

BUREAU OF RECLAMATION

RECORD OF DECISION

COLUMBIA RIVER SYSTEM OPERATION REVIEW
SELECTION OF A SYSTEM OPERATION STRATEGY

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EXHIBIT A: How the Strategies Would Affect River Uses

BUREAU OF RECLAMATION
PACIFIC NORTHWEST REGION

U.S. DEPARTMENT OF THE INTERIOR

COLUMBIA RIVER SYSTEM OPERATION REVIEW
SELECTION OF A SYSTEM OPERATION STRATEGY

I. INTRODUCTION

This record documents the decision of the Bureau of Reclamation (Reclamation) to implement existing and modified plans related to reservoir regulation and project operation for Hungry Horse and Grand Coulee projects. Reclamation selects the System Operation Strategy (SOS) Preferred Alternative (PA) as described in the Columbia River System Operation Review (SOR) Final Environmental Impact Statement, November 1995.

II. DECISION STATEMENT

This records adopts, incorporates and reaffirms the "Record of Decision (ROD) Implementing Actions Pursuant to Biological Opinions of March 1995" signed by the Pacific Northwest Regional Director on March 10, 1995 which is designated herein as the PA and is the best overall operating strategy for the Columbia River system. The previous ROD documents Reclamation's decision to implement measures in the Biological Opinion on "Reinitiation of Consultation 1994-1998 Operation of the Federal Columbia River Power System and Juvenile Fish Transportation Program in 1995 and Future Years" issued by the National Marine fisheries Service (NMFS) on March 2, 1995 on Snake River spring, summer and fall chinook and Snake River sockeye salmon; and the United States Fish and Wildlife Service (USFWS) Biological Opinion on four Snake River snails and the Kootenai River white sturgeon dated March 1, 1995. Moreover, Reclamation has been operating its projects in accordance with that ROD and those Biological Opinions, and as required, will continue to coordinate the projects in the future with NMFS and USFWS to meet the adaptive management approach to Federal Columbia River Power System

(FCRPS) reservoir operations that is contemplated within the operational flexibility of the PA.

Selection of the PA is determined to be the best operating strategy since it has been approved by NMFS and USFWS as meeting the biological needs of the endangered species, has proven to be a workable strategy given Reclamation's experience past short term operation, and after analysis, proven to best meet the other multiple use requirements of the system.

III. BACKGROUND

A. Purpose and Need

Reclamation, the Corps, and the U.S. Department of Energy's Bonneville Power Administration (BPA) are responsible for management of the Federal Columbia River Power System. Multiple uses of the system, including but not limited to flood control, power, navigation, irrigation, and municipal and industrial uses as well as natural resource management have evolved largely from dam development. Today, these river uses are increasingly competing for limited water resources in the Columbia River Basin. Often, they conflict with each other. To date, meeting these demands has been guided somewhat independently by those sharing responsibility for management of the system. The Federal agencies responsible for river management decided to use the pending expiration of several long-term agreements involving power production as an opportunity to review future operations of the Columbia River system and river use issues. Because of renewal of the agreements and after years of trying to accommodate growing multiple-use demands on the system, the three agencies decided that it was time for a "top-to-bottom" review in order to assure the best possible operation and management of the system within the constraints of the systems' required multiple uses and the biological needs of the endangered species. The result of that decision was the System Operation Review. The review is the environmental analysis required by the National Environmental Policy Act (NEPA) to consider changes in Columbia River system operations and the effect of those changes on users of the system and the environment.

The SOR began in 1990 with a focus on all river and reservoir uses for the FCRPS. The Endangered Species Act (ESA) began to

influence the formulation of alternatives in November 1991 when the first of three Snake River salmon species was listed as threatened or endangered. The SOR then began to focus on the role system operations could play in salmon recovery while meeting other project purposes.

There were four actions intended from the SOR: (1) develop and implement a coordinated system operating strategy for managing the multiple uses of the FCRPS while meeting the biological needs of the ESA; (2) provide interested parties a long-term role in system planning and operation through a Columbia River Regional Forum; (3) renegotiate and renew the Pacific Northwest Coordination Agreement (PNCA); and (4) renew current agreements or develop new Canadian Entitlement Allocation Agreements (CEAA).

