



# FISH PASSAGE CENTER

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## MEMORANDUM

TO: Charlie Morrill, WDFW

FROM: FPC Staff

DATE: December 11, 2014

RE: Dworshak Spring 2014 Operations

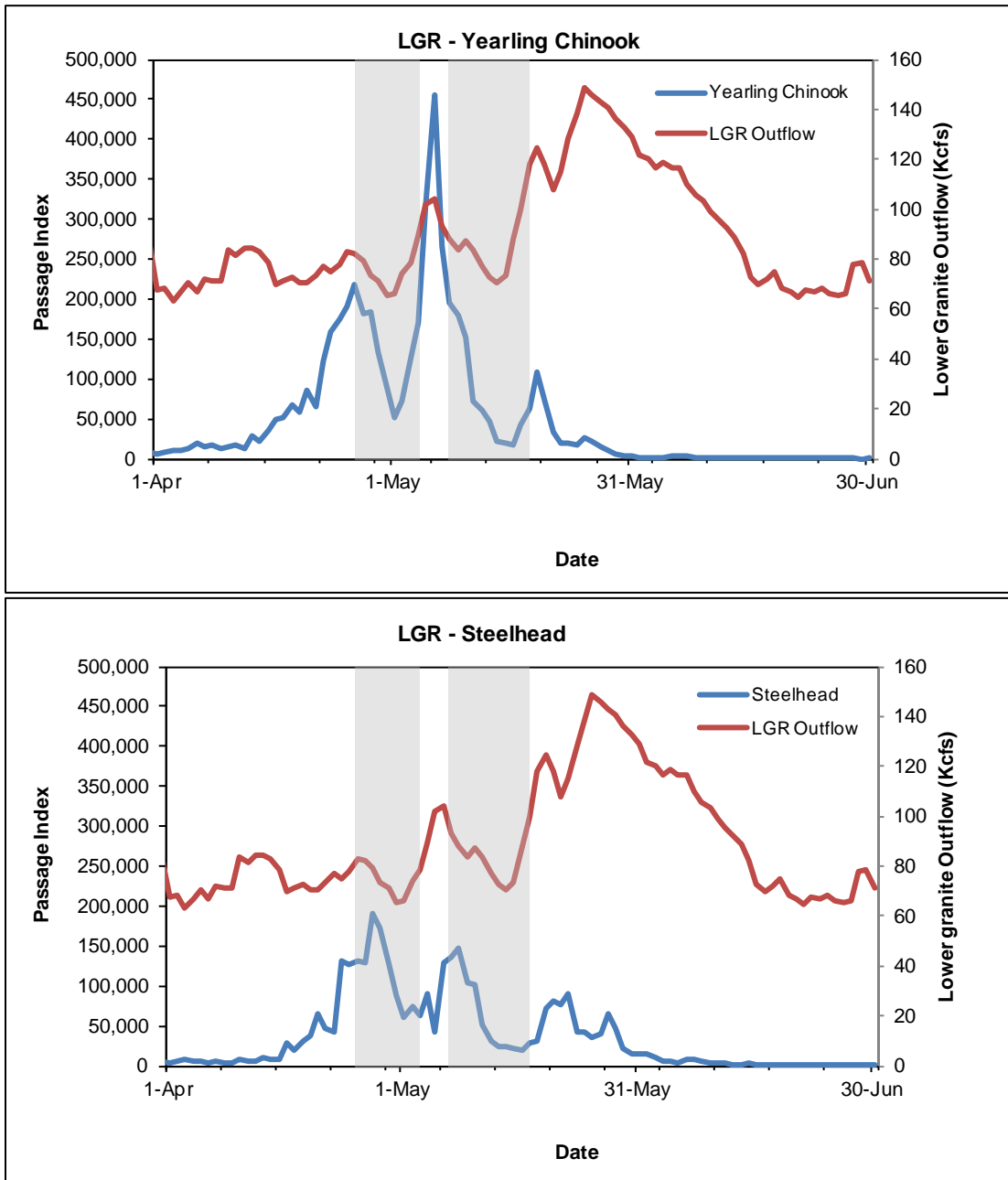
You requested that the spring 2014 operations at Dworshak Dam be reviewed to determine if project releases could have provided more benefits for fish in late April and early May. In response to your request, the FPC re-evaluated springtime operations at Dworshak Reservoir over the spring 2014 with the intent of maintaining lower Snake River flows at Lower Granite throughout the spring juvenile migration.

