



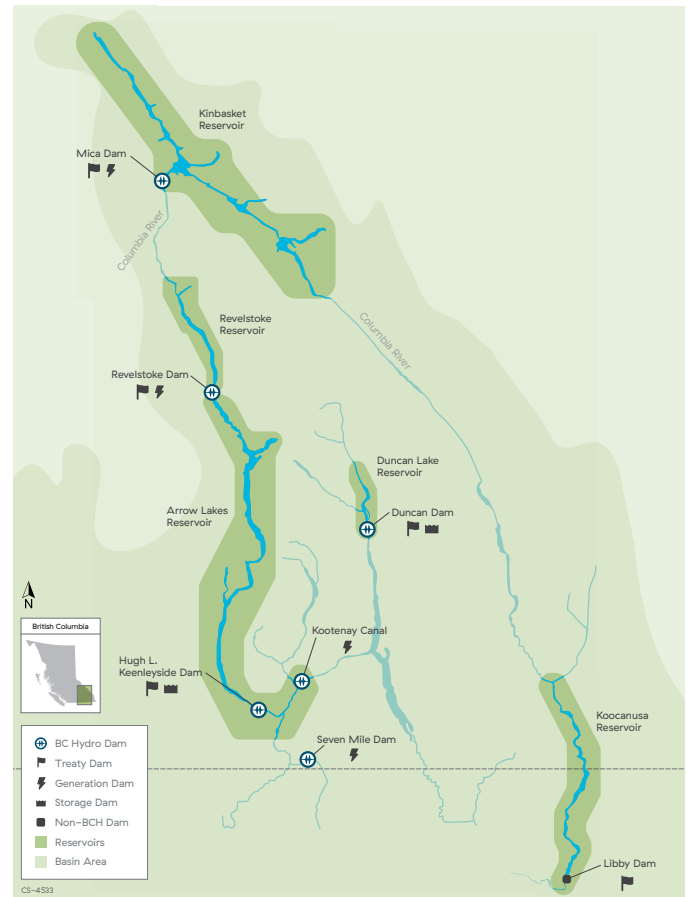
Columbia River operations summary

Spring 2024

This publication provides an overview of BC Hydro’s operations in the Columbia basin, including Kinbasket Reservoir, Revelstoke Reservoir, Arrow Lakes Reservoir, Duncan Reservoir, and Columbia River flows. This summary also offers information about the current operating conditions in the Columbia basin, as well as the operating agreements that inform our operations, including the Columbia River Treaty (“Treaty”).

SNOWPACK AND RUNOFF

Due to low precipitation in the fall and winter, snowpack in the Columbia basin during the 2023/2024 was well below average, particularly in the Canadian portion of the basin. The April 23 forecast runoff for April to September 2024 is low, at 80% of normal for the Canadian portion of the basin and 80% of normal for the entire Columbia basin. By comparison, the observed runoff in the Canadian basin in 2023 was 78% of normal and the overall runoff in the Columbia basin was 83% of normal.



KINBASKET RESERVOIR

Kinbasket Reservoir (12 million-acre-feet [MAF] of storage) is created by Mica Dam. Kinbasket Reservoir regulates discharges for both Mica and Revelstoke dams and generating stations as well as for power plants further downstream.

On October 23, 2023, Kinbasket Reservoir refilled to a maximum level of 747.18 metres (2,451.4 feet). This is about 3.8 metres (12.6 feet) below average for this date. The low refill last year was related to the severe drought conditions last summer in the Columbia basin and across the province. Drought levels in the Upper and Lower Columbia Basins ranged from drought levels 3 to 5 for most of the summer, which were similar to conditions across much of the province.

Precipitation was below average for much of the fall and winter of 2023/2024. Cumulative precipitation at Mica as of April 4, 2024, amounts to only 68% of the year-to-date average since October 1, 2023, the third driest year on record. With low precipitation in the basin, snowpack in the Upper Columbia basin is currently about 60% of normal, which is well below this time last year.



Mica Dam and Kinbasket Reservoir



Kinbasket Reservoir

The water supply forecast informs expectations of inflows each year. The April water supply forecast for Mica is 76% of normal for combined inflows measured between February to September 2024. This includes actuals measured in February and March of 2024. By comparison, the observed water supply for the same period in 2023 was 85% of normal. Due to two consecutive years of below normal inflows, Kinbasket Reservoir is being managed like prior low inflow years. This ensures sufficient water in storage for the fall so that electricity demand can be met over the winter and next spring from Mica and Revelstoke generating stations.

