# Executive Summary

# Executive Summary



This Final Feasibility Report/Environmental Impact Statement (FR/EIS) and its 21 appendices document the results of a comprehensive analysis of the four dams on the lower Snake River (collectively called the Lower Snake River Project) and their effects on four lower Snake River salmon and steelhead stocks listed for protection under the Endangered Species Act (ESA). The U.S. Army Corps of Engineers (Corps), along with the Bonneville Power Administration (BPA), U.S. Environmental Protection Agency (EPA), and U.S. Bureau of Reclamation (BOR) as cooperating agencies, analyzed four alternatives to evaluate the best way to improve juvenile salmon migration through Lower Snake River Project. The Final FR/EIS includes the best available information on the biological effectiveness, engineering components, costs, economic effects, and other environmental effects associated with the four alternatives: Alternative 1—Existing Conditions, Alternative 2—Maximum Transport of Juvenile Salmon, Alternative 3—Major System Improvements (Adaptive Migration), and Alternative 4—Dam Breaching. In the Final FR/EIS, the Corps identifies Alternative 3—Major System Improvements (Adaptive Migration) as the recommended plan (preferred alternative) and explains the process for selecting that alternative.

## ES.1 Study Area

The FR/EIS coverage of the affected environment and the effects of the alternatives on environmental resources and economic uses, focuses on the 140-mile long lower Snake River reach between Lewiston Idaho, and the Tri-Cities in Washington.

The Snake River is the principal tributary to the Columbia River, draining approximately 109,000 square miles in Idaho, Wyoming, Utah, Nevada, Washington, and Oregon. The Lower Snake River Project features four locks and dams in the state

of Washington: Ice Harbor Dam, Lower Monumental Dam, Little Goose Dam, and Lower Granite Dam.

Juvenile fish from the lower Snake River drainage system may have to travel past as many as eight Federal dams before reaching the Pacific Ocean. The four dams on the mainstem Columbia River are addressed in the Feasibility Study, where appropriate, because they are part of the corridor juvenile salmon travel between the Lower Snake River Project and the ocean. Federal and private dams on the middle and upper Snake River are not included in this study.

## ES.2 Decline of Salmon and Steelhead

The decline of salmon and steelhead in Pacific Northwest rivers is a complex problem. It is not possible to point to one specific cause. The problem stems from a variety of interrelated sources that regional scientists are working hard to evaluate and understand. Factors contributing to the decline of salmon and steelhead runs in the Columbia-Snake River Basin are: overharvest; loss and degradation of habitat in rivers and tributaries; destruction of estuary habitat used for rearing; competition and other dangers posed by hatchery fish; altered habitat and related challenges posed by dams and reservoirs; and other human-related causes such as timber harvest, farming, industrial facilities, urbanization, etc. Each of the above factors either individually or in combination may be major contributors to the decline of anadromous fish runs in the Snake River.

Because of the continued decline of some Columbia-Snake River Basin salmon and steelhead populations, the National Marine Fisheries Service (NMFS) listed the Snake River sockeye salmon as endangered under the ESA in 1991. In 1992, Snake River spring/summer chinook and Snake River fall chinook salmon were listed as threatened. In 1997, lower Snake River steelhead were listed as threatened. By 1999, NMFS had placed another nine anadromous fish species throughout the Columbia-Snake River Basin on the Endangered Species List. This Feasibility Study focuses on one piece of an overall regional salmon decline with causes above and beyond the four lower Snake River dams.

## ES.3 The Feasibility Study

The genesis of this Feasibility Study was the 1995 NMFS *Biological Opinion for the Reinitiation of Consultation on 1994-1998 Operation of the Federal Columbia River Power System (FCRPS) and Juvenile Transportation Program in 1995 and Future Years* (1995 Biological Opinion). In 1998, NMFS issued a supplement to the 1995 Biological Opinion, and, in 2000, it issued an updated Biological Opinion on FCRPS operations. The Final FR/EIS responds to the reasonable and prudent alternative in these documents.

### ES.3.1 Background

The Feasibility Study was officially announced to the public on June 5, 1995. In July 1995, the Corps conducted public scoping meetings to initiate the Feasibility Study and begin the National Environmental Policy Act (NEPA) process. The stated purpose of the Feasibility Study was to evaluate and screen structural alternative measures that may increase the survival of juvenile anadromous fish through the Lower Snake River Project and assist in the recovery of listed salmon and steelhead stocks. In December 1996, the Corps issued the Interim Status Report, which marked

the decision point to elevate dam breaching—removal of the earthen embankments and shutdown of hydropower operations at all four dams to allow for a near-natural flow—as the drawdown alternative that would be evaluated in the EIS.

Because the alternatives considered in this study would affect resources of concern to all people of the Pacific Northwest, the Corps structured the Feasibility Study process to involve participation of the whole region. During the alternative development stage, the Corps provided numerous opportunities for public input through Regional Roundtable Workshops and a series of public information meetings held in 1997 and 1998.

