International Kootenay Lake Board of Control

2011 Annual Report to the International Joint Commission

Duncan Dam (BC Hydro)

Duncan Dam (BCHydro) was constructed in 1967 as the first of three Canadian dams in British Columbia required under the Columbia River Treaty, creating the Duncan Lake reservoir along the Duncan River, about 10 km upstream of the north end of Kootenay Lake (BC). This Dam does not generate electricity but serves a storage purpose to assist in the optimization of downstream hydroelectic facilities via regulation of flow to Kootenay Lake.

Kootenay Lake Board of Control members toured BCHydro's Duncan Dam on September 22nd (2012).

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2011 Annual Report

This Annual Report covers the operations of the Corra Linn Dam by FortisBC (the Applicant) and the associated effects on the water level of Kootenay Lake. FortisBC operates Corra Linn Dam on the Kootenay River approximately 22 kilometres upstream from its confluence with the Columbia River, and downstream from the West Arm of Kootenay Lake. Fortis BC 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 lake level control structure—the Kootenay Canal Plant—at the lake's outlet.]

Kootenay Lake 2011 Summary

Throughout 2011, 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 20:00 PST on April 23rd at elevation 530.494 metres (1740.47 feet). Lake levels did not lower to the elevation of 1739.32 feet specified for April 1 in condition 6 of the 1938 Order because of high inflow conditions resulting primarily from the operation of upstream facilities during March. During this time, FortisBC lowered the level of the Corra Linn Dam forebay sufficiently to move the control of outflow from the lake upstream from the Dam to Grohman Narrows, maximizing the lake's discharge. Impacts of reduced gravity drainage of fields and associated higher pumping/drainage costs and difficulty in conducting annual repairs around the lakeshore were reported to the Kootenay Lake Board of Control.

The Board and the Applicant jointly determined the date of the commencement of the spring rise as May 3, 2011. The maximum instantaneous water level for the lake at Queens Bay was subsequently observed at 05:00 PST on June 16th at elevation 533.917 metres[1] (1751.70 feet). The Board received a comment appreciative of the flood control effort, noting that the water level came within approximately nine inches of flooding their house. One negative impact of the high water level that was reported to the Board was increased costs of mosquito control attributed to increased flooding of wetlands.

Kootenay Lake discharged 29.3 cubic kilometres (23.7 million acre-feet) of water in 2011, with an average flow of 929 cubic metres per second (32,800 cubic feet per second).

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

Board Membership

The Board members during 2011 were as follows:

For the United States,

Colonel Bruce Estok, District Engineer, Seattle District, United States Army, Corps of Engineers, Seattle, Washington;

Mr. Stephen Lipscomb, Director, Idaho Water Science Center, United States Geological Survey, Boise, Idaho;

and for Canada,

Mr. Kirk Johnstone, Chief, Pacific Storm Prediction Centre, Environment Canada, Vancouver, British Columbia;

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

Board Secretariat,

Ms. Amy Reese and Mr. Daniel Millar provided secretariat support to the US and Canadian sections, respectively.

Notes on changes to Board Membership,

Colonel Bruce Estok replaced Colonel Anthony Wright in July 2011 as a Board member for the United States. This date also marks Colonel Wright's retirement from the United States Army, Corps of Engineers, after 30 years of distinguished service. Colonel Wright served on the Board from 2008 to 2011.

Stephen Lipscomb also announced his resignation as a Board member in December 2011 in tandem with planned retirement from the United States Geological Survey (Director, USGS Idaho Water Science Centre). Mr. Lipscomb served on the Board from 2008-2011.

Mr. Daniel Millar retired from Environment Canada in December of 2011 after 32 years with Environment Canada in the field of water resource management. Mr. Millar provided secretariat support to the Board from 2000 to 2011. The Canadian secretariat duties have transferred to Mr. Gwyn Graham (Environment Canada).

Dan Miller

Colonel (Ret.) Anthony Wright

Stephen Lipscomb

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 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*

