words, the carrying capacity of "hard-core" lands could be increased nearly four times. With limited management and development under the wildlife management agreements on the adjacent State and private lands in the block, the carrying capacity of these lands could be incresed to 1 elk per 24 acres.

Likewise, according to the same document, mule deer and grouse were expected to be materially aided by proper management of the acquired "hard-core" lands, viz:

> Mule deer losses would also be mitigated -- a portion by the land acquisition and another portion by the management agreements. The average density of mule deer on the proposed management area under existing conditions is about one deer per 128 acres. On lands acquired and developed, the carrying capacity could be increased to one deer per 40 acres. Lands under agreement would support one deer per 120 acres.
>
> Ruffed grouse habitat could also be improved on the management area, but greatest improvement would be achieved on the lands under agreement. The more intensive development of browse species anticipated on acquired lands would not be as beneficial as the mixed conifer-shrub types which would prevail on the agreement lands. Carrying capacity ranges from 15 acres per bird under existing conditions, to 8 acres per bird on acquired lands, to 5 acres per bird on agreement lands.

No benefits were forseen by the FWS in 1968 for white-tailed deer, i.e.:

> Because of loss of nearly their entire winter habitat, the white-tailed deer will be almost completely extirpated from

Table 7 . -- Land and water areas within proposed wildlife management area (Heezen Block) Dworshak Dam and Reservoir

Description	Area	
	Hectares	Acres
Inside normal project taking line[1]		
Private land (purchased for project)	1,496.51	3,697.82
Public land:		
State 2,650.85		
Federal 612.35	1,320.61	3,263.20
Subtotal	2,817.12	6,961.02
Outside normal project taking line		
Private land (proposed for acquisition)	1,962.46	4,849.16
Private land (under management agreement)	1,277.44	3,156.50
Federal land (Forest Service and BLM)	579.17	1,431.12
State land (under management agreement)	11,951.39	29,531.49
Subtotal	15,770.46	38,968.27
Total	18,587.58	45,929.29

[1] Of the 2,817.12 ha (6,961.02 ac), 978.60 (2,418.08 ac) will be inundated, and of the remaining 1,839 ha (4,543 ac) within the project taking line, 84 ha (207 ac) will be reserved for log loading sites and other administrative purposes. This leaves 1,754 ha (4,335 ac) available for recreational use and wildlife management

Source: Baetkey, Henry. 1968. Statement in support of land acquisition recommended to mitigate project-associated wildlife losses at Dworshak Dam and Reservoir, North Fork Clearwater River, Idaho. Portland Regional Office, Portland, Oregon. February 27, 1968.

the project area.

The average annual effects of the mitigation plan over conditions without the plan were presented in tabular form. This table, slightly modified, is presented herein as Table 8.

The result of the FWS's February 27, 1968, report was again to request acquisition in fee of the 1,963 ha (4,850 ac) "hard-core" tract located at the junctions of the Little North Fork and North Fork of the Clearwater River. Some 1,650 ha (4,077 ac) of the area was held by PFI.

In April 1968 the IDFG notified PFI that they would not agree to management of the "hard-core" lands under a management agreement (16).

In response to an inquiry from the Walla Walla District, Governor Samuelson indicated continuing opposition to acquisition of any more land at the Dworshak project (23), viz:

> The purpose of this correspondence is to comment on the justification report of the State and Federal Wildlife authorities for acquisition of an additional 5,000 acres of private land for replacement of elk browse being inundated in the upper reaches of Dworshak Reservoir. The State of Idaho is, of course, very concerned over land policies and the proposition for acquisition of the additional lands. I have conferred with the Idaho State Land Board on this matter and am prepared to reflect their views, as well as my own as Governor and President of the Land Board.
>
> While no State lands are involved in the 5,000 acre proposed acquisition, the State Land Board is interested in over-all land policy matters affecting the economy of our State and is concerned with all aspects of public land use. It is from this point of view that the Land Board and I indicate our position that the proposed acquisition of 5,000 additional acres of land for replacement of elk browse is unjustified.
>
> The Board members strongly support the multiple use concept of land management. The lands in question would be dedica-

Table 8. -- Effects of mitigation plan on game species in the proposed Heezen Block Management Area

Species	Annual net gains[1]		
	On lands acquired[2]	On lands under management[3]	Total
Elk			
Population increment	576	309	885
Harvest	144	78	222
Hunter-days	7,200	3,900	11,100
Mule deer			
Population increment	108	20	128
Harvest	27	5	32
Hunter-days	486	90	576
Ruffed grouse			
Population increment	366	4,937	5,303
Harvest	37	494	531
Hunter-days	74	988	1,062

[1] These figures indicate the increase in game populations and related harvest and use over what would prevail there without the mitigation plan

[2] A total of 2,542 ha (6,280 ac) would be available. This includes 1,963 ha (4,850 ac) of private land purchased for this purpose and 579 ha (1,431 ac) of Federal lands

[3] A total of 14,983 ha (37,023 ac) would be available. This includes 1,278 ha (3,157 ac) of private land, 11,951 ha (29,531 ac) of State land, and 1,754 ha (4,335 ac) of project land

Source: Baetkey, Henry. 1968. Statement in support of land acquisition recommended to mitigate project-associated wildlife losses at Dworshak Dam and Reservoir, North Fork Clearwater River, Idaho. Portland Regional Office, Portland, Oregon. February 27, 1968.

> ted to single use management. The private owner involved has indicated his willingness to enter into a cooperative agreement with the Fish and Game Department providing that this Department shall be responsible for game management in the lands in question. A program of this type is the best solution to the problem involved.

A month later (August 15, 1968) the Commissioners of the [illegible] reiterated their position in favor of acquisition of the "hard-core" lands (16). The FWS expressed continuing support for the acquisition plan on August 29, 1968. (24).

The FWS's letter expressing support for acquisition of the "hard-core" land contained strong language from the frustrated FWS representative (op.cit.), viz:

> The authorizing document for the project (PL 89-874) included the Chief of Engineers' position established in his March 31, 1961, letter to the Secretary of the Army that all planning for the project include provisions for range replacement as a project feature and that the feeding capability of big game winter range inundated by the project would be replaced by equivalent feeding areas and improved feeding measures. Assurances were made in your agency's General Design Memorandum of September 15, 1961, for Bruces Eddy dam and reservoir project that suitable land would be purchased to compensate for the loss of wildlife habitat. Project General Design Memorandum No. 3 included allowance of $1 million for land acquisition and $70,000 annually for operation and maintenance costs to mitigate project caused losses to wildlife resources.
>
> We believe it unfortunate that you have not seen fit to take decisive action on this matter. The wildlife agencies have been pressured into making one concession after another, and the wildlife aspects have been literally haggled to death in a continuous period of negotiations since 1963. It is unfortunate that solution to this matter seems to have departed from the realm of well-based technical justification.

Opposition to acquisition of the 2,024 ha (5,000 ac) "hard-core" continued on the part of the owners and elected state officials. This prompted consideration by the CE of a land transfer instead of a simple fee

title acquisition. The proposal was to transfer the required private lands for lands owned by the Bureau of Land Management (BLM). This concept first surfaced in a letter from the District Engineer dated August 1969 (25), viz:

> I have received the Resolution of 20 August 1969 by the Idaho State Board of Land Commissioners, signed by Jack M. Murphy, Acting Governor and Acting President, addressed to the Corps of Engineers among others.
>
> The Resolution opposes acquisition of additional private land for a big game management area at the mouth of the Little North Fork Clearwater River to mitigate damage to wildlife habitat which will be caused by impoundment of Dworshak Reservoir. The Resolution suggests that acquisition be through exchange for other Federal land in Clearwater County to preserve the tax base.
>
> The Board's suggestion follows a similar one by the Idaho Congressional Delegation. I have been working with the State Director, Bureau of Land Management, at Boise on the possibility of a land exchange. He advises that his report on the matter probably will be submitted in early September to his central office in Washington, D.C. I do not know what his conclusions or recommendations will be about a land exchange.

Several documents of note appeared in 1970. The earliest was a letter dated 19 March 1970 in which District Engineer Giesen informed a private citizen that the only acquisition which the conservation agencies deemed necessary to provide browse would be the 2,024 ha (5,000 ac) "hard-core" area (26), viz:

> The U. S. Fish and Wildlife representatives stated at the 10 March 1970 meeting that acquisition of elk browse land beyond the 5,000-acre "hard core" area would not be requested and that the provision of the 5,000-acre "hard core" area constituted mitigation for browse areas lost due to the reservoir construction. John Woodworth, Director of Idaho Fish and Game, agreed that this was all the acquisition which would be requested. They also stated that any other browse requirements would be through cooperative management

agreements with landowners.

Colonel Giesen went on to describe the CE's general attitude toward big-game mitigation (op.cit.), viz:

> It was the consensus of all present that environmental changes in the Clearwater basin, principally related to successful fire suppression and maturity of timber stands, has resulted in a reduced elk population. This cannot be traced to the Dworshak project since it has not yet affected the carrying capacity of the region and will not be a factor until the pool begins to fill in the winter of 1971. The improvement of habitat for elk in the Clearwater drainage must consist principally of improved productivity of lands not under control of the Corps of Engineers. The "hard core" area and adjacent reservoir lands become important on a very infrequent (perhaps 1-in-10-year) basis. We plan to manage lands adjacent to the reservoir in the vicinity of the "hard core" lands compatible with big game management objectives. Our land use plan now being printed will so state and when approved will be the basis for continued management for the future of those lands under control of Corps of Engineers.

The CE's Public Use Plan for the Dworshak project was released in April 1970 (12).

The FWS prepared a big-game management plan for incorporation into the Public Use Plan. This document contained a development schedule for the 2,024 ha (5,000 ac) "hard-core" lands consisting of a development phase and a maintenance phase (27), viz:

> In general, the program can be divided into two phases: the initial 5-year phase in which the major changes would be made in the vegetative types of the area, and then the second phase consisting of the year-to-year maintenance of the area in the most productive habitat for wildlife. It is quite likely that most of the initial development work can be accomplished within the first 5 years, provided contractors are available to do the work. Therefore, in this letter we shall concentrate on what we call the "5-year plan." The major activities of the 5-year plan would be (1) survey and inventory, (2) clearing and road development, (3) establishment of burn areas, (4) the establishment of a headquarters, and (5) miscellaneous wildlife development work.

In addition to the "hard-core" lands, the CE's Public [illegible] wildlife management opportunities of lesser intensity [illegible] types of project lands (12), viz:

> While all development and management work accomplished specifically for the benefit of fish and wildlife will be undertaken by State and Federal fish and wildlife agencies rather than by the Corps of Engineers, some discussion is appropriate here delineating the extent and nature of such development activities which can be accepted on project lands. Four different degrees or levels of project control are contemplated. They are: (1) hard-core area [2,084 ha (5,150 ac)] - essentially complete freedom of development and management for benefit of wildlife; (2) fish and wildlife project lands [1,221 ha (3,017 ac)] - freedom of development for fish and wildlife, except to avoid interference with project operation; (3) general access lands [4,325 ha (10,687 ac)] - available for utilization by wildlife with Corps' development and management activities designed with consideration of wildlife values; and (4) public recreation areas [initially 1,429 ha (3,532 ac); future 2,754 ha (6,806 ac)] - complete control for benefit of public recreation use, but with development and management activities designed to recognize and permit incidental wildlife use when not detrimental to project recreation values.

The FWS computed slightly different acreages and wildlife benefits from the anticipated management opportunities afforded by project and agreement lands than those presented in their February 27, 1968, report (28). These data are presented in Table 9.

It should be noted that the FWS anticipated wildlife management on 8,509 ha (21,025 ac) of general access plus public recreation lands compared to the CE's Public Use Plan's figure of 7,079 ha (17,493 ac). The FWS estimated, however, that only 809 ha (2,000 ac) of these higher intensity use lands would be available for "effective" management.

In May, Idaho's Senators Church and Jordan sought help from Interior

Table 9 . -- Expected results with wildlife habitat development plan in effect at the Dworshak project, as presented by FWS in 1970

Species	Net increase in game carrying capacity			
	Hard-core lands[1]	Project lands[2]	Agreement lands[3]	Total
Elk	459	183	273	915
Deer	86	34	17	137
Grouse	312	117	4,360	4,789

[1] Includes 3,305 ha (8,167 ac) of which about 2,024 ha (5,000 ac) are effective area

[2] Includes 8,509 ha (21,025 ac) of which about 809 ha (2,000 ac) are effective area

[3] Includes about 13,234 ha (32,700 ac) available for limited development subject to owners' approval

Source: Giesen, Robert J. 1970. Letter from District Engineer, Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington to Morton R. Brigham, Lewiston, Idaho. March 19, 1970.

Secretary Hickel to expedite the land transfer arrangement for the "hard-core", (29), viz:

> Because of the opposition to further fee acquisition of land in Clearwater County, we have held numerous discussions with affected agencies and with private owners -- primarily Potlatch Forests, Inc. -- in hopes of working out a compromise which will meet the wildlife needs of the area, while at the same time preserving, insofar as possible, the tax base of the area. As a result of those discussions, it is apparent that the most logical solution is an exchange of lands in the county between the Bureau of Land Management -- which controls sufficient acreage in isolated tracts -- and the present owners. This solution, we have found, is acceptable to the Army Corps of Engineers, which has agreed to pay the costs associated with a transfer; the Bureau of Sport Fisheries and Wildlife; the Idaho Fish and Game Department; The Bureau of Land Management; and Potlatch Forests (which owns most of the land).
>
> The problem, therefore, is one of speed in completing the transfer. At present, the filling of the Dworshak pool is slated to begin in 1971 and to be completed in 1972. If land is to be provided, and an adequate wildlife management plan implemented, the exchange will have to be expedited.
>
> We therefore urge you to do all within your power to see that this land exchange, which all affected parties agree is an adequate solution to a very pressing problem, is completed in the shortest possible time.

Secretary Hickle responded that the Department would pursue the matter as rapidly as possible (30).

In early 1971, an eleven year old land acquisition request resurfaced within the IDFG and FWS. This "new" proposal was to acquire additional lands on the south slopes of Smith Ridge to complement the "hard-core" block. This decision was based upon the singular lack of wildlife management success on the Heezen Block agreement lands. Management of the ILB lands, which had been under management agreement between the ILB and the IDFG since August 1965, had not progressed satisfactorily in

the view of the conservation agencies. This situation was clearly described by state game biologists in an internal IDFG memorandum dated April 14, 1971, (31), in part as follows:

> Since 1965 we have been under a cooperative management agreement with the State Land Board. This agreement was proffered in lieu of outright purchase by the Army Corps of Engineers as part of the mitigation for elk winter ranges that will be inundated. If we had fully understood the ramifications of the legal entanglements embodied in the endowment fund we might never have accepted this agreement. Basically, endowment fund lands cannot be managed under any other manner than that of returning the maximum dollars to the fund.
>
> We have been meeting since 1965 with members of the State Department of Public Lands on a Technical Committee to review and recommend management plans. In 1970 the State Land Board allowed us to burn approximately 400 acres in conjunction with adjacent Corp's take-line lands. The Corps provided funds for the burning program. Burning of state lands was allowed and only in areas where conifer stocking was inadequate for timber management. [This burn was located on Smith Ridge].
>
> In our deliberations with the State Department of Public Lands personnel this year, it was made clear that those burns could not continue without some rental or lease fee, especially in the case where tree stocking occurs.

This memorandum was forwarded to the FWS who, in turn, sought a conference with CE personnel to discuss the situation.

IDFG game biologists considered the Smith Ridge lands to be of greater value for elk mitigation than the "hard-core" block. The reasons were listed as follows (32):

1. The present "hard core" block is not a block at all, but rather three separate blocks--North, South, and West. Since the elk could not freely move from one unit to the other, each block would have to be managed as a separate entity.

2. The West and South blocks are further subdivided. The all-weather road through the West block at or above 2,000

ft, from Grandad Bridge north to Breakfast Creek, will effectively eliminate all the area between it and the pool. If snow gets deep enough to force animals below the road, they'll be as good as dead. The all-weather road bisects the South block on its way from Grandad Bridge out to Headquarters. Add to this the present Long Creek road; a proposed road connecting Grandad Bridge to Robinson Creek road; a proposed road from Grandad along the pool to Butte Creek; a road from Grandad south to connect to the Silver Creek road; numerous logging roads already present--the area is going to be completely dissected with roads which are located at the most critical spots as far as the elk are concerned. Studies in neighboring states have shown that when roads come in, elk move out.

3. The Grandad Recreation Area eliminates over a mile of the lowest elevation land in the South block. There is also the possibility of log handling facilities at the mouth of Robinson Creek and Benton Creek.

4. The South block is generally a north aspect. During tough winters the snow is too deep for the elk here, and they move elsewhere.

5. Very few elk winter in the South and West blocks, even though much of the area has already been logged. On five Corps helicopter flights to count elk throughout the winter of 1968-69, the maximum number of elk counted in the West and South blocks was <u>zero</u>.

6. There is no natural boundary around the area. A wide fire break would have to be maintained in order to prevent fire from spreading to adjoining lands.

7. The West and South blocks do not figure prominently in elk movement patterns in the upper pool area. Established migration routes bring most of the elk down in elevation and down the drainage toward Smith Ridge. With more and more roads being built along major drainages further up the North Fork, it is becoming easier and easier for a major downriver flood of elk to occur if we ever get an exceptionally bad winter. The endpoint will be Smith Ridge. Further movement to the West or South blocks will be blocked by the arms of the pool.

On the other hand, the Smith Ridge lands, if combined with the Hughes Point or east side of the "hard-core" block, was considered a highly desirable unit for elk mitigation. The advantages of such a plan were

enumerated by the game biologists (op.cit.), viz:

1. It's one solid block. This, together with the Hughes Point area and the adjacent Forest Service land, could be managed as a single, continuous unit.

2. The whole area could be kept roadless, a sanctuary for the elk.

3. The aspect is generally south; snow depth is minimal.

4. A resident herd is already established here and will remain as long as human activity is kept out of the area. It is already a major wintering area for animals spending the summer elsewhere (see map). The Smith Ridge area, if developed, could prevent a mass dieoff if there is a large-scale intrusion of elk from upriver.

5. The rock cliffs near the 3000 ft level are a natural fire barrier; burning could be conducted safely either in spring or fall.

The map referred to in item 4 is duplicated herein as Figure 5.

The formal request submitted by IDFG in October to manage 1,619 ha (4,000 ac) on Smith Ridge for elk rather than timber production was rejected by the BLB in December of 1971 (33), viz:

> The State Board of Land Commissioners met on December 14, 1971 and considered your letter of request dated October 20, 1971, to manage approximately 4,000 acres in the Smith Ridge area for browse production rather than for timber production. The Board denied this request, as the removal of these lands from timber production would reduce the allowable cut of endowment lands with a consequent loss of income amounting to $18,000 per year.

Just prior to this exchange, on September 27, 1971, the dam was closed impounding the North Fork Clearwater to form Dworshak Lake.

As the reservoir filled and an ice cover formed, white-tailed deer mortality began to occur around and on the rising ice surface. During [illegible] 1971, an minimum of 110 deer fell through the ice and

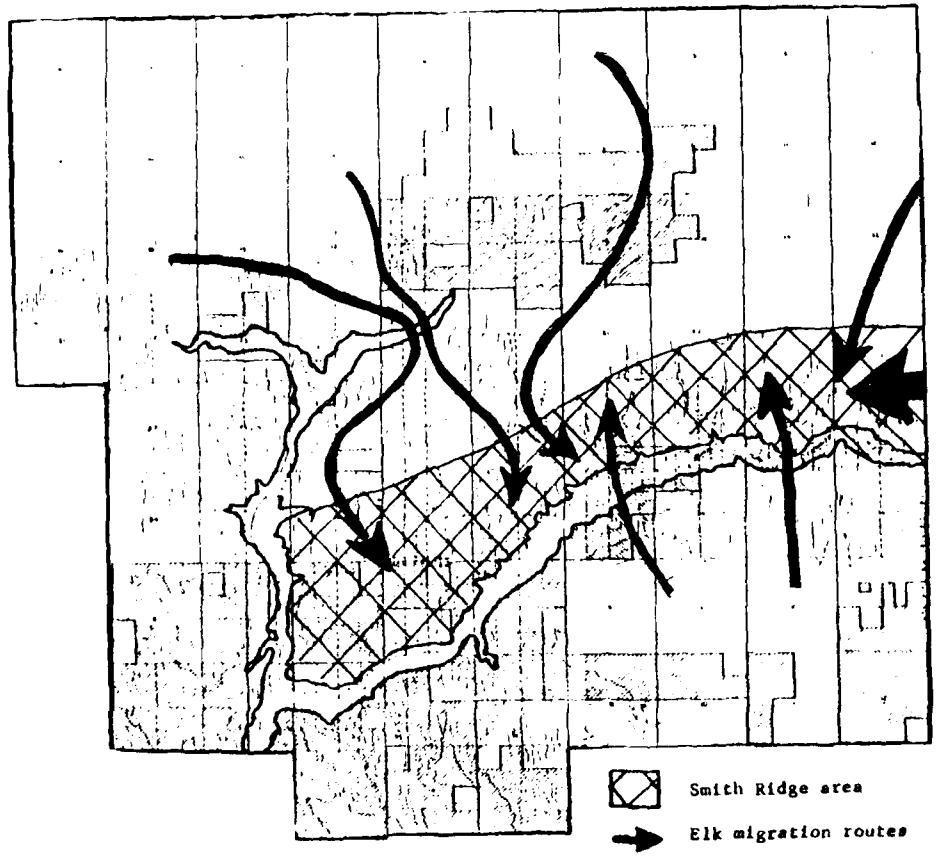


Figure 5. -- Assumed elk migration routes to Smith Ridge wintering area.

drowned. Additionally, 95 were eaten by coyotes (34). Many of the deer were attracted by the foliage of the felled trees which had floated and then been frozen into the lake surface.

The deer mortalities emphasized in a highly visual manner a serious and not unsuspected problem associated with inundation of the North Fork Clearwater River. The winter events of 1971-1972 precipitated a flurry of activity and a vigorous and sustained exchange of correspondence among concerned agencies.

In a letter to the CE dated February 1, 1972, the FWS explained the recently initiated effort to acquire part of Smith Ridge for mitigation purposes in addition to the "hard-core" lands (35).

The District Engineer's responses addressed the questions of CE funding of operations and maintenance (O and M) of mitigation features and sought additional enlightenment with regard to the recently requested assistance in obtaining portions of Smith Ridge for mitigation (36), viz:

> While we understand your rationale on O & M, we do not concur that it is a project responsibility. Our position continues to be that responsibility of the project for wildlife mitigation is limited to acquisition of replacement habitat land and its initial development for wildlife use. Other project caused activities such as archeological research, fish hatchery operation, and [illegible] safety are funded by the agency concerned. We fund for other agencies only when their services are needed to solve some problem in our construction of a dam and reservoir.
>
> Your proposal would be an exception to the procedure of each Federal agency or department formulating its budget programs for coordination by the Office of Management and Budget and then, as requested providing justification and supporting

testimony for the Congressional Appropriations Committees. Nevertheless, we shall submit your views on funding for operation and maintenance for consideration of the Chief of Engineers.

Your statement on the problem of managing the 4,000 acres of State land on the south slope of Smith Ridge for wildlife is noted. The original decision in the mid 60's was to acquire nearly all the remaining, low lying, privately owned land in the Heezen Block along the reservoir. This is the 5,100 acre "hard-core" area. That decision considered that there would be joint use of the Heezen Block as agreed to in the Memorandum of Understanding, dated August 1965 between the Fish and Game Department and the State Board of Land Commissioners.

Now, as I understand it, the State Fish and Game Department has proposed exclusive wildlife use of 4,000 acres on the south slope of Smith Ridge. My examiniation of the Memorandum of Understanding does not reveal that this was ever the intention when the document was executed in 1965. Not being privy to the results of the cooperative planning provided for in the Memorandum of Understanding, I cannot assess what went wrong. All I can determine is that the State Land Board has refused to consider the latest proposal of the Fish and Game Department for exclusive wildlife management without payment of foregone timber revenue.

Until details are submitted to me on this controversy, I am unable to make an objective analysis of whether this is strictly a squabble between State agencies or, in fact, there is a project responsibility. Your letter of 1 February 1972 makes it clear that you believe the Federal Government has an obligation to arrange for exclusive wildlife use of 4,000 acres. I am willing to listen to your detailed justification. Considering the problem we had in obtaining authority to acquire the "hard-core" mitigation area, I think you will appreciate the necessity for presentation of comprehensive details. This would include, but not be limited to, information on big game population, habitat conditions, and how they relate to the present mitigation and enhancement. There should be correlation with the figures and information which supported the acquisition of the "hard-core" area. It would be helpful if your presentation will show the relationship between the two areas as to development and usage.

When your detailed report is received on what you think went wrong on the Memorandum of Understanding and the justification for arranging for exclusive use of 4,000 acres of State-owned land, I shall be glad to meet with you personally to review the results and discuss future action.

Both of Idaho's Senators expressed continuing interest in resolving the wildlife mitigation problems at Dworshak. The Commission members of the IDFG convened a meeting in Twin Falls in June 1972 to discuss the situation with Senator Church. CE and FWS representatives also attended this meeting. As summarized by FWS staff (37), the meeting stressed six select points of discussion, viz:

1. The purpose of this meeting was to discuss and stress the need for obtaining the 4000+-acre Smith Ridge area for wildlife mitigation use.

2. The previous commitments by the State Land Board agreeing that the State lands in the Smith Ridge area could be used for wildlife habitat manipulation purposes were null and void, inasmuch as the lands involved are "endowment" lands and must be managed so as to insure the greatest possible return to the endowment fund involved. Thus the Memorandum of Understanding between Fish & Game and the State Land Board was defined as a "shotgun marriage that didn't and, legally, couldn't work."

3. Further, the 5,150 acre "hard core" area was simply that area left over after the shotgun marriage between the two State agencies and the one between the Idaho Fish and Game Dept. and the Potlatch Forests, Inc., had been consummated.

4. The point was also made that the hard-core area and the situation as it presently exists came about chiefly due to the views of the previous State administration.

5. The Corps of Engineers' position was that they could not commit themselves to additional expenditures of money for obtaining more land, that is, in addition to the 5,150 acre hard-core area, without being supplied more specific data regarding exactly what they were mitigating for.

6. Senator Church stated that he would be willing to consider the problem further if we could make a case justifying the need for the additional 4,000 acres on Smith Ridge, and with that statement, indicated the meeting was adjourned.

The request for additional information by both the CE and Senator Church

prompted preparation of an updated impact projection for elk damages associated with the project. This statement was forwarded to the CE in August, 1972 (38). This document compared previously anticipated benefits on the three types of mitigation-related lands, i.e., CE-project lands, "hard-core" lands, and agreement lands, with new projections which actually indicated loss of elk on the agreement lands. The earlier FWS projections for elk impacts (presented as part of Table 9 of this report) and the "new" projections (presented by the FWS for elk only) are presented in Table 10. The FWS projected that with acquisition and intensive development of the 1,821 ha (4,500 ac) area on Smith Ridge the net increase in elk carrying capacity for the Smith Ridge lands would approximate 270 elk. This figure agreed very closely with the estimated 273 elk previously considered as the increased carrying capacity potential of the agreement lands. In summary, the FWS noted that adequate mitigation could be realized by implementation of the recommendation (op. cit.), viz:

> It is our judgement that full control of 4,500 acres on Smith Ridge are required, in addition to the 3,217 acres within the project takeline, plus the 5,120 acres of hard core land under intensive management, to adequately compensate for big-game losses caused by construction and operation of Dworshak Dam and Reservoir.

The statement above, which related development of the three tracts of land with adequate compensation for all "big-game losses" associated with the construction of the Dworshak project was disavowed by the FWS within a year's time.

The CE accepted the FWS's justification and sought the opinion of the

Table 10. -- Predicted increases in elk numbers associated with wildlife habitat development at Dworshak project

Predictive data	Net increase in elk carrying capacity				
	"Hard-core" lands	Project lands	Agreement lands	Smith Ridge lands	Total
1970	459	183	273	--	915
1972	459	183	none*	270	912

*Actually a decrease in carrying capacity of 156 elk was considered likely due to normal timbering practices.

ILB regarding withdrawal of the Smith Ridge lands from timber production for big-game mitigation purposes. The ILB's response was that the only acceptable course of action would be a land exchange for the Smith Ridge lands which would prevent any further reduction in the limited State and private land base in Idaho (39).

The District Engineer immediately contacted the State Director of the BLM regarding the possibility of anotner land transfer request involving that agency (40).

On another matter, the District Engineer informed the FWS in December of 1972 that the CE, at the Washington, D.C. level, had rejected consideration of funding of operation and maintenance costs for the wildlife mitigation features (41), viz:

> I have recently been informed by our Washington office that it is their position that the Corps of Engineers should not have funding responsibility for operating and maintenance costs incurred by a wildlife agency in maintaining and managing lands acquired to mitigate wildlife losses. They would favorably consider an agreement with the Department of the Interior similar to the one being developed for Dworshak Hatchery whereby the wildlife lands would be transferred to your Department for conduct of and funding for wildlife activities. Under such an agreement, the Department would provide the Walla Walla District with a statement of costs for inclusion in the overall cost of project operations for accounting purposes.
>
> If neither the Department of the Interior nor the State of Idaho is willing to accept responsibility for these lands, it is the opinion of our higher authority that the lands should remain under Corps of Engineers jurisdiction and be managed by the Corps in the same manner as other unlicensed project lands having wildlife values. Our wildlife management would consider continuing technical guidance from a State-Federal wildlife advisory group.

As part of their internal deliberations regarding justification of the

proposed Smith Ridge acquisition request, CE staff prepared an analysis report (42). This report contained the first formal effort to correlate habitat carrying capacity and elk populations. Previous mitigation justification statements had depended upon aerial counts of elk made during the winter months. The computational sections of this report are presented in their entirety below (op.cit.), viz:

> Computation of Requirements.
>
> a. Mitigation. - BSF&W Latter of 25 August 1972
> BSF [Bureau of Sport Fisheries and Wildlife] has determined that project elk mitigation is 915 animals. The wildlife agencies have estimated that it takes around 30 acres to support one elk on unmanaged land; 16 to 20 acres per elk on agreement lands which can be partially managed; and 10 to 12 acres per elk on fully managed lands like the "hard-core" area and the herein contemplated 4,500 acres of Smith Ridge.
>
> The "hard-core" 5,120 acres cannot be developed to necessary standards for two reasons; 2,100 acres are steep north facing slopes and the new Grandad Bridge crossing of the reservoir creates a highway hub in the center of the area.
>
> b. Forage Requirements.
> Elk require some 3 pounds of air dry usable forage per day per 100 pounds of animal for survival. Average weight of elk in the project area is 430 pounds, therefore, on the average elk require 12.9 pounds of forage per day to survive in winter. A quality adjustment factor must be applied to account for protein content of forage, elevation of forage and the distance to shelter. In this case, the factor is 0.49 which results in a forage requirement of 26.3 pounds per day per animal. For the estimated 90-day winter period the animal unit requirement is 2,367 pounds of forage. Another factor must now be introduced, that of 50 percent as the proper maximum use of available forage. So, the seasonal requirement of 2,367 pounds must be increased to 4,734 pounds per animal per season.
>
> c. Forest Acreage.
> The largest variables to computing acreage requirements are the amount and quality of the forage production per acre of land. Fully managed land can produce 500 pounds per acre which would only require some 10 acres per elk or 8,656 acres

for the project mitigation of 915 animals. Natural or poorly managed land may produce less than 50 pounds of forage per acre which would require some 31 acres per elk or 28,365 acres for the 915 animals. Theoretically, project mitigation for 915 elk is computed as follows:

*3,000 acres (hard-core land) + 10A/elk	= 300
*4,500 acres (Smith Ridge) + 10A/elk	= 450
*3,217 acres (Project joint-use land) + 19A/elk	= 169
	919 elk

*This is maximum forage production at some point in time 12 years from start of browse development.

The total of 10,717 acres noted above would support only some 339 elk at present, which is also optimistic in that we have assumed 150 pounds of forage per acre natural production. The average forage production on this particular land is now probably less than 100 pounds per acre. Because of the above and because of the many delays in implementing habitat restoration for mitigation, the District initiated last year interim habitat improvement work at Mangus Bay (350 acres) with other selected areas to be improved this year.

The CE staff report concluded by recommending that approval be given to obtaining the 1,821 ha (4,500 ac) on Smith Ridge for exclusive use for browse improvement.

As an interesting aside, a letter was sent from the Director of IDFG to the CE's District Engineer, dated March 2, 1973. This correspondence, which discussed water releases from the project, concluded with the following remarks (43):

> As more information becomes available on the impacts of Dworshak operations on fish and game resources, we will submit them to the District together with our recommendations. We very much appreciate the good working relationship we have with the Walla Walla District and look forward to ironing out some of the problems and conflicts of interest associated with the operation of Dworshak Dam and Reservoir.