Biological data were collected and analyzed to allow for the best possible comparison of alternatives and their associated effects on the migration of juvenile salmon and steelhead, and on other environmental resources. Most of the data related to anadromous fish were provided by NMFS and a workgroup called the Plan for Analyzing and Testing Hypotheses (PATH). Engineering analysis and design reviews of the alternatives were also conducted to present key engineering and cost information as well as the engineering/construction process necessary for implementation. Additional economic data were collected and analyzed to allow for an accurate cost comparison of the alternatives at both the regional and national levels. The Drawdown Regional Economic Workgroup (DREW), a group of regional economists convened for the Feasibility Study, provided input on the economic issues associated with the alternatives. All of this biological, environmental, engineering, and economic information was collected, reported, and evaluated in the Draft FR/EIS and its associated appendices.

### ES.3.2 Draft FR/EIS

The Draft FR/EIS and its appendices were released for public review and comment in December 1999. The Draft FR/EIS synthesized the biological, environmental, engineering, and economic information and evaluation to allow for a comparison between four selected alternatives.

The comment period on the Draft FR/EIS began December 1999 and extended through April 30, 2000. Formal public meetings were conducted after the Draft FR/EIS was distributed for public review. In conjunction with the Federal Caucus (a group of Federal agencies with interests in salmon recovery efforts), a series of 15 formal meetings were held around the region in February and March 2000 to provide an opportunity for public questions and comments on the Draft FR/EIS, the Corps' John Day Drawdown Study, and the Federal Caucus Conservation of Columbia Basin Fish "All H" Paper. A total of nearly 9,000 participants consisting of stakeholders, special interest groups, elected officials, and individuals from the public presented 1,787 oral and taped comments. Oral comments, taped comments, and written comments (over 230,000 written comment documents) were received during the comment period. Written comments were received in the form of individual letters, reports, notecards, petitions, emails, etc.

The Corps evaluated each comment received so that issues of concern could be identified and considered by technical experts. Issues raised in public comment were summarized into issue statements and are provided, along with a response, in Appendix U to the Final FR/EIS.

NMFS released their most recent Biological Opinion on Federal Columbia Power System Operations in December 2000. The Final FR/EIS incorporates considerations

of the applicable aspects of the NMFS 2000 Biological Opinion. The Final FR/EIS also incorporates considerations from the U.S. Fish and Wildlife Service (USFWS) Biological Opinion and the Federal Caucus' Basinwide Recovery Plan released in December 2000.

### ES.3.3 The Final FR/EIS

The Corps released the Final FR/EIS and its 21 appendices in February 2002. The Final FR/EIS incorporates evaluation of additional data, comments, and other information gathered since release of the draft document.

The Final FR/EIS combines the format of a traditional Corps feasibility planning document and a NEPA EIS. The FR/EIS and associated technical appendices provide: 1) a complete presentation of study results and findings; 2) compliance with applicable statutes, Executive Orders, and policies; 3) a sound and documented basis with which both Federal and regional decision makers can judge the recommended solution; 4) scope, schedule, budgets, and technical performance requirements for the implementation of the selected alternative; and 5) documentation for subsequent funding for the implementation of specific measures associated with the preferred alternative (recommended plan).

At least 45 days after release of the Final FR/EIS to the public, the Corps will prepare a Record of Decision (ROD) documenting the recommended action resulting from the Feasibility Study process.

## ES.4 The Lower Snake River Project

The dams became operational between 1961 and 1975. The four dams are all run-of-river facilities, which means that they have limited storage capacity in their reservoirs and pass water through the dam at about the same rate as it enters the reservoir. All four of these dams are multiple-use facilities that provide navigation, hydropower, irrigation, recreation, and fish and wildlife conservation benefits. These dams were not built to control floods. Storage reservoirs, such as the Dworshak Reservoir on the North Fork of the Clearwater River, are used to store water and adjust the river's natural flow patterns. The normal operating ranges and usable storage volumes for the affected four lower Snake River facilities are listed in Table ES-1.

**Table ES-1**. Characteristics of the Four Lower Snake River Facilities

| Facility | Type of Facility | Snake River Mile | Reservoir Name | Reservoir Capacity [1/] (acre-feet) | Total Reservoir Capacity (acre-feet) | Reservoir Elevation [1/] (NGVD29) |
|---|---|---|---|---|---|---|
| Lower Granite | run-of-river | 107.5 | Lower Granite Lake | 49,000 | 483,800 | 733 to 738 |
| Little Goose | run-of-river | 70.3 | Lake Bryan | 49,000 | 565,200 | 633 to 638 |
| Lower Monumental | run-of-river | 41.6 | Lake Herbert G. West | 20,000 | 432,000 | 537 to 540 |
| Ice Harbor | run-of-river | 9.7 | Lake Sacajawea | 25,000 | 406,500 | 437 to 440 |

1/ normal operating range
NGVD29 = National Geodetic Vertical Datum
Source: Corps and NMFS, 1994

## ES.5 Current Fish Passage at the Lower Snake River Project

The four lower Snake River dams were designed with features to aid the migration of both juvenile and adult fish. In the last 25 years, the Corps has consistently investigated and adopted new technologies for maximizing the number of fish that safely pass the dams in both directions. Successful features at the lower Snake River dams include adult fish ladders, juvenile bypass systems, and the fish transportation program.

