



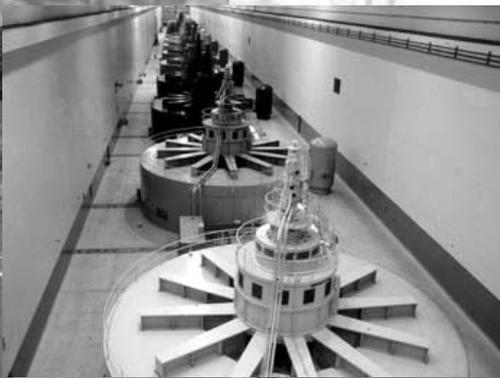
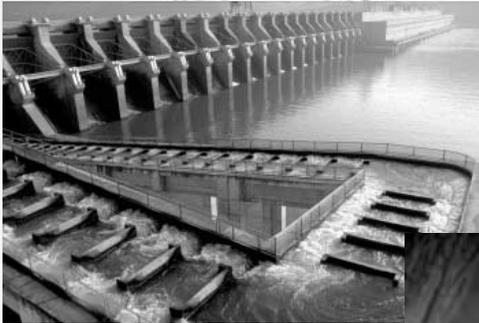
US Army Corps  
of Engineers®  
Portland District

# Salmon Recovery through John Day Reservoir

## John Day Drawdown Phase I Study

---

### Economic Analysis Technical Appendix Recreation Section



September 2000

# Table of Contents

<b>SECTION 1. INTRODUCTION.....</b>	<b>1</b>
<b>SECTION 2. BACKGROUND OF THE PROJECT.....</b>	<b>1</b>
<b>SECTION 3. DESCRIPTION OF THE STUDY AREA.....</b>	<b>1</b>
<b>SECTION 4. ALTERNATIVES .....</b>	<b>3</b>
4.1. Spillway Drawdown without Flood Control (Alternative 1) .....	3
4.2. Spillway Drawdown with Flood Control (Alternative 2).....	4
4.3. Natural River Drawdown without Flood Control (Alternative 3).....	4
4.4. Natural River Drawdown with Flood Control (Alternative 4).....	4
<b>SECTION 5. OVERVIEW OF THE ANALYSIS.....</b>	<b>4</b>
5.1. Geographic Scope of the Analysis .....	6
5.2. Existing and Proposed Pool Elevations.....	6
5.3. Recreation Sites.....	7
5.3.1. Railroad Island Park, Washington.....	9
5.3.2. Le Page Park, Oregon.....	10
5.3.3. Phillippi Park, Oregon.....	10
5.3.4. Rock Creek Park, Washington .....	11
5.3.5. Sundale Park, Washington .....	11
5.3.6. Roosevelt Park, Washington .....	12
5.3.7. Blalock Canyon Boat Ramp, Oregon.....	13
5.3.8. Arlington Marina, Oregon.....	13
5.3.9. Earl Snell Park, Oregon.....	14
5.3.10. Quesnel (or Threemile Canyon) Park, Oregon.....	15
5.3.11. Alderdale Park, Washington .....	15
5.3.12. Crow Butte State Park, Washington.....	15
5.3.13. Boardman Park, Oregon.....	16
5.3.14. Irrigon Park, Oregon .....	17
5.3.15. Nugent Park, Oregon.....	17
5.3.16. Plymouth Park, Washington.....	18
5.3.17. Umatilla Park, Oregon.....	18
5.4. Summary of Facility Impact Modification Costs.....	19

5.5. Existing Recreation Use and Value.....	21
<b>SECTION 6. PROJECTED GROWTH IN RECREATION DEMAND .....</b>	<b>24</b>
6.1. Future With-Project Recreation Use .....	27
6.1.1. Drawdown to Spillway Crest (with or without flood control) .....	27
6.1.2. Drawdown to Natural River Level (with or without flood control).....	28
6.2. Risk and Uncertainty Considerations.....	32
<b>SECTION 7. SUMMARY AND CONCLUSIONS .....</b>	<b>35</b>
<b>SECTION 8. REFERENCES.....</b>	<b>37</b>

## Tables

Table 1. Alternatives Evaluated in Recreation Impact Analysis.....	5
Table 2. Alternative Water Surface Elevations at John Day Dam.....	6
Table 3. Current John Day Reservoir Recreation Sites.....	7
Table 4. John Day Recreation Facility Modification Costs .....	20
Table 5. Recreation Site Visitation 1989-1998.....	21
Table 6. Percent of Visitor Participation by Activity, John Day Reservoir, 1991 .....	22
Table 7. Recreation Demand Allocation by Activity.....	22
Table 8. Recreation Demand Allocation (Fishing and Non-Fishing Activities).....	23
Table 9. Average Annual Baseline Recreation Value of John Day Reservoir Reservoir Recreation.....	24
Table 10. Projected Recreation Demand Growth Rates, 1990-2010 (Oregon, Washington, and Idaho).....	26
Table 11. Without Project Reservoir Recreation Value, John Day Reservoir .....	27
Table 12. Estimated Recreation Impacts of Drawdown to Spillway Crest John Day Reservoir .....	28
Table 13. Demand Growth Adjustment Factors for Drawdown to Natural River Level.....	29
Table 14. Recreation Suitability During Phased Recovery from Drawdown .....	30
Table 15. Average Annual Demand Growth Projections With Drawdown to Natural River Level.....	31
Table 16. Estimated Recreation Impacts of Drawdown to Natural River Level, John Day Reservoir .....	32
Table 17. Risk and Uncertainty Analysis Probability Distribution.....	33

## Figures

Figure 1. John Day Drawdown Phase I Study Area.....	2
Figure 2. John Day Pool, Columbia River Area .....	8
Figure 3. Risk and Uncertainty Analysis Probability Distribution .....	33

## Section 1. Introduction

This technical appendix section documents the results of the recreation economics evaluation for the John Day Drawdown Phase I Study. This Phase I Study is a reconnaissance-level evaluation of the potential consequences and benefits of the proposed drawdown of the John Day Reservoir. This technical appendix section supplements the main report, which describes more fully the alternatives, purpose, scope, objectives, assumptions, and constraints of the study.

## Section 2. Background of the Project

In 1991, the National Marine Fisheries Service (NMFS) proposed that Snake River wild sockeye, spring/summer chinook, and fall chinook salmon be granted “endangered” or “threatened” status under provisions of the Endangered Species Act. Natural resource agencies believe that the drawdown of the 76-mile John Day Reservoir may provide substantial improvements in migration and rearing conditions for juveniles by increasing river velocity, reducing water temperature and dissolved gas, and restoring riverine habitat. It is also speculated that drawdown may improve spawning conditions for adult fall chinook by restoring spawning habitat and the natural flow regimes needed for successful incubation and emergence.

As a result, the NMFS Reasonable and Prudent Alternative Action #5 of its’ Biological Opinion on Operation of the Federal Columbia River Power System (FCRPS), and subsequent reports recommended that USACE investigate the feasibility of lowering John Day Reservoir. In compliance with appropriation conditions, only two alternatives were to be evaluated: reduction of the current water surface elevation 265 National Geodetic Vertical Datum<sup>1</sup> (NGVD) to the level of the spillway crest that would vary between elevations 217 and 230, or reduction to natural river level elevation 165. Both alternatives were proposed by NMFS. These two alternatives were then expanded to consider each alternative with 500,000 acre-feet of flood storage and without such storage. Flood storage and hydropower are the current approved authorizations for the John Day project.

## Section 3. Description of the Study Area

The Columbia River originates in Canada and flows for 300 miles through eastern Washington to Oregon and continues west to the Pacific Ocean, as shown in [Figure 1](#). The adjoining region is mostly open country, with widely scattered population centers. The climate of the region is semiarid. Agriculture, open space, and large farms are prevalent. Lands adjacent to the reservoir are used to grow grains and other crops. The reach of the Columbia River under consideration in this report extends from John Day Lock and Dam at river mile (RM) 215.6, to McNary Lock and Dam RM 291. The body of water impounded by John Day Dam, Lake Umatilla, is referred to as the John Day Reservoir throughout this report. The John Day is the second longest reservoir on the Columbia River, extending 76 miles upstream to McNary Dam.

---

<sup>1</sup> All elevations referred to in this Phase I Study are reference in feet to the National Geodetic Vertical Datum.

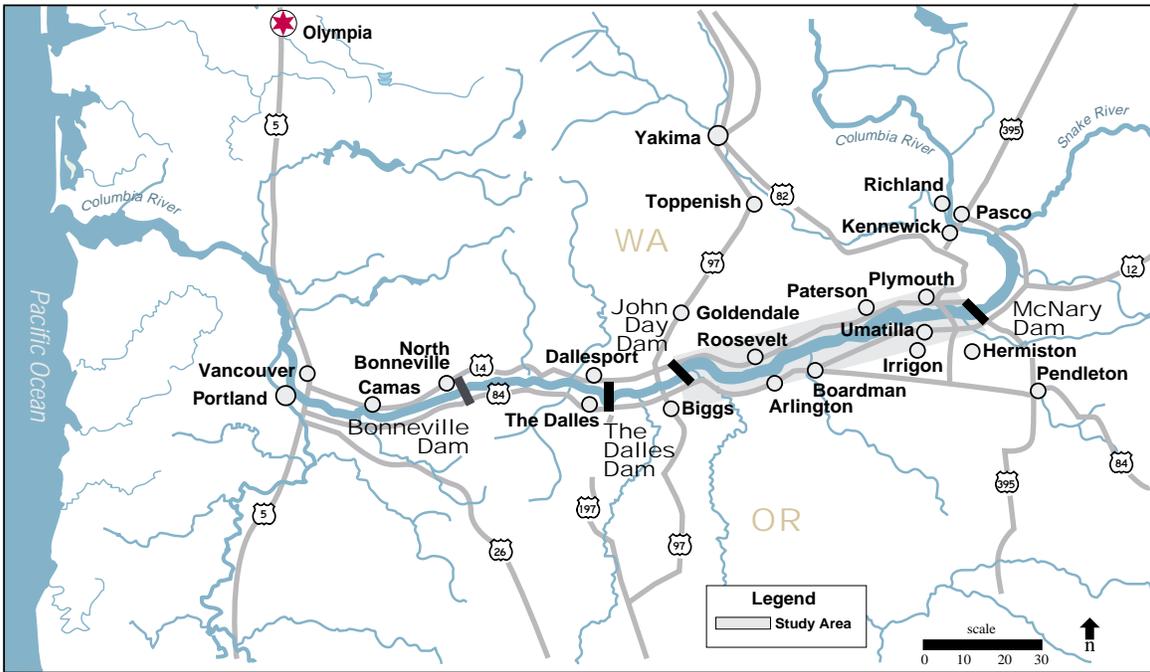


Figure 1. John Day Drawdown Phase 1 Study Area

John Day Dam and Reservoir are part of the Columbia-Snake Inland Waterway. This shallow-draft navigation channel extends 465 miles from the Pacific Ocean at the mouth of the Columbia River to Lewiston, Idaho. The entire channel consists of three segments. The first is the 40-foot-deep water channel for ocean-going vessels that extends for 106 miles from the ocean to Vancouver, Washington. The second is a shallow-draft barge channel that extends from Vancouver to The Dalles, Oregon. Although this section is authorized for dredging to a depth of 27 feet, it is currently maintained at 17 feet. The third section of the channel is authorized and maintained at a depth of 14 feet and extends from The Dalles to Lewiston. In addition to the main navigation channel, channels are dredged to numerous ports and harbors along the river.

The middle Columbia River area is served by a well-developed regional transportation system consisting of highways, railroads, and navigation channels. Railroads and highways parallel the northern and southern shores of the reservoir. Interstate 84 (I-84), a divided multilane highway, runs parallel on the south shore with the Columbia River from Portland, Oregon, to points east. Washington State Route 14 (SR-14) also parallels the Columbia River from Vancouver to McNary Dam on the north shore. Umatilla Bridge at RM 290.5, downstream from McNary Dam, is the only highway bridge linking Oregon and Washington across the Columbia River in the John Day Reservoir.

The study area includes lands directly adjacent to the reservoir as well as those directly and indirectly influenced by the hydrology of the reservoir (e.g., irrigated lands). It includes the reservoir behind the John Day Dam, and adjoining backwaters, embayments, pools, and rivers.

