



CRSO EIS Multiple Objective Alternative 2

The Multiple Objective Alternative 2 (MO2) was developed to increase hydropower production and reduce regional greenhouse gas emissions while avoiding or minimizing negative impacts to other authorized project purposes and co-lead agency missions. It would slightly relax the No Action Alternative's restrictions on operating ranges, ramping rates, and elevations to evaluate the potential to increase hydropower production efficiency and increase operators' flexibility to respond to changes in power demand and changes in generation of other renewable resources. The measures within the MO2 Alternative would increase the ability to meet power demand with hydropower production during the most valuable periods (e.g., winter, summer, and daytime peak demands). The upper basin storage projects would be allowed to draft slightly deeper, allowing more hydropower generation in the winter and less during the spring.

MO2 also differs from the others by excluding the water supply measures and evaluating an expanded juvenile fish transportation operation season. This alternative proposes to transport all collected ESA-listed juvenile fish for release downstream of the Bonneville project by barge or truck and reducing juvenile fish passage spill operations to a target of up to 110% TDG. Inclusion of the target of up to 110% TDG spill operation provides the lowest end of the range of juvenile fish passage spill operations evaluated in this EIS.

Structural measures of the MO2 Alternative are aimed at benefits for ESA-listed fish and lamprey. These measures are similar to other alternatives and include making improvements to adult fish ladders, upgrading spillway weirs, adding powerhouse surface passage, and turbine upgrades at John Day. A brief description of the measures follows:

Structural Measures

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.

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. This measure would also be implemented at the John Day project.

Fewer Fish Screens This measure would cease installation of fish screens to increase the efficiency of hydropower turbines at Ice Harbor, 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



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on river flows. Weirs at Lower Granite, Lower Monumental, Ice Harbor, McNary, and John Day dams would be upgraded to Adjustable Spillway Weirs.

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.



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- **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, 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.

Operational Measures

Spill to 110% TDG This measure would decrease spill for juvenile fish passage from the current operational levels, and limit fish passage spill to no more than the 110% TDG levels, as measured in-river, (including tailraces and downstream forebays), except when minimum spill levels are higher, including spill needed for the powerhouse surface passage routes, for the spillway weirs, and/or for adult attraction to fish ladders. These operations would be implemented at the four lower Snake River and the four lower Columbia River projects. Spill during high flow and flood events would not be constrained to a cap of 110% TDG, but would be set to levels necessary to ensure public safety. Lack-of-market spill would follow the spill priority list set by TMT. These spill operations would be implemented annually beginning April 3 at the lower Snake River projects and April 10 at the lower Columbia River projects. Juvenile fish passage spill at all projects would cease at midnight July 31 each year.

Increase Juvenile Fish Transportation This measure would transport all juvenile fish that enter juvenile fish bypasses at Lower Granite, Little Goose, Lower Monumental, and at the Powerhouse Surface Passage facility at McNary, for release below Bonneville Dam. Juvenile salmon would be transported by barge or by truck, and transport would be conducted from April 25 – August 31. This would extend the current juvenile transport season, starting slightly earlier than No Action, and ending at a fixed end date, which is later in the summer than current transport operations.

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.



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Modified Draft at Libby This measure would base the date for initiation of refill of Lake Kootenusa 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 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 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 power plants 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.



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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.

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.

Full Range Reservoir Operations This measure would allow the four lower Snake River projects (Lower Granite, Little Goose, Lower Monumental, and Ice Harbor) to operate within their full normal operating range to provide greater flexibility to meet demand for hydropower generation. This would remove the current requirement that the projects operate within a one foot Minimum Operating Pool (MOP) range during fish passage season (April – August).

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.

Slightly Deeper Draft for Hydropower This measure would provide slightly more operational flexibility for hydropower generation by relaxing restrictions on seasonal pool elevations at the storage projects (Libby, Hungry Horse, Albeni Falls, Grand Coulee, and Dworshak). The operations in this measure would allow deeper drafting of the FRM pool to meet hydropower demand.

Full Range Turbine Operations This measure would lift the requirement to operate hydropower turbines within 1% of peak efficiency during fish passage season at the lower Snake and lower Columbia Projects: Lower Granite, Little Goose, Lower Monumental, Ice Harbor, McNary, John Day, The Dalles, and Bonneville. This would allow the turbines to operate across the full range of their generating capacity, and provide more flexibility to generate hydropower to meet demand. Removing the limitation would allow more water to pass through the turbines during periods of high flow, potentially reducing TDG levels in the river.

Zero Generation Operations This measure would allow the lower Snake River projects to cease hydropower generation when there is little demand, unless limited by grid stability requirements. Currently, these projects are allowed to operate at Zero Generation mid-December – mid February. This measure would extend that period to begin in September and extend through March. This would allow operators to save water in low demand periods to use during high demand periods in order to meet demand for hydropower.



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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).

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