Restoring the Lower Snake River

Economics Anthology

It just makes
DAM SENSE!
DAMSENSE.ORG

DamSense is a coalition of diverse interests—anglers, recreationists, engineers, families, businesses and economists—advocating for fact-based, economically sensible use of the lower Snake River. We are a force for truth and a catalyst for change, and we hold local, state, and federal government agencies accountable for serving the public interest and protecting the public purse.

We support revitalizing local economies, sustaining natural resources, preventing extinction of iconic Northwest species, and returning the lower Snake River to its rightful owners: Native American people.

"The four lower Snake River dams are man-made structures with a finite lifetime. They are part of the problematic aging U.S. infrastructure which requires more money for maintenance each year. Although these dams will be breached in the future, they are economically unsustainable today. It's simply a matter of time before the responsible federal agencies admit it. So, the question is, when the dams come down, will the salmon and Southern Resident Killer Whales still be with us? Extinction is forever; dams are not."

~DamSense

"We are all intricately connected, from tiny plankton to forage fish, salmon, orcas, tall firs and cedars, mountains, rivers, and the ocean. It is time to reflect, to reconnect, and to respond as better caretakers of our planet."

~Susan Berta Orca Network

Economic Anthology

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Forward

After a 35-year career as a Civil Engineer with the U.S. Army Corps of Engineers (the Corps), I began dedicating my retirement time and energy to reviewing the government documents related to the biological and economic reasons for breaching the 4 lower Snake River Dams (4LSRD) in eastern Washington. The Corps' 2002 lower Snake River Feasibility Report and Environmental Impact Statement (EIS) is the major source document I studied. The 5,000 page EIS, which is the product of a seven year $33 million study, offers four alternatives from which to choose the most reasonable and prudent method to improve juvenile salmon passage over the 4LSRD. Of the four alternatives, do nothing to the dams was determined to be slightly better than either of the two non-breach alternatives: (1) transporting juveniles fish around the dams in barges and (2) building additional fish passage systems at the dams. Even though not selected, breaching the earthen berms to by-pass natural river flow around the remaining concrete structure was and still is the environmentally preferred alternative. However, this fourth alternative was deemed to be "not necessary at this time." Consequently, the two non-breach alternatives were implemented at what has added up to at least $1 billion.

Over the past five years, I've dedicated myself to in depth comprehensive research into biological, economic, and policy data in order to understand, correct, and update the 2002 EIS and other government documents with well researched comprehensive data. These corrections and updates repeatedly reveal breaching as the only viable solution to save money, salmon, and orca. I welcome every opportunity to share my research in order to inform and educate agency officials, elected leaders, non-government organizations, media outlets, and the general public. The informal citizen-scientist DamSense team has joined forces to support revealing the unvarnished truth about an ecosystem devastated by fish killing dams. The 1970s dam builder promise that dams and wild fish could harmoniously coexist has proven to be a billion dollar fantasy.

I agree with other Corps retirees and employees that the Corps' 2002 EIS, after a few minor updates, will provide adequate operational instruction to remove the earthen berms from the 4LSRD. This initial step to restoring the Snake River watershed's ecosystem can be accomplished in a matter of months with the right political will and support. Using the 2002 EIS's substantial body of operational guidance supporting a decision by the Corps and Bonneville Power Administration to immediately breach the 4LSRD is at the foundation of DamSense. To alleviate the threat of extinction, Pacific Northwest endangered Snake River salmon and Southern Resident Killer Whales depend on achieving this goal.

Documents in this anthology were created or chosen for inclusion by a diverse group of men and women that includes fisherman, economists, federal employees and retirees, environmentalists, scientists, politicians,Tribal members, and various business entity personnel. I hope this anthology provides you with a basic understanding of how the lower Snake River watershed ecosystem can and must be set on a path of restoration this year.

I greatly appreciate the dedicated DamSense volunteers and staff who stay passionately involved with supporting the DamSense goal. Thank you DamSense team for countless hours of work, impeccable attention to detail, and a deep seated commitment to restoring a free flowing Snake River.

Jim Waddell,
Civil Engineer, PE USACE Retired
January 2019

The 2018 "State of the Snake"

In 2018 the fish returns at Lower Granite dam are **down for all categories** compared to both the 10-year average, 2017, and 2016. A **total of 55,364 Chinook salmon and 53, 136 steelhead returned** to Lower Granite Dam in 2018. These precipitous declines should come as no surprise. They were predicted in the 2015 Salmon White Paper (see Damsense.org, reports page) which was distributed to Pacific NW state representatives as well as federal agency representatives.

Five-year reviews by NOAA show *minimal improvement* in the risk-status of ESA-listed salmon and steelhead despite a billion taxpayer dollars being spent on system improvements. Current NOAA recovery plans are predicted to NOT achieve fish recovery. Pacific NW state fisheries reports show that smolt-to-adult ratios have not improved either and still show Snake River fish returns are not meeting criteria for species survival.

Lower Granite Dam			
	Compared to 10yr Average		
Fish Returns	**2016**	**2017**	**2018**
Spring Chinook	+6%	-56%	-50%
Summer Chinook	-28%	-48%	-58%
Fall Chinook	+6%	-35%	-54%
Sockeye	-21%	-80%	-76%
Steelhead	-42%	-54%	-67%
Wild Steelhead	-47%	-67%	-72%
Data from Columbia Research Basin, http://www.cbr.washington.edu			

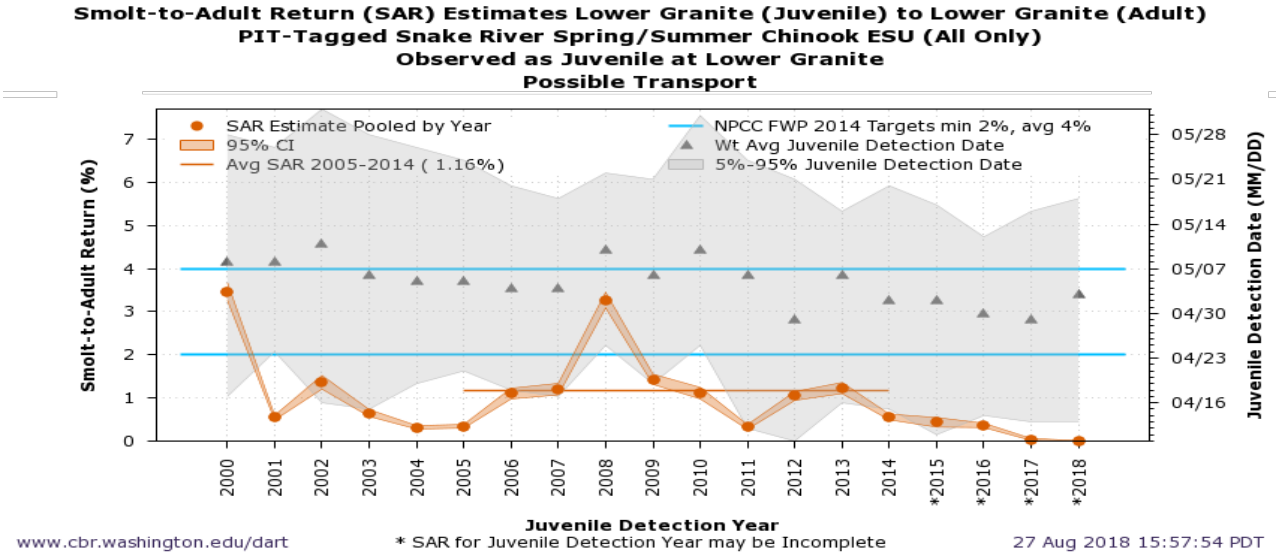
Snake River wild steelhead are on a decline to levels not seen in 20 years. Adult returns in 2018 will mark the third steepest 5-year trend since the 2009-2013 trend. The fourth worst 5-year trend will be from 2002-2006 adult counts*. This recent 5-year trend is so low that it will hit a trigger point in the 2014 biological opinion.* The BiOp states that the agencies must implement a solution within 12 months. However, the downward trend is not the only problem; the actual number of wild steelhead is now so low that the only solution or recovery action that can be implemented quick enough to prevent virtual extinction is the breaching alternative in the existing EIS for the 4 Lower Snake River dams.

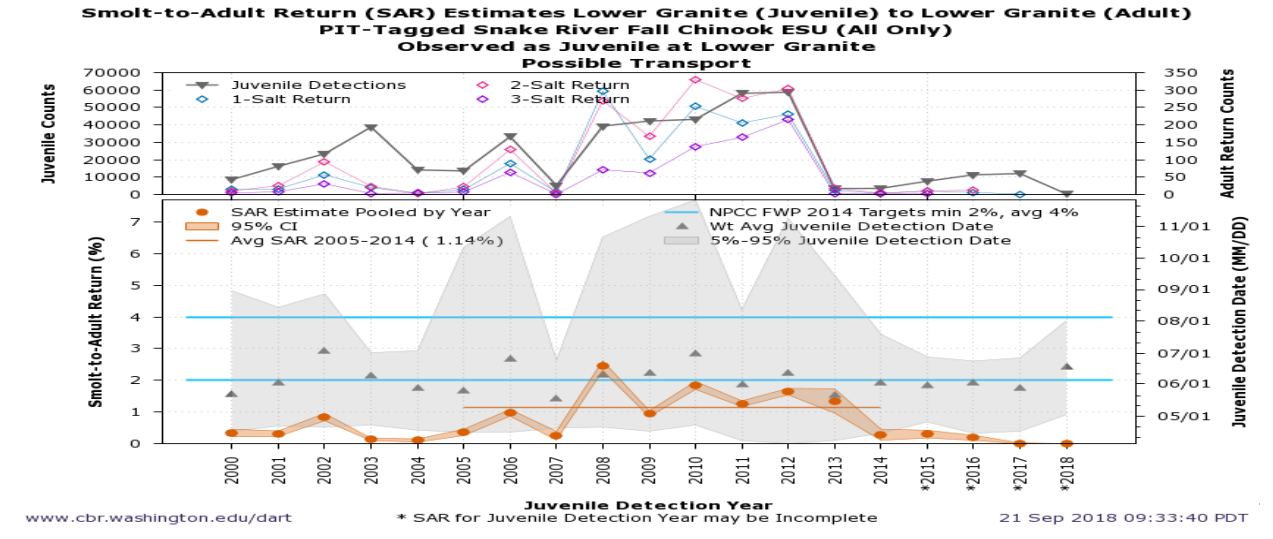
From both the 2016 and 2017 NOAA Recovery Plans for Snake River Spring/Summer Chinook Salmon & Snake River Steelhead, National Marine Fisheries Service, West Coast Region "*Over $1 billion* has been invested since the mid-1990s in baseline research, development, and testing of prototype improvements, and construction of new facilities and upgrades." "NMFS estimates that recovery of the Snake River spring/summer Chinook salmon ESU and steelhead DPS, like recovery for most of the ESA-listed Pacific Northwest salmon and steelhead, ***could take 50 to 100 years***." This recovery plan contains an extensive list of actions to move the ESU and DPS towards viable status; **however, the actions will not get us to recovery.**

From the 2016 Comparative Survival Study SAR Patterns: Snake and Mid-Columbia
SAR (smolt to adult return ratio) is a measure of fish survival, or the % of smolts that return as spawning adults. The Northwest Power & Conservation Council's goals are **2% for mere survival of the species** and **6% for recovery of the species**. Overall, Snake River Chinook and steelhead SARs have only been above 2% in 5 of 20 years in recent history (and never above 6%). These results are in spite of increased spill and barging around the dams.

In contrast, Mid-Columbia Chinook and steelhead are generally meeting the NPCC SAR goals and have SAR ratios ***2.3x – 3.4x greater than Snake River wild SARs***. Keep in mind that Snake River salmon and steelhead pass over 8 dams... 4 on the Columbia and 4 on the Snake. Mid-Columbia fish only pass 1- 4 lower Columbia dams. ***If the 4 lower Snake River dams were removed, Snake River salmon and steelhead would have very similar migration and spawning conditions, which should lead to fish recovery. See charts below for trend of SAR's below 1.***

From the Draft Comparative Survival Study 2017 Annual Report by the Fish Passage Center
"If the lower four Snake River dams are breached and the remaining four Columbia dams operate at BiOp spill levels, we predict approximately **a 2-3 fold increase in abundance** above that predicted at BiOp spill levels in an impounded system, and up to a **4 fold increase if spill is increased** to the 125% TDG limit. This analysis predicts that higher SARs and long-term abundances can be achieved by reducing powerhouse passage and water transit time, both of which are reduced by increasing spill, and reduced further when the lower four Snake River dams are breached."





Bonneville Power Administration Financial Crisis

"*If there is an axis of nonchalance (on one end) to panic (on the other), I think it's important that we don't get into a panic mode, I'm not in a panic mode, but I am in a very, very significant sense of urgency mode.*" Elliot Mainzer, BPA Administrator, to NPCC, March 2018, https://vimeo.com/260456507

"[Bonneville Power Administration] don't typically provide project by project line items. This is system wide, not just the lower Snake River dams. We, as BPA, wouldn't have the full picture for any given project as we are not the owners of any of the projects." Joshua Warner, Constituent Account Executive, BPA

Here are some of specifics which reinforce Bonneville Power Administration's (BPA) statement on the urgency of the financial issues.

Financial

1. The Columbia River Fish Mitigation program ***spent about $1 billion since the year 2000*** on bypass improvements on the 4 lower Snake River dams (LSRD) to improve salmon survival. ***It failed to improve survival*** and added $1 billion to BPA's debt load.
2. BPA's total **debt load is $15-$16 billion**. Its **interest payments on the LSRD are $43 million**, versus revenues of around $200 million.[i]
3. The BPA 2018 Strategic Plan reported that BPA's **debt-to-asset ratio was 95% last year** (Elliot Mainzer stated it is 99% in March 2018). See Figure 1. This is far higher than any public utility in the country.[ii]
4. **Approximately 50% of BPA debt is owed to the Treasury**. BPA's primary source of financing is its U.S. Treasury borrowing authority. This works like a revolving line of credit and is capped at $7.7 billion.
5. The financial debt will continue to build resulting in ever-increasing interest payments. BPA annually repays Treasury debt but is borrowing money from other sources in the region to make these debt payments. About 90% of this borrowing is done through refinancing.

Environmental

1. **Snake River dams will continue to deteriorate.** The cost of dam and fish passage improvements will continue to increase move rapidly, beyond BPA's fiscal means to maintain and repair them. This will lead to increased fish mortalities as the expensive-to-maintain bypass systems degrade and impair the fragile juvenile salmon. This could only be reversed with significant rate increases, which would make LSRD hydro power more expensive, thus driving off more customers.

2. Habitat restoration projects with no or low returns are claimed as "project failures" when the reason is more likely that dams are not allowing fish passage for habitat use. Lack of sufficient fish passage, market shifts, and Federal Court decisions are used as an excuse to cut funding on Fish and Wildlife programs; this is evidenced by BPA's recent $30 million cut per year from environmental spending.[iii] In reality, **BPA is simply going broke trying to keep the entire hydro-system going** and paying for mitigation on the LSRD.

Power Production

1. The LSRD add about 1,000 Mwh to the significant surplus of energy in the Pacific Northwest. For example**, only 2 out of the last 93,000 hours were needed by BPA customers**. This surplus energy is sold below BPA's current and projected firm priority rates, thus at a loss.
2. The **average annual cost of power production from the 4 LSRD is higher** than the much larger dams on the Columbia River.
3. During spring runoff, all but a few dams, have no choice but to spin the generators or face massive fish kills. Surplus hydropower from the LSRD for the past several years is **sold below the BPA firm priority rate** at a tremendous loss, and at times BPA must pay California to take the power, although California does not want Washington's hydropower. We know it has been as low as -$16 Mwh, noted in May 2018. Since 2012, California has installed 9,000 Mw of solar power (The equivalent of 12 Snake River Dams). This situation will continue to rapidly decrease the viability of surplus sales and thus further bankrupt BPA's hydropower assets (see BPA Strategic Plan graph, pg. 35).
4. Because of surplus energy on the grid in 2017, there have been **50 curtailments of wind turbines**. Breaching the LSRD frees 1000 Mwh of energy on an annual basis. Therefore, it is easier to integrate and use additional wind power, which is $10 cheaper than hydropower. **Current wind production provides 3 times the production of the LSRD** (15 years ago wind was not economically superior).
5. **If the BPA does not abandon losing assets such as the LSRD, they will likely never recover**. Even with dam breach, it will still be difficult.
6. Due to surplus energy, there is **zero impact to the power network after dam breach**, and a cost saving for BPA. If the dams are breached, and the power production was replaced (although it doesn't need to be) with 50% solar in eastern Washington and open market (includes wind), there is still an economic benefit of $4 to $1. *However*, it is a $19 to $1 benefit / cost ratio if this surplus power is not replaced because it has already been replaced and is not needed. To be clear, breaching the LSRDs should decreases rates, not increase rates, as proposed by the Northwest Energy Coalition in a recent report.[iv]
7. BPA is relying on large PUD contracts that will not expire until 2028. Aluminum plants pulled out of contracts with BPA and could happen with PUDs. Some of these PUDs may break contracts, take the penalty, and still be better off in the open market. But, with a smaller customer base, rates will continue to increase for those still holding BPA contracts.
8. **Breaching can be financed through existing debt reduction and credit mechanisms** as a fish mitigation action by BPA. New appropriations are not needed. If the "4h10c fish credit" mechanism is used, there will be no cost to BPA and its ratepayers.
9. BPA appears to be borrowing money to make annual interest payments. BPA is in $16 billion dollars of debt and the only option to make a significant debt payment is to significantly increase rates and further drive customers away.

