



Lower Snake River Dams Stakeholder Engagement Report

FINAL DRAFT

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Contents

Executive Summary	1	Opportunities to Increase Understanding	52
Background and Context	2	Public Comments Related to Agriculture.....	52
Major Findings and Perspectives	3	Section 7: Transportation.....	53
Opportunities to Increase Understanding	12	Context	53
Moving Forward	13	Perspectives	60
Section 1: Purpose and Scope of Report	15	Opportunities to Increase Understanding	62
Background	15	Public Comments Related to Transportation.....	62
The Intent of the Report and Engagement Process	15	Section 8: Recreation.....	64
Methodology.....	16	Context	64
Public Engagement Process.....	17	Perspectives	64
Report Overview	18	Opportunities to Increase Understanding	65
Section 2: Background on Columbia River and Lower Snake River Dams.....	19	Public Comments on Recreation.....	65
Columbia River System Dams	19	Section 9: Economics	67
Lower Snake River Dams	19	Context	67
Section 3: Tribal Connections to the Lower Snake River Dams	22	Perspectives	72
Loss of Salmon	23	Opportunities to Increase Understanding	75
Loss of Access to Land and Cultural Sites	24	Public Comments on Economics.....	75
Tribal Engagement Moving Forward.....	25	Section 10: Moving Forward	76
Section 4: Salmon/Steelhead/Orca/Ecological.....	26	Careful Framing of Any Subsequent Conversation Is Important..	76
Context.....	26	An Increase in Respect and Understanding is Needed	77
Perspectives.....	35	A Desire for Dialogue	77
Opportunities to Increase Understanding	39	Appendix A: Annotated Bibliography	80
Public Comments Related to Salmon/Steelhead/orca/Ecological	39	Appendix B: Relevant State and Federal Studies and Task Forces	98
Section 5: Energy.....	41	Appendix C: Lower Snake River Dams Stakeholder Engagement Interviewee List.....	103
Context.....	41	Appendix D: Online Survey	107
Perspectives.....	44	Copy of Online Survey.....	107
Opportunities to Increase Understanding	46	Survey Responses	115
Public Comments Related to Energy	47	Appendix E: Public Workshop Panel Members.....	116
Section 6: Agriculture.....	48	Appendix F: Frequently Asked Questions and Responses	120
Context.....	48	Appendix G: Works Cited	128
Perspectives.....	50		

Executive Summary

Salmon, orca, agriculture and energy are fundamental to Washington's past and future. They symbolize who we are as residents of the Pacific Northwest and define our communities and our economy. The lower Snake River dams have touched on each of these topics since they were constructed over 40 years ago. They have boosted the economy and local communities in southeast Washington but have also harmed tribal and fishing communities throughout the Pacific Northwest. The future of the LSRD is inextricably linked to the future of southeast Washington, Washington state and the Pacific Northwest.

There are differing perspectives on how breaching and removing or retaining the lower Snake River dams will affect salmon and orcas as well as agricultural, transportation, power and recreation interests. The term *breach* refers to removing river barriers, such as the earth-filled embankments that create reservoirs. *Remove* means that, along with the earth filled embankment, the concrete portions of the dam including the powerhouse would be taken down. For the purposes of this report, the term breach is used to capture both concepts. Over the past 25 years, multiple studies by different organizations and from different perspectives have evaluated the issues with, as yet, no clear consensus about impacts of breaching or retaining the LSRD.

At the same time, some themes emerged from the studies, interviews and public engagement process: (1) There are significantly different views of the impacts from breaching the dams on salmon, orca, agriculture, transportation and economics. More information is needed to create opportunities for greater understanding. (2) Energy, transportation, agriculture, salmon and orca are complex issues and decisions about the lower Snake River dams need to consider the broader systems and context for each. Each issue is dynamic, future changes may provide more options as well as more challenges. (3) People across the diversity of interests expressed the desire to have more informed and respectful conversations. Given that issues around the lower Snake River dams have long been in litigation, the ability for shared learning, collaborative problem-solving and a new dialogue has so far been limited. Many of those interviewed are hopeful about the significant benefits a collaborative dialogue could offer to a process that has so far been stuck in a cycle of study, legal actions and court decisions.

The intent of this report is to summarize the views of Washingtonians on retaining or breaching the LSRD. It was prepared in response to recommendations of Gov. Jay Inslee's Southern Resident Orca Task Force to further investigate the impacts of breaching the LSRD as a means to provide more salmon for Southern Resident orcas to eat. Gov. Inslee will use this information to inform his perspective on the LSRD and determine if and how to participate in ongoing federal environmental evaluations of the Columbia and Snake River system, including the draft Columbia River System Operations Environmental Impact Statement that was released in February 2020. Findings from the draft CRSO EIS are not incorporated in this report because it was released after the public comment period.

This report captures perspectives on the potential positive and negative impacts (social, economic and environmental), as well as opportunities gained and lost, of either retaining the dams or breaching them. Perspectives the consultant team heard repeatedly from stakeholders or found in published documents are summarized into themes supporting retaining or breaching the dams. The consultant team did not try to reconcile divergent perspectives, determine who was "right" or decide

which perspectives carry more weight than others. The emphasis is on faithfully capturing what people said and, where possible, why they said it. The report is based on four sources of information: review of relevant reports and studies; interviews with stakeholders, jurisdictions and organizations that would be affected by a decision about the LSRD; an open online public survey; and public review and comment on the draft report. The report's emphasis is on understanding and summarizing what people think and the context for those ideas; the governor will consider the diversity of perspectives when he makes his decisions.

Background and Context

The U.S. Army Corps of Engineers operates the four run-of-river dams and locks on the lower Snake River in Washington: Ice Harbor, Lower Monumental, Little Goose and Lower Granite. Together, the LSRD produce 1,000 average megawatts of electricity annually, which is roughly the amount of electricity Seattle City Light consumes annually. They help meet peak power loads and contribute to the reliability of the power transmission grid. They also provide river navigation and transportation between Lewiston, Idaho, and the Tri-Cities, Washington — more than 100 miles — and access to ports on the lower Columbia River.

All species of salmon that use the Snake River are currently listed as threatened or endangered under the Endangered Species Act. The LSRD, along with four other federal dams on the lower Columbia River, are the biggest human-constructed obstacles Snake River fish and other aquatic species encounter on their migration to and from the Pacific Ocean. The LSRD were designed with fish ladders to assist adult fish passage, and juvenile fish passage facilities have been added along with improvements to adult passage facilities.

Five tribal nations are primarily impacted by the LSRD: the Nez Perce Tribe, the Yakama Indian Nation, the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes of the Warm Springs Reservation of Oregon and the Shoshone-Bannock Tribe. The LSRD are part of a broader set of impacts of European settlement on tribal nations, which include the loss of tribal lands and suppression of tribal cultures. At a practical scale, the dams affect tribal people in two main ways: (1) they affect the abundance and distribution of salmon and reduce salmon fishing opportunities and harvest available to tribal people and (2) they cut off access to tribal fishing, hunting and harvesting of roots, plants and berries and prevent tribal people from holding religious and cultural ceremonies at their usual places. On a cultural and spiritual scale, the impact of the loss of salmon on tribes cannot be overstated. Other tribes in the Columbia Basin and along the West Coast of the Pacific Ocean also are affected by the loss of salmon in rivers throughout Washington State which has occurred since European settlement.

The Columbia River hydropower system which includes the LSRD is credited with transforming the landscape, economics and local communities in eastern Washington. Dams have provided inexpensive electricity for the Pacific Northwest and irrigation for hundreds of thousands of acres. In addition, the LSRD and lower Columbia river dams allow for river transportation of agricultural and other commodities that support the local communities of central and southeast Washington. The legacy of the dams and their relationship to the local communities is cherished by many citizens in Washington state.

Major Findings and Perspectives

The report focuses on six major topics: (1) salmon and Southern Resident orcas, (2) energy, (3) agriculture, (4) transportation, (5) recreation, (6) and economics. Each section provides a summary of the topic context and presents the perspectives of those who support the current system (people who want to retain the LSRD) and those who support alternatives to the current system (people who want to breach the LSRD). Each section also includes a summary of comments received during the public engagement process and highlights any perspectives that were not captured in the draft report.

Salmon and Southern Resident orcas

The lower Snake River is home to five species of anadromous fish: spring/summer Chinook, fall Chinook, coho, sockeye, steelhead and Pacific lamprey. Salmon are critical to the physical, cultural and spiritual wellbeing of Columbia and Snake River basin tribal nations and peoples, and access to salmon for harvest is a right reserved in tribal treaties. Salmon also are important for commercial and recreational harvest by non-tribal people both within and outside the Columbia and Snake River basins, to non-tribal values and cultural identity in the Pacific Northwest, and as a food source for Southern Resident orca whales, which are an endangered species.

Historically the Columbia and Snake river systems were characterized by high flows due to snowmelt with peak runoff in spring/early summer. Salmon migration patterns evolved over time to respond to this historical flow regime. Construction of dams in the Columbia and Snake river systems changed river flows. Dams control how water follows in the modern Columbia River basin; storing runoff, reducing flood flows, and shifting flows from natural spring/early summer peak to fall and winter to generate electricity for the region's peak electricity demand. The LSRD are run-of-river dams that have limited storage capacity and do not control floods. Except for the Hanford Reach and part of the Snake River between Hells Canyon Dam and Lower Granite Reservoir, the lower Snake and the lower Columbia rivers now operate essentially as a series of reservoir lakes. Breaching the LSRD would significantly alter the current hydrology and increase flow velocity in the lower Snake River, returning it to a pattern closer to that observed before the dams were in place. However, the seasonal flow regime and temperature would continue to be affected by upstream dams, Dworshak and Hell Canyon, that are operated for flood control and electricity generation. Sediment and contaminants trapped behind dams would be released — temporarily increasing water turbidity and distributing chemical contamination. Land currently inundated would be exposed as reservoirs are drawn down and removed.

Dams on the Columbia and Snake rivers can affect fish in three ways: (1) they alter fish migration; (2) they change river conditions to cause lower water velocity which increases migration time; and/or (3) they reduce the overall fitness of fish and decrease their future survival, referred to as “latent mortality.” Fish abundance in the Snake River has declined to a fraction of its historic amount since European settlement in the region which brought logging, mining, irrigation diversions, commercial harvest, and construction of the dams. All species of salmon that use the Snake River are currently listed as threatened or endangered under the Endangered Species Act (ESA). Wild Snake River coho went extinct in 1987;¹ the current coho population in the Snake River is produced by hatcheries. In the Middle Fork Salmon River, a tributary of the Snake River in Idaho, the redd counts (the number of salmon egg nests) in the 1950s were estimated to have an annual average of 24,000 redds; over the last 20 years the annual average has only been 711 redds.²

Hatcheries and management efforts have been used over the past decades to increase salmon returns to the Columbia and Snake River systems. Hatcheries have raised and released five species: Chinook, coho, steelhead, sockeye, and chum; most hatchery production has been focused on Chinook. Hatcheries are generally credited with preserving salmon populations in the Snake River and for increasing salmon numbers. In recent years, production from hatcheries on the Snake River have been at an all-time high³, even though hatchery releases across Washington and in the Columbia River Basin have been lower than historic levels due to ESA concerns and funding-related issues.

Management efforts to support salmon recovery have included improvements to adult fish ladders for upstream migration, installation of spillway weirs and juvenile bypass systems for downstream passage of juveniles and increase in spill at the lower Snake and lower Columbia River dams. Spill is the release of water over a dam to encourage migrating juvenile salmon to go over the spillway instead of passing through turbines. Spill is credited with improving juvenile survival and thereby increasing adult returns. A 2018 agreement on flexible spill brought together the states of Oregon and Washington, the Nez Perce Tribe and USACE, USBR and BPA with the dual goals of achieving improved salmon survival through the dams and managing the cost of hydropower generation. This agreement lays out a plan for managing spill to benefit fish as well as complementary measures related to turbine improvements, water cooling and predator management.

There are two main modeling tools for estimating the impact of breaching the LSRD on salmon: the Comparative Survival Study (2017) model developed by the U.S. Fish and Wildlife Service, Columbia River Inter-Tribal Fish Commission, Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife, Idaho Department of Fish and Game and the Fish Passage Center and the Comprehensive Passage (COMPASS) model developed by NOAA Fisheries, other state, federal and tribal organizations, and the University of Washington. The CSS model estimates an approximately two- to three-fold increase in smolt-to-adult ratios for Snake River salmonids if the LSRD are breached and spill on the four lower Columbia dams is increased significantly above current levels. Published estimates from the COMPASS model are now available in the draft Columbia River System Operations Environmental Impact Statement which was released on February 28, 2020.

NOAA identified the Snake River fall and spring/summer Chinook in the top ten most important populations of Chinook for the Southern Resident orca.⁴ NOAA has also stated that, for Southern Resident recovery, Columbia and Snake River salmon stocks are a lower priority than North and South Puget Sound salmon stocks because the Southern Residents' foraging patterns do not overlap as much with Columbia and Snake River salmon as they do with the North and South Puget Sound salmon. However, in recent years, Southern Resident foraging patterns have been changing; they are spending less time in the Salish Sea and more time on the outer coast.

People recognize and generally agree on the critical importance of successful salmon recovery to southeast Washington and the Pacific Northwest. However, there are significant differences in how people view the impacts of potential breaching of the LSRD on salmon. Similarly, there is broad support for action to improve conditions for Southern Resident orcas but people disagree on whether salmon from the Columbia and Snake river systems can contribute to that goal, especially in the next 10 to 20 years.

Perspectives of those who support retaining the LSRD and emphasizing other approaches to support salmon and orca recovery

- Actions over the last several decades and the anticipated success of the flex-spill agreement will result in increasing salmon returns to the Snake River and NOAA's assessment of the results for salmon and orca recovery from dam removal.
- Breaching the LSRD is not the most effective, or cost-efficient, way to spend billions of additional dollars for salmon recovery.
- There is no certainty that the river would return to conditions supportive of salmon in the short or long term, and, at least in the short term, breaching would adversely impact conditions for salmon by removing riparian cover and increasing water turbidity.
- Rather than focus attention on dam breaching, investment should be made in: habitat restoration and protection which support increased salmon populations and build climate resiliency; continuing improvements to management of the dams in place including flexible spill and more aggressive predator management in the lower Snake River; increasing hatchery production; the reintroduction of salmon to the upper Columbia; and investments in salmon recovery of Puget Sound stocks. These efforts would be more effective, more cost-efficient and would improve salmon abundance and increase food for orca more quickly.

Perspectives of those who support breaching the LSRD to support salmon and orca recovery

- Dam breaching is the only action that has not been already tried which could make a significant difference in the trend line for salmon populations. The Fish Passage Center analysis of potential increases in salmon returns if the dams are to be breached is accurate.
- There has been a \$17 billion investment in making improvements in the structure and management of the current system to support salmon recovery without reversing the downward population trend.
- Breaching the dams will take time, and the resulting improvements in salmon populations also will take time, but this approach is overall the best way to increase resiliency in the system, especially considering climate change, and provides the greatest opportunity to prevent extinction and move toward sustainable salmon runs.
- Flexible spill efforts are helpful but insufficient to support long-term salmon recovery.
- Hatchery production is not a viable long-term strategy particularly for Southern Resident orca since hatchery fish tend to be smaller and contain less fat than wild fish, making them a less substantial food source. Hatcheries may support harvest, but they depress the genetic diversity of wild salmon.

Energy

The LSRD are part of the broader integrated system of hydroelectric facilities that make up the Federal Columbia River Power System, the largest source of renewable electricity in the Pacific Northwest. The energy that is produced from the dams is sold and marketed by the Bonneville Power Administration to a variety of customers. BPA also is responsible for covering the costs of Columbia River Basin fish and wildlife mitigation.

Each year the LSRD produce an average of 1,024 average megawatts of electricity annually, which is about 10% of BPA's annual energy portfolio, or about 12% of the federal hydropower system

output.⁵ The LSRD can produce 3,033 megawatts of electricity at peak capacity for a short period of time if there is both high water storage and high river flows.⁶

A portion of the LSRD energy capability provides reserves to ensure BPA has enough reliable power to provide its customers. Typically, the LSRD supply BPA with one-fourth of its operating reserves.⁷ The energy is especially important during peak demand periods, most often in the winter months when energy loads are high due to individuals heating their homes and wind and solar power generation are at their lowest levels. In addition to power generation, the LSRD provide transmission stability and capacity. Power from the LSRD flows into 500-kilovolt transmission lines that integrate the LSRD into the power grid. Due to their location, the LSRD are an important transmission system link between the east and west sides of the Cascade Mountains.

The LSRD help to maintain the reliability of the Northwest power grid by providing key reserves of energy to the system that can be quickly accessed when other energy sources become unavailable. The dams are connected to the Automatic Generation Control System which allows the power grid to meet constantly fluctuating electricity demand, often referred to as “load.” Replacing the power provided by the LSRD would require finding renewable locations within BPA’s geographic range that have high generation potential and are not so remote that the cost of distribution is prohibitive. Replacing the reliability of the LSRD would require other energy resources to steadily perform under a range of conditions and respond quickly (scaled up or down) to demand.

In recent years the energy market has gone through a large-scale transformation due to a variety of factors such as wide-scale development of renewable resources, demand response, the proliferation of low-cost natural gas generation and periods of oversaturated wholesale markets that dampened sales of surplus energy. BPA’s contracts with its preferred customers are set to expire in 2028. Many local utilities that have BPA contracts have seen rate increases of 2.2% annually since 2008 due to a variety of factors.

Perspective of those who support the current energy system (retain dams)

- Losing the energy generated by the LSRD would complicate achieving Washington’s clean energy goal of being carbon free by 2045. Future population growth; the loss of coal plants; resistance to expanding the use of nuclear energy; policy efforts in Washington to increase electricity loads by shifting vehicles and buildings away from using fossil fuels to electricity; cutting back reliance on natural gas electricity; and climate change are all reasons the LSRD are needed for the state to become a carbon-free system.
- While on average Washington state has a surplus of electrical generation, averages are not the most important measure when energy is operating close to the current maximum capacity. Reserves like those provided by the LSRD increase the reliability of meeting load demand and reduce the likelihood of more drastic measures like brownouts or blackouts.
- Ice Harbor Dam is fundamental to meeting the energy needs of the Tri-Cities during summer peak periods. It also is a key link between the energy grids on the east and west sides of the Cascade Mountains.
- The federal hydropower system has supported communities throughout the Puget Sound and the Pacific Northwest like the direct service industries in Whatcom County and Port Townsend.

- Many communities in southeastern Washington were built and have prospered because of the inexpensive energy provided by the dams. The dams are a part of the history, legacy and heritage of the people who live there.

Perspective of those who support alternatives to the current energy system (breach dams)

- The Pacific Northwest has a surplus of power, and the LSRD are not ultimately needed to meet energy needs or to successfully transition to a clean energy grid by 2045. Increases in solar and wind generation coupled with technology improvements for energy storage will support Washington state in meeting the 2045 goal.
- Dam breaching would take time, and this time would allow for alternative renewable energy generating plants to be built, and potentially for improvements in energy storage technology to be realized.
- Based on findings from the NW Energy Coalition, supporters of breaching the dams believe the energy provided by the dams can be replaced with energy from other renewable sources and improvements in energy efficiency and demand response, without losing any system reliability and at only small cost increases to BPA ratepayers.
- A transition away from using power generated by the LSRD will cost less over time than maintaining energy production from the LSRD, especially when considering increasing maintenance and repair costs for the LSRD.
- The evolution of energy conservation and renewable sources demonstrates the region's ability to adapt in changing circumstances. The same ability to adapt is possible with the breaching of the LSRD.

Agriculture

There are approximately five million total acres of farmland within the eight counties surrounding the lower Snake River (Adams, Asotin, Benton, Columbia, Franklin, Garfield, Walla Walla and Whitman) in southeast Washington, which is approximately 33% of the total farmland in the state.⁸ Agricultural production in the areas surrounding the LSRD includes both dryland and irrigated farming.

In southeast Washington non-irrigated, or dryland, agriculture is dominated by grain production. In 2017, over one million acres of dryland wheat were harvested in the eight counties surrounding the Snake River.⁹ The local grain economy relies on a complex set of relationships between grain producers (farmers), cooperatives, transporters, exporters and customers, all of whom are all also part of an equally complex and competitive global market.

If the LSRD are breached, it would eliminate barging down the Snake River because the lower river depth would not be deep enough for barge transportation. This would be a significant change for dryland farmers, many of whom rely at least in part on barge transportation for their crops. Barge transportation is the least expensive and most reliable transportation method for those producers close to the reservoirs when compared to truck and rail transportation.

The LSRD currently support approximately 47,000 acres of irrigated farmland drawn from Lake Sacajawea, the reservoir created by Ice Harbor Dam. Lake Sacajawea is the only reservoir of the four LSRD that provides direct irrigation.¹⁰ Fruit orchards are the predominate irrigated crop within one mile of the river; vegetables, like onions, potatoes or sweet corn, are more common within five

miles.¹¹ Irrigated farming requires significant resources and staffing. Irrigated farmland also is more profitable than dryland.

If the LSRD are breached, specifically Ice Harbor Dam, impacts to irrigated agriculture — for both farms that draw directly from the reservoir and groundwater users that rely on the higher groundwater table created by the dams — would need to be addressed. Mitigating these changes would involve lowering intake structures, creating additional pumping capacity, digging deeper wells and other operational changes. Other options if water availability were to change due to breaching the dams could include changing crops to accommodate new water supply or fallowing fields during periods of water interruption.

Perspective of those who support the current barge and irrigation system (retain dams)

- Breaching the dams would lead to increased shipping costs and a downturn in the overall grain economy due to the loss of barging. This could lead to the loss of family farms, local community economic viability and the overall way of life that the dams have supported in the region through lower grain transportation costs and the ability to irrigate farmland.
- Water levels would not be stable enough to provide reliable irrigation if the dams are breached, which would lead to increased costs, uncertain infrastructure upgrades, uncertainty of water supply and shifts in the type of agriculture that is viable.
- The reduction in certainty of water availability would increase capital costs for farmers due to increases in infrastructure and energy needs.
- Breaching the dams would make the current irrigation infrastructure obsolete and would require significant investment in lowering water intake infrastructure, more pumping stations and drilling deeper wells to reach the lower water table.
- Local farmers are skeptical that current irrigated agriculture like orchards and vineyards would be able to easily transition to other crops or move to other areas down river if they are displaced from their current farms. The costs of these transitions can be significant, and the disruption to farming families, farm businesses and communities that rely on them also is significant.

Perspective of those who support alternatives to the LSRD (breach dams)

- It is important to make agriculture “whole,” so farmers do not suffer significant economic losses if the dams are breached. Suggestions include paying for the infrastructure to lower irrigation pumps and wells; subsidizing the increased cost of energy required to pump water; subsidizing farmers for their increased transportation costs; and building or upgrading infrastructure for storage and transportation.
- The costs to implement the suggestions above and make agriculture whole would be less than the cost of ongoing maintenance and repair of the dams and locks.
- Approximately 5,000 acres of the 14,000 acres currently inundated by LSRD reservoirs could potentially be used for farming if the dams are breached.

Transportation

The transportation that serves the region surrounding the LSRD is a multi-modal network of barge, rail lines and trucks. The LSRD and their associated locks allow local agricultural producers and shippers to market and transport agricultural products downstream and move other materials by

barge up and down the lower Snake River between the Tri-Cities and Lewiston/Clarkston. In the area surrounding the LSRD, there are both mainline and shortline railroads. While some of the shortline rail infrastructure that existed before the LSRD were constructed remains, much of it is in disrepair and would require improvements to be relied on in the future.¹² Trucks are the most expensive and carbon intensive form of transportation within the network¹³; their main purpose is to move grain or produce from farms to nearby ports, cooperative elevators or processing facilities. Compared to rail or trucks, barging is the safest method of moving cargo. There are lower numbers of injuries, fatalities and spill rates from barge transportation than from rail and trucks.

Over the past 20 years, the transportation infrastructure in southeast Washington around the LSRD has evolved. Investments have been made in capacity for shortline rail, mainline rail, port terminals and barging. Local agricultural producers, cooperatives and shippers take several factors into account when determining which modes of transportation to use. Barge transport is generally less expensive than the other options, and the timing of delivery is more predictable.¹⁴ Transport of commodities by barge has trended downward in recent years on the entire Columbia and Snake river system. However, a 2017 report prepared for the Washington Public Ports Association estimates continuation of current levels or modest growth in the amount of overall grain transport by barge.

Exporters, producers and shippers report that having access to both rail and barge transportation helps them create the most cost-effective, cost-competitive and reliable transportation combination tailored to the specifics of each shipment. If the LSRD are breached, it would no longer be feasible to transport materials by barge on the lower Snake River; this would create the need to improve road, rail and other infrastructure to provide for transportation.

Perspective of those who support the current transportation system (retain dams)

- A multimodal shipment system (i.e., barge, rail and truck) is necessary for competition and capacity, and the removal of one major mode (i.e., barge) would have disastrous ramifications for farmers and the local economy. Removal of barge transportation would put farmers at the mercy of the railroads who would have the freedom to increase shipping prices due to the lack of competition.
- Barges are more efficient, cleaner and safer for the public than other modes of transport like rail or trucks. Supporters of the current transportation system questioned why there would be a push to shift from what they see as a cost-effective, safe, low carbon mode of transport to higher carbon modes like trucks and rail.
- Some question the ability to sufficiently expand the rail and roadway system both in the LSRD region and on the main lines. Even if the rail improvements in the LSRD region could be addressed, some question the capacity to increase transportation on the main lines, especially downstream along the Columbia River.

Perspective of those who support alternatives to the current transportation system (breach dams)

- If the dams are breached actions should be taken to improve the rail and road transportation system as alternatives to the existing barge transportation system. Rather than maintaining the lock systems at the LSRD, these investments in rail line and road and highway improvements will be more cost effective in the long run.
- Rather than using federal dollars to support continuation of the barge system and continued investment in salmon recovery and restoration efforts which have not so far succeeded,

investment in transportation upgrades could make better economic sense and be coupled with increased salmon abundance.

- Current investments into multi-car loading facilities in the LSRD region show a trend within the system towards rail and away from the barge system for the transport of grain.

Recreation

The reservoirs, dams and shorelines on the lower Snake River provide land- and water-based recreational opportunities and access. Land-based recreation activities include hiking, camping and hunting; water-based activities include fishing, swimming and boating. If the LSRD are breached the Snake River will be a free-flowing river instead of a series of reservoirs. The shift to a free-flowing river system would result in the loss of some existing recreational opportunities and create the potential for growth of new recreational opportunities. For example, if the dams are breached, many current swimming beaches and river access points would close, and a free-flowing river could provide new whitewater recreation opportunities.

Salmon recovery efforts afforded by dam removal are also likely to increase recreational and sportfishing opportunities. Some of the existing activities that currently occur on reservoirs, like certain fishing, boating and wildlife opportunities, could continue with a free-flowing river.

Perspective of those who support the current recreational system (retain dams)

- The existing parks and other recreational facilities that would be closed or modified by dam removal, including the local cruise boat industry, are considered vital parts of the local communities and would cause disruptions to many people's way of life.
- Local communities may not receive the same levels of revenue from tourists visiting their communities for whitewater rafting as they currently do from flat water recreators.
- Shifting from current recreation opportunities, which are accessible to most people, to those available on a free-flowing river will disproportionately benefit younger, more physically fit individuals.

Perspective of those who support alternatives to the current system (breach dams)

- Breaching the LSRD would open new trails, campgrounds and other recreation-based infrastructure that could connect the communities surrounding the LSRD.
- A wild river recreation economy may also provide increased public access and the growth of a tourism industry in the Lewiston/Clarkston region.

Economics

Breaching the LSRD would have economic impacts on communities surrounding the dams as well as the state and region more broadly due to shifts in salmon abundance, agriculture, transportation, recreation usage, employment and energy production. The primary economic analyses referenced by participants in this effort were the 2002 "Lower Snake River Juvenile Salmon Migration FS/EIS," completed by USACE, and the June 2019 "Lower Snake River Dams: Economic Tradeoffs of Removal" report, prepared by ECONorthwest for Vulcan, Inc. The draft Columbia River System Operations EIS (released in February 2020) includes a new economic analysis of the Columbia River operating system, including retaining and breaching the LSRD (which was not used for this report because the public comment period ended before the draft CRSO EIS was released).

The FS/EIS and ECONorthwest reports reached different conclusions. The FS/EIS recommended major system improvements to improve salmon migration; breaching the LSRD was not seen as necessary to avoid jeopardizing the ESA-listed species. The ECONorthwest report concluded that the public benefits of breaching the LSRD exceeds the costs of retaining them. Comparison of the conclusions of the FS/EIS and ECONorthwest reports is difficult because they analyzed different study areas, study periods, and reported values in 1998 dollars versus 2018 dollars, respectively.

Perspective of those who support LSRD (retain dams)

- The ECONorthwest report did not adequately consider the impacts of dam breaching on the people, communities and industries throughout the Northwest, especially those in the vicinity of the LSRD.
- There will be drastic economic consequences if the LSRD are lost, including loss of tax revenue, jobs, businesses and property values, especially for rural and agricultural communities, and users of the current barge system.
- The positive benefit-cost analysis in the ECONorthwest report is driven by the estimated non-use value associated with salmon (economists define non-use value as the willingness of the public to pay their own money to protect or enhance an environmental resource, regardless of whether they ever plan on visiting or directly using that resource). Supporters of the LSRD question the validity of the methods used to determine non-use values.
- Millions, if not billions, of dollars would be needed to improve road and rail transportation infrastructure for agriculture, provide annual subsidies for increased costs of transportation and electricity and other costs. Supporters of the LSRD do not believe there would be political support to fund the needs of farmers and the agricultural community now and for years into the future.
- If the LSRD are breached the political focus will next shift to removal of other Columbia River system dams and the economic consequences will increase exponentially across the region.
- Efforts to breach the LSRD are a distraction when time and resources would be better spent optimizing the current system to allow for multiple benefits, including salmon recovery.

Perspective of those who support LSRD alternatives (breach dams)

- The cost of retaining the dams will continue to increase, some are not cost effective now, and more will become cost-ineffective over time.
- While there may be short-term job loss and disruption to local communities, these impacts can be mitigated through thoughtful transition strategies and investments. In the long term, it is realistic to expect a new, more robust economy to be achieved, as there are significant economic benefits associated with increase salmon and steelhead abundance for fisheries, rural economies, etc.
- New federal subsidies could be identified to cover the costs of rail and road infrastructure improvements and surface water and groundwater infrastructure upgrades for irrigators and other water users. In the long term, these investments could provide more benefits to farmers, businesses and communities than the current LSRD transportation and agriculture system does.
- BPA is already operating at a deficit and technology improvements continue to accelerate for things like intermittent renewable battery storage. Energy production lost through breaching the LSRD can be replaced with little to no increase in carbon emissions.

- BPA and USACE’s investments to date in fish passage, salmon restoration and hatcheries are considered insufficient (and ineffective) to truly restore Snake River salmon and support Southern Resident orca recovery.

Opportunities to Increase Understanding

Although differences remain deep, for each issue there also are clear opportunities to increase understanding. Major opportunities and questions include the following:

- Explore differences in interpretation of salmon, orca and ecological studies and data to clarify areas of agreement, areas of disagreement and data gaps.
 - What is known about how the Snake River might respond to breaching of the dams?
 - What are the impacts of current dam management on salmon returns?
 - What are key differences around conclusions regarding latent mortality?
 - What are recovery goals for both Southern Residents and salmon can the region agree to?
- Further examine ways to meet energy demand in the near and long term with a decarbonized power generation system.
 - Will there be certainty that the state can meet its energy needs with a decarbonized power generation system as the population grows and the climate changes?
 - Determine if energy efficiency, demand response, wind and solar, or other carbon-free energy sources can replace the flexibility and reliability currently provided by the LSRD?
 - Are BPA ratepayers willing to pay more and, if they are, how much more and under what circumstances?
 - What are the environmental effects of the quantity of renewable generation resources needed to replace coal, natural gas and the LSRD?
- Define what it would mean to make agriculture “whole” if river transportation is not available through the LSRD.
 - What are the costs and timing of implementing surface water and groundwater infrastructure improvements?
 - Who would finance or subsidize this work and compensate for impacts?
 - Can farmers be certain they will be able to pull the same levels of water they are currently using without the dams?
- Conduct more detailed analyses to determine the viability and costs associated with main- and shortline rail and highway infrastructure improvements to accommodate the loss of the barge system if the LSRD are breached.
 - What are source(s) of funds and compensation provided to farmers, cooperatives, ports, and potentially private companies for the improvements to infrastructure, lost capital and increased cost of shipping?
- Identify the total cost and funding sources for potential replacement and modification of parks and other recreational amenities.

Moving Forward

The consultant team was not tasked with making recommendations for future steps to address the issues and interests of the different communities affected by the LSRD if they are retained or breached. However, interviewees were asked what would help make forward progress. Debate over the dams has gone on for several decades and the issues are complex. Despite some recent improvements in collaboration, many people remain wary of the cycle of study, lawsuits and court decisions. There is both hope and despair about what comes next and the potential for progress.

The draft Columbia River Systems Operation Environmental Impact Statement provides the next detailed analysis of the environmental and social impacts of the operations, maintenance and configurations for 14 federal dams in the Columbia River system, including the four lower Snake River dams. Although we heard from several people that they believe the federal process is necessary and helpful because the updated information will provide an analysis of alternatives, they do not hold high hopes that it will to build consensus or end debate.

Careful and sensitive framing of any subsequent conversation would be needed to lay a foundation for productive engagement. People told us that the manner in which the issue of dam removal is raised contributes to the overall frustration and negative reaction of those who live in southeastern Washington and are closest to the dams. Dam supporters feel the “coast” is telling eastern Washington communities what to do in a way that lacks respect and understanding of local values and priorities and minimizes how changes to the dams would significantly affect their communities. The need for greater respect and understanding extends to the tribal communities as well. The tribes point out the harm that was inflicted on their communities and the suffering and challenges they have faced for well over a century. People interviewed recognize the need to respectfully engage the tribes by acknowledging their losses and the responsibility to address the issues of the dams on salmon, other species and tribal culture.

People across the diversity of interests expressed the desire to have more informed and respectful conversations. Given that issues around the LSRD have long been in litigation, the ability for shared learning, collaborative problem-solving and a new dialogue has so far been limited. Many of those interviewed are hopeful about the significant benefits a well-structured collaborative dialogue could offer to a process so far stuck on its challenging issues. People point to the NOAA Columbia Basin Partnership Task Force and 2019–21 Spill Operation Agreement as causes for optimism.

Workshop Panel Dialogue

At the three public workshops held in January 2020, a panel of people with diverse interests provided their perspectives on the issues surrounding the lower Snake River dams. The panel demonstrated part of what others identified as needed to move forward: informed and respectful dialogue.

By sharing their beliefs and values and by listening to each other, panel members demonstrated what a civil, respectful dialogue could be between people who hold divergent views on whether the dams should be retained or breached. Some key actions supported this outcome. During the workshop, panel members did not advocate for their position on the dams. Instead, they focused on why the issues of energy, salmon, agriculture and the local economy were important to them and their communities. They spoke of their deep commitment for a better future, referencing frequently a

future that included the interests of others. They listened to each other. They took in new information. They tapped into their curiosities about “the other side.”

They saw some commonalities. The panel was not asked to reach consensus or agreement, but some common themes arose. They agreed that a future that includes local agriculture and fishing will need continued support and expanded public investment. They also agreed there is a need for investment in the road and rail transportation system in southeast Washington, whether the dams are retained or breached.

They also were pointed in their differences. For example, panel members differed on the future of the dams and on issues like whether the energy from the dams could be easily replaced or if improvements to rail or road transportation infrastructure could effectively replace barge transportation.

Despite these differences, panel members, based on their past experiences and participation in the three workshops, feel strongly that not only is there a need for dialogue across diverse interests, but a new dialogue is possible. The panel saw the benefit of having a group of diverse, interested parties work together to develop a shared and common base of understanding and guide collection and analysis of information to address gaps in understanding. A number of these gaps are highlighted in the topical sections of this report. They also agreed on the urgency for the whole state to address the fate of salmon and orca. Panelists also exemplified the tone and quality of the discussion needed to move forward in a fashion that could achieve benefits across multiple interests – and showed that a dialogue of this nature is possible. The audience at each one of the workshops were attentive and complementary of the panel, further demonstrating the interest of many for a civil, respectful and informative dialogue.

Section 1: Purpose and Scope of Report

Background

In fall 2018 Gov. Jay Inslee's Southern Resident Orca Task Force recommended further investigation of the impacts of breaching the lower Snake River dams as a means to provide more salmon for Southern Resident orcas to eat. The task force received hundreds of public comments about breaching the LSRD. It did not have adequate time to fully consider all the issues raised by commenters, so it recommended a separate engagement process.

In response to the task force recommendation, the Washington State Legislature provided funding in the 2019–21 operating budget:

... to contract with a neutral third party to establish a process for local, state, tribal and federal leaders and stakeholders to address issues associated with the possible breaching or removal of the lower Snake River dams in order to recover the Chinook salmon populations that serve as a vital food source for Southern Resident orcas.

To conduct the engagement process funded by the Legislature, the Washington state Governor's Office contracted with the project team of Ross Strategic, Kramer Consulting and White Bluffs Consulting to provide neutral facilitation, research and report development.

The Intent of the Report and Engagement Process

The intent of this process is to faithfully capture the views of Washingtonians on potential positive and negative impacts (social, economic and environmental) and opportunities gained and lost from breaching or removing, the LSRD, as well as from retaining the dams. The term *breach* refers to removing river barriers, such as the earth-filled embankments that create reservoirs. *Remove* means that the actual infrastructure of the dams would be taken down. For the purposes of this report, the term breach is used to capture both concepts.

Gov. Inslee will use this information to inform his perspective on the LSRD and determine if and how to participate in ongoing federal environmental evaluations of the system, including the draft Columbia River System Operations Environmental Impact Statement which was released in February 2020. Findings from the draft CRSO EIS are not incorporated in this report because it was not available until after this report's public comment period. Perspectives the consultant team heard repeatedly from stakeholders or found in published documents are summarized into themes supporting retaining or breaching the dams. The consultant team was not asked to adjudicate between perspectives or to determine which perspective is "right." The emphasis is on summarizing available information and on documenting what people think and, wherever possible, why they think it.

The engagement process and report will:

- Provide a Washington state-focused summary of the effects of both retaining and breaching the LSRD.

- Allow stakeholders, tribes and citizens an opportunity to express their opinions in a structured, neutral facilitated process.
- Help inform the state of Washington position on the federal court ordered EIS on Columbia River system operations.

The engagement process and report will not:

- Not recommend whether the LSRD should be retained or breached.
- Not develop new or prioritize potential mitigation options, although it will reflect a range of stakeholder thoughts and existing information on this subject.
- Not provide recommendations on the best way to address costs and benefits from breaching or retaining the LSRD.
- Not use a stakeholder board to review and approve the draft or final report.
- Not provide a summary of the effects on retaining or breaching the LSRD in Oregon, Idaho or Montana.

Methodology

Information was gathered for the report through a combination of literature/document review, telephone and in-person interviews, results from an online questionnaire and public comments submitted in response to the draft report.

In the literature review, the project team assembled and reviewed publicly available information and analyses related to LSRD operations and potential retention or breaching. The goal of the literature review was to understand information and cost estimates on impacts of LSRD retention and breaching, fact-check statements from interviews and provide high-level context. Sources examined are summarized in an annotated bibliography in Appendix A. In addition, Appendix B provides a summary of major state and federal studies and task forces directly related to the LSRD.

Interviews were carried out in two phases. First, the project team conducted 25 “framing interviews” with individuals who have experience and expertise with the different issues surrounding the effects, concerns and issues with retaining or breaching the LSRD. The framing interviews provided an overall sense of the range of perspectives and helped identify information resources and additional individuals and groups to be contacted. Phase two included 70 telephone and in-person interviews with representatives of the organizations identified in the framing interviews. Most of the interviews were conducted with a two-member team. The questions included:

- What do you see as the major benefits if the dams stay in place? What are the major impacts that need to be addressed if the dams stay in place?
- What do you see as the major benefits if the dams are breached? What are the major impacts that need to be addressed if the dams are breached?
- Who are the impacts most important to? What are the challenges or barriers to addressing impacts?
- How might these challenges or barriers be overcome? Do you have suggestions for approaches or processes that would be most useful in addressing the above topics and why?

- What scientific studies or information should we review and consider so we can understand perspectives on the Lower Snake River Dams? What economic studies or information? Other studies or information?
- Is there anyone else you think we should be interviewing? Why is it important to talk with them?

Interviewees were selected based on the following criteria: (1) broadly representative of the interests affecting and affected by the retention or removal of the LSRD; (2) organizational and/or subject matter expertise and/or leaders; (3) geographic diversity; and (4) representative of the diverse perspectives and views regarding the retention or removal of the LSRD. The goal of the report is for people to feel confident their perspectives are represented, whether they themselves were interviewed or not.

To encourage interviewees to be as candid as possible, this report does not attribute specific statements to individual interviewees. There is a list of interviewees (who agreed to have their name included) in Appendix C.

To complement the interviews, an online survey was distributed to the individuals and organizations that participated in interviews or expressed interest in being informed about the stakeholder engagement process. The online survey stayed open through Jan. 24, 2020, the end of the public comment period on the draft report. In addition to the literature review, interviews and online survey carried out by the consultant team, the Governor's Office led an engagement process with impacted tribes and tribal organizations including the Columbia River Inter-Tribal Fish Commission and Upper Columbia United Tribes. The Governor's Office also sent a letter to 39 tribal chairs to invite them to participate in the process.

Public Engagement Process

The draft report was available for public review from December 20, 2019, through January 24, 2020. Public comments were collected online, by mail and at a series of public workshops. Online comments were provided through a form at www.lsrdstakeholderprocess.org, and/or through an online survey that had both multiple choice and open-ended (i.e., short answer) questions. Comments by mail were submitted both electronically (email to info@lsrdstakeholderprocess.org) or by paper mail.

Public comments and questions were collected at each of three public workshops: 1) Clarkston, Washington, on January 7, 2020, 2) Vancouver, Washington, on January 9, 2020 and 3) Tri-Cities (Pasco), Washington, on January 13, 2020. Approximately 720 people attended the meetings (320, 150 and 250, respectively).

By the end of the public comment period, the consultant team received approximately 167 online form submissions, 2,223 emails and attachments (1,981 of which were copies of three form letters), 21 letters and 110 comment sheets collected at public workshops. To read all public comments, please click here: <https://ofm.wa.gov/sites/default/files/public/publications/LSRD-public-comments.pdf>.

7,201 people participated in the online survey. The survey had nine sections related to the draft report sections (Agriculture, Transportation, etc.). Each survey section gave the survey participant

the option to answer two multiple choice questions and one open-ended question. There were 15,240 open-ended question responses, i.e., short answers. Appendix D summarizes every multiple-choice question response and provides more information on all open-ended question responses.

Report Overview

The rest of this report is divided into the following sections:

- Section 2 provides an overview of the Columbia River system and history of the LSRD and their intended purposes.
- Section 3 provides a summary of the effects of the LSRD on tribal resources and culture.
- Sections 4–9 discuss social, economic and environmental issues related to retaining or breaching the LSRD. Each section includes a summary of the context, perspectives in support of retaining the dams or breaching them, and a summary of the opportunities to increase understanding. The sections are:
 - Section 4: Salmon/Steelhead/Orca/Ecological
 - Section 5: Energy
 - Section 6: Agricultural
 - Section 7: Transportation
 - Section 8: Recreation
 - Section 9: Economics
- Section 10 provides a summary of the perspectives on factors to consider in moving forward.

Section 2: Background on Columbia River and Lower Snake River Dams

The first nation people who lived along the shores of the Snake River in southeast Idaho would mark their territory with sticks that showed an image of a snake and would greet traders with snake-like hand motions which was meant to represent swimming salmon. These tribes were noted as the “Snake Indians” by Lewis and Clark, but were actually the Shoshone tribe who called the river Ki-moo-e-nim or Yam-Pah-pa for the herbs that grew along the banks.¹⁵

Columbia River System Dams

The Columbia River is the predominant river in the Pacific Northwest. From its headwaters in British Columbia’s Rocky Mountains to its mouth on the Pacific Ocean at Astoria, the river and its tributaries drain parts of seven states.¹⁶ The U.S. Army Corps of Engineers, Bureau of Reclamation and Bonneville Power Administration planned, designed, constructed and currently own and operate 14 federal multi-purpose dams and related facilities known as the Columbia River System, which is a subset of the 31 dams that make up the Federal Columbia River Power System including nine on the Columbia River, one on the Clearwater River, and four on the Lower Snake River. Figure 1 shows the location of the 14 federal dams that make up the Columbia River System.

The first federal dam constructed in the Columbia River Basin, Bonneville Dam, was completed in 1938. Since then, 13 more dams have been constructed, the most recent being Lower Granite Dam on the Snake River in 1984. The dams fall into two major categories: (1) storage reservoirs, which adjust the river’s natural flow patterns to meet water and energy demand and (2) run-of-river projects, which primarily aid in navigation and generate hydropower. Because of their limited storage capacity, run-of-river dams do not control floods.

The 14 Columbia River system dams are a part of the Federal Columbia River Power System, one of the largest hydroelectric systems in the world. This power system generates more than 40% of the total hydroelectric capacity in the United States and is the foundation of the Pacific Northwest’s power supply. Through interconnected transmission grids, it serves utility customers as far away as Los Angeles, CA. BPA markets and distributes the power produced by the Columbia River Power System.

Lower Snake River Dams

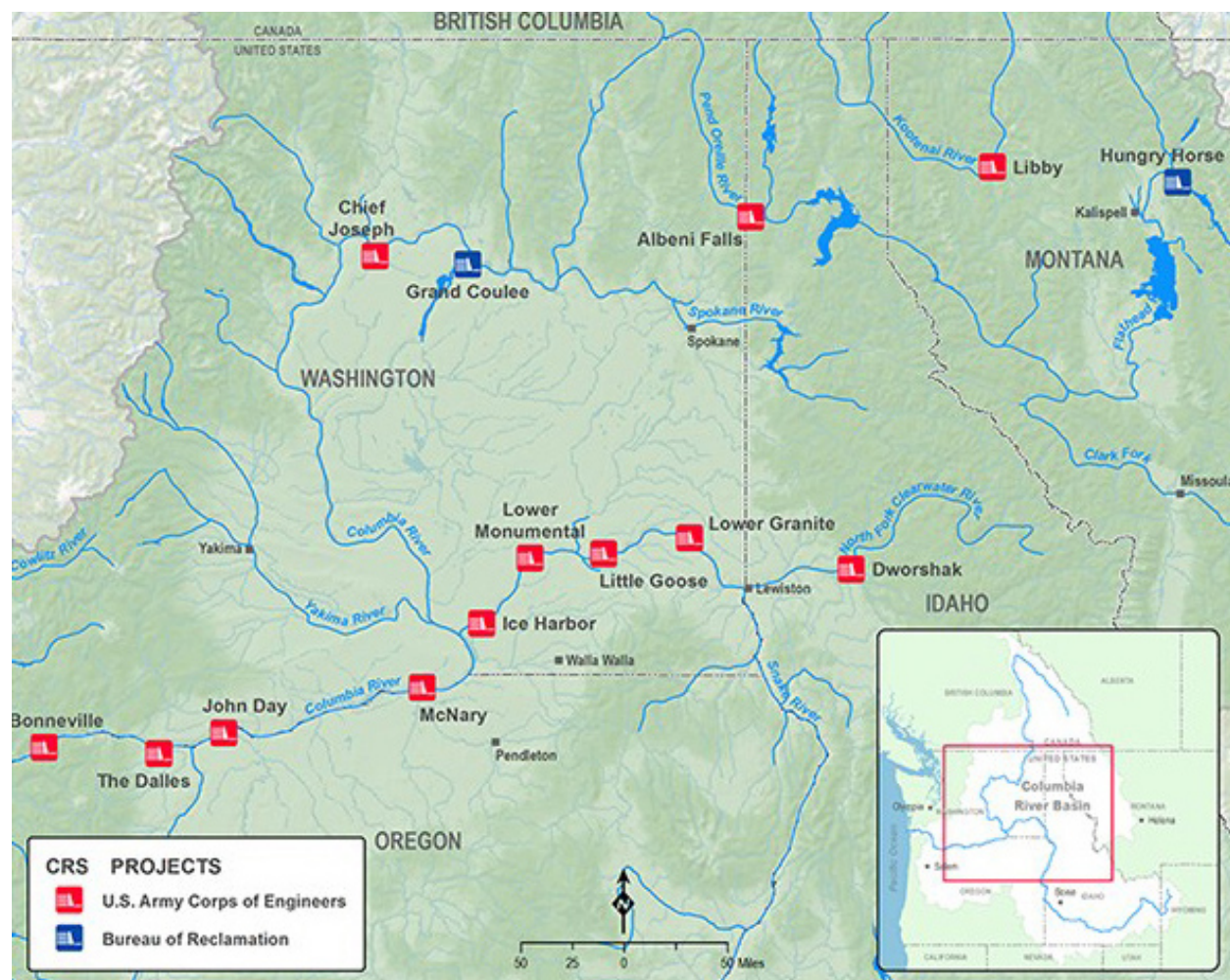
The Snake River is the largest of the Columbia River tributaries in both length and volume. It flows over 1,000 miles from its headwaters in western Wyoming through Idaho and Oregon before converging with the Columbia River at Lake Wallula (the reservoir formed by the McNary Dam) in the Tri-Cities, Washington.

USACE operates four run-of-river dams and locks on the lower Snake River in Washington state: Ice Harbor, Lower Monumental, Little Goose and Lower Granite. Table 1 provides more details about each LSRD. Together, the LSRD produce 1,000 average megawatts of electricity annually, which is roughly the amount of electricity that Seattle City Light consumes annually. They help meet

peak power loads and contribute to the reliability of the transmission grid. They also provide river navigation from Lewiston to the Tri-Cities — more than 100 miles — and ultimately to ports on the lower Columbia through additional dams. The capacity of the LSRD is 3,033 megawatts, which is the amount of electricity that can be generated at full output.