On March 23, 1973, the District Engineer recommended to the Division that the 1,821 ha (4,500 ac) Smith Ridge tract be acquired through land

transfer with BLM. The expected transfer cost was placed at $135,000. The report to the Division also contained an appraisal value of $820,000 for the timber and $412,000 for the land, for a total value of $1,232,000.

Planning for browse development for the Hughes point portion of the "hard-core" area was initiated in 1972 when a memorandum of understanding was signed. This document provided for preparation by the BLM of a clearing plan incorporating helicopter logging techniques which were deemed necessary by the affected conservation agencies in order to minimize the extent of skidding trails and haul roads. Initiation of browse development suffered a serious setback when no bids were received from lumber companies, ostensibly due to the helicopter logging restriction. The Director, IDFG, defended the helicopter logging requirement following the unsuccessful bidding (44), viz:

> As you know, this is not a normal timber sale. The primary objective of the Hughes Point development plan is not merely to remove the timber, but to obtain maximum production of browse, primarily redstem ceanothus. Optimum cost-logging conditions include minimum soil disturbance and an evenly distributed fuel supply so that seed in the entire area will be subjected to heat from the ensuing fire, followed by germination and growth. Examination of several cable-logged and burned areas on the North Fork has shown the results of this treatment to be highly variable as far as redstem production is concerned, ranging from good to very poor. Dragging the logs up the hill removes ground cover from large areas and removes or unevenly redistributes the fuel supply. This method also increases the possibility of erosion. Fire then has too little effect on some areas; some areas do not burn at all and there is no resulting browse production. Since seedling mortality is high on the relatively dry southerly aspects, maximum germination is required to assure an adequate stocking of browse, and even this is no guarantee.

> At the present time there is no proven method of establishing redstem artificially, and even if this turns out to be possible, the high cost should be taken into consideration when deciding the logging method. Helicopter yarding is more expensive but the benefits it provides are all superior to those of cable logging.
>
> *****
>
> Economics is a secondary factor in this sale, except the Corps did specify that the operation had to at least break even. With the original appraisal at well over a quarter of a million dollars, it seems we should first take another step in the same direction before considering cat logging, cable logging, and roads in the areas previously designated for helicopter yarding.
>
> If unavailability of a helicopter is a major factor, then I would suggest waiting, if necessary, rather than using an inferior method. An even longer wait may be involved if it becomes necessary to establish browse by other than natural means.

A second effort to attract bids for the 607 ha (1,500 ac) Hughes Point timber sale also failed (the timber was finally sold to PFI in June 1975 after the helicopter portion of the sale was deleted).

During the period (1973), an independent evaluation of wildlife planning was made for the Dworshak project. The review was conducted by the General Accounting Office (GAO) for the Subcommittee on Fisheries and Wildlife Conservation and the Environment, Committee on Merchant Marine and Fisheries, U. S. House of Representatives.

The GAO investigators' requests for specific wildlife-related data, prompted the FWS to review project records and to develop specific impact estimates. These new estimates varied greatly from all previous wildlife-related loss projections dating back to and including the 1960 and 1962 Coordination Act reports. The new FWS material was prepared

in two formats: (1) a five-page memorandum which transmitted a summary of the requested information to the GAO (45); and (2) a 26-page detailed procedural report which included the actual computations used to produce the figures which were presented to the GAO (46). The final figures contained in the two reports were essentially the same although there were several minor discrepancies.

The purpose for which the new analysis was made, as stated by the FWS, was to provide the GAO with (op.cit.):

> ...information on the percent mitigation of wildlife losses due to construction of Dworshak Reservoir that would accrue as a result of varying amounts of land purchases for mitigation purposes [i.e., Heezen Block, "hard-core" and Smith Ridge, and "hard-core" only].

In the same procedural report, the FWS characterized the approach (in comparison to all preceeding efforts) in rather surprising terms, viz:

> Because of the nature of the information needed in order to arrive at such values, including information on the long-term trend in game numbers and the limited substantiating information available in the past, no attempt had previously been made to arrive at these values (emphasis added).

The reports treated only elk losses. The new figures were estimated from the 1957 Clearwater Game and Range Study report, and IDFG hunter questionnaire data. The author(s) pointed out that comparable information was not available for any species of wildlife other than elk, and thus no mitigation values for any other wildlife species were provided.

According to the FWS biologists, elk harvest statistics collected by the IDFG for the period 1954-1971 (assuming a generally direct relationship between harvest and size of the elk population) indicated that the

North Fork elk population peaked between 1959-1963.

They (FWS biologists) assumed a 15 percent harvest rate, which provided a North Fork peak elk population of 13,773 head (2,066 harvest ÷ 0.15). After subtracting the 15 percent harvested and a 2 percent natural mortality factor, an average late winter (post-hunting season) elk population figure of 11,431 animals was obtained for the North Fork Clearwater drainage. After dividing this maximum elk population figure by the square miles of big game winter range in the North Fork, a maximum elk density figure of 39 head per square mile was derived.

A number of subjective judgements were made in the absence of specific factual survey data for the Dworshak project site. These correction factors were applied to the survey data to more correctly reflect conditions in the area of the reservoir proper.

More specifically, the FWS's assumptions were:

(1) Winter browse and animal numbers were near optimum for elk during the 1956 surveys of the Upper North Fork.

(2) The lower North Fork, including the project site, was of less value to wintering elk herds. The Heezen Block and downstream project area were assigned maximum elk densities of 88 percent and 75 percent, respectively, relative to the optimum habitat of the upstream area. That is, maximum carrying capacities under the best conditions of 39, 34 and 30 elk per square mile (approximately 16, 19, and 21 acres per elk, respectively) of winter range were assumed for the Upper North Fork, Heezen

Block, and Lower North Fork, respectively.

(3) Under the normal forest management practices (as opposed to "best" in relation to elk requirements) expected to occur over the 50-year period of project analysis, the project locale would continue to support elk numbers only 50 percent as great as the above listed maximums which would prevail under optimum seral conditions.

(4) Even under intensive seral stage management specifically for elk, shrub vegetation could only be maintained at 75 percent of optimum on a sustained basis.

(5) In addition to lands actually inundated, additional lands would be lost as big game winter range due to increased cultural development, i.e., housing, roads, bridges, recreation areas, etc. This loss was arbitrarily estimated as 20 percent of the direct loss due to inundation.

As noted, the winter range within the lower Clearwater drainage (project site) was of lower quality than either the upper drainage or the Heezen Block. Also, a maximum elk density under optimum conditions of 30 animals per square mile (21 acres per elk) of winter range was assumed. This same area under normal forest management practices (rather than optimum seral conditions) was assumed to be capable of supporting only one-half the optimum density, or 15 elk per square mile (42 acres per elk).

By applying the 15 elk per square mile to the 23.4 square miles of winter range habitat inundated by the Dworshak project, a project-associ-

ated loss estimate of 351 elk was developed. After adding the additional 20 percent loss from cultural impacts, the total project associated elk loss was calculated to be 420 head.

Estimates of winter carrying capacity under managed and non-managed scenarios for the three separate mitigation proposals, i.e., Heezen Block, Smith Ridge and "hard-core" lands, and "hard-core" lands only, were developed by the FWS (Table 11). Careful review of this information clearly indicates that, at this juncture, the FWS projected that none of the three mitigation proposals would provide full compensation for the estimated loss of 420 elk. This potential increase of 119 animals on the "hard-core" plus Smith Ridge is contrary to CE estimates (750), and to the 729 figure computed by the FWS in 1972. The difference was essentially due to different assumptions of maximum carrying capacity under optimum managed conditions.

The hunter-day statistics computed by the FWS for the GAO investigation contained a gross error. The FWS inadvertently considered the average yearly carrying capacity loss figure of 420 elk as the yearly elk harvest loss. This erroneous discussion is presented below (46), viz:

> HUNTER-DAYS LOST DUE TO CONSTRUCTION OF DWORSHAK RESERVOIR
>
> On the basis of 420 elk lost due to the construction of Dworshak Reservoir and an average elk hunter success of 10% during the life of the project [50 years] plus an average of 7.6 hunter-days annually per hunter, 31,920 elk hunter-days will be lost with the project.

As noted previously, early in the computations, the FWS used a 15 percent annual harvest figure. If 15 percent was a reasonable assumption,

Table 11. -- Fish and Wildlife Service's 1973 analysis of probable results of various mitigation plans to compensate for the estimated loss of 420 head of elk resulting from the construction of the Dworshak project in Idaho

Land management	Potential wintering elk carrying capacity								
	Original Heezen Block			Hard core plus Smith Ridge			Hard core area		
	Take lands	Remainder	Total	Take lands	Remainder	Total	Take lands	Remainder	Total
Under normal forestry practices	35	391	426	35	255	290	35	136	171
Under intensive range management	35	578	613	35	374	409	35	195	230
Net gain from management	--	--	187	--	--	119	--	--	59

Source: Greenley, Joseph C. 1973. Letter from Director Idaho Department of Fish and Game to District Manager, Bureau of Land Management, Coeur d'Alene, Idaho. July 10, 1973.

then the average annual wintering population of 420 elk which was assumed to have been sacrificed by the project would have supported an annual harvest of 63 animals (420 x .15). If, as stated by the FWS, one in ten hunters killed an elk, the harvest of 63 head would have supported the recreational hunting effort of approximately 630 hunters or 4,788 hunter-days (630 x 7.6 trips). The hunter-day value of 4,788 is only 15 percent of the FWS's reported figure of 31,920.

Similarly the potential mitigatory social benefits computed by the FWS, of 14,212, 9,044, and 4,884 elk hunter-days for the Heezen Block, "hard-core"-Smith Ridge, and the "hard-core" only respectively (op.cit.), were similarly inflated, and each should have been reduced by 85 percent. The correct figures would have been 2,132, 1,357 and 733 elk hunter-days.

In summary, the FWS's 1973 memorandum to the GAO indicated that their new analysis largely voided earlier presentations (45), viz:

> We wish to acknowledge that we can no longer support the magnitude of the elk loss listed in our 1962 detailed report, nor the degree of elk production under intensive management suggested in the 1970 report, entitled "Big Game Habitat Management Plan, Dworshak Reservoir, Clearwater County, Idaho." In addition, our present evaluations are at variance with the wording in the final paragraph in the letter sent to the District Engineer, Walla Walla District, dated August 25, 1972. That particular correspondence was drafted following a meeting with Senator Church, the U. S. Army Corps of Engineers, and the Idaho Fish and Game Department, on June 14, 1972. At that meeting, the Corps of Engineers requested a substantiating statement documenting the need for an additional 4,500-acre parcel of land now known as the Smith Ridge area. Senator Church expressed his support if such documentation was made. The correspondence of August 25, 1972, attempting to do this, included the term "total compensation" instead of wording indicating

> a reasonable degree of mitigation. The premise of mitigation, not compensation, has been one that our Bureau and the Idaho Fish and Game Department have adhered to throughout this work, and which, in our opinion, was generally understood at our meeting with Senator Church.

Concurrently, the issue of project funding continued to generate considerable exchange of communications. The disagreement over funding of operation and maintenance (O and M) costs of mitigation lands provoked the IDFG to seek assistance from Senator Church (47). On September 20, 1973, the CE's Director of Civil Works, in a letter to the Under Secretary of Interior noted the CE's conclusion that acquisition of the Smith Ridge and dedication of those lands to elk forage production was justified. He further noted that acquisition should be accomplished through a transfer of BLM lands to State ownership in return for the State-owned Smith Ridge lands. Regarding the question of funding for "managing" the wildlife lands the CE's Director of Civil Works stated (48):

> I also believe that, should the exchange be made, the land received (Smith Ridge) should be retained under the jurisdiction of the Department of the Interior and be managed specifically for wildlife. To complete the management unit, jurisdiction of the "hard-core" land acquired specifically for wildlife use also should be transferred to your Department along with budgeting responsibility for necessary operation and maintenance costs for the entire unit.
>
> The cost of managing these wildlife lands should be considered a project cost. Therefore, I further propose that at the end of each fiscal year the Department of the Interior would advise the Corps of Engineers of the actual costs incurred for this purpose in order that appropriate charges could be made to the project.

It later became clear that "managing" the wildlife lands at project cost was not meant to connote inclusion of either operation or main-

tenance costs which, the CE continued to maintain, were State responsibilities and not legitimate claims against the project.

The question of O & M funding remains unresolved to the present time.

By December of 1973 essentially all of the lands required for the Dworshak project, exclusive of mitigation lands, had been acquired. Consolidation of these lands from the various owners entailed withdrawal of areas already under federal ownership and acquisition of state and privately held lands. Acquisition of the non-federal lands involved the BLM. The Bureau exchanged lands of equal value already held by that agency for the needed acreages within the project area. These project area acquisitions then became BLM lands. The Bureau later succeeded in acquiring all of the "hard-core" mitigation lands also via land exchange primarily from PFI, the major holder.

On June 10, 1975, timber sales were offered for the majority of the Hughes Point and Long Creek portions of the "hard-core" mitigation area. Spirited bidding, unexpected by PFI who had submitted a sealed bid at the minimum appraised value, increased the price 10 times on Hughes Point and almost 4 times on Long Creek. PFI was the successful bidder for both sales. It should be noted that the highly desired helicopter logging requirement had been removed from the terms prior to the sale.

BLM staff evaluated the suitability of the "hard-core" lands for elk winter range in August 1977. The lands were under BLM ownership by this time, having been acquired previously via land exchange as dis-

cussed earlier. This field study resulted in a determination that the Long Creek area could be developed so as to provide excellent forage for elk. However, winter use of the area by elk was considered to be questionable (49), viz:

> It is questionable whether or not elk will use the habitat once it is created. Will an elk herd that traditionally winters near Smith Ridge travel approximately nine airline miles across another "ideal" winter habitat to be created on Hughes Point, cross the Little North Fork of the Clearwater (approximately 300 yds. wide) and use the habitat created in the Long Creek-Robinson Creek area? No literature could be found that indicates substantial shifts from traditional winter ranges to newly created winter ranges.

That section of the "hard-core" mitigation area located on the south side of Dworshak Reservoir was considered by the BLM to be unsuited for use as winter range for elk (op.cit.), viz:

> Lands in this area would not be suited for elk winter ranges. Not because suitable forage could not be created but because of snow depths on steep, open north facing slopes.
>
> Excellent spring-summer-fall habitat could be created through timber harvesting practices. Creation of small openings to provide forage, leaving corridors for hiding, thermal, and travel lanes requirements would be highly desirable.

Only the Hughes Point section of the "hard-core" area was deemed suitable by the BLM investigators for use as winter range for elk.

It should be noted that these conclusions were essentially identical to the internal analysis compiled by elk biologists with the IDFG some six years previously, as discussed earlier in this report (32).

BLM's District Manager forwarded his staff's analysis to the State Director (BLM) for consideration relating to the withdrawal of the total "hard-core" area for elk mitigation purposes as had been requested

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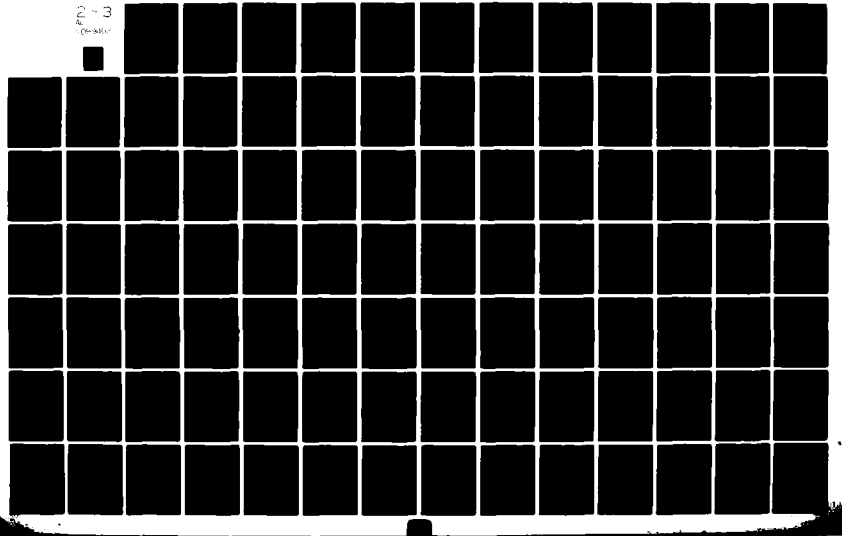

by the CE. The District Manager's i[illegible]:posed to withdraw only a portion of the area for elk mitigation essentially along the lines of the following discussion (50):

> Field examination revealed the subject lands located south of the Dworshak Reservoir are not suited and would not be used by big game for the purpose proposed in the application for withdrawal, i.e. as winter range. The subject lands located north of the Dworshak Reservoir contain areas presently used lightly to moderately for the proposed primary use as winter range for elk and deer. The north facing slopes are used during the summer by resident elk and deer which shift their use to the more south facing slopes in winter along with the migrant herd from the nearby higher elevation lands. Though not all of the lands north of the reservoir are suitable for big game winter range, a significant portion of those lands are suitable. The vegetation can be converted to that required with a reasonable expectation of use by big game during the winter.
>
> Acreage Actually Needed to Effect the Purpose of the Proposed Withdrawal
>
> The lands north of the Dworshak Pool will not replace all of the winter habitat lost to inundation. Significant acreages of winter range can be developed on the subject lands north of the reservoir, but additional acreages must be found elsewhere where suitable aspect, slopes, etc. are available.
>
> The subject lands south of the reservoir are not suitable and therefore should not continue in the development of winter range for deer and elk. Winter snows on these north facing slopes prevent use by big game during the critical winter season.

When the conservation agencies learned that BLM was recommending withdrawal of only a portion of the "hard-core" area for mitigation purposes with the remainder to be managed under normal timbering practices by BLM, they expressed "shock and dismay." The following statement was made in defense of the IDFG's long-standing request for the entire "hard-core" mitigation area (51), viz:

> The insert map on page 69 of the BLM analysis show elk winter range potential for proposed withdrawal. We disagree with the selection of areas (colored green on the map) as being unsuitable for winter range development and find no supportive data for this determination. Although we feel that justification has previously been made to develop this area for wildlife mitigation as indicated earlier in this letter, further elaboration specific to those sites is as follows:
>
> The north facing slopes referred to would be developed through prescribed logging plans with selected areas being left for escape and thermal cover depending on slope, aspect, elevation and site potential. There are many slopes other than "north" interspersed in the area in question. The development will include areas being clearcut logged, interspersed with areas of cover which will not be logged. The uncut areas will serve a dual purpose of game cover and protecting watercourses and streams in the area. Brush would be encouraged through broadcast slash burning. Supplemental seeding of scarified redstem seed and seedling planting would be used in specific areas. There would be no general access and any needed roads would be closed after logging, as any roads will detract from the big game use of this and the adjacent areas and areas across the river.

In summary, the Department expressed the view that withdrawal of the full area was necessary and justified.

On January 16, 1978, the Idaho State BLM Director summarized the withdrawal question for the Director with the following recommendation (52):

> From a resources standpoint, it is apparent the best alternative is to deny the withdrawal for those lands south of the reservoir. However, in view of prior actions taken by the Department and the strong feelings of the Congressional Delegation and the Secretary that the entire area be withdrawn, it appears that approval in total is inevitable. Accordingly, it is our recommendation that the entire acreage originally applied for by the Corps be withdrawn.

BLM released an environmental assessment report (EAR) for the proposed Dworshak withdrawal in April of 1978. This report followed review of a draft EAR by affected agencies. The FWS had submitted 36 suggested

changes and the IBFG suggest 50 separate changes to the draft. The summary conclusion for the BLM prepared EAR stated (53):

> The Army Corps of Engineers has requested a withdrawal of approximately 4000 acres from multiple use management for single use management, development of big game winter range. Development of subject lands will, in part, mitigate the 15,000 acres of river bottom lands, formally used as winter range by elk, white-tailed deer and mule deer, lost during the filling of Dworshak Dam.
>
> Both the development and operation and maintenance phases will cause beneficial as well as adverse impacts to the environment. The primary beneficial impact will be the provision of approximately 1000 acres of additional forage and 4000 acres of total habitat for big game. Significant adverse impacts include potential loss of soils, reduction of a sustained yield timber management base, reduced funds and jobs to the local communities and reduced aesthetic values to those individuals who do not like the natural forest altered, creating visual intrusions to the natural landscape.
>
> The product, as a result of the proposed action, will be a potential to produce approximately 5000 elk for harvest over the next 100 years. This will provide recreation in the form of both consumptive and non-consumptive uses.

The letter which accompanied transmittal of the EAR from the Idaho office of BLM to the Director BLM contained language which was later described by the Secretary of Interior's field representative in Seattle, Washington, as a deliberate attempt to delay the withdrawal action (54), viz:

> This letter is in response to the attached memo signed by Associate State Director Larry Woodard, Idaho BLM, accompanying the Environmental Assessment for the Dworshak withdrawal.
>
> I believe that Mr. Woodard's memo is a deliberate attempt to delay the withdrawal action. It is intentionally negative, it brings to the issue elements that have no relevance to the withdrawal, it is a reflection of extremely poor judgement and it hurts the credibility not only of the

BLM, but of the Department as a whole.

The Secretary's representative concluded by strongly supporting withdrawal of the entire 1,619 ha (4,000 ac) "hard-core" (op.cit.), viz:

> I strongly recommend that you personally approve the entire withdrawal and submit it to Assistant Secretary Martin for his approval and to Secretary Andrus for final action. It is important that the withdrawal be completed by the week of May 15 to permit the Corps of Engineers to proceed with a timber sale scheduled to commence on May 22.

On May 17, 1978, Secretary Andrus approved the withdrawal of the entire 1,630 ha (4,027.56 ac) tract on the recommendation of the Director BLM. In his letter of support for the withdrawal, the BLM Director did indicate some apprehension, however, about future actions of a similar nature (55), viz:

> While withdrawal is the proper form of action in this instance, I believe that preference should be given in the future to considering cooperative agreements as a more flexible method of transferring management responsibility for BLM lands to other government entities.

Currently, CE programs at Dworshak include development of elk winter range within the wildlife mitigation area. The habitat development program is guided by a tri-agency team of wildlife biologists representing the CE, IDFG and FWS. Habitat development consists primarily of clearing selected areas followed by controlled burning. Timbering is conducted by high-lead techniques on terrain of high relief. Traditional cat-logging is employed on level areas. The controlled burns are designed to furnish sufficient heat to germinate desirable browse species, primarily redstem ceanothus.

Development of this habitat by the CE will be concluded in September,

1984. Administration and management of the mitigation area will then be made available to the IDFG under terms of a draft interim General Plan submitted to the CE by the conservation agencies in September, 1979. The plan lists the general management concepts to be employed on the mitigation area as follows (56):

> Clearcuts throughout the wildlife resource properties will be held in a state of dis-climax to maintain brush habitat. Redevelopment of these areas will be required as maturity is reached in order to set back succession and continue to produce browse forage for big game wintering on the wildlife resource properties. Practices such as conifer removal, slashing, burning, reseeding, and bracken fern control will be accomplished as required to sustain dis-climax of the seral brush habitat. A minimum of 25% of each major unit will be maintained as reserve timber areas to serve as thermal cover and travel corridors for wildlife. Selective timber harvest may be used to improve these areas for their intended purposes.

A description of the lands planned to be incorporated under terms of the conservation agencies' draft General Plan was as follows (op.cit.):

> All project take lands from river mile 34 (mouth of Silver Creek) upstream to include the Little North Fork and North Fork Arms will be administered by the Idaho Department of Fish and Game (Map 2). The project take lands that were not conveyed to the Corps of Engineers above the U. S. Forest Service boundary will be dedicated for wildlife purposes for management either by the Clearwater National Forest or the Idaho Department of Fish and Game. All project take lands (approximately 2,700 acres) above the present mitigation boundary on the Little North Fork River Arm will be administered by the Idaho Department of Fish and Game. In addition to the project take lands, the "hardcore lands" (5,120 acres) and Smith Ridge (4,680 acres) will be part of the wildlife resource properties for mitigation to be administered by the Idaho Department of Fish and Game. The approximate total acreage of the wildlife resource properties dedicated to wildlife loss mitigation is 20,000 acres, over 75% of the recommended acreage from the 1962 Coordination Act Report issued by Region 1 of the U. S. Fish and Wildlife Service.

Terms of the draft General Plan were unacceptable to the CE and further development of a mutually satisfactory document continues (1980).

An Operation and Maintenance Contract was awarded by the CE to IDFG for purposes of carrying out development and management of wildlife mitigation efforts for FY 1979-80 in the amount of approximately $42,000 (John McKern, pers. comm.).

Efforts to acquire the Smith Ridge lands for replacement of winter range for elk had been tracking parallel to "hard-core" mitigation area deliberations. On April 22, 1975, the ILB denied a proposal submitted by the CE to exchange 1,894 ha (4,679 ac) of state land on Smith Ridge for BLM land of equal value. A follow-up attempt by IDFG in 1976 to convince the ILB to exchange these lands listed 16 points of clarification/justification. Among the items noted by the IDFG were several which amplified the habitat-big game population relationships involved (57), viz:

> The lands along the lower half of the reservoir are unsuitable as the primary site for mitigation efforts. The choice areas have been reserved by the Corps for public recreational developments, and the potential future private developments would further nullify any serious attempts to improve big game habitat in this area.
>
> Mitigation must be accomplished at the upper end of the reservoir. The two species of prime importance here are elk and whitetail deer, therefore, all references to mitigation are in terms of elk and deer, even though other wildlife species live along the entire course of the reservoir.
>
> A ten year study of elk migration in the upper reservoir area has established the importance of Smith Ridge not only as winter range, but also as a spring calving range. Many of the elk which are found 20 miles up the Little North Fork in summer and fall return to Smith Ridge for the winter and/

> or spring (Map 2). When the snow gets too deep on the south side of the reservoir some elk have traditionally crossed over to the more open slopes of Smith Ridge. There is also a downriver shift of elk into the Smith Ridge area. A portion of the herd resides there throughout the year.
>
> The Smith Ridge winter range is rapidly deteriorating due to overuse by big game and because of rapidly encroaching conifers. Witnout development specifically for big game there is little hope of even maintaining present elk numbers, let alone making up for losses attributable to the reservoir. The longer the delay, the worse the situation will become. During the winter of 1974-75, snow depths and a lack of browse resulted in at least 70 elk funneling down to Hughes Point where they were concentrated for over a month with inadequate browse. The same situation can be expected to reoccur in the future.

In April of 1976, the Assistant Secretary for Fish and Wildlife and Parks addressed the Smith Ridge land exchange issue in a letter to the Chief of Engineers (58), viz:

> Finally, it was determined several years ago by the Fish and Wildlife Service, the Idaho Fish and Game Department, and several conservation groups, that the "hard core" lands were not sufficient to provide necessary mitigation. It was proposed that 4,500 additional acres of land be acquired on Smith Ridge for elk habitat mitigation purposes. Your agency concurred with the proposal and determined that the best manner to accomplish the acquisition would be a land exchange between the Bureau of Land Management and the Idaho State Land Board.
>
> The Under Secretary of the Interior formally approved of this land exchange in a letter to the Corps dated April 24, 1974. The exchange has not yet been initiated. We reiterate the critical need for these lands and consider it the responsibility of the Corps to see that these lands are obtained. It is our opinion that needed developments for wildlife mitigation have been delayed too long.
>
> We would appreciate being informed of your progress in this matter.

About this time the ILB reversed its earlier rejection of land exchange for Smith Ridge and directed the Idaho Department of Lands to proceed

with trade possibilities with the CE in cooperation with BLM (59). The IDFG asked Assistant Secretary Reed for assistance so that BLM would place high priority on the Smith Ridge land exchange (60).

In February, 1977, Senator Church arranged a meeting of CE, FWS, BLM and U. S. Forest Service (USFS) representatives to resolve the Smith Ridge land transfer dilemma. The USFS representative indicated that that agency was willing to examine the possibilities of a land trade. The ILB maintained that BLM owned no more large blocks of land in which they were interested and thus favored the possibility of a land exchange involving Smith Ridge and the USFS (59).

After some period of deliberation the Idaho Department of Lands selected USFS lands referred to as the "Charlie Creek" block in April 1978. This block of land, located within the St. Joe National Forest, was not acceptable to the USFS and a counter proposal by the USFS was rejected by the ILB.

The general USFS position on the land exchange issue was summarized in 1979 by the CE's District Engineer as follows (61):

> On 17 November 1978 the Department of Lands wrote to the Panhandle National Forest Office reaffirming the State's 13 April 1978 selection of Forest Service lands. In our last contact with Department of Lands on 9 April 1979 there had been no progress either in land selection or in the lawsuit. On 10 April 1979 we were informed by the Forest Service Region I office in Missoula that, on 9 March 1979, they had sent a report and recommendation to their Washington, D. C., office. We were later furnished a copy of that report. Mr. Worf informed us that Region I is not in favor of using Forest Service lands for the exchange unless they are replaced, preferably by the Corps' acquiring lands on Hope Peninsula. The Department of Lands' selection in the "Charlie Creek" block is not acceptable to USFS and

> they recommend use of BLM lands for exchange as previously proposed. The course of action preferred by USFS is to reopen the total wildlife mitigation question and approach it from the standpoint of providing additional elk forage through intensive habitat improvement on existing state, BLM, and National Forest lands. They do not believe any authority exists at the Regional level to enter into any Forest Service-State-Corps exchange even if the lands were agreed to.

A letter from the IDFG to the Secretary of Interior's Western Field Office Director on May 25, 1979, reflected the IDFG's frustrations over the apparent impasse between the ILB and the USFS regarding a land exchange for Smith Ridge (62):

> Your June 22, 1977, memo following the June 17 meeting at Smith Ridge cogently summarized the whole land exchange situation and stimulated action toward resolving the longstanding elk mitigation problem at Dworshak.
>
> A subsequent meeting to start negotiations for exchange between the Idaho Department of Lands and the U. S. Forest Service raised our hopes that after 25 years of frustration the solution was finally forthcoming.
>
> However, we recently inquired about progress and learned from the Corps (April 20, 1979, letter from Colonel Allaire, copy of which you received) and the Idaho Department of Lands that little has been accomplished in the almost two years since involvement of Forest Service lands in the exchange was directed.
>
> *****
>
> As we perceive it the current obstacle is that the Forest Service still holds a negative attitude toward pursuing this exchange with any degree of enthusiasm. While this may be understandable, since they were only recently made unwilling participants in this 25 year attempt to achieve mitigation, we don't think it should be necessary to replow a quarter-century of negotiations to bring them up to speed when the solution is so near and obvious.
>
> This has been a long, tedious, frustrating, often discouraging road, in attempting to achieve reasonable mitigation for losses caused to Idaho by a federal project.

As the USFS land selected by the State (Charlie Creek) is located within the boundary of the St. Joe National Forest, Congressional action would be required to culminate the exchange. The last significant action relating to the Smith Ridge land exchange was the introduction on August 3, 1979, by Senator Church of a bill (S. 1667) which would mandate a trade of the Smith Ridge lands for the lands desired by the ILB located in the Charlie Creek drainage.

Upon completion of the exchange, should it occur, the USFS would then include the Smith Ridge land in a planned USFS-CE land exchange (63).

The foregoing discussion concludes the chronological summary of events dealing with acquisition of replacement wildlife habitat at the Dworshak project. Studies were continuing all during this period of intense negotiation to identify the effects of project construction on big game resources. These studies were conducted by the IDFG under contract to the CE.

Interim impressions of deer and elk losses, three to four years after Dworshak Reservoir was filled, were contained in an interesting intra-agency memorandum prepared by the IDFG big-game biologist responsible for the Dworshak game studies (64). The following excerpts were taken from that 1975 document which discussed justification materials for the Smith Ridge land exchange proposal:

> I hate to be tied down to numbers in trying to justify the land trade. I will no doubt want to revise my estimates at a later date. I think figures used in the past have been too high, both the number of elk to be lost strictly because of the project, and also the number of elk which could be supported on intensively managed lands acquired for mitigation.

*****

Elk losses due to the project, based on observations, may be as little as ten animals so far. However, major losses are yet to come. More pressure is now concentrated on the remaining range; deterioration has accelerated. I expect the major loss to come all at once, on a winter similar to the last one, when the elk are forced to the lowest elevations and funneled to the end of Smith Ridge. The development we can accomplish on Hughes Point will not be enough (much of the Hughes Point area is either too steep and rocky or else on a north-facing aspect). Last winter the 70+ elk stood around on Hughes Point for over a month on an undesirable starvation diet rather than trying to cross the ice. The ice barrier, due to the huge blocks of ice left on the steep hillside after the water level dropped, was even more formiddable the previous winter.

