



International Kootenay Lake Board of Control

2020 Annual Report to the International Joint Commission



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

Kootenay Lake 2020 Summary

Throughout 2020, FortisBC operated Corra Linn Dam in a manner consistent with that prescribed by the 1938 Kootenay Lake Order.

During the 2020 spring draw down period, the lake level reached the low elevation target of 1739.32 feet (530.145 metres¹) on March 12th, which is before the required date in the Order (on or around April 1st). The minimum instantaneous water level was observed at 13:20:00 PDT on March 26th, at elevation 1738.74 feet (529.968 metres).

The International Kootenay Lake Board of Control determined the date of the commencement of the spring rise as April 25th, 2020, when the lake level surpassed the rule curve but Kootenay Lake outflow was controlled by Grohman Narrows for three consecutive days. This exceedance was determined by the Board to be in compliance with the IJC Order, since Grohman Narrows was restricting outflows and Corra Linn Dam was releasing as much water as possible. The maximum instantaneous water level of the lake at Queens Bay was subsequently observed at 16:50:00 PST on June 4th at elevation 1,750.09 feet (533.427 metres). The lake drafted below elevation 1,743.32 feet (531.364 metres) at Nelson on August 3rd, 2020, triggering the end of the high water period. Kootenay Lake discharged 19.9 million acre-feet (24.5 cubic kilometres) of water in 2020, with an average flow of 27,400 cubic feet per second (776 cubic metres per second). FortisBC made a payment of \$41,028 in June 2020 to Idaho farmers to compensate for increased pumping costs during high lake levels in 2019. A payment has yet to be made for 2020 pumping costs.

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

Introduction

This Annual Report covers the operations of Corra Linn Dam (Figure 3) by the Applicant to the IJC Order (FortisBC) and the associated effects on the water level of Kootenay Lake in 2020. 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 (Figure 3). 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 hydroelectric generating facility (the Kootenay Canal Project) which is hydraulically connected to the Corra Linn Dam forebay on the Kootenay River through a constructed canal.