The LSRD, along with four other federal dams on the lower Columbia River, are the biggest human constructed obstacles Snake River fish and other aquatic species encounter on their migration to and from the Pacific Ocean. The LSRD were designed with fish ladders to assist adult fish passage. As USACE learned more about juvenile and adult fish migration, it updated the LSRD to add fish passage facilities, including installing spillway weirs and flow deflectors, making turbine improvements, investing in surface bypass systems, and other improvements to reduce juvenile travel time and increase juvenile survival passing each dam. In recent decades, the adult fish ladders have been improved and updated with features such as metal plating to assist Pacific lamprey migration.

Figure 1: Map of 14 Federal Columbia River System Dams¹⁷



Source: U.S. Bureau of Reclamation

Table 1: Summary of Lower Snake River Dams

	Ice Harbor ¹⁸	Lower Monumental ¹⁹	Little Goose ²⁰	Lower Granite ²¹
Location	River mile 10	River mile 42	River mile 70	River mile 107
Construction	1956–76	1961–81	1963–78	1965–84
Reservoir	Lake Sacajawea	Lake Herbert G. West	Lake Bryan	Lower Granite Lake
Type	Concrete gravity-type dam with earth fill abutment embankments	Concrete gravity-type dam with earth fill abutment embankments	Concrete gravity-type dam with earth fill abutment embankments	Concrete gravity-type dam with earth fill abutment embankments
Maximum power capacity	603MW	810MW	810MW	810MW
Infrastructure	<ul style="list-style-type: none"> One single-lift lock Six generators 10-bay spillway 	<ul style="list-style-type: none"> One single-lift lock Six generators 	<ul style="list-style-type: none"> One single-lift lock Six generators Eight-bay spillway 	<ul style="list-style-type: none"> One single-lift lock Six generators Eight-bay spillway Eight miles of levees around Lewiston
Fish passage infrastructure	<ul style="list-style-type: none"> Two fish ladders Spillway weir Lamprey passage structures 	<ul style="list-style-type: none"> Two fish ladders Juvenile fish facility Spillway weir Lamprey passage structures Juvenile Fish Collection and Bypass System 	<ul style="list-style-type: none"> One fish ladder Juvenile fish facility Spillway weir Lamprey passage structures Passive integrated transponder-tag monitoring system 	<ul style="list-style-type: none"> One fish ladder Spillway weir Lamprey passage structures Juvenile fish collection and bypass system Two intake chimneys to pump cool water
Project Footprint	<ul style="list-style-type: none"> 3,576 acres Four habitat management areas 	8,335 acres	5,398 acres	13,000 acres
Recreation and visitation	<ul style="list-style-type: none"> 345,000+ visits in 2015 Four developed recreation areas Three public access areas Seven public boat launch sites 	<ul style="list-style-type: none"> 115,000+ visits in 2015 Seven day-use areas Five camping areas Five boat launch sites One swimming beach 	<ul style="list-style-type: none"> 166,000+ visits in 2015 Seven day-use areas Five camping areas Five boat launch sites Two swimming areas 	<ul style="list-style-type: none"> 1.9+ million visits in 2015 12 boat launch sites
2015 Annual expenditures	\$11.5 million	\$9.5 million	\$10.2 million	\$23.6 million

Section 3: Tribal Connections to the Lower Snake River Dams

“Fish provide us with both physical and spiritual sustenance. Other cultures seem unable to recognize how those two concepts go hand in hand. Instead, they see them as separate, traditional beliefs on one side, science on the other. For Indian people those concepts have never been separate. Our fate and the fate of the fish are linked.” —Jaime Pinkham quote from Salmon and His People (Landeem and Pinkham, 1999).

Five tribal nations are primarily impacted by the construction and ongoing operation of the LSRD: the Nez Perce Tribe, the Yakama Indian Nation, the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes of the Warm Springs Reservation of Oregon and the Shoshone-Bannock Tribe. The upper Snake tribes are primarily impacted by Hells Canyon Dam where there is no fish passage. Table 2 summarizes tribal nations in the United States and First Nations in Canada that have management authorities and responsibilities affected by the Columbia River treaty.²² These tribal nations and First Nations are affected to varying degrees by decisions that impact the Columbia Basin, including any decisions on the LSRD. The LSRD are part of a broader set of impacts European settlement has had on tribal nations, which include the loss of tribal lands and suppression of tribal cultures. The dams affect tribal people in two main ways: (1) they affect the abundance and distribution of salmon and reduce salmon fishing opportunities and harvest available to tribal people and (2) they cut off access to tribal fishing, hunting, and harvesting of roots, plants and berries and prevent tribal people from holding religious and cultural ceremonies at their usual and accustomed places. Other tribes in the Columbia Basin and along the West Coast of the Pacific Ocean are also affected by the loss of salmon on rivers throughout Washington State and the West, which has occurred since European settlement. All of the Columbia River Treaty Tribes have published salmon restoration plans and reports that have reconfirmed two premises on what salmon restoration means for tribal communities: (1) the baseline for tribal salmon restoration and harvest is 1855 and (2) there is a large gap between current conditions and the baseline.

Table 2: Tribal Nations and First Nations Affected by Decisions that Impact the Columbia Basin

Tribal Nations in the United States	First Nations in Canada
Burns Paiute Tribe	Lower Kootenay Indian Band
Coeur d'Alene Tribe	Tobacco Plains Indian Band
Confederated Salish and Kootenai Tribes of the Flathead Nation	Columbia Lake Indian Band
Confederated Tribes and Bands of the Yakama Nation	St. Mary's Indian Band
Confederated Tribes of the Colville Reservation	Upper Similkameen Indian Band
Confederated Tribes of the Umatilla Indian Reservation	Lower Similkameen Indian Band
Confederated Tribes of the Warm Springs Reservation of Oregon	Penticton Indian Band

Tribal Nations in the United States	First Nations in Canada
Cowlitz Indian Tribe	Westbank First Nation
Fort McDermitt Paiute Shoshone Tribes	Okanagan Indian Band
Kalispel Tribe of Indians	Osoyoos Indian Band
Kootenai Tribe of Idaho	Shuswap Indian Band
Nez Perce Tribe	Upper Nicola Band
Shoshone Paiute Tribe of the Duck Valley Indian Reservation	Little Shuswap Indian Band
Shoshone-Bannock Tribes of the Fort Hall Reservation	Adams Lake Indian Band
Spokane Tribe of Indians	Simpco First Nation
	Neskonlith Indian Band
	Splatsin First Nation

Loss of Salmon

The importance of salmon to the physical, cultural and spiritual well-being of Columbia and Snake River tribes cannot be overstated. Historically, the typical tribal member ate almost a pound of salmon every day, and salmon fishing and harvest shaped tribal peoples' lives. Tribal creation stories throughout the Columbia Basin feature the importance of salmon in tribal culture. According to information compiled by the Columbia River Inter-Tribal Fish Commission:

From a tribal legend, we learn that when the Creator was preparing to bring forth people onto the earth, He called a grand council of all creation. From them, He asked for a gift for these new creatures—a gift to help the people survive, since they would be quite helpless and require much assistance from them all. The very first to come forward was Salmon, who offered his body to feed the people. The second to come forward was Water, who promised to be the home to the salmon. In turn, everyone else gathered at the council gave the coming humans a gift, but it is significant that the very first two were Salmon and Water. In accordance with their sacrifice, these two receive a place of honor at traditional feasts throughout the Columbia Basin. These ceremonies always begin with a blessing on and the drinking of water, followed by a prayer of thanksgiving on and the serving of my-kan-ush, the salmon. This ceremony reinforces the central role that salmon and water play in the health of Indian people and their culture.²³

Tribes took care to protect their rights to harvest salmon and other resources during treaty negotiations. In treaties with the Nez Perce, Yakama, Umatilla and Warm Springs, the U.S. government agreed that “the exclusive right of taking fish in all streams, where running through or bordering said reservations is further secured to said confederated tribes and bands of Indians, as also the right of taking fish at usual and accustomed places in common with the citizens of the Territory, and of erecting temporary buildings for curing them; together with the privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed lands.”²⁴

Current tribal harvest of salmon is a fraction of what it was before European settlement and before construction of the LSRD. Table 3 summarizes estimated historic harvest amounts of the five tribes most affected by the LSRD compared to current harvest.

Table 3: Comparison of Estimated Tribal Harvests from the Columbia/Snake System Contact Times to 1999²⁵

Benchmark	Annual Harvest in Thousands of Pounds				
	Nez Perce	Shoshone/ Bannock	Yakama	Umatilla	Warm Springs
Estimated Pre-Contact Harvest	2,800	2,500	5,600	3,500	3,400
Estimated Harvest in mid-1800s	1,600	1,300	2,400	1,600	1,000
Tribal harvest in 1999*	160	1	1,100	77	
Present vs. Pre-Contact Harvests					
Above lower Snake River Dams	0.6%	0.04%	–	–	
Below lower Snake River Dams	5.1%	–	9.4% for three mid-Columbia tribes		

* Shoshone Bannock estimates include harvests by Sho-Pai Duck Valley peoples.

Not all losses of salmon are attributed to the LSRD. Initially, the losses of salmon were principally caused by preemption by competing non-Indian harvesters and obstruction or denial of access to usual and accustomed fishing places — sometimes fenced off by non-Indian property owners. Over time, as tribal access to usual and accustomed sites has been restored, loss of salmon numbers and salmon harvesting areas for these five tribes is more related to the LSRD.

Loss of Access to Land and Cultural Sites

The reservoirs behind the LSRD inundated approximately 140 river miles and 34,000 acres of land,²⁶ important to tribes and 600–700 sites where tribal people historically lived; fished and hunted; harvested plants, roots and berries; and conducted cultural and religious ceremonies. Numerous tribal gravesites were inundated, making it impossible for tribal people to care for these graves in their normal ways. Table 4 describes the loss of access to land and cultural sites for these five tribes in the LSRD by tribal organization.²⁷

In addition to the effects to the tribes summarized in Table 3, tribes from outside the region who historically visited the lower Snake River area for hunting, gathering, fishing and trading are similarly affected. If a decision is made to breach the LSRD, now-inundated tribal cultural resources will be exposed and accessible to tribes but require protection. Reservoir drawdowns cause erosion of tribal cultural sites and expose them to vandalism. When the Wanapum Lake was drawn down for repairs to Wanapum Dam, Grant County Public Utility District spent over \$1 million for enforcement to protect tribal archeological sites.

Table 4: The Relationship Between Present Tribal Treaty-Based Entities and Pre-Treaty Tribal Groups in the Lower Snake Reservoir Area

Tribal Organization	Original Tribal Groups in Lower Snake Territory	Associated Inundation by Lower Snake Reservoirs
Nez Perce Tribe	Nez Perce Indians living along the Clearwater River and downstream along the lower Snake River to Palouse River (north side) and Tucannon River (south side).	Lower Granite Little Goose Lower Monumental
Yakama Indian Nation	Palouse peoples living at the confluence of the Snake and Palouse rivers and downstream along the north riverbank. Possibly other bands near the mouth of the Snake.	Lower Monumental Ice Harbor
Confederated Tribes of the Umatilla Indian Reservation	Palouse peoples living at the confluence of the Snake and Palouse rivers, and downstream along the north riverbank. Walla Walla peoples living from the mouth of the Tucannon River downstream along the south bank of the Snake River.	Lower Monumental Ice Harbor

Tribal Engagement Moving Forward

Decisions about the LSRD need to take into account the state and federal government’s responsibilities to comply with tribal treaties and government-to-government protocols for engagement and consultation with the tribes. The Governor’s Office is engaging with impacted tribes and tribal consortia including the Columbia River Inter-Tribal Fish Commission and Upper Columbia United Tribes.

Section 4: Salmon/Steelhead/Orca/Ecological

Context

Concern over the impacts of the LSRD on salmon abundance in the Columbia and Snake river systems and the relationship between Columbia and Snake river salmon and Southern Resident orca recovery stimulated this engagement process. As described in the introduction to this report, in fall 2018 Gov. Inslee's Southern Resident Orca Task Force recommended further investigation of the impacts of breaching the lower Snake River dams as a way to provide more salmon for Southern Resident orcas to eat. In response to the task force recommendation, the Washington State Legislature provided funding in the 2019-21 operating budget for this effort.

The lower Snake River is home to four Endangered Species Act-listed species of anadromous fish: spring/summer Chinook, fall Chinook, sockeye and steelhead. It is also home to non-listed populations of anadromous coho (which were extirpated and reintroduced) and Pacific lamprey, as well as resident species including white sturgeon and ESA-listed bull trout. Historically, salmon spawning and rearing occurred in both the main river (fall Chinook) and in tributaries. There are five principal salmon-producing tributaries to the lower Snake River. Three of the five, the Clearwater, Grande Ronde, and Salmon rivers, are large, complex systems composed of several smaller tributaries which are further composed of many small streams. The two others, the Tucannon and Imnaha rivers, are smaller and most salmon spawning and rearing occurs in the main rivers. There also are additional smaller streams, including Asotin, Granite and Sheep creeks, that enter the Snake River between Hells Canyon and Lower Granite dams and provide additional spawning and rearing areas.²⁸ Currently, salmon spawning and rearing occurs almost exclusively in tributaries, except for fall Chinook which spawn in the free-flowing stretch of the Snake River between Hells Canyon Dam and the Lower Granite Dam's reservoir, as well as in the lower tributaries such as the Clearwater and Grande Ronde.

Historically, fall Chinook and steelhead spawned in the Snake River as far inland as Shoshone Falls, 600 miles upstream of the confluence of the Snake and the Columbia. The LSRD inundated the lower 140 miles of the lower Snake River, some of which served as fall Chinook spawning habitat. Other wildlife was also affected by the dams. Before the dams, this section of the river had 48 islands and supported an estimated 1,800 deer, 120,000 upland game birds and animals, 13,000 fur bearers as well as waterfowl and nongame species.²⁹ Currently, less than 20% of the portion of the mainstem Snake River once used by salmon remains accessible. Regardless of the future of the LSRD, fish are limited to the lower 247 miles of the Snake River because there is not fish passage beyond Hells Canyon Dam, the lowermost of three dams that are part of the privately owned Hells Canyon dam complex.³⁰ The upstream Dworshak Dam limits anadromous fish in the North Fork Clearwater to just two miles before blocking upstream and downstream salmon. However, as noted above, Snake River salmon and steelhead retain access to several large tributaries of the lower Snake River, including largely pristine salmon habitat such as Idaho's Middle Fork Salmon and Selway rivers.

Changes in Wild Salmon Abundance in the Snake River and Columbia Basin

Salmon decreased significantly in the Columbia and Snake river system following European settlement. When Europeans first arrived in the basin in the 1800s, the runs of salmon were substantial. An early European settler wrote, “the number of fish who reached these beds was so great the receding waters would leave missions of dead salmon strewn along the banks, emitting a stench that could be smelled miles off, and which never failed to attract a great number of bears.”³¹

In the years that followed, salmon runs declined significantly. As early as 1894, the Oregon Fish and Game Protector warned that Chinook populations were “threatened with annihilation.”³² With the falling numbers of Chinook, fishermen moved onto the other salmon species in the region like sockeye and coho; these species also saw a pronounced fall in the 1920s. In 1911, 46 million pounds of canned salmon were produced from the Columbia and Snake river systems; by 1938 the annual catch had decreased to 20 million pounds.³³

Salmon populations decreased further with logging, mining, irrigation diversions, draining of wetlands, constructing roads and railroads and associated developments over the last century, including the construction of both public- and privately-owned dams on the Columbia and Snake rivers and their tributaries. Based on estimates compiled by the Washington Department of Fish and Wildlife and the Oregon Department of Fish and Game in the Columbia River Fish Runs and Fisheries Status report, salmon runs in the Columbia and Snake river system have declined by over 90% during the last century.³⁴

Table 5 shows the current abundance levels for the ESA-listed salmonids within the Snake River detected at the Lower Granite Dam as well as the historic abundance levels.

Table 5: LSRD ESA-listed Salmonids Historic and Projected Current Abundances

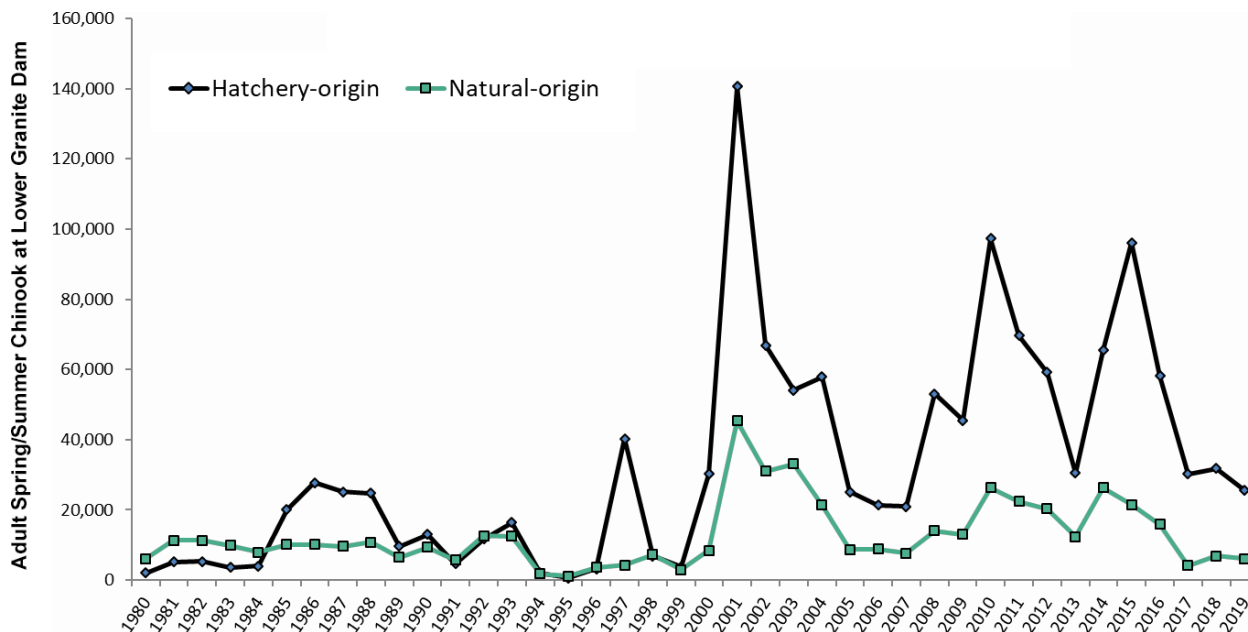
Species	Historic Abundance ³⁵	2019 Wild Abundance ³⁶	2019 Total Abundance (Wild & Hatchery Origin) ³⁷
Spring/summer Chinook	1,000,000	6,130	31,831
Fall Chinook	500,000	5,435	15,451
Sockeye	84,000	43	129
Steelhead	602,000	17,614	60,700

All species of salmon that use the Snake River are currently listed as threatened or endangered under the Endangered Species Act, with the exception of coho. Wild Snake River coho went extinct in 1987;³⁸ the current reintroduced coho population in the Snake River basin is supported by hatcheries.

Year over year, salmon abundance fluctuates based on many factors including weather and climate, ocean conditions and prey availability. Figures 2–5 show the natural and hatchery origin annual returns of salmon to the Snake River at Lower Granite Dam from 1980 through the present. Returns for 2019 are projected because fish counts have not been finalized. Recent returns to the

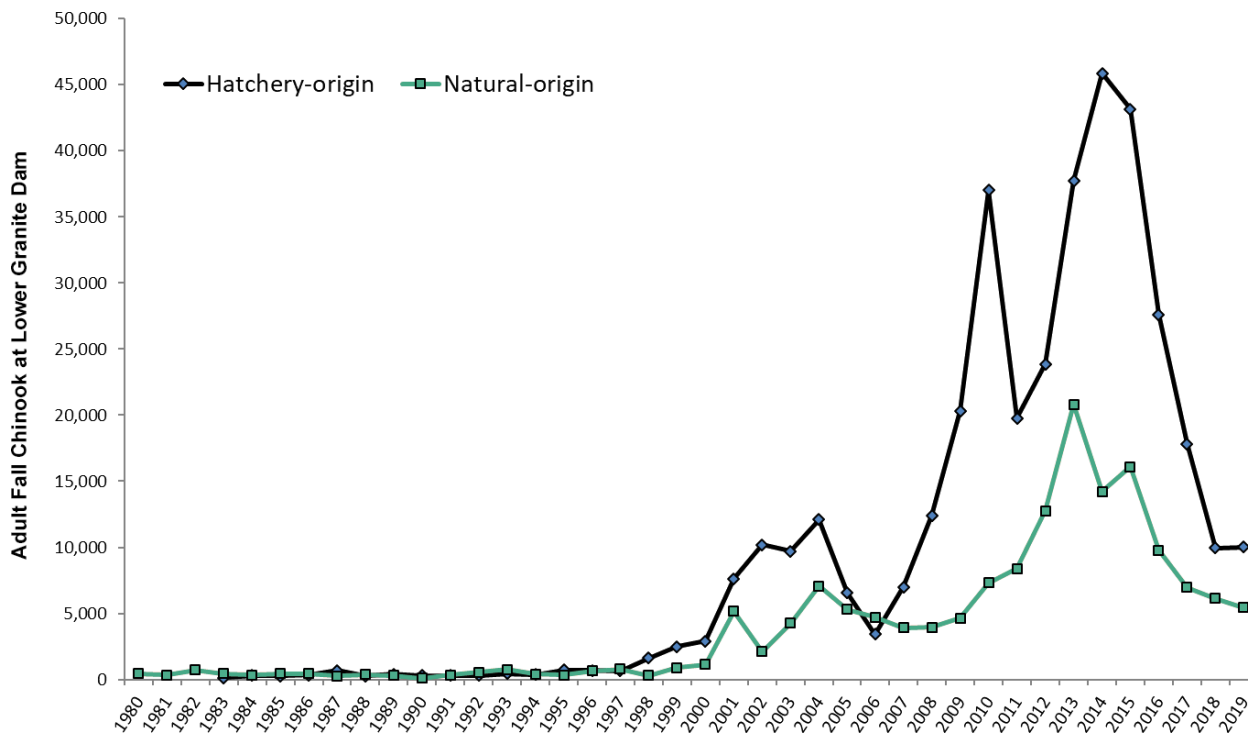
Snake River are higher than their historic lows, but lower than a bump in returns in the earlier part of this century, and much lower than historic abundance.

Figure 2: Snake River Spring/Summer Chinook Abundance at Lower Granite Dam Over Time³⁹



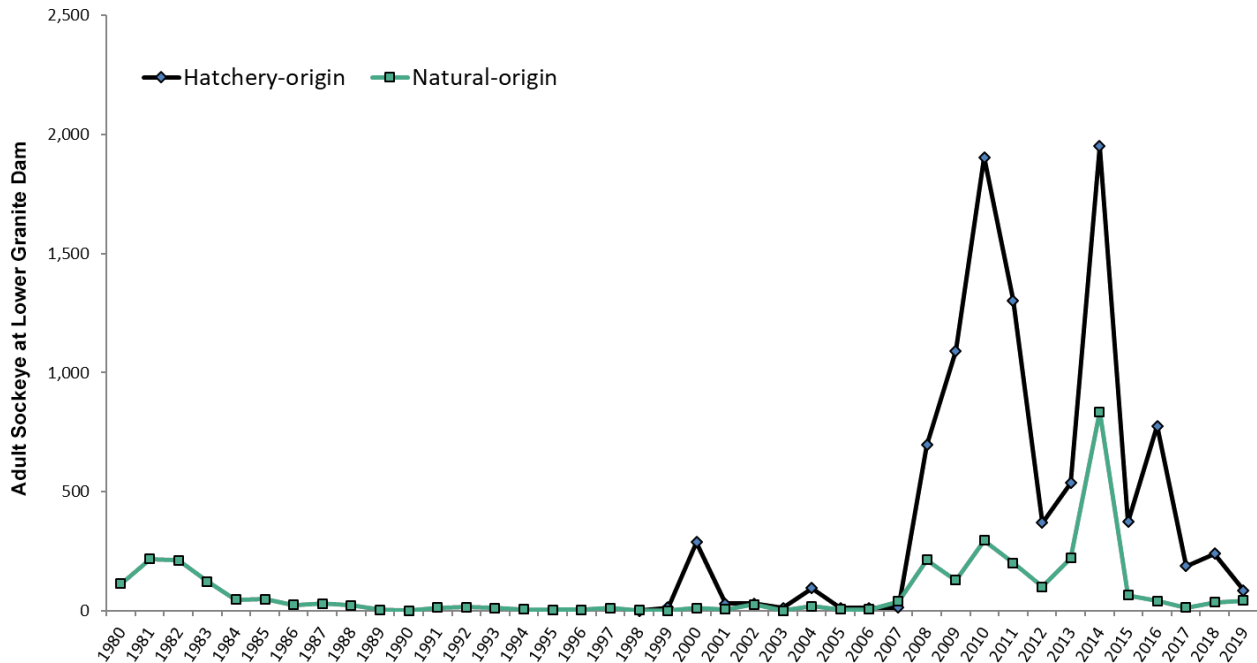
Source: Northwest Power and Conservation Council

Figure 3: Snake River Fall Chinook Abundance Counted at Lower Granite Dam Over Time⁴⁰



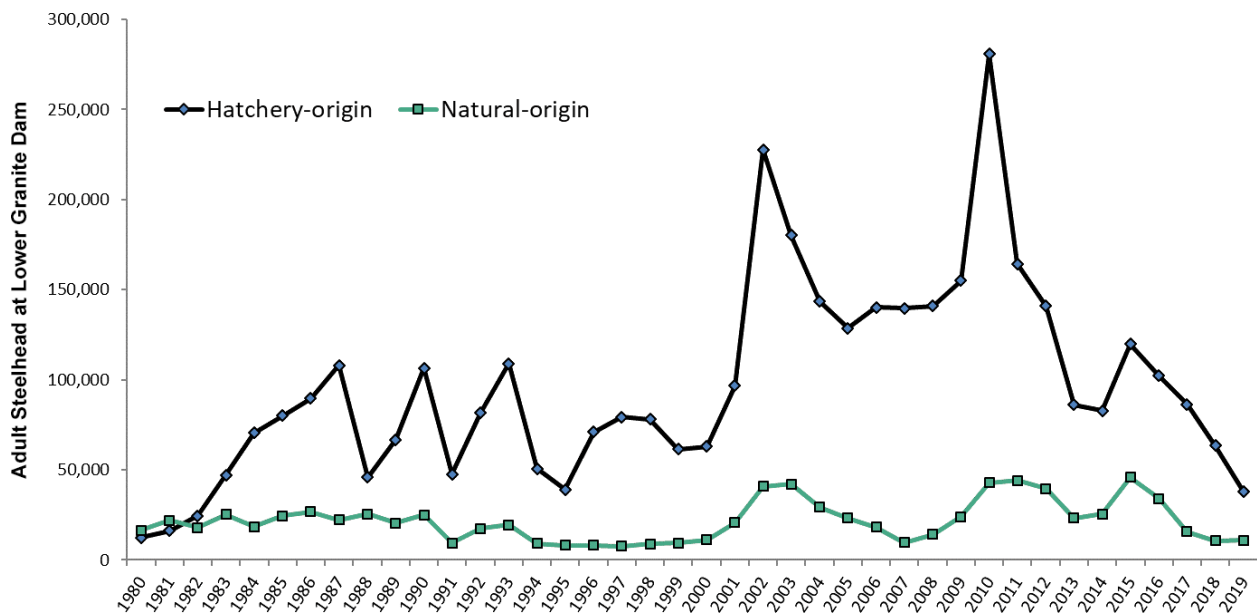
Source: Northwest Power and Conservation Council

Figure 4: Snake River Sockeye Abundance Counted at Lower Granite Dam Over Time⁴¹



Source: Northwest Power and Conservation Council

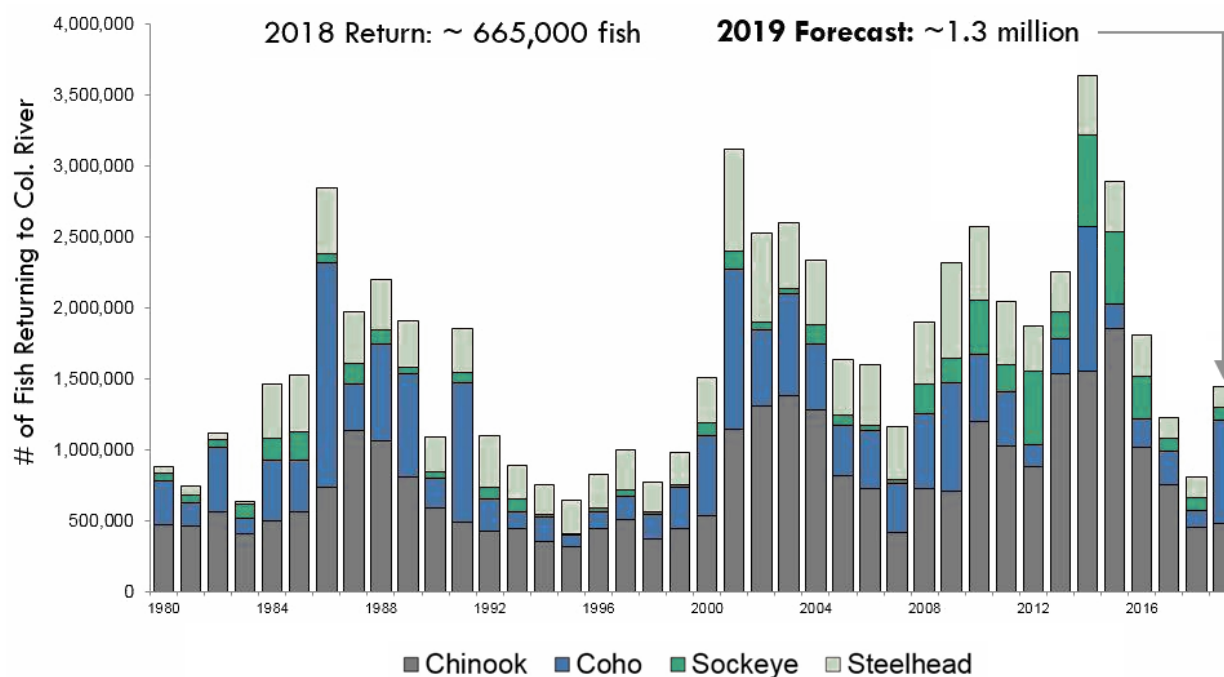
Figure 5: Snake River Steelhead Abundance Counted at Lower Granite Dam Over Time⁴²



Source: Northwest Power and Conservation Council

Figure 6 below shows the annual returns of all (natural and hatchery origin) adult salmonids to the Columbia River as detected at the Bonneville Dam with the current 2019 counts forecasted because they have not been finalized yet.

Figure 6: Total Returns of All Columbia and Snake Rivers Salmonid Returns Counted at Bonneville Dam Over Time⁴³



Source: Northwest Power and Conservation Council

Columbia and Snake River Hydrology and Effects of Dams

Historically the Columbia and Snake river systems were characterized by high water flows due to snowmelt with peak runoff in spring and early summer. Salmon migration patterns evolved over time to respond to these typical flows. Construction of dams in the Columbia and Snake river systems changed these historical flows. Dams control how water flows in the modern Columbia River Basin; storing runoff, reducing flood flows, and shifting flows from natural spring/early summer peak to fall and winter for the purpose of generating electricity for the region's peak electricity demand. The LSRD are run of the river dams with limited storage and flood prevention capabilities. Except for the Hanford Reach and a section of the Snake River between Hells Canyon Dam and Lower Granite Reservoir, the lower Snake and the lower Columbia rivers now operate as a series of reservoirs. Sediment, which formerly moved down river and formed sand bars, beaches and other habitat, is now largely impounded behind dams.

Breaching the LSRD would significantly alter the current hydrology, stream morphology and increase flow velocity in the lower Snake River, returning it to a pattern closer to that observed before the dams were in place. However, the seasonal flow regime and temperature would continue to be affected by upstream dams, Dworshak and Hells Canyon, that are operated for flood control and electricity generation. Sediment and contaminants trapped behind dams would be released, temporarily increasing water turbidity and distributing chemical contamination in the form of DDT, manganese, dioxin and un-ionized ammonia⁴⁴ Approximately 50 to 70 million cubic yards of

sediment could be released.⁴⁵ The 2002 USACE FS/EIS estimated that water quality would be poor for up to three years following breaching the LSRD.⁴⁶

If the dams are breached, land currently inundated by reservoirs would be exposed as the river returns to its historic channel. Flow velocity would increase and water temperatures would fluctuate but may generally have a cooler pattern in the summer. This could include higher daily fluctuations in water temperatures, although overall water temperatures would be cooler. Spillway flows from dams increase total dissolved gas concentrations; if the dams were breached, these concentrations would decrease. High levels of total dissolved gas concentrations have been found to cause gas bubble trauma in salmonids. Gas bubble trauma causes loss of equilibrium, abnormal buoyancy and hemorrhaging of the gills, fins, skin and muscles, which can lead to death.⁴⁷

There are several municipal waste discharges into the Snake River above Lower Granite Dam. If Lower Granite Dam is breached, the permit requirements for the discharges will need to be reviewed to address the change in the receiving body water volume and capacity for dissolution of water pollution.

Salmon Life Cycle and Effects of Dams

Salmon are a migratory fish. They hatch in freshwater systems, migrate to the ocean after a few months to several years of freshwater rearing, spend most of their adult lives in the ocean, and then return to the freshwater systems in which they hatched to spawn and die. Dams impede salmon migration by limiting migratory routes, reducing in river water velocity, reducing access to tributaries and, even where there is fish passage provided by ladders, increasing the time it takes for migration. Increased time for juvenile migration affects their fitness for survival once they enter the ocean estuary. The increased time for adult migration back upstream can affect their success in spawning. Dams can also increase river temperatures by absorbing more of the sun's rays in their reservoirs, which increases rates of disease, reduces reproductive viability in salmonids and increases predation because the warmer, slow waters support more predators which can easily access fish at dams and in slower moving, deeper reservoirs.⁴⁸

The current survival rate of juvenile spring/summer Chinook and steelhead salmon through the dams from Lewiston, Idaho, on the Snake River to Bonneville Dam on the Columbia River is approximately 50%.⁴⁹ For returning adult fish, once they are back in the river the average survival rate of Snake River salmonids is about 90% through the eight dams from 2008 - 17.⁵⁰ While these survival rates are improved from previous years⁵¹, the listed species of salmonids that inhabit the river still are not meeting regional recovery goals that the NWPCC has laid out of 2-6% smolt-to-adult ratio (SAR) with an average of 4% SAR.⁵²

SAR is a measure of survival of salmonids from their beginning point as a smolt to an ending point as an adult.⁵³ For Snake River salmon it can be a measure of salmon passing Lower Granite Dam as a smolt and returning over the same dam as an adult. The average SAR for natural origin spring/summer Chinook in the Snake River from 1997–2015 is 1.07% while the average SAR for natural origin steelhead over the same period is 1.74%.⁵⁴ Spring/summer Chinook only met the NWPCC SAR goal of at least 2% SAR twice during that period, while steelhead on average were better reaching the goal in eight of the years.⁵⁵ SARs have been reduced in many rivers across the West Coast in recent years (both in rivers that are impounded with dams and in rivers that are free flowing) likely due to unfavorable ocean conditions. In the Middle Fork Salmon River, a tributary of

the Snake River in Idaho, the redd counts (the number of salmon egg nests) in the 1950s are estimated to have had an annual average of 24,000 redds; over the last 20 years the annual average has only been 711 redds.⁵⁶ Part of the reason for this low overall survival rate in the lower Snake River could be caused by the effect passage through the dams and reservoirs has on the fitness of salmon once they pass Bonneville dam.⁵⁷ Latent mortality refers to this reduced fitness and increased likelihood of death for fish in their first year in the ocean from the cumulative effects of a highly altered and managed river system.⁵⁸

Spill to Improve Juvenile Salmon Passage and Survival

In the spring and summer, water is routed over the tops of the LSRD dams to help juvenile salmon and steelhead migrate to the ocean. This is referred to as “spill”. During spill periods, juvenile fish can migrate past the dams in water that flows over the spillways rather than traveling through the turbines or bypass systems.⁵⁹ Spill is credited with improving juvenile Snake River spring/summer Chinook survival and thereby increasing adult returns. The effectiveness of spill to increase fish survival varies and depends on the configuration at each dam and how spill is managed. Strong benefits to salmon and steelhead adult-to-survival and adult abundance are anticipated from increased spill and subsequent decreased powerhouse encounter rate.⁶⁰ There are frequently periods of involuntary spill at and exceeding 125% TDG, with the data and evidence showing that the incidence of gas bubble trauma increases do not reach levels of concern until TDG is at or above 130%.⁶¹ However, this will need to be closely monitored since increased dissolved gasses caused by water agitation during spill can cause gas bubble trauma in fish.⁶²

A 2018 agreement on flexible spill has brought together the states of Oregon and Washington, the Nez Perce Tribe, USACE, USBR and BPA with the dual goals of achieving improved salmon survival through the dams and maintaining hydropower revenues at 2018 levels. In 2018, per a court injunction, the lower Snake and lower Columbia River dams spilled 24 hours, seven days a week to 115% total dissolved gas levels in the forebays and 120% as measured in the tailrace. The flexible spill agreement called for spill to a 120% tailrace-only standard in 2019 and is calling for spilling to a 125% TDG standard at five of the eight dams in 2020–21. But rather than spill to those levels 24 hours per day, the flexible spill agreement allows spill to be reduced to lower 2014 BiOp levels (lower than 2018 levels) for eight hours a day to allow BPA to take advantage of times with higher energy demand that fetch higher prices per unit of power produced. On balance, preliminary data indicated that 2019 flexible spill operations were roughly on par with 2018 in terms of overall fish survival and power revenue. 2020 operations are expected to provide for improved fish survival relative to 2018 (and 2019), and at least equal power revenue.

Another mitigation method to reduce juvenile mortality is juvenile transport. Juvenile transport is when fishery managers collect juveniles at upstream locations or at a dam’s juvenile bypass system and load the juveniles onto barges that take the fish downriver below Bonneville Dam for release. This mitigation method has changed over time, with nearly 100% of juvenile Chinook and steelhead being transported in 2001, to only 19.7% of Chinook and 22.1% of steelhead being transported in 2017.⁶³ While transported juveniles do have a high direct survival rate of 98%, NOAA’s 2019 Columbia River System Biological Opinion recommended reducing the number of juveniles being transported due to negative or potentially negative effects associated with transporting juveniles from the lower Snake River.⁶⁴ The 2019 BiOp found (1) returning adults that were transported as juveniles have demonstrated to stray from their natal spawning areas at higher rates; (2) the handling of juveniles for transportation results in fish being exposed to higher densities than they naturally

would be exposed to; (3) the fish being released are smaller once they reach the ocean which is associated with higher ocean mortality rates; (4) and the increased sound and reduction in natural inputs has been observed to impair the fish's ability to avoid predators in the days soon after release.⁶⁵ It has also been found that the benefit of juvenile transport decreases in the lower Snake River as in-river juvenile survival increases in both Chinook and steelhead.⁶⁶

Differing Methods to Estimate the Impacts of Breaching the LSRD

There are two main modeling efforts to characterize survival of Snake River salmonids: (1) the Comparative Survival Study (CSS) model, which was developed by research scientists from U.S Fish and Wildlife, Columbia River Inter-Tribal Fish Commission, Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife, Idaho Department of Fish and Game and Fish Passage Center and (2) the comprehensive passage (COMPASS) model which was developed by NOAA Fisheries along with federal, state and tribal agencies, and the University of Washington. While both models are used to characterize survival through the system, they are methodologically quite different.

The CSS is a statistical modelling approach based on retrospective analysis of a long series of data sets from the Columbia and Snake River system. It estimates that if the LSRD were breached, and there was a significant increase in spill above current BiOp spill levels (24-hour 125% total dissolved gas at the four lower Columbia dams) there would be an approximately two to three-fold increase in SARs for Snake River salmonids.⁶⁷

The COMPASS model is a mechanistic modeling approach composed of four main components: dam passage and survival, reservoir survival, fish travel time and hydrological processes.⁶⁸ Published estimates from the COMPASS model are available in the draft Columbia River System Operations Environmental Impact Statement.

Hatcheries

Since the late 1800s fish hatcheries have been used in the Columbia River Basin and throughout Washington, including Puget Sound, to mitigate the impacts of habitat alteration to naturally produced salmon populations and provide for harvest.⁶⁹ Some hatchery programs raise salmon and steelhead to supplement depressed natural populations and are part of a recovery strategy. Fish hatcheries collect returning adult fish, harvest their eggs and produce juvenile fish in controlled conditions. The juvenile fish are then returned to the river to migrate to the ocean. Hatcheries are generally credited with bolstering total current salmon returns to the Snake River and for increasing salmon numbers to support limited harvest and supplementing naturally produced populations, including Snake River fall Chinook and sockeye. In 1976, Congress authorized the creation of the Lower Snake River Compensation Plan to construct fish hatcheries to compensate for the impacts of the dams on salmon and steelhead populations. The goals of the program are to return 55,100 adult steelhead, 58,700 adult spring/summer Chinook and 18,300 fall Chinook to the Snake River, plus ensure enough abundance to support harvest in the ocean and lower river.

Hatcheries in the Columbia and Snake river systems have raised and released five salmonid species (Chinook, coho, chum, sockeye and steelhead) but most hatchery production has been focused on Chinook. Ten hatcheries in Oregon, Washington and Idaho supplied a total of 16.8 million juvenile fish to the lower Snake River in 2002.⁷⁰ Fall Chinook returns boosted by hatchery supplementation

increased from less than 1,000 adults at Lower Granite Dam in the mid-1990s to a record (post-dam construction) of more than 80,000 in 2014.⁷¹ The natural-origin fall Chinook adult returns at Lower Granite Dam in 2014 was just over 35,000 fish⁷², which was also a record since the initial construction of Lower Granite Dam in 1975. While hatchery fish have boosted returns, total Snake River fall Chinook returns remain a fraction of the historical estimate of over 500,000 fish⁷³ before either the lower Snake River dams or the Hells Canyon dams complex, the latter of which blocks most of the upstream historical spawning habitat.

Separate from the Lower Snake River Compensation Plan, there are also hatcheries for the endangered Snake River sockeye conducted in collaboration with NOAA, the Idaho Department of Fish and Game, the Shoshone-Bannock Tribes and BPA. In 1991, only 16 Redfish Lake sockeye returned to spawn. From the genetic material of those last surviving fish, the hatchery program has produced over 4,300 adult sockeye. Without the hatchery program, it is likely that Snake River sockeye would now be extinct.⁷⁴

Hatchery production in the Columbia River system has declined in recent years due to a variety of factors, including increasing costs and concerns about biological interactions between hatchery and wild fish. In 1998 the combined Chinook and coho hatchery releases in the Columbia River system (including the Snake River) was 216 million fish; in 2015 it was 139 million fish, a decrease of 36%. However, in recent years production from hatcheries on the Snake River have been at an all-time high: in 1998 there were 14,837,940 smolts released from hatcheries on the Snake River and its tributaries and in 2013 the number of releases was doubled to 30,118,213 smolts.⁷⁵

Southern Resident Orcas

The Southern Resident orca population is comprised of three family groups: J Pod, K Pod and L Pod. The pods traditionally spend most of the year in the Salish Sea and in the Pacific Ocean between the mouth of the Columbia River and off the west coast of Vancouver Island. They feed primarily on Pacific salmon, especially Chinook salmon. In the mid to late 1800s, before Euro-American settlement started to impact the natural resources of the region, the Southern Residents had a population of over 200 individuals;⁷⁶ today there are 73 remaining.⁷⁷ The population was listed as endangered in 2004.⁷⁸

Multiple factors have contributed to the Southern Residents' population decline: bioaccumulation of contamination, disturbance from vessels and the noise they create and reduced food sources — which links the Southern Resident orcas to the question of the management and future existence of the LSRD. The lack of Chinook abundance has been recognized as the primary limiting factor to the Southern Residents' immediate survival and future recovery.⁷⁹ NOAA's 2008 Southern Resident Recovery Plan states that, "Perhaps the single greatest change in food availability for resident killer whales since the late 1800s has been the decline of salmon in the Columbia River Basin."⁸⁰ NOAA has found a positive correlation between Chinook abundance and Southern Resident birth rates, however, it has not been able to quantify this relationship because of confounding factors.

NOAA Fisheries assessed the operation of the four lower Snake River dams and their effects on listed salmon and steelhead in the FCRPS Biological Opinion issued in 2008. In 2014, the supplemental Biological Opinion re-examined the issues, including consequences for Southern Resident orcas. Neither opinion, nor the recovery plans NOAA Fisheries has developed for

individual salmon species and stocks, concluded that breaching the dams is necessary for recovery of Snake River salmon or Southern Resident orcas.⁸¹

In its Southern Resident Killer Whale Priority Chinook Stocks Report, NOAA and the Washington Department of Fish and Wildlife stated that, for Southern Resident recovery, Columbia and Snake river salmon stocks are a lower priority than North and South Puget Sound salmon stocks because the Southern Residents' foraging patterns do not overlap as much with Columbia and Snake River salmon as they do with the North and South Puget Sound salmon.⁸² At the same time, Columbia and Snake river fall Chinook were ranked as the fifth most important salmon stock for Southern Resident orcas, and Snake River spring/summer Chinook as the ninth most important. Orca scientists have observed that Southern Residents are shifting their foraging patterns in response to the lower salmon abundance levels within the Salish Sea, spending less time in the Sea and more time on the western shore of Vancouver Island to intercept salmon migrating from Alaska to return to the Columbia and Snake river systems, which make up over half of their diet when they are in these coastal waters.⁸³ Other scientists note that the Southern Residents still gather along the Washington coast and at the mouth of the Columbia River between January and April to feed on Columbia and Snake spring/summer Chinook, which they argue is a critical time for the orcas to find nourishment and put on weight.⁸⁴ An average adult orca must consume between 28 and 34 adult salmon daily as adults and 15 to 17 daily as juveniles.⁸⁵ Between 2008–14, up to 69% of all detectable Southern Resident pregnancies were unsuccessful. Of these, up to 33% failed relatively late in gestation or immediately post-partum.⁸⁶ This high pregnancy failure rate appears to be linked with low availability of Chinook salmon as well as the bio-accumulated toxins that are released during fat metabolism in nutritionally deprived whales.⁸⁷

As part of the ongoing Columbia River System Operations EIS, USACE, USBR and BPA are evaluating different operations and maintenance options for the dams on the lower Columbia and Snake rivers, including breaching one or more dams. The EIS will conclude with a decision in 2020. After the process is complete, if dam breaching is recommended, then those three agencies would need to seek Congressional authorization to do so. NOAA Fisheries has distinct statutory obligations under the ESA, including the duty to consult with the federal agencies about the impact of the dams on salmon runs.⁸⁸

Perspectives

People recognize and generally agree on the critical importance of successful salmon recovery to the LSRD region and to the Pacific Northwest. However, there are significant differences in how people view the impacts of potential breaching of the LSRD on salmon. Similarly, there is broad support for action to improve conditions for Southern Resident orcas, but disagreement on what level salmon stocks from the Columbia and Snake river systems can contribute to that goal — especially in the near term of the next 10 to 20 years.

Support for retaining the LSRD and optimizing current efforts for salmon and orca recovery

People who support retaining the LSRD point to the positive impact of salmon recovery actions over the last several decades and the further anticipated benefits of the flex-spill agreement in increasing salmon returns to the Snake River. Some agree more with NOAA's assessment of the potential impact of dam removal on salmon returns and may believe that removal of the LSRD is

not the most effective, or cost-efficient, way to spend billions of additional dollars on salmon recovery. They would like to see investment made, instead, in continuing improvements to management of the dams in place and investing in salmon recovery efforts and dam mitigation efforts in other places. They make some or all of following points:

- Recent increases in returns show that salmon recovery efforts are on the right track with flex spill and other improvements to system management. Rather than start over, we should increase investment in the things that are already working. These actions are working; for example, their results have been significant enough to allow harvest on Snake River salmon.
- Removing the dams will dramatically disrupt river hydrology by releasing tons of sediment; this may have short-term adverse effects on salmon in both the Snake and the Columbia River systems, it could cause problems for the dissolution of pollutions from municipal waste discharges and other sources
- The river will not be the same as it was in terms of natural beauty and the towns along the river may be subject to muddy banks and turbid water for years after breaching.
- Removing the dams will, at least temporarily, reduce riparian cover by moving the river channel in, away from existing banks; in the short term this may decrease fish access to cooler water.
- Predators are a large problem for returning salmon to the Columbia River, especially pinnipeds like sea lions and seals, we should try to control this source of mortality before taking more drastic steps like breaching the dams.
- The upper Columbia once provided upwards of 40% of the returning adult salmon to the Columbia River system, reintroduction of the salmon to the upper Columbia could have an equal and more immediate benefit to orca and overall salmon recovery
- Decline in hatchery production in the Columbia River system as well as in Puget Sound plays a significant role in decreasing salmon returns; increasing hatchery production is a faster and more reliable way to increase salmon abundance overall and increase food for Southern Resident orcas than a large-scale dam removal process which would take years to accomplish and even longer for any increase in salmon populations to be realized. Removal of the dams could end the funding from BPA for hatchery production, creating a significant gap in both salmon available for harvest and in food supply for Southern Resident orcas in the short, and potentially, the long term.
- Other factors are more important for Southern Resident orca recovery than Columbia and Snake River salmon abundance including pollution, vessel noise and Puget Sound/Salish Sea salmon abundance.
- Ocean conditions are one of the most significant factors affecting the cyclical returns of salmon. Poor ocean conditions are the reason for the recent decline in returns.
- Instead of breaching all four of the dams, a deep draw down of the two upstream dams (Lower Granite & Little Goose) should be implemented to reduce the travel time for juvenile fish on their out-migration.
- Other dams should be considered for removal before the LSRD, specifically the Hells Canyon and Dworshak dams that do not have fish passage infrastructure like the dams on the Lower Snake and Columbia.
- The habitat within the tributaries of the Snake River have shown signs of reaching their carrying capacity, even though runs are much lower than historic levels, this could be due to

a variety of factors like the availability of food, protection from predators and competitors and the availability to move to other suitable habitat.

People who support retaining the LSRD and addressing salmon recovery needs through new and ongoing management changes criticize the Fish Passage Center, one of many organizations that developed the CSS model, as a biased entity that advocates for specific policy positions rather than an unbiased provider of scientific and technical information. They do not see the CSS model estimate of a four-fold increase in salmon as accurate.

