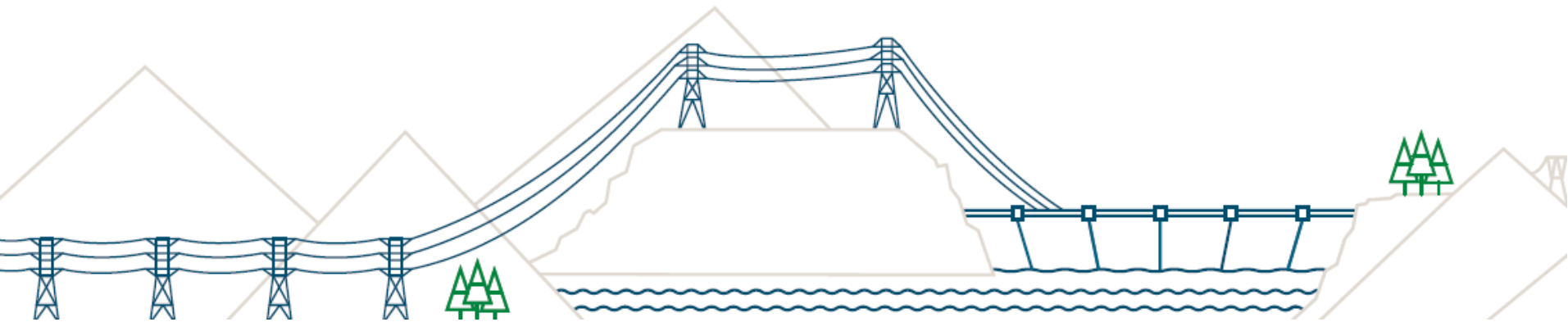


Kinbasket Reservoir Debris Management Program

Mark Sherrington

Water License Requirements Dept.

BC Hydro



May 30, 2022

Debris Program and Revegetation

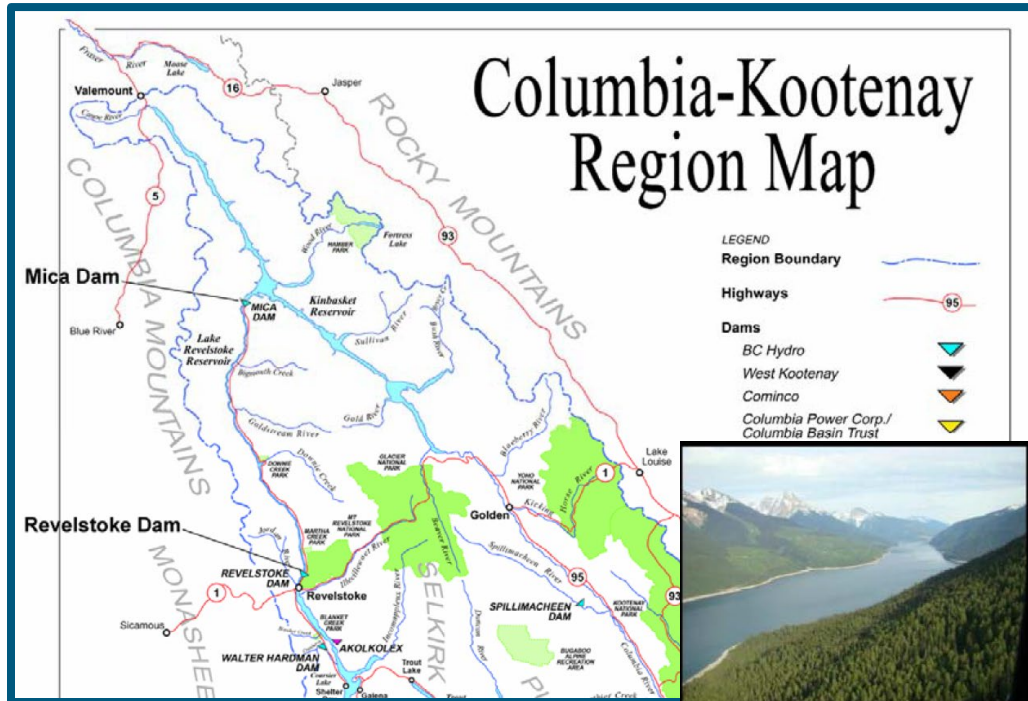
1. Introductions
2. Columbia System Overview
3. Water Use Plan (WUP) Overview
4. What does BC Hydro do manage debris? (CLBWKS16)