For adult fish returning from the Pacific Ocean to spawn, fish ladders and devices to attract fish to the entrances of the ladders are the primary aid to their passing the dams. Fish ladders have been in place since the dams were built in the 1960s and early 1970s. Improvements to these ladders have been made at all four dams. Since 1996, the cumulative survival for adult salmon through all four lower Snake River dams and reservoirs ranges from 92 to 98 percent. The survival rate through each dam and reservoir is 96 to 100 percent.

For juvenile fish traveling downriver, the dams and reservoirs present a more complex set of hazards. The slower water exposes juvenile fish to resident fish predators for a longer time. In addition, spill below the dam increases turbulence and exposure of juvenile salmon to predatory birds. When juvenile fish arrive at a dam, they can pass it in three ways: through the turbines (about 90 to 95 percent survival past a dam), through the spillway with the water (about 98 percent survival past a dam), or through bypass systems, where most are diverted to trucks or barges for transport downriver (about 98 to 99 percent survival to the point of release below Bonneville Dam).

Currently, the Corps, in coordination with NMFS, manages juvenile fish passage to "spread the risk." This spread-the-risk policy balances the number of fish that pass through the Lower Snake River Project in the river versus those that are diverted and transported below Bonneville Dam by barge or truck. About 50 to 65 percent of all fish traveling through the lower Snake River are diverted and collected for transport. The remainder are left in the river. The spread-the-risk policy is necessary because the long-term positive and negative effects of both in river and barge/truck transportation are not clear. Balancing the two approaches is a prudent course of action while there is still some uncertainty because it ensures that no inadvertent reduction in survival occurs if one approach is significantly favored over another.

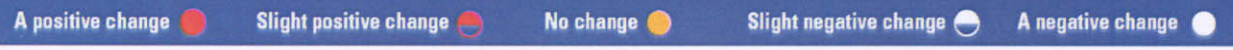
Short-term (direct) survival of juvenile fish through the Lower Snake River Project is measurable, and the numbers are generally positive. The average survival through a dam and reservoir on the lower Snake River for most stocks of juvenile salmon is in the 90-percentile range. Cumulative survival for juvenile salmon through all four dams and reservoirs is over 80 percent. Cumulative survival for juvenile salmon through all eight dams on the Columbia River System ranges from 45 to 60 percent.

Scientists do not know the cause of mortality for a certain portion of salmon who make it to the ocean as juveniles, but then do not return upriver to spawn as adults. Some suspect that a portion of this "extra mortality" is delayed mortality that may occur after juvenile salmon have passed Bonneville Dam. Scientists are unsure whether this delayed mortality could be caused by passing in river through the series of eight dams and reservoirs from Lower Granite Dam to Bonneville Dam, from the transportation of fish by barge or truck, or by non-hydropower related causes.

The anticipated effects of each alternative on listed Snake River anadromous fish are shown in Table ES-2.

**Table ES-2.** Anticipated Effects of Each Alternative on Snake River Anadromous Fish

| *Alternatives* | Extinction 1/ | Recovery 1/ | Juvenile Survival 2/ | Adult Survival 3/ | Habitat 4/ |
|---|---|---|---|---|---|
| **Alternative 1- Existing Conditions 5/** | | | | | |
| SPRING/SUMMER CHINOOK | | | | | |
| FALL CHINOOK | | | | | |
| STEELHEAD | | | | | |
| SOCKEYE | | | | | |
| PACIFIC LAMPREY | 6/ | 6/ | | | |
| **Alternative 2 - Maximize Transportation 5/** | | | | | |
| SPRING/SUMMER CHINOOK | | | | | |
| FALL CHINOOK | | | | | |
| STEELHEAD | | | | | |
| SOCKEYE | | | | | |
| PACIFIC LAMPREY | 6/ | 6/ | | | |
| **Alternative 3 - Major Systems Improvements ( Adaptive Migration) 5/** | | | | | |
| SPRING/SUMMER CHINOOK | | | | | |
| FALL CHINOOK | | | | | |
| STEELHEAD | | | | | |
| SOCKEYE | | | | | |
| PACIFIC LAMPREY | 6/ | 6/ | | | |
| **Alternative 4 - Dam Breaching 5/** | | | | | |
| SPRING/SUMMER CHINOOK | | | | | |
| FALL CHINOOK | | | | | |
| STEELHEAD | | | | | |
| SOCKEYE | | | | | |
| PACIFIC LAMPREY | 6/ | 6/ | | | |




1/ Extinction and Recovery parameters are estimates limited to the contributions of lower Snake River hydrosystem actions as evaluated by CRI (Extinction) and PATH (Recovery). They are represented by the NMFS lambda estimates reported in Table 6-3 of the FR/EIS main report.

