

3.8 Implementation/Avoided Costs

3.8.1 Introduction and Study Organization

The purpose of this section of the analysis is to describe and display the *equivalent average annual costs* associated with implementation and avoided costs for each of the study alternatives under consideration. These costs are presented as equivalent average annual costs. The following discussion is divided into 6 sections: discussion of alternatives, implementation costs, average annual costs, avoided costs, risk and uncertainty, and other considerations.

3.8.2 Discussion of Alternatives

The alternatives analysis evaluated eight options for operating the four lower Snake River Dams and one option for breaching the dams:

3.8.2.1 Existing Conditions Alternative

Alternative A-1, which is also referred to as the Base Case or Existing Conditions, represents system operations under the requirements of the 1995 Biological Opinion issued by National Marine Fisheries Service (NMFS).

3.8.2.2 Modified Existing Conditions Alternative

Alternative A-2a, the maximum transport option under existing conditions, enhances existing barge transportation with the acquisition of new barges and related equipment. Alternative A-2a corresponds to A-2 in the PATH analysis.

3.8.2.3 Major Improvements Alternative

Alternative A-2c includes major system improvements to enhance fish recovery efforts:

- Surface bypass collectors (SBC) with dewatering systems,
- SBC with modified spillbays,
- Behavioral guidance curtains with modified spillbays (BGS), and,
- Raised spillway basins, among other major improvements.

Alternative A-2c corresponds to the Path A-2' alternative.

3.8.2.4 Dam Breaching Alternative

Alternative A-3 is the dam breaching or “Natural River” alternative.

3.8.2.5 Comparison of Study Alternatives

The construction and acquisition costs associated each alternative are documented in Table 3.8-1. The costs presented in this report are:

- based on the detailed project schedule PB-2A and engineering annexes (Annexes A through D),
- at the concept level, based on a 100-year life cycle analysis, and,

- developed at a price level October 1, 1998 (e.g., the start of the fiscal year) and adjusted to the year 2005 which is the starting year of construction.

Table 3.8-1. Total Construction & Acquisition Costs by Study Alternative (\$1,000) *

Alternatives	Description	Detailed Description	Starting Year	Construction & Acquisition Costs
A-1	Existing Conditions	Adaptive Management Strategy	2005	\$97,990
A-2a	Modified Existing Conditions	Maximum Transport	2005	\$74,693
A-2c	Major Improvements	(SBC) with Maximum Transport (low cost)	2006	\$167,972
A-3	Dam Breaching	Channel Bypass or Natural River Alternative	2007	\$809,530

* These costs have been adjusted to base year 2005 using the 6 7/8% discount rate.

Source: U.S. Army Corps of Engineers, Walla Walla District

The starting dates of the various alternatives, indicating when each project will be functional, range from 2005 to 2010. However, it should be noted that this schedule is based on the following assumptions:

- that a record of decision will be made with work commencing in FY 2001, and
- that funding and other limitations will not impact the implementation schedule.

Failure to reach a record of decision or delays for any other reason will delay the starting date of the projects.

3.8.2.6 Comparison of Annual Implementation & Avoided Costs

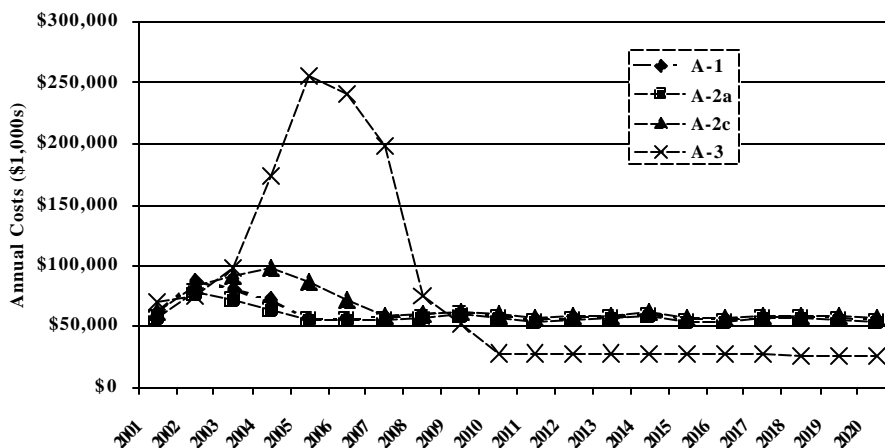
Figure 1 presents a comparison of the annual implementation and avoided costs for alternatives A-1, A-2a, A-2c and A-3.