BPA Charts

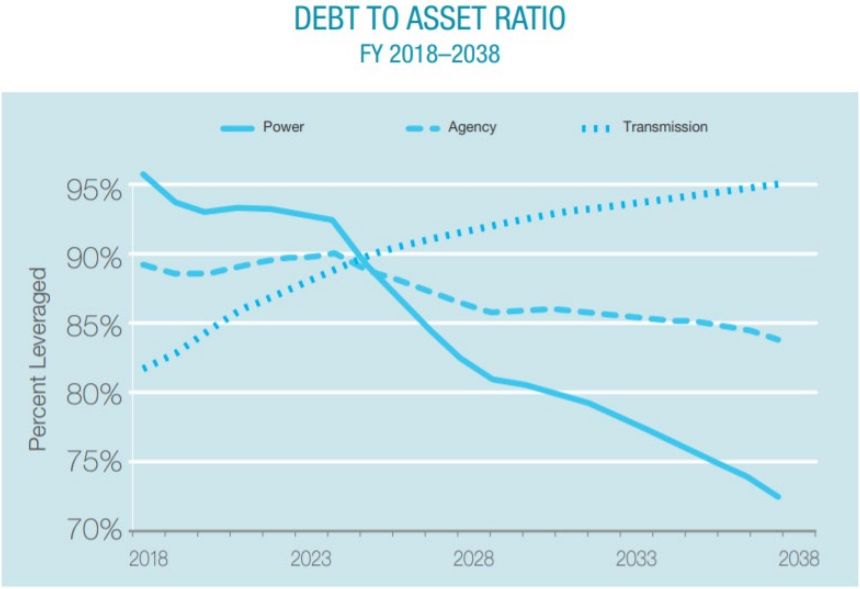


Figure 1 "While the downward debt-to-asset ratio trajectory for Power Services is positive, the upward trajectory for Transmission Services is a significant risk to the future financial health of BPA." BPA Financial Plan 2018, pg. 12

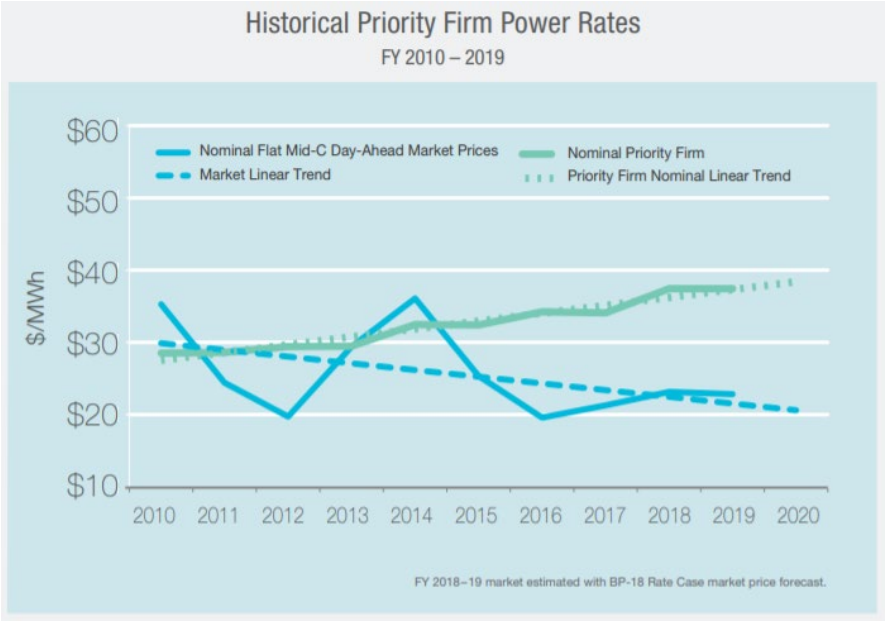


Figure 2 "As wholesale market prices (blue) have trended downward, BPA's Priority Firm power rates (green) have trended upward." BPA Strategic Plan 2018-2023, pg. 35

Shift in California power demand

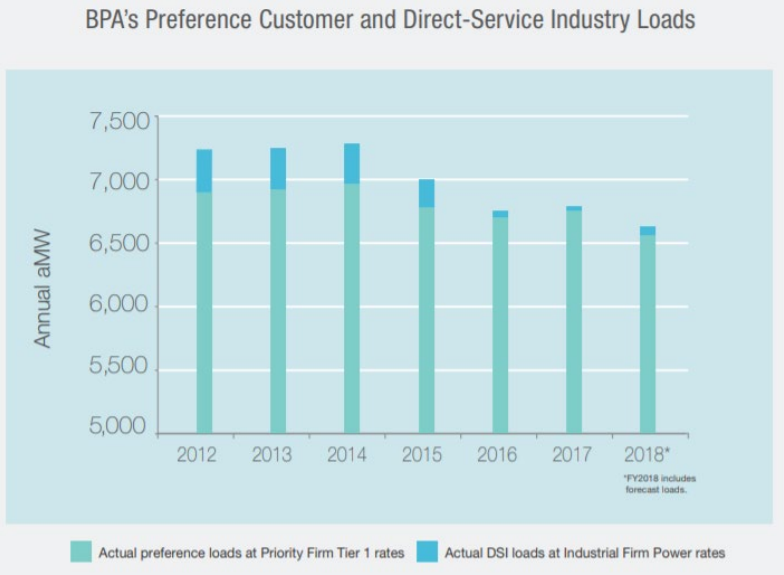
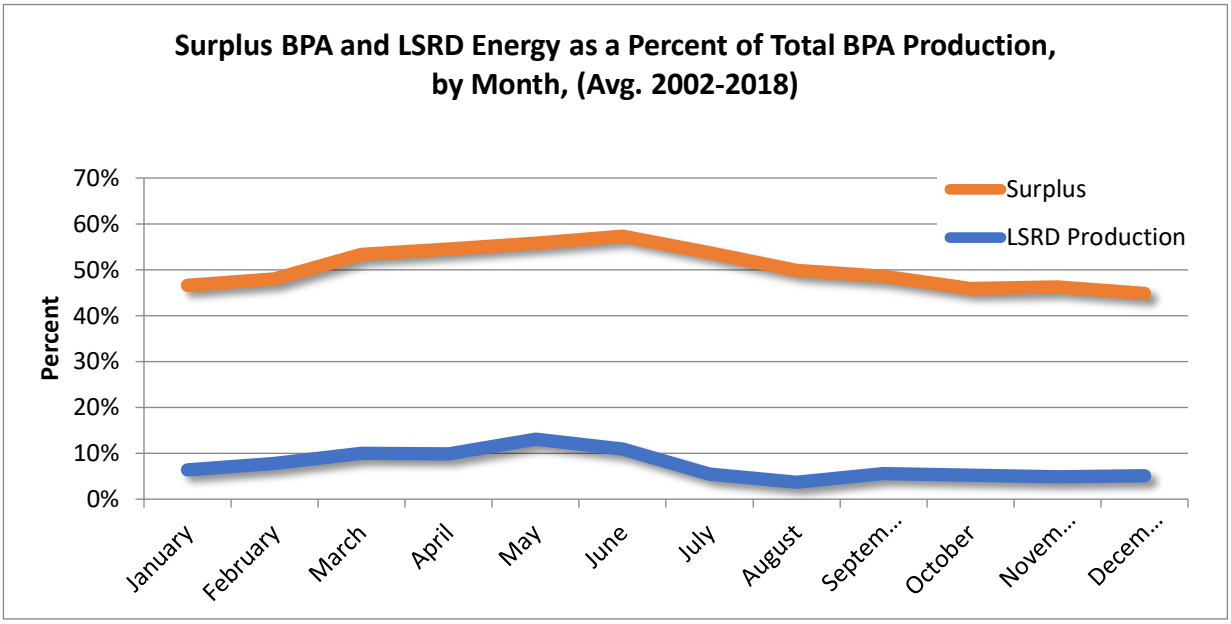


Figure 3 "BPA's preference customer and direct-service industry loads have steadily declined since 2014." BPA Strategic Plan 2018-2023, pg. 37



Source: Rocky Mountain Economics

BPA has generated nearly 50% surplus power since 2002. The LSRDs have contributed to this surplus and are therefore unnecessary. Operations of the LSRDs should be halted immediately.

NP15 DAM Prices, 2016 - Current.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann.
2016	28.54	24.01	19.60	21.23	20.76	28.09	32.80	34.85	34.66	34.03	30.17	36.60	28.81
2017	34.90	29.23	22.11	22.13	28.81	33.12	35.84	45.20	39.72	41.19	36.28	34.22	33.61
2018	32.95	30.48	30.05	24.91	20.75	28.14	54.92	59.21					33.95

Red = Prices below LSRD cost of production. Yellow = Prices at or above BPA current priority firm rates. Green = Prices at or above RME estimated LSRD cost of production.

Note, these are OASIS, DAM prices for NP15. NP15 DAM tend to trade about $3/MWh higher than MID-C DAM. And, Both NP15 and MID-C DAM tend to be $3 - $5 higher than the respective RTM markets. In other words, the prices shown here are approximately $6-$10/MWh higher than the prices BPA gets when it dumps its surplus power on the MID-C wholesale market (Rocky Mountain Economics).

To view the financial and strategic plans created by BPA, please visit the links below.
Strategic Plan, 2018-2023: https://www.bpa.gov/StrategicPlan/StrategicPlan/2018-Strategic-Plan.pdf
Financial Plan, 2018:
https://www.bpa.gov/Finance/FinancialInformation/FinancialPlan/Documents/Financial-Plan-2018.pdf

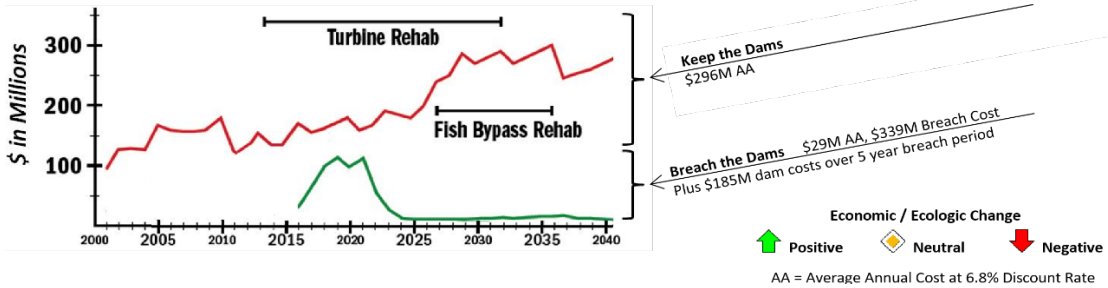
A remedy is at hand: The Army Corps of Engineers can breach now!

1. With a Benefit to Cost ratio well below 1, the **Army Corps has jurisdiction to breach immediately**. They need **no new authorities** to place the 4 LSRDs into a "non-operational" status while normative river flows are reestablished by removing the dams' earthen portions.
2. The Corps' **2002 Environmental Impact Statement and Record of Decision provide the necessary NEPA coverage for breaching**, although some updating may be required. Breaching of the LSRD was included as the alternative with best chance of salmon recovery.
3. The ongoing litigation over the 2014 Federal Biological Opinion nor the Court order for a new Columbia River Systems Operations review/EIS constrains the Corps from breaching the dams through channel bypass now.
4. **Breaching is far easier than originally planned**, making it possible to move from a "decision to breach" to "breaching" in a matter of months (not years).
5. Breach will **cost $300-340 *million*** *(not* $1 or $2 *billion*) with contingencies for adaptive construction. Mitigation for rail and irrigation improvements could add $90 million to the breach costs.
6. The **financial and biological urgency calls for breaching to begin** with at least two dams in 2019. Breaching two dams is possible and improves the chances of salmon recovery and should be the goal for 2018.

[i] BPA 2018-2023 Strategic Plan. 2018. https://www.bpa.gov/StrategicPlan/StrategicPlan/2018-Strategic-Plan.pdf
[ii] ibid
[iii] The Columbia Basin Bulletin. Oct. 12, 2018. *Council Hears Update On Latest BPA Funding Reductions To Fish And Wildlife Program Projects*. http://www.cbbulletin.com/441652.aspx
[iv] Northwest Energy Coalition. Aug. 27, 2018. *Lower Snake River Dams Power Replacement Study.* https://nwenergy.org/featured/lsrdstudy/

SCORECARD

Lower Snake River



AA = Average Annual Cost at 6.8% Discount Rate

National Economic Development Benefit Cost Ratios →	Keep the Dams *15¢ return on $1 spent*	Remove the Dams *$4.30 – $19.76 return on $1 spent*
Endangered Species Mitigation		
Endangered Southern Resident Killer Whales (SRKW) & Salmon Species	The USACE spent $800.0M over 15 years on failed system improvement efforts for juvenile salmon passage thru the four dams	Only remaining alternative in EIS for ecosystem recovery, increasing salmon numbers *and* prey availability for SRKW
Climate Change Challenges	Warming reservoirs kill salmon and favor predators, methane emissions increase	Diurnal cooling in natural rivers increases fish survival, allowing more fish to utilize high elevation spawning grounds in Idaho
Hydropower		
Hydropower	Benefit $202.6M AA, *high side* Power generated is 2.9% of regional, with production trending downward due to aging infrastructure and the benefit likely a transfer from idle wind turbines	Cost $0 - $261.8M AA Shift to wind or other surplus sources; costs trending downward, regional grid surplus is 5 times production of LSR dams
Life Cycle Implementation	Cost $269.4M AA, 91% of costs	Cost $29.0M AA, breach 1 dam / yr
Transportation		
Inland Navigation, down 50% over last 20 years	Benefit $7.6M AA, *high side* Cost $26.6M AA, 9% of dam costs	Cost / Loss $7.6M AA, DOT rail improvements mitigate loss, max $100M
Agriculture & Local Economy		
Land Use	Slack water reservoirs, poor fish habitat, 20,000 acres flooded land unavailable	4-5,000 acres, available for viticulture, orchards, etc., significant increase in economic development
Recreation & Local Economy		
Recreation Activities, nonangler	Benefit $13.9M AA Cost $1,370.0M AA, Measured in forfeited consumer surplus Cost $500.0M AA Measured in forfeited expenditures	Benefit $1,370.0M AA Cost $14.0M AA Significant increase in wide variety of income producing river recreation activities, pumping $500.0M into local economy in the first few years
Recreation Jobs	Less than 500 jobs, LSFR provided no basis	Over 4,000 new Full & Part-time jobs, Yr-1
Recreation Angler	Benefit $30.9M AA Cost $34.9M AA	Benefit $65.8M AA Cost $0.0M AA
Fisheries		
Commercial & Tribal, not updated since 1999	Benefit $2.8M AA Cost $2.2M AA	Benefit $4.9M AA Cost $0.0M AA
Non Authorized Purposes		
Flood Control & Sediment, dams not capable of flood control	2-3M cubic yards drops out per year at Lewiston, increasing flood risk	Sediment moves downstream allowing removal of levees and economic development of riverfront
Water Supply & Irrigation	30,000 acres with low to medium value crops	Cost $22.5M AA Modification of pumps & wells significantly overestimated

It costs more to kill Snake River salmon than to save them!

Data provided by current & retired federal employee volunteers & Earth Economics. Documentation available at www.damsense.org

March 25, 2018

Lower Snake River Agricultural Benefits

Excerpt from email correspondence between Jim Waddell, PE and Hans Radtke, economist.

Hans Radtke:

> If the dams are breached, new lowland rich soil acreage may be added to the agricultural base of the region. What would be the economic impact of using such lands for high value crops such as tree fruits or grapes?
>
> Estimates are that at least 5,000 arcs of available agricultural lands may result from breaching the dams (some other estimates are that up to 40,000 may be developed). The following analysis is a first cut, using available information. The budgets and expected harvest volume and value are taken from reports by Oregon State University and Washington State University extension services. (Proper citation of these reports and of the following Input / Output model can be provided.) The annual harvest value per acre of such production ranges between $15,000 and $19,000. For this analysis, I use $17,000 per acres per year. The processing and marketing of these products will most likely be equal, so that the total harvesting, processing and marketing value will be double the reported harvest value. Therefore, we could expect the product produced as it leaves the region or state, to be about $34,000 per acre cultivated. An economic Input / Output model can be used to measure the income generated within the region or state resulting from such cultivation, harvesting, processing and marketing. The total Income coefficient from the agricultural processing sector at the state level is about 0.70 (IMPLAN state level model). Therefore, each cultivated acre that produces tree fruit or wine products may generate $23,800 of income to a state economy in the Pacific Northwest ($17,000 x 2 x 0.70). (In Input / Output terminology, this includes direct, indirect, and induced income generated.) At the lower level of estimated new land that could be developed, **about $119 million of new annual income could be generated.** (At the high-level estimate of 40,000 acres, this income could rise to $952 million annually.) To convert this income generated to Jobs, a full-time equivalent (FTE) job that generates $50,000 is used. This reflects the average employee compensation in a Northwest state. Therefore, we could expect that every new acre that Is developed from these lands may generate just below one-half FTE, or a total of 2,380 FTEs from the estimated 5,000 acres (at the high-level estimate, this would be 19,040 FTEs).

Hans Radtke is an independent economist who has worked on a range of natural resource issues in the Pacific Northwest. He has served on several advisory boards, as well as management positions, such as the Pacific Fishery Management Council.

In the early 2000s, he was part of the Drawdown Regional Economic Working group (DREW), convened by the US Army Corps of Engineers to review the technical, economic, and social analyses of four alternatives to improve fish passage and fish survival along the Lower Snake River.

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Lower Snake River Dam
Alternative Power Costs

June 19, 2015

Rocky Mountain Econometrics
Anthony Jones

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Preface

Rocky Mountain Econometrics (RME) has been actively analyzing northwest energy issues since 1985. In the 1980s and 1990s, the author was the staff economist for the Idaho Public Utilities Commission.

In 1998 Governor Kempthorne, and later, Governor Batt, contracted with RME to monitor the Army Corp of Engineers' (ACOE) development of the FREIS[1] and the potential breaching of the four Lower Snake River Dams in Washington State (LSRD). In that capacity RME documented for Idaho's elected leaders the conclusions, errors and omissions in the ACOE's analysis.

In 2002 Northwest Resource Information Center and RME published, *"Idaho Economic Effects of Breaching/Not Breaching the Army Corps of Engineers' Snake River Dams in S.E. Washington."* That document details that much of the ACOE's findings in the FREIS were flawed and that the best economic alternative was to decommission the LSRD.

In early 2015 Idaho Rivers United asked RME to once again bring its expertise to the subject and revisit the FREIS for the purpose of calculating the cost of replacing the energy produced by the LSRD in current (2015) dollars. To that end, the following pages present the context in which the four Lower Snake River Dams in Washington State currently operate as energy producing entities within the greater Pacific Northwest region. The following pages also present scenarios for viewing the cost of replacing the electric power that would be lost if the dams are decommissioned.

[1] US Army Corps of Engineers, Walla Walla District, "Lower Snake River Juvenile Salmon Migration Feasibility Report/Environmental Impact Statement", 1999.

Executive Summary

The median electricity production of the four LSRD is about 795 aMW[2], about seven percent of the region's 11,000 aMW of hydropower capacity. While the NW is renowned for hydropower, hydro accounts for only a little more than one third of the region's total capacity of 28,900 aMW. Of system wide total energy, the LSRD account for less than 3 percent. The system is currently running at about 84% of capacity with about 4,600 aMW's of surplus energy.

If the LSRD dams were decommissioned today, capacity utilization would increase only slightly from about 84% to about 86.5%.

From that standpoint, the LSRDs are not of critical importance. Still, they are resources that are in continual use. In the absence of other actions, such as conservation, other resources would be substituted for them. It is reasonable to ponder the financial impact if alternative resources are brought online.