Support for breaching the LSRD to support salmon and orca recovery

People who support breaching the LSRD see it as the only action that has not been already tried which could make a significant difference in the trend line for salmon populations. Some emphasize that the results from the \$17 billion investment in making improvements in the structure and management of the current system to support salmon recovery can be built upon with dam removal; others emphasize that a \$17 billion investment has not reversed the downward population trend. They make the following points:

- Although breaching the dams will take time, and the resulting improvements in salmon populations also will take time, this approach is overall the best way to increase resiliency in the system, especially considering climate change, and provides the greatest opportunity to prevent extinction and move toward sustainable, harvestable salmon runs.
- Fish ladders are a fragile system prone to disruption; these disruptions will increase as the dam infrastructure continues to age. Two of the four LSRD have only one fish ladder. If the ladder is “out” due to mechanical or other difficulty it will have significant impacts on fish migration.
- Flexible spill, including in the lower Columbia River, represents progress but alone is not enough to bring populations back. Additional spill can be put in place while dam breaching is planned and flex spill on the lower Columbia will be necessary to achieve full benefits if the LSRD are breached.
- There is significant, high-quality spawning habitat in the Snake River basin, particularly in large tributaries like the Salmon, Grande Ronde, and Clearwater rivers. Even with the improvements made to fish passage over the years, there are still not enough adult salmon getting over the dams to return to the upper watershed to spawn. Breaching the dams is the most reliable and effective way to ensure fish can access and use upstream habitat and increase overall productivity.
- Dam breaching will result in cooler river temperatures by returning the river back to a free-flowing river. Cooler temperatures will benefit the species in the future, as climate change is expected to increase water temperatures in the region.
- Hatchery production is not a viable long-term strategy for increasing Southern Resident orcas’ food. Hatchery fish are smaller contain less fat than wild fish, making them a less substantial food source, and hatcheries can depress the genetic diversity of wild salmon.
- Other supporters of dam breaching have identified that breaching the LSRD would provide similar survival benefits for hatchery fish. The continuation of these hatcheries is necessary to continue to provide the significant benefits to non-tribal and tribal fisheries, and the associated benefits these fisheries provide to tourism, rural economies, etc.

- Increasing the food base for the Southern Residents is a critical action to their recovery and it can be accomplished more quickly than other actions such as cleaning up pollution and addressing bioaccumulation of chemicals.
- Breaching the dams is the only remaining action to try to reverse the downward trend in wild salmon populations; abundant, healthy, wild salmon populations are critical to recovery of the Southern Residents. We should not be trying to reach the minimum ESA requirements for delisting but should go further with recovery efforts to reach abundance levels that can accommodate sustainable tribal, commercial and recreational harvest.
- The recovery efforts for salmon have a “shifting baseline scenario” issue: fishery managers try to maintain abundance levels from when they first enter the industry and later their replacement tries to maintain abundance levels from when they first enter the industry. This causes the baseline for recovery to slowly shift downward as abundance levels have over time. The region needs to establish clear recovery goals and criteria that don’t fluctuate to accommodate present conditions.
- When you compare the current population trends of Southern Resident and transient-type orcas, the Southern Residents have been doing much worse and have had lower pregnancy success. Transients do not have the prey scarcity issues that Southern Residents face; they consume mostly pinnipeds, which have higher levels of bio-accumulated toxins than Chinook salmon (the primary source of food for the Southern Residents) and, in general, have higher levels of bio-accumulated toxins than Southern Residents. Transients do not have to metabolize as much fat where these toxins are stored.
- When you compare the SARs from salmonid populations that do not have to traverse as many dams (such as salmon in the John Day River, which only traverse three dams, compared to salmon in the Snake River, which have to traverse eight dams) there are consistently lower SARs for Snake River populations. It appears that there is a system balance issue: salmon have the ability to co-exist with dams, but the LSRD are too many dams for these fish to traverse. The fish are past the point of balance with this many dams in place.

People who support breaching the LSRD do not agree with the NOAA estimates about the impact of breaching the LSRD on salmon populations or to Southern Resident recovery. They believe NOAA may be overly influenced by political forces that are in favor of retaining the LSRD. They see the Biological Opinions as a negotiation between the federal agencies responsible for the LSRD (USACE, USBR and BPA) and NOAA, which is also a federal agency, and believe NOAA is susceptible to pressure from the other federal agencies to maintain the status quo. They consider the CSS model results to be a more accurate representation of potential benefits for salmon if the LSRD were to be breached.

Different perspectives on how the Snake River would respond if dams are breached

In part, differences in perspective about how breaching the LSRD would affect salmon stem from differences in perspective about what the river would become if dams were to be breached. Supporters of breaching believe the river would relatively quickly return to what it once was — with sandy beaches, swimming holes and riparian areas of cottonwoods supporting abundant wildlife and waterfowl. In contrast, supporters of retaining the dams believe the river will become a mud filled, unstable floodplain with invasive species and high sediment loads and turbidity as the sediment currently impounded behind the dams are eroded. These two very different visions for how the river

might respond to dam breaching distill people's different ideas about what is best for the region, and color people's ideas and responses to virtually all subsequent questions.

Supporters of breaching the LSRD point to the Conduit Dam removal on the White Salmon River and the Elwha Dam removal on the Elwha River as examples where a river recovered relatively quickly after dam removal and salmon returned. Supporters of retaining the LSRD believe that the Conduit and Elwha projects are not relevant examples because the scale is so different from the lower Snake River.

Opportunities to Increase Understanding

The impacts of the LSRD on salmon and the factors contributing to the Southern Resident orcas' decline have been extensively studied. If there is continued interest in exploring the potential to breach the LSRD, the main opportunities to increase understanding around salmon and the Southern Residents relate to: exploring differences in interpretation of data to clarify areas of agreement; areas of disagreement; and data gaps (if any). In particular:

- What is known and can be reasonably predicted about how the Snake River might respond to breaching of the dams? What steps could be taken to influence how and the speed at which the river responds?
- What recovery goals for both Southern Residents and salmon can all stakeholders agree to so that all parties are working towards a shared common goal?
- What are the current impacts of management (e.g., spill or hatcheries) on salmon returns? How durable are those management efforts in terms of maintaining and increasing salmon populations?
- What are the key differences around conclusions regarding latent mortality and is there an opportunity to develop agreement around a quantitative estimate?
- What are the current foraging patterns of the Southern Residents and where are increases in salmon production (from hatcheries and restoration of wild stocks) accomplished most quickly, most cost-effectively and with most impact?

The current differing estimates of the impact of dam breaching on salmon populations and the lack of trust in the organizations providing the estimates is seen as a significant challenge to progress.

There also are opportunities to explore differences in perspective about the role of hatchery production relative to restoration of wild stocks, particularly in light of climate change and Southern Resident prey needs. Questions to explore could include: What should be the approach to balancing between hatchery production and wild stocks to increase confidence in overall species survival and to meet interests around tribal and non-tribal harvest and Southern Resident prey needs? What is the role of hatcheries (if any) if dams are breached and how would any ongoing hatchery production be funded?

Public Comments Related to Salmon/Steelhead/Orca/Ecological

The majority of public comments received on salmon, steelhead, Southern Residents and ecology reflected the themes and perspectives included in the draft report. Many supporters of retaining the LSRD reinforced the perspectives that investments would be better spent in continuing

improvements to the management of the dams and investing in salmon recovery efforts in other places, improving predator management and imposing limits on harvest. These actions are better approaches to achieve salmon recovery than breaching the LSRD. Other factors are more important for Southern Resident recovery than Columbia and Snake River salmon abundance than breaching the LSRD. Conversely, many supporters of breaching the LSRD reinforced the perspectives that a \$17 billion investment has not achieved the results needed to meet salmon goals and breaching is the only major step left to make a significant difference in the trend line for Snake River salmon populations and to support Southern Resident recovery.

After reviewing public comments, the consultant team changed the draft report to include more information from the NOAA 2008 Southern Resident Killer Whale Recovery Report and related studies to reflect a more comprehensive picture of salmon and Southern Resident recovery (e.g., more information about the relationship between Chinook salmon stocks and the rise of transient orcas/decline of Southern Residents). The public comments also presented new perspectives to include in the final report: supporters of retaining the dams observe that all salmon populations along the West Coast are in decline which indicates there are significant factors other than dam passage contributing to low fish returns, including poor ocean conditions, increased predation and harvest practices. Some supporters of retaining the dams also emphasized concerns about the silt and pollution currently stored behind the dams and the impact it will have on the ecosystem if the dams are breached; they point out that the river will not be the same as it was before in terms of natural beauty and worry that towns along the river would be subject to muddy banks and turbid water. Some supporters of breaching the dams suggest considering a deep drawdown for two of the dams as opposed to removing all four, which could reduce travel time for smolts moving downstream and decrease latent mortality rates. Supporters of breaching the dams also point out that the NWPCC SAR recovery goals were put in place in 2003 and may not be adequate in the future given climate change projections.

Section 5: Energy

Context

The four Lower Snake River dams are part of the broader integrated system of hydroelectric facilities that make up the Federal Columbia River Power System, the largest source of renewable electricity in the Pacific Northwest. BPA markets and delivers the energy generated by the FCRPS through the transmission system.

Each year the LSRD produce an average of 1,024 average megawatts (aMW) of carbon-free power (aMW is the total amount of energy produced by a plant divided by the 8,760 hours of the year) and have the ability to produce up to 3,033 MW of power at peak capacity. Table 6 provides more detail on the LSRD's power generating capacity. Because the LSRD are run-of-river dams and the total water flow of the river varies throughout the year, the dams do not always have significant water storage built up behind them. Therefore, the dams are only able to produce energy at peak capacity for a few hours at a time when there is both high water storage and high river flows.⁸⁹

Table 6: LSRD Power Generating Capacity⁹⁰

Plant	Peak MW Capacity	aMW Energy
Ice Harbor	603	272
Lower Monumental	810	263
Little Goose	810	278
Lower Granite	810	211
Total	3,033	1,024

Source: ECONorthwest

Reliability and Flexibility of LSRD

The electricity system is a complex system of generation, transmission, substations, distribution, consumer loads and a wide array of management, metering, control and safety devices installed throughout. BPA has reliability responsibilities as a transmission operator, called a balancing authority, and has a separate set of reliability responsibilities as a power provider with contracts to meet customer utility loads. As a transmission operator BPA must keep loads and generation balanced on a second to second basis. As a power provider, BPA must meet its customers' loads as they fluctuate every hour of every day. The LSRD produce approximately 10% of BPA's annual energy portfolio, or 12% of the federal hydropower system. A portion of the LSRDs energy capability is used as reserves to ensure BPA has enough capacity to provide power reliability for utility customers. Typically, the LSRD supply BPA with one-fourth of its operating reserves.⁹¹ BPA uses energy from the LSRD during peak demands, most often in the winter months when energy loads are high due to individuals heating their homes and wind and solar power generation are at their lowest levels. During cold snaps or during emergency situations when energy production from other forms of generation may be negligible or unavailable, the LSRD can produce 10% of BPA's total capacity for 10 hours a day over a five-day period provided there is adequate river flow.

Depending on river flow, energy produced by the LSRD can quickly come online in the event another power generation source goes offline and address peak loads and unexpected increases in demand. Hydroelectric dams like the LSRD are responsive to fluctuations in the energy grid in that they can come online and reach peak production more quickly than other forms of power generation.

In addition to power generation, the LSRD provide transmission stability and capacity. Power from the LSRD flows into 500-kilovolt transmission lines that integrate the LSRD into the power grid. Due to their location, the LSRD are an important transmission system link between the east- and west-sides of the Cascades. Ice Harbor Dam is the most important of the LSRD from a transmission point of view, because it provides power and voltage to the Tri-Cities, especially during peak demand in the summer and when food processing plants are operating at full capacity.⁹²

Current and Future Power Grid Stability

In 2017, hydropower accounted for approximately 67.7% of Washington's energy, 13.4% was generated from coal, 10.8% natural gas, 4.19% nuclear, 2.84% wind and 1.07% from other renewables (solar, biomass)⁹³ The Washington Clean Energy Transformation Act requires all utilities in Washington to provide carbon-neutral electricity by 2030, with all coal to be phased out of the Washington energy grid by 2025. The Act calls for 100% clean energy by 2045.⁹⁴

The Pacific Northwest's total consumption of energy in 2013 was 19,400 aMW. Annual consumption is expected to grow by 0.5% to 1% a year, adding an additional 2,200–4,800 aMW by 2035. Because of relatively cool summers and low rates of air conditioning, the Pacific Northwest has historically had higher peak demand in the winter, when more people are using heat. This is shifting due to increases in air conditioning use and the gap between winter and summer peak usage is expected to shrink over time. The winter peak is expected to grow from 30,500 to 33,600 MW by 2035, at an average annual growth rate of 0.6%. The summer peak is expected to grow from 27,500 to 32,100 MW, at an average annual growth rate of 0.85%.⁹⁵

With the phase out of coal energy, Washington utilities' ability to meet peak load demands becomes less certain. By 2024, there are 1,746 MW of coal planned to be retired, most of which comes from the Centralia and Boardman coal power plants (which are set to close in the near future) and the Colstrip units 1 and 2 (which closed at the beginning of 2020). Additional coal power plant retirements are expected after 2024. While the amount of energy generated from Centralia and Boardman coal power plants is estimated to be entirely met by energy efficiency savings and demand response, the probability of a loss of load event, i.e., a large-scale blackout, occurring is expected to increase and exceed NWPCC's reliability threshold if no other resources are added to the system.

The probability of a loss of load event occurring within the grid is called loss of load probability (LOLP). Currently, NWPCC uses a 5% LOLP standard as the measure of reliability for the region's electric grid. Currently the region's LOLP falls below the 5% threshold, but the NWPCC's present-day forecasts indicate the region's LOLP is expected to rise to 8.2% in 2024. Such loss of load events are more likely to occur in the winter and could last longer than in prior periods. It is during these winter periods that the LSRD are most valuable (or vital) for system balancing and reliability. Importantly, the NWPCC's current projections have been made assuming the LSRD energy production will be available to serve the system. The NWPCC's analytical work is ongoing in

preparation for its 2021 Power Plan, including its forecast of the region's short- and long-term LOLP.⁹⁶

Role of Intermittent Renewable Energy Sources

In 2005 three Pacific Northwest states (Montana, Oregon and Washington) enacted renewable energy portfolio standards to encourage development of renewable energy resources. Since then approximately 8,500 MW of wind energy and approximately 540 MW of solar power have been added to the Pacific Northwest power grid. In 2012 the development of renewable energy resources slowed due to uncertainty over whether Congress would renew federal tax incentives. More recently, renewable energy development is on the rise again due to a variety of factors including Oregon developing a more aggressive renewable portfolio standard in 2016; large corporations like Apple and Microsoft developing renewable resources on their own; and the falling costs of wind and solar development. A NWPCC energy analyst stated, "Renewable energy costs have fallen so substantially that a renewable energy project could be constructed to deliver energy at a lower cost than an existing gas plant."⁹⁷

The LSRD provide more reliability and flexibility than wind and solar can with current battery storage and energy distribution technologies and capabilities.⁹⁸ There is significant research and development occurring into energy distribution technologies and capabilities such as the Automatic Generation Control system that BPA uses on 10 of its 31 dams and intermittent sources. The Automatic Generation Control system allows energy operators to adjust energy generation from connected facilities on a real-time basis to meet the load. This system was updated in 2019 to allow BPA to optimize grid operation and improve flexibility for balancing reserves or secondary sales.⁹⁹

Replacing power provided by the LSRD would require finding renewable locations within BPA's geographic range that have high generation potential and are not so remote that the cost of transmission is prohibitive. A Northwest Energy Coalition report identified locations in Montana for wind power that, if there is transmission service available due to coal plant closures in the Pacific Northwest, it is very possible that the new renewable generation built to replace the coal will consume the available transmission service. Locations near existing power infrastructure were identified in Idaho and eastern Oregon that would be suitable for solar projects.¹⁰⁰ Another more recent report by E3 looked at decarbonizing the electrical grid more broadly than just the LSRD, including identifying similar sources for wind generation in Montana and Wyoming, but noted that the cost of reaching decarbonization becomes increasingly more expensive the closer you get to decarbonization. The land required to achieve decarbonization could range between 2,913,000 and 13,701,000 acres across the six Pacific Northwest states.¹⁰¹ A similar study by the Deep Decarbonization Pathways Project and Evolved Energy Research found that passenger transportation (cars, trucks, buses) would need to shift to entirely electric vehicles and that spending on energy would need to shift towards large, up-front capital investments like heat pumps and wind power plants, and less on gasoline and natural gas, in order to achieve Washington's clean energy goals by 2045.¹⁰²

Changing Energy Markets and BPA

In recent years the wholesale power market has gone through a large-scale transformation due to a variety of factors such as wide-scale development of renewable resources, improvements in demand response, the proliferation of low-cost natural gas generation and periods of oversaturated wholesale

markets that dampened sales of surplus energy. Before large volumes of renewable sources of energy entered the surplus energy market, BPA could sell their surplus energy on the open market for \$60–\$100 per megawatt-hour. As of 2019, the price has dropped to \$20–\$43 per megawatt-hour.¹⁰³ Recently, when the energy market was oversaturated with solar energy from California, BPA had to sell its surplus energy at a net loss.¹⁰⁴

BPA recently began a process to join the Western Energy Imbalance Market, which connects most of the utilities west of the Rocky Mountains to support real-time energy trading.¹⁰⁵ Participation in the Energy Imbalance Market should lead to better market price signals for efficient use of BPA resources, especially for hydropower. For example, because California has a cap-and-trade program, energy providers in California want Washington hydroelectricity to supplement their portfolios because it is a renewable source that can generate electricity at night when solar is not generating. In addition, the flexible spill agreement was negotiated in part to position BPA for current opportunities in the energy market, it aims to increase spill for most of the day to benefit fish, while also decreasing spill to increase energy generation during windows of higher energy demand and higher prices (e.g., evenings when solar generation decreases). In this way, flexible spill may help BPA compensate and adapt to changes in the energy market.

BPA is a self-financing federal power marketing agency that receives its revenue from the sale of electricity to its primary utility customers, not from taxpayers, and from sales of surplus power on the open market. BPA had to raise rates in recent years to maintain revenue due to changes in the surplus energy sales market.¹⁰⁶ However, for the past 35 years BPA has made all its payments to the U.S. Treasury on time and in-full. In fiscal years 2020–21, BPA projects enough annual revenue to pay of its annual debt payments.¹⁰⁷

BPA's recent fiscal challenges have led them to be more strategic with capital investments (such as major improvements to turbines) within its system of 31 dams. In its 2017–30 Hydro Asset Strategy, BPA laid out for ratepayers a transition from a \$200 million to \$300 million annual plan for capital investments into hydropower generation assets. BPA is implementing this plan over several years to build capacity and in acknowledgement of fiscal constraints.¹⁰⁸ BPA proposed total capital investments of \$425 million for the LSRD in the \$200 million annual plan and \$666 million for the LSRD in the \$300 million annual plan. In contrast, the Grand Coulee and McNary dams, which are much larger than the LSRD from an energy production standpoint, are scheduled to receive \$2 billion in capital investments through 2035.¹⁰⁹ These capital improvements are in addition to the \$50 million that it costs annually to operate and maintain the LSRD.¹¹⁰

BPA's contracts with its preferred customers are set to expire in 2028. Many local utilities that have BPA contracts have seen rate increases of about 2.2% annual since 2008 due to a variety of factors such as the recent changes to the energy market.

Perspectives

Support for Retaining Lower Snake River Dam Energy Production

Stakeholders supportive of retaining the LSRD energy system believe that losing the energy generated by the LSRD would complicate achieving the state's clean energy goal of being carbon free by 2045. They see future population growth, the loss of coal plants, resistance to expanding the

use of nuclear energy and climate change as reasons the LSRD are needed for the state to become a carbon-free system.

Supporters of retaining the LSRD note that, while on average Washington state has a surplus of energy, averages are not the most important measure when energy is operating close to the current maximum capacity. Reserves provide the flexibility to meet load demand with local or regional resources rather than add to the risk of brownouts or blackouts. LSRD energy reserves provide balance to the intermittency of demand needs. Supporters also noted that the power system may be over supplied with energy in the future, but the capacity for flexible distribution of power is decreasing, which is energy that can quickly be generated within the system in the case where other sources are not available.

Other energy sources, especially renewable sources like wind and solar, are not seen as providing the same level of flexibility or reliability that the LSRD provide. While the LSRD do not generate a significant portion of energy compared to the entire grid, the dams can be called upon quickly, which is important to the reliability of the broader energy system. Supporters of retaining the LSRD believe the state's energy grid will not have the same level of power that can be quickly dispatched to the system when other non-hydropower renewable energy sources are not available, such as during extreme cold events in the winter when the dams are used most often.

In addition to the importance of the LSRD to the energy portfolio and grid overall, energy produced by Ice Harbor Dam is seen as fundamental to the energy needs of the Tri-Cities. Ice Harbor Dam provides 30–40% of the energy needs of the Tri-Cities during summer peak load and when food processing plants are operating at full capacity. Supporters of retaining the LSRD also brought up an equity dimension for BPA ratepayers: BPA's service area covers Washington, Oregon, Idaho and Montana, and it serves many small communities and customers who do not have the economic capacity to absorb the rate increases that removal of the LSRD could cause.

Supporters of retaining the LSRD believe the communities surrounding the Columbia and Snake river dams in eastern Washington were built and prospered because of the dams and depend on the inexpensive electricity provided by the dams. They believe that if the LSRD or other major electricity producing dams are breached, the surrounding communities will be devastated. Electricity provided by the dams is a major reason why large corporations like Microsoft and others have located facilities in eastern Washington. The electricity is central to the jobs that have been created and, with the construction of large data centers in the region, is likely to be in higher demand in the future. The increase in electric vehicles and buildings is also assumed to increase demand for electricity.

Supporters of retaining the LSRD are concerned if the LSRD are breached there will be an increased focus to breach other dams on the Columbia River. The direct jobs provided by the Columbia and Snake river dams and the electricity they generate create economic benefits across the state and region. Aluminum manufacturing, which is supported by the low-cost electricity, supports the aerospace industries which total tens of thousands of jobs. Over decades, many of these jobs have become legacy jobs, meaning that multiple generations have been employed. The dams are not just an economic issue, they are seen by dam supporters as part of the history, legacy and heritage of people and communities across Washington. Dam supporters also questioned the logic of losing the electricity from the dams when there is a priority on achieving the goal of clean electricity by 2045. The closure process for the TransAlta coal plant is acknowledged as an example of the long

transition necessary for the loss of a community's economic assets and the challenges for making a community whole in the process.

Supporters of retaining the LSRD do not agree with the assessment that the dams are in an extreme state of disrepair that is not conducive to positive operations of the system. They see the dams as being cost effective and being taken good care of by the USACE.

Support for Alternatives to the Lower Snake River Dams Energy Production

Supporters of alternatives to the LSRD believe the Pacific Northwest has a surplus of power, and the LSRD are not ultimately needed to meet energy needs or to successfully transition to a clean energy grid by 2045. They acknowledge that a transition strategy for energy would be needed but believe such a strategy can be successful and cost-effective, especially when weighed against the substantial benefits to salmon and Southern Resident orca recovery, which they believe would be a result of breaching the LSRD.

Supporters of breaching the LSRD believe that increases in solar and wind generation coupled with technology improvements for energy storage will support Washington state in meeting the 2045 clean energy goal without relying on the LSRD. They note that dam breaching would take time, and this time would allow for alternative renewable energy generating plants to be built, enhanced energy conservation to be implemented and improvements in energy storage technology to be realized.

Supporters of breaching the LSRD believe increasingly lower costs for renewable power generation from wind and solar will become more cost-effective than hydropower generation over the next 20 years, in addition to improvements in energy efficiency and demand response. Breaching the dams will incentivize the region to modernize energy systems and plan for a better, smarter grid in the future. Many referenced findings in a report from the NW Energy Coalition, who investigated the feasibility of replacing power and energy services provided by the LSRD with a portfolio of clean and renewable resources that support a reliable and adequate regional power system while minimizing increases to greenhouse gas emissions.¹¹¹

Supporters of breaching the LSRD believe a transition away from using power generated by the LSRD will cost less over time than maintaining energy production from the LSRD, especially when considering increasing maintenance costs and repair for the LSRD. Based upon findings from the NW Energy Coalition report on replacing LSRD energy, they believe it is possible to have increased reliability and flexibility now and more so in the future. They also referenced the NW Energy Coalition report's findings that increases to BPA ratepayers would only be 2–3% if LSRD energy were to be replaced.

Opportunities to Increase Understanding

There are three primary ideas related to energy-production that would need to be addressed in any continuing conversation about the future of the LSRD.

First, how to meet load demand in the near- and long-term with a decarbonized power generation system. Given the region's goal is to continue to decarbonize, this would include examination of questions such as:

- Will the state be able to rely on technologies improving for battery storage for wind and solar?
- Will there be certainty that the state can meet its energy needs with a decarbonized power generation system as the population grows and the climate changes?
- What are the environmental effects of the quantity of renewable generation resources needed to replace coal, natural gas and the LSRD?
- Will it be physically possible to replace the power portfolio of the LSRD?

Second, to determine if energy efficiency, demand response, wind and solar, or other carbon-free energy sources can replace the flexibility and reliability currently provided by the LSRD.

Third, any long-term discussion needs to acknowledge whether BPA ratepayers are willing to pay more and, if they are, how much more and under what circumstances. Utilities would likely object to paying for costs that are not directly related to the cost of producing energy, e.g., improving rail for agriculture would not be an appropriate expense.

Public Comments Related to Energy

The majority of public comments received on energy reflected the themes and perspectives included in the draft report. Many supporters of retaining the LSRD reinforced the perspective that it would be counterproductive to lose the energy generated by the LSRD and would complicate achieving the state's clean energy goals. Conversely, many supporters of breaching the LSRD reinforced the perspectives that Washington has a surplus of clean energy and the LSRD are not ultimately needed to meet energy needs or to successfully transition to a clean energy grid by 2045, with many commenters suggesting that the costs of meeting new energy needs are less than the benefits breaching the LSRD would achieve for salmon and Southern Residents.

Other public comments provided new information and perspectives that were not included in the draft report. Changes from the draft report include new information on statewide decarbonization scenarios based on reports by E3 and the Deep Carbonization project and updated emissions comparison data from the Department of Energy Center for Transportation Analysis. New perspectives from supporters of breaching the dams included how the dams maintain the “status quo” and do not provide the State of Washington an incentive to modernize and change its energy portfolio. New perspectives from supporters of retaining the dams included how recent construction of large data centers in the region are an indicator of future energy needs and the need to maintain energy production from the LSRD.

Section 6: Agriculture

Context

There are approximately five million total acres of farmland within the eight counties surrounding the lower Snake River (Adams, Asotin, Benton, Columbia, Franklin, Garfield, Walla Walla and Whitman) in southeast Washington, which is approximately 33% of the total farmland in the state.¹¹² Agricultural production in the areas surrounding the LSRD includes both dryland and irrigated farming.

The area surrounding the LSRD is part of the Palouse region. The Palouse region has a combination of deep, fertile soil and temperate weather that supports dryland crops like wheat, lentils and dry peas, and the lower Snake River near Burbank, Washington, supports irrigated farming like potatoes, onions, grapes, peaches and apples. Over the last several decades, farmers in southeast Washington have significantly increased productivity of the food grown per acre. Average production of wheat per acre in southeast Washington has increased from approximately 25 bushels per acre to as high as 90 bushels per acre. During the same period, soil erosion has decreased by over 85%. By reducing soil erosion and retaining crop residue on the land after harvest, farm families have made major progress preserving soils and helping to keep streams clearer.¹¹³

Dryland Agriculture

In southeast Washington non-irrigated, or dryland, agriculture is dominated by grain production. The primary crop is soft white wheat, which is highly desirable in Asian countries due to its low moisture content and is used to make noodles, steam breads and cakes.¹¹⁴ In 2017, over one million acres of dryland wheat were harvested in the eight counties surrounding the Snake River.¹¹⁵ The local grain economy relies on a complex set of relationships between grain producers (farmers), cooperatives, transporters, exporters and customers, who are all also part of an equally complex and competitive global market.

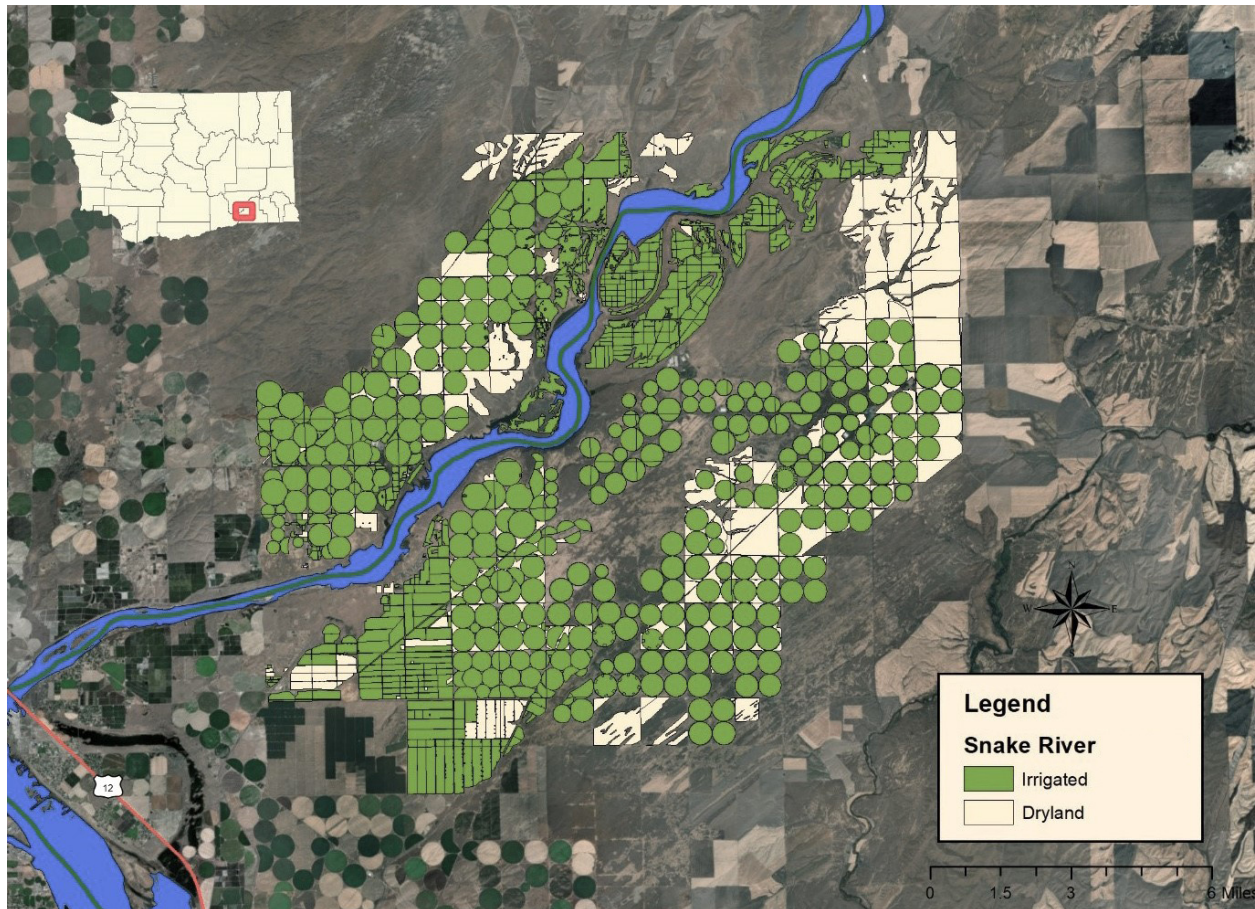
Most grain producers in eastern Washington, including in the areas around the LSRD, are part of grain cooperatives.¹¹⁶ Cooperative sizes range from several hundred members to up to 15,000.¹¹⁷ In areas around the LSRD local farmers truck their product to nearby “up country” grain elevators owned by the cooperatives. At the time of sale, the cooperatives move the product either to a barge terminal on the river or to a rail unit loading facility for transport to one of the exporters on the lower Columbia. Exporters load the grain onto a ship for transport to customers.

Eighty to 90% of the grain grown in the area around the LSRD is shipped overseas.¹¹⁸ Shippers and exporters noted most of the grain is purchased by overseas buyers who actively track and respond to activities in the global marketplace. Pacific Northwest wheat growers compete with producers in Canada, Russia and Ukraine.¹¹⁹ They currently have a slight competitive advantage due to high product quality and a low price point. The ability to transport wheat downriver by barge contributes to the price advantage because it is the least expensive means of transport for cooperatives close to the Snake River.

If the LSRD are breached, it would eliminate barging down the Snake River because the lower river depth would not be deep enough for barge transportation. This would be a significant change for

dryland farmers, many of whom rely at least in part on barge transportation for their crops. See Section 7: Transportation for more discussion of the relationship between dryland agriculture and transportation. Figure 7 shows irrigated and non-irrigated land near Ice Harbor Dam.

Figure 7: Map of Irrigated and Dryland Agriculture Near Ice Harbor Dam¹²⁰



Source: US Army Corps of Engineers

Irrigated Agriculture

The LSRD currently support approximately 47,000 acres of irrigated farmland through water drawn from Lake Sacajawea, the reservoir created by Ice Harbor Dam. Lake Sacajawea is the only reservoir of the four LSRD that provides direct irrigation.¹²¹ Farmers in this area draw water directly from Lake Sacajawea (approximately 37,000 acres) and take advantage of the higher groundwater table created by the dams (approximately 10,000 acres). Fruit orchards are the predominate irrigated crop within one mile of the river, and vegetables, like onions, potatoes or sweet corn are more common within five miles.¹²²

Irrigated farming requires significant resources and staffing. For example, a 16,000-acre farm near Eureka has 45 full-time employees as well as hundreds of temporary farm laborers that work on the farm during harvest and planting seasons. Interviewees suggested a farm of comparable size on dryland would only require approximately three full-time staff.

Irrigated farmland also is more profitable than dryland. Several interviewees estimated that an irrigated acre generates \$3,000–\$5,000/acre annually and dryland wheat production generates approximately \$100–\$240/acre annually. The 2019 ECONorthwest economic analysis cited USDA Agricultural Census data, which found “on average farmland values in Washington state show a \$7,400 premium for irrigated over non-irrigated acres. This Washington state premium for irrigated farmland is greater than the premium in Oregon (\$2,900) or Idaho (\$3,850).”

In 2018, approximately 10,000 acres of land irrigated by Lake Sacajawea produced 6.3 million pounds of potatoes which the producer sold for \$49.6 million, supporting over 2,000 jobs. The indirect value of these potatoes was \$467.2 million and hundreds more jobs. In the same year, 8,000 irrigated acres produced 316.8 million pounds of apples for a farm market value of \$108.6 million.¹²³

If the LSRD are breached, specifically Ice Harbor Dam, impacts to irrigated agriculture — for both farms that draw directly from the reservoir and groundwater users that rely on the groundwater table created by the dams would need to be addressed. The Department of Ecology Water Rights Tracking System lists 41 total surface water diversions and 84 wells within one mile of the lower Snake River that would be impacted by water level changes if the LSRD are breached.¹²⁴ Irrigators and out-of-stream users rely on the LSRD; removing Ice Harbor Dam would significantly disrupt these systems and change the water supply. Mitigating these changes would require the cost of lowering intake structures, creating additional pumping capacity, digging deeper wells and other operational changes. Other options to address water constraints could include changing crops to accommodate new water supply, fallow during periods of water interruption or selling water rights to other users. There also is a question about the change in certainty for farms drawing water from a free-flowing river compared to the current water withdrawals from the reservoir.

A Pacific Northwest Waterways Association report found that if the LSRD are breached, the amount of federal subsidies necessary to keep farm operations at the current level of net cash income would need to increase between \$18.9 million to \$38.8 million annually. If these farm subsidies were not increased the economic impacts could be devastating to local farmers and could result in over 1,100 farms at risk of bankruptcy.¹²⁵

Perspectives

Support for the Current Barge Transportation and Irrigation Systems

Stakeholders reliant on and supportive of the current dryland agricultural system believe if the dams are breached it would lead to increased shipping costs and a downturn in the overall grain economy due to the loss of barging. (See Section 7: Transportation for more discussion). Breaching the dams could lead to the loss of family farms, local community economic viability and the overall way of life that they see the dams and barge system as having supported through lower grain transportation costs and the ability to irrigate farmland. They see the growth of agriculture in the Palouse region over the past several decades as one of the biggest gains in productivity and stewardship of any generation, and the loss of barge and transportation is seen as a threat to these gains.

The grain economy relies on very tight profit margins, and the dams provide an efficient and reliable way to get a large portion of their product to market by barge. Some farmers projected that in the next 20 years there will be approximately 25% more grain produced in the area surrounding the LSRD and feel that this increased production is not being taken into consideration by those who think grain shipping can easily move to other modes.

Supporters of the current agricultural system suggest that if the LSRD were breached, the new water levels would not be stable enough to provide reliable irrigation which would lead to increased costs, uncertain infrastructure upgrades, uncertainty of water supply and shifts in the type of agriculture that is viable. Without irrigation, they anticipate widespread job losses for those working in the irrigated farm economy, causing a negative effect on the broader local economy and surrounding communities.

The reduction in certainty of water availability would increase capital costs for farmers due to increases in infrastructure and energy needs. Anecdotal information from interviews suggests that if pumps are lowered to reach lower water levels, the energy costs for irrigation would increase by approximately 20% or more. Energy expenses are one of the highest costs for irrigated agriculture drawing water from Lake Sacajawea.

Some farmers are skeptical of the feasibility of moving to other areas down river if they are displaced from their current farms because of lack of access to water. Irrigated farms like orchards or vineyards do not have the flexibility to quickly shift their operations given that trees and vines are a significant sunk cost that are impossible to move and would require large-scale capital investments to replicate elsewhere. In addition, producers do not see that there are options for moving to new areas based on soils, geography and current land use.

Concerns about the potential impacts of breaching the lower Snake River dams on irrigation water supply extend to farmers well downstream of the dams. There is concern that sediment released from behind dams would settle in downstream reservoirs and reduce access to (or significantly increase costs of) irrigation water.

Support for Alternatives to the Lower Snake River Dams

Many of the people interviewed who support alternatives to the LSRD believe it is important to make agriculture “whole,” so local farmers do not suffer significant economic losses if the dams are breached. Some mentioned that if farmers cannot be made whole, their support for breaching the dams would change. What is meant by “making agriculture whole” is so far not defined. Suggestions included paying for the infrastructure to lower irrigation pumps and wells; subsidizing the increased cost of energy required to pump water; subsidizing farmers for their increased transportation costs; and building or upgrading infrastructure for storage and transportation. Supporters of breaching the dams believe these costs would be less than the cost of ongoing maintenance and repair of the dams and locks. These issues are discussed in more detail in the transportation and economic sections of this report. In addition, it is estimated approximately 5,000 acres of the 14,000 acres currently underneath the LSRD reservoirs could potentially be used for farming if the dams are breached. Some also questioned if growing wheat, and specifically the type of wheat grown on the fertile soils of the Palouse, is the best use of those rich soils.

Opportunities to Increase Understanding

If the LSRD remain in place, significant changes to the current agricultural system are not likely beyond whatever shifts in production and farming costs the domestic and global marketplaces dictate. If there is continued interest to understand the implications of breaching the LSRD, what it would mean to make agriculture “whole” if river transportation is not available through the LSRD needs to be defined specifically. This includes clearly identifying the costs and timing to implement surface water and groundwater infrastructure improvements if the dams are breached, including intake facility modifications into a lowered surface elevation and free-flowing river pump modification costs for municipal and other industrial water users and irrigation well modifications. More research is needed to identify how to provide certainty that farmers can pull the same levels of water they are currently using, especially in the event of a low flow year or with a changing climate. Defining who would finance or subsidize this work and compensate for impacts would also be needed.

Public Comments Related to Agriculture

The public comments received on agriculture reflected the themes and perspectives included in the draft report. Many supporters of retaining the LSRD reinforced the perspectives that breaching the dams would cause a downturn in the grain economy and lead to the loss of family farms, local community economic viability and the overall way of the life that the dams have supported in the region. Conversely, many supporters of breaching the LSRD reinforced the perspective that the agriculture community could be made “whole” if the dams were breached, with several commenters suggesting that the costs of infrastructure upgrades to maintain irrigation and subsidize farmers for increased transportation costs would be less than ongoing maintenance and repair of the dams and locks.

Section 7: Transportation

Context

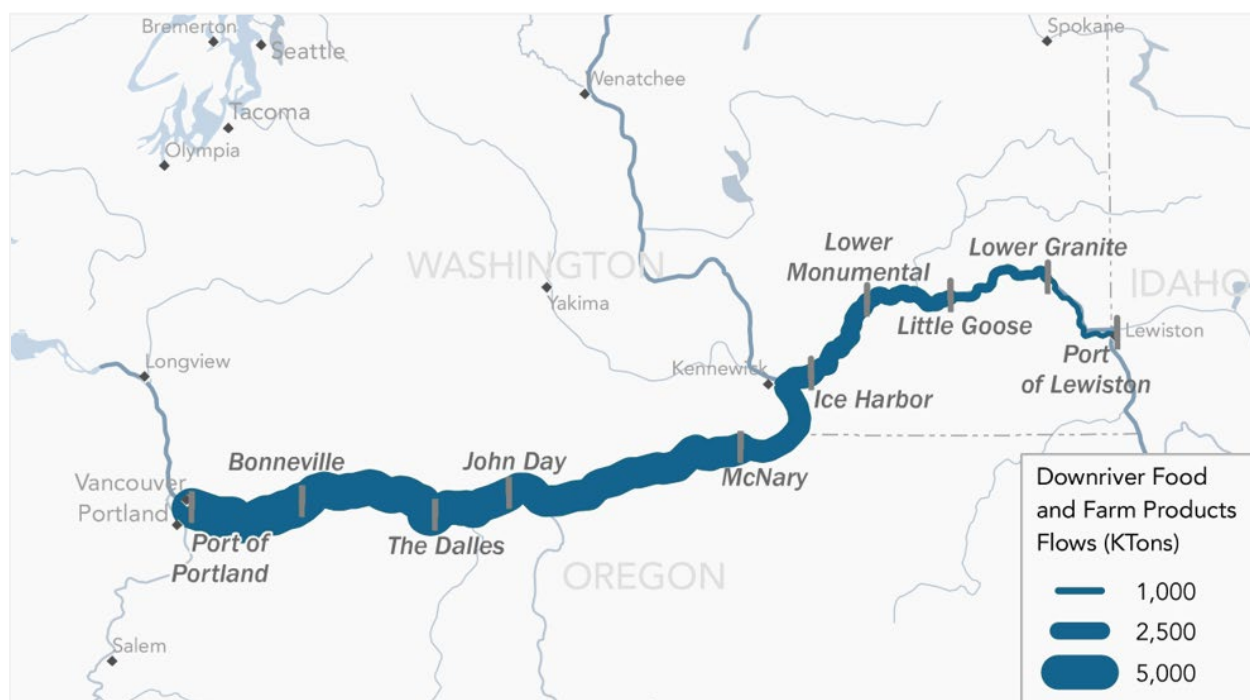
The transportation network that serves the region surrounding the LSRD is a multi-modal network of rail lines, barge and trucks on the Columbia-Snake River lock system. The transport of grain is an example of the use of the multi-modal network: Farmers use trucks to move their grain to nearby storage facilities. Rail and barges are used to move the product to exporters on the lower Columbia River. Of all the grain exported through the lower Columbia River, approximately 40% is by barge and 60% is by rail, with a high percentage of the rail volume coming from the Midwest.¹²⁶ How far away farmers are from the river affects their choice for how their product moves to market. In the Pacific Northwest, farmers in Eastern Oregon, northern Idaho, and southern Washington move approximately 90% of their grain by barge, while farmers in northern Washington or southern Idaho only move an average of 18% of their grain by barge along the Columbia and Snake river navigation system.¹²⁷

Barge Transport

The LSRD and their associated locks allow local agricultural producers and shippers to market and transport agricultural products downstream and move other materials by barge up and down the Lower Snake River between the Tri-Cities and Lewiston/Clarkston, with most downstream movement of products destined for the Port of Portland. A similar system of locks and dams on the Columbia River provides access to Oregon Pacific Ocean ports (Portland and Astoria, Oregon) making Lewiston, Idaho, the farthest inland water port on the West Coast.

Figure 8 displays the Columbia and Snake river navigation systems. As can be seen, the width of the river progressively grows larger to express the additional amount of food and farm products that enter the system downriver.

Figure 8: Downriver Food and Farm Products Flows (KTons) Between April 2017 and March 2018¹²⁸

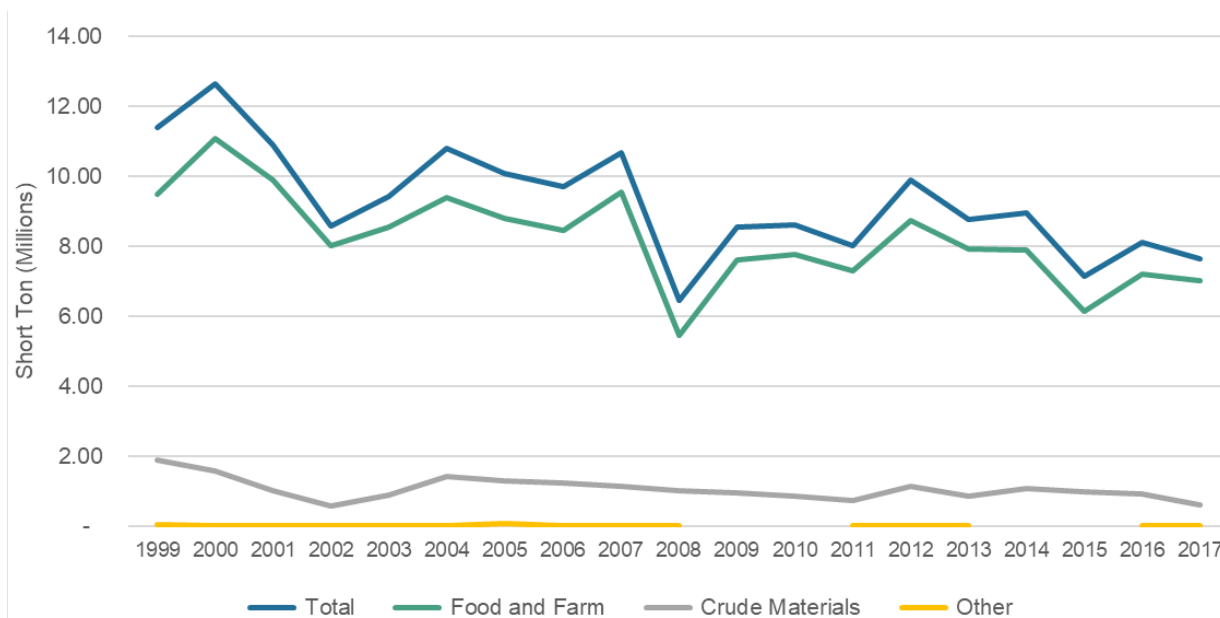


Source: ECONorthwest with data from U.S. Army Corps of Engineers Lock Performance Monitoring System

Washington is the fourth-largest wheat producing and wheat exporting state in the nation.¹²⁹ Whitman County has been the nation's top wheat producing county in the nation since 1978. Eighty to 90% of the grain grown around the LSRD is ultimately shipped overseas;¹³⁰ approximately 90% of the tonnage shipped downstream on the Snake River is grain and other food products produced in southeast Washington.^{131 132} Approximately 45% of all barged grain (primarily wheat) coming out of the Columbia River system is from the area around the LSRD, with the remaining 55% of grain entering the system below Ice Harbor Dam. Other commodities like agriculture supplies, logs and sawdust, fuel and chemicals, municipal waste, manufacturing equipment and machinery travel upstream from ports on the Columbia into the LSRD region. Figure 9 displays the downriver tonnage by major commodity for the Snake River between 1999 and 2017. The transport of grain has a widespread effect for agricultural producers throughout southeast Washington and the transport of other materials by barge provides flexibility and reliability for other products and industries both in and beyond the LSRD region.¹³³

One reason for the decrease in barge transportation in recent years is the loss of container shipping from the Port of Portland which ended in 2015. However, the port recently announced the return of container shipping.¹³⁴ This could encourage an increase in barge shipping through the LSRD in the future.

Figure 9: Downriver Commodity Flows on the Snake (1999-2017)



Source: U.S. Army Corps of Engineers

The system of locks and navigation aids in the lower Snake River is federally supported by a tax on commercial barge diesel fuel. This funding source is known as the Inland Waterways Trust Fund. The IWTF provides ongoing federal investments in maintenance and operations and major rehabilitation and construction for lock and navigation aid repairs.¹³⁵ In recent years, construction, operations and maintenance costs nationwide, including for the LSRD, have exceeded the tax revenue in the IWTF. Stopgap funding was provided under the American Recovery and Reinvestment Act of 2009; however, given the age of the dams, future significant investments will be required to maintain their viability.

