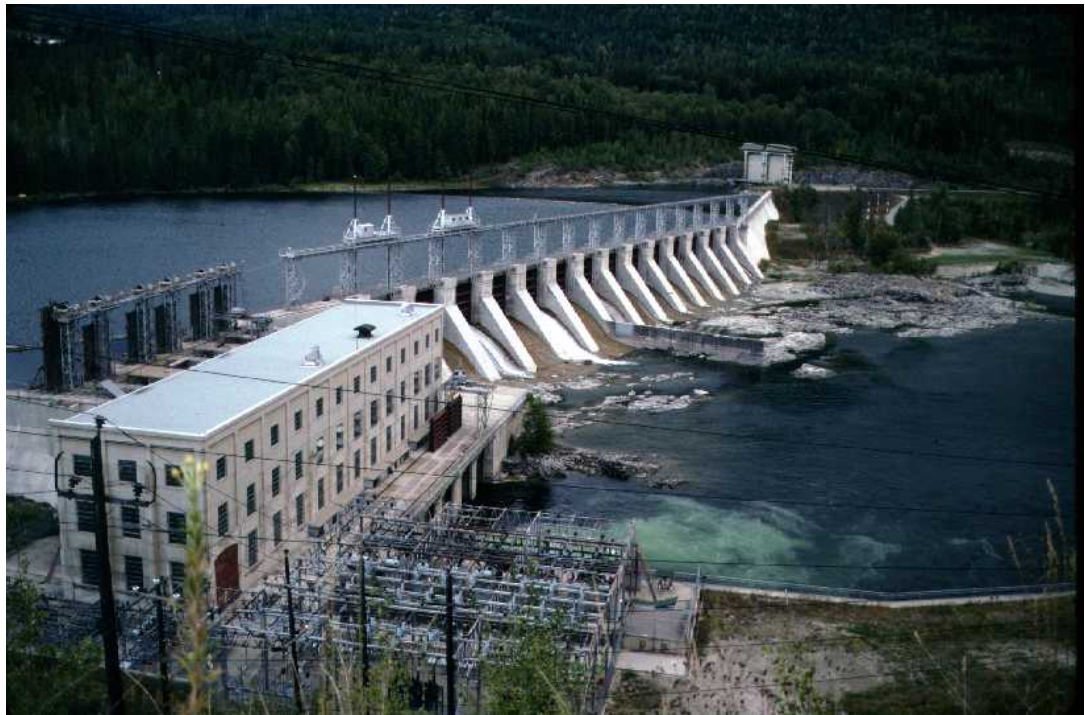




International Kootenay Lake Board of Control

2019 Annual Report to the International Joint Commission

This Annual Report covers the operations of Corra Linn Dam by FortisBC, the Applicant to the International Joint Commission (IJC) Order, and the associated effects on the water level of Kootenay Lake in 2019. 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. FortisBC controls discharge through and around Corra Linn Dam in accordance with requirements of the Order of the IJC dated November 11, 1938. FortisBC co-operates with BC Hydro, which 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.



Corra Linn Dam

Kootenay Lake 2019 Summary

Throughout 2019, 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 21:20:00 PDT on April 5, 2019, at elevation 529.90 metres¹ (1738.51 feet), and the lake level reached the low elevation target of 530.14 metres (1739.32 feet) on March 24, 2019, which is before the required date in the order (on or around April 1).

The Board determined the date of the commencement of the spring rise as April 24, 2019, when the lake level surpassed the rule curve despite Kootenay Lake outflow being controlled by Grohman Narrows for three consecutive days. This exceedance was determined by the Board to be in compliance with the IJC Order. The maximum instantaneous water level for the lake at Queens Bay was subsequently observed at 21:00:00 PDT on June 4, 2019, at elevation 532.28 metres (1746.31 feet). Kootenay Lake discharged 18.0 km³ (14.6 million acre-feet) of water in 2019, with an average flow of 572 m³/s (20,200 cfs).