Jim Waddell, a recently retired ACOE engineer, calculates that it will cost $312.9 million annually[3] to maintain the dams, 90 percent of which, $281.6 million, is allocated for power generation. One of the simplest ways to replace the LSRD power is to purchase it on the open market. If that had been done from 2009 through 2014, it would have cost NW ratepayers, on average, $263 million per year, an annual savings of about $19 million. The $19 million reduction translates to a $0.06 reduction of a typical monthly residential power bill.

If utility scale photovoltaic energy is developed to replace the LSRD with energy purchased on the open market during nightime hours when PV's are not producing the replacement power will likely cost about $260 million per year. This is $21.7 million less than it costs to maintain the LSRD. Monthly residential power bills will decrease by, again, about $0.06.

To summarize, the LSRDs are not needed from a capacity standpoint. From a cost standpoint there are options that result in lower cost power for NW ratepayers if the dams are removed.

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[2] An average megawatt (aMW) is the amount of electricity produced by the continuous production of one megawatt over a period of one year. The term, sometimes also called average annual megawatt, defines power production in megawatt increments over time. Because there are 8,760 hours in a year, an average megawatt is equal to 8,760 megawatt-hours

[3] The Costs of Keeping the Four Lower Snake River Dams: A Reevaluation of the Lower Snake River Feasibility Report, Jim Waddell, 2015, pp. 10.

The Lower Snake River Dams in the Context of Pacific Northwest Power Resources

The LSRD are physically large. Each dam is about 100 feet high and the combined reservoirs stretch half way across Washington State. However, physical size is a poor measure of energy generation potential.

The energy potential of a hydroelectric dam is a function of the amount of water that flows through the turbines and the height from which it falls. By the time the Snake River passes Lewiston much of its energy generating potential has already been spent. From Lewiston to Pasco, a distance of about 140 miles, the river only drops about 400 feet. Compare that to Grand Coulee dam at 550 feet tall on a far larger river.

The Lower Snake River Dams are neither a major or critical part of the northwest energy picture. Table 1 illustrates that the median generation of 795 aMW by the LSRD are only about 3 percent of the total annual average northwest energy portfolio of 28,900 aMW. Chart 1, on the following page, presents the data from Table 1 in a graphic format.

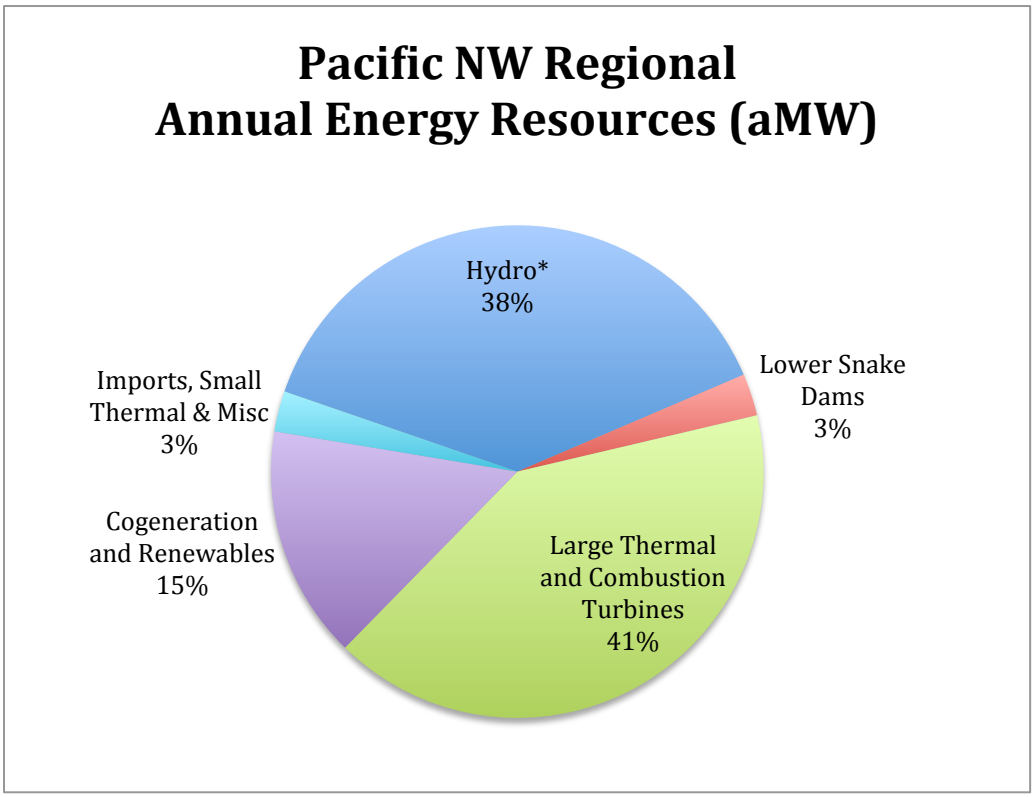
Table 1, Pacific Northwest Energy Resources[4]

Resource	Pacific NW Regional Annual Energy Resources (aMW)	Percent of Total
Hydro*	11,067	38.3%
Lower Snake Dams	795	2.8%
Large Thermal and Combustion Turbines	11,851	41.0%
Cogeneration and Renewables	4,418	15.3%
Imports, Small Thermal & Misc.	769	2.7%
Total PNW Regional Resources	28,900	100.0%

*Does not include LSRD.

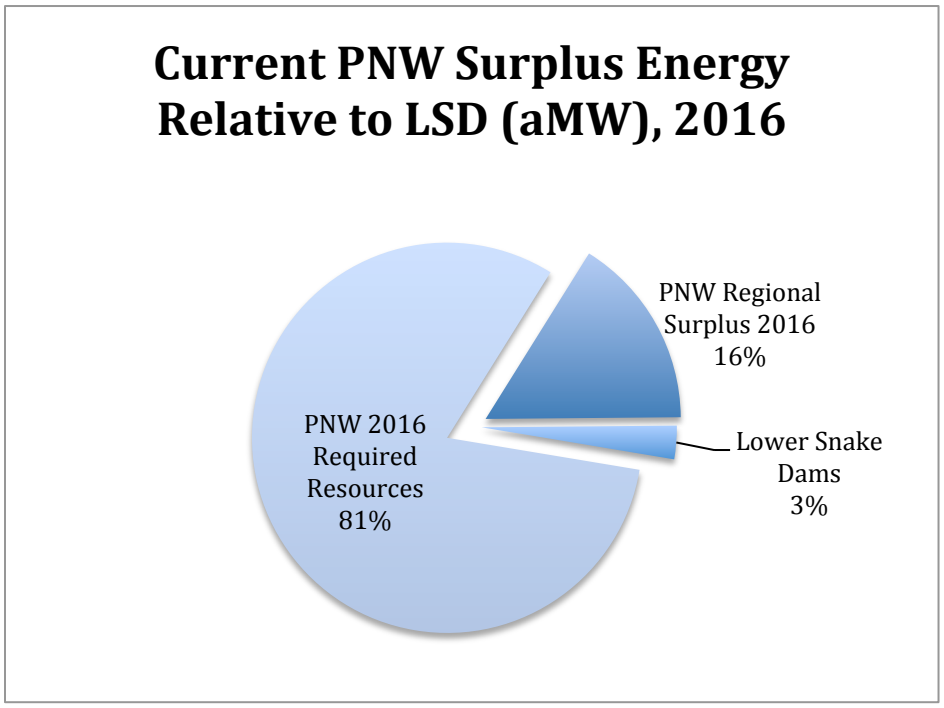
[4] Source: Bonneville Power Administration, 2014 Pacific Northwest Loads and Resources Study, January 2015, Table 1-6, PNW Regional Resources, OY 2016, 1937-Critical Water Conditions, pp.12, and RME.

Chart 1, Pacific Northwest Energy Resources



To put the energy produced into even better perspective, Chart 2, on the following page displays the LSRD energy production relative to the amount of surplus potential energy production in the region. In 2016, the Pacific Northwest will use about 84 percent of its energy generating potential. This includes energy from the LSRD.

Chart 2



By 2025 the NW Council and others project energy loads to grow and energy surpluses to be down to about 5 percent of total energy potential. Significantly, even then, the LSRD, or the absence of same, are not a critical part of the northwest energy picture. Even then, there will be sufficient surplus resources to accommodate energy loads even if the LSRD have been decommissioned and no other resources have been installed. Table 2, below, shows the LSRD relative to NW energy surplus in 2016 and 2025.

Table 2, Pacific Northwest Energy Surplus

LSRD v Surplus Energy	2016	%	2025	%
PNW Regional Surplus 2016	4,616	16%	1,343	5%
Lower Snake Dams	795	3%	795	3%
PNW 2016 Required Resources	23,489	81%	26,762	93%
Total PNW Regional Resources	28,900		28,900	

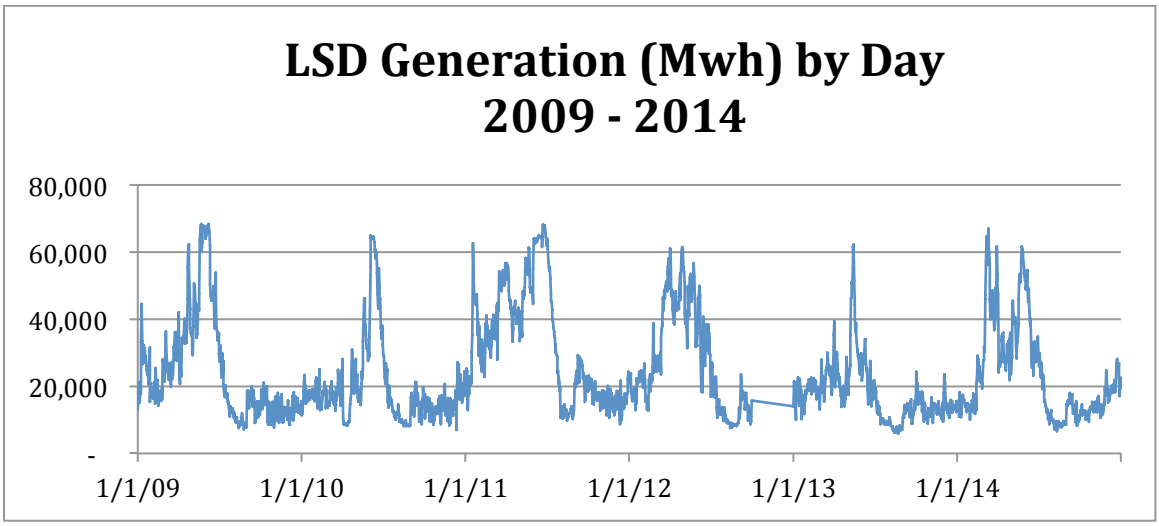
This is not to say that some alternative to the LSRD, generation, conservation, etc., will never be needed at some point in the future. It will. The bigger point is that it has always been the case that as long as energy loads continue to grow, new energy resources or other alternatives will continually be needed. This is true regardless of whether or not the LSRD are in place. The only significant impact of removing the LSRD is that the critical point at which new resources are needed is one to two years sooner than would be the case if they were not removed. From a critical needs perspective the point at which the amount of power produced by the LSRD is absolutely necessary does not occur until sometime after 2025. And, as other new resources are brought online before 2025, just as new resources have been coming online every year in the past, the critical point at which LSRD power needs to be replaced moves even farther into the future.

Open Market Value of LSRD Power

As a beginning point, it is possible to make a very simple and very precise measure of the value of the power produced by the LSRD. On the generation side, the United States Army Corp of Engineers (ACOE) operates the dams and publishes hour-by-hour generation data dating back to the construction of the projects.

The LSRD generation for 2009 through 2014 is presented in Chart 3 immediately below. Like most hydro projects LSRD generation exhibits extreme seasonal variation, with spring runoff peaks in the vicinity of 60,000 megawatt hours (Mwh), roughly three times as high as the 20,000 Mwh per day generation that is normal in the summer, fall and winter.

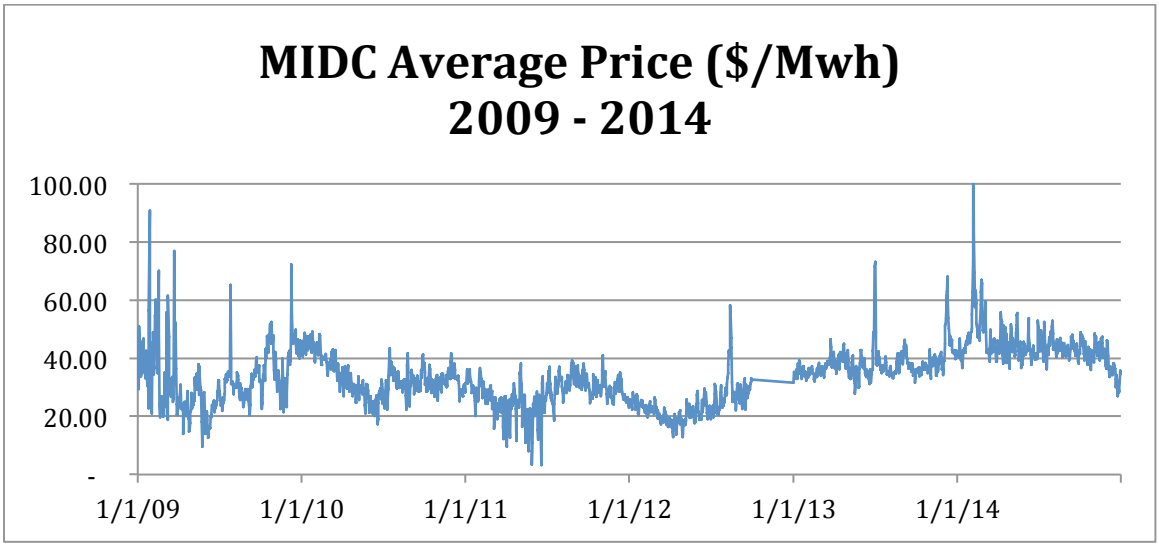
Chart 3



On the pricing side, the closest open market trading hub for the LSRD is the Mid Columbia (MIDC) trading hub. MIDC is not publicly reported. However, the California Independent System Operation (CAISO) publishes hour-by-hour price data for the California-Oregon Border (COB) trading hub (Listed as NP15 in CAISO data). NP15 is a mirror of the unpublished MIDC trades. See Appendix I for more detail on NP15v vs. MIDC prices.

Chart 4, below, presents the MIDC, day-ahead[5] prices for electricity for the time period matching LSRD generation in Chart 3. There is a corresponding seasonality to price swings, but the magnitude is less severe than the swings in generation by the LSRD, at least in part because market prices deal with a multitude of generating resources in addition to the LSRD. Where spring generation is roughly three times that of generation the rest of the year, late spring open market prices typically only fall to about half of the annual peak prices.

Chart 4



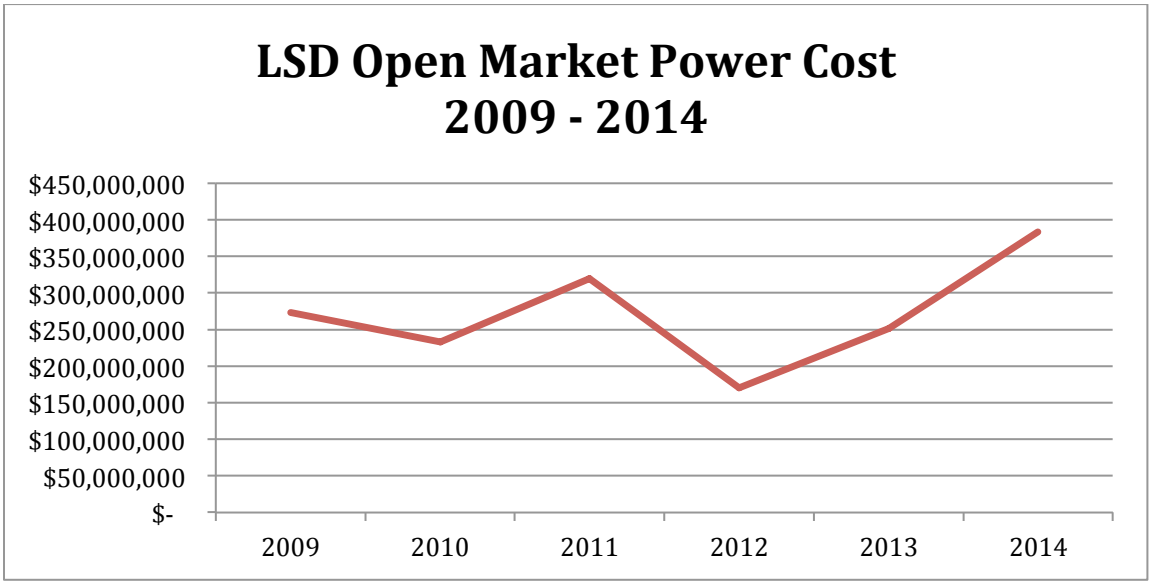
With the table of LSRD generation, at the hourly level from 2009 to present, and the table of MIDC Day Ahead firm prices, at the hourly level from 2009 to present, it is a simple mater to multiply one set of numbers by the other to arrive at what it would have cost to procure the exact value of LSRD generation, hour by hour, year by year. The result of that calculation is presented in Table 3 and Chart 5 below.

[5] CAISO also publishes real time, spot, and prices for all the trading hubs. RME used day-ahead pricing. Day-ahead prices are for firm power. As such the prices are a little higher and less volatile than spot prices.

Table 3

Year	Total Cost
2009	$273,702,134
2010	$233,266,843
2011	$319,619,726
2012	$170,313,879
2013	$251,319,878
2014	$383,592,786
Avg. 2009 - 2014	**$271,969,207**
Median 2009 - 2014	**$262,511,006**

Chart 5



Based on actual generation numbers and actual pricing numbers for 2009 through 2014[6], the most it would have cost to replace LSRD energy would have been $383 million in 2014. At the other extreme, in 2012 it would have only cost $170 million to replace the energy. The average cost of replacement would have been $272 million. The median replacement cost was a bit lower at $263 million.

[6] A quick glance at Chart 5 might lead a person to believe that open market prices are headed for the roof. Please see Appendix II for more detail on NP15 price history and why fears of higher prices are unfounded.

There are arguments for using numbers both higher and lower than the ones presented in this section. I will deal with those arguments in following sections. The more interesting point for the moment is that the numbers presented in this section are exactly what it would have cost to procure on the open market the precise amount of power that the LSRD produced at the precise moment when the power was being produced. While the ACOE and others have presented forecasts of power costs, as RME will do in the following sections, the numbers presented above are actual numbers. To that end they have a degree of validity hard to arrive at with price forecasts.