2/ Estimate of effects based on total system juvenile passage survival through the eight lower Snake/lower Columbia River Federal mainstem dams, with and without transportation, as applicable to the alternative operations using ranges found in the FR/EIS.

3/ Estimate of effects based on total system adult passage survival through the four lower Snake River dams.

4/ Habitat effects are estimated based on fish passage, rearing, and spawning.

5/ Alternative 1 is change through time relative to existing conditions; Alternatives 2, 3, and 4 are compared to Alternative 1.

6/ No estimate of extinction or recovery is available for Pacific lamprey (not an ESA-listed species).

## ES.6 FR/EIS Alternatives

The four alternatives that are evaluated in detail in the FR/EIS are:

- Alternative 1—Existing Conditions
- Alternative 2—Maximum Transport of Juvenile Salmon
- Alternative 3—Major System Improvements (Adaptive Migration)
- Alternative 4—Dam Breaching

Figure ES-1 highlights the features of each of the alternatives. A brief description of the components of the alternatives is provided here.

### ES.6.1 Alternative 1—Existing Conditions

Alternative 1—Existing Conditions consists of continuing the operation of the fish passage facilities and project operations that were in place or under development at the time that this FR/EIS was initiated. Operations under Alternative 1—Existing Conditions would continue to meet the authorized uses of the Lower Snake River Project. In addition to the structural changes that would be implemented (e.g., additional barges for transporting juvenile fish, new turbine cams and runners, and upgraded Lower Granite juvenile fish facilities), it is assumed that flow augmentation would continue. Project operations—including all ancillary functions such as fish hatcheries and Habitat Management Units (HMUs), recreation facilities, power generation, navigation, and irrigation—would remain the same, unless modified through future actions. Alternative 1—Existing Conditions would include the spread-the-risk strategy for downstream juvenile fish passage using existing or currently planned facilities. This alternative is the base case or "no action" alternative considered in this NEPA process.

### ES.6.2 Alternative 2—Maximum Transport of Juvenile Salmon

All of the existing or planned structural configurations and flow augmentation of 427 thousand acre-feet (KAF) from the existing conditions would be included in this alternative. However, this alternative assumes that the juvenile fish transportation systems would be operated to maximize fish transport and that voluntary spill would not be used to bypass fish through the spillways (except at Ice Harbor). To accommodate maximum transport of juvenile salmon, measures would be used to maintain, upgrade, and significantly improve fish facilities that would focus on limiting in-river migration.

### ES.6.3 Alternative 3—Major System Improvements (Adaptive Migration)

The Corps has selected Alternative 3 as the recommended plan (preferred alternative). This alternative has been modified slightly since the Draft FR/EIS to provide more of a focus on adaptive migration, reflecting the strategies in the 2000 NMFS Biological Opinion. Adaptive migration is an approach that provides greater flexibility to switch between in river migration and barge or truck transportation as conditions require, and as new information becomes available.

**Figure ES-1.** Lower Snake River Juvenile Salmon Migration Feasibility Study, Alternatives Matrix

| | **Alternative 1** —Existing Conditions | **Alternative 2** —Maximum Transport | **Alternative 3** —Major System Improvements | **Alternative 4** —Dam Breaching |
|---|---|---|---|---|
| **Existing System Operations** | | | | |
| **Adult Fish Passage Systems** | | | | |
| Fish Ladders | √ | √ | √ | |
| Pumped Attraction Water Supplies | √ | √ | √ | |
| Powerhouse Fish Collection Systems | √ | √ | √ | |
| **Juvenile Fish Bypass and Collection Systems** | | | | |
| STS – IHR, LMO | √ | √ | √ | |
| ESBS – LGO, LGR | √ | √ | √ | |
| Collection and Transportation Facilities | √ | √ | √ | |
| Trash Shear Boom | √ | √ | √ | |
| **Minimum Operating Pool** – During Fish Migration | √ | √ | √ | |
| **Turbine Operations** – Within 1 percent Peak Efficiency | √ | √ | √ | |
| **Voluntary Spill** | | | | |
| Current Operations | √ | | | |
| Minimize Operations – IHR Only | | √ | | |
| Optimize Operations | | | √ | |
| No Spill | | | | √ |
| **Flow Augmentation (Dworshak)** | √ | √ | √ | √ |
| **Flow Augmentation (Upper Snake River) –** 427,000 acre feet | √ | √ | √ | √ |
| **Dissolved Gas Abatement Measures** | | | | |
| Spillway Gas Control Measures (Deflectors) | √ | √ | √ | |
| Spillway Gas Monitoring | √ | √ | √ | |
| **Continue Fish Facility Operations** | √ | √ | √ | |
| **Continue AFEP Evaluations** | √ | √ | √ | |
| **Power** | | | | |
| Current Production | √ | | √ | |
| Increased Production | | √ | | |
| No Production | | | | √ |
| **Navigation** | | | | |
| Current Operations | √ | √ | √ | |
| No Operations | | | | √ |
| **Fish Transportation** | | | | |
| Spread-the-Risk | √ | | | |
| Optimize Transportation | | | √ | |
| Maximize Transportation | | √ | | |
| No Transportation | | | | √ |

