



Wahleach Project Water Use Plan

*Revised for Acceptance
by the Comptroller of
Water Rights*

1 December 2004



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Wahleach Project Water Use Plan



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Preface

The water use planning process for BC Hydro's Wahleach hydroelectric facility was initiated in September 2000 and completed in October 2002.

The proposed conditions in this Water Use Plan, for the operation of BC Hydro's Wahleach hydroelectric facility reflect the October 2002 recommendations of the Wahleach Water Use Plan Consultative Committee.

BC Hydro thanks all those who participated in the process that led to the production of this Water Use Plan, for their effort and dedication. The proposed conditions for the operation of BC Hydro's Wahleach hydroelectric facility will not come into effect until implemented under the *Water Act*.

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1.0 INTRODUCTION

The proposed conditions in this Water Use Plan, for the operation of BC Hydro's Wahleach hydroelectric facility reflect the October 2002 recommendations of the Wahleach Water Use Plan Consultative Committee. The proposed terms and conditions to be authorized under the *Water Act* for the beneficial use of water at the Wahleach hydroelectric facility are set out in this document. Future reference to the Wahleach hydroelectric facility includes: the Boulder Creek Diversion Dam, the Jones Lake Reservoir, the Wahleach Dam, and the Wahleach Generating Station.

The proposed conditions will change current operations and are expected to affect fish, power generation, recreation and wildlife.

A monitoring program is proposed in order to study key uncertainties to enable improved operating decisions in the future. Refer to the *Wahleach Water Use Plan: Consultative Committee Report* dated October 2003 for details on the consultative process, interests, objectives, performance measures and values associated with operating alternatives and details of the proposed monitoring program. A review period has also been specified for this Water Use Plan.

2.0 DESCRIPTION OF WORKS

2.1 The Wahleach System

The Wahleach hydroelectric facility is situated in the Lower Mainland approximately 25 km west of Hope and 100 km east of Vancouver. An area map of the Wahleach hydroelectric facility is provided in Figure 2-1.

The Wahleach Dam is situated at the outlet of Jones Lake Reservoir, which was a natural lake prior to impoundment. The Wahleach Dam has since raised the lake level. Water is drawn from the west side of the reservoir through the Four Brothers Mountain via a tunnel and penstock. The penstock connects to the Wahleach Generating Station, which diverts water into the Herrling Island Sidechannel of the Fraser River.

Additional water is supplied to the reservoir by the diversion of Boulder Creek into Jones Lake Reservoir. The Boulder Creek Diversion Dam is located approximately 400 m east of the Wahleach Dam.

Jones Creek, which is also known as Wahleach Creek, originates on Cheam Ridge. From the headwaters, the creek flows approximately 3 km north and enters Jones Lake Reservoir. Most of the flow from Jones Creek is diverted through the power tunnel and into the Wahleach Generating Station. The remaining creek-water and the water released from the Wahleach Dam flows north, then passes under the Trans-Canada Highway and the Canadian National Railway to the creek's confluence with the Fraser River near Laidlaw. The section of the creek referred to as lower Jones Creek flows from the Wahleach Dam to the confluence of the Fraser River. The total length of lower Jones Creek is approximately 9 km, of which less than 1 km is accessible to anadromous species as access is blocked by a natural barrier located 100 m above Laidlaw Bridge crossing. The lower Jones Creek non-anadromous section is between the natural barrier and the Wahleach Dam. The lower Jones Creek anadromous section is between its confluence with the Fraser River and the natural barrier.

2.2 Existing Works

Boulder Creek Diversion Dam: The Boulder Creek Diversion Dam is an earthfill dam with a crest length of 180 m. The Dam diverts flow from Boulder Creek into Boulder Creek Diversion Channel which flows into Jones Lake Reservoir. The Boulder Creek Diversion Dam was originally built with a release gate capable of allowing up to 1.4 m³/s of Boulder Creek flow to continue into Jones Creek to provide flows for an artificial spawning habitat. However, over time, erosion at the intake of this gate has resulted in all the water now being diverted to the reservoir at very low flows.

Wahleach Dam: The Wahleach Dam is an earthfill dam with a crest length of 418 m and a normal maximum elevation of 646.2 m. A free-crest overflow spillway is located on the east abutment of the dam. The spillway discharges into an excavated channel, which then carries water into Jones Creek, approximately 400 m downstream of the dam. In 1969, a fish water release siphon capable of diverting up to 0.85 m³/s of flow from Jones Lake Reservoir into Jones Creek was added to the top of the dam near to the west abutment of Wahleach Dam. The siphon can be primed at elevations over 637.6 m and becomes deprived below 636.4 m.

Jones Lake Reservoir: Jones Lake Reservoir is the storage reservoir in the Wahleach hydroelectric facility. It is an oligotrophic lake with a surface area of 460 ha, a maximum depth of 29 m and a mean depth of 13.4 m.

Penstock and Wahleach Generating Station: Water from Jones Lake Reservoir enters an intake structure on the west side of the reservoir and is carried through a 4.2 km tunnel and a 500 m penstock to the generating station, on the south bank of the Fraser River. The station has a 60 MW Canadian General Electric generator with a maximum sustained generating capacity of 63 MW.

