International Kootenay Lake Board of Control

2016 Annual Report to the International Joint Commission

This Annual Report covers the operations of Corra Linn Dam by the Applicant to the IJC Order (FortisBC) and the associated effects on the water level of Kootenay Lake in 2016. FortisBC operates Corra Linn Dam on the Kootenay River approximately 22 kilometers upstream from its confluence with the Columbia River, and downstream from the West Arm of Kootenay Lake. FortisBC controls discharge through and around Corra Linn Dam in accordance with requirements of the Order of the International Joint Commission dated November 11, 1938. FortisBC co-operates with BC Hydro, which also manages a hydro-electric generating facility (the Kootenay Canal Project) which is hydraulically connected to the Corra Linn dam forebay on the Kootenay River through a constructed canal.

Photograph of Kootenay River discharge through Corra Linn dam(Fortis BC)

Kootenay Lake 2016 Summary

Throughout 2016, FortisBC operated Corra Linn Dam in a manner consistent with that prescribed by the 1938 Kootenay Lake Order.

The minimum instantaneous water level was observed at 14:15, PST on March 8, 2016 at elevation 530.417 metres[1] (1740.213 feet). The Lake elevation did not reach the low elevation goal of 1739.32 feet due to high lake inflow beyond the control of the Applicant, therefore, there was no violation of the IJC Order, despite the exceedance of the rule curve. The high inflow events in 2016 were the result of intense precipitation events which resulted in rainfall-driven runoff rather than snow melt. There was lower than normal snow accumulation in 2016 due to warmer than normal late winter temperatures. The Board and the Applicant jointly determined the date of the commencement of the spring rise as April 8th, 2016. The maximum instantaneous water level for the lake at Queens Bay was subsequently observed from 18:40 to 18:55 PST on May 27, 2016 at elevation 532.816 metres (1748.048 feet). Kootenay Lake discharged 24.7 cubic kilometres (20.0 million acre-feet) of water in 2016, with an average flow of 782 cubic metres per second (27,600 cubic feet per second).

Board Membership

There were no changes to the Board membership in 2016. The Board members during 2016 were as follows:

For the United States:
Colonel John Buck, District Engineer, Seattle District,
United States Army, Corps of Engineers, Seattle, Washington;

Dr. Kyle Blasch, Director, Idaho Water Science Center;
United States Geological Survey, Boise, Idaho.

For Canada:
Mr. Bruno Tassone, Manager (retired), Water Survey of Canada, Vancouver, British Columbia;

Mr. Glen Davidson, Director, Water Management Branch;
BC Ministry of Natural Resource Operations, Victoria, British Columbia.

Board Secretariat:
Ms. Sara Marxen and Mr. Gwyn Graham provided secretariat support to the US and Canadian sections, respectively.

1938 Kootenay Lake Order Sections 2(4) 2(5) and 2(6)

2(4) …the Applicant shall be permitted to store water in the main body of Kootenay Lake to a maximum elevation of 1745.32, Geodetic Survey of Canada datum, 1928 adjustment (i.e. six feet above zero of the Nelson gauge), in accordance with the rule curve detailed in Sub-section (5).

(5) That after the high water of the spring and early summer flood and when the lake level at Nelson on its falling stage recedes to elevation 1743.32, Geodetic Survey of Canada datum, 1928 adjustment, the gates of the dam

[1] All elevations are referred to G.S.C. 1928 datum.

may be so operated as to retain it at said level until August 31st, and after said date, the level of the main body of the lake may be raised to elevation 1745.32, which shall be the maximum storage level until January 7, and thereafter it shall be lowered so that it shall not exceed elevation 1744 on February 1, elevation 1742.4 on March 1, and elevation 1739.32 (i.e. zero of the Nelson gauge) on or about April 1, except under extraordinary natural high inflow conditions, when sufficient gates shall be opened and remain open throughout such period of excess so as to lower the level of the main body of Kootenay Lake to the storage level at that time obtaining as above defined.

