

# **Scoping for Feasibility of Columbia River Mainstem Passage Cost- Effectiveness Analysis**

**Independent Economic Analysis Board  
Task 85 Report**

**November 2004**

## Executive Summary

The Independent Economic Analysis Board (IEAB) has been asked to review current information about Columbia River mainstem bypass spill and alternative juvenile passage strategies to determine if the information base can support a formal cost-effectiveness analysis (CEA) of any passage options, and if so, how the information can be characterized to represent the range of opinions about the effectiveness and costs of bypass spill and passage alternatives.

For purposes of this analysis the IEAB defines a *cost-effective scenario* as one that reduces net costs (power revenue losses plus costs of passage actions) and increases juvenile survival relative to the status quo scenario. Therefore, our scoping is concerned with quantitative information about power revenues, passage costs and juvenile survival.

In early 2004, Bonneville Power Agency (BPA) and the U.S. Army Corps of Engineers (USACE), the “Action Agencies” proposed to modify bypass spill operations at the Federal Columbia River Power System (FCRPS) dams while providing “offsets” to compensate for the reduced juvenile survival caused by the reduced bypass spill. The scope of the review includes analysis, comments, and response to comments in relation to the “Preliminary Proposal for FCRPS Summer Juvenile Bypass Spill Operations” (BPA and USACE, 2004a) released March 30, and the “Amended Proposal for FCRPS Summer Juvenile Bypass Operations” (BPA and USACE 2004b), released June 8. We also describe the proposed revised BiOp as provided by the Amendment to the 2004/2004-2008 Implementation Plan, (USDC 2004c).<sup>1</sup> For the purposes of this paper, the status quo for spill requirements is defined by NOAA Fisheries’ 2000 Biological Opinion for FCRPS Operations.

Our descriptions of the proposals and comments include text related to cost-effectiveness taken verbatim from the documents. This body of information provides a current and detailed information base that reveals the range of opinions about the cost-effectiveness of summer spill as compared to other actions to increase salmon and steelhead runs.

Our review finds that

- Conclusive and complete CEA of the modified spill proposals and offsets is currently not feasible because of a large amount of uncertainty regarding their survival effects, because survival effects of some offsets have not been estimated, and because some offsets were not well-defined. Still, we are able to provide some CEA that reflects the range of uncertainty.
- Our review highlights areas of uncertainty most important to the feasibility and cost-effectiveness of actions intended to improve juvenile survival. These are:

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<sup>1</sup> On July 28, Judge Redden in the District Court of Oregon ruled in favor of a motion for a preliminary injunction to stop implementation of a modified summer spill proposal. As of September, bypass spill in 2004 conformed to the 2000 BiOp.

passage timing, smolt-to-adult survival rates, effects of spill on pool survival, delayed mortality of transported juveniles, and water quality factors (primarily temperature and dissolved gas).

- More advance planning might increase the acceptability of a spill reduction/offset package. It is difficult to propose offsetting actions for a migration season that will begin within months, because most actions take time to implement. Some of the most promising offsets, Removable Spillway Wiers (RSWs) for example, could not be considered for the 2004 migration season.
- Some stakeholders might have been more supportive if more time had been allowed for comments, and if stakeholder proposals had been more directly included in the modified proposals.
- Some offsets were criticized because stakeholders felt they should be regarded as BiOp actions. There needs to be a clear distinction between actions included in the BiOp baseline, and actions above and beyond the BiOP.

If it can be assumed that the Action Agencies' proposals and analysis are correct, then a number of cost-effectiveness implications follow.

- The Preliminary Proposal suggests that reduced bypass spill and proposed offsets would be cost-effective for Hanford Reach fall run chinook stocks. However, the package is not shown to be cost-effective for other non-listed stocks or for the ESA-listed Snake River fall run stock because quantified survival losses are larger than quantified survival increases from offsets.
- The Amended Proposal includes actions intended to fully compensate for reduced survival of ESA-listed Snake River wild stocks. The key action is increased outflow from Brownlee Reservoir. For this ESA-listed stock, the Amended Proposal judges this action to be adequate for offsetting reduced spill. Survival benefits from augmenting the pikeminnow program are shown, but because of an issue involving BiOp requirements, the pikeminnow program augmentation is not counted as an offset.
- The Amended Proposal suggests that reduced bypass spill and proposed offsets would be cost-effective for the Snake River fall chinook wild and hatchery stocks, for the Hanford Reach natural stock, and for all non-listed stocks (including Hanford Reach) taken as a group. The cost of all proposed offsets (\$10 million annually) is forecast to be less than the increased revenue from reduced bypass spill (\$33 to \$44 million annually).
- The pikeminnow program augmentation is not counted as an offset. However, an analysis is presented in an appendix to the Amended Proposal (BPA and USACE 2004d) showing that, for most non-listed stocks, the amount of survival increase from pikeminnow program augmentation is less than the survival reduction from

reduced spill. For these stocks, survival benefits from other offsets (habitat improvements for natural fish and hatchery actions) are not quantified. Therefore, for these non-listed stocks, the analysis provided by the Amended Proposal does not show that proposed offsets can increase survival enough to compensate for reduced spill, even if the pikeminnow augmentation program is counted as an offset.

- The Amendment to the 2004/2004-2008 Implementation Plan for the FCRPS Biological Opinion Remand (the Revised BiOp) issued in June 2004 proposed relatively small changes to the Amended Proposal. At Ice Harbor and John Day, BiOp spill would end on August 25 instead of August 21. NOAA Fisheries (USDC 2004) finds that survival increases for Snake River fall chinook salmon from increased Brownlee releases are adequate to offset survival reductions from reduced bypass spill. Based on this opinion and likely power benefits and costs, the Action Agencies argued that this change is likely to be a cost-effective change for management of the Snake River fall chinook stocks. Again, increased net survival and cost-effectiveness were not demonstrated for the majority of the affected Columbia River stocks

There is substantial controversy about many factors affecting the cost effectiveness of mainstem actions.

- Tribal interests, environmental groups and fish and wildlife agencies raised many issues with the biological analysis used to support the Preliminary Proposal. Taken at face value, the juvenile survival issues raised by the comments imply much uncertainty regarding the cost-effectiveness of the Preliminary Proposal. An alternative analysis provided by CRITFC suggests negative effects on ESA-listed adults about 10 to 15 times as large as the Action Agencies' analysis. An analysis provided by the Fish Passage Center (FPC) suggests negative effects about 10 to 20 times as large.
- Most controversy is associated with juvenile survival and smolt-to-adult returns. Some important areas of controversy involve passage timing, smolt-to-adult survival rates, effects of spill on pool survival, delayed mortality of transported juveniles, and water quality factors, primarily temperature and dissolved gas.
- There is much less debate about changes in power production and revenue savings from bypass spill reductions, and about the costs of the offsets.