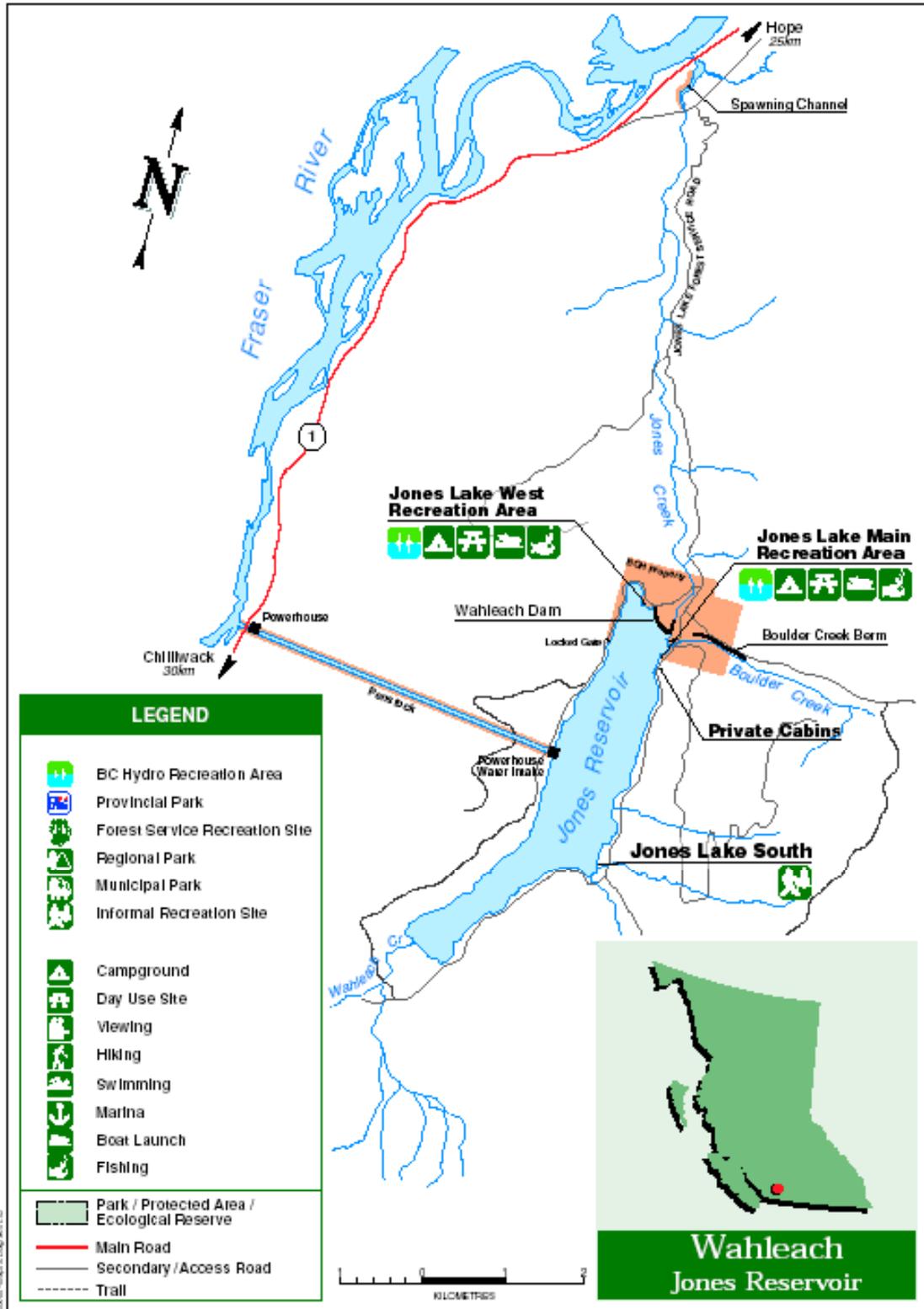


Figure 2-1: Wahleach Hydroelectric Facility Area Map

3.0 HYDROLOGY OF THE WAHLEACH BASIN

Appendix 1, Wahleach Water Use Plan Hydrology Memo, describes the physiography, climate, and hydrology of the Wahleach basin. The memo also describes daily inflow and seasonal volume inflow forecasting procedures, the supporting network of hydrometeorological stations in the area and the summaries of inflow hydrographs for Jones Lake Reservoir.

4.0 OPERATING CONDITIONS FOR FACILITY

4.1 Role of Facility in BC Hydro’s System

The Wahleach hydroelectric facility is part of BC Hydro’s Coastal Region, which is described in *Making the Connection*, published by BC Hydro in April 2000.

The Wahleach hydroelectric facility is one of six hydroelectric developments in the Fraser Valley Region. Given the facility's close proximity to the load center, it provides consistent voltage in the transmission network, and system security in the event of transmission or generation problems elsewhere in the system. The Wahleach hydroelectric facility has historically provided an average of 245 GWh per year and contributes approximately 0.67% of BC Hydro’s hydroelectric generation.

4.2 Use of Water for Power Generation at the Wahleach Facility

The Wahleach hydroelectric facility is classified as a “coastal” system with the majority of inflow resulting from seasonal rainstorms and spring snowmelt. As a result, the average daily turbine discharge from the Wahleach Generating Station varies seasonally and daily with the demand for electricity and the availability of water. Spills occur when inflows exceed generation and storage capacity.

4.3 Emergencies and Dam Safety

Emergencies and dam safety requirements shall take precedence over the operational constraints outlined in this Water Use Plan. Emergencies include, but are not limited to, actual and potential loss of power to customers. Dam safety requirements for operations are outlined in *Wahleach: Operation, Maintenance and Surveillance Requirements (OMS) for Dam Safety* issued by BC Hydro’s Director of Dam Safety.

4.4 Conditions for the Operation of Works for Diversion and Use of Water

BC Hydro proposes to operate the Wahleach hydroelectric facility in accordance with the conditions outlined below. BC Hydro may not be able to operate within these conditions during extreme hydrological events.

4.4.1 Boulder Creek Minimum Flow

To the extent that Boulder Creek inflows are available, BC Hydro will provide a minimum flow of 0.14 m³/s from Boulder Creek to Jones Lake Reservoir via the Boulder Creek Diversion Channel year-round. It is expected that there will be times when the minimum flow will not be available.

To the extent that Boulder Creek inflows are available, flows from Boulder Creek in excess of 0.14 m³/s can be diverted at the Boulder Creek Diversion Dam to the original Boulder Creek channel to meet flow obligations downstream in Jones Creek. This condition may require a capital investment to undertake structural modifications to the discharge facilities at the Boulder Creek Diversion Dam.

It is recommended that the Comptroller of Water Rights direct BC Hydro to provide temporary works to modify the discharge facilities at the Boulder Creek Diversion Dam for five years. It is recommended that the Comptroller of Water Rights direct BC Hydro to undertake permanent structural modifications to the discharge facilities at the Boulder Creek Diversion Dam upon review of the results of the monitoring program and the availability of Boulder Creek inflows five years after implementation of this Water Use Plan.

The details regarding this recommendation are provided in the *Wahleach Water Use Plan Consultative Committee Report*.

4.4.2 Jones Lake Reservoir Elevation

The minimum operating level of Jones Lake Reservoir is 628 m.

A fertilization program in Jones Lake Reservoir is recommended, in lieu of operational constraints on the reservoir, as a means to improve littoral and pelagic productivity. It is recommended that the Comptroller of Water Rights direct BC Hydro to implement a fertilization program for Jones Lake Reservoir to be reviewed after five years. The details regarding this recommendation are provided in the *Wahleach Water Use Plan Consultative Committee Report*.

4.4.3 Jones Creek Minimum Flow

When the Jones Lake Reservoir elevation level is at or above 637.6 m and/or Boulder Creek inflows in excess of 0.14 m³/s are available:

- From 15 September to 30 November, BC Hydro will maintain a minimum flow of 1.1 m³/s in Jones Creek measured at a staff gauge installed in Jones Creek near Laidlaw.
- BC Hydro will maintain a minimum flow of 0.6 m³/s in Jones Creek measured at a staff gauge to be installed in Jones Creek near Laidlaw.

It is expected that there will be times when the minimum flow will not be available.

4.4.4 Jones Creek Fish Habitat Enhancement

A fish habitat enhancement project in Jones Creek is recommended, in lieu of operational constraints that would maintain a minimum flow in Jones Creek greater than that proposed in section 4.4.3, as a means to improve fish habitat. It is recommended that the Comptroller of Water Rights direct BC Hydro to implement a fish habitat enhancement project in Jones Creek. The details regarding this recommendation are provided in the *Wahleach Water Use Plan Consultative Committee Report*.

4.4.5 Wahleach Generating Station Capacity

From 15 September to 30 November, BC Hydro will curtail generation to zero for a two-hour period every twenty-four hours. There is no time of day condition. At all other times, BC Hydro can generate at maximum capacity. There is no constraint on the rate of change of flow from the powerhouse.

5.0 PROGRAMS FOR ADDITIONAL INFORMATION

Development of the proposed conditions for the Wahleach hydroelectric facility was complicated by uncertainties and information gaps. The October 2002 recommendations of the Consultative Committee were contingent upon the implementation of a monitoring program to reduce these uncertainties over time. The monitoring program is designed to address key questions that affected decision making throughout the consultative process.

Accordingly, it is recommended that the Comptroller of Water Rights direct BC Hydro to undertake a monitoring program that will:

- Assess expected outcomes of the operational change being recommended.
- Provide improved information for future operating conditions.

Details and costs of the proposed monitoring program is provided in the *Wahleach Water Use Plan: Report of the Consultative Committee*.

Table 5-1 provides a summary of the monitoring program and research questions.

Table 5-1: Monitoring Program Components and Research Questions. Refer to the Wahleach Consultative Report (October 2003) for details on program implementation and objectives.