This ROD applies solely to the first of these actions: selection of a system operation strategy. Separate RODs are being prepared for the PNCA and CEAA. No action is likely for the Regional Forum because that need is being met through other regional activities such as the Technical Management Team, the ESA Implementation Team and the Northwest Power Planning Council's Fish and Wildlife Program amendment process.

The SOR EIS assessed operations at the 14 Federal dams in the Columbia River basin in the United States. Reclamation operates two of those -- Grand Coulee and Hungry Horse dams. These projects play a prominent role in the coordinated operation of the Columbia River system because of their size and location. Their 8 million acre-feet of storage is about half of the federally-controlled storage in the FCRPS. They are keystones in the system operation for hydropower, flood control, and irrigation.

B. Scope and Process

The first step of the review was to establish the scope of the study. After public meetings in 14 cities in the region during August 1990 and consultation with numerous local, state, and Federal agencies, the three lead agencies were better able to define the geographic scope of the study and the process.

Scope: The specific scope of the SOR encompasses 14 Federal dams on the Columbia and lower Snake Rivers that have major influenced

on multiple-purpose system operation and for which power production is coordinated under the PNCA. These include five storage dams: Hungry Horse and Grand Coulee (Reclamation) and Libby, Albeni Falls, and Dworshak (Corps); and nine downstream run-of-river projects: Chief Joseph, Lower Granite, Little Goose, Lower Monumental, Ice Harbor, McNary, John Day, The Dalles, and Bonneville (all Corps). The SOR Scoping Document presented the scope of the study and analytical methods was issued in may 1991.

Process: Pilot studies of four river uses were conducted simultaneously with development of the Scoping Document. From July 1991 to August 1992, work groups representing 10 key river uses developed and screened 90 initial system operating alternatives. Ten candidate strategies were then formulated for public review. Following public comment in September 1992, seven strategies were developed for full scale analysis in the EIS which took place from September 1992 to January 1994. A Draft EIS was issued in July 1994 and following public comment, the Final EIS was issued in January 1996.

Ten interagency work groups were assigned one river use or resource: flood control, navigation, anadromous fish, resident fish, wildlife, power, recreation, irrigation, water quality, and cultural resources. These work groups provided a forum for experts and other interested parties to work together on analysis for a specific river use. Key objectives were to share ideas and information, provide the best available science and reach consensus.

Overseeing the work groups was the Analysis Management Group, an interagency coordination group consisting of project managers, the 10 resource work group leaders and other representatives from the lead agencies. Other groups that reported to the Analysis Management Group were the Economic Analysis Group; the River Operation Simulation Experts; PNCA Alternatives Analysis Group; NEPA Action Group; Public Involvement Group; Forum Alternatives Work Group; and contractors.

After analyzing information from scoping, the SOR followed a three-phase decision process for developing a system operation strategy: 1) pilot or test analysis; 2) public participation in the work groups and the beginning of the screening phase; and 3) full scale analysis of the candidate strategies. Further

information about this process is in Section V. Alternatives Considered.

IV. PUBLIC INVOLVEMENT

The three SOR agencies held numerous public meetings across the Pacific Northwest at different points in the review to involve the public and listen to their views:

- In 1990, about 800 people attended 14 scoping meetings to explain the SOR and gather comments on the scope of the study. These meetings were held in Seattle, Spokane, Kennewick and Grand Coulee, Washington; Sandpoint, Boise, Idaho Falls, and Orofino, Idaho; Libby, Eureka, Missoula, and Kalispell, Montana; and Pendleton and Portland, Oregon.
- From November 1991 through January 1992, roundtable meetings were held to provide the public an opportunity to preview and comment on the preliminary alternatives developed by the SOR work groups. These meetings were held in Sandpoint and Orofino, Idaho; Kalispell and Libby Montana; and Kennewick, Grand Coulee and Seattle, Washington. About 300 people attended these meetings.
- In September 1992, about 500 people attended 14 mid-point meetings to learn about and comment on the strategies being considered. In the fall of 1994, over 500 people turned out to comment on the Draft EIS at nine public meetings around the region. The locations were nearly the same as for the scoping meetings.
- In September and October, 1994, a series of nine public hearings was held on the Draft EIS. Approximately 500 people attended these hearings in Boise, Lewiston, and Sandpoint, Idaho; Kalispell and Libby, Montana; Grand Coulee, Pasco, and Seattle, Washington; and Portland, Oregon. In all, the agencies received written or verbal comment from over 360 people during the public review process of the Draft EIS. All comments received full consideration.

