



CRSO EIS Multiple Objective Alternative 1

The Multiple Objective Alternative 1 (MO1) was developed to integrate actions that would benefit both juvenile and adult life stages of ESA-listed anadromous fish, as well as measures to benefit ESA-listed resident fish. At the same time, the alternative incorporates measures for water management flexibility, hydropower production, and additional water supply.

MO1 differs from the others by carrying out a juvenile fish passage spill operation referred to as a block spill design. The block test concept alternates between a base operation that releases surface flow, where juvenile fish are most present, over the spillways using different spill designs. During one block, the spill for juvenile fish passage is roughly the same as the spill in 2016. In the other block, the operators would release flow through the spillways up to a target of 120% total dissolved gas (TDG) in the tailrace of projects and 115% TDG in the forebay of those projects. In addition, MO1 sets the duration of summer juvenile fish passage spill to end based upon a fish count trigger rather than a predetermined date. MO1 proposes to initiate transport operations for juvenile fish approximately 2 weeks earlier than under the No Action Alternative.

After setting the juvenile fish-passage spill measure, MO1 incorporated a measure to adjust the use of stored water at Dworshak to potentially improve downstream water temperature control in the summer. MO1 then includes measures similar to the other action alternatives, which includes increased water management flexibility, water supply, hydropower generation flexibility in the lower basin projects opportunities for disruption of ESA-listed fish predators, and optimize inclusion of local forecasts into whole-basin planning. A brief description of the measures in MO 1 follows:

Structural Measures

Additional Powerhouse Surface Passage This measure would reestablish the operation of existing ice and trash sluiceways for fish passage. To implement this measure, existing bulkheads would be replaced with telescoping weirs. This would also require modifications to the existing juvenile fish facility and to the floor elevation at McNary project. Operation of these sluiceways would divert 8 kcfs from the powerhouse at McNary. The diversion at Ice Harbor would amount to 4 kcfs from the powerhouse. The surface passage would be used March 1 – Aug. 31.

Upgrade to Adjustable Spillway Weirs This measure would replace those existing spillway weirs that are not adjustable with adjustable spillway weirs which will provide better operational flexibility based on river flows. Weirs at Lower Granite, Lower Monumental, Ice Harbor, McNary, and John Day dams would be upgraded to Adjustable Spillway Weirs.

Lower Granite Trap Modifications This measure would reconfigure the existing adult trap bypass at Lower Granite project to benefit fish by reducing the height that adult fish must ascend, reducing deployment of the main fish ladder diversion gate, and use a vacuum tube to move adult fish that are handled for monitoring and research at the trap.

Modify Bonneville Ladder Serpentine Weir This measure would modify the upper serpentine flow control fish ladder sections at Bonneville project, converting them to a vertical slot-style fishway. The existing baffles at the project's Bradford Island and Washington Shore fish ladders would be replaced with baffles that have vertical slot orifices for fish passage.



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Lower Snake Ladder Pumps This measure would install new pumping systems for the fish ladders at Lower Monumental and Ice Harbor projects. The pumps would pull water from elevations deep in the reservoir to provide cooling water to fish ladders and at fish ladder entrances to reduce thermal barriers to fish passage for adult salmon migrating upstream.

Lamprey Passage Structures Existing fish ladders at John Day, and Bonneville projects would be modified with additional structures to make upstream passage easier for Lamprey. The structures may be an aluminum slot or tunnel that lamprey would use to travel an alternate, but parallel route along the existing fish ladder. The lamprey structure would use an independent water source and employ flow velocities that attract lamprey to the alternative route. These structures would be constructed as follows:

At Bonneville project, additional LPSs would be installed in two locations: on the Bradford Island ladder (south ladder) and at the Washington Shore fish ladder (north ladder).

At The Dalles project diffuser grating plating would be added to the North ladder.

At John Day project, an LPS would be constructed on the south fish ladder and the existing LPS on the north ladder would be extended from the tailrace deck to the forebay.