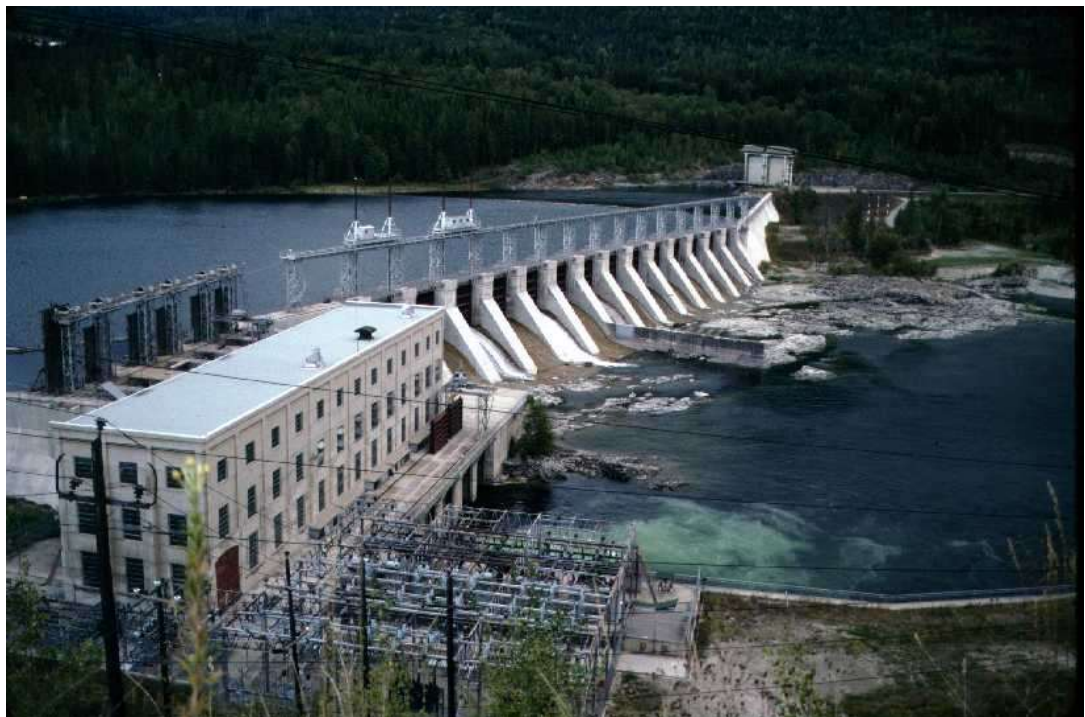


Figure 1: Corra Linn Dam

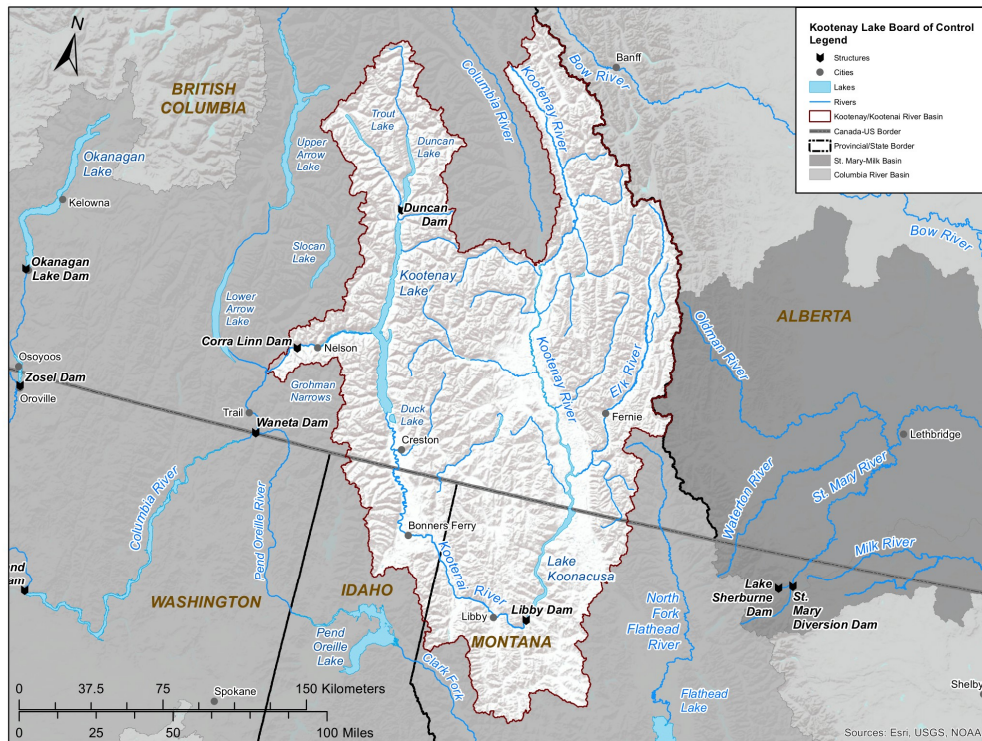


Figure 2: Kootenay System

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

Board Membership

In 2020, there was one change to the Board membership affecting the U.S. section. U.S. section Chair Colonel Mark Gerald completed his tenure as District Engineer, Seattle District, U.S. Army Corps of Engineers (USACE), and resigned from his role with the Board on June 30th, 2020. He was replaced by Colonel Alexander Bullock as District Engineer and approved by IJC Commissioners as U.S. section Chair of the Kootenay Board. The Board members at the end of 2020 were as follows:

For the United States:

Colonel Alexander Bullock, 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, Regional Chief - Hydrometric Operations BC and North
National Hydrological Services
Environment and Climate Change Canada, Vancouver, British Columbia

Mr. Ted White, Director, Water Management Branch
BC Ministry of Forests, Lands, Natural Resource Operations and Rural
Development, Victoria, British Columbia

Board Secretariat:

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

Lake Regulation

Figure 3 presents observed calendar-year 2020 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 2020, corresponding to increased inflows from snowmelt 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 levelled off in late-March during the winter-spring drawdown period but rose slightly through April as outflows were reduced at Corra Linn Dam. Sustained rising inflow from snowmelt began in late-April and peaked on May 31st, 2020. The Board determined the commencement of the Spring Rise, the point at which the IJC Rule Curve switches from maximum lake elevation criteria to the lowering formula as stipulated in the IJC Order, to be 00:00 PDT on April 25, 2020. Spring Rise was declared based on the Queens Bay level surpassing the 1,739.32 feet level with Grohman Narrows in control for three consecutive days. This was a result of 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 1,743.32 feet (531.364 metres) at Nelson on August 3rd, 2020, triggering the end of the high water period. The level at Nelson subsequently rose marginally above the Rule Curve (1,743.32 feet) again on August 4th and 5th; however, Grohman Narrows was in control of lake outflows and the Applicant remained in compliance with the Order. Between August 6th and 31st, Kootenay Lake levels at Nelson varied considerably but remained below the Rule Curve, with lake outflow controlled by both Grohman Narrows and Corra Linn Dam. Dam operations maintained fairly stable water levels on Kootenay Lake through late September, then allowed levels to rise through most of the fall storage period. Water levels were raised towards the storage maximum by late-November (November 22, 2020), at which point they were kept within 1 foot of the Rule Curve.

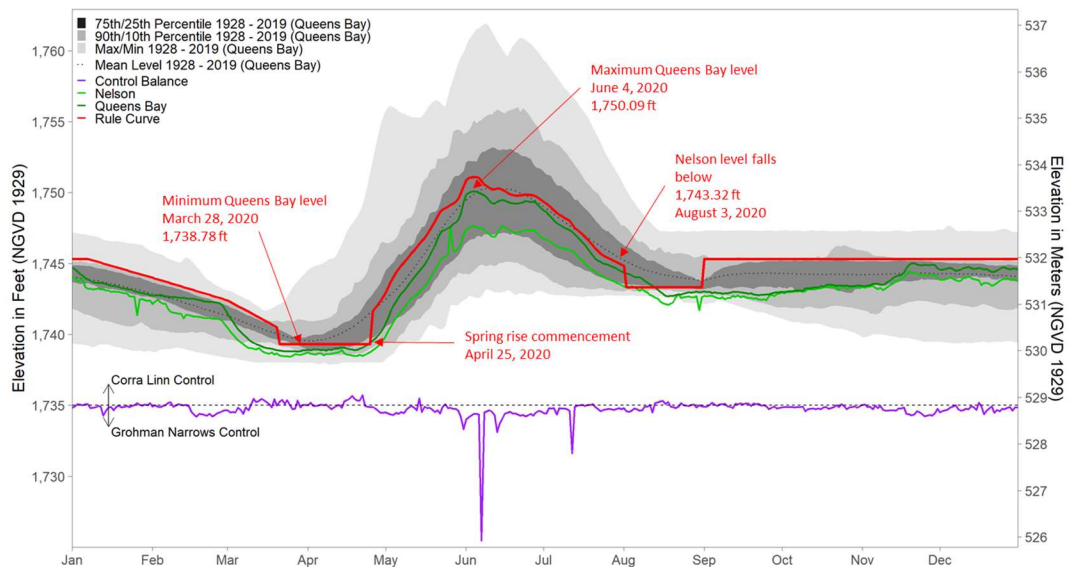


Figure 3 – Kootenay Lake at Queens Bay and Nelson 2020 hydrographs (FortisBC), historical maximum/minimum, 90th/10th and 75th/25th percentiles, daily mean, rule curve, key transition dates along with the Corra Linn Dam / Grohman Narrows control balance.

The maximum instantaneous water level of 1,750.08 feet (533.424 metres) for the lake at Queens Bay was reached on June 4th, 2020, between 16:50:00 and 16:55:00 PST. The minimum instantaneous water level, elevation 1,738.74 feet (529.968 metres²), was observed at 13:20:00 PDT on March 26th, 2020. Relative to the 90-year period of record (1931 to 2020, with two years missing; 1934 and 1947), this year's maximum daily mean water level ranked 51th highest, and the minimum daily mean was the 26th lowest annual minimum. Over the period of record, water levels in the lake have ranged from a high of 1,761.95 feet (537.04 metres) in 1961 to a low of 1,737.41 feet (529.56 metres) in 1944, as seen in Figure 3.

