The Costs of Keeping the Four Lower Snake River Dams: A Reevaluation of the Lower Snake River Feasibility Report

Updated 28 July 2015

Executive Summary

In its 2002 Lower Snake River Juvenile Salmon Migration Feasibility Report, the Walla Walla District of the U.S. Army Corps of Engineers vastly understated the costs of maintaining and operating four dams on the lower Snake River in eastern Washington State. The report concluded that modifications to these dams would result in the recovery of 13 species of threatened and endangered salmon and steelhead, and that the economic benefits of keeping the four Lower Snake River dams in place far exceeded those of a free flowing river.

An honest cost analysis turns the conclusion of the Lower Snake River Feasibility Report on its head. The belief that we cannot afford to breach the lower Snake River dams is false. The opposite is true. Neither the American public, nor the U.S. Army Corps of Engineers, can afford to keep the four lower Snake River dams in place.

The cost and economic analysis that led to the Walla Walla District's 2002 decision to keep the dams is seriously flawed. A professional reevaluation of the 2002 report—correcting earlier cost projections, verifying them with now available actual costs and addressing omissions, errors, miscalculations and faulty assumptions—demonstrates the Walla Walla District understated the true cost of keeping the dams in place by a staggering $140 million on an average annual basis. A reevaluation of the claimed economic benefits of keeping the dams in place will be addressed in a separate report.

Civil Engineer Jim Waddell recently completed the reevaluation presented here. Waddell retired from the U. S. Army Corps of Engineers in 2013 after 35 years with the agency and was the Deputy District Engineer for Programs in the Walla Walla District when the Lower Snake River Feasibility Report was finalized.

The Walla Walla District's faulty analysis and unfounded conclusions in the Lower Snake River Feasibility Report have cost the American public hundreds of millions, and perhaps billions, of dollars in actual expenditures and lost benefits.

Table of Contents

This report was prepared by Jim Waddell and Linwood Laughy based on Waddell's 2014 reevaluation of the 2002 Lower Snake River Feasibility Report. The report will be updated as new information becomes available.

> GAO's recent reviews of four Corps civil works projects and actions found that the planning studies conducted by the Corps to support these activities were fraught with errors, mistakes, and miscalculations, and used invalid assumptions and outdated data. Generally, GAO found that the Corps' studies understated costs and overstated benefits, and therefore did not provide a reasonable basis for decision-making.[1]
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> U.S. General Accounting Office report to the
> United States Congress, 2006

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Introduction

During the 1990s, the National Marine Fisheries Service listed 13 stocks of Snake River sockeye salmon, spring/summer Chinook, fall Chinook and steelhead as threatened or endangered under the Endangered Species Act (ESA). These listings triggered a $32 million, six-year study by the U.S. Army Corps of Engineers (USACE) of the four Lower Snake River dams. The Snake River Project had driven iconic fish and marine mammal species to near extinction, wreaked economic havoc on coastal and inland communities, deprived millions of acres of forest of needed nutrients, and violated treaties protected by the U.S. Constitution. In 2002, the Walla Walla District (NWW) of the USACE released its final report designed to address the question of whether the four dams should be breached. Called the Lower Snake River Juvenile Salmon Migration Feasibility Report (LSRFR), the report considered four alternatives for addressing legally-required salmon and steelhead recovery.

1. Existing Conditions—This "no action" alternative included operating the four lower Snake River dams as they were currently being operated, including in-place adult and juvenile fish passage operations and a limited number of previously planned improvements to fish passage.
2. Maximum Transport of Juvenile Salmon— This alternative focused on maximizing the barging and/or trucking of smolts downriver past Lower Granite, Little Goose and Lower Monumental dams, and bypassing Ice Harbor through its spillway.
3. Major System Improvements—This alternative included installing bypass collectors, removable spillway weirs, submerged bar screens, fish guidance structures and other infrastructure improvements intended to divert juvenile salmon away from turbines. NWW indicated the implementation of this alternative could be combined with Alternative 2 above in what they described as "an adaptive migration strategy."
4. Dam Breaching— This approach involved removing the earthen portion of the four dams, creating a river channel around the powerhouses and navigation locks and thus returning the Snake River to near its natural flow.

The biological analysis of the four alternatives determined that Alternative 4, breaching, presented the highest probability of recovering endangered and threatened Snake River salmon and steelhead. However, NWW concluded the dams could be successfully modified to improve fish passage and that the net economic benefits of keeping the dams in place (Alterna-

tive 3) greatly exceeded those of breaching (Alternative 4). The decision not to breach, but to commit to Alternative 3, rested squarely on NWW's cost-benefit analysis within the LSRFR.