Component	Research Questions
Salmonid Productivity Monitoring: Lower Jones Creek	Will habitat improvements translate into fish productivity in lower Jones Creek?
Channel Stability Assessment: Lower Jones Creek	Does channel stability affect spawning success in lower Jones Creek? Do flows in lower Jones Creek promote channel change? Is spawning success related to hydrology further affected by changing channel structure?
Pink Salmon Genetic Composition Assessment: Lower Jones Creek	Is the pink salmon spawning in lower Jones Creek on a bi-annual basis distinct to that watershed?
Entrainment Monitoring: Jones Lake Reservoir	Will reservoir spill and penstock diversion affect fish abundance in Jones Lake Reservoir by entraining fish?
Chum Salmon Spawning Behaviour Monitoring: Herrling Island Sidechannel	Is chum salmon spawning behaviour affected by operations of the Wahleach Generating Station?
Fertilization Program: Jones Lake	Is the fertilization program methods and performance effective in maintaining Kokanee abundance?

6.0 IMPLEMENTATION OF RECOMMENDATIONS

The proposed conditions and monitoring program in this Water Use Plan will be implemented after BC Hydro receives direction from the Comptroller of Water Rights.

7.0 EXPECTED WATER MANAGEMENT IMPLICATIONS

Implications for the provincial interests that were considered during preparation of this Water Use Plan are expected outcomes relative to current operations based on the best available information. After BC Hydro has been directed to implement the proposed conditions, BC Hydro will be responsible for meeting the operational parameters, but not for achieving the expected outcomes.

7.1 First Nations

BC Hydro's Wahleach hydroelectric facility is located within the claimed traditional territory of the Stó:lō Nation. The Stó:lō Nation is divided into a number of member bands including Popkum, Cheam and Shwx'ow'hamel First Nations. Stó:lō Nation and its member bands, the Peters Band and the Seabird Island First Nation participated to some extent in the Wahleach water use planning process. The proposed conditions in this Water Use Plan are expected to

benefit fish and wildlife in Jones Lake Reservoir, Jones Creek and Herrling Island Sidechannel, an objective of the First Nations.

7.2 Archaeological Considerations

The proposed conditions in this Water Use Plan are not expected to affect archaeological interests.

7.3 Fisheries

The proposed conditions in this Water Use Plan are expected to increase trout habitat in Jones Lake Reservoir through the provision of a fertilization program and a minimum reservoir elevation level. Salmon habitat is expected to increase in Jones Creek anadromous through the provision of a minimum flow and a habitat enhancement project. Overall salmon habitat is expected to decrease in Herrling Island Sidechannel from decreased flows through the Wahleach Generating Station. Salmon spawning success is expected to increase in Herrling Island Sidechannel by curtailing generation to zero for a two-hour period every twenty-four hours. Fish passage is expected to be maintained in Boulder Creek below the Boulder Creek Diversion Dam through the provision of a minimum flow.

7.4 Flood Control

The proposed conditions in this Water Use Plan are not expected to affect flooding routing associated with Jones Lake Reservoir, Jones Creek or the Herrling Island Sidechannel below the facilities.

7.5 Industrial Use of Water

There are no industrial uses of water in the Wahleach system that are affected by the recommended changes in operations.

7.6 Other Licensed Uses of Water

The proposed conditions in this Water Use Plan are not expected to affect other licensed uses of the water associated with Jones Lake Reservoir, Jones Creek or the Herrling Island Sidechannel below the facilities.

7.7 Power Generation

The proposed conditions in this Water Use Plan are expected to decrease power generation associated with the Wahleach hydroelectric facility relative to current operations. However, it has been BC Hydro's practice to ask the Comptroller of Water Rights for permission to use water in excess of the current diversion licence for power generation. The proposed conditions in this Water Use Plan are expected to increase power generation associated with the Wahleach hydroelectric facility relative to the current diversion licence.

7.8 Recreation

The proposed conditions in this Water Use Plan are expected to improve recreational opportunities on Jones Lake Reservoir through the provision of a minimum reservoir elevation level.

7.9 Riparian Rights

The proposed conditions in this Water Use Plan are not expected to affect other riparian rights associated with Jones Lake Reservoir, Jones Creek or the Herrling Island Sidechannel below the facilities.

7.10 Water Quality

The proposed conditions in this Water Use Plan are not expected to affect water quality associated with Jones Lake Reservoir, Jones Creek or the Herrling Island Sidechannel below the facilities.

7.11 Wildlife

The proposed conditions in this Water Use Plan are expected to increase riparian habitat around Jones Lake Reservoir through the provision of a minimum reservoir elevation level.

8.0 RECORDS AND REPORTS

8.1 Compliance Reporting

BC Hydro will submit data as required by the Comptroller of Water Rights to demonstrate compliance with the conditions conveyed in the Water Licences. The submission will include records of:

- Jones Lake Reservoir elevation.
- Wahleach Dam discharges.
- Wahleach Generating Station discharges.
- Boulder Creek Diversion Dam discharges.
- Minimum flows measured at a staff gauge in Jones Creek near Laidlaw.

8.2 Non-compliance Reporting

Non-compliance with operating conditions, or anticipation thereof, will be reported to the Comptroller of Water Rights in a timely manner.

8.3 Monitoring Program Reporting

Reporting procedures will be determined as part of the detailed terms of reference for each monitoring study or undertaking.

9.0 PLAN REVIEW

Five years after the implementation of this Water Use Plan, BC Hydro will assess the results of the monitoring program and the Boulder Creek inflows and the need to review the Wahleach Water Use Plan. A review may be triggered sooner if scientific data or significant new risks are identified that could result in a recommendation to change operations. If the Wahleach Water Use Plan is not reviewed five years after implementation, the plan will continue for an additional five years.

10.0 NOTIFICATION PROCEDURES

Notification procedures for floods and other emergency events are outlined in the *Wahleach Dam Emergency Planning Guide* and the *Power Supply Emergency Plan (PSEP) Fraser Valley Generation* (Alouette, Buntzen, Coquitlam, Stave, Ruskin and Wahleach dams). Both these documents are filed with the Office of the Comptroller of Water Rights.

Appendix 1
Wahleach Creek Basin Hydrology

Inter-office memo

TO: Eric Weiss 4 February 2003

FROM: Chris Caryula File: PSE 151.0
C-WAH-151.0

SUBJECT: Wahleach Water Use Plan
Hydrology of Wahleach Basin

1 INTRODUCTION

The Jones Lake / Wahleach project is a single reservoir hydroelectric project with the following general characteristics:

- ❑ Wahleach Dam impounds Jones Lake Reservoir (also referred to as Wahleach Lake)
- ❑ Boulder Creek has been permanently diverted into Jones Lake Reservoir (no diversion control structures) and is now considered to be part of the natural drainage basin.
- ❑ Spill and all other non-power releases from Wahleach Dam discharge into Wahleach Creek
- ❑ Power releases (turbine discharge) are diverted via a 3.6 km power tunnel to the Wahleach Power Plant (one unit, max output ~ 63 MW).
- ❑ Discharge from the Wahleach Power Plant enters the Fraser River

This report highlights the hydrology of the Wahleach hydroelectric system. Physiography and climatology are reviewed for the Wahleach Creek watershed.

Methods used to calculate reservoir inflows, such as BC Hydro's FLOCAL program, are discussed. Typical inflow hydrographs and summaries are provided. Flow records for the Wahleach system referred to in this report were used in power studies conducted for the Wahleach Water Use Plan.

Procedures used to provide daily inflow and seasonal volume inflow forecasts are also described.

2.1 Physiography¹

The Wahleach basin is situated in the southern coastal mountains. The drainage area upstream of Wahleach Dam is 88 km². Steep valley side slopes and short tributary streams that flow into Jones Lake from all directions characterize the Wahleach Basin. Upstream of Wahleach dam, the valley trends in a southerly direction and is part of the Skagit Range that extends further south and east outside the basin. The drainage basin for the Wahleach system is shown in Figure 1.

