



## CRSO EIS Multiple Objective Alternative 3

The Multiple Objective Alternative 3 (MO3) was developed to integrate actions for water management flexibility, hydropower production, water supply and ESA-listed resident fish with measures that would breach the four lower Snake River dams (Lower Granite, Little Goose, Lower Monumental, and Ice Harbor). In addition to breaching these four projects, MO3 differs from the others by carrying out a juvenile fish passage spill operation that sets flow through the spillways up to a target of no more than 120% total dissolved gas (TDG) in the tailrace of the four lower Columbia River projects (McNary, John Day, The Dalles, and Bonneville). The alternative also proposes an earlier end to summer juvenile fish passage spill operations than the No Action Alternative. Instead, flows would transition to increased hydropower production when low numbers of juvenile fish are anticipated.

Structural measures in this alternative include breaching the four lower Snake River dams by removing the earthen embankment at each dam location, resulting in a controlled drawdown. Operational measures in the MO3 Alternative are intended to improve juvenile fish travel times, improve conditions for resident fish in the upper basin, increase hydropower generation flexibility, provide more flexibility to water managers, and provide additional water supply.

A brief description of the measures contained in MO3 is contained below.

### **Structural Measures**

**Breach Snake Embankments** This measure would breach the lower Snake River dams. The demolition would remove the earthen embankments, abutments, and portions of existing structures at the dams to eliminate the reservoirs behind Lower Granite, Little Goose, Lower Monumental, and Ice Harbor projects. In order to minimize impacts to migrating salmon and ensure safety, the removal of the embankments would be conducted in two phases during the low water period in the river. Drawdown would begin in August, with the removal of structures during October, months when few ESA-listed salmon would be present in the Snake River. To do this, the north embankments at Lower Granite and Little Goose projects would be removed the first year, and the south embankment at Lower Monumental and north embankment at Ice Harbor projects would be removed the second year. The co-lead agencies would implement a controlled drawdown, at a rate of two feet per day, beginning in August and continuing through December, in order to safely evacuate the reservoir and minimize damages to infrastructure (highways, bridges, railroads) adjacent to the reservoirs. In-water structures such as anchored concrete blocks would be installed at Ice Harbor to produce resting pools and hydraulic conditions needed for fish passage.

**Lower Snake Infrastructure Drawdown** In order to implement breaching the reservoirs would be drawn down to spillway elevations. In order to evacuate the reservoirs below this level, three turbines at each of the four lower Snake River dams would be modified so that they could be used as low-level water outlets to support a controlled drawdown of the reservoirs. The



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turbines would not operate and instead be modified with changes to the cooling water systems, and removal of the turbine blades. This would allow maximum discharge of water through the turbine passages at low head. These actions would be taken several months in advance of initiation of drawdown.

**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 surface passage would be used March 1 – Aug. 31.

**Fewer Fish Screens** This measure would cease installation of fish screens to increase the efficiency of hydropower turbines at McNary, and John Day projects.

**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. Two dams, McNary and John Day, would receive the upgrades. One weir would be upgraded at McNary and two weirs would be upgraded at John Day.

**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

**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



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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 the McNary project.

**Lamprey Passage Ladder Modifications** This measure would modify existing fish ladders at the 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), and The Dalles (north ladder),** 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.
- **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** Round edges at fish ladder entrance weirs to eliminate 90 degree surfaces which hinder lamprey from entering fish ladders at the McNary project. Rounding these edges would provide lamprey a constant attachment surface to overcome the high water velocities encountered at the entrance of the fish ladders.

### Operational Measures

**Drawdown Operating Procedures** This measure would be implemented in conjunction with the structural measures described above. Under this measure equipment at the dams to be used for drawdown would be tested and calibrated to establish operational limits. Engineers,



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and powerhouse and transmission operators would establish manual operations and procedures using the modified equipment to facilitate a controlled and safe reservoir evacuation to support dam breaching.

**Drawdown Contingency Plans** Dam operators would develop plans for unexpected operations or emergency shut-down during reservoir drawdown. To address the risks of breaching such large dams, training would be provided to dam and transmission system operators to implement emergency actions during unanticipated circumstances to ensure the safety of the general public and construction and dam personnel during reservoir drawdown.

**Spring Spill to 120% TDG** This measure would modify spring juvenile fish passage spill to allow spill up to 120% tailrace gas cap. Juvenile fish passage spill to 120% TDG would be implemented annually at McNary, John Day, The Dalles, and Bonneville projects from April 10 – June 15. McNary, John Day, and The Dalles would spill to 120% in the tailrace, while Bonneville would spill to 120% in the tailrace not to exceed a 150kcfs spill constraint. The juvenile fish spill volumes at each project are described here:

Location	Spill Regime
McNary	120% tailrace Spill Cap*
John Day	120% tailrace Spill Cap*
The Dalles	120% tailrace Spill Cap*
Bonneville	120% tailrace Spill Cap*, not to exceed 150 kcfs spill

\*The term “spill cap” refers to the maximum spill level at each project that is estimated to meet, but not exceed, the gas cap in the tailrace unless the spill cap is constrained (e.g. 150 kcfs maximum spill for Bonneville Dam). In this measure, spill caps will be set to meet, but not exceed, the gas cap of 120% TDG as measured at the tailrace fixed monitoring stations. This gas cap is consistent with the current Oregon TDG water quality standard modification and with the Washington TDG water quality standard criteria adjustment as measure at the tailrace. This measure is consistent with Washington State’s current short-term modification to its TDG water quality standard, which removed the 115% TDG criteria.

**Reduced Summer Spill** This measure would reduce the period of fish passage spill in the summer, ending all summer spill operations at midnight July 31 at McNary, John Day, The Dalles, and Bonneville to allow for an increase in hydropower production during periods when low numbers of juvenile fish are migrating.

**Ramping Rates for Safety** This measure would provide operational flexibility for hydropower generation by applying ramping rates only for safety or engineering purposes (e.g. erosion in the tailrace), relaxing all other ramping rate constraints such as those implemented to benefit fish and wildlife. This would allow operators to change flow operations within a 24 hour period to meet changes in hydropower demand. The measure would apply at all 14 CRS projects.



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**John Day Full Pool** This measure would remove current restrictions on seasonal pool elevations at John Day project, allowing more operating flexibility for hourly and daily shaping of hydropower generation. The measure would allow for operation of the reservoir across the full range possible, between 262.50- 266.5 feet elevation all year, except as needed for flood risk management.

**Above 1% Turbine Operations** This measure would lift the requirement to operate hydropower turbines only within a 1% peak efficiency during the fish passage season at McNary, John Day, The Dalles, and Bonneville projects. This would allow turbine operation within and above the current 1% peak efficiency limit to increase flexibility for hydropower generation to meet demand during high flow periods. Removing the upper limitation would allow more water to pass through the turbines during periods of high flow, potentially reducing TDG levels in the river.

**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).

**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 Kootenai 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.



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**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

2400 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 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 slightly from the measure as described in MO1 because it maintains what is known as the “flat spot” from the No Action Alternative. The “flat spot” is a range of water supply conditions that doesn’t require additional draft, but rather requires a consistent draft (“flat”) of 1222.7 feet over those conditions. This slight adjustment to the flood risk draft elevation reduces impacts to water supply operations. 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 power plants would reduce the number of 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.



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