The Environmental Protection Agency made critical comments regarding the draft LSRFR Environmental Impact Statement, noting missing information, the selective use of data and a failure to clarify assumptions.[2] Many organizations and individuals also raised serious issues with the EIS, including private economists. During the final stages of plan preparation, a decision brief team of NWW employees tasked with developing an argument for breaching based solely on the data in the developing report pointed out serious flaws in some of the study's assumptions and procedures. This team's written observations included the following statements:

- The economics involved with calculating implementation costs ignore the fact that for alternatives 1, 2 & 3, construction and acquisition costs will occur throughout the 100 year life cycle. The current analysis assumes that all improvement costs for fish facilities will occur between 2001 and 2010.(FR/EIS Table 5.15, Appendix I Table 3.8-2, Appendix E pages 13, 15, & 17, Appendix D pg D2-30). Therefore, the costs for the non-breach alternatives appear to be underestimated.
- The dam breach alternative #4 is shown in Appendices D & E as alt. A-3a, with the estimated timeline to perform breaching as 2001-2010. After breaching (2010-2015) various costs for O & M will continue to occur for AFEP, mitigation and monitoring costs, O & M for recreation sites, and minor associated repairs. Together with costs to operate during the breaching period these costs fairly well depict the cost of implementing and monitoring breaching in the overall period 2001-2015.
- The three non-breach alternatives are also shown to have significant implementation costs in the period from 2000-2007 (Table 3.8-2, Appendix I). However, a logic error appears in the overall comparison of the 4 alternatives over the 105 year period 2001-2105. After the initial construction period to implement the 3 non-breach alternatives, the out-year costs for rehab and replacement of fish improvements are not considered. Secondly, the list of future upgrades in this Table list only those items that are known to be needed today. There does not appear to be any allowance for items of work in the out-years that have not yet been developed for fish passage improvement. Thirdly, the costs for the listed items are in many cases not realistic. Considering that many of the proposed new work items have now been estimated and in some cases implemented since this Table was prepared, numbers should be revised. This list needs to be updated to include those items that will require significant out-year replacement expenditures as long as cost allowances are not duplicated elsewhere. Also, these non-breach alternatives do not have estimates (Appendix E) that track with the economics section (App I). Basically many if not all of the items listed in the subject Table will be replaced or significantly rehabbed on a 20 to 25 year replacement cycle. All of these costs would need to be brought forward to the base year 2005, but the amounts could be significant. For example, considering Alt. #3 as being the most probable option, this logic should add cost spikes of $100-150M near out-years 25, 50, and 75. This does not include costs for items that are unknown today.
- Due to the fact that breaching will have considerably less out-year O & M costs than the non-breach alternatives, these cost savings in the FR/EIS report are considered avoided costs. However, the determination of avoided costs (see Appendix I Para. 3.8.5) does not adequately consider all of the future maintenance and repair items if the

dams are left in place. Basically, the determination of avoided cost savings under breaching has been underestimated.

- The Corps only includes the direct costs of dam operations and maintenance in its cost analysis. It does not include: (a) the costs of the [fish] transportation and other mitigation programs. Estimates of these costs range from $194.4M to $230M a year. (b) Subsidized electric power production, river transport, and irrigation that are paid by taxpayers and ratepayers. When these subsidies are accounted for, the benefits of these dams actually amount to a net loss of $114M annually. (c) Electric power generated by these dams is not cost competitive when all the costs, such as necessary mitigation costs, are included in the total.

After the above comments were submitted, NWW leadership responded by saying that too much additional time and money would be required to create any substantial changes in the draft report. Thus the final report includes numerous statements such as "If dam breaching is recommended and authorized for further study, review of this issue and possible revision of the transportation model should be undertaken."[3] The latter statement or a similar one appears eight times just in the section on waterborne transportation in the economics appendix.[4]

Many of the projections and data contained in the LSRFR are nearly 15 years old, making it possible to reevaluate the report's findings and conclusions based on actual numbers rather than NWW's predictions of future costs. NWW's annual reports to the Secretary of the Army on Civil Works, documents prepared by the Bonneville Power Administration (BPA), the Army Corps' Waterborne Commerce Statistical Center and other official agency reports all contain data that point to the true cost of keeping the lower Snake River dams in place. A reevaluatin of the LSRFR can also address the issues raised by NWW's internal decision brief team.