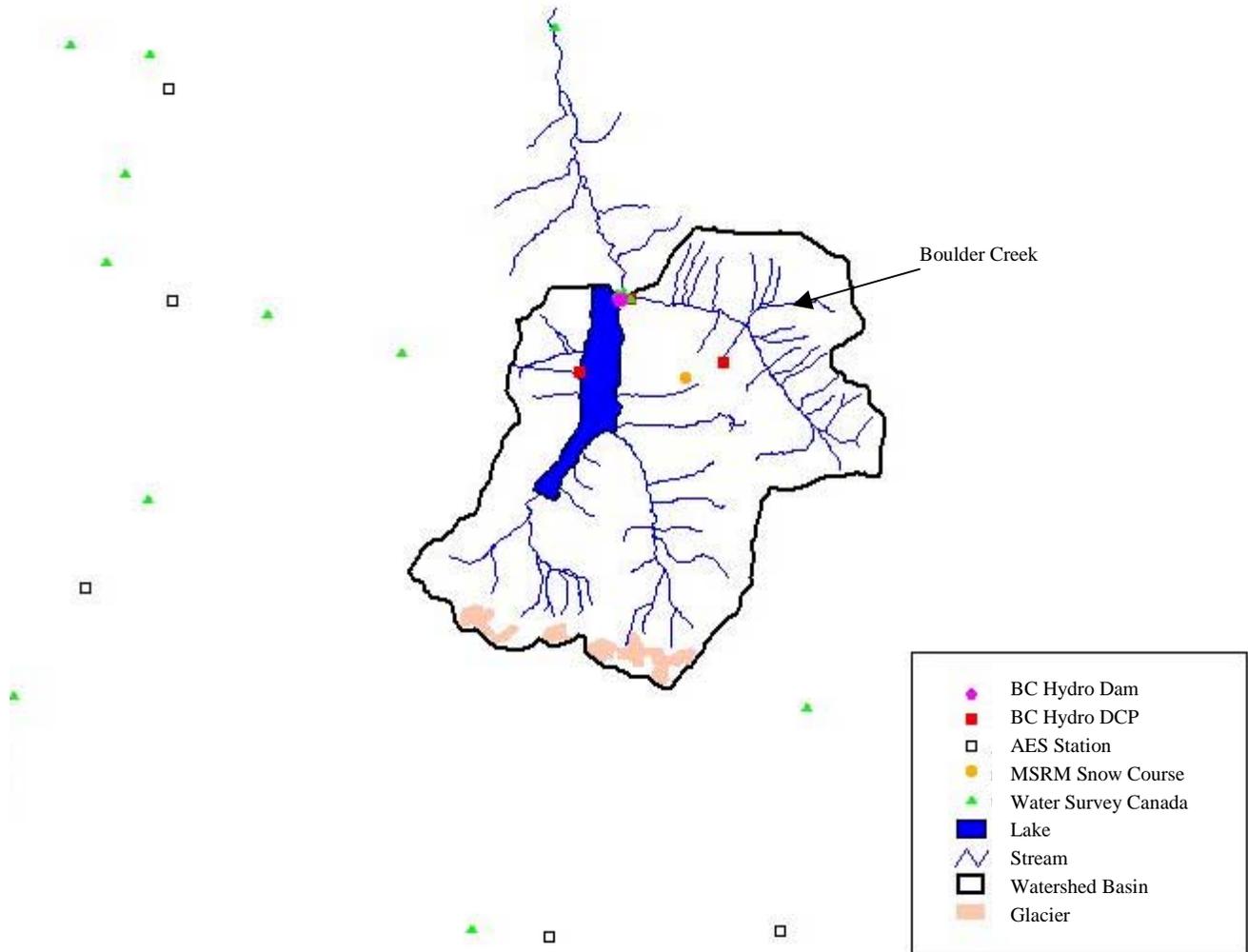


Figure 1: Watershed Map and Hydrometeorological Stations

The mountains around the Wahleach basin represent the first major barrier that moisture-laden air masses from the Strait of Georgia encounter in their movement into the Interior.

¹ Basin information obtained from BC Hydro, "Wahleach Dam Probable Maximum Flood", Hydroelectric Engineering Division report no. H1855, December 1985

Elevations within the Wahleach basin range from 640 m to approximately 2300 m (Foley Peak) and the median elevation is 1220 m. The basin hypsometric (area-elevation) curve is shown in Figure 2.

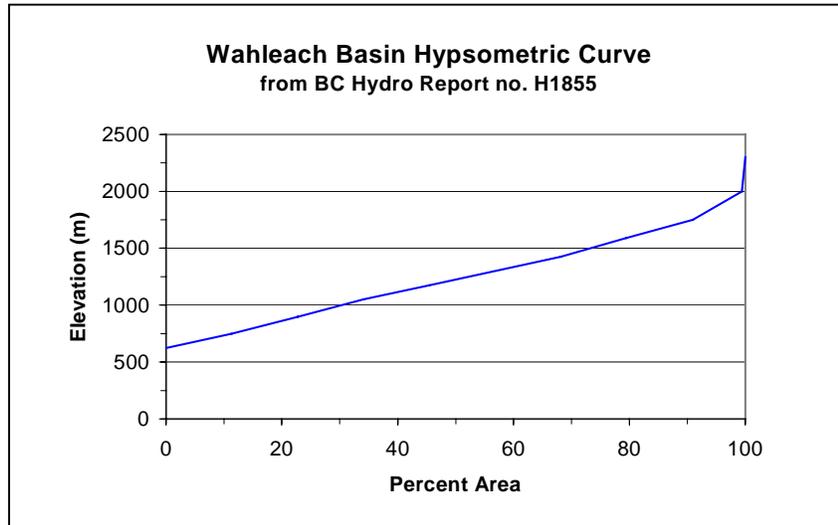


Figure 2: Hypsometric curve for the Wahleach Basin upstream of Wahleach Dam

There is insignificant natural lake storage within the basin other than at Jones Lake; the natural lake storage has an impounded surface area of 4.9 km². Figure 3 shows the elevation-storage relationship for Jones Lake Reservoir within its normal reservoir operating ranges. Between its normal maximum and minimum operating elevations Jones Lake has a storage capacity of approximately 700 cms-days (60.5 million m³).

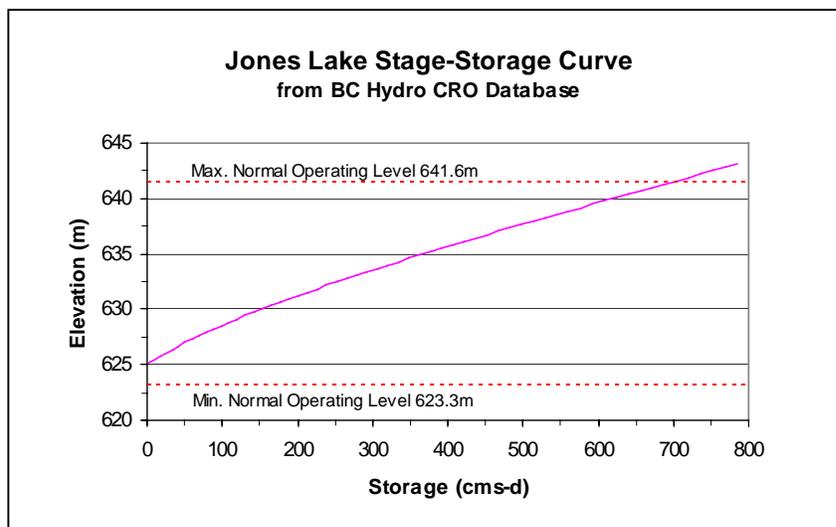


Figure 3: Stage-storage relationship for Jones Lake Reservoir

2.2 Climatology²

The synoptic conditions affecting the Wahleach basin are typical of the conditions on the western side of the Pacific Coast Range in British Columbia and Oregon. Cyclonic storms produce heavy prolonged rainfall as strong winds moving east or northeast push saturated or nearly saturated air masses from the Pacific onto the windward slopes. The largest storms occur during the winter months, predominately October through February, and the least amount of storm activity occurs during the summer months, from June to August.

