

Columbia River Operations Summary

Spring 2018



Seven Mile Reservoir. Photo by Megan Chadwick.

This publication provides an overview of BC Hydro's operations on the Columbia River. At 2,000 kilometres long, the Columbia River is the fourth largest river in North America. The headwaters of the Columbia River are in Canal Flats, British Columbia (B.C.). The river then flows northwest through the Rocky Mountain trench to head south through B.C. and Washington, emptying into the Pacific Ocean at Astoria, Oregon. Other major tributaries of the Columbia River in Canada include the Kootenay and Pend D'Oreille rivers.

Only 15% of the Columbia River basin lies in Canada. The Canadian portion of the basin is mountainous and receives a lot of snow producing, on average, 30 to 35% of the runoff for Canada and the United States (U.S.) combined. The river's large annual discharge and relatively steep gradient gives it tremendous potential for the generation of electricity. The hydroelectric dams on the Columbia's main stem and many more on its tributaries produce more hydroelectric power than on any other North American river.

BC Hydro's facilities in the Columbia basin include 11 hydroelectric dams, two water storage dams, and a system of reservoirs. Four of the larger reservoirs within Canada are operated according to the Columbia River Treaty and other agreements signed between Canada and the U.S.



BC Hydro's Operations Agreements

COLUMBIA RIVER TREATY

The Columbia River Treaty between Canada and the U.S. was ratified in 1964. The Treaty resulted in the construction of three dams in B.C. (the Duncan, Hugh L. Keenleyside and Mica dams) for flood control and to increase hydroelectric generating potential in both countries. The Treaty also provided for the construction of Libby Dam in the U.S. and the resulting Kootanusa Reservoir, which crosses the Canada–U.S. border.

Water stored and then released by the Canadian reservoirs provides the U.S. with the potential to generate additional electricity, as well as to increase flood protection. Under the terms of the Treaty, Canada receives a one-half share of the extra power generation potential in the U.S. This is called the Canadian Entitlement to Downstream Benefits and is owned by the Province of British Columbia.

The Canadian Entitlement varies from year to year, but is currently about 4,161 gigawatt hours (GWh) per year of energy and 1,304 megawatts (MW) of capacity for the period between August 1, 2017 and July 31, 2018. Since September 16, 2014 both Canada and the U.S. have had the option to terminate the Treaty, provided that either country provides 10 years' notice of its intent to terminate.

After extensive consultation with basin residents, the Province decided in March 2014 to continue with the Columbia River Treaty and seek improvements within the existing Treaty framework. More information on the Treaty and its review process can be found at:

<http://engage.gov.bc.ca/columbiarivertreaty/>



Mountain Goat, Valhalla Range. Photo by Megan Chadwick.

Other Agreements

The Treaty Entities (BC Hydro, Bonneville Power Administration [BPA], and the U.S. Army Corps of Engineers) periodically negotiate and sign supplemental operating agreements when there is mutual benefit to modify the water releases specified by the Columbia River Treaty.

In September 2013, the Treaty Entities signed a short-term agreement to address some of Canada's concerns about the timing of water releases from the Libby Dam, known as the VarQ operating regime. This agreement was extended to be in effect until August 2019 and is supplemental to the Libby Coordination Agreement that was signed in 2000. Under the new agreement, the U.S. has committed to continued coordination with Canada to consider alternative reservoir operations to reduce flood risk in both countries, similar to the extensive collaboration that occurred during the 2012 and 2017 high water events. In addition, BC Hydro is compensated for energy losses at its Kootenay Canal operations that result from the timing of water releases from the Libby Dam. The Entities have also agreed to continue working together to reach a long-term agreement.

In late 2017, the joint Canada–U.S. Treaty Operating Committee responsible for the implementation of the Flood Control Operating Plan signed the 2018 Non-Power Uses Agreement. This annual operating agreement modifies Arrow Lakes Reservoir releases between January and July 2018 to protect Canadian whitefish and rainbow trout eggs, as well as to provide flow benefits for endangered U.S. salmon.

NON-TREATY STORAGE AGREEMENT (NTSA)

The Kinbasket Reservoir, created by Mica Dam, is licensed by the Province for more water storage than is required to meet the terms of the Columbia River Treaty. This additional storage is called Non-Treaty Storage and the water can be released across the Canada–U.S. border only under agreement between BC Hydro and its U.S. partners. The current Non-Treaty Storage Agreement (NTSA) was signed by BC Hydro and BPA in 2012 and remains in effect until 2024.

The new NTSA gives BC Hydro more control over reservoir levels, provides more energy benefits to B.C. and gives BC Hydro more operating flexibility to balance competing non-power interests on the Columbia system. These interests include recreational activities, wildlife habitat, and fisheries. Since the agreement was signed, BC Hydro and BPA have made good use of NTSA flexibility to reduce the impacts of high and low water levels downstream of Arrow Lakes Reservoir and to improve power and non-power benefits for both countries.

