Irrigation Sector Economic Impacts on the Lower Snake River

Benchmark Review for Dam Breaching and Mitigation Costs

Ice Harbor Dam Tailrace, Lower Snake River (2023)

Prepared For:

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And the Washington State Legislature

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This benchmark review is already dated as it is being written, as it reaches into an unknown future, where decisions affecting dam breaching on the Lower Snake River (LSR) are far from being certain--particularly as they impact mainstem irrigation projects along Ice Harbor and Upper McNary pools.

The LSR EIS litigation settlement agreement, approved by the Plaintiffs and Defendants, defers significant physical changes to the LSR hydro projects by at least five to ten years. In real-world terms, decisions would have to be determined and reconstruction measures executed today, for irrigation systems to be operational by 2030.

Nevertheless, the economic impacts can be placed in today's context for executive and legislative considerations.

Irrigation Impact Area:

- This review designates a well-specified impact area, taking into account the full effect of dam breaching and pool drawdowns on the LSR and Columbia River system. The primary impact area covers about 92,500 acres served by the Ice Harbor and Upper McNary Pools.

Irrigation Pump Station Modifications:

- The breaching of Ice Harbor Dam would lower the water surface elevations making all of the existing irrigation pump stations located in the pool inoperable; and changes to river topography and huge volumes of siltation would affect pumping stations below the existing Ice Harbor Dam tailrace to the confluence of the Walla Walla River and McNary Pool.
- Direct reconstruction costs are considered to be water pumping infrastructure costs associated with significant modifications or replacement of irrigation pump platforms and/or pumps, intakes and screens entering the river, manifolds from the pumps to the mainline piping systems, associated electrical connections, all excavation works, and drilling replacement wells.
    - The direct station-by-station reconstruction costs are estimated to be between $92-184 million (2021$). Future costs are expected to escalate significantly.
    - A main pipeline configuration is estimated to cost at least $500 million to $1 billion.
    - Reconstruction timelines from design to operations are estimated to be about 2-5 years.
    - Minimal disruption to irrigation water service is estimated to be about 1-2 years (unavoidable).

Risk Mitigation Cost Estimates:

- The risk mitigation assessment methodology accepts that national economic development (NED) impacts would manifest as "distressed" land values under dam breaching conditions. This value impact would be about $578 to 759 million.
    - $578 to 759 million required mitigation payments to land-irrigation project owners.
    - Estimated shared debt (financing) obligations by Bonneville Power Administration and Washington State would be about $35 to $47 million, annually.

Regional Household Income Impact Estimates:

- The potential regional economic development (RED) impacts are estimated as annual value of household income tied to the affected irrigation area, defined as the Irrigated Agriculture Industry, with direct, indirect, and induced impacts to regional income.
    - Total regional income values (impacts) are estimated to range between $450 to $464 million.
    - It would be impossible to mitigate fully regional income impacts, if LSR dam breaching occurred.

Irrigation Sector Economic Impacts on the Lower Snake River Benchmark Review for Dam Breaching and Mitigation Costs

Figure 1. Ice Harbor Pool Irrigation Pump Station, South Shoreline Location (2023)

This review is already dated as it is being written, as it reaches into an unknown future, where decisions affecting dam breaching on the Lower Snake River (LSR) are far from being certain--particularly as they impact mainstem irrigation projects along Ice Harbor and Upper McNary pools, the two lower system hydro projects. The review is a glimpse-in-time today, that dimly illuminates tomorrow's decisions.

The LSR litigation settlement agreement approved by the Plaintiffs and Defendants defers significant physical changes to the LSR hydro projects by at least ten years.[1] There would have to be renewed litigation actions to bring breaching or deep pool drawdowns forward between 2025-2030. That only could happen if the key Plaintiffs—the Nez Perce Tribe or EarthJustice—perceive little gain in the current Federal Hydro Agencies' commitments to change LSR hydro project operations. The commitments may prove to be unsatisfactory to achieving the Plaintiffs' long-stated objective to bring change to the LSR hydro system. Even so, the decision timeframe would likely extend more than a decade for actual irrigation project reconstruction work to commence. Revised irrigation development plans and economic impact and mitigation assessments would be revised, once more. In real-world terms, decisions would have to be determined and reconstruction measures executed today, for irrigation systems to be operational by 2030.

So being, the review conveys a "benchmark" perspective to understand and quantify irrigation sector impacts. It forms a picture from which to visualize potential impact mitigation measures and to provide insight into the "opportunity costs" associated with LSR dam breaching.

[1] U.S. Federal Administration Agencies Commitments and Agreements, Federal Mediation and Consiliation Service (FMCS) Process, December 15, 2023, as transferred to the U.S. Federal District (OR) Court, Portland, Oregon.

1. Legislative and Executive Direction.

Figure 2. Ice Harbor Dam Forebay with Irrigation Fields in Background (2023)

Responding to the study recommendations made earlier in 2022 by Washington Governor Jay Inslee and U.S. Senator Patty Murray,[2] the Washington State legislature reauthorized funding for a more complete review of impacts to the irrigation sector stemming from LSR dam breaching during the 2023 legislative session.

This directive to the Office of Columbia River (OCR), Ecology, specifically asked OCR to address:

1) Existing information and studies dealing with irrigation sector (infrastructure) impacts.
2) Potential mitigation needs to irrigators to off-set breaching impacts.
3) Impacts to water rights.
4) Cost estimates for direct irrigation system impacts and modifications/upgrades.
5) Interim approaches to supplying irrigation water during the actual pool(s) drawdown phase.

In this review, some additional irrigation impacts and issues are considered, including:

6) Irrigation sector impacts below the Ice Harbor tailrace caused by four-dam breaching; flow elevation and siltation-debris impacts.

[2] "Lower Snake River Dams Replacement Services Report," Prepared for WA Gov. Jay Inslee, Sen. Patty Murray, Olympia, WA, October 2022.

7) Whether realistic timelines for preconstruction engineering and infrastructure modifications can be/should be pursued? Can irrigation water pumping operations precede stable and suitable water quality conditions?

8) Are there some impact areas, like regional household secondary income impacts, that cannot be realistically mitigated, where seasonal production disruption occurs?

2. State/Federal Litigation-Policy History and Direction.

The LSR projects--Lower Granite, Little Goose, Lower Monumental, and Ice Harbor—were constructed during the 1962-1975 period. Since construction, about half of the projects' operating life has been subjected to Endangered Species Act (ESA) litigation, with an initial ESA violation filing made by EarthJustice in 1992. The Federal Courts have upheld several operating challenges levied by EarthJustice, representing about ten regional environmental and sport fishing groups, with support from others. Over the course of thirty years, project operations have been significantly altered to obtain survival improvements to migrating juvenile salmon and steelhead, and returning adult fish. These changes have principally affected hydro power production, to increase flows over the spillways, as opposed to power production, as well as other operational and system changes.

The project operations to date have not directly affected irrigation operations along the river. The irrigation pumping systems rely on stable reservoir levels created by the LSR dams, and portions of the Upper McNary Pool reaching into the tailrace of the Ice Harbor Dam. But things could change.

In 2016, U.S. Federal District (OR) Judge Michael Simon vacated the 2014 Biological Opinion for Columbia-Snake River hydro project operations, a centerpiece for fish protection under the Endangered Species Act (ESA). He accepted the argument by the state of Oregon, EarthJustice, and other plaintiffs that the Columbia River System Operation (CRSO) agencies had failed to include adequate operation measures to protect thirteen "listed" salmon and steelhead species from "risk of extinction." In doing so, Judge Simon further ordered the CRSO agencies to prepare a new Environmental Impact Statement (EIS), that would become the technical foundation for a new Biological Opinion, changing hydro project operations. His order was very specific, in that he told the agencies to review in detail a Lower Snake River dam breaching/drawdown alternative.[3]

The CRSO agencies completed the Final EIS in September 2020.[4] It was immediately challenged by the BiOp litigation plainfiffs, EarthJustice, et al., the state of Oregon, and with Tribal support. Rather than file immediately in 2021 for injunctive relief, the plaintiffs agreed to pursue a litigation "stay" with the federal agencies (U.S. Army Corps of Engineers, Bonneville Power Administration, U.S. Bureau of Reclamation-Interior, and NOAA Fisheries). The stay period was to determine if a settlement agreement could be fashioned that would meet the plaintiffs' dam breaching objective and still mitigate for major river system

[3] Order by U.S. Federal District (OR) Judge Michael Simon, Case 3:01-cv-00640-SI Document 2065 Filed May 4, 2016, Pages 1-149

[4] USACE, BPA, USBR, NOAA Fisheries, "Final Columbia River System Operations EIS," Portland, OR (Washington DC), September 2022.

economic industries, the electric power production, Lower Snake River (LSR) barge navigation, and irrigation projects along the Ice Harbor-Upper McNary pools.[5]

Proceeding concurrently with the Federal EIS Process, the Washington State legislature approved funding for a stakeholder study to address issues associated with the possible removal of the four LSR dams. This study was supported by Gov. Inslee and Sen. Murray. Its two conclusions were: 1) the LSR dams should be breached to protect/restore salmon and steelhead recovery; and 2) dam breaching should be conditional on providing "replacement services" to the major industries being affected. Recognizing the technical deficiencies associated with the first study, the legislature authorized a second study to deal more thoroughly with the dam breaching proposition; during the 2023 legislative session, legislators and Gov. Jay Inslee approved funding for further state review of LSR dam breaching impacts to the irrigation sector.

This benchmark review responds to the 2023 legislative-Administrative directive, taking into account "on-the ground" knowledge of the irrigation projects and decades of experience in adhering to resource economics standards that require federal and state principles and regulations.

3. Water Right Impacts.

The primary review area along Ice Harbor and McNary pools affects about 92,500 acres, served by multiple surface and groundwater water rights (see Tables 6-9 and Figures 5-8). These rights consist of permits, certificates, and claims. The rights are in good standing as documented within the Washington State Dept. of Ecology database (water right mapping data, October 2023). These rights' irrigated acres estimates have been calibrated against the Washington State Department of Agricultural 2022 Crop Mapping data, used here to estimate the total impact area for Ice Harbor and McNary Pools.

During an irrigation pump station modification phase, all of the rights will likely be curtailed by reconstruction activity. Unavoidable cessation of water right use would likely be about 1-2 years, a period of time that would not invoke relinquishment of the rights under state water law (RCW-90.14.140). Further, the rights are protected from legal provisions interfering with their use, and the litigation/Court directives for Lower Snake River dam breaching would apply in this situation. If further protection from relinquishment is deemed necessary, the rights could be placed in the Temporary Trust Instream Program (RCW 90.42) for the period of disruption, and then reactivated thereafter.

It can be concluded with certainty that the water rights are secure from nonuse relinquishment or other regulatory impediments. The water rights would remain unchanged in private sector hands.

4. Impact Measures.

a. Irrigation Station Reconstruction Costs.