The annual costs to breach the dams (e.g., A-3) are relatively larger than the costs to improve the dam retention alternatives (e.g., A-1, A-2a and A-2c) between the years 2001 and 2009 because the annual construction costs to breach the dams are significantly greater than the costs to improve the existing system under the dam retention alternatives.

However, the construction costs are completed under all alternatives by the year 2009, after which time the on-going annual implementation and avoided costs are lower under the dam breaching alternative than under the dam retention alternatives from the year 2010 until the end of the study period (e.g., 2104).

Figure 3.8-1 – Comparison of Annual Implementation & Avoided Costs

Comparison of Annual Implementation & Avoided Costs



3.8.3 Implementation Costs

Implementation costs considered below include all project-related construction and acquisition costs and operation, maintenance, repair, replacement and rehabilitation costs (O, M, R, R&R) associated with the building and operation of the new features of the Lower Snake River projects and related lands, included as part of each alternative being considered in this study.

Table 3.8.2 presents the construction and acquisition costs by major category of cost across each alternative under consideration.

3.8.3.1 Construction and Acquisition Costs for Dam Retention Alternatives

The first set of improvements is designed to enhance the performance of existing fish facilities, which is required for alternatives A-1, A-2a and A-2c. Improvements are being proposed to reduce fish fatality at the turbines at each of the four dams. These measures include cam field test improvement studies, and related cam improvements on the turbines. Each of the dams has 6 turbines, which would be sequentially improved. The cost to study and enhance the cams is estimated to be \$3.5 million, as shown in Table 3.8-2. In addition, there are a series of fish-related improvements planned for each dam, as required, including:

- Auxiliary water supplies for fish ladders - these improvements are required at each of the four lower Snake River projects and range in cost \$10.8 million across all four projects.

- Fish facility cylindrical de-water systems, which are needed at Ice Harbor, Lower Monumental and Little Goose but not at Lower Granite, are expected to cost \$460,000 per affected project or \$1.4 million for across all four projects.
- Gantry crane modifications are needed at Lower Monumental dam, at a cost of \$630,000.
- Juvenile fish facility improvements, which are needed at Lower Granite, are expected to cost \$24.3 million.
- Separator improvements, which are needed at Lower Monumental and Little Goose, are expected to cost approximately \$7.3 million in total.
- De-gasification improvements (DGAS), which are required at Lower Monumental, Little Goose and Lower Granite projects, have already been implemented at Ice Harbor. These improvements, which include adding end bay deflectors and modifying the deflectors and pier extensions, are planned to decrease gasification and improve water quality. Under the base case, the cost of these improvements is \$33.7 million across all projects.
- Improvement to the Trash boom (used to pickup trash and debris at the project) is required at Little Goose dam, at a cost of \$5.3 million.
- Additional barges and improved barge moorage cells at Lower Granite, which are intended to improve and enhance the fish transportation program, are expected to cost \$9.3 million (e.g., \$6.7 million for five additional barges and \$2.6 million for an improved barge moorage cell).
- Extended screen bypass systems (ESBS) are expected to cost \$1.8 million.

Additional Fish Facility Improvements (A-2c)

Under A-2c, additional major systems improvements are also planned, including studying and installing extended screen bypass collection systems (ESBS) at Ice Harbor, Lower Monumental, and Lower Granite dams. These improvements are estimated to cost \$93.3 million.

3.8.3.2 Construction and Acquisition Cost for Dam Breaching Alternative

The implementation costs associated with A-3, the dam breaching or Natural River alternative, are summarized in this section. The construction costs associated with A-3 (the dam breaching alternative) are also summarized in Table 3.8-2. The construction process includes modifying, removing, or protecting structures (e.g., roads, railroads, bridges, reservoir embankments, drainage structures, recreation access corridors, the hatchery at Lyons Ferry and like structures) that would remain after the dams are breached. The largest construction costs are for dam embankment removal and river channelization, which in combination, exceed \$70 million at each of the dams. Each dam embankment is scheduled for removal concurrently over a three-year period between 2004 and 2007. There would be a need to shore up the reservoir embankment prior to water release to prevent the undermining of the riprap and structures along the banks under high-water conditions, after the river is returned to a natural state. There would also be a need to re-vegetate the newly exposed banks of the river to create improved fish habitat. In addition, before the dams are breached there would be a requirement to construct temporary fish handling facilities.