BC Hydro Columbia Operations

Much of the region's summer and winter generating potential depends on precipitation and snowpack levels. Due to above normal precipitation in the fall and winter of 2017, the runoff for the Columbia basin (Canada and U.S. combined) between April and September 2018 is currently forecast to be 113% of normal. For the Canadian portion of the Columbia basin, the forecast runoff is 116% of normal. Many types of future variables affect the ability to predict with certainty a long term forecast including: weather, runoff volumes and patterns, system electricity demands, and Treaty discharge requirements.

KINBASKET RESERVOIR

Kinbasket Reservoir regulates discharges for both the Mica and Revelstoke Generating Stations, as well as for generating stations further downstream.

Kinbasket Reservoir did not fully refill to its maximum storage level ("full pool") in 2017 due to dry summer conditions. It reached a maximum level of 752.2 metres (2,467.8 feet) on August 19, 2017, which is 2.19 metres (7.2 feet) below normal full pool. The water level was lowered ("drafted") as typically observed across the fall, to reach near average water levels. Significantly more draft occurred between December 2017 and February 2018 due to high winter electricity demand. The Kinbasket Reservoir is currently forecast to reach a minimum level of approximately 719.9 metres (2,362 feet) in April 2018. By comparison in 2017, the minimum level reached was of 728.7 metres (2,390.8 feet) on May 4, 2017.

The current snowpack in the upper Columbia region is above normal and well above 2017 levels. Based on March 1st snowpack levels, the inflows of water into Kinbasket Reservoir for the period from March to September 2018 are forecast to be 107% of average. The reservoir is expected to begin refilling by mid to late April and to reach near full pool in August 2018.

Kinbasket Reservoir can be operated at up to two feet above its normal maximum water level, if approved by the Comptroller of Water Rights. This additional storage would typically be used to avoid increased spill risk and to improve flood routing benefits in high inflow years.

Under the Water Sustainability Act and the Utilities Commission Act, the Comptroller of Water Rights is responsible for the regulation of BC Hydro's water licenses. The licensed operating range for Kinbasket Reservoir is between 754.4 metres (2,475 feet) and 706.96 metres (2,319.42 feet). Kinbasket Reservoir provides 7 million acre feet (MAF) of Treaty Storage and 5 MAF of Non-Treaty Storage, for a total storage of 12 MAF.



Kootenay Winter. Photo by Megan Chadwick.

The licensed range for Kinbasket Reservoir is between 754.4 metres (2,475 feet) and 706.96 metres (2,319.42 feet). The reservoir can be operated up to two feet above its normal maximum level, if approved by the Comptroller of Water Rights. Kinbasket Reservoir provides 7 million acre feet (MAF) of Treaty Storage and 5 MAF of Non-Treaty Storage.

REVELSTOKE RESERVOIR

Revelstoke Reservoir was created by the Revelstoke Dam. Revelstoke Reservoir levels may fluctuate in response to weather patterns, inflow levels and generation requirements. During the spring freshet and winter peak electricity load periods, it is common to have daily fluctuations of the reservoir within 1.5 metres (5 feet) of full pool. The reservoir may be periodically drafted below its normal minimum level of 571.5 metres (1,875 feet) to meet increasing system needs for short term generating capacity or may fill to near full pool during periods of high reservoir inflows.

The licensed operating range for Revelstoke Reservoir is between 573 metres (1,880 feet) and 554.7 metres (1,820 feet). At most times, the reservoir is maintained at or above 571.5 metres (1,875 feet). During the 2017/2018 operating year, Revelstoke Reservoir remained within its normal operating range.

ARROW LAKES RESERVOIR

Arrow Lakes Reservoir was created by the Hugh L. Keenleyside Dam. For operations to be consistent with the principles of the Treaty, under wet conditions it is necessary to store excess water so that surplus energy is not generated by downstream U.S. Columbia River projects.

In 2017, the Arrow Lakes Reservoir reached near full at 439.58 metres (1,442.2 feet), or 0.55 metres (1.8 feet) below full pool on July 27, 2017. The summer drought in 2017 was followed by a wet fall that brought increased inflows into the basin. Basin inflows rapidly declined in the dry summer months resulting in a storage draft from near full levels in July, to near average levels by September 30, 2017.

Arrow Reservoir discharges were significantly reduced in October and November 2017. Arrow Reservoir refilled from near average levels in October 2017, to well above average in January 2018 due to above typical discharges through Upper Columbia generating stations to meet high winter electricity demands. Since then, the reservoir has been drafting to meet Treaty flood control requirements. A minimum level was reached in March 2018 of 429.2 metres (1,408 feet). By comparison, in 2017 the reservoir reached its minimum level of 427.15 metres (1,401.4 feet) on February 4, 2017.