## **Section 4. Alternatives**

The Phase 1 Study includes a preliminary evaluation of the impacts of the drawdown scenarios relative to the “without project condition,” which is defined as the condition that would prevail into the future in the absence of any new federal action at John Day. The four alternatives are summarized below. One of the most important constraints on the alternatives is the requirement to pass fish for river flows up to the 10-year flood flow of 515,000 cfs. Under the four alternatives, John Day Reservoir would be drawn down at a rate of one foot per day. For greater detail, please refer to the main report, *John Day Drawdown Phase 1 Study*, and *John Day Drawdown Phase 1 Study, Engineering Technical Appendix, Structural Alternatives Section*.

### **4.1. Spillway Drawdown without Flood Control (Alternative 1)**

The first drawdown alternative is based on requirements for improved downstream fish passage conditions during both low and flood flow conditions on the Columbia River. The existing 20-bay spillway will be operated differently from current operations, but without any structural modifications. All project inflows will be directly passed through the dam spillway with the spillway gates fully opened in free overflow condition, resulting in a pool elevation that will vary from elevation 217 to 230.

## **4.2. Spillway Drawdown with Flood Control (Alternative 2)**

The second study alternative is based on requirements for improved downstream fish passage conditions during low flow periods, while maintaining authorized flood control for the John Day Project. The existing 20-bay spillway will be operated differently from current operations, but without any structural modifications. During low flow periods, project inflows will be directly passed through the dam spillway with the spillway gates set in fully open, free overflow condition. During a flood event, however, the spillway gates will be controlled to reduce downstream flood flows based on using 500,000 acre-feet of allocated project storage space. Ponding will occur upstream from the dam.

## **4.3. Natural River Drawdown without Flood Control (Alternative 3)**

The third study alternative is based on a natural river drawdown for fish passage “without flood control” condition. Natural river conditions pertain to an opening at the John Day Dam that permits acceptable upstream fish passage conditions. The size of the total dam opening must conform to two criteria based on an invert elevation at the dam of 135. The first criterion is that the opening must be sufficiently large to meet maximum allowable stream velocity criteria for sustained swim speed for the weakest salmon species, which is estimated to be 10 feet per second (fps). The second criterion is that fish passage for this opening must correspond to the 10-year annual flood peak (515,000 cfs). This alternative will require extensive modifications to John Day Dam even beyond modification of the 1,228-foot long spillway structure.

## **4.4. Natural River Drawdown with Flood Control (Alternative 4)**

This fourth study alternative is based on natural river conditions for fish passage and includes the “with flood control” condition. It requires natural fish passage conditions for both upstream and downstream directions at the dam and includes a requirement for full authorized flood control. The calculated width of the total dam opening will correspond to that previously calculated for natural river conditions without flood control (Alternative 3).

# **Section 5. Overview of the Analysis**

Objectives of the recreation impact analysis were to

- Profile current recreation amenities and use in the John Day Reservoir
- Conduct a preliminary quantification of the economic costs associated with maintaining current recreation access sites and facilities with implementation of the drawdown alternatives
- Conduct a preliminary assessment of the expected changes in recreation use with implementation of the various drawdown alternatives
- Estimate NED gains and losses

For the recreation analysis, it was assumed that the Snake River drawdown options would not have a significant impact on recreation facility costs or recreation use in the John Day Reservoir area (the analysis assumes that the effect of any potential displaced demand from the Lower Snake River reservoirs would be more significant at the closer McNary pool). As

such, these two options were not evaluated in the analysis. Thus, four alternatives were evaluated as summarized in [Table 1](#).

<b>Table 1. Alternatives Evaluated in Recreation Impact Analysis</b>	
Alternative 1:	No-Action
Alternative 2:	Drawdown to Spillway Crest without Flood Control
Alternative 3:	Drawdown to Spillway Crest with Flood Control
Alternative 4:	Drawdown to Natural River Level without Flood Control
Alternative 5:	Drawdown to Natural River Level with Flood Control

The basis for comparison of costs and benefits of alternatives is recreation use and facility operation based upon the current operation of the John Day project (without-project condition). All four alternatives (including no-action) were evaluated to determine their respective cost and benefit levels (with-project conditions). Of interest for the analysis and decision making are the changes in costs and benefits from the without project conditions associated with the no-action alternative to each other alternative's with-project condition.

This analysis focuses primarily on direct national recreation impacts (for example, changes in recreation use and capital modification costs of facilities), a qualitative discussion of indirect regional economic impacts (for example, income and employment effects) is provided. More detailed quantified analysis of regional economic impacts associated with the drawdown alternatives is included in the assessment of regional impacts found in the Phase 1 Study.

This reconnaissance-level recreation analysis is based primarily on existing information and data. To establish the base condition, existing recreation facilities around the John Day Reservoir were inventoried and reviewed. Where available, site-specific recreation visitation records were reviewed and documented. The John Day Drawdown Study's engineering analyses estimated capital modification costs to maintain recreation access to the river at most facilities<sup>2</sup>. Due to limited existing data, changes in recreation visitation and value were estimated for the John Day Study based upon combinations of professional judgment, informal discussions with Corps personnel, and review of similar studies.

A feasibility-level study of drawdown at the lower four reservoirs on the Snake River was being conducted concurrently with the John Day Drawdown study. Changes in the value of the recreation experience at John Day with drawdown to natural river were drawn from the Snake River study. Surveys conducted for the Snake River recreation analysis identified willingness to pay values for reservoir and natural river fishing and non-fishing recreation in various reaches of the Snake River in Washington and Central Idaho. A limiting difference in applicability of Snake River results (for example, changes in visitation/use and origin of visitors) at the John Day Reservoir are the physical differences in the two systems. Drawdown through the lower Snake River reaches is expected to result in a more wild and scenic natural river providing high demand activities such as whitewater rafting and backpacking that draw visitors from more distant origins. Natural river level through the John

<sup>2</sup> Modification cost estimates were developed only for the drawdown to spillway crest alternative for the Phase 1 Study. It is assumed that these estimates are appropriate for use in estimating modification costs for drawdown to natural river level. More detailed assessment of modification costs for natural river level drawdown should be conducted if a Phase 2 study is conducted.

Day reach of the Columbia River is expected to be less “wild and scenic” with river currents characterized as more of a “slow float” than a “whitewater adventure”. Still, some of the data from the Snake River study provides appropriate existing information for use in the John Day reconnaissance analysis. Limiting assumptions are identified and described throughout this report where data is estimated or drawn from other sources. John Day-specific surveys are recommended to better define willingness to pay values and visitation levels if a feasibility-level Phase 2 study is conducted of John Day Drawdown.

## 5.1. Geographic Scope of the Analysis

The geographic scope of the recreation impacts analysis was determined to be the aquatic and riparian environments in and around the existing John Day Reservoir. Thus, the geographic scope includes all facilities, sites, refuges, and public lands in vicinity of the existing John Day Reservoir that provide recreation amenities. The John Day Reservoir is a segment of the Columbia River that extends from John Day Lock and Dam (located at river-mile 215.6) to McNary Lock and Dam (located at river-mile 291), a distance of 77 miles. The lands along either side of the river include lands of the states of Oregon and Washington, including three counties in Oregon (Sherman, Gilliam, and Morrow) and two counties in Washington (Klickitat and Benton).

## 5.2. Existing and Proposed Pool Elevations

Current (1999) operating procedures for the John Day Reservoir provide pool elevations that generally range from 262 to 265. Each of the alternatives would lower water surface elevations in the John Day reach. The alternatives that include features to maintain flood control storage introduce potentially wide ranges in water surface elevations. The water surface elevation ranges at John Day Dam for the four alternatives are presented in [Table 2](#). Water surface elevations will vary at each site and are described in Section 5.3.

Pool lowering will affect recreation facilities that provide access to the river and include amenities such as boat ramps, docks, and moorage. Pool lowering while maintaining flood control storage capacity could have significant impacts on modified recreation facilities due to water surface level fluctuations. This following section identifies costs that would occur to specific facilities to maintain current recreation amenities with each drawdown scenario.

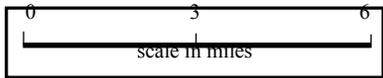
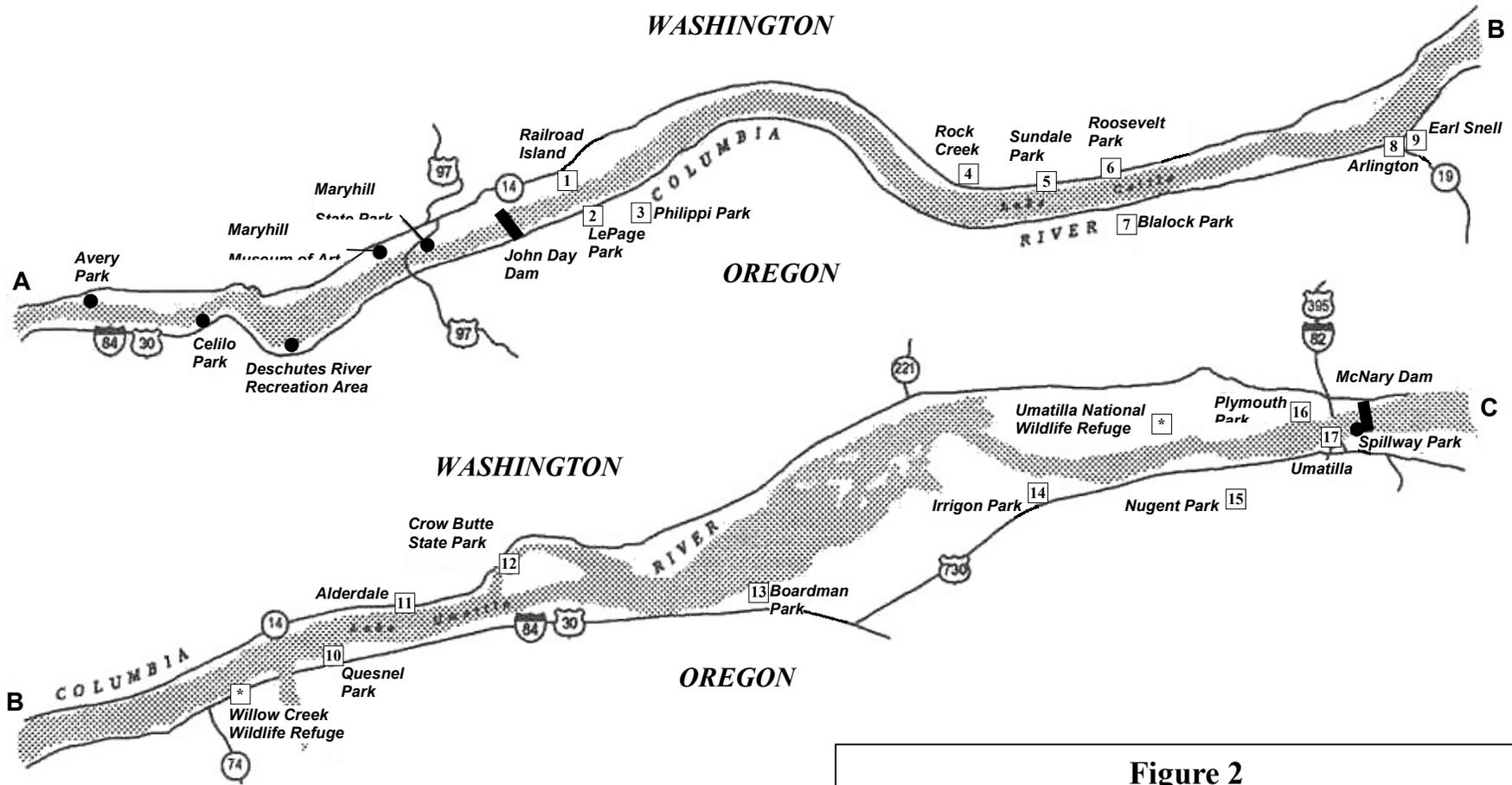
<b>Alternative</b>	<b>Water Surface Elevation Range</b>
Existing Operation (No Action Alternative)	262-265
Minimum Operating Pool*	257
Spillway Crest without Flood Control	218-233
Spillway Crest with Flood Control	218-254
Natural River without Flood Control	160-165
Natural River with Flood Control	160-227

\*Drawdown of John Day Reservoir to Minimum Operating Pool is not an alternative under evaluation in this study but is included in Table 2 for reference.