Board Membership

In 2019, there was one change to the Board membership affecting the Canadian section. The term of previous Canadian section Chair Bruno Tassone ended on October 25, 2019, following the Ottawa IJC semi-annual appearance. He was replaced by Dave Hutchinson who had previously been nominated by Environment and Climate Change Canada and approved by IJC Commissioners. The Board members at the end of 2019 were as follows:

For the United States:

Colonel Mark Geraldi, 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. Dave Hutchinson, Chief, Hydrometric Operations BC and North Region
National Hydrological Services
Environment and Climate Change Canada, Vancouver, British Columbia

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

Board Secretariat:

Mr. Kevin Shaffer (United States Army Corps of Engineers)
Mr. Martin Suchy (Environment and Climate Change Canada)

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

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 effected 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 2019 water levels on Kootenay Lake and the elevations specified in the November 11, 1938, IJC Order. Water levels on Kootenay Lake showed a distinct freshet peak in 2019, corresponding to increased inflows from snow-melt in this mountainous watershed. Water levels on Kootenay Lake were drawn down in accordance with the IJC rule curve, beginning in early January. The lake draft stalled once in early March during the winter-spring drawdown period, primarily due to increased outflow from upstream storage reservoirs in the basin. Sustained rising inflow from snowmelt began in early-May and peaked in early-June. The Board determined the commencement of the Spring Rise to be 00:00 PDT on April 24, 2019, 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 snowmelt. The Applicant maintained the maximum outflow through Grohman Narrows for the duration of the high water period. The lake drafted below elevation 531.36 metres (1,743.32 feet) at Nelson on June 30, 2019, triggering the end of the high water period. Corra Linn Dam operations maintained fairly stable water levels on Kootenay Lake through the end of August, drafting slightly in early-September, then allowing levels to rise slowly through most of the fall storage period. Water levels were raised towards the storage maximum by late-December (December 28, 2019).

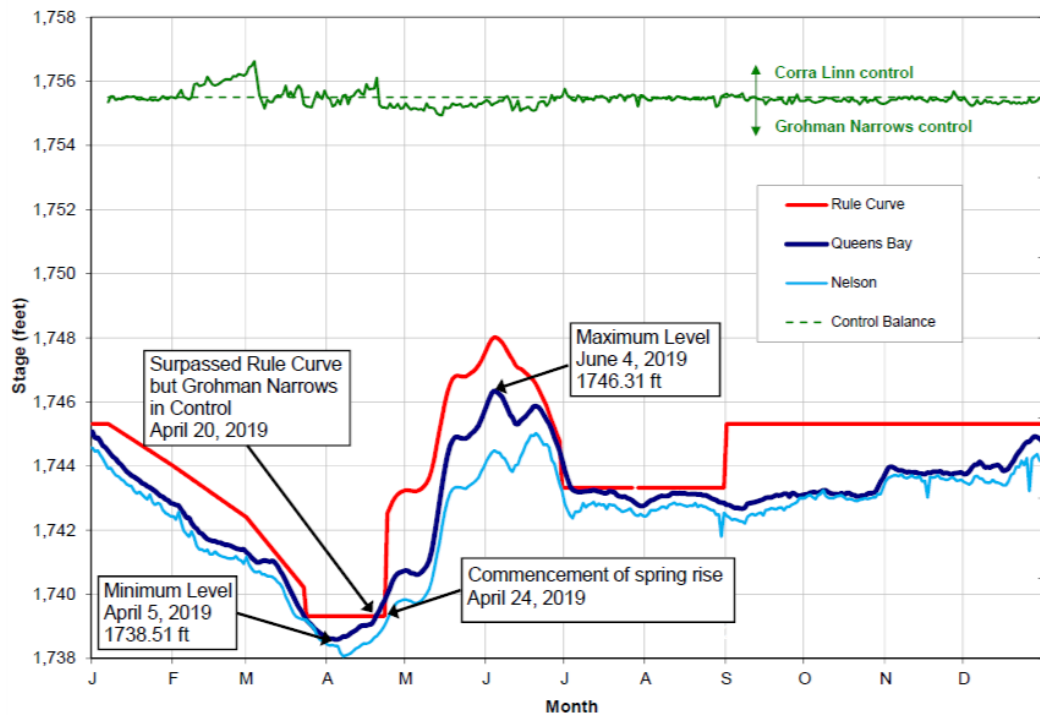


Figure 1 – Kootenay Lake Hydrograph

The maximum instantaneous water level of 532.28 metres (1746.31 feet) for the lake at Queens Bay was reached on June 4, 2019, at 21:00:00 PDT. The minimum instantaneous water level, elevation 529.90 metres² (1738.51 feet), was observed at 21:20:00 PDT on April 5, 2019. Relative to the 89-year period of record (1931 to 2019, with two years missing; 1934 and 1947), the 2019 maximum daily mean water level ranked 78th highest, and the minimum daily mean was the 18th 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 18.1 km³ (14.6 million acre-feet) of water this year through Corra Linn Dam and the Kootenay Canal Plant, with an average flow of 572 m³/s (20,200 cfs). Relative to the 82 years of available discharge data, the annual volume of flow out of the lake was 77th highest over this period of record. Total lake outflow has ranged from a high of 33.8 km³ (27.4 million acre-feet) in 1954 to a low of 13.8 km³ (11.2 million acre-feet) in 1944. The

