



## CRSO EIS Multiple Objective Alternative 4

The Multiple Objective Alternative 4 (MO4) was developed to examine an additional combination of measures to benefit ESA-listed fish integrated with measures for water management flexibility, hydropower production, and additional water supply. The additional combination of fish measures that differ from the other alternatives include the highest spill target in the range considered in this EIS, dry year augmentation of spring flow with water stored in upper basin reservoirs, proposing spillway weir notch inserts, changes to the juvenile fish transportation operations, annually drawing down the lower Snake River and Columbia River reservoirs to their minimum operating pools, a measure for establishment of riparian vegetation, and increased powerhouse surface passage for kelt and overshoots.

The structural measures in this alternative are primarily focused on improving passage conditions for ESA-listed salmonids and Pacific lamprey. The inclusion of spillway weir notch inserts is the only structural measure difference from the other action alternatives. The operational measures are focused on making improvements and providing flexibility across authorized project purposes. In MO4, the juvenile fish transport program is proposed to only operate in the spring and fall while juvenile fish passage spill is set to a target of no more than 125% TDG during the spring and summer spill season. The alternative also contains a measure for flows from the Libby project targeted for downstream riparian vegetation establishment that is intended to improve conditions for ESA-listed resident fish, bull trout, and Kootenai River white sturgeon in the upper Columbia River Basin.

A brief description of the measures contained in Multiple Objective Focus Alternative 4 follows:

### **Structural Measures**

**Additional 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.

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

**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.

**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



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**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.

**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.
- **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.



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**Spillway Weir Notch Inserts** Modify existing spillway weirs at Lower Granite, Little Goose, Lower Monumental, Ice Harbor, McNary, and John Day dams. A notch gate would be installed in one spillway weir at each dam to create a smaller opening in the weir and enable reduced spill flow velocities. The notched weirs would be operated October 1 – November 31 at all dams.

### Operational Measures

**Spill for Adult Steelhead** Implementation of this measure would require modification of the spillway weirs as described above for the measure “Spillway Weir Notch Inserts” to facilitate downstream passage of adult salmon, steelhead, and kelt. Flows would be directed through the weirs at Lower Granite, Little Goose, Lower Monumental, Ice Harbor, McNary and John Day projects, from October 1 – November 31. The measure is intended to increase adult salmon and steelhead survival by decreasing passage mortality of adult steelhead.

**Spill to 125% TDG** This measure would set the target for juvenile fish passage spill up to 125% TDG, as measured in the tailrace, at the four lower Snake River and four lower Columbia River projects. Juvenile fish passage spill to this level would be dependent upon availability of sufficient flow to meet minimum generation requirements for hydropower. Upstream storage reservoirs would not be drafted specifically to reach 125% TDG spill levels. This juvenile fish passage spill regime would be implemented March 1 – August 31 at Lower Granite, Little Goose, Lower Monumental, Ice Harbor, McNary, John Day, The Dalles, and Bonneville 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.

**Spring & Fall Transport** Juvenile fish transportation on barges and trucks would be implemented in two timeframes, April 25 – June 14, and August 16 – November 15, rather than transport (insert NAA dates). During these two transport seasons, all juvenile salmonids that enter the juvenile fish bypass systems at Lower Granite, Little Goose, and Lower Monumental dams would be collected and transported to a location downstream of Bonneville dam for release.

**No Summer Transport** Suspend the juvenile transport program at Lower Granite, Little Goose, and Lower Monumental during the full summer timeframe (June 15 – August 15). Instead of collection for transport, all juvenile fish entering the fish bypasses at these projects would be returned to the river to migrate during the June 15 – August 15 window.

**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



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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 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 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.



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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.

**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 Lower Granite, Little Goose, Lower Monumental, Ice Harbor, 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.

**McNary Flow Target** This measure would augment flows in the lower Columbia River during the juvenile salmon outmigration period in low water years. The summer flow objective at McNary is supported by various flow augmentation measures in the No Action Alternative that would continue, but this measure would provide additional flow augmentation. Even with this additional water there is a limited amount of water available for flow augmentation and flow objectives are provided as a biological guideline. To meet this minimum flow objective for the lower Columbia River, up to 2.0 MAF of storage water from the Hungry Horse, Libby, Albeni Falls, and Grand Coulee projects would be provided above that provided currently, in order to meet spring or summer flow objectives established for the McNary project. Grand Coulee would be drafted from first to meet the target, with no more than 40 kcfs being released in a single day and drafting the reservoir to no more than the minimum pool elevation. Then, Hungry Horse, Libby, and Albeni Falls reservoirs would be drafted to support the augmented flow target as well as to refill Grand Coulee's reservoir, but to a reduced refill elevation. Local resident fish operations in the upper basin, such as minimum flows for resident fish, would be maintained. In the event that all 2.0 MAF of water has not been used by June 15, then the remaining volume of water would be released to meet a reduced minimum flow target of 200 kcfs at McNary through to July 31. This measure is not anticipated be implemented every year, but rather only when the system-wide April to August water supply forecast is below 87.5 MAF.



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**Drawdown to Minimum Operating Pool (MOP)** Operate the lower Snake River and lower Columbia River projects at lower elevations to reduce travel times for juvenile fish out-migration while providing slightly increased operating range flexibility at the lower Snake River projects. These operations would be implemented at the lower Snake River projects from March 15 – August 15, and at the lower Columbia projects from March 25 – August 15. The projects would be drafted down to the following reservoir elevations:

Location	MO4 MOP Forebay Elevation
Lower Granite	733.0' + 1.5' range
Little Goose	633.0' + 1.5' range
Lower Monumental	537' + 1.5' range
Ice Harbor	437' + 1.5' range
McNary	337.0' + 1.0' range
John Day	261.0' + 1.5' range
The Dalles	155.0' + 1.5' range
Bonneville	71.5' + 1.5' range

**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).

**Winter Stage for Riparian** Operate to limit the Bonners Ferry river elevations to a maximum of 1753 feet from November – March to create conditions that would increase survival of riparian vegetation downstream of Libby Dam. The riparian vegetation is considered an important factor in creating good conditions for Kootenai White Sturgeon and Bull Trout.