### 5.3. Recreation Sites

There are 17 recreation sites on the John Day Reservoir and tributary outlets. The sites are listed in upstream order with river-mile (RM), state, and maintaining agency in [Table 3](#). For reference, a map showing the location of each recreation facility is provided as [Figure 2](#).

<b>Recreation Site</b>		<b>State</b>	<b>River/River-Mile</b>	<b>Maintaining Agency</b>
1	Railroad Island Park	Washington	Columbia RM 216	Corps of Engineers
2	Le Page Park	Oregon	Columbia RM 217	Corps of Engineers
3	Albert Philippi Park	Oregon	John Day RM 3.5	Corps of Engineers
4	Rock Creek Park	Washington	Columbia RM 229	Corps of Engineers
5	Sundale Park	Washington	Columbia RM 236.5	Corps of Engineers
6	Roosevelt Park	Washington	Columbia RM 241	Corps of Engineers
7	Blalock Canyon Boat Ramp	Oregon	Columbia RM 233.5	Corps of Engineers
8	Arlington Marina	Oregon	Columbia RM 241	Port of Arlington
9	Earl Snell Park, Arlington	Oregon	Columbia RM 241	City of Arlington
10	Quensel (Three-Mile Canyon)	Oregon	Columbia RM 255	Corps of Engineers
11	Alderdale Park	Oregon	Columbia RM 258	Not currently maintained
12	Crow Butte Park	Washington	Columbia RM 262	State of Washington
13	Boardman Park	Oregon	Columbia RM 269	Boardman Park and Recreation District
14	Irrigon Park and Marina	Oregon	Columbia RM 282	Irrigon Park and Recreation District
15	Nugent Park	Oregon	Umatilla River Mouth	City of Umatilla
16	Plymouth Park	Washington	Columbia RM 289	Corps of Engineers
17	Umatilla Park and Marina	Oregon	Columbia RM 289	Port of Umatilla



**Figure 2**  
**JOHN DAY POOL, COLUMBIA RIVER**  
**John Day Drawdown Study**  
**U.S. Army Corps of Engineers**  
**Portland District**

In addition to the recreation-oriented sites listed in [Table 3](#), additional facilities in the John Day Reservoir include wildlife refuges (Umatilla National Wildlife Refuge and Willow Creek Wildlife Refuge) and treaty fishing access sites (at the Railroad Island, Le Page, Sundale, and Quesnel recreation sites). Impacts to these facilities are not evaluated in this recreation analysis, but are evaluated and documented in the environmental and tribal sections of the Phase 1 Report.

Impacts to recreation-related visitation (e.g., hunting, fishing, viewing) at wildlife refuges is uncertain at this phase of study because modification policy for such impacts is not yet defined. Records of annual visitation at the Umatilla National Wildlife Refuge show approximately 140,000 visitors a year. If a Phase 2 Study is conducted, the impacts to the sites, any modification, and the resultant changes in recreation demand should be further evaluated.

The following paragraphs describe each of the recreation sites listed in [Table 3](#). Descriptions include facilities, access, current critical pool elevation requirements, facility impacts, and modification measures/costs for each site<sup>3,4,5</sup>.

### **5.3.1. Railroad Island Park, Washington**

**Description/Facilities.** Railroad Island Park is located on the Washington shore at RM 216, immediately above and east of the John Day Dam. The following facilities can be found at the park: a boat ramp with a dock, a gravel parking lot, potable water, and a water-borne sewer system. Annual visitation records from 1998 report a total of 18,397 visitors at the park.

**Access.** The park is accessible by State Road (SR) 14 from the north or by boat through a culvert passing under the Burlington Northern Railroad.

**Water Surface Elevation Requirements.** The existing boat ramp toe elevation is 256.2 feet. The bottom of the access culvert is 254.6 feet. Assuming that 3 to 4 feet of floating clearance is required by most boats using the park, the usable pool elevation is approximately 260 feet.

**Facility Impacts of Drawdown.** Water surface elevations with drawdown at Railroad Island Park will be:

Spillway Crest: 218 to 233

Natural River Level: 160 to 166

With either alternative, all river access facilities are dry and new facilities will be required to provide boat access to the river. Any damages to water and sewer systems are addressed in the Phase 1 Study's analysis of utility impacts.

---

<sup>3</sup> For the Phase 1 Study, facility impacts and modification measures are not differentiated for the two primary alternatives (drawdown to spillway crest and drawdown to natural river level). If a Phase 2 Study is conducted, more detailed analysis will be required that shows the variations in facility modification costs for the two primary alternatives.

<sup>4</sup> Modification cost estimates have been developed at a preliminary level of detail. If a Phase 2 study is conducted these estimates will be further refined. Dredging costs are included where necessary to maintain boat access to facilities.

<sup>5</sup> The identification of planned modification activities (or no planned modification) at specific sites is based upon assumptions from the Corps engineering analyses as to which sites are likely to be mitigated and which are not likely to be mitigated. These assumptions for the Phase 1 study will be further evaluated if a Phase 2 study is conducted.

**Modification Measures for Drawdown.** Based upon preliminary engineering studies, this economic analysis assumes that modification measures at Railroad Island will consist of: extension of boat ramps, relocation of docks, placement of rip rap along boat ramp, and modification of access roads. The preliminary cost estimate for these modification measures is \$525,703.

### 5.3.2. Le Page Park, Oregon

**Description/Facilities.** Le Page Park is located on the Oregon shore at RM 217, on the west side of the John Day River, approximately 3 miles upstream from John Day Dam at the John Day River/Columbia River Confluence. The following facilities can be found at the 51-acre park: a boat ramp with two docks, four moorage docks, a swimming beach, potable water, and a water-borne sewer system. Activities include picnicking, swimming, boating, boat launching, boat handling/short term moorage, and overnight camping. The boat ramp is also used by tribal fishermen for launching and net drying. Annual visitation records from 1998 report a total of 195,624 visitors at the park.

**Access.** The park is accessible by 1-84 from the north or by boat under the Union Pacific Railroad and I-84 bridges.

**Water Surface Elevation Requirements.** The boat ramp toe elevation is 252.3 feet. The elevation of the river bottom at the east end of the docks along the boat ramp is 257.9 feet for the northern dock and 252.8 feet for the southern dock. The river bottom elevations along the moorage docks range from 255.0 feet at the north to 241.6 feet near the middle to 254 feet at the south end. The river bottom elevation of the swimming beach near the warning floats is 241.3 feet, but about 30 feet inland, the bottom elevation is 259.3 feet.

**Facility Impacts of Drawdown.** Water surface elevations at drawdown will be as follows:

Spillway Crest:	218 to 233
Natural River Level:	160 to 167

With either alternative, the entire boat ramp, moorage and established swimming areas will be dry.

**Modification Measures for Drawdown.** Based upon preliminary engineering studies, this economic analysis assumes that modification measures at LePage Park will consist of: extension of boat ramps, relocation of docks, placement of rip rap along boat ramp, creation of replacement swim beaches, and modification of access roads. The preliminary cost estimate for these modification measures is \$835,297.

### 5.3.3. Phillippi Park, Oregon

**Description/Facility.** This park is located in Oregon on the east shore of the John Day River at RM 3.5, upstream from Le Page Park. The 82-acre park includes one developed beach. The following facilities can be found at the park: two moorage docks, a swimming beach, potable water, and a water-borne sewer system. Activities include camping, picnicking, fishing, sailboarding, swimming, and water skiing. Annual visitation records from 1998 report a total of 8,824 visitors at the park.

**Access.** Access to the park is by boating or hiking only.

**Water Surface Elevation Requirements.** The river bottom elevation at the north end of the northern dock is 253.8 feet and at the southern end is 254.4 feet. The river bottom elevation

at the southern dock ranges from 258.9 feet at the east end to 245.6 feet at the west end. The river bottom elevation at the swimming beach warning floats is 245.2 feet.

**Facility Impacts of Drawdown.** Water surface elevations at drawdown will be as follows:

Spillway Crest:	218 to 233
Natural River Level:	160 to 167 (no backwater to Philippi Park)

The Columbia River will not back up into the John Day River as it does currently. The entire facility will be landward of the John Day and dry. Recreational use will change from slack water to swift water activities. Any damages to water and sewer systems are addressed in the Phase 1 study's analysis of utility impacts.

**Modification Measures for Drawdown.** Based upon preliminary engineering studies, this economic analysis assumes no mitigating measures are implemented at Phillippi Park.

### 5.3.4. Rock Creek Park, Washington

**Description/Facilities.** This park is located on Rock Creek in Washington at RM 229. The park was closed by the Corps in 1981. There is a boat ramp and a swimming beach at this park. Due to continued use portable toilets and dumpsters have been placed at the park. These minimal facilities are maintained by the Corps. Annual visitation records from 1998 report a total of 14,954 visitors at the park.

**Access.** Access to the park is via SR-14 from the south or by boat under a Burlington Northern Railroad bridge.

**Water Surface Elevation Requirements.** The boat ramp toe elevation is 259.6 feet. The river bottom elevation of the swimming beach near the warning floats is 256.8 feet. The embayment along the north and west sides is very shallow, with the river bottom elevation averaging 260.9 feet.

**Facility Impacts of Drawdown.** The water surface elevations at drawdown will be as follows:

Spillway Crest:	218 to 233
Natural River Level:	168 to 183

River access will be dry except for water coming down Rock Creek. The backwater will be gone. All water-based facilities will be dry at all drawdown alternative elevations.

**Modification Measures Drawdown:** Based upon preliminary engineering studies, this economic analysis assumes that modification measures at Rock Creek Park will consist of: extension of boat ramps, relocation of docks, placement of rip rap along boat ramp, creation of a replacement swim beach, and modification of access roads. The preliminary cost estimate for these modification measures is \$1,323,876.

### 5.3.5. Sundale Park, Washington

**Description/Facilities.** This park is located on the Washington shore at RM 237. In the 1980's the park was closed due to lack of use. The park will be transferred to the Bureau of Indian Affairs for exclusive use as a treaty fishing site. The following facilities can still be found at the park: a boat ramp, a dock along the boat ramp, a swimming beach, and a vault toilet. Annual visitation records from 1998 report a total of 33,846 visitors at the park.

**Access.** Access to the park is by road off SR-14 for the north or by boat under both the Burlington Northern Railroad bridges.

**Water Surface Elevation Requirements.** The boat ramp toe elevation is 260.8 feet. The elevation of the river bottom at the east end of the dock along the boat ramp is 260.8 feet. The river bottom elevation of the swimming beach near the warning floats is 255.9 feet at the north end and 259.7 feet at the south end. The northeast side of the embayment is shallow, with a bottom elevation ranging from 263.2 to 258.4 feet. The vault toilet will not be affected.

**Facility Impacts of Drawdown.** The water surface elevation at drawdown will be as follows:

Spillway Crest:	218-234
Natural River Level:	176-190

Access to the site by boat under the railroad bridge will be too shallow. The boat ramp and dock will be dry and unusable.

**Modification Measures for Drawdown.** Based upon preliminary engineering studies, this economic analysis assumes no mitigating measures are implemented at Sundale Park.

### **5.3.6. Roosevelt Park, Washington**

**Description/Facilities.** This park is located on the Washington shore, at RM 241, at the community of Roosevelt, Washington. The developed area of the park is approximately 26 acres. The day use park activities include boat launching as well as picnicking, fishing, windsurfing, water-skiing, and swimming. Three breakwaters provide protection from high waves. Boat launching activities are separate from the picnic area. There is a boat launching ramp and tie-up dock with piles and access in-place for a second dock along the boat ramp. A courtesy dock with gangway access is located adjacent to the launching area. There are no formal camping areas; however, it has been observed that camping does occur. There is a large swimming beach adjacent to a large lawn area with picnic shelters and tables. The area west and windward of the groin was not developed as a formal swim beach but is used by windsurfers as a launching area. Annual visitation records from 1998 report a total of 125,160 visitors at the park.

The park was being maintained by local volunteers but recently the John Day project has taken over mowing and minor maintenance. The swim beach, that was developed east of and leeward of a rock groin breakwater, has not been maintained and except for peak use days appears to receive minimal use for swimming. The swim beach has some wetland plant species but the entire beach is not vegetated. On high wind days windsurfing use is high. No subsurface material information is currently available.