Members of the public served on SOR work groups and helped prepare technical appendices. Others followed work group

activities by mail, without direct involvement. There were hundreds of people who participate on an ad hoc basis through letters, telephone and meeting attendance.

The Final EIS consists of the Main Report (450 pages), the Summary and 20 technical appendices that analyze river use areas: River Operation Simulation; Air Quality; Anadromous Fish and Juvenile Fish Transportation; Cultural Resources; Flood Control; Irrigation/Municipal and Industrial Water Supply; Land Use and Development; Navigation; Power; Recreation; Resident Fish; Soils, Geology, and Groundwater; Water Quality; Wildlife; Economic and Social Impacts; CEAA; Columbia River Regional Forum; PNCA, USFWS Coordination Act Report; and Comments and Responses. The SOR team also compiled a variety of publications to educate the public about the Columbia River and its system operations. A newsletter was mailed to over 5,000 homes and businesses regularly during the six-year life of the SOR to inform people about new developments in the study and to present river management information.

V. ALTERNATIVES CONSIDERED

More than 90 approaches to river system operations were initially considered. Many were proposed by citizens and organizations, others were suggested by SOR work groups and the project managers. Computer models simulated implementation of all 90 alternatives so that the environmental and social effects and impacts on power generation, natural and cultural resources, and all other river activities could be assessed and compared.

As a result of screening by SOR work groups and public review of the results, many of the initial alternatives were redesigned, combined or deemed unworkable because these alternatives did not meet the system's multiple use requirements while accommodating the biological needs of the endangered species. Seven System Operation Strategies (SOS) were then chosen and analyzed in detail. Various options within these seven strategies were considered, so that a total of 21 alternatives were examined for the Draft EIS.

The Draft EIS alternatives were further modified following comments from Tribes, State and Federal agencies, industry, environmental organizations, and individuals. Six of the 21

alternatives in the Draft EIS were carried into the analysis for the Final EIS without modification (SOSs 1a, 2c, 5b, 6b, and 6d). Four alternatives in the Draft EIS were modified following public comment and again considered in the Final EIS (SOSs 4c, 9a, 9b, and 9c). Three new alternatives were identified and evaluated in the Final EIS in response to public comment (SOSs 5c and PA) or as a result of recommendations from the 1994-98 Biological Opinion issued by NMFS (SOS 2d). Several Draft EIS alternatives were eliminated as unreasonable based upon additional analysis results and consideration of public comment (SOSs 2a, 2b, 3a, 3b, 4a, 4b, 5a, 6a, and 6c). The Final EIS Main Report describes the evolution of the alternatives on pages 4-4 and 4-5.

The following System Operating Strategies received detailed consideration in the Final EIS since Reclamation determined that these strategies were the best suited to meeting the multiple use needs of the system and the requirements of the endangered species. See attached Exhibit A for a comparison of the following strategies and associated river uses. The numbering is not consecutive due to adjustments made in the list of alternatives considered between the Draft and Final EISs.

SOS 1a - Pre-Salmon Summit Operation: This strategy simulates the way the system was operated from 1983 through the 1990-91, prior to the listing of salmon species under the ESA. Elements of an alternative recommended by the Columbia River Alliance, Recover 1, were included.

SOS 1b - Optimum Load-Following Operation: This option maximizes system benefits for the traditional uses of the system, power generation, flood control, and navigation. It simulates the way the system was operated prior to the Northwest Power Planning and Conservation Act of 1980.