Median Water Power Planning

First, to procure as much as 60,000 Mwh of energy per day on an occasional basis, or 20,000 Mwh of energy per day on a regular basis, on the open market would probably strain current MIDC market and force prices higher. To that end, this valuation could be viewed as being on the low side.

Second, countering the first argument, it must be observed that the only reason the LSRD produce and sell 60,000 Mwh of energy each spring is because the marginal cost of doing so is zero. This is power that would not be produced if the marginal cost were anything above zero. This is surplus production that tends to drive open market prices down. It is power that already has backup resources in place. It is power that does not need to be replaced. The result is that adding in the market value of this surplus power produced in the spring tends to overvalue cost of replacing LSRD power.

Every power source has an Achilles heel. Wind turbines fail in calm conditions and solar fails at night. Hydropower fails in drought years. Any plans to sell hydropower in excess of that which can be produced by minimum stream flows must necessarily be backed up by one or more other resources, typically a gas or coal plant. In practice minimum stream flow planning is a bit sever so most utilities use some version of median stream flow planning. For the LSRD the median power produced from 2009 through 2014 is 19,067 Mwh per day, or 795 aMW.

Looking at the same data tables used to produce the results in Table 1, it is possible to extract both median levels of power generation at the LSRD, by hour, for 2009 – 2015. It is also possible to extract the median price of power at MIDC, by hour, for 2009 – 2014. The result is presented in Table 4 on the following page.

Procuring median water levels of LSRD generation at open market pricing based on actual MIDC prices would cost $239 million.

Table 4, Median Value of LSRD Power.

Hour	Med Price x Med Gen
1:00 AM	$14,214
2:00 AM	$12,223
3:00 AM	$10,762
4:00 AM	$10,378
5:00 AM	$11,481
6:00 AM	$15,427
7:00 AM	$22,818
8:00 AM	$28,466
9:00 AM	$29,845
10:00 AM	$31,094
11:00 AM	$32,169
12:00 PM	$32,421
1:00 PM	$32,150
2:00 PM	$32,229
3:00 PM	$32,842
4:00 PM	$33,860
5:00 PM	$36,499
6:00 PM	$40,242
7:00 PM	$41,403
8:00 PM	$40,945
9:00 PM	$39,438
10:00 PM	$32,861
11:00 PM	$25,013
12:00 AM	$17,149
Total Median Day	**$655,930**
Total Median Year	**$239,414,453**

Replacement Power Via Solar and the Open Market

The previous section dealt with the lack of need to replace surplus power production in excess of median waterpower production. However, especially in the absence of the surplus spring runoff production, it may be unreasonable to suddenly go to the open market to replace LSRD median generation of 19,067 Mwh per day on a continuing basis without it having an upward impact on prices.

It is worth emphasizing the phrase "may have an upward impact on prices." As this is being written various PUC's across the region are being lobbied to stop the deluge of PURPA wind and solar plants that are putting them into a surplus power position. The surplus power portion is, of course, finding its way onto the open market where it is driving prices down. The point being, since the region is going further into surplus as more and more wind and solar projects come in under the $35.10 Mwh PURPA hurdle, it seems just as likely that picking up 19,067 Mwh per day on a continuing basis won't be either difficult of expensive.[7] Further, the energy market is like any market, it reacts. If producers see higher equilibrium prices, and believe they can profitably supply the demand, they will build projects, supply additional energy, and prices will come back down. Still, for the purpose of this exercise, the next few paragraphs explore the cost of sourcing power from a combination of solar and open market. My reason for choosing solar is that solar is a great fit for the northwest. It is "on" when demand is highest, namely the summer irrigation and air conditioning peaks. Admittedly, it gets dark at night, but that is when there is always abundant power available on the open market.

Table 3, on the following page, presents a case for providing median water amounts of LSRD power via a combination of solar and the open market. The price of solar is based on the Avista and Idaho power avoided cost rates of $35.10 per Mwh. To account for the cloudy days and different sun angles over the course of the year I applied a capacity factor of .85. This increases the cost of solar to $41.29 per Mwh. For the hours 8 PM till 8 AM the assumption is that power will be sourced from MIDC.

This option is a very feasible option. The avoided cost rates are rates that solar producers are routinely seeking from northwest investor owned utilities as this is being written. The off-peak power is readily available at MIDC / NP15 at

[7] The Idaho PUC recently granted Idaho Power a rate increase as part of their annual power cost adjustment (PCA). As a means of offsetting some of their production costs, IPC sells surplus power on the open market. One of the factors cited as the need for Idaho Power to increase costs was, "**Because of lower prices on the wholesale energy market**, Idaho Power is forecasting only $39 million in sales, down from the $51.7 million included in base rates." IPUC Press Release, 5/28/2015. (Emphasis RME)

comparable prices. Finally, significantly, the total annual cost to replace median water LSRD power via the method presented here, at $260 million, is both very firm and very close to the cost displayed in the open market case presented in Table 1 above.

Table 5, Solar Replacement Power

Hour	Median Gen	Median MIDC	Avista-Idaho Power ACR			Solar + Open Market Value
1:00 AM	506.06	$28				$14,214
2:00 AM	475.9	$26				$12,223
3:00 AM	463.12	$23				$10,762
4:00 AM	463.32	$22				$10,378
5:00 AM	483.5	$24				$11,481
6:00 AM	559.42	$28				$15,427
7:00 AM	764.57	$30				$22,818
8:00 AM	889.22		$35.10	0.85	$41.29	$36,720
9:00 AM	925.47		$35.10	0.85	$41.29	$38,216
10:00 AM	937.46		$35.10	0.85	$41.29	$38,712
11:00 AM	935.05		$35.10	0.85	$41.29	$38,612
12:00 PM	923.26		$35.10	0.85	$41.29	$38,125
1:00 PM	913.51		$35.10	0.85	$41.29	$37,723
2:00 PM	903.43		$35.10	0.85	$41.29	$37,306
3:00 PM	898.56		$35.10	0.85	$41.29	$37,105
4:00 PM	907.83		$35.10	0.85	$41.29	$37,488
5:00 PM	928.17		$35.10	0.85	$41.29	$38,328
6:00 PM	968.88		$35.10	0.85	$41.29	$40,009
7:00 PM	991.7		$35.10	0.85	$41.29	$40,951
8:00 PM	1000.9	$41				$40,945
9:00 PM	985.15	$40				$39,438
10:00 PM	913.89	$36				$32,861
11:00 PM	750.91	$33				$25,013
12:00 AM	577.91	$30				$17,149
Sum of Median Hours	**19,067**					**$712,006**
Total Year	**6,959,524**					**$259,882,009**

Footnote to solar power cost. There is an element to solar power, at least photovoltaic-based systems, that is rather unique to power production. Just about every other power production system has a lot of moving parts that have to be repaired and replaced on a continual basis. PVs, on the other hand just sit there. They do degrade a little over time but not nearly to the extent that turbines and conventional generators do. The point is that the prices shown here are primarily for the first 20 years of a project. After that the capital cost associated with a PV solar plant will be retired and the cost of PV power may drop into the teens. To the extent these prices and values are going to be used for 100 year planning, this estimate is very, very conservative.

Summary

In the preceding pages RME presented three alternative scenarios for replacing LSRD power generation. The first, Open Market purchase of LSRD power resulted in a median annual cost of $263 million. The second, open market purchase of median water levels of LSRD generation resulted in an annual cost of $239 million. The third, using photo voltaic power to cover the bulk of power, with open market purchase covering night time power, resulted in an annual cost of $260 million.

Jim Waddell, retired ACOE engineer, has calculated that it will cost $312.9 million annually[8] to maintain the dams, 90 percent of which, $281.6 million, is allocated for power generation.[9] Compared to Waddell's calculations, all three of the scenarios developed by RME are lower cost options than maintaining the dams. Open Market purchases of the power would save ratepayers nearly $19 million per year, or six cents off of each monthly bill. If replacement power were limited to median water purchases, the savings would be $42 million per year, about a thirteen-cent reduction in a typical residential monthly bill. If PV farms were utilized to replace the power, with open market purchases of nighttime power, the annual savings would be about $22 million, six cents per month cheaper for a typical residential consumer.

Table 6, Cost of Maintaining the LSRD vs. Replacement Power

Total Annual Cost to Keep LSRD*	Open Market Purchases 2009-2014		Median Water Open Market Purchase		Combination PV Gen and Open Market Purchase	
	Cost (Median)	Incremental Cost	Median Cost	Incremental Cost	Median Cost	Incremental Cost
$281,600	$262,511	-$19,099	$239,414	-$42,196	$259,882	-$21,728
Monthly Difference In Residential Bills	-$0.06		-$0.13		-$0.06	

[8] The Costs of Keeping the Four Lower Snake River Dams: A Reevaluation of the Lower Snake River Feasibility Report, Jim Waddell, 2015, pp. 10.

[9] The Costs of Keeping the Four Lower Snake River Dams: A Reevaluation of the Lower Snake River Feasibility Report, Jim Waddell, 2015, pp. 10.

Appendix

I Mid-C / NP15 Price Differential

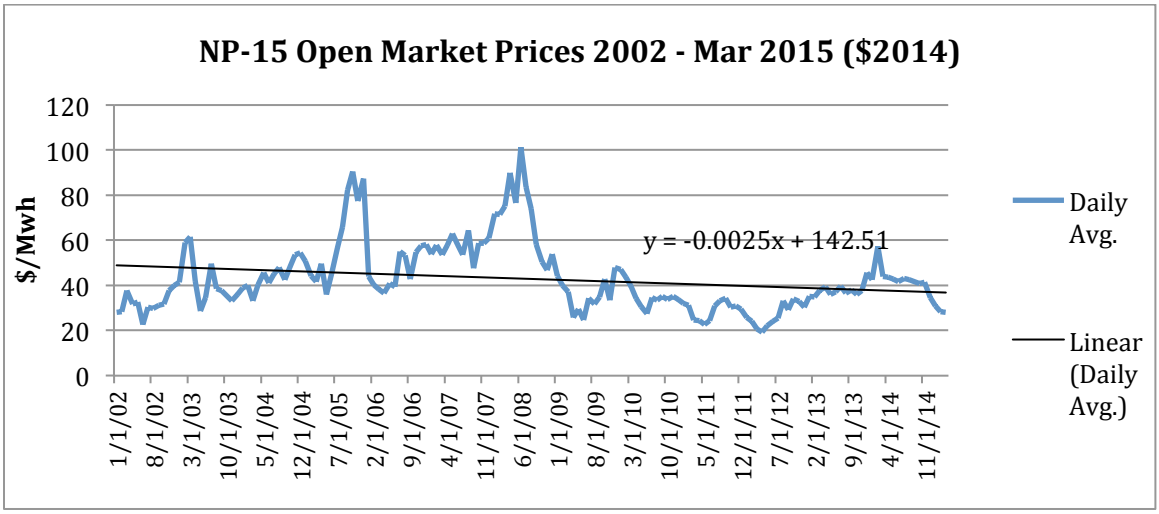
Annual Average Day Ahead On Peak Prices ($/Mwh) [10]

	2006	2007	2008	2009	2010	5-Year Avg.
Mid-Columbia (Mid-C)	$50.18	$56.57	$65.00	$35.66	$35.90	$48.67
California-Oregon Border (COB)	$55.58	$62.14	$73.86	$38.02	$38.84	$53.70
NP15	$61.08	$66.59	$80.14	$39.29	$40.08	$57.45
Difference, NP15 Minus Mid-C	**$10.90**	**$10.02**	**$15.14**	**$3.63**	**$4.18**	**$8.78**

NP15, COB, and Mid-C are, in order of magnitude, the three main open market electricity trading hubs in the Pacific Northwest. NP15 represents the Northern California market, COB represents the California Oregon Border, and Mid-C is the Mid Columbia Basin. Mid-C is the most relevant market for the LSRD but it is not publicly reported. The fact that NP15 is publicly reported on the California ISO Open Access Same-time Information System (CAISO/OASIS) site, and that it moves consistently with and is slightly higher than Mid-C, makes it ideal for analyses such as this. In the tables in the body of this exercise, MIDC is assumed to be NP15 minus $2.50 per Mwh. This has the effect of making MIDC prices appear about $5.28 per Mwh higher than the 2006 – 2010 average calculated by the Federal Energy Regulatory Commission. It also means the cost savings associated with open market purchase presented in the body of this paper are understated.

[10] Federal Energy Regulatory Commission • Market Oversight @ FERC.gov, NW, CA, pp. 5, 2011.

II NP15 Day Ahead Open Market Energy Prices, 2002 – Current



Open market prices are somewhat volatile. That said, extreme high prices are invariably followed by downward corrections. The trend from 2002 through 2008 was clearly upward. The correction in 2009 reversed the previous trend. 2014 prices were higher than the two previous years, but 2015 prices have returned to near record lows. The long-term trend in open market prices continues to be downward.

A Rebuttal to the Pacific Northwest Waterways Association's June 2015 Review of "The Costs of Keeping the Four Lower Snake River Dams: A Reevaluation of the Lower Snake River Feasibility Report"

Background

"The Costs of Keeping the Four Lower Snake River Dams: A Reevaluation of the Lower Snake River Feasibility Report," by Waddell and Laughy was first published in January 2015. It was reviewed by the Pacific Northwest Waterways Association (PNWA) in June 2015. The rebuttal to PNWA's June 2015 review was first published on July 29, 2015.

In 2014, I, Jim Waddell, worked to correct the Corps' errors in a document entitled "The Costs of Keeping the Four Lower Snake River Dams: A Reevaluation of the Lower Snake River Feasibility Report." This report focused on reviewing and correcting the cost estimates in the Systems Improvement Appendix of the 2002 LSRFR and not the Economic Appendix. This was not an economic analysis but an effort to correct cost information that was fed into the economic analysis. In this report I show the NWW seriously understated the cost of keeping the dams and (when compared to the undervalued economic benefits from breaching and the overstated economic benefits of keeping the dams) give evidence that the dams should be breached. NWW's faulty analysis and the Corps unfounded conclusions to keep the dams have cost the American public hundreds of millions of dollars and is leading to the extinction of salmon, steelhead and Southern Resident Orca populations. The Pacific Northwest Waterways Association (PNWA), an organization that represents Snake River dam interests, recently commissioned a review to attempt to discredit my report. The review ignores hard data and instead cherry picks economic guidance intended to justify keeping the dams in place. The review also is fraught with faulty premises, and errors and omissions. For example, the PNWA's premise that financial cost cannot be used as economic cost, and therefore must be disregarded when comparing the costs of different alternatives is wrong. This error riddled report is biased and should be disregarded.

Jim Waddell's Cost Report can be found at link: https://damsense.org/cost-analysis-shows-lower-snake-dams-will-be-an-ongoing-financial-sinkhole/

Rebuttal Summary

In the 1960's and 1970's the U.S. Army Corps of Engineers constructed four dams on the lower Snake River without specific measures to allow juvenile salmon and steelhead to migrate downstream and out to the ocean. As a result, these dams killed millions of juvenile salmon and steelhead every year. In the 1990's all four salmon and steelhead runs on the lower Snake River were listed under the Endangered Species Act. In 1995 the Corps began a long-term study purportedly to resolve the problem. In 2002 the study, the *Lower Snake River Juvenile Salmon Migration Feasibility Report,* was released. While this study and especially the biological information therein can support a decision to breach, a non-breach alternative was selected.

To reach the conclusion that the four lower Snake River dams should not be breached, the

Corps Walla Walla District (NWW) greatly overestimated the costs of breaching the dams, while greatly underestimating the costs of keeping the dams in place by at least $140 million on an average annual basis. These estimating errors are important. Under the Corps policies and procedures, if a project costs more than the benefits it provides, the project should not continue.

History

In the 1930s the U.S. Army Corps of Engineers determined that commercial navigation on the Lower Snake River could not be economically justified. The Army Corps was correct in that decision. Commercial navigation was still not justifiable in 1947 when the Corps attempted to create a benefit-cost ratio greater than 1 for the Snake River Project. Yet in the 1960's and 1970's the Corps erected four dams on the lower Snake River.

As predicted, the four dams decimated already depleted salmon and steelhead runs and turned 140 miles of healthy rearing and river habitat into slack water fish-killing reservoirs. In 1995 the Corps began a five-year, $33 million study to address juvenile salmon mortality caused by the dams. The study was issued in 2002, as the *Lower Snake River Juvenile Salmon Migration Feasibility Report* (LSRFR). As part of that study, the COE erroneously determined that breaching the four Lower Snake River dams was far more expensive than modifying the dams for better juvenile fish passage.

I worked as a civil engineer for the U.S. Corps of Engineers for 35 years and was the Deputy District Engineer for Programs in the NWW during the latter stages of the development of the LSRFR. Other employees and I had serious doubts about the validity of the data being used. I expressed concerns at that time about omissions, errors, miscalculations and faulty assumptions in the work at hand, but the study progressed to its predetermined and erroneous conclusion that modifying the dams to improve fish passage was the preferred alternative. The conclusion was based on the faulty premise that breaching the dams would be far too expensive, both in the short and long term, according to the final report.

Hard data over the past 15 years confirm the mistakes made in reaching the non-breach decision. A reevaluation of the 2002 LSRFR demonstrates that the projected cost of keeping the dams was understated by approximately $140 million on an average annual basis. This is a huge error. Today the reality is not that breaching the dams would be too expensive, but rather that we cannot afford to keep these dams in place in their present configuration. I reported these findings in "*The Costs of Keeping the Four Lower Snake River Dams: A Reevaluation of the Lower Snake River Feasibility Report*" issued in January 2015 (hereafter "*2015 LSR Dams Cost Report*").

The Pacific Northwest Waterways Association (PNWA), an organization that represents interests that make money off the dams, recently requested Dennis Wagner, of PNWA's related Center for Economic Development, Education and Research, to write a review to attempt to discredit the *2015 LSR Dams Cost Report*. Mr. Wagner is retired from the US Army Corps of Engineers and was the Northwest Division Economist and Plan Formulation Team Leader at the time the LSRFR was prepared by the Corps Walla Walla District. Mr. Wagner played a key oversight role in the original formulation of LSRFR alternatives—their

development, presentations and comparisons—that led to the faulty cost analysis in the 2002 LSRFR.
The PNWA/Wagner report can be found at:
http://www.pnwa.net/wp-content/uploads/2012/10/20150602_Analysis-of-Snake-River-dam-cost-claims.pdf.

The *2015 LSR Dams Cost Report*

The *2015 LSR Dams Cost Report* is a reevaluation of the **cost estimates** in the LSRFR contained in *Appendix E: Existing Systems and Major Systems Improvements Engineering of the LSRFR* and **not** the *Economics Appendix* The 2015 report is solely intended to address errors in cost assumptions, analysis and estimates. Indeed, the *2015 LSR Dams Cost Report* does not mention National Economic Development (NED). However, PNWA's report includes frequent reference to the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies,* as published in 1983 (referred hereafter as the P&G) and is the federal governments bases for NED Analysis. A complete understanding of these principles will actually validate my work in the *2015 LSR Cost Report*.