Table 3.8-2. Total Construction & Acquisition Costs Adjusted to Base Year 2005 (\$1,000)*

Cost Category by Alternative	A-1	A-2a	A-2c	A-3
Improvements to Existing Fish Facilities				
Gantry Crane Modifications	\$630	\$630	\$630	\$-
Fish Facility Cylindrical Dewatering System	\$1,433	\$1,430	\$ 1,430	\$-
ESBS Modifications	\$1,780	\$1,780	\$ 1,780	\$-
Cam Improvements and Studies	\$3,546	\$3,546	\$ 3,546	\$-
Trash Boom	\$5,280	\$5,280	\$ 5,280	\$-
Separator Improvements	\$7,262	\$7,260	\$ 7,260	\$-
Additional Barges & Moorage Cells	\$9,270	\$9,270	\$ 9,270	\$-
Aux. Water Supply Fish Ladder	\$10,805	\$10,805	\$ 10,805	\$-
Degasification Efforts	\$33,676	\$10,384	\$ 10,384	\$-
Juvenile Fish Facility Improvements	\$24,308	\$24,308	\$ 24,308	\$-
Sub-total	\$98,000	\$74,693	\$ 74,693	\$-
Additional New Fish Facility Improvements				
Prototypes, Testing of surface bypass collectors (SBC)	\$ -	\$ -	\$ 1,024	\$-
New Extended Screen Bypass (ESB) Screens	\$ -	\$ -	\$ 32,718	\$-
Full Flow Bypass SBC w/ Modified Spillbay	\$ -	\$ -	\$ 59,537	\$-
Sub-total	\$ -	\$ -	\$ 93,279	\$-
Dam Breaching Construction Costs				
Real Estate (Excessing Property)	\$ -	\$ -	\$-	\$841
Project Dam Decommissioning	\$ -	\$ -	\$-	\$ 5,006
Cultural Resources Protection	\$ -	\$ -	\$-	\$ 5,999
Cattle Watering Facilities	\$ -	\$ -	\$-	\$ 6,030
Drainage Structures Protection	\$ -	\$ -	\$-	\$ 8,830
Lyons Ferry Hatchery Modifications	\$ -	\$ -	\$-	\$ 9,047
HMU Modification	\$ -	\$ -	\$-	\$ 8,841
Recreation Access Modification	\$ -	\$ -	\$-	\$ 12,509
Railroad Relocations	\$ -	\$ -	\$-	\$ 21,913
Power House Turbine Modifications	\$ -	\$ -	\$-	\$ 30,952
Reservoir Revegetation (For Air & Water Quality)	\$ -	\$ -	\$-	\$ 26,336
Temporary Fish Handling Facilities	\$ -	\$ -	\$-	\$ 37,018
Bridge Pier & Abutment Protection	\$ -	\$ -	\$-	\$ 48,321
Railroad and Roadway Damage Repair	\$ -	\$ -	\$-	\$ 95,538
River Channelization	\$ -	\$ -	\$-	\$123,446
Dam Embankment Removal	\$ -	\$ -	\$-	\$158,775
Reservoir Embankment Protection	\$ -	\$ -	\$-	\$184,432
Sub-total	\$ -	\$ -	\$-	\$783,834
Mitigation Costs				
	\$ -	\$ -	\$-	\$ 25,696
Total	\$97,990	\$74,693	\$167,972	\$809,530

* These costs have been adjusted to base year 2005 using the 6 7/8% discount rate.

Source: U.S. Army Corps of Engineers, Walla Walla District

The power house turbine modifications, presented in Table 3.8-2, would be required to allow a controlled release of the water in the reservoirs behind the dams and would not be associated with turbine rehabilitation projects that are required under dam retention strategies. There is also an agreement to modify and/or protect cattle watering corridors¹ in selected areas, modify existing habitat management units (HMUs), and protect cultural resources from exposure after dam breaching and river channelization.

