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ENDANGERED SPECIES ACT

RECORD OF DECISION

Regarding

BIOLOGICAL OPINIONS

by the

NATIONAL MARINE FISHERIES SERVICE

and

U.S. FISH AND WILDLIFE SERVICE

on

OPERATION

of the

FEDERAL COLUMBIA RIVER POWER SYSTEM

in

1995 AND FUTURE YEARS

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RECORD OF DECISION

I. INTRODUCTION

A. Description of the Action

The Bonneville Power Administration (BPA), the Army Corps of Engineers (COE), and the Bureau of Reclamation (BOR) coordinate operation of the FCRPS. The FCRPS consists of the various Federal hydroelectric projects in the Columbia and Snake Rivers. Operation of the FCRPS entails coordinated operation of these projects, including development and implementation of various agreements used to plan for operation of the FCRPS, to actually operate the FCRPS, and to coordinate operations with Canada and utilities in the Pacific Northwest. Examples include: (1) implementation of the Columbia River Treaty (Treaty) between the United States and Canada, such as by adoption of assured operating plans and detailed operating plans, (2) arrangements with Canada for Non-treaty storage, and (3) renewing and revising the Pacific Northwest Coordination Agreement.

B. Endangered Species Act Responsibilities

Pursuant to the Endangered Species Act (ESA), National Marine Fisheries Service (NMFS) and Fish and Wildlife Service (FWS) have listed several species potentially affected by operation of the FCRPS. NMFS has listed Snake River sockeye, Snake River spring/summer chinook, and Snake River fall chinook as endangered species. FWS has listed four Snake River snail species, Kootenai River white sturgeon, the grey wolf, and peregrine falcon as endangered species, and one Snake River snail species, the grizzly bear and Pacific Northwest bald eagle population as threatened species.

The ESA requires Federal agencies, in consultation with NMFS and FWS, to insure that their actions are not likely to jeopardize the continued existence of listed species and to utilize their authorities to further the purposes of the ESA by carrying out programs for the conservation, or recovery, of listed species.[1] The ESA also proscribes take of these species, unless such take is consistent with an incidental take statement or permit issued by NMFS or FWS.[2]

[1] 16 U.S.C. § 1536(a).
[2] 16 U.S.C. §§ 1536(o), 1538, 1539.

C. Process Leading to New NMFS B.O.

1. Reconsideration of NMFS 1994-1998 B.O.

In Idaho Department of Fish and Game v. NMFS, Civ. No. 92-973-MA (Lead Case) and consolidated cases (D.Or.), the Idaho Department of Fish and Game, State of Oregon and four treaty Indian tribes challenged the legal adequacy of NMFS' 1993 B.O. on FCRPS operations. In an opinion dated March 28, 1994, Federal District Court Judge Marsh set aside the 1993 B.O. and instructed the Federal defendants to review and reconsider it. Because the period covered by the 1993 B.O. had passed, and NMFS had just issued a new B.O. for the years 1994-1998, the Federal defendants chose, with the court's approval, to review and reconsider the 1994-1998 B.O. instead.

2. Extensive Consideration of State, Tribal, and Other Views

The Federal defendants further chose to engage in an extensive process of meetings and discussions with Federal, state, tribal, and non-governmental participants in the Idaho Dept. of Fish and Game v. NMFS litigation to consider and develop new information and approaches for avoiding jeopardy to the listed fish and for facilitating their recovery. A list of these participants follows.

Federal	States	Tribes	Utilities and Industries
NMFS	Alaska	Colville Confederated Tribes	Aluminum Co. of America
FWS	Idaho	Makah Tribe	Elf Atochem North America
COE	Oregon	Nez Perce Tribe	Columbia Falls Aluminum Co.,
BOR	Montana	Quinault Indian Nation	Kaiser Aluminum and Chemical Corp.
BPA	Washington	Umatilla Tribes	Intalco Aluminum Corp.
Dept. of Commerce		Warm Springs Tribe	Northwest Aluminum Co.
Dept. of the Interior		Yakima Nation	Oregon Metallurgical Corps.
			Reynolds Metal Co.
			Intermountain Forest Industries Association

Environmental Groups

American Rivers	Federation of Fly Fishers	Oregon Natural Resources Council
Boulder-White Clouds Council	Idaho Rivers United	Salmon for All
Coalition for Idaho Water	Idaho Salmon & Steelhead United	Sawtooth Wildlife Council
	Northwest Resource Information Center	

Meetings and discussions with Idaho v. NMFS participants began in June 1994 and continued into January 1995. Participants engaged in additional studies, review of models and methodologies to analyze impacts of activities upon fish, identification of scenarios to analyze with models, analyses of scenarios with the models, additional analyses, and reports on biological parameters and possible actions. On December 15, 1994, prior to continuing formal consultation on FCRPS operations, the action agencies submitted to NMFS a supplemental biological assessment on FCRPS operations and made it available to the public.

On January 25, 1995, NMFS issued a draft biological opinion for 1995 and future years and solicited written comments on the draft from the Idaho v. NMFS participants by February 10, 1995. In addition to receiving written comments, later in February, NMFS met with various groups to hear their oral comments.

These meetings and discussions are more fully described in NMFS' B.O. for 1995 and future years and in the Federal Defendants' reports to the court.

3. Consultation

While considering the views of states, tribes and non-governmental participants in the Idaho v. NMFS litigation, NMFS and the FCRPS action agencies renewed formal consultation on FCRPS operations. On December 15, 1994, the FCRPS action agencies submitted to NMFS a supplement to their 1994-1998 Biological Assessment (B.A.) The supplement to the B.A. addressed future operation of the FCRPS and potential impacts upon listed species. The action agencies also made this document available to the public.

Beginning in mid-January, NMFS and the action agencies engaged in a series of meetings, discussions, review of opinions and information provided by Idaho v. NMFS participants, and exchanges of information. NMFS and the action agencies considered various possible actions to avoid jeopardy to fish and further enable their recovery.

To provide an additional opportunity for consideration of all viewpoints, NMFS solicited comment on its January 25, 1995, draft B.O. from Idaho v. NMFS participants. By February 10, 1995, BPA and other entities submitted comments.

Formal consultation culminated with issuance by NMFS of a final B.O. on March 2, 1995.

4. NMFS Final B.O.

On March 2, 1995, NMFS issued its final B.O. regarding operation of the FCRPS and Juvenile Transportation Program in 1995 and Future Years (1995+ B.O.). The B.O. recommends an alternative for avoiding jeopardy.