One brief note regarding semantics: my initial reevaluation used *escalation* in the sense that changes in real costs were used to develop the annual costs for each feature of the existing projects. The term *inflation* was introduced into the final report as an editorial attempt to improve readability for the general public. The *2015 LSR Dams Cost Report* has since been revised to reflect the term *escalation* rather than *inflation.*

The P&G and Corps of Engineers Analysis Requirements

What do the P&G and the Corps' *Planning Guidance* say about costs? First the need to understand the complete cost of an alternative. This means all costs. To do otherwise prevents the decision makers and the public from seeing what the impacts of alternatives are to the taxpayer and NED. The P&G repeatedly cites the need to incorporate the concept of complete cost into the project to insure a valid comparison of alternatives.

P&G, paragraph 1.6.2 mandates consideration of all necessary investments and the most cost-effective means to mitigate the problem, in this case juvenile salmon mortality:

> (c) Alternative plans, including the NED plan, should be formulated in consideration of four criteria: completeness; effectiveness; efficiency; and acceptability.
> (1) Completeness is the extent to which a given plan **provides and accounts for all necessary investments** and other actions to insure the realization of the planned effects. (emphasis added)
> (3) Efficiency is the extent to which an alternative plan is the **most cost-effective means** of alleviating the specified problem and realizing the specified opportunities consistent with protecting the nation's environment. (emphasis added)

P&G, paragraph 1.7.2 requires the report to consider all costs of each alternative:

> (a)(3) Adverse effects in the NED account are the opportunity costs of resources used in implementing a plan. These **adverse effects include: Implementation outlays**, associated costs, and other direct costs. (emphasis added)
>
> (g) NED cost categories. For convenience of measurement and analysis, NED costs should be classified as implementation outlays, associated costs and other direct costs.
> (1) Implementation outlays. These are the **financial outlays** (**including operation, maintenance and replacement costs**) incurred by the responsible Federal entity and by other Federal or non-Federal entities for implementation of the plan in accordance with sound management principles. (emphasis added)

Further, the Corps' *National Economic and Procedures Manual--National Economic Development Costs*, June 1993, makes clear that for estimating the cost of operating and maintaining the dams, which can be measured in dollars, the economic and financial costs are the same:

> "The vast majority of costs encountered in a water resource project will be both economic and financial costs. All the basic inputs to a project like land, concrete, steel, labor, equipment, etc. require the exchange of money while they cost society the opportunity to use these scarce resources in an alternative way. In virtually all of these cases the money exchanged for the resource will be a good measure of the resource's economic value. When this is so, economic and financial costs are equal, as they are for the vast majority of resources used in project construction and operation."

Finally, Engineering Regulation ER 1105-2 NED Benefit Evaluation Procedures requires accounting *for all life cycle costs*. Paragraph E-5 (d) provides:

> Life cycle costs will also be explicitly considered in the development of project cost estimates. These life cycle costs, including operation, maintenance, repair, replacement and rehabilitation (OMRR&R) costs as well as any necessary environmental monitoring and compliance inspection costs, **play an important role in the trade--offs between high capital cost projects and those that have high operation and maintenance (O&M) costs.** (emphasis added)

The PNWA is simply incorrect in claiming that the *2015 LSR Cost Report*'s "use of financial data… is inconsistent with proper evaluation procedures under the Principles and Guidelines." The financial data in the report represents the actual or projected costs that were or will be expended in the year the costs were or will be incurred, and hence real exchanges of money. The increases in cost over time reflect real increases in the forgone opportunities realized to the rest of the economy.

Because these annual costs require real exchanges of money, pursuant to the Corps' policies and procedures, they must be calculated in then-year dollars through some escalation or cost trend method, as in the case for the fish hatchery costs. The *2015 LSR Cost Report* explains how this was done for each of the six cost categories, but uses the term *inflation*, which apparently confused the PNWA. All of the 2015 report's future year estimates were brought back to the same base year using the same discount rate the Corps used in the LSRFR. These were then converted to average annual costs, also as was done in the LSRFR.

The LSRFR provided a set of nine alternatives or options for mitigating juvenile salmon mortality by keeping the dams in place. Each option for retaining the dams had similar scopes for Operations, Maintenance and Repair, (OM&R) costs. The only alternative that did not have a similar scope was dam breaching. With dam breaching, there are virtually no out year (OM&R) costs after the dams are breached, when compared to the alternatives for keeping the dams in place.

The P&G and Corps procedures set forth above require accounting for the difference in future year costs. Using current costs without escalation to arrive at an annual cost for each option over a 100-year study period does not make sense and is inconsistent with the Corps' policies and procedures. Yet this is what the Corps Walla Walla District did in writing the LSRFR. This made dam breaching appear to be a high cost alternative, because its costs were projected to be incurred during the first seven years, and then flat line thereafter. In other words, dam breaching was highly front-loaded, while each alternative for keeping the dams incurred high costs throughout their lifetimes. By using flat line OM&R costs, discounted over a 100-year period, the NWW (under the guidance of the Northwest Division) disingenuously lowered the average annual costs for each alternative that retained the dams, while showing high costs for dam breaching. This is because discounting had little effect on the average annual costs for breaching.

ER 1105-2 provides that "With increased… Federal emphasis on budgetary restraint, commanders must be sensitive to real financial constraints on project scale. Accurate estimates of the costs of alternative plans play a vital role in plan formulation and project scoping." Contrary to this directive, the LSRFR's approach distorted the real costs to society, making tradeoff analysis difficult to understand. The NWW comparisons of dam retention alternatives versus the dam breaching alternative rested on simple, cherry picked words and phrases that allowed indecipherable, if not outright misleading, plan formulation, i.e., alternative comparisons. The comparisons are also at odds with PNWA's recent statement "that the reevaluation cannot be accomplished through utilization of overly simplified approaches, particularly when considering the highly complex nature of the Lower Snake System". Indeed, my reevaluation went to great length to correct the over simplifications in price/cost data that led to distorted comparisons and displays of cost information that was fed into the NED analysis in the Economic Appendix of the LSRFR.

The PNWA's Assertion that DREW and IEAB Reviewed the Cost Analysis Is Misleading

PNWA's statements regarding the work of the Drawdown Regional Economic Work Group (DREW) and reviews by the Independent Economic Analysis Board (IEAB) of the

Northwest Power Planning Council are misleading and do not help the PNWA. Neither DREW nor the IEAB worked on or reviewed the Implementation costs developed and displayed in the *Existing Systems and Major System Improvements Engineering Appendix* of the LSRFR, which was the primary focus of my cost reevaluation. Both DREW and the IEAB accepted as correct the faulty LSRFR original cost figures. This was an unfortunate oversight and is indicative of the lack of independent review evident in the planning process of the LSRFR. Other than an internal assessment for decision analysis by Walla Walla District engineers in 2000, that pointed out significant errors in the cost estimates as noted in my cost report, my reevaluation in the *2015 LSR Dams Cost Report* likely stands as the only serious independent review of this key document.

PNWA's Critique of the Six Cost Categories in the *Cost Report*

Category 1-- Improving Fish Passage (System Improvement Costs)

The PNWA report accurately describes my method for correcting the underestimates made by the engineers engaged in decision analysis. These errors were pointed out in the decision briefing to the District Commander at the time, but the Commander's and the Northwest Division Planning staff ignored the errors because "it was too late in the study process to correct them."

The PNWA report criticizes my work on *System Improvement* Costs for using financial costs and inflation (more accurately *escalation*) and stated that the "fully funded" cost I used from 12 years of Walla Walla District Activity reports is for budget planning and not a NED cost. These fully funded costs incurred are actual cost for each year that I used to verify my corrections and escalation rates and are in fact economic costs. Every effort was made to insure there was no "double counting" of costs. PNWA further argues this information is "of no consequence in a NED analysis" in spite of planning guidance to the contrary. As noted above, PNWA's comment represents an inaccurate oversimplification of the *Principles and Guidelines*, Corps *Planning Guidance* and common sense. The PNWA's comment also disregards economic efficiency and protecting the nation's environmental resources—other key principles of the guidelines.

Category 2-- Operations and Maintenance Costs

Again, the conclusions in the PNWA report violate the *Principles and Guidelines* by claiming the LSRFR rightfully ignored future OM&R costs associated with keeping the four LSR dams in place. My reevaluation corrects and verifies these costs based on actual expenditures since the completion of the LSRFR, on Means Cost Estimate information, and on 35 years of experience in Corps project planning and cost analysis.

Category 3-- Turbine Rehab Costs

The PNWA report criticizes my use of "financial data", this time from the Bonneville Power Administration, as inconsistent with the P&G. This data reflects the

current estimate of rehabbing three turbine units and validates the corrections to underestimates for all 24 turbines and their escalation using the Corps own construction cost indices. Not using this information in a NED analysis begs the question what cost would PNWA find acceptable in a NED analysis.

Ignoring these necessary cost corrections of rehabbing the 24 turbines in the four lower Snake River dams makes a mockery of the *Principles and Guidelines and Corps Planning guidance*, including the admonition within the P&G that common sense must prevail. The PNWA does appear to agree with the LSRFR's and my own conclusions that a third rehab would be inadvisable for the dams, which by then would be well over 100 years old and turbine rehabs would entail the replacement of surrounding concrete. Finally, my turbine rehab cost estimates used the upper limit of turbine life span projected by NWW, a conservative approach.

Category 4-- Lower Snake River Compensation Plan Cost

One of the fastest growing costs of keeping the lower Snake River dams in place is the OM&R hatcheries constructed to mitigate for the loss of salmon and steelhead. The PNWA report citizens my of use 5% inflation when in fact BPA's own cost and projections reflect a 5.5% escalation rate, as noted in my report. Despite this pretense, compensation plan costs are real and will continue for the life of the project. As noted above, to ignore these costs violates the Corps' own planning guidance and the P&G.

Category 5-- BPA Power Services Cost

O&M costs for the four LSR dams in 2014 provide a reasonable estimate for these costs based upon expenditures over the previous dozen years. Further, the use of a 3% escalation rate for future O&M costs during the second half of an aging dam's lifespan is conservative. Once again, the P&G require that these costs be included in any reevaluation of the Snake River Project.

Category 6-- Navigation and Flow Conveyance Dredging

NWW's Lower Snake River Programmatic Sediment Management Plan provides valuable information relevant to a reasonable estimate of future sediment management costs, particularly in the Lower Granite pool. First, annual costs for dam maintenance over the past 14 years do not include costs associated with flow conveyance (flood risk). Second, the cost of sediment management for this purpose will be much greater than that for navigation alone. Finally, as a "major finding," NWW concluded that sediment management for navigation and flow conveyance combined will require the removal of 700,000 cubic yards of sediment annually. To state that NWW does not currently have any plans for further sediment action does not eliminate the need. Alternatives to dredging include the construction of an upstream sediment trap accompanied by the removal of 600,000 cubic yards annually (which sounds like dredging by some other name) or the raising of the entire levee system at Lewiston. The use of $13/cubic yard in the 2015 LSR Dam Cost Study for sediment removal and disposal has since been shown to be an underestimate. In 2014/15 dredging cost in the original contract was close to $17/cubic yard. NWW has not announced the actual cost per cubic yard of this project after a contract revision, but the final cost will certainly exceed this cost. One of the alternatives the Corps included in its

initial Lower Snake River Programmatic Sediment Management Plan announcement in the *Congressional Record* was the purchase of flood insurance for all property owners in downtown Lewiston. This cost has not been included in the *2015 LSR Dams Cost Report.* Therefore, the future cost for sediment management in the LSR Project is likely understated in the *2015 LSR Dams Cost Report*.

The Analysis Period and Base Years Used in the *Cost Report* Are Reasonable

The PNWA takes issue with the period of analysis in the *2015 LSR Dams Cost Report.* PNWA attempts to discredit the report by claiming the cost reevaluation used a different base year than did the LSRFR. The LSRFR contains numerous cost discrepancies among appendices and between the appendices and the LSRFR itself. The presentation of costs and/or benefits in the Economic Appendix is often indecipherable, even to seasoned economists. Further, some costs were located in sources other than the LSRFR itself, e.g. the NWW Civil Works Activity Reports. As a remedy to this potential confusion, 2001 was chosen as the base year and all costs converted to that year using the same discount rate and methods NWW applied in the LSRFR

The table using 2015 as a base year was included to show what the cost of operating the dams over a 100-year project life would be starting today. All costs from 2001 to 2014 were eliminated, thus many of the *System Improvement* costs incurred during that period were not included. The turbine rehabs began in 2014, instead of 2004 as projected in the LSRFR. Cost projections for the turbine rehabs are based on actual cost data for the first three turbines, rather than using a 1998-dollar cost estimate that we now know was significantly understated 15 years ago. PNWA's claim that the 3-year discrepancy between starting dates of a 100-year project in the two reports constitutes a serious issue, particularly when corrections in values have been appropriately made to a given base year, appears to be simply a weak attempt to discredit inconvenient information, rather than an attempt at honest review.

The LSRFR Understated the Average Annual Cost of Keeping the Dams by at Least $140 Million

A final monetary issue is the cost to decommission the four Snake River dams. All dams erected by the federal government must be decommissioned when they have outlived their useful lives. While the *Principles and Guidelines* clearly identify the need to consider *all* future costs of a project, the LSRFR included no cost for decommissioning the LSR dams once their useful lives have ended. The *2015 LSR Dams Cost Report* set forth a $20 million average annual cost for dam decommissioning. This amount appears to be high given the use of high discount rates over a 100 years period and will be revised. Yet even if the decommissioning cost is omitted entirely, the LSRFR continues to reflect an understatement of average annual cost for keeping the dams of at least $140 million.

For further information or questions, contact Jim Waddell at karios42@earthlink.net

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.

> 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 pro- vide a reasonable basis for decision-making.[1]
>
> U.S. General Accounting Office report to the United States Congress, 2006

A Reevaluation of the Lower Snake River Feasibility Report
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 (Alternative 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 20012105. 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 4 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 re-evaluation 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.

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. Read the remainder of this report at: http://bit.ly/LSRDcostRebuttal

Draft (21 Feb 2016)

REEVALUATION:
Lower Snake River Juvenile Salmon Migration Feasibility Report/ Environmental Impact Statement

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SUPPLEMENT:
Appendix D
Natural River Drawdown Engineering

Prepared by

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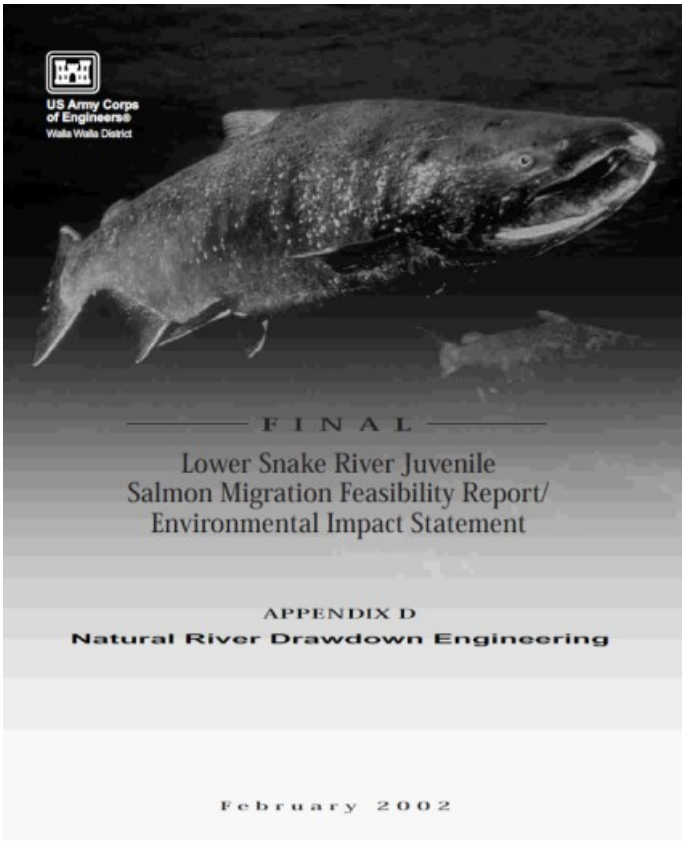

Executive Summary- Breach Plan and Costs

When the Army Corps of Engineers Northwest Walla Walla District (NWW) drafted the FR/EIS to explore four alternatives for improving juvenile salmon migration through the lower Snake dams, it used the opportunity to paint a picture of dam breaching as an elaborate, prohibitively expensive, time consuming, and overall unattractive option - even when correctly selecting channel bypass over full removal. Their bloated plan/cost only served to further reinforce their assertion that the dams must continue to operate.

Through a careful reevaluation of the NWW FR/EIS, a revised channel bypass plan for breaching that costs significantly less (a 70% reduction) than the NWW near billion-dollar proposal and it can be accomplished in half the time. The keys to accomplishing a cost and time efficient breaching of each dam are as follows:

- **Very little modification to the power house is needed.** The NWW proposal involved significant alterations to the six turbines that even their own data showed was unnecessary to safely draw down the reservoir.
- **Allow the river to do the majority of the embankment removal.** The NWW proposal was to mechanically excavate the entire earthen embankment and only allow the river to breach the cofferdams, although it appears that more hydraulic removal of material is required than assumed. Hydraulic breaching has been used numerous times in the Pacific Northwest in the years since the FR/EIS was written and new technology exists to model hydraulic breaching in a safe and predictable manner as was done in this updated plan.
- **River channelization can be accomplished using materials already in place at the dam.** During dam construction, the natural river channel was successfully routed around the concrete structure without the levees proposed in the FR/EIS.
- **Fish handling is unnecessary.** Dam breaching will take place at a time when few anadromous fish are present in the river (in the winter). Hydraulic conditions through the breached embankments will be favorable to fish passage, just as they were during dam construction. Even still, due to specialized pumps in Lower Granite Dam, it can be breached even when fish are present, or in other words, can be breached at any time of the year.
- **Minimal reservoir embankment actions are necessary for road/railroad protection and repairs.** The NWW proved this during the 1992 drawdown test. In the FR/EIS, NWW planned to spend one hundred times more money on repairing damages to roads and railroads than drawdown actually caused. Drawing the reservoir down at a slower initial rate, as this reevaluation recommends, will further reduce the minimal damage that occurred in the 1992 test.
- **Lyons Ferry Hatchery should not be modified as the NWW's plan proposes.**
- **This Supplemental Appendix D simply improves on Alternative 4 (channel bypass) at lower cost; this plan is consistent with the existing FR/EIS for the overall project.**

The NWW's breaching proposal certainly appears to have been created with a pre-determined conclusion that breaching is an unjustifiably expensive and lengthy process. This revised breaching plan was developed with efficiency and safety in mind, using innovative means. Implementation of the breaching plan as outlined in this document could be started in January 2019 with the hydraulic breaching of Lower Granite Dam commencing any time after 1 February 2019. With each successive dam breach money will be saved and salmon will take another step towards recovery. Read the full report at https://damsense.org/wp-content/uploads/2018/09/Breach-Plan-Estimate-21-Feb-2016.pdf

Commercial Navigation on the Lower Snake River

The Truth About Benefits vs. Costs

Men occasionally stumble over the truth, but most of them pick themselves up and hurry off as if nothing happened.
Winston Churchill

The 2002 Environmental Impact Statement (EIS) for the Lower Snake River Programmatic Sediment Management Plan (LSRPSMP) created by the U.S. Army Corps of Engineers (USACE) erroneously claimed that maintenance of the lower Snake River navigation channel provides an annual *savings* of $25 million. The Northwest Division's Walla Walla District (NWW) of USACE continues to make this claim and waste millions of tax payer dollars.