Data summary, program challenges, benefits and successes

5. Vegetation Case Study: CLBWORKS-1/CLBMON-9 Bush Causeway Debris Mounds

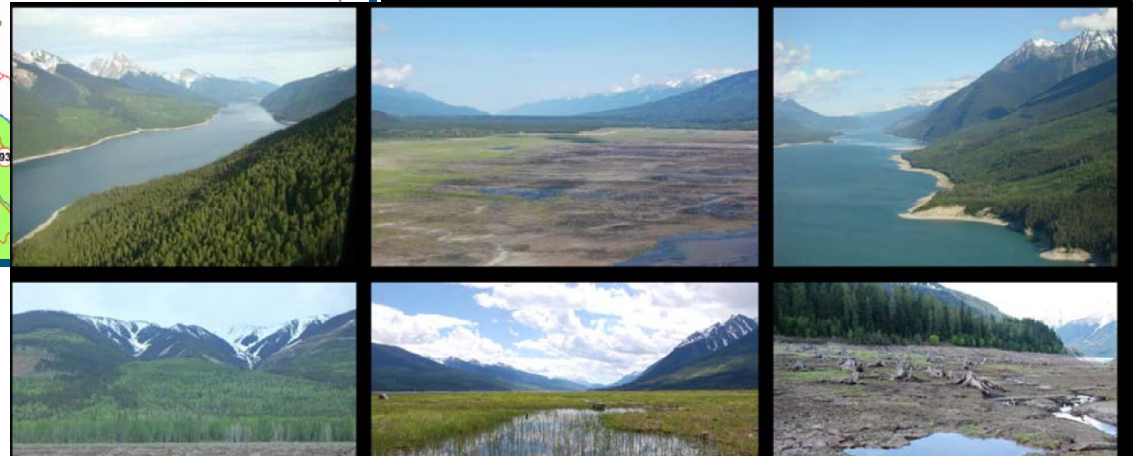
Kinbasket Reservoir

Upper Columbia River System



Kinbasket Reservoir

- Located in southeastern British Columbia
- Mica Dam 1973
- Kinbasket Reservoir ~ 216 km long; 430 km²; ~42,650 ha flooded
- Annual operating range: 707.41–754.38 m ASL (\bar{x} annual range = ~ 25 m)
- Shoreline steep and rocky, but low-lying land and alluvial fans exist



Water Use Planning: 13 Steps

Steps 1-11

Step 12

Step 13 – Periodic Review

*BC 13 step guidelines

Consultative Committee

WUP

Approval

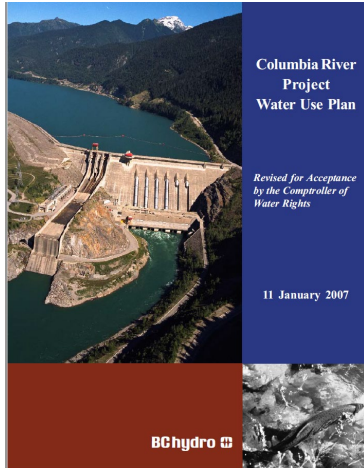
WUP Order

Constraints, monitoring, physical works

WUP Order Review

Approval

WUP Order



Columbia River Project Water Use Plan

Revised for Acceptance by the Comptroller of Water Rights

11 January 2007

BC Hydro

Province of British Columbia
Water Act

ORDER
Water Act
Sections 87 and 88

No. 0212269, 0115688, 0161431, 0210847, 0202694, 0285200, 0199585, 00073, 3005075 and 3005074.

WHEREAS British Columbia Hydro and Power Authority (BC Hydro) is the owner of the Bridge River hydroelectric system which comprises the Lupton, Edge 1, Bridge 2, and Beton generating stations, the La Jole, Terraghi, and ten dams, Downtown, Carpenter and Beton reservoirs, and the Capoose version facilities, in respect of which it holds Final Water Licenses 126279, 6278, 126280, 126281, 126286, 126287, 126288, 126282, 126283, 126284, 6250 and 126259;

WHEREAS an order issued July 28, 2000 requires flow releases from Terraghi in and related monitoring requirements;

WHEREAS BC Hydro has engaged in public consultation to determine values system parameters and to develop operating procedures which may provide netra as described below;

WHEREAS the licensee has submitted the Bridge River Power Development Water Use Plan dated March 17, 2011, which recommends operational changes the Bridge River hydroelectric system and recommends additional works in as influenced by the system, with the intent of providing benefits to fisheries and wildlife habitat, shoreline conditions, recreation and flood mitigation;

WHEREAS the Bridge River Power Development Water Use Plan has proposed a monitoring programme to determine whether operating the facility in accordance with the operating parameters and procedures in the Water Use Plan will provide the expected benefits; and

WHEREAS I have accepted the Bridge River Power Development Water Use Plan dated March 17, 2011;

I HEREBY ORDER THAT:

1. The Order dated July 28, 2000 for flow releases at Terraghi Dam and monitoring of the lower Bridge River, is hereby revoked.