A combination of future logging roads on Smith Ridge (if the trade isn't accomplished) plus added people pressure caused by the Dworshak project, could be very detrimental in the future, but I can't make any definite number predictions right now.

In the lower reservoir where snow depths are less, the elk are not so limited to the lands immediately adjacent to the pool, but they cause added pressure on the deer population.

Norberg didn't try to make any accurate total counts (which is impossible) but he estimated 4000 Whitetailed Deer in the North Fork drainage, with 98% of those observed in the pool area. With a 40% reduction in the WT winter range area, he expected a 40% loss of the WT population.

I believe the 40% loss figure is pretty close. From number of deer counted on the ice (over 500, with up to 700 estimated for the previous flight) and the number observed along the edges, I would estimate the total number of whitetails in winter 1971-72 at close to 2500. 40% loss would = 1000 of which 800 are already gone, with 200 to go yet.

A summary report was released by IDFG which covered the big game evaluation studies for the period July, 1969, through June, 1977 (65). This report was presented in three parts covering, respectively: (1) North Fork of the Clearwater River elk and deer harvest and Smith Ridge census figures, (2) studies in mitigation area and on lower end of reser-

voir, and (3) elk migration study. The essential findings from each of these studies is presented in the following section.

Harvest statistics for areas of relatively small size, such as the Dworshak project area, are not possible to obtain under Idaho's current survey methods. Questionnaires are mailed to a random sample of big game tag buyers. Tabulations of the responses are suitable only for statewide statistics. However, hunters are also asked to voluntarily return hunter report cards which provide additional information such as designation of the management unit in which their kill was made as well as the name of the nearest town, stream or landmark. This information is routinely summarized only by management units and not by drainages.

Harvest statistics specifically for Dworshak project lands were, therefore, not available since portions of five different management units are involved. However, IDFG staff have analyzed those hunter report cards which listed kill sites within the North Fork drainage. These data are presented in Table 12 for elk and Table 13 for deer. It should be noted that not all successful hunters voluntarily return a completed hunter report card. Based on the years 1970-1975, the IDFG estimate that only about 35 percent of the successful elk hunters and 30 percent of the successful deer hunters return their cards. To arrive at a rough estimate of the total kill figures, the harvest data presented should be divided by 0.35 for elk and 0.30 for deer.

To average out year-to-year variability, the IDFG report presented the elk harvest data averaged by three year intervals. Table 14, which was

Table 12. -- Location and number of elk kills as listed on IDFG hunter report cards, 1958-1976, by major drainages. Dworshak Reservoir backs water upstream approximately to Isabella Creek and Thompson Creek

Area	Year																		
	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970*	1971	1972	1973	1974	1975	1976**
North Side of North Fork from Mouth to Robinson Cr.	83	101	99	49	70	70	43	124	109	79	103	50	--	44	37	28	34	29	22
South Side of North Fork from Mouth to Gyppo Cr.	120	97	63	98	76	70	55	92	89	62	62	81	--	48	41	59	45	28	13
Little North Fork	108	144	165	171	123	113	118	115	112	104	114	116	--	108	71	94	74	55	42
Hughes Point to Isabella Cr.	42	27	29	44	14	27	7	23	40	40	41	38	--	25	18	14	10	4	5
Grandad Cr. to Thompson Cr.	23	11	17	12	3	13	6	13	17	15	12	12	--	10	14	10	8	4	2
SUBTOTAL	376	380	373	374	286	293	229	367	367	300	332	297	--	235	181	205	171	120	84
Beaver Cr. to Head waters of North Fork	908	635	607	735	448	499	420	534	477	501	508	450	--	362	304	319	308	254	157
TOTAL	1,284	1,015	980	1,109	734	792	649	901	844	801	840	747	--	597	485	524	479	374	241

* Most elk hunter report cards lost for 1970

** Either sex hunting until 1976; then bulls only except for upoer end of Little North Fork, where season was 19 days either sex followed by 14 days bulls only

Source: Walla Walla District. 1977. Plan for development of Rocky Mountain elk habitat, Dworshak Dam and Reservoir, North Fork Clearwater River, Idaho. Design memorandum No. 15. Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington.

Table 13. -- Location and number of deer kills as listed on IDFG hunter report cards, 1958-1976, by major drainages. Dworshak Reservoir backs water upstream approximately to Isabella Creek and Thompson Creek

Area	Year																		
	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
North Side of North Fork from Mouth to Robinson Cr.	42	77	44	24	20	80	55	38	59	14	57	27	45	28	14	24	76	67	38
South Side of North Fork from Mouth to Gyppo Cr.	15	42	1	1	--	63	60	24	63	4	64	10	41	35	31	28	25	30	20
Little North Fork	49	49	31	43	30	31	44	17	31	24	26	20	26	35	21	31	6	15	8
Hughes Point to Isabella Cr.	12	21	9	4	3	9	24	10	34	14	16	9	16	11	4	13	4	2	3
Grandad Cr. to Thompson Cr.	--	--	1	2	--	2	2	2	--	1	1	--	1	1	4	1	5	2	--
SUBTOTAL	118	189	275	74	53	185	185	91	187	57	164	66	129	110	74	75	116	116	69
Beaver Cr. to Head waters of North Fork	34	101	17	11	11	103	105	68	92	8	77	36	65	55	68	80	65	53	38
TOTAL	152	290	292	85	64	288	290	159	279	65	241	102	194	165	142	155	181	169	107

Source: Walla Walla District. 1977. Plan for development of Rocky Mountain elk habitat, Dworshak Dam and Reservoir, North Fork Clearwater river, Idaho. Design memorandum No. 15. Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington.

Table [14]. -- Percent decline in elk harvest from hunter report card data for the period 1958-60 to 1973-75

	Three-year averages		Percent decline in reported elk harvest
	1958-60	1973-75	
North side of North Fork from mouth to Robinson Cr	94	30	68
South side of North Fork from mouth to Gyppo Cr	93	44	53
Little North Fork	139	74	47
Hughes Point to Isabella Cr	33	9	73
Grandad Cr to Thompson Cr	17	7	59
Mouth of North Fork to Isabella Cr	376	166	56
Total for area of reservoir	752	330	56
Beaver Cr to head of North Fork drainage (above reservoir proper)	717	293	59

Source: Walla Walla District. 1977. Plan for development of Rocky Mountain elk habitat, Dworshak Dam and Reservoir, North Fork Clearwater River, Idaho. Design memorandum No. 15. Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington.

extracted from the IDFG report reflects the relative decline in elk harvest for various geographical areas of the North Fork Clearwater drainage. This table was described as follows in the IDFG report (65), viz:

> Percent decline in reported elk harvest from the earliest to latest three-year period is given in TABLE 8 for major sections of the North Fork drainage. The percent card return for successful hunters is unknown for the period 1958-60, but was probably greater than for the period 1973-75. Although the actual percent decline listed may not be accurate, comparisons can be made between areas in the percent decline column. Percent decline for the reservoir area was about the same as for the upper North Fork.

The IDFG report made an interesting observation regarding elk population declines compared to the apparent harvest decline (op.cit.), viz:

> There have been only two major North Fork censuses, one in 1956 and one in 1972, with the latter excluding the area below Grandad Bridge. In TABLE 9, 1956 and 1972 census data are compared with three-year-average harvest data for 1958-60 (the earliest available) and 1970-72 from Grandad Bridge upstream. The indicated census decline should be maximum, since less flying time was used in 1972 and the entire winter range was not covered as in 1956. On the other hand, the indicated decline in harvest should be minimum, since harvest was already presumably lower in the period 1958-60 than in 1956, and the 1970-72 three-year-average is higher than one would expect for 1972 alone, due to the steady annual decline. Even allowing for a differential card return rate, it appears that harvest has decreased more than has the population.

The above referenced Table 9 is presented herein as Table 15.

The North Fork drainage was not the only area in Idaho which experienced a decline in the number of elk harvested as noted in the same IDFG report, viz:

> Statewide elk harvest, based on report card returns, was estimated to be 15,910 in 1956 and 9,324 in 1972, a 59 percent decline, even greater than the 44 percent indicated for the North Fork.

Table 15. -- Percent decline in elk population compared to decline in reported harvest

	1956	1972	Percent decline
Elk census from Grandad Cr to head of North Fork drainage	5,000	3,815	24
	Three-year averages 1958-60	1970-72	
Reported elk harvest from Grandad Cr to head of North Fork drainage	906	508	44

Source: Walla Walla District. 1977. Plan for development of Rocky Mountain elk habitat, Dworshak Dam and Reservoir, North Fork Clearwater River, Idaho. Design memorandum No. 15. Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington.

Elk census work on Smith Ridge proper revealed some interesting elk usage patterns as summarized by the IDFG biologist in the report referenced above, viz:

> Trapping and tagging data seems to indicate that the elk population in recent years more than doubles in spring as compared to winter. However, efforts to substantiate this by aerial census has proved impossible due to poor counting conditions in the spring.
>
> Following is a comparison of elk harvest on Smith Ridge on opening weekend with total season reported harvest.

	1971	1972	1973	1974	1975	1976
Opening weekend elk harvest	22±	19+	22	12	11	6
Season harvest reported by hunters	25	18	14	10	4	5

> The figures are not from exactly the same area, since I was not able to cover the upper end of Smith Ridge which is accessible by the Dog Ridge Road at the head of Salmon Creek. The 35 percent card return for successful hunters probably does not apply very well, and certainly not every year in an area this small. I make contact with most of the hunters and sometimes pick up the report card. As a general rule, my guess is that about half of the season kill in the Smith Ridge area occurs on the opening weekend, or the opening five days since we have gone to Wednesday opening dates.
>
> From the figures I have been able to collect it appears that here, as well as in the area from Grandad Bridge to the headwaters of the North Fork, decline in hunter harvest has exceeded the decline in elk population. The Smith Ridge elk population appears to be remaining fairly stable in recent years.
>
> Distribution of elk during the census periods and distribution of the harvest indicate a concentration of Smith Ridge elk in the area from Spires Creek to Salmon Creek. This is an indication of the condition of the range. The greatest deterioration has occurred from Long Bar Creek to Hughes Point and hence this is the area which can be most improved through habitat development.

The number of elk wintering on the project averaged approximately 100

head according to the CE's development plan for elk habitat (63) over the period 1973-1976. Counts as high as 479 animals have been encountered, however. This is reflected in available winter survey data presented in Table 16.

According to comments provided by the FWS during the BLM draft EAR process regarding the "hard-core" withdrawal, in 1978 a projected population of 300 elk were subject to using the mitigation area at Dworshak during some period of the year (66).

Browse development experiments comprised a major task of the IDFG studies. Redstem ceanothus was considered the most desirable winter browse species for the following reasons (65):

> Redstem has several qualities which should make it prime target of any development plan for this area. (1) It is the most preferred species on the winter range; (2) height of the plant is relatively low, from one to three meters, and on a well-used winter range, browsing will keep the plant within reach until it becomes decadent; therefore, range rehabilitation will not be necessary at such frequent intervals in order to keep browse production at a high level; (3) diameter of the current year's growth is greater than for most other shrubs; (4) with an abundant supply of seed stored in the soil from previous generations, it is easy to rehabilitate an area simply by using nature's tool -- fire.

The inability to employ fire to stimulate germination of redstem in all situations led the IDFG to experiment with various planting procedures including bare root seedlings, potlets, and heat-treated seed.

In addition to the harvest, census, and browse development aspects of the IDFG studies referenced in the preceeding discussion, the investigations examined indirect indices of big game abundance on Dworshak pro-

Table 16. Number and composition (sex and age) of elk observed wintering within or near the boundary of the Dworshak project

Winter	Elk Count	Composition Ratio			Percent	
		Bulls	Cows	Calves	Cows	Calves
1948-49*	40	--	--	--	--	--
1955-56	579	--	--	--	--	--
1960-61	272	--	--	--	--	--
1968-69	110	--	--	--	--	--
1973-74	81	12	100	25	73	19
1974-75	106	38	100	38	57	22
1975-76	134	16	100	36	66	24

* 1949 census conducted by Forest Service and Idaho Fish and Game Department

**Provided by Idaho Fish and Game Department under contract to the Walla Walla District

Source: Allaine, C. J. 1979. Letter from District Engineer, Walla Walla District, U. S. Army Corps of Engineers to Director, Idaho Department of Fish and Game, Boise, Idaho. April 20, 1979.

ject lands. Browse utilization studies were conducted for both white-tailed deer and elk. The white-tailed deer browse studies were established to try to determine when the winter range and deer population returned to a balanced state following the elimination of the low elevation lands when the lake originally filled. The browse studies indicated that the deer population crashed in the 1971-72 winter (when the reservoir first filled). The population was actually reduced to a level below the carrying capacity of the remaining winter range. Since then, the deer population has rapidly expanded to carrying capacity of tne range.

The severe winter of 1975 resulted in higher than normal deer mortality as described by the IDFG (op.cit.), viz:

> Observations in 1975 indicated a much higher than normal winter deer mortality. With deep snow even at the lowest elevations, one might expect that the browse plants would be severely over-utilized. Although nearly one hundred percent of the twigs were browsed, individual twigs were not severely hedged back so as to be overly detrimental to the plant. Whether due to limited mobility because of deep snow or some other reason, deer mortality occurred before they could seriously damage the long range food supply. This does not mean that the browse plants are in good shape. In nearly all cases the brushfields are well past their prime and in need of rehabilitation.

Elk were not affected as dramatically as were deer by creation of the Dworshak project according to the IDFG report referenced above, viz:

> Four transects were established along the upper half of the reservoir, where browsing is mainly by elk. With a smaller percentage of winter range inundated, the initial loss of elk was not drastic as compared to the deer, although there is a potential for further losses in the future. Utilization on winter range used primarily by elk was and has remained near maximum.

The IDFG biologist concluded that the winter range along Dworshak Reser-

voir is the key to the white-tailed deer population from surrounding areas. According to the IDFG game biologist for the Dworshak area, the white-tailed deer losses were approximately 40 percent of the pre-project population and were directly proportional to the quantity of winter range inundated by the lake (64).

The subsequent IDFG studies documented winter migration patterns for white-tailed deer (65). Based upon trapping and radio-tagging studies on 14 deer, it was determined that average distance from winter to summer range was 9 airline miles, ranging from one-half mile to twenty-one miles. Three out of the fourteen deer crossed the reservoir at least once. Not all of the radio-collared deer returned to winter at Dworshak. Deer which did return to winter along the project came back to the same spot each year.

Among the 14 recommendations provided were the following two of special interest (op.cit.):

> That the goal of initial development and future management be to produce a long-term-average of 200 pounds of palatable browse per acre on all developed areas. This assumes that a total of approximately 20,000 acres will be made available for management primarily as big game winter range (all lands above Silver Creek including Smith Ridge), that 60 percent of this total (12,000 acres) will be developed as brushfields, that 915 is the number of elk to be supported, that each elk eats 12 pounds of air dried browse per day for an average 100 day winter. 915 x 12 x 100 = 1,098,000 pounds of browse needed per winter, divided by 12,000 acres = 95 pounds of useable browse per acre to be produced. Allowable use factor is about 50 percent; therefore, total long-term-average production needs to be about 200 pounds per acre. This is a realistic figure, but it will require aiming for a 100 percent shrub crown cover in the clearcut areas.

> That as much land as possible in the lower reservoir area be developed intensively as winter range for whitetailed deer. Although the migration study is not completed, enough information is available to point out the high value of the thin ribbon of land surrounding the lower reservoir. Deer travel at least 20 miles laterally (from beyond Headquarters and Elk River) and more than 30 miles parallel to the reservoir (from the headwaters of the Floodwood drainage) down to the critical winter range. It is clear that winter range is a severely limiting factor in the deer population. Unfortunately, nearly all of the choice winter range areas have been usurped for present or future intensive use recreation areas. However, brushfields need not be considered an incompatible use and should be developed as extensively as possible.

The elk migration studies entailed annual trapping and collaring from 1963 to 1972. Radio transmitters were attached to the collars of some of the elk from 1969 through 1972. Over the 10 year period, 489 different elk were trapped and tagged. This work provided evidence which proved contrary to conventional wisdom with regard to the area's wintering elk population. For example, as presented in the IDFG summary report (op.cit.), viz:

> The elk using the Smith Ridge area are primarily a Little North Fork herd, although a small portion is resident yearround. It had been thought previously that the Smith Ridge area might be subject to a heavy influx of elk from further up the main North Fork during severe winters. This has turned out not to be the case, although there is a small amount of overlap.
>
> *****
>
> The radio-tracking, in particular, shows that there is frequent crossing of the North Fork. The reservoir does not seem to bother the elk, as they still swim across or cross on the ice as before. So far, no major crossing problems have been noted. However, the potential hazard is much greater than previously. The upper end of the pool has been freezing over solid before snow depths make it necessary for the elk to cross. In the event of heavy snowfall when the ice is still thin, it is forseeable that twenty or more elk

> could be lost at one time. Crossings are frequently in groups. Elk are not able to climb back onto the ice. A number of elk have been observed in the reservoir in recent years, but it is not known if these losses are attributable strictly to reservoir conditions. An added hazard is the huge blocks of ice which are left all along the shoreline as the water level recedes each winter.

To help avoid the loss of elk in the future, the IDFG report recommended the creation of winter browse on the south side of the reservoir so that elk would not attempt to cross the reservoir to reach Smith Ridge before solid ice was formed on the reservoir surface.

Supplementary data relating to the Dworshak area elk herd were presented in a CE document (D.M. No. 15) which was prepared to guide development of elk winter range on Dworshak project lands (63). The CE adopted management strategy for elk habitat on Dworshak lands was described as follows (op.cit.):

> B. MANAGEMENT. All Corps of Engineers' lands either immediately (project) or distantly (mitigation) adjacent to Dworshak Reservoir upstream of Grandad Creek Bridge and the two downstream units (Grandad Creek and Robinson Creek) located near the bridge shall be managed primarily to sustain a wintering habitat for a population of about 915 elk. The elk management area is divided into habitat units whereby each unit is identified by the local name of the principal drainage (see Plate 1). Each unit is further divided into subunits and identified by an alphabetical progression of letters that represents the chronological sequence of development. Hence, each opening will be identified as a sub-unit by an alphabetical letter. Although habitat development is the most important facet being considered in this management scheme, additional items relating to the regulation of human disturbance, livestock grazing, and elk number will be addressed.

The CE's plan for elk management, referenced above, includes a total of 5,582 ha (13,793 ac) as described below (op.cit.), viz:

> In August 1972, the Fish and Wildlife Service, after 12 years

of negotiations, defined project wildlife mitigation as 5,120 acres of "hard-core" land, plus 3,217 acres (recomputed by the Corps as 3,993 acres) of project land in the same vicinity, plus 4,680 acres of Smith Ridge, all to support 915 elk through severe winters.

Special effort will be made to minimize human disturbance of elk utilizing Dworshak project lands according to the CE's elk habitat development plan, viz:

1. Human Disturbance. Most authorities agree that the presence of recreationists, either consumptive or non-consumptive, tends to shift the occupancy of elk from an open grassland situation to the more protected escape cover provided by timber (Knight, 1970: 14; Moran, 1973: 81-82). Continued harassment during periods of parturition and winter stress may either discourage elk use in a specific area or result in the unnecessary loss of animals on winter range. The following precautions should be taken to minimize the harassment of elk which occurs on the lands surrounding Dworshak Reservoir.

   a. All trails and secondary roads above Grandad Creek Bridge will be closed to off-road vehicles, including snowmobiles.

   b. Future recreation development beyond Grandad Creek Bridge will be primitive in nature and constructed in a manner compatible with the natural environment.

   c. No roads will be constructed to provide access to the mini-camps surrounding Dworshak Reservoir.

   d. Only visitor travel by foot and horseback will be permitted on project and mitigation lands identified for elk management.

A major inventory of riparian habitats and associated wildlife communities within the Dworshak project area and along the North Fork and main Clearwater River below the project for a distance of 42.4 miles was published in 1978. This investigation was conducted by the Idaho Cooperative Wildlife Research Unit, University of Idaho (UI) Moscow, Idaho.

This excellent publication contains 267 pages of text and a similar quantity of appended tabular and pictorial materials. A summary of the investigators findings is presented in the following passages quoted verbatim from the report. Only materials not presented earlier from other sources are presented herein (67), viz:

> Big Game.
>
> Aerial counts of big game animals wintering along Dworshak Reservoir were conducted on 15-16 April 1976. Counts were flown using a helicopter and only the lower 33 miles of the reservoir were intensively covered. This includes nearly all of the white-tailed deer winter range. A total of 584 white-tailed deer, 9 mule deer, 134 elk, and 22 black bears were counted.
>
> White-tailed deer utilize the early greenup on the exposed mud banks in the early spring. The potential exists for seeding these areas with annual early-growing grasses and forbs in the fall as they are exposed, thereby creating some highly nutritious food for big game animals early in the spring. The potential also exists for substantially increasing the carrying capacity of the range adjacent to the reservoir with an intensive range rehabilitation program.
>
> Upland Game.
>
> The ruffed grouse is the principal upland game bird occurring along Dworshak Reservoir. A total of 19 ruffed grouse drumming transects were established along the reservoir. These routes were subjectively located along the reservoir to sample the major coniferous vegetation types. Each route was sampled during the spring of 1976 and 1977.
>
> *****
>
> In 1976 ruffed grouse drumming was heard along all transects. There is a general decreasing trend in drumming activity toward the upper end of the reservoir.
>
> *****
>
> In 1977 ruffed grouse drumming was heard along all transects except the one from RM 48.8 to Butte Creek. The same general trend of lower drumming activity at the upper end of the reservoir was noted in 1977.

*****

During the fall, grouse flushing counts were conducted along the reservoir encompassing the same routes used for the spring drumming counts.

*****

Due to time limitations during the fall of 1976, only 15 of the 19 transects along the reservoir were sampled. During 1977 all of the transects along the reservoir were sampled. In 1976 the transects at the mouth of Elk Creek and Elkberry Creek had the highest bird densities and the highest number of birds per kilometer of transect length. In 1977, the transects opposite Dent Acres and at Magnus Bay were highest in birds per kilometer of transect length, while the Elk Creek arm transect was highest in bird density.

*****

Hungerford (1951) studied ruffed grouse populations on the University of Idaho experimental forest from 1946 to 1950. He censused grouse using a variation of the King method and found a high population of grouse in 1948 with 0.5 birds per hectare and a low in 1950 with 0.27 birds per hectare. The average densities of grouse we found along Dworshak Reservoir generally fall within these ranges.

Supplemental observations of ruffed grouse during the 2 years of the study documented use on 2 additional areas along the reservoir. Ruffed grouse were regularly seen and flushed from the green-up areas on the exposed mud banks during the spring and fall. It was very evident they were seeking the succulent grasses and forbs on these areas. We also noticed numerous ruffed grouse on 2 recent prescribed-burn areas at Little Bay and at Ladd's Creek. Again it was very evident they were seeking newly emerged grasses and forbs on these areas.

Four other species of upland game birds were recorded along the reservoir during the study. Only one blue grouse was observed -- an adult male at RM 35.2 on 5 April 1977 in the Gold Creek burn area. The only mountain quail observed was one adult male at Magnus Bay (RM 26.5) on 25 September 1977. California quail were observed at 2 locations on 29 April 1977: numerous quail were heard calling near the recent prescribed burn at Little Bay (RM 7.9); and quail were flushed from the green-up area on exposed mud banks at the mouth of Elk Creek (RM EO.1). The gray partridge [Hungarian partridge] was documented several times along the reservoir:

on 22 December 1976 a single bird was flushed at RM 47.5, RB, in brackenfern/orchard-grass timothy vegetation type; on 29 April 1977 and 24 September 1977 gray partridges were flushed from the grassland area at Freeman Acres (RM 8.7); and on 24 September 1977 a group of birds was flushed from the grassland area at the mouth of Elk Creek (RM EO.3).

A total of 7 snowshoe hare observations were made along the reservoir. Six of these observations were made during the 1976-77 winter period from track sightings in the snow. The other observation was made on 14 October 1977 when a snowshoe hare was caught in a rat trap set in a brushfield at Oneil Creek. Based on these few sightings, there does not appear to be a significant snowshoe hare population on the lands adjacent to Dworshak Reservoir.

Waterfowl.

Highest numbers of species of waterfowl (46%) occur during the spring migration months of March, April, and May on Dworshak Reservoir. The months of June, July, August, and September accounted for only 15 percent of the total number of waterfowl counted annually on the reservoir.

Most waterfowl on the reservoir were associated with bays and inlets and were usually found near the shoreline. The highest use areas on the reservoir included Marry's Bay, Indian Creek, Canyon Creek, Little Bay, Freeman Creek, the mouth of Elk Creek, the Dent Acres area, Cranberry Creek, Reed's Creek, Magnus Bay, and the mouth of Breakfast Creek. Large groups were noticeably absent on the reservoir except during the spring migration period when large flocks of American wigeon, northern shovelers, pintails, and whistling swans were occasionally observed.

Mallards, northern shovelers, American wigeon, and common mergansers were documented nesting and brooding young along the lower Clearwater River. Mallards, common mergansers, and wood ducks were observed nesting and brooding young along Dworshak Reservoir.

*****

The annual drawdown exposes mud banks on the reservoir and provides a source of forage for geese and dabbling ducks. Seeding areas of exposed mud banks could be beneficial for migrating waterfowl. Inundation of nesting attempts on the mud banks is expected to occur as the pool is filled each spring.

A summary of the waterfowl use at Dworshak for the period November 1976 through October 1977 is presented in Table 17.

Terrestrial Furbearers.

Six terrestrial furbearers were documented along Dworshak Reservoir: the striped skunk, shorttail weasel, coyote, bobcat, raccoon, and badger.

Data obtained from scent stations and a furbearer harvest questionnaire were used to indicate the relative abundance of terrestrial furbearers along the reservoir. From a total of 202 scent station nights, 2 bobcat visits, 3 striped skunk visits, 2 raccoon visits, and 3 white-tailed deer visits were recorded. Results of the furbearer harvest questionnaire indicated the following minimum totals of terrestrial furbearers taken by trappers from 1972 to 1976: 32 coyotes, 13 bobcats, 11 raccoons, 8 weasels, 4 striped skunks, and 1 badger. Two shorttail weasels were caught in live traps in grand fir vegetation types during the study.

Aquatic Furbearers.

Species included in this group were the beaver, muskrat, mink, and river otter. All species were documented along the lower Clearwater River, along Dworshak Reservoir all were noted except the muskrat. Scent stations along both study segments failed to attract any aquatic furbearers. The occurrence of aquatic furbearers was documented from the furbearer harvest questionnaire, shoreline searches for sign, and supplemental observations.

Fourteen beaver observations were made along Dworshak Reservoir, with 86 percent below RM 25.6 and 64 percent between the months of October and April. The large annual drawdown may have eliminated all beaver production from the entire pool area. Our beaver observations indicate a movement of a few individuals from tributaries into the pool area during the winter months, these individuals are at an extreme disadvantage for survival due to the fact their only food source exists above the high water line. From the furbearer harvest questionnaire, a total of 53 beaver were reported taken from 1972 to 1976; most beaver trapping took place in the headwaters of tributaries. We recommend a follow-up intensive study of the beaver situation on and adjacent to the reservoir.

Only 5 mink observations were made along the reservoir; however, these observations indicated that mink are distri-

Table I7. Waterfowl survey summary for Dworshak Reservoir, November 1976-October 1977

Species	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Common loon	1					2	21				1	4
Horned grebe	12	7	10	6	8	1	3		1		2	9
Eared grebe							1				1	
Western grebe							1	8	6	12	2	3
Red-necked grebe								2				
Pie-billed grebe												
Great blue heron	8	5	10	6	6	2	2	1	3	2	16	9
American bittern												
Whistling swan					362		1					
Canada goose					1		45	5	3			3
Snow goose							2					
Ross' goose												
Mallard	5	263		2	10	230	9	44	16	22		
Gadwall												
Pintail						10	8	4				
Green-winged teal	3					51	5			18		2
Blue-winged teal		2					6			5		
Cinnamon teal						2	1					
American wigeon				2	12	58	6	3	6			
Northern shoveler						8	14					
Wood duck						1	2	5	4			
Redhead												
Ring-necked duck							6					
Canvasback												
Unidentified scaup						2						
Greater scaup												
Lesser scaup												
Goldeneye		53	44	48	3							
Common goldeneye	36											
Barrow's goldeneye												
Bufflehead	5	9	2			6	3					
Harlequin duck						2						
Ruddy duck							20					
Hooded merganser		13	8	19	12	1					2	
Common merganser	27	105	83	66	74	53	59	17	83	34	25	33
Red-breasted merganser												
American coot						7	1			14		
Domestic goose												
Surf scoter												
White-winged scoter												10
Unidentified ducks	5	9									3	1
Monthly total	102	466	157	149	488	436	216	89	122	108	60	75

Source: Maske, T. A. No date. Dworshak big game studies, Idaho. Summary report concerning period July 1969 - June 1977 prepared by Idaho Department of Fish and Game for the U. S. Army Corps of Engineers, Contract DACW68-78-C-0029.

buted from one end of the pool to the other. A total of 21 mink were reported taken by trappers from 1972 to 1976.

Seventeen river otter observations were made along the reservoir with 71 percent occurring above RM 25.5. During the winter period, otter and/or sign were regularly observed at the edge of the ice sheet. Observations of family groups of otter indicate successful reproduction is taking place along the reservoir.

Impacts to mink and river otter are most likely to occur from the flooding of den sites as the reservoir is filled each spring. Denning requirements of mink and otter along the reservoir are unknown. We strongly recommend an intensive study on the otter and mink along Dworshak Reservoir.

The UI surveys also documented the use of project lands by birds of prey and other birds as well as small mammals, bats, amphibians, and reptiles. As these animal groups were not addressed in the pre-construction or post-construction wildlife mitigation reports, these data will not be repeated in this report. Individuals interested in these wildlife groups should refer to the subject report (67).

Operation of the Dworshak project has resulted in relatively minor changes to the vegetative communities on the Clearwater River downstream from the dam. These impacts were also described in the UI report, (op.cit.):

From these observations it is apparent that the lower Clearwater River is receiving impacts from two sources--the annual flood control operation and the power peaking operation.

*****

With the operation of Dworshak Dam, the flow and resultant impact of the spring runoff has been decreased. In future years black cottonwood could possibly becomeestablished in areas now dominated only by coyote willow. Coyote willow may also be favored under these conditions even though it is capable of withstanding more severe flooding. General observations between the years of 1976 and 1977 indicated better development of coyote willow on some gravel bars in 1977 than

1976. However, river flow of 1977 was lower than normal due to the unusually dry 1976-77 winter.

Even though some preliminary assessments indicate possible beneficial impacts due to altered river flows, some negative impacts could also be occurring. The annual high spring runoffs prior to operation of the dam were capable of scouring sand and cobble bars and creating new seedbeds for seedling establishment.

*****

Perhaps the altered flows in the lower Clearwater River will favor already established black cottonwoods but be detrimental to providing seedbed preparation for new establishment. This effect could also apply to many other species besides cottonwoods.

*****

Under present power peaking operations, daily changes in water levels do not cause complete inundation or exposure of most riparian communities. The 1 to 3 foot fluctuations affect only portions of a community, depending on the general water level of the river. During low flows in the summer months, power peaking operations do not affect most riparian plant communities because water levels are below them.

*****

The edges of sloughs, ponds, and more protected eddy areas along the lower Clearwater River generally support the best woody riparian vegetation. Power peaking will have more severe effects on riparian vegetation if or when the 3 additional power generating units are installed at Dworshak Dam. Exact effects of power peaking on riparian vegetation cannot be predicted without special studies.

*****

We did not notice extensive shoreline erosion along the lower Clearwater River. This is probably a result of extensive rock rip-rap areas, cobble banks, and the small amount of shoreline area in sand or mineral soil. Almost all bank erosion noted during the project was associated with the major islands and was a result of the normal high spring runoffs. Lowered spring runoffs due to dam operation could be beneficial in controlling future bank erosion on the islands.

Some islands or gravel bars normally flooded with spring runoff may now have portions which remain dry in most years. These islands will become more fully vegetated and provide future nesting sites for Canada geese and other waterfowl.

The authors of the UI report discussed possible impacts of the altered river flow on wildlife communities associated with the riparian habitat. Each of the major wildlife groups were treated and the essence of each discussion is reproduced below, viz:

Big Game

Documented big game use of riparian habitats and islands along the lower Clearwater River was extremely light. Deer sign was noted on only one occasion on one island, and use of riparian habitats was noted in only 3 places. Direct impacts of water level fluctuations on big game along the lower Clearwater River are expected to be almost nonexistent. The indirect effects of water fluctuations on future development of riparian vegetation will to some degree affect future big game use of riparian habitats.