(6) ...throughout the period of flood flow in each and every year, (i.e. from the commencement of the spring rise in March or April until the level of the lake at Nelson returns to elevation 1743.32, Geodetic Survey of Canada, 1928 adjustment, on the falling stage), a sufficient number of gates and sluiceways of the dam shall be opened to provide, in conjunction with the flow through the turbines, for the lowering of the main body of Kootenay Lake ... by at least the amounts ... as follows:

Discharge from Kootenay Lake under original conditions (in second feet)	[vs.] Amount of lowering to be affected on the main body of Kootenay Lake (in feet)
10,000	1.0
25,000	1.3
50,000	1.7
75,000	2.1
100,000	2.6
125,000	3.0
150,000	3.2
175,000	3.5
200,000	3.8
225,000	4.0

Lake Regulation

Figure 1 presents observed calendar-year 2016 water levels on Kootenay Lake and the elevations specified in the November 11, 1938 IJC Order. Water levels on Kootenay Lake showed a distinct yet relatively subdued freshet peak in 2016, corresponding to increased inflows from snow-melt in this mountainous watershed. Water levels on Kootenay Lake rose early for a brief period in mid-February due to an intense rainfall event (unusual for this time of year) and then began an early sustained rise in mid-March due to additional large rainfall events and subsequent onset of higher-elevation snow-melt. During this period, upstream Libby Dam was essentially in a storage mode with inflow to Lake Koocanusa greater than the outflow, thus having a further moderating effect on the maximum lake level achieved during the 2016 freshet. Freshet ended relatively early in 2016 (early July) and Corra Linn dam operations maintained fairly stable water levels on Kootenay Lake through the end of August at which point water levels were allowed to decrease slightly during the peak Kokanee (fish) spawning period, prior to raising water levels towards the storage maximum by mid-November.

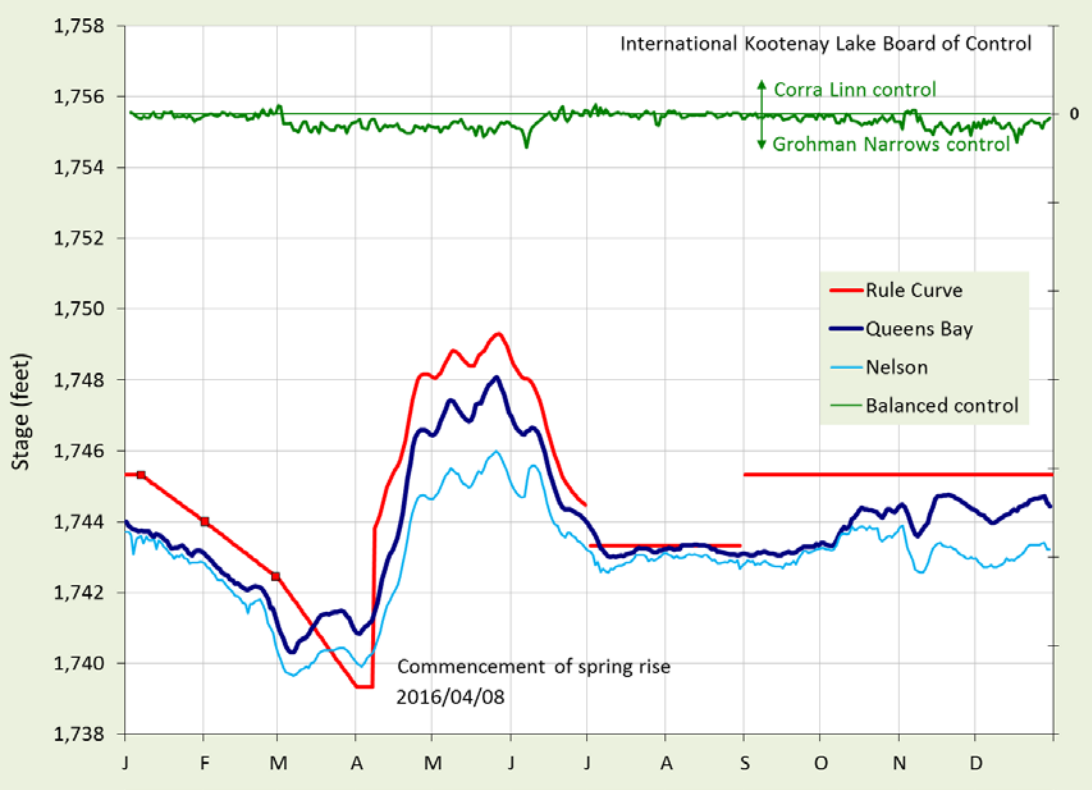

Figure 1 – Kootenay Lake Hydrograph

The maximum instantaneous water level of 532.816 metres (1748.084 feet) for the lake at Queens Bay was reached on May 27, 2016 from 18:40 to 18:55 PST. The minimum instantaneous water level was observed on March 8 at 14:15 PST, elevation 530.417 metres (1740.213 feet). Relative to the 86-year period of record (1931 to 2016, with two years missing; 1934 and 1947), this year's maximum water level ranked 63rd highest, and the minimum was the 82nd lowest annual minimum. Over the period of record, water levels in the lake have ranged from a high of 537.04 metres (1761.95 feet) in 1961 to a low of 529.56 metres (1737.41 feet) in 1944.