Page 1 of 12

BC Hydro

Columbia River Project Water Use Plan
Monitoring Program Terms of Reference
Physical Works Terms of Reference
KINBASKET AND ARROW LAKES RESERVOIRS
REVEGETATION MANAGEMENT PLAN

- CLBMON-9 Kinbasket Reservoir Monitoring of Revegetation Efforts and Vegetation Composition Analysis

25 January 2008

BC Hydro

Columbia River Project Water Use Plan
Physical Works Terms of Reference
KINBASKET AND ARROW LAKES RESERVOIRS
RECREATIONAL MANAGEMENT PLAN

- CLBWORKS-23 Kinbasket and Arrow Lakes Reservoirs Debris Removal Environmental Review

27 April 2007

BC Hydro Power smart

How can we help? Sign Up Log In

Accounts Energy savings News Projects & operations Community Work with us Outages & safety

Home » About us » Climate leadership » Conservation » Water Use Plans » Southern Interior

Southern Interior Water Use Plans

The Water Use Plan aims to find a sustainable balance between competing uses of water through a consultative planning process designed to consider environmental, social and economic values.

Find more information below on water use planning projects for BC Hydro's hydroelectric facilities located in the Southern Interior:

- Aberfeldie
- Columbia River
 - Kinbasket Reservoir Fish and Wildlife Information Plan
 - Kinbasket and Arrow Reservoirs Revegetation Management Plan
 - Kinbasket and Arrow Recreation Management Plan
 - Revelstoke Flow Management Plan
 - Columbia River White Sturgeon Management Plan
 - Arrow Reservoir Operations Management Plan
 - Arrow Reservoir Wildlife Management Plan
 - Lower Columbia River Fish Management Plan
 - Heritage Management Plan
- Duncan Dam
- Elko
- Seven Mile
- Shuswap Falls and Sugar Lake
- Spillimacheen
- Walker Hardman
- Whitishan

WATER USE PLANS

- Lower Mainland
- Northern Interior
- Southern Interior
 - Aberfeldie
 - Columbia River
 - Duncan Dam
 - Elko
 - Seven Mile
 - Shuswap River
 - Spillimacheen
 - Walker Hardman
 - Whitishan
- Vancouver Island
- FAQs

Kinbasket Debris Management

2007 Order requirements

- “Monitor site-specific targets for debris management activities, determine best practices, and inventory existing debris fields and sources of new debris recruitment in Kinbasket Reservoir.” (Conditional Order 76973-35/Columbia, Clause 1a)
- “Removal of floating debris immediately following a full pool event (at or above 2470 feet) in Kinbasket Reservoir” (Conditional Order 76973-35/Columbia, Clause 1c)
- “Submit an environmental review to assess potential impacts of debris removal on other interests such as fish and wildlife and identify potential uses of debris for fish habitat and wetland habitat restoration in Kinbasket Reservoir (Schedule A, Clause 3a)

