

APPENDIX M

Variable December Draft at Libby

Implementation of the 31 December Variable Flood Control Draft for Libby Dam and Impacts to Franklin D. Roosevelt Lake, Salmon Flow Augmentation, Winter Flows in the Kootenai River

Background

The Corps of Engineers recently implemented a 31 December variable flood control draft for Libby Dam. Previously Libby Dam had a fixed draft to an elevation of 2,411 feet by 31 December, which provides 2.0 million acre-feet (maf) of flood control space. This fixed draft adversely affected Libby's ability to refill in some dry years.

Flood control draft requirements for Libby Dam are based on the forecasted runoff volume for the April-August period. Historically, forecasts were issued at the beginning of each month from January 1 through June 1. There was no reliable way to issue a Libby volume runoff forecast earlier than January, so Libby reservoir was drafted to the same point each year on 31 December.

In 2003, the Corps developed a methodology to forecast runoff volume for Libby based on principal components regression. This new procedure incorporates climatic variables such as the ocean-temperature-based El Niño Southern Oscillation Index (SOI), and computes early-season forecasts in November and December. From the December forecast, the Corps could then calculate a variable draft for 31 December, which would allow Libby to be drafted less (i.e. holds the reservoir higher) than the fixed 2.0 maf.

The relaxation of the December draft requirement would be permissible only with VARQ FC because it does not compromise the ability to meet flood control targets in subsequent months. It would not be permissible with Standard FC. This is because the Standard FC procedure typically specifies deeper drafts in January, February, and March, and allowing a relaxed December draft could compromise the ability to meet flood control targets in these later months.

The Corps developed the following criteria for determining the 31 December flood control draft at Libby (Corps 2004):

- If the December 1 forecast is greater than 5900 kaf, draft to 2.0 maf (i.e. reservoir elevation of 2,411 feet)
- If December 1 forecast is less than 5500 kaf, draft to 1.4 maf (i.e. reservoir elevation of 2,426.7 feet)
- For December 1 forecasts between 5500 kaf and 5900 kaf, draft by interpolating between 1.4 maf and 2.0 maf (i.e. reservoir elevation between 2,411 and 2,426.7 feet).

In years when Libby is drafted the fixed 2.0 maf on 31 December, minimum outflow requirements will keep Lake Koocanusa below its flood control rule curve if forecasts

issued in January and later months predict a low runoff volume. These are the years that would benefit from a relaxed 31 December draft point. By allowing a lesser draft on 31 December, Lake Kooconusa would have a higher elevation in subsequent months and would be closer to (or on) the rule curve. This improves the probability of refilling Lake Kooconusa.

In practical terms, a higher rule curve can be achieved under VARQ FC compared to Standard FC generally in years with runoff forecasts between 80% and 120% of average. In higher-runoff years, VARQ FC and Standard FC are the same. In lower-runoff years, minimum flow maintenance in winter makes it difficult to bring the reservoir level up to the VARQ FC rule curve. Being at a higher draft point on 31 December may assist the reservoir to be closer to the VARQ FC rule curve at some point during the winter during the lower-runoff years. Thus, with less draft on 31 December, an observable effect of VARQ FC on reservoir levels may extend to years with less than 80% of average runoff.

Impacts to Libby and resulting impacts to Franklin D. Roosevelt Lake

As Grand Coulee flood control draft requirements are dependent on available space at other flood control reservoirs, a reduction in the flood control space available at Libby could require additional space requirements for Coulee in some years.

Based on the above criteria, Libby is able to relax the draft point in 14 of 54 years of the period of record as shown by computer modeling.

Of those 14 years, 4 years (1953, 1973, 1983, 1957) have forecast increases in January and/or February and/or March, causing the elevation of Lake Kooconusa on March 15 to be back where it would have been without the relaxed December draft. In these years there is no additional flood control requirement at Grand Coulee on April 30.

In 4 years (1988, 1977, 1994, 2001), Libby receives full benefit of the reduced draft (600 kaf more full on March 1), but the flood control requirements for Grand Coulee are not changed. These were typically dry years where Grand Coulee was at its absolute minimum space requirements. There was more space than necessary available in upstream reservoirs.