Kootenay Lake discharged 24.7 cubic kilometres (20.0 million acre-feet) of water this year through Corra Linn Dam and the Kootenay Canal Plant, with an average flow of 782 m^3/s (24,000 cfs). Relative to the 79 years of available discharge data, the annual volume of flow out of the lake was 66th highest over this period of record. Total lake outflow has ranged from a high of 33.8 km^3 (27.4 million acre-feet) in 1954 to a low of 13.8 km^3 (11.2 million acre-feet) in 1944. The maximum daily mean outflow was 1,710 m^3/s (60,400 cfs) on May 27 and 28, 2016. The minimum daily mean outflow of 269 m^3/s (9,500 cfs) was observed on October 8, 2016.

FortisBC has continued to supply the Board with complete records of the regulation of Kootenay Lake as affected by the operations of Corra Linn Dam and the Kootenay Canal Plant. FortisBC attempts to operate the lake within the optimal range of 1738.5 feet to 1749.5 feet, subject to the stipulations of the IJC Order and natural inflows.

The Board and the Applicant jointly determined the commencement of the spring rise to be 00:00 PST on April 8, 2016, the point at which the IJC rule curve switches from maximum lake elevation criteria to the lowering formula as stipulated in the IJC Order. The spring rise was declared based on

sustained increases in unregulated stream hydrographs throughout the Kootenay River Basin, in response to snow-melt conditions in early April.

Compliance Summary

As shown in Figure 1, the lake level elevation did not reach the low level target of 1739.32 feet on or about April 1 (section 2(5) of the IJC Order), due to high inflows beginning mid-March that exceeded the maximum lake discharge capacity. The Board confirmed that the applicant (Fortis BC) was operating Corra Linn dam in free-fall mode during this time and that Kootenay Lake outflow capacity was constrained by the natural channel constriction at Grohman Narrows (upstream of Corra Linn dam) and not by the dam itself. Based on this information, the Board confirmed that operation of Corra Linn dam was in compliance with the IJC Order.

Board Meetings

The Board held its annual and public meetings in Bonners Ferry, Idaho on September 22, 2016.

Board Tour

The morning of September 22 board members received a tour of the Kootenai Tribes recently opened sturgeon and burbot hatchery by Chairmen Gary Aiken and biologists Kevin James and Chris Miller. Restoration of the two species has been a major goal of the Kootenai Tribe since its first sturgeon hatchery opened in 1991. The hatchery is the first facility, nationally or internationally, to be built to rear and release burbot to rehabilitate a native population. Burbot were once a primary winter food source for tribal members but the population has been nearly extirpated to an estimated 50 fish through many miles of the Kootenai River in Idaho. Additionally changes in river flow after the 1975 completion of Libby Dam in Montana altered river conditions drastically, reducing both burbot and sturgeon numbers.

Tribal members described some of the limiting factors to natural recruitment of sturgeon populations they are: silt settling and suffocating eggs due to decreased fluctuations in river flows from the dams, lack of a pool-ladder structure in the river which helps sturgeon move to suitable spawning areas, ambient water temperatures that are too low, lack of nutrients due to Koocanusa being a “sink” for nutrients, and lastly lack of food sources. Tribal members indicated the sturgeon pulse from Libby Dam was one improvement that the tribe depended on for supporting sturgeon spawning.

Following the hatchery tour board members toured a Budweiser hops farm on the Kootenay River close to the U.S.-Canada border. Ed described the operations of the hops farm. The farm employs over 200 people and is in the top five of employers in the County. He expressed that when the river elevation at the USGS Porthill gage exceeds 1750 feet he sees inundation in the fields at his farm. He also indicated that if inundation persists for 30 days it can kill whole plants. He indicated that the sturgeon pulse had exacerbated the frequency of inundation at the farm.