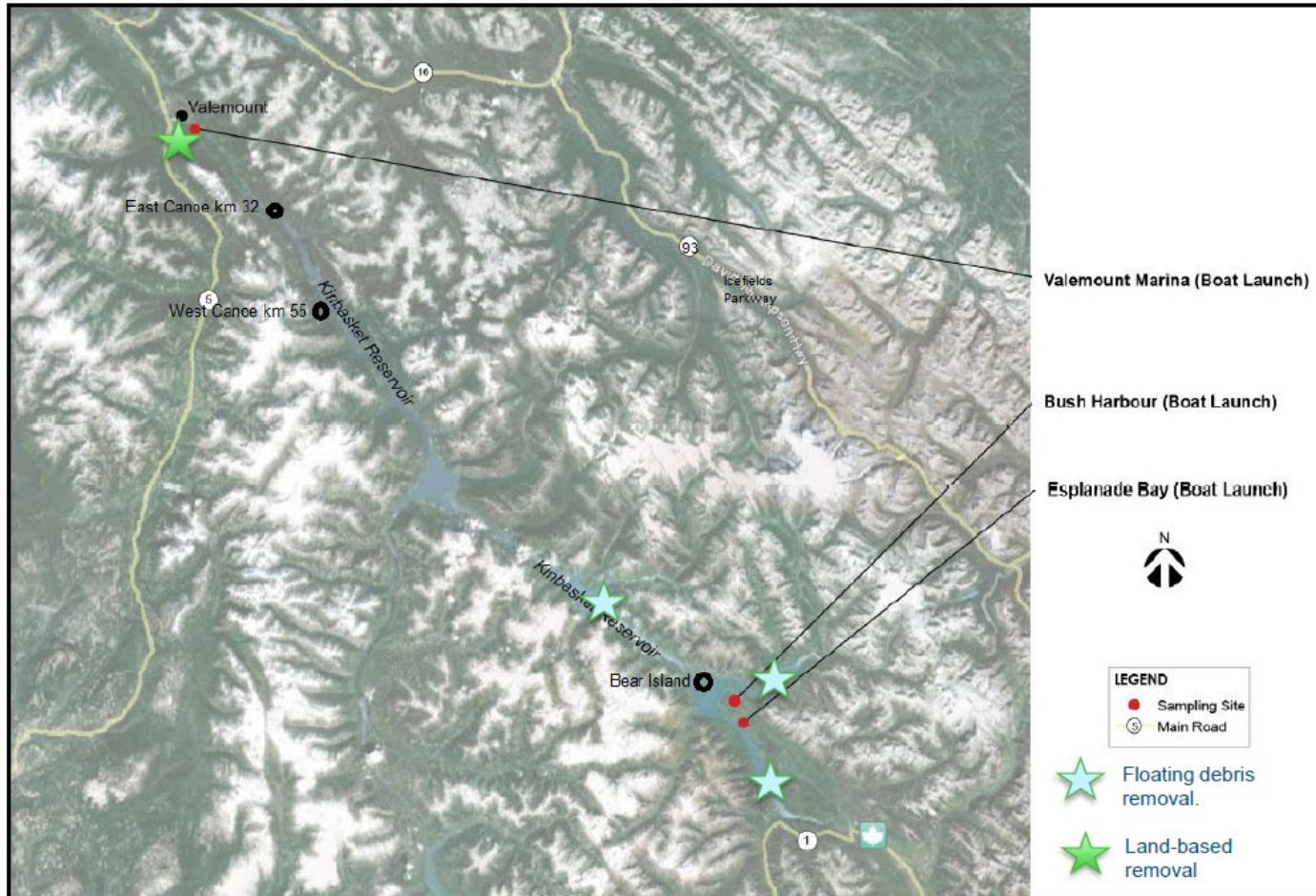
Kinbasket Debris Management Objectives

CLBWORKS-16

- ❖ Shore-based woody debris collection and disposal.
- ❖ Increase recreation and boat access/safety/fishing activity.
- ❖ Prescribed reservoir debris removal in Kinbasket since 2008.
- ❖ In 2007, independent debris committees were established in both Golden and Valemount.
- ❖ Kinbasket Debris Committee revises strategy annually.

Kinbasket Reservoir Wood Debris Management Locations

Debris management as recommended by committees

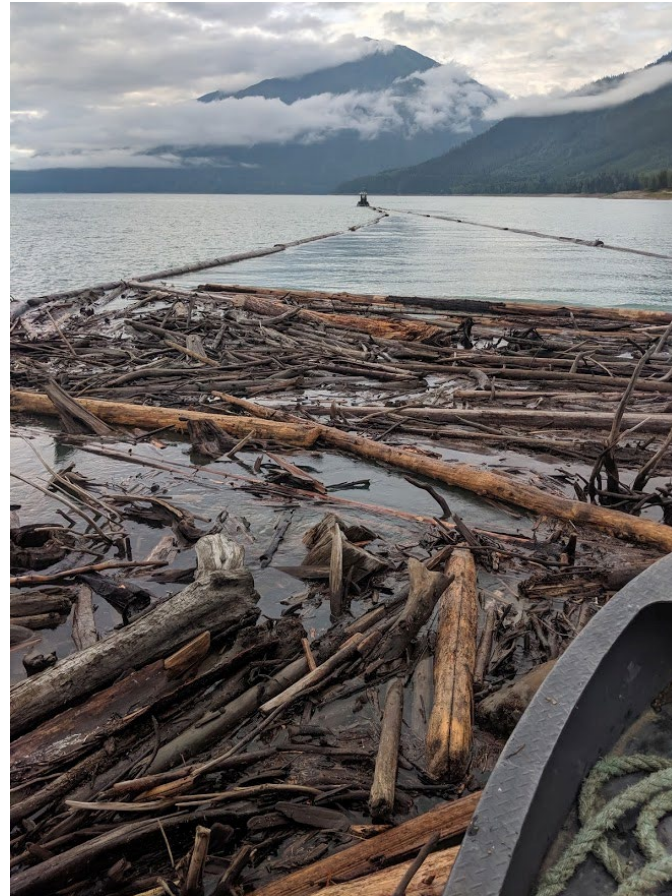


Shore-based and Floating debris removal

Floating debris program based out of Bush Harbour



- Debris collection from upper drawdown area
- Avoids areas with archaeology and vegetation sensitivities - preplanning

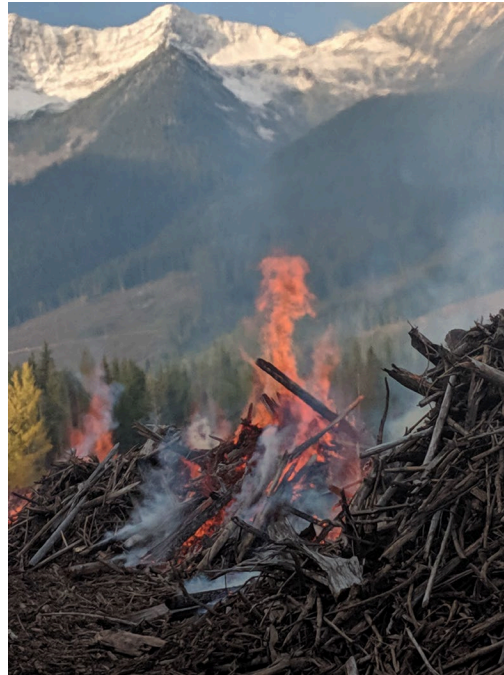


Debris Removal Process

Debris piles burned in early spring or fall



Tug Boat and Excavator
at Bear Island; Burning piles in fall.