The breaching of the LSR dams would have significant adverse direct impacts to the existing irrigation pump stations and irrigation wells serving tens of thousands of acres of high value irrigation lands lying adjacent to

[5] Some relatively small amounts of irrigated acres exist along the Lower Monumental Pool, about 700 acres.

the Snake River above Ice Harbor Dam. Additionally, the irrigation pump stations lying below Ice Harbor Dam, located in the McNary Pool, would experience impacts to their water intakes.

Direct reconstruction costs are considered to be water pumping infrastructure costs associated with significant modifications or replacement of irrigation pump platforms and/or pumps, intakes and screens entering the river, manifolds from the pumps to the mainline piping systems, associated electrical connections, all excavation works, and drilling replacement wells.

Modifying River Pump Stations.

The breaching of Ice Harbor Dam would lower the water surface elevation of the Snake River by about 80 ft. at the dam forebay, changing pool elevations from where the existing irrigation pump stations are located. This would make all of the existing irrigation pump stations located above Ice Harbor Dam inoperable. Each pump station is unique, but each pump station will require at least some significant changes to intake and screen structures, some requiring extensive piping and platform changes.

The river pump stations located below Ice Harbor Dam also would be impacted. The breaching of the Lower Snake River Dams will result in millions of tons of sediment to travel down the Snake River[6] and be deposited in the Columbia River above McNary Dam—primarily below the tailrace area below (the existing) Ice Harbor Dam, and along the north shore between the Snake-Columbia River confluence and the confluence with the Walla Walla River. This sedimentation will have severe impacts on the pump station water intakes making those pump stations inoperable. It also is very unclear how the new river topography would evolve below Ice Harbor Dam affecting variable flow fluctuations/elevations during the irrigation season.

Several of the independently owned intake, pumping units, platforms, and manifolds/mainline systems share platform infrastructure. There are approximately 25 independent surface water pumping units within the Ice Harbor Pool and Upper McNary Pool (north shore) to the Walla Walla River confluence, serving production irrigated agriculture.

Wells.

There are numerous groundwater wells located along the Lower Snake River above Ice Harbor Dam. These wells are in hydraulic continuity with the Lower Snake River and as such their static water levels are directly impacted by the water level in the Snake River. The breaching of Ice Harbor Dam would lower the water surface elevation, where most of these irrigation wells are sited (some in the Upper McNary Pool deemed to be largely unaffected). The associated lowering of static water levels in the wells would effectively make them inoperable and require modifications.

In most places, new wells would need to be constructed. Most of the existing wells penetrate either the alluvial sands and gravels lying adjacent to the river, or the shallow basalt aquifer. In either case lowering the static water levels 30 to 90 feet will make them inoperable. This will require drilling wells further into the basalts. New drilling will likely have mixed results, as this has been previously attempted at locations along the river, with some wells being productive and others not. If adequate groundwater cannot be obtained,

[6] CRSO Agencies, "Columbia River System Operations Environmental Impact Statement," 2020.___

additional river pump stations may be required to obtain the water needed for the project currently being irrigated from well(s).

Like the river pump stations, the wells along the river differ greatly. None are identical, making cost estimates for modification very difficult to estimate.

b. Direct Net Assets and Mitigation—National Economic Development.

The concepts and analyses for irrigation sector direct economic impacts, with inherent mitigation measures, should be modeled on well-established principles for federal water resources management. This standard should incorporate direct net value (NED) changes to water distribution and land assets, predicated on observable, market-based determinations for willingness-to pay.

Resource economics valuation methods for land and water investments have long-embraced fundamental principles for changes to net social welfare (utility) using market-based transactions.[7] This work largely identifies changes to NED values determined through basic measures of willingness-to-pay, opportunity costs, and avoided/replacement costs. These types of marginal value changes can reflect both direct net benefits and costs.

Specific to these economic evaluations: *"Risk and uncertainties should be identified and described in a manner that is clear and understandable to the public and decision makers. This includes describing the nature, likelihood, and magnitude of risks (including quantitatively where feasible)…Mitigation of adverse effects associated with each plan, strategy, or action is to be an integral part of all alternatives."*[8]

The Lower Snake-Columbia River irrigation sector impacts would cover the total asset values of the pump stations and water delivery system modifications, the loss of agricultural production/markets during re-construction, and the costs to on-site product processing facilities. In total, this represents the full asset value being impaired (or potentially lost); it is the direct net impact (value) that should be included under National Economic Develop accounting--that should be used in all CRSO and State impact studies.

This asset value is best measured by the market value of the land that "bundles" all values in a land transaction between buyers and sellers. This is the true expression of willingness-to-pay, and it measures the direct net value baseline for the existing water/land assets, as well as allowing for a determination of the impaired asset value under breaching/drawdown conditions.

The breaching/drawdown action would create "distressed assets," where the assets' value in the market is diminished. The distressed assets are created by the risks associated with the uncertain costs of modifying pump stations, the unknown time frame for loss of operations, how effective the future pumping operations would be, and how the agricultural production markets respond to interruptions to site-specific supply.

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[7] Since the 1950s, federal water resources management agencies have followed methodologies outlined in evolving forms of "Principles and Guidelines" (WA-DC 1982); or "Principles and Requirements for Federal Investments in Water Resources in Water Resources" (CEQ-DOI 2013, CEQ 2014 and 2015); and described historically in Alvin Goodman, "Principles of Water Resources Planning," Prentice Hall, 1984.

[8] "Principles and Requirements," CEQ, March 2013, October 2019.

It is this inherent asset risk that defines the irrigation sector costs and the required mitigation compensation caused by breaching/drawdowns. Like the baseline asset value, the risk mitigation impairment value can be best measured by the market—what is the market's willingness-to-pay for land assets that will be subject to breaching/drawdowns.[9] What does the change to asset market value reveal?

c. Regional Income Impacts—Regional Economic Development (RED).

The RED economic impacts consist of household dollar impacts most often referenced in irrigation project developments—the stream of income obtained from direct agricultural production, agricultural support services, and food processing (nondurable goods manufacturing). These "direct" sectors serve other "indirect" sectors throughout the economy and create "induced" impacts from additional household expenditures. It is the total composition of inter-weaving economic sector purchases and sales that compose Regional Economic Development, described as income value.

d. Focus on Acre-Level Impacts.

The Review economic impact study requires a common denominator to better understand and interpret what is being measured. In this review, the economic impacts are determined, and summarized, at the irrigated acre level. The review impact measures are threefold.

An ability to estimate future reconstruction impacts for diverse pump stations becomes more practical to first assess acre costs for recent reconstruction/develop projects, and then apply this range to the full impact acreages under review (approximately 92,500 acre).

For estimating direct net economic development (NED) impacts, with mitigation, the focus is on establishing a baseline for irrigated acres market value (2021$ estimates). And for regional economic development (RED) impacts, reasonable household income impacts can be assigned to the project acres as an average value per acre.

Bringing these three economic impact areas to an acre-value common denominator also provides decision makers with a more appreciable metric for considering the magnitude of impact levels. For example, reconstruction cost alternatives can vary greatly, and most land owners view project cost impacts across their own farm acreages.

5. The Economic Impact Area.

a. Franklin-Walla Counties.

The review irrigation pump stations are located in Franklin and Walla Walla counties. The affected acreages are displayed in Figures 5 and 6 and Tables 6-8. Both the project reconstruction costs and NED impacts are easily assigned to these acreage locations. This does not hold true for the RED impacts, as some portion of the household income estimates "leak" into Benton County, or the state. The INPLAN model and state-wide Bureau of Economic Analysis (BEA) derived estimates take this into account, unless specified otherwise.

[9] It is unclear to CSRIA if the USBR will accurately measure fully the Irrigation Sector impacts, and how they will account for asset value changes.

b. Ice Harbor Pool and McNary Upper Reach Pool to Walla Walla River Confluence.

The irrigation sector requires a well-specified impact area, taking into account the full effect of dam breaching and pool drawdowns on the Mainstem Snake and Columbia River system. The primary impact area includes the Ice Harbor and Upper McNary Pools displayed in Figures 5 and 6.

In total, approximately 92,500 acres are being irrigated along the pools.[10] About 54,900 acres are served by the Ice Harbor Pool,[11] and about 37,600 are served below Ice Harbor Pool and along the Upper McNary Pool reach.

Under the four Lower Snake River dam breaching alternatives, the Ice Harbor Pool would be lowered by about 80 ft. at the project forebay location (assuming some remaining in-river head elevation). This creates a deep pool drawdown condition for all pumping stations (and wells), eliminating existing water access to the pumping intakes. The topography of the river system is not 90 degrees vertical, but involves various gradients depending on location. Under breaching conditions, the entire pump station intake system would have to be rebuilt and debris/fish screens rebuilt/repositioned. In several cases, pumping plants would need to be reconfigured and repositioned. The overall stability of the existing pool elevations would change, and with a narrowed/reconfigured channel, pumping elevations would fluctuate—the reconstructed pump stations would need to be rebuilt to function under these variable conditions. The existing pool stability would no longer exist, moderating river elevations for river flows varying between 20-120 kcfs during the irrigation season.

The Upper McNary Pool reach would be very problematic under dam breaching conditions, as it is unclear what would happen to reconfigured pool stability between Ice Harbor Dam and the Snake River confluence; and the area below the confluence to the mouth of the Walla Walla River is a shallow backwater area. This entire eastern-side reach area would be severely affected under minimum operating pool (MOP) drawdowns on the McNary Pool, about 2-6 ft., that are included within the EIS alternatives and could be employed in combination with Lower Snake River dam breaching. Even without McNary MOP operations, the Lower Snake River siltation deposits will settle in the McNary Pool backwater area, requiring major dredging and pump station intake reconfiguration measures.

The 4-dam LSR breaching action would likely have some degree of impact on other portions of the McNary Pool not considered in this review. Some siltation impacts should be expected, but the level of pumping impairment is highly speculative, and cannot be quantified until actual river system operations change. Vegetation and river debris problems should be expected leading to more operation and maintenance needs.

[10] Estimates based on irrigated acres/water rights data reviewed from the Washington State Dept. of Agriculture Crop Mapping Project (2018); the Washington State Dept. of Ecology GWIS and WRTS data bases (2019); and data modeling by the Benton-Franklin Conservation District (2019). See Figures 1 and 2.

[11] About 800 acres above Ice Harbor Pool below Lower Monumental.

Figure 3. Irrigation Pump Station on Upper McNary Pool, Backwater Area (2022)

Figure 4. Pump Station Intake-Screen Structure into Pool (2022)

6. Reconstruction Cost Estimates, Potential Pump Station Costs Per Acre.

a. Direct Reconstruction Approach.

The most direct approach to estimating potential impacts, and associated mitigation costs, to pump station infrastructure reconstruction is to assess existing pump station modifications or developing new structures, along the Lower Snake-Columbia River system. There have been several projects that either have been reconstructed or built within the past six years, that offer some insight into a cost range that could apply to the LSR projects.