Rail Line Transport

Railroads are used for multiple purposes throughout Washington, including moving freight between cities or states and moving people commuting for work or to cities in other states. In 2007, nearly half (41%) of all interstate freight was hauled by rail and a quarter (27%) of all wheat produced in the state is transported by rail at some point.¹³⁶ In the area surrounding the lower Snake River, there are both mainline and shortline railroads. Mainlines are larger rail lines which provide higher freight capacity and more frequent trips over longer distances between destinations. Shortline rail lines are shorter in distance, usually less than 100 miles, with fewer trips and less freight capacity. The mainline rail companies near the lower Snake River are BNSF and Union Pacific.¹³⁷ Shortline railroads include Camas Prairie Railnet, Port of Columbia Railroad, Blue Mountain Railroad, Columbia Basin Railroad and the Palouse River & Coulee City Railroad.¹³⁸ In Washington there are 1,346 total miles of shortline rail, 600 miles of which are privately owned and the remaining 746 miles are publicly owned. The longest of these is the Palouse River & Coulee City Railroad, which is owned by the Washington Department of Transportation.¹³⁹ While a lot of the rail infrastructure that existed before the LSRD were constructed remains, much of it is in disrepair and would require improvements to be relied on in the future.¹⁴⁰

Truck Transport

Trucks are the most expensive and carbon intensive form of transportation within the system.¹⁴¹ The main purpose that trucks serve in transporting agricultural products in the region is to move the grain from farms to nearby ports if the farm is located within 50 miles of the river, or to the grain cooperative elevators if the farm is located further away. Trucks are also used to move perishable produce like apples or potatoes to either processing or distribution facilities. It should be noted that there is currently a severe shortage of truck drivers in Washington with just over 3,000 unfilled truck driver positions as of September 2019 according to the Washington Department of Employment Security.¹⁴²

Safety and Emissions

Compared to rail or trucks, barging is the safest method of moving cargo. There are lower numbers of injuries, fatalities and spill rates from barge than both rail and trucks. For every one injury on the Inland marine navigation system, there are 125.2 injuries on rail and 2,171.5 injuries on highways.¹⁴³ In 2016, according to the Transportation Energy Data Book, barging emitted 40.2 million tons of CO₂e, rail emitted 38.9 tons of CO₂e and trucks emitted 437.5 tons of CO₂e.¹⁴⁴ If the LSRD are breached, the PNWA report found the shift in commodity flows from barge to truck and rail will result in annual increases in emissions across the board: 860,000 tons of CO₂, 306.5 tons of nitrogen oxide (NO_x), 7.5 tons of particulate matter (PM), 69.7 tons of CO and 7 tons of volatile organic compounds (VOC).¹⁴⁵ This would be the CO₂ equivalent of adding 181,889 passenger cars to the roadways or clearing 6,927 acres of forest. Breaching would result in more truck accidents and fatalities which would annually cost \$3.3 million for injuries and \$2.6 million for fatalities. The shift in ton-miles from barge to rail or truck will increase fuel consumption by 4.67 million gallons per year and would result in one additional traffic fatality every three years.¹⁴⁶

The Transportation Network

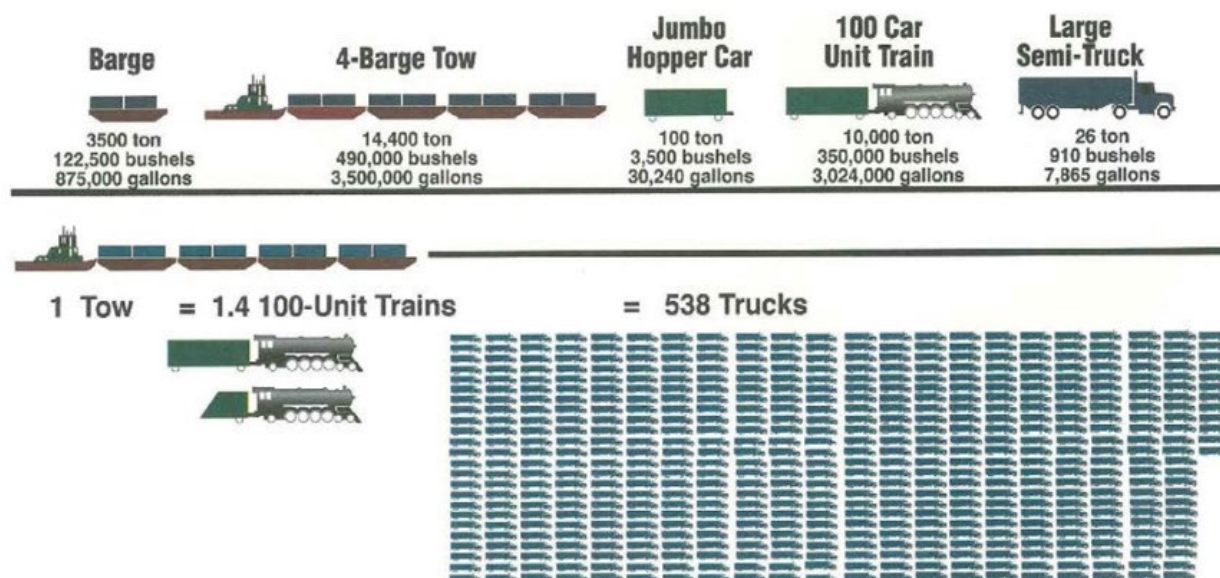
Local agricultural producers, cooperatives and shippers take numerous factors into account when determining which modes of transportation to use. As discussed above, trucks are used to transport grain from the field to the local cooperative. Depending on the location of the cooperative in southwest Washington, they transport their grain by rail, barge or, in some cases, have the option to choose either.

The exporters on the lower Columbia receive orders from customers for grain and a timeframe for delivery. The exporter arranges for transport from their facility on the lower Columbia to the overseas customer. They solicit supply from cooperatives in the LSRD region and producers in other regions. These solicitations often specify the amount of grain they want from rail and water transport. Exporters report that having two modes of transportation for the exporter to choose from is important for reliability, flexibility and cost. While it generally costs more to transport grain by rail, rail is generally faster to unload and transfer to ships. Barge transport is generally less expensive, and the timing of delivery is more predictable.¹⁴⁷

Exporters, producers and shippers report that having access to both rail and barge transportation helps them create the most cost effective, cost competitive and reliable transportation combination tailored to the specifics of each shipment. Figure 10 shows that for every four-barge tow that is used to move product along the navigation channel the equivalent amount of freight would take 1.4 100-

car unit-trains or 538 semi-trucks. Barging is more fuel efficient than the other two methods of transportation and for every single injury that occurs due to barge transportation, 125.2 injuries occur on rail and 2171.5 injuries occur on highways.¹⁴⁸

Figure 10: Freight Comparison of Barges, Trains, and Trucks¹⁴⁹



Source: Pacific Northwest Waterways Association

Transportation Trends

Over the past 20 years, the transportation infrastructure in southeast Washington around the LSRD has evolved. Investments in capacity of shortline rail, mainline rail, port terminal capacity and barging capacity have occurred. For example, a number of facilities, such as Wallula, Endicott¹⁵⁰ and McCoy Terminal¹⁵¹ have built relatively new facilities to increase the transport of grain from both the Snake River and Midwest, and in the last 20 years there have been 10 new grain barges built for transport of grain on Columbia River.

Rail Loading Facilities and Shortline Rail

Over the last several years, grain cooperatives have constructed multi-unit railcar loading facilities in the area around the LSRD. The shift to multi-unit railcar loading facilities was in response to mainline rail companies, including BNSF and Union Pacific, no longer being willing to pick up a few railcars from more dispersed storage facilities. These multi-car facilities load 100 or more railcars at a time. There are currently five multi-car loading facilities in southeast Washington with another being built in Dusty, Washington. Some of the loading facilities are located where it is not cost effective to ship by barge and several are located where both modes are possible. Existing rail loading facilities would likely need to be refurbished and additional facilities constructed if the dams were breached.

Shortline rail is used to transport grain from a local storage facility (upcountry) to either a multi-unit railcar loading facility or to a port on the Columbia for shipping downstream by barge. These shortline rail systems are owned and operated by a combination of state and private entities. The Washington Grain Train currently serves over 2,500 cooperative members in southeast Washington;

this rail line is unique in that the railcars are publicly owned by the state, but the tracks are operated by BNSF and Union Pacific and move grain to facilities on the Snake River. This shortline rail operation is composed of 118 hopper cars, operates without any taxpayer subsidies, and helps to preserve shortline railroads in the region by generating revenue that can be used to upgrade existing infrastructure. The state of Washington purchased the cars because there was a national shortage of railcars, which made it hard for Washington farmers to get their grain to market in the early 1990s. Washington State Department of Transportation used federal funds to purchase railcars to assist in the movement of grain from elevators in the east to export facilities in the West.¹⁵²

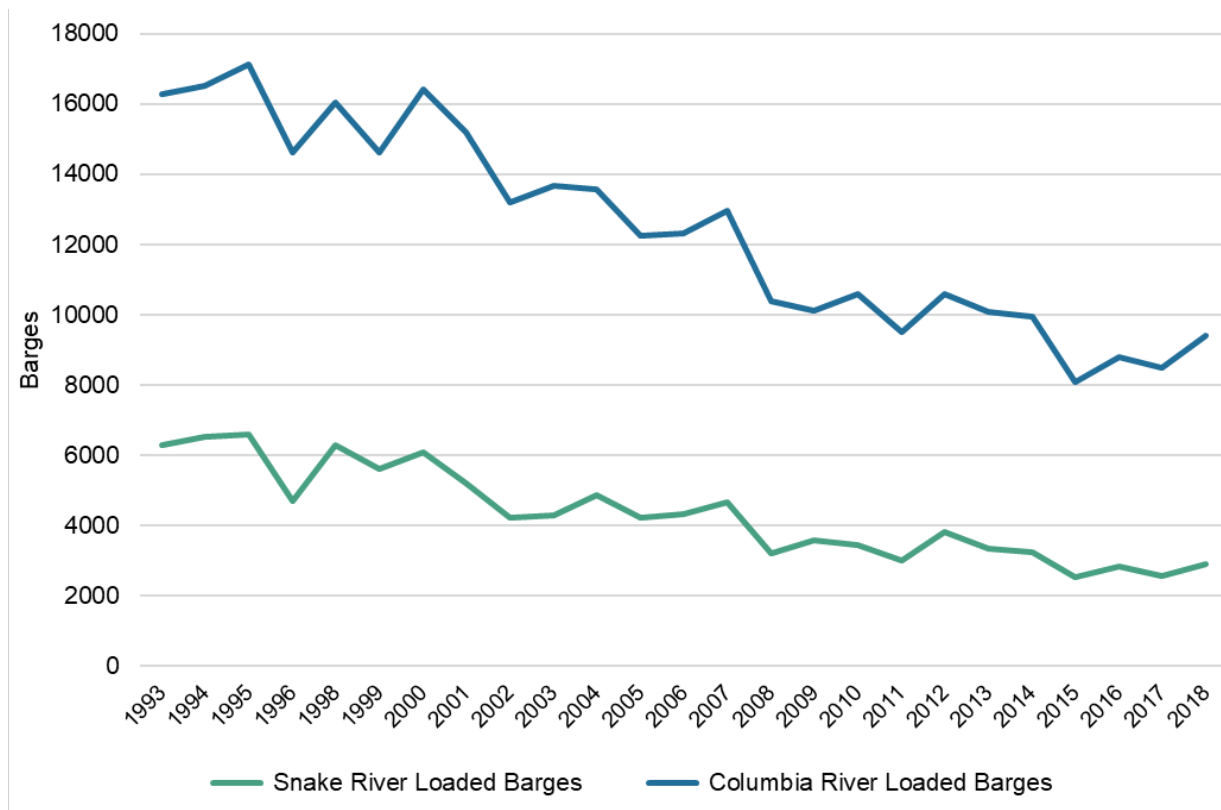
Mainline Rail

Improvements have been made over the past several years to the infrastructure and operation of the mainline railroads to increase the capacity to transport materials from southeast Washington. During the Bakken Oil Boom in winter 2013, large volumes of oil were exported from North Dakota. There were system capacity constraints because the weather conditions prevented freight from being moved quickly, which led to issues with moving grain out of eastern Washington because trains were tied up moving oil. Since 2013, BNSF has made significant investments in infrastructure improvements between Chicago and Seattle to reduce the possibility of a situation like this occurring in the future.¹⁵³ With the refurbishment of Stampede Pass to allow double-stack trains to pass through, the overall efficiency of the Pasco to Portland rail network has increased. Trains are loaded at multi-car loading facilities in eastern Washington and travel along the Columbia River to export facilities in Portland. The empty trains then travel north to Auburn and are routed east over Stampede Pass to then be reloaded; creating a highly efficient loop. There has also been a recent expansion in rail improvements from Spokane to Portland.¹⁵⁴

Barging Capacity

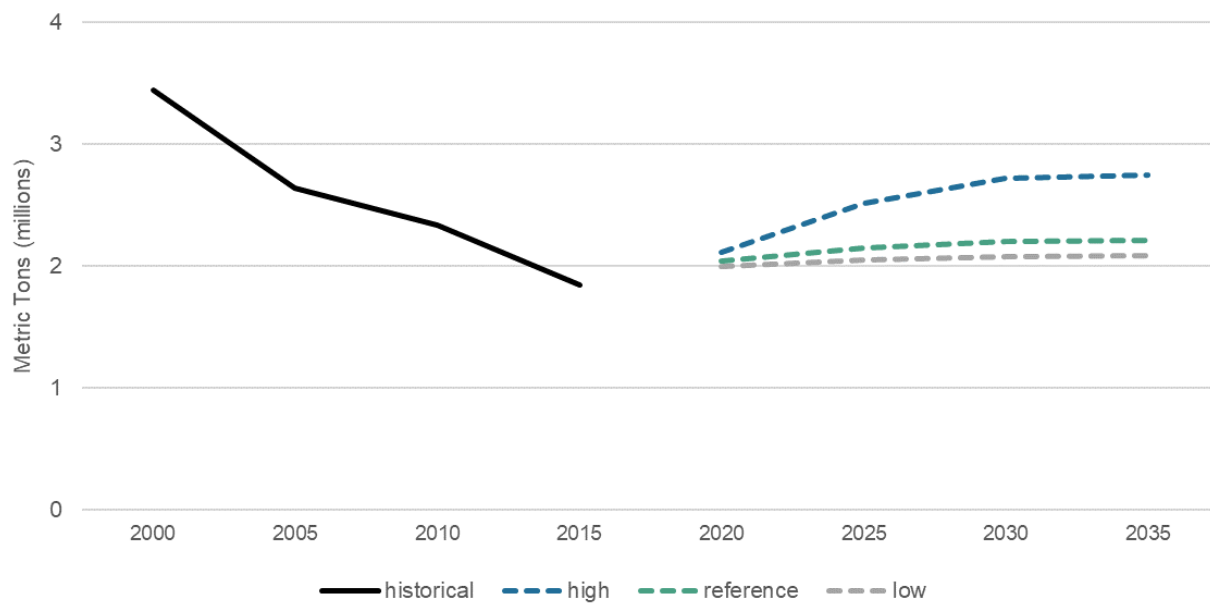
Transport of commodities by barge has trended downward in recent years on the entire Columbia and Snake river system. In 2000, a total of 13.8 million tons on 6,071 barges was transported versus 7.8 million tons on 2,554 barges in 2017.¹⁵⁵ Figure 11 below summarizes lockage data along the Columbia and Snake rivers from 1993-2018. This downward trend is largely due to restrictions on the shipment of hazardous materials by barge on the Snake River and declines in markets like pulp and paper and manufactured goods. The downward trend can also be attributed in part to the end of container shipping at the Port of Portland in recent years, which was used to move pulp and paper products as well as hay and lentils. These commodities are now trucked up to Tacoma or Seattle to be exported from those ports by container. In the past five years, there also have been investments in two new upstream fertilizer facilities at the Port of Wilma across the river from Clarkston, one built by the McGregor Company and the other by Cenex Harvest States.¹⁵⁶ These relatively new facilities are expected to increase the amount of upstream movement of commodities by barge. A 2017 report prepared for the Washington Public Ports Association estimates continuation of current levels or modest growth in the amount of overall grain transport by barge (see Figure 12). The gap from 2015–20 in Figure 12 is because historical data was only available up to 2015 and projections begin in 2020.

Figure 11: Lockage data along the Columbia and Snake rivers from (1993-2018)¹⁵⁷



Source: US Army Corps of Engineers

Figure 12: Snake River Waterborne traffic above Ice Harbor Lock Current Trend and Future Projections¹⁵⁸



Source: BTS Associates (2017)

If the LSRD are breached, it would no longer be feasible to transport materials by barge on the lower Snake River. Barge transportation would still occur between Tri-Cities, Washington, and the lower Columbia. The Tri-Cities is approximately 100 miles downriver from Lewiston, Idaho. Grain cooperatives that currently transport by barge on the lower Snake River would have to truck to Tri-Cities to load on barges, to an existing unit rail-loading facility or construct new unit rail-loading facilities. Based upon the PNWA report regional freight movements would shift to 60% rail, 30% barge and 10% truck as long as new highway, rail and grain storage facilities are constructed.¹⁵⁹ This report also found that it would require up to \$1.1 billion in public and private transportation and infrastructure improvements.¹⁶⁰ This redistribution is expected to result in 201 additional unit trains and 23.8 million miles in additional trucking activity annually.¹⁶¹

Perspectives

Support for the Current Transportation System

People reliant on and supportive of the current transportation system believe that a multimodal shipment system (i.e., barge, rail and truck) is necessary for competition and capacity, and the removal of one major mode (i.e., barge) would have disastrous ramifications on farmers and the local economy (see Section 7: Agriculture). They equate the loss of barges with a loss in cost advantages and reliability and worry that dam removal would create a de facto monopoly for the rail companies. In contrast to agriculture, the barging industry around the LSRD can never be made “whole” because their industry would be lost entirely. Supporters of the current transportation system do not see the 2010-11 and 2016-17 lock outages as a meaningful example of a potential shift to a rail-centric system. They noted that these outages were part of broader lock navigation management plans and they received upwards of a one-year notice which allowed for extensive preplanning.

If rail is the only viable transportation option, supporters of the current transportation system worry that farmers would be at the mercy of private rail lines to set prices because competition would be eliminated. Having barge cargo capacity as an alternative is seen as keeping trucking and rail rates competitive.

Barges are considered more efficient, cleaner and safer for the public than other modes of transport like rail or trucks. Supporters of the current transportation system questioned why there would be a push to shift from what they see as a cost-effective, safe, low-carbon mode of transport to higher carbon emission modes of transport like trucks and rail. They cited a 2017 report regarding greenhouse gas emissions from freight transport that found that barge produces 15.6 grams of CO₂ per ton-mile, 21.2 grams of CO₂ per ton-mile for Freight, and 154.1 grams of CO₂ per ton-mile for trucks.¹⁶² Barges use less fuel per ton of cargo and are seen as supportive of the state’s efforts to reduce carbon emissions and allow for safer roadways without the increase in trucks.

Barge transport is seen as a more service-oriented transportation provider and more responsive to customers’ needs to move product. Supporters of the current transportation system note that this responsiveness is especially important when engaging in a complex global wheat market. The global market for wheat is highly competitive; producers in southeast Washington compete with other wheat growers in the world. Price, quality and reliability are key factors for customers in choosing who they buy from. The customers have a sophisticated understanding of the market and frequently

ask questions about issues of transportation capacity and reliability to ensure they can trust their suppliers.

Supporters of the current transportation system also question the ability to sufficiently expand the rail and roadway system both in the LSRD region and on the main lines. Some see existing rail congestion in Lewiston as an issue and are skeptical of the economic feasibility and practicality of adding what could amount to 300 miles of shortline rail improvements. They also question the feasibility of purchasing a significant amount of right-of-way, which could include the condemning property and relocating residents to implement rail improvements.

Even if the rail improvements in the LSRD region could be addressed, they question the capacity to increase transportation on the main lines, especially downstream along the Columbia River. Finally, supporters of the current transportation system note that the recent investments in barge facilities by grain cooperatives, local ports and private facilities, some of which have recently invested millions of dollars in support of water transportation by barge, would all be lost, along with significant job losses.

Supporters of Alternatives to the Barge Transportation System

Many of the people interviewed that support breaching the LSRD believe that if the dams are breached actions should be taken to improve the rail and road transportation system as alternatives to the existing barge transportation system. Rather than retaining the lock systems at the LSRD, they see investments in rail line and road/highway improvements as more cost effective in the long run.

Supporters for breaching the dams often cite the ECONorthwest 2019 economic analysis findings regarding the shipping cost increases: “The net annual increase in shipping costs to the region as a result of LSRD removal is \$6.2 million. The evaluation of the full suite of benefits and costs indicates that there are numerous costs that are not incorporated in the transportation of products via barge. Significant federal appropriations are dedicated to operating transportation infrastructure on the LSRD that are not recovered via the USACE fuel surcharge and are borne by the federal government. A comparison of solely the transportation costs and the federal appropriations indicates that barge transportation along the lower Snake River would not be viable without this subsidy. There are, however, additional public costs that need to be accounted for should the volume of products currently projected to ship via barge switch to another alternative.”

There is acknowledgement that barge shipping is less expensive for transporting grain to lower river facilities than truck or rail, but supporters of alternatives to barge transportation system cite the significant amount of federally appropriated funds dedicated to maintaining the locks that allow barges to travel up and down the river, as well as the fact that most of the product transported by barge is shipped overseas. Rather than using these federal subsidies to continue the barge system, and with salmon recovery and restoration efforts funded by BPA seen as less effective, those who support breaching say investment in transportation upgrades could make better economic sense and be coupled with increased salmon abundance.

The growth in multi-car loading facilities is cited as an example of a trend toward more use of rail for transport of grain even with barging options still in place. Supporters of breaching the LSRD believe this trend could be built on with additional investments in rail and highway transport if the LSRD are breached.

The recent lock closures in 2010–11 and 2016–17 were also cited as examples of what a new rail-centric transportation system could look like around the Snake River. A Freight Policy Institute study found that during the 2010–11 closure over 90% of the grain by volume was shipped by rail, and there was an increase in shipping and storage cost shipments of almost 40% for shippers. There were also increases in shipping in the months leading up to the outages, as shippers made coordinated efforts with overseas buyers to ensure there were no major changes in the supply chain.

Supporters of breaching the LSRD see a future where the transportation needs of local farmers are still met. They acknowledge that the resulting shift in the transportation system would require investment in infrastructure and potential subsidies for farmers and cooperatives, and that there may be emission increases due to the increased use of trucks and rail but believe the benefits of breaching the dams would outweigh these impacts. Another benefit of breaching the dams could include less noise and other pollution from barge traffic, which could improve water quality.

Opportunities to Increase Understanding

If the LSRD remain in place, significant changes to the current transportation system are not likely beyond whatever shifts in rail and handling capacity are already underway, or other shifts in the domestic and global grain marketplace. If improvements needed for operations and management of the lock system continue to be delayed and unfunded, there could also be more frequent lock outages or disruptions to the current barge system. Otherwise, the existing transportation system is apt to operate in a similar fashion to the way it has in recent years.

There are two primary issues that need to be addressed if there is continued interest to understand the implications of potentially breaching the LSRD and the full effect of losing the barge transportation system: First, more detailed analyses are required to determine the viability and costs associated with the necessary main-line rail, short-line rail and road and highway network improvements to accommodate the loss of the barge system. The question of when the improvements would occur in relation to the dams being breached would also need to be determined to ensure agricultural producers and shippers do not face a significant loss if/when the dams came down. Second, the source(s) would need to be determined for funds and compensation provided to farmers, cooperatives, ports and potential private companies for the improvements to infrastructure, lost capital and increased cost of shipping.

Public Comments Related to Transportation

The majority of public comments received on transportation reflected the themes and perspectives included in the draft report. Many supporters of retaining the LSRD reinforced the perspective that the current multimodal transportation system allows farmers to maintain a competitive advantage and the loss of the barge system would have disastrous ramifications on farmers and the local economy. Conversely, many supporters of breaching the LSRD reinforced the perspective that rather than retaining the lock systems at the LSRD, investments in rail line and road/highway improvements are achievable and will be more cost effective in the long run.

The final report incorporated new information from the Pacific Northwest Waterways Association report, “National Transportation Impacts & Regional Economic Impacts Caused by Breaching Lower Snake River Dams.” Specifically, updated information on how the regional freight movement

would shift to accommodate the cessation of barging on the lower Snake River and the emissions, safety and cost impacts associated with this shift. Public comments that came from supporters of retaining the dams point out that the discussion around the barging industry active in the lower Snake River should align with that of the agriculture industry: in the event the dams are breached, the barging industry needs to be made “whole.” However, in contrast to agriculture, the barging industry around the LSRD can never be made “whole” because their industry would be lost entirely. A new perspective from supporters of breaching the dam is that eliminating barge traffic will reduce noise and other pollution in the river.

Section 8: Recreation

Context

The reservoirs, dams and shorelines on the lower Snake River provide land- and water-based recreational opportunities and access. Land-based recreation includes hiking, camping and hunting; water-based activities include fishing, swimming and boating. The USACE operates and supports 58 parks and recreational facilities along the lower Snake River.¹⁶³ There are four state parks and three recreation areas managed by Washington State Department of Fish and Wildlife. In addition, there are numerous parks and recreational sites operated by local cities, counties and ports. In 2018, the USACE counted 1.7 million visitors to recreation areas associated with the Lower Granite Lake. The current reservoir system also allows for large river cruise boats that bring tourists up the Snake River to Clarkston, WA. The biggest draw for cruise boat tourists is to visit Hells Canyon Recreation Area on jet boats.

If the LSRD are breached the river will shift from a series of flat-water reservoirs to a free-flowing river. The shift to a free-flowing river would result in the loss of some existing recreational opportunities and create the potential for growth of new recreational opportunities. The 2002 EIS evaluated 33 recreational areas that would be affected if the LSRD are breached, and found that 11 would close entirely, two would be closed to river access and 18 would require modifications for river access. Nine marinas would no longer exist, and all current swimming beaches would be impacted by changes in water surface elevations. Recreation that relies on motorized boats is likely to experience an economic loss from dam breaching while non-motorized boaters will likely experience an economic benefit.¹⁶⁴

New whitewater recreation opportunities may be realized if the LSRD are breached. Before the LSRD were constructed, USACE identified 63 rapids between Lewiston, Idaho, and the confluence with the Columbia River.¹⁶⁵ Salmon recovery efforts afforded by dam removal also may increase recreational and sportfishing opportunities. Some of the existing activities that currently occur on reservoirs, like certain fishing, boating and wildlife opportunities, could continue with a free-flowing river.¹⁶⁶

Perspectives

Support for the Current Recreational System

Supporters of the LSRD and its associated reservoirs want to maintain the significant use of parks that already exists and preserve the value of investment in boats and other equipment for the lake environment. They see the existing parks and other recreational facilities that would be closed or modified by dam breaching, including the local cruise boat industry, as vital parts of the local communities and losing these parks or recreational facilities would cause disruptions to many people's way of life.

Supporters of the LSRD are skeptical that the local communities will receive the same levels of revenue from tourists visiting for whitewater rafting as they currently do from flat-water recreators. Shifting from current recreation opportunities, which are accessible to most people, to those

available on a free-flowing river will disproportionately benefit younger, more physically fit individuals.

LSRD supporters assume the USACE would not manage the existing park system in place if the dams were breached, which would have a significant impact on the federal as well as state and local recreational facilities. State and local funding sources are limited and may not have the capacity to address the costs of revamping facilities and the ongoing operation and maintenance of alternative recreation facilities. They also believe the current river cruise and tour boat industry would not be viable in a free-flowing river.

Support for Alternatives to the Current Recreational System

Supporters of restoring the lower Snake to a free-flowing river argue that the river is currently underused for recreation, citing national and regional research findings that a river environment is preferred over lake recreation.¹⁶⁷ Breaching the LSRD would open new opportunities for trails, campgrounds and other recreation-based infrastructure that could connect the communities surrounding the LSRD. Recreational, sportfishing and hunting opportunities would also have the potential to grow significantly with a free-flowing river. Eliminating barge traffic by breaching the dams will reduce some hazards to smaller crafts and people recreating on the river.

The transition from a flat-water recreation economy to a wild river recreation economy could enable growth of the local rafting industry and associated tourism, and the possibility of multi-day rafting trips within the 60-plus rapids that would be accessible if the dams were breached. Interviewees noted that many people are willing to travel great distances for high quality rafting, with people waiting up to 10 years for permits to raft the Grand Canyon. Breaching the LSRD may also provide for increased public access and the growth of a tourism industry in the Lewiston-Clarkston region.

Supporters of breaching the LSRD believe that there will be more river access in and near Lewiston-Clarkston if the river is returned to free-flowing. Prior to the dams, they pointed out that the sand bars and beaches were a popular attraction for local residents, as they currently are upriver of Lower Granite reservoir and along the lower Salmon River.

Opportunities to Increase Understanding

The primary issue that would need to be addressed regarding recreation in any continuing conversation about the LSRD is to identify the total need, cost and funding sources for potential replacement, modification and expansion of trails, parks and other recreational amenities if the dams were breached.

Public Comments on Recreation

The majority of public comments received on recreation reflected the themes and perspectives included in the draft report. Many supporters of retaining the LSRD reinforced the perspective that the existing parks and other recreational facilities that would be closed or modified by dam breaching are vital parts of the local communities and losing these parks or recreational facilities would cause disruptions to many people's way of life. Conversely, many supporters of breaching the LSRD reinforced the perspective that new opportunities for trails, campgrounds and other

recreation-based infrastructure would connect the communities surrounding the LSRD, and recreational, sportfishing and hunting opportunities would also have the potential to grow significantly with a free-flowing river.

Section 9: Economics

Context

This chapter summarizes information from previous studies about the economic impacts that breaching the LSRD would have on local communities surrounding the dams, as well as the state and region more broadly, due to shifts in recreation usage, salmon abundance, agriculture, transportation, employment and energy production. The consultant team does not attempt to validate the accuracy of these perspectives but does aim to capture the range of viewpoints.

The primary economic analyses referenced by participants in this effort were the 2002 “Lower Snake River Juvenile Salmon Migration FS/EIS,” completed by the USACE, and the June 2019 “Lower Snake River Dams: Economic Tradeoffs of Removal” report, prepared by ECONorthwest for Vulcan, Inc. An additional study, “Washington State Travel Impacts & Visitor Volume 2010-18,” prepared by Dean Runyan Associates for the Washington Tourism Alliance, focused on the economics of tourism across Washington state with specific information for the counties adjacent to the lower Snake River. Another study was released by the Pacific Northwest Waterways Association written by FCS Group, “National Transportation Impacts & Regional Economic Impacts Caused By Breaching Lower Snake River Dams,” focused on the economic impacts of LSRD breaching on 10 counties in Washington and Idaho that are within a two-hour drive of the ports of Lewiston, ID and Clarkston, WA. The draft CRSO EIS due to be released in February 2020 will include a new economic analysis of the Columbia River operating system, including retaining and breaching the LSRD.

The PNWA report noted that average wages in their study area were \$40,211, or about 25% below the national average in 2017.¹⁶⁸ The report found that local communities believe breaching the LSRD will have disproportionate effects on the low-income Hispanic community within the Tri-Cities that currently fill the seasonal jobs irrigated agriculture provides, and do not believe there would be similar economic opportunities for this community if the dams are breached. This is a topic also discussed in the 2002 EIS that states, “Hispanic workers employed on farms irrigated from the Ice Harbor reservoir would be disproportionately affected if these farms go out of business as a result of Alternative 4 - Dam Breaching.”¹⁶⁹ The actual quantified effect that breaching might have on this community has not yet been evaluated and will need to be addressed.

Note that the 2002 FS/EIS and 2019 ECONorthwest report cost estimates referenced below are not an “apples-to-apples” comparison. All 2002 FS/EIS values reported are in 1998 dollars and reflect a 100-year study period, and the study area generally encompasses the 140-mile long lower Snake River reach between Lewiston and the Tri-Cities. All 2019 ECONorthwest report values reported are in 2018 dollars and reflect a 20-year study period (2026–45), and the study area is based upon a geographic boundary for spending in the eight counties in Washington that surround the LSRD and one county in Idaho (Nez Perce County).

The 2002 FS/EIS included an economic analysis of breaching the LSRD. The study found that uncertainties remained that prevented the USACE from concluding whether it would be cost-effective to breach the LSRD. The USACE noted that further work was needed to “(1) more precisely quantify the recreational benefits of the lower Snake River if the dams are breached; (2)

more thoroughly assess the effect of dam removal on future anadromous fish stocks, and; (3) further specify the configuration of the future power supply system if the dams are breached.”¹⁷⁰

The 2019 ECONorthwest report is the most recent comprehensive economic analysis of retaining or breaching the LSRD. The ECONorthwest report concluded that the public benefits of breaching the LSRD exceed the costs of retaining them. The report found that while breaching the LSRD would result in increased power and transportation costs, benefits in recreational uses (including a calculation of the “non-use” value for salmon recovery) more than offset costs of removing the dams. Economists define non-use values as the willingness of the public to pay their own money to protect natural resources, regardless of if they plan on directly using that resource.¹⁷¹

The ECONorthwest report summarizes their analysis of the costs and benefits of removing the LSRD by major category, including grid services, dam removal, irrigation, transportation, use value and potential non-use value. Without the inclusion of non-use values the costs of dam removal exceed the benefits by \$2.32 billion. With the inclusion of non-use values the benefits of dam removal exceed the costs by \$8.65 billion. The PNWA report found that the national cost impacts of breaching the LSRD may exceed \$1.9 billion over 30 years at the standard discount rate.¹⁷²

Recreation and Non-Use Values

Both the 2002 FS/EIS and ECONorthwest report estimated the shift from a flat-water reservoir system to a free-flowing river system would create economic benefits in the form of increased high-value recreation activities, like whitewater rafting and river related tourism. The reports both predict dam breaching would also lead to increases in recreation and sportfishing from salmon population gains. These recreational changes would benefit river system users and tourism-based businesses in Clarkston and Lewiston.^{173 174}

The ECONorthwest report included non-use values for salmon in their economic analyses. The ECONorthwest study found that “on a per-household basis...there is a willingness to increase electricity bills by an average of \$39.89 per year to help protect wild salmon, but the cost of removal is estimated at only \$8.44 per year.”¹⁷⁵ In the ECONorthwest report these non-use values were applied to the populations of Oregon, Washington, Idaho, Montana and California (over 18 million households). These non-use values are the determining factor to the ECONorthwest report’s overall finding that benefits significantly offset the costs of dam removal. The 2002 FS/EIS did not include non-use values for salmon in its economic analyses. USACE is one of the only federal agencies that does not consider non-use evaluations in economic analyses.

Cruise boats tours have also become popular along the river in the last ten years. In 2017 over 18,000 passengers visited in 2017 and contributed over \$15 million to the communities along the Columbia and Snake rivers, with almost \$3 million contributed to Lewiston and Clarkston.¹⁷⁶ The PNWA report identified that breaching the LSRD would lead to over \$3 million in annual GDP spending and over 70 jobs would be lost from the cruise boat industry.¹⁷⁷

Commercial and Recreational Fishing

Commercial and recreational fishing jobs are important contributors to Washington’s coastal economy. In these rural areas without many alternative job opportunities, the loss of fisheries jobs has been devastating to the local communities that for decades relied on the living wage jobs this

industry provided.¹⁷⁸ The main catch that the coastal Washington fisheries focus on are Chinook and coho salmon, with the populations that spawned in the Columbia and Snake River basins providing most of the runs they catch.

In November 2019 unemployment rates in coastal communities were among the highest in Washington, with Pacific County having the third highest unemployment rate in the state at 7.4% and Grays Harbor County tied for fifth highest.¹⁷⁹ Over the last three years, the Chinook troll fisheries in southeast Alaska are at the lowest harvest rate over a three year period since 1911. Unlike other states, Washington salmon fishing permits can only be owned by individuals, not larger boats or corporations, making each boat its own small-scale food production business (like a small family farm). These individuals often work alone or with one other person, 3–70 miles offshore for weeks at a time in waters that intersect major shipping lanes, creating hazards for these small boats. Based on Washington Department of Fish and Wildlife data, the price per pound of Chinook drops as the season goes on from \$8.00–\$9.50 per pound at the beginning of the season down to \$3.50–\$6.00 at the end of the season. At the same time, supermarket prices stayed between \$19.99–\$37.00 per pound. Due to the variations in revenue as well as shortened seasons, many Washington-based fishermen need to own and use catch permits in Oregon and Alaska, with some fishermen switching to tuna fishing if salmon becomes unviable. If fishers lose revenue in a season because of a lower fish year they often need to defer boat maintenance, which has a ripple effect throughout communities with industries built around servicing boats.

The Washington Department of Fish and Wildlife manages the amount that fishers can catch on a weekly basis during the season and has the authority to close fishing with only a 24-hour notice for days or weeks at a time, sometimes for the rest of the season. As abundance within the Columbia and Snake river have declined, so have the number of commercial fishermen. Commercial fishing fleets along the Washington coast and in the lower Columbia River are a fraction of what they were, and their communities, once known for their abundant natural resources and food production, are suffering from increased poverty and food insecurity.¹⁸⁰ In 1978 there were 3,041 vessels operating salmon trolling operations in the coastal waters of Washington; by 2018 the number had fallen to 102 boats.¹⁸¹ From 1971–75 the salmon troll fishery was annually valued at an average of \$21.8 million; in 2018 the value had dropped to \$2.35 million.¹⁸² These numbers do not reflect losses associated with fishers who fish in rivers and catch salmon using nets of various types, the tribal fishers who fish along the non-tribal fishers, or recreation fishing businesses and guides that are hired by outdoor enthusiasts to help them catch salmon and steelhead.

A 2017 study prepared for the Pacific Salmon Commission on the economic impacts of commercial and recreational salmon fisheries in the Pacific Northwest region of Oregon, Washington, British Columbia and southeast Alaska found that from 2012–15, the contribution of the commercial and recreational sectors combined averaged:

- \$3.4 billion in output; \$1.9 billion in Gross Domestic Product; \$1.2 billion in Labor Income and 26,700 Full-time Equivalent jobs to the U.S. economy
- \$1.3 billion in Output; \$850 million in Gross Domestic Product; \$485 million in Labor Income and 12,400 Full-time Equivalent jobs to the Canadian economy

Both the commercial and recreational salmon fishing sectors are major contributors to these economic impacts.¹⁸³ This study also showed that Chinook salmon contributed \$19.2 million in value for the commercial and recreational fishing industry. As the salmon have steadily declined so

have the fishing jobs as well as the workers at seafood processing plants; many of the industries that service the fishing fleet like fuel docks, fishing gear stores, boat and engine repair businesses.

The overall effect of hatchery fish on the survival of certain wild anadromous species led NOAA to place a ceiling on the total hatchery releases in the Columbia River System. A 1999 report developed to inform the 2002 FS/EIS found that “the economic impact on the Pacific Northwest region from eliminating most hatchery programs and thereby most harvesting of salmon produced in the Columbia River Basin may be as high as \$213 million per year. The burden of these reductions would be felt all along the Pacific West Coast and inland throughout the Columbia River Basin. Projecting over 100 years for what is at stake from all production, the net-present-value at the current Corps discount rate may be as high as \$2.0 billion,” (values reported in 1999 dollars).¹⁸⁴

Transportation

The 2002 FS/EIS found that if the LSRD are breached commercial barge transportation would be eliminated and the use of more trucks and trains would increase some emissions. The cost per bushel of grain was estimated to increase from 6 cents in Oregon to 21 cents in Montana and costs for transportation other commodities was expected to increase by approximately 5%. The average annual cost over the 100-year study period associated with transportation would be approximately \$38 million. Rail improvements were estimated to cost \$50 million to \$89 million and highway improvements were estimated to cost \$84 million to \$101 million. In addition, grain elevator improvements were estimated to cost \$60 million to \$352 million. The FS/EIS also noted the potential increase of highway and rail safety concerns due to additional traffic from the increased transportation of goods.¹⁸⁵

The PNWA report found that breaching the LSRD would shift the freight movement status quo of 90% exported by barge and 10% exported by rail to 60% rail, 30% barge and 10% truck. To achieve this future redistribution of regional freight movement, new highway, rail and grain storage facilities improvements would require up to \$1.1 billion in public and private transportation and infrastructure investments.¹⁸⁶ The report also estimated that increased trucking activity will increase fuel costs, highway maintenance costs, terminal facility maintenance costs, driver time and vehicle maintenance costs that total \$63.6 million annually.¹⁸⁷ The combined investments and social costs from dam breaching are conservatively estimated to annually cost \$155 million over a 30-year analysis period.¹⁸⁸

The ECONorthwest report estimated that if the LSRD are breached it could result in: (1) potentially higher shipping costs for local growers and shippers; (2) the need for additional rail and road infrastructure improvements; and (3) increases in emissions from the increased use of truck and rail due to the loss of barge. The ECONorthwest report identified several transportation-related costs if the LSRD were breached, summarized below:

- Reservoir drawdown mitigation and damage costs (\$205 million–\$551 million)
- Additional rail infrastructure (\$113 million–\$136 million)
- Additional road infrastructure (\$14 million–\$17 million)
- Road wear and tear costs (\$13 million–\$15 million)
- Net change in transportation costs for shippers (\$41 million–\$78 million)

- Net change in emissions costs (CO₂ equivalent, PM_{2.5}, NO_x, VOC) (\$18 million–\$20 million)
- Net present value change in accident costs (crash fatality costs, crash injury costs and crash property damage costs) (\$43 million–\$49 million)

In addition to the transportation-related costs identified above, the ECONorthwest report identified that during the 20-year study period (2026-45) the net change in appropriated spending for USACE operation and maintenance costs of the LSRD to be \$239 million–\$248 million and USACE Columbia River Fish Mitigation costs are \$9 million–\$23 million. When taking the entire ECONorthwest report's variables into account, the report ultimately concluded that federal appropriations dedicated to operating and maintaining the lock system on the Lower Snake River are more costly than the economic benefits of maintaining the barge system. Even without breaching the LSRD, the continued operation of the lock system was deemed unjustified by the ECONorthwest report.

Agriculture

The 2002 FS/EIS found pump modifications for irrigators and other water users would be required if the LSRD are breached. If irrigated water from the Snake River was no longer available, the impact on lowered farmland value was estimated at \$134.2 million. Implementing pump modifications for both municipal and other industrial water users was estimated to cost \$11 million–\$55 million. In addition, irrigators within one mile of the reservoirs would require further modifications estimated at \$56.4 million. These costs resulted in an annual average cost of \$15.4 million over the 100-year period of analysis used for this study. The FS/EIS also anticipated job losses because of projected reductions in irrigated farmland, reductions in spending by the Corps and the loss of barge transportation and cruise ship operations.¹⁸⁹

The ECONorthwest report acknowledged that the loss of irrigation could create significant economic challenges to some reliant on irrigation around the LSRD. If currently irrigated acres within five miles of the lower Snake River are converted to non-irrigated land, the ECONorthwest report estimates a loss of value of \$390 million. However, the report assumed that water withdrawals for irrigation could continue, even without the LSRD, through surface water and groundwater infrastructure upgrades estimated to cost \$146 million–\$183 million.¹⁹⁰ Overall, impacts to the agricultural industry were assumed to potentially negatively affect current users of Lower Snake River waters, but the overall regional impacts were expected to remain constant.

Energy

The 2002 FS/EIS acknowledged that hydropower generation could not continue if the LSRD are breached. The FS/EIS found the net economic costs of losing hydropower generation to be \$271 million, not including implementation or avoided costs. The FS/EIS assumed non-polluting resources could replace the lost hydropower energy generated and would result in no net changes in air pollution from existing conditions. However, the study noted that using this conservation strategy would require government subsidies and implementation to occur before the dams are breached.¹⁹¹

The ECONorthwest report assumed that the region could meet power needs without LSRD energy production, though there could be some higher carbon emissions and a need for low-cost

adjustments to BPA's grid operations. If the LSRD were breached, BPA would also pay less for operations and maintenance, capital replacement, overhead, and fish mitigation.¹⁹² The "Lower Snake River Dams Power Replacement Study," developed by Energy Strategies for the Northwest Energy Coalition, found that energy grid services from the LSRD could be replaced at a cost of \$400 million to \$1.2 billion per year, depending on the mix of replacement resources and other assumptions, which could result in zero to \$1–\$2/month increases in monthly utility bills.

LSRD Operations & Maintenance Needs

BPA is responsible for paying the USACE to staff and perform operations and maintenance for the LSRD. BPA's total O&M expenses for the 2019 fiscal year were \$2.137 billion, a 2% increase from the previous fiscal year.¹⁹³ These O&M costs reflect the core funding for maintenance, operation, and minor equipment replacements of the entire BPA energy system. Of this total, the LSRD's O&M costs are \$50 million annually, most of which goes towards general O&M costs stated previously and workers compensation. In addition, 15% of total O&M costs are fish and wildlife costs for fish screens, hatcheries, fish bypass facilities, and transport of smolts.¹⁹⁴ Into the future, O&M costs are less certain due to factors like the ongoing environmental costs of the fish and wildlife program, the uncertainty around annual weather and water supply available to use for power generation, the aging infrastructure of the FCRPS that will require investments to preserve the value of the system, and changing attitudes towards hydropower plants.¹⁹⁵

Perspectives

Support for the Lower Snake River Dams

Supporters of retaining the LSRD believe that the ECONorthwest report did not adequately consider the impacts of dam breaching on the people, communities and industries throughout the Northwest, especially those in the vicinity of the LSRD. They believe there will be drastic economic consequences if the LSRD are lost, including loss of tax revenues, jobs, businesses and property values, especially for rural and agricultural communities and users of the current barge system. While the ECONorthwest report recognizes societal costs from LSRD removal and the loss of energy production, supporters of the LSRD disagreed with the notion that surrounding communities in aggregate would "experience gains in employment, incomes, and economic output."¹⁹⁶

For recreation, supporters of the LSRD did not agree that a new whitewater rafting industry will be created, or if it was that it would have a significant economic benefit, noting that the actual river conditions may not be conducive for whitewater rafting after dam removal. They believe the assumption about more economic benefit for river-based tourism is based on national data and the benefit would not necessarily be to the local communities. Supporters of the LSRD believe the existing benefits from recreation on the reservoirs, boating, fishing and camping have significantly more economic benefit than the recreation on a free-flowing Snake River. The local cruise boat industry is also cited as a significant economic benefit that was not included in ECONorthwest's analyses and that could be lost through breaching the LSRD.

The positive benefit-cost analysis in the ECONorthwest report is driven by the estimated non-use value. Supporters of the LSRD question the validity of the survey that is the basis for the non-use value. They believe the wording in the survey was biased and then calculated with the assumption

that people as far away as California would actually pay more on their utility bills for Snake River salmon. They view BPA's investments in fish passage, salmon restoration, and hatcheries as already achieving significant long-term progress and not being sufficiently valued. Finally, they see retaining the dams and increasing hatchery production as an approach to achieve significant economic benefits for the Pacific Northwest recreational and commercial fishing industries.

For transportation, they disagreed with ECONorthwest's assessment that the costs of losing barge transport and switching to trucking/rail are less valuable than the current federal appropriations that support the locks. Supporters of the LSRD did not think the report recognized the importance of maintaining a multi-modal transportation network and overestimated the ease and costs of implementing rail and road infrastructure improvements. They also believe the report inadequately recognized the carbon benefits of the dams, both in terms of energy production and the increased carbon emissions that could result from the loss of barging and increased rail and truck usage.

For agriculture, they believe the ECONorthwest report's assumption that the costs to replace irrigation infrastructure will be less than \$200 million is too low. And even if this number were accurate, supporters of the LSRD questioned the viability of finding a funding source to pay for these improvements. They also challenged the ECONorthwest report's assumption that farmers could find new jobs, switch crops, relocate or access other water sources, noting that the "human element" is inherently missing in economic analyses and broader considerations of LSRD breaching. Supporters of the LSRD do not see how it would be possible that farmers and the general agricultural community would be made "whole" if the LSRD were breached. Millions, if not billions, of dollars would be needed to improve road and rail transportation infrastructure, provide annual subsidies for increased costs of transportation and electricity, and other costs. Supporters of the LSRD do not believe there would be political support to fund the needs of farmers and the agricultural community. They also question the willingness to subsidize farmers and farm cooperatives for their infrastructure losses and ongoing increased cost of transportation. Finally, if water volumes in the Snake River are decreased significantly, municipalities and private businesses releasing effluent into the river will have difficulty satisfying increasingly stringent water quality standards and incur significant costs.

For energy, they believe the loss of low-cost, low-carbon energy production and the jobs associated with the management and maintenance of the dams would be significant. There would be a ripple effect throughout the local communities and across parts of the region by losing the energy provided by the dams. Supporters of the LSRD believe that if the dams are breached the political focus will shift to removal of other Columbia River system dams and the economic consequences will increase exponentially across the region.

Lastly, supporters of the LSRD are skeptical that the federal government will make the capital and long-term investments assumed in the ECONorthwest report for economic development in the communities affected by the loss of the LSRD.

Support for Alternatives to the Lower Snake River Dams

Supporters of alternatives to the LSRD believe the cost of retaining the dams and its associated subsidies will continue to increase, some are not cost effective now, and more will become cost-ineffective over time. They acknowledge there needs to be a transition plan for local communities

that would be impacted, recognizing there is a likelihood of job loss and disruption, but believe that the transition to a new, more robust economy can be realistically achieved.

For recreation, supporters of alternatives to the LSRD are confident that LSRD breaching would generate widespread growth in fishing and whitewater rafting, and lead to a thriving tourism industry and economic development opportunities in the Lewiston/Clarkston area and other surrounding counties. The ECONorthwest report uses national data as the basis for their analysis that river recreation will generate more economic benefit than the current reservoir recreation. Supporters of breaching the LSRD believe this assumption is accurate and perceive that Clarkston and Lewiston could be a recreational magnet for people across the country to visit and add to the economic vitality of the community.

While some supporters of alternatives to the LSRD understand concerns raised about the non-use value estimates in the ECONorthwest report, they do believe non-use values are a valid component of any technically sound economic analysis. They are concerned the CSRO FS/EIS will not include non-use values, similar to the 2002 USACE FR/FS/EIS; if the CRSO FS/EIS does not include non-use values, they worry the FS/EIS will conclude that removing the LSRD does not have a positive benefit-cost ratio. Supporters of breaching the LSRD also noted that the ECONorthwest report did not include benefits provided by restored salmon populations in the Columbia River basin and along the coast as well as in farther upstream Idaho. They see breaching the LSRD as an approach to achieve significant economic benefits for the Pacific Northwest recreational and commercial fishing industries.

For transportation and agriculture, supporters of alternatives to the LSRD believe that if a plan was in place to breach the LSRD, new federal subsidies could be identified to cover the costs of rail and road infrastructure improvements and surface water and groundwater infrastructure upgrades for irrigators and other water users. In the long term, these investments could provide more benefits to farmers, businesses and communities than the current LSRD transportation and agriculture system does.

For energy, supporters of alternatives to the LSRD believe that BPA is already operating at a deficit and technology improvements continue to accelerate for things like intermittent renewable battery storage. Ultimately, they believe that energy production lost through breaching the LSRD can be replaced with little to no increases in carbon emissions. They note that while the ECONorthwest study accounts for the cost of power replacement should the dams be breached, it does not reflect the potential benefits from corresponding investment of those funds in the build-out of new renewable resources to replace the power. Finally, BPA's investments to date in fish passage, salmon restoration and hatcheries are seen as insufficient to truly restore Snake River salmon and support Southern Resident orca recovery.