- Debris collection from shallow water using hoe-chucking technique
- Avoids ground impact in areas with archaeology and vegetation sensitivities
- Program Order - wood for habitat enhancement
- Debris burning is regulated for timing (venting conditions and forest fire risk)

Debris from 1973-1974 reservoir clearing



Reservoir Operations and Debris Mgmt

Debris is deposited and redeposited in natural collection areas



June 2019



Sept 2019



Aug 2020



June 2021

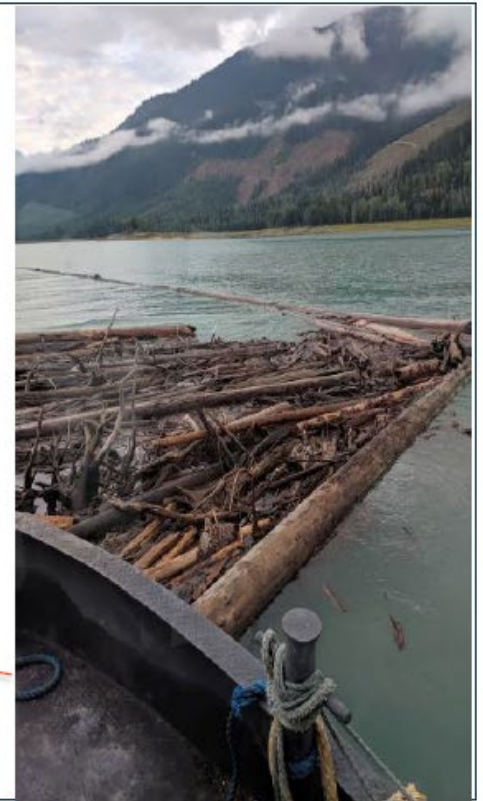
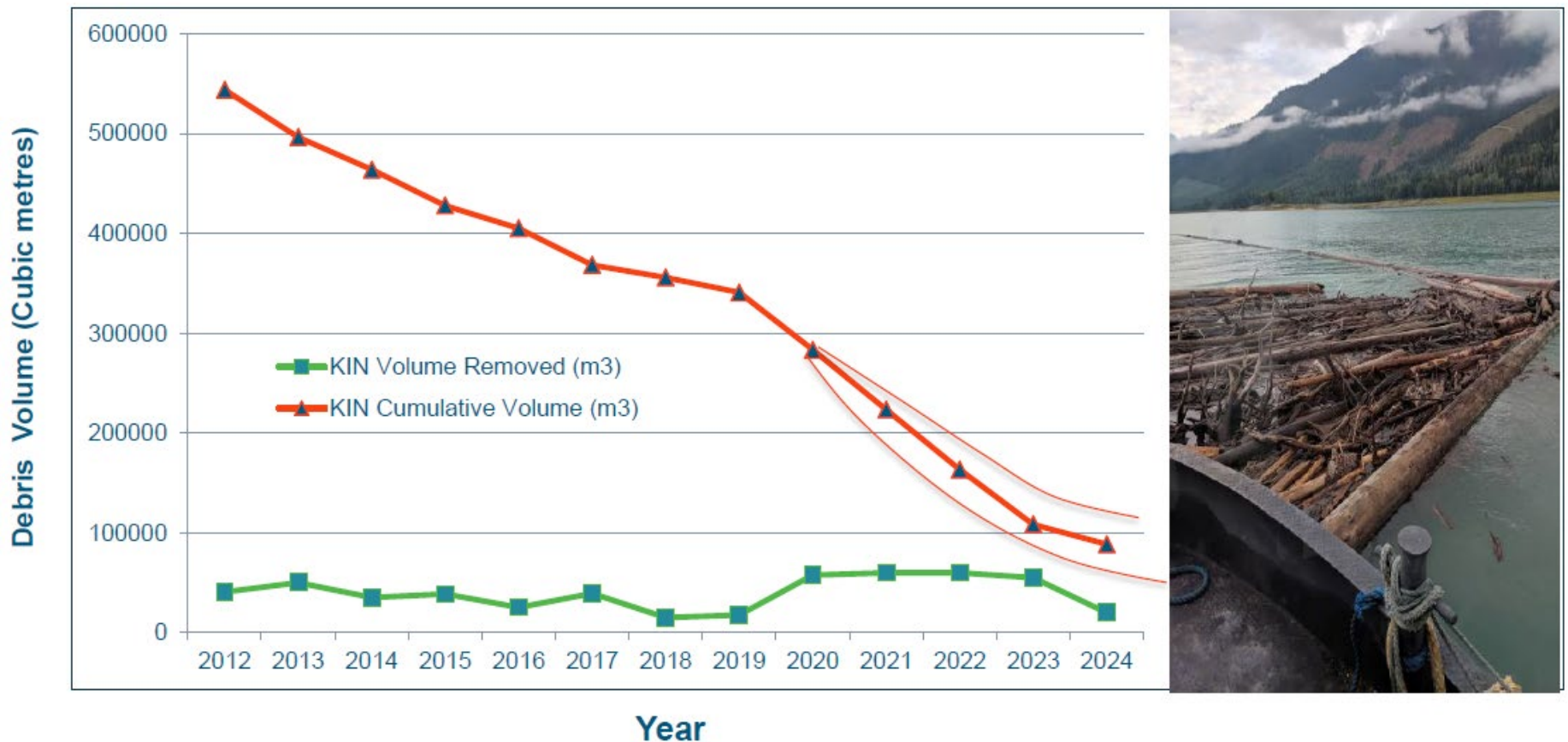
Debris Inputs to Kinbasket Reservoir