*****

Upland Game

All species of upland game utilize riparian habitats along the lower Clearwater River for nesting, brooding, roosting, and foraging. Seasonal buffering of the flows in the lower Clearwater River could be a beneficial effect on upland game. Lower spring flows could result in less inundation of nesting attempts in the floodplain. Power peaking operations will partially inundate riparian habitats daily, displacing coveys or individuals. This impact would be greatest during spring and early summer during brooding of young birds. Current power peaking fluctuations are not high enough to completely inundate total riparian habitats, therefore birds are not forced to leave riparian areas. Insects are an important food item for young chicks of all upland game birds; the effects of power peaking on the availability of insect fauna is unknown.

*****

Waterfowl

The buffering of the seasonal runoff will be beneficial for

the resident Canada goose population. Some gravel bars or low islands traditionally inundated with high spring flows should be used for nesting in future years, provided that the river flow in the spring does not get so low that land bridges from islands to mainland would be formed. Lower Turkey Island at RM 13.6 and Snell Island at RM 37.7 are possibilities for future nesting. The buffered spring flows could also be of benefit for geese nesting in floodplain areas. Over 14 percent of the goose nests located during the study were in floodplains and 58 percent were within 10 m of the high water line. None of the nests located in the floodplains were lost to high water during the study.

There is also potential for serious impacts under the above conditions. If significant portions of the goose population begin nesting in floodplains, high water flows from an unusual year could destroy a significant portion of the nesting attempts.

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Power peaking could have serious impacts on foraging areas for early Canada geese broods. Emergent lands immediately adjacent to the water's edge were the early brooding areas. The effects of power peaking on the insect fauna, forbs, and grasses in the emergent zone are unknown.

Only limited duck nesting was documented in the lower Clearwater River; however, the same factors affecting Canada geese nesting and brooding apply to ducks.

Most waterfowl use in the lower Clearwater River is during the fall, winter, and spring months. Waterfowl utilize the numerous gravel bars and coyote willow habitats for resting areas and some limited foraging. Power peaking operations, together with changes in overall river flows, are capable of inundating the gravel bars for periods of time. This would displace waterfowl, making resting periods shorter or forcing them to seek other perhaps less secure, resting areas. The long-term impact of fluctuating water levels on the coyote willow habitats will also affect future use of many areas by waterfowl.

Canada geese and many species of ducks were observed utilizing aquatic plants many times. The effect of fluctuations on the development and abundance of these plants is not known.

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Terrestrial Furbearers

Species of terrestrial furbearers associated with riparian habitats during the study included the striped skunk (and possibly the spotted skunk), and raccoon. The other terrestrial furbearers were found more in upland habitats. We did not find any denning in riparian habitats for any of the terrestrial furbearers; however, we suspect that skunk and raccoon dens are present within the riparian habitats. The buffered spring runoff could be very beneficial in protecting some dens from flooding. The buffered spring flows could be beneficial for prey populations within riparian habitats, thus being beneficial for the carnivorous furbearers and birds of prey also. On the other hand, power peaking operations could be detrimental to some prey populations in the emergent zone. Power peaking could also be beneficial by stranding prey species, making them more available to the furbearers during the short run, but detrimental to furbearers in the long run due to loss of some prey base.

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Aquatic Furbearers

All species of aquatic furbearers use riparian habitats along the lower Clearwater River for denning, foraging, resting, and as travel lanes. The buffered spring runoff could be very beneficial to all species by protecting some denning sites from flooding. Detrimental impacts would occur whenever water levels are high enough to flood denning areas or whenever they are low enough to expose entrances to terrestrial predators. Denning for all species of furbearers ranges over a broad period of time from mid-February to July; therefore, fluctuating water level problems are complex.

The power peaking operations are not severe enough to cause complete inundation of riparian habitats; therefore, aquatic furbearers would not be forced to leave riparian areas. Frequent fluctuations would affect the availability of prey for mink and river otter--some prey could be less available while some could become more available due to stranding. At this time it is unknown what effect fluctuating water levels will have on forage sources for beaver and muskrat.

Wildlife Resources -- Evaluation of Planning Input

The potential for adversely influencing big game animals could scarcely have been greater than was envisioned for the Dworshak project. Winter conditions at higher elevations of the North Fork Clearwater drainage force elk, mule deer, and white-tailed deer to lower elevations where food supplies are not buried by winter snows. Thus, the Dworshak project-associated loss of 6,071 ha (15,000 ac) of low elevation winter range, resulting from the permanent inundation of 85 km (53 mi) of river bottom habitat to an elevation of 487.7 m (1,600 ft) msl, was expected to create serious losses to both elk and deer populations within the North Fork Clearwater drainage.

Efforts to alleviate these anticipated wildlife damages has involved a highly complex and intricate series of multi-agency actions involving four federal and two state bureaucracies, several private landowners, including a large timber company, federal, state and local political delegations and the general public. Acquisition and management of replacement habitat for the inundated winter range for elk has clearly dominated the mitigation effort. Rocky Mountain elk were considered of significantly greater value economically and socially than the other wildlife groups; thus, a commensurately greater share of the mitigation efforts were directed at saving this particular resource. Table 18 presents a chronological summary of the major actions between 1953 and 1979 that dealt with mitigating Dworshak project impacts to wildlife.

Project-related influences on wildlife have not been resolved with the

Table 18. -- Chronological narrative summary of mitigation efforts for elk at Dworshak Reservoir project

Year	Action prompted by	Action
1953	FWS	Stated that if the project was constructed: "little or no restitution could be provided---".
1958	IDFG	Recommended "purchase winter range comparable in amount to those inundated at maximum pool elevation" [approximately 4,452 ha (11,000 ac)].
1960	FWS	Recommended fee acquisition of 9,713 ha (24,000 ac) for winter range development and management.
1961	CE	Recommended acquisition and management of 4,856 ha (12,000 ac) of project lands plus "an additional 4,856 ha (12,000 ac) of the most suitable land available."
1962	CE	Altera project design to increase reservoir surface area by 52 percent.
1962	FWS	Recommended fee acquisition of 10,522 ha (26,000 ac) for winter range development and management.
1962	Congress	Conferee's report for legislation which authorized construction stated: "the Secretary of the Army shall adopt appropriate measures to insure the preservation and propagation of fish and wildlife affected by this project."
1963	IDFG	Recommended management for elk of 20,559 ha (50,800 ac) Heezen Block; including 14,043 ha (34,700 ac) of state land (ILB), 5,423 ha (13,400 ac) of private land (primarily PFI) and 1,093 ha (2,700 ac) of federal land.
1963	CE	Requested more specific information regarding 1963 proposal.
1964	FWS/IDFG	Recommended fee acquisition of 1,059 ha (2,616 ac) of private land, and wildlife management agreements on about 3,885 ha (9,600 ac) of private land (PFI). Fee acquisition of the 3,885 ha (9,600 ac) was recommended if management agreements not acquired. All lands in question were located within Heezen Block. Proposal assumed management agreements between two state agencies for an additional 14,043 ha (34,700 ac) of ILB lands.
1964	PFI	Company opposed management agreements, preferring fee acquisition of the 3,885 ha (9,600 ac).
1964	CE	Rejects acquisition of 4,944 ha (12,216 ac), i.e., 3,885 ha (9,600 ac) plus 1,059 ha (2,616 ac).
1964	CE	Stressed management agreements between ILB and IDFG on ILB lands in Heezen Block.
1965	ILB/IDFG	Sign management agreements for ILB lands within Heezen Block.
1965	PFI	Reverses stand and agrees to management agreement for 9,600 acres.
1965	CE	Suggests perpetual easement instead of management agreement for PFI lands.
1966	FWS/IDFG/CE	By mutual agreement abandoned easement idea and decided to acquire necessary lands in fee.
1966	FWS/IDFG	Abandoned 1964 proposal and recommended instead fee acquisition of 2,851 ha (7,045 ac) including 834 ha (2,060 ac) on Gobbler's Knob.
1966	CE	Removed 834 ha (2,060 ac) area on Gobbler's Knob from fee acquisition considerations.
1966	IDFG	Opposed CE's unilateral decision to eliminate Gobbler's Knob acreage from acquisition plans.

Table 18. -- (Continued)

Year	Action prompted by	Action
1967	CE	Received authorization to acquire ("hard core") 2,024 ha (5,000 ac) located at junction of Little North Fork and North Fork Clearwater Rivers (principally owned by PFI). Asked for additional justification if acquisition of Gobbler's Knob still believed necessary.
1967	ILB	Awarded leases for open pit mining of kyanite clay on Smith Ridge land which was the most important elk winter range within the ILB lands covered by the ILB/IDFG management agreement.
1967	FWS/IDFG	Provided additional justification for fee acquisition of Gobbler's Knob lands.
1967	PFI	Initiated intense political pressure to prevent fee acquisition of the 2,851 ha (7,045 ac) of mitigation lands ("hard core" plus Gobbler's Knob lands).
1967	Idaho Governor	Gov. Samuelson urged IDFG to accept management agreement on PFI lands in lieu of fee acquisition.
1967	CE	Asked FWS/IDFG to prepare another report justifying fee acquisition of the requested 2,851 ha (7,045 ac) for elk mitigation.
1967	Idaho Senator	Senator Jordon strongly opposed acquisition of lands at Dworshak for wildlife mitigation.
1967	FWS/IDFG	Decided to accept management agreement for lands on Gobbler's Knob. Management agreement signed October 27, 1967.
1968	FWS/IDFG	Recommended fee acquisition of 1,963 ha (4,850 ac) at junction of Little North Fork and North Fork Clearwater Rivers ("hard core"). Referenced existing 1,275 ha (3,150 ac) of private lands under management agreement (PFI) and 15,379 ha (38,000 ac) of State lands under management agreement (ILB).
1968	IDFG	Notified PFI that they would not agree to management agreement on "hard core" lands, requiring instead fee acquisition.
1968	Idaho Governor	Governor Samuelson reaffirmed opposition to fee acquisition of "hard core" lands.
1969	ILB	Suggested that CE acquire "hard core" lands via exchange between private owner and BIM.
1970	CE/FWS	Released CE's Public Use Plan which contained FWS data which projected that under appropriate management, the "hard core" (after fee acquisition), project lands, and agreement lands together, could support 915 elk, 137 deer, and 4,789 grouse.
1970	Idaho Senators	Senators Church and Jordan asked the Secretary of Interior to expedite land exchange for "hard core."
1971	FWS/IDFG	Proposed fee acquisition of lands on south slopes of Smith Ridge; existing management agreement of ILB lands were claimed to be ineffectual, thus necessitating this additional acquisition.
1971	IDFG	Sought authorization to manage 1,619 ha (4,000 ac) of Smith Ridge for elk rather than timber production; request rejected by ILB.
1971	CE	Closed Dworshak Dam and began to inundate Dworshak River.
1972	FWS	Requested CE assistance in acquiring 1,619 ha (4,000 ac) on Smith Ridge for elk management; CE, in turn, asked for detailed justification for acquisition proposal.
1972	IDFG	Officials sought and held meeting with Senator Church to discuss acquisition of Smith Ridge lands. Senator Church also sought detailed justification.

Table 18. -- (Continued)

Year	Action prompted by	Action
1972	FWS/IDFG	Released report detailing need for fee acquisition of 1,821 ha (4,500 ac) of Smith Ridge which would, if properly managed, support 270 additional elk, thereby effectively replacing previously anticipated mitigatory influence of ILB lands.
1972	ILB	Informed CE that timberlands of equal value would have to be offered in exchange in order to obtain Smith Ridge lands for elk management.
1972	CE	Contacted BLM regarding possibility of exchanging BLM land for Smith Ridge.
1972	CE	Prepared an internal staff report based on forage production needs for 915 elk, which supported need for 1,821 ha (4,500 ac) area on Smith Ridge.
1973	FWS	Prepared special analysis of project at request of GAO, computed new elk loss figure of 420 animals; report concluded that even with intensive elk management, none of the current or past mitigation plans, including management of the entire Heezen Block, would completely compensate for the loss of 420 elk.
1974	Under Secretary of Interior	Approved exchange of BLM lands for state lands on Smith Ridge.
1975	ILB	Denied, and then, reversing their position, accepted for consideration, a CE proposal to exchange BLM lands for Smith Ridge lands.
1977	BLM	District office evaluated winter range value of "hard core" lands, recently acquired by BLM via land exchange. Concluded that only northeast third suitable for such use and recommended withdrawal of only that portion for mitigation purposes.
1978	BLM	State office published EAR on "hard core" withdrawal, and recognizing political pressures to do so, recommended withdrawal of entire acreage.
1978	Secretary of Interior	Approved withdrawal of entire "hard core."
1978	ILB	Selected USFS lands referred to as the "Charlie Creek" block for exchange for the Smith Ridge lands.
1978	USFS	Rejected ILB's proposal to exchange "Charlie Creek" lands for Smith Ridge lands.
1979	Senator Church	Introduced federal legislation mandating exchange of "Charlie Creek" lands for Smith Ridge lands.

FWS -- U.S. Fish and Wildlife Service

IDFG -- Idaho Department of Fish and Game

CE -- U.S. Army Corps of Engineers

USFS -- U.S. Forest Service

PFI -- Potlatch Forest Industries

ILB -- Idaho Land Board/Idaho Department of Lands

BLM -- U.S. Bureau of Land Management

same degree of professional responsibility as other project features. This generalization may seem contrary to the voluminous files that have accumulated; files that readily testify to the serious efforts which have been made to obtain some level of treatment of the adverse impacts to elk. However, on-the-ground corrective treatments of project-created wildlife damages have only recently begun, while most other project features are well established and in full operational modes.

Early recommendations from the conservation agencies dealing with mitigation lands were provided in general terms. Generalized geographical locations of preferred habitat acquisitions were provided in both the 1960 and 1962 FWS reports. However the early (1962) FWS recommendations were seemingly adopted by the action agency. The CE's 1961 general design memorandum included plans to acquire 4,856 ha (12,000 ac) "of the most suitable lands available" specifically to provide additional wintering elk habitat. Acquisition of this additional acreage was recommended by the CE with the understanding that it would complement a similar acreage of project lands which were also to be managed as elk habitat. House and Senate conferees included a special statement in their report to the effect that their intention in authorizing construction of the project was that fish and wildlife resources would be preserved. These documents seemed to reflect early, basic agreement on the part of the action agency, the conservation groups and Congress with regard to resolving the mitigation requirements for the project. That was in 1962.

A review of present conditions reflects that a more specifically delin-

eated, but in scope quite similar acquisitional/management regime, is once again being considered a suitable elk mitigation package by most of the agencies involved. Between the 1962 and 1980 periods of seemingly more harmonious accord regarding habitat requirements for elk mitigation, the road was convoluted and torturous for all agencies involved.

Within a year of the project's authorization in 1962, a modified mitigation concept (departing from the 1960 recommendation for fee acquisition and management of 9,713 ha [24,000 ac]) was birthed by the conservation agencies. The new request for mitigation lands specified fee acquisition of only a small area of 1,059 ha (2,616 ac). This greatly reduced fee acquisition recommendation was combined with the proposal that all remaining habitat needs for elk mitigation could be obtained via management agreements between the IDFG and private and governmental land owners. The leadership role played by the conservation agencies with regard to the management agreement concept (a concept which has proven singularly unsuccessful), in lieu of fee acquisition, no doubt influenced the action agency to assume a similar posture. The CE later prevailed upon the conservation agencies to rely almost exclusively upon management agreements between state agencies to provide the replacement elk winter browse.

Not until 1966, four years after project authorization, did the major agencies again unanimously concur that fee acquisition of at least some acreage was indeed required, by condemnation if necessary. By that time, additional land acquisition, especially for purposes believed to

be peripheral to prime project purposes, was politically untenable. In truth, throughout the process, biology has played an important but not dominant role in the mitigation process at Dworshak; that distinction has been firmly held by politics. Had not the top-level political delegation from Idaho (including Governor and U. S. Senator) opposed acquisition of necessary replacement winter range during the 1960s, adequate mitigation lands might have been acquired by this time.

The political pressures which were brought to bear served to focus further land acquisition efforts on an exchange of existing federal land for the desired privately owned "hard-core" lands. The "hard-core" lands were located at the junction of the Little North Fork Clearwater River and the North Fork Clearwater River. This "hard-core" was not selected by wildlife biologists on the basis of technical merit with regard to its value as winter habitat for elk. Rather, the tract (actually three physically separate acreages) was the residue of the negotiation process of over 10 years.

Results of the management agreements between the IDFG and the ILB were, as indicated, wholely unsatisfactory to the IDFG. The ILB operates under a constitutional mandate to maximize revenues from the lands under their control. Thus, timbering and other revenue-generating uses receive top priority. Timber clearing followed by maintenance of disclimax vegetation for elk browse proved not to be sufficiently compatible with maximized timber production. To alleviate this conflict, the ILB requested regular payments for lands used (controlled burning) for

browse production. The potential conflicts between administrative control by one agency and use under management agreement by another agency was accentuated when the ILB awarded surface mining leases on prime winter range habitat on Smith Ridge, which was a part of the management agreement lands.

Thus in 1972, the year the lake filled, the conservation agencies responded to the failure of the management agreements by submitting a major request for lands considered vital to the preservation of the impacted elk population (located on Smith Ridge). It is ironic to note that the same lands were recommended for fee acquisition by the FWS in their original detailed report of 1960.

Deferral of land acquisition for wildlife purposes, as a distinct action separate and apart from the land acquisitional requirements of other project purposes, has unquestionably hampered the mitigation process at Dworshak.

Some 2,072 ha (5,120 ac) of habitat have been acquired specifically for winter browse development and management at the Dworshak project. This represents 34 percent of the terrestrial habitat inundated by the project. It would be necessary to increase the carrying capacity for wildlife by fourfold on these lands to mitigate the losses suffered via inundation. The FWS's February, 1968, report (22) indicated that through management, carrying capacity of the "hard-core" could be increased nearly fourfold. Management plans for Dworshak lands indicate the preferred development for maximizing winter carrying capacity involves creation of

60 percent feeding habitat and 40 percent cover, i.e., remaining forested. The 60-40 ratio is the development goal generally recommended by big game biologists. However, those aspects with minimal snow accumulations are most suitable for browse development (primarily southern exposures).

Prior to project construction, white-tailed deer wintered along the North Fork Clearwater River at lower elevations, in areas essentially segregated from the wintering area used by elk and mule deer. Project-associated loss of white-tailed deer was predicted to run as high as 2,900 animals or 28 percent of the preproject population. The North Fork Clearwater River white-tailed deer herds supported a harvest of 1,250 animals in some 9,350 man-days of hunting. This harvest was approximately 40 percent as high as the elk harvest, but hunting effort for deer was estimated at only 10 percent of the effort expended by elk hunters in the same area.

Apparently in response to the greater perceived value of elk, the conservation agencies emphasized replacement of the inundated winter range for both deer and elk, a total of 6,071 ha (15,000 ac), with winter browse development in areas primarily beneficial to elk. This approach incidentally accommodated mule deer but essentially ignored white-tailed deer.

Actually, according to the FWS's 1962 planning report (11), of the 6,071 ha (15,000 ac) of deer and elk winter range that was flooded by the Dworshak project, less than 8 percent was classified by the FWS as the type of brush habitat which is essentially the habitat of value to

overwintering elk.

The conservation agencies recommended development and management of an unspecified number of plots on incidental project lands at essentially unspecified locations (below 2,500 ft elevation) for replacement of an undetermined portion of the lost white-tailed deer habitat.

Wildlife communities within the project site included several species other than elk and deer. The conservation agencies did not anticipate significantly adverse impacts to any of these resources except fur animals, ruffed grouse and, to a lesser extent, blue grouse.

Although no recommended action was presented for fur bearers, the small tracts of cleared lands recommended for white-tailed deer on the lower reaches of the project were expected to benefit grouse as well. As presented in preceding discussion, the conservation agencies plainly elected to emphasize replacement and management of the elk population and did not stress replacement "in kind" for the whole range of wildlife populations impacted by the Dworshak project.

If the latest (1973) FWS projection for elk loss attributable to the project is correct, perhaps as few as 420 elk relied on the habitat within the immediate project area for winter forage prior to project construction.

Current management strategies adopted by all agencies insist that the potential increase in carrying capacity under intensive development and management on the 2,024 ha (5,000 ac) of "hard-core", 809 ha (2,000 ac)

of project lands (subject to "effective" management), and 1,821 ha (4,500 ac) on Smith Ridge, is 915 elk. The estimate of 915 elk was independently computed by the FWS in 1972, based upon estimated carrying capacity, and by CE biologists in 1973, based on forage requirements and production potential. As indicated, 915 elk is the currently targeted carrying capacity for ongoing habitat development efforts.

Conflicting estimates of elk carrying capacity potential under optimum management conditions, leave some doubt as to whether proper management of the available habitat (assuming eventual Smith Ridge management) would leave the elk population within the impact zone in a depressed or enhanced condition compared to pre-project conditions.

One thing is clear, it is quite apparent that elk losses at the current time, some nine winters after lake flooding, have not been nearly as severe as the potential losses which were envisioned by the conservation agencies prior to project construction. This hopeful tone must be tempered with the realization that a truly critical winter may not yet have occurred, although the winter of 1974-75 was apparently quite severe. Predicted elk carrying capacity losses were variably estimated by the FWS at 2,700 animals (1962-1972) and 420 in 1973. Actual direct losses associated with the reservoir had been estimated by IDFG biologists at perhaps as few as ten animals up to 1975.

Other expected adversities have failed to materialize. The reservoir was expected to create major impediments to big game utilization of remaining range by blocking traditional migration routes. Radio-tracking

studies conducted after the reservoir was impounded have documented that elk and white-tailed deer frequently cross the reservoir. No major crossing problems were noted by IDFG studies.

Contrary to long held beliefs, the Smith Ridge area has now been shown to attract more elk during the spring calving season than during the winter periods. Maximum winter use has averaged between 100 and 150 elk for the past five winters. This use is increasing, however.

Also, the intensive studies conducted by the IDFG have documented that winter use of the Smith Ridge "hard-core" lands are essentially from the Little North Fork Clearwater basin elk herd and not, as previously suspected, from elk herds resident to the higher elevations of the North Fork Clearwater drainage.

Contrary to the pre-authorization reports from the FWS which predicted continuing expansion of the North Fork Clearwater basin elk herd over the life of the project, the herds have continuously declined throughout the state of Idaho. In fact, the statewide decline in elk harvest has exceeded the decline experienced within the project impact area.

Thus it seems most of the impact projections for elk were proven faulty by subsequent findings.

Contrary to the observed post-impoundment conditions for elk, winter range was indeed a limiting factor for white-tailed deer. The dramatic losses expected for white-tailed deer proved to be a prophetically significant loss in direct proportion to the extent of winter range inun-

dated by the project. Although baseline inventory data were not available prior to project construction, nor are such data available currently, knowledgeable biologists estimate from browse studies and other indices of abundance that the impacted white-tailed deer herd was reduced by approximately 40 percent, or a loss of 1,000 animals as a result of the construction of the Dworshak project. If true, the loss has been approximately one third of the anticipated loss of 2,900 animals as predicted in the FWS's 1962 report.

To mitigate as much of this loss as possible, the IDFG recognize the value of deer winter range development on the narrow band of project lands surrounding the lower portion of the project. Such development is strongly supported by the IDFG and the FWS. However, winter range development for deer is in direct conflict with current project zoning which has dedicated all significant tracts of land in the lower portions of the project to present, or future intensive use recreation areas.

Elk mitigation has been such a complex problem with such high priority that little time or attention has been given to the needs of other species. It seems probable that species of lesser economic significance will become more important from a mitigation point-of-view as the losses to major species are successfully mitigated.

The only fish and wildlife-related planning report which addressed the probable effects which the Dworshak project would have on such wildlife groups as upland game, waterfowl, and fur-bearers was the 1962 FWS report (11).

Black bear, mountain goats, and moose were not expected to suffer significantly as a result of the project. As indicated by the UI study, black bear continue to be common along the reservoir with the highest numbers observed shortly after the hibernation period. There is no indication that moose and mountain goats, neither commonly occurring in the project area, were harmed by the project.

Significant losses of ruffed grouse were expected, but the losses in terms of habitat or populations were never identified. The UI study indicated average ruffed grouse densities within the range of 0.27 to 0.5 birds/ha within the coniferous vegetation types. Considering that 5,423 ha (13,400 ac) of timber lands were inundated by the project, perhaps as many as 1,500 to 2,700 ruffed grouse were displaced and lost as a result of project construction. This assumes that ruffed grouse populations were of similar density prior to project construction.

No quantitative data exist relating to upland game or furbearer hunting at Dworshak. Therefore, accuracy of the pre-construction projection of 5,000 man days of grouse hunting cannot be evaluated. As expected, waterfowl use of the project has not been high and nesting is minimal. No projections were provided for furbearer harvest in the pre-construction documents.

FISHERY RESULTS AND DISCUSSION

Fishery Resources -- Plan Formulation History

Although not as complex as the effort to mitigate big game, the potential loss of both resident and anadromous fisheries of major consequence stimulated a major mitigative planning effort at the Dworshak project.

An early appraisal (1953) of the potential adverse impacts contained the following historical notation (3), viz:

> The Clearwater River and tributaries presently support populations of resident trout, steelhead trout, and a few chinook salmon. The construction of Lewiston Dam near the mouth of the river about 1928 seriously impeded the migration of anadromous fish and greatly reduced their abundance. Prior to the construction of that dam, the river supported large runs of salmon and steelhead trout, but due to the inadequate fish-passage facilities incorporated in the structure, the salmon runs have been virtually exterminated. Steelhead trout, however, have been able to negotiate Lewiston Dam to a much better degree than the salmon; recent escapements of this species have ranged from 3,600 to over 11,000. It is estimated that the commercial and sport catch of steelhead produced from the spawning in the Clearwater River system amounts to approximately 150,000 pounds annually. Thus the Clearwater River and its tributaries are still important producers of steelhead trout, and the watershed has a very high potential for the production of both steelhead trout and salmon.

The early discussions between the conservation agencies and the lead planning agency addressed the possibility of passing the anadromous steelhead runs over the Dworshak dam. Originally the dam was expected to raise 175.6 m (576 ft) above the river bed. This constituted a significant obstacle to fish passage and the 1953 report on fish and wildlife sought a delay in authorization of the Dworshak (Bruces Eddy)

project, on the basis that insufficient data were available to engineer the preservation of the fishing resources, viz:

> In conclusion, the Fish and Wildlife Service is of the opinion that the ill effects to both fish and wildlife resulting from the construction of Bruces Eddy and Penny Cliffs Dams are of sufficient magnitude to warrant a delay in the authorization and construction of these projects. Such a delay would allow time for the Fisheries Research Engineering Program, sponsored by the Corps of Engineers and now in progress, to produce answers to the problems of better fish passage at dams-----.

The potential elimination of the valuable North Fork Clearwater River steelhead fishery received considerable attention during Congressional hearings relating to authorization of the Dworshak project. The political pressures (orchestrated primarily by Idaho Senator Dworshak) to push authorization of the project through Congress were examined in great detail in the preceeding section dealing with the terrestrial wildlife resources.

Only brief characteristic segments of this testimony will be presented below to describe the basic nature of the opinions held by the affected agencies during the authorization period. According to the Congressional Record, the following testimony was provided before the Senate in 1956 (4).

Senator Neuberger (OR), who led the opposition to the Dworshak and Penny Cliffs projects submitted the following statement from the IDFG, viz:

> The program of dam construction, as proposed by the Corps of Engineers for the Clearwater River drainage, would most certainly block and annihilate all runs of salmon and steelhead above the point of construction. In fact, it might well be

> that the salmon and steelhead will be almost completely annihilated from the entire Clearwater River drainage, since there is only a very small portion of the river below the proposed dam sites that is suitable for spawning purposes.

Major General Itschner, the Assistant Chief of Engineers for Civil Works entered the following data into the hearing record.

> Former runs of salmon in the Clearwater River have been largely blocked since 1927 by the Washington Water Power dam near the mouth of the river at Lewiston. Fishways installed in the dam at the time of its construction operated satisfactorily during periods when water was being passed through the spillway, but were not effective when water was diverted through the powerhouse. Recent attempts by the State of Idaho to restore the runs have met with very little success. An average of only 26 salmon have passed over the dam each year between 1950-53, and observations during 1954 indicated no salmon passing the dam. The river sustains a relatively small run of steelhead trout amounting to approximately 8,000 fish annually during 1950-55. While no specific estimates are available, it is apparent that only a minor portion (probably less than 25 percent) of these fish pass the Bruces Eddy dam site.

As Congress continued to consider the merits of the Dworshak project, studies were continuing by the IDFG and the FWS's two Bureaus in cooperation with the CE. The purposes of the studies were to quantify resident and migratory fishery resources threatened by the project, and to develop mitigation techniques should the project be authorized and constructed. Funding of these studies was actively sought by the Director, IDFG, (68) viz:

> The United States Congress has made available to the Army Corps of Engineers approximately one and a half-million dollars during the past two years for engineering studies leading to the construction of Bruces Eddy Dam (Dworshak Dam). The Fish and Wildlife Agencies have unanimously opposed this [illegible] I am sure that this position has not changed since the early proposals were made for this construction program. Since however, money is being made available annually for investigations and construction planning, atten-

> tion must be given to ways and means to secure funds which might be used to discover methods or procedures which would save as much of the Fish and Wildlife resources as possible.
>
> Unless some studies of this nature are initiated in the very near future, we will again be faced with the problem of attempting to find answers to mitigate losses while construction is under way. We should presently be engaged in attempts to find the peak of downstream migrations of steelhead trout. Possibly an experimental pilot hatchery should be established to determine the feasibility of perpetuating the steelhead which migrate this far into the interior. We have been advised that certain sums of money have been set aside for such studies. If this is true, research programs should be initiated immediately. If money is not available, procedures should be examined to determine the possibility of securing money for these purposes.

Studies were funded and the effort culminated in the FWS's 1960 planning report (6). It should be remembered that the 1960 report was based upon engineering data which was altered by the lead agency soon after its release.

The conservation agencies opposed construction of the Dworshak (Bruces Eddy) project in their appraisal report of 1960. In opposing the project, the FWS summarized its opposition with regard to the affected fisheries as follows:

> Fish resources of the North Fork Clearwater system include both resident and anadromous species. Resident species, principally rainbow trout and cutthroat trout, would be adversely affected in the reservoir site by replacement of excellent stream habitat by a large, fluctuating, unproductive body of water. Annual releases of large numbers of catchable-sized trout in Bruces Eddy Reservoir would be needed to maintain at best a mediocre sport fishery.
>
> It is upon anadromous fish, both steelhead trout and chinook salmon, but especially steelhead trout, that the project would have its most adverse effects. About 60 percent of the steelhead which pass Lewiston Dam on Clearwater River spawn upstream from Bruces Eddy damsite. There is enough suitable spawning habitat upstream to accommodate

109,000 steelhead trout redds and 74,000 chinook salmon redds.

The project would either inundate, isolate, or cause irreparable damage to all steelhead trout and chinook salmon spawning habitat in the North Fork Clearwater Basin. About 700,000 square yards, or 45 percent of the spawning habitat available in the North Fork drainage, would be irretrievably lost by inundation. Without fish passage facilities, an additional 830,000 yards of spawning gravel of 54 percent would be isolated upstream from the impoundment. The proposed method of log transportation would seriously damage the remaining spawning habitat downstream from the dam.

North Fork Clearwater has considerable importance for winter steelhead trout fishing. More important than the amount of fisherman utilization in the North Fork system is the large contribution this drainage makes to the steelhead sport fisheries of the Clearwater and Columbia Rivers. Steelhead fishing would be eliminated in the North Fork drainage, and the sport catch in Clearwater and Columbia Rivers would be reduced.

North Fork Clearwater Basin's significant contribution to commercial catches in the Lower Columbia River would be lost.

The report concluded by explaining the conservation agencies serious concern regarding fish passage problems at the dam, viz:

However, there are implications extremely serious to the future of the steelhead trout and chinook salmon. These fish have been provided means to continue their historic runs past a long series of dams which have been built across the Columbia and Snake Rivers. Were Bruces Eddy to be built before proved means of passing downstream migrants are available, these valuable fish runs would be jeopardized. Even with passage facilities the productivity of the North Fork system for anadromous fish would be drastically reduced.

We are opposed to the authorization of the Bruces Eddy project at this time because of the serious impact it would have on fish and wildlife resources. If the project were to be constructed we have no assurance that the runs of anadromous fish could be maintained at even present levels. If, however, the project is authorized, notwithstanding these objections, conservation and development of fish and wildlife resources should be includ-

ed as an authorized project purpose.