D. Process Leading to New FWS B.O.

1. Reconsultation on FWS 1994-1998 B.O.

The FWS B.O. was not challenged in the Idaho v. NMFS litigation. However, because the FCRPS is operated as an integrated system, any modifications to system operations resulting from the reconsultation on FCRPS operations with NMFS needed to be coordinated with the needs of species listed by the FWS. In addition, the Kootenai River white sturgeon which had been proposed for listing when the FWS issued its B.O./Conference Opinion on 1994-1998 FCRPS Operations on July 27, 1994, had been listed as an endangered species on September 6, 1994[3], thereby necessitating a B.O.

On December 15, 1994, the FCRPS action agencies submitted a supplement to their 1994-1998 B.A. to FWS. The Supplemental B.A. addressed future operation of the FCRPS and potential impacts upon listed species. In order to fully integrate the FWS reconsultation with the NMFS consultation process described above, the action agencies also made this document available to the public.

Beginning in mid-December, FWS and the action agencies formally consulted by engaging in a series of meetings and exchanges of information. NMFS participated in some of the meetings to enable analysis of the impacts of various actions to be coordinated between FWS and NMFS. FWS and the action agencies considered how the proposal to operate the FCRPS as described in the Supplemental B.A. could avoid jeopardy to the Kootenai River white sturgeon and Snake River snails. To provide an additional opportunity for consideration of other viewpoints, FWS solicited comment on its January 25, 1995, draft B.O. from affected State management agencies. FWS issued its final B.O. on March 2, 1995. The new B.O. addressed the effects of FCRPS

[3] 59 Fed. Reg. 45989.

operations in 1995 and future years on four species of Snake River snails and the Kootenai River white sturgeon.

2. Effects on Other Species.

The July 27, 1994, B.O. on the effects of FCRPS operations on bald eagles remains in effect. FWS concurred with the conclusion of the action agencies that the proposed action is not likely to adversely affect the gray wolf, grizzly bear or peregrine falcon, and will have no effect on the Banbury Springs lanx (a listed Snake River snail).

E. Environmental Impact Analyses

Since NMFS listed species of salmon in 1991 and 1992, and FWS listed the Snake River snails in 1992 and the Kootenai River white sturgeon in 1994, the action agencies have conducted environmental analyses of the impacts of FCRPS operations. The action agencies performed these analyses in accordance with the National Environmental Policy Act (NEPA).

In 1992 the action agencies issued a final Columbia River Salmon Flow Measures Options Analysis/Environmental Impact Statement. This EIS addressed flow improvement measures that could be implemented in 1992. In 1993 the action agencies produced the final Columbia and Snake Rivers Flow Improvement Measures for Salmon Supplemental Environmental Impact Statement (SEIS). This SEIS evaluated water management actions implementable in 1993 and subsequent years.

The action agencies are now completing their Columbia River System Operation Review (SOR), an environmental analysis of a wide range of possible longer-term changes in operations of the FCRPS. The action agencies issued a draft SOR EIS in July 1994 and plan to issue the final SOR EIS in the summer of 1995.

The COE is also conducting the Columbia River System Configuration Study, a long-term study of structural alternatives to improve salmon migration conditions. Options under analysis include drawdown of the four lower Snake River reservoirs.

II. Recommendations of NMFS and FWS Biological Opinions

A. NMFS Biological Opinion

The NMFS B.O. on FCRPS Operations for 1995 concluded that operation of the FCRPS for the remainder of the 1994-1998 B.O., without additional activities consistent with NMFS' proposed Recovery Plan and provision for longer-term changes, failed to avoid jeopardy to the listed species.[4] To avoid jeopardy, NMFS recommended a comprehensive alternative.[5] The alternative includes immediate and intermediate term

[4] 1995+ B.O. at Part VIII.
[5] 1995+ B.O. at Part VIII.

actions to improve survival as well as immediate research, evaluation and engineering studies to improve survival in the intermediate and long term.

The immediate actions to improve in-river survival include increases in flows and spill, lowering of the lower Snake River reservoirs to near minimum operating pool, and lowering of John Day reservoir to near minimum irrigation pool. The intermediate term actions to improve survival include improvements in juvenile bypass systems and gas abatement programs.

The alternative emphasizes research, evaluation and engineering studies to improve survival in the intermediate and long term during the migration of fish. The alternative delineates a process for using information gathered from these studies to select one of three major long-term changes to the FCRPS: (1) passage improvements at dams, such as surface collectors, that significantly improve bypass and/or collection efficiency, (2) a spillway crest drawdown at the lower Snake River projects, or (3) a natural river drawdown at the lower Snake River projects.

B. FWS Biological Opinion

The FWS B.O. describes operations to regulate flows at Libby Dam for 1995 and 1996-1998. Regulation of flows is to be consistent with existing treaties and laws.[6] Operations for 1995 are more limited that those described for 1996-1998 due to time required to repair a turbine at the dam. Monitoring and evaluation activities to monitor sturgeon movements, spawning, egg deposition, fry production and recruitment are set forth in the measures, terms and conditions of the incidental take statement.

III. Decisions

The Biological Opinions issued March 2,1995, by NMFS and FWS recommend implementation of alternatives for avoiding jeopardy and implementation of measures in incidental take statements. This Record of Decision (ROD) documents BPA's decision to participate with the COE and BOR to operate the Federal Columbia River Power System (FCRPS) for 1995 and future years consistent with these alternatives and the measures in the incidental take statements. BPA makes this decision in order to satisfy its responsibilities under the ESA consistent with its authorities and responsibilities under other statutes and applicable law. The source of BPA's authority is the Pacific Northwest Electric Power Planning and Conservation Act and related enabling statutes.

[6] BPA notes that the Government of Canada, by Diplomatic Note of January 12, 1995, has objected to operation of Libby Dam to provide flows for fish during the May - June period and has requested Consultations with the United States pursuant to Article XII of the Columbia River Treaty.

This ROD constitutes a final action of the BPA Administrator taken pursuant to the Northwest Power Act.