Table ES-1 shows the range of estimated effects on adult fish based on analysis provided by the Action Agencies and selected commenters. Alternative estimates were selected because they represent different opinions, not because the opinions have any more or less scientific merit.<sup>2</sup> Table ES-1 reveals the range of impacts suggested by the Preliminary Proposal and comments, and it shows that, for some stocks, estimated survival benefits of offsets were not large enough to compensate for losses from spill reduction.

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<sup>2</sup> The IEAB is not qualified to evaluate biological information and arguments.

Table ES-1. Estimated Change in Adult Returns Under Preliminary Proposal. Action Agencies' Estimates, and Alternative Estimates									
	Change in Number of Adults Caused by Action								
	Losses from Preliminary Spill Proposal <sup>1</sup> .			Gains from Hanford Reach Anti-Stranding <sup>2</sup> .		Gains from Pikeminnow Augmentation <sup>3</sup> .		Net Effect of All Actions	
	Agencies	FPC	CRITFC	Agencies	WDFW	Agencies	Alternate	Agencies	FPC
ESA-listed Snake River Fall Chinook	-2 to -20	-46 to -192	-28 to -180	0	0	1 to 11	0	-1 to -10	-46 to -192
Non-listed Hanford Reach Fall Chinook	-885 to -7,080			3,916 to 80,662	218 to 4,481	250 to 8,000	0	2,591 to 76,062	
Other Non-listed Chinook	-690 to -5,520			0	0				
<ol style="list-style-type: none"> <li>1. For Agency analysis, the range in adults affected is caused by a range of smolt-to-adult survival rates (SARs) of 0.5 to 4.0 percent. For FPC, the range is caused by a range of SARs and passage timing. For the CRITFC analysis, the range is caused by a range in pool survival and passage timing.</li> <li>2. For Agency analysis, the range in adults affected is caused by a range of smolt-to-adult survival rates of 0.2 to 4.0 percent. Only half of the biological benefit is assigned to the preliminary proposal. Alternate analysis is based on comment by State, Federal and Tribal agencies that SAR should be 0.2%, not 4%.</li> <li>3. For Agency analysis, the range in adults affected is caused by a range of increase in pikeminnow catch of 5% to 11%, and Smolt-to-Adult survival rates of 0.2 to 4.0 percent. The Alternate viewpoint is that additional Pikeminnow funding would have an imperceptible effect on juvenile survival.</li> </ol>									

- In the comments provided for the Preliminary Proposal, many alternative offsets were proposed for reduced spill, and some data on effectiveness and costs were provided. For Columbia River stocks, many of these offsets might be reasonable and cost-effective alternatives to bypass spill. Quite possibly, some of these may be cost-effective alternatives to the offset actions proposed by the Action Agencies.
- In the Preliminary Proposal and comments to it, there was no analysis of any offset or combination of offsets that would compensate for reduced spill impacts on ESA-listed Snake River wild stocks (see first row and last two columns of Table ES-1). The Amended Proposal includes increased outflow from Brownlee Reservoir, but it is not clear that this offset would have the intended benefits, and because of water temperature effects, could actually be counterproductive.

The IEAB is unable to make an unambiguous statement about cost-effectiveness of spill reductions because 1) some of the necessary biological information has not been provided, and 2) where information is disputed, we are not qualified to judge and resolve the disputes. To obtain more definitive results, new information about some of the offsets is required, and judgements regarding the disputed information are required. The IEAB's role simply does not include such judgements.

Clearly, there is a need for a process that can include offsets such as RSWs that can only be implemented in the long run. The 2004 process for proposing spill reductions and offsets was simply too short to consider all forms of potential offsets. A long-term

process would also be better able to involve stakeholders, conduct the necessary research, resolve key issues, and recommend changes in a fully inclusive and scientific way. The Council should continue to encourage research and processes that might reduce the biological uncertainties, evaluate alternatives to spill, and identify cost-effective outcomes.

## 1. Introduction

Section §4(h)(6)(C) of the Northwest Power Act requires that the Council “will utilize, where equally effective alternative means of achieving the same sound biological objective exist, the alternative with the minimum economic cost.” Section §4(h)(10)(D)(vi) states that “in making its recommendations to BPA, the Council shall determine whether the projects employ cost-effective measures to achieve program objectives.”<sup>3</sup>

Since the energy crisis of 2000-01 and the ensuing BPA financial difficulties, increasing attention has been paid to the cost-effectiveness of fish and wildlife mitigation programs. In particular, the cost-effectiveness of spill for juvenile passage has come under increased scrutiny. The Council’s 2003 Mainstem Amendments to the Columbia River Basin Fish and Wildlife Program call for “a rigorous evaluation of the biological effectiveness and cost of spillway passage.” The stated goal of the evaluation would be to “determine if it is possible to achieve the same, or greater, levels of survival and biological benefit to migrating fish as currently achieved while reducing the amount of water spilled, thus decreasing the adverse impact on the region’s power supply.”<sup>4</sup>

Partially in response to this Council objective, the Independent Economic Analysis Board (IEAB) undertook Task 79 - Preliminary Analysis of Mainstem Program Cost Effectiveness. The IEAB’s analysis illustrated how certain alternative mainstem actions, all having the objective of improving juvenile survival, could be compared in terms of cost effectiveness. The IEAB analysis showed that there are likely to be alternative actions that are far more cost effective than summer spill in improving juvenile survival.

The work under Task 79 was highly constrained by design. The analysis only considered one scenario of reduced juvenile bypass spill, that being cessation of bypass spill at Ice Harbor in August. This scenario was judged to be relatively uncontroversial in that, in comparison to the entire Columbia basin, there are relatively few stocks in the Snake River, the out-migration of most stocks is done before August, and a large amount of data are available about passage survival. All non-spill actions considered in the preliminary analysis involved passage improvements at Snake River facilities, or passage improvements at Lower Columbia facilities that would benefit all Columbia basin stocks. No spill modifications were considered that could be detrimental to Columbia River stocks.

The purpose of this report is to investigate the potential and limitations for formal, quantitative cost effectiveness analysis (CEA) of mainstem Columbia River spill actions using currently available data. In particular, our purposes are

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<sup>3</sup> Northwest Power Act, 94 Stat. 2710, as amended by Pub. L. 104-206 §5124(h)(6)(C) §512(4)(h)(10)(D)(vi) September 30, 1996 110 Stat. 3005

<sup>4</sup> Mainstem Amendments to the Columbia River Basin Fish and Wildlife Program, NPCC Council Document 2003-11. Page 19.