Mitigation Costs (A-3)

The mitigation costs required under the dam breaching alternative (A-3) include fish and wildlife habitat mitigation efforts, and, cultural resources preservation associated with preserving and protecting habitat and cultural sites such as burial grounds.

3.8.3.3 O,M,R,R&R Costs for Dam Retention Alternatives

In addition to construction costs, O, M, R, R&R costs also occur with implementation of the project-related or fish-improvement components of the dam retention alternatives. Some of the costs are associated with studies and others are related to operation and maintenance of the fish-improvement systems. The efforts to maintain and enhance existing fish-related facilities and operations are summarized in Table 3.8-3 and include:

- Continued study of anadromous fish (called the anadromous fish evaluation program or AFEP) entails a process for testing, research and evaluation of the performance of the proposed improvements in meeting fish-improvement goals and objectives. The AFEP study costs occur for approximately 25 years during construction and rehabilitation improvements. Total AFEP costs adjusted to base year 2005 are expected to range from a low of \$55 million under A-2a to a high of \$88 million under A-2c.
- BOR water acquisition costs enable an increased volume of water to pass over the dams during critical flow periods. The water is purchased from natural (irrigator) flow rights, changes in Snake River reservoir operations, and additional water from BOR storage reservoirs. Water purchases are expected to continue to occur throughout the study period to meet flow requirements, at an estimated total cost of \$43 million over the 100-year study period adjusted to base year 2005 for the existing flow augmentation requirement of 427,000 acre feet (AF) of water.
- Total maintenance costs associated with screen bypass collector systems for alternative A-2c are expected to cost \$10 million over the 100-year life of the project adjusted to base year 2005.

¹ It should also be noted here that cattle watering corridor modification costs were included in the implementation costs because of deed requirements. Refer to the Engineering Appendix for further details regarding what constitutes implementation costs.

Table 3.8-3. Total Project-Related O, M, R, R&R Costs (\$1,000)*

Cost Category by Alternative	A-1	A-2a	A-2c	A-3
Anadromous Fish Evaluation Program	\$82,413	\$55,488	\$88,516	\$38,428
BOR Water Purchase	\$43,300	\$43,300	\$43,300	\$43,300
Wildlife Monitoring	\$ -	\$ -	\$ -	\$ 179
Vegetation Monitoring	\$ -	\$ -	\$ -	\$ 382
Fish Monitoring Costs	\$ -	\$ -	\$ -	\$32,442
Water Quantity Monitoring Costs	\$ -	\$ -	\$ -	\$6,094
Air Quality Monitoring Costs	\$ -	\$ -	\$ -	\$ 504
Sedimentation Monitoring Costs	\$ -	\$ -	\$ -	\$1,553
Fish Improvement Related, Dam Operation, Maintenance and Repair	\$ -	\$ -	\$10,068	\$ -
Total	\$ 125,713	\$98,788	\$ 141,884	\$ 122,882

* Costs are adjusted to base year 2005 using the 6 7/8% discount rate.

Source: U.S. Army Corps of Engineers, Walla Walla District

3.8.3.4 O,M,R,R&R Cost for Dam Breaching Alternative

In addition to the mitigation and construction/acquisition costs, there are ongoing O&M costs associated with continued anadromous fish evaluation program, purchase of water by the BoR and monitoring costs associated with dam breaching. These costs are also summarized in Table 3.8-3. Total AFEP costs for the 100-year period of study are estimated to be \$38 million and monitoring costs are estimated to equal \$41,160, as adjusted to the base year 2005.

3.8.4 Average Annual Costs

3.8.4.1 Average Annual Costs of Fish Facility Improvements

This section presents a summary of the total and average annual implementation costs. Construction, IDC, AFEP and O,M,R,R&R costs are displayed in average annual equivalent terms taking into account the 100-year period of analysis and adjusted to base year 2005 in Table 3.8-4.