A number of supporters of alternatives to the LSRD see the need for a coalition of Northwest congressional representatives and governors to convene a process involving tribes, state and federal governments and stakeholders to identify the needs and potential solutions for energy, salmon, transportation and economic challenges presented by retaining or breaching the LSRD.

Opportunities to Increase Understanding

To determine the full economic impacts of retaining or breaching the LSRD, more detailed analyses are required to determine (1) the viability and costs of retaining the LSRD (and viability and costs of LSRD breaching); (2) viability and costs of implementing needed infrastructure improvements; (3) identify potential funding sources, if the LSRD are breached; and (4) the potential impact that breaching the LSRD would have on low-income communities, including the Hispanic community in the Tri-Cities that currently fill the seasonal jobs irrigated agriculture provides.

Public Comments on Economics

The majority of public comments received on economics reflected the themes and perspectives included in the draft report. Many supporters of retaining the LSRD reinforced the perspective that there will be drastic economic consequences if the LSRD are lost, including loss of tax revenues, jobs, businesses and property values, especially for rural and agricultural communities and users of the current barge system. Conversely, many supporters of breaching the LSRD reinforced the perspective that breaching would generate widespread growth in fishing and whitewater rafting, and lead to a thriving tourism industry and economic development opportunities in the Lewiston/Clarkston area and other surrounding counties.

Many public comments and questions were provided regarding the impact of retaining or breaching the LSRD on commercial and recreational fishing. The primary change in the Economics section is the addition of a new subsection on this topic. Like the Transportation section, new information from the Pacific Northwest Waterways Association report, *National Transportation Impacts & Regional Economic Impacts Caused by Breaching Lower Snake River Dams*, was included in the context portion of this section. A new perspective from supporters of breaching the dams is that increased runs of salmon and steelhead will fuel healthy local and regional commercial, tribal and recreational fisheries; possible benefits include increased tax revenues, jobs and business and property values.

Section 10: Moving Forward

The consultant team was not tasked with making recommendations for future steps to address the issues and interests of the different communities affected by the lower Snake River dams if they are retained or breached. However, we did ask people interviewed what would help in achieving forward progress. This section summarizes the ideas we heard. As noted in the preceding sections, debate over the dams has gone on for several decades and the issues are complex. Despite some recent improvements in collaboration, many of the participants remain wary of the cycle of study, lawsuits and court decisions. There is both hope and despair about what comes next and the potential for progress.

The draft Columbia River Systems Operation Environmental Impact Statement (in response to the 2016 Judge Simon decision) provides the next detailed analysis of the environmental and social impacts of the operations, maintenance and configurations for 14 federal dams in the Columbia River system including the four lower Snake River dams. It will assess several alternatives and may include a preferred alternative from the perspective of the three federal agencies associated with the dams: Bonneville Power Administration, U.S. Army Corps of Engineers and Bureau of Reclamation. There will likely be thousands of comments on the draft and potentially litigation. Although we heard from several people that they believe the federal process is necessary and helpful because the updated information will provide an analysis of alternatives, they do not hold high hopes that it is likely to build consensus or end debate.

Careful Framing of Any Subsequent Conversation Is Important

Careful and sensitive framing of any subsequent conversation would be needed to lay a foundation for productive engagement. We heard a strong desire from some parties for the issues surrounding the dams to be discussed and decided in a larger context. By “larger context” people mean a number of things depending on their interests and perspectives. Some emphasize the larger context around the changing supply and demand for energy across the Pacific Northwest. People focused on the larger context for energy feel decisions and conversations solely about whether energy production from the lower Snake River dams should continue or can be alternatively produced would not be fruitful. They want any future discussions to also address the future role of BPA and the financial issues facing BPA and its customers especially in the context of the BPA contracts that will be up for renewal by 2028.

For others, the larger context is centered around deepening understanding of the role of retaining or breaching the LSRD relative to the many other actions underway to support recovery of salmon and orca. People focused on this part of the larger context believe it is critical to consider the future of the LSRD as part of the overall efforts to recover these complex species and not as a discrete, stand-alone choice.

Still others see the larger context as including the effects of retaining or removing the dams on the broader economic future of southeast Washington considering fisheries, agriculture, industry, recreation and other economic drivers. They see the large context as including a conversation about the vision for the future of the southeastern Washington communities that have grown up around the LSRD.

While many see framing a decision about the LSRD within the “larger context” of each of the major issues as necessary to make the best decisions, there also is the fear that adding more complexity to an already complicated decision process would be a distraction and result in no decision, or additional delays. Bridging the gap between those that want to broaden the focus and those that fear inaction is part of what people feel needs to be addressed to make progress.

Some noted that decisions about solutions will need to be implemented over a ten year or longer timeframe. The energy, economic and environmental fields are dynamic. Significant changes are occurring, and more are anticipated. By considering solutions that may not be possible today, but could become possible over a longer timeframe, people see the potential for solutions that can more fully address the interests and concerns of people and their communities.

An Increase in Respect and Understanding is Needed

People told us that the manner in which the issue of dam breaching is raised contributes to the overall frustration and negative reaction of those who live in eastern Washington and benefit from the dams. Dam supporters feel the “coast” is telling eastern Washington communities what to do in a way that lacks respect and understanding of local values and priorities and minimizes how changes to the dams would significantly affect their communities. The Southern Resident Orca Task Force recommendations and the ECONorthwest economic report are cited as examples of this kind of “outsider” perspective being imposed on eastern Washington. Pushing for breaching the LSRD affects other issues that leaders in eastern Washington are trying to address. Some leaders noted that the pressure and negativity from proponents of dam breaching make it more challenging to make progress on issues like clean energy, worker’s rights and other concerns that might be held in common. They question the seriousness of the “coast’s” commitment to addressing salmon and orca recovery when the focus of energy from western Washington is on the LSRD instead of fully committing to the level of change needed in their own communities with their own sacrifices.

The need for greater respect and understanding extends to the tribal communities as well. The tribes point out the harm that was inflicted on their communities and the suffering and challenges they have faced for well over a century. Tribes have essentially lost the salmon they protected in their treaties with the United States. Above the LSRD, tribal harvest is a small percentage of pre-contact levels. As each dam was constructed, the tribes objected, calling on the government to reconsider - pointing out that these actions were contrary to the treaties the United States had signed with them, and predicting adverse consequences for the salmon and for tribal peoples. The four reservoirs inundate 140 miles of treaty-protected tribal fishing; hunting; and harvesting of roots, plants and berries at usual and accustomed stream side locations. People interviewed recognize the need to respectfully engage the tribes by acknowledging their losses and the responsibility they have to address the issues of the dams on salmon, other species and tribal culture.

A Desire for Dialogue

People across the diversity of interests expressed the desire to have more informed and respectful conversations. Given that issues around the LSRD have long been in litigation, the ability for shared learning, collaborative problem-solving and a new dialogue has so far been limited. Many of those interviewed are hopeful of the significant benefits a collaborative dialogue could offer to a process

stuck on its challenging issues. Participants point to two recent examples that give cause for optimism.

First, the NOAA Columbia Basin Partnership Task Force was mentioned as an example of the type of collaboration that has been successful in building relationships between diverse interests and creating momentum. The task force is a collaboration of different interests from across the basin landscape including: environmental, fishing, agricultural, utility, and river-user groups; local recovery groups; the states of Idaho, Montana, Washington and Oregon; and federally recognized tribes. A report from Phase 1 (January 2017–March 2019) of this collaboration reflects consensus around a shared vision, qualitative goals and provisional quantitative goals for 24 stocks of Columbia Basin salmon and steelhead. This is the first time a comprehensive set of goals for salmon recovery has been agreed to by any group of diverse interests in the Columbia basin. The task force is now focused on defining the actions needed to achieve their near and long-term goals.

Second, is the 2019–21 Spill Operation Agreement (flexible spill agreement). Federal, State and Tribal partners came together to develop an agreement on a key component of operating federal dams in the Columbia River Basin. Parties to the agreement have aligned on a flexible spring spill operation premised on achieving improved salmon survival while also managing costs for BPA and testing the promise of increased hydropower generation and energy marketing during daily windows of high energy demand that have been created by increasing deployment of solar energy in the western U.S. This is one of the first agreements amongst the parties for action that was not in response to a federal court decision. It happened because leaders of the different organizations and interests agreed to discuss concerns and collaboratively seek actions.

Workshop Panel Dialogue

At the three public workshops held in January 2020, a panel of people from diverse interests provided their perspectives on the issues surrounding the lower Snake River dams (see their bios in Appendix E). The panel demonstrated part of what others identified as needed to move forward: informed and respectful dialogue.

By sharing their beliefs and values and by listening to each other, panel members demonstrated what a civil, respectful dialogue could be between people that hold divergent views on whether the dams should be retained or breached. Some key actions supported this outcome. During the workshop, panel members did not advocate for their position on the dams. Instead, they focused on why the issues of energy, salmon, agriculture and the local economy were important to them and their communities. They spoke of their deep commitment for a better future, referencing frequently a future that included the interests of others. They listened to each other. They took in new information. They tapped into their curiosities about “the other side.”

They saw some commonalities. The panel was not asked to reach consensus or agreement, but some common themes arose. They agreed that a future that includes local agriculture and fishing will need continued support and expanded public investment. They also agreed there is a need for investment in the road and rail transportation system in southeast Washington, whether the dams are retained or breached.

They also were pointed in their differences. For example, panel members differed on the future of the dams and on issues like whether the energy from the dams could be easily replaced or if

improvements to rail or road transportation infrastructure could effectively replace barge transportation.

Despite these differences, panel members, based on their past experiences and participation in the three workshops, feel strongly that not only is there a need for dialogue across diverse interests, a new dialogue is possible. The panel saw the benefit of having a group of diverse, interested parties work together to develop a shared and common base of understanding and guide collection and analysis of information to address gaps in understanding. A number of these gaps are highlighted in the topical sections of this report. They also agreed on the urgency for the whole state to address the fate of salmon and orca. Panelists also exemplified the tone and quality of the discussion needed to move forward in a fashion that could achieve benefits across multiple interests – and showed that a dialogue of this nature is possible. The audience at each one of the workshops were attentive and complementary of the panel, further demonstrating the interest of many for a civil, respectful and informative dialogue.

Appendix A: Annotated Bibliography

“2018 Columbia River Basin Fish and Wildlife Program Costs Report.” *Northwest Power and Conservation Council*, Mar. 2019, www.nwccouncil.org/sites/default/files/2019-5_0.pdf.

Since 2001, the Northwest Power and Conservation Council has reported annually on all costs related to fish and wildlife incurred by BPA. This includes the cost of implementing the Council’s Columbia River Basin Fish and Wildlife Program. In this 18th annual report, the Council provides an update of Bonneville’s fish and wildlife costs in fiscal year 2018 (October 1, 2017 – September 30, 2018). The information in this report was provided by Bonneville in response to requests from the Council staff. The Council prepares this report solely for informational purposes, not as a requirement of the Northwest Power Act. BPA reported spending \$480.9 million total for fish and wildlife costs – 19.6% of Bonneville's entire Power Business Line costs. The Council also tracks progress of fish and wildlife efforts in the Columbia River Basin using three high-level indicators: abundance/health of fish species, whether the operations are meeting fish-passage survival objectives, and what is being accomplished by the fish and wildlife programs.

American Waterways Operators. “Economic Contribution of the US Tugboat, Towboat and Barge Industry.” U.S. Department of Transportation, 2014.
<http://www.americanwaterways.com/sites/default/files/Econ%20Impact%20of%20US%20Tugboat%20Towboat%20and%20Barge%20Industry%20h%206-22-17.pdf>

Nearly 5,500 US-flag tugboats and towboats and more than 31,000 barges move an average of 763 million tons of cargo on the nation’s waterways each year, including raw materials and commodities as well as finished consumer products. This report considers three separate channels -- the direct impact, the indirect impact and the induced impact – that, in aggregate, provide a measure of the total economic impact of the US tugboat, towboat and barge industry.

American Waterways Operators. “The Tugboat, Towboat and Barge Industry: A Leader in Marine Safety and Environmental Stewardship.” U.S. Department of Transportation, 2017.
<https://www.americanwaterways.com/sites/default/files/AWO-PWC%20press%20kit%20-%20Safety%20and%20Environmental%20Stewardship.pdf>

This one-pager from the American Waterways Operators is about how the tugboat, towboat and barge industry has been a leader in marine safety and environmental stewardship. In 1994, AWO developed the Responsible Carrier Program as a code of best practices for member companies which has been used to develop company-specific safety programs meet or exceed applicable laws and regulations, while being practical enough to reflect a company's unique needs. In 2015 AWO implemented a web-based Safety Statistics Reporting Program to help member companies foster a culture of safety and strive toward continuous improvement.

“A Northwest Energy Solution: Regional Power Benefits of the Lower Snake River Dams Fact Sheet.” *Bonneville Power Administration*, U.S. Department of Energy, Mar. 2016,
www.bpa.gov/news/pubs/FactSheets/fs-201603-A-Northwest-energy-solution-Regional-power-benefits-of-the-lower-Snake-River-dams.pdf.

This fact sheet was designed to inform users of the LSRD's functionality, current impact on fish migration/habitat relative to other dams in the Columbia River system, and the costs/uncertainties of breaching the dams. It highlights that LSRD have some of the most advanced and successful fish passage systems in the world; that they're on track to achieve up to 96% survival rates; wind and solar generators are not reliable replacements for the dams, which produce over 1000MW of reliable, carbon-free energy.

“A Vision for Salmon and Steelhead: Goals to Restore Thriving Salmon and Steelhead to the Columbia River Basin.” *NOAA Fisheries*, U.S. Department of Commerce, 11 July 2019, www.fisheries.noaa.gov/vision-salmon-and-steelhead-goals-restore-thriving-salmon-and-steelhead-columbia-river-basin.

This is the Phase 1 (Jan. 2017-March 2019) report of the Columbia Basin Partnership Task Force of the Marine Fisheries Advisory Committee (MAFAC). It reflects consensus around a shared vision of a healthy Columbia River and outlines qualitative and provisional quantitative goals for the salmon and steelhead stocks of the Columbia River Basin. The task force's vision is, "A healthy Columbia River Basin ecosystem with thriving salmon and steelhead that are indicators of clean and abundant water, reliable and clean energy, a robust regional economy, and vibrant cultural and spiritual traditions, all interdependent and existing in harmony." In June 2018, MAFAC approved continuation of this effort to further test and refine the provisional quantitative goals. The Phase 2 report is expected in June 2020.

Arthur, Bill, and Julia Reitan. “Best Chance to Save Wild Salmon in Columbia Basin: Remove Four Dams on Lower Snake River.” *Sierra Club*, 8 Feb. 2017, www.sierraclub.org/washington/best-chance-save-wild-salmon-columbia-basin-remove-four-dams-lower-snake-river.

This online article is pro-breaching of the LSRD; it was posted within the Washington chapter of the Sierra Club on February 8, 2017. It describes the general history of the dam system, with a perspective towards opposing the dams, as well as where the removal process has come through 2017. There are references to specific facts about the dam system, but the report does not provide any specific sources or citations for their statements.

Bilby, Robert. “Latent Mortality Report.” *Independent Scientific Advisory Board*, Northwest Power and Conservation Council, 6 Apr. 2007, app.nwcouncil.org/media/31244/isab2007_1.pdf.
https://www.nwcouncil.org/sites/default/files/isab2007_1.pdf

This report reviews a number of hypotheses about causative factors that contribute to latent mortality. The ISAB concludes that the hydrosystem causes some fish to experience latent mortality, but strongly advises against continuing to try to measure absolute latent mortality. Latent mortality relative to a damless reference is not measurable. Instead, the focus should be on the total mortality of in-river migrants and transported fish, which is the critical issue for recovery of listed salmonids. Efforts would be better expended on estimation of processes, such as in-river versus transport mortality that can be measured directly. Future monitoring and research is needed to further quantify biological factors that contribute to variability in estimated post-Bonneville mortality. In particular, the ISAB recommends that acoustic tags continue to be developed and used to assess and partition mortality in the lower river, the estuary and the Pacific Ocean shelf. In addition, the ISAB recommends the

continuation of PIT tagging with a monitoring and evaluation program designed to reduce the current levels of uncertainty.

Bogaard, Joseph. “Why Remove The 4 Lower Snake River Dams?” *Save Our Wild Salmon*, 2019, www.wildsalmon.org/facts-and-information/why-remove-the-4-lower-snake-river-dams.html.

This online article is pro-breaching the LSRD; it was posted on the website of the NGO Save Our Wild Salmon in 2019. It is a list of short essays that goes through common questions and arguments that people have about the LSRDs. All of the essays have a strong anti-dam perspective since the NGO is focused on restoring river systems to their natural state for the benefit of salmon. There are many facts that appear to be either direct quotes from the literature or are summarizations of the literature but there are no citations or linked research.

“Bonneville Power Administration Response to Public Comments on the BPA Resource Program.” *Bonneville Power Administration*, U.S. Department of Energy, 2018, www.bpa.gov/p/Power-Contracts/Resource-Program/Documents/BPA%202018%20Resource%20Program%20Reponse%20to%20Public%20Comments.pdf.

This document is a list of BPA's responses to public comments that were collected as part of the public review of Bonneville's updated Resource Program in 2018. The comments don't go into specifics of the lower Snake River dams as the review pertained to how Bonneville forecasted their future needs in terms of power supply obligations while focusing on potentially optimal resource choices absent of evaluating existing sources of supply in isolation. The questions that were brought forward that had to do with the lower Snake River dams were referred to the ongoing environmental impact statement as an answer source.

“Bonneville Power Administration's Summary of Energy and Capacity Values and Energy Production Costs of Lower Snake River Dams.” Bonneville Power Administration, 12 Sept. 2019.

This memo from the Bonneville Power Administration is about the energy and capacity values and energy production costs of the lower Snake River dams. The dams annually produce around 1,000 average megawatts (aMW) of power which is roughly equivalent to the annual consumption by the businesses, households and industries served by Seattle City Light (SCL). It brings up that the power generated by the LSRD is significant during Washington's high winter power loads as well as during extreme weather events during the entire year. The dams also provide valuable capacity that can be used for integrating renewables as well as meeting peak energy periods.

“BPA Invests in Fish and Wildlife Fact Sheet.” *Bonneville Power Administration*, U.S. Department of Energy, Jan. 2019, www.bpa.gov/news/pubs/FactSheets/fs-201901-BPA-invests-in-fish-and-wildlife.pdf.

Under its Northwest Power Act authorities and responsibilities, BPA mitigates the effects of the federal hydropower system on fish and wildlife in the Columbia River Basin. BPA partners with other federal agencies, states, tribes, conservation organizations, and others to enhance habitat, improve hatchery practices and protect lands and streams. BPA funds fish

and wildlife projects in the Basin, directly pays USACE for fish passage improvements at the dams, purchases extra power when the dams cannot meet energy demands due to additional spillage requirements and considers foregone revenue in the event water is spilled (rather than passing through the dams). Since 2007, BPA has restored or protected over 13,500 acres of estuary floodplain and over 50 miles of tidal channels.

“Citizen's Guide to the 2016 Comprehensive Evaluation: Protecting Salmon and Steelhead in the Columbia Basin.” *Bonneville Power Administration*, U.S. Department of Energy, Feb. 2017, www.bpa.gov/news/pubs/GeneralPublications/fish-Citizens-Guide-to-the-2016-Comprehensive-Evaluation.pdf.

This report is a more accessible version of the information that is outlined in the 2016 Comprehensive Evaluation (a progress report on the work done to protect ESA-listed salmon and steelhead within the Columbia River Basin by the U.S. Army Corps of Engineers, Bureau of Reclamation and Bonneville Power Administration). The report describes how the listed stocks within the system have been trending upwards in terms of abundance even with poor ocean conditions; the improvements to fish passage at the hydro projects which lead to better survival rates; investments made towards habitat restoration; the hatchery programs that have made improvements to abundance; predator management; and what still needs to be done in the future for the benefit of the stocks. This report has graphics and pictures to give the reader an understanding of what the on the ground projects look like and how they benefit salmon.

“Columbia Basin Salmon and Steelhead Fact Sheet: Many Routes to the Ocean.” *Bonneville Power Administration*, U.S. Department of Energy, June 2017, www.bpa.gov/news/pubs/FactSheets/fs-201306-Columbia-Basin-salmon-and-steelhead-many-routes-to-the-ocean.pdf.

This fact sheet was published by the Bonneville Power Administration in 2013. It goes over various methods juvenile salmonids use to pass dams as they migrate down the Columbia River. The main ways in which juveniles make their way down the river are through spill, the juvenile bypass system which diverts juvenile salmon to then be transported down river by truck or barge, and turbines. With improvements to spillway weirs, bypass systems and increases in spill during the months the juveniles are migrating downriver, the current survival rate through each dam is between 95% - 98%. The amount of capture and transportation has been reduced to about 35% (depending on the species) in recent years due to improvements made to passage infrastructure.

“Columbia River System Operation Review Final Environmental Impact Statement.” *Bonneville Power Administration*, U.S. Department of Energy, Nov. 1995, www.bpa.gov/efw/Analysis/NEPADocuments/nepa/System_Operation_Review/pdf/FinalEISSummary.pdf.

The goals of the System Operation Review are to 1) develop a system operating strategy and a regional forum for allowing interested parties (other than USACE, USBR and BPA) a long-term role in system planning and 2) provide the environmental analysis needed for the federal agencies to sign new agreements for coordinating power generation. The preferred alternative for a system operating strategy is adaptive management, where operations can be modified to meet changes in the natural environment, as well as other arenas. Means to achieve the preferred alternative include a combination of in-river migration and barge

transportation of smolts; a combination of different spill rates; operate John Day Dam and the LSRD at minimum operating pools (drawdown) throughout the year and during spring/summer; maintain sliding scale targets for flow augmentation; and limit the elevation to which the reservoirs are drafted.

Connolly, Kieran P. “2018 Pacific Northwest Loads and Resources Study.” *Bonneville Power Administration*, U.S. Department of Energy, Apr. 2019, www.bpa.gov/p/Generation/White-Book/wb/2018-WBK-Loads-and-Resources-Summary-20190403.pdf.

The Pacific Northwest Loads and Resources Study (commonly referred to as the “White Book”) is a planning document produced by the Bonneville Power Administration that presents its projection of load and resource conditions for the upcoming 10-year period (OY 2020 through 2029). The White Book includes analysis of Bonneville’s forecasts of expected power obligations and resource generation for both the Federal system and the Pacific Northwest region as a whole. The information contained in the White Book is used for: 1) long-term planning throughout Bonneville; 2) in planning studies for the Columbia River Treaty; and 3) as a published record of information and data for customers and other regional planning entities. The White Book is not used to guide day-to-day operations of the Federal Columbia River Power System.

Dauble, D. D., and D. R. Geist. “Impacts of the Snake River Drawdown Experiment on Fisheries Resources in Little Goose and Lower Granite Reservoirs, 1992.” *Impacts of the Snake River Drawdown Experiment on Fisheries Resources in Little Goose and Lower Granite Reservoirs, 1992 (Technical Report)* | OSTI.GOV, U.S. Department of Energy, 1 Sept. 1992, www.osti.gov/servlets/purl/7148129.

In March 1992, USACE initiated a test to help evaluate physical and environmental impacts resulting from the proposed future drawdown of Snake River reservoirs. Drawdown would reduce water levels in Snake River reservoirs and was proposed as a solution to decrease the time it takes for salmon and steelhead smolts to migrate to the ocean. The Pacific Northwest Laboratory evaluated impacts to specific fisheries resources during the drawdown experiment by surveying Lower Granite Reservoir to determine if fall Chinook salmon spawning areas and steelhead access to tributary creeks were affected. In addition, shoreline areas of Little Goose Reservoir were monitored to evaluate the suitability of these areas for spawning by fall Chinook salmon. Surveys and observations made during the drawdown indicated that known fall Chinook salmon spawning areas upstream of Lower Granite Reservoir were not influenced by the experiment. However, lower pool elevations would prohibit adult steelhead passage to Alpowa Creek.

Dehart, Michele. “Comparative Survival Study of PIT-Tagged Spring/Summer/Fall Chinook, Summer Steelhead, and Sockeye 2017 Annual Report.” *Fish Passage Center*, Bonneville Power Administration, Dec. 2017, www.fpc.org/documents/CSS/2017%20CSS%20Annual%20Report%20ver1-1.pdf.

This report updates the historical time series life-cycle monitoring data and includes enhancements to analyses based upon review comments and recommendations from the fishery management agencies, tribes and the Northwest Power and Conservation Council’s Independent Scientific Advisory Board. The long-term objective of the CSS is to link stages of the salmon life cycle, the factors influencing survival at each life stage, and understanding how each factor affects survival at later life stages, resulting in smolt-to-adult return rates. If

the lower four Snake River dams are breached and the remaining four lower Columbia dams operate at BioP spill levels, FPC predicts approximately a two- to threefold increase in abundance above that predicted at BiOp spill levels in an impounded system, and up to a two to three-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.

DeHart, Michele. "Comparative Survival Study Of PIT-Tagged Spring/Summer/Fall Chinook, Summer Steelhead, and Sockeye 2018 Annual Report." *Fish Passage Center*, Dec. 2018, <http://www.fpc.org/documents/CSS/2018%20CSS%20Annual%20Report.pdf>

This Comparative Survival an annual report from the Fish Passage Center in collaboration with US Fish and Wildlife, the Columbia River Inter-Tribal Fish Commission and the Fish and Wildlife Departments of Idaho, Oregon and Washington; it has been ongoing since the mid-1990s. The long-term objective of the CSS is to link stages of the salmon life cycle, the factors influencing survival at each life stage and understanding how each factor affects survival at later life stages, resulting in smolt-to-adult return rates. This report has new analysis compared to previous reports by including life cycle analysis of upper Columbia Chinook, with an analysis of PIT tag and coded wire tag effects on SARs, and new methods of estimation of detection probability at Bonneville Dam for juvenile migrants.

Dehart, Michele. "Delayed/Latent Mortality and Dam Passage, Fish Passage Operations Implications." Received by Ed Bowles, 6 Oct. 2010. <http://www.fpc.org/documents/memos/135-10.pdf>

This is a memo from Michele DeHart of the Fish Passage Center to Ed Bowles of the Oregon Department of Fish and Wildlife on delayed and latent mortality associated with dam passage as well as the implications that the FPC findings have on fish passage operation in the Columbia and Snake river systems. The FPC concludes there is a broad range and scope of evidence that indicates powerhouse passage and the transportation/collection/bypass system at dams result in significant delayed and latent mortality of juvenile salmonids. It cites findings from a variety of studies, including one that found that bypassed and transported fish have similar experiences in passing through powerhouses, and concludes these two types of dam passage result in similar levels of delayed and latent mortality. It also cites studies that find individual project acoustic tag estimates of bypass survival at a single dam do not capture latent mortality as a result of the juvenile bypass passage.

DeHart, Michele. "Review of Paulsen and Fisher Draft Entitled, 'Bypass Effects and Smolt-to-Adult Survival: A Re-Analysis of CSS and Transport Study Yearling Chinook and Steelhead Smolts', Dated July 1, 2016." Received by Tom Lorz, et. al, 847 NE 19th Ave., Suite 250, 15 Nov. 2016, Portland, OR. <http://www.fpc.org/documents/memos/63-16.pdf>

This memo from Michele Dehart of the Fish Passage Center to the writers of a draft report from the USACE Study Review Work Group indicates the FPC does not agree with the overall conclusions of the report due to a variety of factors and feels that the report doesn't raise valid concerns regarding the Comparative Survival Study analytical results and the management applications of those results. The draft report proposes that smaller fish are more likely to enter juvenile bypass and collection systems, but FPC reviewed the findings and states, if this was actually occurring, the bypass systems would be disproportionately

affecting wild stocks of salmon and steelhead than on larger hatchery produced fish. FPC also found that the draft report was fraught with contradictions and conflicting findings which raise serious questions and concerns about the validity and conclusions of the report.

Domanski, Adam. "Lower Snake River Dams Economic Tradeoffs of Removal." *ECONorthwest*, Vulcan, Inc, 29 July 2019, [static1.squarespace.com/static/597fb96acd39c34098e8d423/t/5d41bbf522405f0001c67068/1564589261882/LSRD Economic Tradeoffs Report.pdf](https://static1.squarespace.com/static/597fb96acd39c34098e8d423/t/5d41bbf522405f0001c67068/1564589261882/LSRD+Economic+Tradeoffs+Report.pdf).

This report by the firm ECONorthwest, funded by Vulcan Inc., explores the economic implications of removing the lower Snake River dams. It was published on July 29, 2019. It estimates the removal of the lower Snake River dams would provide the region with \$12.1 billion in benefits and would cost the region \$3.46 billion for a net benefit of \$8.65 billion. The majority of these benefits would come from what the report states are "Potential Non-Use" benefits which are described as how much the average household is willing to pay out of pocket to protect salmon and steelhead. Through public surveys, it determined that the average household would be willing to pay an additional \$39.89 on their electric bill in order to protect salmon and steelhead populations as well as restoring the habitat to a natural state. In terms of transportation costs, it estimates that the current amount spent by federal appropriations to subsidize barging as well as lock and dam maintenance is enough to offset any costs to transportation that would result with the removal of the dams.

"ESA Recovery Plan for Snake River Spring/Summer Chinook Salmon (*Oncorhynchus Tshawytscha*) & Snake River Basin Steelhead (*Oncorhynchus Mykiss*)." *Nation Marine Fisheries Service*, National Oceanic and Atmospheric Administration, Nov. 2017, www.westcoast.fisheries.noaa.gov/publications/recovery_planning/salmon_steelhead/domains_interior_columbia/snake/Final%20Snake%20Recovery%20Plan%20Docs/final_snake_river_spring-summer_chinook_salmon_and_snake_river_basin_steelhead_recovery_plan.pdf.

This document includes the components of the ESA Recovery Plan for Snake River spring/summer Chinook and steelhead. The goal of the Plan is to improve the viability of Snake River spring/summer Chinook salmon and steelhead, and the ecosystems upon which they depend, to the point that the fish populations are self-sustaining in the wild and no longer require ESA protection. The Plan provides a roadmap that builds on past and current efforts to recover the species. It includes a summary of threats, strategies and actions, an adaptive management framework (which includes research, monitoring, and evaluation), time and cost estimates, and an implementation framework. NMFS intends to use the recovery plan to organize and coordinate recovery of the species in partnership with state, tribal, and federal resource managers.

Filardo, Margaret, et al. "Science-Based Solutions Are Needed to Address Increasingly Lethal Water Temperatures in the Lower Snake River." Received by Northwest Policymakers - Governors and Members of Congress, 22 Oct. 2019. <https://static1.squarespace.com/static/55a5773ae4b081289a66090b/t/5db0886bbf234954c1932976/1571850347966/2019.Sci.Letter.Snake.climate.final.pdf>

This is a letter from a group of 55 fisheries and natural resources scientists to Gov. Inslee about how the current Federal Columbia River Power System reservoirs on the lower Snake River have been increasingly warming the river above critical levels during the late summer

months. The warming has been found to have multiple negative effects on salmon at all life stages, like direct mortality, migration delay, reduced gamete viability and increased rates of disease. The letter states that cold-water resources to protect migrating salmonids in the existing hydrosystem are extremely limited and there are no additional resources available that can significantly cool the river.

“Final Lower Snake River Juvenile Salmon Migration Feasibility Report/Environmental Impact Statement.” *US Army Corps of Engineers Walla Walla District*, U.S. Department of Defense, Feb. 2002, www.nww.usace.army.mil/Portals/28/docs/library/2002%20LSR%20study/Summary.pdf?ver=2019-05-03-131237-337.

This Feasibility Study/EIS focused on the relationship between the four dams on the lower Snake River and their effects on juvenile fish traveling toward the ocean. It was generated as a response to the alternatives presented in NMFS's 1995 Biological Opinion (which was updated in 2000). The Final FR/EIS incorporates evaluation of additional data, comments and other information gathered since release of the draft document. The Final FR/EIS also provides river managers, users and the general public with the information and evaluation processes that were used to select a preferred alternative: Major System Improvements, with increased focus on adaptive migration capabilities. This alternative provides the maximum operational flexibility for juvenile fish passage; it optimizes in river passage when river conditions are best for fish and optimizes the juvenile transportation program when that operation is best for fish.

“Fish Passage & Reintroduction into the U.S. & Canadian Upper Columbia Basin.” *Canadian Columbia River Inter-Tribal Fisheries Commission*, July 2015, ccrffc.org/cms/wp-content/uploads/2015/10/Fish_Passage_and_Reintroduction_into_the_US_And_Canadian_Upper_Columbia_River4.pdf.

The Columbia Basin tribes and First Nations jointly developed this paper to inform the U.S. and Canadian Entities, federal governments, and other regional sovereigns and stakeholders on how anadromous salmon and resident fish can be reintroduced into the upper Columbia River Basin. Reintroduction and restoration of fish passage could be achieved through a variety of mechanisms, including the current effort to modernize the Columbia River Treaty. Restoring fish passage and reintroducing anadromous fish should be investigated and implemented as a key element of integrating ecosystem-based function into the Treaty.

“Fish Passage and Reintroduction Phase 1 Report: Investigations Upstream of Chief Joseph and Grand Coulee Dams.” *Upper Columbia United Tribes*, 2 May 2019, securservercdn.net/104.238.71.140/b63.d34.myftpupload.com/wp-content/uploads/2019/05/Fish-Passage-and-Reintroduction-Phase-1-Report.pdf.

This analysis determines whether the reintroduction of salmon to the United States portion of the upper Columbia River upstream of Chief Joseph Dam is likely to achieve identified goals given current dam operations, riverine and reservoir habitat condition, donor stock availability, reintroduction risk to native species and effectiveness of state-of-the-art juvenile and adult passage technology. The Joint Paper identifies four initial goals for reintroducing anadromous salmon to habitat located upstream of Chief Joseph and Grand Coulee dams. The goals will be achieved by providing salmon access to the hundreds of miles of stream habitat in areas of the upper Columbia River basin currently blocked by Chief Joseph and

Grand Coulee dams. Ideally, this will be accomplished by providing adult and juvenile fish passage at all anthropogenic barriers that currently prevent Chinook, sockeye, coho and steelhead access to historical habitat.

Ford, Richard. "Statewide Rail Capacity and System Needs Study." *Washington State Transportation Commission*, Dec. 2006, wstc.wa.gov/Rail/RailFinalReport.pdf.

The Washington Rail Capacity and System Needs Study was requested by the Washington State Legislature to assess rail needs in the state, determine the state's interest in rail, develop policies to govern the state's participation in rail and develop a plan for managing the rail lines, railcars and service rights owned by the state. The economic vitality of Washington requires a robust rail system capable of providing its businesses, ports and farms with competitive access to North American and overseas international markets. The benefits that Washington can obtain from a robust rail system are threatened because the system is nearing capacity. Service quality is strained and rail rates are going up for many Washington businesses. The pressure on the rail system will increase in the next decades. The state should participate in the rail system through a mix of direct investment, financial incentives to private parties and advocacy on behalf of Washington businesses and communities. However, the state should do so only when the projects or actions can be demonstrated to deliver public benefits to the citizens and businesses, and when it has been demonstrated that there is a low likelihood of obtaining these benefits without public involvement.

Giles, Deborah A, et al. "Orca Scientists Letter." Received by Stephanie Solien, and Les Purce, *Orca Scientists Letter*, 15 Oct. 2018, <https://www.documentcloud.org/documents/5002547-Orca-Scientists-Letter-10-15-18-Final.html>

This letter was sent to Gov. Inslee and the chairs of the Southern Resident Orca Recovery Task Force from a group of scientists who are advocates for the Southern Resident orcas; it describes key considerations that the scientists believe should be brought up within the task force's process. The scientists state that the abundance of Chinook salmon needs to increase on a year-round basis; the task force needs to fully appreciate the role that spring Chinook play in the life history of the orcas; that stocks of spring Chinook within the Columbia Basin warrant special attention; and they recommend that spill be increased to 125% TDG. They also assert that breaching the LSRD is the way to restore the lower Snake River. The scientists include individuals we are considering interviewing as a part of our stakeholder engagement process as experts on Southern Resident orcas.

Grace, Sharon. "Policy & Factual Points for Breaching the Four Lower Snake River Dams." *Dam Sense*, 2018, damsense.org/policy-factual-points-breaching-four-lower-snake-river-dams/.

This is an online list of facts and policy points listed by Dam Sense, a community that advocates for the removal of the Lower Snake River Dams. The general format of each point includes a quote or excerpt from a research report and commentary on how the excerpt shows why the lower Snake River dams should be breached. Due to the nature of the sources of this list, it is useful to show the perspectives and where those perspectives are rooted from the breaching side of the argument, but the sources need to be researched further to show what the reports are stating as fact.

Hammond, Paula J. “Washington State 2010-2030 Freight Rail Plan.” *Washington State Department of Transportation*, Washington State, Dec. 2009, www.wsdot.wa.gov/NR/rdonlyres/AFF740F6-20F2-4C85-8569-F107E5B649D8/0/StateFreightRailPlan.pdf.

Washington’s economy needs a vibrant, competitive rail network. This network must provide a reliable, accessible and cost-effective freight service to shippers and customers across the state. An assessment of the freight needs was completed as part of this plan. The assessment is based on data provided directly by the state’s freight railroads, ports, public agencies and other key stakeholders. In total, this needs assessment identifies 109 short- and long-term capital improvement projects and other initiatives. The total cost for the requested projects, where cost estimates are available, is \$2 billion. Other issues that need to be considered in the development of this plan are: proposed rail abandonments and at-risk lines, port access, intermodal connectors and emerging issues that face freight rail in this state. The state needs to develop a comprehensive system to prioritize these projects, using a cost benefit approach, to obtain the maximum benefit for the public’s investment into any private infrastructure that is clearly measurable.

Harkema, Peter. “Columbia River Basin Salmon and Steelhead Long-Term Recovery Situation Assessment.” *The William D. Ruckelshaus Center*, The University of Washington Evans School, 7 June 2013, <https://s3.wp.wsu.edu/uploads/sites/2180/2013/06/ColumbiaRiverBasinSalmonandSteelheadLong-TermRecoverySituationAssessment-FinalReport.pdf>

This report was written by the William D. Ruckelshaus Center in 2013 in collaboration with the Oregon Consensus Center at the request of NOAA Fisheries. It provides a neutral third-party situation analysis of the regional views around lower Snake River dams and recommends an approach to comprehensive, long-term salmon and steelhead recovery in the region. Some key takeaways from the report are: all parties are committed to the recovery of salmon and steelhead; there is general sentiment among a majority of the parties that any process needs a strong leadership body charged with overseeing the salmon recovery process; and there should be a neutral science board that is the arbiter of what is considered “good” science. Some groups believe that more should be invested in the monitoring and evaluation of recovery actions, as well as greater efficiency, certainty, transparency, and predictability; improved relationships; and more durable solutions for salmon and steelhead recovery in the Basin.

Jones, Anthony. “Lower Snake River Dam Navigation Study.” *Rocky Mountain Econometrics*, Save Our Wild Salmon, 30 Sept. 2015, static1.squarespace.com/static/55a5773ac4b081289a66090b/t/563be13be4b0678da1393b9d/1446764859083/LSD+Navigation+Study+2015.Final.pdf.

This report emphasizes the decline/reduced need of shipping/barging on the Snake River; its thesis is the benefits of navigation are decreasing, the costs of maintaining the LSRD are increasing and the benefit-cost ratio indicates the dams should be shut down. The only product still being shipped regularly is barley/wheat, and Jones argues that farmers are interested in exploring higher-value crops (e.g., chickpeas/rapeseed) that don't fit well into shipping containers. He points out that rail is a better alternative to barge for shipping crops.

Jones, Anthony, and Linwood Laughy. “Bonneville Power Administration and the Lower Snake River Dams: The Folly of Conventional Wisdom.” *Rocky Mountain Econometrics*, June 2018, www.rmecon.com/examples/BPA%20&%20LSRDs%206-5-18.pdf.

This report was written by the firm Rocky Mountain Econometrics, an economic analysis firm that performs economic analysis for a variety of private and public organizations primarily within the Columbia Basin. It deals with the economic implications of the current operating conditions of the lower Snake River dams. It describes the level of power generation the dams currently operate and how surplus power generated from the dams is sold on the open market, often at either no profit or even at a negative price. The analysis is limited to hydropower production; it does not address the economic benefits from recreation, tourism, commercial fishing or the biological implications of breaching the dams.

“Juvenile Salmon Survival in 2018 and River Conditions.” Fish Passage Center. Received by Michele DeHart, 6 Mar. 2019. <http://www.fpc.org/documents/memos/9-19.pdf>

This is a memo from the Fish Passage Center (FPC) to Michele Dehart about the findings from the 2018 Comparative Survival Study on juvenile salmon survival rates on a per reach basis and compares that year’s results with the previous twelve years of results. The 2018 juvenile spring/summer Chinook survival rate was 0.64 which was slightly higher than the 2006 - 17 average of 0.63, while steelhead had a survival rate of 0.68 which was above the average rate of 0.60. It also compared their survival estimates with those of NOAA and found that NOAA estimates of survival were lower in 2018 and in general, were lower from 2006 - 17. Differences in estimates of reach survival between FPC and NOAA may indicate the effect of the bypasses since the NOAA estimates are generally lower than FPC estimates.

Lewison, Pam. “Study Suggests Dry Land Farming, New Lives to Southeastern WA Farmers.” Washington Policy Center, 12 Aug. 2019, www.washingtonpolicy.org/publications/detail/study-suggests-dry-land-farming-new-lives-to-southeastern-wa-farmers.

This article is a rebuttal to ECONW's *Lower Snake River Dams: Economic Tradeoffs of Removal* report. Lewison takes issue with two of the report's assertions:

1. *Non-irrigated farming is a reasonable choice for farmers who currently grow irrigated crops.* Lewison points out that each area of outheastern Washington faces unique challenges and a one-size-fits-all approach to agriculture is not appropriate; irrigated crops are more valuable than non-irrigated crops; different areas lend themselves well to specific types of farming; and it's not easy or efficient for farmers to move from one product to another, especially as agriculture is a business of relationships built over time.

2. *The cost to change irrigation infrastructure is relatively minor.* Lewison points out that ECONW used data from 1999 to estimate infrastructure changes would cost ~\$165 million.

“Lower Snake River Dams Power Replacement Study.” *Energy Strategies*, NW Energy Coalition, Mar. 2018, rossstrategic365.sharepoint.com/BD/BidTracking/
<https://nwenergy.org/featured/lsrcstudy/>

This NW Energy Coalition report from 2018 shows it is possible to replace the power generated by the Lower Snake River Dams with a variety of different energy portfolios, some of which could increase the reliability of the system with only minor rate and emission

increases. This report used data from Bonneville Power Administration, grid constraints laid out by the Northwest Grid Council, and models used by the National Reliability Council for their analysis. While this analysis shows that it is possible to compensate for the energy production lost from breaching the dam, the proposed portfolios would need to be optimized by the NWPCC and BPA to fit with their energy goals.

Mainzer, Elliot. “Greenwire Article Response.” Received by Cyril T. Zaneski, 5 Sept. 2019
<https://www.bpa.gov/news/newsroom/Pages/BPA-responds-to-deeply-flawed-article-on-agencys-financial-health.aspx>

This is a letter from Elliot Mainzer the current CEO of Bonneville Power Administration in response to an article E&E News. The letter outlines areas of the article that BPA took issue with and provides context as well as additional information to back up their claims. One instance is on BPA’s debt which as BPA states is not paid for with taxpayer dollars and they are on track to pay their annual debt payments for the next three years.

Matthews, Gene M, and Robin S Waples. “Status Review for Snake River Spring and Summer Chinook Salmon.” *NOAA Tech Memo NMFS F/NWC-200: Status Review for Snake River Spring and Summer Chinook Salmon*, June 1991,
www.nwfsc.noaa.gov/publications/scipubs/techmemos/tm200/tm200.htm.

The National Marine Fisheries Service Species Definition Paper (Waples 1991) provides a guide for evaluating the petitions for the three forms (spring-, summer-, and fall-run) of Snake River Chinook salmon. NMFS considers fall Chinook separately and spring and summer Chinook in ESA evaluations. This report summarizes the review of the status of Snake River spring and summer Chinook conducted by the NMFS Northwest Region Biological Review Team. Collectively, the data indicate that spring and summer Chinook in the Snake River are in jeopardy: Present abundance is a small fraction of historical abundance, the Dennis model provides evidence that the ESU is at risk, threats to individual subpopulations may be greater still, and the short-term projections indicate a continuation of the downward trend in abundance. NMFS does not feel the evidence suggests that the ESU is in imminent danger of extinction throughout a significant portion of its range; however, it is likely to become endangered in the near future if corrective measures are not taken.

Mojica, J., Cousins, K., Briceno, T., 2016. 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). Earth Economics, Tacoma, WA.
<http://www.damsense.org/wp-content/uploads/2014/12/National-Economic-Analysis-of-the-Four-Lower-Snake-River-Dams-2.16.pdf>

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. It concludes 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 report says the four lower Snake River dams in southeast Washington do not provide a net benefit to the nation, and they may never have.

Myers, Todd. *The Environmental Tradeoffs of Removing Snake River Dams*, 53 Idaho L. REV. 209 (2017) <https://www.washingtonpolicy.org/library/doclib/Todd-Myers-1--1.pdf>

This analysis examines the cost of replacing the energy generated by the LSRD and fully mitigating the carbon emissions associated with replacement. It concludes that the cost of removing the dams is very high for both the economy and the climate; it would eliminate carbon-free energy greater than the entire stock of wind and solar energy in Washington and oblige utilities to replace a relatively low-cost source of energy with high-cost alternatives. The report acknowledges that this conclusion is not entirely objective, given how one might value different aspects of the dams; it does "not claim to be a mathematical calculation of the overall benefits and costs of removing the dams." It is meant to serve as a data source to narrow and refine the debate over the dams.

"NOAA Fisheries 2019 CRS Biological Opinion." *NOAA Fisheries West Coast Region*, National Oceanic and Atmospheric Administration, 29 Mar. 2019, www.westcoast.fisheries.noaa.gov/publications/hydropower/fcrps/master_2019_crs_biological_opinion_1.pdf.

This report was released by NOAA Marine Fisheries Services as their most recent Biological Opinion in 2019 for how the operations within the Columbia River system are affecting the ESA-listed stocks within the system. This Biological Opinion is broken down by the various reaches that the ESA-listed stocks inhabit, including the four listed Snake River stocks. The BiOp describes the stock's current status, range, environmental baseline, the effects the action would have on the stocks and their conclusion for moving forward for recovery on the stocks. One of the main actions considered in this Biological Opinion is the shift towards 125% TDG Flex Spill plans at the dams to increase juvenile survival through the dams. For all the stocks, this proposed action would not have detrimental effects on recovery or survival of the stocks.

Peterson, Lynn. "Washington State Rail Plan Integrated Freight and Passenger Rail Plan 2013-2035." *Washington State Department of Transportation*, Mar. 2014, www.wsdot.wa.gov/sites/default/files/2019/03/08/Rail-Plan-20132035.pdf.

The purpose of the Washington State Rail Plan is to outline strategies for addressing changes and provide a blueprint for ensuring the continued movement of people and goods on the rail system in support of a healthy economy. It sets a course for state action and investment to ensure that these vital services continue to meet transportation needs now and through 2035. This plan melds the state-level policy direction with feedback from stakeholders, Tribes and the public to guide identification of needs and development of recommendations. Public actions to improve the rail system are identified, and policies for state action are recommended.

Purce, Les, and Stephanie Solien. "Southern Resident Orca Task Force Report and Recommendations." *Washington Governor Jay Inslee*, Washington State, 16 Nov. 2018, www.governor.wa.gov/sites/default/files/OrcaTaskForce_reportandrecommendations_11.16.18.pdf.

This report was produced by Gov. Jay Inslee's Southern Resident Orca Task Force, a collaborative process that brought together stakeholders from around the state to discuss a plan on how to restore the Southern Resident orca populations in Puget Sound. The report

highlights four goals for restoring the Southern Resident orca population and 36 recommendations. Recommendations eight and nine refer to this current stakeholder engagement process. The four goals are 1) increase chinook salmon abundance, 2) decrease disturbance of and risk to Southern Resident orcas from vessels and noise and increase their access to prey, 3) reduce the exposure of Southern Resident orcas and their prey to contaminants, and 4) to ensure funding, information and accountability mechanisms are in place to support effective implementation. The report includes public comments, responses to those public comments and minority reports that include views and perspectives that can be captured within our process.

“Recovery Plan for Southern Resident Killer Whales (*Orcinus orca*).” National Marine Fisheries Service, Northwest Region, Seattle, Washington, 2008, https://www.westcoast.fisheries.noaa.gov/publications/protected_species/marine_mammals/killer_whales/esa_status/srkw-recov-plan.pdf

This is NMFS's recovery plan for Southern Resident orcas, as required by the Endangered Species Act. Southern Resident orcas were ESA-listed in 2005; this document outlines the process NMFS went through to develop a recovery plan, the recovery strategy and its goals/objectives, and estimates the cost of recovery. The recovery strategy acknowledges the considerable uncertainty as to which threats are responsible for the declining orca population and provides an adaptive management approach that addresses each of the potential threats based on the best available science.

Resources, Meyer. “Tribal Circumstances & Impacts from the Lower Snake River Project on the Nez Perce, Yakama, Umatilla, Warm Springs, and Shoshone Bannock Tribes.” *Columbia River Intertribal Fisheries Commission*, Apr. 1999, www.critfc.org/wp-content/uploads/2014/11/circum_exec.pdf.

This report considers impacts on the Nez Perce Tribe, the Yakama Indian Nation, the Confederated Tribes of the Umatilla Indian Reservation and the Confederated Tribes of the Warm Springs Reservation of Oregon. Today, the tribes have lost the greatest part of the salmon protected in their treaties with the United States. The further up-river one goes, the greater the losses that have occurred. Above the four lower Snake River dams, tribal salmon are presently harvested at less than 1% of pre-contact levels. The four lower Snake River dams evaluated in this report have significant, but not sole responsibility for the desperate present circumstances of tribes. Construction of these dams transformed the production function of the lower Snake River – taking substantial Treaty-protected wealth in salmon away from the tribes, as evidenced by the miniscule tribal harvests currently taken above the dams.