**Access.** Access to the park is by road from SR-14 or by boat.

**Water Surface Elevation Requirements.** The boat ramp toe elevation is 253.8 feet and the river bottom elevation at the end of the boat ramp dock is 251.9 feet. The river bottom elevation at the western end of the moorage dock is 250 feet and 251.8 feet at the east end. The river bottom elevation at the swimming beach warning floats is approximately 257 feet. The bottom elevation at the east end of the embayment is 252.2 feet and the west end is 239.2 feet. The vault toilet will not be affected.

**Facility Impacts of Drawdown.** Water surface elevations with drawdown at Roosevelt Park will be:

Spillway Crest:	218 to 234
Natural River Level:	185 to 197

Boat ramps, docks, and swimming beaches will be dry with the drawdown options.

**Modification Measures for Drawdown.** Based upon preliminary engineering studies, this economic analysis assumes that modification measures at Roosevelt Park will consist of: extension of boat ramps, relocation of docks, placement of rip rap along boat ramp, creation of a replacement swim beach, and modification of access roads. The preliminary cost estimate for these modification measures is \$668,752.

### **5.3.7. Blalock Canyon Boat Ramp, Oregon**

**Description/Facilities.** This facility is located on the Oregon shore At RM 233.2. The only amenity at this primitive facility is a gravel boat ramp. This site is used as a refuge for boaters, during stormy, windy conditions on the river. No visitation records were available for Blaylock Canyon. Therefore, attendance at the site is excluded from the analysis and should be further examined in a Phase 2 Study.

**Access.** Land access to the facility is via I-84 from the west. Boat access is through a culvert under the Union Pacific Railroad.

**Water Surface Elevation Requirements.** The boat ramp toe elevation is 261.3 feet. The river bottom of the access culvert is 254.3 feet. Assuming that three to four feet floating clearance is needed for most boats using the park, the usable pool elevation is approximately 265 feet.

**Facility Impacts of Drawdown.** The water surface elevation at drawdown will be as follows:

Spillway Crest:	218 to 234
Natural River Level:	172 to 187

Access through the culvert will not be available at either drawdown scenario. The boat ramp and docks will be dry.

**Modification Measures for Drawdown:** Based upon preliminary engineering studies, this economic analysis assumes that modification measures at Blaylock Canyon will consist of: extension of boat ramps, relocation of docks, placement of rip rap along boat ramp, and modification of access roads. The preliminary cost estimate for these modification measures is \$525,532.

### **5.3.8. Arlington Marina, Oregon**

**Description/Facilities.** This park is located on China Ditch in the city of Arlington, Oregon, at RM 241. It is leased and maintained by the Port of Arlington. The following facilities can be found at the park: a boat ramp, a floating bandstand and access ramp, one moorage dock, one tie-up dock, and a swimming beach. The bandstand is located on the north edge of the swimming area at the warning floats. There is an inactive ferry slip adjacent to the boat ramp. The toe of the slip is eroded and currently not usable without some work to re-establish the

ramp. A ramp for wheelchair access to docks was recently added. Annual visitation records from 1998 report a total of 5,511 visitors at the park.

**Access.** Access to the park is by city street and access ramps off I-84 from both the east and west, and by boat under the Union Pacific Railroad and I-84 bridges.

**Water Surface Elevation Requirements.** The boat ramp toe elevation is 258.5 feet. The river bottom elevation of the west end of the boat ramp dock is 252.4 feet and the east end is 258.5 feet. The river bottom elevation of the tie-up dock is 252.3 feet. The river bottom elevation of the west end of the moorage dock is 248.2 feet and the east end is 244.5 feet. The bottom elevation of the swimming beach near the warning floats is 252.5 feet. The river bottom elevation along the south side of the bandstand is about 256.5 feet.

**Facility Impacts of Drawdown.** The water surface elevations at drawdown will be as follows:

Spillway Crest:	218 to 234
Natural River Level:	185 to 197

**Modification Measures for Drawdown.** Based upon preliminary engineering studies, this economic analysis assumes that modification measures at Arlington Park will consist of extension of boat ramps, placement of riprap along boat ramp, and marina dredging. The preliminary cost estimate for these modification measures is \$7,301,577. This cost is relatively higher than costs at other sites primarily due to the quantity of dredging required and difficulty in excavation at the site. Due to this relatively high cost, (and relatively low recreation visitation records) the Phase 2 Study should evaluate the merits of modification at this site.

### 5.3.9. Earl Snell Park, Oregon

**Description/Facilities.** The day-use park is located on China Ditch in the city of Arlington, Oregon. The park is leased and maintained by the City of Arlington. It is fully developed and landscaped with mature trees and large lawn expanse. The park is the site of many local outdoor events. Site facilities include a floating bandstand, a small handling dock, a swimming beach, picnic areas, and children's play area. There is no boat launch facility. Boat launching facilities are in the harbor area at the marina. Annual visitation records from 1998 report a total of 8,181 visitors at the park.

**Access.** Access to this park is via city streets off I-84 or by boat.

**Water Surface Elevation Requirements.** Water surface elevation requirements were not available for Earl Snell Park at the time of report production.

**Facility Impacts of Drawdown.** The water surface elevations at drawdown will be as follows:

Spillway Crest:	218 to 234
Natural River Level:	185 to 197

The entrance into the China Creek embayment will have shallow water, dependent on flows. The main embayment area will be dry except for China Creek channel outflow.

**Modification Measures for Drawdown.** Based upon preliminary engineering studies, this economic analysis assumes that modification measures at Earl Snell Park will consist of:

creation of a replacement swim beach. The preliminary cost estimate for these modification measures is \$143,050.

### **5.3.10. Quesnel (or Threemile Canyon) Park, Oregon**

**Description/Facilities.** This park is located on the Oregon shore at RM 255. Site facilities include windsurfing access and small boat launching. There is a small boat ramp at this park but is in major disrepair. Currently a gravel boat ramp on the other side of the dock is being used for launching. Tribal fishermen use this site for launching and net drying. There is also a vault toilet. Annual visitation records from 1998 report a total of 9,869 visitors at the park.

**Access.** Access to the park is by road off I-84 from the south or by boat through either entrance channels in the reef to the north.

**Water Surface Elevation Requirements.** The boat ramp toe elevation is 259 feet. The elevation of the river bottom at the east entrance channel is 258.1 feet. The elevation of the river bottom at the west entrance channel is deeper than 244 feet.

**Facility Impacts of Drawdown.** The water surface elevation at drawdown will be as follows:

Spillway Crest:	218-235
Natural River Level:	202-215

**Modification Measures for Drawdown.** Based upon preliminary engineering studies, this economic analysis assumes that modification measures at Quesnel Park will consist of: extension of boat ramps, relocation of docks, placement of rip rap along boat ramp, and modification of access roads. The preliminary cost estimate for these modification measures is \$525,532.

### **5.3.11. Alderdale Park, Washington**

**Description/Facilities.** This park is located on the Washington shore at RM 257. The park is not currently maintained or operated as a recreation site and no recreation visitation data exists for the site. Therefore no further analysis was conducted for the site. If a Phase 2 study is conducted further examination of recreation use at Alderdale Park is recommended.

### **5.3.12. Crow Butte State Park, Washington**

**Description/Facilities.** This park is located on Crow Butte on the Washington shore at RM262. Crow Butte is a full facility state park including the following facilities; overnight camping areas, day use areas, three boat ramps, a tie-up dock in the east embayment, a boat ramp dock between two of the boat ramps, several swimming beaches, potable water, and water-borne sewage. The two boat ramps are used frequently and a fee is assessed for launching. Annual visitation records from 1998 report a total of 132,957 visitors at the park.

**Access.** Access to the park is by road off SR-14 from the north or by boat.

**Water Surface Elevation Requirements.** The toe elevation for the boat ramp in the embayment is 261.3 feet. The toe elevation for the east boat ramp is 259.6 feet, and for the west boat ramp is 258.8 feet. The river bottom elevation along the tie-up dock is 259.5 feet. The river bottom elevation of the swimming beach ranges from 260.3 to 253.1 feet. The east embayment bottom elevation is approximately 254 feet. In addition to the recreational facilities, an irrigation pump is mounted to a steel pile dock adjacent to the swimming beach

(outside the embayment for swimming). The river bottom elevation on the southwest side of the pump intake is approximately 260 feet and on the northeast side is 258.4 feet. However, at 15 feet to the north from the intake, the river bottom drops away to be deeper than elevation 249.3 feet.

**Facility Impacts of Drawdown.** Any damages to water and sewer systems are addressed in the Phase 1 study's analysis of utility impacts. Water surface elevations at drawdown will be as follows:

Spillway Crest:	219-236
Natural River Level:	209-223

All river access facilities will be dry.

**Modification Measures for Drawdown.** Based upon preliminary engineering studies, this economic analysis assumes that modification measures at Crow Butte will consist of: extension of boat ramps, relocation of docks, placement of rip rap along boat ramp, creation of a replacement swim beach, and modification of access roads. The preliminary cost estimate for these modification measures is \$996,283.

### 5.3.13. Boardman Park, Oregon

**Description/Facilities.** This park is located on the Oregon shore, near the community of Boardman, Oregon, at RM 268. The following facilities can be found at the park. two moorage docks, a swimming beach, a boat ramp, a boat ramp dock, a tie-up dock, camping facilities, potable water, and water-borne sewage from the city of Boardman. Annual visitation records from 1998 report a total of 127,593 visitors at the park.

**Access.** Access to the park is by road from I-84 to the south.

**Water Surface Elevation Requirements.** The boat ramp toe elevation is 259.2 feet and the river bottom elevation at the end of the boat ramp dock is approximately 249 feet. The river bottom elevation at the northern end of the western moorage dock is 251.1 feet and 257.3 feet at the south end. The river bottom elevation at the northern end of the eastern moorage dock is approximately 252 feet and 257.2 feet at the south end. The river bottom elevation at the warning floats for the swimming beach ranges from 242.3 feet at the northern float to 248.5 feet at the southern float. The river bottom elevation at the east end of the embayment ranges from 256.7 to 249.9 feet. The bottom elevation at the west end of the embayment entrance is approximately 247 feet. Portions of the bottom of the embayment are rock.

**Facility Impacts of Drawdown.** Water surface elevations at drawdown will be as follows:

Spillway Crest:	221-238
Natural River Level:	221-231

The entire facility will be dry.

**Modification Measures for Drawdown.** Based upon preliminary engineering studies, this economic analysis assumes that modification measures at Boardman Park will consist of: extension of boat ramps, relocation of docks, placement of rip rap along boat ramp, creation of a replacement swim beach, modification of access roads, and marina dredging. The preliminary cost estimate for these modification measures is \$2,380,777.

### 5.3.14. Irrigon Park, Oregon

**Description/Facilities.** This park is located at Irrigon, Oregon at RM 282. There are the following facilities at this park: a boat ramp, two long-term moorage docks, one tie-up dock, a swimming beach, a field games area, and camping facilities. Annual visitation records from 1998 report a total of 178,911 visitors at the park.

**Access.** Access to the park is by city street off US 730 from the south.

**Water Surface Elevation Requirements.** The boat ramp toe elevation is 259.9 feet. The river bottom elevation at the north end of the boat ramp dock is 255.5 feet. The river bottom elevation along the tie-up dock ranges from 253.2 at the north end to 255.8 feet at the south end. The river bottom elevation at the eastern moorage dock ranges from 251.2 feet at the north end to 253.2 feet at the south end. The river bottom elevation of the channel north of the docks ranges from 251.5 feet at the west end to 254.2 feet off the end of the boat ramp to 255.6 feet at the entrance to the embayment. The river bottom elevation of the swimming beach near the warning floats ranges from about 258.3 feet at the northern float to 259.4 feet at the southern float to 257.9 feet at the swimming platform.

**Facility Impacts of Drawdown.** The water surface elevations at drawdown will be as follows:

Spillway Crest:	236 to 249
Natural River Level:	236 to 248

Boat ramps, docks, and swimming beaches will be dry with the drawdown options. Water levels throughout the marina will be too low to maintain current use.