During the public comments for the LSRPSMP, many requested NWW address the Cost-Benefit issues in a final EIS and LSRPSMP. In response to these comments, the NWW stated:

> *To ensure that continued maintenance is warranted, the Corps considered the current amount of traffic and the increased cost of transporting goods by alternative modes (rail or trucks) as opposed to barge.*
>
> *A variety of products are transported by barge on the lower Snake River, including grain, containers, fertilizer, and machinery. Based on the 2002 Final Lower Snake River Juvenile Salmon Migration Feasibility Report/Environmental Impact Statement, (http://www.nww.usace.army.mil/Library/2002LSRStudy.aspx), the increased cost to transport grain by rail or truck is about $8.45 per ton in current dollars [2014]. Total tonnage on the lower Snake River is currently estimated at about 3 million tons with the majority being grain. Therefore, annual transportation savings of approximately $25M can be expected if the navigation system is maintained. In reality it is likely that benefits will increase in the future as traffic continues to recover from the recession. Annual costs to maintain the lower Snake River navigation channel are estimated to be in the $1-5M range. Therefore, based on the estimated transportation savings, ongoing channel maintenance on the lower Snake River is warranted from the navigation perspective.*[i]

To ascertain $8.45 per ton requires a review of the EIS noted in the NWW comment. Appendix I, section 3.3 of the EIS lays out the methodology for the report's claim that barge transportation resulted in a savings of $5.75 per ton in 1998 dollars compared to freight transportation by other means. Based on a 3% inflation rate, $5.75 in 1998 would indeed become $8.45 in 2014. Section 3.3 contains the following paragraph:

> *The direct economic costs that would result from breaching the four lower Snake River dams are measured and expressed as changes in the NED [national economic development] account. NED costs represent the opportunity costs of resource use, measured from a national rather than a regional perspective. In the case of dam breaching, the change in the cost of transporting products and commodities now shipped from ports on the lower Snake River is a NED cost, but the loss of revenue and profit by barge companies is not. Only the costs of resources actually used are included in the NED analysis. Although market prices (e.g., transportation rates) often*

reflect the total opportunity cost of resources, this is not always the case, and surrogate costs must sometimes be used to adjust or replace market prices (or published or contract rates). In this study it was judged appropriate to use modal costs computed through analysis of the actual fixed and variable costs of each transportation mode—barge, rail, and truck, rather than rates.[ii]

Note the NWW elected to use costs generated by a computer model rather than actual rates for shipping goods to calculate changes in the NED account. Members of the barging industry were the first to identify a problem with this approach as documented in the appendix on page I3-85:

During the course of this study it was determined that there is a large difference between barge costs as estimated by the Reebie Barge Model and rates that are actually charged by the barge industry. For example, the Reebie Model estimates a cost of $3.07 per ton for shipping grain from Almota, Washington to Portland, Oregon, compared with the actual rate charged by the industry of about $6.07 per ton. Industry representatives have stated on numerous occasions that the costs estimated by the Reebie Barge Mode/ are incorrect (too low). In response to the comments by representatives of the barge industry, Corps analysts reviewed three other studies of barge costs. The finding was that all of the studies showed that rates are significantly higher than costs. In addition, input data for the Reebie Mode/ were provided to an industry representative for review and comment. No comments on the input data were ever received from representatives of the industry. On the basis of currently available information, barge costs produced by the Reebie model are considered appropriate for use in the study. ***The effect of using higher costs in the model****, as has been suggested by representatives of the barge industry,* ***would be to reduce the transportation system cost impacts of dam breaching and possibly indicate a large shift of grain from barge to rail.*** *(Emphasis added)*

This last quote requires careful review. Rates (the actual prices shippers charged customers) were much higher than the costs proposed by the Reebie Model. High levels of profit in the rates the barging industry charged at the time for shipping grain on the lower Snake River contributed to the higher rates, which the barging industry considered "costs." However, if NWW's analysis used these higher costs in their formulation, the claimed navigation benefit of keeping the dams in place would be reduced—in fact, the benefit would be reduced to zero.

In an effort to confirm the difference in cost versus rates, NWW hired another consulting firm, TransLog Associates to obtain truck / barge and truck / rail rates which indeed verified significant differences between barging costs versus rates from all locations. It also found that in 11 of 18 locations the rail rates were below the rail costs calculated from the cost model. The NWW assessment of this information is noted on page I3-82:

A total of 18 origins were compared—nine in Washington, eight in Idaho, and one in Oregon. The comparison showed that truck / barge rates are consistently higher than costs and range from about one percent above costs to over 50 percent above costs. In the case of truck / rail, the comparison showed that rates were below costs for 11 of the 18 origins with a range from about 3 percent below costs to 30 percent below costs. The remaining seven origins had truck / rail rates that were higher than costs with a range of from nearly 33 percent above costs to a low of about one percent above costs. ***The wide disparity between rates and costs suggests that in many cases rates are not set in a competitive environment, which is the condition required for rates to be used in NED analyses****. (Emphasis added)*

Of importance here is not only the fact that barging rates were much higher than the costs, but also the comparison of shipping rates for truck / barge with shipping rates for truck /rail. Table 3.3-1 (see Appendix) shows relatively small differences between actual shipping rates across modes from the same location, indicating that a competitive market *was* in place. This competitive market existed in spite of the very high profit margins reflected in the truck / barge rates.

Further, the Corps' planning ER 1105-2-100 Appendix D relating to the calculation of benefits for Navigation projects states:

> *It is currently more difficult to accurately compute the long-run marginal costs of particular rail movements on the basis of cost estimation studies than to determine the rates at which railroad traffic actually moves. In competitive markets, rates (prices) correspond to marginal cost, and, given market stability, prices will settle at long-run marginal costs. Moreover, the rates actually charged determine the distribution of traffic among modes.* ***For these reasons, rates will be used to measure shift of mode benefits.*** *(Emphasis added)*

By disregarding this guidance, the District made an error in the LSRFR that provided a faulty and overstated benefit for truck / barge navigation versus truck / rail. The decision by the NWW to use *costs* generated by the Reebie Model rather than rates raised the NED costs of breaching the dams and thus supported keeping the dams in place. NWW also predicted that use of the higher costs in their formulation would "possibly indicate a large shift of grain from barge to rail", a prediction borne by the decline of freight traffic on the lower Snake River by 71% between 2014-2017.[iii]

The LSRFR does include a means of more accurately approximating the difference between truck / barge and truck / rail at the time of the LSR feasibility study upon which the NWW has based its $8.25/ton differential. Rather than using the Reebie Cost Model the Corps erroneously adopted, a comparison can be made using the average shipping rate for each state identified by the Translog Associates' study as summarized in Table 3.3-1 and weighting this rate by the percentage of grain each State shipped contained in Table 3.3-25 (see Appendix).

The Translog study provided data for Washington, Idaho, and Oregon, which in 1998 accounted for 92% of the grain shipped on the lower Snake River. Washington shipped 66.6% of the barged grain, Idaho 25.5%, and Oregon 0.8%. For Washington, the average truck / barge cost was $12.84 per ton, with truck / rail at $13.44. Idaho had average truck / barge cost of $20.01, with truck / rail at $18.77, while the data for Oregon was $17.89 for truck / barge and $16.48 for truck / rail. When the State average rates are weighted by each State's freight volume, truck / barge cost is $13.80 per ton and truck / rail is $13.87, a difference of just 7 cents a ton.

Thus, the NWW today is using the results of a faulty analysis in the LSRFR to "ensure that continued maintenance [of the lower Snake River navigation channel] is warranted." The claim of a $25 million benefit for maintaining this channel is a false claim. The 2002 EIS which the NWW relies on to make this claim is flawed, and the actual NED benefit can best be estimated at zero based on the 2002 LSRFR. Further, the Corps' estimated $1-$5 million annual cost in the sediment management plan for maintenance of this waterway fails to fully consider the cost of lock operations/maintenance, major repairs such as $10 million lock gate replacements, and needed major lock rehabilitation expenditures on the near horizon, let alone the +$16 million the NWW has now spent on the sediment management plan itself.

NWW has a vested interest in keeping the lower Snake River Project alive, and they are partnered with the special interests that benefit from maintenance of the waterway at public expense. An honest, unbiased Cost/Benefit analysis of commercial navigation on the lower Snake River leads to two major conclusions: further expenditure of taxpayer dollars on this waterway is not economically justifiable, and the money that could be saved by closing the lower Snake to commercial navigation would be much more wisely spent on maintaining more productive waterways such as the Columbia River.

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Appendix

Table 3.3-1. Comparison of Truck/Barge and Truck/Rail Costs and Rates

	Truck/Barge					Truck/Rail			
State/County	Location	Truck/Barge $/ton (rate)	Truck/Barge $/ton (cost)	Difference Rate minus Cost	Way Point*	Truck/Barge $/ton (rate)	Truck/Barge $/ton (cost)	Difference Rate minus Cost	Way Point*
Washington									
Adams	FRD	7.74	12.23	4.49	Tri-Cities	16.34	13.24	(3.10)	Odessa 1
Asotin	FRD	14.60	16.54	1.94	McNary	20.50	18.95	(1.55)	Pendleton1
Columbia	FRD	7.67	10.86	3.19	McNary	13.83	13.02	(0.81)	Pendleton1
Franklin	FRD	5.14	8.14	3.00	Tri-Cities	12.04	9.72	(2.32)	Plymouth
Garfield	Dodge	9.58	12.68	3.10	McNary	15.30	14.17	(1.13)	Pendleton1
Lincln	Odessa2	10.68	15.63	4.95	Tri-Cities	14.69	14.20	(0.49)	Odessa 1
Spokane	FRD	14.41	15.55	1.14	Tri-Cities	13.44	14.29	0.85	Spangle2
Walla Walla	FRD	5.94	8.82	2.88	McNary	12.70	9.01	(3.69)	Pendleton1
Whitman	FRD	10.47	15.10	4.63	Tri-Cities	19.20	14.37	(4.83)	Pendleton1
Idaho									
Bennewah	FRD	15.83	20.85	5.02	Tri-Cities	15.17	19.21	4.04	Spangle2
Boundary	FRD	15.71	24.71	9.00	Tri-Cities	23.83	16.69	(7.14)	Spangle2
Idaho	FRD	16.88	21.45	4.57	Tri-Cities	16.17	20.97	4.80	Grangeville
Canyon	FRD	17.65			Hogue Warner	15.24			Nampa1
Kootenai	FRD	15.83	19.34	3.51	Tri-Cities	17.33	14.60	(2.73)	Spangle2
Latah	FRD	15.29	18.88	3.59	Tri-Cities	19.15	19.39	0.24	Spangle2
Lewis	FRD	17.18	17.67	0.49	Tri-Cities	15.50	20.54	5.04	Craigmont
Nez Perce	FRD	15.68	17.14	1.46	Tri-Cities	16.71	19.99	3.28	Craigmont
Oregon									
Wallaowa	FRD	13.37	17.89	4.52	Kennewick	15.13	16.48	1.35	Pendleton1

*Way point refers to the point where commodities would be transferred from truck to barge or rail or from truck to rail.

Note: FRD = Farm to River Direct

Table 3.3.-25

Increase in Grain Shipments and Shipping Costs with Dam Breaching for 2007 Projected Volume, by State* (1998 dollars)

State/Unit Cost	Volume (bushels)	Transportation ($)	Storage ($)	Handling ($)	Total ($)	Share of Cost (%)	Share of Grain (%)
Idaho	32,289,941	4,954,984	894,385	410,294	**6,259,633**	28.6	25.5
Cost per bu (cts)	32,289,941	15.3	2.8	1.3	**19.4**		
Cost per ton ($)	969,668	5.11	0.92	0.42	**6.45**		
Montana	6,537,310	1,376,031	0	0	**1,376,031**	6.3	5.2
Cost per bu (cts)	6,537,310	21.00	0.0	0.0	**21.0**		
Cost per ton ($)	196,139	7.02	0.00	0.00	**7.0**		
N. Dakota	2,458,172	261,556	0	0	**261,556**	1.2	1.9
Cost per bu (cts)	2,458,172	10.60	0.0	0.0	**10.6**		
Cost per ton ($)	73,753	3.55	0.00	0.00	**3.55**		
Oregon	980,218	61,328	0	0	**61,328**	0.3	0.8
Cost per bu (cts)	980,218	6.30	0.0	0.0	**6.3**		
Cost per ton ($)	29,409	2.09	0.00	0.00	**2.09**		
Washington	84,355,029	11,586,875	1,580,001	737,028	**13,903,904**	63.6	66.6
Cost per bu (cts)	84,355,029	13.70	1.90	0.90	**16.5**		
Cost per ton ($)	253,904	4.58	0.62	0.29	**5.49**		
Subtotals	**126,620,670**	**18,240,774**	**2,474,386**	**1,147,322**	**21,862,452**	100	100
Cost per bu (cts)	126,620,670	14	2.0	0.9	17.3		
Cost per ton ($)	3,802,423	4.80	0.65	0.30	5.75		
Total NED Infrastructure Costs - Low					4,250,000		
Total NED Costs - Low Infrastructure Costs					26,118,482		
NED Infrastructure Cost - High					27,211,000		
Total NED Costs - High Infrastructure Costs					49,083,482		

*Cost shown do not include the "adjustment" cost of $794,781 that was calculated by the model to prevent the cost of any movement with dam breaching from being less than it was estimated to be in the base condition.

Endnotes

[i] Lower Snake River Programmatic Sediment Management Plan, Final Environmental Impact Statement; Appendix G – Public Involvement. 2014. Page 69 (G-67), comment no. 8360
https://www.nww.usace.army.mil/Portals/28/docs/programsandprojects/psmp/Revised_Appendix_G_consolidated_FINAL_8-13-14_HandF.pdf

[ii] Final Lower Snake River Juvenile Salmon Migration Feasibility Report/Environmental Impact Statement. Appendix I: Economics. Page 152 (I3-81)
https://www.nww.usace.army.mil/portals/28/docs/environmental/lsrstudy/Appendix_I.pdf

[iii] Laughy, L. Jan. 4, 2018. *Lower Snake River commerce hits all-time low.*
https://www.idahorivers.org/newsroom/2018/1/4/2017-lower-snake-river-freight-transportation-review

National Economic Analysis of the Four Lower Snake River Dams

A REVIEW OF THE 2002 LOWER SNAKE FEASIBILITY REPORT/ENVIRONMENTAL IMPACT STATEMENT ECONOMIC APPENDIX (I)

EXECUTIVE SUMMARY

This report presents a thorough analysis of the benefits and costs of the four Lower Snake River dams in both "keep dam" and "breach dam" scenarios. The dams were originally purposed for hydropower and navigation benefits, but in order to achieve a positive benefit-cost ratio, indirect benefits for navigation and power and additional credits for the use of "cheap hydroelectric power" over coal-fired plants were included.[1] Additionally, the original analysis did not account for lost direct and indirect benefits, such as the recreational benefits associated with a free-flowing river or tribal fishing benefits.

This report concludes that the benefits created by the four dams are outweighed by the costs of keeping them. Furthermore, with the possible exception of navigation and irrigation water supply, the current benefits would not be lost, but rather increased, if the dams were breached. Due to subsidies and unclear rail and barge cost data, the verdict is still out on whether there is an economic benefit to shipping by barge over rail. The four Lower Snake River dams in southeast Washington do not provide a net benefit to the nation, and they may never have.

This document should be used to inform the Army Corps of Engineers, the Walla Walla District of the Corps, key decision-makers, and concerned ratepayers.

KEY CONCEPTS AND CONCLUSIONS

- The Snake River dams have two authorized purposes: hydropower and navigation. The direct benefits of these purposes do not surpass the costs of maintaining them.
- In many years, the costs of operating the dam outweigh the value of the electricity produced; these costs are then passed on to the ratepayers. Breaching the dams would save ratepayers money.
- The current state of the four Lower Snake River dams yield a yearly benefit-cost ratio of 0.15, well below a positive return on investment.
- A free-flowing river yields a yearly benefit-cost ratio of 4.3 in term of National Economic Development (NED). These benefits are not realized with the current state of the river.
- Wild salmon are keystone species in trophic webs from the North Pacific Ocean to the far reaches of the Lower Snake River and tributaries, but their stocks are not recovering. Salmon are important for food provision, cultural value, and for sustaining other key species throughout the Pacific Northwest.

Read the full report at www.damsense.org/reports-documents

Regional Economic Analysis of the Four Lower Snake River Dams

A REVIEW OF THE 2002 LOWER SNAKE FEASIBILITY REPORT/ENVIRONMENTAL IMPACT STATEMENT ECONOMIC APPENDIX (I)

INTRODUCTION

This report estimates the number of jobs that will be provided by outdoor recreation spending in the six southeast Washington counties along the LSR as a result of dam breaching. In January 2015, Earth Economics released a report entitled Economic Analysis of Outdoor Recreation in Washington State, one of the most comprehensive studies of its kind in the state. This economic contribution analysis follows the same methodologies to analyze the regional economic effect of increased outdoor recreation spending.

The Earth Economics statewide report found that the six southeast Washington counties along the LSR (Asotin, Columbia, Franklin, Garfield, Walla Walla, and Whitman) were among the lowest performers for total expenditures in outdoor recreation. A free-flowing LSR will attract visitors from across the country. These visitors will increase spending and foster the growth of income, jobs, and tax revenue. While local users may not spend much to visit the river, long-distance participants will likely dine at local restaurants and bars, stay in campgrounds or hotels, and buy from local shops. This analysis finds that a free-flowing LSR will significantly boost the economic activity within these six counties, which in turn will boost incomes, create jobs, and generate local, state, and federal taxes. A free-flowing LSR can be a vessel for economic development through outdoor recreation tourism.