SOS 2c - Current Operation/No Action: This alternative calls for operations consistent with the Corps of Engineers' 1993 Supplemental EIS. It is similar to how the system was operated in 1992-93, after three salmon species were listed under the ESA.

SOS 2d - 1994-98 Biological Opinion: This alternative represents the operation that would have occurred had the recommendations resulting from the ESA consultation completed in 1994 been

implemented. It is closest to the way the system was being run just after the analysis in the Draft EIS was completed.

SOS 4c - Stable Storage Project Operation with Modified Grand Coulee Flood Control: This alternative specifies monthly elevation targets to be used year-round to improve conditions at the major Federal storage projects for recreation and resident fish and wildlife. In response to public comments, this alternative includes minimum elevation levels, known as Integrated Rule Curves (IRCs) for Libby and Hungry Horse Reservoirs.

SOS 5b - Natural River Operation: This alternative specifies that the four lower Snake River projects would be drawn down to near riverbed levels for four and one-half months during the spring/summer salmon migration period. Construction of new low-level outlets would be required to allow water to bypass the dam, powerhouse, and spillway.

SOS 5c - Permanent Natural River Operation: This alternative specifies that the four lower Snake River projects would be drawn down to near riverbed levels year-round.

SOS 6b - Fixed Drawdown Operation: This alternative specifies that the four lower Snake River projects would be drawn down to near spillway crest for four and one-half months during the spring/summer salmon migration period.

SOS 6d - Lower Granite Drawdown: This strategy would draw down Lower Granite to near spillway crest for four and one-half months.

SOS 9a - Detailed Fishery Operating Plan (DFOP): This operation was recommended by the region's fish agencies and tribes. It establishes flow targets at Lower Granite and The Dalles, draws down the lower Snake River projects to near spillway crest for four and one-half months, specifies spill levels at run-of-river projects, and eliminates fish transportation.

SOS 9b - Adaptive Management: This modification of DFOP establishes flow targets at McNary and Lower Granite, specifies maximum water releases from upstream projects, draws down lower Snake River projects to minimum operating pool, draws down John

Day to minimum irrigation pool, and specifies spill levels at run-of-river projects.

SOS 9c - Balanced Impacts Operation: This strategy was originally recommended by the State of Idaho, which subsequently withdrew its support. It draws down the four lower Snake River projects to near spillway crest for about two months during the spring salmon migration period. It also includes flow augmentation at 1994-98 Biological Opinion levels, IRCs at Libby and Hungry Horse, and a higher winter operating elevation at Albeni Falls.

SOS Preferred Alternative: This strategy adopts operations recommended in the NMFS and USFWS Biological Opinions issued in March of 1995. Its intent is to support the recovery of ESA-listed fish by storing water in reservoirs during the fall and winter to meet spring and summer flow targets. Maximum summer draft limits at Libby, Hungry Horse, and Dworshak are used to minimize detrimental effects on other natural resources, provide flood protection, and produce a reasonable amount of power generation.

One additional alternative was considered that was identified late in the analysis process for the Final EIS. While the agencies could not incorporate the results of this additional analysis in the comparative analysis in the Final EIS, the effects of the alternative were described in Chapter 4 of the Final EIS Main Report. This alternative was suggested by the Confederated Tribes of the Umatilla Indian Reservation. It was similar to SOS 9a above with higher flow targets during the spring and summer, drawdown to natural river levels, higher spill levels, and reduced flood control storage space during the winter to allow for higher spring and summer flows. This alternative was designated as SOS 9d.

Exhibit A, "How the Strategies Would Affect River Uses: summarizes the environmental effects for the alternatives by category. In addition to the effects on each major river use, the overall economic impact is shown as well.

VI. ESA SECTION 7 CONSULTATION

Because of the listed species within the Columbia River system, fourteen system operation strategies from the SOR Draft EIS were

provided to NMFS and USFWS in the 1995 supplemental Biological Assessment as part of the reinitiation of consultation on the 1994-1998 proposed operations. As a result of this consultation, NMFS and USFWS issued separate Biological Opinions which addressed the effects of the FCRPS operation upon listed species within their jurisdictions.