Six specific fishery related recommendations were provided by the FWS in the event the project was authorized by Congress. These recommendations, included features for passage of adult fish that would be expected to use the remaining spawning grounds above the reservoir, and the outward migrating juveniles, as well as hatchery facilities to replace the fish to be lost within the area of the new reservoir. The recommendations are listed below, viz:

> Fish-passage facilities to be provided at Bruces Eddy Dam, the type and design of facilities to be developed cooperatively by the Fish and Wildlife Service, the Idaho Department of Fish and Game, and the Corps of Engineers. Estimated cost of passage facilities is $15 million.
>
> The project to provide funds for construction, operation, and maintenance of artificial propagation facilities to produce anadromous fish. Estimated cost of the facilities is $2 million and annual operation and maintenance cost would be $200,000. The Fish and Wildlife Service in cooperation with the Idaho Department of Fish and Game would determine the type, location, and design of the facilities, including a pilot hatchery operation.
>
> The project to provide funds for construction, operation, and maintenance of hatchery and rearing facilities to produce 500,000 catchable-size trout annually for stocking in Bruces Eddy Reservoir and tributary streams. The Fish and Wildlife Service in cooperation with the Idaho Department of Fish and Game would determine the location and design of the hatchery. Estimated cost of the resident trout hatchery is $600,000, and annual operation and maintenance would be $90,000.
>
> The project to provide for stream improvement upstream from Bruces Eddy Reservoir at an estimated cost of $1 million.
>
> An instantaneous minimum flow of 2,000 second-feet of water, within a temperature range of 45° to 65° F., to be provided in North Fork Clearwater downstream from Bruces Eddy Dam.
>
> Outlet structures to be so designed, and located at such depths, that downstream migrating fish will not be drawn in-

to them.

A lengthy substantiating report was appended to the FWS's 1960 letter report. As was noted in the discussion of wildlife planning, this document was rewritten two years later to reflect major reservoir design changes. However, the project was authorized by Congress on the basis of the biological data contained in the FWS's 1960 report, as interpreted and presented by the CE. Therefore selected data from the report are presented herein.

The same FWS report contained a single table which summarized angling effort and harvest for resident and migratory species as well as the spawning habitat conditions for anadromous species under with-and-without project conditions. This table has been reproduced following as Table 19.

This FWS table contained a serious mathematical or typographical error in the summer fishing season/angler days data for with-the-project conditions. The total should have read 25,800 angler days with a net gain of 15,428 rather than the 5,428 shown.

The information contained in the FWS's report, along with a CE prepared report on fish facilities for the project, largely provided the basic data incorporated into the CE's General Design Memorandum (GDM) which was released in 1961 (9). The information contained in the GDM constituted to a great degree, the supporting evidence submitted to Congress by the lead agency to justify authorization of project construction.

There existed faint similarity between the descriptive prose used by the CE to describe fish and wildlife impacts compared to the descriptions

Table 19. -- Summary of estimated angler utilization, fish harvest, and spawning habitat without and with Dworshak project.

	Winter steelhead season		Summer fishing season		1959 Use by spawning	Spawning gravel available (sq.yd.)		Potential redds	
	Angler days	Fish caught	Angler days	Fish caught	steelhead (No. of fish)	Steelhead trout	Chinook salmon	Steelhead trout	Chinook salmon
Without the project									
North Fork Clearwater downstream from Dworshak Dam site	470	130	272	544	Insignificant	11,000	11,000	790	690
Dworshak reservoir site	2,670	720	2,600	12,600	500	700,000	680,000	50,000	40,000
Upstream from Dworshak Reservoir site	No fishing permitted	---	7,500	61,346	14,500	830,000	580,000	59,000	34,000
Dworshak Reservoir	----	---	----	----	----	----	----	----	----
Total	3,140	850	10,372	74,490	15,000	1,541,000	1,271,000	109,790	74,690
With the project									
North Fork Clearwater downstream from Dworshak Dam site	0	0	3,000	10,000	----	11,000	11,000	790	690
Dworshak reservoir site	0	0	0	0	----	0	0	0	0
Upstream from Dworshak reservoir site	0	0	10,000	80,000	----	0	0	0	0
Dworshak Reservoir	0	0	12,800	64,000	----	0	0	0	0
Total	0	0	15,800[2]	154,000	----	11,000	11,000	790	690
Gain or loss[1]	-3,140	-850	5,428[3]	79,510	----	-1,530,000	-1,260,000	-109,000	-74,000

1 Average annual sport an commercial catch of steelhead trout in Columbia River and Pacific Ocean would be reduced by 30,000 fish with Dworshak project

2 Error, should have shown 25,8000 instead of 15,800

3 Error, should have shown 15,428 instead of 5,428

Source: Tunnison, A. V. and D. L. McKernan. 1960. Bruces Eddy Dam and Reservoir, North Fork Clearwater River, Idaho. A report on the fish and wildlife resources. Report of the directors of the Bureau of Sport Fisheries and Wildlife and the Bureau of Commercial Fisheries. U. S. Fish and Wildlife Service, Washington, D. C. June 1960.

contained in the FWS's 1960 report. The following example was extracted from the CE's description of the anticipated with-project fish and wildlife conditions (op.cit.), viz:

> Created Fish and Wildlife Resources. - Bruces Eddy reservoir with its irregular shoreline, including deep and shallow water bays, will encompass an area of attractive fish and wildlife habitat. The area to be inundated has an irregular, undulating surface and is composed of various types of rock, gravel, and soil formations which will provide a favorable environment of fish. Excellent steelhead fishing should continue subsequent to impoundment and it is probable that trout fishing will increase. Field observations indicate that there will be abundant environment remaining on the periphery of the reservoir for the principal upland game specie, the ruffed grouse. The existing deer herd will find ample escape cover in the ravines and along the valleys of tributary streams. The elk herds and other big-game populations will be maintained and should increase with an expanded management program. It is considered that sufficient seed stock of beaver, mink, river otters, and other fur bearers exist along the present river valley to serve as a basis for population increases which are expected because of the increased lake environment to be created by Bruces Eddy reservoir. The activity of fur bearers is expected to be especially important in the tributary streams. Appropriate licenses will be issued to Federal and State fish and wildlife agencies to permit development and management of the fish and wildlife resources of the reservoir area.

Additional descriptive passages from this important pre-authorization document are provided below. The importance of the North Fork Clearwater River as spawning grounds for steelhead was upgraded compared to previous CE statements, on this subject, viz:

> Studies have not been made to determine the distribution of fish in the Clearwater River system, but spawning ground observations and creel census data indicate that approximately 60 percent of the Clearwater River steelhead utilize the North Fork for spawning purposes, and therefore must be considered in connection with the Bruces Eddy project. Although the number of fish estimated to use the North Fork is not large, it represents a fish population of sufficient proportions to justify installation of fish passage facilities to assure that the run is maintained.

Fish Problems. - The anadromous fish problem in relation to water resource development resolves itself into the following three categories: the adult must be safely passed upstream to spawning areas; suitable spawning areas and rearing environment must be available for successful reproduction; and the young fish must be safely brought downstream to the sea.

*****

Based upon admittedly meager evidence, the Fish and Wildlife Service has indicated concern that both adult and fingerling anadromous fish may not successfully pass through the reservoir. They have suggested that, pending further research, consideration be given to the development of facilities capable of assuring passage through the reservoir. Preliminary plans have been developed for a facility to trap downstream migrants on tributary streams with transportation provided by barge through the reservoir. The successful functioning of such a facility is not only doubtful, but the cost is expensive. There are 11 streams tributary to the pool that support runs of steelhead. To install devices capable of separating fingerlings from the reservoir would require construction of dams on each of these streams, the largest of which would be about 60 feet high. Trash and ice would present such problems that it is doubtful if these facilities could be kept in continuous operation during the high water period which coincides with the time of downstream migrations. If adults do not migrate through the reservoir, it would be impossible to maintain runs of steelhead in the tributary streams, and only those fish spawning in the North Fork above the reservoir would remain. Considering these factors, it appears more practical to try to support the run by some means of artificial propagation if migration through the reservoir becomes a major problem.

However, the concept of artificial propagation of steelhead was not readily embraced by the CE as reflected in the following passages from the GDM, viz:

Artificial Propagation, Anadromous Fish. - In addition to passage of fish at the project, the Fish and Wildlife Service recommends artificial propagation facilities for anadromous fish. It is understood that these facilities are proposed to replace the loss expected as a result of inefficiency of fish passage facilities. If fish passage facilities are to be considered satisfactory, they must allow sufficient survival to support the run, taking into account

> the sports and commercial harvest. If this is not the case, the stock will gradually diminish. If there is adequate escapement past the project to support a run, increased production could be achieved by a temporary reduction in the harvest, thus allowing greater spawning escapement. The increased production could be patterned to replace losses or perhaps sustain an increased population. This appears practical as there is spawning area available to support a spawning stock several times the size of present escapement.
>
> To augment a run by artificial means requires that artificial propagation be more efficient than natural propagation. There is little evidence to support this contention for either salmon or steelhead. From information now available it is questionable if a spring steelhead population can be supported by artificial means. Therefore, studies and investigations necessary to develop criteria to establish the most feasible artificial propagation facilities are planned and will be scheduled so that such a program could be initiated in time to assure preservation of the resource if fish do not migrate through the reservoir or if the fish passage facilities proposed do not function satisfactorily. The project cost estimate does not, however, contain allowances for artificial propagation of anadromous fish.

The CE did request funds for a hatchery for resident trout to provide fish for the reservoir. They did not recommend the $1,000,000 asked for by the FWS to improve spawning conditions for anadromous species in the North Fork above the reservoir, seeking instead to delay such work until fish passage at the dam and through the reservoir was proven a success. Further study was recommended by the CE to determine the feasibility of trash fish removal in the project area prior to filling the lake, as recommended by the FWS.

In August of 1962, the FWS released the updated planning report which addressed fish and wildlife problems expected to result from the higher dam and longer lake then planned by the CE. As related previously, in the interim, Secretary of the Interior Udall, believing additional pow-

er to be an overriding factor in the Pacific Northwest, issued statements supporting authorization of the Dworshak project. This was in contrast to the position of project opposition held by the FWS as stated in the report of 1960. The 1962 FWS report did not contain language opposing construction of the Dworshak project. Congress authorized construction of the Dworshak project 65 days after the FWS released their updated report.

In the 1962 FWS report, the increase of 18.6 m (61 ft) in dam height and 6.4 km (4 mi) in reservoir length were addressed and the anticipated fishery problems discussed. These design changes represent the project essentially as constructed, the predictions provided in this report are therefore those of record for the existing project.

Spawning habitat for the project area under without-the-project conditions, were stated essentially in the terms of the 1960 report increased slightly to reflect the additional river mileage inundated. However, major changes appeared in the other statistics for both with and without-project conditions. Table 20 summarizes the fishery data as supplied in the 1962 updated report. It should be noted that the data presented by the FWS assumes adequate fish passage facilities.

The use figures were based upon 1958 studies which included a post-card survey of winter anglers during 1957-58 and a creel census of the summer trout and fall steelhead fishermen. The studies indicated that 2,670 angler-days were spent to catch 720 steelhead in the reservoir area. In addition, a large portion of the steelhead caught in the

Table 20.--Summary of estimated angler utilization, fish harvest, and spawning habitat without and with Dworshak project

	Life of proj.(50 yrs.) Angler days fishing		1959-60 Use by spawning steelhead (no. of fish)	Spawning gravel Available (sq.yds.)		Potential redds	
	Steelhead	Resident		Steelhead trout	Chinook salmon	Steelhead trout	Chinook salmon
Without the project							
Downstream from Dworshak damsite	1,500	500	1/	11,000	11,000	790	690
Dworshak Reservoir site	8,000	5,500	500	716,800	694,500	51,200	43,400
Upstream from Dworshak Reservoir site	0	14,500	11,900	813,200	565,500	58,100	35,400
Totals	9,500	20,500	12,400	1,541,000	1,271,000	110,090	79,490
With the project							
Downstream from Dworshak damsite	400	500	0	11,000	11,000	790	690
Dworshak Reservoir site	0	7,500*	0	0	0	0	0
Upstream from Dworshak Reservoir site	0	6,320*	9,300	813,200	565,500	58,100	35,400
Totals	400	14,320	9,300	824,200	576,500	58,890	36,090
Net Loss 2/	-9,100	-6,180	-3,100	-716,800	-694,500	-51,200	-43,400

1/ Insignificant.
2/ Additionally, average sport and commercial catch of steelhead trout in Columbia River drainage below Dworshak Dam and in Pacific Ocean would be reduced about 9,500 fish with Dworshak Project
* Author's note -- Narrative section of 1962 report reverses these numbers,I.E., Dworshak Reservoir -- 6,500 angler days, and upstream tributaries -- 7,500 angler days

Source: Quick, Paul T. and Samuel J. Hutchinson. 1962. A detailed report on fish and wildlife resources effected by Bruces Eddy Dam and Reservoir Project, North Fork Clearwater River, Idaho. U. S. Fish and Wildlife Service, Portland, Oregon. August 20, 1962.

Clearwater River below the project was assumed by the FWS to have been spawned in the North Fork. It was estimated that during the 50-year period of project analysis 9,500 angler-days would have been supported each year by the steelhead trout hatched and reared in the North Fork Clearwater.

The FWS estimated that the harvest of steelhead produced in the North Fork from throughout the Clearwater, Snake and Columbia Rivers was probably as high as 27,000 adult fish.

The resident fishery within the North Fork Clearwater River supported 10,400 angler-days in 1958. This resulted in a harvest of 50,700 rainbow trout (including immature steelhead), 14,620 cutthroat trout, 745 brook trout, and 8,425 miscellaneous fish. This works out to an excellent fishing success rate of over seven fish per angler trip. Over the 50-year period of project analysis the effort was expected to double to 20,500 angler-days annually.

The remainder of the narrative section of the 1962 FWS report, describing with-project fishery conditions, reflected different figures than those presented in the report's summary table, reproduced herein as Table 20. Pertinent sections of the narrative portion of the report are presented verbatim in the following section, viz:

> At normal level the reservoir would eliminate 53 miles of North Fork Clearwater, 8 miles of Elk Creek, 6 miles of Little North Fork, 2 miles of Breakfast Creek, and the lower reaches of numerous small tributaries. All steelhead and salmon spawning habitat in these stream segments would be irretrievably lost. The reservoir would not provide suitable spawning habitat for either resident trout or anadromous fish.

> About 717,000 square yards of spawning habitat within the pool area suitable for resident trout and anadromous fish would be eliminated. This habitat is adequate for about 51,200 steelhead trout redds and 43,400 chinook salmon redds. Approximately 12,500 adult steelhead trout and chinook salmon utilized the reservoir site as a migration route or for spawning during the 1958-59 fish year. About 500 steelhead trout spawned in this site during the spring of 1962.
>
> Loss of habitat and spawning area in the reservoir site would result in decreased sport fish catches in the North Fork as well as downstream in the main stem Clearwater River. No estimates of this reduced sport catch have been made for mainstem Clearwater River. Approximately 4,100 man-days of steelhead fishing and an average annual catch of about 1,000 fish would be eliminated in the impoundment site.
>
> About 55 percent of the fish caught in the summer sport fishery of the North Fork Clearwater are immature steelhead trout. About 2,600 man-days of stream fishing for resident fish and an average annual catch of about 12,600 fish including immature steelhead trout would be eliminated in the reservoir site.

According to figures contained in the narrative, the reservoir was expected to attract and support only one angler trip/ha (0.4 trips/ac) per year, for the following reasons, viz:

> Initially, the impoundment would have a rather high fertility, and quantities of fish-food organisms would be adequate to sustain fish life. After a few years fertility would decline, resulting in a reduction of fish-food organisms and game-fish populations. Fishery value of the reservoir would be limited by extreme reservoir fluctuations and declining water level in the littoral zone during the most critical fish-food producing season. Turbidity would not be a problem, except in isolated arms of the reservoir where logging operations have denuded steep hillsides. Water temperatures, although somewhat higher than natural streamflows, would be well within a range suitable for trout.
>
> *****
>
> During the early years of the impoundment, fishing pressure would be high. As the fertility of the reservoir

> water diminished and the quality of fishing declined, an intensive fishery management program would be required to maintain the angler-use that had developed during those early years. It is estimated that the average annual fisherman utilization of the reservoir fishery throughout the life of the project would be about 6,500 man-days. Average annual harvest would be about 13,000 fish.

The upstream remnant of the North Fork was expected to receive 7,500 man-days effort, viz:

> Undesirable fish, particularly squawfish and suckers, would become abundant in Bruces Eddy Reservoir. After a few years, the lower limits of all streams entering the pool area would probably be invaded and overpopulated by nongame species from the impoundment. Seaward migrants entering the reservoir would suffer a high rate of mortality through predation by squawfish.
>
> Loss of more than 70 miles of fishing streams in the reservoir site would result in increased angler utilization upstream from the head of the reservoir. An increase in numbers of fish stocked in these streams might be necessary to provide for the increased fishing pressure. Because of losses in numbers of steelhead trout and salmon, anadromous fish would no longer contribute as much to the catch. In the area upstream from the pool, there would be an estimated 7,500 man-days of fishing for resident species resulting in a catch of about 30,000 fish.
>
> Additional losses would occur to spawning and rearing habitat for anadromous and resident fish as log-drive operations in the North Fork Clearwater River between the upper limits of the impoundment and Cold Springs increased.

Downstream from the project, adverse impacts were expected within the 3.1 km (1.9 mi) reach of North Fork Clearwater River for resident fish and a serious loss was predicted for the anadromous fisheries in the lower Clearwater, Snake, and Columbia Rivers. No particular impact predictions were presented for the resident fishery of the Clearwater River below the confluence with the North Fork Clearwater, viz:

> Transportation of logs in the river downstream from the dam also would prevent production of resident trout. In addition, fluctuations in the river resulting from power peaking operations would cause hazardous fishing conditions in the North Fork Clearwater and Clearwater River downstream from Bruces Eddy Dam. There would be an estimated 500 man-days of fishing for resident species resulting in a catch of about 1,000 fish in the North Fork Clearwater River downstream from the dam. Loss of anadromous fish spawning habitat in the North Fork Clearwater system would cause decreases in the sport fishery catch in North Fork Clearwater, Clearwater, Snake, and Columbia Rivers, and the commercial catches in lower Columbia River. North Fork system makes a significant contribution to these catches, and the average annual loss is expected to be approximately 30,000 adult and 40,000 juvenile fish.

In the *discussion* section of the report, the FWS again expressed their serious concern regarding passage of adult and juvenile migrants over a dam as high as the one planned at Dworshak. In any event, they pointed out that, based on recent experience, the CE's cost estimates for fish passage facilities as reflected in the GDM were grossly underestimated and that the true cost would be more in the order of $15 million.

Construction of a fish hatchery was recommended to replace the anadromous fish reproduction potential loss resulting from inundated spawning gravels within the lake site. The FWS estimated the cost of such a facility at $3 million and annual operation and maintenance costs of $200,000. Hatchery facilities for residen trout species were also recommended, viz:

> Additional hatchery and rearing facilities would be required to mitigate the loss of spawning habitat of resident trout, provide fish for annual stocking in the reservoir, and to provide fish for stocking upstream from the head of the impoundment and downstream from the dam. Destruction of about 70 miles of good fishing streams would result in a significant increase in fishing pressure in upstream reaches, and supplemental stocking would be needed. Hatchery facilities

> to produce 300,000 catchable-size fish annually would be needed to compensate for resident trout losses and provide for the additional burden Bruces Eddy project would impose upon the State's fishery management program. The hatchery would cost about $900,000, and estimated operation, maintenance, and distribution costs would be $90,000 annually.

Water releases from the project were considered by the FWS and selected amounts and temperatures were specified as being desirable from a fishery point of view, viz:

> Operation studies for Bruces Eddy project indicate that the average minimum daily water releases from the reservoir during initial and future operating conditions could be 3,765 second-feet; however, there would be diurnal variations in release flows from 0 to 17,450 second-feet. Except for about a 100 second-foot outflow loss, there would be periods in each day during the critical power production season when no releases would be made. This type of operation would result in loss of fish habitat downstream from the dam and eliminate the winter steelhead trout fishery of North Fork Clearwater River. An assured minimum instantaneous release of not less than 2,000 second-feet of water of a temperature not to exceed 65° F. should be specified in the authorizing legislation for optimum fishery benefits in the North Fork Clearwater River and main Clearwater River to its confluence with Snake River. Studies should be made to determine exact effects the project would have on downstream water temperature.

During the mid-1960's, following release of the FWS's report and Congressional authorization of the Dworshak project, fish passage success at the project became more problematical. The affected agencies slowly gravitated toward relying exclusively upon hatchery facilities rather than fish passage over Dworshak Dam.

One of the concerns held by the conservation agencies was that they did not wish the downstream juvenile migrants to be subjected to passage through the 85 km (53 mi) long reservoir. To avoid this, a system of screening devices were proposed for installation above the reservoir

on both the Little North Fork Clearwater and the North Fork Clearwater arms. After the fish were trapped, they were to be transported around Dworshak Reservoir and released below the dam.

On November 4, 1964, a Bureau of Commercial Fisheries memorandum was submitted to Washington which described a plan based upon total reliance upon hatchery production at the Dworshak project (69). The memo retraced the history of fish passage discussions at the project, relating the many difficulties associated with passing juvenile fish around the Dworshak project. As a result of these difficulties, the Bureau staff recommended construction of a hatchery and abandonment of fish passage facilities, viz:

> With these various problems associated with determining a logical means of handling the steelhead affected by Dworshak, greater consideration was given to total artificial propagation. Basic information was assembled from all known sources to determine what portion of the run would have to be handled to maintain populations of the present magnitude. This meant that propagation facilities must be adequate to insure a spawning escapement of approximately 20,000 adults. Based on information from experiments on hatching and rearing summer steelhead in other parts of the Columbia Basin, it was determined that a fish hatchery large enough to handle 6,000 adult steelhead would be required. Cost estimates were developed for a hatchery of this magnitude. With an additional cost of about $300,000 incubators and tanks were to take care of the eggs of 6,000 more adults for rearing to a smaller size for early planting without greatly increasing the basic rearing capacity or operating cost. The total construction cost is estimated to be approximately $11,378,000 with annual cost of approximately $1,267,000. It is hoped that this cost can be reduced before actual construction begins by using the anticipated results of new research on recirculation of water in rearing ponds.

The memo contained design criteria for the proposed hatchery. The more pertinent criteria relating to anticipated production have been extrac-

ted and are presented in Table 21.

Even at this stage, the lead agency continued to embrace a two-phase plan of passage and artificial propagation. Therefore the FWS recommended liberating adult steelhead captured at the proposed hatchery in excess of the 12,000 needed for hatchery operations above the dam, viz:

> Since more than 12,000 adults undoubtedly would be appearing at the dam, we would propose to pass part of those in excess of the needs for artificial propagation and place them in the reservoir a short distance upstream from the dam. This operation would be experimental and would be designed to determine if the fish would migrate through the reservoir to suitable spawning and the young return downstream without special facilities for passage. These fish would be surplus to the hatchery program as presently visualized. Their ultimate disposition would be determined by results of these studies. Others would be transferred to the South Fork or other tributaries not affected by Dworshak Dam as deemed advisable and profitable. These fish would provide sport fishing, both as adults and as resultant progeny during their residence in the reservoir or the streams, wherever stocked.

The FWS believed the proposed facility would adequately mitigate the anticipated damages to the steelhead fishery, viz:

> Through these methods we feel there is reasonable assurance that the steelhead runs of the North Fork Clearwater can be perpetuated and would provide a satisfactory solution to this very immediate problem. This program is strongly supported by Idaho Fish and Game Department, and it has been thoroughly reviewed by our Regional staff.

The hatchery plan was transmitted to the Walla Walla District Engineer on November 30, 1964, (70). Two paragraphs of special interest from this letter are provided below. One held the CE responsible for a continuing effort to devise acceptable fish passage procedures at the project, the other addresses the subject of water supply for the hatchery, viz:

Table 21. -- Production goals planned for Dworshak Hatchery by FWS in 1964

Number of steelhead	
Holding	
Number adult steelhead to hold	12,000
Percent survival to spawning	80
Number adult steelhead to spawning	9,600
Number females (50%)	4,800
Average number eggs per female	4,000
Number eggs per 12,000 adults	19,200,000
Production	
Number green eggs at start	19,200,000
Percent survival through incubation and early rearing	70
Number juveniles available for early planting	6,720,000
Number juveniles available for downstream migration (8/lb.)	6,720,000

Source: Hutchinson, Samuel J. 1964. Memorandum from Regional Director, Bureau of Commercial Fisheries, Seattle, Washington to Director, Bureau of Commercial Fisheries, Washington, D. C. November 4, 1964.

> In view of this fixed time schedule, we are obliged to acquiesce to artificial propagation as a major means of maintaining the steelhead run at Dworshak Dam. Should artificial propagation prove unable to maintain the steelhead run at substantially its present level, we will insist on the development of passage facilities as soon as a satisfactory method of passing downstream migrants has been devised. In this connection, and because of the experimental release of steelhead into the impoundment, we expect the Corps to utilize the best information available on design of the turbines.
>
> *****
>
> A water supply of approximately 372 c.f.s. will be required for this hatchery with control such that water of optimum temperature can be obtained from the reservoir in the fall and early winter for rapid growth of the young, and at other times cool water can be assured for holding adults. We understand, as a part of your plan, that variable selector gates are to be provided at turbine intakes. The main hatchery water supply could be pumped from the tailrace of such turbines. This arrangement also would permit use of cooler water from other turbines for tempering the Clearwater and Snake Rivers during warm periods, thus providing good holding conditions for adult steelhead.

The CE accepted the artificial propagation alternative and immediately began tentative planning for its construction. In May of 1965, the IDFG submitted a request that they operate the hatchery (71), viz:

> We recognize the magnitude of the task of operating a steelhead hatchery capable of rearing more than 850,000 pounds of fish annually. We have experienced, capable supervisory personnel who will be assigned to the station and we anticipate no restriction in the hiring of labor and less experienced personnel to perform the routine hatchery duties.

The FWS supported the state's request for operational control of the Dworshak hatchery (72). Slightly over a year later the IDFG withdrew their request to operate the proposed hatchery (73), viz:

> Under date of May 5, 1965, we advised you that the Idaho Fish and Game Commission felt that the steelhead fish hatchery proposed for construction in lieu of fish passage over Dworshak Dam should be operated by the Idaho

> Fish and Game Department. In recent weeks, however, we have concluded that it would be impossible for us to recruit from our limited hatchery personnel the number of experienced men which would be required to operate the Dworshak hatchery. Therefore, we regretfully inform you that we wish to relinquish the operation to the Fish and Wildlife Service.

The FWS, in turn, advised the CE that they would operate the Dworshak Hatchery as part of the National Hatchery System.

A special design document was prepared by the CE to plan the Dworshak Hatchery. This report, Design Memorandum No. 14.1 was released in July, 1966 (74).

A letter from the IDFG had earlier advised the CE that it would not be advisable to construct the hatchery to the final production specifications until the number of steelhead entering the North Fork Clearwater could be determined, (75). The pertinent passages of this letter are as follows:

> In the 1962 report "Bruces Eddy Dam and Reservoir Project, North Fork Clearwater River, Idaho" prepared by the U. S. Fish and Wildlife Service, it is estimated that about 60 percent of the steelhead trout which pass Lewiston Dam on the Clearwater spawn in the North Fork waters upstream from Bruces Eddy Damsite. Sixty percent of the average annual count of steelhead over Lewiston Dam from 1958 through 1962 amounts to approximately 20,000 fish. No actual counts of adult fish migrating up the North Fork of the Clearwater River are available to substantiate the 60 percent estimate.
>
> This Department has every intention of demanding the most applicable mitigative measures considered feasible for the loss of steelhead habitat occasioned by Dworshak Project. On the other hand, it is recognized that constructing hatchery facilities which are capable of propagating the progeny of substantially more adult fish than enter the North Fork would be imprudent. We propose, therefore, that initially the hatchery facilities be constructed to rear the progeny of 3,000 female steelhead requiring eighty-four 17 by 75 foot circulating ponds to handle and rear two year

> classes. Final sizing of the facilities should be based on analysis of numbers of steelhead passing Lewiston Dam and the numbers entering the North Fork in future years.

Construction of the hatchery was started in 1967 and completed in the fall of 1969, so as to establish the return of the steelhead to the hatchery before the reservoir was impounded in 1972.

Construction proceeded under terms of the IDFG's letter, i.e., a scaled down version of the ultimate facility was built initially. In July of 1970, the CE prepared a supplement to D.M. 14.1 outlining the needs for, and alternative plans for accomplishing an expansion of the hatchery to the originally requested dimensions (76). An explanation of the situation can best be presented by quoting appropriate passages from the supplement, viz:

> The hatchery was constructed in accordance with the criteria established in DM 14.1 as furnished by the Bureau of Sport Fisheries and Wildlife, the State of Idaho Fish and Game Department, and concurred in by the Corps of Engineers. The basic requirements for the hatchery was that "...Facilities should be sufficient to hold 12,000 adults and rear the young of 6,000 adults to migratory size of about 8 per pound." By agreement between the fishery agencies and the Corps of Engineers, however, facilities to accommodate 6,000 adult fish were constructed, with facilities to accommodate an additional 6,000 adults deferred until the size of the existing natural fish run can be preciesly determined.

After less than two years of operation two deficiencies were discovered which required enlarging the hatchery to the originally planned dimensions, viz:

> (1) During the 1969 spawning season it was discovered that the North Fork Steelhead is a completely different strain from that assumed as standard in DM 14.1. For instance, the adults are of larger size averaging 12 to 20 pounds rather than 5 to 7 pounds, and the female adults produce an average of 6,200 eggs each rather than 4,000.

(2) Loading capacity assumptions (pounds of fish per unit of water) were found to be excessive under actual hatchery operations for both rearing tanks and ponds.

The original, scale-down hatchery also was not designed to produce the 300,000 trout requested for stocking Dworshak Reservoir. These fish were expected to be produced at a separate hatchery facility.

To accommodate the needed increase in production of steelhead and to produce the 300,000 catchable size trout needed for stocking the reservoir, the CE outlined several construction options. Only one was deemed to be a justifiable plan. This plan for operation is described below, viz:

a. Growth rates for fish in the ponds with the controlled environment system have far exceeded estimates assumed in designing the hatchery. This plan therefore increases hatchery capability by providing environmentally controlled water facilities for all of the 84 existing ponds; 25 ponds are now on the system. This plan, through improved management of rearing, would allow release of the fish in one year instead of two. Of course, O&M costs are less for the one-year cycle than for the two-year, as fish food costs alone would be some $45,000 less.

b. The main features of this alternative include 2 new filter bed systems as dictated by available space; one for 25 ponds similar to the one now existing, and one for the remaining 34 ponds. The new 25-pond system would require only minor piping revisions, with more extensive piping additions needed for the new 34-pond system. Also required would be 104 new rearing tanks with support facilities, supplemental water heating capability by converting existing water chillers to heat pumps, and a water sterilizing system of an electric grid and ultraviolet units. Secondary treatment of hatchery waste water, which is required under Executive Order 11507 to avoid stream pollution, is estimated to cost $320,000.

c. The main advantage of this plan is that the number of rearing ponds required for mitigation of steelhead can be reduced from 84 to 70, and the other 14 ponds can be used for resident fishery mitigation of 100,000 pounds annually.

> Operational flexibility with this method is such that almost any rate of growth can be predicted and scheduled.

The proposed plan of development reflected a target completion date of April 1972 thereby permitting use for the 1972 spawning season. The cost was expanding rapidly as reflected by the following paragraph, viz:

> Hatchery expenditures to date amount to $9,400,000. This compares to the DM 14.1 estimate of $6,300,000 for the same facilities. Estimated future costs will include $100,000 to complete the initial hatchery and at least $3,700,000 as noted herein for capability increase. Temporary fish facilities for the project have cost approximately $400,000 to date. Permanent fish facilities at the dam, now under contract, amount to approximately $3,600,000 and mechanical equipment at the power intake structure is estimated at $2,500,000, making the total cost of all project fish facilities $19,700,000.

As the date of closure of Dworshak dam approached, the IDFG submitted a request to delay closing the dam. The request was made to allow collection of the 1971 fall run of steelhead. The collection of the fall run had not been considered necessary and had not been requested previously. However, high mortality of juveniles in the hatchery and depressed runs of spring and summer steelhead convinced the IDFG that it would be necessary to use fall steelhead as broodstock in 1971.

A special problem raised by the IDFG which related to the requested delay of dam closure dealt with an anticipated nitrogen supersaturation problem, described as follows (77):

> It also appears that there is a definite possibility of serious nitrogen supersaturation below Dworshak Dam if closure is undertaken prior to the time powerhouse generating units are installed. This should be avoided at all costs.
>
> Full production at Dworshak Hatchery during the initial years

> of operation is imperative if establishment of a successful hatchery run is to be assured. Because of this and because of the potential nitrogen supersaturation problem, we urge that closure of Dworshak Dam be delayed until 1972 and that means be devised to collect the fall portion of the steelhead run during the entire fill period.