Kootenay Lake discharged 19.9 million acre-feet (24.5 km³) of water this year through Corra Linn Dam and the Kootenay Canal Plant, with an average flow of 27,400 cfs (776 m³/s). Relative to the 83 years of available discharge data, the annual volume of flow out of the lake was 44th highest over this period of record. Total lake outflow has ranged from a high of 27.4 million acre-feet (33.8 km³) in 1954 to a low of 11.2 million acre-feet (13.8 km³) in 1944. The maximum daily mean outflow was 73,500 cfs (2,081 m³/s) on June 4th, 2020, while the minimum daily mean outflow of 8,100 cfs (229 m³/s) was observed on October 17rd, 2020.

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.

Order Compliance

Rule Curve

As shown in Figure 3, the lake level elevation reached the low level target of 1,739.32 feet (530.145 metres) on March 12th, 2020, which is prior to the required date of April 1st (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. While the lake levels exceeded the IJC rule curve before the commencement of spring rise on April 25th, 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 2020, except for the two-day exceedance in August where Grohman Narrows was again in control of lake outflows, 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 \$3,000.00 (U.S) 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. Payments have not yet been issued to Idaho for pumping costs in 2020 but will likely be within the

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

range of the 2019 payment amount of \$41,028, which was made in June 2020.

Board Activities

Annual Board Meeting

The Annual Board Meeting was to be held in Bonners Ferry, Idaho this year; however, due to the COVID-19 pandemic, the Board held its annual meeting virtually using Webex on October 6, 2020 from 9:00 to 12:00 pm PDT. In addition to the Board and Secretaries, 16 additional attendees were either guests (FortisBC, BC Hydro, USACE, Global Affairs Canada, U.S. Dept. of State) or representatives of the International Joint Commission. Col. Alexander Bullock, U.S. section Co-Chair, provided an update on board membership, did introductions, and reviewed the agenda.

Kevin Shaffer, U.S. section Secretary reviewed 2020 hydrologic conditions, which included a review of basin weather conditions. The year included an above-average snowpack for the Kootenay/Kootenai basin in both Canada and the U.S., 120% and 110% of normal, respectively, with rapid snow buildup events particularly in December (2019) and January. However, snowpacks melted out at all snow pillow stations before their respective 30 year averages. Mr. Shaffer shared current and historical annual maximum and minimum lake levels, and discussed potentially favorable flooding conditions due to the above average snowpack, which did not materialize in 2020. The Board declared the commencement of spring rise on April 25, 2020, triggering the Rule Curve increase. In summary, it was generally a benign year, with the Applicant (FortisBC) meeting Order compliance.

The U.S. Board secretary, Kevin Shaffer, reviewed Libby Dam operations, which was drafted over the winter to a relatively high minimum Lake Koocanusa level 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 Koocanusa Reservoir was close to the mean historical records.

Gillian Kong (BC Hydro) 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.

Ms. Kong presented an overview of BC Hydro Columbia River system operations, along with 2020 Canadian portion Columbia runoff forecast which was at 109% of normal. Ms. Kong presented on Duncan, Kootenay and Mica inflows and operations. The 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.

Observations of redd dewatering in spring 2019 have raised the focus on the kokanee shoal spawning operation, and Ms. Kong noted that BC Hydro is working with Fortis BC to review the operation. Kootenay Lake will be operated to target stable levels (~1,742 feet) from mid-September to mid-October to protect shoal spawning Kokanee in the West Arm of Kootenay Lake, especially

in suspected years of peak spawning, with a general agreement that it will take place every 3 years.

Shannon Price (FortisBC) provided a presentation by the Applicant, reviewing Kootenay Lake levels in 2020 to date, Corra Linn Dam operations and an update of on-going upgrades at the dam. Ms. Price presented on 2020 maximum and minimum Kootenay Lake elevations, and indicated the peak lake elevation was relatively low, compared to recent years, and FortisBC had no concerns regarding fish spawning this year. It was also noted that flood impacts occur on Kootenay Lake beginning at 1,752 ft.