The USFWS adopted the non-jeopardy Biological Opinion dated July 27, 1994 on the bald eagle, Lake Roosevelt (Grand Coulee project) population, and concurred that the action is not likely to adversely affect the endangered gray wolf, threatened grizzly bear, and endangered peregrine falcon. The USFWS also issued a non-jeopardy Biological Opinion for Snake River snails.

In their March 2, 1995 Biological Opinion, NMFS recommended a Reasonable and Prudent Alternative (RPA) and concluded that the RPA does not jeopardize the continued existence of the spring/summer and fall Chinook, and does not reduce appreciably the likelihood of survival and recovery of the Snake River sockeye salmon.

Reclamation continues to coordinate with NMFS and USFWS on operations. Under adaptive management, operations are adjusted in-season as well as year-to-year as scientific information is further collected and evaluated.

The following ESA-established regional forums facilitate making operational recommendations:

- The Technical Management Team (TMT) makes recommendations to Reclamation and the Corps on weekly management of river operations related to flows, spill, and transport.
- The Implementation Team (IT) coordinates activities of federal, state, and tribal sovereigns for implementation of regional plans to restore anadromous fish and addresses weekly issues raised by the TMT.
- The Executive Committee oversees implementation activities and if the IT cannot resolve an issue, makes final recommendation to Reclamation and the Corps on operation changes.

All forums consist of representation from Federal, state, tribal, and regional agencies. Additionally, all forums are public and provide opportunity for non-members to participate.

In July, 1996, NMFS proposed several Snake River and Columbia River basin steelhead stocks for listing as threatened and endangered. Reclamation will coordinate with NMFS on the proposed listings and may modify the selected SOS after evaluating effects on these proposed stocks and considering recommendations of the TMT.

VII. SYSTEM OPERATION STRATEGY (SOS) AND SELECTION OF THE PREFERRED ALTERNATIVE (PA)

The SOS PA in the SOR Final Environment Impact Statement (FEIS) represents the operation recommended by NMFS and USFWS in their Biological Opinions issued on March 2, 1995 and March 1, 1995, respectively. SOS PA was selected as the best alternative because it supports recovery of ESA-listed species as outlined in these Biological Opinions, specifically the Reasonable and Prudent Alternative and the Incidental Take Statement, by limiting water releases during the fall and winter in an attempt to provide water supplies for spring and summer fish target flows.

Since environmental protection for anadromous fish and other listed species became the focus of this analysis, the selected strategy is an environmentally preferable alternative. It favors ESA-listed species as a matter of compliance with law and policy. It is focused on the protection of anadromous fish at the expense of other species, primarily resident fish and wildlife. It is possible to design additional environmentally preferable alternatives by choosing different combinations of operating measures that reflect other tradeoffs among river uses and resources. For example, second environmentally preferable alternative could be designed which would contain elements from several SOSs considered in the Final EIS.

The system will be operated to achieve flood control elevations by April 15 each year and to meet demands for irrigation supplies, power production and recreation. Storage water from Grand Coulee and Hungry Horse will also be used for flow

augmentation for fish recovery. Moreover, the selected PA adopts the adaptive management approach of the RPAs. Under this approach, operations may be modified in-season for actual hydrologic and fish migration conditions and year-to-year based upon new scientific information or to support studies for long-term system configuration changes as provided within the PA's flexibility.

The TMT will make in-season recommendations to Reclamation based on runoff conditions, fish migration and other factors. Reclamation will continue to participate in various regional forums, such as the IT and Executive Committee, where system operations are proposed and discussed. Reclamation will also continue to coordinate with NMFS, USFWS, the Corps, BPA, the Northwest Power Planning Council (NPPC), states, and Tribes on newly proposed reservoir operations. In coordination with these groups, Reclamation may need to change operations for flood control, emergencies, approved research, or other project uses which is provided within the PA's flexibility. Reclamation will rely upon existing authority and information in the SOR FEIS to evaluate and implement such new operations, and to adjust the SOS in coordination with NMFS and USFWS and others.