- To investigate the feasibility of expanding the scope of cost-effectiveness analysis to mainstem Columbia River spill actions, including spill and offsetting actions;
- To identify specific information issues that must be resolved before defensible quantitative analysis can be provided.

The analysis is conducted using information generated by the 2004 proposals for bypass spill modification. Specifically, we review the Preliminary and Amended Proposals, background documents, comments, and the Action Agencies' response to comments. We summarize these documents, identify issues, and characterize uncertainty associated with potential cost effectiveness analysis as applied to juvenile passage in the entire Columbia system. The IEAB defines cost-effective, for purposes of this review, as achieving the same, or greater, levels of survival while increasing net financial returns (revenues minus costs) to the power system.

## **2. Summary of the Preliminary and Amended Proposals and Revised BiOP**

### ***2.1 Proposed Changes to Mainstem Bypass Spill***

The Preliminary Proposal, released March 30, 2004 by Bonneville Power Agency (BPA) and the U.S. Army Corps of Engineers (USACE; together, the Action Agencies) proposed to change bypass spill for three years (2004 to 2006, BPA, USACE, 2004a) and provide mitigation in the form of "offsets." August bypass spill at Ice Harbor, John Day, The Dalles, and Bonneville would have ceased. In July, bypass spill at the Dalles and John Day would not have changed. Proposed changes to operations at Ice Harbor and Bonneville in July are shown in Table 1.

The June 8 Amended Proposal, incorporating many comments as discussed in the next section, proposed a one-year reduction in summer spill operations and would have provided mitigation using offsets. Presumably, some spill reduction would have continued in future years and offsets for 2005 and 2006 were discussed. July bypass spill at The Dalles and John Day would not change from the BiOp. At the other two facilities, tests of alternative spill regimes would be conducted. For 2004, as compared to the Preliminary Proposal, less spill reduction was proposed for Ice Harbor and John Day. At Ice Harbor and John Day, bypass spill would cease on August 21 instead of July 31.

The Amendment to the 2004/2004-2008 Implementation Plan for the FCRPS Biological Opinion Remand (the Revised BiOp), released June 23, 2004, made relatively small changes to the Amended Proposal. At Ice Harbor and John Day, BiOp Spill would have ended on August 25 instead of August 21.

Changes in spill proposed by the Preliminary and Amended Proposals and the Revised BiOp are shown in Table 1. Offsets are discussed in Section 2.3.

<b>Table 1. Summary of Bypass Spill Under 2000 BiOp, the Preliminary Proposal, the Amended Proposal, and the Revised BiOp<sup>1</sup>.</b>								
	<b>Ice Harbor</b>				<b>John Day</b>			
	BiOp <sup>2</sup>	Preliminary Proposal	Amended Proposal	Revised BiOp	BiOp	Preliminary Proposal	Amended Proposal	Revised BiOp
July	45 kcfs day, 120% TDG night	Test <sup>3</sup> 45 kcfs to 7/15, no spill 7/16 to 7/31	Test <sup>3</sup> 45 kcfs to 7/15; BiOp 7/16-31	Test <sup>3</sup> 45 kcfs to 7/15; BiOp 7/16-31	30% of flow, 24 hours	BiOp	BiOp	BiOp
August	Same as July	No spill	BiOp through 8/21; no spill 8/22-31	BiOp through 8/25; no spill 8/26-31	Same as July	No spill	BiOp through 8/21; no spill 8/22-31	BiOp through 8/25; no spill 8/26-31

  

	<b>The Dalles</b>				<b>Bonneville</b>			
	BiOp	Preliminary Proposal	Amended Proposal	Revised BiOp	BiOp	Preliminary Proposal	Amended Proposal	Revised BiOp
July	40% of flow, 24 hours	BiOp	BiOp	BiOp	75 kcfs day, 120 TDG night	Test <sup>3</sup> 50 kcfs, 24 hrs	Test <sup>3</sup> 50 kcfs/ 24 hrs	Test <sup>3</sup> 50 kcfs/ 24 hrs
August	Same as July	No spill	No spill	No spill	Same as July	No spill	No spill	No spill

1. Preliminary Proposal is for 3 years. Amended Proposal is for 2004.

2. kcfs = thousand cubis feet per second. TDG = total dissolved gas. 120% is a percent of saturation. BiOp means NOAA Fisheries' 2000 Biological Opinion for FCRPS Operations. This is the existing, status quo condition for bypass spill.

3. The Ice Harbor test would alternate BiOp spill with 45 kcfs spill, 24 hours. The Bonneville test is the same, but with 50 kcfs instead of 45.

Source: Preliminary Proposal (2004a), Amended Proposal (2004b), and Amendment to the 2004/2004-2008 Implementation Plan, 2004c

## ***2.2 Action Agencies' Estimates of Juvenile Survival Reductions with Reduced Spill***

The Proposals recognized that, without offsets, survival of fall run Chinook salmon juveniles and upper Columbia summer chinook would be reduced by the proposal. Table 2 provides the Action Agencies' estimate of additional losses of juvenile salmon caused by reduced bypass spill in the Preliminary Proposal. Results of three different analyses are shown in Table 2: two different analyses of the preliminary proposal spill levels presented in the Amended Proposal, and the analysis in Appendix A of the Amended Proposal. The two additional analyses were provided to respond to numerous comments about the original SIMPAS analysis (see section 3.0 below). "These estimates reflect impacts of our March 30 spill curtailment proposal – which will be greater than those estimated for the lower level of spill curtailment we are now proposing." (BPA and USACE, 2004b)

The Revised BiOp presented estimates of impacts to Snake River fall run chinook salmon from reduced spill and offsets. Ranges were provided that depended on the assumed smolt-to-adult ratio (SAR). Reduced spill was expected to reduce adult escapement by 1 to 37 fish.