Corra Linn Dam undergoes preventative maintenance twice annually, and was last completed in June 2020, and will be scheduled again in winter 2020. Ms. Price reviewed the progress of the Corra Linn Spillway Gate Replacement Project. Four gates have yet to be started, three gates are complete, seven are in progress between the concealed component and gate replacement.

Erika Klyszejko, Engineering Advisor and Watershed Committee co-chair of the Rainy-Lake of the Woods Watershed Board, gave a guest presentation on the history and operation of that board. Ms. Klyszejko discussed the features of the system, the natural features and what controls lake levels, including the chain of Namakan Lakes, and the balance of hydropower concerns for both sides of the border. It was discussed how an Order review was conducted, the development of educational tools and products, and engagement activities.

Gregory Hoffman, Fisheries Biologist with USACE, gave a presentation on ecosystem flows in the regulated Kootenai River, particularly on the white sturgeon recovery in the river. Mr. Hoffman discussed the Flow Plan Implementation Protocol team and flow recommendations for sturgeon operations at Libby Dam in 2020, with emphasis on flow pulse and water temperatures. Mr. Hoffman identified the limitations of the 1938 Kootenay Lake Order, which pre-dates ecosystem science and a desire to revisit the Order to address spring lake levels to encourage sturgeon rehabilitation.

Next, the Board discussed official Board business by reviewing public correspondence. There were many inquiries to Board secretaries in 2020. Each correspondence was reviewed and the responses were discussed. Topics ranged from posting commercial natural disaster recovery guides on the Board website, raising spring lake levels to address Kokanee salmon shore spawning, status of dredging in Grohman Narrows, geodetic survey datums clarification for the Queens Bay gauge, and shoreline development concerns.

The Board reviewed the previous 2019-2020 Work Plan items, and updated the routine and priority activities. Completed priority activities were removed while ongoing activities were edited as required. The new Work Plan priority activities are now focused on the following: 1) tracking FortisBC spillway renewal project, 2) continue monitoring regional climate change impacts, 3) continue development of a visualization tool, and 4) continue the work on the Order of Approval information paper.

The U.S. Board secretary, Kevin Shaffer provided an update on the Order review information paper. 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. In 2019, USACE contracted with a consultant to support the preparation of the information paper, the main objective of which is to document information on key topics such as: the Order of Approval, flooding concerns, climate change concerns, and fisheries

interests. The draft document was reviewed by the Board, the Applicant, BC Hydro, and is in internal contract review at the time of this report.

The Canadian Board secretary, Martin Suchy, provided an update on the development of the Kootenay Lake Visualization Tool. The Board submitted an IJC International Watersheds Initiative proposal in spring 2020 for the development of this tool, which was later approved. The purpose of the tool is schematically describe the relationship of hydraulic control of Corra Linn Dam and Grohman Narrows upon the Kootenay Lake level. Board Secretaries have been in contact with potential contractors to discuss relevant experiences.

Annual Public Meeting

The annual public meeting of the Board was held October 6, 2020. Due to the COVID-19 pandemic the meeting was held virtually using the GoToWebinar platform. The meeting was attended by 19 public attendees, the highest participation in recent years, likely due to the virtual format. In addition, four people attended representing the Applicant, BC Hydro, and Global Affairs Canada, while the remaining four audience members were representatives of the International Joint Commission.

Commissioner Jane Corwin (U.S. section) started the meeting with some introductory comments. Col. Alexander Bullock, U.S. section Co-Chair, reviewed the agenda then described the International Joint Commission framework, responsibilities, and composition. He outlined the history of the Kootenay Lake Order of Approval, referenced the geographic area of the Kootenay Basin, described the duties of the Kootenay Board, and described the limitations on lake level control due to the outflow constriction at Grohman Narrows. Col. Bullock also detailed the Order information paper, which includes the collection and coalescence of relevant Kootenay Lake water management information, identify knowledge gaps to determine if additional studies are necessary, and ultimately assist the Board in making a recommendation to the IJC on whether an Order review is warranted.

Kevin Shaffer, U.S. section Secretary, reviewed the weather and hydrology from for water year 2020, which was an average water supply year with an early snow-melt runoff. Mr. Shaffer, reviewed the IJC rule curve and the 2019-2020 hydrology year-in-review, indicated that the Applicant was in full compliance with the order in 2020, and noted that the Board declared the commencement of spring rise on April 25, 2020.