- While conditions that dictate reservoir operations are always changing, and the in-season management of a reservoir attempts to balance the needs of multiple objectives, the indication is that there was limited risk in operating Dworshak differently and operations to provide maximum benefits for migrating salmonids could have been implemented.
- At Lower Granite Dam over the spring of 2014, there were two distinct periods when flows and juvenile passage indices were experiencing declines in between periods of increased flow and passage.
- By limiting drafts below the April 10<sup>th</sup> FC elevation, allowing drafts and flow augmentation releases from Dworshak during late April period when the ESP forecast decreased (yet snowpack was increasing and precipitation was relatively steady), and allowing later spring outflows at Dworshak to decrease to 1.6 Kcfs, flows at Lower Granite were increased between 9–11 Kcfs during the periods of reduced flow and passage in the modeled alternative operation.

### **Fish Migration and Flow**

At issue was the fact that Dworshak released high volumes of water prior to the juvenile migration and decreased outflow during the peak of the spring juvenile passage period.

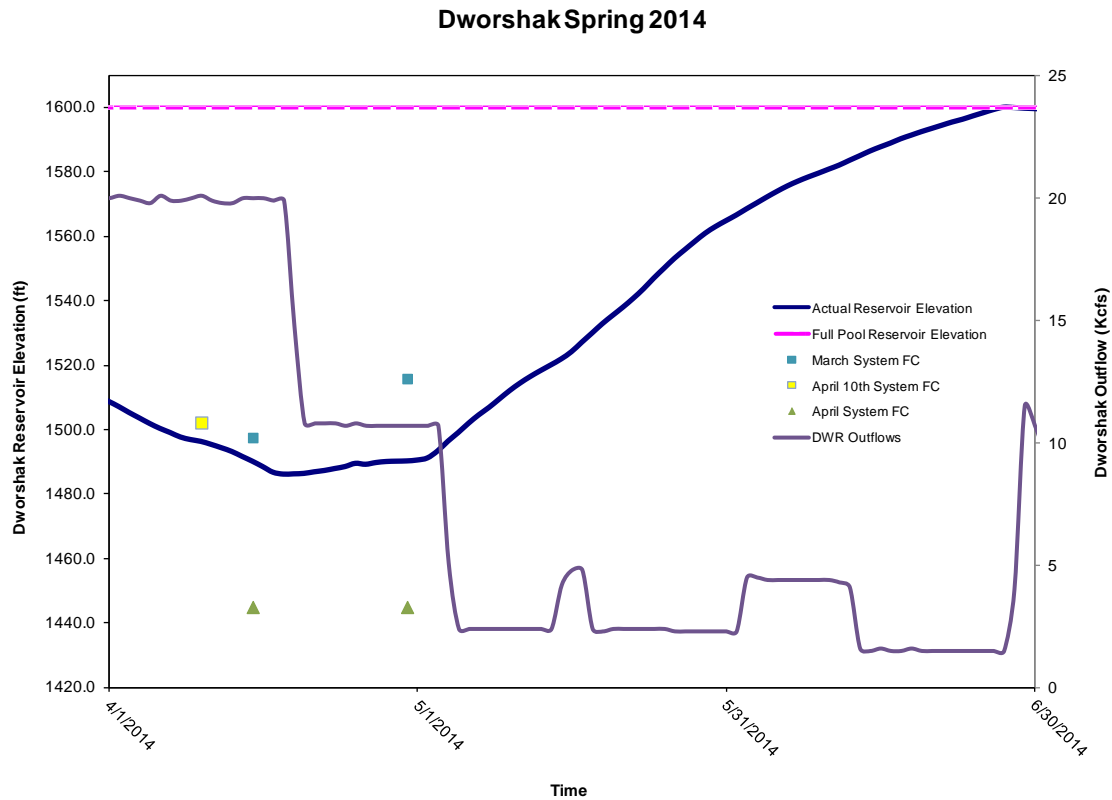
Figures 1 and 2 display the passage indices at Lower Granite Dam for yearling Chinook and steelhead along with actual outflows at Lower Granite Dam between April 1 and June 30, 2014. The shaded areas in the figures are periods when the passage indices and Lower Granite outflows were decreasing, following a period of increasing passage index and general increasing flow. The intent of this memorandum will be to retrospectively modify spring of 2014 operations at Dworshak Dam and evaluate this impact on Snake River flows, focusing on the shaded periods in Figures 1 and 2 when decreases in flow and passage index were seen at Lower Granite Dam.