In addition to recommending immediate and intermediate actions to benefit listed salmon, the NMFS B.O. delineates a process of study, monitoring and evaluation leading to selecting longer-term options for FCRPS operations.[7] BPA's objective is to select one of the options identified by the B.O., subject to timely consideration in the SOR and other environmental processes.[8]

IV. Changes from "Status Quo"

The FCRPS operations to be implemented pursuant to this decision substantially change operation of the reservoirs in the FCRPS compared to prior biological opinions, and especially compared to operations prior to the listing of Snake River sockeye in 1991. The action agencies have continuously increased their commitment in terms of flow augmentation, spill, drafting of reservoirs, structural changes, and research, monitoring, and evaluation. The matrix entitled "Comparison of Measures in the 1992 Biological Opinion, 1993 Biological Opinion, 1994-1998 Biological Opinion and 1995 Biological Opinion" summarizes changes in FCRPS operations under successive biological opinions.[9]

These changes have caused BPA to incur tremendous costs both in terms of expenditures and in lost revenues. The table entitled "1995 Biological Opinion Costs to BPA" estimates these costs.[10]

V. Rationale for Decision Respecting NMFS B.O.

A. Resolution of Uncertainties and Different Views

BPA recognizes, and the record demonstrates, that there are different views among scientists regarding what measures are most appropriate to benefit listed salmon. As described above, the action and consulting agencies engaged in extensive discussions, meetings, and review of information with scientists and representatives expressing the full spectrum of opinions. As expressed in this ROD, and based upon its biological analyses and review of the science, BPA believes a different set of actions could more effectively satisfy responsibilities under the ESA. However, the actions in NMFS' alternative provide benefits to fish that can enable these fish to reach survival levels and maintain the potential for recovery. In addition, by emphasizing research,

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[7] See Part II.A of this ROD.
[8] See Part I.E of this ROD.
[9] See Appendix A.
[10] See Appendix B. BPA based these estimates on information available as of February 28, 1995, and expects to refine them as it studies the final NMFS 1995+ B.O. issued on March 2, 1995.

monitoring, and evaluation, NMFS provides a responsible approach for better ascertaining benefits to the listed species, reducing uncertainties, and resolving different views. BPA agrees that this analysis over the next few years is essential to reasoned decisionmaking on longer term operations and structural changes. NMFS' alternative, therefore, is a reasonable one for avoiding jeopardy to and facilitating recovery of the listed salmon species.

B. Collective and Interdependent Effort to Reach Survival Escapement Levels

Improved spawning escapements of the listed fish are heavily dependent upon improvements by all actions affecting any of the various stages of the species' life cycles (habitat, hydro, hatcheries, and harvest). As long as a species is below levels needed for survival, improved benefits to the listed fish by all actions is critical to avoiding jeopardy. NMFS recognizes this interrelationship by calling for consistency by all actions with its proposed recovery plan.

C. Summary of Biological Analyses

BPA's own analysis shows that the improvements possible under NMFS' alternative, together with improvements by other actions affecting the listed species, are sufficient to enable positive trends in spawning escapement.

1. Biological Modeling

A wide array of operational alternatives identified through the Idaho v. NMFS settlement negotiations and additional consultations with NMFS on future FCRPS operations were analyzed relative to fish survival and recovery with the Columbia River Salmon Passage Model (CRiSP) and the Stochastic Life Cycle Model (SLCM). The CRiSP model provides estimates of juvenile passage survival and was developed by the Center for Quantitative Science, University of Washington. The SLCM provides estimates of spawning escapement trends and was developed by Dr. Danny Lee (U.S. Forest Service, Inter-mountain Research Station, Forestry Sciences Laboratory, Boise, Idaho) and Dr. Jeffery Hyman (Quality of the Environment Division, Resources for the Future, Washington, DC).. Together these models provide a quantitative assessment of the many actions and environmental factors that combine to affect the juvenile survival and long-term population trends of the ESA listed Snake River salmon stocks. Our review of regional analytical tools has found these models to be the best available and the only models available with adequate documentation and public access. The data used in these model analyses are also believed to be the best currently available. NMFS' review of the simulation capabilities of the regional passage models and available research for spring chinook showed that the CRiSP model results should be given more weight than the state and Tribal model results.

A more detailed documentation of the models, the biological data, and the modeling analyses performed for this assessment is provided in a separate document entitled "Biological Modeling Analyses of Alternatives Considered in The Record of Decision on Endangered Species Act Biological Opinions on Operation of the Federal Columbia

River Power System", BPA 1995. Additional information on the modeling analyses provided to NMFS during consultations is documented in "Life-Cycle and Passage Model Analyses Considered in Evaluating Effects of the Actions During Reinitiation of Consultation on The Biological Opinion on 1994-1998 Operation of the Federal Columbia River Power System", NMFS, 1995. Documentation for the CRiSP and SLCM models is provided in "Columbia River Salmon Passage Model, CRiSP.1, Documentation for version 5" Anderson et al 1995 and "SLCM: A Tool For Simulating The Population Dynamics of Anadromous Salmonids" Lee and Hyman 1992.

The results of this assessment show that both the 1994-98 BO Operations and the 1995 NMFS Draft BO - Option 1 alternatives[11], which provide a combination of additional flow augmentation, spill, modifications to fish bypass systems, and improvements in fish transportation, can result in major improvements in juvenile fish survival. Both of these alternatives provide approximately the same levels of survival improvements which were significantly higher than all other alternatives analyzed. The average juvenile survival in the years 1995 and 2003 increases by approximately 25 and 50 percent respectively for spring chinook and 80 and 190 percent respectively for fall chinook relative to the average survival during the environmental baseline years of 1975 through 1993. These juvenile passage improvements in combination with some minor changes in habitat, hatchery, and harvest impacts show substantial increases in spawning escapement trends toward recovery levels and increasing probabilities of being above critically low population levels for the Snake River spring, summer and fall chinook ESUs and the majority of the spring and summer chinook indicator stocks. Although sockeye were not explicitly analyzed in this assessment, they would be expected to have similar juvenile survival improvements as those projected for spring chinook.

This assessment found substantially lower survival improvements for reservoir drawdown alternatives such as the 1995 BO - Options 2 and 3[12]. In many cases these options resulted in even lower survival levels than the environmental baseline conditions. In addition to low survivals and population trends, these drawdown options also showed the potential for catastrophic adverse impacts to the listed stocks.

The assessment of alternatives also shows that measures that reduce fish transportation levels such as increasing spill at fish transportation projects and elimination of transportation at McNary are likely to reduce juvenile survival. The existing biological data and modeling analyses supports continued and expanded levels of fish transportation. Monitoring and evaluation efforts should help clarify uncertainty regarding the most effective fish passage routes. BPA believes that Option 1 in NMFS' alternative should include consideration of increased levels of transportation at all

[11] NMFS 1995+ B.O. at part VIII.B; NMFS 1994-1998 B.O.
[12]. NMFS 1995+ B.O. at part VIII.B.

existing projects, the addition of transportation at other projects, and transportation to the estuary.

2. Additional Beneficial Actions

In addition to the actions modeled, BPA provides funding for a wide array of actions contained in the NPPC's Columbia River Basin Fish and Wildlife Program. Other activities by BPA, the action agencies and others continue to provide improvement for fish passage and survival. Funded under the Council's Program are projects such as spawning habitat improvement, application of fish disease research, and supplementation. BPA and others are also working to benefit the listed populations through the inseason management process, optimizing river operations for timing of active fish movement, turbine peak efficiency and facility improvement measures such as fish ladder temperature control. Benefit quantification for these activities is inexact, but BPA and the region, through the Council's Implementation Planning Process, believes benefits are realized by the weak and listed salmonid populations.

