

**Special Operations Request for Coordination of
Cougar Dam Debris Removal and Intake Tower Trashrack Repairs
February 22, 2016**

Purpose. The purpose of this Special Operations Request (SOR) is to coordinate the drawdown of Cougar Reservoir and the operation of the diversion tunnel in support of debris removal and wet well trashrack repairs.

Background. On 16 January 2016, inspection using a Remote Operated Vehicle (ROV) confirmed that an interior wet well trashrack inside the Cougar water temperature tower had failed and three of nine 24" x 58" panels on the lowest row had fallen from the frame. The compromised trashrack has allowed large amounts of debris to accumulate in the penstock and wedge between the turbine generating unit blades causing damage and complete shutdown of the powerhouse. If not corrected, this will affect the ability to generate power at Cougar Dam and provide attraction flows to the adult fish collection facility, which is used to collect and transport ESA-listed spring Chinook salmon upstream of Cougar Dam from March to August.

Reservoir Drawdown during Special Operation. Beginning in late-February, debris removal and trashrack repairs will commence. This work will require reservoir drawdown, cul-de-sac de-watering and operation of the diversion tunnel which will be used to discharge water downstream of Cougar Dam during repairs. A two-week period with the work area de-watered is required to complete this work.

Cougar Reservoir drawdown will begin immediately after the Portable Floating Fish Collector (PFFC) has been moved out of the cul-de-sac area. This is currently scheduled for 29 February 2016. The reservoir will be drawn down from minimum conservation pool elevation (El. 1532 feet*) to El. 1,470 – 1,450 feet¹; debris removal will take place as the reservoir is lowered. The reservoir will be held down for two weeks to complete trashrack repairs. Refill will begin on 01 April.

Drawdown rates will be held at three feet per day to prevent instability (bank sliding/sloughing). Discharges will be released through a combination of regulating outlets (ROs) – only, ROs + the diversion tunnel, and the diversion tunnel – only, depending on reservoir elevations and outlet availability. The ROs will be used solely to discharge water from the reservoir while elevations are above 1495 feet. Once the reservoir has been drawn down below El. 1495 feet, the transition between controlled RO flow and uncontrolled RO flow will occur. El. 1495 feet is most favorable to make the transition, as this will ensure that the RO flow can transition from controlled flow to uncontrolled flow without cycling between pressurized and unpressurized flow regimes in the conduit upstream of the gate. During this transition, the diversion tunnel will be used to make up the difference in outflows. The transition between outlets will be monitored closely using downstream discharge data to avoid deviations to ramping rates detailed in the BiOp. Once the reservoir has been drawn down below the RO gates (El. 1470 feet), the penstock gates will be opened up to dewater the remainder of the cul-de-sac area and the diversion tunnel will be used solely to discharge water into the river below.

Timing and transition of gate operations has been developed in details and can be found in the Cougar Reservoir Drawdown Operations Plan attached to the Cougar SOR form.

¹ This elevation range was chosen to ensure that the reservoir is low enough to keep the worksite dry, yet high enough to provide a buffer so that discharge from the Rush Creek pipe does not scour the saddle dam.

ResSim Model Results. ResSim modeling was conducted to determine the likelihood of drawdown and the potential impacts that may be realized from this operation. The model was set up to run a 73-year period of record (water years 1936-2008) with a daily time-step. Dam operations were imposed on the 73-year period of record to simulate project operations over a large span of water year types.

The shaded areas on the figure below represents baseline conditions. The white area, shown as the P05 (5%) non-exceedance, means that for 5% of the time, the elevation on each day of the year (for the period of record) did not go above that level. These daily values are calculated for each day of the year independently, meaning that the non-exceedance curves do not represent any specific year.

Figure 1, below, shows the likely reservoir response under the proposed drawdown and delayed refill operation. Results indicate that under this operation, it is possible to draw the reservoir down to El. 1450 feet for water years modeled ($\leq 50\%$ non-exceedance curves, see yellow, green and purple lines). However, in the event of a large rain storm, the reservoir may fill and inundate the cul-de-sac and worksite during repairs (see blue and red lines). Weather forecasts and inflow predictions will need to be closely monitored. The Contractor will be notified by the Corps when weather events are expected, or occurring, that may result in an increase in reservoir elevations. If the worksite is inundated, it is likely that completion of repairs will be delayed, potentially delaying the date in which reservoir refill can begin. A delay in refill by a few days should not impact refill potential; a delay by a few weeks, however, may make refill more difficult. Undoubtedly, there is a risk in not meeting the refill date of 01 April. In this event, impacts will be re-evaluated and reservoir operations will be adaptively managed.