<b>Table 2.</b> <b>Survival Reductions Caused by Reduced Spill in Preliminary Proposal, Change from Biop Spill, for Affected Runs</b>				
	<b>Preliminary Proposal Spill Levels, Modified Analysis</b>		<b>Amended Proposal Appendix A<sup>1</sup></b>	
	<b>Number Juveniles Agency Estimate</b>	<b>Number Juveniles NOAA Approach</b>	<b>Number of Juveniles</b>	<b>Decline in % Survival</b>
<b>ESA-listed Runs</b>				
Fall Chinook Bright, Wild Snake River	143-193	143-943	900	0.50%
<b>TOTAL LISTED</b>	143-193	143-193	900	0.50%
<b>Runs Not Listed</b>				
<b>Fall Chinook, Upriver Bright</b>				
Priest Rapids & Ringold Springs Hatcheries	72,000 to 172,000	25,000 to 174,000	72,000	1.70%
Hanford Reach Natural	177,000 to 423,000	61,000 to 425,000	177,000	1.70%
Yakima River & Marion Drain	5,000 to 10,000	5,000 to 19,000	5,000	1.60%
<b>Fall Chinook, Snake River Bright</b>				
Unlisted Lyons Ferry Hatchery	1,000 to 2,000	1,000 to 8,000	1,000	0.50%
Unlisted Nez Perce & Big Canyon Hatcheries	1,000 to 1,000	300 to 2,000	1,000	0.50%
<b>Fall Chinook, Mid-Columbia Bright</b>				
Deschutes River	10,000 to 24,000	8,000 to 23,000	10,000	2.20%
Klickitat River	13,000 to 32,000	10,000 to 32,000	13,000	1.00%
Umatilla River	5,000 to 14,000	4,000 to 11,000	5,000	4.50%
Little White Salmon River	7,000 to 16,000	5,000 to 16,000	7,000	1.00%
<b>Upper Columbia Summer Chinook</b>	18,000 to 43,000	10,000 to 32,000	18,000	1.70%
<b>TOTAL UNLISTED</b>	308,100 to 737,700	130,000 to 742,000	315,000	1.60%

1. BPA and USACE. 2004e

## 2.3 Proposed Offsets and their Effects

### 2.3.1 Preliminary Proposal Offsets

The Preliminary Proposal included “offsets” proposed as compensatory increases in fish abundance or survival to match or exceed fish losses from curtailed spill. The offsets proposed were:

- Northern pikeminnow management program augmentation, and
- Hanford Reach anti-stranding operations

The augmentation of the northern pikeminnow management program would have included focused removals of this predatory fish from Bonneville, The Dalles, and John Day forebays and tailrace boat-restricted zones as well as a general increase in the reward structure of the sport-reward fishery to provide systemwide enhancement and benefit to all affected stocks.

The Hanford Reach anti-stranding operations would have obligated BPA to maintain certain outflows from the federal projects upstream of Priest Rapids Dam so that Priest Rapids could provide adequate, sustained flows to the Hanford Reach immediately downstream. BPA would deliver Grant PUD amounts of energy to mitigate generation losses that Grant would incur from operating Priest Rapids to limit hourly and daily flow fluctuations.

The total change in survival to adults from reduced bypass spill and offsets was estimated by the Action Agencies. This analysis suggests that the two offsets would not entirely compensate for losses to ESA-listed Snake River Fall Chinook caused by the Preliminary Spill Proposal, losses to non-listed Hanford Reach Fall Chinook would be fully compensated by the Hanford Reach Anti-Stranding program, but pikeminnow augmentation might not increase survival of other non-listed Chinook enough to compensate for spill reductions.

Therefore, other actions “were also under consideration as possible offsets.” These were

- Council Fish and Wildlife Program enhancement (exact actions not specified)
- Additional flow augmentation from Dworshak Reservoir
- Tribal harvest enforcement funding
- Additional or improved artificial production
- Avian predation research
- Additional water acquisitions
- Habitat protection/enhancement
- Commercial harvest reductions (non-tribal), as available
- Additional removable spillway weirs (RSWs)

The Preliminary Proposal requested “comments on which of these might be feasible and beneficial as summer spill offsets to fill the remaining gap.”

### 2.3.2. Amended Proposal Offsets

The Amended Proposal provided an expanded set of offsets, and a substantial amount of additional modeling and analysis was presented relative to the Preliminary Proposal. The Amended Proposal states that “with full consideration of the inherent risks and uncertainties involved in any analysis of summer spill impacts, we have determined that the package we are proposing will fully offset the impacts of the 2004 proposed operation on ESA-listed fish.” The actions proposed for the ESA-listed Snake River Fall Chinook are duplicated in Table 3.

Table 3. Offsets Proposed for ESA-Listed Fall Chinook in the Amended Proposal	
2004	2005-2006
Brownlee flows in July	Additional water in Lower Snake
	Fish passage technologies
	Harvest reductions

The most important offset was additional flow to be provided from storage in Idaho Power Company’s (IPC) Brownlee Reservoir on the Snake River. BPA negotiated a one-year agreement with IPC that gave BPA the option to increase water releases from Brownlee by 100,000 acre-feet in July. The one-year option agreement provided for BPA to pay IPC \$1 million for the right to call upon an additional release of 100 kaf from Brownlee Reservoir between July 7 and 28, with weekly release volumes of at least 33 kaf (a flow increase of 2.4 kcfs.) This call option had to be exercised by June 23, and when exercised, BPA was to pay IPC an additional \$3 million, for a total cost of \$4 million.

A long-term effort to accelerate installation of RSWs and other technologies would have enhanced spill reductions without adverse affects on passage. WDFW recommended expedited installation of RSWs or surface bypass at McNary and Little Goose Dams, followed by John Day and Lower Monumental Dams, and The Dalles Dam. The Action Agencies agreed that surface bypass methods have the potential to provide for lower spill volumes than the current operation, with similar or better projected survival. The Action Agencies are moving ahead on an expedited schedule to install an RSW at Ice Harbor Dam on the Snake River. The Dalles Dam is a high priority in the lower river, where the Action Agencies have been planning to install a forebay juvenile guidance device. The next Snake River priority identified is Lower Monumental Dam.

The Amended Proposal states that commercial harvest reduction could be used as a supplemental offset only if juvenile stage offsets prove to be insufficient. The Action Agencies discussed this concept with Oregon and Washington resource agencies, as well as representatives of commercial fishing interests. The proposal would address potential

impacts to juvenile fish by targeting part of the commercial fishery on hatchery fall chinook, thereby reducing harvest of naturally produced fish. The Action Agencies proposed a three-stage approach to determine the viability of a selective commercial fishery and its potential as an offset to spill reductions. Under this approach, non-tribal commercial fisheries might be able to reduce their impact on listed and non-listed naturally produced fall run fish without reducing total harvest.

The Action Agencies anticipated benefits to ESA-listed Snake River fall chinook as a result of the recent increase in the northern pikeminnow removal program; however, because of an issue regarding the level of the pikeminnow program required by the BiOp, the Amended Proposal does not claim any additional benefits for these listed fish from this action.

For non-listed fish, proposed offsets are shown in Table 4.