| | | | |
|---|---|---|---|
| STS | submerged traveling screen | LGO | Little Goose Dam |
| ESBS | extended submerged bar screen | LGR | Lower Granite Dam |
| IHR | Ice Harbor Dam | AFEP | Anadromous Fish Evaluation Program |
| LMO | Lower Monumental Dam | | |

Alternative 3—Major System Improvements (Adaptive Migration) assumes that juvenile fishway systems would be operated under an adaptive migration strategy that balances the passage of fish between in-river and transport (via barge or truck) methods. It would allow the flexibility for implementing operational changes within a migration season, if necessary. This alternative would include all of the existing or planned structural configurations from Alternative 1—Existing Conditions and Alternative 2—Maximum Transport of Juvenile Salmon. For example, spillway flow deflectors and pier extensions would be used to help lower total dissolved gas (TDG) concentrations. In addition, Alternative 3—Major System Improvements (Adaptive Migration) would include major system improvements that would provide a greater ability and more options to better adjust migration approaches (i.e., either in-river or transport).

Operations under Alternative 3—Major System Improvements (Adaptive Migration) would include activities prescribed in the 1995, 1998, and 2000 Biological Opinions to improve juvenile fish passage conditions.

Alternative 3 would incorporate several recently developed and/or tested technological improvements to increase survival through the Lower Snake River Project. Figures illustrating surface bypass collectors (SBC), behavioral guidance structures (BGS), removable spillway weirs (RSW), and technology for reducing total dissolved gas are provided in Section 2.1 of the FR/EIS.

Even though survival rates through the Lower Snake River Project dams are high, prototype systems of the SBC, BGS, and RSW have been tested at Lower Granite Dam to see if survival and passage conditions can be improved. Preliminary tests indicate increased fish passage efficiency through a combined system, including submerged screens. Development of additional system technologies is one of the measures recommended in the 2000 NMFS Biological Opinion.

### ES.6.4 Alternative 4—Dam Breaching

Dam breaching would create a 140-mile stretch of river with near-natural flow by removing the earthen embankment section of each dam and eliminating the reservoirs at all four lower Snake River dams. The powerhouses, spillways, and navigation locks would not be removed, but would no longer be functional. All facilities for transporting fish would cease to operate, as would hydropower operation. The navigation locks would no longer be operational, and navigation for commercial and large recreation vessels would be curtailed. Similarly, recreation opportunities, operation and maintenance of hatcheries and Habitat Management Units (HMUs), and other activities associated with the modification from a reservoir environment to an unimpounded river in the lower Snake River would entail important changes in these activities. Under Alternative 4—Dam Breaching, some water quality conditions such as TDG concentrations, would likely be at or near natural conditions. However, other conditions such as water temperature, would still be affected by upstream conditions or releases.

## ES.7 Economics

Actions taken to improve fish passage and survival along the lower Snake River could have economic and social effects on local communities, the Snake River region, the Pacific Northwest, and the nation, as a whole. To reduce conflicting analyses and

pool resources for a more efficient effort, the Corps convened DREW to develop a combined economic and social analysis. Members of DREW included representatives of various Federal and regional agencies, tribal representatives, and other interested parties.

Primary areas of analysis included power, recreation, transportation, irrigation, water supply, commercial fishing, avoided costs, implementation costs, and tribal circumstances. The final analysis addresses potential economic and social effects at three geographic scales—national, regional, and local. National and regional effects are addressed in separate accounting stances. The National Economic Development (NED) account displays changes in the economic value of the national output of goods and services, while the Regional Economic Development (RED) account addresses changes in the distribution of regional economic activity. Local effects—specifically those to potentially affected local communities and tribes—are addressed under separate accounts. The results of the tribal analysis conducted as part of the Feasibility Study are discussed in the Native American Indian section of the FR/EIS.

### ES.7.1 National Economic Development (NED)

The NED account addresses the net effects of a proposed action upon the nation. NED analysis is concerned only with economic efficiency at the national level. Economic gains achieved by one region at the expense of another region are not measured as NED benefits.