River inputs, avalanches and landslides total 5000-7000 cubic metres/year



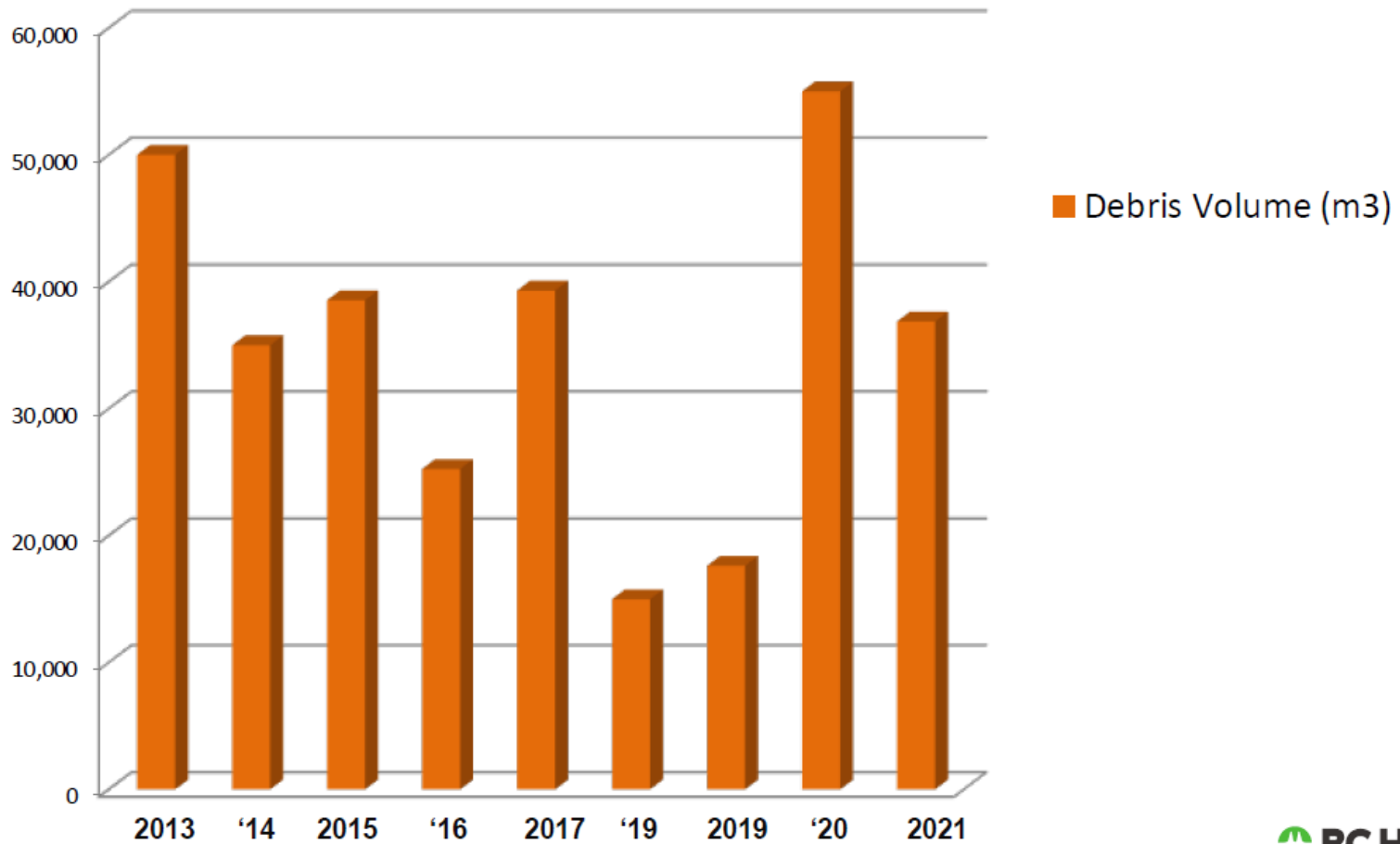
Kinbasket Reservoir Debris Removal 2012-2020