Table 4 Summary of Offsets for Non-listed Natural and Hatchery Fish in the Amended Proposal	
2004	Future year(s)
Brownlee flows in July	Additional water in Lower Snake
Hanford Reach anti-stranding	Hanford Reach anti-stranding
Pikeminnow control	Pikeminnow control
Lyons Ferry hatchery actions	Lyons Ferry hatchery actions
Habitat improvements for natural fish	Habitat improvements for natural fish
Hatchery actions for other fish	Hatchery actions for other fish
	Harvest reductions
	RSWs & other fish passage technologies

Most of these actions have already been discussed in Section 2.3.1.

At the suggestion of WDFW, BPA funded an action to rear 200,000 subyearling fall chinook at the Lyon's Ferry hatchery to the yearling stage. The suggested offset would have released these juveniles at a larger size in 2005. This was expected to increase the survival rate of these fish and their subsequent return rates as adults.

Habitat improvements were proposed to complement the benefits expected from hatchery offsets and also provide benefits to affected non-listed naturally spawning populations in the Deschutes, Umatilla and Okanogan river basins. The States and tribes recommended a number of specific habitat improvements to benefit listed and non-listed fish. The Action Agencies would have established a habitat fund in the amount of \$2 million in 2004 to fund habitat projects targeted at benefits to naturally spawning fish affected by summer spill reductions. Habitat enhancements would be funded beginning in 2005. Survival benefits are not quantified.

By providing additional funding for hatchery actions for specific stocks, the Amended Proposal claimed to address diversity in individual river basins. A hatchery fund in the

amount of \$2 million was to be established in 2004 to increase production at specific hatcheries, targeting stocks that are affected by the summer spill reductions. BPA funds would be allocated first and primarily to fish affected by the summer spill reductions (i.e., fall and summer chinook salmon) in subbasins not benefited by other offsets. Survival benefits were not quantified.

The estimated net effect of reduced spill and offsets on non-listed stocks is shown in Table 5.

Table 5. Estimated Net Effect of Reduced Spill and Offsets on Non-listed Stocks in the Amended Proposal (Total juvenile losses)	
Action	Estimated Impact <sup>1</sup>
Proposed summer spill operation	-130,000 to -742,000
Hanford Reach anti-stranding	+1,094,870 to +1,287,981
Pikeminnow control	+39,252 to +84,549
Lyons Ferry actions	+200,000
Total Offsets	+1,334,122 to +1,572,530
1. Impacts estimated using "NOAA Parameters," as described in the text. Estimated total run size for non-listed fall chinook is 50 million juveniles (smolts)	

The NOAA survival analysis (USDC, 2004b) for Snake River fall run chinook juveniles showed that increased Brownlee flows would increase survival by 730 to 950 fish. Reduced spill would reduce survival by 140 to 940 fish, so net survival would increase by 10 to 590 fish, depending on conditions.

The Amended Proposal Appendix C (BPA and USACE 2004d) showed estimates of benefits of northern Pikeminnow Management Program Augmentation by stock. Table 6 shows results. For every stock, estimated survival increases from pikeminnow program augmentation are less than the survival reductions in Table 2.

### 2.3.2. Revised BiOp Offsets

The Revised BiOp included increased Brownlee releases of 100,000 AF in July to mitigate for impacts to Snake River fall chinook. For Snake River ESA-listed fall chinook, this offset was deemed enough to mitigate for the impacts from reduced spill. Increased control of northern pikeminnow was proposed, but because of an issue involving the level of the pikeminnow program required by the BiOp, survival benefits of the pikeminnow program were not counted. The Action Agencies' analysis showed that escapement increases from Brownlee flow augmentation alone would be greater than or equal to the escapement reduction from reduced spill.

<b>Table 6. Change in Survival of Individual Stocks from Northern Pikeminnow Management Program Augmentation</b>				
	<b>Percent Change in Survival</b>		<b>Change in Smolts Surviving to Bonneville</b>	
	<b>5% Exp. Rate Increase</b>	<b>11% Exp. Rate Increase</b>	<b>5% Exp. Rate Increase</b>	<b>11% Exp. Rate Increase</b>
<b>Increase in Pikeminnow exploitation rate&gt;&gt;</b>				
<b>ESA-listed Runs</b>				
Fall Chinook Bright, Wild Snake River	0.16%	0.36%	308	678
<b>Runs Not Listed</b>				
<b>Fall Chinook, Upriver Bright</b>				
Priest Rapids and Ringold Springs Hatcheries	0.18%	0.40%	7,613	16,338
Hanford Reach Natural	0.18%	0.40%	18,659	40,045
Yakima River and Marion Drain	0.18%	0.40%	527	1,132
<b>Fall Chinook, Snake River Bright</b>				
Lyons Ferry Hatchery	0.16%	0.36%	381	840
Nez Perce Tribal Hatchery	0.16%	0.36%	97	214
Oxbow and Umatilla Hatchery Releases at Hells Canyon	0.16%	0.36%	105	231
<b>Fall Chinook, Mid-Columbia Bright</b>				
Deschutes River	0.33%	0.72%	1,355	2,955
Klickitat River	0.33%	0.72%	4,400	9,598
Umatilla River	0.33%	0.72%	380	829
Little White Salmon River	0.33%	0.72%	2,200	4,799
<b>Upper Columbia Summer Chinook <sup>1</sup></b>	0.18%	0.40%	3,843	8,246
1. Includes Dryden Ponds, Charlton Pond, Turtle Rock and Similkameen				
<b>Source: BPA and USACE 2004d</b>				

## **2.4 Increase in Power Revenues and Cost of Offsets**

Increases in power revenues and costs of offsets for the Preliminary and Amended Proposals are shown in Table 7 below. For the Preliminary Proposal, gross power revenues would have been increased by an average of \$47 million per year, or \$141 million over three years. After deducting the incremental costs of “offsets”, the Preliminary Proposal was expected to provide a net revenue of about \$40 million per year for three years. This net revenue included additional expenditure of \$10 million for the fish and wildlife program over 3 years, plus \$6 to \$15 million of other, unspecified offsets.

<b>Table 7. Revenue from Reduced Bypass Spill, Annual Average Costs of Offsets, and Net Revenue, Million Dollars per Year</b>		
Action	Preliminary Proposal (Million \$/Yr over 3 years)	Amended Proposal (Million \$ in 2004 only)
Revenue from Additional Generation from Reduced Bypass Spill	\$47	\$33-\$44
Enhanced Pikeminnow Program	-\$1 to -\$3	-\$1.5
Hanford Reach Anti-Stranding	-\$0.1	-\$0.1
Council Fish and Wildlife Program Enhancement	-\$3.33	-\$3.3
Placeholder for Other Offsets	-\$2 to -\$5	
Brownlee flows in July		-\$4.0
Lyons Ferry hatchery actions		-\$0.1
Habitat improvements		-\$2.0
Hatchery production increases		-\$2.0
Total Cost of Offsets	-\$6.4 to -\$11.4	-\$13.0
Net Revenue	\$40.6 to \$35.6	\$20 to \$31

### **3.0 Information from Comments Received on the Preliminary Proposal**

This section discusses some of the quantitative information provided in comments on the preliminary proposal. The Action Agencies received 246 comments consisting of hundreds of pages regarding the Preliminary Proposal (BPA, USACE, 2004b). In general, commenters had strong opinions about the merits of the proposal. Power and water users, and representatives of local industries were overwhelmingly in favor of the proposal. In general, these groups felt that spill does not improve survival enough to justify its costs, and the analysis of survival improvements from the offsets was conservative.