In Table 1, available cost estimates are displayed for recent project modifications and new development. The projects considered here are large-scale in pumping requirements, all have intake systems that are somewhat similar in design to the affected dam breaching projects, and have similar types of infrastructure configurations. The projects exist on the Mainstem Columbia-Snake River system.

Table 1. Cost Estimates for Existing/New Projects

Pump Station-Project Location	Construction Modification	Estimated 2021$	Estimated Direct Acres Served	Estimated $/Acre
Lower McNary Pool	New Pump Station Infrastructure 50% Intake Structure	$32,500,000 $12,500,000	16,000	$2,030 $780
Upper McNary Pool	Rebuilt Intakes-Pump Station Modification	$16,250,000	15,0000	$1,080
Ice Harbor Pool	Rebuilt Intakes-Pump Station Modifications	$8,750,000	5,200	$1,680
John Day Pool	Rebuilt Intakes-Screens	$5,000,000	16,000	$310
Ice Harbor-McNary* Pools New Structures	Intakes-Pump Station Manifold-Electric	$12,000,000	5,000	$2,500
John Day Pool** 2024 Development	New Well Drilled	$750,000	400	$1,880
Ice Harbor Pool* Existing Project	Redrilled Wells Casing, Pumps	$600,000	205	$2,930
Ice Harbor Pool* Existing Project	Redrilled Wells Casing, Pumps	$3,000,000	3,000	$1,000
Estimated Cost Mid-Range/Acre				$1,000-$2,000
Estimated Cost Range for 92,500 Acres				$92,000,000 To $184,000,000

Sources: Existing and future costs estimates from CSRIA Representatives/Members, IRZ Consulting, Benton-Franklin County Water Conservancy Board cost estimates.
<u>Escalation rates to 2021 costs from:</u>
Mortenson Construction Cost Index for Portland, OR: 2018-2021, 30%.
Federal Reserve Economic Data, Costs Index for Producers-Construction: 2016-2021, 29%.
Energy News Record, Heavy Construction Index: 2016-2021, 21%.
*Future development cost estimate (CSRIA); Since 2021, construction cost estimates have increased by about 14-20%.
** Cost estimate from Benton County Water Conservancy Board, 2021$. Project to be built in 2024.

The estimates provided are based on actual, private sector construction costs during the 2016-2021 period, with estimates updated to reflect 2021 construction dollars.[12] The costs are provided as estimated direct capital costs for specific acreages, with costs allocated on a per acre basis. Taken as a broad range, the costs per acre, per project, span from about $300/acre to about $1,800/acre. A future estimate also is provided for a "generic" pump station modification, visualizing upward costs to about $2,500/acre. CSRIA's consulting engineers indicate that unknown reconstruction factors could readily increase this future cost estimate.

Applying the above costs to reflect reconstruction projects suggest a mid-range of about $1,000 to $2,000/acre. Further applying this cost range to the overall impact area of about 92,000 acres, suggests total reconstruction costs falling in the $92 to $184 million range. The higher estimate of this cost range may capture a large set of unknowns affecting each pumping system and assumes a certain amount of efficiency that would have to be obtained in the reconstruction process.

This reconstruction approach is estimated to take about 1-4 years from design to operations, and it is accepted that at least 1-2 year of irrigation disruption would occur, as some of the reconstruction work would likely take place after a pool drawdown occurs. It also is uncertain whether siltation problems would severely affect new pumping system operations, further delaying irrigation production. The design, construction, and re-started operations would have to be precisely coordinated.

b. River Pump Station Reconstruction with Main Pipeline Design.

Another approach to pump station reconstruction would be to forego direct project-by-project redevelopment and instead rely on a main pipeline configuration, where either existing pump stations tie-in to the new main pipeline; or the pipeline is routed to an upriver field elevation (with reregulation reservoir). New pumping units would then be connected to the system.

It is most likely that two new intake-screen systems would be sited upriver from the existing irrigation projects, feeding new lift stations on both sides of the river. From the lift stations, large pipelines would require road-causeway construction for supporting the new pipelines. This could be designed along the existing railroad-bed on the north bank or along the "new" riverbank along the south side—two new pipeline corridors. Under this configuration, existing river pump stations could be used with tie-ins to the main pipelines, with water then using existing distribution lines to the fields.

The above pipeline approach also could be modified to pump from the new riverbed intake site, to reregulation reservoirs on both sides of the river. From the reregulation reservoirs, main pipelines would then distribute water to specific field areas downriver. New boosting pump units would be built at the field locations.

The above is a very, very brief conceptual sketch of shifting to a large-scale pumping-piping system that would require significant design work and coordinated construction with river dam breaching activity. Like the project-by-project approach, it would require at least 1-4 years from design to operations, or likely a longer period. It is uncertain whether it could be developed without some delays in irrigation production, perhaps for 1-2 years.

[12] The cost estimates do not include net power costs (net present value over time).

In this review, no attempt is made to design such a system or make formal cost estimates. But given previous work in building several pipelines and pump stations along the Columbia-Snake River system, this type of project could easily be in the $500 million to $1 billion cost[13] range, particularly given recent heavy construction cost increases. The project costs reflect private sector development.

7. National Economic Development (NED) Impacts/Assets. With Mitigation.

a. Market Based NED Aanalysis.

To convey more accurately the direct irrigation sector economic impacts and a required mitigation strategy, the CSRIA developed a Risk Mitigation Response Alternative (2020). The approach defines the legal, technical, and economic factors that must be fully considered by the CRSO agencies and Washington State elected leadership, under LSR dam breaching and project pool drawdowns.

The ESA-CRSO litigation EIS was authorized via the National Environmental Policy Act and generally followed the Council of Environmental Quality Regulations for EIS preparation.[14] Within the EIS, the agencies must assess appropriate mitigation measures for the proposed action or other EIS alternatives.[15] Benefit-cost analyses are optional for inclusion in an EIS, but in the case of major, federal water resources actions, B-C analyses are almost always prepared. Such economic analyses incorporate the direct economic costs for mitigation measures.

Authorized under Washington State's 2019 operations budget,[16] the legislature allocated $750,000 for the Governor's Office 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 four Lower Snake River dams in order to recover the Chinook salmon populations that serve as a vital food source for southern resident orcas."*

In 2023, further review was authorized by the legislature to review the irrigation sector economic costs of dam breaching, and ways to avoid or limit impacts. The risk mitigation impact method employed by CSRIA follows three basic principles:

1. The concepts and analyses for Irrigation Sector direct economic impacts, with inherent mitigation measures, should be modeled on well-established principles for federal water resources

[13] Recent estimates by USBR for this type of construction exceed $1 billion.
[14] NEPA, Pub.L. 91-190, 24 U.S.C. 4321-4347, as amended 1970, 1975, 1982; CEQ Regulations 2005, and October 10, 2019, Title 40 Protection of the Environment, Part 1502—Environmental Impact Statement.
[15] Providing mitigation plans under NEPA/EIS frameworks is applied as standard practice, for example, see NOAA, U.S. Dept. of Commerce, "Guidelines and Principles for Social Impact Assessment," NOAA Interagency Committee, May 1994; and CSRIA Representatives note that virtually all EIS preparation handbooks elaborate on defining mitigation measures for proposed alternatives.
[16] House Appropriations Committee, Operations Budget, ESHB 1109, Section 118; and see Southern Resident Orca Task Force, "Report and Recommendations," November 2018, November 2019.

management. This standard should incorporate direct net value changes to water distribution and land assets, predicated on observable, market-based determinations for willingness-to pay.

2. The direct economic impacts must be defined based on market asset values for the irrigated land impacts, taking into account pump station modifications, loss of production, and on-site processing infrastructure. The dam breaching-pool drawdown actions would create a "distressed asset value" that must be the foundation for EIS/State study impacts and mitigation compensation.

3. The primary Irrigation Sector impacts can be measured through recent asset-based market transactions and the market perception toward risks associated with distressed asset values. The asset market reflects the private, corporate, and institutional entities that have made recent market purchases, and those entities who have an ability and desire to expand farm asset operations.

The direct economic value baseline for the affected irrigated acres is well known, and it is the market asset value displayed through irrigated land purchases and sales.[17] These transactions take into account the full land asset value for pump stations, agricultural production, and on-site processing facilities serving irrigation operations. The values also reveal the market's true accounting for real irrigated land escalation rates and future terminal values, that are not captured in conventional lenders' enterprise/production budget calculations.[18] This full market valuation factor is extremely important to the privately held farming operations along the pools, as these lands are perhaps the most desired irrigation holdings in the Western U.S.[19]

In Table 3 attached, the more recent land/asset value sales are displayed for the farming operations served by the Ice Harbor, McNary, and John Day pools. This sales information is accumulated from County Assessor land transaction and taxation data bases, private realty land value data bases, CSRIA members' comparable land sales information, and land sales contracts reviewed by CSRIA representatives. This information covers the 2016-2018 and 2020-2023 periods.

To provide a single asset value estimate, in dollar value per acre terms, the 2016-2018 land asset sales data have been weighted by acres for the direct sales involved, and then adjusted to reflect the current acreage mix for tree fruit-grape production versus field-row crop production. This yields an "average" asset value of about $16,400/acre, relevant to the primary impact acres (92,500 acres). Since 2018, two additional land sales pertinent to this market assessment occurred in 2020-2023, for about $16,500/acre and $16,700/acre. As such, the overall valuation per acre is determined to be about $16,500/acre (2021$).[20]

In total, the baseline, primary asset value is about $1.526 billion. This serves as the baseline value from which to estimate the risk mitigation value affecting the primary impact acres.

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[17] In more technical terms, the market value is equivalent to the capitalized value of the annual income streams to ownership and management over time, discounted to present value dollars. This market value is the direct economic value that should be applied to National Economic Development accounting. Changes in direct net economic value form the basis for federal water resources benefit/cost analyses, for river management impacts.

[18] The irrigated land enterprise/production budgets used by the USBR to measure direct net value are inadequate to measure the full asset values of irrigated land, for high quality, 21st Century irrigated farming operations.

[19] There is strong market demand for all the Columbia-Snake River direct-pumper farms, with the CSRIA regularly contacted for land market availability.

[20] The 2018-2021 national Agricultural lands sales values display little change, NASS Data, 2023.

Subject to dam breaching, the risk impacts create a "distressed asset value" that is best estimated by the market. In this circumstance, the market is composed of the individual land holdings owners and farm mangers who have written the checks to acquire the existing assets, and they are actively engaged in the market to purchase additional holdings where opportunities emerge. Most of these market entities are CSRIA members.

The calculation of the distressed market is made by how the market discounts the asset value given the dam breaching-pool drawdown risks. These risks include intake and pump station rebuilding costs, lost production income during the initial breaching/drawdown phase, stranded asset costs for on-site processing facilities, and potential market losses or reintroduction costs with product buyers. The question becomes, if the breaching/drawdown action is known to happen today, how does that affect the baseline asset value? How much would the new distressed asset value be worth? What would be the market's new willingness-to-pay to acquire the subject land assets?