The Wahleach basin discharges northward into the Fraser River. The Skagit Range of mountains to the south acts as a significant barrier to air masses moving northward and forces them to release much of their moisture prior to reaching the Wahleach basin. The basin does however receive considerable precipitation since the western boundary of the basin is the first barrier which air masses moving eastward up the Fraser Valley encounter.

These general climatic conditions produce large snowpacks in the winter, warming conditions in April to June, predominately sunny periods with occasional heavy short duration rainfalls in the summer months, and mainly overcast periods with intense storms from October to February.

At elevations in excess of 1800 m, long-term precipitation has accumulated as glacial snow and ice at the southern edge of the basin. The snowpack in the Wahleach valley bottom is usually depleted by the end of May.

² Climate information obtained from BC Hydro, "Wahleach Dam Probable Maximum Flood", Hydroelectric Engineering Division report no. H1855, December 1985

Figure 4 shows the maximum, mean, and minimum daily precipitation at nearby Agassiz AES located at elevation 15 m.

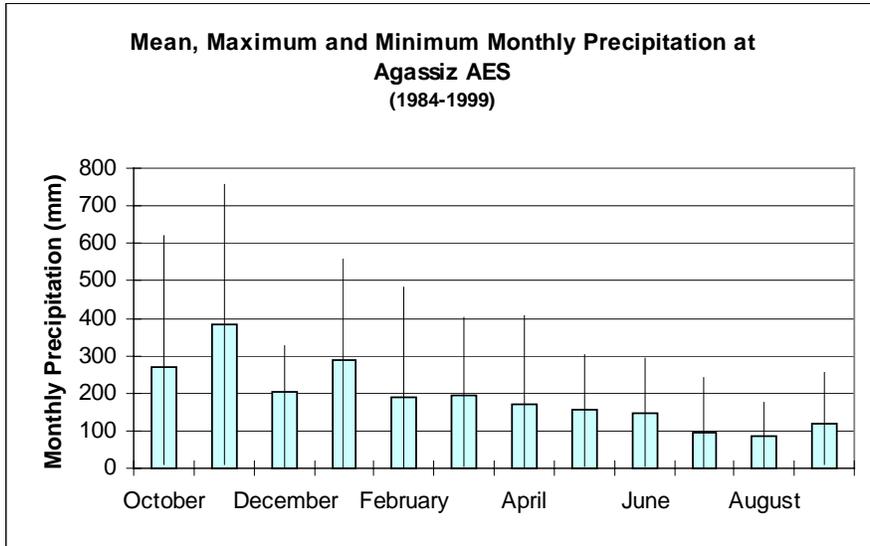


Figure 4: Maximum, mean and minimum monthly precipitation at Agassiz AES

Figure 5 shows the maximum, mean, and minimum daily temperatures at Agassiz AES.

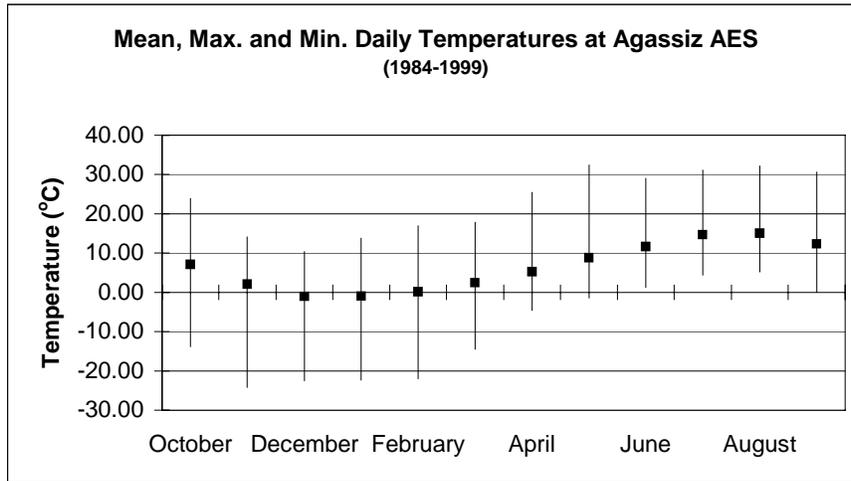


Figure 5: Maximum, mean and minimum daily temperature at Agassiz AES

Figure 6 shows the monthly snow water equivalent at Wahleach Lake snow course (1D09), located at El. 1400 m.

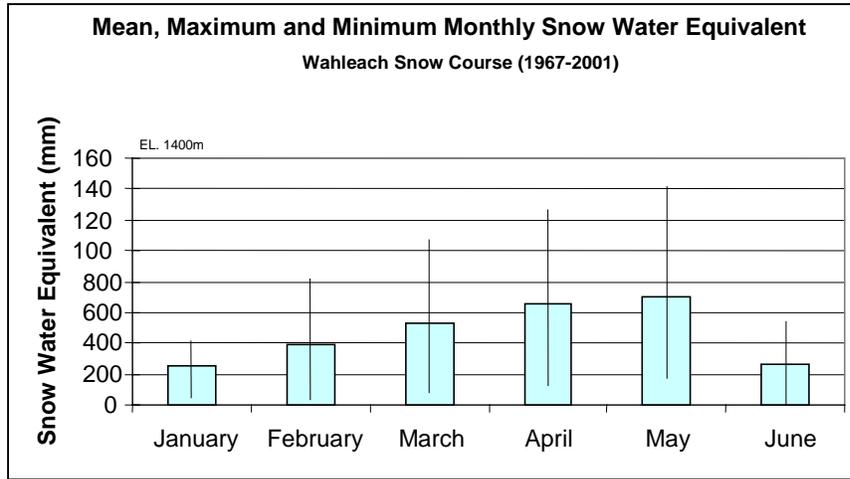


Figure 6: Maximum, mean and minimum monthly snow water equivalent at Wahleach Lake snow course (1D09)

3.1 Inflow calculations

Reservoir inflow calculations: Inflow is the volume of water entering a reservoir within a given period of time. Reservoir inflows are calculated rather measured directly. Daily inflows may be derived from mean daily discharge from the reservoir and change in reservoir storage over a period of 24 hours. The generic formula is:

$$\text{INFLOW} = \text{OUTFLOW} + \Delta \text{ STORAGE} \dots \dots \dots (1)$$

- where INFLOW = average inflow over a one - day period
- OUTFLOW = average outflow over a one - day period
- $\Delta \text{ STORAGE}$ = $S_2 - S_1$, where
 - S_2 = reservoir storage at the end of the day
 - S_1 = reservoir storage at the end of the previous day

Reservoir storage for a specific reservoir elevation is derived from a stage – storage curve unique to each reservoir.

The nature of the calculation of inflows can result in “noisier” hydrographs than observed at unregulated, natural river channels. Noisy inflows can arise due to various sources of error, such as wind set up on the reservoir, resolution of elevation measurements, errors in reservoir elevation readings, errors in outflow measurements through turbines, spillways or valves, errors in stage-storage curves and errors in the rating curves for various outlet

facilities. The impact of noise tends to reduce as the time interval over which inflow is computed increases.

Storage relationships: The storage relationships used to determine the volume of water in Jones Lake Reservoir is shown in Figure 3.