² All elevations are referred to G.S.C. 1928 datum.

maximum daily mean outflow was 1,458 m³/s (51,500 cfs) on June 4, 2019, while the minimum daily mean outflow of 224 m³/s (7,900 cfs) was observed on October 3, 2019.

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.

Compliance Summary

As shown in Figure 1, the lake level elevation reached the low level target of 530.14 metres (1739.32 feet) on March 24, which is prior to the required date of “on or about” April 1 (section 2(5) of the IJC Order). Based on this information, the Board confirmed that operation of Corra Linn dam was in compliance with the IJC Order. The lake levels exceeded the IJC rule curve before the commencement of spring rise on April 24. The Board confirmed that the Applicant was maintaining maximum outflow through Grohman Narrows and was in compliance with the IJC Order. At all other times in 2019, the Applicant maintained the lake below the IJC rule curve.

Applicant’s Payment to Farmers in the Kootenai Valley (Idaho)

According to the 1938 Order, FortisBC must pay farmers on the Kootenai Flats in Idaho up to US\$3,000.00 for additional pumping costs related to dyke seepage from higher water levels during storage periods. FortisBC has a separate agreement with the Kootenai Valley Reclamation Association for an additional pumping cost payment based on actual receipts. The Applicant had not yet reported on 2019 payments at the time of publication.

Board Meetings

Board Tour

On the morning of September 19, Board members and guests visited the Fortis BC Operations Centre near Castlegar, BC, the Fortis BC Corra Linn Dam, and stopped near Grohman Narrows on the Kootenay River. At the Operations Centre the tour was led by Dale Ernst, System Operations Manager, and Wayne Gritchlin, Power System Supervisor. The facility opened in 2017 and is utilized by Fortis BC to operate and monitor power generating facilities on the Kootenay and Pend Oreille Rivers. Transmission operators also control and monitor distribution ties with customers from the centre. Corra Linn Dam gates can be operated remotely from the centre, as well as at the dam site. Generation at Corra Linn Dam is dispatched under an operating agreement by BC Hydro, while Fortis BC makes decisions on flows and choice of generating units to meet the generation requests. The Kootenay Lake Operating Order specifies the Kootenay Lake Order of Approval and both Fortis BC and BC Hydro monitor dam operations for compliance with the Order. Mr. Ernst indicated that the general operation during the spring freshet is to operate Corra Linn on freefall, to ensure maximum outflow from Kootenay Lake.

Board members visited Corra Linn Dam. The tour was led by Mr. Ernst and Darren McElhinney, Dam Upgrade Project Manager. Spillway gate replacement was underway at the dam site, with concrete work and construction of a gantry crane underway at the time of the tour (Figure 2). The project consists of replacing all 14 spillway gates, reinforcing the hoist superstructure, and

upgrading associated components. The work was driven by new seismic requirements and the age of the gates, which are original from 1931. At the time of the tour, workers were preparing to pull the initial 3 spillway gates for replacement. The number of gates being refurbished at once may be revised as the project progresses. The current schedule for the work is through the second quarter 2022.

Board members visited the Grohman Narrows area on the West Arm of Kootenay Lake. Kevin Shaffer, United States Kootenay Board Secretary, provided an overview of the expansion of Grohman Narrows that occurred under the Order of Approval and how the dam, the narrows, and the flow into the lake combine to influence the level of Kootenay Lake. Mr. Shaffer noted that under low lake level and/or high inflow conditions, the narrows becomes the limiting factor on how much water can be released from Kootenay Lake. Under these conditions, the expanded Grohman Narrows provides additional outflow capacity and allows for a lower peak lake level.



Figure 2 – Clockwise from Top Left: Original Corra Linn Dam spillway gate, Temporary Cofferdam to allow gate replacement, IKLBC and guests group photo. September 19, 2019.