**Figures 1 and 2.** Passage indices at Lower Granite Dam for yearling Chinook and steelhead along with actual outflows at Lower Granite Dam between April 1 and June 30, 2014.

## Dworshak Flood Control Operations

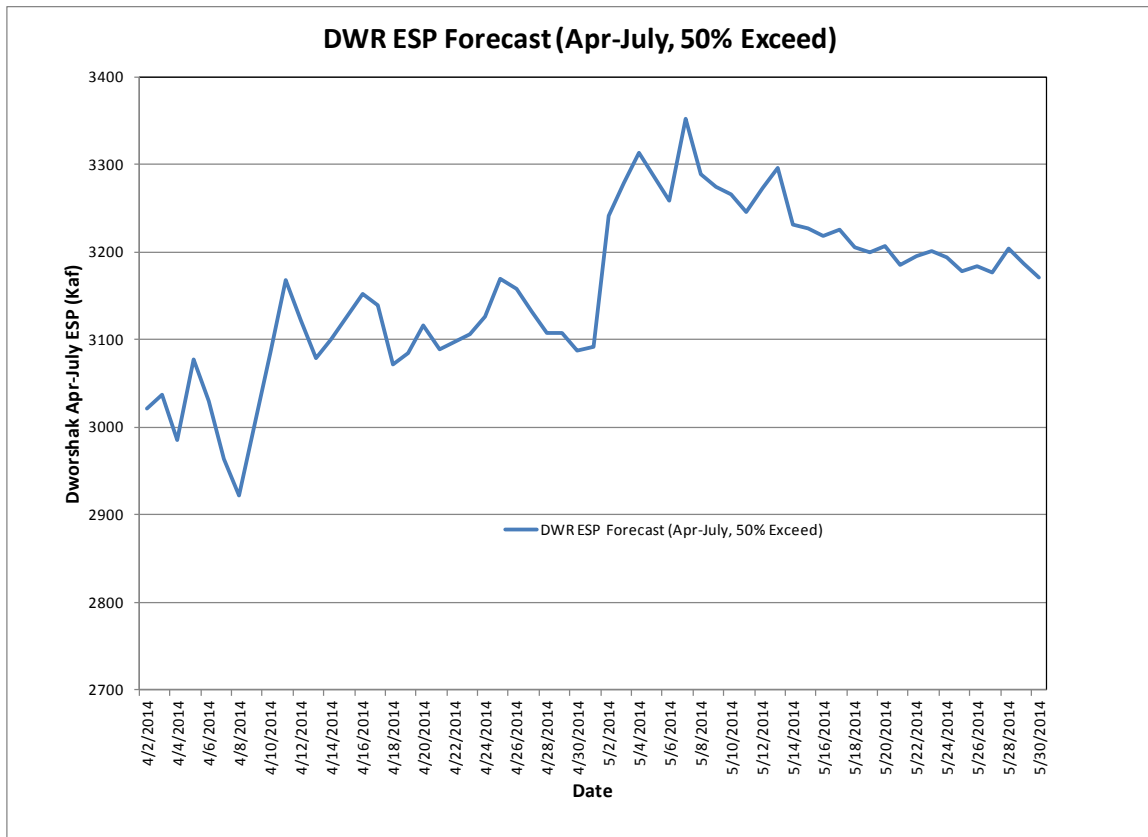
Figure 3 displays operations at Dworshak Dam over the spring of 2014. Generally, outflows were at near maximum levels (approximately 20 Kcfs) for nearly a month between late March and mid to late April, within the constraints of downstream Total Dissolved Gas (TDG) and the powerhouse capacity at Dworshak. These outflows were needed for Dworshak to draft to its end of March Flood Control Elevation. However, by maintaining the 20 Kcfs outflow through mid to late April, Dworshak was drafted below its April 10<sup>th</sup> Flood Control (FC) Elevation. The April 10<sup>th</sup> FC elevation was 1502.3 feet, where the actual elevation on April 10<sup>th</sup> was 1496.5 feet. By having to refill from 1496.5 feet as opposed to 1502.3 feet by the end of June, approximately 66 Kaf of water was drafted before the spring flow period. It should be pointed out that the FC elevations based on the April forecast at Dworshak were much lower than those based on the March forecast; so low that it was not feasible for the Corps of Engineers (COE) to draft to the April 15 and 30 FC elevations as the outflows needed for this draft would have caused downstream flooding and TDG levels too large for the downstream hatchery. As a result, the COE submitted and received a flood control deviation request to not have to draft down to the mid and end of April FC Elevations. If it is assumed that Dworshak could have been operated to its April 10 FC elevation while still deviating from late April FC, then 66 Kaf could have been moved into the spring period.