As of April 22, Kinbasket Reservoir is at 725.9 metres (2,381.7 feet), approaching the minimum level for the year. The current forecast summer maximum is 749.8 metres (2,460 feet), which is about average for this time of year.

The normal licensed range for Kinbasket Reservoir is between 754.4 metres (2,475 feet) and 706.96 metres (2,319.42 feet) respectively. 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 MAF of Treaty storage and 5 MAF of non-Treaty storage.

REVELSTOKE RESERVOIR

Revelstoke Reservoir (1.5 MAF of storage) is created by Revelstoke Dam. Unlike Arrow Lakes Reservoir or Kinbasket Reservoir, Revelstoke Reservoir has limited storage and is usually operated within the top 1.5 metres (5 feet) of full pool. Revelstoke Reservoir water levels may fluctuate in response to weather patterns, inflow levels, and electricity demand. It is common to have daily fluctuations of the reservoir within 1.5 metres (5 feet) of full pool during the spring freshet and winter peak load periods. Periodically, the reservoir is lowered below its normal minimum level of 571.5 metres (1,875 feet) to meet increasing system needs for short-term generating capacity. The reservoir may fill to near full pool during periods of high reservoir inflows. Water is occasionally released over the Revelstoke Dam spillway during low demand and high inflow periods to maintain minimum flows or to maintain the reservoir water level.

The licensed range for Revelstoke Reservoir is between 573 metres (1,880 feet) and 554.7 metres (1,820 feet). Most of the time, Revelstoke Reservoir is maintained at or above 571.5 metres (1,875 feet).



Revelstoke Reservoir

ARROW LAKES RESERVOIR

Arrow Lakes Reservoir (7.1 MAF of storage) is created by the Hugh L. Keenleyside Dam. Water releases from Arrow Lakes Reservoir are regulated under the Treaty and its supplemental operating agreements. The Treaty requires Canada to hold back water during wet years and release more water during dry years.

Actual runoff from April to September 2023 in the Canadian portion of the Columbia basin was the fifth driest year on record. Despite low inflows in June, Arrow Lakes Reservoir refilled relatively close to full due to the ability to hold back additional water under the Non-Treaty Storage Agreement (NTSA). Arrow Lakes Reservoir reached a maximum level of 439.06 metres (1,440.5 feet) on June 23, 2023, about 1.07 metres (3.5 feet) below full pool.

Starting in July, the drought conditions, the required increased releases under the Treaty, and the need to hold water in Kinbasket Reservoir for winter generation resulted in a steeper decline in Arrow Lakes Reservoir levels over the rest of the summer. The reservoir reached 426.7 metres (1,400 feet) on September 2, 2023 (Labour Day). Although these levels were within the water licence limits, they were unusually low for that time of year.

Persistent dry conditions in the fall and winter of 2023/2024 resulted in lower basin inflows and further reduction of Arrow Lakes Reservoir over the winter. The reservoir reached a minimum level of 422.7 metres (1,386.98 feet) on January 11, 2024.

The April water supply forecast for Arrow Lakes Reservoir is 82% of normal for February to September 2024. By comparison, the observed water supply for the same period in 2023 was 82.5% of normal.

This year's refill of Arrow Lakes Reservoir is expected to be operationally challenging under current forecast conditions associated with the below average snowpack. As of April 22, the reservoir is forecasted to refill to between 434.3–434.5 metres (1,425–1,432 feet) in June. If dry conditions persist in the summer, Arrow Lakes Reservoir could reach levels similar to what we saw at the end of last summer. BC Hydro is very aware of the impacts associated with low Arrow Lakes Reservoir levels over each season. We will continue to consider options, when available, to support higher Arrow Lakes Reservoir levels this summer, while ensuring that operations will remain within the water licence limits.

The normal licensed 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 Reservoir at Burton during the fall of 2023

DUNCAN RESERVOIR

Duncan Reservoir (1.4 MAF of storage) is created by Duncan Dam. The dam's operations help meet Treaty flood control requirements, help minimize flood risk on Kootenay Lake, and provide minimum fish flows year-round as required by the Duncan Dam Water Use Plan.

To manage the integrated Columbia system under drought conditions and to support higher Arrow Lakes Reservoir levels in the summer, Duncan flows were increased to help offset the required Treaty releases from Arrow Lakes Reservoir in August. As a result, levels on Duncan Reservoir deviated from the Duncan Reservoir Water Use Plan recreation target elevation of 575.5 metres ± 0.3 metres (1,888.1 feet ± 1 foot) until Labour Day.

In 2023, Duncan refilled to a maximum of 575.01 metres (1,886.5 feet), 1.68 metres (5.5 feet) below full pool on August 10, 2023, and reached an elevation of 572.6 metres (1,878.9 feet) on September 2, 2023 (Labour Day).