The snowpack in the Arrow basin is currently well above average and 2017 levels. The inflows into Arrow Lakes Reservoir for the period from February to September 2018 are forecast to be 106% of average and 113% of average for the entire Columbia basin. Based on the current runoff forecast, the reservoir is expected to refill to its maximum permissible level for Treaty flood risk management of 431.0 metres (1,414 feet) by the end of April 2018, 434.3 metres (1,425 feet) by end of May and 439.5 metres (1,442 feet) by the end of June.



Canoe Trip. Photo by Megan Chadwick.

The normal licensed operating range for Arrow Lakes Reservoir is between 440.1 metres (1,444 feet) and 419.9 metres (1,377.9 feet). The reservoir can be operated up to two feet above its normal maximum level (to 440.7 metres or 1,446 feet), if approved by the Comptroller of Water Rights. Arrow Lakes Reservoir provides 7.1 MAF of Treaty Storage.



Arrow Lakes at Nakusp. Photo by Jen Walker-Larsen.

DUNCAN RESERVOIR

Duncan Dam's operations help meet Treaty flood control requirements, minimize flood risk on Kootenay Lake and provide minimum fish flows year round, as required by the Water Use Plan. In 2017, the Duncan Reservoir reached a maximum level on August 13, 2017 of 576.5 metres (1,891.4 feet) and 0.18 metres (0.6 feet) below full pool. The reservoir then drafted to about 575.46 metres (1,888 feet) on August 31, 2017 and it held at this level until Labour Day.

From September through late December 2017, Duncan Reservoir was operated to provide the flows necessary for kokanee and whitefish spawning downstream of the dam. Discharges were later increased to facilitate drafting the reservoir for Treaty flood control requirements during the winter period.

For flood risk management downstream of the Duncan Dam at Meadow Creek and on Kootenay Lake, Duncan Reservoir is normally drafted to its licenced minimum level of 546.9 metres (1,794.2 feet) each year by April, or prior to the start of the freshet. In 2017, Duncan Reservoir reached a minimum level of 547.3 metres (1,795.6 feet) on April 11, 2017.

Snowpack in the Kootenay region is currently well above average and above 2017 levels. The inflows into Duncan Reservoir for the period from February to September 2018 are forecast to be 109% of average. Based on the current inflow forecast, Duncan Reservoir is expected to fill to near full pool by August 2018.

The normal operating range for Duncan Reservoir is between 576.7 metres (1,892 feet) and 546.9 metres (1,794.2 feet). The reservoir can be operated up to 1.2 feet above its normal maximum level of 577 metres (1,893.2 feet), if approved by the Comptroller of Water Rights. Duncan Reservoir provides 1.4 MAF of Treaty Storage.



A walk down the Seven Mile Dam causeway. Photo by Megan Chadwick.

COLUMBIA RIVER FLOWS

Columbia River flows downstream of the Kootenay River confluence at Castlegar are the result of flow regulation at Hugh L. Keenleyside and other dams on the main stem Columbia, as well as dams on the Kootenay River system. Actual discharges depend on many factors including upstream runoff, storage operations and Treaty discharge requirements.

In 2017, there were no flood concerns on the Columbia River downstream of Hugh L. Keenleyside Dam. The Columbia River discharge at Birchbank is measured at a flow measuring station between Castlegar and Trail. Flow peaked at about 4,247 cubic metres per second (m³/s) (150,000 cubic feet per second [cfs]) on June 21, 2017. This flow was well below the peak regulated flow experienced in 2012 of 6,090 m³/s (215,000 cfs), and prior to dam construction of 10,590 m³/s (374,000 cfs) in 1961.

The 2018 inflows into the reservoirs are forecast to be higher than the 2017 actual runoff, with peak flows at Birchbank to be similar or higher than last year. Actual flows will depend on the timing and volume (“shape”) of runoff. BC Hydro’s water licence has no minimum discharge requirements for the Columbia River downstream of Hugh L. Keenleyside Dam, but under the Treaty there is an obligation to reduce to a minimum weekly average flow of 5,000 cfs under certain water conditions.

KOOCANUSA (LIBBY) RESERVOIR

The Kooconusa Reservoir on the Kootenay River is controlled by Libby Dam in Libby, Montana and operated by the U.S. Army Corps of Engineers. The reservoir backs into Canada and provides approximately 5 MAF of storage.