**Modification Measures for Drawdown.** Based upon preliminary engineering studies, this economic analysis assumes that modification measures at Irrigon Park will consist of: extension of boat ramps, relocation of docks, placement of rip rap along boat ramp, creation of a replacement swim beach, modification of access roads, and marina dredging. The preliminary cost estimate for these modification measures is \$2,059,470.

### 5.3.15. Nugent Park, Oregon

**Description/Facilities.** Nugent is a city park located in Umatilla, Oregon on the east shore of the Umatilla River at about RM 0.5. There is a boat ramp, a single unit dock along the ramp, and a fishing access structure for persons with disabilities. No attendance records were available for Nugent Park for this analysis. Therefore, attendance at Nugent Park was not included in the impact assessment. Attendance at the Park should be further examined if a Phase 2 study is conducted.

**Access.** Access to the park is by boat up the Umatilla River or by city street off US Highway 730 (US 730) from the north.

**Water Surface Elevation Requirements.** The boat ramp toe elevation is 260.3 feet. The elevation of the river bottom at the end of the dock along the boat ramp is approximately 265 feet. At the mouth of the river, the river bottom elevation is 256.4 feet and directly off the boat ramp, the river bottom elevation is 259.3 feet.

**Facility Impacts of Drawdown.** The water surface elevations at drawdown will be as follows:

Spillway Crest:	250 to 260
Natural River Level:	250 to 260

At drawdown, the John Day impoundment will not extend upstream to Nugent Park; the boat launch ramp and fishing structure will no longer be usable.

**Modification Measures for Drawdown.** Based upon preliminary engineering studies, this economic analysis assumes no mitigating measures are implemented at Nugent Park.

### **5.3.16. Plymouth Park, Washington**

**Description/Facilities.** This facility is located on the Washington shore, at RM 289, across the river from Umatilla, Oregon. The park contains camping areas, picnicking areas, a swimming beach, a boat ramp with two docks, and a tie-up dock in the boat ramp embayment. Annual visitation records from 1998 report a total of 172,398 visitors at the park.

**Access.** Access to the facility is via SR-14 from the north or by boat.

**Water Surface Elevation Requirements.** The boat ramp toe elevation is 257.8 feet. The river bottom elevation at the end of the eastern boat ramp dock is 255.3 feet and at the end of the western dock, is 253.7 feet. The river bottom elevation at the eastern end of the tie-up dock is 253.1 feet and at the western end of the dock, is 255.4 feet. The river bottom elevation of the access channel leading to the swimming beach from the Columbia River east of the park ranges from approximately 250 to 254 feet. The river bottom elevation of the swimming beach at the warning floats is approximately 250 feet. The boat ramp embayment bottom elevation is approximately 251 feet.

**Facility Impacts of Drawdown.** The water surface elevations at drawdown will be as follows:

Spillway Crest:	250 to 260
Natural River Level:	250 to 260

All river access facilities will be dry.

**Modification Measures for Drawdown.** Based upon preliminary engineering studies, this economic analysis assumes that modification measures at Plymouth Park will consist of: extension of boat ramps, relocation of docks, placement of rip rap along boat ramp, creation of a replacement swim beach, and modification of access roads. The preliminary cost estimate for these modification measures is \$668,752.

### **5.3.17. Umatilla Park, Oregon**

**Description/Facilities.** This park is located at Umatilla, Oregon, at RM 290. The following facilities are provided: a boat ramp, four long-term moorage docks, a fueling dock, a swimming beach, and camping facilities. The park is also used by large cruise ships and the sternwheeler for short-term handling for passenger loading/unloading and fueling. Annual visitation records from 1998 report a total of 153,855 visitors at the park.

**Access.** Access to the park is by city streets off US 730 from the south.

**Water Surface Elevation Requirements.** The boat ramp toe elevation is 256.2 feet. The river bottom elevation at the north end of the boat ramp docks is 252.5 feet. The river bottom elevation along the fueling dock ranges from 247.8 feet at the north end to 252 feet at the south end. The river bottom elevation along the western moorage dock ranges from 251.7 feet at the north end to 254.3 feet at the south end. The river bottom elevation along the eastern covered moorage dock ranges from 251.9 feet at the north end to 253.8 feet at the south end. The river bottom elevation along the eastern moorage dock ranges from 252.2 feet at the north end to 252.8 feet at the south end. The river bottom elevation of the channel north of the docks ranges from 250.9 feet at the east end to 250.7 feet off the end of the western moorage dock to 247.8 feet west of the fueling dock. The entrance channel is quite deep since the current marina was built over an older one. The river bottom elevation of the swimming beach along both the east and west sides is 255.9 feet and ranges from 253.5 feet at the western float to 255.1 feet at the eastern float. The bottom of the embayment at this marina appears to be solid rock.

**Facility Impacts of Drawdown.** The water surface elevations at drawdown will be as follows:

Spillway Crest:	250 to 260
Natural River Level:	250 to 260

Boat ramps, docks, and swim beaches will be dry with drawdown. Water elevations in the marina will be too low to maintain current uses.

**Modification Measures for Drawdown.** Based upon preliminary engineering studies, this economic analysis assumes that modification measures at Umatilla Park will consist of: extension of boat ramps, relocation of docks, placement of rip rap along boat ramp, creation of a replacement swim beach, modification of access roads, and marina dredging. The preliminary cost estimate for these modification measures is \$3,730,370.

## 5.4. Summary of Facility Impact Modification Costs

Table 4 presents an itemized breakdown of the costs of proposed modification activities at each recreation facility. The primary modification categories, as identified in Section 5, include boat ramps, docks, rip-rap protection for boat ramps, swim beaches, access roads, and marina dredging. A 10 percent mobilization cost is applied to the subtotal for each site. A 55 percent markup is applied to the subtotal plus mobilization cost to estimate total first costs for each site<sup>6</sup>. As discussed in Section 5, no modification is anticipated at Phillippi, Sundale, Alderdale, and Nugent Parks. The preliminary total first cost estimate for all remaining sites is \$21,685,000<sup>7</sup>.

---

<sup>6</sup> The 55% markup accounts for cost categories such as Preconstruction Engineering and Design, Contingency, Planning Supervision, and Construction Management.

<sup>7</sup> This total modification cost estimate is based upon preliminary cost estimates, for more detail on cost estimates, refer to the Cost Engineering Section in the Engineering Appendix.

**Table 4.**  
**John Day Recreation Facility Modification Costs**

Sites	Facility Modification Costs <sup>1</sup>									
	Boat Ramps	Docks	Ramp Rip Rap	Swim Beaches	Access Roads	Marina Dredging	Subtotal	10% MOB	55% Markup	Total First Cost
1 Railroad land	61,540	97,780	20,910	-	128,100	-	\$308,330	\$30,833	\$186,540	\$525,703
2 LePage Park	61,540	195,560	20,910	83,900	128,000	-	\$489,910	\$48,991	\$296,396	\$835,297
3 Philippi Park	-	-	-	-	-	-	\$0	\$0	\$0	\$0
4 Rock Creek Park	61,540	97,780	20,910	83,900	512,337	-	\$776,467	\$77,647	\$469,763	\$1,323,876
5 Sundale Park	-	-	-	-	-	-	\$0	\$0	\$0	\$0
6 Roosevelt Park	61,540	97,780	20,910	83,900	128,100	-	\$392,230	\$39,223	\$237,299	\$668,752
7 Blalock	61,540	97,780	20,910	-	128,000	-	\$308,230	\$30,823	\$186,479	\$525,532
8 Arlington Park	61,540	-	20,910	-	-	4,200,000	\$4,282,450	\$428,245	\$2,590,882	\$7,301,577
9 Earl Snell Park	-	-	-	83,900	-	-	\$83,900	\$8,390	\$50,760	\$143,050
10 Quesnel Park	61,540	97,780	20,910	-	128,000	-	\$308,230	\$30,823	\$186,479	\$525,532
11 Alderdale Park	-	-	-	-	-	-	\$0	\$0	\$0	\$0
12 Crow Butte State Park	61,540	97,780	20,910	83,900	320,200	-	\$584,330	\$58,433	\$353,520	\$996,283
13 Boardman Park	61,540	350,000	20,910	83,900	160,000	720,000	\$1,396,350	\$139,635	\$844,792	\$2,380,777
14 Irrigon Park	700,000			83,900	64,000	360,000	\$1,207,900	\$120,790	\$730,780	\$2,059,470
15 Nugent Park	-	-	-	-	-	-	\$0	\$0	\$0	\$0
16 Plymouth Park	61,540	97,780	20,910	83,900	128,100	-	\$392,230	\$39,223	\$237,299	\$668,752
17 Umatilla Marina/Park	1,000,000			83,900	64,000	1,040,000	\$2,187,900	\$218,790	\$1,323,680	\$3,730,370
<b>TOTALS:</b>							<b>\$12,718,500</b>	<b>\$1,271,800</b>	<b>\$7,694,700</b>	<b>\$21,685,000</b>

<sup>1</sup> The final cost estimate as reported in Section 10 of the *Salmon Recover through John Day Reservoir, John Day Drawdown Phase I Study* report totals \$28,287,054.

## 5.5. Existing Recreation Use and Value

Visitation at recreation sites and facilities along the John Day Reservoir exceeded 2,000,000 visitors in 1998. [Table 5](#) presents recent visitation records for the sites. Visitation figures are taken from Corps of Engineers visitation records at thirteen recreation facilities in the John Day Reservoir<sup>8</sup>. The visitation records indicate that over the ten-year period of 1989 through 1998, over 25 million visitors used the recreation facilities provided in the John Day Reservoir. The average attendance in this period was over 2.5 million visitors a year<sup>9</sup>. The high use of the recreation facilities along the John Day Reservoir indicates the economic utility of the sites.

<b>Year</b>	<b>Visitation (visitor-days)</b>
1989	2,559,400
1990	2,540,800
1991	2,407,500
1992	2,650,900
1993	2,518,300
1994	3,689,098
1995	2,733,337
1996	2,180,163
1997	2,086,266
1998	2,024,635
10-Year Total	25,390,399
10-Year Average	2,539,040

Recreation use on the John Day Reservoir can be broken down into ten main categories (listed in order of participation): boating, fishing, picnicking, sightseeing, swimming, camping, water-skiing, hunting, windsurfing, and other. The percentages of participation in each of these categories at the John Day Reservoir are presented in [Table 6](#)<sup>10</sup>. The data in [Table 6](#) was published in the Columbia River System Operation Review Environmental Impact Statement (November 1995) and comes from records maintained by the Corps of Engineers Portland District. For this analysis the percent participation figures were

---

<sup>8</sup> The primary source of visitation data for Federal facilities within the pool is the Corps' Natural Resource Management System (NRMS) database maintained by Portland District for Middle and Lower Columbia River facilities. Corps visitation data in the NRMS is collected through a combination of actual vehicle counts and visitor surveys.

<sup>9</sup> Attendance appears to have declined in recent years (1996-98) from previous levels. There is no clear indication of the particular cause(s) of the decline, which can depend on a variety of variables including weather and sampling. If conducted, the Phase 2 study should examine causes for recent declines in reported visitation.

<sup>10</sup> NRMS data were used to determine the percent of total visitation by the specific recreation activities listed in [Table 6](#).

normalized to indicate the relative contribution of demand for each activity to total recreation participation.

<b>Activity</b>	<b>Percent Participation</b>	<b>Normalized</b>
Boating	33.0 %	19.60 %
Fishing	31.7 %	18.82 %
Picnicking	25.2 %	14.96 %
Sightseeing	15.6 %	9.26 %
Swimming	14.5 %	8.61 %
Camping	12.0 %	7.13 %
Water-skiing	9.9 %	5.88 %
Hunting	6.7 %	3.98 %
Windsurfing	5.0 %	2.97 %
Other	14.8 %	8.79 %
<b>Total*</b>	<b>168.4 %</b>	<b>100.00 %</b>

\*Total is greater than 100% because visitors participate in more than one activity.

Table 7 applies the normalized visitation percentages to the average annual visitation (2,539,040 per year) from Table 5 to estimate the allocation of recreation visitation demand to each activity category.