Duncan Reservoir is normally drafted across the fall/winter to provide flows for fish and to meet system Treaty flood control requirements. Every year, Duncan Reservoir is drafted to its licensed minimum level of 546.9 metres

(1,794.2 feet) by April, or before the start of freshet, for local flood risk management. Duncan Reservoir is forecast to draft to its water licence minimum this month. By comparison, the minimum level reached in 2023 was 547.2 metres (1,795.3 feet) on April 29, 2023.

The April water supply forecast for Duncan is 85% of normal for February to September 2024. By comparison, the observed water supply for the same period in 2023 was 82.1% of normal. Under current forecast conditions, Duncan is not expected to refill fully this year but is expected to be within 1.5 metres (5 feet) from full this summer, similar to last year.

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



Duncan Reservoir

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 mainstem Columbia, as well as dams on the Kootenay River system. Actual discharges depend on many factors, including upstream runoff and storage operations and Treaty discharge requirements.

Columbia River flows are measured at the Birchbank flow measuring station downstream of the Kootenay River confluence between Castlegar and Trail. Flooding conditions on the Columbia River are not anticipated this year based on the current forecast conditions associated with the below average snowpack.

On May 22, 2023, Columbia River flows at Birchbank peaked at about 3,494 cubic metres per second (m³/s) or 123,400 cubic feet per second (ft³/s). This flow is well below the peak regulated flow experienced in 2012 of 6,090 m³/s (215,000 ft³/s), and the peak pre-dam flow of 10,590 m³/s (374,000 ft³/s) in 1961.

BC Hydro's water licence has no minimum discharge requirements for the Columbia River downstream of the Hugh L. Keenleyside Dam. However, BC Hydro can be obliged (per the Treaty) to reduce flows to a minimum weekly average flow of 141.5 m³/s or 5,000 ft³/s under certain water conditions. Please note that although this is the lowest possible flow rate under the Treaty, the required weekly discharges are largely based on inflows. The Treaty requires Canada to hold back water during wet conditions and release more water during dry conditions.



The Columbia River in Trail

KOOCANUSA RESERVOIR

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

Koocanusa Reservoir is typically drafted during the winter for Treaty flood risk management. The forecast runoff from USACE is only 83% of normal for April to August 2024. Due to well below average inflow forecast, lesser draft is required to manage flood risk this year. As such, the reservoir reached a minimum level of 736.2 metres (2,415.45 feet) on March 18, 2024, about 13.4 metres (44 feet) above average for this date. By comparison, the reservoir reached a minimum of 732 metres (2,401.5 feet) on April 10, 2023, about 9 metres (30 feet) above average for this date.

Libby Dam continues to be operated under VarQ¹ procedures for U.S. fisheries interests and flood control.

Information regarding the operation of Libby Dam and Koocanusa Reservoir water levels is available from USACE at nws.usace.army.mil or by calling 406 293 3421.

The normal operating range for Koocanusa 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 Koocanusa Reservoir.

KOOTENAY LAKE

For information regarding Kootenay Lake, please contact FortisBC.

Website: fortisBC.com

Phone: 1 866 436 7847

¹ VarQ was developed to improve the multi-purpose operation of Libby and Hungry Horse while maintaining the current level of system flood control protection in the Columbia River. VarQ reduces the contribution of reservoir space at Libby and Hungry Horse for system flood control of spring runoff in the Columbia River in years with low to moderate potential for flooding. For more information, please visit nwd-wc.usace.army.mil/cafe/forecast/VARQ/varq.htm.

About the Columbia basin

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 before heading 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, receives a lot of snow, and produces an average of 30% to 35% of the runoff for Canada and the U.S. combined. The river's large annual discharge and relatively steep gradient gives it tremendous potential for generating electricity. Hydroelectric dams on the Columbia's mainstem and its many tributaries produce more hydroelectric power than on any other North American river.

BC Hydro's facilities in the Columbia basin include 13 hydroelectric dams, two water storage dams, and a system of reservoirs. Four of the larger reservoirs within Canada are operated according to the Treaty and other agreements signed between Canada and the U.S.