A structured ranking question was posed to individual market entities (12 separate entities), and again collectively to the CSRIA Board of Directors, identifying land asset discounting ranges (90% to "no sale'), where the entities had cash-in-hand or financing preapproval for new purchases. The market entities provided a consistent asset (capital) discount rate of 30-50% (two entities replied "no sale"). In effect, the market would not reject the land assets for new purchase, but the market entities would substantially reduce the asset value of the land holdings, confronted with the risk surrounding many unknown costs.

The breaching/drawdown risk deflates the asset holdings. The difference between the asset value baseline and the distressed asset value level establishes the amount of the risk mitigation response required for Irrigation Sector compensation. Allocated for each pool, the risk mitigation value is:

- Ice Harbor Pool, 30-50% distressed asset value: $271,260,000--$452,100,000.
- Upper McNary Pool, 30% distress asset value: $306,900,000.

This risk mitigation response estimate establishes a benchmark compensation value at about $578,160,000 to $759,000,000. This is the "average" compensation value required to bring the irrigation sector back to a baseline, market-based value level of $16,500 per acre, for 92,500 acres.

. **b. Risk Mitigation Compensation.**

The risk mitigation response alternative includes obligations by the irrigation sector and a capital repayment structure that equitably assigns mitigation costs. The irrigation sector would be responsible for pump station and infrastructure modifications, incurred agricultural production costs, and disrupted market functions. The Bonneville Power Administration and Washington State would be responsible for up-front mitigation payments to the Irrigation Sector.

Compensation to injured parties by those holding liability is a normative legal standard[21] and is implicitly expressed in EIS mitigation alternatives. This standard applies more cogently, where intent is premeditated or is part of an agency action that benefits some broad societal objective at the expense of select parties. In

[21] For example, see Steven Shavell, "Foundations of Economic Analysis of Law," Fellows of Harvard College, Harvard University Press, 2004.

this case, the irrigation sector is the party to be compensated for injuries, and the social liability payments are best compensated through the Bonneville Power Administration (BPA) and the state of Washington.

The Irrigators can be unequivocally recognized as the affected (injured) party, they must bear the costs of changes to river operations that impair irrigation water pumping. The BPA has received power benefits from the hydro projects, distributed throughout the Western States, and it is responsible for fish mitigation costs under the Northwest Power Act of 1980. The state of Washington has received significant economic benefits from the Lower Snake River-Columbia system irrigation projects, including direct and secondary impacts from income, employment, and taxation. These statewide benefits should now engender some degree of liability for the Irrigation Sector impacts, and for continued contribution to the state economy and tax structure.[22]

Under a shared compensation responsibility, the BPA and Washington State would need to borrow about $578,160,000--$759,000,000 to provide up-front capital payments, for risk mitigation response compensation. If borrowed from long-term Federal Treasury debt and state General Obligation capital bonding sources, the annualized BPA and State debt repayments would be approximately:

- Bonneville Power Administration (T-bonds), $289--379 million: $17.6—23.5 million annually.
- Washington State (General Obligation Bonds), $289--379 million: $17.6--$23.5 million annually.

Using the above benchmark estimates for risk mitigation response, the total annual irrigation sector cost for debt repayment would be about $35 to $47 million.[23]

Receiving the risk mitigation response compensation, the Irrigation Sector would be responsible for pump station and infrastructure modifications, incurred agricultural production income losses, and impaired market functions. All these obligations would be incurred by the private sector irrigators.

8. Regional Economic Development (RED) Impacts.

While economists prefer measures of direct (NED) value for determining net social welfare benefits (or costs), most state and regional decision makers prefer "local" impact estimates (RED) expressed as regional household income or employment. The preferred estimate provided here is annual household income impacts, across the 92,500 acres within the project area. The estimates are principally based on income estimates derived from the agricultural production, agricultural services, and food processing sectors (direct) and linked to income estimates from associated indirect and induced purchases made from other sectors (secondary impacts). This series of product sales (output) and purchases (inputs) create inter-sector income throughout the regional economy.

These income estimates can be calculated using independent input-output models (IMPLAN) or income data/models from the U.S. Bureau of Economic Analysis (BEA multipliers).[24] The INPLAN model and BEA

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[22] The State (legislature/Governor Inslee) also assumes some inescapable liability by requesting dam breaching studies.

[23] Payment amortization at 30-years with a 4.5% bonding interest rate.

[24] IMPLAN is a private sector economic model with cloud-based access/structure https://implan.com/company/. BEA models and multipliers may be reviewed/obtained on a government website referred to as BEARFACTS, https://apps.bea.gov/regional/bearfacts/. Modification of the multipliers is made by CSRIA, per discussion with BEA

model estimates can be very similar depending on data and assumptions used for both. They both depict a "spreadsheet" of the regional economy containing the numerous linkages between economic sectors. Both model estimates are reported in Table _ , as prepared by the USBR (2020 EIS) and CSRIA.

The RED estimates for the project area suggest significant contributions to regional household income. The USBR and BEA estimates are congruent, suggesting an annual income contribution range of about $4,870 to $5,020 per acre. In total, this amounts to about $450 to $464 million annually. The closeness of the range also suggests reliability of the estimates for the policy-based objective of this review.

Table 2. Estimated Regional Economic Development-Household Income Impacts

Regional Income Model-Sectors	Acres	Annual Income/Acre Estimated 2021$	Total Annual Income 2021$
Ice Harbor Pool USBR INPLAN Model	48,999	$5,020	$245,683,000
Ice Harbor-Upper McNary Pools-USBR INPLAN Model*	92,500	$5,020	$464,350,000
WA State Irrigated Ag. Estimate BEA Data-Multipliers	1,850,000	$4,870	$9,005,800,000
Project Area Irrigated Ag. Estimate BEA Data-Multipliers**	92,500	$4,870	$450,475,000
Regional Irrigated Ag. Estimate-NASS-BEA-Data-Mult.***	92,500	$4,280	$394,000,000

Sources: U.S. Army Corps of Engineers, Bonneville Power Administration, U.S. Bureau of Reclamation, "Columbia River System Operations EIS," Portland, OR, 2020, Appendix N Water Supply Impacts.
NASS and Bureau of Economic Analysis Data from Table 4.
BEA Multiplier Estimates from RIMS II Data-Model Sets with Adjustments by CSRIA (see Table 4).
*INPLAN Model estimates carried forward to adjacent crop production estimates below Ice Harbor Pool given similar crop mix for high-value crop production (potatoes, alfalfa, tree fruit, other).
**BEA Data-Multiplier estimates rely on percentage estimates for irrigated acres income, for state-wide impacts, minus cattle production income (estimated at 30% of total income, per 2021 production value).
***BEA income data estimate based on direct economic sectors, Production Agriculture, Ag. Services, Food Processing sectors, with indirect income multiplier (combined sectors) at 1.90, per statewide estimate in Appendix Table . Estimated direct income based on irrigation acreage percentage of project area counties, that exclude income within Benton County and other areas serving the project. Estimate should be considered preliminary.

When the direct model sectors--agricultural production, services, and food processing--are aggregated, forming the "Irrigated Agricultural Industry," income (or value added) multipliers usually fall within the 2.0-2.5 range.[25] The multiplier estimate used here is calculated as 1.9 applied to the secondary economic sectors.

models, to avoid double counting of income impacts between sectors (based on final demand contributions by sector). For example, the agricultural production sector multiplier for income earnings is reduce by about 50% to avoid double counting with the food processing sector.

[25] Pacific NW Project, "Western Irrigated Agriculture Economic Impacts," White Paper Prepared for the Family Farm Alliance, Kennewick, for service to the USBR commissioner, WA 2015; Pacific NW Project, "Southeastern Idaho Water Resources Management Impacts, A Policy White Paper Review," Prepared for the Bingham, ID, Groundwater District for service to the Idaho Department of Water Resources, technical hearings, January and June 2023, Kennewick, WA.

9. What Cannot Be Mitigated, What Can Be Mitigated.

a. Development Timelines.

As noted above, being able to complete irrigation pump station reconstruction, without some loss to irrigation season(s) pumping will not likely be feasible given multiple timing factors affecting dam breaching and pool drawdowns, and integrating this development schedule with pump station reconstruction, for either pump station-by-pump station work or for a regional pipeline approach. It is estimated that from design to reconstruction development will require 2-4 years (at best), and disruption to some irrigation pumping will likely fall within a (minimal) 1-2 year period. Even these timing estimates may be overly optimistic.

10. Regional Impact Mitigation.

Attempting to mitigate for regional household income impacts for the direct, indirect, and induced economic sectors will be next to impossible. At best, the risk mitigation alternative may be the most optimal manner to provide some degree of income compensation to the farm operators and some farm employees. This compensation would include payment for private sector reconstruction for the pump stations, directly implemented by the farm/asset owners (all private sector reconstruction).

11. Further Consideration for the Pipeline Implementation.

The Franklin Conservation District and CSRIA have only preliminarily discussed above a pipeline implementation approach to serving the Ice Harbor and Upper McNary Pools pump stations, under LSR dam breaching conditions. This type of approach carries with it much different reconstruction needs and timing than that contemplated by pump station-to-pump station modifications. The District and CSRIA have some approaches, or potential alternatives, that likely differ from that currently be considered by the USBR. The state would likely benefit from pursuing further review work with the District and CSRIA to better understand these alternatives.

ATTACHED TABLES AND MAPS

Table 3. Land/Production Asset Market Sales Values.

For Ice Harbor, McNary, and John Day Pools 2016-2019, and with 2021-2023 Sales.

Columbia-Snake R. Project Pools*	**Approximate Irrigated Acres**	**Sale Composition**	**Est. $/Acre 2018$**
Ice Harbor Pool-R	2,200	Pumps/System/Land (Equipment)	$14,500
Ice Harbor Pool-R	2,200	Pumps/System/Land (Equipment)	$11,700
Ice Harbor Pool-T/V	510	Pumps/System/Land (Contract Bid)	$17,800
Ice Harbor Pool-T/V	6,200	Pumps/System/Land Processing, Other	$23,000
Ice Harbor Pool-R	1,250	Pumps/System/Land Processing, Other	$20,100
John Day Pool-R	13,500	Pumps/System/Land (Equipment)	$13,000
John Day Pool-T/V	20	Pumps/System/Land	$21,100
McNary Pool-T/V	150	Pumps/System/Land	$30,000
McNary Pool-R	130	Pumps/System/Land	$17,600
McNary Pool-R	160	Pumps/System/Land	$10,500
Transaction Acres:	26,320	Weighted Ave. $/Acre:	$15,900
		Adjusted Ave. $/Acre: For Site Crop Types	**$16,400**
McNary Pool (2021$)	**12,400**	Pumps/System/Land	**$16,500**
John Day Pool (2023$)	**2,640**	Pumps/System/Land and Additional Water	**$16,950**

Sources: Benton, Franklin, Walla Walla Counties' Assessor Offices, Taxation and Sales Web Site Data 2019; Acre Value Google Website, WA Land Sales and Prices for Benton, Franklin, and Walla Walla Counties, September 2019; CSRIA Board Member Land Valuation Comparables Appraisal; Personal Communications with CSRIA Members (land sales); and CSRIA Representative Review of Selected Land-Water Purchase and Sales Agreements (2017-2019); 2021 and 2023 Sales Data from CSRIA Representatives and Members.