The NMFS proposed framework for adaptive management and monitoring and evaluation will help the region quantify benefits for some of these activities, while others will remain unevaluated. We continue to support a strong, objective adaptive management program based on sound science.

3. Biological Analysis Conclusions

BPA concludes that the alternative described in the NMFS B.O. avoids jeopardy to and facilitates the recovery of listed salmon based on the substantial improvements in juvenile survival and increasing population trends. This conclusion is further supported by the significant number of recovery measures that were not included in the modeling analyses making this a conservative assessment. In addition, the emphasis on monitoring and evaluation sets a framework for continuing to improve the effectiveness of operational alternatives and helps insure that we make informed adaptive management decisions if additional measures are required in the future.

BPA also concludes that NMFS' alternative avoids the destruction or adverse modification of critical habitat. The analysis of whether an action jeopardizes listed species is almost identical to the analysis of whether the action adversely modifies or destroys critical habitat.[13] During the processes leading to NMFS' final B.O., NMFS and the action agencies have considered the impacts of the alternative upon features of habitat. Their analysis of impacts upon the survival of the listed fish necessarily encompassed evaluation of impacts upon critical habitat.

[13] See the regulatory definitions of "jeopardize the continued existence of" (reduce appreciably the likelihood of both the survival and recovery of a listed species") and "destruction or adverse modification" ("appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species") at 50 C.F.R. § 402.02.

D. Issues Warranting Study, Monitoring and Evaluation

Adaptive management directed by monitoring and evaluation forms the basis for avoiding jeopardy and achieving recovery of the listed Snake River salmon. A comprehensive life cycle ecosystem approach with a succinct decision protocol is essential for answering the critical uncertainties within the FCRPS, estuary, near shore ocean and the ocean encompassing the adult range of the listed salmon. With this information the region can make the resource allocation decisions needed to best advantage the listed populations.

The NMFS BO and Draft Recovery Plan contain the framework necessary to avoid jeopardy to the listed species, promote their recovery, and base decisions upon the best available science. Although there has been much study of Snake River salmon, the species are extremely complex, and the data regarding effects and benefits to these species is limited. Immediate concerns exist over spill and resulting gas supersaturation and its effect on fish, reservoir drawdowns that may not achieve survival improvements and limitation of transportation at McNary Dam which may decrease survival of upstream Columbia River populations.

We understand that these and other issues will be addressed by the monitoring and evaluation (M&E) and adaptive management framework provided by NMFS. The research and availability of fish for sampling should be given the highest priority so that the region can make the best decisions on the benefits of these often costly measures.

The M&E and evaluation stressed in the NMFS B.O. is also critical to determining the effectiveness of the following costly operational measures.

- Flow augmentation releases could be more effectively utilized by timing the releases coincident with significant juvenile outmigrations. Such operations would conserve storage in low water years to provide more augmentation for summer (especially August) migrants. The opinion specifies refilling the Lower Granite pool above minimum operating pool (MOP) after November 15. Yet, it is believed that the juvenile outmigration and adult migration are completed by the end of October. Thus, through M&E the migration timing can be confirmed and unnecessary and costly Lower Granite MOP operations can be avoided.

- Similarly, M&E can confirm the effectiveness of operating the John Day pool within a one-and-a-half foot range of minimum irrigation pool (MIP).[14] Operating

[14] The provision regarding John Day anticipates economic mitigation from some source. However, funding for such mitigation must come from a source other than BPA: BPA lacks authority to provide such economic mitigation. August 12, 1992, Memorandum from Harvard P. Spigal, General Counsel, to Randall W. Hardy, Administrator, entitled "Legal Authority of the Bonneville Power Administrator to Fund Economic Mitigation Measures"; March 9, 1995, Memorandum from James O. Luce, Assistant General

John Day within this very narrow range will be a difficult operation, and may often be impossible, due to wind effects, rapid streamflow changes, and changes in spill. With M&E actual pool survival improvement could be measured, and the benefits weighed against hydro system operational flexibility.

- Further monitoring and evaluation are warranted to determine the effectiveness of operating turbines within 1% of peak efficiency during adult migration. Through comprehensive monitoring and evaluation millions of dollars and millions of acre-feet of water could potentially be redirected to more optimal measures.

BPA raised additional issues in its comments on NMFS draft B.O. dated January 25, 1995.[15] BPA incorporates these prior comments by reference.

VI. Rationale for Decision Respecting FWS B.O.

A. SNAKE RIVER SNAILS

BPA is not now involved in operational decisions on the upper and middle Snake River and therefore has not consulted with FWS on a proposed BPA action. If BPA later actively participates in operational decisions on the middle and upper Snake River, BPA expects to consult with FWS. BPA's involvement in snail consultation and level of participation in operational decisions in the Snake River will determine BPA's level of involvement in further snail research or assessments.

B. 1995 AND FUTURE YEARS OPERATIONS AVOIDS JEOPARDY TO KOOTENAI RIVER WHITE STURGEON.

The FWS B.O. describes specific operations of Libby Dam as a reasonable and prudent alternative to the proposed action and monitoring and evaluation as measures, terms and conditions of an incidental take statement. It is BPA's opinion that implementation of these operations and performance of the described monitoring and evaluation will avoid jeopardy to the sturgeon. BPA has performed and funded analyses over the past eight years to better understand the status and life history requirements of the sturgeon and bases its opinion on these analyses.

Counsel, and Philip S. Key, Attorney, to R. Hardy, Administrator, entitled "Legal Authority to Fund the Extension of Pumping Facilities in the John Day Pool".

[15] Comments by the Bonneville Power Administration on the January 25, 1995, Draft Biological Opinion by the National Marine Fisheries Service on Operations of the Federal Columbia River Power System for 1995 and Future Years, submitted to NMFS with a February 10, 1995, letter from Judith Johansen to William Stelle and Michael Spear.

1. Status of the Species

Libby Dam was completed in 1974. At that time little was known regarding the status and life history of the Kootenai River white sturgeon (*Acipenser transmontanus*). British Columbia Ministry of Environment and Parks[16], Idaho Department of Fish and Game (IDFG)[17], and Montana Department of Fish, Wildlife and Parks (MDFWP)[18] initiated studies in the late 1970's and early 1980's to evaluate the status and life history of these sturgeon.