Two years (1992, 1993) Libby receives partial benefit from the variable end-of-December draft with no additional draft requirement at Grand Coulee.

The remaining 4 years (1980, 1970, 1979, 1955), Libby received either partial or full benefits from the variable draft. With Libby more full on April 30, the Grand Coulee draft requirement has increased. In three of the four years, the increased draft requirement is 9 inches or less. The fourth year, Grand Coulee would need to draft about 2 ½ feet deeper on April 30 due to implementation of the 31 December variable draft at Libby.

The following table shows estimates of Grand Coulee (GCL) impacts due to a 31 December variable draft at Libby and cumulative impacts due to implementation of VARQ FC.

Years	When affected	Maximum Increase in GCL Draft Requirement (Feet)	Maximum Increase in GCL Draft due to VARQ FC (feet)	Total Cumulative Increase in GCL Draft (feet)
1980	April 30	0.3	3.9	4.2
1970	April 30	2.6	2.8	5.3
1979	April 30	0.4	5.8	6.2
1955	April 30	0.75	2.5	3.25

Impacts to Salmon Flow Augmentation

In years where variable December draft results in a higher peak elevation at Libby after refill, flows in the mainstem Columbia River are affected during the spring and summer. The following table shows the effects on flows at Priest Rapids and McNary Dams for the April-August spring and summer salmon outmigration period when there are seasonal flow objectives at these two projects.

Effects of Variable December Draft on Mainstem Flows @ Priest Rapids and McNary Dams						
		Apr 15-Apr 30	May	June	July	August
Priest Rapids	# of years w/ lower flows w/ var. draft	4	5	6	n/a	n/a
	# of years w/ higher flows w/ var. draft	1	6	6	n/a	n/a
	Avg. flow difference (cfs) in years with a difference	74	722	831	n/a	n/a
	Maximum Increase	1805	5149	6940	n/a	n/a
	Maximum Decrease	1004	1027	2506	n/a	n/a
McNary	# of years w/ lower flows w/ var. draft	4	5	6	5	0
	# of years w/ higher flows w/ var. draft	1	6	6	5	10
	Avg. flow difference (cfs) in years with a difference	74	722	831	305	957
	Maximum Increase	1805	5149	6940	7258	2515
	Maximum Decrease	1004	1027	2506	4205	5

In general, years where the variable December draft increase the peak elevation at Libby tend to result in increased flows in the mainstem Columbia. Flows can be as much as about 7,000 cfs higher in rare years, but, on average, increases are small in relation to the flow objectives of 135 kcfs at Priest Rapids Dam, and 200 to 260 kcfs at McNary Dam.

Impacts to Winter Flows on the Kootenai River during Burbot Migration and Spawning

Studies indicate that lower flows in December and January may benefit burbot by providing better conditions for burbot migration into Idaho from Kootenay Lake. In December, implementation of variable December draft would not change Libby operations in about 75 percent of years, but in the 25 percent of years with a higher Lake Kooconusa elevation on 31 December, it would result in an average decrease in dam discharge of almost 6,000 cfs. Accordingly, variable December draft would tend to benefit burbot in December by facilitating lower average dam discharges and river flows.

In January, variable December draft would not change dam discharges in almost 90 percent of years, but, for the 10 percent of years where there would be a higher Lake Kooconusa elevation on 31 December, it would result in an average increase in dam discharge of about 4,000 cfs. Higher flows in January would likely occur in about half of the years with reduced December flows. Accordingly, benefits to burbot in winters with lower December flows due to variable December draft may be offset in some years by higher January flows that could hinder burbot migration and spawning in January.

References:

- (Corps) U.S. Army Corps of Engineers. 2004. Summary Report: 31 December Variable Flood Control Draft for Libby Reservoir. Northwestern Division, Portland, Oregon.
- (Corps) U.S. Army Corps of Engineers. 2005. Hydropower Impacts Analysis of Libby Variable End of December Elevations, Preliminary Report. Northwestern Division, Portland, Oregon.