* T/V = Trees/Vineyards; R = Row or Field Crops.

Table 4. The Irrigated Agriculture Industry—Real Dollar Meaning

State water policy governing the Irrigated Agriculture Industry has "real dollar meaning" to the economic life of Eastern WA and state citizens. It drives the future for irrigators, laborers, managers, scientists, entrepreneurs, manufacturers, and suppliers working directly within the Industry and to the thousands of people who sustain support services and community needs.

Political leaders' water policy directives become agency actions, with agency staff interpreting statutes and administrative rules "to fit" the policy objectives. Those in the Industry say that political leaders should recognize the economic prevalence already in-hand and be working with Industry representatives to shape the future, not just react to it. Basic water supplies for irrigation are far more stable in Eastern WA than most other areas of the Western U.S. That puts the state in a unique position to further grow real dollar economic benefits.

Washington State Irrigated Agriculture Industry[26]
Estimated Annual Household Income Value, 2021$

Industry Sector	Estimated % Irr. Ag.	Direct 2021$ Earnings/Income	Indirect/Induced Multiplier Impact	Estimated Total Impact 2021$
Direct Irr. Ag. Production	85%	$2,719,150,000	1.49	$4,051,534,000
(Crops and Cattle)				
Ag. Services	75%	$1,025,250,000	1.16	$1,189,290,000
(Non-Forestry-Irr. Ag.)				
Food Processing/Manuf.	90%	$2,569,500,000	2.60	$6,680,700,000
(Irr. Ag. Products)				
Beverages	60%	$429,600,000	2.20	$945,120,000
(Irr. Ag. Products)				
TOTAL:		**$6,743,500,000**		**$12,866,640,000**

[26] **The Irrigated Agriculture Industry:** is comprised of the direct irrigated farm production, agricultural services (includes some crop/food packaging), and the food processing and manufacturing sectors. The non-irrigated Ag. sector is excluded. Impact multipliers applied here are adjusted to avoid inter-sector double counting.
Analysis Sources include: USDA, National Agricultural Statistical Services (NASS), 2017-2018 Market Value Production Estimates and Irrigation Survey, Census of Agriculture, WA; NASS, Washington State Production Data, 2020, Statistical Bulletin, Production and Value Series, 2022; U.S. Bureau of Economic Analysis, Personal Income by Major Industry (NAICS) Data Tables WA 2021 Estimates (Earnings/Income); U.S. Bureau of Economic Analysis Regional Economic Impacts Tools, Regional Input-Output Inter-Industry Modeling and Regional I/O Model Multiplier Estimates (Income/Employment) for WA and Central WA Counties, BEARFACTS; Inter-Industry Final Demand/Requirements Linkages for 2012 with 2020 Data Estimates.
Note: Impact estimates reflect broad sector impacts and are not specific to any independent project or sub-industry sector. Estimates prepared by the Pacific NW Project and are considered conservative and reliable for policy-based alternatives and decisions affecting WA State Irrigated Agriculture. Further information may be obtained by contacting CSRIA representatives at 509-783-1623 or CSRIA.org.

Table 5. Risk Mitigation Asset Values

Market-Based Determinations for Baseline Values and Impacts

Columbia-Snake R. Project Pools*	**Approximate Irrigated Acres**	**Ave. Land Asset Value $/Acre 2018$**	**Total Impact Area Baseline Asset Value**
Ice Harbor Pool	54,900	------	------
Upper McNary Pool	37,600	------	------
Total Acres/Asset Value	92,500	$16,500	$1,526,250,000
Distressed Assets	**Market Based**		
Impact Value by Pool	**Estimated Impact**	**Value of Distress Assets**	**Total**
Ice Harbor Pool	30%	$271,260,000	------
	50%	$452,100,000	------
Upper McNary Pool	30%	$306,900,000	------
		Total Distressed Asset:	$578,160,000
			$759,000,000
			Annual Long-Term Dept
	Shared Payment Level	**Capital Asset Liability**	**Repayment Liability***
Distressed Assets	Bonneville Power Admin. 50%	$289 to $379 Million	$17.6 to $23.5 Million
Capital Repayments	State of WA 50%	$289 to $379 Million	$17.6 to $23.5 Million
			Total
			$35 to $47 Million

Sources: Market-Based Distressed Values estimated by current land sales purchasers and active market participants,

CSRIA members and CSRIA Representatives.

* Assumes BPA financial obligation tied to long-term Federal Treasury Bonds (or similar debt), and long-term WA State general

obligation bonds. A "mixed" interest/discount rate of 4.5% annually is applied to the above financing assumptions.

Table 6. Irrigated Crops – Total, Above Ice Harbor Pool, and McNary Pool

Irrigated Crops within Area of Interest/Impact	
Crop Type	**Acres**
Potato	20,017
Apple	13,877
Corn, Field	12,896
Wheat	11,828
Corn, Sweet	11,345
Alfalfa Hay	4,825
Onion	2,897
Pea, Green	2,357
Carrot	1,255
Cherry	1,232
Pasture	1,166
Grass Seed	1,115
Fallow, Tilled	1,030
Timothy	1,017
Bean, Dry	973
Grape, Juice	749
Blueberry	712
Wildlife Feed	549
Mint	437
Fallow, Idle	424
Grape, Wine	253
Pea, Dry	233
Garlic	225
Canola	203
Asparagus	190
Corn Seed	138
Barley	136
Wheat Fallow	112
Grass Hay	88
Cover Crop	50
Developed	40
Filbert	34
Pea Seed	27
Alfalfa/Grass Hay	21
Unknown	9
Fallow	3
Market Crops	2
Caneberry	1
Kiwi	1
Nectarine/Peach	1
Grand Total	**92,468**

Irrigated Crops within Area of Interest/Impact Above Ice Harbor Dam	
Crop Type	**Acres**
Potato	11,455
Corn, Field	9,651
Apple	8,855
Wheat	7,897
Corn, Sweet	5,358
Onion	2,265
Pea, Green	1,690
Alfalfa Hay	1,236
Carrot	1,140
Pasture	817
Grass Seed	685
Grape, Juice	647
Cherry	558
Wildlife Feed	549
Fallow, Tilled	369
Mint	329
Pea, Dry	233
Canola	203
Grape, Wine	147
Timothy	140
Corn Seed	138
Wheat Fallow	112
Grape, Wine	104
Fallow, Idle	102
Grass Hay	81
Filbert	34
Pea Seed	27
Cover Crop	18
Fallow	3
Grand Total	**54,843**

Irrigated Crops within Area of Interest/Impact McNary Pool	
Crop Type	**Acres**
Potato	8,562
Corn, Sweet	5,987
Apple	5,022
Wheat	3,931
Alfalfa Hay	3,589
Corn, Field	3,245
Bean, Dry	973
Timothy	877
Blueberry	712
Cherry	674
Pea, Green	667
Fallow, Tilled	661
Onion	632
Grass Seed	430
Pasture	349
Fallow, Idle	322
Garlic	225
Asparagus	190
Barley	136
Carrot	115
Mint	108
Grape, Juice	102
Developed	40
Cover Crop	32
Alfalfa/Grass Hay	21
Unknown	9
Grass Hay	7
Grape, Wine	2
Market Crops	2
Kiwi	1
Caneberry	1
Nectarine/Peach	1
Grand Total	**37,625**

Table 7. Franklin County Irrigated Crops – Total, Above Ice Harbor Pool, and McNary Pool

Franklin County Irrigated Crops within Area of Interest/Impact

Crop Type	Acres
Potato	4,611
Apple	3,292
Wheat	2,662
Corn, Sweet	2,068
Corn, Field	1,815
Onion	1,315
Pea, Green	738
Fallow, Tilled	605
Grass Seed	576
Cherry	495
Blueberry	439
Wildlife Feed	395
Alfalfa Hay	259
Pea, Dry	233
Canola	203
Wheat Fallow	112
Grape, Wine	104
Grass Hay	81
Pasture	79
Fallow, Idle	37
Filbert	34
Pea Seed	27
Alfalfa/Grass Hay	21
Developed	20
Timothy	18
Fallow	3
Grand Total	**20,242**

Franklin County Irrigated Crops within Area of Interest/Impact Above Ice Harbor Dam

Crop Type	Acres
Potato	2,805
Wheat	2,193
Apple	1,729
Corn, Field	1,685
Corn, Sweet	1,219
Onion	1,076
Pea, Green	738
Grass Seed	576
Wildlife Feed	395
Alfalfa Hay	241
Pea, Dry	233
Canola	203
Cherry	193
Wheat Fallow	112
Grape, Wine	104
Grass Hay	81
Pasture	41
Fallow, Idle	37
Filbert	34
Pea Seed	27
Timothy	18
Fallow	3
Grand Total	**13,743**

Franklin County Irrigated Crops within Area of Interest/Impact McNary Pool

Crop Type	Acres
Potato	1,806
Apple	1,563
Corn, Sweet	849
Fallow, Tilled	605
Wheat	469
Blueberry	439
Cherry	302
Onion	239
Corn, Field	130
Pasture	38
Alfalfa/Grass Hay	21
Developed	20
Alfalfa Hay	18
Grand Total	**6,499**

Table 8. Walla Walla Irrigated Crops – Total, Above Ice Harbor Pool, and McNary Pool

Walla Walla County Irrigated Crops within Area of Interest/Impact

Crop Type	Acres
Potato	15,406
Corn, Field	11,081
Apple	10,585
Corn, Sweet	9,277
Wheat	9,166
Alfalfa Hay	4,566
Pea, Green	1,619
Onion	1,582
Carrot	1,255
Pasture	1,087
Timothy	999
Bean, Dry	973
Grape, Juice	749
Cherry	737
Grass Seed	539
Mint	437
Fallow, Tilled	425
Fallow, Idle	387
Blueberry	273
Garlic	225
Asparagus	190
Wildlife Feed	154
Grape, Wine	149
Corn Seed	138
Barley	136
Cover Crop	50
Developed	20
Unknown	9
Grass Hay	7
Market Crops	2
Caneberry	1
Kiwi	1
Nectarine/Peach	1
Grand Total	**72,226**

Walla Walla County Irrigated Crops within Area of Interest/Impact Above Ice Harbor Dam