Population estimates were made from these studies in 1982 and 1990. They showed that during this time period the sturgeon population declined from an estimated 1,194 fish[19] to approximately 880 fish[20]. Only eight fish have been captured during monitoring activities since 1989 that were determined to be from post 1974 year classes. Four of these fish resulted from natural spawning in the years 1976 through 1978, and four fish came from the 1991 year class. There is some uncertainty whether the fish from the 1991 year class were naturally spawned or spawned in the Kootenai Tribe of Idaho experimental sturgeon hatchery.

2. BPA'S Research Activities

In 1988 BPA began funding IDFG and the Kootenai Tribe of Idaho (KTOI) to identify environmental factors limiting the white sturgeon population in the Kootenai River as part of the Northwest Power Planning Council's Fish and Wildlife Program. IDFG research focused on the status and life history requirements of the sturgeon. KTOI constructed an experimental hatchery to determine the feasibility of artificial propagation of the sturgeon.

In the spring of 1991 IDFG requested the COE to shape flows from Libby Dam for sturgeon research. The COE shaped flows as requested which provided flows of above 35,000 cfs at Bonners Ferry, Idaho for 15 days. A peak flow of 53,000 cfs was recorded on May 19 at Porthill, Idaho. A similar request was made in 1992, but not implemented since it was a poor water year and water was therefore not required to be released for flood control during the sturgeon spawning period.

The Kootenai River white sturgeon was petitioned for listing under the ESA on June 11, 1992, by the Idaho Conservation League, Northern Idaho Audubon and Boundary Backers.

3. Sturgeon Technical Committee 1992-1993

On June 16, 1992, the COE, BPA, FWS, IDFG, MDFWP, KTOI, and several other U.S. and Canadian organizations formed the Kootenai River White Sturgeon Technical

[16] Andrusak 1980.
[17] Partridge 1983.
[18] Graham 1981.
[19] Partridge 1983.
[20] Apperson and Anders 1991.

Committee. The Committee sought to identify factors affecting Kootenai River white sturgeon and develop a regional pre-listing recovery strategy that would form the basis of a conservation agreement between the FWS and various agencies. This group focused on lack of flows as the primary cause of sturgeon decline and did not address the possible impacts of contaminants, loss of habitat and lack of nutrients.

In 1993, the FWS requested flows of 35,000 cfs over a 40-day period with ramp up and ramp down periods. The requested operation extended from mid-April to mid-August. The COE and BPA responded that the FWS request did not fall within the operating constraints of the hydrosystem, but agreed to provide 400,000 acre-feet of water for an experimental flow to be released beginning June 1, 1993. The goal of the experiment was to determine if 20,000 cfs sustained for two weeks at Bonners Ferry would result in sturgeon spawning (presence of eggs/larvae). A total of three eggs were collected. The Committee did not reach a conclusion on a recovery strategy and disbanded in April 1993.

On July 7, 1993, the FWS proposed to list the Kootenai River population of white sturgeon as "endangered" under the ESA[21]. On November 18, 1993, BPA submitted written comments on the proposed rule to the FWS .

4. Kootenai River Basin Steering Committee 1993-Present

In October 1993, the Kootenai River White Sturgeon Steering Committee convened to continue white sturgeon discussions following the disbanding of the Committee. The group initially focused on technical issues related to white sturgeon recovery and coordination of BPA funded research activities in the Kootenai River. In February 1994 they expanded to include all research (burbot, nutrient dynamics, etc.) in the Kootenai River basin and changed their name to the Kootenai River Basin Steering Committee. The group facilitates technical discussions, exchanges of information and coordinates research activities in the basin.

5. Formal Conferencing

On December 2, 1993, the COE and BPA requested formal conferencing under section 7 of the ESA on the effects of 1994-1998 FCRPS operations on the Kootenai River white sturgeon. The FWS issued a formal Conference Opinion on July 27, 1994, concluding that the proposed action was not likely to jeopardize the sturgeon.

The action proposed was in three out of ten years to: 1) maintain 15,000 cfs at Bonner's Ferry in May; 2) increase flows to provide 20,000 cfs at Bonners Ferry for 35 days during the suspected sturgeon spawning period; 3) ramp down and maintain 11,000 cfs for 28 days; and 4) conduct no load-following during May through July in years in which these flows were provided. This action also provided potential benefits to the listed salmon species.

[21] 58 Fed. Reg. 36379.

During the 1994 runoff period, BPA and the COE stored 1,200,000 acre-feet of water behind Libby Dam which was shaped and released from May-July to stimulate natural sturgeon spawning. Beginning on May 9, the flow at Bonners Ferry was held above 15,000 cfs, then increased to 20,000 cfs on June 1 and held for 28 days. Flows were ramped down over three days to 12,000 cfs and held stable over the holiday weekend (Fourth of July) at the request of Montana, then further ramped down over five days to 4,000 cfs by July 11. This operation exhausted the 1.2 MAF of water stored for sturgeon.[22] Although the release fell short of the intended operation due to record low incremental flows and concerns for final refill elevations of Lake Koocanusa, a total of 253 eggs and one larvae were collected in the Shorty's Island area. The location of these eggs is significant because, until they were found in 1994, the Shorty's Island area was thought only to be a staging area for the sturgeon. Presence of eggs suggests that spawning may have occurred in prior years in which sturgeon were observed in that area but sampling was not conducted as extensively as in 1994.

6. Listing and Consultation

The Kootenai River population of white sturgeon was listed as endangered under the ESA on September 6, 1994.[23] In the final rule FWS states "that there is no recent evidence of successful spawning and survival past the egg stage" and "existing regulations and experimental flow programs have not been effective in arresting this decline."[24]

Even though sturgeon spawned in 1994, there was no evidence that young sturgeon were recruited to the population. The lack of larvae and fry collected in sampling gear may have been related to time and location of sampling rather than lack of sturgeon in the system.[25] BPA believes that sampling for larval, fry and juvenile sturgeon needs to be done in the lower Kootenai River, the south arm delta area of Kootenay Lake and in Kootenay Lake, B.C. However, sampling in Canada is dependent upon approval from British Columbia. Unfortunately, demonstrating any juvenile recruitment, let alone "significant" recruitment, may require more than one year after any proposed operation. BPA believes that flows are one of the important components affecting sturgeon recruitment. However, the exact magnitude and duration of flow required to produce "significant" recruitment is unknown. Other possible factors affecting sturgeon recruitment include reduced biological productivity, loss of habitat, poor water quality and effects of contaminants. Focus on only one potential limiting factor responsible for poor recruitment since 1974 should be avoided because it may prevent the development of effective recovery measures. This comprehensive approach should be used to develop research priorities and conservation measures to insure the continued existence of the sturgeon. Future refinement of the technical standard for "significant

[22] Kootenai Tribe at al 1994.
[23] 59 Fed. Reg. 45989.
[24] 59 Fed. Reg. 45989.
[25] Biological Assessment.

recruitment" will be made by the FWS in coordination with the Kootenai River White Sturgeon Recovery Team.