“Revenue Stream: An Economic Analysis of the Costs and Benefits of Removing the Four Dams on the Lower Snake River.” *Save Our Wild Salmon*, 2005, docs.streamnetlibrary.org/revenuestream8.pdf

This BCA answers two questions: 1) What are the costs of restoring salmon with and without the dams, and 2) What are the economic benefits with and without the dams? Ultimately, it demonstrates that removing the four lower Snake River dams in Washington state as the centerpiece of a Columbia River salmon protection plan will return significant economic dividends to the Northwest and the nation, creating a “revenue stream” of both cost savings and economic benefits from new and restored industries.

“Review of the 2014 Columbia River Basin Fish and Wildlife Program.” *Independent Science Advisory Board*, Northwest Power and Conservation Council, 23 Mar. 2018, www.nwcouncil.org/sites/default/files/isab-2018-3-review2014fwp23march.pdf.

This report is by the Independent Science Advisory Board; it was commissioned by the Northwest Power and Conservation Council to evaluate the scientific merits of the Council's 2014 Columbia River Basin Fish and Wildlife Program so that NWPCC could amend the program in 2018. Overall, the ISAB found that most sections of the 2014 Program provide sound scientific guidance for actions to mitigate hydrosystem impacts and move toward recovery of fish and wildlife resources in the Columbia River Basin. Program strengths include Mainstem Hydrosystem research, the Protected Areas, strategies such as the Stronghold Habitat and Anadromous Fish Mitigation in Blocked Areas, and Public Engagement. Weaknesses include the fact that the majority of Program goals do not have corresponding objectives, key program strategies do not have monitoring and evaluation plans or funding, and the Program provides limited guidance and use of adaptive management. In addition to specific recommendations for weaknesses listed above, the ISAB's review contains additional points of emphasis for the Council's consideration.

“Review of the SOS Revenue Stream Report.” *Northwest Power and Conservation Council*, Independent Economic Analysis Board, 25 Feb. 2007, www.nwcouncil.org/fish-and-wildlife/fw-independent-advisory-committees/independent-economic-advisory-board/review-of-the-sos-revenue-stream-report.

The Independent Economic Analysis Board reviewed SOS's Revenue Stream BCA and found: (1) The Revenue Stream report underestimates hydropower replacement costs by enough to invalidate its main conclusion that the region could save money by removing the dams. (2) The Revenue Stream report is not a peer reviewed analysis, the work was not conducted by an open public process, and many of the sources that the report relied on came from reports that were also not products of an open, public peer-reviewed process. (3) The Revenue Stream report does not discount future benefits and costs of dam removal, which could drastically affect conclusions. (4) The reported recreational fishery benefits rely heavily on a study by Don Reading (2004), which the IEAB reviewed in December 2005. The IEAB concluded that Reading had made a number of methodological errors which seriously biased his benefit estimates upward. The non-fishery recreational benefits are derived from a study by John Loomis (1999) which the IEAB reviewed during its overall review of the Corps' EIS in 2001. The IEAB had significant concerns about some of Loomis' results as well, and the numbers actually used in the final Corps EIS differed substantially from those presented in the original Loomis study. Hence, the Revenue Stream's reported benefits from salmon recovery in the Snake River appear unreliable.

“Seventh Northwest Conservation and Electric Power Plan.” *Northwest Power and Conservation Council*, 25 Feb. 2016, www.nwcouncil.org/sites/default/files/7thplanfinal_allchapters_1.pdf.

The Council's seventh NW Conservation and Electric Power Plan addresses the uncertainties faced by the Pacific Northwest's power system (e.g., compliance with federal carbon dioxide emissions regulations, future fuel prices, or renewable resources and technology) and provides guidance on which resources can help ensure a reliable and economical regional power system over the next 20 years. Acquiring energy efficiency is the primary action for the next six years. The Plan's second priority is to develop the capability

to deploy demand-response resources or rely on increased market imports to meet system capacity needs under critical water and weather conditions. After energy efficiency and demand response, new natural gas-fired generation is the most cost-effective resource option for the region in the near-term. The Plan encourages research in advanced technologies to improve the efficiency and reliability of the power system. For example, emerging smart-grid technologies could make it possible for consumers to help balance supply and demand.

Simmons, Sara, and Ken Casavant. "The Economic and Environmental Impacts of The Columbia-Snake River Extended Lock Outage." *Freight Policy Transportation Institute*, Washington State University, Aug. 2011, ses.wsu.edu/wp-content/uploads/2015/07/FPTI-12.pdf.
<http://ses.wsu.edu/wp-content/uploads/2015/07/FPTI-12.pdf>

This report's main objectives are to 1) analyze the change in rates and modal costs for shippers, commodity industries and ports prior to, during and after the 15-week lock outage and 2) determine the impacts on the environment in the form of energy consumption and emissions production prior to, during and after the lock outage in winter 2010-11. During a transportation disruption, such as the extended lock outage, alternative modes are used more frequently and heavily as barge transportation is unavailable. The lock outage on the Columbia-Snake River forced commodities that regularly travel by barge to shift to rail and truck. As a result, transportation costs incurred a 37.4% increase. Along with energy consumption, emissions production also increased due to the lock outage. The total change in emissions due to the loss of barge during the lock outage caused a 9% increase in overall emissions from the transportation commodities.

"Southern Resident Killer Whales: 10 Years of Research and Conservation." *Northwest Fisheries Science Center*, National Oceanic and Atmospheric Administration, June 2014,
www.nwfsc.noaa.gov/news/features/killer_whale_report/pdfs/bigreport62514.pdf.

This report by NOAA Fisheries in 2014 covers the past 10 years of conservation efforts for the benefit of the Southern Resident orcas and what needs to happen for the recovery of the species over the next 10 years. It summarizes the current recovery plans for the orcas, the current major threats to the species, what critical information gaps were filled over the past ten years and what ongoing recovery measures are in place for the orcas. The report brings up the fact that the Southern Residents are altering their behavior in the presence of vessel noise and that even though PCBs have been phased out by humans, are still being bioaccumulated within the tissues of the Southern Residents due to the high prevalence of the toxins within their food and habitat.

"Southern Resident Killer Whale Priority Chinook Stocks Report." *National Marine Fisheries Service*, National Oceanic and Atmospheric Administration, 22 June 2018,
www.westcoast.fisheries.noaa.gov/publications/protected_species/marine_mammals/killer_whales/recovery/srkw_priority_chinook_stocks_conceptual_model_report_list_22june2018.pdf.

This 2018 report describes the current status of the key fish stocks identified as being the highest priority for recovery due to their prevalence within the Southern Resident orca whale's diet. The report was the basis of the shorter summary in the Fact Sheet and shows how NOAA concluded that the northern and southern Puget Sound stocks of fall Chinook salmon are the most important to recover for the benefit of the orcas. NOAA evaluated each stock based upon the amount that the stock contributes to the diet of the orcas, the

amount that the particular stock is consumed when other stocks are less abundant, and the amount of spatial and temporal overlap with the range of the stock and the orcas. The Snake River spring/summer Chinook stocks come in fifth due to the lower levels of spatio-temporal overlap with the Southern Resident orcas compared to other higher priority stocks like Puget Sound fall or lower Columbia spring Chinook.

“Sothern Resident Killer Whales and Snake River Dams Fact Sheet.” *NOAA Fisheries West Coast Region*, National Oceanic and Atmospheric Administration, 2016, www.westcoast.fisheries.noaa.gov/publications/protected_species/marine_mammals/killer_whales/killerwhales_snakeriverdams.pdf.

This fact sheet was released by NOAA Fisheries Service in 2016. It presents a high-level overview of how the dams along the lower Snake river affect the Southern Resident orcas. It explicitly states that NOAA has not concluded that breaching the dams is necessary to the recovery of Snake River salmonids or Southern Resident orcas. It addresses other factors affecting the Southern Residents, such as vessel traffic and pollution within the Salish Sea, and states that saving the Southern Residents will take a variety of mitigation and recovery efforts over the course of many years and that the recovery effort of one salmon species in one river won't bring about recovery of the Southern Residents on its own.

“Southern Resident Killer Whales and West Coast Chinook Salmon.” *NOAA*, National Oceanic and Atmospheric Administration, 2018, www.nww.usace.army.mil/Portals/28/docs/V2N/FactSheets%20not%20508/10.4.2018_S_RKW_salmon_sources_factsheet%206PM.pdf?ver=2018-10-22-181659-907.

This fact sheet that NOAA Fisheries released in 2018 shows the link between the Southern Resident orcas and Chinook salmon on the West Coast. It shows the key threats the Southern Residents currently face, the key stocks NOAA identified as priority stocks for the Southern Residents, the current abundance of these key Chinook stocks, and the trends for the different stocks in Washington. The fact sheet states that dam breaching is a long-term proposition that takes congressional authorization and recovery results will not be apparent until several generations after the breaching. NOAA perceives that northern and southern Puget Sound stocks of fall Chinook salmon are the highest priority for recovery, with Snake River spring/summer Chinook being the 5th highest priority, and these stocks aren't showing the increases in returns that the Snake River stocks is currently experiencing.

Tweit, Bill, et al. “State of Washington November 2018 Comprehensive Evaluation of the Columbia River Basin Salmon Management Policy C-3620, 2013-2017.” *Comprehensive Evaluation of the Columbia River Basin Salmon Management Policy C-3620, 2013-2017*, Washington Department of Fish and Wildlife, Nov. 2018, wdfw.wa.gov/sites/default/files/publications/02029/wdfw02029.pdf

This report by the Washington Fish and Wildlife Commission in 2018 that is a comprehensive review of the previous five years of the Columbia River Salmon Management Policy, which was first adopted in 2013. The evaluation assesses the success the policy was having toward stated objectives, areas where the policy was not working well, and to provide information on why areas were either doing well or poorly. It concluded the large economic benefits expected for both commercial and recreational fisheries were not observed, that commercial area enhancements and alternative gear development had not replaced mainstem

fisheries, recreational fisheries only had marginal benefits due to changes in allocations and that the overall expectations in the development of the Policy were not met.

Widener, D. L., J. R. Faulkner, S. G. Smith, T. M. Marsh, and R. W. Zabel. 2018. Survival Estimates for the Passage of Spring-Migrating Juvenile Salmonids through Snake and Columbia River Dams and Reservoirs, 2017. Draft report of the National Marine Fisheries Service to the Bonneville Power Administration, Portland, Oregon, 2/1/2018.
https://www.nwfsc.noaa.gov/assets/26/9359_02262018_135356_Widener.et.al.2018-Spring-Survival-2017.pdf

In 2017, NOAA completed the 25th year of a study to estimate survival and travel time of juvenile Pacific salmon passing dams and reservoirs on the Snake and Columbia rivers. All estimates were derived from detections of fish tagged with passive integrated transponder (PIT) tags. In light of planned operations that will reduce detection probabilities below the current low levels, the need is now more urgent than ever before to develop PIT-tag detection capability through passage routes other than the juvenile bypass systems.

Ziegler, Brian. "2017 Marine Cargo Forecast and Rail Capacity Analysis Final Report." *Freight Mobility Strategic Investment Board*, Washington Public Ports Association, Aug. 2017,
<static1.squarespace.com/static/5a8499e518b27dc83c2403ce/t/5af0ba816d2a73731f8d1faa/1525725867212/Marine-Cargo-Forecast-2017-Final-10-2017.pdf>.

This report assesses the expected flow of waterborne cargo through Washington's port system and evaluates the distribution of cargo through the state's transportation network, including waterways, rail lines, roads and pipelines. The study includes forecasts of trade by commodity and cargo type from 2015 through 2035. Of the Snake River, the report says the Columbia-Snake River navigation system allows Washington-grown agricultural products to move from farm to market and creates price competition between modes of transportation. There is a steady demand for barge transportation on the Snake River. The report says Washington's public ports are vital and investing in transportation infrastructure – beginning with an efficient, cost-effective rail system - is the best way to maintain and expand the state's place in the global economy.

Ziegler, Brian. "2017 Marine Cargo Forecast and Rail Capacity Analysis Appendix A Rail Capacity Analysis." *Freight Mobility Strategic Investment Board*, Washington Public Ports Association, Aug. 2017,
<static1.squarespace.com/static/5a8499e518b27dc83c2403ce/t/5b5631f370a6ad58609ec92f/1532375542016/MCF-2017-Appendix-A.pdf>.

This analysis uses a rail model simulation for the greater rail network within Washington state (essentially the BNSF Railway network). The model simulation program used was the Rail Traffic Controller (RTC) simulation suite, which is used by all Class I North American railroads and is accepted as the standard analysis program for analyzing rail operations and capacity under various operating protocols, train volumes and infrastructure design. The Base Case conditions indicate that BNSF does not currently have capacity issues on most of their line segments in the PNW.

The following link includes additional letters, fact sheets, opinion pieces, resolutions and other information sources related to the LSRD provided by interviewees and other interested parties:
<https://app.box.com/s/smdi3sx4nz8z1pmfs5osteiemlohv61e>

Appendix B: Relevant State and Federal Studies and Task Forces

In recent decades, the LSRD have been the subject of numerous scientific, economic and environmental analyses and task forces. Listed below are the significant state and federal actions and organizations that informed the report.

Endangered Species Act Listings for Anadromous Fish in the Lower Snake River & NOAA National Marine Fisheries Service Biological Opinions

Four anadromous fish species in the lower Snake River are currently listed under the Endangered Species Act. Table 4 summarizes the species, status and year of listing. Under Section 7 of the ESA, federal agencies must consult with NOAA Fisheries on activities that may affect ESA-listed species. These inter-agency consultations are designed to help federal agencies in fulfilling their duty to ensure that their actions do not jeopardize the continued existence of a species or destroy or adversely modify designated critical habitat. NOAA Fisheries' Office of Protected Resources issues Biological Opinions to document its Opinions on how federal agencies' actions affect ESA-listed species and critical habitat.¹⁹⁷ Table 5 (below) summarizes the findings of NOAA National Marine Fisheries Service BiOps issued since 1992 on operation and maintenance of the Columbia River System Operations, including the LSRD.

NOAA has adopted three recovery plans for the four ESA-listed Snake River basin species – steelhead, spring/summer Chinook salmon, fall Chinook salmon and sockeye. NOAA's intent is to optimize recovery plan implementation through stakeholder involvement to prioritize and implement recovery actions; particularly through NOAA Fisheries' Snake River Coordination Group.¹⁹⁸

Table 7: Endangered Species Act Listings for Anadromous Fish in the Lower Snake River¹⁹⁹

Species	Status	Listing Year
Snake River fall Chinook	Threatened	1992
Snake River spring/summer Chinook	Threatened	1992
Snake River sockeye	Threatened	1991
Snake River steelhead	Endangered	1997

Table 8: NOAA National Marine Fisheries Service Biological Opinion Findings ²⁰⁰

Year	Findings	Litigation
1992 FCRPS BiOp	Two BiOps were issued this year. The first found that the federal power system's operations did not jeopardize the continued existence of listed fish or detrimentally alter their critical habitat. The second found no jeopardy to protected salmonids in the basin as a result of ocean fisheries and in-river fisheries.	Several users of the FCRPS energy filed suit challenging these BiOps claiming restricted operations would lead to increased rate, but the case was dismissed in the U.S. District Court of Oregon and an appeal was rejected by the Ninth Circuit Court of Appeals.
1993 FCRPS BiOp	Found that the federal power system's operations did not jeopardize the continued existence of listed fish or detrimentally alter its critical habitat.	This BiOp was challenged in the U.S. District Court of Oregon in the case <i>Idaho Department of Fish & Game v. National Marine Fisheries Service</i> and remanded to be rewritten by Judge Malcom Marsh.
1994 FCRPS BiOp	Found that the federal power system's operations did not jeopardize the continued existence of listed fish or detrimentally alter its critical habitat.	This BiOp was challenged in the case <i>American Rivers v. National Marine Fisheries Services</i> but the court stayed the case while NMFS revised the BiOp to comply with the previous ruling.
1995 FCRPS BiOp	Found that the federal power system's operations did jeopardize the continued existence of listed fish and adversely modified critical habitat, proposed Reasonable Prudent Alternatives (RPAs).	This BiOp was challenged in two cases, one by American Rivers and the other by a group of users of the FCRPS energy. The former suit was dismissed in the Ninth Circuit and the later suit was also dismissed by the same court.
2000 FCRPS BiOp	Found that the federal system's operations would jeopardize protected salmonids and proposed RPAs to alleviate the effects of operation on salmonids, but even with the implementation of these RPAs jeopardy would not be avoided so they proposed offsite activities unrelated to system operations to avoid jeopardy in tandem with the RPAs.	This BiOp was challenged in the case <i>Wildlife Federation v. National Marine Fisheries Service</i> where it was remanded to be rewritten in the U.S. District Court of Oregon by Judge James Redden due to his conclusion that the offsite activities were not reasonably certain to occur.
2004 FCRPS BiOp	NMFS took a different approach to BiOps and excluded the effects of each of the dams that already exists (i.e., included the dams in the environmental baseline) and found that the discretionary elements of the system's operations would not jeopardize the salmonids.	This BiOp was found incompatible with the Endangered Species Act by Judge James Redden and was remanded to be rewritten after the Ninth Circuit affirmed Judge Redden's decision.
2005 Upper Snake River BiOp	Found that the effects of BOR-proposed operations on the Snake River would not jeopardize the salmonids or detrimentally alter critical habitat.	This BiOp was challenged in the U.S. District Court of Oregon before Judge James Redden who remanded it to be rewritten because it utilized the same methodology of the 2004 BiOp that the court held to be flawed.
2008 BiOp	Found that the federal power system's operations did jeopardize the continued existence of listed fish or detrimentally alter its critical habitat through 2018 with the use of RPAs they could mitigate the effects of the FCRPS.	This BiOp was challenged by the same group of litigants from the 2000 BiOp, Judge James Redden ruled that parts of the BiOp did comply with the ESA but ultimately remanded it to be rewritten.

Year	Findings	Litigation
2010 Supplemental BiOp	Incorporated the measures that were agreed upon in the “Fish Accords” to avoid jeopardizing the listed salmonids as well as their critical habitat	This BiOp was collectively ruled upon with the 2008 BiOp.
2014 Supplement BiOp	Supplemented the 2008 BiOp and found that the implementation of RPAs could be utilized to mitigate jeopardy caused by the operation of the federal power system	This BiOp was challenged by the same group of litigants of recent previous BiOps, in the U.S. District Court of Oregon where Judge Michael Simon remanded it to be rewritten and a new EIS was required because the proposed RPAs violated NEPA since an EIS was not prepared in connection with the RPAs and the relied upon EISs were no longer satisfactory.
2019 CRS BiOp	Found that actions proposed in the Flexible Spill Agreement would not jeopardize listed salmonids or detrimentally alter critical habitat	As of the writing of this report there has not been litigation regarding this BiOp

Lower Snake River Juvenile Salmon Migration Feasibility Report/Environmental Impact Statement (2002)

The 2002 federal Feasibility Report/Environmental Impact Statement led by the US Army Corps of Engineers was a seven-year analysis under the National Environmental Policy Act that examined alternatives for improving salmon migration through the four LSRD. It evaluated the effects of the operation and configuration of the dams on the status of ESA-listed salmon, water quality, commercial navigation and other resources.

The FR/EIS considered four alternatives and their technical, environmental and economic effects: (1) maintain the status quo (continue existing conditions); (2) maximize juvenile fish transportation; (3) make major system improvements (an adaptive migration approach); and (4) breach the dams. The FR/EIS incorporated input from federal agencies, including US Fish and Wildlife and National Marine Fisheries Service, state agencies, regional entities, tribes and the public. The USACE identified alternatives 3 and 4 (adaptive migration and breach the LSRD, respectively) as the environmentally-preferred alternatives, although both had negative short- and long-term effects on key environmental resources and economic factors. Elements of alternatives 3 and 4 in the FR/EIS are being evaluated in a Columbia River System Operations environmental impact statement that will soon be released in draft form for public review and is described later in this section.

Ultimately, the Corps recommended a modified version of alternative 3 (major system improvements [adaptive migration]), that combined a series of structural and operational measures intended to improve fish passage through the lower Snake River. The adaptive management alternative was meant to complement regional actions and processes that already address salmon recovery. This recommendation was, in part, due to the conclusion in the NMFS 2000 Biological Opinion that breaching was not necessary at that time to avoid jeopardizing ESA-listed species, although that BiOp did include contingency measures that would, under certain circumstances, trigger additional analysis of breaching and whether congressional authorization for breaching should be considered.

Columbia Basin Partnership Task Force

The Columbia Basin Partnership Task Force was convened in 2017 by NOAA Fisheries' Marine Fisheries Advisory Committee to develop shared goals and a comprehensive vision for the future of Columbia Basin anadromous fish, including lower Snake River salmon and steelhead. The task force includes many groups with different interests from across the Basin, including federally-recognized tribes, fishing groups, environmental groups, energy, freight transportation, agricultural representatives and northwest states.

The Phase 1 task force report (January 2017–March 2019) reflects consensus around a shared vision for a healthy Columbia River and provisional goals for the 24 stocks of Columbia Basin salmon and steelhead. The goal-setting process reflected and considered the full range of social, cultural, economic and ecosystem values and diversity in the Basin. In Phase 2 the task force is exploring scenarios for how the goals from Phase 1 might be achieved and their potential impacts on stakeholder and reserved right-holder interests and consider if any of the provisional goals developed in Phase 1 should be adjusted based on Phase 2 work. Phase 2 will be complete in June 2020.

Southern Resident Orca Task Force

In March 2018, Gov. Inslee's Southern Resident Orca Task Force was created by executive order to develop recommendations for orca recovery and future sustainability. The task force was comprised of 47 members from many organizations, including the Washington State Legislature; Washington state agencies; the Government of Canada; tribal, federal, local and other state governments; and the private and nonprofit sectors.

The task force released a final report in November 2018 that identified four overarching goals: (1) increase chinook abundance and access to other prey; (2) decrease disturbance and risk from vessels and noise; (3) reduce the exposure of Southern Resident orcas and their prey to contaminants; and (4) ensure funding, information and accountability mechanisms are in place to support effective implementation. The report included a package of 36 recommendations designed to support the four goals. Each recommendation identified a lead agency and key partners for execution and identified whether the recommendation required federal, state or local actions or decisions. Recommendations 8 and 9 directly relate to LSRD: immediately increase total dissolved gas allowances to facilitate increased volumes of water spilled over the federal dams on the lower Snake and lower Columbia rivers, and establish a stakeholder process to discuss potential breaching LSRD.

Columbia River System Operations Environmental Impact Statement

Unrelated to the Southern Resident Orca Task Force process and recommendations, since 2016 USACE, USBR and BPA have been preparing, pursuant to a federal court order, an environmental impact statement to determine whether any changes should be made to the coordinated long-term operations, maintenance and configuration of the 14 federal dams in the Columbia River System, including the LSRD. The EIS will present a range of alternatives for long-term system operations and evaluate potential environmental and socioeconomic impacts of each. Alternatives include maintain the status quo (no change from 2016 actions) and four multiple-objective alternatives. The following five measures are in most of all of the four multiple-objective alternatives: (1) updating flood risk management operations at Libby and Grand Coulee dams; (2) providing for authorized

irrigation water supply; (3) providing structural measures for fish passage; (4) modifying operations to smooth triggers for summer draft as some upstream projects; and (5) providing more flexibility during fish passage season to shape flows within the day. One of the four multiple-objectives alternatives being evaluated in the EIS includes breaching the LSRD.

The draft CRSO EIS will have a public comment period. The final EIS is scheduled to be released in June 2020. If the EIS determines that significant modifications to the dams are advisable and it is approved by the USACE's Administration, the EIS recommendations can be implemented (in the case of additional spill) or submitted to Congress for authorization and appropriation (in the case of breaching the LSRD).

Appendix C: Lower Snake River Dams Stakeholder Engagement Interviewee List

Below is the list of people interviewed during the process. Each interview was approximately 90 minutes and most of the interviews were in person. The interviewees were asked a series of questions focused on the impacts (positive and negative) from retaining or breaching the LSRD. The consultant team greatly appreciates the time provided by the interviewees and this report benefits from their insights. The interviewees did not review the draft report before it was released and may have different perspectives on the report content.

Name	Organization
Blaine Meek	Irrigated farmer, AgReserves Inc.
Wendy McDermott	American Rivers
Brian Shinn	Asotin County
Chad Bartram	Benton Public Utility District
Elliot Mainzer	Bonneville Power Administration
Liz Klumpp	Bonneville Power Administration
Greg Guthrie	Burlington Northern Santa Fe Railway
Butch Smith	Coho Charters and Port of Ilwaco
Mike Talbott	Columbia County
Amy Grondin	Commercial Fisher
Joel Kawahara	Commercial Fisher and Coastal Trollers Association
Jim Waddell	Dam Sense
Robb Kriebel	Defenders of Wildlife
Tom Tebb	Department of Ecology
Todd True	Earth Justice
Adam Domanski	ECONorthwest
Michelle DeHart	Fish Passage Center
Deb Bone-Harris	Franklin Public Utility District
Holly Dohrman	Franklin Public Utility District
Roger Wright	Franklin Public Utility District
Scott Rhees	Franklin Public Utility District
Justin Dixon	Garfield County

Name	Organization
Katie Nelson	Gordon Bros. Winery
Marc Nelson	Gordon Bros. Winery
Tom Dresser	Grant County Public Utility District
Dustin Aherin	Idaho River Adventures
Travis Swayze	International Brotherhood of Electrical Workers Local 112
Matthew Hepner	International Brotherhood of Electrical Workers of WA
Mike Bosse	International Union of Operating Engineers, Local 302
Scott Zuger	Lewiston-Clarkston Terminal Inc
Jacques White	Long Live the Kings
Barry Thom	National Oceanic and Atmospheric Administration
Ritchie Graves	National Oceanic and Atmospheric Administration
Dave Johnson	Nez Perce, Department of Fisheries
Jay Hesse	Nez Perce, Department of Fisheries
Nakia Williamson-Cloud	Nez Perce, Department of Natural Resources
Dave Cummings	Nez Perce, Office of Legal Counsel
Nancy Hirsh	Northwest Energy Coalition
Chris Peha	Northwest Grain Growers
Guy Norman	Northwest Power and Conservation Council
Austin Rohr	Northwest RiverPartners
Kurt Miller	Northwest RiverPartners
Liz Hamilton	Northwest Sport Fishing Industry Association
Ed Bowles	Oregon Department of Fish and Wildlife
Glen Spain	Pacific Coast Federation of Fishermen's Associations
Kristin Meira	Pacific Northwest Waterways Association
Roy Keck	Port of Benton
Wanda Keefer	Port of Clarkston
Jennie Dickinson	Port of Columbia
David Doeringsfeld	Port of Lewiston
Randy Hayden	Port of Pasco
Marla Harrison	Port of Portland

Name	Organization
Patrick Reay	Port of Walla Walla
Brenda Stav	Port of Whitman County
Joe Poire	Port of Whitman County
Tom Kammerzell	Port of Whitman County
Mark Pinch	Private Development/Real Estate
Bill Hector	Retired Irrigation Farmer
Bryan Jones	Dusty Wheat Farmer
Joseph Bogaard	Save our Wild Salmon
Sam Mace	Save Our Wild Salmon
Lynn Best	Seattle City Light
Rob Rich	Shaver Transportation
Bill Arthur	Sierra Club
BJ Kieffer	Spokane Tribe Natural Resource
Chris Casserino	Spokane Tribe, Cultural Resources
Brent Nichols	Spokane Tribe, Natural Resources
Alex McGregor	The McGregor Company
Leslie Druffel	The McGregor Company
Brian Fletcher	Tidewater Barge lines
Craig Nelson	Tidewater Barge Lines
David Konz	Tidewater Barge lines
Jennifer Riddell	Tidewater Barge lines
David Reeploeg	Tri City Development Council
Rob Masonis	Trout Unlimited
Dan Wilson	United Steelworkers Local 338
Todd Kimball	Walla Walla County
Mark Riker	Washington Building Trades
Derek Sandison	Washington Department of Agriculture
Michael Garrity	Washington Department of Fish & Wildlife
Glen Squires	Washington Grain Commission
Bill Newbury	Washington Grain Growers Association

Name	Organization
Chris Herman	Washington Ports Association
Gerry O'Keefe	Washington Ports Association
Matt Harris	Washington Potato Commission
Larry Brown	Washington State Labor Council
Ken Casavant	Washington State University
Greg Mueller	Washington Trollers Association
Michelle Hennings	Washington Wheat Growers
Michael Largent	Whitman County
Deborah Giles	Wild Orca Center
Buzz Ramsey	Yakima Bait
Dan McDonald	Yakima Bait

Appendix D: Online Survey

The draft report was available for public review from December 20, 2019, through January 24, 2020. Public comments were collected online, by mail, at a series of public workshops, and through an online survey that had both multiple choice and open-ended (i.e., short answer) questions.

7,201 people participated in the online survey. The survey had nine sections related to the draft report sections (Agriculture, Transportation, etc.). Each survey section gave the survey participant the option to answer two multiple choice questions and one open-ended question. There were 15,240 open-ended question responses.

Appendix D has two sections: The first section is a copy of the text and questions in the online survey. The second section provides a summary of multiple choice responses, as well as a link to read all short answer responses.

Copy of Online Survey

This questionnaire is part of a process to gather and summarize the perspectives of Washingtonians on the impacts, both positive and negative, of retaining or breaching/removing the four lower Snake River dams (LSRD). The results of the questionnaire will be summarized into themes.

Governor Inslee supports this process to understand the full range and diversity of views in Washington state in regard to the LSRD. He plans to use this information to help craft his recommendations on the Columbia River Systems Operations Environmental Impact Statement being developed by U.S. Army Corps of Engineers, Bureau of Reclamation, and Bonneville Power Administration anticipated in February 2020 regarding the operations, maintenance and configurations for 14 federal projects in the Columbia River System in the interior Columbia River Basin.

Responses to the questionnaire will be treated confidentially. Please email twendel@rossstrategic.com with the subject line "LSRD Distribution List" if you would like to be added to a contact list for updates.

1. Please select the option(s) that best represent your affiliation. You may select more than one option, and if you like you can identify your primary affiliation in the next question.

- Conservation
- Business
- Sport or Commercial Fishing Industry
- Recreation
- Agriculture
- Not-for-Profit Organization
- For-profit Company
- Federal Government
- Tribe
- State Government

- Local Government
- Interested Citizen
- Other (please specify)

2. Which is your primary affiliation?

3. What is your primary interest(s)? You may select more than one.

- Retaining the dams
- Breaching or removing the dams
- Prosperity of agriculture
- Economic viability of communities supported by the dams
- Recovery of salmon and steelhead
- Economic viability of communities supported by salmon and steelhead
- Transportation
- Cultural
- Heritage
- Energy supply and transmission
- Environmental/ecosystem function

4. Your Zip Code

The next questions are meant to gather your perspectives on various social, economic, and environmental categories that could be impacted by retaining or breaching/removing the four lower Snake River dams (LSRD). You do not need to answer every question. For those questions that you do answer under each category, a short (600 characters, with spaces) text box is included to give you space to describe why you answered the way you did.

5. Agriculture

In 2017, over 1 million acres of wheat were harvested in the 7 counties adjacent to the Snake River. In addition, the LSRD currently support approximately 37,000 acres of irrigated farmland drawn from the Ice Harbor Reservoir and allow for the transport of wheat and other commodities, generally at a reduced cost relative to other modes of transportation.

Description of the statement above:

- I agree with how the statement is framed
- I disagree with how the statement is framed

Retaining/Leaving the dams will:

- Have a significant benefit for agriculture in the region
- Have a small benefit for agriculture in the region
- Have no benefit for agriculture in the region
- Slightly harm agriculture in the region
- Significantly harm agriculture in the region

- Not sure/NA

Breaching/removing the dams will:

- Have a significant benefit for agriculture in the region
- Have a small benefit for agriculture in the region
- Have no benefit for agriculture in the region
- Slightly harm agriculture in the region
- Significantly harm agriculture in the region
- Not sure/NA

Why? (If you'd like, please provide a short (600 characters, with spaces) answer on why you answered the way you did for the questions under this category.

6. Transportation

The LSRD currently allow for barge and tourism navigation up and down the lower Snake River that supports shipments of agricultural products and other materials used or produced by local communities. Transport of materials by barge are less than their historical levels in 2000. Some forecasts include continuation of current levels or increases in the amount of barge transportation.

Description of the statement above:

- I agree with how the statement is framed
- I disagree with how the statement is framed

Retaining/Leaving the dams will:

- Have a significant negative impact on the transport of materials upstream and downstream
- Have a small negative impact on the transport of materials upstream and downstream
- Have no impact on the transport of materials upstream and downstream
- Slightly improve transport of materials upstream and downstream
- Significantly improve transport of materials upstream and downstream
- Not sure/NA

Breaching/Removing the dams will:

- Have a significant negative impact on the transport of materials upstream and downstream
- Have a small negative impact on the transport of materials upstream and downstream
- Have no impact on the transport of materials upstream and downstream
- Slightly improve transport of materials upstream and downstream
- Significantly improve transport of materials upstream and downstream
- Not sure/NA

Why? (If you'd like, please provide a short (600 characters, with spaces) answer on why you answered the way you did for the questions under this category.)

7. Energy

The LSRD are a carbon free energy source, produce an average of 1,000 average megawatts of electricity annually, and currently support the reliability of the energy system regionally. Energy supply and markets are changing rapidly which may increase or decrease the role of energy provided by the LSRD.

Description of the statement above:

- I agree with how the statement is framed
- I disagree with how the statement is framed

Retaining/Leaving the dams will:

- Have a significant positive impact on the region's energy system
- Have a small positive impact on the region's energy system
- Have no impact on the region's energy system
- Slightly harm the region's energy system
- Significantly harm the region's energy system
- Not sure/NA

Breaching/Removing the dams will:

- Have a significant positive impact on the region's energy system
- Have a small positive impact on the region's energy system
- Have no impact on the region's energy system
- Slightly harm the region's energy system
- Significantly harm the region's energy system
- Not sure/NA

Why? (If you'd like, please provide a short (600 characters, with spaces) answer on why you answered the way you did for the questions under this category.)

8. Salmon and Steelhead

There are significantly different predictions of the benefits of breaching/removing the LSRD on Snake River salmon and steelhead returning adults that range from a fourfold increase in returning Snake River salmon/steelhead to a smaller percent increase.

Description of the statement above:

- I agree with how the statement is framed
- I disagree with how the statement is framed

Retaining/Leaving the dams will:

- Have a significant negative impact on the abundance of Snake River salmon and steelhead

- Have a small negative impact on the abundance of Snake River salmon and steelhead
- Have no impact on the abundance of Snake River salmon and steelhead
- Slightly improve the abundance of Snake River salmon and steelhead
- Significantly improve the abundance of Snake River salmon and steelhead
- Not sure/NA

Breaching or Removing the dams will:

- Have a significant negative impact on the abundance of Snake River salmon and steelhead
- Have a small negative impact on the abundance of Snake River salmon and steelhead
- Have no impact on the abundance of Snake River salmon and steelhead
- Slightly improve the abundance of Snake River salmon and steelhead
- Significantly improve the abundance of Snake River salmon and steelhead
- Not sure/NA

Why? (If you'd like, please provide a short (600 characters, with spaces) answer on why you answered the way you did for the questions under this category.)

9. Ecological

There are differing interpretations of what the river will look like if the dams were to be breached, how long it will take the river to fully provide anticipated benefits, and what the impacts on water quality will be from sediment and turbidity.

Description of the statement above:

- I agree with how the statement is framed
- I disagree with how the statement is framed

Retaining/Leaving the dams will:

- Have a significant positive impact on the ecology of the river system
- Have a small positive impact on the ecology of the river system
- Have no impact on the ecology of the river system
- Slightly harm the ecology of the river system
- Significantly harm the ecology of the river system
- Not sure/NA

Breaching/Removing the dams will:

- Have a significant positive impact on the ecology of the river system
- Have a small positive impact on the ecology of the river system
- Have no impact on the ecology of the river system
- Slightly harm the ecology of the river system

- Significantly harm the ecology of the river system
- Not sure/NA

Why? (If you'd like, please provide a short (600 characters, with spaces) answer on why you answered the way you did for the questions under this category.)

10. Recreation

There are differing interpretations of what the recreational shift will be in the river system if the dams were to be breached/removed, causing the river to shift from a flat water/slack water system to a more natural system featuring riffles, pools, and whitewater rapids.

Description of the statement above:

- I agree with how the statement is framed
- I disagree with how the statement is framed

Retaining/Leaving the dams will:

- Have a significant positive impact on the recreational use of the Snake River system
- Have a small positive impact on the recreational use of the Snake River system
- Have no impact on the recreational use of the Snake River system
- Slightly harm recreational use of the Snake River system
- Significantly harm recreational use of the Snake River system
- Not sure/NA

Breaching/Removing the dams will:

- Have a significant positive impact on the recreational use of the Snake River system
- Have a small positive impact on the recreational use of the Snake River system
- Have no impact on the recreational use of the Snake River system
- Slightly harm recreational use of the Snake River system
- Significantly harm recreational use of the Snake River system
- Not sure/NA

Why? (If you'd like, please provide a short (600 characters, with spaces) answer on why you answered the way you did for the questions under this category.)

11. Tribal Cultural Resources

When the dams and reservoirs were created, tribal communities' sites were lost as well as sites for fishing, hunting, and gathering.

Description of the statement above:

- I agree with how the statement is framed
- I disagree with how the statement is framed

Retaining/Leaving the dams will:

- Have a significant positive impact on tribal cultural resources in the basin
- Have a small positive impact on tribal cultural resources in the basin
- Have no impact on tribal cultural resources in the basin
- Slightly harm tribal cultural resources in the basin
- Significantly harm tribal cultural resources in the basin
- Not sure/NA

Breaching/Removing the dams will:

- Have a significant positive impact on tribal cultural resources in the basin
- Have a small positive impact on tribal cultural resources in the basin
- Have no impact on tribal cultural resources in the basin
- Slightly harm tribal cultural resources in the basin
- Significantly harm tribal cultural resources in the basin
- Not sure/NA

Why? (If you'd like, please provide a short (600 characters, with spaces) answer on why you answered the way you did for the questions under this category.)

12. Economics

There are differing estimates and perspectives on what the impacts will be on the local economy of the communities surrounding the LSRD as well as the state and region more broadly, due to shifts in recreation usage, shifts in employment, shifts in shipping, and shifts in energy and water supply.

Description of the statement above:

- I agree with how the statement is framed
- I disagree with how the statement is framed

Retaining/Leaving the dams will:

- Have a significant positive economic impact to local communities and the region
- Have a small positive economic impact to local communities and the region
- Have no economic impact to local communities and the region
- Slightly harm the economy of local communities and the region
- Significantly harm the economy of local communities and the region
- Not sure/NA

Breaching/Removing the dams will:

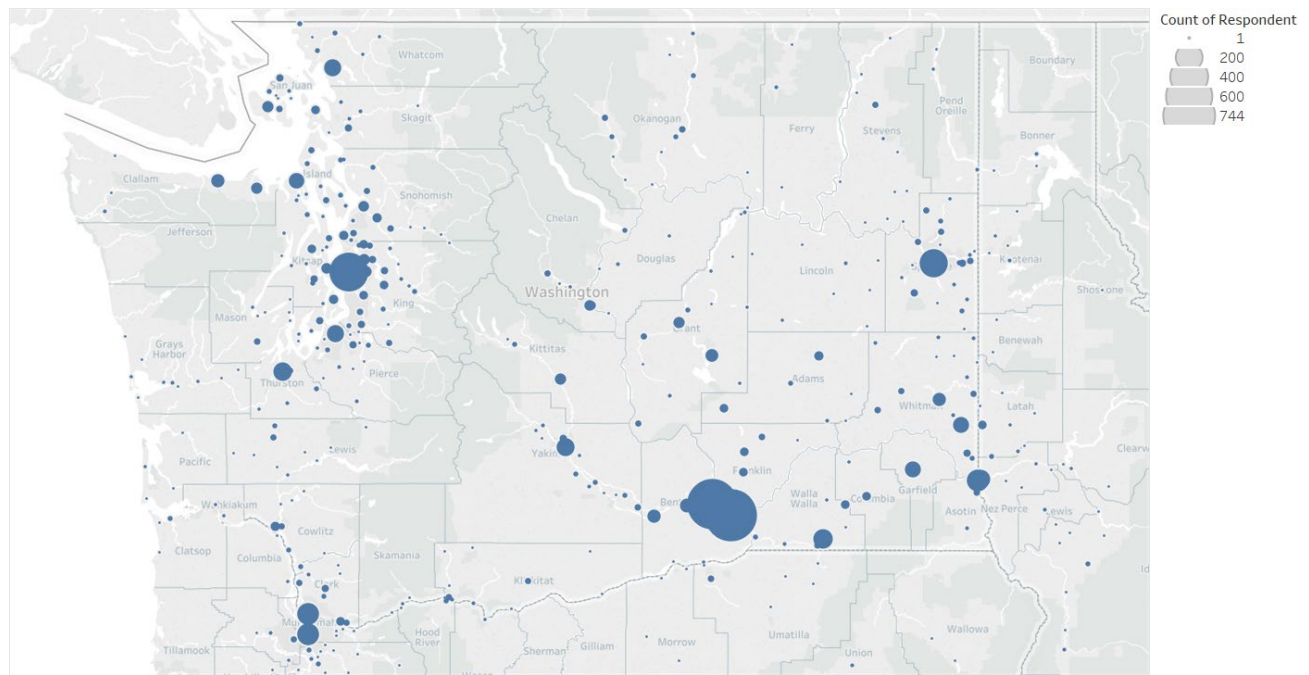
- Have a significant positive economic impact to local communities and the region
- Have a small positive economic impact to local communities and the region
- Have no economic impact to local communities and the region
- Slightly harm the economy of local communities and the region

- Significantly harm the economy of local communities and the region
- Not sure/NA
Why? (If you'd like, please provide a short (600 characters, with spaces) answer on why you answered the way you did for the questions under this category.)

Survey Responses

7,201 people from across the country responded to the survey; most responses came from people who live in Washington state. Figure 13 is a map that shows the distribution of survey responses across Washington.

Figure 13: Map of Distribution of Online Survey Responses Across Washington State



All multiple choice question responses are captured in the charts and graphs below. There were 15,240 open-ended question responses, i.e., short answers. Every open-ended question response can be read online by clicking this link:

<https://ofm.wa.gov/sites/default/files/public/publications/LSRD-public-comments.pdf>.

Lower Snake River Online Engagement

Survey Questions and Results

The survey was available online between November 12, 2019-January 24, 2020

Lower Snake River Dam Online Engagement

This questionnaire is part of a process to gather and summarize the perspectives of Washingtonians on the impacts, both positive and negative, of retaining or breaching/removing the four lower Snake River dams (LSRD). The results of the questionnaire will be summarized into themes.

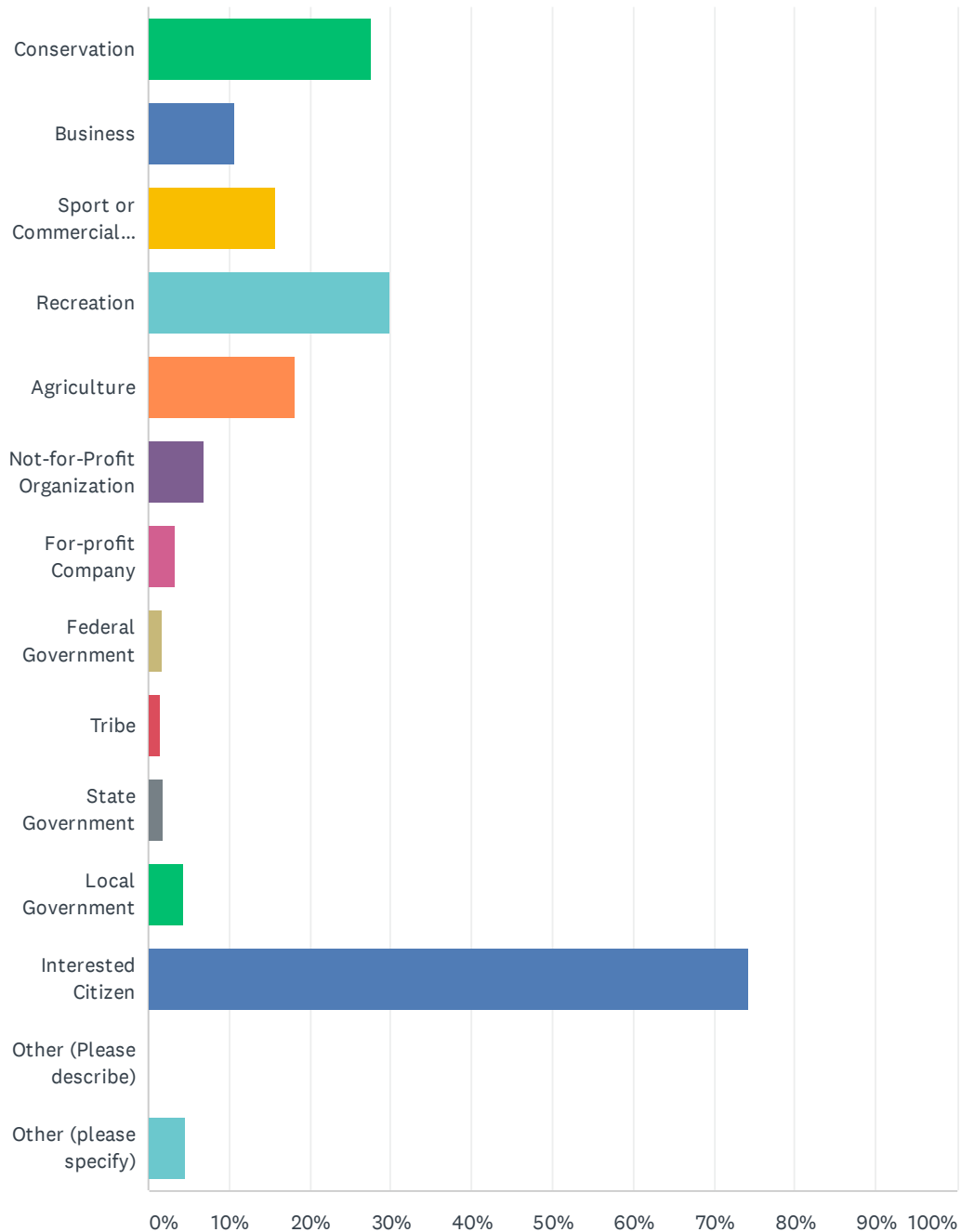
Governor Inslee supports this process to understand the full range and diversity of views in Washington state in regard to the LSRD. He plans to use this information to help craft his recommendations on the Columbia River Systems Operations Environmental Impact Statement being developed by U.S. Army Corps of Engineers, Bureau of Reclamation, and Bonneville Power Administration anticipated in February 2020 regarding the operations, maintenance and configurations for 14 federal projects in the Columbia River System in the interior Columbia River Basin.

Responses to the questionnaire will be treated confidentially. Please email twendel@rossstrategic.com with the subject line "LSRD Distribution List" if you would like to be added to a contact list for updates.

Lower Snake River Dam Online Engagement

Q1 Please select the option(s) that best represent your affiliation. You may select more than one option, and if you like you can identify your primary affiliation in the next question.

Answered: 7,105 Skipped: 96

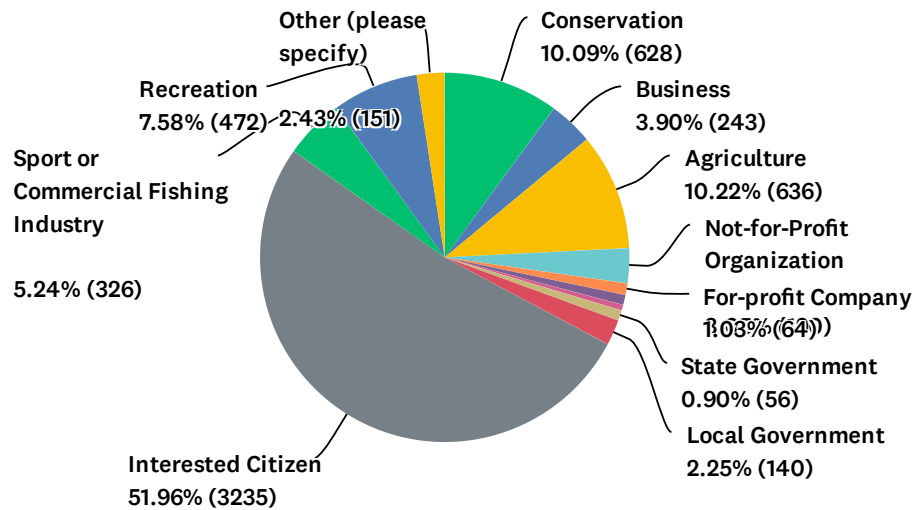


Lower Snake River Dam Online Engagement

ANSWER CHOICES	RESPONSES	
Conservation	27.67%	1,966
Business	10.60%	753
Sport or Commercial Fishing Industry	15.75%	1,119
Recreation	29.82%	2,119
Agriculture	18.13%	1,288
Not-for-Profit Organization	6.84%	486
For-profit Company	3.27%	232
Federal Government	1.63%	116
Tribe	1.53%	109
State Government	1.79%	127
Local Government	4.36%	310
Interested Citizen	74.26%	5,276
Other (Please describe)	0.00%	0
Other (please specify)	4.60%	327
Total Respondents: 7,105		

Q2 Which is your primary affiliation?