Turbine Strainer Lamprey Exclusion This measure would install structures to prevent juvenile lamprey and all other fish from being entrained into the turbine unit cooling-water source. A hood would be installed over the existing intake grating and allow sweeping flows to move fish past the opening, making entrainment unlikely, and keeping all fish out of the cooling water piping.

Bypass Screen Modifications for Lamprey This measure would replace existing fish screens used to divert fish into the collection channel of the juvenile bypass system. The co-lead agencies would replace existing extended length bar screens with submerged traveling screens to reduce juvenile lamprey entanglement at McNary, Little Goose, and Lower Granite projects.

Lamprey Passage Ladder Modifications This measure would modify existing fish ladders at the Lower Snake and Lower Columbia River projects as described:

- **Install ramps to salmon orifices at Bonneville dam.** Install concrete or aluminum ramps in the fish ladder to make salmon orifices elevated above the fish ladder floor more accessible to lamprey. A ramp would enable adult lamprey to more easily and directly access the salmon passage openings by removing right angles at the approach.
- **Install diffuser grating plating at Bonneville (south and Cascade Island ladders), The Dalles (north ladder), and Lower Monumental (north and south ladders)** Install a solid stainless steel plate over the floor diffuser grating within the existing fish ladder. The diffuser adds water to the fish ladder to increase flows in the ladder, but existing grating and water velocities make it difficult for lamprey to pass through the wall passage orifices. This plating would provide an attachment surface for lamprey to attach and rest as they swim upstream through the fish ladder.
- **Install additional refuge boxes at Bonneville Dam** Construct metal refuge boxes on the floor of the fish ladder to provide a protected resting environment for lamprey migrating upstream. Additional refuge boxes would be installed in the Washington shore and Bradford Island fish ladders.



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- **Install a wetted wall in the fish ladder at Bonneville Dam** Install a metal wall in the serpentine section of the Washington shore fish ladder at Bonneville (similar to that already installed in the Bradford Island ladder). This would provide an alternate upstream passage route for migrating adult lamprey and allow the lamprey to escape the higher water velocities in the fish ladder.
- **Install entrance weir caps at McNary, Ice Harbor, Lower Monumental, Little Goose, and Lower Granite** Round edges at fish ladder entrance weirs to eliminate 90 degree surfaces which hinder lamprey from entering fish ladders on the lower Snake projects and at McNary. Rounding these edges would provide lamprey a constant attachment surface to overcome the high water velocities encountered at the entrance of the fish ladders.

Improved Fish Passage Turbines This measure would install Improved Fish Passage (IFP) turbines at John Day project to improve hydraulic conditions for fish passing through the turbines. These IFP turbines would be similar to the IFP turbine installed at Ice Harbor project as a test. The IFP turbines would improve hydropower turbine efficiency and hydraulic conditions for fish. The existing sixteen turbines would be replaced two at a time over a period of approximately eight to twelve years.

Operational Measures

Block Spill Test (Base + 120/115%) This measure is to operate the lower Snake River and lower Columbia River projects in a manner that allows comparison of two different fish passage spill operations by alternating between a base spill operation and a test spill operation. The details of the two spill operations are contained in the table below. The base spill would be implemented first in year one, and the test block operations implemented first the following year. These operations would be implemented annually from April 3 – June 20 for the lower Snake River projects and from April 10 – June 15 for the lower Columbia River projects. The test and base block spill operations would exchange specific dates biannually while holding overall spill dates constant.

Location	Spring Base Spill Operation: (Volume/Percent of Total Flow Routed to Spillway)	Spring Test Spill Operation: (Volume/Percent of Total Flow Routed to Spillway)
Lower Granite	20 kcfs	120/115% Gas Cap*
Little Goose	30%	120/115% Gas Cap*
Lower Monumental	120/115% Gas Cap*	120/115% Gas Cap*
Ice Harbor	30%	120/115% Gas Cap*
McNary	48%	120/115% Gas Cap*
John Day	32%	120/115% Gas Cap*
The Dalles	40%	120/115% Gas Cap*
Bonneville	100 kcfs	120/115% Gas Cap*