Tribal interests, environmental groups and fish and wildlife agencies were overwhelmingly opposed to the Preliminary Proposal. These groups generally felt that the survival losses from spill reductions were understated and the survival increases from offsets were highly uncertain or overstated. A variety of comments related to legal and baseline issues are not discussed here in detail. However, it should be noted that these stakeholders felt that the offsets should not be counted entirely as mitigation for reduced spill because part of the expense would restore the level of effort to previous levels (pikeminnow augmentation) or the action was already required under the status quo (Hanford Reach).

The sections below summarize comments that provide or suggest quantitative information that could contribute to a range of cost effectiveness analyses.

The information included in this section is analyzed because it is different from or adds to the Action Agencies' information. Information that is redundant to that of the Action Agencies is not included, as it is already represented in that analysis.

### **3.1 Juvenile Survival Reductions from Reduced Bypass Spill**

The Confederated Tribes of the Colville Indian Reservation (Colville Tribes) found that

“1) the analysis conducted by the federal government and BPA fails to sufficiently account for impacts to upper Columbia summer/fall Chinook. . . the upper Columbia summer/fall Chinook sub-yearlings are the last fish to migrate through the federal hydropower system each summer, and thus, are subject to the highest impacts. . . predation may increase with elimination or reduction of spill as spill increases velocity in tailraces that disperses predators away from bypass outfalls and below turbines where smolts are most vulnerable to predation.”<sup>5</sup>

CRITFC had the following critiques of BPA's SIMPAS application.

- Failure to include a life-history approach
- Lack of an integrated ecosystem and cumulative effects approach. For example, water quality, disease, and flows are not considered in the analysis.
- Failure to evaluate adult fallback loss (upstream-migrating adults spilled over dams) from spill curtailment. CRITFC analysis using fallback rates in 2001 operations under no spill indicates that 11,852 adults could be lost under the federal spill curtailment proposal. (The IEAB did not find the information needed to back up this estimate in CRITFC's Attachment E).
- Failure to consider selection against critical stock genetic make-up and biodiversity. The later migrating Hanford Reach juvenile fall chinook contribute disproportionately to older, larger age classes.
- The BPA analysis predicts greater smolt-to-adult survival from multiple screen bypass, when empirical information indicates the opposite.
- The BPA analysis shows a positive response to transportation when empirical evidence indicates that many more adults return from juvenile salmon that are left in-river than are transported.
- The BPA analysis assumes static and unrealistic operational conditions throughout all of the proposed spill curtailment period. The BPA analysis only used average year flows.<sup>6</sup>

CRITFC provided an alternative SIMPAS analysis. Paraphrasing, the modifications to SIMPAS relative to the Action Agencies' analysis are:

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<sup>5</sup> Collville Tribes page 2

<sup>6</sup> CRITFC page 4 to 5

At Bonneville, operation of the sluiceway without 50 kcfs spill is too risky to implement. We used the TDA summer sluiceway survival of 95% when spill was not provided at Bonneville as opposed to 98% used by BPA regardless of spill level. At McNary, BPA appears to have used a 97% survival estimate. 2003 data indicated that survival from both radio tagged fish and Pit-Tag fish was 89-90%. BPA assumed a nighttime spill cap of 125 kcfs while we used a value of 140 kcfs. BPA used a 1% change in pool survival at Ice Harbor and John Day and 0.5% at The Dalles and Bonneville. We used both the BPA pool mortality values and a 4% increase in pool mortality at the same four projects to better understand the range of impacts that could occur.<sup>7</sup>

Under these assumptions, survival from Ice Harbor to Bonneville under the BiOp was estimated to be 34.6%. Survival under the preliminary proposal was estimated to be 24.6% or 27.8%, depending on whether the 4% or 1% pool mortality is used, respectively. In addition “BPA used an average value for run timing; we employed a range to better estimate the impacts to an early or late migration. A range of 25% to 8% of the Snake River migrants would still be above Bonneville and below McNary after August 1.”<sup>8</sup> Using an SAR of 0.2, CRITFC estimated the range of impacts on Snake River adult fish as shown in Table 8.

Table 8. CRITFC Analysis of Potential Impact of Reduced Spill on Snake River Fall Chinook				
	Number of Adults		Percent of the Run	
	First percentage rate in parentheses (4% or 1%) is the increase in pool mortality with spill reduction. The second rate (25% or 8%) is the share of Snake River migrants still above Bonneville and below McNary after August 1			
	High Impact (4% and 25%)	Low Impact (1% and 8%)	High Impact (4% and 25%)	Low Impact (1% and 8%)
Total ESU	720	114	7.3%	1.2%
Total ESA	180	28	10.7%	1.9%

The CRITFC analysis indicated a much higher impact to Snake River ESA-listed stocks than the Action Agencies analysis, which showed a range of impacts of 2 to 20 adults. The impacts to ESA-listed fish in Table 8 are about 10 times greater than the Agency’s estimates. The CRITFC comments go on to say that “If we applied a SAR of 0.1 for all in river fish and used a delayed mortality of 0.2 and an SAR of 0.015 for transported fish we could expect a reduction in basin adult fall chinook of 118,171 to 17,725.”<sup>9</sup>

The State, Federal and Tribal Agencies (Joint Technical Staff 2004) found that “the best available biological data indicate that the elimination of summer spill increases the risk to the affected salmon, steelhead, sturgeon and lamprey populations, and the offset

<sup>7</sup> CRITFC, page 6

<sup>8</sup> CRITFC, page 6 to 7

<sup>9</sup> CRITFC, page 8

measures in the Proposal are insufficient for mitigating the biological impacts of reductions in spill. The reliance on transportation of fall chinook migrants . . . needs to be reconsidered. Analysis of the available data on PIT tagged transported and in-river migrating fall chinook indicates that transportation is not benefiting fall chinook survival to adult. The impact estimates using SIMPAS ignore uncertainty in passage parameters, impacts on adults that fall back over dams, environmental conditions, and biological demographics.”<sup>10</sup>