In summary, under the selected system operation, Reclamation will operate Hungry Horse and Grand Coulee projects in the FCRPS to:

- continue to provide irrigation water supplies to meet contractual arrangements; provide fish and wildlife enhancement; provide recreation opportunities; provide hydro power production; and meet other authorized target objectives.
- provide additional flow augmentation in the Columbia and Snake Rivers and manage these flows during the fish migration season to optimize anadromous fish survival.
- manage reservoir elevations within Grand Coulee and Hungry Horse to maximum summer draft limits to the extent possible to minimize detrimental effects on resident fish, wildlife, cultural resources and recreational facilities.
- meet flood control requirements at Grand Coulee and Hungry Horse to reduce mainstem and tributary flood damage.

- manage system inflows and releases during the fall and winter so that reservoir elevations at Grand Coulee and Hungry Horse meet flood control levels in April as determined by that year's runoff probability.
- release stored water from Grand Coulee and Hungry Horse during the migration season in a manner that strives toward meeting specified flow targets measured at McNary Dam, recognizing that these targets are not achievable in many years.

Reclamation will coordinate with the other Federal, state, and tribal representatives in the TMT process and consider TMT recommendations in making final decisions on the operation of Reclamation projects. Operations may be modified on a case-by-case basis if recommended by the TMT.

VIII. MITIGATION FOR PREFERRED ALTERNATIVE

A major issue in selecting the PA was to provide for Snake River salmon recovery. Events such as ESA listings and corresponding Biological Opinions dramatically impacted FCRPS operations. Improving conditions for listed anadromous fish was a main (is the) objective of the selected SOS, however, in selection of the preferred alternative, Reclamation employed all practicable means to avoid environmental impacts from its implementation. However, under the preferred alternative, there will be some level of adverse environmental impact at Reclamation projects in the following areas:

Cultural Resources: Fluctuating water levels and associated shoreline erosion have the potential to adversely affect significant cultural resources at all Federal reservoirs in the FCRPS.

The National Historic Preservation Act (NHPA) requires Federal agencies to take into account adverse impacts and formulate plans to address them. The SOR agencies are currently finalizing a Programmatic Agreement with the Advisory Council on Historic Preservation (Council), the appropriate State Historic Preservation Officers, affected agencies, and affected Federally-recognized Tribes. The Programmatic Agreement will address the requirement of Section 106 of the NPA to consult with the Council

on the effects of the undertaking on historic properties. Government-to-government consultations with affected Tribes on the Programmatic Agreement and its implementation are ongoing.

Pursuant to the Programmatic Agreement, Reclamation will develop individual Historic Preservation Management Plans (HPMP) for each reservoir which will identify significant cultural resources, the approaches to resource protection, preservation and treatment, the framework for research designs for data recovery where data recovery is the preferred treatment, plans for site monitoring, plans for public education and interpretation of cultural materials, and plans for the long-term curation of recovered artifacts and information. The HPMP will also address issues required by other relevant legislation, including the Archeological Resources Protection Act and the Native American Graves Protection and Repatriation Act. The HPMPs will be developed with input from and through consultation with affected Tribes and other affected or interested parties.

Wildlife: At Grand Coulee, emergent, submerged and riparian areas around Lake Roosevelt could experience negative impacts from rapid withdrawal of water from those habitats. Direct effects from impacts to habitat could include increased vulnerability to predation, increased energy expenditure and potential for physiological stresses. Species likely to be impacted include great blue heron, colonial and bank-nesting birds, Canada geese, mallard, deer, beaver, and otter. Additional information is necessary to determine full impacts to wildlife at Lake Roosevelt. Mitigation measures will need to include surveys and inventories of existing wildlife populations and habitat suitability.

IX. CONTINUING ACTIONS

In addition to selection of the SOS PA in this ROD, Reclamation is involved in other actions which may impact or require modification to operations in the future.