This document provides a reevaluation of the costs of keeping the four Lower Snake River dams in place over the remaining 86 years of the LSRFR project, as well as over a 100-year time period with 2015 as a baseline. Using NWW and BPA reports, the reevaluation first corrects the assumptions and cost estimates used in the LSRFR and verifies these corrections based on actual costs over the past 15 years. These corrected costs are then projected over the remaining life of the project using carefully-chosen escalation rates and the same methodology the Walla Walla District used in 2002.

This reevaluation addresses six major cost categories:

1. Improving Fish Passage through "system improvements," including construction and major rehabilitation of related equipment.
2. Operations and Maintenance (O&M) costs, including minor repairs to the four dams and O & M costs of the system improvements.
3. Turbine Rehabilitation costs over the remaining life of the project.
4. Lower Snake River Compensation Plan costs.
5. Power Services, which are O & M and minor repair costs related specifically to power generation.
6. Navigation and Flow Conveyance Dredging costs.

Category 1: Improving Fish Passage (System Improvement Costs)

The selected alternative to breaching the dams involved making major structural modifications to each dam to lower smolt mortality as the juvenile salmon and steelhead traveled to the ocean. The list of system improvements was a long one. Gantry crane modifications at Lower Monumental Dam appears a bargain at $630,000 compared to degasification improvements at three dams for $33.7 million, or surface bypass collectors and behavioral guidance structures for $183.8 million.[5]

Actual costs for system improvements over the past 15 years can be found in NWW's, annual reports to the Secretary of the Army for Civil Works under the heading "Columbia River Fish Mitigation Program" (CRFMP). These reports combine the costs for all five dams in the Walla Walla District, including McNary dam on the Columbia River. To eliminate the system improvement costs for McNary in this reanalysis, total system improvement costs were reduced by 20%.

The NWW decision brief team noted that the LSRFR ignored the fact that construction and acquisition costs will occur throughout the 100-year project life cycle. The LSRFR identified a 25-year replacement schedule for system improvements but failed to include any associated costs.[6] Based on a review of the Corps' Construction Cost Indexes and the RS Means data source for cost estimating, this reanalysis applies a 3% escalation factor to estimate the future cost of replacing the system improvement/fish mitigation hardware. These costs were then converted to their present value using a 6.88% discount rate, the same federal discount rate used in the LSRFR.[7] As noted in Attachment 1 to this document, Snake River Dam Costs, with a base year of 2001, the calculated average annual cost for system improvements is $29.7 million.

Category 2: Operations and Maintenance Costs, including minor repairs to the four dams and O & M costs for system improvements

Walla Walla District's annual reports to the Secretary of the Army include, in a single category, repair costs for each dam and the costs for improving fish passage. Also included are the costs for the Anadromous Fish Evaluation Program (AFEP). Appendix E of the LSRFR estimated these costs at $37 million for 2013,[8] which is close to the average repair and AFEP costs reported in the annual reports over the previous 12 years . The present reevaluation uses actual costs for years 1-12 and the 2013 cost projected in Appendix E of the LSRFR for cost calculations in this category.

The tables in Appendix E of the LSRFR show that future O & M costs are not escalated.[9] Corps economists at the time argued that these costs did not need to be calculated for each year across the 100-year study period because all three alternatives that included keeping the dams in place had nearly the same O & M, Repair and Rehabilitation costs over time. Although this methodology may work when comparing the non-breach alternatives, it is not appropriate to ignore these costs when comparing a non-breach alternative with breaching. NWW's breaching decision brief team pointed out that breaching would have few O & M, R, R out-year costs.[10]

This LSRFR reevaluation again used a 3% escalation factor and the 6.88% federal discount rate to arrive at O & M and minor repair costs, including AFEP. Total O & M cost on an average annual basis is $50.2 million as noted in Attachment 1, O & M.

Category 3: Turbine Rehabilitation Costs

The cost of rehabilitating the 24 turbines that generate hydropower on the Lower Snake River is the third major cost of keeping the lower Snake River dams in place. BPA pays the cost of turbine rehabilitation, which means this cost does not appear in NWW's annual Report on Civil Works Activities. Appendix E in the LSRFR notes that the Lower Snake River dams' turbines have a life expectancy of 35-45 years[11] and subsequently require at least two rehabs during the 100-year life of the project. After 70 to 90 years, the Corps would theoretically choose either to complete a third turbine rehabilitation or decommission or breach individual dams. Therefore, a cost estimate for a third rehab or for an estimate to breach must be included in the corrected cost of keeping these dams.