The reservoir was closed on schedule in September 1971, resulting in the formation of Dworshak Reservoir and the permanent blockage of anadromous fish runs into the North Fork Clearwater River.

Fishery Resources -- Post-construction Occurrences

Two separate fisheries continue to exist on the river systems impacted and the impoundment created by the Dworshak project. The two fisheries, an anadromous steelhead population, now supported by artificial propagation, and the resident lake and river fisheries, will be discussed separately in the following sections.

Steelhead trout fishery

Any examination of the North Fork Clearwater steelhead sport fishery must begin with a review of the production history of Dworshak Hatchery. This, the largest steelhead hatchery in the world, has been in production since 1969 and since 1973 with the expanded facilities. Considerable variability from year to year have typified the steelhead smolt production program. Several disease and water systems management problems have been met along the way. A brief description of the hatchery's production history was provided for purposes of this investigation. These remarks and comments have been reproduced below (Wayne Olson, Manager, Dworshak National Fish Hatchery, pers. comm., 1979), viz:

> The Dworshak hatchery, after completion of construction in 1973, was designed for an annual production program of 3,360,000 steelhead at 420,000 pounds and a resident trout program of 100,000 pounds.
>
> Steelhead production (1-year rearing) was met according to design only in 1974 or the first year after all three pond systems were on reuse water.
>
> The 1975 release was reduced by early fry and fingerling losses. White-spot disease in fry and dietary deficiencies in fingerling contributed to high mortalities.
>
> A program change in 1976 shifted emphasis from producing a

180-mm smolt to 200 mm for release. Production was reduced in mitigation numbers from 3.3 million to 2.4 million, however, weight would essentially remain the same at 400,000 pounds. A 2-year rearing program was again initiated using System I ponds for production of a 200-mm size fish from the later egg takes. (Note: Dworshak maintains production from the entire run of their adult returns to retain genetic integrity.) This shift in program along with a 3-year period of testing and study, as assigned by a 1975 Task Force Team, reduced production.

Disease losses from white-spot and Ichthyophthirius, along with high nitrogen gas, added to Dworshak's problems. The Corps of Engineers continued to make modifications to existing facilities and to plan for additional construction.

Changes in production planning were made in the interim to adjust for the studies and construction; i.e., Systems II and III operated on recycled water with selected temperature control while System I remained on single pass raw water, no temperature control, resulting in a 2-year rearing program on cold water. Fish sizes were not obtained as projected due to various rearing problems noted above. Consequently, weights were less than anticipated.

The 1980 release will again be made up from two brood year classes as has been the case since 1977. Planned releases will vary according to the number of 2-year-old fish released from System I ponds on single pass raw water. Alternating years of increased release numbers occur when the 2-year-olds are planted.

Planned construction places System I back on reuse. With all rearing ponds environmentally controlled (Systems I, II, III), the hatchery anticipates a future annual production release of 2.6 million steelhead smolts weighing 340,000 pounds. This figure is lower than original design, however, it appears more realistic at the time based upon actual operation of the facilities.

The hatchery also has the responsibility of transf[illegible] excess unspawned adult steelhead into waters of the [illegible]atwate[illegible] River drainage. In 1978, i.e., nearly 90,000 pounds (6,000 fish) were hauled from Dworshak. Other years have been fewer depending upon escapement into the hatchery. Excess eggs and fry are made available to Idaho Department of Fish and Game for planting the river-system. Dworshak is also the egg source for the Hagerman National Fish Hatchery supplying nearly 1.4 million eyed eggs over the past 2 years. This program will continue as the Corps of Engineers moves ahead in their expansion of Hagerman for steelhead rearing.

Steelhead production and adult return records for the Dworshak Hatchery (1969-1980) are presented in Table 22. As noted, the target juvenile release number was reached only in 1974 and again in 1980. The hatchery staff is optimistic that the currently accepted production quota of 2.6 million smolts weighing 154,225 kg (340,000 lbs) can be consistently attained now that the engineering problems have been largely overcome at the facility.

A presentation of the complete adult returns of steelhead by year released as smolts (year-class) from the Dworshak Hatchery appears in Table 23 (Stephen W. Pettit, Senior Fishery Research Biologist, IDFG, pers. comm., 1980). A maximum return to the Clearwater of 28,180 individual adults was realized from the 1975 smolt release of approximately 1.8 million fish for a total return of 1.6 percent. Most frequently the cumulative returns have been significantly less, however with an average of 0.46 percent for the 1970 through 1976 smolt releases.

Based upon studies conducted by the IDFG between 1972-73 and 1979-80 (fish-years), annual adult steelhead returns of Dworshak Hatchery origin to the Clearwater River have ranged from less than 2,000 fish to just under 27,000 fish (78) (Table 24). These data reflect returns by fish-year which are composed of mixed age class adults representative of one through three ocean returns. As such, the adult return figures are not directly comparable to the total adult returns by age class reflected in Table 23.

Table 24 also presents the return of wild (non-hatchery) steelhead.

Table 22. -- Steelhead trout production records from Dworshak National Fish Hatchery for the years 1969 through 1980

Year	Adult returns	Eggs collected	Anticipated release		Actual release				Average size (mm)	Number per pound
			Numbers 000's	Pounds 000's	Numbers	Brood year	Pounds	Totals		
1969	--	11,472,500	*	*						
1970	--	11,627,946	*	*	1,371,543	1969	189,238		187	7.25
1971	2,291	6,448,600	*	*	1,341,366	1969	238,209	3,143,571	205	5.63
			*	*	1,802,205	1970	176,837	@ 415,046	165	10.19
1972	2,324	5,224,697	*	*	977,054	1970	165,829		200	5.89
1973	9,938	26,561,861	*	*	1,270,197	1971	89,373	2,628,719	148	14.21
			*	*	1,358,522	1972	91,239	@ 180,612	146	15.22
1974	7,910	26,047,748	3,360	420	3,864,491	1973	456,894		179	8.45
1975	1,560	5,561,988	3,360	420	1,761,878	1974	291,668		200	6.04
1976	1,858	7,519,247	1,900	315	1,751,805	1975	210,442		180	8.32
1977	3,100	8,491,225	2,400	400	286,913	1975	44,484	1,846,859	195	6.45
					1,542,498	1976	187,714	@ 233,630	180	8.22
					17,448	1976	1,432		158	12.18
1978	12,727	18,650,000	1,900	315	1,546,695	1977	176,187	1,597,695	175	8.79
					51,000	1976	12,000	@ 188,187	225	4.25
1979	4,939	13,000,000	1,865	238	45,636	1977	5,927		184	7.70
					1,181,288	1978	102,761	1,708,600	162	11.50
					444,288	1978	17,770	@ 128,258	125	25.00
					37,000	1978	1,800		133	20.56
1980	2,519	9,500,000	2,225	315	431,172	1978	66,549		195	6.50
					93,210	1979	6,697	2,696,601	150	13.90
					2,172,219	1979	266,390	@ 339,636	180	8.15

*Major construction raw water and reuse rearing combination

Source: Wayne Olson, Manager, Dworshak National Fish Hatchery, pers. comm., 1979.

Table 23. Number and percent of adult steelhead returns to the Clearwater River from Dworshak smolt releases. Returns include hatchery spawning run and harvest in lower Clearwater River

Release year	No. smolts	One ocean	%	Two ocean	%	Three ocean	%	Total	%
1970	1,371,543	(1972) 834	.061	(1973) 9,916	.723	(1974) 906	.066	11,656	.850
1971	3,143,573	(1973 1,421	.045	(1974) 8,767	.280	(1975) 34	.001	10,222	.325
1972	976,554	(1974) 1,872	.192	(1975) 1,393	.143	(1976) 55	.006	3,320	.340
1973	2,199,899	(1975) 414	.020	(1976) 1,450	.066	(1977) 52	.002	1,916	.087
1974	3,397,859	(1976) 345	.010	(1977) 2,345	.070	(1978) 394	.001	3,084	.091
1975	1,761,900	(1977) 1,115	.066	(1978) 25,413	1.440	(1979) 1,612	.092	28,180	1.600
1976	1,753,300	(1978) 905	.052	(1979) 7,920	.430	(1980) 490	.028	9,315	.531
1977	1,850,000	(1979) 507	.027	(1980) 2,960	.160				
1978	1,597,695	(1980) 320	.020						

Source: Pettit, Stephen W., Senior Fishery Research Biologist, IDFG, pers. comm., 1980

Table 24. -- The estimated number of steelhead into the Clearwater River and the proportion of Dworshak Hatchery fish and native, wild steelhead entering the river for the fish runs between 1972-73 and 1978-80. The table includes harvest estimates for both hatchery and wild steelhead as well as escapements to Dworshak Hatchery and upper Clearwater tributaries

Run component	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80[d]
Estimated run size	20,330	14,610	3,640	6,400	6,360	33,530	15,960	9,500
Estimated harvest	5,393	2,970	390[b]	530[b]	460[b]	14,900	4,820	1,380
Hatchery return								
Number	11,890	10,230	1,850[a]	2,280[a]	3,510	26,730	9,550	3,830
Percentage	58.5	70.0	50.8	35.6	55.2	79.7	59.8	40.3
Hatchery harvest								
Number	2,068	2,320	290[b]	430[b]	410[b]	14,000[c]	4,610	1,250
Percentage	38.3	78.1	74.4	81.1	89.1	94.0	95.6	90.6
To Dworshak	9,830	7,910	1,560	1,858	3,100	12,730	4,940	2,580[e]
Wild fish return								
Number	8,440	4,300	1,000	2,200	2,850	6,800	6,410	5,640
Percentage	41.5	29.4	27.5	34.4	44.8	20.3	40.2	59.7
Wild fish harvest								
Number	3,325	650	100[b]	100[b]	50[b]	900	210	130
Percentage	61.7	21.9	25.6	18.9	10.9	6.0	4.4	9.4
Escapement	5,115	3,650	900	2,100	2,800	5,900	6,200	5,510

[a]Does not include hatchery straying past North Fork
[b]Nez Perce Tribal harvest only (catch-and-release)
[c]Includes 2,000 steelhead caught in Snake River
[d]1979-80 data provided by Steve Pettit (pers. comm.)
[e]Includes 60 Dworshak steelhead captured at Kooskia NFH

Source: Pettit, Stephen W. and Ronald L. Lindland. 1979. Clearwater River steelhead investigations. Idaho Department of Fish and Game. Dingell-Johnson Proj. F-73-R-1.

During the period (1972-1979), annual returns of wild steelhead into the Clearwater River ranged from 1,000 fish in 1974-75 to 8,440 fish in 1972-73. Escapement of wild steelhead to the upper Clearwater tributaries reached a low of 900 fish in 1974-75 but has increased steadily since, reaching 6,200 fish in 1978-79.

A 30-year record of the total adult steelhead return into the Clearwater River, including wild fish and hatchery fish, is presented in Table 25. After peaking in the late 1950's and early 1960's, the number of adult steelhead returning to the Clearwater River to spawn has been on the decline. Decidedly contrary to the trend, was the run of 1977-78 which, at 33,530 fish, was second only to the 1962-63 run of just over 43,000 fish.

In addition to the migrant count data, the IDFG has also conducted studies of the steelhead supported recreational fishery within the Clearwater River between Lewiston and Orofino. These data are contained in the IDFG report dated September 1979 (78).

Sport fish harvest data, also presented in Table 24, clearly reflects the direct impacts which the variable returns of adult steelhead have imposed upon the recreational fishery of the Clearwater River. It became necessary to prohibit the taking of steelhead during the 1974-75, 1975-76, 1976-77 a 1979-80 runs in Idaho. The aforementioned strong returns from the 1975 Dworshak release supported the exceptionally large sport harvest of 1978-79. The 1978-79 recreational catch from the Clearwater River of 14,900 fish was almost three times higher than

Table 25. -- Estimated yearly steelhead counts for Clearwater River, Idaho

Years	Steelhead counts		
	Fall run (July-Dec.)	Spring run (Jan.-June)	Total
1950-51	526	3,676	4,202
1951-52	1,094	5,243	6,337
1952-53	380[1]	10,266	10,646
1953-54	1,392	5,755	7,147
1954-55	3,154	11,121	14,175
1955-56	2,950	5,011	7,961
1956-57	463	3,630	4,093
1957-58	6,581	14,362	20,943
1958-59	19,375	13,841	33,216
1959-60	11,892	10,681	22,573
1960-61	10,883	14,279	25,162
1961-62	9,325	18,691	28,016
1962-63	26,960	16,236	43,196
1963-64	13,258	8,378	21,636
1964-65	10,342	6,988	17,330
1965-66	16,561	5,338	21,899
1966-67	14,985	8,320	23,305
1967-68	13,659	5,968	19,627
1968-69	14,469	10,809	25,278
1969-70	9,522	6,609	16,131
1970-71	8,876	5,724	14,600
1971-72	7,601	7,672	15,273
1972-73	12,044	8,286	20,330
1973-74	9,846	4,764	14,610
1974-75	2,475	1,165	3,640
1975-76	4,400	2,000	6,400
1976-77	5,500	860	6,360
1977-78	22,100	11,430	33,530
1978-79	10,530	5,430	15,960
1979-80	--	--	9,500

[1] No counts Sept. 15-Oct. 7 and Dec. 16-Jan. 23, 1952, Jan. and Feb. 1957

the next highest harvest of 5,393 fish.

A rapid decline in the proportion of wild (non-hatchery) steelhead has been apparent in sport harvest statistics, declining from 61.7 percent in 1972-73 to less than 10 percent since the 1977-78 runs (Table 24). Management strategies including adoption of a catch-and-release only season during the early part of the migration when the wild steelhead run upriver have selectively influenced the reduction in harvest of wild stocks.

Angling effort for steelhead has varied widely from year to year and has generally been directly dependent upon the available harvestable surplus of steelhead trout within the river. Table 26 summarizes the steelhead fishing effort data for the period 1969-70 through the 1978-79 fish year. Four years of closures and restricted seasons, and an outstanding run of steelhead, combined to attract extremely heavy fishing pressure during the 1977-78 and 1978-79 runs. Both fall and spring seasons were characterized by crowds of anglers in certain areas. The crowding conditions as described in the IDFG report are presented for the 1977-78 seasonal fisheries below. First the fall season, viz:

> Finding a place to fish in most of the traditional fishing spots was difficult during the first month of the consumptive fishery. In addition, conflicts between shore anglers and boat fishermen increased significantly during the same period. It is the author's opinion that the unprecedented number of boats on the lower Clearwater during census intervals 3 and 4 may have reduced angler success by keeping the steelhead population in a state of harassment.

The spring fishery created even worse crowding, viz:

> The 1978 spring steelhead fishery on the lower Clearwater and North Fork below Dworshak Dam far surpassed any pre-

Table 26. -- Estimated angling effort during fall and spring steelhead seasons, 1969-1979

Year[a]	Estimated effort (hours)		
	Fall	Spring	Total
1969-70	52,821	14,495	67,316
1970-71	44,288	12,552	56,840
1971-72	39,966	1,343[b]	41,309
1972-73	58,561	22,701[c]	81,262
1973-74	45,252	14,196	59,448
1974	14,248	--[d]	14,248
1975	3,058[e]	--[d]	3,058
1976	9,058[e]	--[d]	9,058
1977-78	82,500	110,164	192,664
1978-79	10,935[e]	112,660	123,595

[a]The 1969-1971 and 1977 fall fishing seasons opened on 15 September; the following seasons opened 1 October

[b]Spring steelhead season closed 29 February 1972

[c]Season closed 15 March 1973

[d]No spring steelhead season

[e]Catch-and-release only

vious spring season in both angler participation and the number of fish harvested. Because of their migratory behavior (Ball and Pettit 1974), large numbers of hatchery steelhead continued to concentrate in the North Fork and larger pools immediately below the confluence in 1978 and spring season developed into a crowded, almost carnival-like fishery. Hoping to improve their chances, steelhead fishermen tended to fish as close to the hatchery as possible. During late February and through March, workers commonly counted several hundred anglers fishing along the banks of the North Fork between the dam and hatchery. Because the Idaho Department of Fish and Game's closure sign sat approximately 9m (30 ft) above the actual confluence, anglers began fishing at the Dworshak Hatchery point. We often encountered groups of 50 to 100 anglers crowded onto the point, fishing elbow-to-elbow and standing one above another on the steep rip-rap shoreline (Fig. 5). Boat anglers encountered similar conditions, and popular runs and pools became difficult to fish because of the number of boats attempting to utilize the same areas. Workers often counted between 20 and 30 boats between the McGill Hole and the confluence.

*****

Although the lower Clearwater River below the North Fork provided excellent steelhead fishing during the few periods when water conditions improved, the bulk of the shore harvest occurred in the North Fork and immediately below the confluence. The spring fishery was characterized by groups of extremely crowded anglers all fishing in the same area. It is my opinion that anglers fishing for steelhead during the spring will tolerate crowded conditions more readily than anglers fishing during the fall season. However, the number of fishermen that often crowded the point of rocks at the mouth of the North Fork made it extremely difficult to avoid snagging other angler's gear and numerous altercations were observed between sportsmen at the hatchery point. Workers at Dworshak Hatchery experienced problems with anglers leaving their garbage and refuse from cleaning steelhead on the hatchery grounds. Fishing pressure became so intense at the point that anglers began remaining there overnight in sleeping bags in order to reserve the best locations the next morning. With utilization so heavy, the problems associated with human waste quickly developed, and hatchery personnel were forced to provide temporary lavatories at the point. Hatchery personnel also reported several cases of theft and vandalism during March, when anglers began remaining on the hatchery grounds overnight.

Observations of Dworshak Hatchery personnel

should work closely together to develop regulations to prevent similar occurences in future catch-and-keep steelhead seasons.

In part, the crowding conditions of the spring fishery in the North Fork resulted from influences which the reservoir had on water quality, viz:

> An unusually wet winter and above normal temperatures caused the river to remain high and extremely turbid during most of the spring fishery. The high water levels and poor visibility made much of the lower Clearwater unfishable, and steelhead anglers began shifting their efforts to the North Fork below Dworshak Dam. Anglers also concentrated their efforts in the main Clearwater immediately below the North Fork confluence. In this area, from the confluence downstream to the McGill Hole (Nez Perce County line), river conditions were somewhat improved due to clear water withdrawals at Dworshak Dam.

Discharge regimes from the reservoir initially created difficult fishing conditions for steelhead fishermen. The CE has attempted to modify the reservoir release schedule to better accommodate anglers in more recent years (79), viz:

> Local area anglers began complaining in the fall of 1972 when they found lower Clearwater River levels high during the fall steelhead season. The first fall evacuations from Dworshak Dam periodically forced bank anglers and wading fly fishermen to abandon favorite fishing areas. The Dworshak Reservoir Regulation Manual, Revision No. 1 (1973), took steelhead angling requirements into consideration and established an evacuation schedule to lessen impacts on the lower Clearwater River during the prime period of steelhead fishing.
>
> The manual called for a total release from Dworshak Dam during the period 1 October to 15 November of 1,200 cfs over inflow. The 20-year average North Fork flow (1940-1960) prior to dam construction during the month of October was 2,068 cfs; for November, 3,297 cfs (U.S. Geological Survey, Water Resources Division 1974). When lower Clearwater River flows increase to above 4,400 cfs (Spalding guage), fishing opportunity for bank anglers becomes limited, and in some instances dangerous for fishermen attempting to wade traditional steelhead runs. It quickly becomes apparent that any additional North Fork discharge over the recommended 1,200 cfs level could, when added to the main Clearwater flow, significantly

limit participation and catch rates of shore anglers fishing below the confluence.

Because of the increased mobility offered to boat anglers, there has been an increasing postimpoundment trend in the percentage of the harvest caught by boat anglers. Boaters had the ability to fish prime holding waters which often became inaccessable to shore anglers during the periods of increased flows. The obvious exception to this trend occurred in 1971, during the filling of Dworshak Reservoir. Extreme low flows below the North Fork limited participation by boat anglers and bank anglers harvested a greater proportion of the catch.

Radio transmitter tagged steelhead, captured and tagged by IDFG biologists during early fall of 1977 when water temperatures were high and stress factors were highest, illustrated an extremely high survival rate after release to the Clearwater. Only one of fourteen tagged fish died as a result of the catch-and-release experience (78).

Some Dworshak Hatchery adults strayed beyond the confluence with the North Fork, continuing upstream in the Clearwater River. Tagging studies concluded that these fish eventually moved back downstream and entered the North Fork. None of the radio-equipped hatchery fish spawned in the upper Clearwater drainage.

Resident fisheries

The resident fisheries of Dworshak Reservoir, the North Fork Clearwater River above the impoundment, and the North Fork and mainstem Clearwater were studied intensively between 1969 and 1977 by the IDFG. The Department's investigations were designed to quantify initial changes resulting from the construction and impoundment of Dworshak Reservoir. Results of this pre-impoundment/post-impoundment investigation were

summarized in an IDFG report published in 1976 (79). The investigation continued for one more year after this summary report was published (March 1, 1976 to February 28, 1977) and the results of this additional year were published in 1977 (80).

Population survey data from the North Fork Clearwater River for fish remaining upstream above the lake, and for the North Fork tributaries, are reflected in Table 27. Reduction of wild rainbow trout-juvenile steelhead populations and increases in cutthroat trout numbers characterize the stream fishery above the Dworshak Reservoir. The appearance of juvenile rainbows in 1973 indicated that reservoir stocked fish would successfully use the North Fork tributary spawning areas.

The number of suckers in the tributaries above the reservoir increased, most noticeably in the lower tributaries. This increase indicated to IDFG biologists that the reservoir was serving as the source of the suckers. Suckers were in fact the most abundant species observed in 1976.

Underwater observations by divers have indicated a return of squawfish to the reservoir tributaries since a 1971 squoxin treatment. Selected portions of this discussion from the IDFG report appear below, viz:

> Underwater observation has been useful in documenting the return and penetration of northern squawfish into the drainage. Treatment with the selective piscicide, squoxin, in 1971 all but eliminated the species from the North Fork above Canyon Ranger Station. Prior to the squoxin treatment, no squawfish were recorded in angler's creels above Weitas Creek (Fig. 1) or were they observed by University of Idaho divers in Kelly Creek or the upper North Fork (Cannon 1971). The first dead squawfish observed after treatment began in August 1971 was in the vicinity of Weitas Creek and it can be assumed that in

Table 27. -- Fish collected from selected pools on tributary streams on the North Fork of the Clearwater River, 1969-1976

Years	Number of each species collected											Totals
	HRB	WRB	CT	DV	WF	SCU	CHN	BRT	SU	KOK	RSS	
1976		27	48	4	18	1			65		126	289
1975		25	48	3	35	1			25		104	227
1974	2	42	22		43	1			27		133	270
1973		60	41	2	60	3				6	19	191
1972		15	11		30							56
1971		29	14	1	20	2		1				67
1970		65	10	4	32	8						119
1969		125	14	5	19	14						177

HRB = Hatchery rainbow trout
WRB = Wild rainbow trout
CT = Cutthroat
DV = Dolly Varden
WF = Whitefish
SCU = Sculpin
BRT = Brook trout
SU = Sucker
KOK = Kokanee
RSS = Redside shiner
CHN = Chinook

Source: Pettit, Stephen W. 1977. Dworshak fisheries studies. Idaho Department of Fish and Game. Dingell-Johnson Proj. DSS-29.

> the upper 80 km (50 mi) of the North Fork minimal numbers of squawfish succumbed (Ball and Cannon 1972).
>
> No squawfish were observed by divers in 1972, nor did any appear in angler's creels on the North Fork. Mature, over 305 mm (12 in), squawfish were observed by project personnel during August 1973 near Weitas Creek (Ball and Pettit 1974). In addition, anglers captured an estimated 61 squawfish, nearly double the greatest preimpoundment catch. Divers counted 53 northern squawfish during the summer of 1974 and squawfish abundance in the angler's creels increased 88% over the previous years estimate (Pettit et al 1975). Perhaps the most significant observation was by divers in the Upper North Fork (Black Canyon) and Kelly Creek. Schools of mature squawfish were seen in both locations, including observations as far upstream as Cayuse Creek.

The referenced Figure 1 is duplicated herein as Figure 6.

The creel survey on the river located above the reservoir pool covered a 77 km (48 mi) reach of the North Fork Clearwater River beginning at Isabella Creek, just above normal pool and ending at the Kelly Forks Ranger Station. Results of the seven years of angler effort data were summarized as follows, viz:

> The estimated total angler effort spent on the North Fork during the summer census periods between 1969 and 1975 appears in Figure 5. Anglers spent an average of 11,300 hours each summer fishing the North Fork within the census area and although no significant postimpoundment changes were obvious, a slight decreasing trend occurred in 1972, the same year that the reservoir filled. Local area residents may have switched their angling efforts to the newly created reservoir fishery behind Dworshak Dam. An increasing trend in angler effort began in 1973, and the highest total (16,291 hours) was recorded for the 1975 census period. Angling effort trends are often difficult to analyze and compare because of environment factors. Weather conditions and stream flows effect the North Fork fishery and the extreme low flows in 1973 and the fire danger regulations in 1974 reduced total angler participation. The restricted trout limit regulation (3 fish) may have also caused a reduction in total angler effort in 1972 and subsequent years.

Harvest rates have declined slightly from approximately 1.3 fish per

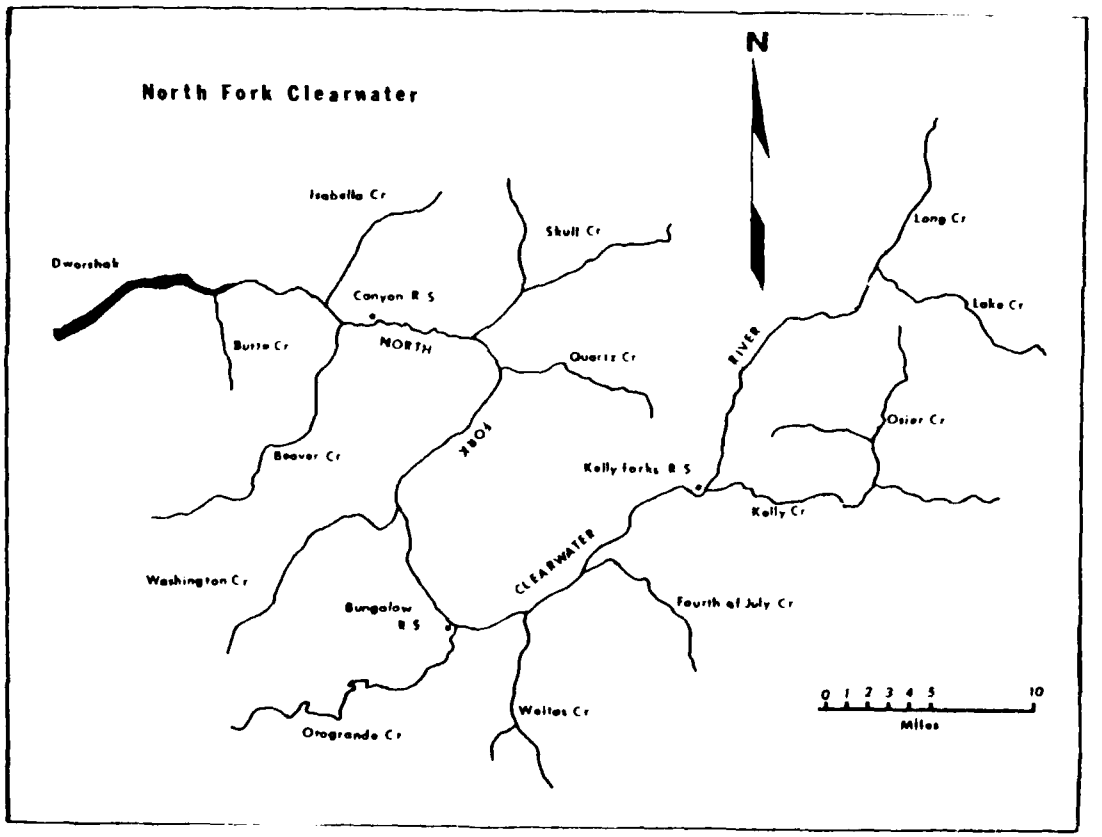

Figure 6. -- North Fork of the Clearwater above Dworshak Reservoir.

hour in 1969 to just under 1.0 fish per hour in 1975. Catches of rainbow-juvenile steelhead have declined. Cutthroat trout and Dolly Varden trout have increased in the catch, while mountain whitefish have exhibited no significant trend since construction of Dworshak Dam.

Creel data were also collected from the Clearwater River below the Reservoir, between Lewiston and Orofino, and from the North Fork Clearwater River below Dworshak Dam. Statistics gathered included effort and harvest of smallmouth bass and rainbow trout. A major change in the river fishery occurred over the period of the study as evident from the catch data presented in Table 28. Boat fishermen were not censused although this type of use of the lower Clearwater River was increasing and harvest by float fishermen may have been significant according to the IDFG report.

The average shore-fishing effort on the river over the three year period of study prior to project completion was 10,490 hours while the post-construction fishing effort on the same area for five years averaged 10,292 hours.

Post-impoundment river temperatures were significantly lowered during the summer in all years compared to historical values, and warm reservoir releases elevated water temperatures in the lower Clearwater River during the winter. The most recent IDFG report (80), described these conditions as follows:

> The cooling effects of North Fork discharge on the lower Clearwater below the confluence was again well documented in 1976 during the summer months. Perhaps just as signif-

Table 28. -- Estimated effort and harvest of smallmouth bass and rainbow-juvenile steelhead by shore fishermen during the summer census periods, lower Clearwater River and North Fork below Dworshak Dam, 1969-1976

Year	Summer census period	Estimated effort (hours)	Estimated summer harvest	
			Smallmouth bass	Rainbow trout
1969	8 June - 13 Sept	11,556	6,782	92
1970	26 April - 12 Sept	10,665	3,724	772
1971	11 April - 11 Sept	9,249	1,835	6,812
1972[1]	9 April - 23 Sept	11,845	2,671	2,805
1973[1]	8 April - 22 Sept	13,150[2]	1,434	8,670
1974	7 April - 21 Sept	6,427	1,031	2,409
1975	25 May - 13 Sept	7,377	499	1,857
1976	25 May - 25 Sept	12,661	650	5,050

1 - Season opened for trout on the lower Clearwater River on 27 May 1972, and 26 May 1973; previous years were year around fishing. North Fork below Dworshak Dam closed in 1972.

2 - Includes 1,241 hours by chinook fishermen

Source: Pettit, Stephen W. 1977. Dworshak fisheries studies. Idaho Department of Fish and Game. Dingell-Johnson Proj. DSS-29.

> icant was that river temperatures remained suppressed as far downstream as Lewiston during July, August and September. The cooling effect of North Fork water in 1976 was significantly greater than in the previous two summers when multi-level outlet gate operations helped reduce the temperature difference at the confluence (Pettit 1976). Water quality related problems at Dworshak Hatchery required that discharge temperature be kept below 13 C (55 F) in an effort to reduce juvenile steelhead mortality.

Although no significant water quality changes have occurred in the main Clearwater River, certain characteristics have been altered on the 3 km (1.9 mi) reach of free-flowing North Fork below the dam, (79) viz:

> As in previous postimpoundment years, no significant water quality changes occurred in the main Clearwater River during 1975. The water quality of the North Fork below the reservoir has shown a decreasing trend for both total hardness and alkalinity since 1972. Total hardness values for North Fork water taken at Ahsahka prior to the construction of Dworshak Dam averaged 46 ppm for the 3-year period between 1969 and 1971 (Edwin Tulloch, personal communication). Postimpoundment values have dropped steadily, and currently range between 12-15 ppm. Values for alkalinity have shown a similar downward trend.

The post-construction water temperature changes in the main Clearwater River below Dworshak Dam have perhaps contributed to the significant changes in the fish community structure which is reflected in the recreational harvest statistics (Table 28). However, it should be noted that the most significant changes in the recreational harvests occurred prior to the closure of Dworshak Dam. An attempt by IDFG biologists to explain this situation appeared as follows:

> A total of 7,123 smallmouth bass were caught by anglers fishing the lower Clearwater River in 1969. The estimated bass catch had fallen to less than 500 by 1975 (Fig. 3). The rapid decline in smallmouth bass harvest experienced prior to the completion of Dworshak Dam and filling of the reservoir during the winter of 1971-1972 is hard to explain. Perhaps the answer lies in a major switch in effort from bass to rainbow-juvenile steelhead. Since the estimated effort remained relatively constant in the preimpoundment years, and

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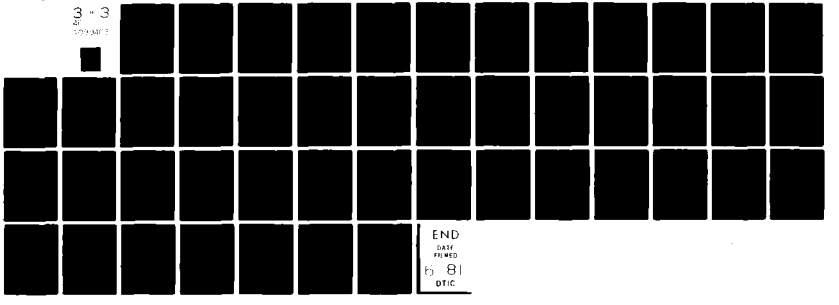

the lower river environment [illegible] yet been altered by Dworshak Dam discharge, a ch[illegible]gear or selectivity best answers the 70% drop in the sm[illegible]ch bass harvest.