Cultural Resources

As previously described, the three SOR agencies are currently finalizing a Programmatic Agreement with all interested and affected parties to address long-term protection and preservation

of significant cultural resources that are or may be adversely affected by FCRPS operations. Actions and activities called for in the final Programmatic Agreement will be carried out over a multiple-year period. The processes to implement the terms of the Programmatic Agreement at specific reservoirs or larger subareas of the project area will be defined in specific agreements with affected Tribes and other affected parties.

Regional Coordination

Organizations and coordination mechanisms referenced in the Biological Opinions which have been established to provide scientific information related to dam and reservoir operations and/or ecosystem management in the Columbia River Basin include the Salmon Recovery Implementation Team, the Independent Scientific Advisory Board, the Technical Management Team, and Memoranda of Agreement/Understanding signed by various Federal officials. Reclamation will continue to participate in these processes through appropriate coordination, consultation, or decision making.

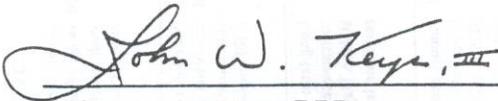
Recovery Plan

The NMFS is preparing a Recovery Plan for endangered Snake River salmon stocks. Reclamation will cooperate with NMFS in development of the Recovery Plan. The NMFS Biological Opinion states that the Recovery Plan will be the best evidence of the amount of improvement required in each life stage and the measures likely to accomplish that improvement. Consistency with the Recovery Plan will be considered in jeopardy determinations. Reclamation recognizes that the system operation strategy described in this ROD may change as a result of the NMFS Recovery Plan for salmon.

X. APPROVED:

I hereby approve the PA as the selected operating strategy for the Bureau of Reclamation.

Issued in Boise, Idaho on February 7, 1997.



John W. Keys III
Regional Director, Pacific Northwest Region
Bureau of Reclamation