**Figure 3.** Dworshak reservoir elevation and outflows with March and April Flood Control elevations (April–June 2014).

## Dworshak Refill and Runoff Forecasts

At the April 30, 2014, Technical Management Team (TMT) meeting, the COE stated that their planned operation was to reduce total outflows from Dworshak to 2.4 Kcfs beginning on May 1, 2014, in order to achieve a full reservoir by the end of June. At this time, the fisheries managers asked for a more gradual decrease in flows from Dworshak to augment flows in the lower Snake River that were declining. The TMT did agree to extend full powerhouse outflows at Dworshak until May 2, 2014, and then drop to 5.0 Kcfs for one day before reducing flows to 2.4 Kcfs on May 4, 2014. Although the COE did agree to this operation, there was a warning that this operation could result in Dworshak being two feet below full in June. Figure 4 displays the April–July ESP forecasts at Dworshak over April and May of 2014. At the time of the April 30, 2014, TMT discussion, the ESP forecast at Dworshak had been declining for several days; however the forecast at Dworshak increased by over 100 Kaf immediately after this discussion.



**Figure 4.** April–July ESP forecasts at Dworshak over April and May of 2014.

It is unclear as to what caused the forecasts at Dworshak to decline around the end of April then drastically increase over the start of May. Weekly snowpack and water year precipitation issued by the Natural Resources Conservation Service (NRCS) in the Clearwater/Salmon is shown in Table 1. Snowpack in the Clearwater/Salmon was

above average through April; on April 28<sup>th</sup> snowpack was 138% of average and had increased over 10% from the previous week. Water year-to-date precipitation for the Clearwater/Salmon was slightly above average through April and early May.

**Table 1.** Weekly Snowpack and Water Year-to-Date Precipitation issued by the Natural Resources Conservation Service (NRCS) in the Clearwater/Salmon over April and early May of 2014.  
<http://www.wcc.nrcs.usda.gov/reports/SelectUpdateReport.html>.

<b>Date</b>	<b>Snowpack (%)</b>	<b>Water Year-to-Date Precipitation (%)</b>
31-Mar	126	105
7-Apr	129	105
14-Apr	126	102
21-Apr	127	101
28-Apr	138	105
5-May	138	103
12-May	152	105

In retrospect, more water was available for flow augmentation beyond early May of 2014. The sum of water released at Dworshak above minimum flows (1.6 Kcfs) from May 5, 2014, through the end of June was 157 Kaf. Dworshak refilled several days prior to June 30 and operators were forced to increase outflows as high as 11.5 Kcfs over the last several days of June.