*NED costs are:*

- Implementation costs, including all project-related construction and acquisition costs; interest during construction; and operation, maintenance, repair, replacement, and rehabilitation costs. Implementation costs also include water acquisition from U.S. Bureau of Reclamation, mitigation costs for fish and wildlife programs, and cultural resources protection (Alternatives 3 and 4)
- Cost increases associated with the shift from hydropower to more expensive forms of replacement power (Alternative 4—Dam Breaching)
- Transportation cost increases associated with the shift of barge-transported commodities to more costly truck and rail systems (Alternative 4—Dam Breaching)
- Construction/operation and maintenance costs for irrigation and water supply systems (Alternative 4—Dam Breaching)
- Avoided costs—costs incurred under Alternative 3—Major System Improvements (Adaptive Migration) that would not be incurred under Alternative 1—Existing Conditions, or under Alternatives 2 and 4 (turbine maintenance and replacement, lock and dam maintenance, etc.)

*NED benefits are:*

- Costs incurred under Alternative 1—Existing Conditions that would be avoided under Alternative 4—Dam Breaching. These include operations, maintenance, repair, and replacement costs, as well as the costs associated with the rehabilitation of existing infrastructure
- Recreation benefits from increased fish runs and the shift to a near-natural river

- Commercial fishing benefits from increased fish runs
- Implementation costs for fish-related improvements that would not be incurred under Alternative 2—Maximum Transport of Juvenile Salmon
- Power benefits from increases in system hydropower generation (Alternatives 2 and 3).

Table ES-3 summarizes average annual NED costs/benefits for Alternatives 2, 3, and 4.

**Table ES-3.** Summary of Average Net Annual Economic Effects, 1998 Dollars in Thousands of Dollars at 6.875 Percent Discount Rate

| | *Alternative 2* | *Alternative 3* | *Alternative 4* |
|---|---|---|---|
| ***Costs*** | | | |
| *Implementation Costs* | *-* | *(22,880)* | *(48,790)* |
| *Power* | *-* | *-* | *(271,000)* |
| *Transportation* | *-* | *-* | *(37,813)* |
| *Water Supply* | *-* | *-* | *(15,424)* |
| *Avoided Costs* | *-* | *(10)* | *-* |
| ***Total Costs*** | ***-*** | ***(22,890)*** | ***(373,027)*** |
| ***Benefits*** | | | |
| *Avoided Costs* | *-* | *-* | *33,570* |
| *Recreation* | *1,405* | *1,437* | *71,255* |
| *Commercial Fishing* | *160* | *158* | *1,486* |
| *Implementation Costs* | *3,460* | *-* | *-* |
| *Power* | *8,500* | *8,500* | *-* |
| ***Total Benefits*** | ***13,525*** | ***10,095*** | ***106,311*** |
| ***Net Benefits*** | ***13,525*** | ***(12,795)*** | ***(266,716)*** |

*Notes:*

1. *These costs and benefits, calculated for a 100-year period of study extending from 2005 to 2104, are discounted using a 6.875 percent discount rate and converted to 1998 dollars.*
2. *Costs and benefits are presented for Alternatives 2 through 4 net of the base case (Alternative 1—Existing Conditions).*
3. *A positive monetary value indicates that the alternative being evaluated has a lower cost or greater benefit than Alternative 1—Existing Conditions. A negative monetary value (in parentheses) indicates that the evaluated alternative has a higher cost or lower benefit than Alternative 1—Existing Conditions. Positive monetary values, therefore, represent benefits, while negative values represent costs.*

*Source: Appendix I, Economics (Table ES-11).*

### ES.7.2 Regional Economic Development (RED)

The RED account measures the impacts that the types of economic effects addressed in the NED account would have upon the regional economy. Direct changes in one sector of the economy have indirect and induced effects distributed throughout the regional economy. Economic activity within one industry ("direct" activity) generates activity in others as firms purchase services and materials as inputs ("indirect" effects) and employees spend their earnings within the local economy ("induced" effects).

### ES.7.3 Passive Use Estimates

Economists generally recognize that there is a benefit associated with knowing that a resource exists, even if no use is made of it. These values are typically referred to as passive use, non-use, or existence values. There are, however, disagreements about how to measure passive use values. Passive use values were estimated by transferring and adapting values from other passive use studies. Corps Planning Guidance does

not allow passive use values to be included in NED analysis. However, since these values could be useful as a social indicator, they were calculated as part of the Feasibility Study to provide additional information for the decision maker to consider.

## ES.8 Effects of the Alternatives

Before making its selection of a recommended plan (preferred alternative), the Corps evaluated the implications of each alternative. The effects of the four alternatives on key environmental resources and economic factors were evaluated. Table ES-4 summarizes the effects on some of these resource areas and economic uses. Details are provided in the FR/EIS and associated appendices.