7. FWS Biological Opinion

The 1995 and 1996-1998 operations described in the FWS B.O. will come closer to replicating the shape (fluctuating flows) of the natural hydrograph that has been attributed by some with providing favorable conditions not only for spawning but also for larval dispersion, which may increase survival and recruitment. The operations for 1995 coupled with the vastly improved snow pack this year in the watershed below Libby Dam and above Bonners Ferry will provide flows that will, at times, double the volume of water that passed Bonners Ferry in 1994. In addition, the 1995 hydrograph will be very similar to the 1991 hydrograph which is the year in which four out of the eight known post-1974 white sturgeon recruited to the population.

In evaluating the effects of fluctuating flows on this population of sturgeon, BPA took into consideration the following information. As noted above, four of the eight-known post-1974 age class sturgeon were spawned in 1991[26] and the remaining four were spawned between 1976 and 1978. Flows during May-July 1991 in Porthill, Idaho ranged from 14,000 cfs to 53,700 cfs and water temperature varied between 7° and 17.5° C. In 1978 flows ranged from 5,940 to 29,300 cfs during the same time period and water temperature varied between 9.0° and 20.5° C. In 1977 flows ranged from 4,140 to 24,400 cfs and water temperature varied between 10° and 20.5° C. Flows in 1976 ranged from 8,800 to 44,000 cfs and water temperature varied between 10° to 16° C. Canadian information on white sturgeon below Keenleyside Dam suggests that spawning is enhanced when adequate temperatures are reached on a rising hydrograph.[27] This information suggests that a more natural hydrograph, (pre-1974, 1976-1978, and 1991 flows) is adequate for spawning and recruitment of sturgeon in the Kootenai River.

Replicating a more natural hydrograph with releases from Libby Dam will allow a comparison between this operation and the steady flow of 20,000 cfs that was provided in the drought year of 1994. This comparison will provide a wider range of site specific flows in the spawning areas which will allow further data collection and ultimately refined assumptions as to the physical conditions that Kootenai River white sturgeon require for spawning and recruitment. Potential benefits of the 1995 and 1996-1998 operations may include: 1) better spawning conditions by allowing temperatures to increase with a rising hydrograph; 2) increased survival due to improved egg incubation and larval rearing conditions; 3) dispersion of larval, fry and juveniles downstream to Kootenay Lake and 4) a more natural hydrograph that has been shown to provide recruitment.

[26] There is some uncertainty whether the fish from the 1991 year class were naturally spawned or spawned in the Kootenai Tribe of Idaho experimental sturgeon hatchery.
[27] Hildebrand 1994.

VII. Reinitiation of Consultation

As provided in the regulations and in the biological opinions, BPA will reinitiate consultation if (a) the amount or extent of taking specified in the incidental take statement is exceeded, (b) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered, (c) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion, or (d) a new species is listed or critical habitat designated that may be affected by the identified action.[28]

Issued in Portland, Oregon, on March 10, 1995.

Randall W. Hardy
Administrator and Chief Executive Officer

[28] 50 C.F.R. § 402.16

Appendix A

Comparison Of Measures In The 1992 Biological Opinion, 1993 Biological Opinion, 1994-1998 Biological Opinion And 1995 Biological Opinion

COMPARISON OF MEASURES IN THE 1992 BIOLOGICAL OPINION, 1993 BIOLOGICAL OPINION,

1994-1998 BIOLOGICAL OPINION AND 1995 BIOLOGICAL OPINION

The following document is a comparison of measures contained in the 1992, 1993, 1994-98, and 1995 Biological Opinions (BO) prepared by the National Marine Fisheries Service (NMFS) and United States Fish and Wildlife Service (USFWS). Most measures, but not all, are outlined within each year of the BO's. Additionally, comparitive measures are included in the year they were/are to be implemented. Measures designed for implementation in future years are omitted for ease of comparison.

This document shows a substantial alteration of the operation of the FCRPS for 1995, compared to 1993 and 1994. In 1992-1994, 10-11 million acre-feet of water was shifted from fall and winter to the spring and summer, for anadromous fish flow enhancement. Had the 1995 Biological Opinion been in effect during this same period, 13-16 million acre-feet of water would have been released for salmon. Similarly, the 1995 Biological Opinion calls for significantly greater spill levels than in the past, and accordingly, less fish collection for transportation. As a result of these changes, and others, the 1995 costs will be approximately $101 million above what they would have been under the 1994-98 Biological Opinion.

1992 Biological Opinion	1993 Biological Opinion	1994-1998 Bio Opinion	1995 Biological Opinion
Snake River Dworshak April 15-June 15: Release up to 900 kAF based on runoff volume forecast plus min. outflow of 1.2 kcfs. June 16-Sept. 30: Release 400 kAF above min. outflow.	Snake River Dworshak April 10-June 20: Release up to 1000 kAF based on runoff volume forecast plus min. outflow of 1.2 kcfs. June 21-September 30: Release 470 kAF above min. outflow (shifted from June 16-Sept. 30 period).	Snake River Dworshak April 10-June 20: Release up to 1000 kAF based on runoff volume forecast plus min. outflow of 1.2 kcfs. June 21-July 1: Release 470 kAF above min. outflow (shifted from June 16-Sept. 30 period). Draft DWR to, but no lower than, elevation 1520 ft for flow augmentation.	Snake River Dworshak April 20: Operate DWR to upper rule curve. April 10-June 20: Release up to 1000 kAF plus min. outflow of 1.2 kcfs to achieve a minimum period average flow of 85-100 kcfs, based on runoff volume forecast. June 21-August 31: Draft DWR, to no lower than the minimum elevation listed below, to achieve a minimum period average flow of 50-55 kcfs, based on runoff volume forecast. April 10-August 31: Minimum DWR reservoir elevation, unless lower as required for flood control, is 1520 ft.