### **3.2 Juvenile Survival Improvements from Offsets**

#### **3.2.1 Northern pikeminnow management program augmentation**

The Colville tribes stated that “the proposed offset measures are weak, poorly developed, and are deficient in addressing the true impact . . . An increase of 1-2% in the northern pikeminnow “Heavy Up” action is not substantial enough to realize any detectable reductions in predation on upper Columbia stocks”.<sup>11</sup>

#### **3.2.2 Hanford reach anti-stranding operations**

The State, Federal and Tribal Agencies (Joint Technical Staff 2004) found that benefits of the current anti-stranding program were overestimated. Given the demographic parameters on egg-to-fry and fry-to-smolt survival rates, an SAR = 0.2% resulted in a predicted number of spawning adults similar to empirical observations. However, using an SAR = 4.0% results in an estimated average of 862,438 spawning adults, an 18-fold increase over the empirical average. The Preliminary Proposal uses a 4% SAR in its estimate of anti-stranding benefits. If the true SAR is 0.2%, then the survival benefit of anti-stranding would be overstated by 18-fold.<sup>12</sup>

### **3.3 Alternative Offsets Proposed**

Washington Department of Fish and Game (WDFG) provided a detailed set of alternative offsets which they “believe have a realistic probability of providing survival benefits commensurate with the loss in survival due to reduction of spill.”<sup>13</sup> These proposed offsets are summarized below. WDFG provided some quantitative information about expected survival increases. Tables 9 and 10 provide a summary.

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<sup>10</sup> Joint Technical Staff Page 1 to 3

<sup>11</sup> Colville Tribes page 2 and 4

<sup>12</sup> Joint Technical Staff page 4

<sup>13</sup> WDFG Page 1

<b>Table 9. WDFW proposed package to offset effects of potential reduction of summer spill at several Columbia River federal dams</b>		
<b>Offset</b>	<b>Estimated Cost, Million \$</b>	<b>Description</b>
Overwinter Acclimation	\$1.5	Retrofit two existing acclimation ponds (Carlton and Dryden)
Ringold Hatchery Enhancement	\$7.65	Modification of current trap facility, new incubation building, 8 additional concrete raceways, new abatement pond, 20 standard concrete raceways, fix river pump system, replace outlet structure, rebuild main intake box, new feed storage building, other mods.
Chandler Bypass Reach	Unknown	Terminate (or subordinate to a higher instream flow) hydroelectric power production at the Chandler Power Plant (CPP). Increase bypass flow from 600 to 1,400 cfs mid-October to April
Dole-Beebe Acclimation Pond	\$1.0	Provide a half-acre pond, or several smaller ponds, plus pump and additional water rights on the Dole-Beebe property near Chelan, WA.
Northern Pikeminnow Removal	\$0.504	Restore registration stations to 2003 level. "Heavy-Up" Northern Pikeminnow Sport Reward Fishery. More dam angling and site-specific removal. Contract out commercial fishers and purchase gear.
Snake River flow/temperature supplementation	\$4/yr just for Brownlee	<b>Draft Dworshak to 1500' elevation by Sep. 15. Provide 100kaf additional water in July from Brownlee</b>
Hanford Reach flow stabilization	Unknown	Provide more seasonal sideboards on flow fluctuations through the Hanford Reach.
Expedited installation of RSWs/surface bypass	Unknown	McNary Dam and Little Goose Dam (2006), John Day Dam and Lower Monumental (2007), and Dalles Dam (2008).
Big Valley Ranch Wildlife Area well conversion and side channel enhancement	\$0.306	Sacrifice the Rockview screen and irrigation ditch, with restoration of this to historic side channel and riparian habitat.
Steigerwald Lake/Gibbons Creek Restoration	\$3.463	Reconnect the former Steigerwald Lake bed and wetlands to the Columbia R., and restore unobstructed fish passage into Gibbons Creek.

<b>Offset</b>	<b>Runs Benefitted</b>	<b>Quantitative Information</b>
Overwinter Acclimation	Upper Columbia River summer Chinook	CWT analysis of the 1994 and 1995 brood Wenatchee River summer chinook indicated a 160% and 266% increase in smolt-to-adult (SAR) survival for fish over wintered on river water in the Wenatchee and Similkameen versus well water at a central hatchery facility (Eastbank Fish Hatchery). A similar study on Methow River summer chinook resulted in an 83% increase in SAR.
Ringold Hatchery Enhancement	Upriver Bright (URB) fall Chinook smolts, spring chinook smolts summer steelhead	500,000 spring Chinook smolts, thus returning the production to 1 million. Other runs not quantified
Chandler Bypass Reach	Yakima River fall chinook.	Current production in the bypass reach is 100 to 200 redds. Redd surveys will enumerate total redds formed and estimate fry production to quantify project prior to and subsequent to implementation.
Dole-Beebe Acclimation Pond	Upper Columbia River summer chinoo	Improve SAR from current, which is about 0.2%
Northern Pikeminnow Removal	All anadromous salmonids	Slight increase in adult returns on the order of 0.5%-1.0%.
Snake River flow/temperature supplementation	Snake River fall Chinook	Should correlate into a 1% increase in survival for juveniles
Hanford Reach flow stabilization	Hanford Reach fall chinook	should substantially improve the juvenile rearing survival for fall Chinook within the Hanford Reach.
Expedited installation of RSWs/surface bypass	All anadromous species	Over a period of years, benefits could conceivably equal or exceed spill reduction for all species
Big Valley Ranch Wildlife Area well conversion and side channel enhancement	Methow River summer steelhead (ESA listed), spring Chinook (ESA listed) and to a lesser degree summer Chinook	Probability of success is high
Steigerwald Lake/Gibbons Creek Restoration	Chinook salmon (rearing), steelhead (spawning, rearing), coho salmon (spawning, rearing) and cutthroat trout	This offset mitigation has a high certainty of success.

The total cost of these offsets for 3 years, just for those estimated, is \$26.4 million, about the same as the cost of offsets in the Preliminary Proposal (\$19.2 to \$34.2 million; see Table 7), but less than the expected revenue from spill reductions (about \$140 million). Annual costs for some of the other offsets, especially those that require large volumes of water, might be relatively large. For the Chandler Bypass, 800 cfs for 6 months would require almost 290,000 AF of water. If this water is assumed to cost \$50 per AF the annual cost would be \$14.5 million. The additional cost of the RSWs is not clear, but they would also have the added benefit of being long-lived structures.