**120/115% Gas Cap spill is spill to the maximum level that meets, but does not exceed, the TDG criteria allowed under state law. Co-lead agencies would manage juvenile fish passage spill on a daily 24-hour basis. Implementation of the daily spill averaging would facilitate integration of renewable power, including solar and wind power.*

Summer Spill Stop Trigger The existing spill regime at the lower Snake and lower Columbia River projects would be modified to curtail fish passage spill when fish collection numbers at the projects



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remain below 300 juvenile fish for four consecutive days. This has the potential to end summer spill at one or more of the lower Snake River dams as early as August 1, and all spill operations would cease by August 31. This summer spill operation would begin annually June 21, and end when the criteria described here is met.

Early Start Transport The transport of juvenile salmon collected at Lower Granite, Little Goose, and Lower Monumental projects would begin on April 15, approximately two weeks earlier than current fish transport operations described in the No Action Alternative. Transport operations would end September 30 at Lower Monumental and October 31 at Lower Granite and Little Goose. Collected juvenile fish would be transported to a location below Bonneville project via barge or truck on a daily or every-other-day schedule, depending on the numbers of fish collected at the collector projects.

Contingency Reserves in Fish Spill This measure would allow operations to change fish spill in the event of a contingency for short durations during fish passage spill season. The change would be implemented to meet energy demands that are caused by unexpected events such as transmission interruption or the failure of a generator. These events are rare and, when they occur, the co-lead agencies may be able to cover the contingencies without temporarily reducing spill. This measure would provide operating flexibility to allow BPA to carry required reserves on the turbines to ensure grid reliability. This measure would be implemented at all lower Snake River and lower Columbia River projects during the fish spill season.

Modified Draft at Libby This measure would base the date for initiation of refill of Lake Koocanusa on the local forecast of water volume in the Kootenai River Basin of the Columbia River System during lower water years, rather than on the No Action practice of initiating refill based upon water volume forecast in the lower Columbia River at The Dalles. This would modify water operations at Libby to provide water managers more flexibility to respond to local conditions in the upper basin. The measure would change flow management so that local flood durations and the start of refill operations are tied to Kootenai Basin runoff. The new procedure will also take into consideration other planned releases for resources such as flow pulses for resident fish. This measure would provide more flood space for local high spring flow, and lower the risk of filling the reservoir early, which can result in a need to spill to create more flood space before the end of the FRM operations season.

December Libby Target Elevation This measure would change current operations at Libby from a variable draft implemented at the end of December to a fixed draft target of elevation 2420 feet to prevent over-drafting of the reservoir in years that have less precipitation than forecasted. In most years, this operation would allow the reservoir draft to be shifted from November/December to January/February, holding more water in the reservoir longer to meet demand in drier years, and providing flexibility for water managers to adapt to a wide range of runoff conditions throughout the water year. It would reduce the frequency of spill, and support delivery of nutrients and water temperatures that support sturgeon during the sturgeon flow augmentation operation.

Update System FRM Calculation This measure would change the end-of-month target flood space elevation of Lake Roosevelt at Grand Coulee based on whether the storage reservoirs upstream of Grand Coulee had drafted to reach their required flood space elevations at the end of the months of



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January, February, March and April. If one or more upstream storage reservoirs were unable to draft down to their required flood space elevations at the end of each of those months, then Lake Roosevelt would be utilized to provide additional flood storage space for the Columbia River System. This measure differs from No Action by allowing the Grand Coulee project to better respond to changing conditions in the upstream storage reservoirs. There would be no change to the current level of flood risk management, but rather, a shift in where flood space is held.

Planned Draft Rate at Grand Coulee This measure would change the way that Lake Roosevelt is drawn down to reach flood space elevations in winter and spring at Grand Coulee. Under the proposed operation, the reservoir drawdown would begin earlier, and the reservoir elevations would be lowered more slowly in order to reduce the risk of landslides along the shoreline. Ultimately, the deepest lake elevations targets for system FRM are not changed by this measure, but the timing and rate for reaching those lower reservoir elevations would change.