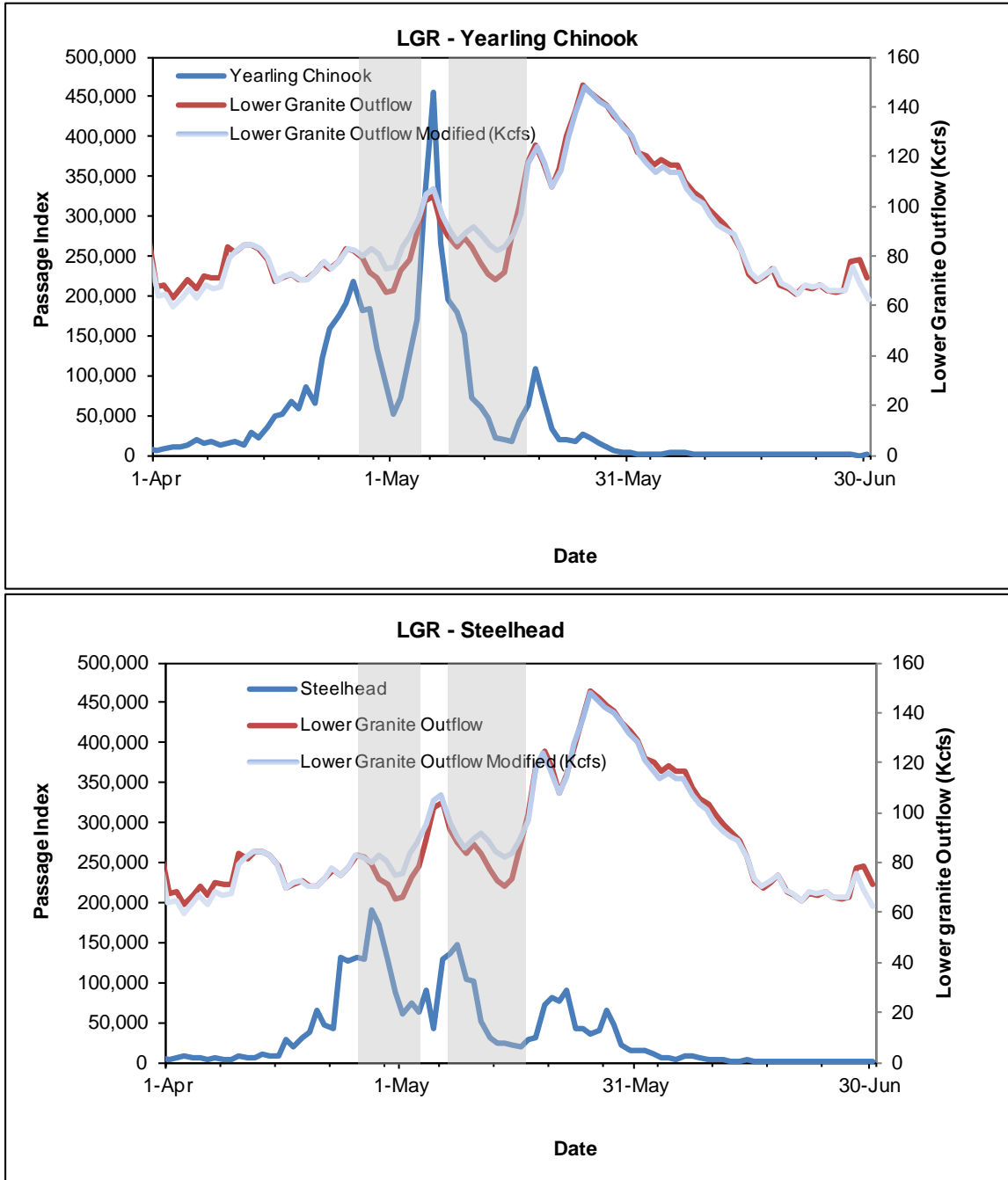
### **Alternative Operations**

Operations were re-evaluated at Dworshak over the spring of 2014 and modifications to Dworshak outflows were translated to modified flows at Lower Granite. The following modifications were made to Dworshak operations over the spring of 2014:

1. Did not draft significantly below the April 10<sup>th</sup> FC elevation; this water was saved for use during the spring flow period.
2. Did not curtail drafts and releases from Dworshak during late April period when the ESP forecast decreased, yet snowpack was increasing and precipitation was relatively steady.
3. Attempted to release as much water as possible (assumed maximum was 20 Kcfs) during periods of decreased flow and passage at Lower Granite.
4. Attempted to focus water above the 1.6 Kcfs minimum discharge into periods that would have maximum benefit to juvenile passage.
5. Refilled under actual and modified operations.

The following plots display actual flows at Lower Granite Dam as well as modeled flows at Lower Granite had Dworshak been operated in a way that attempted to concentrate flow augmentation during periods when flows and juvenile passage indices were

experiencing declines in between periods of increased flow and passage. Two periods in particular were April 28–May 2 (Period 1) and May 12–15 (Period 2). During these periods, actual Lower Granite flows averaged 70.2 Kcfs and 73.3 kcfs, respectively. Under the modified Dworshak operations scenario, flows at Lower Granite averaged 79.5 Kcfs during Period 1 (an increase of 9.3 Kcfs) and 84.5 Kcfs during Period 2 (an increase of 11.2 Kcfs)



**Figures 4 and 5.** Passage indices at Lower Granite Dam for yearling Chinook and steelhead along with actual and modified outflows at Lower Granite Dam between April 1 and June 30, 2014.

## **Summary**

In taking a retrospective look at operations at Dworshak Dam over the spring of 2014, the project could have been operated differently to provide the maximum benefit to the juvenile migration at Lower Granite Dam. At Lower Granite Dam, there were two distinct periods when flows and juvenile passage indices were experiencing declines in between periods of increased flow and passage. By limiting drafts below the April 10<sup>th</sup> FC elevation, allowing drafts and flow augmentation releases from Dworshak during late April period when the ESP forecast decreased (yet snowpack was increasing and precipitation was relatively steady), and allowing later spring outflows at Dworshak to decrease to 1.6 Kcfs, flows at Lower Granite were increased between 9–11 Kcfs during the periods of reduced flow and passage.