1992 Biological Opinion	1993 Biological Opinion	1994-1998 Biological Opinion	1995 Biological Opinion
Brownlee April 15-May 15: Release up to 150 kAF of Water Budget. September 1-30: Release up to 200 kAF for temperature control.	Brownlee April 15-May 30: Release up to 110 kAF of Water Budget. June 21-September 30: Release up to 137 kAF. September 1-30: Release up to 100 kAF.	Brownlee April 15-May 30: Release up to 110 kAF of Water Budget. July 1-31: Release up to 137 kAF. August 15-September 15: Release up to 100 kAF.	Brownlee May 1-May 30: Draft as needed to meet LWG flow targets or to as low as elevation 2069', then pass inflow, no refill. July 1-31: Draft to as low as elevation 2067', them pass inflow, no refill. August 1-September 30: Draft to as low as elevation 2059'.
Upper Snake April 15-June 15: Release up to 190 kAF.	Upper Snake April 15-June 15: Release up to 190 kAF. September 1-30: Release up to 100 kAF.	Upper Snake April 15-June 15: Release up to 190 kAF. August 15-September 15: Release up to 100 kAF.	Upper Snake
		April 10-September 30: Secure additional 500 kAF for flow aug. by January 31. 1999	April 10-September 30: BOR to take actions to ensure 427 kaf by 1998 and additional after 1998 if necessary for listed stocks.

1992 Biological Opinion	1993 Biological Opinion	1994-1996 Biological Opinion	1995 Biological Opinion
Columbia River April 15-April 30: Release flood control volume shifted to Grand Coulee (GCL) from DWR. April 15-June 15: Release 3.45 MAF of Water Budget from Grand Coulee.	Columbia River April 15-April 30: Release flood control volume shifted to Grand Coulee (GCL) from DWR. April 15-April 30: Release flood control volume shifted to GCL from BRN. May 1-June 30: Release 3.45 MAF of Water Budget from Grand Coulee.	Columbia River April 15-April 30: Release flood control volume shifted to Grand Coulee from DWR. April 15-April 30: Release flood control volume shifted to GCL from BRN. April 20-July 31: Release 3.45 MAF of Water Budget from Grand Coulee.	Columbia River April 20: Operate GCL, HGH, and LIB to upper rule curve. April 20-June 30: Draft reservoirs, to no lower than the minimum elevations listed below, to achieve a minimum period average flow of 220-260 kcfs, based on runoff volume forecast.

	1993 Biological Opinion	1994-1998 Biological Opinion	1995 Biological Opinion
Columbia River (cont.) May 1-June 30: Release up to 3.0 MAF of Flow Augmentation from Grand Coulee and upper Columbia.	Columbia River (cont.) May 1-June 30: Release up to 3.0 MAF of Flow Augmentation from Grand Coulee and upper Columbia.	Columbia River (cont.) April 20-July 31: Released 3.0 MAF of Flow Augmentation from Grand Coulee and upper Columbia. April 20-September 30: Beginning in 1995, secure additional 1 MAF, in 250 kAF increments per year, for flow aug. by January 31. 1998. April 20-August 31: Draft Grand Coulee to, but no lower than, elevation 1277 ft for flow augmentation.	Columbia River (cont.) July 1-August 31: Draft reservoirs to no lower than the minimum elevations listed below, to achieve minimum period average flow of 200 kcfs. April 20-August 31: Minimum reservoir elevations, unless lower as required for flood control, are as follows: Grand Coulee: 1280.0 ft[1] Hungry Horse: 3540.0 ft[1] Libby: 2439.0 ft[2]

1 - The Technical Management Team "may recommend lower summer reservoir elevations if necessary to meet flow objectives depending on the circumstances of the run-off and the salmon migration..."

2 - The Technical Management Team may recommend drafting Libby to a lower summer elevation to meet flow objectives for sturgeon.

Spill	1995 Biological Opinion Spill	1994-1998 Fish Opinion Spill	1995 Biological Opinion Spill
No spill at transportation projects during spring or summer periods: LWG, LGS, MCN. Spring LMN: 40% for 12 hrs. April 15-May 30. IHR: 60% for 12 hrs. April 15-May 30 JDA: No spring spill. TDA: 10% day average (Spill MOA) May 1-June 6. BON: 50% day average (70% FPE) April 15- June 6. Summer LMN: 43% for 12 hrs. June 1-August 22. IHR: 30% for 12 hrs. June 1-August 22. JDA: 20% for 10 hrs. (Spill MOA) June 7- August 22. TDA: 5% day average (Spill MOA) June 7- August 22. BON: 40% day average (50% FPE) June 7- August 22.	No spill at transportation projects during spring or summer periods: LWG, LGS, LMN and MCN. Spring IHR: 25 kcfs for 12 hrs. April 15-May 30 JDA: No spring spill. TDA: 10% day average (Spill MOA) May 1-June 6. BON: 50% day average (70% FPE) April 15- June 6. Summer IHR: 25 kcfs for 12 hrs. June 1-August 22. JDA: 20% for 10 hrs. (Spill MOA) June 7- August 22. TDA: 5% day average (Spill MOA) June 7- August 22. BON: 40% day average (50% FPE) June 7- August 22.	No spill at transportation projects during spring or summer periods: LWG, LGS, LMN and MCN. Spring IHR: 25 kcfs for 12 hrs. April 15-May 30 JDA: No spring spill. TDA: 10% day average (Spill MOA) May 1-June 6. BON: 50% day average (70% FPE) April 15- June 6. Summer IHR: 30% or 25 kcfs, whichever is less, for 24 hrs. June 1-July 31. JDA: 20% for 10 hrs. (Spill MOA) June 7- August 22. TDA: 5% day average (Spill MOA) June 7- August 22. BON: 40% day average (50% FPE) June 7- August 22.	Spring April 10-June 20 (Snake River); April 20-June 30 (Columbia River): If LWG flows >100 kcfs, spill at all projects (including ollector). If LWG flows 85-100 kcfs, spill at all but LWG. If LWG flows <85 kcfs, spill at all but LWG, LGS, and LMN. Spill to achieve 80% FPE limited to 120% TDG (tailrace), 115% TDG (downstream forebay), or 125% TDG instantaneous at all projects. Spill 12 hrs. per day at all projects except 24 hrs. per day at IHR, TDA, and BON. Spill levels for 80% FPE are as follows[3]: |	spring	summer | |---|---|---| | LGR: | 80% | ** | | LGS: | 80% | ** | | LMN: | 81% | ** | | IHR: | 27% | 70% | | MCN: | 50% | ** | | JDA: | 33% | 86% | | TDA: | 64% | 64% | | BON: | * | * | * Daytime spill cap of 75 kcfs and 100% nightime spill limits FPE to 74% (spring) and 59% (summer). **Spill not recommended for summer migrants. Summer June 21-Augusl 31 (Snake) and July 1-August 31 (Columbia) No spill at transportation projects (LWG,LGS,LMN, and MCN). Spill at non-transportation projects like spring.

3 - At almost all flow levels spill will be limited by the TDG cap before achieving 80% FPE spill levels.
4 - Spill based on 12 hours per day at each project except 24 hours per day at IHR, TDA, and BON.