Appendix I: Economics of the LSRFR lists the total cost for rehabilitating turbines during the life of the project as $380 million.[12] NWW staff reviews of the draft LSRFR in 2000-2001 suggested this estimate for turbine rehabs was low, but cost data were not corrected in the final report. As noted, dam turbine life expectancy is 35-45 years. Nine turbines will be 45 or more years old by 2016, twelve more will reach that age over the following ten years, and the last three turbines will reach the upper end of their life expectancy in 2029.[13] Major expenditures for turbine rehabilitation will be required during the next 15 years if the Lower Snake River Project remains in place.

Ice Harbor is the oldest of the four dams constructed on the Lower Snake River. The first three of its six turbines were installed between 1961 and 1971, and the rehabilitation of these turbines may now be underway. BPA's 2013 Capital Investment Budget lists the costs of rehabilitating these three turbines at $97 million.[14] At this level of expenditure, rehabilitating all 24 turbines would cost approximately $776 million in 2013 dollars. Two rehabs would cost more than four times the estimate in the LSRFR. The reanalysis of the economics of turbine rehabilitation includes the revised cost of two turbine rehabs based on actual 2013 cost, with a 3% escalation factor and present value calculated at the 6.88% discount rate used in the original study. The calculated average annual cost for turbine rehabilitation is $20.7 million as noted in Attachment 1, Turbine Rehab.

The construction midpoint for a third rehab would occur at the end of the 100-year project period when the dams would be over 120 years old. At that point, decommissioning or breaching would be cheaper than a third set of turbine rehabs. Therefore, the lower cost estimate for decommissioning is added to the costs of the other six cost categories when calculating total costs.

Category 4: Lower Snake River Compensation Plan Costs

The Lower Snake River Compensation Plan was created to mitigate the loss of salmon and other fish and wildlife affected by the construction of the four Lower Snake River dams. Land acquisition, riparian and upland habitat restoration, construction of eight fish hatcheries, and the expansion of the Dworshak National Fish Hatchery are included in these costs.[15] The tables in the LSRFR's Appendix E include costs associated with the operation and maintenance and repair of these hatcheries.[16] However, the tables do not reflect any costs for major rehabilitation or replacement of the hatcheries or include any escalation of costs. This reevaluation uses the LSRFR's total annual cost of $14.4 million in 2002 as a baseline.

Most of the O & M, repair, rehabilitation, and replacement costs for the hatcheries are paid by BPA. This agency provides funds to the U.S. Fish and Wildlife Service, state fish and wildlife agencies and tribes, which are responsible for hatchery management and operation. Two USFWS budget briefing charts used in BPA's 2013 Integrated Program Review,[17] along with BPA's May 2014 Integrated Program Review Chart 20 showing actual and proposed costs for fish and wildlife compensation from 2013-2017,[18] provide information regarding the appropriate rate of escalation to apply to the baseline cost. These documents demonstrate that the O & M, Repair and Rehabilitation costs are accelerating at a rate of 5% per year. In long term application, this is likely a conservative estimate since costs thus far do not appear to include major hatchery rehabs. The reanalysis of the Lower Snake River Compensation Plan used the 2001 base cost in the LSRFR, an annual escalation rate of 5%, and a 6.88% discount rate. The total average annual cost for the Lower Snake River Compensation Plan is $45.6 million as noted in Attachment 1, Category 4, Comp Plan.

Category 5: Power Services

Power Services refers to operations, maintenance and minor repair costs related specifically to power generation. BPA pays these costs. The May 2014 BPA Integrated Program Review charts provide overall funding levels for power services.[19] Based on this information, the estimated cost for power services on the four Lower Snake River dams in 2014 is $33.7 million. In the reevaluation of the LSRFR, this cost is first deescalated at 3% for 14 years to a baseline cost for 2001 and then adjusted going forward for 86 years using a 3% escalation factor. This escalation rate is derived from BPA's Integrated Program Review Chart 15 for the years 2009-2017, which shows a 3.2% average rate of escalation.[20] Average annual cost for Power Services is $39.6 million as noted in Attachment 1, Category 5, Power Services.