<b>Activity</b>	<b>Estimated Visitation Demand % by Activity</b>	<b>Average Annual Baseline Visitation</b>	<b>Visitation Demand by Activity</b>
Boating	19.60 %	2,539,040	497,652
Fishing	18.82 %		477,847
Picnicking	14.96 %		379,840
Sightseeing	9.26 %		235,115
Swimming	8.61 %		218,611
Camping	7.13 %		181,034
Water-skiing	5.88 %		149,296
Hunting	3.98 %		101,054
Windsurfing	2.97 %		75,409
Other	8.79 %		223,182
<b>Total</b>	<b>100.00 %</b>		<b>2,539,040</b>

Table 8 summarizes the data in Table 7 into two categories: 1) fishing-related visitation, and 2) non-fishing visitation. Fishing activities account for approximately 19 percent of visitation, non-fishing activities account for approximately 81 percent of visitation. Of the fishing activity, fishing for resident species such as Walleye account for the majority of fishing recreation in the pool.

<b>Table 8. Recreation Demand Allocation (Fishing and Non-Fishing Activities)</b>			
<b>Activity</b>	<b>Estimated Visitation Demand % by Activity</b>	<b>Average Annual Baseline Visitation</b>	<b>Visitation Demand by Activity</b>
Reservoir Fishing Activities	18.82 %	2,539,040	477,847
Reservoir Non-Fishing Activities	81.18 %		2,061,193
Total	100.00 %		2,539,040

As part of the Phase 2, Recreation and Tourism Analysis of the Lower Snake River Juvenile Salmon Migration Feasibility Study (U.S. Army Corps of Engineers, Walla Walla District, Draft, April 1999), surveys were conducted to estimate the value that visitors place on reservoir-related recreation activities (their willingness to pay for recreation activities). The Lower Snake River Study is similar to the John Day Drawdown study in that it evaluates the drawdown of reservoirs on the Snake River to natural river levels.

In the Lower Snake River study, a Travel Cost Method<sup>11</sup> (TCM) Survey was applied to estimate the willingness to pay for existing recreation opportunities. A TCM survey that incorporated aspects of the Contingent Behavior<sup>12</sup> (CB) was used to estimate the willingness to pay for recreation opportunities with drawdown. Multiple surveys were conducted to determine the value of visits for reservoir-related recreation (two surveys for fishing and general reservoir recreation activities) and for natural river-related recreation (again two surveys for fishing and other activities). Further description of the survey approaches is available in the Draft Lower Snake River Juvenile Salmon Migration Feasibility Study Phase 2 Recreation Report.

For the preliminary Phase 1 John Day recreation analysis, willingness to pay (WTP) values from the Lower Snake Study are applied to visitation projections to estimate the value of recreation opportunities in the John Day Reservoir<sup>13</sup> (if a Phase 2 study is conducted, site-specific valuation surveys should be conducted for John Day). The Snake River survey findings reported the average net WTP per visit for reservoir fishing as \$22.48, the average net WTP of non-fishing reservoir recreation as \$45.19 per visit. When multiplied by the visitation breakdown from Table 8, average annual baseline reservoir fishing recreation at the

<sup>11</sup> TCM uses the actual number of trips taken by an individual as the quantity variable and the visitor's travel cost as the price variable to statistically trace out a demand curve for recreation using multiple regression. From this demand curve, the net willingness to pay is calculated.

<sup>12</sup> CB is a hybrid approach to TCM used for conducting valuation surveys regarding non-existent future scenarios that involves subjectively describing the future scenario to the survey respondent to elicit visitation quantities and travel costs.

<sup>13</sup> Physical differences (e.g., size, landscape, proximity to population centers) in the Snake River Reservoirs and the John Day pool stress the need for specific valuation studies for John Day if a Phase 2 study is conducted.

John Day Reservoir has an estimated value of \$10,742,000; average annual baseline reservoir non-fishing recreation at the John Day Reservoir has an estimated value of \$93,145,000. This information is summarized in [Table 9](#).

<b>Table 9. Average Annual Baseline Recreation Value of John Day Reservoir Reservoir Recreation</b>			
<b>Activity</b>	<b>Visitation Demand by Activity</b>	<b>WTP Values</b>	<b>Estimated Annual Baseline Recreation Value</b>
Reservoir Fishing Activities	477,847	\$22.48	\$10,742,000
Reservoir Non-Fishing Activities	2,061,193	\$45.19	\$93,145,000
Total	2,539,040	-	\$103,987,000

## **Section 6. Projected Growth in Recreation Demand**

The Columbia River System Operation Review indicated an increased demand for recreation facilities and services throughout the northwestern United States and southwestern Canada. A large part of the attractiveness of the region for both residents and visitors is the quantity and variety of recreation facilities and opportunities. As the regional population continues to grow through both the expansion of the existing population base and immigration from outside the region, increased demand for recreation sites and facilities is expected.

The Pacific Northwest Outdoor Recreation Committee, comprised of the parks and recreation departments of Oregon, Washington, and Idaho and six Federal land management agencies completed the “*Pacific Northwest Outdoor Recreation Consumption Projection Study: Tri-State Summary Project*” in 1989. The Tri-State Summary assessed future recreation demands for the three-state area. The Tri-State Summary breaks recreation participation into 60 different activities, including all but two of the water-related recreation activities (“Hunting”, and “Other”) associated with the John Day Reservoir listed in [Tables 6](#) and [7](#). Predicted low, average, and high growth rates from the Tri-State Summary for the John Day Reservoir recreation categories are listed in [Table 8](#). Average annual growth rates have been calculated to conduct a disaggregated projection of future without-project visitation at the John Day Reservoir facilities. The annual growth rates are used to grow recreation demand at the facilities over the period of analysis. In this preliminary Phase 1 Study, it is assumed that recreation facilities have the capacity to accommodate future visitation projections. If conducted, the Phase 2 Study should examine facilities (as modified for modification for spillway crest drawdown) and assess carrying capacities at each site.

For the recreation analysis, the more conservative low growth numbers were selected for use. The low estimates of average annual growth (1.02 percent for fishing and 1.65 percent for non fishing activities) are closest to the recreation growth rate cited in the Economic Appendix, Recreation Impacts of Minimum Operating Pool (U.S. Army Corps of Engineers, Portland District, 09/95). For the MOP analysis, population in five Oregon Counties, and four Washington Counties was used as a proxy for the number of potential recreators. The MOP study suggested that the local population growth rate would serve as a proxy for growth in recreation use. The analysis identified the growth rate of approximately 1.1 percent.

To project future recreation use without drawdown, the average growth rates for both fishing and non-fishing from [Table 10](#) (1.02 percent and 1.65 percent, respectively) were applied to the baseline average annual visitation estimates for each corresponding category from [Table 8](#). Each of the two categories of recreation demand was grown by the respective growth rate for each year in the 100-year period of analysis. To estimate the present value of this stream of recreation values, the WTP values from [Table 9](#) were applied to visitation in each year, converted to their present value using the current Federal interest rate for Corps of Engineers water resource planning studies of 6.875 percent, and summed. The present values of non-fishing and fishing recreation activities were summed to calculate the total recreation value over the period of analysis without drawdown of \$2,087,833,000. This value was then converted to its average annual equivalent of \$148,898,000. The values are summarized in [Table 11](#).

<b>Table 10. Projected Recreation Demand Growth Rates, 1990-2010 (Oregon, Washington, and Idaho)</b>							
<b>Activity</b>		<b>Low</b>		<b>High</b>		<b>Medium</b>	
		<b>20-Year Growth</b>	<b>Average Annual Growth</b>	<b>20-Year Growth</b>	<b>Average Annual Growth</b>	<b>20-Year Growth</b>	<b>Average Annual Growth</b>
Boating	Boating (non-motorized)	51.0%	2.082%	176.0%	5.207%	114.0%	3.877%
	Boating (motorized)	29.0%	1.281%	89.0%	3.234%	59.0%	2.346%
	Boating (average)	40.0%	1.697%	132.5%	4.309%	86.5%	3.165%
Fishing	Freshwater Fishing (boat)	25.0%	1.122%	78.0%	2.925%	52.0%	2.116%
	Freshwater Fishing (bank or dock)	20.0%	0.916%	61.0%	2.410%	41.0%	1.733%
	Freshwater Fishing (average)	22.5%	1.020%	69.5%	2.674%	46.5%	1.928%
Picnicking		44.0%	1.840%	121.0%	4.045%	83.0%	3.068%
Sightseeing		46.0%	1.910%	109.0%	3.755%	78.0%	2.925%
Swimming		39.0%	1.660%	117.0%	3.950%	78.0%	2.925%
Camping	Camping (recreational vehicle)	39.0%	1.660%	112.0%	3.829%	76.0%	2.867%
	Camping (tent with vehicle)	46.0%	1.910%	124.0%	4.115%	85.0%	3.124%
	Camping (boat)	24.0%	1.081%	62.0%	2.441%	43.0%	1.804%
	Camping (average)	36.3%	1.560%	99.3%	3.508%	68.0%	2.628%
Water-skiing		32.0%	1.398%	92.0%	3.315%	62.0%	2.441%
Hunting <sup>1</sup>		24.0%	1.081%	88.0%	3.207%	56%	2.248%
Windsurfing		24.0%	1.081%	88.0%	3.207%	56%	2.248%
Other <sup>2</sup>		39.0%	1.660%	117.1%	3.950%	78%	2.925%
Average		34.2%	1.468%	102.1%	3.534%	68.4%	2.610%
Weighted <sup>3</sup> Average Annual Fishing Growth			1.02%	69.50%	2.67%	46.50%	1.93%
Weighted <sup>3</sup> Average Annual Non-Fishing Growth			1.65%	107.09%	3.69%	71.72%	2.73%
<sup>1</sup> Because no projected growth rates were available for Hunting, the growth rates for Windsurfing are applied for Hunting. Hunting and Windsurfing have similar participation rates as identified in <a href="#">Table 6</a> .							
<sup>2</sup> Because no projected growth rates were available for Other, the growth rates for Swimming are applied for Other. Other and Swimming have similar participation rates as indicated in <a href="#">Table 6</a> .							
<sup>3</sup> Weighted average annual growth rates were developed by applying the percentage of visitation for each activity (see <a href="#">Table 7</a> ) to the average annual growth rate for each activity.							

<b>Table 11. Without Project Reservoir Recreation Value, John Day Reservoir*</b>		
<b>Format</b>	<b>Activity</b>	<b>Value</b>
Present Value	Fishing Recreation	\$195,376,000
	Non-Fishing Recreation	\$1,892,457,000
	Total	\$2,087,833,000
Average Annual Equivalent Value	Fishing Recreation	\$13,934,000
	Non-Fishing Recreation	\$134,964,000
	Total	\$148,898,000

\*Based upon the low-growth scenario in [Table 10](#)

## 6.1. Future With-Project Recreation Use

Lowering the John Day operating pool will have significant effects on recreation visitation levels as well as on the types of recreation use that take place on the river. While this analysis assumes that boat launch ramps will be extended to reach the river at most sites, the types of recreation use will change as the pool is drawn down from a slack water pool to a free flowing river channel. Current slack water recreation users would possibly move to other currently less attractive areas, possibly incurring higher costs in terms of travel time and distance to recreation areas providing similar slack water amenities. The cumulative economic impact of reduced opportunities for slack water recreation on the John Day Reservoir will be offset to some degree by increased opportunities for free-flowing natural river recreation activities. This section describes the estimated recreation impacts associated with the two primary alternatives, 1) drawdown to spillway crest, and 2) drawdown to natural river level.

For the preliminary Phase 1 Recreation Analysis, no quantified estimates were developed for the impact of drawdown to spillway crest or natural river level with flood control maintained. If the reach is operated for flood storage, it is anticipated that the impact would be negative for recreation opportunity and value. The significant rise in water surface elevation would likely result in closure of facilities during flood control operation as well as following flood control operation for facility maintenance and repair. Deposition of sediment would likely result in lower aesthetic value at impacted sites and operation and maintenance problems. If a Phase 2 Study is carried out that includes alternatives to maintain flood storage, evaluation of impacts both to operation and maintenance costs and to recreation opportunity and value is recommended.