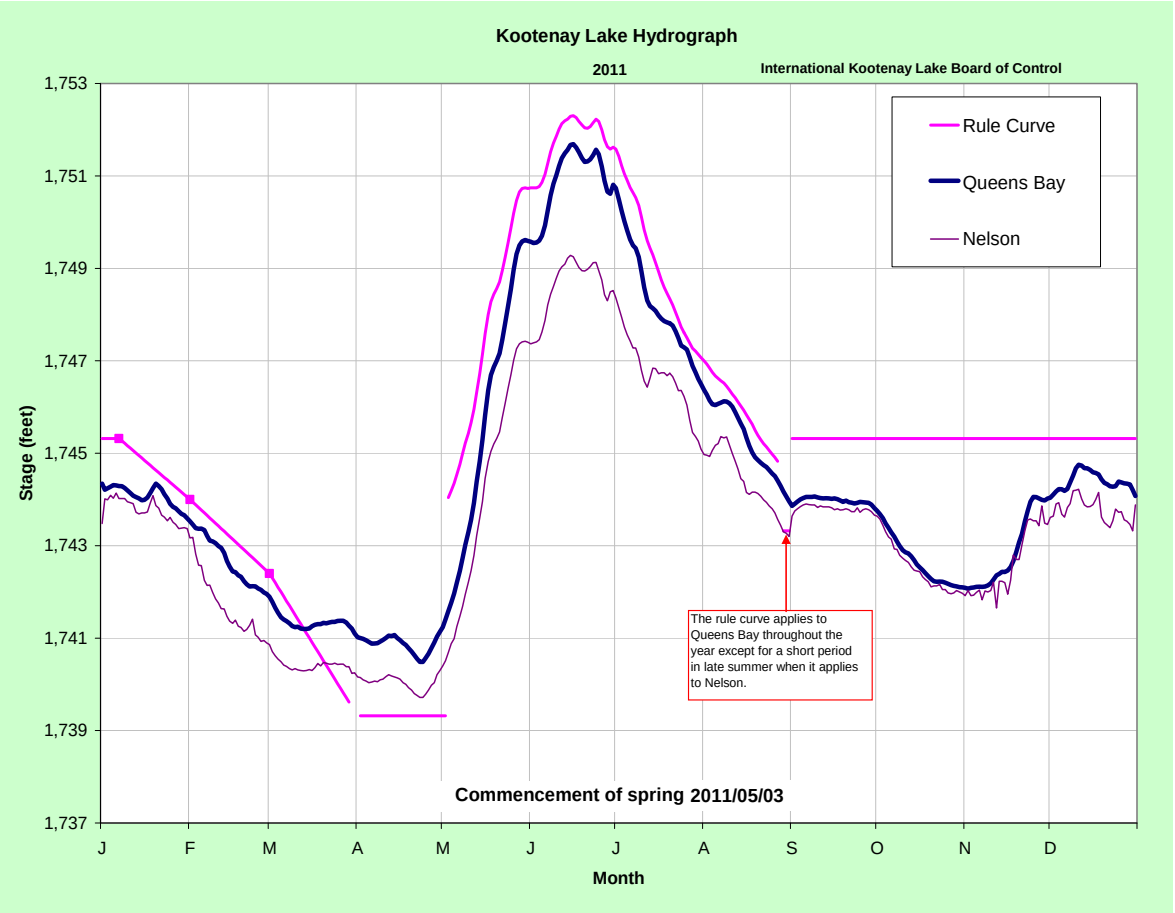
Lake Regulation

Figure 1 presents observed water-year 2011 water levels on Kootenay Lake and the elevations specified in the November 11, 1938 Order. The maximum instantaneous water level of 533.917 metres (1751.70 feet) for the lake at Queens Bay was reached on June 16h at 05:00 PST. The minimum instantaneous water level was observed on April 23rd at 20:00 PST, elevation 530.494 metres (1740.47 feet). Relative to the 81-year period of record (1931 to 2011 with two years missing), this year's maximum water level ranked 39th highest, and the minimum was the highest annual minimum for the lake over the

81 year period of record (there are two years of missing data - 1934 and 1947). Over the period of record, water levels in the lake have ranged from a high of 537.042 metres (1761.95 feet) in 1961 to a low of 529.563 metres (1737.41 feet) in 1944.

Kootenay Lake discharged 29.3 cubic kilometres (23.7 million acre-feet) of water this year through Corra Linn Dam and the Kootenay Canal Plant, with an average flow of 929 m^3/s (32,800 cfs). Relative to the 74 years of available discharge data, the annual volume of flow out of the lake was 63rd highest. 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 2,407 m^3/s (85,000 cfs) on June 24th; the minimum was 297 m^3/s (10,500 cfs) on October 18th.

Figure 1



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 ft to 1749.5 ft, subject to the stipulations of the IJC Order.

In March 2011, Board members received information on a Columbia River Treaty Operating Committee (CRTOC) decision that Treaty facilities would not be required to reduce releases in the event of Kootenay Lake exceeding the IJC rule curve.

FortisBC, the owner of Corra Linn Dam, reported to the Board that Kootenay Lake failed to reach the low water target of 1939.32 ft on April 1st, as per the IJC Order. Exceptionally high run-off inflows contributed to high lake levels even though the lake was effectively under free-fall conditions (where the lake discharge controlled by Grohman Narrows and not Corra Linn Dam).

The Board and the Applicant jointly determined the commencement of the spring rise to be 00:00 PST on May 3, 2011.