**Table ES-4**. Summary Resource Comparisons

| Resource List | Alternative 2 Maximum Transport | Alternative 3 Adaptive Migration | Alternative 4 | |
|---|---|---|---|---|
| | | | Dam Breaching Short Term | Dam Breaching Long Term |
| Aquatic Resources—Anadromous Fish | | | | |
| **Spring/Summer Chinook Salmon Passage** | ◒ | ● | ○ | ● |
| **Fall Chinook Salmon Recovery Passage** | ◒ | ● | ○ | ● |
| **Steelhead Passage** | ◒ | ● | ○ | ● |
| Sockeye Salmon | ◒ | ● | ○ | ● |
| Aquatic Resources—Resident Fish | | | | |
| Resident Fish | ◒ | ◒ | ○ | ◒ |
| Lamprey | ◒ | ◒ | ○ | ● |
| Bull Trout | ◒ | ◒ | ○ | ● |
| Water Resources | | | | |
| **Sediment** | ◒ | ◒ | ○ | ○ |
| Temperature | ◒ | ◒ | ◒ | ◒ |
| **Dissolved Gas** | ● | ● | ● | ● |
| Contaminants | ◒ | ◒ | ○ | ◒ |
| Air Quality | | | | |
| Fugitive Dust Emissions | ◒ | ◒ | ○ | ◒ |
| Transportation Emissions | ◒ | ◒ | ◒ | ◒ |
| **Replacement Power Emissions** | ◒ | ◒ | ○ | ○ |
| Terrestrial Resources | ◒ | ◒ | ○ | ◒ |
| Cultural Resources | ◒ | ◒ | ◒ | ◒ |
| **Electric Power** | ● | ● | ○ | ○ |
| **Transportation (Navigation)** | ◒ | ◒ | ○ | ○ |
| **Recreation and Tourism** | ◒ | ◒ | ○ | ● |
| **Water Supply/Irrigation** | ◒ | ◒ | ○ | ○ |
| Commercial Harvest | ◒ | ◒ | ○ | ◒ |
| **Implementation/Avoided Costs** | ◒ | ○ | ○ | ○ |
| **Native American Indians (Tribal Values)** | ◒ | ◒ | ● | ● |
| Social Effects | | | | |
| **Community Views** | ◒ | ◒ | ○ | ○ |
| **Low Income and Minority Pop.** | ◒ | ◒ | ○ | ○ |
| Traffic Safety | ◒ | ◒ | ◒ | ◒ |
| Geological Resources | ◒ | ◒ | ○ | ◒ |
| Aesthetic Resources | ◒ | ◒ | ○ | ◒ |

● A Positive effect
◒ Minimal or No notable change in effect
○ A Negative effect

Bolded resources indicate those that would have the greatest impact or potential effect. Table reflects relative change as compared Alternative 1—Existing Conditions.

When evaluating the effects of the alternatives on the environmental resources and economic factors summarized in this document, it is important to note that some of the analyses carry with them varying degrees of uncertainty. Uncertainty is inherent in any planning effort, especially when the period of implementation may span several years, as is likely for this FR/EIS. Information might be unavailable, incomprehensive, and scientifically untestable or reflect wide natural variability in the resource studied. There are also uncertainties in the assumptions and models used to extrapolate this information to future conditions. Relevant uncertainties are described in the FR/EIS, where appropriate. For this Feasibility Study, noticeable uncertainty exists in the effects analyses for salmon, recreation, and economics.

## ES.9 The Recommended Plan (Preferred Alternative)

Based on a thorough examination of the best available biological, economic, social, environmental and other related information, the Corps has selected a recommended plan (preferred alternative). The recommended plan (preferred alternative) is a modified version of Alternative 3—Major System Improvements (Adaptive Migration), with increased focus on adaptive migration capabilities. The alternative analysis and evaluation of impacts summarized in this document and described in detail in Chapter 5 of the Final FR/EIS include all components or actions contained in the recommended plan (preferred alternative). Sensitivity and trade-off analyses were conducted and considered for each alternative.

The recommended plan (preferred alternative) combines a series of the structural and operational measures described and evaluated in the FR/EIS for Alternative 3 that are intended to improve fish passage through the four lower Snake River dams. This alternative provides the maximum operational flexibility for juvenile fish passage; it optimizes in river passage when river conditions are best for fish and optimizes the juvenile transportation program when that operation is best for fish. It also allows for optimized combined passage when necessary for spread-the-risk operation or to conduct needed research. These improvements are not only intended to reduce direct mortality associated with dam passage, but also to reduce stress on juvenile fish, reduce total dissolved gas, and improve operational reliability.

The rationale for selecting the recommended plan (preferred alternative) is a composite of analyses, information briefings, evaluations, technical expertise, and comments concerning the factors evaluated as part of the Feasibility Study. The selection of the recommended plan (preferred alternative) resulted from the evolution and development of the extraordinary collection of scientific data and information presented in the FR/EIS, its associated appendices, and supporting research materials and reports. Although not without uncertainties, the Corps believes the information collected represents the best available science and information to date.

The key factors supporting the selection of this alternative were:

- High current juvenile and adult salmon and steelhead survival rates through the Lower Snake River Project
- Proposed improvements provide the maximum flexibility of all alternatives in terms of optimizing both in river migration conditions and transport conditions
- Lesser magnitude of uncertainty in current biological information

- Minimal economic impacts to users
- Compatibility with NMFS and USFWS 2000 Biological Opinions
- Minimal effects to other environmental resources.