### 6.1.1. Drawdown to Spillway Crest (with or without flood control)

Previous studies of the drawdown of the John Day Reservoir include the Columbia River System Operation Review (1995) and the Columbia River Salmon Modification Analysis, System Configuration Study (Appendix B, John Day Reservoir Minimum Operating Pool Technical Report, 1995). These studies include the preliminary evaluation of a drawdown of John Day Reservoir to its MOP elevation of 257 (See [Table 2](#)). The System Operation Review estimated a 20 percent reduction in annual visitation on the reservoir with drawdown

to MOP as compared with normal operation of the project. While drawdown to spillway crest would result in a water surface elevation approximately 25-35 feet below MOP, the effects could be expected to be similar if not slightly more pronounced. The 20 percent reduction in annual visitation from the MOP was selected as a conservative proxy for the total impact on recreation with drawdown to spillway crest. The 20 percent reduction in demand can be attributed to a variety of impacts including reductions in resident fish habitat quantity and productivity, reductions in boating area, reductions in numbers of access sites (those unmitigable sites), reductions in backwater sites, and reductions in aesthetic quality.

To estimate the economic impact of drawdown to spillway crest, the 20 percent reduction in recreation use was netted from the annual visitation projections developed for the without-project analysis. The WTP estimates for fishing and non-fishing, displayed in [Table 9](#) and used in the without-project analysis, were reapplied to the modified visitation estimates and the present value of the resultant recreation value stream was calculated as \$2,087,833,000. This present value was converted to its average annual equivalent value of \$148,898,000. The change in recreation value was calculated to be a loss (in total net present value terms) of \$417,567,000, or a loss (in average annual equivalent terms) of \$29,780,000 per year for 100 years. The impacts of drawdown to spillway crest are summarized in [Table 12](#).

<b>Table 12. Estimated Recreation Impacts of Drawdown to Spillway Crest John Day Reservoir</b>				
<b>Format</b>	<b>Activity</b>	<b>Value Without Drawdown</b>	<b>Value With Drawdown</b>	<b>Change In Value</b>
Present Value	Fishing	\$195,375,000	\$156,300,000	-\$39,075,000
	Non-Fishing	\$1,892,457,000	\$1,513,966,000	-\$378,491,000
	Total	\$2,087,833,000	\$1,670,266,000	-\$417,567,000
Average Annual Equivalent	Fishing	\$13,934,000	\$11,147,000	-\$2,787,000
	Non-Fishing	\$134,964,000	\$107,971,000	-\$26,993,000
	Total	148,898,000	\$119,118,000	-\$29,780,000

### **6.1.2. Drawdown to Natural River Level (with or without flood control)**

Drawdown of John Day Reservoir to natural river level is expected to result in significant changes in recreation demand and value. Recreation demand growth projections for the without project and drawdown to spillway crest alternatives used the low growth projections which were close to population growth projections for the rural Washington and Oregon counties in proximity to the John Day Reservoir. The Draft Recreation Analysis results from the Lower Snake River Drawdown Study indicate that with natural river drawdown, an increase in total river recreation trips would come in part from more distant areas such as Portland, Seattle, and California.

The Snake River analysis indicated that the change in distribution of the origin of visitors is consistent with the visitation patterns identified in the TCM surveys. The surveys found that current reservoir recreation use is primarily by local visitors coming from within 100-200 miles. Surveys conducted in the natural river sections in Central Idaho found that 21 percent of the river visitors come from 1,000 miles or further away, with 12 percent coming from

1,500 miles or further. The increases in visitation from more distant recreators is likely to be less pronounced for the John Day Reach, where high demand activities such as whitewater rafting are not likely.

Demand growth adjustment factors developed for the purposes of this recreation analysis are provided in [Table 13](#) for each activity with natural river level drawdown. Adjustment factors were developed for this analysis based upon review of the Snake River Drawdown Study methodologies and informal discussions with Corps personnel and found to be reasonable for the Phase 1 study. If conducted, the Phase 2 Study should determine more rigorous estimates of adjustment factors – one method would be through an expert panel.

Fishing was estimated to increase by 10 percent with drawdown, with expected increases in demand for salmon and steelhead fishing assumed to offset expected losses of resident fishing opportunities. Non-motor boating was estimated to increase by 25 percent and motorized boating to decrease by 50 percent from existing reservoir use levels. The activities of picnicking, sightseeing, camping, hunting, and other were all estimated to increase by 10 percent with natural river level drawdown, assuming modification occurs for impacts to facilities. Swimming was estimated to decrease by 25 percent due to lost swimming beach opportunities and facilities. Water-skiing and Windsurfing were estimated to decrease by 80 percent due to adverse conditions for the activities.

If a Phase 2 study is undertaken of John Day Drawdown, Contingent Valuation Surveys are recommended to more rigorously estimate quantified changes in recreation demand. The Phase 1 Study assumes that all recreation facilities have the capacity to accommodate demand projections. It is recommended that the Phase 2 study evaluate the capacity of facilities (as modified to mitigate for the drawdown) to meet demand projections.

<b>Table 13. Demand Growth Adjustment Factors for Drawdown to Natural River Level</b>	
<b>Activity</b>	<b>Adjustment Factor</b>
Fishing	10%
Boating (non-motor)	25.00%
Boating (motor)	-50.00%
Picnicking	10.00%
Sightseeing	10.00%
Swimming	-25.00%
Camping	10.00%
Waterskiing	-80.00%
Hunting	10.00%
Windsurfing	-80.00%
Other	10.00%

The demand adjustment factors for each activity were applied to the 20-year growth rates found in [Table 10](#) and converted to annual growth rates. These annual growth rates were further adjusted to account for natural system recovery times. To account for the time lag following drawdown prior to realization of projected recreation demands, a suitability recovery matrix was developed for the Lower Snake Study that was used in this analysis for John Day Drawdown. [Table 14](#) presents the expected suitability of the area for categories of recreation activity.

<b>Table 14. Recreation Suitability During Phased Recovery from Drawdown</b>				
<b>Activity</b>	<b>Years</b>			
	1-5	6-10	11-20	21-100
Motorized Boating	0.2	0.5	0.7	1.0
Non-Motorized Boating	0.3	0.5	0.8	1.0
Swimming	0.2	0.4	1.0	1.0
Picnicking	0.8	1.0	1.0	1.0
Primitive Camping	0.8	1.0	1.0	1.0
Developed Camping	0.6	0.9	1.0	1.0
Hiking & Mountain Biking	0.8	1.0	1.0	1.0
Hunting	0.5	0.8	1.0	1.0
Fishing <sup>1</sup>	0.3	0.5	0.8	1.0
Sightseeing <sup>2</sup>	0.8	1.0	1.0	1.0
<sup>1</sup> No recreation suitability phasing factors were provided for fishing in the Snake River Study from which this table is drawn. This analysis assumes a period of recovery for salmon and steelhead fishing of 30% productivity in the first five years, 50% in the second five years, 80% in years 11-20, and 100% following year 21. <sup>2</sup> No recreation suitability phasing factors were provided for sightseeing in the Snake River Study. This analysis uses the same phasing values as hiking & mountain biking (activities with the most similar physical requirements) for sightseeing.				

The recreation suitability phasing indices listed in [Table 14](#) were applied to the corresponding recreation demand growth projections to forecast recreation demand growth with drawdown to natural river level. [Table 15](#) shows the growth rates by activity used in the recreation analysis for the natural river alternative. The adjusted growth rates to account for recreation suitability phasing are also displayed. The table shows the average phasing-adjusted growth rates for fishing and non-fishing activities that were used in demand projections.

Activity	Average Annual Demand Growth Projections	Phased Recovery Adjusted Annual Growth Rates			
		Years 1-5	Years 6-10	Years 11-20	Years 21-
Fishing	1.11%	0.33%	0.56%	0.89%	1.11%
Boating (non-motorized)	0.30%	0.09%	0.15%	0.24%	0.30%
Boating (motorized)	0.08%	0.08%	0.08%	0.08%	0.08%
Picnicking	0.37%	0.29%	0.37%	0.37%	0.37%
Sightseeing	0.24%	0.19%	0.24%	0.24%	0.24%
Swimming	0.14%	0.03%	0.05%	0.14%	0.14%
Camping	0.15%	0.12%	0.15%	0.15%	0.15%
Water-skiing	0.02%	0.02%	0.02%	0.02%	0.02%
Hunting	0.06%	0.03%	0.05%	0.06%	0.06%
Windsurfing	0.01%	0.01%	0.01%	0.01%	0.01%
Other	0.19%	0.04%	0.08%	0.19%	0.19%
Adjusted Fishing Growth Rates		0.33%	0.56%	0.89%	1.11%
Adjusted Non-Fishing Growth Rates		0.90%	1.19%	1.50%	1.56%

To estimate visitors' willingness to pay for fishing and non-fishing recreation activities with drawdown to natural river level, another TCM survey conducted for the Lower Snake River drawdown study was used as a proxy. The TCM survey was of anglers and other river recreators in the free flowing Snake River Basin in Central Idaho. The WTP values from the survey are \$33.35 for fishing, and \$55.29 for non-fishing river recreation. The \$55.29 WTP value for non-fishing activities was adjusted down to \$50.24 (50 percent of the difference in reservoir non-fishing recreation and the Snake free flowing non-fishing recreation values) to account for high valued recreation opportunities such as whitewater rafting on the Snake that are not likely to occur in the John Day Reach due to hydraulic characteristics such as flow velocities. The same method of computing recreation values for every year in the period of analysis, converting to present values, and summing results to calculate the present value of the recreation stream was employed.

**Table 16.**  
**Estimated Recreation Impacts of Drawdown to Natural River Level, John Day Reservoir**

Format	Activity	Value Without Drawdown	Value With Drawdown	Change In Value
Present Value	Fishing	\$195,375,000	\$279,806,000	\$84,431,000
	Non-Fishing	\$1,892,457,000	\$1,773,976,000	-\$118,481,000
	Total	\$2,087,833,000	\$2,053,782,000	-\$34,050,000
Average Annual Equivalent	Fishing	\$13,934,000	\$19,955,000	\$6,021,000
	Non-Fishing	\$134,964,000	\$126,514,000	-\$8,450,000
	Total	\$148,898,000	\$146,469,000	-\$2,429,000

The data in [Table 16](#) indicate an increase in the value of fishing recreation and a decline in the value of non-fishing opportunities provided in the John Day reach with drawdown to natural river level. The sum of these two effects is a net loss in recreation value over the period of analysis having a present value of -\$34,050,000. The average annual equivalent of this present value is -\$2,429,000.

## 6.2. Risk and Uncertainty Considerations

Uncertainty is inherent to the data upon which this preliminary Phase 1 economic analysis is based. The lack of previous valuation survey studies and analysis of recreation demand impacts at John Day with natural river drawdown required the use of data developed for other similar studies as proxy information for both changes in demand and willingness to pay for recreation activities. While it is assumed that existing data from *the Lower Snake River Juvenile Salmon Migration Feasibility Study* (willingness to pay values and recovery suitability factors) and the *Pacific Northwest Outdoor Recreation Consumption Projection Study: Tri-State Summary Project* (recreation demand adjustment factors) are appropriate for use in this preliminary Phase 1 analysis and are representative of expected changes in recreation use and value with drawdown, significant uncertainty remains in the precision of the results produced. If conducted, the Phase 2 analysis should incorporate site-specific valuation surveys to determine more refined willingness to pay and demand estimates with the drawdown scenarios.

To assess the sensitivity of the recreation analysis to uncertainty in input data, a risk and uncertainty analysis was conducted to examine the distribution of analytical results when incorporating variability in WTP values and demand growth factors. This analysis focused on the drawdown to natural river level scenario and assumed a normal distribution with a 10 percent standard error in the WTP and growth factor values. The analysis was run through 25,000 iterations, with each taking a random sample for WTP fishing value, WTP non-fishing value, and the growth rates (for each of the 10 recreation activities) to calculate recreation value for each scenario. A statistical analysis was then conducted on the 25,000 resultant present values to assess the range of possible outcomes and the probabilities associated with each.

The results of the risk and uncertainty analysis indicated a mean value of the change in recreation present value of -\$38,066,000 (slightly more negative of an impact from the -

\$34,050,000 expected value from the non-R&U analysis). The minimum (most negative) present value for the change was calculated through the R&U analysis to be -\$712,635,000, the maximum present value was calculated to be +\$743,710,000 (the probability that values near these end-points would result is extremely low).

The analysis indicated that there is approximately a 60 percent probability that the impact would be negative and over an 80 percent probability that the impact would be less than +\$115,000,000 (present values). [Table 17](#) displays the probability distribution, indicating the probability that the impact would be less than the range of displayed values. [Figure 3](#) graphs the probability distribution, displaying on the y-axis (vertical axis) the probability that the present value of the impact would be less than the value displayed on the x-axis (horizontal axis).