The company undertakes preventative maintenance of its water level recorders twice each year, most recently December 2010 and June 2011. FortisBC is currently working on firm access rights to the Queen's Bay water gauge.

According to the 1938 Order, FortisBC must pay farmers on the Kootenai Flats in Idaho up to $3000.00 for additional pumping costs related to dyke seepage from higher water levels during storage periods. A number of years ago, Fortis made a separate agreement with the State for an additional payment. A negotiated settlement to cover the period from 2004 to 2008 was reached in 2009 for a lump sum payment of $42,000. The 2009 pumping costs were settled in April 2010 at $19,978. Payments have also been made for 2011 at $24,681.76.

2011 High Water on Kootenay Lake
(Marko Aaltomaa, FortisBC)

FortisBC has initiated a Corra Linn spillgate refurbishment project which was pending recommendations from a consultant report as of September 2011.

FortisBC representative Marko Aaltomaa presented a brief slide show of photos taken around the lake during the June 2011 high water period. He noted that at 1751.7 feet, there is evidence of minor flooding and the lake level is very close to causing damage to lakeside structures and properties.

Board Meetings

The Board held its annual and public meetings in Nelson, British Columbia on September 22nd. The minutes have been delivered to the Commission. Guests raised a series of questions about lake levels, particularly why the Order requirement for the April 1st lake level was exceeded and the nature of peak water levels on the lake (double peak condition). The issue of mosquito control costs were raised in connection with high water levels as well as the issue of compensation for Canadian farming interests in the Creston area in view of compensation benefits provided to U.S. farmers across the border (Idaho). Additional questions were raised regarding perceptions of a possible Columbia–Kootenay River diversion, the capacity of the lake outlet at Grohman Narrows and potential dredging to improve capacity. Also raised was the need to consider storm waves on the lake when managing lake levels as well as questions related to water quality on the lake and upstream dyke erosion.

During the Board's annual (business) meeting, several presentations were provided, as follow:

- The Canadian secretariat, Daniel Millar, provided a presentation on factors that influenced the 2011 Kootenay Lake hydrograph as well as a presentation on methodology used to determine the relative influence of Grohman Narrows on Kootenay Lake levels in relation to the influence of Corra Linn and Kootenay Canal dam operations. Information and analysis was also provided to indicate that the channel at Grohman Narrows is not aggrading on an inter-annual basis (there is uncertainty regarding potential short-term intra-annual or seasonal sedimentation effects that may get remobilized during high water periods, but no evidence of aggradations from year to year).

- On behalf of the Columbia River Treaty Operating Committee (CRTOC), Peter Brooks (United States Army Corps of Engineers) gave a presentation to the Board evaluating a study of Libby Dam and Duncan Dam flood risk management operations on Kootenay Lake. This study was conducted to assess the potential for incomplete flood storage evacuation at Libby and Duncan Dams (a.k.a. trapped storage) that may result from attempts to meet the 1938 IJC Order for Kootenay Lake. In the past, Libby Dam would decrease its draft rate if Kootenay Lake elevation rose above the IJC rule curve. There is concern that "trapped storage" could adversely impact both system and local flood risk management.

  The CRTOC study is related to the question of the relationship between upstream reservoir operations under the Columbia River Treaty (Article XII (6)) and the IJC Kootenay Lake Order.

  Mr. Brooks referenced an earlier conclusion by the Commission (2008) which states that the 1938 IJC Kootenay Lake Order is directed solely to the Applicant (FortisBC), and operation of the

upstream dams is a separate matter for the two federal governments.[2]

The CRTOC analysis was structured to compare the proposed Libby and Duncan operations against the previous method of restricting Libby and Duncan Dam's flow to meet the IJC rule curve maximum elevations.

The outcomes of the CRTOC study pointed to a significant reduction in peak water elevations as a result of Libby and Duncan Dams being in place. The study also indicated a "barely perceptible" difference on Kootenay Lake's pre-freshet peaks if Libby and Duncan Dam operations were not restricted by the IJC Order and that Libby Dam and Duncan Dam operations often decreased post-freshet peaks at Kootenay Lake but never increased peaks.

After the presentation by Mr. Brooks, Amy Stevenson (BCHydro) advised that BCHydro would not operate Duncan Dam in a manner that would raise Kootenay Lake above 1749.5 feet, other than to hold the reservoir at a steady state keeping outflow equal to inflow.

Concern was expressed that under the proposed regime the Order's requirement to draw down Kootenay Lake to 1739.32 feet (pre-freshet) by April 1st would not be met more frequently. There were additional concerns that the studies did not show the frequency and duration of April low-water levels and the related significance of this issue to upstream farming areas faced with a flood control versus gravity drainage implications to their activities including operational costs.

[2] International Kootenay Lake Board of Control. 2008 Annual Report to the International Joint Commission, March 24, 2009.