The Colville Tribes proposed that “the Action Agencies fund the following actions should you decide to proceed with your proposal for reduced spill.”<sup>14</sup> These actions are shown in Table 11 below. The cost of these offsets would be \$3.64 million over three years, a small fraction of the expected revenue from spill reductions (about \$140 million). We might infer that the Colvilles believe these actions would be sufficient to compensate them for impacts to upriver stocks from Table 2 which they utilize.

<b>Offset</b>	<b>Total Cost over 3 years</b>	<b>Description</b>
Construct the Omak Acclimation Pond.	\$665,000	Develop a new summer/fall Chinook acclimation pond on the Okanogan River near the city of Omak
Modify the Tonasket Acclimation Pond.	\$250,000	This acclimation pond would disperse existing summer/fall Chinook production to make greater use of natural spawning habitat and improve production from over escaped spawning habitat in the upper Okanogan basin.
Operate and Maintain the Bonaparte, Omak and Tonasket Acclimation Ponds.	\$675,000	These acclimation ponds would disperse existing summer/fall Chinook production to make greater use of natural spawning habitat and improve production from over escaped spawning habitat in the upper Okanogan basin.
Purchase and operate a “gravel gurdy”	\$129,000	The gravel gurdy would be operated and evaluated in selected river reaches to remove sediments from spawning gravels and evaluated
Initiate a Habitat Protection and Improvement Program for the Okanogan River.	\$950,000	A phased and programmatic habitat protection and improvement effort in the Okanogan River.
Initiate an Enhanced Tribal Enforcement Program. \$825,000	\$825,000	Target the mainstem Columbia River above and below Chief Joseph Dam, and the Okanogan River mainstem.
Evaluate Effects of Summer Spill Experiment	\$150,000	Evaluate potential effects of the reduced spill on the Colville Tribes’ trust resources by PIT tagging natural-origin summer/fall Chinook emigrating from the Okanogan River and experimentation

The Pacific Northwest Generator’s Cooperative “supports offsets that maintain the federal agencies stated commitment to cost effective mitigation. Because we are not convinced that additional offsets are needed, spending \$2 - \$5 million on them per the proposal seems unwarranted. However, if the federal agencies feel compelled to select additional offsets they should be based on their ability to achieve the greatest biological benefit for the least cost. The following are additional offsets that could provide further mitigation:”<sup>15</sup>

The additional offsets favored by PNGC were:

- Commercial harvest reductions

<sup>14</sup> Colville Tribes page 5

<sup>15</sup> PNGC page 3

- Avian predation research; and
- Smallmouth bass management

## **4.0 Information from Comments Received on the Amended Proposal**

A review of comments on the Amended proposal found little additional information that could be useful for cost-effectiveness analysis. Some commenters (such as WDFW) found that the amended proposal addressed their concerns about the preliminary proposal. Others found that the offsets in the amended proposal do not compensate for the effects of reduced spill.

Potentially, the increased releases from Brownlee could be counter-productive (Coutant, 2004). Dworshak reservoir is operated in summer to release cold water to compensate for the warm Snake River flows. In this view, increasing the warm flows from Brownlee would increase mortality, rather than enhance survival. The IEAB has not yet obtained an evaluation from a range of experts of the merits of this opinion.

## **5.0 IEAB Analysis**

The Action Agencies' analysis suggested that the Preliminary Proposal represents a cost-effective change for all species taken as a group, for all non-listed species taken as a group, and for the Hanford Reach natural stock. For the ESA-listed Snake River Fall Chinook, and for other non-listed runs (not Hanford Reach), numbers of fish were not shown to be increased or even maintained, so it is not clear that the Preliminary Proposal would be cost-effective.

For the Amended Proposal, the Action Agencies' analysis indicated a cost-effective change for all species taken as a group, for all non-listed species taken as a group, for the ESA-listed Snake River fall chinook, for the Hanford Reach natural stock, and for the Lyons Ferry hatchery stock. However, analysis was not provided to show that the aggregate population of eight non-listed stocks would be increased, or that numbers of each of the eight stocks would be increased. These eight stocks are all of the Columbia River stocks except for the Hanford Reach natural.

Brownlee flows would have an appreciable benefit only for Snake River stocks, Hanford Reach anti-stranding would benefit only that stock, and Lyons Ferry hatchery actions would benefit only that stock, so the only quantified benefit for all other stocks is from pikeminnow augmentation. For every stock, estimated survival increases from pikeminnow program augmentation (Table 6) are less than the survival reductions from reduced bypass spill in Table 2. Benefits of hatchery and habitat actions are not quantified. Therefore, based only on an analysis provided by the Action Agencies, we cannot conclude that the Amended Proposal is cost-effective for most of the affected

Columbia River stocks. More quantitative analysis of offsets is needed to address survival of most of the Columbia River stocks.

Section 3.3 shows a number of offsets proposed by commenters that could be used for the non-listed Columbia River stocks. Also, some offsets considered by the Action Agencies in the Preliminary Proposal were not included in the Amended Proposal for 2004 because they could not be developed in time. Additional quantitative analysis could be focused on the ability of these offsets to provide survival benefits for the Columbia River stocks.

Removable spillway wiers (RSWs) could not be included in the offsets proposed for 2004 because of the implementation time required. Also, it is not clear that RSWs will increase juvenile survival. Ongoing studies of the RSW at Lower Granite dam may clarify whether or not survival can be increased. If not, then RSWs may become a revenue mechanism viewed as being survival neutral, or increased revenues might be used as funding for other types of fish and wildlife actions.

## **6.0 Where to from Here**

The IEAB is unable to make a conclusive statement about cost-effectiveness of spill reductions for two reasons. First, some of the necessary biological information has not been provided. For some stocks and some offsets, the offsets are not clearly defined or quantitative estimates of effectiveness have not been proposed. Second, most of the quantitative information that has been provided is disputed. For our purposes, the range of credible biological information needs to be narrowed. To obtain more definitive results, judgements regarding the biological arguments are required, but the IEAB's role simply does not include such judgements. If the IEAB was directed to use a more narrow range of biological parameters, then a less ambiguous statement regarding cost-effectiveness of mainstem spill actions might be possible.

There is a need for a process that can consider offsets that can only be implemented in the long run. Some of the best potential offsets: RSWs, for example, could not be evaluated within the short time frame of the spill reduction proposal. The 2004 process for proposing spill reductions and offsets was simply too short to consider all forms of potential offsets. A long-term process would also be better able to involve stakeholders, conduct the necessary research, resolve key issues, and recommend changes in a fully inclusive and scientific way.

The Council should continue to encourage research and processes that might reduce the biological uncertainties, evaluate alternatives to spill, and identify cost-effective outcomes. The 2004 mainstem spill proposals and the comments received clearly show what the issues are, and they suggest the types of studies needed to resolve them.

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