Crop Type	Acres
Potato	8,650
Corn, Field	7,966
Apple	7,126
Wheat	5,704
Corn, Sweet	4,139
Onion	1,189
Carrot	1,140
Alfalfa Hay	995
Pea, Green	952
Pasture	776
Grape, Juice	647
Fallow, Tilled	369
Cherry	365
Mint	329
Wildlife Feed	154
Grape, Wine	147
Corn Seed	138
Timothy	122
Grass Seed	109
Fallow, Idle	65
Cover Crop	18
Grand Total	**41,100**

Walla Walla County Irrigated Crops within Area of Interest/Impact McNary Pool

Crop Type	Acres
Potato	6,756
Corn, Sweet	5,138
Alfalfa Hay	3,571
Wheat	3,462
Apple	3,459
Corn, Field	3,115
Bean, Dry	973
Timothy	877
Pea, Green	667
Grass Seed	430
Onion	393
Cherry	372
Fallow, Idle	322
Pasture	311
Blueberry	273
Garlic	225
Asparagus	190
Barley	136
Carrot	115
Mint	108
Grape, Juice	102
Fallow, Tilled	56
Cover Crop	32
Developed	20
Unknown	9
Grass Hay	7
Grape, Wine	2
Market Crops	2
Kiwi	1
Caneberry	1
Nectarine/Peach	1
Grand Total	**31,126**

Table 9. Irrigated Water Rights within the Impacted Area

Water Right Number	Water Right Type[1]	Instantaneous Amount (Qi)	Annual Volume (Qa)	Irrigated Acres	Instantaneous Unit	Purpose Of Use	Source
S3-00812C	CE	125	21,000	7,000	CFS	IR	surfaceWater
S3-20371C	CE	84	15,673	4,514	CFS	IR	surfaceWater
S3-01062C	CE	30	18,000	4,500	CFS	IR	surfaceWater
SWC11862	CE	63	15,916	3,979	CFS	IR	surfaceWater
S3-22838C(A)	CE	87	18,191	3,912	CFS	IR	surfaceWater
SWC10703	CE	80	23,121	3,303	CFS	IR	surfaceWater
S3-*18108C	CE	37	8,532	2,942	CFS	IR	surfaceWater
S3-01503C	CE	44	5,138	2,492	CFS	IR	surfaceWater
S3-21044(C)	CE	58	11,320	2,435	CFS	IR	surfaceWater
S3-*28646J	CE	64	12,000	2,400	CFS	IR IR IR	surfaceWater
S3-22228(A)SC	CE	36	11,531	2,200	CFS	IR	surfaceWater
S3-01599CWRIS	CE	27	6,465	2,155	CFS	IR	surfaceWater
S3-21045C	CE	42	7,628	1,907	CFS	IR	surfaceWater
S3-24501C	CE	30	8,370	1,800	CFS	IR	surfaceWater
S3-01593C	CE	30	7,212	1,379	CFS	IR	surfaceWater
SWC09252	CE	40	8,850	1,319	CFS	IR	surfaceWater
S4-01351(A)C	CE	15	3,282	1,231	CFS	IR	surfaceWater
S3-01180CWRIS	CE	17	4,102	1,111	CFS	DS ST IR	surfaceWater
S3-21044C(B)	CE	22	4,314	928	CFS	IR	surfaceWater
S3-21433APCWRIS	CE	17	3,072	920	CFS	IR	surfaceWater
S3-24719C	CE	19	3,340	835	CFS	IR	surfaceWater
S3-21433C(B)	CE	13	2,632	788	CFS	IR	surfaceWater
S3-24274C	CE	14	3,515	756	CFS	IR	surfaceWater
S3-21044(A)	CE	16	3,134	674	CFS	IR	surfaceWater
S3-22228(B)SC	CE	10	3,145	600	CFS	IR	surfaceWater
S3-01602C	CE	11	2,180	545	CFS	IR	surfaceWater
S3-26448C	CE	13	1,948	487	CFS	IR	surfaceWater
S3-24806C	CE	9	2,516	480	CFS	IR	surfaceWater
S3-*20260BPCWRIS	CE	7	1,864	466	CFS	IR	surfaceWater
S3-26000C(A)	CE	9	1,810	453	CFS	IR	surfaceWater
S3-28993C	CE	3	733	450	CFS	HP FP IR	surfaceWater
S3-26139C	CE	8	2,250	450	CFS	IR	surfaceWater
S3-01486C	CE	9	2,202	420	CFS	IR	surfaceWater
S3-26230C	CE	12	1,680	420	CFS	IR	surfaceWater
S3-22228(C)SC	CE	7	2,097	400	CFS	IR	surfaceWater
S3-24273C	CE	7	1,860	399	CFS	IR	surfaceWater

S3-00334C	CE	8	1,185	395	CFS	IR	surfaceWater
S3-22838C(B)	CE	9	1,802	388	CFS	IR	surfaceWater
S3-29063C	CE	14	1,606	384	CFS	FP IR IR	surfaceWater
S3-25062C	CE	9	1,834	350	CFS	IR	surfaceWater
S3-26503C	CE	9	672	336	CFS	IR	surfaceWater
S3-28015C	CE	7	1,488	320	CFS	IR	surfaceWater
S3-23526C	CE	5	1,225	320	CFS	IR	surfaceWater
S3-24558C	CE	2	1,221	300	CFS	IR	surfaceWater
S3-21433(C)C	CE	5	990	296	CFS	IR	surfaceWater
S3-26000C(B)	CE	5	1,110	278	CFS	IR	surfaceWater
S3-25127C	CE	6	1,310	250	CFS	IR	surfaceWater
S3-28723C	CE	6	996	249	CFS	IR	surfaceWater
S3-20478C	CE	4	1,048	200	CFS	IR	surfaceWater
S4-01335(C)C	CE	3	527	195	CFS	IR	surfaceWater
S3-24580C	CE	4	794	171	CFS	IR	surfaceWater
S3-28177C	CE	4	668	167	CFS	IR	surfaceWater
S3-26456C	CE	4	415	166	CFS	IR	surfaceWater
S3-01483C	CE	4	839	160	CFS	IR	surfaceWater
S3-24882C	CE	4	640	160	CFS	IR	surfaceWater
S3-01370C	CE	4	828	158	CFS	IR	surfaceWater
S3-27096C	CE	3	620	155	CFS	IR	surfaceWater
S3-26492C	CE	3	244	150	CFS	IR	surfaceWater
S3-21433(E)C	CE	3	495	148	CFS	IR	surfaceWater
S3-21433(D)C	CE	2	495	148	CFS	IR	surfaceWater
S3-25420C	CE	3	420	120	CFS	IR	surfaceWater
S3-27433C	CE	3	400	100	CFS	IR	surfaceWater
S3-26490C	CE	2	162	81	CFS	IR	surfaceWater
S3-24667C	CE	2	419	80	CFS	IR	surfaceWater
S3-22263CWRIS	CE	1	372	80	CFS	IR	surfaceWater
S3-25101C	CE	2	393	79	CFS	IR	surfaceWater
S3-25427C	CE	2	300	75	CFS	IR	surfaceWater
SWC07981	CE	1	296	74	CFS	IR	surfaceWater
S3-24583C	CE	2	329	71	CFS	IR	surfaceWater
S3-20829C	CE	2	325	70	CFS	IR	surfaceWater
S3-28188C	CE	1	325	70	CFS	IR	surfaceWater
S3-27901C	CE	1	280	70	CFS	IR	surfaceWater
S3-20916C	CE	2	304	65	CFS	FP ST IR	surfaceWater
SWC07056	CE	1	196	49	CFS	IR	surfaceWater
S3-25193C	CE	1	225	43	CFS	IR	surfaceWater
S3-24898C	CE	1	210	40	CFS	IR	surfaceWater
S3-20479C	CE	1	199	38	CFS	IR	surfaceWater

S3-23611C	CE	1	144	31	CFS	IR	surfaceWater
S3-20763C	CE	1	144	31	CFS	IR	surfaceWater
SWC03939	CE	1	0	27	CFS	IR	surfaceWater
S3-25086C	CE	0	104	20	CFS	IR	surfaceWater
SWC03241	CE	0	0	17	CFS	IR	surfaceWater
SWC05191	CE	0	0	1	CFS	FR IR	surfaceWater
SWC11865	CE	18	13,292	*	CFS	IR	surfaceWater
S3-*21411C	CE	14	8,532	*	CFS	IR	surfaceWater
S3-24900C	CE	44	4,984	*	CFS	IR	surfaceWater
S3-*21411CPCWRIS	CE	3	1,558	*	CFS	IR	surfaceWater
S3-162377CL	CL	4	1,340	700	CFS	IR	surfaceWater
S3-24704	PE	225	43,704	10,926	CFS	IR	surfaceWater
S3-28903P	PE	50	9,253	1,990	CFS	IR	surfaceWater
S3-28907	PE	12	3,911	1,054	CFS	IR	surfaceWater
S3-27891(A)	PE	5	852	213	CFS	IR	surfaceWater
S3-27891(B)	PE	3	508	127	CFS	IR	surfaceWater
G3-CV1-3P494	CC	2,170	660	165	GPM	IR	groundwater
CCVOL2-3P13	CC	1,200	744	160	GPM	IR	groundwater
G3-00216(CCVOL1-3P292)SC	CE	1,200	1,440	840	GPM	IR	groundwater
G3-22873C	CE	5,000	3,458	660	GPM	IR	groundwater
G3-26487C	CE	4,185	2,560	640	GPM	IR	groundwater
GWC06962(CCVOL1-3P290)-ASC	CE	1,200	962	610	GPM	IR	groundwater
G3-28146C	CE	5,000	2,790	600	GPM	IR	groundwater
G3-29364(A)	CE	5,104	2,735	547	GPM	IR	groundwater
G3-26485C	CE	4,320	2,132	533	GPM	IR	groundwater
G3-00942C	CE	4,500	2,500	500	GPM	IR	groundwater
G3-*08350ALCWRIS	CE	350	467	500	GPM	IR	groundwater
G3-27934SC	CE	3,000	2,320	499	GPM	IR	groundwater
G3-01349C	CE	4,500	2,588	495	GPM	IR	groundwater
G3-28160C	CE	2,500	1,680	480	GPM	IR	groundwater
G3-28992C	CE	760	1,216	450	GPM	IR IR HP FP DS FP HP	groundwater
G3-27933SC	CE	2,500	1,860	375	GPM	IR	groundwater
G3-27932SC	CE	2,300	1,711	368	GPM	IR	groundwater
G3-27839	CE	3,000	1,396	365	GPM	IR	groundwater
G3-22242C	CE	2,000	1,325	285	GPM	IR	groundwater
G3-29240	CE	3,500	1,209	250	GPM	IR FP	groundwater
G3-28463C	CE	950	1,520	240	GPM	CI IR	groundwater