<b>Table 17. Risk and Uncertainty Analysis Probability Distribution</b>	
<b>Probability that Impact is Less than Value*</b>	<b>Value</b>
5%	-\$337,199,000
10%	-\$268,027,000
15%	-\$226,120,000
20%	-\$192,237,000
25%	-\$161,348,000
30%	-\$134,551,000
35%	-\$109,676,000
40%	-\$84,991,000
45%	-\$62,786,000
50%	-\$39,223,000
55%	-\$16,846,000
60%	+\$7,174,000
65%	+\$31,883,000
70%	+\$57,503,000
75%	+\$85,631,000
80%	+\$114,988,000
85%	+\$150,576,000
90%	+\$195,360,800
95%	+\$261,775,000
*If value is negative, probability that impact is more negative than value	

# Probability Distribution for Change in Present Value with Natural River Level Drawdown

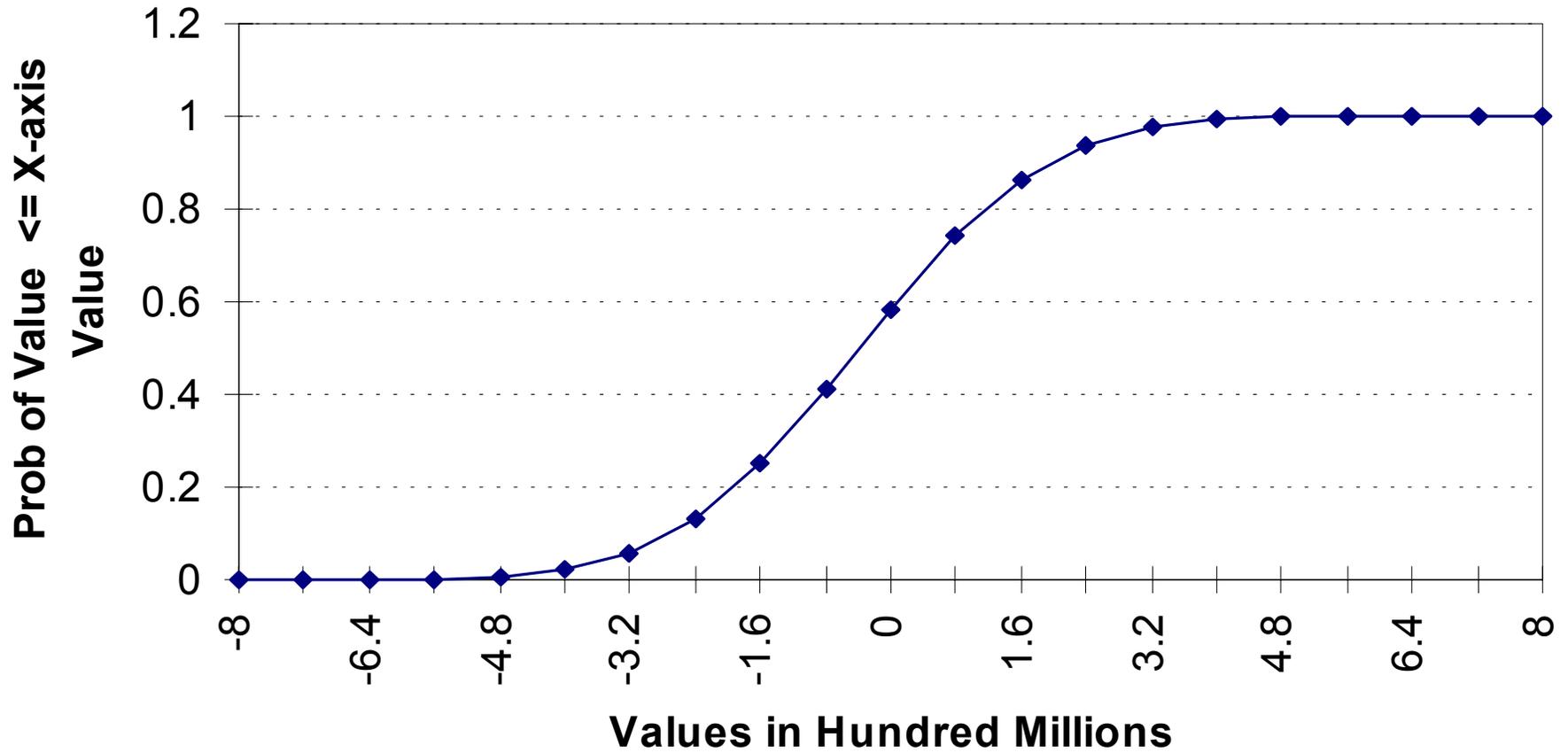


Figure 3 – Risk and Uncertainty Analysis Probability Distribution

The risk and uncertainty analysis indicates that based upon a 10 percent standard error in the WTP and growth factor variables, the impact could be positive or negative with a tendency for a negative impact. While the results may appear to indicate that the 10 percent error results in a wide range of possible impact outcomes, the values are not that wide-ranging taken in context of the total value of the recreation being analyzed (the total without-project recreation value is \$2,087,833,000). The analysis indicated an 80 percent probability that the impact would be less than +\$114,988,000, which is approximately 5.5 percent of the without-project present value. Similarly, the analysis indicated only a 20 percent probability that the impact would be greater (more negative) than -\$226,120,000, which is approximately 10.8 percent of the without-project present value.

While the above R&U analysis focused on the sensitivity of results to variation in WTP and growth rate factors, results are also sensitive to additional variables. The analysis assumes the modification of boat ramp access, camping, and swimming facilities at most of the existing recreation sites. If these impacts to existing recreation facilities are not mitigated the growth rate adjustment factors in [Table 13](#) may underestimate the impacts to recreation value. Similarly, the analysis assumed that recreation sites when modified to mitigate for drawdown would have the carrying capacity to support recreation demands. If adequate carrying capacity is not provided, recreation growth would need to be capped at the facility capacity. If the carrying capacity assumption does not hold, the result would be an overestimation of visitation and recreation value. The Phase 2 Study should conduct studies of these variables in an effort to better define future scenarios and reduce the uncertainties.

## **Section 7. Summary and Conclusions**

Seventeen recreation sites associated with the John Day Reservoir were evaluated to assess the economic impacts related to modification costs, changes in recreation opportunities and use, and changes in recreation value that would result from two alternatives to lower pool elevations. These alternatives involved drawdown to spillway crest and drawdown to natural river level. Modification to maintain recreation access with drawdown is proposed at thirteen of the seventeen sites. The breakdown of the facility modification costs by site and modification feature is provided in [Table 4](#). The total first cost of the proposed modification features at all sites sums to \$21,685,000. No separate cost estimates were available for the two scenarios. The estimates developed reflect drawdown to spillway crest. Modification costs would be expected to be higher for drawdown to natural river level.

The analysis identified costs in addition to facility modification costs. These additional costs included lost recreation opportunities and losses in the value of recreation activity. To estimate these losses, an analysis was conducted based upon visitation rates and willingness to pay values for different recreation uses. Visitation records were evaluated and a 10-year average baseline visitation rate of 2,539,000 visitors per year was computed. Baseline visitation was broken down into fishing and non-fishing visitation. Using willingness to pay values for reservoir recreation from the Lower Snake River Drawdown Study (\$22.48 per visit for fishing, \$45.19 per visit for non-fishing), the annual value of the baseline visitation was estimated as \$103,987,000, of which approximately 90 percent was attributed to non-fishing recreation.

Growth in visitation was estimated based upon activity growth rates determined by the Pacific Northwest Outdoor Recreation Committee. The Committees findings showed a 1.02

percent growth rate for fishing recreation demand and a 1.65 percent growth rate for non-fishing recreation demand in the region. The visitation over a 100-year period of analysis was estimated to have a present value of \$2,087,833,000 (in average annual equivalent terms, \$148,898,000/year).

The impacts of drawdown to spillway crest were estimated by applying a predicted 20 percent reduction in reservoir recreation demand to the same willingness to pay values in the without-project analysis. The 20 percent reduction estimate came from the Columbia River System Operation Review. The value of visitation with drawdown to spillway crest was estimated as \$1,670,266,000 (in average annual equivalent terms, \$119,118,000), a loss in recreation value from the without project condition of -\$417,567,000 (in average annual equivalent terms, \$29,780,000). Adding the modification costs, this results in a calculated NED impact with a present value of -\$1,691,951,000 (average annual equivalent - \$120,664,463).

The impacts of drawdown to natural river level were estimated by applying growth rates by activity to account for increased demand for specific activities. The ability of the system to accommodate recreation demand following drawdown was accommodated by the use of recovery suitability phasing factors for categories of recreation activities. The value of visitation with drawdown to natural river level was estimated as \$2,053,782,000 (average annual equivalent: \$146,469,000), a loss of -\$34,050,000 (average annual equivalent: -\$2,428,000). This loss was the balance of an estimated gain in fishing value of \$84,430,000 (average annual equivalent: \$6,021,000) and a loss of non-fishing value of -\$118,481,000 (average annual equivalent: -\$8,450,000). Adding the modification costs, this results in a calculated NED impact with a present value of -\$55,735,000 (average annual equivalent - \$3,974,840).

All alternatives were found to have a net negative economic effect. This effect included the implementation costs and the losses in recreation value over the period of analysis. Positive effects were found for recreational fishing with the natural river drawdown alternative. These positive effects were offset by negative impacts on non-fishing recreation activities. Risk and uncertainty analysis indicated a possible range of outcomes from negative to positive, with natural river drawdown based upon a 10 percent error in analysis inputs. The R&U analysis found a mean value of -\$38,066,000. The analysis indicated that relative to the total recreation provided at the John Day Reservoir, the range of probable impacts (either positive or negative) is likely to be less than 10 percent of the without-project recreation value. If a Phase 2 Study is conducted, it is recommended that valuation surveys and additional analyses be conducted specific to John Day recreation opportunities, WTP values, and demand growth factors to reduce the uncertainty in the analysis.

## Section 8. References

- Anadromous Fish Economic Analysis, Lower Snake River Juvenile Salmon Migration Feasibility Study Environmental Impact Statement; prepared by Radtke, Hans, Shannon Davis, and Rebecca Johnson of the Research Group for the U.S. Army Corps of Engineers, Walla Walla District, 1999.
- Columbia River Salmon Modification Analysis System Configuration Study Phase 1, Appendix B John Day Reservoir Minimum Operating Pool Technical Report, U.S. Army Corps of Engineers Portland District, 1995.
- Columbia River System Operation Review, Final Environmental Impact Statement, Appendix O Economic and Social Impact, U.S. Army Corps of Engineers North Pacific Division, Bonneville Power Authority, U.S. Department of Interior, November 1995.
- Columbia River System Operation Review, Final Environmental Impact Statement, Appendix J Recreation, U.S. Army Corps of Engineers North Pacific Division, Bonneville Power Authority, U.S. Department of Interior, November 1995.
- Lower Snake River Juvenile Salmon Migration Feasibility Study, Recreation and Tourism Analysis, U.S. Army Corps of Engineers Walla Walla District, 1999.
- Lower Snake River Sport Fishery Use and Valuation Study; prepared by Normandeau and Associates for the U.S. Army Corps of Engineers, Walla Walla District; 1999.
- Outdoor Recreation Use and Value on Lower Snake River Reservoirs, Final Draft; prepared by Agricultural Enterprises, Inc. and University of Idaho for the U.S. Army Corps of Engineers, Walla Walla District, June 1999.
- Recreation and Passive Use Values from Removing the Dams on the Lower Snake River to Increase Salmon; prepared by John Loomis and Agricultural Enterprises, Inc. for the U.S. Army Corps of Engineers, Walla Walla District, 1999.
- Recreation Impacts of MOP Design Report; U.S. Army Corps of Engineers Portland District PD-PE, 1995.
- Willingness to Pay and Expenditures by Anglers in the Snake River Basin in Central Idaho; Agricultural Enterprises, Inc. and University of Idaho for the U.S. Army Corps of Engineers, Walla Walla District, June 1999.
- Pacific Northwest Outdoor Recreation Consumption Projection Study: Tri-State Summary Project; Pacific Northwest Outdoor Recreation Committee, 1989.