ECONOMIC CONTRIBUTIONS AND IMPACTS

The terms economic contribution analysis and economic impact analysis, though often used synonymously, are in fact distinctly different measures of economic effects. Both address economic activity as defined by an economy's structure (sectors present and their interface), the spatial boundaries of an economy, and the producers and consumers acting within the economic framework. For policy and business purposes, researchers define regional economies at different scales (city, county, multi-county, state, and national) and in terms of market and non-market measures of well-being.

Economic contributions describe the aggregate economic activity within a given boundary that is generated by initial consumer expenditures as measured through market transactions. Economic impact, on the other hand, refers to new money generated within a boundary either by 1) improving the economic interactivity of sectors (i.e. increasing the multipliers) or 2) attracting increased spending from consumers outside of the regional economy. Thus, economic impact describes the "injection" of new money into markets, while economic contribution describes the "circulation" of existing money. The analysis presented here does not differentiate between new money and local resident spending and should thus be considered an economic contribution analysis.

Economic contribution analyses recognize that there are substitutes for consumers within every possible geographic region of analysis. In this case, a consumer could spend their recreation budget on outdoor recreation either locally or elsewhere or, alternatively, on movies, bars, or other activities. These decisions translate into different types of economic activity and consumer satisfaction. Since each regional economy has its own unique structure, it also has its own "multiplier," or ratio of economic activity resulting from an initial expenditure. The higher the multiplier, the more money that recirculates within the local economy. Usually, the larger the geographic area, the more likely it is that the economic structure will be comprised of diverse sectors, suppliers, and wage earners. Economic activity can be measured in terms of jobs, spending, salaries, tax collections, and industries' economic contribution. This analysis used local data on economic and industry relationships to predict revenue flows to existing businesses (direct contributions), effects on related industries from which purchases are made (indirect contributions), and effects from expenditures made through the affected household incomes and salaries (induced contributions). Local economic models were derived using IMPLAN data from the U.S Bureau of Labor Statistics (BLS), the U.S. Bureau of Economic Analysis (BEA), the U.S Census Bureau and other sources.

CONCLUSIONS AND ADDITIONAL RESEARCH

Indeed, there will be increased economic activity within the counties and legislative districts surrounding the LSR in southeast Washington. The large influx of visitors in Year 1 will have expenditures of $500 million and will generate nearly $400 million in economic contribution. This economic contribution will support and generate jobs, tax revenue, and boost incomes. The economic models clearly show that this economic activity will contribute to nearly 150 industry sectors, many of which are not directly related to the recreation industry.

What is not captured by this analysis are the up-river and down-river economic effects of a free-flowing river. This report does not capture economic effects that would occur in upriver communities, such as the city of Lewiston, ID. Lewiston's population grew at a slower rate than the rest of Idaho according to the 2010 Census (1.8% compared to 4.3%). A free-flowing LSR would increase tourism in Lewiston, making it a more attractive city to live in as incomes grow.

Additionally, the 2002 FR/EIS did not consider the economic effects of lost recreational value due to the potential loss of salmon species should system improvements fail to provide sufficient Snake River Chinook returns. These lost benefits were not considered in the 2002 FR/EIS economic analysis because it was assumed that Alternative 3 would increase salmon runs. However, given the failure of these improvements to restore runs, this must now be taken as a serious potential economic loss. Should a greater number of salmon return to spawn upstream, Idaho would likely have increased opportunities for recreational fishing.

Down-river, the effects may be even greater. Wildlife viewing generated the most consumer expenditures in Washington State in 2014.vii Whale watching, centered on the Southern Resident Killer Whales, provides an immense value to the state through wildlife viewing opportunities. The Southern Residents rely on salmon for food. While it may be difficult to predict the mortality of these whales over time if wild and hatchery Snake Chinook fall below current levels, the killer whales' diminishing numbers will certainly have an impact on viewership and economic benefits that are now running at about $60 million per year in Washington. Given the status of the Snake River stocks outlined in the Salmon

Update/Reevaluation White Paper, a crashing population of wild/natural/hatchery Chinook could lead to starvation given that 70-80% of the Southern Residents' diet is Chinook. It should also be noted that the birth of nine calves would require at least 30,000 more Chinook per year that, under the current system, must come from commercial or sport fisheries.

To read the full report, visit https://damsense.org/reports-documents/

BREACHING THE LSRDS

PICTURE FROM THE CORPS ACTIVE 2002 EIS SHOWING DAM BREACHING HAS ALREADY BEEN STUDIED

FAST SALMON RETURNS

Each dam breached prevents the death of 2 million smolts.

BREACHING TIMELINE- BEGINS IN 2018

1 SEPT	15 OCT	1 DEC	23 JAN	15 MAR, 2019
Prepare Supplemental EIS materials & Record of Decision.	Prepare/Solicit /Award Cost-Type Contract for Excavation	Lower Granite draw-down begins.	Controlled hydraulic breach of Lower Granite. Little Goose draw-down begins.	Lower Granite & Little Goose breached. 70 miles of Free Snake!

BREACH vs. REMOVAL

$340 Million FOR ALL 4 DAMS	vs.	$2 - $3 Billion!
Simple/small size of USACE project- just remove earthen berms	vs.	One of the largest project they have- would remove entire structure.
Can start in December 2018 and finish by March 2020	vs.	Could take years just to begin

TIME IT TAKES FOR SALMON TO BE READY FOR SRKWS VIA:

BREACHING: 14-18 MONTHS

HATCHERIES: 3-10 YEARS

We must request Alternative 4 in the active 2002 EIS be implemented starting in December of 2018.

No new authorities are needed to place these dams in "non-operational" status; the Corps can do so immediately if they are asked.

1

The Corps needs no new authorities to place the 4 LSRD's into a "non-operational" status while normative River flows are reestablished by removing the dams' earthen portions.

2

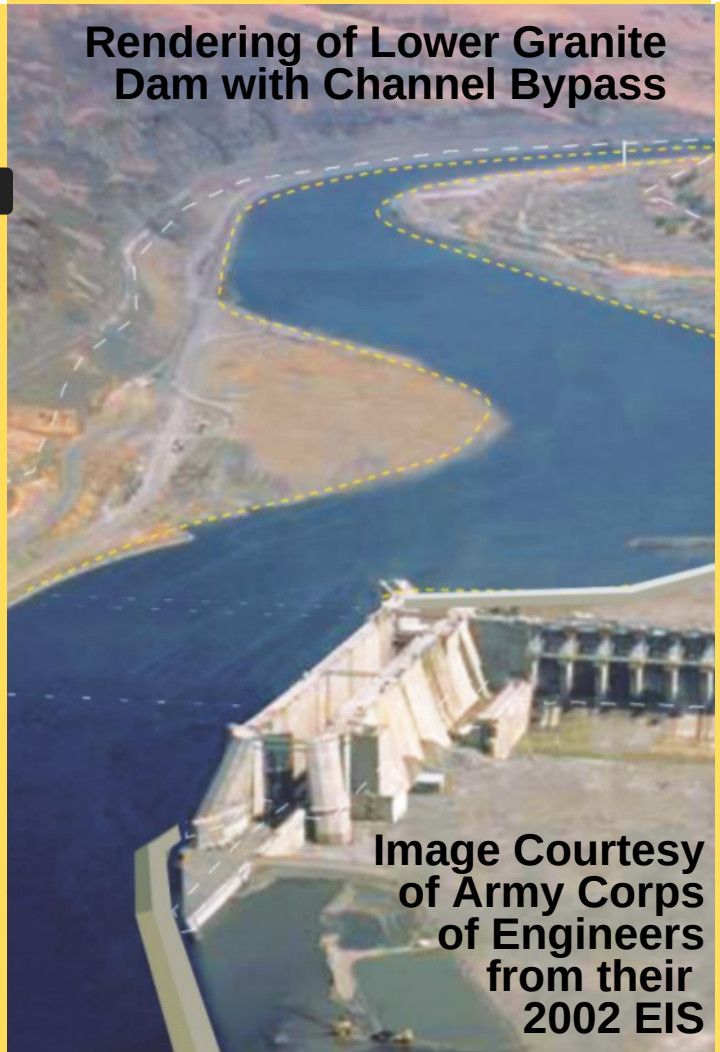
The Corps already studied dam breaching. It's Alternative 4 in the 2002 Environmental Impact Statement (EIS). If updating is necessary, the Corp can do it in 3-4 months.

3

Neither the ongoing litigation over the 2014 Federal Biological Opinion nor the Court's order for a Columbia River Systems Operation review (CRSO/EIS) constrains the Corps from breaching the dams through channel bypass now.

4

Breaching can be financed through existing debt reduction and credits mechanisms as a fish mitigation action or direct funding by BPA. New appropriations are not necessary.



Rendering of Lower Granite Dam with Channel Bypass

Image Courtesy of Army Corps of Engineers from their 2002 EIS

5

Breaching the 4 LSRD's is far easier than originally planned, making it possible to move from a decision to breach, to breaching in a matter of months, not years.

The CRSO/EIS is approximated at $100M, the cost of breaching Lower Granite and Little Goose Dams.

Stakeholder Outreach Timeline

Letters and documents were mailed via U.S. Mail or hand-delivered to the many stakeholders listed. You can review each document in its entirety at www.damsense.org. This list is not exhaustive and does not include all public outreach or education events attended by DamSense volunteers nor the many telephone calls to various parties.

Executive Branch

1. Dec. 26, 2018 | Jim Waddell letter to General Semonite at HQUSACE
2. Oct. 12, 2018 | Email Response from NWD BG Helmlinger
3. Jan. 4, 2018 | Joyce D Parks to Mindy Simmons US Army Corps urging immediate use of 2002 EIS to begin dam breaching
4. Aug. 2, 2018 | Letter to Elected Officials from Amber Rose
5. July 6, 2018 |Letter to General Semonite from Amy Eberling
    a. Aug. 6, 2018 | Response from General Semonite
    b. Aug. 14, 2018 |Rebuttal from Amy Eberling
6. Jan. 1,2018 | Joyce D Parks Letter to Anne Cann, US Army Corps encouraging LTG Semonite, the Environmental Advisory Board and Corps leadership to take immediate action using 2002 EIS
7. Jan. 1, 2018 | Joyce D Parks to President Trump requesting Executive Order to Breach the Dams
8. Feb. 23, 2017 | Jo-Ellen Darcy, Asst Secretary of the Army to James Waddell, page 3
9. Dec. 20, 2016 | Sharon Grace to Chris Yates, NOAA Assistant Regional Administrator
10. June 17, 2016 | Jim Waddell to Lieutenant General Todd Semonite, US Army Corps of Engineers
11. May 11, 2016 | Sharon Grace/Jim Waddell to Jo-Ellen Darcy, Asst Secretary of the Army; re Court Decision
12. April 14, 2016 | Balcomb/Berta/Grace/Waddell to Kathryn D. Sullivan, Undersecretary of Commerce for Oceans and Atmosphere Administrator NOAA
13. March 4, 2016 | Jim Waddell to President Barack Obama letter, email
14. Feb. 23, 2016 | Sharon Grace/Jim Waddell to Jo-Ellen Darcy, Asst Secretary of the Army
15. Nov. 3, 2015 | Carl Christianson/Jim Waddell to Eileen Sobeck, Assistant Administrator, NOAA Fisheries; Recovering Federally Endangered Snake River Salmon and Steelhead
16. Dec. 21, 2015 | Group to Bostic re Vail Follow Up Letter
17. Oct. 21, 2015 | Group to Lt. Col. Timothy Vail, Commander, USACE Walla Walla District
18. May 27, 2015 | Hansen/Waddell/Weiss/Wieland to President Barack Obama; Recovering Federally Endangered Killer Whales

19. May 2015 | Maxine Waddell to Michelle Obama; Recovering Endangered Species by breaching lower Snake dams
20. April 28, 2015 | Thomas O'Keefe, American Whitewater to President Barack Obama
21. April 23, 2015 | Kevin Lewis, Idaho Rivers United to President Barack Obama
22. Jan. 21, 2015 | Group to Jo-Ellen Darcy, Asst Secretary of the Army; Recovering Federally Endangered Killer Whales by breaching the lower Snake dams; also sent to Patty Murray, U.S. Senate 2015
23. Oct. 9, 2014 | Jim Waddell to Jo-Ellen Darcy, Asst Secretary of the Army
24. April 14, 2014 | Jim Waddell comments to the U.S. Army Corps of Engineers Waterway Users Advisory Board
25. Sept. 13, 2013 | Jim Waddell to Jo-Ellen Darcy, Assist Secretary of the Army

Congressional Branch

1. June 13, 2018 | Letter to Senator Kilmer from members of Gig Harbor Rotary Club
2. April 24, 2018 | Joyce D Parks to Alaska's US Congress Murkowski, Sullivan & Young
3. April 2, 2018 | Jim Waddell to the office of Washington Representative Dan Newhouse
4. April 12, 2017 | Gary Lane & Group (small businesses of Riggins ID) to Idaho Senator James Risch
5. Nov. 2, 2016 | Howard Garret, Orca Network to Governor Jay Inslee
6. Nov. 2, 2016 | Howard Garrett, Orca Network to The Honorable Patty Murray
7. Nov. 2, 2016 | Howard Garrett, Orca Network to The Honorable Maria Cantwell
8. Jan. 24, 2015 | Group of Scientists to Senator Patty Murray, SRKW CSI Scientist's Letter
    a. In addition, this letter personally addressed and hand delivered to the following DC offices by Jim Waddell and Jenna Ziogas; Maria Cantwell, Mike Crapo, Jo-Ellen Darcy, Susan Delbene, Eric Hansen, Derek Kilmer, Rick Larson, Rodger McMorris, Jeff Merkley, Dan Newhouse, David Reichert, Adam Smith, Ron Wyden, ASA(CW), CEQ and the Secretary of the Interior.
9. Nov. 3, 2015 | Carl Christianson/Jim Waddell to Senator Murray

State Branch

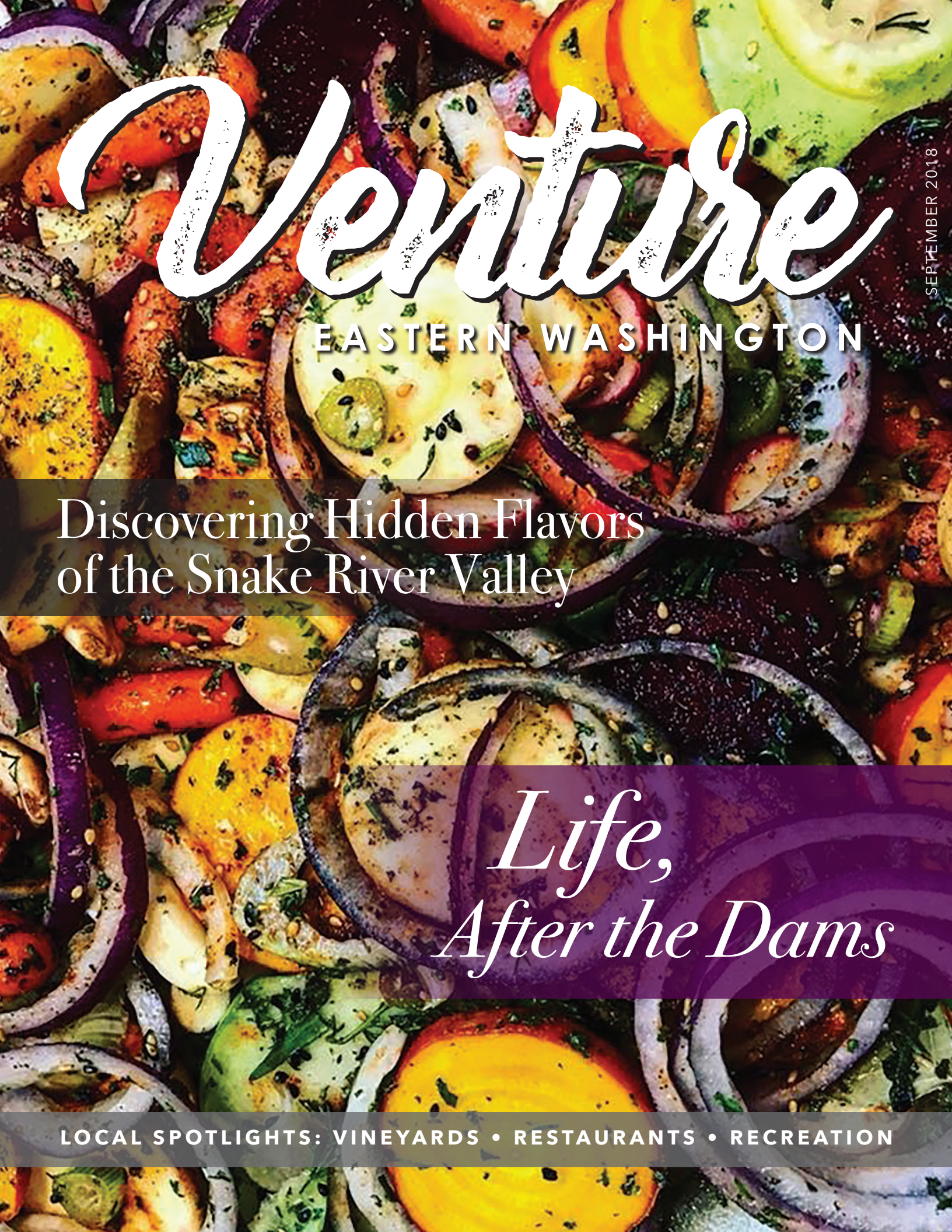
1. May 1, 2018 | Jim Waddell (hand delivered) to Washington's Southern Resident Killer Whale Recovery and Task Force
    a. Was subsequently handed out at all other five Orca Task Force meetings
2. Sept. 20, 2018 | Howard Garrett in response to Sen. Kevin
3. Sept 10, 2018 | 2nd Letter to Senator Kilmer from Gig Harbor Rotary Club
4. Sept. 5, 2018 | Jim Waddell to the residents of Eastern Washington