Outflow relationships: Flow through turbines at the Wahleach powerhouse is computed based on megawatt output and hydraulic head. "Hydraulic head" is a measure of the vertical distance between the water level in the reservoir and the water level immediately below the turbine outlet. Power output is proportional to head and turbine discharge. A generic relationship between these variables is shown in Figure 7.

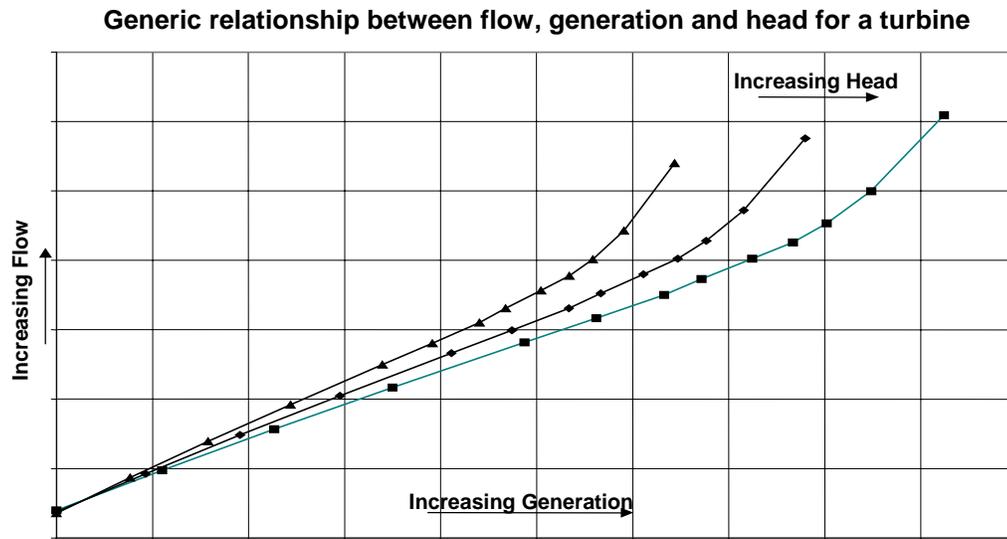


Figure 7: Generic relationship between flow, generation, and head for a turbine

“Rating curves” show the relationship between flow, opening, and elevation for a given release device. A rating curve for spill facilities at Wahleach Dam is shown in Figure 8.

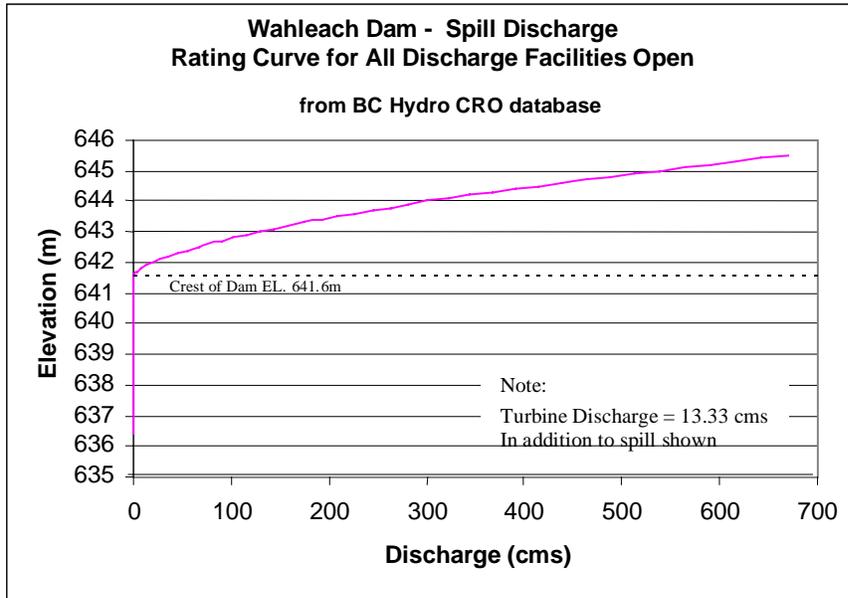


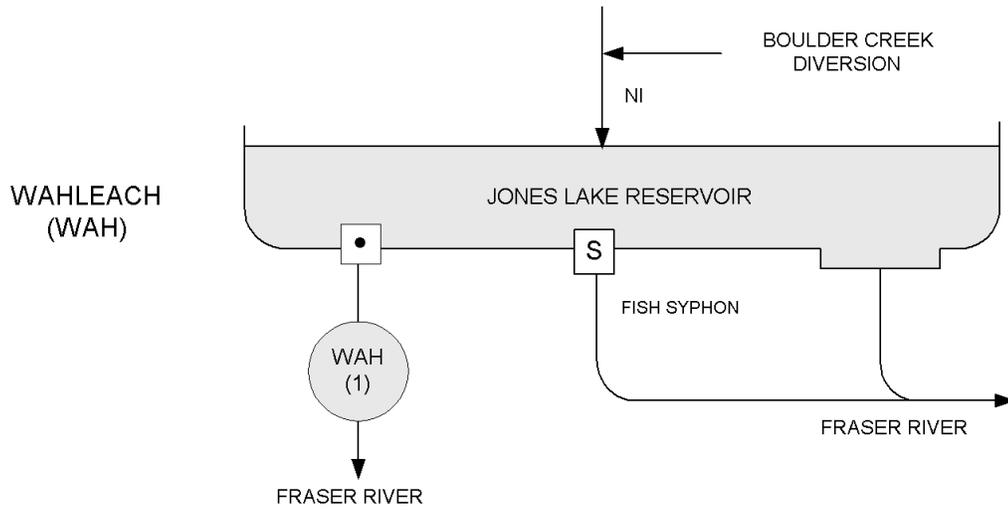
Figure 8: Rating curve for Wahleach Dam with all spill discharge facilities fully open

Data records: BC Hydro computes inflow using a computer program called FLOCAL. Specifically;

Inflows to Jones Lake Reservoir are computed based on equation (1).

Various information, including gate openings, reservoir and tailwater elevations, energy, spill, turbine flows, and inflows are stored in FLOCAL. A FLOCAL configuration for the Wahleach system is shown in Figure 9.

WAHLEACH PROJECT



LEGEND	
	Power Intake
	NPRF Spillway Gate (SPOG)
	NPRF Low Level Outlet (LLOG)
	NPRF Outlet Works Gate (OWOG)
	NPRF Weir (ungated)
	Generating Plant (n units)
	Syphon
NPRF	Non Power Release Facility
LLOG(n)	Low Level Outlet Gate (number of gates or valves)
SPOG(n)	Spillway Gate (number of gates or bays)
OWOG(n)	Outlet Works Gate (number of gates)
HCV(n)	Hollow Cone Valve (number of valves)
NI	Natural Inflow

Figure 9: Schematic of the FLOCAL configuration for the Wahleach system

3.2 Reservoir inflow characteristics

Figure 10a shows a “spaghetti plot” of the historical inflows to the Wahleach project. The 10th, 50th and 90th percentile inflows are shown in bold. Figure 10b shows estimates of historical Boulder Creek diversion flows. The estimates were determined by applying a constant ratio to the daily inflows to Wahleach. The ratio was computed by dividing the basin area for the Boulder Creek diversion basin (29.8 km²) by the total Wahleach basin area, including Boulder Creek, (88.0 km²).