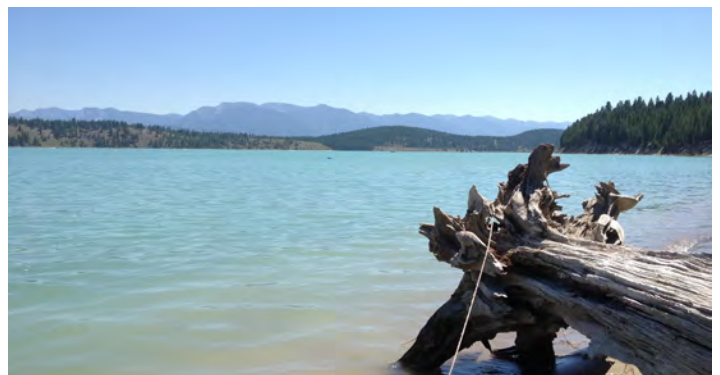
On August 1, 2017 Kooconusa Reservoir reached a maximum level of 746.35 metres (2,448.66 feet), which is 3.15 metres (10.3 feet) below its full pool of 749.5 metres (2,459 feet). Kooconusa Reservoir continues to be operated under VarQ procedures for U.S. fisheries’ interests and flood control. The latest Libby Operating Plan provides for release of:

- flows as needed during March and April to meet the April 30 flood control target;
- at least the minimum flows in May and June necessary to meet the flow rates and sturgeon volume objectives in the U.S. Fish & Wildlife Service Biological Opinion (BiOp) for sturgeon spawning and recruitment;
- minimum bull trout flows as outlined in the BiOp; and
- augmented downstream flows for salmon after the sturgeon flow operation is completed.

Kooconusa Reservoir is drafted across winter for Treaty flood risk management. The current reservoir forecast is for 122% of the normal average long term runoff. Based on this forecast, the reservoir will be drafted to reach a minimum level of about 718.7 metres (2,358 feet) in April 2018. Actual draft amounts will depend on the flood risk requirements that are subject to change when the April to August 2018 forecast inflows into the Kooconusa Reservoir are known and updated.

The normal operating range for Kooconusa Reservoir is between 749.5 metres (2,459 feet) and 697.1 metres (2,287 feet). During periods of high downstream flood risk, the Treaty Entities may coordinate additional storage in Kooconusa Reservoir.

Information regarding the operation of Libby Dam and Kooconusa Reservoir water levels is available from the U.S. Army Corps of Engineers online at <http://www.nws.usace.army.mil/> or by calling 406 293 3421.



Kooconusa Reservoir. Photo by Sally MacDonald

KOOTENAY LAKE

For information regarding Kootenay Lake, please contact FortisBC.

Website: www.fortisBC.com

Phone: 1 866 436 7847

Want to stay informed of BC Hydro operations?

REGIONAL OPERATIONS UPDATE MEETINGS

BC Hydro will be hosting its annual Operations Update meetings in May and June 2018.

May 1: Creston	June 6: Nakusp
May 2: Cranbrook	June 7: Revelstoke
May 2: Wardner	June 8: Golden
June 4: Meadow Creek	June 12: Valemont
June 5: Castlegar	

These meetings are held to:

- Listen to and learn from local residents, stakeholders, First Nations and community representatives who have an interest in the operation of the Columbia River Treaty facilities and BC Hydro facilities in the East Kootenay and Thompson/Okanagan/Columbia regions.
- Provide information on the operations of Columbia River Treaty facilities in Canada and other facilities that are operated in a coordinated manner on the Columbia system.
- Provide an update on BC Hydro activities.

OPERATIONS UPDATE CONFERENCE CALLS

B.C. Hydro periodically hosts conference calls to provide updates on our Columbia and Kootenay system operations. If you would like to receive email notifications regarding these meetings and conference calls, please contact Dayle Hopp at dayle.hopp@bchydro.com.

BC HYDRO'S RESERVOIR LEVEL UPDATES

BC Hydro's toll-free reservoir information line: **1 877 924 2444**

BC Hydro's toll-free reservoir information line provides up to date reservoir water level and river flow information. The recording is updated every Monday, Wednesday and Friday and provides:

- **Current Water Levels:** Arrow Lakes Reservoir, Duncan Dam Reservoir, Kinbasket Reservoir, Kooanus Reservoir, Kootenay Lake, Revelstoke Reservoir, Sugar Lake Reservoir and Whatshan Lake Reservoir.
- **Current River Flows:** Columbia River at Birchbank, Duncan River at the Lardeau Confluence, Shuswap River and the flow downstream from Wilsey Dam at Shuswap Falls.



An Operations Update meeting in Jaffray.
Photo courtesy U.S. Army Corps of Engineers.

Reservoir levels can be checked on our website that provides near real time data:

<https://www.bchydro.com/energy-in-bc/operations/transmission-reservoir-data/previous-reservoir-elevations.html>

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