G3-26527C	CE	1,500	1,600	240	GPM	CI IR	groundwater
G3-*07696C	CE	960	900	225	GPM	IR	groundwater
G3-27804	CE	2,250	975	225	GPM	IR	groundwater
G3-28626C	CE	400	66	194	GPM	FP IR	groundwater
G3-28683C	CE	2,500	883	190	GPM	IR	groundwater
G3-*04681C	CE	800	684	171	GPM	IR	groundwater
G3-20251C(B)	CE	1,535	704	167	GPM	IR	groundwater
G3-26504GWRIS	CE	2,170	660	165	GPM	IR	groundwater
G3-21039C	CE	1,300	744	160	GPM	IR	groundwater
G3-29363	CE	2,500	680	160	GPM	IR	groundwater
G3-27940C	CE	1,200	744	160	GPM	IR	groundwater
G3-29438	CE	2,000	680	160	GPM	IR IR	groundwater
G3-00401C	CE	1,440	786	150	GPM	IR	groundwater
G3-27906C	CE	450	632	136	GPM	FP IR	groundwater
G3-27470	CE	800	501	131	GPM	IR FP HP	groundwater
G3-25157C	CE	1,300	681	130	GPM	IR	groundwater
G3-24791C	CE	650	623	124	GPM	IR IR	groundwater
G3-28475C	CE	800	460	115	GPM	IR	groundwater
G3-*00949CWRIS	CE	600	420	105	GPM	IR	groundwater
G3-00673C	CE	200	38	100	GPM	IR DG	groundwater
G3-*04517CWRIS	CE	720	400	100	GPM	IR	groundwater
G3-27695C	CE	1,200	380	95	GPM	IR	groundwater
G3-*04097CWRIS	CE	676	425	85	GPM	IR	groundwater
G3-21037C	CE	800	372	80	GPM	IR	groundwater
G3-27897C	CE	750	300	75	GPM	IR	groundwater
G3-*04926CWRIS	CE	550	280	70	GPM	DS IR	groundwater
G3-21936C	CE	530	293	63	GPM	IR	groundwater
G3-21038C	CE	560	279	60	GPM	IR	groundwater
G3- *06588ALCWRIS	CE	300	206	50	GPM	DS ST IR	groundwater
G3-25562C	CE	140	195	42	GPM	IR	groundwater
G3-26088C	CE	350	214	40	GPM	DM IR	groundwater
G3-29364(C)	CE	1,472	144	32	GPM	IR	groundwater
G3-24182C	CE	350	189	30	GPM	DM IR	groundwater
G3-27372(C)	CE	210	120	30	GPM	IR	groundwater
G3-28147C	CE	500	130	28	GPM	IR	groundwater
G3-*02612CWRIS	CE	100	100	25	GPM	ST IR	groundwater
G3-*10988CWRIS	CE	180	129	25	GPM	IR	groundwater
G3-00332C	CE	720	100	24	GPM	IR	groundwater
G3-*03489C	CE	25	35	20	GPM	DM HE FR IR	groundwater
GWC00811-D	CE	350	160	20	GPM	DS IR	groundwater

G3-20662C	CE	750	197	20	GPM	DM IR	groundwater
G3-27921C	CE	120	94	20	GPM	DM IR	groundwater
G3-21573C	CE	160	90	19	GPM	DS ST IR	groundwater
G3-22888C	CE	200	85	18	GPM	DS IR	groundwater
G3-24183C	CE	180	77	16	GPM	DM IR	groundwater
G3-25118GWRIS	CE	200	160	15	GPM	DM FR IR	groundwater
G3-22899C	CE	225	56	15	GPM	DS IR	groundwater
G3-01085C	CE	500	82	15	GPM	DM IR	groundwater
G3-22869C	CE	350	45	12	GPM	DM IR	groundwater
G3-22870C	CE	75	45	12	GPM	DM IR	groundwater
G3-*09879CWRIS	CE	30	24	10	GPM	DS IR	groundwater
G3-22495C	CE	450	48	10	GPM	DM IR	groundwater
G3-*08152CWRIS	CE	200	40	10	GPM	IR	groundwater
G3-*03490CWRIS	CE	100	160	10	GPM	DM HE FR IR	groundwater
G3-28014GWRIS	CE	139	45	10	GPM	DS IR	groundwater
G3-24184C	CE	70	46	9	GPM	DM IR	groundwater
G3-27372(A)	CE	105	30	7	GPM	DS IR ST	groundwater
G3-25013C	CE	140	41	7	GPM	DM IR	groundwater
G3-27372(B)C	CE	35	21	5	GPM	DS IR	groundwater
G3-23640SC	CE	35	26	5	GPM	DS ST IR	groundwater
G3-20697C	CE	60	23	5	GPM	IR	groundwater
G3-*03274CWRIS	CE	20	27	5	GPM	DS ST HE IR	groundwater
G3-23899C	CE	40	27	5	GPM	DM IR	groundwater
G3-24899C	CE	50	19	3	GPM	DS ST IR	groundwater
G3-*06117CWRIS	CE	28	12	3	GPM	DS IR	groundwater
G3-24654C	CE	30	12	3	GPM	DS IR	groundwater
G3-24919C	CE	30	14	3	GPM	DS IR	groundwater
G3-26661C	CE	40	12	2	GPM	DS IR	groundwater
G3-22246C	CE	30	8	2	GPM	DS IR	groundwater
G3-20207C	CE	30	9	2	GPM	DS ST IR	groundwater
G3-23252C	CE	25	8	2	GPM	DM IR	groundwater
G3-*02935CWRIS	CE	30	10	2	GPM	IR	groundwater
G3-28328C	CE	40	11	2	GPM	CI DM IR	groundwater
G3-23615C	CE	14	6	2	GPM	DS IR	groundwater
G3-28219C	CE	30	5	1	GPM	DS IR	groundwater
G3-24633C	CE	25	5	1	GPM	IR	groundwater
G3-00675C	CE	15	4	1	GPM	IR DS ST	groundwater
G3-162380CL	CL	0	0	700	GPM	IR	groundwater
G3-154388CL	CL	2,200	1,000	250	GPM	IR	groundwater

G3-154386CL	CL	1,800	800	200	GPM	IR	groundwater
G3-000511CL	CL	180	5	25	GPM	IR	groundwater
G3-154387CL	CL	200	40	10	GPM	DG IR	groundwater
G3-080236CL	CL	30	8	5	GPM	IR	groundwater
G3-020194CL	CL	60	20	5	GPM	IR	groundwater
G3-009044CL	CL	53	17	5	GPM	DG IR	groundwater
G3-080237CL	CL	30	4	5	GPM	IR	groundwater
G3-011834CL	CL	9	9	4	GPM	IR DG	groundwater
G3-129244CL	CL	32	24	4	GPM	DG IR	groundwater
G3-145469CL	CL	75	14	4	GPM	IR DG	groundwater
G3-014520CL	CL	35	13	3	GPM	IR DG	groundwater
G3-120963CL	CL	30	12	3	GPM	ST IR DG	groundwater
G3-115493CL	CL	25	4	3	GPM	DG ST IR	groundwater
G3-098860CL	CL	25	16	3	GPM	ST IR DG	groundwater
G3-163855CL	CL	28	11	3	GPM	IR DG	groundwater
G3-053218CL	CL	30	10	3	GPM	IR DG	groundwater
G3-051124CL	CL	35	0	2	GPM	DG ST IR	groundwater
G3-146856CL	CL	0	3	2	GPM	DG IR	groundwater
G3-116176CL	CL	20	6	1	GPM	IR ST DG	groundwater
G3-006807CL	CL	4	0	1	GPM	IR DG	groundwater
G3-008446CL	CL	5	6	1	GPM	IR DG	groundwater
G3-118018CL	CL	14	5	1	GPM	ST DG IR	groundwater
G3-012270CL	CL	20	4	1	GPM	IR DG	groundwater
G3-006779CL	CL	4	0	1	GPM	IR DG	groundwater
G3-022815CL	CL	4	0	1	GPM	DG IR	groundwater
G3-022227CL	CL	4	0	1	GPM	IR DG	groundwater
G3-023727CL	CL	4	0	1	GPM	IR DG	groundwater
G3-023547CL	CL	4	0	1	GPM	DG IR	groundwater
G3-116749CL	CL	900	3	1	GPM	DG IR	groundwater
G3-096568CL	CL	0	6	1	GPM	DG IR	groundwater
G3-004317CL	CL	15	4	1	GPM	DG IR ST	groundwater
G3-049148CL	CL	14	4	1	GPM	IR DG	groundwater
G3-055440CL	CL	4	0	1	GPM	DG IR	groundwater
G3-060694CL	CL	4	0	1	GPM	IR DG	groundwater
G3-023726CL	CL	4	0	1	GPM	DG IR	groundwater
G3-005362CL	CL	10	4	0	GPM	IR DG	groundwater

G3-004259CL	CL	15	3	0	GPM	ST IR DG	groundwater
G3-28237P	PE	2,250	2,560	640	GPM	IR	groundwater
G3-28440	PE	4,000	1,866	400	GPM	DM IR	groundwater
G3-28599P	PE	3,400	1,581	340	GPM	IR	groundwater
G3-27029SP	PE	2,700	1,200	300	GPM	IR	groundwater
G3-28078P	PE	1,600	1,395	300	GPM	IR	groundwater
G3-29022P	PE	4,000	985	200	GPM	FP IR	groundwater
G3-*09966	PE	1,600	584	160	GPM	DS IR	groundwater
G3-30812	PE	662	265	125	GPM	IR	groundwater
G3-28860P	PE	1,000	559	120	GPM	IR DG	groundwater
G3-29364(B)	PE	3,200	305	61	GPM	IR	groundwater
G3-29050P	PE	550	219	55	GPM	IR	groundwater
G3-26144	PE	400	160	40	GPM	IR	groundwater
G3-28663	PE	350	140	35	GPM	IR	groundwater
G3-29168P	PE	150	65	15	GPM	IR	groundwater
G3-28424	PE	150	46	10	GPM	IR	groundwater
G3-29099P	PE	3,500	8,676	*	GPM	FP HP IR	groundwater

[1] CE&CC = Certificate, PE = Permit, CL = Claim

* Acreage removed to avoid duplication due to either overlapping water rights or supplemental rights.