Other factors considered in this selection include, but were not limited to, those effects associated with social and community resources, Native American Indians, technical feasibility, effectiveness of structural modifications, regional acceptability, public comments, and length of implementation.

The structural and operational measures identified for the recommended plan (preferred alternative) are considered to be technically feasible, implying that the Corps has the capability to design, construct, and operate these measures.

### ES.9.1 Structural Measures

The structural improvements associated with the recommended plan (preferred alternative) can be placed into two categories. The first category is near-term improvements, consisting of modifications to existing systems using current technology. These require little or no additional study or research. Near-term improvements can be implemented relatively quickly (within the first 5 years after the final ROD is signed). The second category is long-term improvements. These improvements require additional evaluation, prototype development, and testing. Therefore, these improvements take more time to put into place. The actual determination on if, where, how, and when these long-term improvements are implemented would be contingent on the prototype testing and evaluation results. Implementation would also be dependent on a continued need for improvements in the hydropower system.

Near-term improvements proposed as part of the recommended plan (preferred alternative) are:

- Complete installation of spillway flow deflectors at Lower Monumental and Little Goose
- Upgrade auxiliary fish ladder water supply systems at Ice Harbor, Lower Monumental, Little Goose, and Lower Granite
- Modify extended submerged bar screens at Little Goose and Lower Granite
- Use additional barges for transport with upgraded mooring facilities at Lower Granite.

Long-term improvements proposed as part of the recommended plan (preferred alternative) are:

- Install new juvenile facility at Lower Granite
- Install new cylindrical dewatering screens at all dams
- Replace submerged traveling screens with extended-length submerged bar screens at Ice Harbor and Lower Monumental
- Install new wet separators at Lower Monumental and Little Goose
- Install turbine improvements (as powerhouses are rehabilitated)

- Install removable spillway weirs with or without behavioral guidance structure at all four dams
- Install two-unit powerhouse surface bypass with or without dewatering system at Lower Monumental and Lower Granite
- Build full-length powerhouse occlusion structure at Little Goose.

### ES.9.2 Operational Measures

In addition to current operational measures and continued participation in ongoing monitoring, evaluation, and regional coordination programs, there are two principal areas where potential future operational changes for the lower Snake River need to be further investigated. These areas are:

- Develop and implement biological rules for flow augmentation
- Develop and implement biological rules for smolt transportation including optimal spill for salmon.

The Corps plans to coordinate with Federal agencies to establish these specific rules for both smolt transportation and flow augmentation. All such operational rule development will continue to be regionally coordinated in a manner consistent with the NMFS 2000 Biological Opinion.

### ES.9.3 Consistency with Planned Regional Salmon Recovery Efforts

Of all the alternatives investigated in the FR/EIS, the recommended plan (preferred alternative) most closely matches recommendations in the NMFS 2000 Biological Opinion for the Lower Snake River Project. The NMFS 2000 Biological Opinion concluded that dam breaching on the lower Snake River is not necessary at this time, but reserved this action as a contingency management alternative if the listed stocks continue to decline in the near future (2005 to 2008). The Corps' selection of a modified version of Alternative 3—Major System Improvements (Adaptive Migration) as the recommended plan (preferred alternative) is consistent with this conclusion. The plan includes implementation of the actions applicable to the Corps as recommended in the NMFS 2000 Biological Opinion and the USFWS 2000 Biological Opinion for system operations, configuration measures, habitat restoration, and continued research and monitoring activities (or alternative measures that result in achieving the current or revised established performance standards).

In implementing the Biological Opinions' lower Snake River actions, the Corps will also contribute to the attainment of the goals identified in the Conservation of Columbia Basin Fish: Final Basinwide Salmon Recovery dated December 2000. This strategy was developed by several Federal agencies (including the Corps) as part of the Federal Caucus. It is a comprehensive, long-term plan to recover 12 anadromous fish stocks and other listed species (i.e., bull trout and sturgeon) in the Columbia-Snake River Basin.

## ES.10 Future Actions

A final Notice of Availability will appear in the Federal Register indicating that the Final FR/EIS is ready for release to the public. The public will have at least 45 days to consider the recommendation and the rationale before a ROD is signed. During the

preparation of the ROD, the Corps will consider new data, science, objections, comments, or opinions brought forward to the Corps during the 45-day period.

The Final FR/EIS, including the recommended plan (preferred alternative) and ROD, will be forwarded to the Northwestern Division Engineer for approval and signature. Since the recommended plan (preferred alternative) is consistent with existing project authorities and does not require additional Congressional authorization, the Division Engineer is slated as the signatory of the ROD. However, many of the proposed actions will be included in the Corps' regular appropriation and budget process, which provides opportunity for input from Congress.

The near-term and long-term actions described in the recommended plan (preferred alternative) will be folded into the existing processes for consideration and coordination with the regional recovery efforts, as they proceed towards implementation, etc., become available on future proposed actions.