Grand Coulee Maintenance Operations This measure would expedite the maintenance schedule for the power plants and spillways of the Grand Coulee project relative to the No Action schedule. The maintenance on the powerplants would reduce the number of turbine units available, requiring additional spill in some situations. The project would keep 27 of the 40 regulating gates and/or 8 drum gates in-service and take the others out of service to perform spillway maintenance activities at an accelerated rate.

Winter System FRM Space This measure would increase flood space in Grand Coulee by 650,000 acre-feet to protect against rain-induced flooding downstream. In order to provide the necessary space, Grand Coulee would be drafted more deeply from mid-December through March. All other existing winter operations described in the No Action alternative would remain the same. This measure is intended to increase operational flexibility to maintain flood risk protection for the lower Columbia River.

Lake Roosevelt Additional Water Supply This measure would deliver 4,472,138 acre feet of water, the amount of additional water required to irrigate the full amount of authorized acres for the Columbia Basin Project, by increasing the amount of water pumped from Lake Roosevelt for irrigation and municipal and industrial water supply. This is an increase of 1,154,138 AF over current withdrawals. This water volume could be delivered annually, generally during the irrigation season (April – October), from Lake Roosevelt at Grand Coulee, as the demand arises.

Hungry Horse Additional Water Supply This measure would change water management operations at Hungry Horse to ensure that an additional 90,000 acre feet of water was available for delivery annually to fulfill the water rights settlement with the Confederated Salish and Kootenai Tribes (CSKT). Operations would prioritize maintaining enough water to meet flow augmentation requirements and the delivery of 90,000 acre-feet of water to the CSK for irrigation and municipal and industrial purposes, as outlined in the settlement.

Chief Joseph Dam Project Additional Water Supply This measure would prioritize annual delivery of 9,600 acre feet of irrigation water to the Chief Joseph Dam Project. This would deliver the full



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Congressionally-authorized amount of water for the irrigation of lands downstream of Chief Joseph Dam using water from the Chief Joseph Project.

Increased Forebay Range Flexibility This measure would provide operating flexibility during the fish passage season (April 3 – August 31) by changing the operating elevation range restriction at the lower Snake projects and John Day project. The lower Snake projects would operate within a 1.5 foot Minimum Operating Pool (MOP) range, and John Day would operate within a 2 foot Minimum Irrigation Pool (MIP) range (262.5 – 264.5 feet), except from April 1 – May 31 when the John Day forebay operating range would remain between elevations 263.5 and 265 feet for a different operation described below. Safety related restrictions would continue, including, but not limited to, maintaining ramp rates to minimize shoreline erosion and maintain power grid reliability. This measure is intended to increase flexibility for water management, shaping hydropower production to meet energy demand and maintain power grid reliability, and to decrease avian predation by fluctuating water elevations on nesting islands.

Modified Dworshak Summer Draft This measure would alter the current draft schedule at Dworshak to provide more cooling water in the lower Snake River for migrating adult salmonids at different times than described in the No Action alternative. The draft would be tied to water temperatures from year to year, but generally would begin drafting Dworshak Reservoir June 21 – August 1 for migrating sockeye salmon and summer Chinook. A second, later draft (September 1 – 30) would provide cooling water for Fall Chinook and Steelhead.

Sliding Scale at Libby and Hungry Horse The trigger for summer draft from Libby and Hungry Horse projects for downstream fish will be changed from a system forecast point to a local forecast point. Libby and Hungry Horse projects would be operated based on local water supply conditions to allow water managers more flexibility to balance local resident fish priorities in the upper basin with downstream flow augmentation for the middle and lower basin. Water operations would be adjusted to end-of summer elevation targets, which would be generated based on conditions in the upper basin, rather than a flow forecast at the gage at The Dalles. The draft volume would not be an abrupt trigger at a single forecast point but would vary over a range of forecasts (a sliding scale trigger).

Predator Disruption Operations This measure would manipulate reservoir elevations on the John Day reservoir to disrupt nesting of avian predators on islands in the reservoir. The measure would allow water managers to fluctuate pool elevations between 263.5' and 265', a 1.5 foot operating range, during the months of April and May.