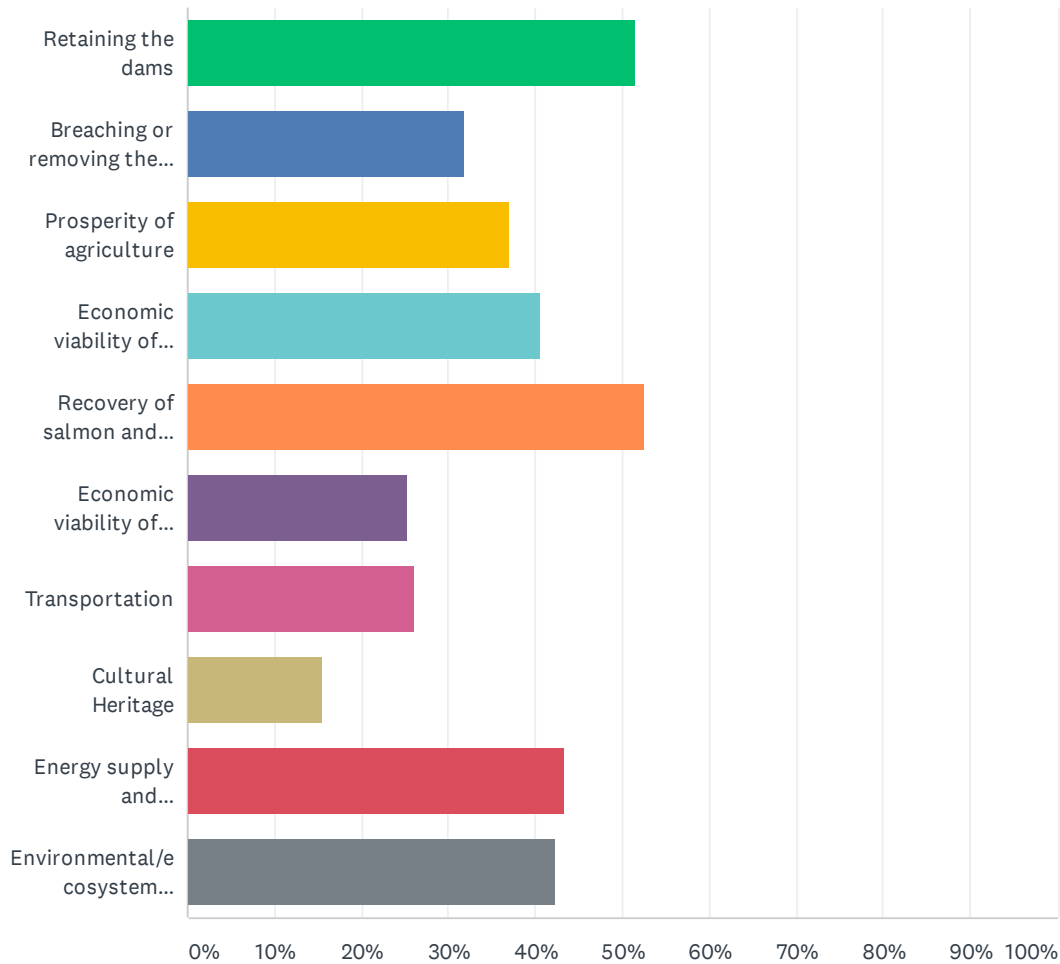
Answered: 6,226 Skipped: 975



ANSWER CHOICES	RESPONSES	
Conservation	10.09%	628
Business	3.90%	243
Agriculture	10.22%	636
Not-for-Profit Organization	3.05%	190
For-profit Company	1.03%	64
Federal Government	0.87%	54
Tribe	0.50%	31
State Government	0.90%	56
Local Government	2.25%	140
Interested Citizen	51.96%	3,235
Sport or Commercial Fishing Industry	5.24%	326
Recreation	7.58%	472
Other (please specify)	2.43%	151
Other (please specify)	0.00%	0
TOTAL		6,226

Q3 What is your primary interest(s)? You may select more than one.

Answered: 7,129 Skipped: 72

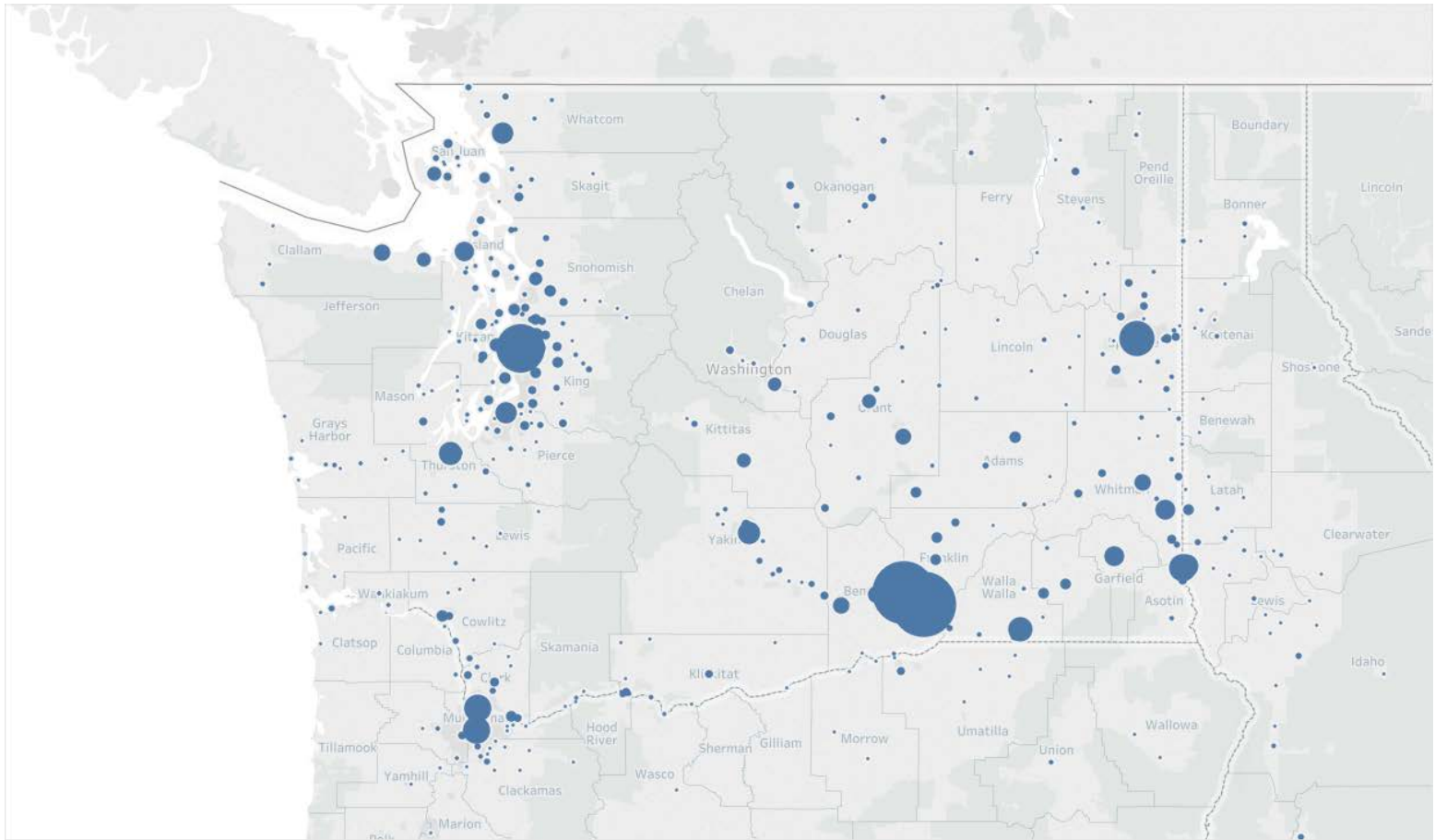


ANSWER CHOICES	RESPONSES	
Retaining the dams	51.44%	3,667
Breaching or removing the dams	31.79%	2,266
Prosperity of agriculture	37.09%	2,644
Economic viability of communities supported by the dams	40.58%	2,893
Recovery of salmon and steelhead	52.49%	3,742
Economic viability of communities supported by salmon and steelhead	25.40%	1,811
Transportation	26.10%	1,861
Cultural Heritage	15.39%	1,097
Energy supply and transmission	43.26%	3,084
Environmental/ecosystem function	42.18%	3,007
Total Respondents: 7,129		

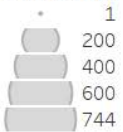
Q4 Your Zip Code

Answered: 6,946 Skipped: 255

Survey respondents based on zipcode submitted*



Count of Respondent

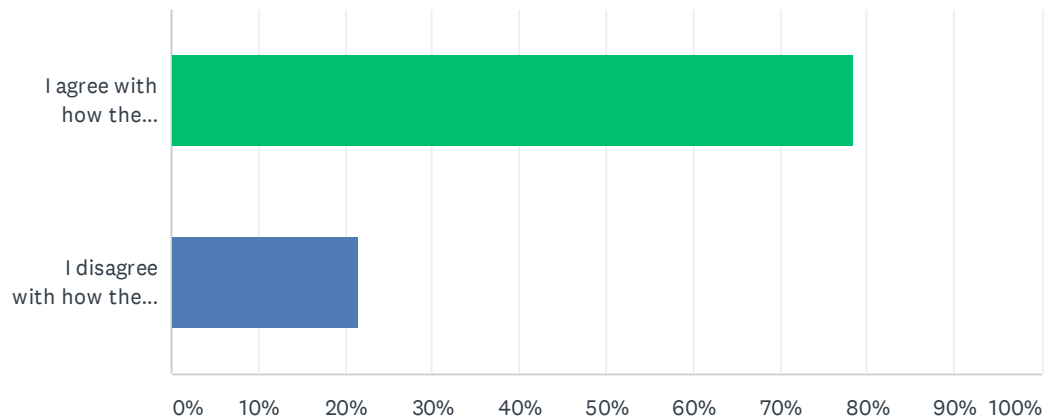


* grouped by city

Agriculture

In 2017, over 1 million acres of wheat were harvested in the 7 counties adjacent to the Snake River. In addition, the LSRD currently support approximately 37,000 acres of irrigated farmland drawn from the Ice Harbor Reservoir and allow for the transport of wheat and other commodities, generally at a reduced cost relative to other modes of transportation.

Q5 Description of the statement above:



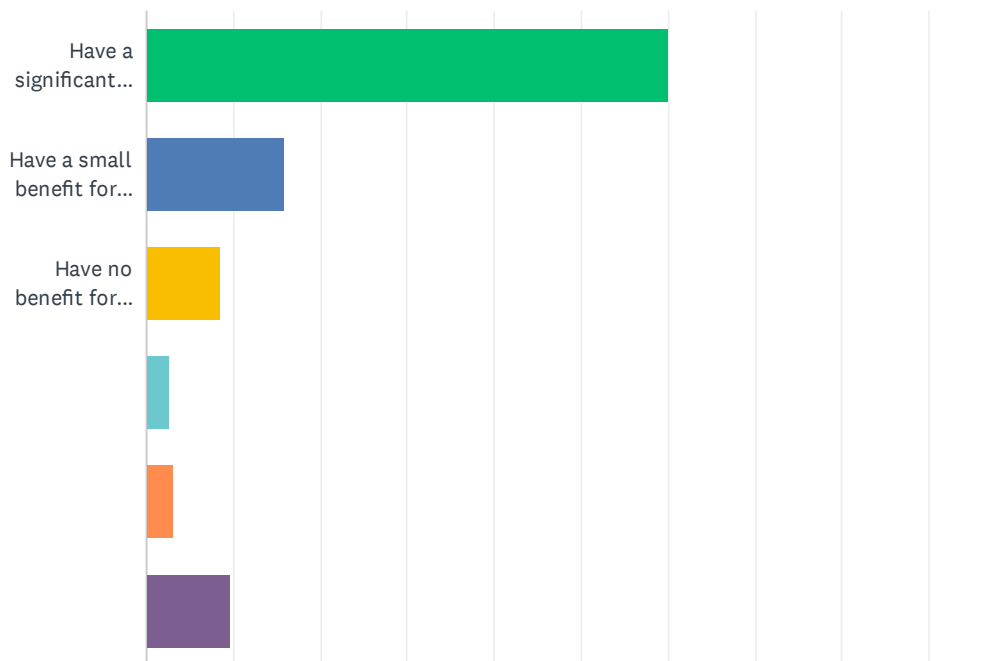
ANSWER CHOICES	RESPONSES	
I agree with how the statement is framed	78.48%	4,798
I disagree with how the statement is framed	21.52%	1,316
TOTAL		6,114

Agriculture

In 2017, over 1 million acres of wheat were harvested in the 7 counties adjacent to the Snake River. In addition, the LSRD currently support approximately 37,000 acres of irrigated farmland drawn from the Ice Harbor Reservoir and allow for the transport of wheat and other commodities, generally at a reduced cost relative to other modes of transportation.

Q6 Retaining/Leaving the dams will:

Answered: 6,379 Skipped: 822



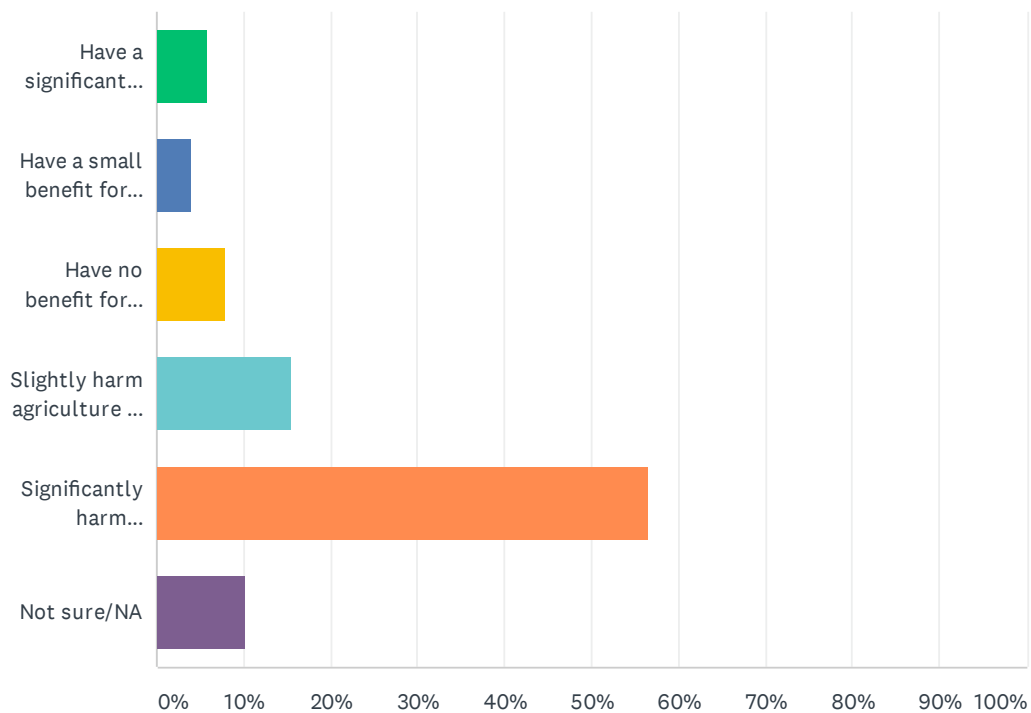
ANSWER CHOICES	RESPONSES	
Have a significant benefit for agriculture in the region	60.03%	3,829
Have a small benefit for agriculture in the region	15.93%	1,016
Have no benefit for agriculture in the region	8.54%	545
Slightly harm agriculture in the region	2.73%	174
Significantly harm agriculture in the region	3.10%	198
Not sure/NA	9.67%	617
TOTAL		6,379

Agriculture

In 2017, over 1 million acres of wheat were harvested in the 7 counties adjacent to the Snake River. In addition, the LSRD currently support approximately 37,000 acres of irrigated farmland drawn from the Ice Harbor Reservoir and allow for the transport of wheat and other commodities, generally at a reduced cost relative to other modes of transportation.

Q7 Breaching/removing the dams will:

Answered: 6,373 Skipped: 828



ANSWER CHOICES	RESPONSES	
Have a significant benefit for agriculture in the region	5.85%	373
Have a small benefit for agriculture in the region	3.95%	252
Have no benefit for agriculture in the region	7.88%	502
Slightly harm agriculture in the region	15.57%	992
Significantly harm agriculture in the region	56.43%	3,596
Not sure/NA	10.32%	658
TOTAL		6,373

Q8 Why? (If you'd like, please provide a short (600 characters, with spaces) answer on why you answered the way you did for the questions under this category.)

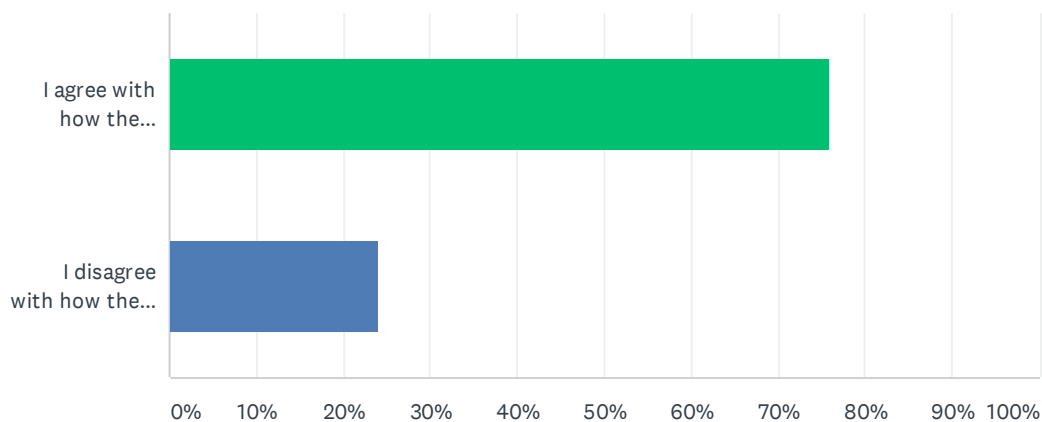
Answered: 2,725 Skipped: 4,476

Transportation

The LSRD currently allow for barge and tourism navigation up and down the lower Snake River that supports shipments of agricultural products and other materials used or produced by local communities. Transport of materials by barge are less than their historical levels in 2000. Some forecasts include continuation of current levels or increases in the amount of barge transportation.

Q9 Description of the statement above:

Answered: 5,594 Skipped: 1,607



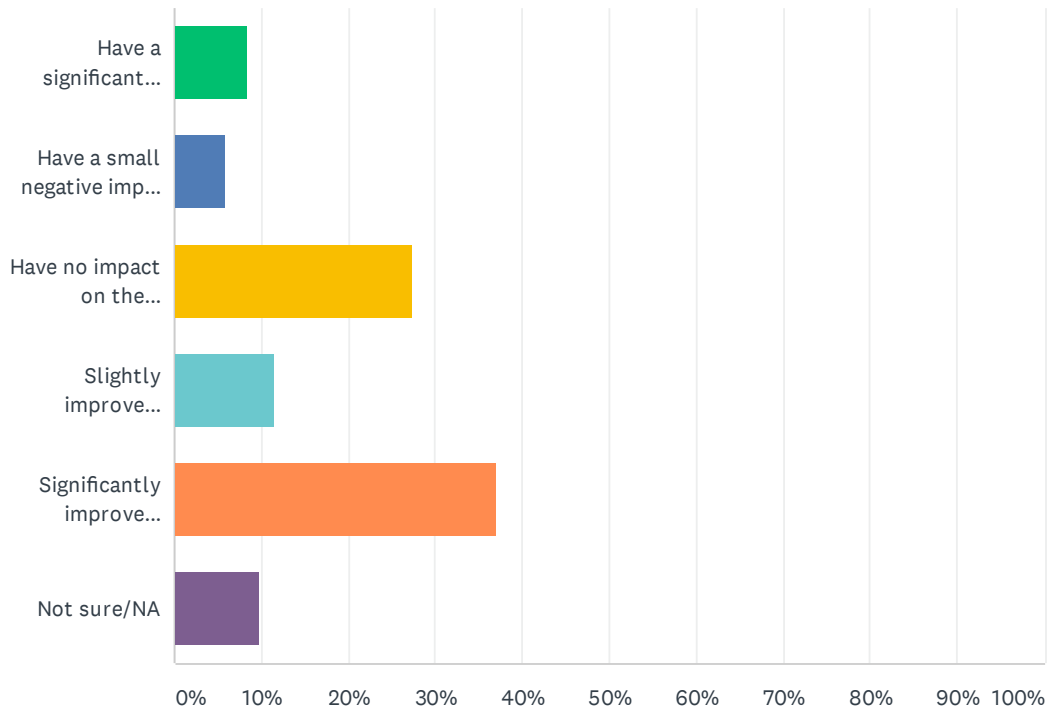
ANSWER CHOICES	RESPONSES	
I agree with how the statement is framed	75.97%	4,250
I disagree with how the statement is framed	24.03%	1,344
TOTAL		5,594

Transportation

The LSRD currently allow for barge and tourism navigation up and down the lower Snake River that supports shipments of agricultural products and other materials used or produced by local communities. Transport of materials by barge are less than their historical levels in 2000. Some forecasts include continuation of current levels or increases in the amount of barge transportation.

Q10 Retaining/Leaving the dams will:

Answered: 5,883 Skipped: 1,318



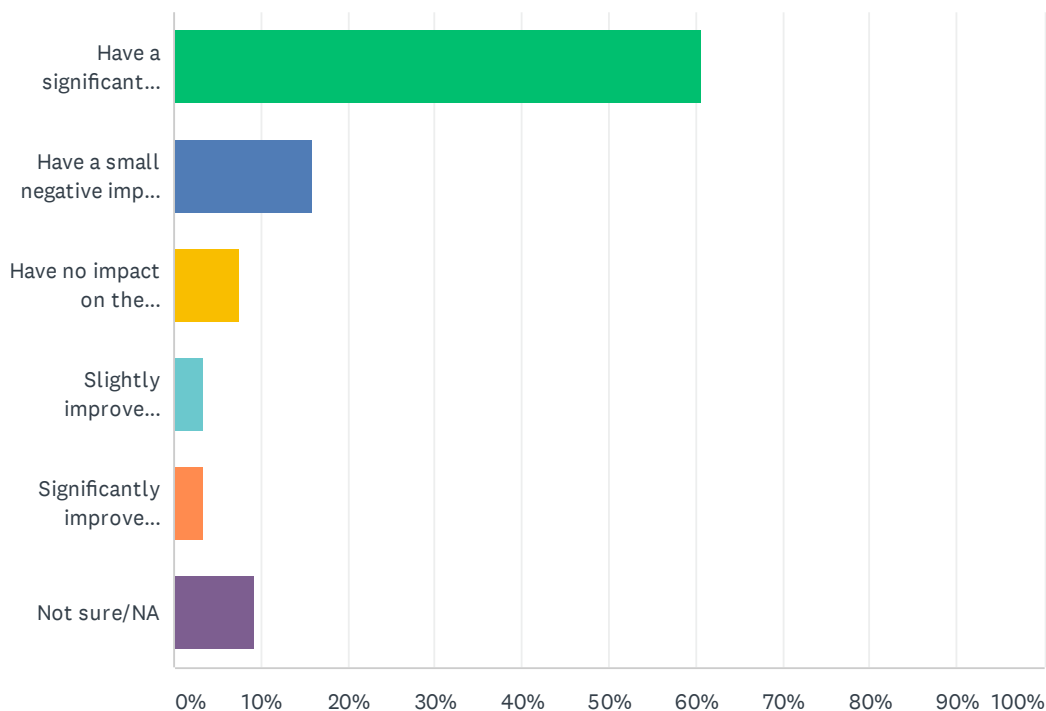
ANSWER CHOICES	RESPONSES	
Have a significant negative impact on the transport of materials upstream and downstream	8.45%	497
Have a small negative impact on the transport of materials upstream and downstream	5.93%	349
Have no impact on the transport of materials upstream and downstream	27.42%	1,613
Slightly improve transport of materials upstream and downstream	11.41%	671
Significantly improve transport of materials upstream and downstream	36.95%	2,174
Not sure/NA	9.84%	579
TOTAL		5,883

Transportation

The LSRD currently allow for barge and tourism navigation up and down the lower Snake River that supports shipments of agricultural products and other materials used or produced by local communities. Transport of materials by barge are less than their historical levels in 2000. Some forecasts include continuation of current levels or increases in the amount of barge transportation.

Q11 Breaching/Removing the dams will:

Answered: 5,902 Skipped: 1,299



ANSWER CHOICES	RESPONSES	
Have a significant negative impact on the transport of materials upstream and downstream	60.61%	3,577
Have a small negative impact on the transport of materials upstream and downstream	15.86%	936
Have no impact on the transport of materials upstream and downstream	7.52%	444
Slightly improve transport of materials upstream and downstream	3.35%	198
Significantly improve transport of materials upstream and downstream	3.35%	198
Not sure/NA	9.30%	549
TOTAL		5,902

Q12 Why? (If you'd like, please provide a short (600 characters, with spaces) answer on why you answered the way you did for the questions under this category.)

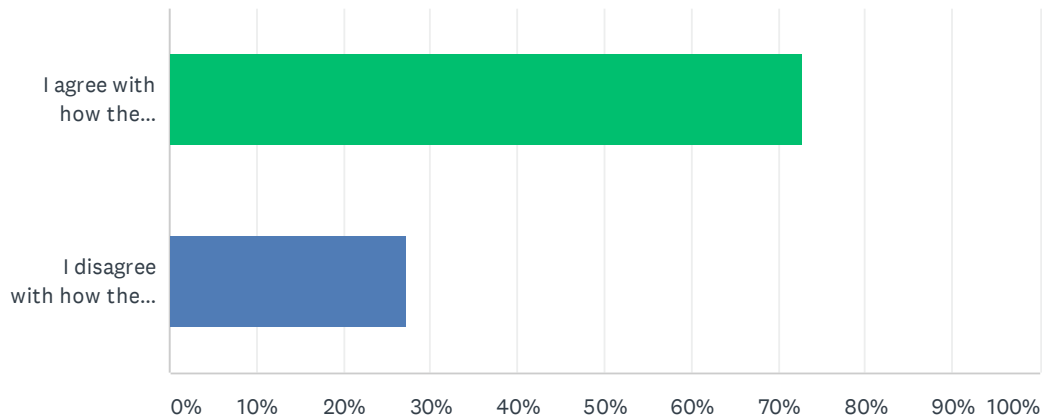
Answered: 1,883 Skipped: 5,318

Energy

The LSRD are a carbon free energy source, produce an average of 1,000 average megawatts of electricity annually, and currently support the reliability of the energy system regionally. Energy supply and markets are changing rapidly which may increase or decrease the role of energy provided by the LSRD.

Q13 Description of the statement above:

Answered: 5,558 Skipped: 1,643



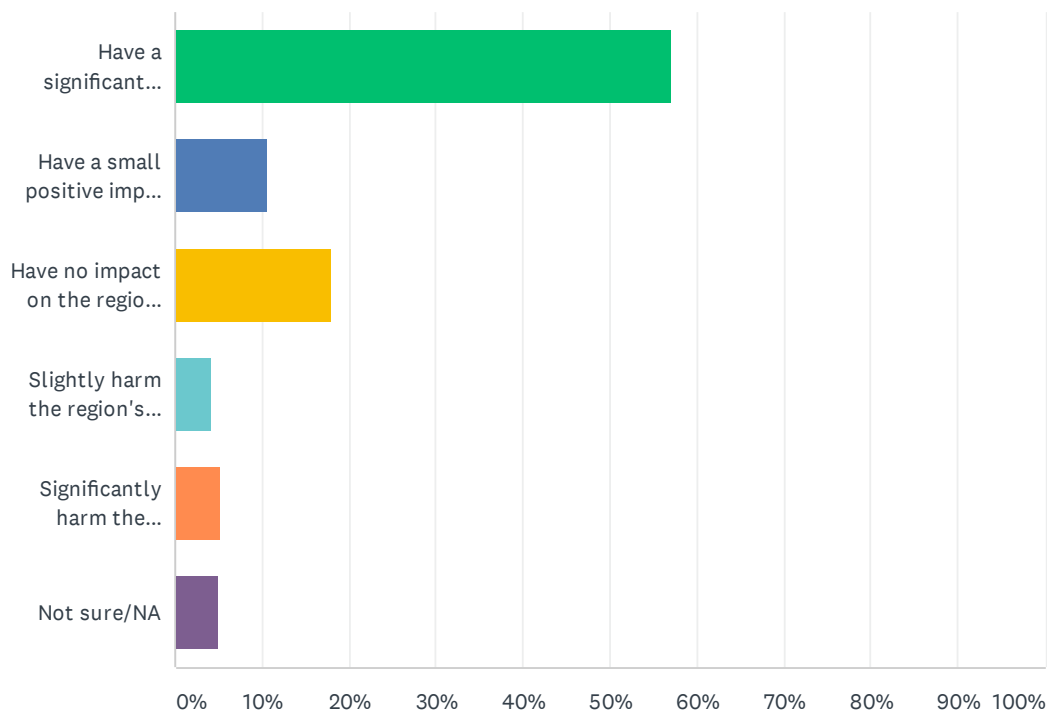
ANSWER CHOICES	RESPONSES	
I agree with how the statement is framed	72.83%	4,048
I disagree with how the statement is framed	27.17%	1,510
TOTAL		5,558

Energy

The LSRD are a carbon free energy source, produce an average of 1,000 average megawatts of electricity annually, and currently support the reliability of the energy system regionally. Energy supply and markets are changing rapidly which may increase or decrease the role of energy provided by the LSRD.

Q14 Retaining/Leaving the dams will:

Answered: 5,701 Skipped: 1,500



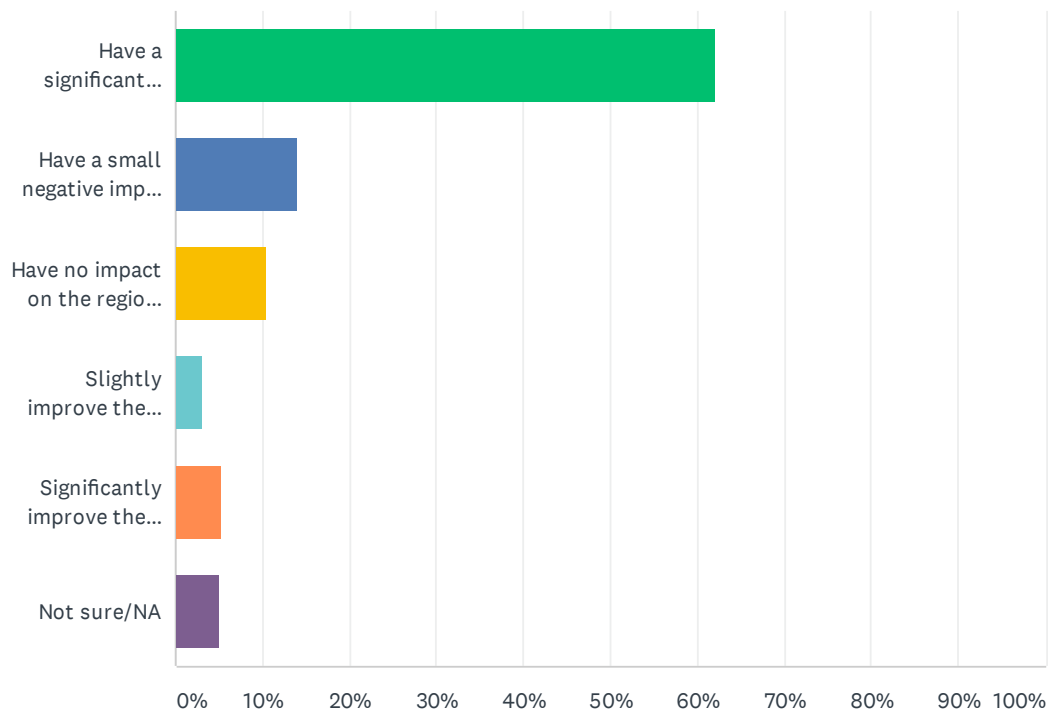
ANSWER CHOICES	RESPONSES	
Have a significant positive impact on the region's energy system	57.15%	3,258
Have a small positive impact on the region's energy system	10.61%	605
Have no impact on the region's energy system	17.93%	1,022
Slightly harm the region's energy system	4.21%	240
Significantly harm the region's energy system	5.16%	294
Not sure/NA	4.95%	282
TOTAL		5,701

Energy

The LSRD are a carbon free energy source, produce an average of 1,000 average megawatts of electricity annually, and currently support the reliability of the energy system regionally. Energy supply and markets are changing rapidly which may increase or decrease the role of energy provided by the LSRD.

Q15 Breaching/Removing the dams will:

Answered: 5,716 Skipped: 1,485



ANSWER CHOICES	RESPONSES	
Have a significant negative impact on the region's energy system	62.12%	3,551
Have a small negative impact on the region's energy system	14.01%	801
Have no impact on the region's energy system	10.37%	593
Slightly improve the region's energy system	3.17%	181
Significantly improve the region's energy system	5.27%	301
Not sure/NA	5.06%	289
TOTAL		5,716

Q16 Why? (If you'd like, please provide a short (600 characters, with spaces) answer on why you answered the way you did for the questions under this category.)

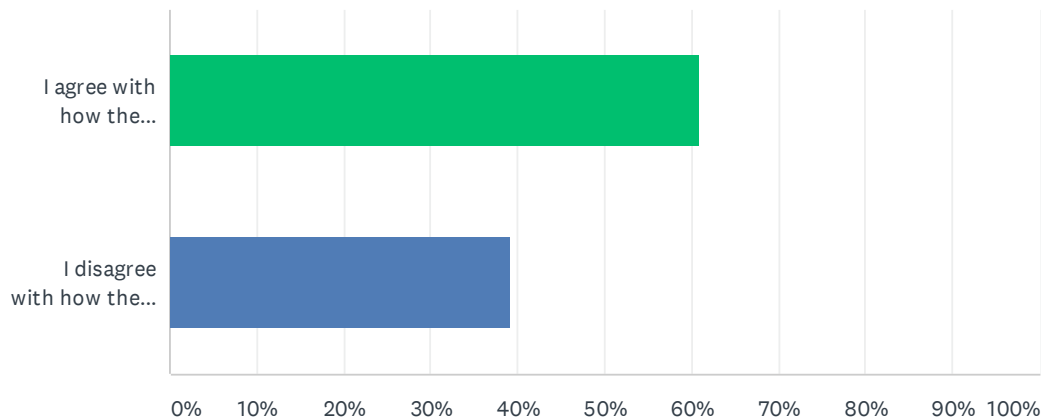
Answered: 2,261 Skipped: 4,940

Salmon and Steelhead

There are significantly different predictions of the benefits of breaching/removing the LSRD on Snake River salmon and steelhead returning adults that range from a fourfold increase in returning Snake River salmon/steelhead to a smaller percent increase.

Q17 Description of the statement above:

Answered: 5,420 Skipped: 1,781



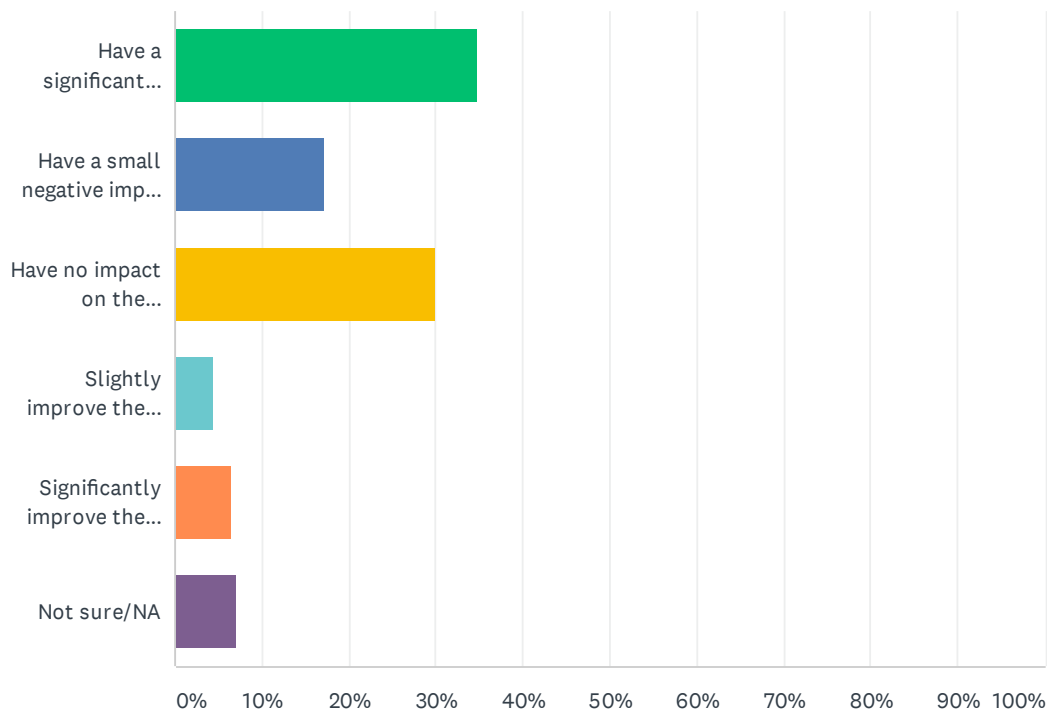
ANSWER CHOICES	RESPONSES	
I agree with how the statement is framed	60.92%	3,302
I disagree with how the statement is framed	39.08%	2,118
TOTAL		5,420

Salmon and Steelhead

There are significantly different predictions of the benefits of breaching/removing the LSRD on Snake River salmon and steelhead returning adults that range from a fourfold increase in returning Snake River salmon/steelhead to a smaller percent increase.

Q18 Retaining/Leaving the dams will:

Answered: 5,670 Skipped: 1,531



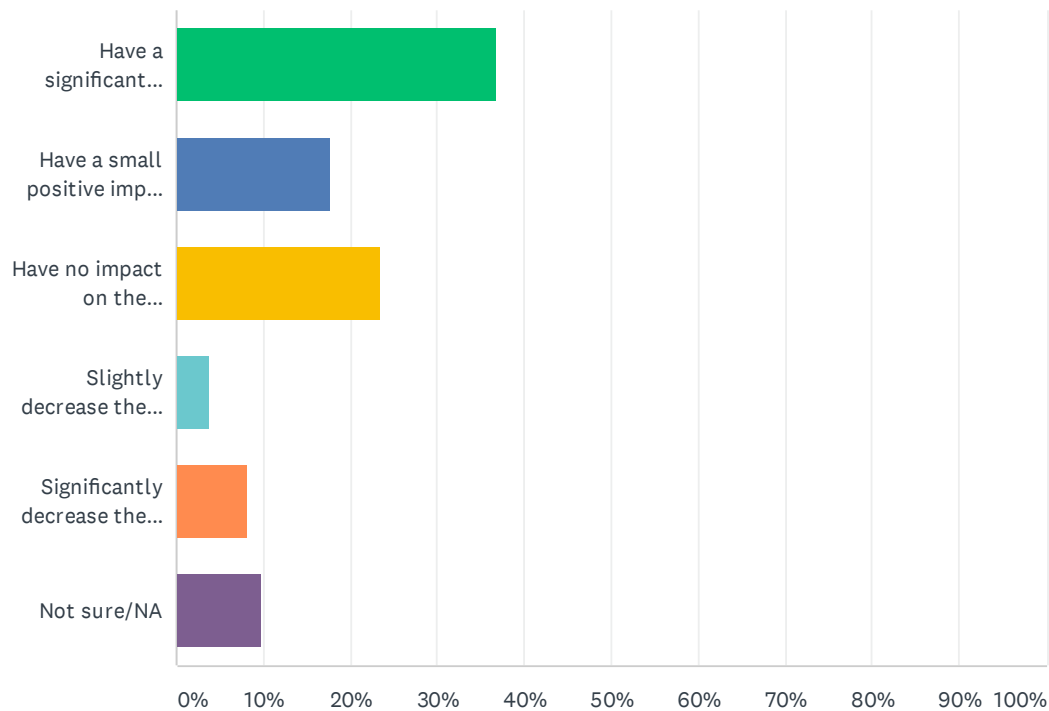
ANSWER CHOICES	RESPONSES	
Have a significant negative impact on the abundance of Snake River salmon and steelhead	34.80%	1,973
Have a small negative impact on the abundance of Snake River salmon and steelhead	17.20%	975
Have no impact on the abundance of Snake River salmon and steelhead	29.93%	1,697
Slightly improve the abundance of Snake River salmon and steelhead	4.46%	253
Significantly improve the abundance of Snake River salmon and steelhead	6.47%	367
Not sure/NA	7.14%	405
TOTAL		5,670

Salmon and Steelhead

There are significantly different predictions of the benefits of breaching/removing the LSRD on Snake River salmon and steelhead returning adults that range from a fourfold increase in returning Snake River salmon/steelhead to a smaller percent increase.

Q19 Breaching or Removing the dams will:

Answered: 5,665 Skipped: 1,536



ANSWER CHOICES	RESPONSES	
Have a significant positive impact on the abundance of Snake River salmon and steelhead	36.86%	2,088
Have a small positive impact on the abundance of Snake River salmon and steelhead	17.86%	1,012
Have no impact on the abundance of Snake River salmon and steelhead	23.37%	1,324
Slightly decrease the abundance of Snake River salmon and steelhead	3.81%	216
Significantly decrease the abundance of Snake River salmon and steelhead	8.17%	463
Not sure/NA	9.92%	562
TOTAL		5,665

Q20 Why? (If you'd like, please provide a short (600 characters, with spaces) answer on why you answered the way you did for the questions under this category.)

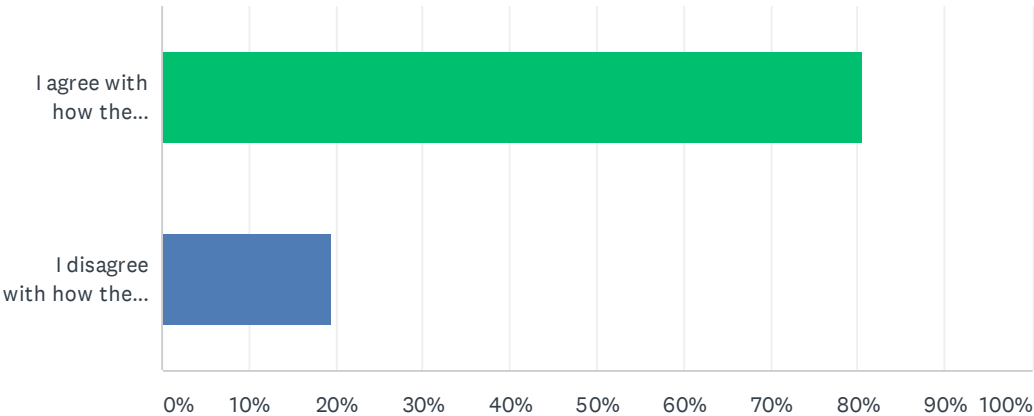
Answered: 2,291 Skipped: 4,910

Ecology

There are differing interpretations of what the river will look like if the dams were to be breached, how long it will take the river to fully provide anticipated benefits, and what the impacts on water quality will be from sediment and turbidity.

Q21 Description of the statement above:

Answered: 5,402 Skipped: 1,799



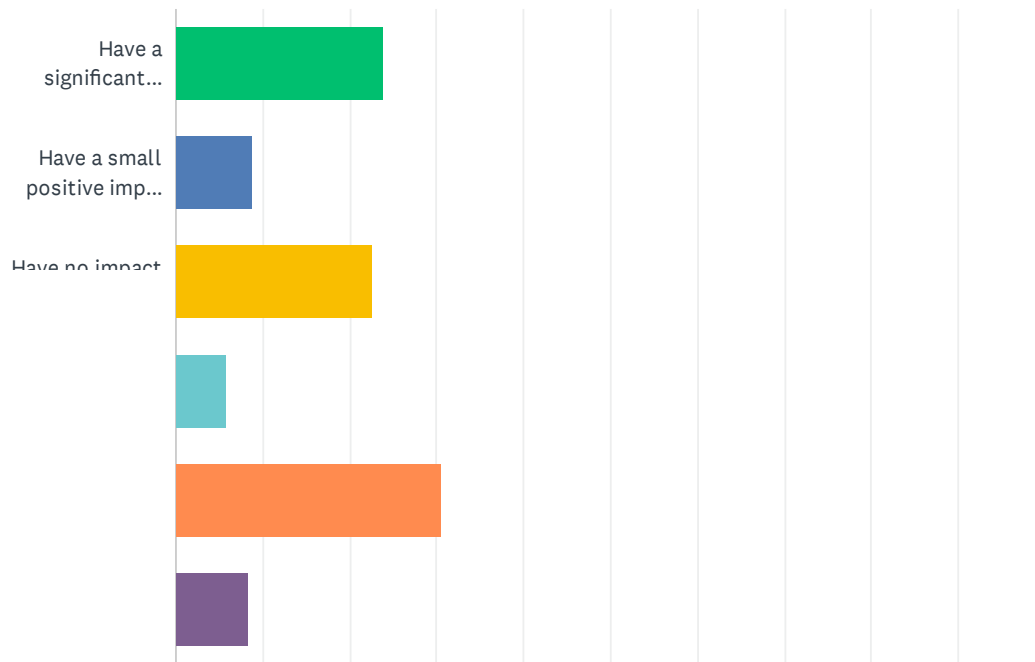
ANSWER CHOICES		RESPONSES	
I agree with how the statement is framed		80.53%	4,350
I disagree with how the statement is framed		19.47%	1,052
TOTAL			5,402

Ecology

There are differing interpretations of what the river will look like if the dams were to be breached, how long it will take the river to fully provide anticipated benefits, and what the impacts on water quality will be from sediment and turbidity.

Q22 Retaining/Leaving the dams will:

Answered: 5,566 Skipped: 1,635



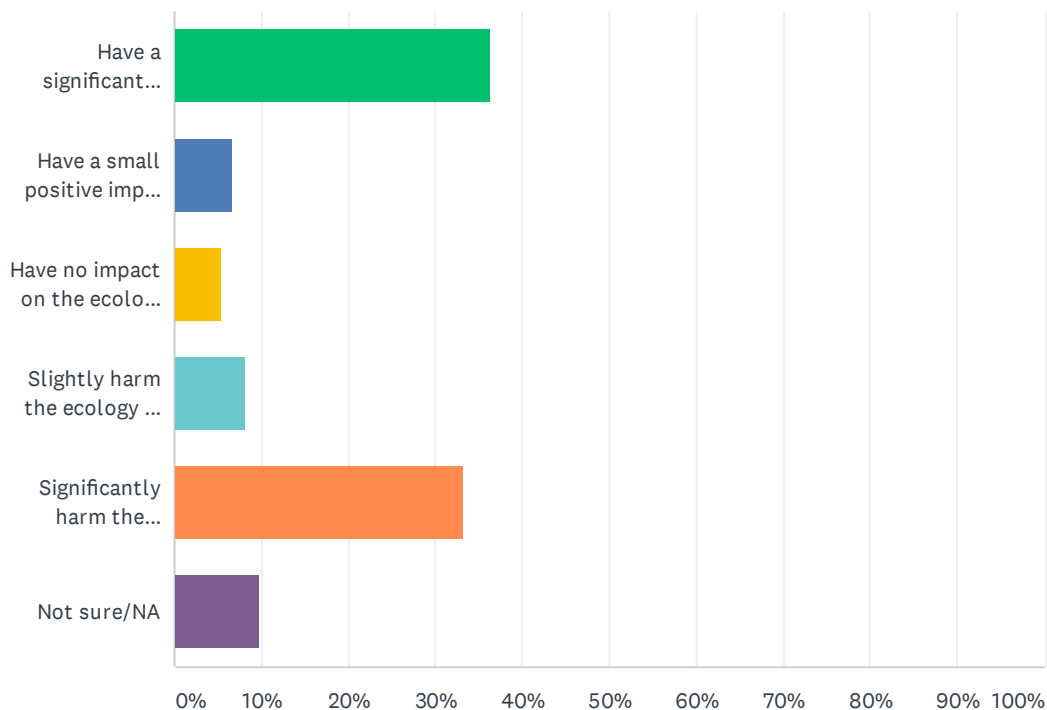
ANSWER CHOICES	RESPONSES	
Have a significant positive impact on the ecology of the river system	23.90%	1,330
Have a small positive impact on the ecology of the river system	8.77%	488
Have no impact on the ecology of the river system	22.51%	1,253
Slightly harm the ecology of the river system	5.95%	331
Significantly harm the ecology of the river system	30.54%	1,700
Not sure/NA	8.34%	464
TOTAL		5,566

Ecology

There are differing interpretations of what the river will look like if the dams were to be breached, how long it will take the river to fully provide anticipated benefits, and what the impacts on water quality will be from sediment and turbidity.

Q23 Breaching/Removing the dams will:

Answered: 5,595 Skipped: 1,606



ANSWER CHOICES	RESPONSES	
Have a significant positive impact on the ecology of the river system	36.50%	2,042
Have a small positive impact on the ecology of the river system	6.76%	378
Have no impact on the ecology of the river system	5.38%	301
Slightly harm the ecology of the river system	8.19%	458
Significantly harm the ecology of the river system	33.28%	1,862
Not sure/NA	9.90%	554
TOTAL		5,595

Q24 Why? (If you'd like, please provide a short (600 characters, with spaces) answer on why you answered the way you did for the questions under this category.)

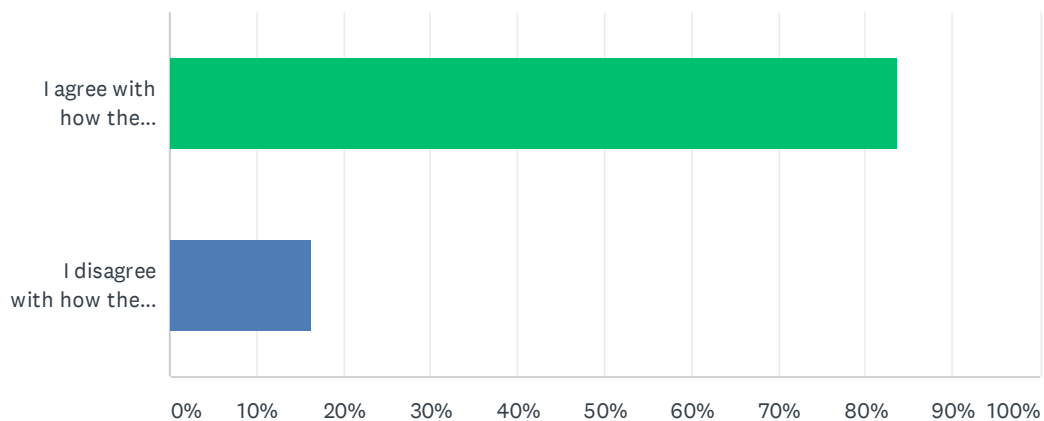
Answered: 1,715 Skipped: 5,486

Recreation

There are differing interpretations of what the recreational shift will be in the river system if the dams were to be breached/removed, causing the river to shift from a flat water/slack water system to a more natural system featuring riffles, pools, and whitewater rapids.