Category 6: Navigation and Flow Conveyance Dredging

In August 2014, NWW released its final Lower Snake River Programmatic Sediment Management Plan and Final Environmental Impact Statement (FEIS). Among the "Major Findings of the Hydraulics and Hydrology Analysis" is the following: "About .7 mcy per year of sand must be dredged to maintain the authorized navigation channel depth and maintain the current hydraulic capacity of the levees."[21] According to the FEIS, NWW has not dredged for flow conveyance since 1992, and dredging for navigation purposes has only occurred once since 2000.[22]

Thus the actual O & M costs noted over the past 14 years in the NWW Civil Works Activity Re- ports include only a small fraction of the dredging costs NWW now predicts will be needed. As noted in the FEIS, dredging is required to maintain the river's navigation channel principally through the confluence of the Snake and Clearwater Rivers and up the Clearwater River to the Port of Lewiston. Dredging is also required to avoid the possible overtopping of the levee sys- tem that protects the city of Lewiston, Idaho from flood.

NWW's plans for FY2015 include dredging and disposing of approximately 490,000 cubic yards of sediment. Based on NWW's budget of $6.5 million for this project, dredging and disposal cost approximately $13 per cubic yard in today's dollars, or $9 million on an annualized basis for navigation and flow conveyance. This reevaluation adjusts this $9 million to the base year 2001 and then applies a 2.5% escalation rate over the 100 years of the project to maintain consistency with the treatment of other cost categories. Corrected annual costs were then discounted using a 6.88% discount rate. Average annual cost for dredging and disposal is $12.8 million as identified in Attachment 1, Dredging. NWW did not include these costs in the LSRFR.

According to NWW, navigation requires the removal of a relatively small amount of sediment compared to the large volumes necessary for flow conveyance and flood prevention in Lewiston. Because flood risk management is a necessary part of the authorized hydropower purpose of the lower Snake River dams, the cost of dredging for flow conveyance may most appropriately be allocated to BPA.

Average Annual Cost of Keeping the Lower Snake River Dams in Place: $197M (base year 2001) or $292 (base year 2015)

The corrected average annual cost of keeping the Lower Snake River dams in place using the base year of 2001 as NWW did in the LSRFR is $197.2 million. An updated, complete and honest reanalysis of the LSRFR there- fore indicates the total average annual cost for keeping the Lower Snake River dams in place is $197million. These costs are summarized for all cost categories in Attachment 1.

Table 10-2 in the LSRFR's Appendix I shows a $22.9 million average annual implementation cost under Alternative 3 (Major Systems Improvements) and $33.6 million in avoided costs under Alternative 4 (Dam Breaching).[23] The Walla Walla District thus claimed the total average annual cost of keeping the dams in place was $56.5 million compared to the corrected amount of $197 million. The difference of $140 million is staggering.

The LSRFR presented cost projections over a 100-year project life beginning in 2001. Attachment 2 uses 2015 as a base year and, as did the LSRFR, projects costs over the following 100 years. The costs of the 86 years remaining in the project, presented in Attachment 1, were moved up on the spreadsheet and a final 14 years of expenses in the six categories noted above were added. As before, the same discount rate of 6.88% was used to calculate average annual cost. The average annual cost of keeping the four Lower Snake River dams in place over the next 100 years then becomes $292 million.

BPA provides approximately 90% of the cost of retaining the four lower Snake River dams. At the time the LSRFR was completed, BPA was using a discount rate of 4.75% in its costing models. Today, the Northwest Power and Conservation Council uses an even lower discount rate of 4%. For comparison purposes, this reevaluation also looks at the costs of keeping the dams in place using the BPA 2002 discount rate of 4.75%. The average annual cost for keeping the dams with base year 2001 at a 4.75% discount rate is $264 million. If 2015 is used as the base year with a discount rate of 4.75%, the average annual cost for keeping the lower Snake River dams climbs to $415 million.

The following charts present cost figures under each of the scenarios described above. All figures in the charts are in thousands of dollars.