Minimum Operating Pool April 1-July 31: Operate the four lower Snake River projects within 1 ft of MOP. May 1-August 31: Operate John Day at minimum irrigation pool (MIP).	Minimum Operating Pool April 1-July 31: Operate the four lower Snake River projects within 1 ft of MOP. May 1-August 31: Operate John Day at minimum irrigation pool (MIP).	1994-1998 Biological Opinion Minimum Operating Pool April 1-July 31: Operate the four lower Snake River projects within 1 ft of MOP. May 1-August 31: Operate John Day at minimum irrigation pool (MIP).	1995 Biological Opinion Minimum Operating Pool April 10-late August: Operate the four lower Snake River projects within 1 ft of MOP, then refill LGS, LMN, IHR. Refill LWG after November 15. April 20-September 30: Operate John Day within 1-1/2 feet of minimum irrigation pool (MIP).
Peak Turbine Efficiency No Load Shaping Guidelines	Peak Turbine Efficiency March 15-October 31: Operate turbine units consistent with BPA's System Load Shaping Guidelines	Peak Turbine Efficiency March 15-October 31: Operate turbine units consistent with BPA's System Load Shaping Guidelines	Peak Turbine Efficiency Operate turbine units within 1% of peak efficiency March 15-October 31 (Columbia) and through November 30 (Snake).
Transportation April 1-October 31: Operate to FTOT Guidelines: maximize transport at LWG and LGS and MCN at <100 kcfs LWG Q_I and <220 kcfs MCN Q_I, respectively. Above these flows return small fish (chinook) to the river at LGS and MCN	Transportation April 1-October 31: Operate to FTOT Guidelines: maximize transport at LWG/LGS/LMN and MCN at <100 kcfs LWG Q_I and <220 kcfs MCN Q_I, respectively. Above these flows return small fish (chinook) to the river at LGS/LMN and MCN	Transportation Late March-October 31 (LWG,LGS,LMN) -December 31 (MCN): Operate to Juvenile Transportation Plan Guidelines: maximize transport at LWG/LGS/LMN and MCN at <100 kcfs LWG Q_I and <220 kcfs MCN Q_I, respectively. Above these flows return small fish (chinook) to the river at LGS/LMN and MCN	Transportation Hydro operations per spill discussion above. Spring Transport collected fish at LGR, LGS, and LMN. Summer Transport collected fish at LWG, LGS, LMN, and MCN.

Libby Sturgeon Operation Attempted to shape release for sturgeon similar to 1991 but discontinued due to drought conditions causing low runoff.	Libby Sturgeon Operation Released 400,000 acre-feet of water stored for sturgeon. This release provided a 20,000 cfs flow at Bonners Ferry, Idaho from June 2-16.	1994 Biological Opinion Libby Sturgeon Operation Released 1,200,000 acre-feet of water stored for sturgeon. This release provided 20,000 cfs at Bonners Ferry for 28 days (June 1-June 28) and 12,000 cfs June 29-July 11.	1995 Biological Opinion Libby Sturgeon Operation Discharge 20,000 cfs from Libby for 42 days. Once spawning has ended or the 42 days have elapsed flows will be reduced to 11,000 cfs at Bonners Ferry for 21 days. Total release of stored water for this operation will be between 1.5-1.7 million acre-feet and occur between May 15 and July 31.

APPENDIX B

1995 BIOLOGICAL OPINION COSTS TO BPA

1995 BIOLOGICAL OPINION COSTS TO BPA
(INCREMENTAL TO THE 1994-98 BIOLOGICAL OPINION)
REVISED AS OF 2/28/95

Fiscal Year	Draft 1995 Biological Opinion						
	1995	1996	1997	1998	...	2001 No Drawdown	2001 With Drawdown 9/
1. Energy Costs 1/							
a. Expected value energy costs (average over 50 water years) 2/	76	61	60	59	...	50 10/	178 10/
b. Reserve coverage for increase in water risk	0	17	19	20	...	19	23
c. Contingent spill (not in TOTAL) 3/	*N.E.*	*N.E.*	*N.E.*	*N.E.*		*N.E.*	*N.E.*
d. Contingent draft (not in TOTAL) 3/	*8-14*	*8-14*	*8-14*	*8-14*	...	*8-14*	*8-14*
e. Max energy cost (not in TOTAL)	*114*	*189*	*188*	*187*	...	*220*	*381*
2. Capacity Costs							
Operational flexibility at John Day	0	16	16	16	...	16	16
1% peak efficiency	9	9	9	9		9	9
3. Upper Snake River Water Acquisition 4/	0	0	0	0	...	16	16
4. Idaho Power Shaping Costs	5	5	5	5	...	10	10
5. Reimbursable Investment Costs							
a. Planned investment costs 5/	0	0.2	5	12	...	26	26
b. Contingent investment costs 6/	0	0	12	27	...	102	267
6. Fish Program Costs 7/	11	32	39	40	...	39	39
TOTALS: 8/	101	140	165	188	....	287	584

1/ This table assumes there would be no compensation of Canadian parties by BPA for violation of the Columbia River Treaty. However, BPA costs for replacing up to 20 feet of draft from full from Arrow could be $25 million in a year.

2/ Energy cost estimates assume replacement of hydro system losses with short-term purchases. In the longer run, reliability concerns may cause some of these losses to be replaced by some amount of combustion turbines, increasing the long-term costs of this plan. In addition, these costs represent costs to BPA only; BPA costs are estimated to be 75 percent of total regional costs.

3/ 1995 BO allows for TMT to modify project draft limits and spill levels. Draft and spill beyond the levels described in BO would increase costs, potentially significantly, but cannot be determined precisely in advance. (N.E.=not estimated)

4/ This assumes that release rates are increased from the present 1.5 kcfs limits for snails.

5/ Includes prototype testing of surface bypass, engineering and design for LSN drawdown, JDA to MOP, relocation of BON outfalls, additional fish barges, and other miscellaneous system improvements.

6/ Includes installation of baffled spillways, surface bypass for turbine units, stilling basin modifications at IHB and JDA, and TDA screens.

7/ This is a rough estimate and includes BPA estimates of research, monitoring and evaluation costs for measures in the draft Biological Opinion plus new hatchery, habitat, and harvest measures, as estimated by Northwest Power Planning Council.

8/ This is a rough estimate of the increase that will be necessary in BPA's revenue requirement. However, detailed rates and revenue model analysis has not yet been performed; therefore, these numbers are subject to change.

9/ Assumes year-round LSN natural river drawdown and JDA spillway crest drawdown. If LSN drawdown is limited to spillway crest for 4.5 months, energy costs would decrease by approximately $100 million and contingent investment costs would increase by approximately $30 million.

10/ This estimate reflects a $20 million reduction due to less spill resulting from the installation of baffled spillways.