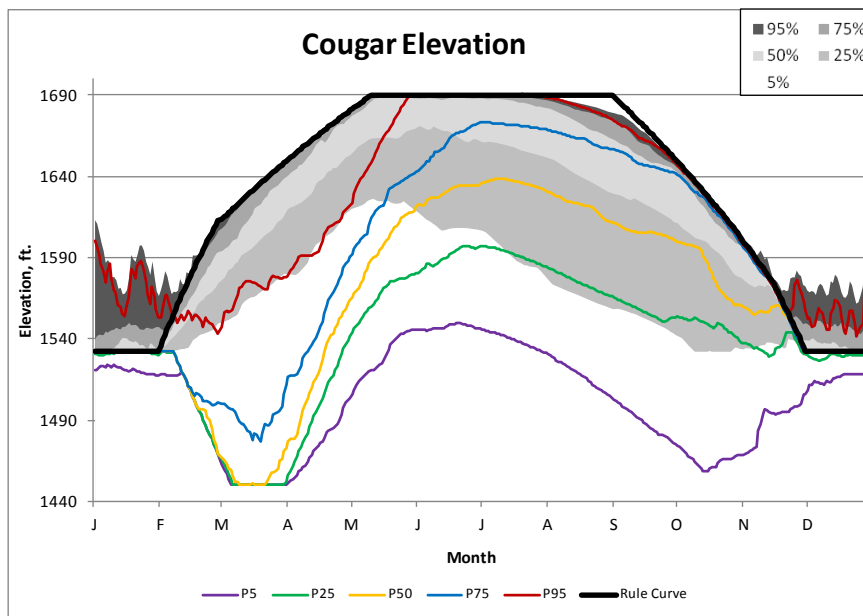


Figure 1. ResSim model simulation showing potential storage impacts from a one month drawdown and delayed refill of Cougar Reservoir (refill typically begins 01 February).²

² Repairs should be completed within two weeks; this simulation evaluated impacts based on a drawdown of up to one month.

The 50% non-exceedance line (yellow line) shows that for 50% of the years modeled, Cougar Reservoir did not refill beyond El. 1640 feet under this operation. Thus, it is not expected that Cougar Reservoir will refill above El. 1640 feet once repair work has been completed. To put this into perspective, Cougar Reservoir did not fill above El. 1605 feet in the drought year of 2015 (Figure 2). So although, this operation will impact storage, Cougar Reservoir will likely refill beyond what was observed in 2015.

Even though storage in Cougar Reservoir was considerably reduced in 2015 due to drought conditions, downstream flow and water temperature targets (Figure 3) were generally met. Therefore, water temperature and instream flow objectives should be achievable under the proposed operation.

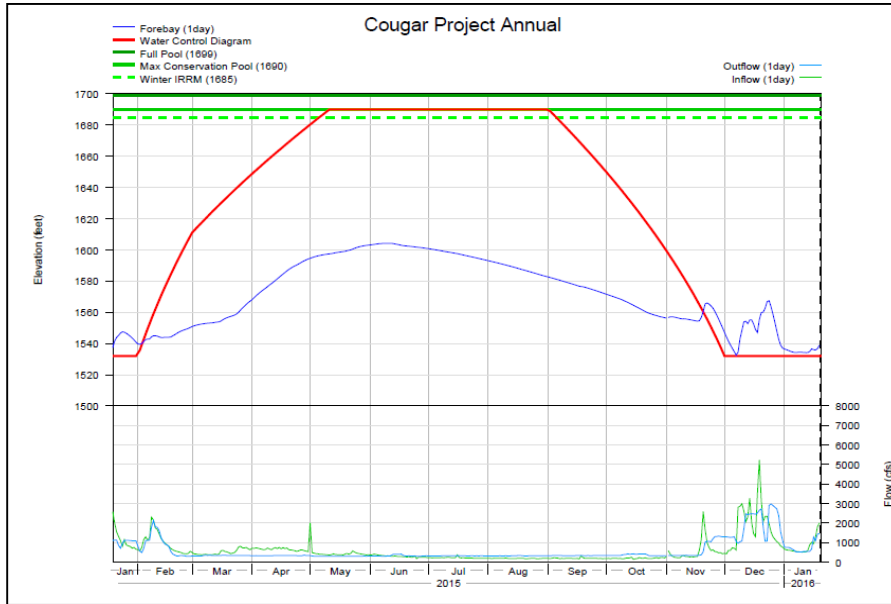


Figure 2. Observed Cougar Reservoir elevations measured in 2015.