Debris removal oscillates year to year



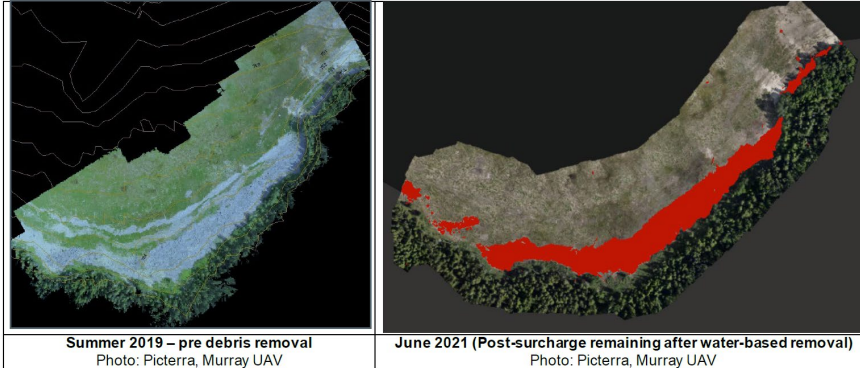
Debris Volumes

Annual collection 2013-2021

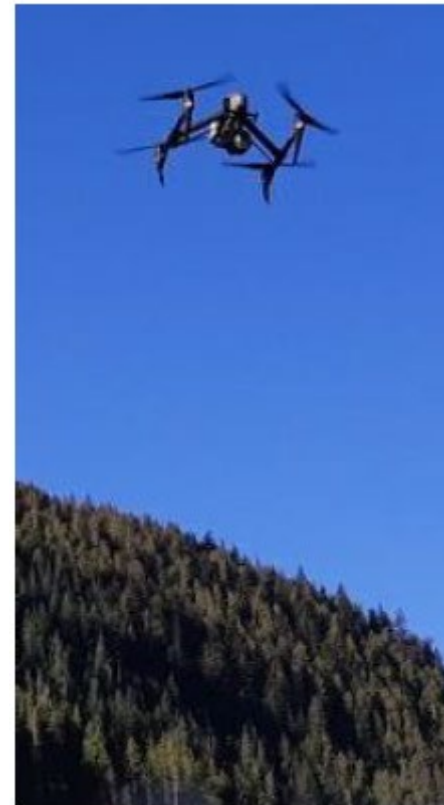


Quantifying Debris from the air

Bear Island Debris Coverage – Comparison of 2019 and 2021 CLBWORKS-16



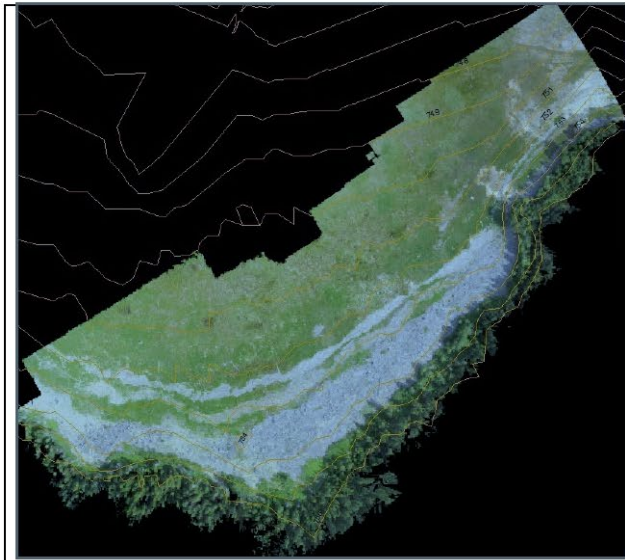
- **Drones/Unmanned Autonomous Vehicles**
- DJI Inspire 2 and DJI Matrice 300 RTK.