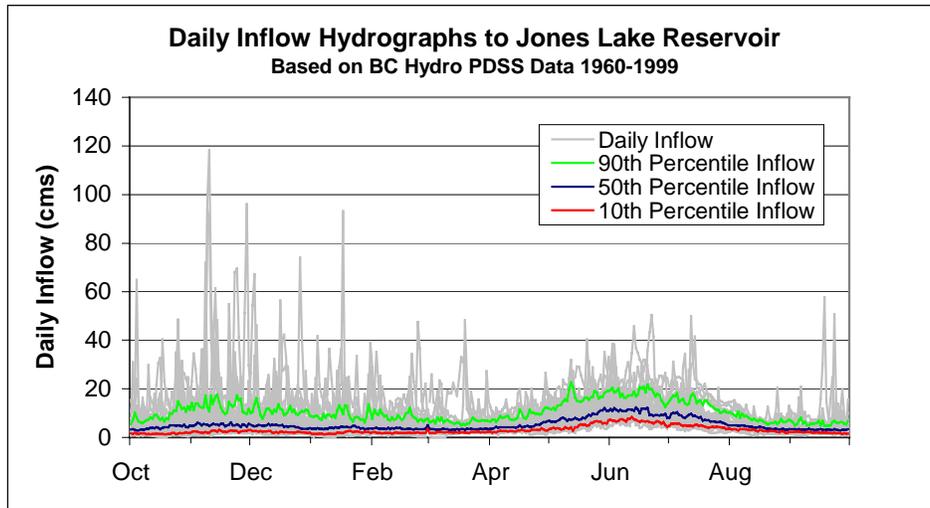


Figure 10a: Historical Daily Inflows to Jones Lake Reservoir (including Boulder Diversion)

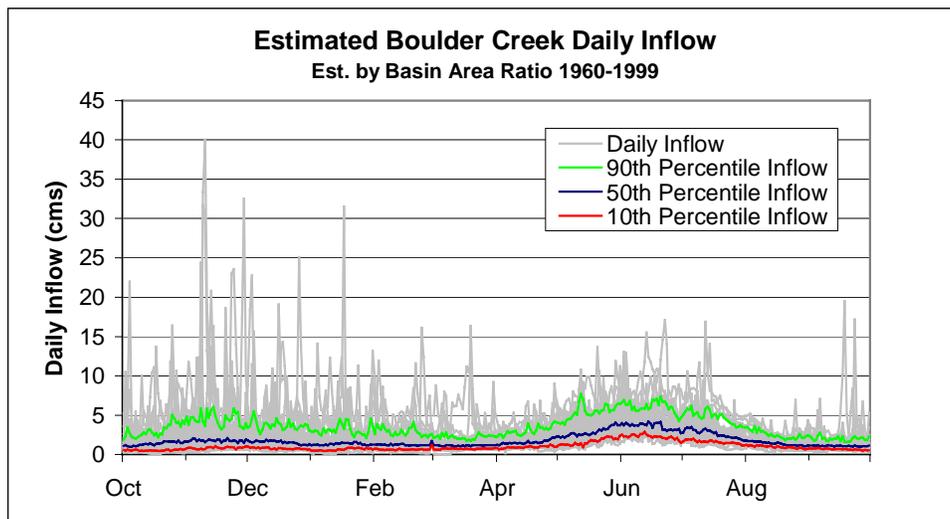


Figure 10b: Estimated Boulder Creek Daily Inflow

Figure 11 and Table 1 summarizes the daily inflows by month. Average monthly and maximum and minimum daily inflows are shown to highlight the variability of inflows to the project.

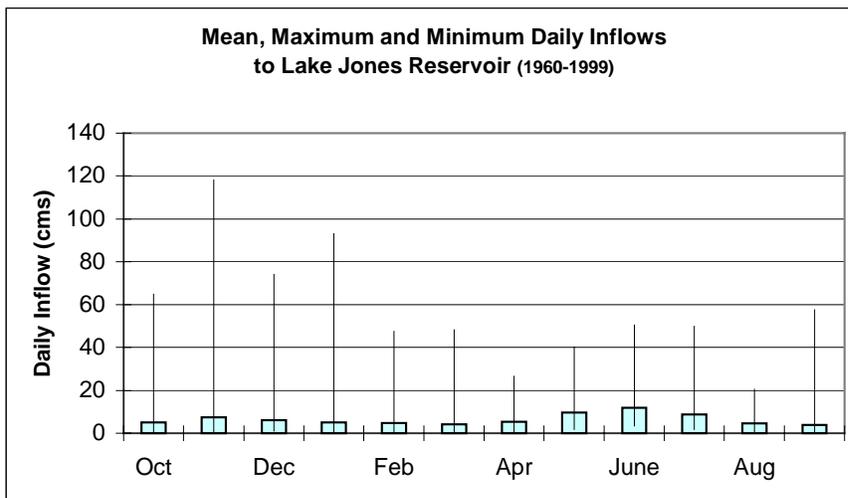


Figure 11: Variability in Wahleach Project's daily inflows

Table 1: Wahleach Project's daily inflows (1960-1999)

	Mean Daily Inflow (cms)	Maximum Daily Inflow (cms)	Minimum Daily Inflow (cms)
October	5	65	0
November	7	118	1
December	6	74	1
January	5	93	0
February	5	48	0
March	4	48	0
April	5	27	1
May	10	40	2
June	12	50	3
July	9	50	2
August	5	20	1
September	4	58	1

A "flow duration curve" indicates the percent of time that a flow is greater than a given discharge. Figure 12 shows a flow duration curve of daily inflows for the years 1960-1999; it illustrates the large range and variability of project inflows.

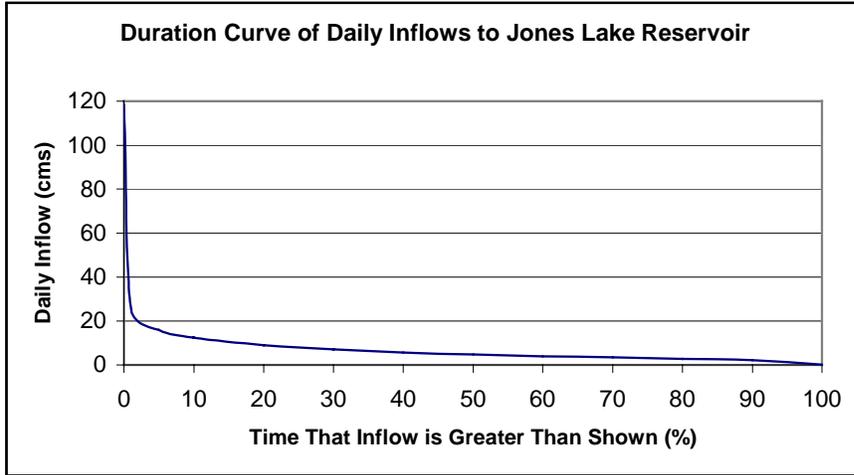


Figure 12: Duration curves of daily inflows to Jones Lake Reservoir

Figure 13 shows a duration curve for annual flows.

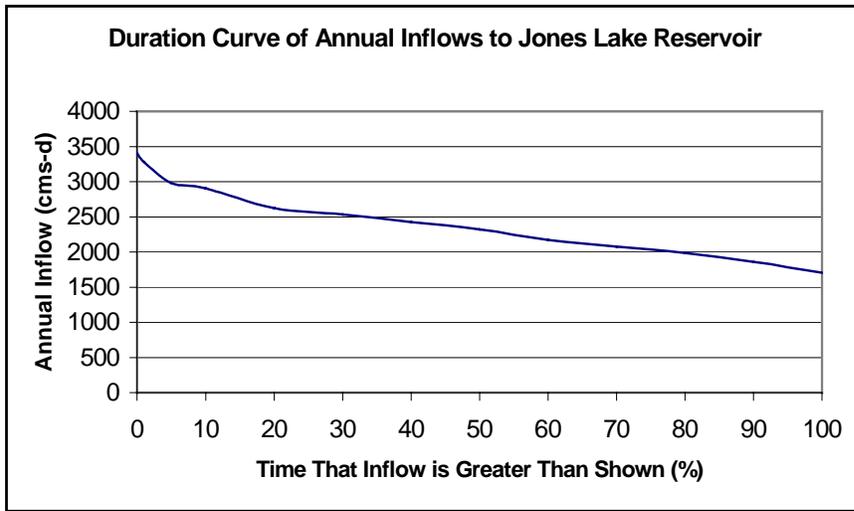


Figure 13: Duration curve of annual inflows to Jones Lake Reservoir

For reference, Figure 14 shows a comparison between the mean annual local inflow and total live storage available for selected BC Hydro and other hydroelectric projects. Jones Lake Reservoir is highlighted and shows that the average annual inflow is approximately 4 times greater than the available project storage.