Figure 5. Irrigated Acres Impacted by Four Dam Breach on Lower Snake River

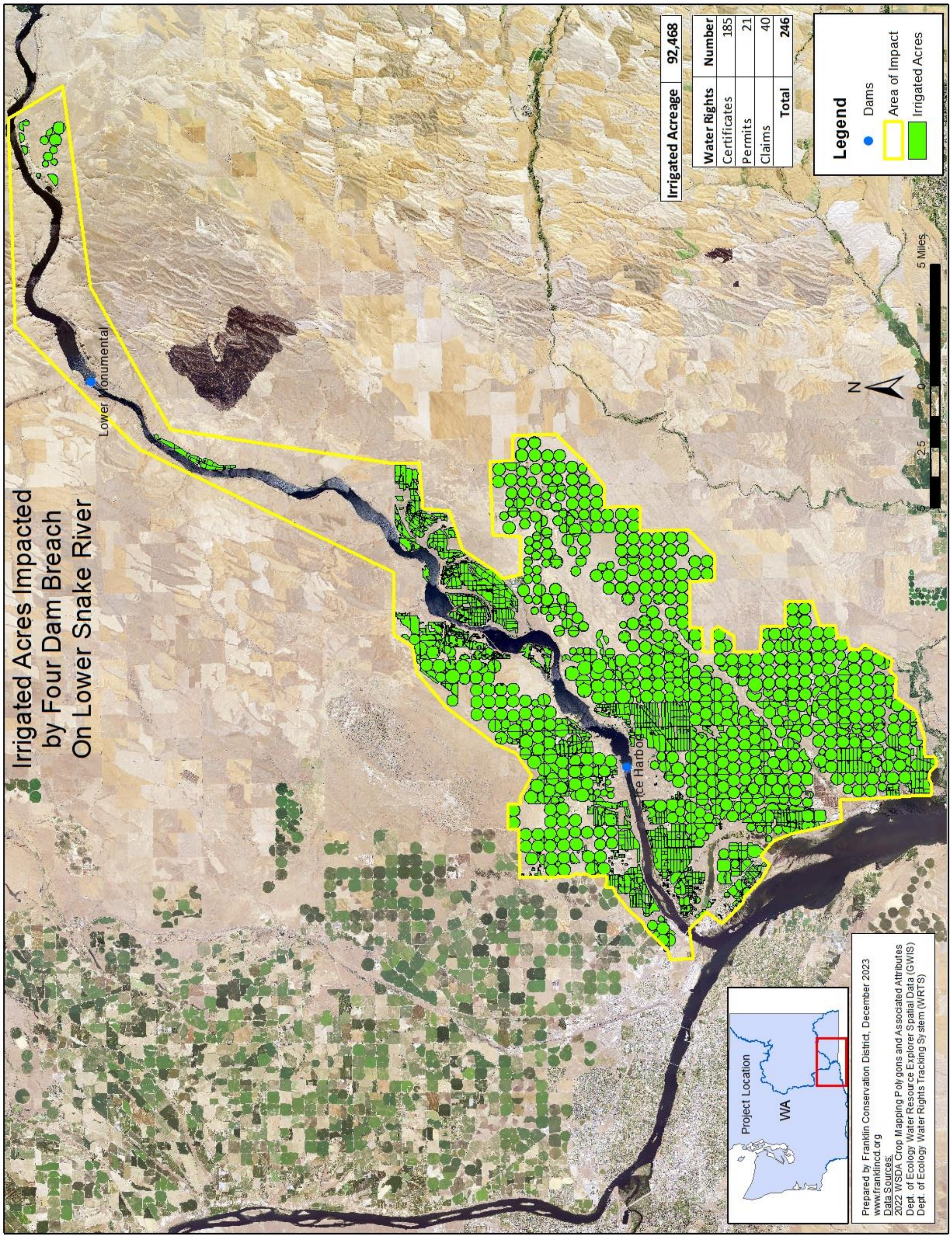

Figure 6. Irrigated Acres Impacted Above Ice Harbor Dam and McNary Pool

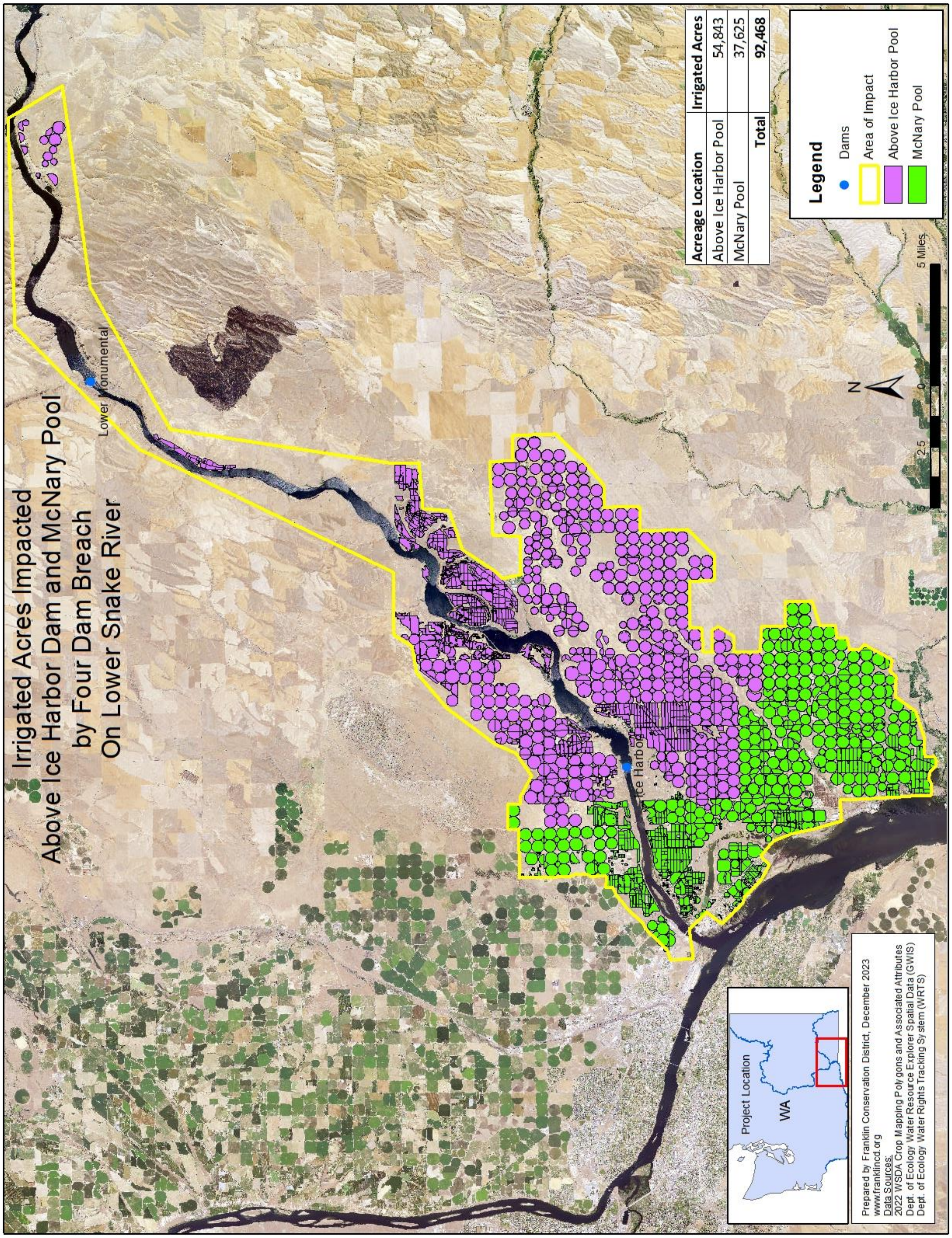

Figure 7. All Points of Diversion/Withdrawal with an Irrigation Use within the Area of Impact

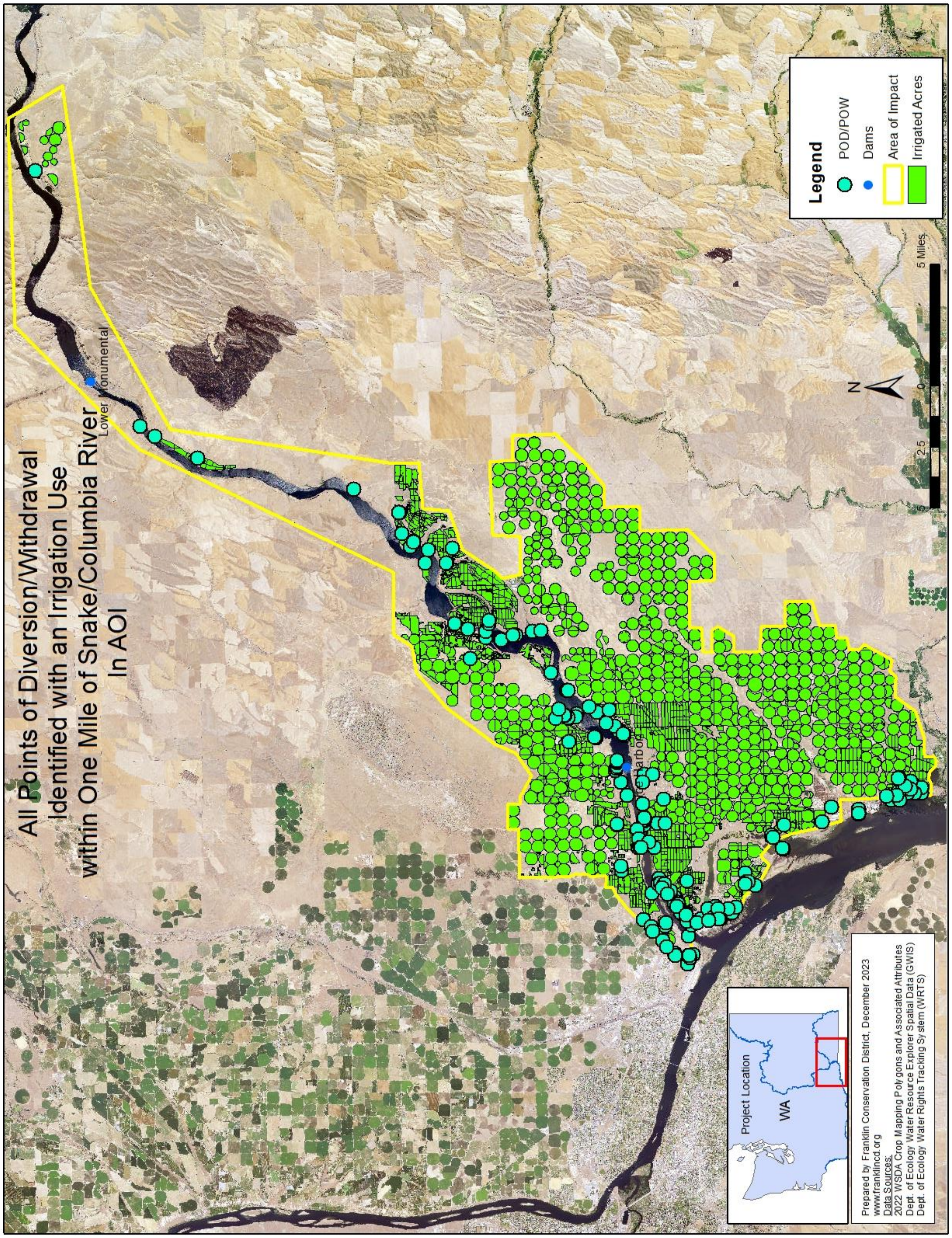

Figure 8. Surface Water Point of Diversion with an Irrigation Use within Area of Impact.