Photograph: Chris Miller (biologist with the Kootenai Tribe) provided a tour of the recently opened sturgeon and burbot hatchery to the International Kootenay Lake Board of Control (IKLBC) on September 22, 2016. Participants include, from Left to Right: Chris Miller, Bruno Tassone (IKLBC Chair, Canada) Rich Moy (IJC Commissioner, USA), David Fay (IJC Engineering Advisor, Canada), Chairmen Gary Aiken (Kootenai Tribe), Camille Mageau (Secretary, IJC Canadian Section), Glen Davidson (IKLBC member), Col John Buck (IKLBC Board Chair, USA)

Annual Board Meeting

The board received a presentation from the Applicant (Fortis BC) on Corra Linn operations and planned upgrades at the dam. Jamie King described that Fall 2015 was a kokanee shoal spawning year according to the COFAC (Columbia Operations Fisheries Advisory Committee) which means that the applicant tries to keep lake levels at around 1742 feet in the Fall to minimize stranding of redds (spawning areas) during spring drawdown of lake levels.

Darren MacIlhaney (Fortis BC) provided an update of dam improvement projects at Corra Linn. Darren provided information on the Corra Linn spillway renewal project which resulted from a 2012 safety review of the dam. As a result of the review Corra Linn was upgraded to an “extreme consequence structure” status due to the downstream impact potential. The new rating requires improvements to withstand seismic activity. The applicant therefore is working to rehabilitate or replace flow control gates; the cost projections indicate that gate replacement may be more viable. If the plan is approved the work is expected to start in July/Aug 2018. A total of 14 gates may require replacement. The proposed plan will have a completion date of 2021. During the construction, four gates will be isolated at a time. Darren indicated there are no implications for free-fall or the ability to pass the PMF (probable

maximum flood) since currently the dam does not open all gates to go into free-fall and only 11 gates are required to meet the probable maximum flood.

Chris Frans (U.S. Army Corps of Engineers) presented information to the board on climate change. It included an overview of the hydrologic assessment process for climate studies, changes in atmospheric CO_2 over history, and of ongoing regional studies in the U.S. and Canada. A preliminary assessment of data by Chris indicates that winter flows are expected to increase, spring peak flows (freshet) are predicted to be more variable and there will be greater uncertainty in prediction capability. The Board noted that the climate change models for Kootenay Lake (as presented) are suggesting lower peak levels but possibly greater rule curve exceedance events in the winter/spring period.

The board received no correspondence in 2016. Canadian Secretary Gwyn Graham presented on the Kootenay River system to a regional Canadian stakeholder group known as the Columbia Basin Regional Advisory Committee in Castlegar (BC) February 1, 2016. This presentation was part of a broader information session on Kootenay River system operations.

Annual Public Meeting

For the Board's public meeting (held on the evening of September 22nd), an overview of the IJC Order and the related compliance requirements for operation of Corra Linn Dam were provided by Col. John Buck, as well as a summary of hydrologic conditions in 2016 affecting Kootenay Lake levels, including upstream operations at Duncan and Libby Dams (CRT operations). The Kootenay Lake hydrograph along with explanation of the Libby effect showed that Corra Linn Dam was in compliance with the IJC rule curve in 2016.

Photograph of the public meeting held the evening of September 22nd at the Best Western Kootenay River Inn in Bonners Ferry, Idaho.

The public meeting was attended by approximately 16 people, including local residents and IJC representatives. Chris Frans (USACE) presented an overview climate change studies and potential impacts to the Kootenay River Basin. He received a number of questions about climate change studies with attendees showing interest in hearing more about it in future years. Other questions received were related to the Columbia River Treaty and how the Treaty relates to the IJC Order, and about concerns with the uncertainty of water levels during a National loggers festival held on May Day. These questions and the Board responses are provided in greater detail in the minutes of the public meeting, located on the Board website.

According to the 1938 Order, FortisBC must pay farmers on the Kootenai Flats in Idaho up to $3,000.00 (U.S) for additional pumping costs related to dyke seepage from higher water levels during storage periods. A number of years ago, Fortis BC made a separate agreement with the Kootenai Valley Reclamation Association for an additional pumping cost payment based on actual receipts. Payments issued to Idaho in 2016 (for pumping costs in 2015) amounted to approximately $30,000 (USD).