Mr. Shaffer reviewed the operations of Duncan Reservoir (Duncan Dam), Koocanusa 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 climate change, impacts from logging on lake hydrology, the Columbia River Treaty, whether a Provincial lake management plan exists, and concerns with shoal dewatering during low lake levels in March/April. All questions and the Board responses are summarized in the minutes of the public meeting, which will be posted to the Board's website once approved.

Board Tour

Due to the COVID-19 pandemic, the annual Board and public meetings were held virtually in 2020 and no field trip took place.

Board Appearances at IJC Semi-Annual Meetings

The spring appearance in Washington, D.C., which was to be held in April, was cancelled due to travel restrictions imposed by the COVID-19 pandemic. The Board presented a progress report virtually during the fall semi-annual IJC meeting on October 22, 2020. The fall presentation was delivered by the Canadian Co-chair. The U.S. Co-chair Col. Alexander Bullock was represented by Ginny Dierich, Deputy District Engineer, Seattle District, USACE. Board Members Ted White and Kyle Blasch also attended, supported by both Board Secretaries.

Tracking Progress: FortisBC Corra Linn Dam spillway gate replacement

The Board has been tracking the progress of the FortisBC Corra Linn Dam spillway gate replacement project. The scope was to replace all 14 spillway gates, reinforce and paint the hoist superstructure and upgrade various components, with a projected cost of \$66.8 million (Cdn). The construction schedule was to be from June 2018 with completion in September 2021; however, the timeline has been extended to late 2022 as a result of delays associated with replacing the concealed components supporting spillway at certain gates. To date seven gates are completed, three gates are in progress, and the remaining four gates are scheduled for be completed by early 2022. The project enables the dam to pass the Probable Maximum Flood, even when gates are under restoration, and has not impacted FortisBC's ability to comply with the Order of Approval.

Kootenay Lake Visualization Tool

The Board submitted an International Watershed Initiative (IWI) proposal and the IJC approved it in spring 2020 for the funding a user-friendly interactive web-based visualization tool to help communicate to the public and stakeholders the drivers and seasonality of Kootenay Lake water levels, the constraints of the IJC 1938 Order of Approval Rule Curve, along with other overlapping demands.

The tool will graphically depict the relationship between Kootenay Lake inflow, Corra Linn Dam forebay, discharge, and Grohman Narrows control. It will allow users to change the lake level, through adjustments to lake outflows (Corra Linn Dam gates) and inflows, both regulated and unregulated (under wet, normal, or dry conditions). The tool will then run the scenario, showing a longitudinal profile of key control points on Kootenay Lake and its outlet, and provide warnings to the users when user-specified lake levels are in violation of the IJC Order of Approval or otherwise result in high flood risk, or when the user-specified lake outflows exceed Grohman Narrows capability. Outputs will highlight what objectives are met or missed (Order Compliance, Flood Control, Power Generation or Ecosystem Impacts).

Because the underlying proprietary routing model for Grohman Narrows is being provided by BC Hydro as an in-kind contribution, BC Hydro has

requested that the tool be developed using their specific experienced contractor. The Board currently working with the contractor develop the Terms of Reference for contract.

Order Information White Paper

In fall 2018, the Commissioners requested a recommendation from the Board for whether the Order of Approval warranted revisions. The Commissioners cited the age of the Order, climate change, and emergent fisheries and flood risk management concerns raised in public meetings. The Board planned a process to respond to the request: 1) gather and coalesce historical information relevant to current or future water management issues on Kootenay Lake, 2) identify knowledge gaps, 3) scope potential studies and complete stakeholder engagement to fill knowledge gaps, 4) complete identified studies with funding utilized from agency, stakeholder, and IJC sources, and 5) respond to Commissioners with a recommendation for Order revision. The Board secured a USACE contractor to collect and coalesce relevant Kootenay Lake water management information. The resulting information paper was reviewed in 2020 by the Board and their supporting agencies, the Applicant, the IJC, and BC Hydro. The paper is in USACE contract document review, as of publication date for this report.