Annual Board Meeting

The annual Board meeting was held on the afternoon of September 19, in Nelson, BC, at the Visitor Information Centre, Nelson & District Chamber of Commerce. In addition to the Board and Secretaries, 11 additional attendees were either guests (FortisBC, BC Hydro, Environment and Climate Change Canada, Global Affairs Canada, United States Department of State) or representatives of the International Joint Commission.

Bruno Tassone, Canadian section Co-Chair, provided an overview of the Kootenay and Columbia Basins, detailed the main provisions of the Order, described the limitations on lake level control due to the outflow constriction at Grohman Narrows, the dredging of Grohman Narrows, the reduction of peak lake levels on Kootenay Lake, and the backwater effects into the Kootenai River valley in Idaho, resulting in repayment of additional pumping costs to farmers in Idaho.

Martin Suchy, Canadian section Secretary reviewed the IJC rule curve and the hydrology year-in-review, which was in summary below-average with an early snow-melt runoff. Fortis BC met Order requirements, despite a rule curve exceedance due to high natural runoff in late-April. The Board determined that this was not a violation of the Orders since Corra Linn Dam was in freefall during this time and lake outflow was controlled by Grohman Narrows. The Board declared the commencement of spring rise shortly thereafter, on April 24, 2019, ending the rule curve exceedance. Mr. Suchy shared current and historical annual maximum and minimum lake levels, and indicated that the peak lake levels continue to be significantly lower than in the past, due to the expansion of Grohman Narrows and, more significantly, due to the construction of the two upstream Columbia River Treaty dams, Duncan and Libby Dams.

The United States Board secretary, Kevin Shaffer, reviewed Libby Dam operations, which was drafted over the winter to relatively high minimum Lake Kootenay levels as determined by the snowpack and forecasted spring/summer runoff. Water was released in late-May through June for augmentation for endangered Kootenay River white sturgeon populations. Due to the low late-season snow accumulation and dry spring, the maximum elevation of Kootenay Reservoir was relatively low, compared to historical records.

Shannon Price, FortisBC, provided a presentation by the Applicant, reviewing Kootenay Lake levels in 2019 to date, Corra Linn operations and an update of on-going upgrades at the dam. Kootenay Lake reached a minimum elevation of 529.90 metres (1,738.51 feet) on April 5, 2019, and a maximum level of 532.28 metres (1,746.31 feet) on June 4, 2019. The peak lake elevation was relatively low, compared to recent years.

Corra Linn Dam undergoes preventative maintenance twice annually, and was last completed in June 2019. Ms. Price noted the receipt of communications with concerns about low water levels in April, exposing shoal spawning kokanee eggs. Lake levels were held lower in the previous October and November to encourage kokanee shoal spawning to occur at lower elevations. Ms. Price reviewed progress of the Corra Linn Spillway Gate Replacement Project. Engineering design is substantially complete, the first cofferdam is installed, concealed components on three spillway gates have been inspected, and gates 9 through 14 are expected to be replaced by the second quarter 2022.

Gillian Kong, BCHydro, presented an overview of BC Hydro Columbia River system operations and the Columbia River treaty. Duncan Dam reservoir was drafted to near-empty and refilled to near-full in the summer. The reservoir drafts some in the late-summer, drafts minimally in the fall during kokanee spawning, and then completes the draft in the winter upon the completion of spawning.

Ms. Kong provided an update on the joint operations, where BC Hydro directs water management at Corra Linn Dam and the Kootenay Canal under an operating agreement with Fortis BC. Observations of redd dewatering in spring 2019 have raised the focus on the kokanee shoal spawning operation and BC Hydro is working with Fortis BC to review the operation. Ms. Kong also noted that in some recent years, Kootenay Lake has not reached the minimum rule curve level in advance of the spring freshet, likely due to rain and early runoff.

Ms. Kong noted that under the current Columbia River treaty, after 2024 Canada will continue to provide a minimum amount of flood protection ("Called-Upon Flood Control") for the United States. The Canadian receipt of 50 percent of the calculated United States flood benefit will continue as long as the current treaty is in effect. The two countries have been holding Columbia River Treaty re-negotiating sessions, approximately every 2 months, since spring 2018.