Juvenile steelhead smolts released from Dworshak National Fish Hatchery first appeared in 1970, and a significant number apparently residualize and remain in the Clearwater River fishery each year. In 1971, the hatchery released 3,143,500 steelhead smolts and anglers harvested 9,624 residualized juvenile steelhead during the summer. At the same time, only 1,957 smallmouth bass were caught.

The further decline in the bass fishery has been well documented during the postimpoundment reports (Ball and Pettit 1974). Chief among the causes for the decline in smallmouth bass abundance and catch rates are the loss of spawning habitat, the delay in spawning brought on by colder water temperatures and nesting failures due to water level and temperature fluctuations during the spawning period.

Two major spawning areas were lost when the Washington Water Power Dam was removed in the winter of 1972. The Lewiston project was removed to make way for slack water created by Lower Granite Dam. The subsequent removal of Potlatch Corporation's log pond and the forebay behind the Washington Water Power dam reduced substantially the quantity of bass spawning area. Of course, the 10 km (6 mi) impoundment behind the dam was also heavily utilized by spawning smallmouth bass.

Larger rainbow-juvenile steelhead appeared in angler catches in the later years of the IDFG survey, viz:

Average length of rainbow-juvenile steelhead measured from anglers' creels was 270 mm (10.7 in) in 1976. Both the quality and average size has increased annually since Dworshak Reservoir discharge began modifying the lower river habitat. Many anglers interviewed during 1976 had trophy-size rainbow trout in their catch.

Mature resident rainbow trout again entered the fish ladder at Dworshak National Fish Hatchery in the spring of 1976. These individuals (n=211) averaged 346 mm (13.6 in) during the 1976 spawning period. The spawn from these returning rainbows is not presently being taken at Dworshak Hatchery, but this policy may be changed in the future to enhance resident fisheries.

The third part of the pre-impoundment/post-impoundment fishery study conducted by the IDFG dealt with Dworshak Reservoir itself. The studies were designed to enumerate anglers and other recreational users, angler harvest, food habits, growth and fish distribution. The angler use studies began in 1972 and extended through August 1976.

Since 1973, when a full seven months were surveyed for the first time, and the floating debris problem on the reservoir had considerably abated, angler effort on Dworshak Reservoir has averaged 129,470 hours (Table 29). Use by other recreationists (boating, skiing, picnicking, etc.) has generally been somewhat less than angler use, exceeding the estimated angler use only in 1976. Average use by all recreationists for the recreational seasons surveyed has averaged 241,820 hours per season.

Specific estimates of the average length of time spent by boat and shore anglers per trip were provided in the individual annual IDFG reports covering the Dworshak studies (77,79,80). Available trip-length information (1973-1975) was used to compute a weighted average for those years and this figure was then applied to the 1976 effort data (available only in total hours). This procedure allows estimation of the average annual project visitation by boat and shore fishermen for the survey periods of 1973-1976 (Table 30). Unfortunately the entire legal fishing season was surveyed in only one year, 1975. For example, in 1973, Dworshak anglers were not surveyed from mid September through December. Using the monthly angler-effort distribution from 1975 (79) and assuming essentially equivalent conditions for the missing legal fishing months of the other years, allowed proportional computation of

Table 29. --Estimated hours of recreational use on Dworshak Reservoir, 1972-1976

	1972[a]	1973[b]	1974[c]	1975[d]	1976[e]
Angler effort	19,172	187,502	118,384	85,248	126,747
Shore angler	9,137	16,816	15,025	11,297	20,169
Boat angler	10,035	170,686	103,359	73,951	106,578
Other recreational use	63,769	148,274	92,326	75,625	133,181
Shore activities	--	--	--	--	12,440
Boat activities	--	--	--	--	120,741
Total recreational use	82,941	335,776	210,710	160,873	259,928

[a]Census period: 27 May to 15 September
[b]Census period: 28 April to 30 November
[c]Census period: 30 December 1973 to 3 November 1974
[d]Census period: 5 January 1975 to 3 January 1976
[e]Census period: 4 January 1976 to 31 August 1976

Source: Pettit, Stephen W. 1977. Dworshak fisheries studies. Idaho Department of Fish and Game. Dingell-Johnson Proj. DSS-29.

Table 30. -- Estimated number of angler-trips at Dworshak Reservoir based upon estimated total hours (1973-1976) and average trip length data (1973-1975)

	Average trip length (hours)		Number of angler-trips	
Year	Boat anglers	Shore anglers	Boat anglers	Shore anglers
1973	4.64	2.91	36,786	5,779
1974	4.79	1.79	21,578	8,394
1975	4.45	2.37	16,618	4,767
Weighted averages	4.64	2.28	--	--
1976*	--	--	22,969	8,846
Average (1973-1976)	--	--	24,488	6,947

* Computed from reported angler-hours and calculated weighted average trip length figures

total average angler effort for each year during the period 1973-1976. The resulting estimate was an average of 35,000 angler trips per year on Dworshak Reservoir.

The recreational fish harvest peaked in 1973, and since 1974 (which was dramatically lower than the preceeding year) has exhibited a moderate but steady annual decline (Table 31). The overall catch rate in 1976 of over one-half fish per hour would still be considered reasonably satisfactory fishing. Composition of the reservoir sport fish catch has been dominated in most years by hatchery planted catchable rainbow trout (Table 32).

In addition to the hatchery planted catchable rainbow trout, kokanee salmon have constituted a significant part of the boat fishery since 1973 (Table 32). Several other species, including smallmouth bass, have contributed only slightly to the total harvest. The harvest of smallmouth is increasing, however, and constituted almost four percent of the boat-fishermen harvest in 1976.

The stocking rate has varied widely from year to year, as have return to the creel which has averaged 34 percent of the catchable plants. Stocking records for rainbow trout and kokanee are presented in Table 33.

Rainbow trout planted at catchable sizes have generally produced a poor quality fish to the creel. This situation was discussed in the IDFG report (79) as follows, viz:

> The quality of catchable rainbow trout has deteriorated several times during the early fishery on Dworshak Reservoir.

Table 31. -- Angler catch rates and harvest estimates for Dworshak Reservoir, 1972-1976

	Year				
	1972	1973	1974	1975	1976
Catch rate (fish/hr)					
Boat	1.5	1.49	.59	.82	.61
Shore	1.2	1.19	1.67	.75	.59
Estimated harvest					
Boat	12,727	246,687	60,092	68,523	55,037
Shore	10,035	18,040	25,237	8,418	11,400
Total	22,762	264,727	85,329	78,941	66,437

Table 32. -- Species composition of catch by percent for boat and shore anglers, Dworshak Reservoir 1972-1976

	Year									
	1972		1973		1974		1975		1976	
Species	Boat	Shore	Boat	Shore	Boat	Shore	Boat	Shore	Boat	Shore
Rainbow Trout										
Hatchery catchables[a]	91.6	94.9	49.2	61.9	25.6	55.5	22.7	42.6	59.3	83.8
Fingerling plants[b]	3.8	1.0	21.3	21.6	26.1	37.3	1.1	2.7	0.3	1.8
Unmarked[c]	3.9	3.9	5.7	11.9	2.1	6.3	51.4	49.8	6.6	10.8
Kokanee	--	--	20.9	0.1	41.7	0.3	20.0	0.2	26.3	1.1
Dolly Varden	0.2	0.0	<.1	0.0	0.2	0.0	0.1	0.1	0.3	0.0
Cutthroat trout	0.1	0.1	0.2	0.3	0.2	0.0	1.4	0.6	2.5	1.3
Smallmouth bass	--	--	--	--	2.3	0.2	2.5	2.5	3.8	0.8
Others	0.4	0.1	2.6	4.2	1.8	0.4	0.8	1.5	0.9	0.4

[a]Includes all rainbow trout with fin erosion
[b]Includes fingerling plants, marked fish
[c]Includes fish with no fin erosion, i.e., wild fish, juvenile steelhead, fry plants, unidentifiable fingerling plants.

Source: Pettit, Stephen W., Senior Fishery Research Biologist, IDFG, pers. comm., 1980.

Table 33. -- Stocking records for rainbow trout and kokanee for Dworshak Reservoir, 1972-1976

Year	Rainbow trout			Kokanee
	Hatchery catchable	Fingerling	Fry	
1972	269,826	773,630	--	1,012,745
1973	118,526	2,324,452	--	591,192
1974	16,702	750,228	--	217,300
1975	234,695	653,026	--	3,084,873
1976	79,207	18,500	615,000	1,326,000

Source: Pettit, Stephen W. 1977. Dworshak fisheries studies. Idaho Department of Fish and Game. Dingell-Johnson Proj. DSS-29.

In the late winter and spring of 1974 the condition of these fish was extremely poor. Anglers complained that catchables were not fit to eat and most were immediately released or found their way into garbage cans. The untested hypothesis for the cause in the loss of condition and poor quality flesh has already been discussed. It has been assumed by project personnel that a proportion of each hatchery catchable plant will fail to convert to a natural diet and fade from the scene rather quickly. In order to ensure that catchables in good condition were available to the winter and spring fishery, the planting schedule for rainbows was spread out over the entire year to include the fall and winter months. The fishery during the 1975 fall and winter months was the best in 4 years and no complaints were received concerning poor quality.

It is my opinion that annual stocking rates for hatchery catchable trout may be excessive.

Much higher quality fish have resulted from the fingerling rainbow plants, although the return to the creel have been considerably lower than for the catchable plants, viz:

The fingerling program has produced excellent quality rainbows for the reservoir fishery. During the 4-year investigation, Dworshak Hatchery planted 4,501,340 rainbow fingerlings into the reservoir (Table 15). Anglers have harvested an estimated 150,600 rainbows that were planted as fingerling fish during the 4-year study. This represents only 3.3% of the total planted but has accounted for approximately 52% of the annual harvest in 1974 and 1975.

Perhaps more significant has been the excellent condition of rainbow planted as fingerling once they are recruited into the fishery. Ball anc Cannon (1974) reported that rainbows planted as fingerling in 1972 averaged 273 mm (10.7 in) the following spring. Rainbows from the 1972 fingerling release (adipose clip) continue to enter the catch and have reached trophy size. An individual fish was captured during the winter of 1975 that weighed 4.8 kg (10.5 lb) and numerous adipose-clipped fish were captured in the 2.3 to 3.2 kg (5 to 7 lb) range.

It appears that rainbows planted as fingerling have been able to adjust well to the available reservoir food sources and more importantly, converted to a piscivorous diet capable of producing trophy-size fish. Fingerling plants did not suffer from the same loss of condition during 1974 that

catchable trout did and this may reflect their better adaptability and fish oriented diet.

The primary prey for piscivorous populations is the redside shiners. Dolly Varden and smallmouth feed almost strictly on this species.

The kokanee fishery has been supported by annual plants of fingerling at selected tributary stream locations. A maximum six percent return has been realized from the 1972, 1973 and 1974 plants (totalling 1.8 million fingerling kokanee). This low percent return may be influenced by the reservoir water management regime according to the IDFG (80), viz:

> The winter and spring drawdown may be responsible for significant losses of kokanee each year. This loss was first noted in April 1974 when immature and mature kokanee were observed dying and washed ashore below the dam. Further investigation showed that hundreds of dead and dying fish could be found each day between the mouth of the North Fork and Peck during periods of high spill. We failed to observe any losses during 1975, but high spills in March and April 1976 produced losses which appeared to be greater than those during 1974. Kokanee from three different year classes could be found by hundreds immediately below the Dworshak powerhouse in 1976. Fish kills were only associated with periods of high spill. These losses would be exceedingly difficult to quantify and impossible to prevent as kokanee were probably responding to migratory urges brought on during periods of increased discharge.
>
> The extreme drought condition during the winter and spring of 1977 eliminated the need for spilling. Project personnel were unable to find any kokanee or evidence of losses during the same period when significant mortalities had been observed in previous years. At the same time, no kokanee entered the hatchery via the fish ladder which had been a common phenomena during the periods of increased spring discharge. It now appears that loss through the dam could be significant, especially during years when high spills occur and particular year classes are weak.

Operation of the reservoir for power generation and other purposes has

influenced reservoir characteristics. Deep water oxygen concentrations are increasing and indicate a trend to increased oligotrophy. This may in part reflect the higher turbidity and lower algae production conditions which has typified Dworshak Reservoir in recent years.

Fishery Resources -- Evaluation of Planning Input

Non-consumptive resource appreciation factors, largely intangible in nature, represent uncompensated losses for a certain segment of the present and future resource users at each and every water resource development project. The Dworshak project, which converted 85.3 km (53 mi) of free-flowing river to a slack-water fluctuating impoundment, was no exception.

However, comparison of pre-impoundment resource conditions with the post-impoundment conditions allows some informed decisions to be made regarding the reasonable sufficiency of the actions taken by project planners to conserve tangible fishery resources during the construction and operation of the Dworshak project. Presentations of available resource-related data such as number of returning populations constitute this evaluation.

Steelhead trout fishery

Early planning conferences and reports dealt largely with designing facilities to pass both adult and juvenile steelhead over Dworshak Dam. Passage of the adult spawners was never considered to be particularly troublesome; however, the conservation agencies expressed serious reservations regarding successful passage of smolts through the reservoir and then through the turbines. Plan formulation and design considerations for passage facilities continued, primarily by staff of the lead agency, until it became apparent that the technical requirements for such facilities did not exist nor could they be developed prior to completion of

the dam and subsequent blockage of continued migrations. Although the IDFG preferred passage of wild strains rather than hatchery releases, it finally became necessary to accept the steelhead hatchery concept. Acceptance of the hatchery plan largely negated the direct application of the FWS's 1962 planning report which focused heavily on passage and spawning habitat improvement.

Abandonment of fish passage facilities in lieu of a steelhead hatchery, virtually eliminated the efforts which had begun to reestablish chinook salmon runs into the Clearwater drainage. The salmon migrations had been blocked on the lower Clearwater River by construction in 1928 of a small dam at Lewiston, Idaho. The IDFG/FWS report of 1962 indicated that access to spawning habitat adequate for 40,000 salmon redds on the upper North Fork Clearwater River would be permanently blocked by Dworshak Dam. This figure assumed passage of adults over the dam and did not include the spawning grounds eliminated via permanent inundation by Dworshak Reservoir. No consideration for artificial propagation of chinook salmon is apparent from the records. Thus, the potential for reestablishment of this important salmon fishery, was a probable indirect casualty of the Dworshak project.

At each juncture of planning, the ultimate objective was to prevent any loss to the existing anadromous fishery. That is to say, whether the discussions encompassed a two phase mitigation package of fish passage plus supplemental hatchery production, as was considered prior to 1964, or entirely hatchery-related compensation, the end result was to avoid any loss to the adult steelhead runs to the Clearwater River.

Dworshak Hatchery produces young steelhead of a desired size, some as one-year-old fish, others at two years of age, for release to the Clearwater River. These fish face a formidable series of obstacles before ascending the Columbia, Snake and Clearwater Rivers to return to the hatchery two to four years later. The migration route between the hatchery and the open ocean is blocked by eight high dams that must be traversed. Supersaturated gas problems, straying and predation within the reservoirs and other difficulties have combined to produce serious losses to all migrants, whether wild or of hatchery origin. Therefore the adult returns of Dworshak Hatchery fish, which have averaged slightly over 8,700 fish, are influenced by many factors not directly related to the Dworshak Project.

The frequency of success of the Dworshak Hatchery to release the desired number of healthy smolts would be a better measure of the mitigatory influence of the hatchery with regard to the sacrificed spawning and rearing contribution previously made by the North Fork Clearwater River. Dworshak Hatchery production goals were established based upon the number of juvenile steelhead estimated to have been produced by the North Fork Clearwater River prior to construction of the project. This goal was originally 3,360,000 steelhead, reared to a length of 180 mm (7.2 in). These production quotas were altered in 1976 so as to produce fewer, larger steelhead. The new goals were 2,400,000 fish with an average length of 200 mm (8.0 in). More recent goals have varied but generally fall around 2,600,000 fish.

Dworshak Hatchery was largely designed "on the job", and as a result many

rearing problems occurred during the initial years of operation. It now appears that the 1981 release will meet the previously established production goal, as did the 1980 release. This would be the first time when consecutive releases have met established quotas.

The steelhead juveniles released in 1980 were in excellent condition. The many rearing modifications incorporated at the Dworshak Hatchery over the years have resulted in the recently successful releases of the desired numbers of suitable quality steelhead juveniles.

It, therefore, appears probable that adequate compensation for the young steelhead believed to have been supplied to the Clearwater-Snake-Columbia River system by the North Fork Clearwater will be obtained by operation of the Dworshak Hatchery.

The recreational fishery for adult steelhead, supported historically by fish produced in the North Fork Clearwater River and of recent years by Dworshak Hatchery smolt releases, has been only imperfectly analyzed. Creel data are limited and useable data exist only for the Clearwater River fishery. Prior to construction of the project, the annual steelhead runs to the Clearwater River had averaged just over 23,000 fish per year (1961-62 through 1970-71). The run sizes were relatively stable from as early as 1957-58, peaked in 1962-63, and appeared to reflect a downward trend beginning with the 1963-64 runs. Over the nine year period of record since impoundment of Dworshak Reservoir (and the concurrent elimination of natural reproduction within the North Fork Clearwater) the annual returns have fluctuated wildly and have averaged less

than 14,000 fish.

One fact is clear, the 1977-78 run of over 33,500 fish, second in magnitude only to the 1962-63 run of 43,196 fish, was supported almost in its entirety by fish hatched and reared to smolt at the Dworshak Hatchery. The vast majority of the 1977-78 run was contributed by the 1975 hatchery release of 1.76 million smolt. Given favorable passage conditions on their seaward and return migrations, the hatchery obviously has the capability of providing sufficient young fish to support an adult return at least equivalent if not superior in numbers to the recent historical runs of record measured prior to project construction.

Societal use of the fishery, as reflected by angler exploitation of the unique B-run steelhead has been altered by the Dworshak project and concurrently by the series of downstream water developments. The single fully successful adult return of steelhead of hatchery origin (1977-78 run) prevents making judgements relative to the probable average effect of the Dworshak project on steelhead angling over a lengthy period. A direct relationship, as would be expected, has been shown to exist between the number of anglers attracted to the fishery and the number of steelhead in the river available for angler harvest.

The mitigation goal relevant to the steelhead fishery was to maintain this important resource at pre-project levels. It should be noted that the FWS predicted that, without the project, steelhead hatched and reared in the North Fork Clearwater would support an average of 9,500 angler-days per year over the period of project analysis (50 years).

Comparison of this value to existing levels of use is difficult as current use values are expressed only in angler hour terms rather than angler-days. Conversion of the angling effort estimates, available in the 1962 FWS report to angler hours for comparison to the post-impoundment records required making some assumption with regard to the number of hours spent per angler-day by the average steelhead angler on the Clearwater River prior to project construction. Published data from a steelhead fisherman survey on the Salmon River, Idaho, was used to compute such an average trip length (83). Based on this check station data for a 12 year period, steelhead fishermen averaged just over eight hours (8.3 hours) per angling trip. The 8.3 hour figure was used to convert the preconstruction angling effort data (angler-days) into angler hours. The 1962 FWS projection of 9,500 angler-days was thereby converted to a figure of 78,850 angler hours.

The actual angling-effort occurring on the Clearwater River between Lewiston and Orofino in those survey years during which the steelhead runs were naturally spawned (pre-project impacted runs) was 55,155 angler hours (1969-70 through 1971-72). This was close to but less than the assumed equivalent average angler effort projected by the FWS for the 50 year period of project analysis.

During the last two years of the IDFG's recreational steelhead fishery survey (1977-78, 1978-79) an average of 158,130 angler hours per year were expended on the Clearwater River below the North Fork. This fishery was supported almost exclusively by hatchery produced fish. Out of the 17,720 fish estimated to have been harvested from the Clearwater in

those two years only 1,110 (6.2 percent) were identified as being from wild stocks.

The returning fish population has, under the best conditions, supported twice as much angler use as was projected for conditions without the project. Some of the increase in effort is a direct reflection of population increase. The two post-impoundment years of greatest angler effort exceeded pre-project levels to such an extent, that population growth alone could not be the sole cause.

The much greater angler effort, concentrated upon a restricted area (no steelhead fishing on North Fork Clearwater River) has created the new problems of crowd control and associated vandalism. The crowding conditions which have typified the fall and spring steelhead fishery during years of large runs, attests in part to the success of the mitigation procedure in replacing the fish which would have been lost without the actions taken. As this intense use was never perceived during the pre-construction planning process, no actions or facilities were recommended to counter the new difficulties associated with intensive angler use.

Resident river fisheries

The Dworshak project directly altered the physical characteristics of the riverine habitat below the dam downstream to the junction of the Clearwater River and the Snake River at Lewiston, Idaho. These changes contributed to major shifts in the recreational fisheries within the river. The resident fishery of the North Fork of the Clearwater River above the reservoir was also altered as a result of the project.

It is difficult to determine how clearly these changes were anticipated by the IDFG and FWS prior to project construction. The sections of the 1962 report that addressed the river impacts were quite brief (approximately two pages total). Much of the discussion within this section related to the anticipated adverse impacts associated with the use of the waterways for transportation of logs. The rivers have not been utilized for this purpose since project completion.

The river below the project was expected to benefit from control of extremely high flows but to suffer from fluctuating water levels caused by project operation. Cold water was expected to be released from the dam but no discussion of the probable impact of such releases on the river's fish community was provided.

The 1962 FWS report did recommend that reservoir releases maintain temperatures less than 18 C (65 F) and to total not less than 2,000 second-feet. Additional studies were sought to allow a more accurate appraisal of project operation on water temperature profiles below the dam. The anticipated water level fluctuations (combined with log transportation) was expected to limit the resident fishery in the North Fork below the dam to 500 man-days and a harvest of 1,000 fish. Unfortunately, no appraisal of the project's impact specifically upon the resident fishery of the Clearwater River downstream to the junction of the Snake River was provided in the 1962 report. An annual loss of 40,000 juvenile steelhead was predicted (along with 30,000 adult steelhead) but this estimate applied to the entire North Fork Clearwater, Clearwater, Snake and Columbia Rivers.

Variable selector gates were provided by the CE to provide temperature control capability for the water releases which included the water supply source for the Dworshak Hatchery. River water temperatures during summer months have been reduced quite dramatically as far downstream as Lewiston, Idaho. The water temperatures sought in the 1962 report have generally been provided, with maximum water temperature at Lewiston of 17 to 18 C (63 - 65 F).

A possible effect of the reduced water temperature was a change in the relative abundance of the fish populations within the river, as reflected by the recreational harvest. Smallmouth bass harvest declined by an order of magnitude between 1969 and 1976. However, the most precipitous decline (-73 percent) occurred prior to completion of the Dworshak Dam, that is, prior to project-caused changes in water temperature.

In 1970 (the first production year), 1.37 million steelhead juveniles, averaging 187 mm (7.5 in), were released from the hatchery. In 1971, 3.14 million young steelhead averaging 182 mm (7.3 in) were released. Since then, at least 1½ million juvenile steelhead have been released into the Clearwater River each spring. Many of these fish residualize within the river rather than migrating directly through the system. The sport harvest of rainbow and juvenile-steelhead in the Clearwater increased from a total catch of 92 fish in 1969 to 6,812 fish in 1971. As noted above, this increase occurred prior to any reservoir-related change in water temperature.

Based upon the IDFG study of shore anglers over a period including three

years prior to project completion and five years after, no net change in angling pressure occurred for the Clearwater River resident fishery, following project completion. Angling effort on the river during both periods averaged just over 10,000 hours per year. Unfortunately these statistics included only shore fishing. Boating use of the Clearwater River below the North Fork is steadily increasing during the summer season and according to recent findings, boat fishermen constitute 15 to 20 percent of the total angling pressure during the summer fishery (John Irving, Student Investigator, University of Idaho, pers. comm. 1980). Assuming 15 percent boat fishing and an average angler trip length of 3.5 hours (arbitrary estimate), the total number of angler trips on the river below the Dworshak project would approximate 3,000 to 3,500 trips per summer angling season.

Prior to project construction, the free-flowing section of the North Fork Clearwater River was populated with juvenile steelhead, resident rainbow trout and cutthroat trout. In 1962 the FWS predicted that over the 50 year period of project analysis, the remaining unimpounded river would attract 14,500 days of angling for resident fishes each year (estimated at 7,400 man days in 1958). With the project, but without supplemental stocking of hatchery-reared rainbow trout, the remaining free-flowing river was expected to attract only 7,500 angler days or essentially to remain at the then current level. The loss of angler effort potential, was associated with the removal of a significant portion of the juvenile steelhead contribution to the recreational fishery. This decline in the number of young steelhead was associated with losses in fish passage operations and from predation by squawfish which were ex-

pected to invade the river and tributaries from Dworshak Reservoir.

To provide a resource base to support the anticipated increase in river fishing, and to stock the reservoir proper, the FWS recommended production facilities capable of rearing 45,360 kg (100,000 lbs) of fish, annually. The proportion of this production deemed necessary to replace the river population as opposed to the reservoir fishery was not stated.

In response, the lead agency included plans for a hatchery for resident fish production at a very early stage in project planning. Although production of resident fishes was not originally planned for the Dworshak Hatchery such production has been possible and the desired quantity of rainbow trout have been reared and stocked into project waters, annually. Since 1970, all of the reared fish have been stocked into Dworshak Reservoir and the free-flowing river above the lake has not been stocked.

To protect the river fishery from the anticipated predation problem the FWS/IDFG sought to have the river treated to control the squawfish population prior to lake inundation. This recommendation was formulated after completion of the 1962 report. A treatment was made in 1971 with squoxin which resulted in a significant but temporary reduction of the species in the treated waters.

The IDFG's investigations of the river fisheries above Dworshak Reservoir were initiated in 1969, three years prior to project completion. As expected, the contribution of juvenile steelhead to the sport harvest dropped dramatically following closure of Dworshak Dam. However, during recent years when proper flow conditions prevailed (particularly 1973), rainbow trout reproduction occurred in the North Fork. The self-sustain-

ing nature of the resident fishery within the North Fork was not anticipated in the preconstruction planning reports. Rather than declining dramatically as expected, the total community of wild game fishes (rainbow trout, cutthroat trout, Dolly Varden and whitefish) have declined only moderately since closure of the Dworshak Dam. Certain contributors to the river fishery have declined, most notably juvenile steelhead, but cutthroat trout and whitefish have increased to fill the gap to some extent.

Natural reproduction and expansion of certain game fishes, and adoption of restrictive harvest regulations have enabled the IDFG to cease stocking the river with hatchery rainbow trout.

No significant post-impoundment changes in angler effort were measured during the IDFG's eight year study of the free-flowing river. The most recent years of the survey (1975) indicated increasing angling effort on the study sections.

Dworshak Reservoir fishery

The 1962 FWS report, contained resource projections relating to Dworshak Reservoir. The impoundment dimensions considered in the report were essentially those of the project as it was built.

Because of the steep shorelines and anticipated water level decline during summer and fall, the reservoir was expected to be relatively unproductive of fish-food organisms and unsuitable for those game species found in the free-flowing river. Turbidity was not expected to be a severe problem except in isolated arms fed by denuded water-

sheds. Although trout reproduction was not expected in the lake, water temperatures were expected to remain well within the range suitable for supporting trout.

To support the anticipated reservoir trout fishery, the FWS recommended provision of hatchery facilities to produce 300,000 catchable trout, weighing 45,360 kg (100,000 lbs), annually. Fish growth rates within the impoundment were expected to be below average due to the limited food supplies. Nongame fish (squawfish and suckers) were expected to thrive and result in reduced game fish populations, unless artificially controlled.

After a few years of high fishing pressure, angler-use was expected to decline and average 6,500 man-days annually over the life of the project. Harvest was expected to average only 13,000 fish or 2 fish per angler day. This represents only a 4.3 percent return on the 300,000 catchable trout requested for stocking.

Actual post-impoundment occurrence, to date indicate the rather moderate expectations expressed in 1962 to have been greatly exceeded in both use and harvest on Dworshak Reservoir.

The reservoir supports a diverse sport fishery of rainbow, Dolly Varden, and cutthroat trouts, and kokanee. A coolwater species, smallmouth bass, has been stocked and is contributing increasingly to the recreational fishery. Angler effort on Dworshak Reservoir averaged an estimated 35,000 angler trips per year between 1973 and 1976. This is 5.4 times higher than the projected average life-time use of the lake as predicted

in 1962. Angling did decline after the first year the reservoir was full (1973) but may have stabilized according to the statistics for the most recent survey year (1976) when angling effort (approximately 31,800 trips) exceeded the preceeding two years.

Harvest averaged 123,860 fish between 1973-1976. This was 9.5 times higher than the average project-life prediction of 13,000 fish. Since the lake opened, harvest has steadily declined, amounting to 66,437 fish in 1976. Even at this level of harvest, the catch was 5.1 times greater than the FWS's 1962 prediction. In 1976, the year of lowest harvest, success rates were 2.0 fish per angler day which just happened to coincide with the success rate predicted in the 1962 report.

Hatchery planted catchable rainbow trout dominated the reservoir fishery for the initial three years (1972-1974) of impoundment. More recently, plants of fingerling and/or fry rainbow trout and wild trout have combined to dominate the sport harvest in combination with kokanee.

Plants of catchable size rainbow have not provided high quality fish to the creel. In fact, the condition of these fish has been so poor that many anglers have discarded or released the fish caught. Rainbow trout fingerling plants, in contrast to the catchable plants, have exhibited excellent growth and body condition. Redside shiners which were inadvertently stocked into the reservoir, have become well established and now provide an abundant prey for picivorous feeders. According to IDFG biologists, rainbow trout stocked into the reservoir as catchables have not converted from an omnivorous diet to a fish diet. These fish have

suffered seriously as a consequence. Fingerling rainbow, on the other hand, have readily converted to a fish diet primarily utilizing the redside shiners. As a result of this adaptability the rainbows stocked as fingerlings have consistently produced excellent quality fish for the recreational fishery.

The kokanee population, which was not envisioned as a reservoir introduction during earlier planning stages, has become increasingly important to the Dworshak Reservoir boat fishery. Each year-class of kokanee in the reservoir has been the result of hatchery plants of fingerlings. These annual plants have ranged from 217,300 to 3,085,000 fish, averaging approximately 1,250,000 or 185 fingerling per ha (75 per ac). Two factors have combined perhaps to preclude an even greater kokanee fishery in Dworshak Reservoir. Many of the highest potential spawning streams are blocked with impassable deadfall barriers that have not been removed. Most of these obstructions are off CE project lands.

There is no readily apparent solution for the occassional losses of adult and young kokanee which have occurred during periods of high water discharge through the dam. An investigation funded by the CE, is currently being conducted by the IDFG to discover ways to reduce these losses. Significantly, no major outmigrations have been identified since 1976.

SUMMARY

The Dworshak project, known early in the planning stages as Bruces Eddy, is located on the North Fork of the Clearwater River, 3.1 km (1.9 mi) above the confluence with the Clearwater River. The dam and lower portion of the project are within the Nez Perce Indian Reservation and the entire project is located in Clearwater County, Idaho. U. S. Highway 12, between Lewiston, Idaho, and Missoula, Montana, provides direct access to the Dworshak project.

The project is part of the comprehensive water resource development plan for the Columbia River and its tributaries. Authorized project purposes are for flood control and "other purposes." Navigation, power, and recreation are contributors to the project purposes. Authority for construction of the project was contained in Public Law 87-874, approved October 23, 1962, Section 201 of the 1962 Flood Control Act in accordance with House Document 403, 87th Congress, 2nd Session.

Construction funds were authorized by Public Law 87-880, approved on October 24, 1962, and construction began early in 1963. The dam was closed on September 27, 1971, and the first power was delivered on November 15, 1973. The Dworshak project is administered by the Walla Walla District of the North Pacific Division, U. S. Army Corps of Engineers.

Dworshak Dam is a concrete gravity structure with a crest length of 1001.9 m (3,287 ft) and a total height of 218.5 m (717 ft). Three generating units are incorporated into the project with a total generating

capacity of 400,000 kilowatts. Water to turn the turbines is removed through an intake structure equipped with selector gates for selective withdrawal to provide temperature control of released water.