2002 LSRFR Corrected Cost at 6.88% (Corps discount rate)	197,224
2002 LSRFR Stated Cost at 6.88% (Corps discount rate)	56,450
Difference	140,774
2002 LSRFR Corrected Cost at 4.75% (BPA discount rate)	263,767
2002 LSRFR Stated Cost at 4.75% (BPA discount rate)	51,090
Difference	212,677

2015 LSRFR Corrected Cost at 6.88% (Corps discount rate)	292,920
2015 LSRFR Corrected Cost at 4.75% (BPA discount rate)	415,638

Concluding Remarks

In 1947 the Army Corps of Engineers was unable to justify economically the construction of the four dams on the Lower Snake River without manipulating the costs and benefits of the Lower Snake River Project.[24] At that time the Corps also ignored completely the advice of every neighboring state and federal fish and wildlife agency "…that any series of dams on lower Snake would be hazardous and might entirely eliminate the runs of migratory fish in that stream."[25] In 2002, the Walla Walla District once again ignored, omitted, misrepresented, and massaged economic data to achieve the agency's desired result. Had the Walla Walla District conducted a thorough and honest economic analysis in its 2002 LSRFR, the 4 lower Snake River Dams would likely have been breached by now.

The findings of the reevaluation of the LSRFR echo the U. S. General Accounting Office's 2006 conclusions that Corps studies can be fraught with errors, mistakes, and miscalculations, often use invalid assumptions and outdated data, and understate costs while overstating benefits.

This is the story, the history, of the Lower Snake River Project.

Footnotes

1. U. S. General Accountability Office, 2006, p.1, (Ref. 10)
2. U.S. Environmental Protection Agency comments on draft LSRFR FEIS (Ref. 6)
3. U.S. Army Corps of Engineer 2002, Appendix I-3, p. 90 (Ref. 4)
4. U.S. Army Corps of Engineers, 2002, Appendix I-3, pp. 81-124 (Ref. 4)
5. U.S. Army Corps of Engineers, 2002, Appendix I -3, pp. 207-209 (Ref. 4)
6. Walla Walla District Decision Team Briefing Comments
7. US Army Corps of Engineers, 2002, Appendix I-ES, p. 3 (Ref. 4)
8. U.S. Army Corps of Engineers, 2002, Appendix E-E, p. 35 (Alternative 3) (Ref. 3)
9. U.S. Army Corps of Engineers, 2002, Appendix E-E, pp. 23-45 (Ref. 3)
10. Walla Walla District Decision Team Briefing Comments 2001
11. US Army Corps of Engineers, 2002, Appendix E-E p. 43 (Ref. 3)
12. US Army Corps of Engineers 2002, Appendix I-3, p. 213 (Ref. 4)
13. U.S. Army Corps of Engineers, 2002 Civil Works Activities Report , p. 30, 9-14 (Ref. 7)
14. Bonneville Power Administration (2013) p. 4 (Ref. 1)
15. U.S. Corps of Engineers Civil Works Activity Reports, 2012, p. 13 (Ref. 7)
16. U.S. Army Corps of Engineers, 2002, Appendix E-E p.43 (Ref. 3)
17. U.S. Fish & Wildlife Services (Ref. 9)
18. Bonneville Power Administration, 2014, p. 20. (Ref. 2)
19. Ibid.
20. Bonneville Power Administration, 2014, p. 15 (Ref. 2)
21. U.S. Army Corps of Engineers, 2014, Appendix F 1.3 pp. 19-20 (Ref. 5)
22. U.S. Army Corps of Engineers, 2014, Appendix A, Table A-2, p. A-11 (Ref. 6)
23. U.S. Army Corps of Engineers, 2002, Appendix I, p. 10-3 (Ref. 4)
24. U.S. Army Corps of Engineers,1947 (Ref. 8)
25. Ibid., p. 132. (Ref. 8)

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5. U.S. Army Corps of Engineers, Walla Walla District (2014). Lower Snake River Programmatic Sediment Management Plan, Appendix F, Hydrology and Hydraulics, Lower Granite Reservoir Sedimentation Analysis and Lewiston Levee Flood Risk Analysis. Retrieved from http://www.nww.usace.army.mil/Portals/28/docs/programsandprojects/psmp/Appendix_F_Hydrology-Complete_8-7-14.pdf

6. U.S. Army Corps of Engineers, Walla Walla District, 2014, Lower Snake River Progammatic Sediment Management Plan, Appendix A, Programmatic Sediment Management Plan, August, 2014, retrieved from http://www.nww.usace.army.mil/Portals/28/docs/programsandprojects/psmp/Appendix_A_PSMP.pdf

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8. U.S. Army Corps of Engineers, (1947) Special Report on Selection of Sites Lower Snake River, Oregon, Washington, and Idaho

9. U.S. Fish & Wildlife Service. Lower Snake River Compensation Plan. Retrieved from http://www.fws.gov/lsnakecomplan/budget/bpa%20rate%20case%20june4.pdf.