5. Jan. 14, 2018 | Jim Waddell to WA Representative Mike Chapman. Provides requested input re: House Bill 2417
6. Jan. 5, 2018 | Howard Garrett to Orca/Salmon Alliance re News Release and Explaining the Feasibility of Breaching
7. Nov. 1, 2017 | Sharon Grace to Puget Sound Leadership Council
8. Oct. 30, 2017 | Howard Garrett, Orca Network appeals to Puget Sound Partnership for help
9. July 19, 2017 | John Twa Comments for the Inland Waterway Users Board meeting
10. July 19, 2017 | James M Waddell Comments for the Inland Waterway Users Board meeting
11. July 12, 2017 | John Twa Letter to the Army Corps of Engineers Environmental Advisory Board meeting in Traverse City, MI
12. July 12, 2017 | James M Waddell Letter to the Army Corps of Engineers Environmental Advisory Board meeting in Traverse City, MI
13. April 17, 2017 | John Twa to the Nez Perce County Commissioners about dam breaching
14. Feb. 23, 2017 | Jim Waddell Addendum ASACW Darcy letter to the Honorable Michael H Simon
15. Feb. 13, 2017 | Jim Waddell Amicus Brief to the Honorable Michael H Simon
16. Dec. 1, 2016 | Letter from London Fletcher, public input to Federal Agency Scoping Meeting
17. Dec. 1, 2016 | Letter from Joel Fletcher, public input to Federal Agency Scoping Meeting
18. March 16, 2016 | Earth Economics Press Release Snake River Dams

Environmental and Other Organizations

1. Dec. 23, 2018 | Full-page newspaper ads published in The Seattle Times, The Oregonian, The Bellingham Herald, Peninsula Daily News, and the Journal of the San Juan Islands
2. Sept. 17, 2018 | Amy Eberling to the Environmental Advisory Board
3. Oct. 29, 2018 | Southern Resident Orca Task Force Draft Report: A Guide for BOLD Commenting
4. Aug. 22, 2018 |Letter to Gov. Inslee & Orca Task Force by Joyce Parks
5. Aug. 20, 2018 |Letter to Mark Pointer by Joyce Parks
6. May 20, 2018 |Tacoma News Tribune, John Burkhart
7. May 8, 2018 |News Release from University of Washington Tacoma, ‘Hope for Orcas’ to Discuss Threats, Prospects for Southern Resident Killer Whales

8. May 5, 2018 |Hope for Orcas: Orca researcher Ken Balcomb and an Urgent Call to Action and Jim Waddell, UW-Tacoma William Philip Hall
9. April 29, 2018 |Salmon and Orca are on the Edge of Extinction, Anacortes Library Community Room
10. Jan. 10, 2018 |Ad expands to the The Olympian to bring attention to plight of Southern Resident Killer Whales and endangered wild salmon they depend upon.
11. Jan. 7, 2018 |Seattle Times Full-page Ad: Dammed to extinction, Southern Resident Orcas are starving. Time is running out!
12. Jan. 6, 2018 |Press Release re Ad Informing Governor Inslee and Senator Murray
13. Jan. 5, 2018 | The Journal of the San Juan Islands: Thousands start ad campaign to breach Snake River dams


Venture
EASTERN WASHINGTON
SEPTEMBER 2018
Discovering Hidden Flavors of the Snake River Valley
Life, After the Dams
LOCAL SPOTLIGHTS: VINEYARDS • RESTAURANTS • RECREATION

Letter From the Editor

ABUNDANCE *This was the hidden beauty beneath the dark waters of the Snake River Valley reservoirs; a fertile 140 mile valley, silently awaiting her rebirth.*

Over 6,000 acres have been reclaimed for high-value crops, including vineyards and orchards, requiring little or no irrigation, while still allowing thousands of acres for wild riparian areas. Along with the restoration of salmon and steelhead fishing and encounters, boating, hiking, biking, horseback riding, restored agriculture, wineries, restaurants, country inns, and supporting services, we have brought in over $400 million in annual expenditures. This translates to over 4,000 new jobs to our six-county area. For example, with that one, 14-acre vacant lot behind the levees in Lewiston, we have experienced job creation, expenditures, tax revenue, and just plain fun in a matter of months after the town was reconnected to the Snake and Clearwater Rivers. The Snake River Valley has also increased in safety, as the removal of the dams mitigated flood risk from overtopped levees that had stymied downtown development.

Protection from the destructive effects of human development–that make many river restorations an expensive challenge–along with prudent stakeholder planning by the State of Washington, the Tribes, the Corps, and local interests, has freed from the depths a highly valued place in terms of economic, ecological, cultural and aesthetic values. With a mindful and modern understanding of these values, the river is telling us where and to what extent a true gem of sustainable, resilient, redevelopment is taking place–and it is overwhelming.

We were ready to take back the river lost to us by these four dams. Removing the earthen berms brought back a well-preserved river and its flood planes; being kept in cold storage for over 50 years, upon meeting the light of day, this region invited the return of previously lost wildlife, agriculture, tourism, and human connection to a sacred place. Collectively and fervently we say, welcome back home–*it was about dam time*.

FEATURES

Lower Snake River Valley, Bountiful Again

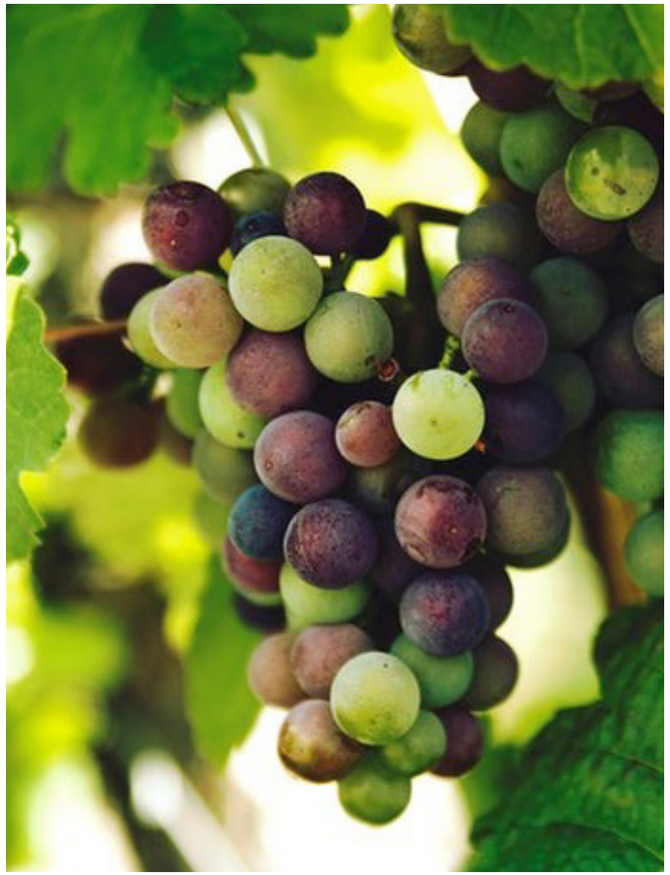
Along the banks of the free-flowing Snake River lies a region with a story of renewal–a picture in itself of resilience, much like the salmon who have returned home to these waters. Rapidly making a name for itself, this valley is a dichotomy of delight–weaving together historic appreciation and a vibrant future.

This area offers a lush and inviting river valley that enhances its position as the entrance to the treacherous Hell's Canyon river gorge. In contrast, family-friendly, fresh water that flows easily for canoeing and fishing are also available. Beyond outdoor treasures, the hospitality and restauranteur businesses are also flourishing. Locally owned and operated bed and breakfasts' paired with fresh and hearty locally sourced meals prepared in restaurants by renowned chefs, will dazzle you. Still, in the flurry of new services and businesses sprouting up in this reclaimed valley, the region maintains the nuance of the local meandering river where farmers, professionals and tourists meet at corner diners. The BBQ joint hops at night with local flavor, secret spices and the same dedicated musicians who'll swear they've been jamming in that joint since blues were invented.

Within the bounty of this region you will discover salmon, wines, cheeses, meats, and vegetables. You will also smile when you stumble across baked goods and pastas made with local grains and flours, and hoppy ales, vintage wine and ciders. Diverse modern craft restaurants and bistros weave a lush tapestry along the Snake River Valley and restored towns.

This newly bustling agricultural valley is rapidly becoming a tourist destination. Boasting sustainable farming, ranching and fishing, a trip to Strawberry Island, Wawawai, or Little Goose Rapids, is perfect for the vacationer looking for farm-to-table dining and an epic outdoor retreat. Quality wines, tastes and experiences are around every bend in the river. Come and see what this renewed valley has to offer–it will not disappoint.

Handmade cheeses from The Alder Board Creamery and vineyards from the surrounding Lower Snake Valley viticulture AVA–bold flavors abound.



Micro Reviews: Local Production

PENAWAWA

Golden Dell Vineyards

The Snake River Valley is perfectly suited for wine production and the breach of the Lower Snake River Dams has yielded a lush, fertile viticultural boom in the area that rivals many global wine regions. Using tried and true European varietals, Golden Dell Winery has rocketed to award winning status with their premium wines. Known predominantly for their Cabernet Sauvignon and white Riesling grapes, their previous year's Cabernet Sauvignon has been described by one reviewer as the best in the country. With the Snake River Valley now boasting some 80 vineyards their sweet, full-bodied, fruity Riesling is regarded as unrivaled in the region.

Golden Dell Riesling Pear Freezer Sorbet

3 - 4	ripe local pears (2½ lbs)
1 cup	Golden Dell Riesling
3 Tbs	chopped ginger
1 cup	granulated sugar
1½ tsp	fresh squeezed lemon juice
½ tsp	sea salt

Combine all & boil. Lower heat and simmer for 20-30 minutes. Blend carefully until smooth. Freeze overnight. Blend with a dash of wine.

ALMOTA

Goodness Gracious Grains

With a commitment to locally sourced ingredients including grains, eggs, and dairy, Goodness Gracious Grains opened its doors just a few years ago. This bakery is already a local staple for all pastry, pie and cake needs. They have now expanded their kitchen to include a variety of hand crafted pastas and bread loaves. In response to their booming success, Almota residents and co-owners, Donia and Francis, decided to take another chance with the adjacent property and operate a savory kitchen with fresh and dried pastas and specialty artesian breads. Come early because these Aelditine-free, rustic, whole grain loaves move fast. We are not-so-secretly hoping they will be offering classes soon.

TUCANNON RIVER

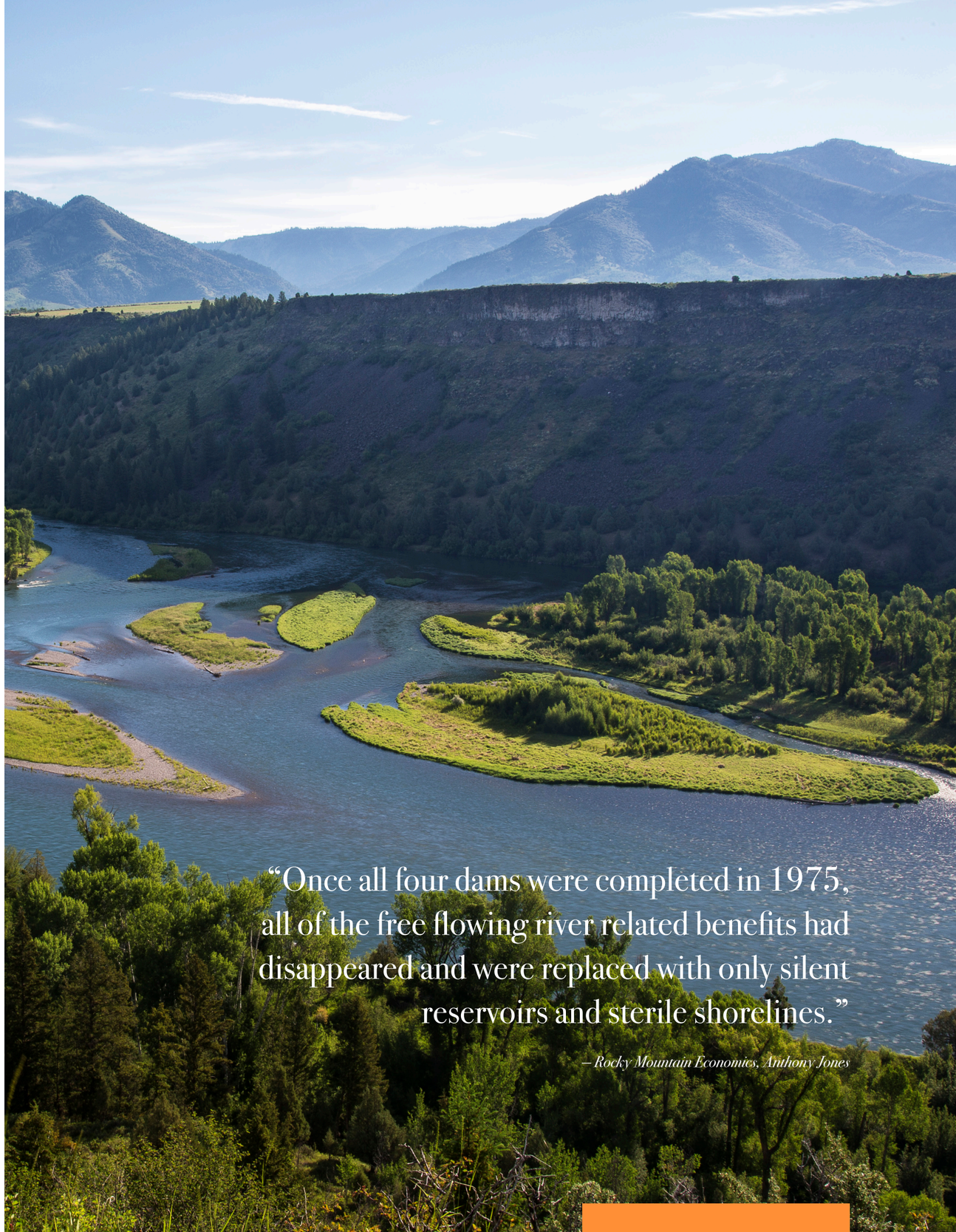
Peterson's Brewery

Peterson's Brewery–this is *the* late night hot spot where locals and tourists alike gather to listen to live blues, alternative, and rock 'n roll while sipping any number of their 25 beers and ciders on tap. The line up includes 10 of their own craft beers and 7 guest beers from around the area–the region's largest selection of varietal craft pear and apple ciders. Come early Sunday evenings for a guided tour of their attached brewing facility. On your visit, you will see where locally sourced hops, barley, wheat, and rye are converted to mash, fermented, and matured into the liquid gold you can sample during your tour.

Peterson's Golden Snakehead Lager Bratwurst

6	locally butchered sausages
3 pints	Clarks Golden Snakehead Lager
2 cups	sauerkraut
1 cup	sliced onions
1 cup	sliced peppers

Gently boil bratwurst in lager for 10 minutes. Sautée sliced peppers and onions. Lift carefully with tongs and move brats to grill or pan and sear until crispy outside. Serve in a fresh baked toasted bun.



In Good Taste: Penawawa's Wooden Canoe Cafe

After the dam breaching, 5,000 acres of lush, verdant agricultural valley were lying in wait to support a renewal of vineyards and orchards. The dams stagnated more than the river since their completion in 1975; luckily, the tides have changed. With the removal of the dams, Penawawa is renewed. An influx of restaurantuers is rapidly establishing this region not only as up-and-coming, but one that we need to keep up with—Wooden Canoe Cafe being top on this list.

Penawawa is reborn as a self-sustaining foodie paradise. When you first walk into this restaurant in Penawawa, you can't tell if you've entered the chef's spacious combo kitchen and dining room or his renowned Farm-to-Table eatery. The term "Farm-to-Table" has been getting quite a bit of attention recently, and when a restaurant boasts this statement, it generally indicates the produce and protein comes from locally sourced farms. In the case of Wooden Canoe Cafe, the produce, protein, dairy, flowers on the table and even the grains have all been locally-sourced. This is the standard for the local fare in this agriculturally rich region. The sous chefs in the exposed kitchen nodded one after the other and smiled as we were seated. Our simple menus were provided to us on handmade paper made by local artisans; The meals listed out before us seem positively delicious.

It's a short menu, but the waitress assures us we can customize any order; After one glance, we didn't want to! This particular evening, appetizers included handmade phyllo wrapped feta, lamb and leek pastries, and a chunky pork stew with pumpkin and crisp pork rinds. Toasty corn nuts and a suggested pairing of either a crisp, light Chardonnay or a fruity, aromatic Riesling arrived at our table just after ordering. Both wines were produced and bottled just up the road at the local award winning Golden Dell Winery. When a steaming plate of fresh flat bread with dripping honey comb on the side arrived, the waitress shared with us about the farm that the grains for their baking flours are sourced from!

Our order consisted of the wide toothsome egg noodle dish of house made pappardelle pasta with a unique pumpkin seed and spicy radish greens pesto. We also received a plate of sizzling bratwursts with sauerkraut, roasted root vegetables and mashed garlic leeks. Not a single bite disappointed. Dessert itself was worth the visit and was utterly irresistible. Rich baked apple rounds with toasted figs and a brandy syrup, dusted with mint. We were almost too full to eat, but we dared not miss the symphony of flavors—and you shouldn't either!

It is undeniable—sourcing fresh ingredients grown by farmers, delivered directly to chefs—Wooden Canoe Cafe prepares incredible meals under the canopy of a uniquely local dining experience.

Spicy Radish Greens and Pepitos Pesto

3 cloves	garlic, crushed
8 cups	loosely packed radish greens, chopped
1/4 cups	fresh parsley leaves
1/4 cups	fresh basil leaves
3/4 cups	roasted pepitos (pumpkin seeds)
3/4 cups	extra virgin olive oil
1 cup	freshly grated Parmigiana-Reggiano cheese

Blend together and garnish with pepitos.

Unearthing the Numbers

This is a prospective publication; a view into the life that is possible for the Snake River Valley. Our goal is to invite individuals, to imagine and understand the future awaiting the Snake River Valley. Breaching the four Lower Snake River dams will breathe life back into the local economy by increasing both jobs and commerce. The far reaching impacts are measurable in dollars, environmental improvements, and increased quality of life across the region.

140 MILES

The amount of free flowing river returned to the valley

5,000 ACRES

Rich soil waiting to be uncovered in the valley for high value crops

$200-300 MILLION

Increase in recreational + fishing benefits adjacent to the Lower Snake River [1]

$100 MILLION

Estimated agricultural value from reclaimed bottom land [2]

4,000 JOBS

Restored in the surrounding counties [3]

DAMSENSE.ORG

What was once flourishing, can be bountiful again.

Bishops Bar along the Lower Snake

1. National Economic Analysis of the Four Lower Snake River Dams, https://damsense.org/wp-content/uploads/2014/12/National-Economic-Analysis-of-the-Four-Lower-Snake-River-Dams-2.16.pdf **2.** Correspondence, Hans D. Radtke, Ph.D. Natural Resource Economist **3.** Regional Economic Analysis of the Four Lower Snake River Dams; https://damsense.org/wp-content/uploads/2014/12/Regional-Economic-Dev-Summary-Reevaluation-Lower-Snake-Dams-22-Feb-16.pdf