Costs incurred during the period of analysis were discounted to the beginning of the period of analysis using the applicable discount rate. Implementation costs incurred during the period of installation (following October 2000) were brought forward to the end of the installation period by charging compound interest at the applicable discount rate, from the date that the costs were incurred. For comparative purposes, all costs for each alternative were then either brought forward, or discounted, as appropriate to FY 2005 (base year), and were then annualized over the 100-year period of analysis at the appropriate discount rate. This analysis presents average annual costs using three discount rates:

- the Federal rate of 6-7/8%,
- the Bonneville Power Administration (BPA) rate of 4-3/4%, and
- 0.0% for the Tribes.

Table 3.8-4. Summary of Implementation Costs (\$1,000s)

Discount Rate by Alternative	Construction And Acquisition Cost	Interest During Construction Cost	Total Investment Cost	Average Annual Investment Cost	Average Annual AFEP Cost	Average Annual O,M,R,R&R Cost	Average Annual Implementation Cost
@6.875%							
A-1	\$89,258	\$8,732	\$97,990	\$6,745	\$5,673	\$2,984	\$15,402
A-2a	\$67,904	\$6,789	\$74,693	\$5,141	\$3,820	\$2,984	\$11,945
A-2c	\$151,939	\$16,033	\$167,972	\$11,563	\$6,093	\$3,677	\$21,333
A-3	\$759,093	\$50,437	\$809,530	\$55,727	\$2,645	\$5,817	\$64,189
@4.75%							
A-1	\$89,258	\$5,971	\$95,229	\$4,567	\$4,498	\$2,759	\$11,824
A-2a	\$67,904	\$4,641	\$72,545	\$3,480	\$3,029	\$2,759	\$9,268
A-2c	\$155,021	\$11,131	\$166,152	\$7,969	\$4,831	\$3,400	\$16,200
A-3	\$800,224	\$35,688	\$835,912	\$40,092	\$2,097	\$5,133	\$47,322
@0.0%							
A-1	\$89,258	\$0	\$89,258	\$893	\$1,373	\$2,423	\$4,689
A-2a	\$67,904	\$0	\$67,904	\$679	\$924	\$2,423	\$4,026
A-2c	\$162,384	\$0	\$162,384	\$1,624	\$1,474	\$2,981	\$6,079
A-3	\$911,122	\$0	\$911,122	\$9,111	\$640	\$3,236	\$12,987

Source: U.S. Army Corps of Engineers (Walla Walla District, Portland District), BPA and BST

Associates

The major cost categories include:

- construction costs for fish-improvement projects and/or to breach the dams (including mitigation costs, such as wildlife mitigation and cultural resources protection and mitigation at each of the four dams, for the dam breaching alternative),
- interest during construction (IDC) - reflects compound interest, at the applicable borrowing rate, on construction costs incurred during the period of installation,
- anadromous fish evaluation program (AFEP), and,
- O,M,R,R&R costs associated with the new fish improvement projects (e.g., purchase of water from BOR and under alternative A-2c for O&M costs associated with the screen bypass system).

The comparative results vary widely depending upon the discount rate that is utilized. However, the ranking of the alternatives does not exhibit the same degree of variance across each discount rate. A-2a is the lowest cost alternative (in fact, it has a lower cost than the base case). A-1 and A-2c are the next lowest cost alternatives. A-3, the dam breaching or Natural River alternative, is the highest cost alternative, under all discount rates.

3.8.5 Avoided Costs

Avoided costs are defined to include those costs that will no longer be required to operate and maintain the Lower Snake River projects, and associated lands, with each alternative. These costs are calculated by comparing the continued operation of the four Lower Snake River lock and dams under the Base Case conditions (Alternative A-1) with the other alternatives under consideration (Alternatives A-2a, A-2c and A-3). If costs are required under the Base Case but not required under the other alternatives, they are considered avoided costs.

Avoided costs include:

- Avoidance of construction costs or major upgrades that would occur with A-1 but not under other alternatives, including major powerhouse system upgrades, and, specific additional major improvements to fish bypass, collection and passage systems.
- Avoidance of O&M costs incurred under A-1 but not under other alternatives: future annual O&M costs, and, additional annual repair costs, and,
- Disposition of equipment that could be surplus, if the dams were breached.