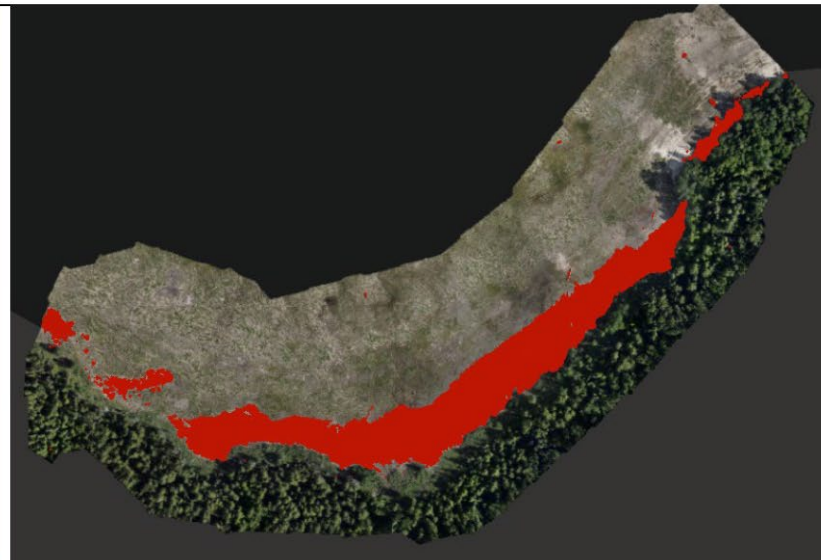
UAV uses for inventory

Area and volume remaining for planning purposes

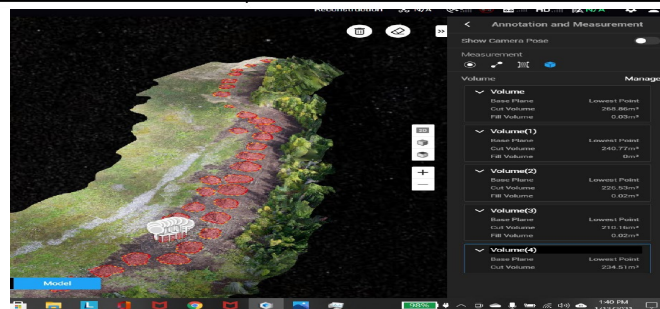
Bear Island Debris Coverage – Comparison of 2019 and 2021 CLBWORKS-16



Summer 2019 – pre debris removal
Photo: Picterra, Murray UAV



June 2021 (Post-surge remaining after water-based removal)
Photo: Picterra, Murray UAV



How to manage debris with interests in mind?



• Planning

- Where to go next to remove debris?
- What environment sensitivities and historical resources are there?
- Is it a site where the environment could be enhanced with removal of wood debris?



For more information on WUP Programs

Terms of Reference and Reports

https://www.bchydro.com/toolbar/about/sustainability/environmental_responsibility/water-use-plans/southern-interior.html

CLBWORKS-23 Kinbasket and Arrow Lakes Reservoirs Debris Removal Environmental Review and CLBWORKS-16 Debris Inventory and Management

BC Hydro
Power smart

About us Careers Newsletters Contact us Sign up Log in

Accounts Energy savings News Projects & operations Community Work with us Outages & safety

Home > About us > Climate leadership > Environmental Responsibility > Water Use Plans > Southern Interior

Southern Interior Water Use Plans

The [Water Use Plan](#) aims to find a sustainable balance between competing uses of water through a consultative planning process designed to consider environmental, social and economic values.

Find more information below on water use planning projects for BC Hydro's hydroelectric facilities located in the Southern Interior:

- Aberfeldie
- Columbia River
 - [Kinbasket Reservoir Fish and Wildlife Information Plan](#)
 - [Kinbasket and Arrow reservoirs Revegetation Management Plan](#)
 - [Kinbasket and Arrow Recreation Management Plan](#)
 - [Revelstoke Flow Management Plan](#)
 - [Columbia River White Sturgeon Management Plan](#)
 - [Arrow Reservoir Operations Management Plan](#)
 - [Arrow Reservoir Wildlife Management Plan](#)
 - [Lower Columbia River Fish Management Plan](#)
 - [Heritage Management Plan](#)
- Duncan Dam
- Elko
- Seven Mile
- Shuswap Falls and Sager Lake
- Spillimacheen
- Walter Hardman
- Whitban

WATER USE PLANS

- Lower Mainland
- Northern Interior
- Southern Interior**
 - Aberfeldie
 - Columbia River
 - Duncan Dam
 - Elko
 - Seven Mile
 - Shuswap River
 - Spillimacheen
- Vancouver Island
- FAQs

BC Hydro
Power smart

About us Careers Newsletters Contact us Sign up Log in

Accounts Energy savings News Projects & operations Community Work with us Outages & safety

Home > About us > Climate leadership > Environmental Responsibility > Water Use Plans > Southern Interior > Columbia River > Kinbasket and Arrow recreation management plan

Kinbasket and Arrow Recreation Management Plan

This Plan is aimed at improving recreational opportunities through boat ramp improvement projects and debris management in Kinbasket Reservoir, Arrow Lakes Reservoir and the lower Columbia River.

Annual Reports

- [January 2021](#) (PDF, 310 KB)
- [January 2020](#) (PDF, 4.7 MB)
- [January 2019](#) (PDF, 176 KB)
- [January 2018](#) (PDF, 283 KB)
- [January 2017](#) (PDF, 172 KB)
- [January 2016](#) (PDF, 310 KB)
- [January 2015](#) (PDF, 316 KB)
- [January 2014](#) (PDF, 206 KB)
- [January 2013](#) (PDF, 80 KB)
- [January 2012](#) (PDF, 133 KB)
- [January 2011](#) (PDF, 141 KB)
- [January 2010](#) (PDF, 131 KB)
- [January 2009](#) (PDF, 211 KB)
- [January 2008](#) (PDF, 102 KB)

COLUMBIA RIVER

- [Kinbasket reservoir fish and wildlife information plan](#)
- [Kinbasket and arrow reservoirs revegetation](#)
- [Kinbasket and Arrow recreation management plan](#)
- [Revelstoke flow management plan](#)
- [Columbia River white sturgeon management plan](#)
- [Arrow Reservoir operations management plan](#)
- [Arrow Reservoir wildlife management plan](#)
- [Lower Columbia River fish management plan](#)
- [Heritage management plan](#)

Questions?

Debris and Vegetation Programs





BC Hydro

Power smart