How the Strategies Would Affect River Uses

	SOS 1	SOS 2	SOS 4	SOS 5	SOS 6	SOS 9	PA
Anadromous Fish	Moderate passage survival and adult escapement; slight differences from existing conditions	Survival rates in the middle range of all alternatives; with transport, juvenile survival is high	Survival about the same as SOS 2	Highest in-river survival for Snake River stocks; for other stocks, similar to existing conditions	In-river survival for Snake River stocks varies greatly depending on assumptions	Some of the highest and lowest in-river survival depending on SOS option and stock	In-river survival for Snake River stocks similar to SOS 2; in-river survival for other stocks in the mid to upper range
Resident Fish	Variable conditions among reservoirs and species; pool fluctuations and failure to refill impact productivity	Variable conditions among reservoirs and species; pool fluctuations and failure to refill impact productivity	Best SOS for resident fish; improved productivity at storage projects	Generally poor; some reservoirs have improved conditions under SOS 5c	Impacts generally the same as SOS 5, but not as severe; conditions worse at Lower Granite and John Day	Some of the best and worst impacts of all SOSs; 9a is generally worse, 9b is good, 9c is mixed	Conditions better at Lake Roosevelt, Hungry Horse, Lower Granite, and John Day; worse at Dworshak, sturgeon improved
Wildlife	Resources largely unchanged from current conditions; continuation of downward trends	Long-term downward trends to resources; slight impacts at John Day due to lower reservoir levels	Moderate to significant increases in wildlife habitat at Lake Pend Oreille, Libby, Hungry Horse, and Grand Coulee	Severe reductions in wildlife habitat at lower Snake and John Day projects	Wildlife habitat impacts similar to SOS 5; 6d limits impacts to Lower Granite	Significant impacts to John Day under 9a and 9c; 9b similar to SOS 4 with no benefit at Libby and Hungry Horse	Impacts at John Day similar to SOS 5b; stable levels allow some restoration of habitat; some impacts at Grand Coulee
Power	Energy production and load shaping maximized; 0.6-1.1% rate decrease	Annual generation costs the lowest of all SOSs except SOS 1; up to 0.4% rate increase	Flows and generation needs mismatched; 1.3% rate increase	Eliminates system load shaping capability; reduces average annual energy generation; 2.5-2.8% rate increase	Generation effects similar to SOS 5; generation costs slightly more than SOS 2c; 0.3-0.9% rate increase	Hydropower generation reduced due to high spill and drawdowns; 2.5-4.0% rate increase	Increased water storage in fall and winter and increased spill mismatches flow and generation needs; 2.0% rate increase
Flood Control	Flooding risk unchanged from current conditions	Flooding risk unchanged from current conditions; expected annual average flood damage costs are \$3.3 million	Increased risk at Bonners Ferry, the upper Columbia, and Clearwater reaches; average annual flood damage costs increase \$0.4 million over SOS 2c	Flood risk in all areas similar to SOS 2	Flood risk in all areas similar to SOS 2	Highest flood risk primarily in upper Columbia; average annual flood damage ranges from \$0.03 to \$0.5 million more than SOS 2c	Upper Columbia flood damages increase \$0.2 million over SOS 2c
Navigation	Normal conditions for shallow draft navigation and reduced costs for Dworshak log transport; net decrease \$0.1 million compared to SOS 2c	Shorter Dworshak log transport operating season; total annual cost for navigation is \$414.4 million	Longer Dworshak log transport operating season; net decrease \$0.2 million compared to SOS 2c	No shallow draft navigation on the lower Snake River for 7 months or permanently; net increase \$14 to \$38 million compared to SOS 2c	No shallow draft navigation on the lower Snake River or Lower Granite for 6 months; net increase \$2 to \$12 million compared to SOS 2c	No shallow draft navigation on the lower Snake for 3 or 6 months; net increase up to \$12 million compared to SOS 2c	Normal operations for navigation; shorter Dworshak log transport season; net increase \$0.1 million compared to SOS 2c
Irrigation, Municipal and Industrial Water Supply	Minor increase in pumping costs at Grand Coulee of \$9,000 over SOS 2c	All irrigation needs served	Minor decrease in pumping costs at Grand Coulee of \$18,400 over SOS 2c	Drawdowns at John Day and Lee Harbor require pump modifications and increase pumping costs by about \$3.3-4.5 million	Drawdowns at John Day and Lee Harbor require pump modifications and increase pumping costs by about \$1.4-2.6 million	Similar impacts to SOS 6 at Lee Harbor and John Day; minor increase in pumping costs at Grand Coulee up to \$34,900	Minor savings in pumping costs at Grand Coulee; \$1.5 million increase at John Day, \$4.3 million increase for M&I
Cultural Resources	Ongoing shoreline erosion and exposure at same rate as current conditions	Ongoing shoreline erosion and exposure at same rate as current conditions	High rates of shoreline erosion at storage projects; decrease in exposure due to high pools	Dramatic increase in exposure at lower Snake River projects; less shoreline erosion at these projects	Similar to SOS 5 but less dramatic	Increased shoreline erosion and exposure due to drawdown; increased bank sloughing due to flow augmentation	Little overall change from current conditions; site exposure increases at Dworshak and John Day
Recreation	Annual benefits could increase up to \$7.9 million under SOS 1b	Annual average recreation benefit is \$315 million	Annual benefits could increase \$4.2 million	Annual benefits could decrease between \$66 and \$90 million	Annual benefits could decrease up to \$40 million	Annual benefits could decrease \$35 to \$97 million depending on option	Annual benefits decrease by \$26 million
Water Quality	Slight decrease in water temperature but increase in total dissolved gas in lower Snake River	Similar to SOS 1 but slight increase in water temperature; decrease in total dissolved gas	Similar to SOS 2 with slightly lower dissolved gas in lower Columbia	Maximum silt concentrations; nearly all excessive dissolved gas eliminated in lower Snake	Major sediment transport similar to SOS 5; dissolved gas and water temperature similar to SOS 2	Highest impacts due to water temperature and total dissolved gas supersaturation	Similar to SOS 2 except high total dissolved gas in the lower Columbia
Change In Total Annual System Costs*	-\$42 to -\$80 million	\$29 million, but SOS 2c equals 0 (no action alt.)	\$81 million	\$266 to \$336 million	\$78 to \$145 million	\$233 to \$400 million	\$164 million

*Includes capital expenditures to modify existing dams