3.8.5.1 Avoided Construction Costs

The major fish-improvement cost that does not occur in alternatives A-2a and A-2c (or obviously in A-3) but is required in A-1 is the second phase of the de-gasification construction projects. This project is required to reduce nitrogen saturation resulting from additional flows. It is not required in A-2a and A-2c because additional collection efforts are undertaken above the dams that reduce the need for additional spills and related system improvements. The additional construction cost associated with the DGAS2 project is approximately \$21 million.

However, there are also additional costs associated with alternatives A-2c and A-3, which are not required under alternative A-1. As a result, net avoided costs of fish-related improvements only accrue to alternative A-2a. These costs are, however, included in the comparison of implementation costs and would be double-counted if included again as avoided costs.

3.8.5.2 Avoided Non-Project Related OMRR&R Costs

Under alternative A-3, the four Lower Snake River dams would be removed and, thus, the power house rehabilitation costs and the annual operations and maintenance non-project related costs associated with the base case would be significantly reduced. These are included as avoided costs credited to alternative A-3. The avoided costs under the dam breaching alternative include:

- Avoidance of rehabilitation of the power houses in the four projects, which includes all twenty-four turbine and generator units (including the turbines, the turbine blades, rewinding generators, and miscellaneous work). Over the study period, this rehabilitation is expected to cost approximately \$380 million for the entire system. This effort is underway at the present time in the Ice Harbor project and will be required again in approximately 50 years. The twenty-four lower Snake River dam turbine units have an approximate life span of 25 to 50 years. It takes approximately 10 years to rehab six turbine units at each dam and only one turbine unit can be rehabilitated at a time for several reasons (including the need to continue generating power during the rehabilitation process and funding limitations).

- Avoidance of O&M and other minor repair activities are expected to average \$25 million per year throughout the life of the system for those alternatives that retain dam operations. Some of the annual O&M costs (e.g., associated with maintenance of HMUs and recreation facilities) would also occur under alternative A-3. In addition, the annual costs of \$14.4 million to operate the Lyons Ferry fish hatchery occurs under all alternatives (including A-3). As an offset to avoided costs, under the dam breaching alternative, normal dam operating expenditures occur between the year 2001 and the actual dam breaching (2007). In addition, after dam breaching, there would be continuing O&M costs associated with the operation and maintenance of the existing HMUs and parks.
- Real property could be disposed of after dam breachings. Personal property that is currently utilized at the Lower Snake River projects could be transferred to other federal agencies and hence represents another avoided cost of dam breaching. The personal property at the Lower Snake River lock and dams (e.g., calculated for items with a value greater than \$2,500) has a value of approximately \$14.9 million.

3.8.5.3 Summary of Avoided Costs

The avoided costs associated with the dam breaching alternative are approximately \$29 million per year over the life of the study, under all discount rates, as shown in Table 3.8-5. Under a discount rate of 6.875%, the avoided costs are calculated by subtracting the sum of the annual costs for turbine replacement, O,M,R,R,&R and surplus property under the base case alternative (e.g., \$64,783,000) from dam breaching alternative (e.g., \$35,605,000) which equals an annual avoided cost of \$29,178,000.

Table 3.8-5. Summary of Avoided Costs (\$1,000s)

Discount Rate/ Alternative	Turbine Rehabilitation	Non-Project Related O,M,R,R,&R	Surplus Property	Sub-Total	Avoided Costs
@6.875%					
A-1	\$4,800	\$ 58,955	\$ 1,028	\$64,783	\$ -
A-2a	\$4,800	\$ 58,955	\$ 1,028	\$64,783	\$ -
A-2c	\$4,800	\$ 58,962	\$ 1,028	\$64,790	\$ -
A-3	\$ -	\$ 35,605	\$ -	\$35,605	(\$ 29,178)
@4.75%					
A-1	\$4,579	\$ 54,476	\$716	\$59,771	\$ -
A-2a	\$4,579	\$ 54,476	\$716	\$59,771	\$ -
A-2c	\$4,579	\$ 54,499	\$716	\$59,794	\$ -
A-3	\$ -	\$ 30,428	\$ -	\$30,428	(\$ 29,343)
@0.0%					
A-1	\$3,871	\$ 46,935	\$149	\$50,955	\$ -
A-2a	\$3,871	\$ 46,935	\$149	\$50,955	\$ -
A-2c	\$3,871	\$ 47,412	\$149	\$51,432	\$ -
A-3	\$ -	\$ 21,905	\$ -	\$21,905	(\$ 29,050)