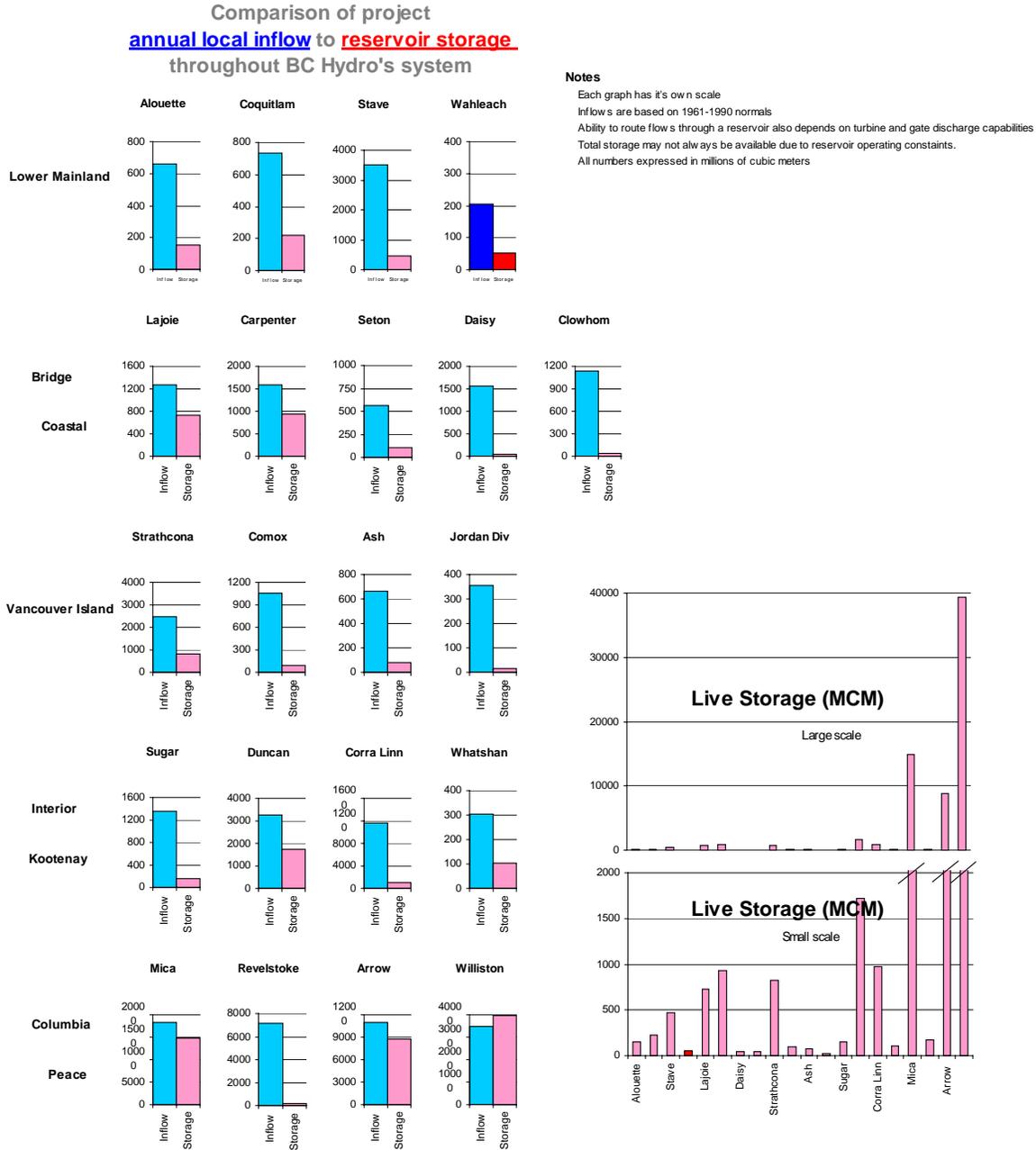


Figure 14: Comparison of project annual inflows to reservoir storage throughout BC Hydro's system

The ratio of average annual inflow to available reservoir storage provides a qualitative indication of how the inflow regulation and spill management capability varies from project to project: the higher the ratio, the lower the regulation capability. Figure 14 also shows the relative contribution of Jones Lake Reservoir to BC Hydro's total reservoir storage capacity.

4 **Operational Inflow Forecasting**

BC Hydro's Resource Management produces two main types of hydrologic forecasts: daily inflow and seasonal volume inflow forecasts for the Wahleach projects.

Daily inflow forecasts: Daily inflow forecasts are short-term forecasts that indicate the inflow expected over the next few days. An in-house conceptual watershed model, FLOCAST, is currently used to produce these forecasts. Each morning of each working day, Resource Management enters observed and forecast precipitation, temperature, and freezing level data into the model to forecast inflow over each of the next five days.

Volume inflow forecasts: Volume inflow forecasts estimate the volume of water that is expected to flow in to the Wahleach system during a given period. BC Hydro typically produces volume forecasts for the period of February through September. The ability to forecast seasonal runoff for this period lies in the fact that much of the runoff during the forecast period is the product of snowmelt runoff. By measuring snow water equivalent in the mountain snowpack, as well as other parameters such as precipitation and streamflow up to the forecast date, a more accurate estimate of future runoff can be made than one based on historical inflow data alone. Volume inflow forecasts are issued beginning January 1 of each year. The forecasts are updated on the first of each month until August 1st.

5 Hydrometeorologic Network

Hydrometeorological data is required to plan, monitor, and operate facilities in the Wahleach system's watershed. Characteristics of the hydrometeorological data collection stations referenced for Wahleach are summarized in Table 2. Locations of hydrometeorological stations within the watershed are shown in Figure 1.

Table 2: Hydrometeorological stations referenced for forecasting, operations and planning.

Station	Type	ID	Elev (m)	Latitude	Longitude	Characteristics
Hope Airport	AES	1113540	39	49.22	121.29	Temp./Precip.
Abbotsford Airport	AES	1100030	58	49.20	122.22	Temp./Precip.
Agassiz	AES	1100120	15	49.15	121.48	Temp./Precip.
Chilliwack	AES	1101530	56	49.10	121.57	Temp./Precip.
Chilliwack River Hatchery	AES	1101N65	42	49.05	121.42	Temp./Precip.
Chilliwack River at Foley Creek	AES	1101565	38	49.06	121.38	Temp./Precip.
Laidlaw	AES	1104488	35	49.21	121.35	Temp./Precip.
Rosedale	AES	1106865	11	49.11	121.48	Temp./Precip.
Wahleach Reservoir	DCP	WAH	641	49.14	121.37	Temp./Precip.
Wahleach Lake	MWLAP	1D09P	1400	49.14	121.35	Snowcourse
Blackwall Peak	MWLAP	2G03P	1940	49.06	120.46	Snowcourse
Klesilkwa	MWLAP	3D03A	1130	49.08	121.18	Snowcourse

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