10. U.S. Government Accountability Office, Corps of Engineers: Observations on Planning and Project Management Processes for the Civil Works Program, March 15, 200

Appendix A: Fish Improvement Cost Analysis

The analysis of Fish Improvement Costs required reconciliation of costs identified as AFEP (Anadromous Fish Evaluation Program), the Construction and Acquisition Costs for Fish Improvements in the LSRFR, and the Columbia River Fish Mitigation Program (CRFM) costs shown in the Report of the Secretary of the Army on Civil Works Activities for fiscal years 2000 to 2012, referred to as the CW Activity Reports. This approach allows the use of publicly available documents and provides a method to correct the cost bases and summary conclusions of the 2002 LSRFR. It also provides a cost basis for bringing costs forward for a current analysis while keeping the analysis and discussion in Corps language
and within Corps methodologies.

Certain assumptions were necessary due to the limited availability of budget documents. All assumptions are noted below. Access to the Corps of Engineers' Financial Management System (CEFMs), the Project Management System (PROMIS) at NWW, and BPA financial records could further refine this analysis.

The CW Activity Reports from NWW show the following costs for CRFM:

Costs (in thousands)	FY 2000	FY 2012
Fully Funded Cost	$682,700	$955,000
Project Costs to Date	$339,370	$750,960
FY costs	$30,657	$50,654

These figures include costs at McNary Dam, which must be removed to limit the re-analysis to only the dams on the lower Snake River. The costs are presumed to include AFEP costs because their description includes study and evaluation work in addition to construction of fish improvements. Because the CW Activity Reports contain no details on CRFM costs at McNary, and because the scopes of work are similar at each dam, 20% of the overall CRFM costs were attributed to McNary. The CRFM costs do not include any expenditures for O & M.

For the four Lower Snake River dams (above totals x 80%)

Costs (in thousands)	FY2000	FY2012
Fully Funded Costs	$546,160	$764,000
Project Costs to Date	$271,496	$600,768
FY Costs	$24,526	$40,523

To compare the FY2000 CRFM costs to the LSRFR's Appendix E costs for construction and AFEP, 1998 dollars were converted to 2000 dollars using a 6.88% discount rate.

Costs (in thousands)	FY2000		FY2012
Fully Funded Cost	$546,160	(.8734(PWF)) =	$477,016
Project cost to Date	$271,496	(.8734(PWF)) =	$237,125
	$24,526	(.8734(PWF)) =	$21,421

At 3% escalation, these construction costs track with the actual costs from the Civil Works Activity Reports from 2000-2012.

The comparison of fully funded costs in the Civil Works Activity Reports with the con- struction and AFEP costs in LSRFR Appendix E requires some adjustment. Annual AFEP costs shown in thousands appear in LSRFR Appendix E, Table E-E-31, with $5,280 for the existing condition. AFEP costs were added to the Civil Works budgets in 1991, but the AFEP program required several years to become fully operational.

The AFEP costs to 1998 were $5,280 x (4.100(PV/A)) = $21,648. Thus fully funded cost minus AFEP should approximate the FY98 construction cost in the LSRFR, Appendix E, p. E-E-29, which as the NWW decision briefing team noted is likely an underestimation.

$477,016 - $21,648 =	$455,368
estimate in LSRFR	$389,646
difference	$ 65,722

This difference represents an underestimate of approximately 17% ($65,722/$389,646 = .1687). Thus the cost of annual construction outlays shown in Appendix E, p. EE-23 (Alternative 3) of the LSRFR was corrected by multiplying 1.17 times the LSRFR's estimates.

	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10
LSRFR	9,960	36,175	39,433	46,035	54,890	47,890	40,556	41,991	41,831	30,947
Corrected Costs[1]	11,660	42,325	46,137	53,861	64,221	55,953	47,451	49,129	48,942	36,202

These numbers were then placed in the present value tables. Three rehabs were also added, as noted on the spread sheets in Attachment 1. The LSRFR failed to consider the costs of necessary rehabilitation of the Alternative 3 (system improvements) equipment, as was noted in the comments of the NWW decision briefing team.[2]

1. Shown in spreadsheet: ALT 3 Fish Improvements Rehab and ALT3Base year 2001 summary cost
2. This correction is based on schedule in Appendix E. Actual schedule continues for another 6-7 years, but totals are close.