Source: U.S. Army Corps of Engineers (Walla Walla District, Portland District), BPA and BST Associates

3.8.6 Risk & Uncertainty

The following section presents an evaluation of the risk and uncertainty associated with implementation and avoided costs. The range of uncertainty within each cost estimate is based on the following estimates of contingencies (prepared by the U.S. Army Corps of Engineers, Walla Walla District):

- 15% to 25% contingency range for construction and acquisition costs associated with the dam retention alternatives (with a most likely estimate of 20%),
- 25% to 35% contingency range for construction and acquisition costs associated with the dam breaching alternative (with a most likely estimate of 30%),
- 0% to 10% contingency range for O,M,R,R&R under all alternatives (with a most likely estimate of 5%),

3.8.6.1 Risk & Uncertainty in Average Implementation Costs

Based upon these contingencies, the range of costs for fish facility improvements is presented in Table 3.8-6. As shown, total average annual implementation costs (e.g., including all construction and other costs) range between \$61.0 and \$67.4 million for the dam breaching alternative, with a most likely cost estimate of \$64.2 million per year under a discount rate of 6.875%. The annual implementation costs net of the base case range from \$46.3 to \$51.2 million, with a most likely net cost of \$48.8 million.

Table 3.8-6. Implementation Costs – Risk & Uncertainty (\$1,000s)

Discount Rate/ Alternative	Annual Implementation Costs			Net of Base Case		
	Most Likely	Low	High	Most Likely	Low	High
@6.875%						
A-1	\$15,402	\$14,632	\$16,172			
A-2a	\$11,945	\$11,348	\$12,542	(\$3,457)	(\$3,284)	(\$3,630)
A-2c	\$21,333	\$20,266	\$22,400	\$5,931	\$5,634	\$6,228
A-3	\$64,189	\$60,980	\$67,398	\$48,787	\$46,348	\$51,226
@4.75%						
A-1	\$11,824	\$11,233	\$12,415			
A-2a	\$9,268	\$8,805	\$9,731	(\$2,556)	(\$2,428)	(\$2,684)
A-2c	\$16,200	\$15,390	\$17,010	\$4,376	\$4,157	\$4,595
A-3	\$47,322	\$44,956	\$49,688	\$35,498	\$33,723	\$37,273
@0.0%						
A-1	\$4,689	\$4,455	\$4,923			
A-2a	\$4,026	\$3,825	\$4,227	(\$663)	(\$630)	(\$696)
A-2c	\$6,079	\$5,775	\$6,383	\$1,390	\$1,321	\$1,460
A-3	\$12,987	\$12,338	\$13,636	\$8,298	\$7,883	\$8,713

Source: U.S. Army Corps of Engineers (Walla Walla District, Portland District), BPA and BST Associates

Under the same discount rate, the average annual implementation costs for dam retention alternatives are estimated to be:

- A-1 ranges from \$14.6 to \$16.2 million, with a most likely estimate of \$15.4 million,
- A-2a ranges from \$11.3 to \$12.5 million, with a most likely estimate of \$11.9 million (e.g., ranging from a negative \$3.3 to negative \$3.6 million net of the base case), and,
- A-2c ranges from \$20.3 to \$22.4 million, with a most likely estimate of \$21.3 million (e.g., ranging from \$5.6 to \$6.2 million net of the base case).

3.8.6.2 Risk & Uncertainty in Average Annual Avoided Costs

Based upon a 5% contingency, the range of annual costs for non-project related operations, maintenance, repair, replacement and rehabilitation costs (O, M, R, R and R) are presented in Table 3.8-7. As discussed above, there are a number of on-going annual costs incurred in dam retention alternatives that are avoided under the dam breaching alternative.

Avoided costs are calculated by subtracting the annual costs associated with the base case from those associated with the dam breaching alternative. For example, the most likely annual avoided costs are calculated by subtracting the base case average annual costs of \$64.8 million from the dam breaching average annual costs of \$35.6 million, which equals (\$29.2 million) at a discount rate of 6.875%. The average annual avoided costs range between \$27.7 and \$30.6 million, with a most likely cost estimate of \$29.2 million per year under a discount rate of 6.875%. Table 3.8-7 also presents the annual avoided costs under the 4.75% and 0.0% discount rates.