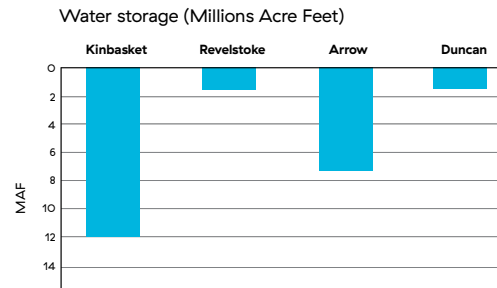
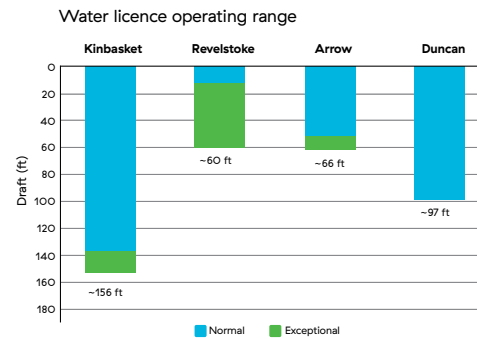
For more information, visit Columbia Region (bchydro.com).

COLUMBIA BASIN RESERVOIR OPERATIONS AND STORAGE

In an average operating year, the overall draft of each reservoir is not expected to use its entire operating range. In years of severe low inflows or high inflows the full extent of the reservoir may be expected to be used. As these challenging years do not occur every year, most years will see the overall seasonal draft to a much lesser extent.

The licensed operating range for Kinbasket Reservoir is 47.5 metres (156 feet), which is twice as much as Arrow Lakes Reservoir, and Duncan Reservoir drafts 30.4 metres (98 feet) annually. The water licence operating ranges for the Canadian Columbia River basin reservoirs are shown on the first graph on the top right of this page.

While Revelstoke Reservoir is normally operated within 1.5 metres (5 feet) from full pool, change to drafts below may be used in challenging circumstances, such as meeting demand during a winter cold snap. Revelstoke has very little available storage and drafting the reservoir does not significantly impact Arrow Lakes Reservoir levels. The water storage for the Canadian Columbia River basin reservoirs are shown in the second graph on the top right of this page.



BC Hydro's operating agreements

COLUMBIA RIVER TREATY

Ratified in 1964, the Treaty agreement between Canada in the US resulted in the construction of the Duncan, Hugh L. Keenleyside, and Mica dams in BC, the Libby Dam in the US, and the Kooconasa reservoir which crosses the Canada-US border. The dams were constructed for flood control and to increase power generating potential in both countries. The Treaty is currently being renegotiated by Canada and the U.S. More information on the Treaty and its review process can be found at: engage.gov.bc.ca/columbiarivertreaty.

OTHER AGREEMENTS

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

NON-TREATY STORAGE AGREEMENT (NTSA)

The Non-Treaty Storage Agreement (NTSA) allows BC Hydro to coordinate additional storage in Kinbasket Reservoir beyond the Treaty requirements. NTSA is implemented by altering the release and storage of water when agreed upon by BC Hydro and its U.S. partners under the terms of the NTSA. This allows the parties to increase or decrease discharges across the Canada-U.S. border. The current NTSA was signed in 2012 and expires this year. This agreement provided BC Hydro with increased control over reservoir levels, energy benefits, and operational flexibility to address various interests such as recreational activities, wildlife habitat, and fisheries.

Want to stay informed of BC Hydro operations?

REGIONAL OPERATIONS UPDATE MEETINGS

BC Hydro hosts annual operations update meetings. These take place each spring for Columbia basin communities.

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 Treaty facilities and BC Hydro facilities in the Southern Interior; and
- provide information on BC Hydro's activities and facility operations in the Columbia basin.

If you would like to receive e-mail notifications about these meetings, please contact us at

southern-interior.info@bchydro.com.

OPERATIONS UPDATE MEETINGS

BC Hydro periodically hosts meetings to provide updates on our Columbia and Kootenay system operations. If you would like to receive e-mail notifications regarding these meetings, please contact us at southern-interior.info@bchydro.com.

BC HYDRO'S RESERVOIR LEVEL UPDATES

You can receive regular updates about reservoir levels in a variety of ways:

Go online to bchydro.com to see near real-time water level information for various locations around our reservoirs.

Sign up to receive weekly water level forecasts by email by contacting southern-interior.info@bchydro.com.

- Call our toll-free reservoir information line at **1 877 924 2444** to get reservoir level and river flow information by phone. This recorded message is updated every Monday, Wednesday, and Friday and includes:
 - Current elevation levels: Arrow Lakes Reservoir, Duncan Dam Reservoir, Kinbasket Reservoir, Koochanusa Reservoir, Kootenay Lake, Revelstoke Reservoir, Sugar Lake Reservoir, and Whatshan Lake Reservoir.
 - Current flows: Columbia River at Birchbank, Duncan River at the Lardeau Confluence, Shuswap River, and the flow downstream from Wilsey Dam at Shuswap Falls.

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Arrow Lakes Reservoir at Fauquier during the fall of 2023