Q25 Description of the statement above:

Answered: 5,298 Skipped: 1,903



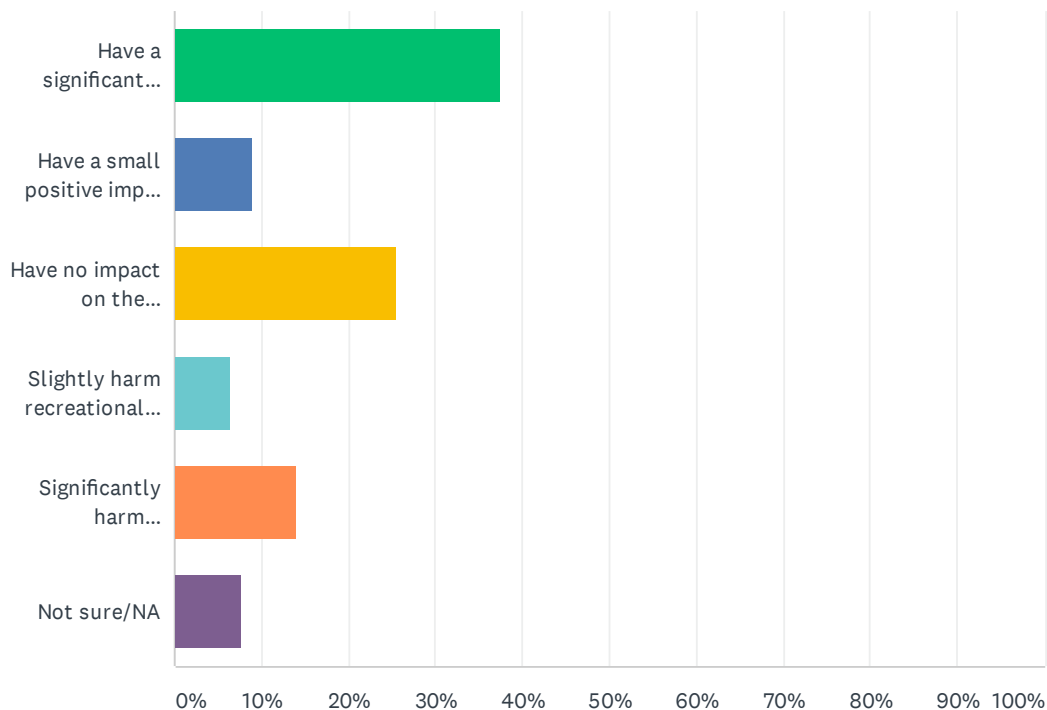
ANSWER CHOICES	RESPONSES	
I agree with how the statement is framed	83.73%	4,436
I disagree with how the statement is framed	16.27%	862
TOTAL		5,298

Recreation

There are differing interpretations of what the recreational shift will be in the river system if the dams were to be breached/removed, causing the river to shift from a flat water/slack water system to a more natural system featuring riffles, pools, and whitewater rapids.

Q26 Retaining/Leaving the dams will:

Answered: 5,460 Skipped: 1,741



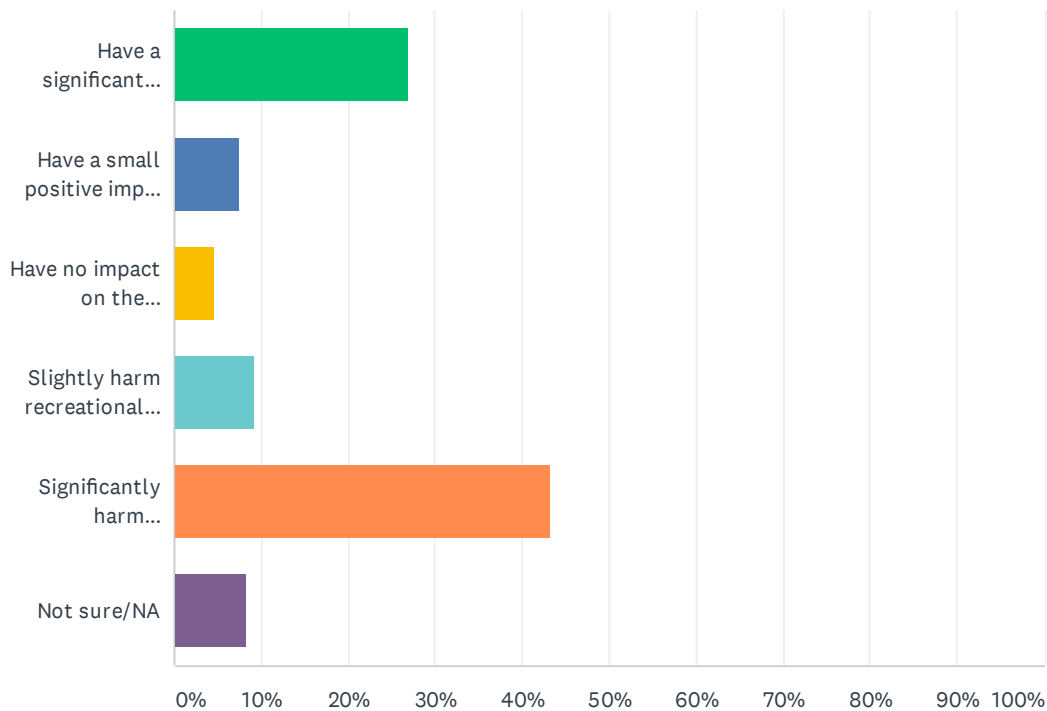
ANSWER CHOICES	RESPONSES	
Have a significant positive impact on the recreational use of the Snake River system	37.38%	2,041
Have a small positive impact on the recreational use of the Snake River system	8.92%	487
Have no impact on the recreational use of the Snake River system	25.46%	1,390
Slightly harm recreational use of the Snake River system	6.43%	351
Significantly harm recreational use of the Snake River system	14.10%	770
Not sure/NA	7.71%	421
TOTAL		5,460

Recreation

There are differing interpretations of what the recreational shift will be in the river system if the dams were to be breached/removed, causing the river to shift from a flat water/slack water system to a more natural system featuring riffles, pools, and whitewater rapids.

Q27 Breaching/Removing the dams will:

Answered: 5,472 Skipped: 1,729



ANSWER CHOICES	RESPONSES	
Have a significant positive impact on the recreational use of the Snake River system	26.97%	1,476
Have a small positive impact on the recreational use of the Snake River system	7.57%	414
Have no impact on the recreational use of the Snake River system	4.66%	255
Slightly harm recreational use of the Snake River system	9.16%	501
Significantly harm recreational use of the Snake River system	43.22%	2,365
Not sure/NA	8.42%	461
TOTAL		5,472

Q28 Why? (If you'd like, please provide a short (600 characters, with spaces) answer on why you answered the way you did for the questions under this category.)

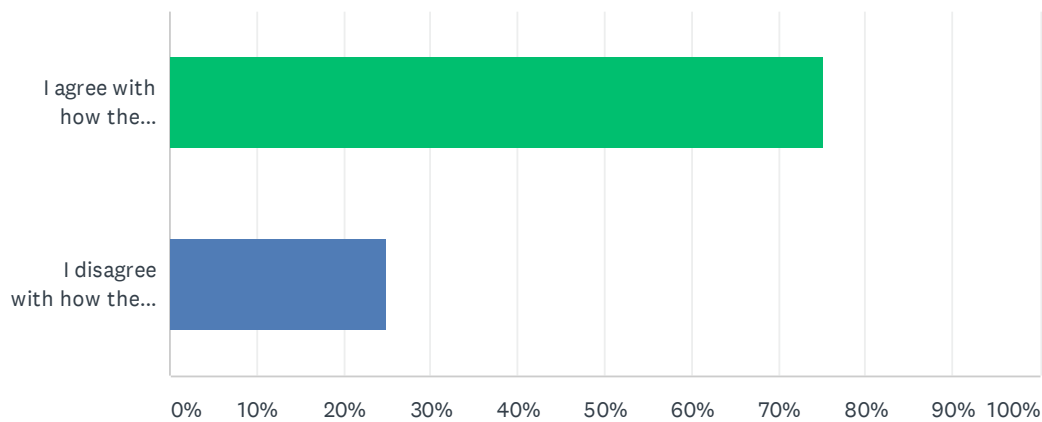
Answered: 1,524 Skipped: 5,677

Tribal Cultural Resources

When the dams and reservoirs were created, tribal communities' sites were lost as well as sites for fishing, hunting, and gathering.

Q29 Description of the statement above:

Answered: 5,302 Skipped: 1,899



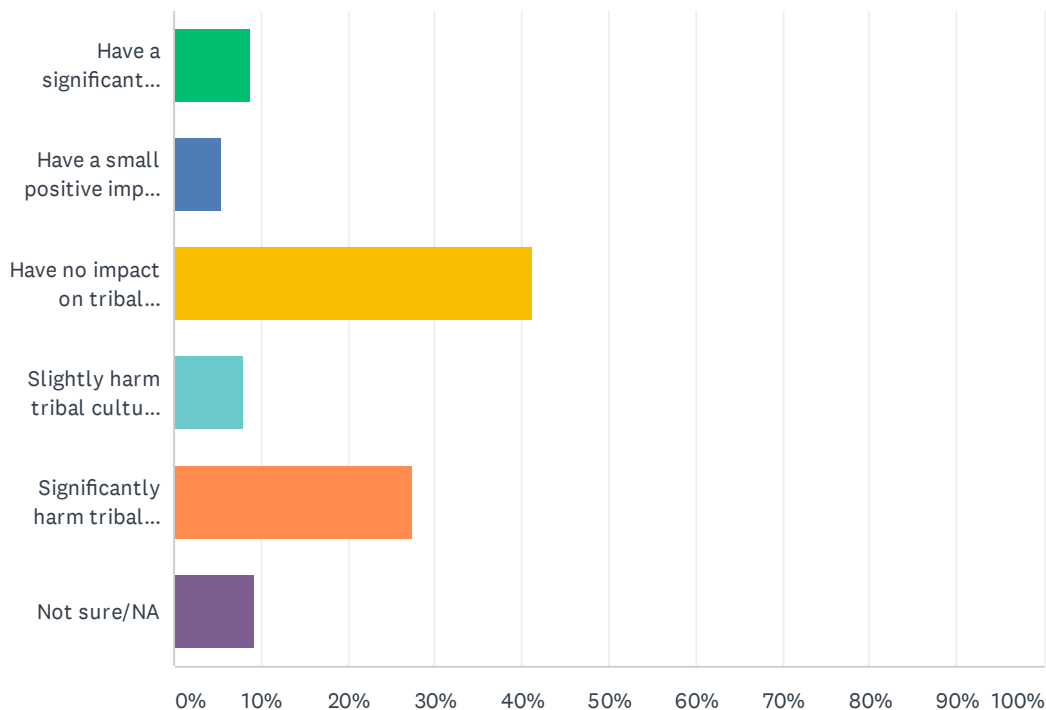
ANSWER CHOICES	RESPONSES	
I agree with how the statement is framed	75.01%	3,977
I disagree with how the statement is framed	24.99%	1,325
TOTAL		5,302

Tribal Cultural Resources

When the dams and reservoirs were created, tribal communities' sites were lost as well as sites for fishing, hunting, and gathering.

Q30 Retaining/Leaving the dams will:

Answered: 5,405 Skipped: 1,796



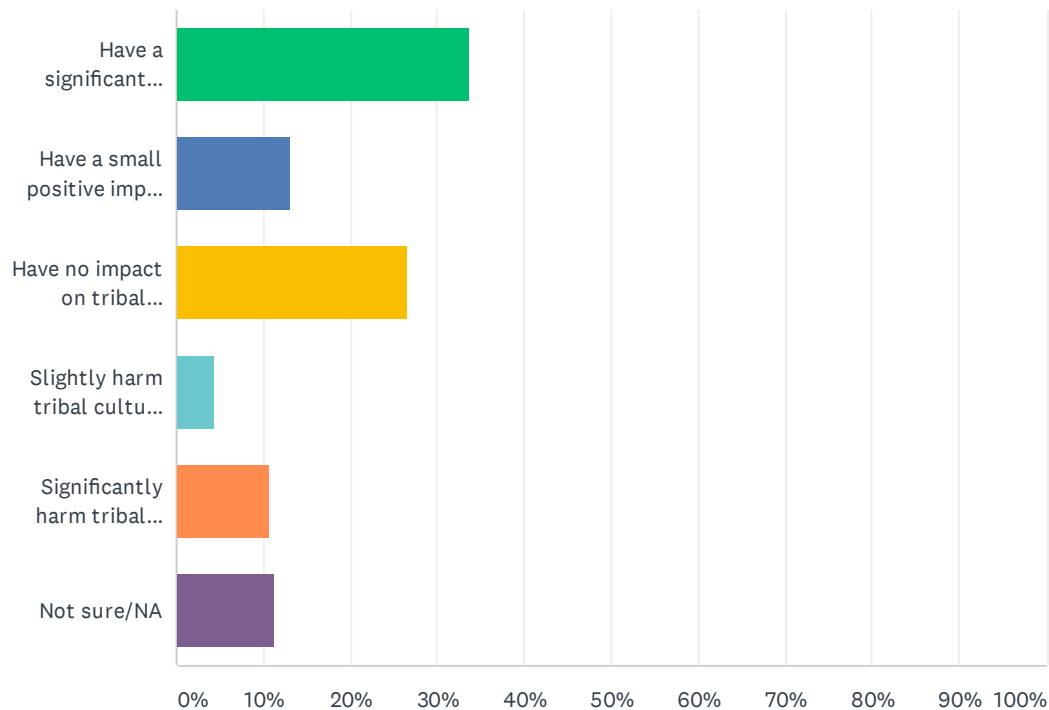
ANSWER CHOICES	RESPONSES	
Have a significant positive impact on tribal cultural resources in the basin	8.70%	470
Have a small positive impact on tribal cultural resources in the basin	5.37%	290
Have no impact on tribal cultural resources in the basin	41.28%	2,231
Slightly harm tribal cultural resources in the basin	7.96%	430
Significantly harm tribal cultural resources in the basin	27.44%	1,483
Not sure/NA	9.27%	501
TOTAL		5,405

Tribal Cultural Resources

When the dams and reservoirs were created, tribal communities' sites were lost as well as sites for fishing, hunting, and gathering.

Q31 Breaching/Removing the dams will:

Answered: 5,418 Skipped: 1,783



ANSWER CHOICES	RESPONSES	
Have a significant positive impact on tribal cultural resources in the basin	33.67%	1,824
Have a small positive impact on tribal cultural resources in the basin	13.25%	718
Have no impact on tribal cultural resources in the basin	26.63%	1,443
Slightly harm tribal cultural resources in the basin	4.45%	241
Significantly harm tribal cultural resources in the basin	10.76%	583
Not sure/NA	11.24%	609
TOTAL		5,418

Q32 Why? (If you'd like, please provide a short (600 characters, with spaces) answer on why you answered the way you did for the questions under this category.)

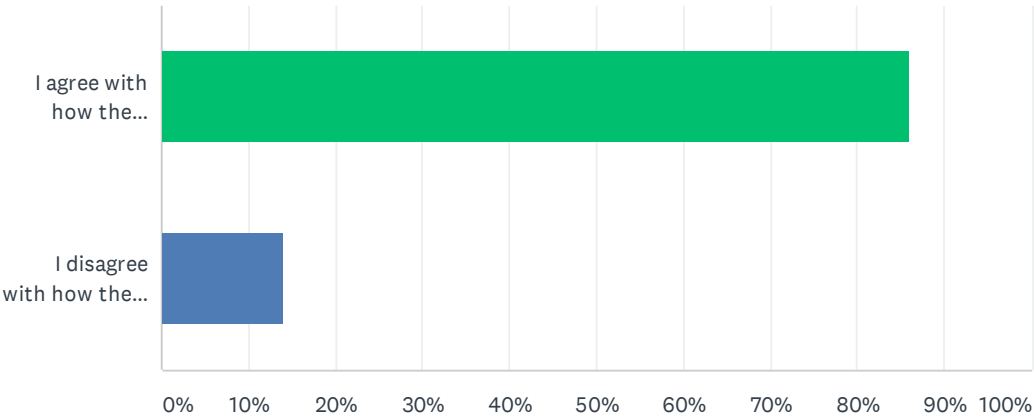
Answered: 1,399 Skipped: 5,802

Economics

There are differing estimates and perspectives on what the impacts will be on the local economy of the communities surrounding the LSRD as well as the state and region more broadly, due to shifts in recreation usage, shifts in employment, shifts in shipping, and shifts in energy and water supply.

Q33 Description of the statement above:

Answered: 5,197 Skipped: 2,004



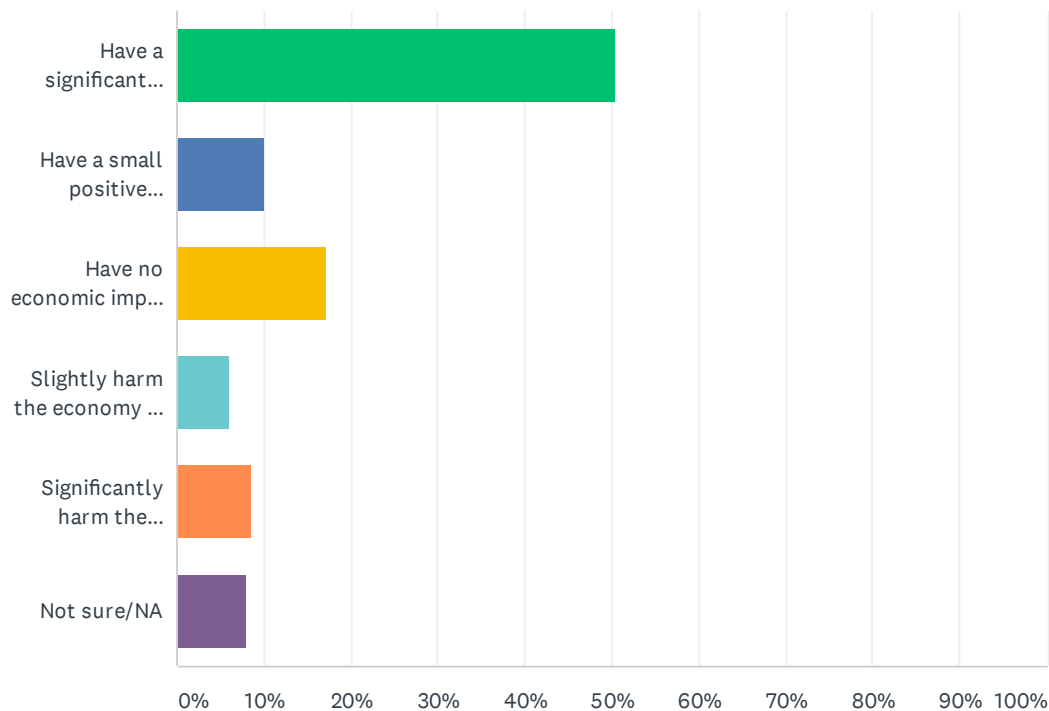
ANSWER CHOICES	RESPONSES	
I agree with how the statement is framed	86.07%	4,473
I disagree with how the statement is framed	13.93%	724
TOTAL		5,197

Economics

There are differing estimates and perspectives on what the impacts will be on the local economy of the communities surrounding the LSRD as well as the state and region more broadly, due to shifts in recreation usage, shifts in employment, shifts in shipping, and shifts in energy and water supply.

Q34 Retaining/Leaving the dams will:

Answered: 5,322 Skipped: 1,879



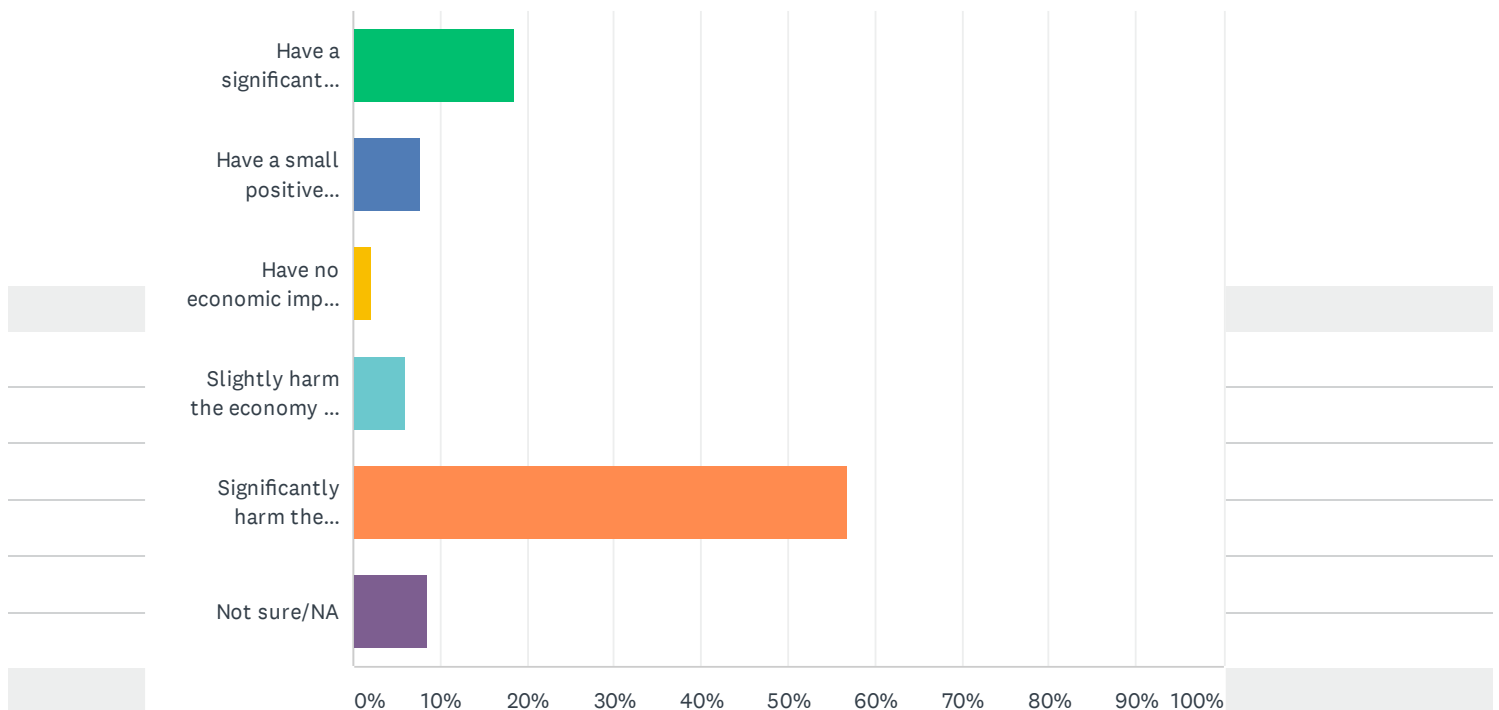
ANSWER CHOICES	RESPONSES	
Have a significant positive economic impact to local communities and the region	50.36%	2,680
Have a small positive economic impact to local communities and the region	10.00%	532
Have no economic impact to local communities and the region	17.17%	914
Slightly harm the economy of local communities and the region	6.05%	322
Significantly harm the economy of local communities and the region	8.51%	453
Not sure/NA	7.91%	421
TOTAL		5,322

Economics

There are differing estimates and perspectives on what the impacts will be on the local economy of the communities surrounding the LSRD as well as the state and region more broadly, due to shifts in recreation usage, shifts in employment, shifts in shipping, and shifts in energy and water supply.

Q35 Breaching/Removing the dams will:

Answered: 5,351 Skipped: 1,850



ANSWER CHOICES

Have a significant positive economic impact to local communities and the region

Have a small positive economic impact to local communities and the region

Have no economic impact to local communities and the region

Slightly harm the economy of local communities and the region

Significantly harm the economy of local communities and the region

Not sure/NA

TOTAL

RESPONSES

18.56% 993

7.81% 418

2.19% 117

6.04% 323

56.81% 3,040

8.60% 460

5,351

Q36 Why? (If you'd like, please provide a short (600 characters, with spaces) answer on why you answered the way you did for the questions under this category.)

Answered: 1,454 Skipped: 5,747

Appendix E: Public Workshop Panel Members

The following fifteen people participated in the three public workshops that happened in Clarkston, Vancouver, and Tri-Cities, Washington during the month of January. Not all panel members were able to participate in all three meetings.

Dustin Aherin (*spoke at all three meetings*) is a 5th generation Idahoan and has been guiding on the Salmon, Snake and Owyhee rivers for over 25 years. He has owned Idaho River Adventures since 2011 operating rafting and fishing trips on the Middle Fork Salmon and Lower Salmon rivers. Dustin has been involved with various efforts to bring back and protect wild salmon and steelhead in Idaho since the mid-1990's. Dustin is president of the Middle Fork Outfitters Association, the trade organization representing the 24 licensed outfitters operating on the Middle Fork Salmon River.

Kieran Connolly (*spoke at the Tri-Cities meeting*) is Vice President of Generation Asset Management in Power Services at Bonneville Power Administration. Managing the federal system with BPA partners (U.S. Army Corps of Engineers, Bureau of Reclamation, and Energy Northwest) to meet the multiple purposes it serves is fundamental to the success of BPA and the region. Kieran previously served as BPA manager of Generation Scheduling, which includes hydroelectric scheduling of the 31 dams in the Federal Columbia River Power System and day-ahead system planning and policy issues that impact real-time power system operations. He has also managed Regional Coordination in Power Services Generation Asset Management's Power and Operations Planning group, requiring knowledge of long-term hydro system modeling, coordination with Canada on river operations, and the integration of fish operations in overall system planning. Kieran began his career at BPA in 1991 as a supply system analyst. He holds a Bachelor of Science degree in Business Economics from Willamette University and a master's degree in Business Administration from the University of Portland.

Dr. Deborah Giles (she goes by her last name) (*spoke at all three meetings*) received her PhD from the University of California Davis in 2014 which focused on the federally listed Southern Resident killer whales. Formerly the Research Director at the Center for Whale Research, she is now the Science and Research Director for the non-profit Wild Orca and a resident scientist and lecturer at the University of Washington's Friday Harbor Lab. Since 2009, Giles has been a research scientist with UW's Center for Conservation Biology, utilizing a scat detection dog to locate floating killer whale scat to monitor the physiological health of whales in the Salish Sea. Giles is a scientific adviser for the Orca Salmon Alliance, a program advisor for Killer Whale Tales, and is on the Steering Committee for the Salish Sea Ecosystem Advocates (SalishSEA).

Nancy Hirsh (*spoke at the Clarkston and Tri-Cities meetings*) is Executive Director for the NW Energy Coalition. Nancy directs the Coalition's efforts to enhance investments in energy efficiency, renewable resources, and low-income energy services through work with utilities, commissioners, regulators, and legislators. She serves on the board of Renewable Northwest and the Centralia Coal Transition Board. She is also on the advisory committee for the Institute for Energy Studies at Western Washington University. From 1996 through 2014 she served as the Coalition's policy director. Before joining the Coalition, she spent twelve years in Washington, DC working on national energy policy issues for the Environmental Action Foundation and the National Wildlife Federation. She lives in Seattle with her

husband, children and dog. When not advocating clean energy solutions, she is an avid backpacker and hiker.

David Johnson (*spoke at all three meetings*) is the Department Manager for the Nez Perce Tribe Fisheries Department. With 190 employees, a \$23 million annual budget, and eight offices located in two states, the Nez Perce Tribe's Fisheries Department is one of the largest tribal fisheries programs of any of the Tribes in the United States. Dave has been the Manager for the program since 2002 and has worked for the Tribe for over 28 years. He has also been employed as Fisheries Biologist with the Forest Service and the Bureau of Indian Affairs. He has a bachelor's and master's degree in Biology from Northern Arizona University and is an enrolled member of the Navajo Tribe.

Joel Kawahara (*spoke at all three meetings*) is a commercial salmon troller based in Quilcene. He has fished salmon first on his father's boat and, since 1987, on his own boat. He has fished salmon from Morro Bay, California, to Yakutat, Alaska. He was born in Seattle and attended the UW, earning a BS in Physics in 1978 and subsequently BSEE in 1985. He left a job and went fishing in 1991. He served on the PFMC Habitat Committee as commercial fishing representative from 2007 until 2018. He has been involved in multiple salmon fishing organizations and currently serves as Vice President to the Coastal Trollers Association. He also serves as one of two commercial fishing representatives to the Save our Wild Salmon Coalition.

Birgit Koehler (*spoke at the Clarkston and Vancouver meetings*) is the Policy Lead for Power on the Columbia River System Operations Environmental Impact Statement (CRSO EIS) at the Bonneville Power Administration. She oversees technical work analyzing potential future operations of the Columbia River System and then brings that information into the policy discussions. Birgit joined BPA in 2002 as a "hydro duty scheduler" responsible for the real-time, hourly operation of the "big 10" projects, ensuring compliance with flood risk management constraints and fish operations, and meeting power needs. She later managed the Regional Coordination group, which is responsible for the implementation of the Columbia River Treaty and negotiation preparation around the future of the Treaty. Prior to joining BPA, Birgit was a DOE Global Change Distinguished Postdoctoral Fellow researching chemical reactions on the surface of polar stratospheric clouds implicated in the formation of the ozone hole. She then joined the faculty at Williams College and studied chemical reactions on soot particles related to contrail formation and climate change. Birgit holds an AB in chemistry and physics from Dartmouth College and a Ph.D. in chemistry from Stanford University.

David Konz (*spoke at the Clarkston meeting*) grew up in the Pacific Northwest and has been working in the maritime industry for nearly two decades. Presently, he works for Tidewater Transportation and Terminals (Tidewater), which has been transporting commodities in the Pacific Northwest for 87 years and is the largest inland marine transportation company west of the Mississippi River. Headquartered in Vancouver, Washington, Tidewater's operating area spans 465 miles of the Columbia and Snake River systems, Canadian West Coast and Puget Sound region. Mr. Konz holds various roles at Tidewater including risk management for all of Tidewater's operating companies as well as building relationships and engagement in advocacy with industry associations, regulatory partners and local, state and federal government officials and staff. Mr. Konz is active in many local organizations including currently serving as the President of the Columbia River Towboat Association, Chair of the Lower Columbia Region Harbor Safety Committee and Board Member for the Rotary Foundation in

Vancouver, Washington. Mr. Konz previously served on the United States' Inland Waterways User Board as the Region Six representative.

Sam Mace (*spoke at the Clarkston and Vancouver meetings*) learned to love rivers and salmon growing up in a fishing/timber town on the Oregon Coast. Sam first got involved in conservation working to protect forested watersheds and began working on Snake River salmon and steelhead restoration in the 1990s for Idaho Wildlife Federation. She had been Save our Wild Salmon's Inland Northwest Director since 2004. Spokane has been home since 1995, where she enjoys gardening, fishing and hiking.

Rob Masonis (*spoke at the Tri-Cities meeting*) manages Trout Unlimited's five conservation programs in the western U.S., which focus on conserving coldwater ecosystems and building an enduring conservation ethic among trout and salmon anglers. During his 26-year professional conservation career he has worked on many aspects of watershed and fisheries conservation and has extensive experience working in the Columbia-Snake Basin. He is an avid angler and fishes throughout Washington and the Pacific Northwest.

Alex McGregor (*spoke at all three meetings*) is chairman of The McGregor Company, a team of 350 colleagues who provide essential crop nutrients and agronomic expertise for 2,000 farm families in more than three dozen farm communities east of the Cascades. He is managing partner of McGregor Land and Livestock, a 137-year old farming and ranching business near the 'breaks' of the Snake River. He serves as chair of the Association of Washington Business Rural Economic Vitality Task Force. Alex is a former history professor who writes about the remarkable people and the remarkable lands of Inland Northwest farm and ranch country.

Blaine Meek (*spoke at the Vancouver and Tri-Cities meetings*) was raised on a family farm and dairy in Southeast Idaho. He graduated from Brigham Young University with a B.S. in finance from the Marriot School of Business. Blaine has been pursuing his passion for farming for 22 years and currently raises process potatoes, carrots, onions, sweet corn, green peas, corn, and wheat with water pumped from Lake Sacajawea behind Ice Harbor Dam. Blaine and his wife Rachelle have been married for 19 years and have 8 children.

Bill Newbry (*spoke at all three meetings*) is President and Chief Executive Officer of Pacific Northwest Farmers' Cooperative (PNW) and has been in that position since 1996. PNW is a 1600-member grain and legume agricultural cooperative formed from numerous cooperative mergers. PNW's growing area spans over 50 facilities and encompasses grain movement from 3 Snake River barge terminals and a shuttle train transportation facility that ships grain from Northern Idaho and Eastern Washington. In Addition to grains, PNW is also a major exporter of pulses to over 40 countries in the world and supplies numerous canners and hummus manufacturers in the U.S.

Rob Rich (*spoke at the Vancouver and Tri-Cities meetings*), originally from Coeur d'Alene, Idaho, started on the river as a deckhand with the former Knappton Towboat Company in 1979. Rob has been at Shaver Transportation Company since 1986 in the operations and administration departments. He currently is V.P. Marine Services. Mr. Rich is Past President of the Columbia River Towboat Association (CRTA), Immediate Past President of Pacific Northwest Waterways Association (PNWA), and Vice Chair of Columbia River Steamship Operators Association (CRSOA), as well as serving on the OMM (Steamer Portland) Board of Directors.

Sara Patton (*spoke at the Vancouver meeting*) led the NW Energy Coalition as its Executive Director from 1993 to 2015 advocating a clean and affordable energy future through energy efficiency, consumer protection, clean renewable energy resources and restoration of fish and wildlife. For 15 years prior to her tenure at the NW Energy Coalition, Ms. Patton built the first major energy efficiency programs at Seattle City Light. Community service and includes the Board of Save Our Wild Salmon, the Board of the Northwest Energy Efficiency Alliance, the Seattle City Light Review Panel, the Sierra Club's Cascade Chapter Executive Committee, the Pike Place Market Historical Commission, the 2006 Helen H. Jackson Woman of Valor Award, and the Friends of the Market Board.

Appendix F: Frequently Asked Questions and Responses

The consultant team collected questions during the public workshops in Clarkston, Vancouver, and Tri-Cities to be considered for the panelists during their discussion. We received many questions from the workshop participants and there was not enough time for the panelists to respond to all of them. However, we reviewed each one and compiled a list of frequently asked questions. Expert teams provided responses for many questions.

Salmon/Steelhead/Ecological Questions

Responses provided by Washington Department of Fish and Wildlife

What role does climate change data play in the dam breaching discussions?

The dams on the lower Snake River slow the river's flow and expand the water surface area exposed to the summer sun, thus altering the river's natural temperature regime and reducing diurnal temperature fluctuations. In general, the dammed river warms up more slowly in the spring with the dams in place, and it cools off more slowly in the late summer and fall. Both a dammed and free-flowing river will warm as the climate warms, but a free-flowing river would likely provide more windows of cooler water for salmon migration in response to cooler weather periods and summer rain events.

In addition, the Snake River basin contains the highest elevation spawning habitat in the Columbia Basin – up to 7,000 feet above sea level. The upper reaches of tributaries like the Salmon River and the Middle Fork Salmon River will remain hospitable for salmon spawning further into climate change scenarios than some lower elevation tributaries in the Basin.

What empirical data shows that breaching the dams would result in restored salmon populations?

The leading empirical data comes from the Comparative Survival Study (CSS), a joint project of the Fish Passage Center, U.S. Fish and Wildlife Service, Columbia River Inter-Tribal Fish Commission, the Idaho Department of Fish and Game, the Oregon Department of Fish and Wildlife, and the Washington Department of Fish and Wildlife. New information on dam breaching from the CSS will be available as part of the CRSO EIS to be released in February 2020. The 2017 CSS report predicts that dam breaching would double to triple Snake River spring/summer Chinook returns relative to the 2014 Federal Columbia River Power System Biological Opinion. Current information is available at www.fpc.org, although that website is currently under reconstruction after a hacking incident.

How do salmon returns in the Snake River system compare to returns on the lower Columbia and other undammed rivers?

According to *A Vision for Salmon and Steelhead: Goals to Restore Thriving Salmon and Steelhead to the Columbia River Basin, Phase 1 Report to the Columbia Basin Task Force of the Marine Fisheries Advisory Committee*, Snake River spring/summer returns have recently averaged 7,700 natural origin fish per year. The “medium” range recovery goal for these fish is 80,000 per year. By comparison, the lower Columbia spring Chinook recent average is 2,200 per year, with medium range recovery goal of 21,550. For the source of this information and more information on Columbia Basin salmon and steelhead stocks, see <https://www.fisheries.noaa.gov/vision-salmon-and-steelhead-goals-restore->

[thriving-salmon-and-steelhead-columbia-river-basin](#), p. 69. Outside of the Columbia Basin in Washington, recent years have seen around 2,500 spring Chinook returning to the Skagit River, just over 200 returning to the Nooksack, and between 500 and 600 in the south Puget Sound's White River. See www.psc.org/download/131/meeting-summaries/11655/2019-psc-post-season-meeting-summary.pdf (see slide #36 titled "Puget Sound Wild Chinook Forecasts").

What are the exact salmon and steelhead return numbers? How many smolt get to the ocean each year?

The best, easily digestible summary of adult and juvenile salmon numbers is probably in the Columbia Basin Partnership report referenced above. Current adult salmon and steelhead numbers are available on p. 69, with more detail on various stocks elsewhere in the report.

For Snake River spring/summer and fall Chinook migrating through the Snake and Columbia river dams, about 58% of juvenile outmigrants, on average, successfully migrate below Bonneville Dam. See Table 2.16-2 in 2019 Biological Opinion for the Federal Columbia River Power System, available at

https://archive.fisheries.noaa.gov/wcr/publications/hydropower/fcrps/master_2019_crs_biological_opinion_1.pdf. More information about smolt migration is available on the Fish Passage Center website at http://fpc.org/smolt/SMP_queries.html.

How much do sea lions and other predators contribute to declining salmon runs? Why not focus more on the impact of other threats, such as predators, ocean conditions, or overharvesting?

On the whole, sea lions consume between about 1-6% of the overall Columbia Basin salmon run, depending on the year. Impacts to specific stocks, such as spring Chinook, has at times reached as high as 40% for certain spring Chinook stocks. Numerous efforts are underway to address predation from pinnipeds, birds, and native and non-native fish, including recent changes in federal law regarding sea lions. More information on sea lion predation is available here:

<https://www.nwcouncil.org/fish-and-wildlife/topics/sealions>; and on predation generally here: <https://www.nwcouncil.org/isab2019-1>.

Harvest levels for Endangered Species Act-listed Columbia Basin salmon and steelhead are quite low, especially for steelhead, sockeye, and spring/summer Chinook, and fisheries target hatchery fish as opposed to wild fish. Harvest rates for all Columbia Basin stocks are discussed on p. 72 of the Phase 1 report from the Columbia Basin Partnership, referenced above.

Ocean conditions can be factored into populations expectations for salmon, but salmon managers do not have a means to affect ocean conditions.

What options do we have for reducing water temperature? Do any of these ideas not include breaching the dams?

Temperatures in the lower Snake River are currently cooled by cool water releases from Dworshak Dam on the Clearwater River, which can reduce temperatures behind the two uppermost lower Snake River dams (Lower Granite and Little Goose) before the effect of those releases fades out by the time the water reaches downstream dams and reservoirs. Beyond releases from Dworshak, options to cool the lower Snake River short of breaching are very limited.

Orca Questions

Responses provided by NOAA West Coast Regional Office

Do orcas distinguish between wild and hatchery salmon?

There is no evidence that killer whales distinguish wild from hatchery fish. From [Hanson et al. 2010](#): Species and stock identification of prey consumed by endangered southern resident killer whales in their summer range

“In addition to considering the effects of reduced abundance of wild salmon on the whales, our results may also inform an assessment of the potential importance of hatchery-produced salmon in meeting the whale’s prey requirements. The data we collected did not allow us to specifically identify hatchery fish in the samples we obtained. However, it is highly likely that some of fish consumed by whales included hatchery fish, because some of the stocks we identified in the whales’ diet contain high proportions of hatchery origin fish.

For example, in many of the South Puget Sound Chinook salmon stocks, the hatchery contribution to these runs exceeds 75% (Pacific Fishery Management Council 2009), and hatchery fish account for approximately 30% of the run of Lower Fraser River Chinook salmon (C. Parken pers. comm.). In the long term, hatchery production has been identified as an important risk factor impacting the viability of wild salmon stocks (Myers et al. 1998) and reducing hatchery releases has been used as a conservation strategy for wild salmon (Moberg et al. 2005, Buhle et al. 2009). In the short term, however, our results suggest that managers may need to consider the potential impacts of reduced killer whale prey that may result by reducing releases of hatchery salmon.”

What is the difference between Puget Sound salmon and Snake River salmon?

In 2018 NOAA Fisheries and WDFW completed a report on [Priority Chinook Stocks](#) which describes a model that analyzes how much endangered Southern Resident killer whales likely depend on different West Coast Chinook salmon stocks. At the end of the paper is a list of West Coast Chinook salmon stocks, according to their importance to the Southern Residents. The model weighs salmon stocks based on how much their ranges overlap with the Southern Residents. The model also incorporates the latest research identifying which salmon stocks the killer whales eat based on fecal samples and scraps of their prey collected by biologists. The model gives extra weight to salmon runs that support the Southern Residents when their access to food is limited, such as in winter when aerial photographs show some whales to have poorer body condition. Puget Sound Chinook salmon stocks and Snake River Chinook salmon stocks are both included on the list with Puget Sound stocks at the top of the list.

What is the connection between SRKW survival/recovery and salmon recovery in the lower Snake River?

In addition to the Priority Chinook Stock Report, please see NOAA’s [Fact Sheet](#) for more information on Southern Resident killer whales and Snake River salmon.

Energy

Responses provided by Washington Northwest Power and Conservation Council Members and Staff

Can you quantify the carbon benefit the dams provide in terms of tons of coal, barrels of oil, or gallons of fuel? It would be possible to do so, but the study's key parameters (e.g. timing of facility removal/decommissioning) would have to be resolved.

To answer the question in a thorough way would require the following:

A study that is grounded on the timing of project decommissioning or removal that includes an analysis of the energy/capacity provided the regional power grid by the projects, the impact of removal or decommissioning on operations throughout the Columbia Basin's hydro system, and the impact on the regional electric system.

Decommissioning or removal would likely affect the rest of the dams in the FCRPS (some might run more and others less); any study would require cooperative effort with BPA and others.

A study analyzing replacement resources should LSRD power be unavailable and assessment of the greenhouse gas output of each when used in a "replacement" capacity.

Closing note: To develop a meaningful study, it would be imperative to clearly identify the period such a study would cover. For example, the renewable resources now included in the regional electric grid are expected to increase in the future as a result of the closure of fossil-fueled facilities, the economic competitiveness of renewable technologies, and the adoption of state policies favoring low carbon emitting resources. These system changes would diminish the projects' expected "carbon benefits" should they be removed or decommissioned. Finally, a decision to remove or decommission the projects would most likely include a staggered timeline for removal that may cover a decade or more.

Should the region be concerned about future energy shortages?

Yes, but not anxious.

An adequate and reliable power system can be achieved with many different combinations of resources, including conservation, demand response, and advanced grid management strategies. For example, this region has offset the need for new fossil fueled resources construction by investing in conservation.

The regional electric industry's reliance upon fossil fuels is rapidly diminishing as a result of economic competition between existing resources and increasingly efficient, lower cost renewable resources and the policy changes enacted by regional state governments.

The transition from fossil fuels to renewable resources has been transforming the region's resource mix for the last decade and planning tools have been developed to ensure system reliability, with renewable resources as a growing contributor to system requirements.

All utilities have a duty to provide safe, efficient, and reliable service.

All but the small (largely rural) utilities are required to develop Integrated Resource Plans, wherein utility system load requirements and the availability of resources to meet load are addressed as key elements of the planning process, including the need for new or replacement resources.

It is expected that regional utilities, including BPA, are planning or will plan for the retirement of regional fossil fuel resources and the development of replacement resources necessary to ensure utility and regional reliability.

Implementation of such Integrated Resources Plans across the region can be expected to mitigate the potential impact of fossil fuel retirements on regional grid reliability.

To ensure a reliable and economic power supply across the region, the Northwest Power and Conservation Council, serving in its statutory role as the region-wide resource planning entity, is currently developing the 2021 Northwest Power Plan to identify the resources necessary to maintain the reliability and cost-effectiveness of the region's electric grid.

Why should we switch to renewable energy sources when they're unpredictable and costly?

First, no generation technology can lay claim to a perfect reliability record. Maintenance requirements, unexpected mechanical breakdowns, fuel delivery interruptions, and transmission service outages all impact the ability of any generator to deliver power to the load, including those fueled by coal and natural gas.

That said, the “expected” or “planned” output of a fossil fuel generator is better predicted than the output of the predominant renewable technologies.

The resource planning process recognizes such uncertainty when determining the cost-effective resources available to meet expected load.

Existing software tools and long-term weather analysis allow utilities (or independent generators) to effectively predict the output of renewable resources over a given region and period.

The intermittent nature of renewable resources can be mitigated by resources offering a complimentary output pattern that “balances” the target system or by importing resources from available market generators.

In recent years, renewable resources have been demonstrated to serve load at a cost that competes with or out-competes fossil fuel generators.

How can the state meet its 2035 and 2045 renewable energy goals if the dams are removed?

Washington's Clean Energy Transformation Act (CETA) has effectively superseded the previous renewable energy goals set forth in the Energy Independence Act (EIA). CETA's carbon objectives in 2035 and 2045 will require the transformation of existing generation resources to low or no carbon generators. Because the expected replacement resources would be comprised of renewable generators with no or low carbon emissions, the renewable energy goals set forth in the EIA would be satisfied.

At this time, the LSR projects are not identified as renewable resources.

What is BPA going to do with its transmission assets?

Should BPA and its federal partner agencies decide to remove the LSR projects, the transmission capacity would still be available for use by BPA and others, with the exception of the stub lines that connect the projects to the grid.

Will infrastructure and energy generation be in place before the dams are breached?

This would be the expectation. Please see the resource adequacy response above.

When do the generators on the LSRD need to be replaced and how much does it cost?

This information is not readily available but could be provided in the CRSO draft environmental impact statement that has not been released to the public.

What are the costs to taxpayers to run the LSRD?

LSRD project operations are expected to be funded by the revenues produced by marketing the power generated by the facilities.

What are the negative effects of wind turbines on the environment?

The environmental impacts linked to the operation of wind turbines are primarily associated with avian and bat mortalities from turbine blades. There are also identifiable terrestrial impacts associated with property development at the turbine construction site. Site selection is a key consideration in the permitting process to minimize impacts to birds and mammals.

Agriculture/Transportation

How does breaching affect irrigation availability and logistics for farmers? Is it still possible to irrigate if the dams are breached?

Breaching the dams will likely lower the groundwater table and reduce farmers' ability to draw water from the river with current pump systems. The Department of Ecology Water Rights Tracking System lists 41 total surface water diversions and 84 wells within one mile of the lower Snake River that would be impacted by water level changes if the LSRD are breached. However, it is possible to irrigate if the dams are breached. Mitigating changes from breaching would include lowering intake structures, creating additional pumping capacity, digging deeper wells and other operational changes.

How do you factor projections for continued production gains in the analysis?

The report acknowledges that agriculture production has increased in recent years and that commodity flows out of the region are projected to increase into the future. However, the report does not provide new analysis on this topic.

How will climate change affect the types of crops grown in the Basin?

Climate change was not discussed much within the report because it falls outside the scope of this project. However, climate change is a significant topic that the agriculture community in eastern Washington is considering. We were able to find information from the Washington State University Center for Sustaining Agriculture and Natural Resources that is on this topic. More information can be found here: <http://csanr.wsu.edu/publications-library/climate-change/climate-impacts-adaptation/>.

Other

How do the costs of maintaining the dams factor into the analysis?

The report primarily references two economics analyses that weigh the costs of retaining and breaching the dams: USACE's 2002 "Lower Snake River Juvenile Salmon Migration FS/EIS" and ECONorthwest's 2019 "Lower Snake River Dams: Economic Tradeoffs of Removal." The 2002 FS/EIS found that uncertainties remained that prevented the USACE from concluding whether it would be cost-effective to breach the LSRD. The ECONorthwest report concluded that the public benefits of breaching the LSRD exceed the costs of retaining them: while breaching the LSRD would result in increased power and transportation costs, benefits in recreational uses (including a calculation of the "non-use" value for salmon recovery) offset costs of removing the dams. For more information, please see pages 69–70 of the report.

Was the stakeholder survey a formal, scientific/statistical process?

No. The stakeholder survey and public workshops were open to all who chose to participate, but it was not a scientific process. The data collected were limited to those who knew about the process and who chose/were able to respond.

How were stakeholders for interviews identified/chosen?

The initial 25 interviewees were selected based on their role, position, and expertise with the different issues surrounding the effects, concerns and issues with retaining or breaching the LSRD. The last 70 interviewees were with representatives of organizations identified in the initial interviews. For more information, please see pages 16–17 of the report.

Is the tribes' input weighted more heavily than other stakeholders, given their status as sovereign nations to whom the federal government has made commitments?

The federal government and Washington have a government-to-government relationship with tribes; decisions about the LSRD need to comply with tribal treaties and government-to-government protocols for engagement and consultation with the tribes. The Governor's Office is engaging with impacted tribes and tribal consortia including the Columbia River Inter-Tribal Fish Commission and Upper Columbia United Tribes.

Moving Forward/Future Questions

Many of the questions submitted at the public workshops related to possible dam scenarios in the future. Though this report can't answer them, these questions are important to consider, as they reflect people's concerns and curiosities.

- If the dams are removed and their services replaced, can federal taxpayers help pay for the transition?
- Could we build canals/water diversions for navigation/irrigation?
- If we agree that salmon and hydropower and navigation and commercial fishing and agriculture/irrigation are important, how do we walk that road instead of "us vs. them" message that seems to dominate the state-wide conversation today?

- If the dams are breached, how will the materials (e.g., rebar, towers, silt, concrete chunks) be dealt with? How might it affect the ecosystem?
- Who would own the land exposed when the dams are breached?
- What effect would breaching the dams have on flood control for the lower Columbia River (Portland and Astoria)?
- Why stop at Washington? What about Dworshak and the upper Snake River dams that prevent salmon passage altogether?
- What effect would breaching the dams have on rural gentrification?
- What if the dams are removed and salmon populations don't return?
- Who determines a reasonable time frame for evaluating whether dam breaching was successful?

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