The Board reviewed correspondence from 2019, which comprised of one public enquiry regarding minimum lake levels in the summer and fall for Kootenay Lake. It was communicated that the rule curve was specifically for maximum allowable lake levels, with no minimums specified.

United States section Board Member Kyle Blasch described efforts by the Bonneville Power Administration and the Kootenai Tribe of Idaho to restore sturgeon and burbot populations in the Kootenai River, and how the United States Geological Survey is performing geomorphic surveys on both sides of the border to support restoration and biological monitoring by identifying areas which are suitable for beneficial fish habitat.

Mr. Blasch also conveyed information on a study by the United States Geological Survey, which reported increased Selenium and Nitrate levels in Lake Koocanusa, and that Selenium concentrations were found in biological tissue sampling in the Kootenai River downstream of Libby Dam. It was discussed that the Board does not have a water quality mandate from the International Joint Commission, but that the issue would be brought to the Commission for awareness.

The Kootenay Board has begun the process of gathering regional information with implications on transboundary water issues in the Kootenay Basin. The Board plans to coalesce the information into an information paper describing current and potential future transboundary water issues on Kootenay Lake, including topics within and outside of the Board's mandate, such as Grohman Narrows, the Columbia River treaty, climate change impacts on the current Order of Approval, and environmental and habitat concerns. The intent is for the Board to use the information to communicate a position to the Commission on whether any updates are recommended for the Kootenay Lake Order. The United States Army Corps of Engineers has contracted with a consultant to support the preparation of the information paper, which is expected to be completed in the fall of 2020. The Board also discussed the value of any such

recommendations prior to the outcome of current Columbia River Treaty negotiations is known.

The Board reviewed the previous Work Plan items. Completed items included posting of information on factors influencing river and lake levels in Porthill, Idaho, and Queens Bay, Kootenay Lake. The development of a basin map for use in public presentations and reporting was also completed. Ongoing efforts in addition to the information paper, noted above, included tracking the spillway gate replacement at Corra Linn Dam, incorporating regional climate change information into Board efforts, and creating a visualization tool to help describe Grohman Narrows and the alternating control on the Kootenay Lake level between Corra Linn Dam and the narrows.

Annual Public Meeting

The annual public meeting was held on the evening of September 19, in Nelson, BC, at the Visitor Information Centre, Nelson & District Chamber of Commerce. The meeting was attended by 19 audience members, including 10 local attendees. The remaining audience members were guests and representatives of the International Joint Commission.

Bruno Tassone, Canadian section Co-Chair, described the International Joint Commission framework, responsibilities, and composition. He outlined the history of the Kootenay Lake Orders of Approval, referenced the geographic area of the Kootenay Basin, and described the duties of the Kootenay Board. Mr. Tassone detailed the main provisions of the Orders, including the dredging of Grohman Narrows, the reduction of peak lake levels on Kootenay Lake, and the repayment of additional pumping costs to farmers in Idaho. Mr. Tassone also described the limitations on lake level control due to the outflow constriction at Grohman Narrows.

Martin Suchy, Canadian Section Secretary, reviewed the weather and hydrology from for water year 2019, which was a below-average with an early snow-melt runoff.

Mr. Suchy reviewed the IJC rule curve and 2019 Order compliance. Fortis BC met Order requirements, despite a rule curve exceedance due to high natural runoff in late-April. The Board determined that this was not a violation of the Orders since Corra Linn Dam was in freefall during this time. The Board declared the commencement of spring rise shortly thereafter, on April 24, 2019, ending the rule curve exceedance. Mr. Suchy indicated that the Applicant was in full compliance with the order in 2019.

Mr. Suchy reviewed the operations of Duncan Reservoir (Duncan Dam), Koochanusa Reservoir (Libby Dam), and Kootenay Lake (Corra Linn Dam and the Kootenay Canal) for the water year, to date. As is typical, Duncan Reservoir was drafted to near-empty and refilled to near full in the summer. Libby Dam was drafted over the winter to levels determined by the snowpack and forecasted spring/summer runoff.

The Board took questions from the audience, covering a wide range of public and Kootenay Lake stakeholder concerns and interests. Questions revolved primarily around the risk to infrastructure at higher lake levels and concerns with shoal dewatering low lake levels in March/April. All questions and the Board responses are summarized in the minutes of the public meeting, located on the Board's website.



Photograph of Kootenay River free-fall discharge through Corra Linn dam during the Spring high-water period (Photo: Fortis BC)