Table 3.8-7. Avoided Costs – Risk & Uncertainty (\$1,000s)

Discount Rate/ Alternative	Annual Non-Project Related Costs			Avoided Costs		
	Most likely	Low	High	Most likely	Low	High
@6.875%						
A-1	\$ 64,783	\$ 61,543	\$ 68,022			
A-2a	\$ 64,783	\$ 61,543	\$ 68,022			
A-2c	\$ 64,790	\$ 61,550	\$ 68,029			
A-3	\$ 35,605	\$ 33,825	\$ 37,385	\$(29,178)	\$(27,719)	\$(30,637)
@4.75%						
A-1	\$ 59,771	\$ 56,782	\$ 62,760			
A-2a	\$ 59,771	\$ 56,782	\$ 62,760			
A-2c	\$ 59,794	\$ 56,804	\$ 62,784			
A-3	\$ 30,428	\$ 28,907	\$ 31,949	\$(29,343)	\$(27,876)	\$(30,810)
@0.0%						
A-1	\$ 50,955	\$ 48,408	\$ 53,503			
A-2a	\$ 50,955	\$ 48,408	\$ 53,503			
A-2c	\$ 51,432	\$ 48,861	\$ 54,004			
A-3	\$ 21,905	\$ 20,810	\$ 23,000	\$(29,050)	\$(27,598)	\$(30,503)

Source: U.S. Army Corps of Engineers (Walla Walla District, Portland District), BPA and BST Associates

3.8.7 Other Considerations

3.8.7.1 Repayment of Outstanding Debt

The Bonneville Power Administration (BPA) is obligated by law to repay to the Federal Treasury all costs allocated to hydropower from the federal dams. The capitalized costs of the project (e.g., initial construction costs, replacement costs) are repaid by BPA over a 50 year period at designated interest rates. The current debt associated with the lower Snake River lock and dams is approximately \$479 million for construction of the dams as of the end of 1998. In addition, there is also additional outstanding debt for the lower Snake River fish hatcheries and fish mitigation funds of approximately \$271 million as of the end of 1998. There is also a construction work in progress account that will transfer to BPA as new additional debt.

If the lower Snake River locks and dams are removed, it is possible that Congress, through the authorizing legislation, will reduce some or all of this long-term debt. It is not known at this time what might be written off. However, this debt-relief is not considered an avoided cost. The debt cost is sunk and a write-off would not avoid it but rather would simply transfer the debt to a different party. The issue of payment of outstanding debt is addressed further under the finance section of the cost allocation report (see Section 10.1).

3.8.7.2 Relationship of Implementation Costs to NED Impacts

Estimates of the NED impacts of power, navigation, recreation, water supply and other study elements are presented in Sections 3.1 through 3.7.2 of this appendix. Care has been taken to eliminate potential double counting of costs. As an example, the avoided cost report documents the cost to operate the Lower Snake River lock and dams under various dam retention alternatives. A major portion of this cost is for power facilities. Including the cost to provide power from the four Lower Snake River dams in the power cost estimates would lead to a double counting of costs. Therefore, the costs of operating the existing plants are excluded from the hydropower analyses. Care has been taken in evaluating other NED impact estimates to assure that double counting is similarly avoided.

The avoided cost estimates indicated above have focussed on federal costs. However, there could also be impacts to state and local governments, private sector individuals and firms, and the Tribes. The NED impact estimates should account for the avoided costs to other parties that could partially offset national cost increases. However, there may be some costs that have not been captured in other study elements. One example is the cost to reconstruct the natural gas line that crosses the Snake River. Under the dam breaching alternative, this reconstruction is estimated to cost \$12.4 million. The study teams have not captured this cost. There may be other examples.

3.8.8 Unresolved Issues

The engineering cost estimates in this report are preliminary and may be adjusted between the draft and final reports.

With respect to avoided costs, the hydropower group is evaluating whether the reduction of the Canadian entitlement should be considered as an avoided cost.