The lake extends 86.3 km (53.6 mi) up the North Fork of the Clearwater River and covers 6,644 ha (16,417 ac) when at full pool elevation 487.7 m (1,600 ft) mean sea level (msl). At full pool the shoreline measures 282 km (175 mi) in length. The minimum instantaneous discharge currently permitted from the project is 305 m^3/sec (1,000 cfs).

Dworshak Reservoir is long and narrow with a maximum width of 2,743 m (9,000 ft) and an average width of only 547 m (1,800 ft). For most of its length, the terrain surrounding the lake is steep and rugged and for the most part heavily timbered. The Dworshak project includes 13,161 ha (32,521 ac) of fee lands located above the normal full pool.

The U. S. Army Corps of Engineers (CE), the U. S. Fish and Wildlife Service (FWS) and the Idaho Department of Fish and Game (IDFG) have been actively involved in fish and wildlife planning at the Dworshak project for over 30 years. As a result of the enormously important natural resources affected by the project, and the number of interested parties impacted, the planning record for the Dworshak project is easily the most extensive and complex of any project encountered in this series of case history studies.

The Dworshak project-associated loss of 6,071 ha (15,000 ac) of low elevation habitat, resulting from the permanent inundation of 85 km (53 mi) of river bottom habitat was expected to create serious losses to wild-

life populations within the North Fork drainage. Prior to project construction, white-tailed deer wintered along the North Fork Clearwater River at lower elevations, in areas essentially segregated from the wintering area used by elk and mule deer. Project-associated loss of white-tailed deer was predicted to run as high as 2,900 animals or 28 percent of the pre-project population. Other terrestrial wildlife communities such as upland game and furbearers were also expected to suffer seriously. However, apparently in response to the greater perceived value of elk the conservation agencies emphasized replacement of the inundated winter range for both deer and elk, a total of 6,071 ha (15,000 ac), with winter browse development in areas primarily beneficial to elk. This approach incidentally accommodated mule deer but essentially ignored white-tailed deer and the numerous other species groups affected.

The early FWS recommendations (1960 and 1962) were seemingly accepted by the action agency. The CE's 1961 general design memorandum included plans to acquire 4,856 ha (12,000 ac) "of the most suitable lands available" specifically to provide additional wintering elk habitat. This acquisition was expected to complement a similar acreage of project lands which were also to be managed as elk habitat.

However, within a year of the project's authorization in 1962, a modified mitigation concept (departing from the 1960 recommendation for fee acquisition and management of 9,713 ha [24,000 ac]) was proposed by the conservation agencies. The new request for mitigation lands specified fee acquisition of only a small area of 1,05[illegible]a (2,616 ac). All remaining habitat needs for elk mitigation were to be realized via management

agreements between the IDFG and private and governmental land owners. The CE readily adopted this approach and not until 1966, four years after project authorization, did the planning agencies once again unanimously concur that fee acquisition of at least a 2,024 ha (5,000 ac) "hard-core" area of elk winter range was indeed required. By that time, land acquisition, especially for purposes believed by some influential public servants to be peripheral to prime project purposes, was politically untenable.

Continuing political pressures served to focus land acquisition on an exchange of federal land for the desired privately owned "hard-core" lands rather than out-right purchase. The "hard-core" lands, located at the junction of the Little North Fork Clearwater River and the North Fork Clearwater River, were not selected by wildlife biologists on the basis of technical merit. Instead, the tract (actually three physically separate acreages) was the residue of the negotiation process of over 10 years. It quickly became clear that the management agreements signed between the IDFG and the ILB on approximately 14,165 ha (35,000 ac) were wholely unsatisfactory to the IDFG. The ILB operates under a constitutional mandate to maximize revenues and wildlife winter range management proved not to be sufficiently compatible with maximized timber production.

Thus, in 1972, the year the lake filled, the conservation agencies responded to the failure of the management agreements by resubmitting a formerly proposed (1960) request for acquisition of additional lands (located on Smith Ridge) considered vital to the preservation of the

impacted elk population. The Smith Ridge lands were separate but contiguous to the "hard-core" tract.

At the present (1980), 2,072 ha (5,120 ac) of habitat in the "hard-core" area have been acquired specifically for winter browse development and management at the Dworshak project. This represents 34 percent of the terrestrial habitat inundated by the project. Actually, according to the FWS's 1962 planning report, of the 6,071 ha (15,000 ac) of deer and elk winter range that was flooded by the Dworshak project, less than 8 percent was classified by the FWS as the type of brush habitat which is essentially the habitat of value to over-wintering elk.

Management strategies eventually adopted by all agencies insist that the potential increase in carrying capacity under intensive development and management on the 2,072 ha (5,120 ac) of "hard-core", 809 ha (2,000 ac) of project lands (subject to "effective" management), and 1,821 ha (4,500 ac) on Smith Ridge, is 915 elk. The estimate of 915 elk which could be supported on project associated lands, if managed specifically for that purpose, was independently computed by the FWS in 1972, based upon estimated carrying capacity, and by CE biologists in 1973, based on forage requirements and forage production potential.

It is quite apparent that elk losses to date, some nine winters after lake flooding, have not been nearly as severe as the potential loss of 2,700 animals which were envisioned by the conservation agencies prior to project construction. This hopeful tone must be tempered with the realization that a truly critical winter may not yet have occurred, al-

though the winter of 1974-75 was apparently quite severe.

Other expected adversities have failed to materialize. The reservoir was expected to create major impediments to big game utilization of remaining range by blocking traditional migration routes. Radio-tracking studies conducted after the reservoir was impounded have documented that elk and white-tailed deer frequently cross the reservoir. No major crossing problems were noted by IDFG studies. Contrary to long held beliefs, the Smith Ridge area has now been shown to attract more elk during the spring calving season than during the winter periods. Maximum winter use has averaged between 100 and 150 elk for the past five winters.

Intensive studies conducted by the IDFG have also documented that winter use of Smith Ridge and "hard-core" lands are essentially from the Little North Fork Clearwater basin elk herd and not, as previously suspected, from elk herds resident to the higher elevations of the North Fork Clearwater drainage.

The North Fork Clearwater basin elk herd has declined since Dworshak Reservoir was built. However, the same trend has occurred throughout the state of Idaho. In fact, the statewide decline in elk harvest has exceeded the decline experienced within the project impact area.

Winter range was clearly a limiting factor for white-tailed deer. Although baseline inventory data were not available prior to project construction, nor are such data available currently, knowledgeable biologists estimate that the project area white-tailed deer herd was reduced

by approximately 40 percent, or a loss of 1,000 animals as a result of the construction of the Dworshak project. If true, the loss has been approximately one third of the anticipated loss of 2,900 animals as predicted in the FWS's 1962 report.

To mitigate as much of this loss as possible, the IDFG recognize the value of deer winter range development on the narrow band of project lands surrounding the lower portion of the project. Such development is strongly supported by the IDFG and the FWS. However, winter range development for deer is in direct conflict with current project zoning which has dedicated all significant tracts of land in the lower portions of the project to present, or future intensive use recreation areas.

Black bear, mountain goats, and moose were not expected to suffer significantly as a result of the project. Black bear continue to be common along the reservoir with the highest numbers observed shortly after hibernation period. There is no indication that moose and mountain goats, neither commonly occurring in the project area, were harmed by the project.

Significant losses of ruffed grouse were expected, but the losses in terms of habitat or populations were never identified. Post-impoundment studies indicated average ruffed grouse densities of 0.27 to 0.5 birds/ha within the coniferous areas. Considering that 5,423 ha (13,400 ac) of timber lands were inundated by the project, perhaps as many as 1,500 to 2,700 ruffed grouse were displaced and lost as a result of project construction.

No quantitative data exist relating to upland game or furbearer hunting at Dworshak. Therefore, accuracy of the pre-construction projection of 5,000 man-days of grouse hunting cannot be evaluated. As expected, waterfowl use of the project has not been high and nesting is minimal. No projections were provided for furbearer harvest in the pre-construction documents.

Early planning conferences and reports associated with the anadromous fishery questions dealt largely with designing facilities to pass both adult and juvenile steelhead over Dworshak Dam. Although the IDFG preferred passage of wild strains rather than hatchery releases, it finally became necessary to accept the steelhead hatchery concept. Acceptance of the hatchery plan largely negated the direct application of the FWS's 1962 planning report which focused heavily on passage and spawning habitat improvement.

Abandonment of fish passage facilities in lieu of a steelhead hatchery, virtually eliminated the potential for reestablishing chinook salmon runs into the Clearwater drainage. The potential for reestablishment of this important salmon fishery, was a probable indirect casualty of the Dworshak project.

The ultimate planning objective for the anadromous fishery was to prevent any loss to the existing adult steelhead runs to the Clearwater River. Dworshak Hatchery produces young steelhead of a desired size for release to the Clearwater River. The hatchery was largely designed "on the job," and as a result many rearing problems occurred during the in-

itial years of operation. It now appears that the many rearing modifications incorporated at the hatchery over the years have resulted in the recently successful releases of the desired numbers of suitable quality steelhead juveniles. It, therefore, appears probable that adequate compensation for the young steelhead believed to have been supplied to the Clearwater-Snake-Columbia River system by the North Fork Clearwater will be obtained by operation of the Dworshak Hatchery.

Prior to construction of the project, the annual steelhead runs to the Clearwater River had averaged just over 23,000 fish per year (1961-62 through 1970-71). Over the nine year period of record since impoundment of Dworshak Reservoir (and the concurrent elimination of natural reproduction within the North Fork Clearwater) the annual returns have fluctuated wildly and have averaged less than 14,000 fish.

One fact is clear, the 1977-78 run of over 33,500 fish, second in magnitude only to the 1962-63 run of 43,196 fish, was supported almost in its entirety by fish hatched and reared to smolt at the Dworshak Hatchery. Given favorable passage conditions on their seaward and return migrations, the hatchery obviously has the capability of providing sufficient young fish to support an adult return at least equivalent if not superior in numbers to the runs measured prior to project construction.

The FWS predicted that, without the project, steelhead hatched and reared in the North Fork Clearwater would have supported an average of 9,500 angler-days per year over the period of project analysis (50 years). Actually, since project construction the returning fish population has,

under the best conditions, supported twice as much angler use as was projected for conditions without the project.

The much greater angler effort, concentrated upon a restricted area has created associated problems of crowd control and related vandalism. As this intensive use was never perceived during the preconstruction planning process, no actions or facilities were recommended to counter the new difficulties associated with intensive angler use.

The Clearwater River below the project was expected to benefit from control of extremely high flows but to suffer from fluctuating water levels caused by project operation. Cold water was expected to be released from the dam but no discussion of the probable impact of such releases on the river's fish community was provided.

The 1962 FWS report did recommend that reservoir releases maintain temperatures less than 18 C (65 F) and to total not less than 2,000 second-feet. As a result, variable selector gates were built into the dam by the CE to provide temperature control capability for the water releases which included the water supply source for the Dworshak Hatchery. Since project operation, river water temperatures during summer months have been reduced quite dramatically as far downstream as Lewiston, Idaho. The water temperatures sought in the 1962 report have generally been provided, with maximum water temperature at Lewiston of 17 to 18 C (63 - 65 F).

Smallmouth bass harvest from the affected river fishery declined by an order of magnitude between 1969 and 1976. However, the most precipitous

decline (-73 percent) occurred prior to completion of the Dworshak Dam. On the other hand, the sport harvest of rainbow and juvenile-steelhead in the Clearwater River increased from a total catch of 92 fish in 1969 to 6,812 fish in 1971. It must be noted that these changes occurred before completion of the dam and prior to any reservoir-related change in water temperature.

Based upon an IDFG study of shore anglers over a period including three years prior to project completion and five years after, no net change in angling pressure occurred for the Clearwater River resident fishery, following project completion. Angling effort on the river during both periods averaged just over 10,000 hours of shore angling per year.

In 1962 the FWS predicted that over the 50 year period of project analysis, the remaining, unimpounded section of the North Fork Clearwater River (above the reservoir) would attract 14,500 days of angling for resident fishes each year. The loss of angler effort potential for this area was associated with the removal of a significant portion of the juvenile steelhead population. To provide fish to support the anticipated increase in river fishing, and to stock the reservoir proper, the FWS recommended production facilities capable of rearing 300,000 fish, annually.

The lead agency included plans for a hatchery for resident fish production of this magnitude at a very early stage in project planning. Although production of resident fishes was not originally planned for the Dworshak Hatchery such production has been possible and the desired

quantity of rainbow trout have been reared and stocked into project waters, annually. Since 1970, all of the reared fish have been stocked into Dworshak Reservoir and the free-flowing river above the lake has not been stocked.

As expected, the contribution of juvenile steelhead to the sport harvest within the remaining free-flowing river above the reservoir dropped dramatically following closure of Dworshak Dam. However, during recent years when proper flow conditions prevailed (particularly 1973), rainbow trout reproduction occurred in the North Fork. The self-sustaining nature of the resident fishery within the North Fork was not anticipated in the preconstruction planning reports. Rather than declining dramatically as expected, the total community of wild game fishes (rainbow trout, cutthroat trout, Dolly Varden and whitefish) in the North Fork have declined only moderately since closure of the Dworshak Dam.

Because of the steep shorelines and anticipated water level decline during summer and fall, Dworshak Reservoir was expected to be relatively unproductive of fish-food organisms and unsuitable for those game species found in the free-flowing river.

To support the anticipated reservoir trout fishery, the FWS recommended provision of hatchery facilities to produce 300,000 catchable trout. After a few years of high fishing pressure, angler-use was expected to decline and average 6,500 man-days annually over the life of the project. Harvest was expected to average only 13,000 fish or 2 fish per angler day.

Actual post-impoundment occurrences, indicate the rather moderate expectations expressed in 1962 to have been greatly exceeded in both use and harvest on Dworshak Reservoir. Production of resident fish species for reservoir stocking have generally met prescribed goals. Angler effort on Dworshak Reservoir averaged an estimated 35,000 angler trips per year between 1973 and 1976. This is 5.4 times higher than the projected average life-time use of the lake as predicted in 1962. Angling did decline after the first year the reservoir was full (1973) but may have stabilized judging from the most recent survey year (1976) when angling effort (approximately 31,800 trips) exceeded the preceding two years. Harvest averaged 123,860 fish between 1973-1976. This was 9.5 times higher than the average project-life prediction of 13,000 fish.

Plants of catchable size rainbow have not provided high quality fish to the creel. In fact, the condition of these fish has been so poor that many anglers in the past have discarded or released the fish caught. Rainbow trout fingerling plants, in contrast to the catchable plants, have exhibited excellent growth and body condition.

The kokanee population, which was not envisioned as a reservoir introduction during earlier planning stages, has become increasingly important to the Dworshak Reservoir boat fishery. Studies have been initiated to help prevent future losses of adult and young kokanee which have occurred in some years during periods of high water discharge through Dworshak Dam.

REFERENCES

1. Walla Walla District. 1975. Final environmental impact statement, Dworshak Dam and Reservoir, North Fork Clearwater River, Idaho. Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington.

2. Walla Walla District. 1977. Dworshak master plan draft, a master plan for the management of all natural and manmade resources of Dworshak Reservoir. Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington.

3. Hutchinson, Samuel J. 1953. Letter of November 25, 1953 from Acting Regional Director, U. S. Fish and Wildlife Service to District Engineer, Walla Walla District, U. S. Army Corps of Engineers.

4. U. S. Senate. 1956. Bruces Eddy -- A conservation test in river basin planning. Congressional Record of proceedings of U. S. Senate debate on Thursday, July 26, 1956.

5. Norberg, Elmer R. and Lester Trout. 1958. Clearwater game and range study, Pittman-Robertson Proj., W-112-R final report, Idaho Fish and Game Department.

6. Tunnison, A. V. and D. L. McKernan. 1960. Bruces Eddy Dam and Reservoir, North Fork Clearwater River, Idaho. A report on the fish and wildlife resources. Report of the directors of the Bureau of Sport Fisheries and Wildlife and the Bureau of Commercial Fisheries. U. S. Fish and Wildlife Service, Washington, D. C. June 1960.

7. Tunnison, A. V. and H. E. Crowther. 1962. Memorandum from Acting Director, Bureau of Sport Fisheries and Wildlife and Director, Bureau of Commercial Fisheries to Commissioner of Fish and Wildlife. U. S. Fish and Wildlife Service, Washington, D. C. August 3, 1962.

8. U. S. Department of Interior. 1960. Sportsmen expenditures associated with big-game hunting, Clearwater Basin, Idaho. Fish and Wildlife Service, Portland, Oregon.

9. Walla Walla District. 1961. Bruces Eddy Dam and Reservoir, North Fork Clearwater River, Idaho, design memorandum No. 3, general design. U. S. Army Engineer District, Walla Walla, Washington.

10. Statts, Elmer B. 1974. Improved federal efforts needed to equally consider wildlife conservation with other features of water resource developments. Report to the Subcommittee on Fisheries and Wildlife Conservation and the Environment, Committee on Merchant

Marine and Fisheries, House of Representatives, Washington, D. C. March 8, 1974.

11. Quick, Paul T. and Samuel J. Hutchinson. 1962. A detailed report on fish and wildlife resources affected by Bruces Eddy Dam and Reservoir Project, North Fork Clearwater River, Idaho. U. S. Fish and Wildlife Service, Portland, Oregon. August 20, 1962.

12. Walla Walla District. 1970. Design memorandum No. 10 -- public use plan for development and management of Dworshak Reservoir, North Fork Clearwater River, Idaho. Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington.

13. U. S. Department of Interior. 1970. Big-game habitat management plan, Dworshak Reservoir, Clearwater County, Idaho. Bureau of Sport Fisheries and Wildlife, Portland, Oregon. April 1970.

14. Heezen, Keith. 1963. Recommended area to be managed for big game. Studies conducted under contract from U. S. Army Corps of Engineers by Idaho Department of Fish and Game, Boise, Idaho.

15. Barnaby, J. T. 1964. Letter from Acting Regional Director, Bureau of Sport Fisheries and Wildlife, to District Engineer, Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington. March 12, 1964.

16. Annon. 1969. Dworshak Dam and the Clearwater elk herd, or the Fish and Wildlife Coordination Act at work in Idaho. Unpublished summary of events prepared by Bureau of Sport Fisheries and Wildlife, Boise, Idaho. February, 1969.

17. Quick, Paul T. 1966. Letter from Regional Director, Bureau of Sport Fisheries and Wildlife, to District Engineer, Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington. June 28, 1966.

18. Woodworth, John R. 1966. Letter from Director, Idaho Fish and Game Department, to Senator Frank Church, United States Senate, Washington, D. C. November 16, 1966.

19. McElwee, Frank D. 1967. Letter from District Engineer, Walla Walla District, U. S. Army Corps of Engineers to Regional Director, Bureau of Sport Fisheries and Wildlife, Portland, Oregon. May 10, 1967.

20. Quick, Paul T. 1967. Letter from Regional Director, Bureau of Sport Fisheries and Wildlife, to District Engineer, Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington. June 7, 1967.

21. White, William M. 1967. Memorandum from Acting Assistant Director, U. S. Fish and Wildlife Service to Director U. S. Fish and Wildlife Service, Washington, D. C. July 31, 1967.

22. Baetkey, Henry. 1968. Statement in support of land acquisition recommended to mitigate project-associated wildlife losses at Dworshak Dam and Reservoir, North Fork Clearwater River, Idaho. Portland Regional Office, Portland, Oregon. February 27, 1968.

23. Samuelson, Don. 1968. Letter from Governor, State of Idaho to Robert A. Giesen, District Engineer, Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington. July 30, 1968.

24. Roberts, Travis S. 1968. Letter from Deputy Regional Director, Bureau of Sport Fisheries and Wildlife to District Engineer, Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington. August 29, 1968.

25. Giesen, Robert J. 1969. Letter from District Engineer, Walla Walla District, U. S. Army Corps of Engineers to Governor, State of Idaho. August 29, 1969.

26. Giesen, Robert J. 1970. Letter from District Engineer, Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington to Morton R. Brigham, Lewiston Idaho. March 19, 1970.

27. Peterson, Liven A., Jr. 1970. Letter from Field Supervisor, Boise Field Office, Bureau of Sport Fisheries and Wildlife to District Engineer, Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington. January 21, 1970.

28. Annon. 1970. Big-game management plan, Dworshak Reservoir, Clearwater County, Idaho. Bureau of Sport Fisheries and Wildlife, Portland Regional Office, Portland, Oregon. April, 1970.

29. Church, Frank and Len B. Jordan. 1970. Letter from authors to Walter J. Hickel, Secretary of the Interior, Washington, D. C. May 27, 1970.

30. Hickel, Walter J. 1970. Letter from Secretary of the Interior to Senators Church and Jordon, State of Idaho. August 3, 1970.

31. McNiell, Sam and Tom Leege. 1971. Memorandum discussing state lands within Dworshak elk mitigation block. Idaho Department of Fish and Game, Boise, Idaho. April 14, 1971.

32. Meske, Ted. 1971. Memorandum discussing a proposed land swap to acquire the south side of Smith Ridge for elk mitigation. Idaho Department of Fish and Game, Boise, Idaho. October 8, 1971.

33. Trombley, Gordon C. 1971. Letter from Commissioner, Idaho Department of Public Lands to Director, Idaho Fish and Game Department, Boise, Idaho. December 15, 1971.

34. Meske, T. A. 1972. Big game habitat improvement studies in the Dworshak Reservoir area, progress report for contract DACW78-72-C-0044, July 1, 1971, to June 30, 1972. Idaho Department of Fish and Game, Boise, Idaho.

35. Findlay, John D. 1972. Letter from Regional Director, Bureau of Sport Fisheries and Wildlife to District Engineer, Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington. February 1, 1972.

36. Connell, Richard M. 1972. Letter from District Engineer, Walla Walla District, U. S. Army Corps of Engineers to Regional Director, Bureau of Sport Fisheries and Wildlife, Portland, Oregon. March 14, 1972.

37. Norberg, Elmer R. 1972. Memorandum to files summarizing meeting with Senator Church, Twin Falls, -- Dworshak Dam and Reservoir, Idaho (CE). U. S. Fish and Wildlife Service, Boise, Idaho. June 22, 1972.

38. Findlay, John D. 1972. Letter from Regional Director, Bureau of Sport Fisheries and Wildlife, Portland, Oregon to District Engineer, Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington. August 25, 1972.

39. Trombley, Gordon C. 1972. Letter from Commissioner, Idaho Department of Public Lands to District Engineer, Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington. November 21, 1972.

40. Connell, Richard M. 1972. Letter from District Engineer, Walla Walla District, U. S. Army Corps of Engineers to State Director, Bureau of Land Management, Boise, Idaho. November 27, 1972.

41. Connell, Richard M. 1972. Letter from District Engineer, Walla Walla District, U. S. Army Corps of Engineers to Regional Director, Bureau of Sport Fisheries and Wildlife, Portland, Oregon. December 6, 1972.

42. Patton, Richard E. 1973. Staff review report on Smith Ridge elk browse land justification, written by Dworshak Project Coordinator, Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington. February 12, 1973.

43. Greenley, Joseph C. 1973. Letter from Director, Idaho Department of Fish and Game, Boise, Idaho to District Engineer, Walla Walla

District, U. S. Army Corps of Engineers, Walla Walla, Washington. March 9, 1973.

44. Greenley, Joseph C. 1973. Letter from Director Idaho Department of Fish and Game to District Manager, Bureau of Land Management, Coeur d'Alene, Idaho. July 10, 1973.

45. Bureau of Sport Fisheries and Wildlife. 1973. Memorandum to General Accounting Office from Acting Regional Director, Bureau of Sport Fisheries and Wildlife, Portland, Oregon. July 18, 1973.

46. Bureau of Sport Fisheries and Wildlife. 1973. Procedure used in determining elk mitigating values, Dworshak Project -- CE, North Central Idaho. Unpublished detailed background report prepared by Bureau of Sport Fisheries and Wildlife for General Accounting Office. August, 1973.

47. Greenley, Joseph C. 1973. Letter from Director, Idaho Department of Fish and Game to Senator Frank Church, Washington, D. C. July 25, 1973.

48. Morris, J. W. 1973. Letter from Director, Civil Works, U. S. Army Corps of Engineers to John C. Whitaker, Under Secretary of Interior, Washington, D. C. September 20, 1973.

49. Korfhage, Robert. 1977. Memorandum to District Manager, Coeur d'Alene District, Bureau of Land Management. August 18, 1977.

50. Zimmer, Martin. 1977. Lands report and required analysis of withdrawal application. In memorandum from District Manager to Idaho State Director, Bureau of Land Management. October 13, 1977.

51. Greenley, Joseph C. 1977. Letter from Director Idaho Department of Fish and Game to Chief, Real Estate Division, Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington. November 22, 1977.

52. Mathews, William L. 1978. Letter from Director, Idaho State Office, Bureau of Land Management to Director, Bureau of Land Management, Washington, D. C. January 16, 1978.

53. Zimmer, Martin. 1978. Dworshak withdrawal, environmental assessment record. Coeur d'Alene District, Bureau of Land Management, Coeur d'Alene, Idaho.

54. Hough, John D. 1978. Memorandum from Director, Western Field Office, Office of the Secretary of the Interior, Seattle, Washington to Director, Bureau of Land Management, Washington, D. C. May 8, 1978.

55. Gregg, Frank. 1978. Memorandum from Director, Bureau of Land Management to Secretary of Interior, Washington, D. C. May 17, 1978.

56. Fisher, Richard J. 1979. Letter accompanying submitted draft of interim general plan from Fish and Wildlife Service, Boise, Idaho to Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington. September 6, 1979.

57. Greenley, Joseph C. 1976. Letter from Director, Idaho Department of Fish and Game to Idaho State Board of Land Commissioners, Boise, Idaho. February 23, 1976.

58. Reed, Nathaniel, P. 1976. Letter from Assistant Secretary for Fish and Wildlife and Parks, Department of the Interior to Chief of Engineers, U. S. Department of the Army, Washington, D. C. April 29, 1976.

59. Annon. 1979. Summary of highlights of the history of mitigation effort concerning the Dworshak Dam and Reservoir project. Unpublished file summary of events prepared by Division of Ecological Services Staff, U. S. Fish and Wildlife Service, Boise, Idaho.

60. Greenley, Joseph C. 1976. Letter from Director, Idaho Department of Fish and Game to Assistant Secretary for Fish and Wildlife and Parks, Department of the Interior, Washington, D. C. August 31, 1976.

61. Allaine, C. J. 1979. Letter from District Engineer, Walla Walla District, U. S. Army Corps of Engineers to Director, Idaho Department of Fish and Game, Boise, Idaho. April 20, 1979.

62. Greenley, Joseph C. 1979. Letter from Director, Idaho Department of Fish and Game to Director, Western Field Office, Department of Interior, Seattle, Washington. May 25, 1979.

63. Walla Walla District. 1977. Plan for development of Rocky Mountain elk habitat, Dworshak Dam and Reservoir, North Fork Clearwater River, Idaho. Design memorandum No. 15. Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington.

64. Meske, Ted. 1975. Memorandum from game biologist to supervising game biologist, Idaho Department of Fish and Game, Boise, Idaho. November 10, 1975.

65. Meske, T. A. No date. Dworshak big game studies, Idaho. Summary report concerning period July 1969 - June 1977 prepared by Idaho Department of Fish and Game for the U. S. Army Corps of Engineers, Contract DACW68-78-C-0029.

66. Greenley, Joseph C. 1978. Comments from Idaho Department of Fish and Game on Dworshak withdrawal environmental assessment record by the Idaho State Office of the Bureau of Land Management, Boise, Idaho. March 1978.

67. Asherin, Duane A. and Mark L. Orme. 1978. Inventory of riparian habitats and associated wildlife along the lower Clearwater River and Dworshak Reservoir. Study conducted by Idaho Cooperative Wildlife Research Unit under contract to North Pacific Division, U. S. Army Corps of Engineers.

68. Leonard, Ross. 1959. Letter from Director, Idaho Department of Fish and Game to Regional Director, Bureau of Commercial Fisheries and Regional Director, Bureau of Sport Fisheries and Wildlife. Boise, Idaho. November 10, 1959.

69. Hutchinson, Samuel J. 1964. Memorandum from Regional Director, Bureau of Commercial Fisheries, Seattle, Washington to Director, Bureau of Commercial Fisheries, Washington, D. C. November 4, 1964.

70. Hutchinson, Samuel J. and Richard E. Griffith. 1964. Letter to District Engineer, Walla Walla District, U. S. Army Corps of Engineers from Regional Director, Bureau of Commercial Fisheries and Acting Regional Director, Bureau of Sport Fisheries and Wildlife, U. S. Fish and Wildlife Service.

71. Woodworth, John R. 1965. Letter from Director, Idaho Fish and Game Department to Regional Directors, Bureau of Commercial Fisheries, Seattle, Washington, and Bureau of Sport Fisheries and Wildlife, Portland, Oregon. May 5, 1965.

72. Quick, Paul T. 1965. Memorandum from Regional Director, Bureau of Sport Fisheries and Wildlife, Portland, Oregon to Director, Bureau of Sport Fisheries and Wildlife, Washington, D. C. May 17, 1965.

73. Woodworth, John R. 1966. Letter from Director, Idaho Department of Fish and Game to Regional Directors, Bureau of Commercial Fisheries, Seattle, Washington and Bureau of Sport Fisheries and Wildlife, Portland, Oregon. August 25, 1966.

74. Walla Walla District. 1966. Fish Hatchery, Dworshak Dam and Reservoir, North Fork Clearwater River, Idaho. Design memorandum No. 14.1. Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington.

75. Woodworth, John R. 1966. Letter from Director, Idaho Department of Fish and Game to District Engineer, Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington. January 7, 1966.

76. Walla Walla District. 1970. Increase in rearing capability and provision for resident fishery mitigation. Supplement No. 1 to design memorandum No. 14.1. Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington.

77. Woodworth, John R. 1971. Letter from Director, Idaho Department of Fish and Game to District Engineer, Walla Walla District, U. S. Army Corps of Engineers, Walla Walla, Washington. January 11, 1971.

78. Pettit, Stephen W. and Ronald L. Lindland. 1979. Clearwater River steelhead investigations. Idaho Department of Fish and Game. Dingell-Johnson Proj. F-73-R-1.

79. Pettit, Stephen W. 1976. Dworshak fisheries studies. Idaho Department of Fish and Game. Dingell-Johnson Proj. DSS-29.

80. Pettit, Stephen W. 1977. Dworshak fisheries studies. Idaho Department of Fish and Game. Dingell-Johnson Proj. DSS-29.

81. Ball, Kent and Stephen Pettit. 1974. Dworshak fisheries studies. Idaho Department of Fish and Game. Dingell-Johnson Proj. DSS-29-4.

82. Pettit, Stephen W., Will Reid and John G. Sneva. 1975. Dworshak fisheries studies. Idaho Department of Fish and Game. Dingell-Johnson Proj. DSS-29-5.

83. Canley, Donald and Tom Welsh. 1971. Statewide fishing harvest survey; Job 3 - Check station surveillance of steelhead trout fisheries. Idaho Department of Fish and Game. Dingell-Johnson Proj. F-18-R-17.

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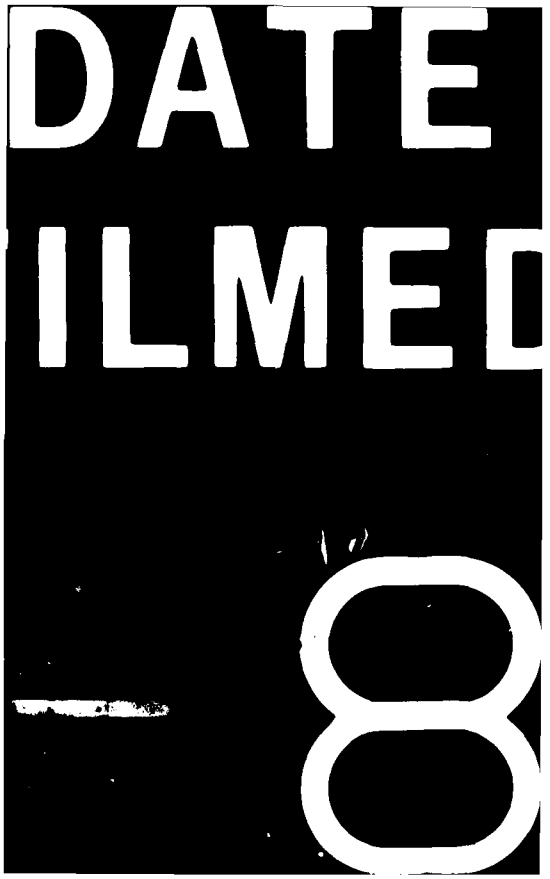
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