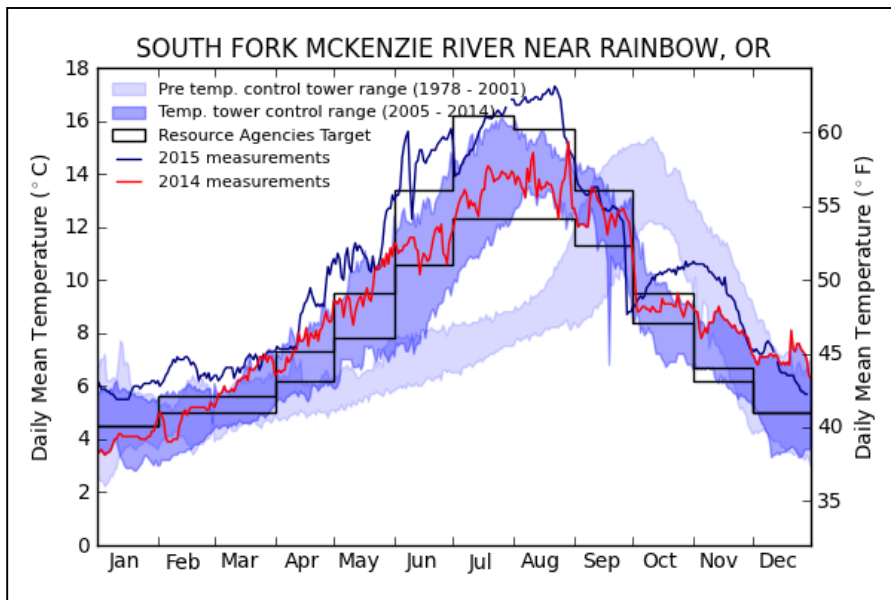


Figure 3. Observed water temperatures measured downstream of Cougar Dam in 2015.

Major Tasks & Schedule:

Prior to reservoir drawdown, the Portable Floating Fish Collector (PFFC) will be disconnected from the tower, moved (floated) out of the cul-de-sac area and anchored near the face of Cougar Dam in the main portion of the reservoir. A secondary forebay elevation gage will be installed in the main portion of Cougar Reservoir to track elevations as the reservoir is drawn down. As the cul-de-sac is dewatered, the Rush Creek culvert may need to be cleaned out; this will be determined once the cul-de-sac area is dewatered. Fish salvage will occur where practicable to remove ESA-listed bull trout that may be stranded during the drawdown. Water quality will be monitored throughout the drawdown period at the U.S. Geological Survey (USGS) gage #14159500, "South Fork McKenzie River near Rainbow". The parameters monitored will include water temperature, turbidity, and total dissolved gas (TDG).

As the cul-de-sac is dewatered, a crane will be used to remove accumulated woody debris, which will be taken off the project site and processed at an approved commercial facility. Equipment will access and stage on existing roads and parking areas; flagging crews will be used to direct local traffic. Advanced American Construction, Inc. (AAC) will install scaffolding to make temporary repairs to the damaged trash racks (i.e. installing j-clips, reinstalling failed sections) and woody debris will be removed from the penstock. Once the repairs are complete, all equipment and scaffolding will be removed and the reservoir will begin to be refilled. The diversion tunnel will be decommissioned when the RO gates can be used again (El. 1505 feet) and the PFFC will be repositioned once reservoir elevations are above El. 1510 feet. Reservoir refill is planned to begin in 01 April³ to ensure there is adequate storage for summer water temperature management and downstream flow augmentation for ESA-listed Upper Willamette River (UWR) spring Chinook salmon. A schedule and list of major tasks is shown in Table 2, below.

Coordination.

Regional coordination has been conducted through the Willamette Fish Operations and Management Team (WFPOM).

This SOR has been vetted internally and regionally.

³ If this date is delayed by more than a few days, impacts will need to be re-evaluated and reservoir operations adaptively managed.

Table 2. General Reservoir Drawdown and Repair Schedule.					
Completed (✓)	Task	Schedule	Target Reservoir Elevation (in feet)	Comments	POC
✓	Move fish research equipment	26-29-Jan	> 1524		USGS
✓	Recommissioning of diversion tunnel	3-Feb	N/A	Perform at current reservoir elevation*	WVP
✓	Installation of downstream turbidity gage	5-Feb	> 1524	Complete prior to initiation of drawdown	USGS
✓	Cougar Dam crest survey	8-9-Feb	> 1524	Complete prior to initiation of drawdown	EC-HC, EC-DG
✓	Installation of forebay elevation gage	16-19-Feb	> 1524	Complete prior to initiation of drawdown	USGS
	Move the Portable Floating Fish Collector (PFFC) and anchor in main reservoir	29-Feb - 4-Mar	> 1524	Disconnect power cable, move PFFC into main reservoir	AAC
	Begin drawdown and debris removal	29-Feb	1524 - 1470	Debris removal will occur as reservoir is drawn down	NWP/AAC
	Remove RO bulkhead	18-Mar	1470		WVP
	Drain cul-de-sac (using penstock), complete debris removal, including debris in sump	21-Mar	1470		WVP/AAC
	Deploy scaffolding, complete trashrack repairs	22-25-Mar	1470-1450		AAC
	Remove scaffolding, begin refill	31-Mar	1450-1470		NWP/AAC
	Move PFFC back into place, hook back up to power	14-21-Apr	1524		AAC
	Cougar Dam crest survey	30-June	~1640	Complete once reservoir has reached highest elevation for season	EC-HC, EC-DG

* Cougar Reservoir is currently at elevation 1527 feet and holding.