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May 31, 2021

Mr. Patrick Wruck
Commission Secretary and Manager
Regulatory Support
British Columbia Utilities Commission
Suite 410, 900 Howe Street
Vancouver, BC V6Z 2N3

Dear Mr. Wruck:

**RE: Project No. 1598907
British Columbia Utilities Commission (BCUC or Commission)
British Columbia Hydro and Power Authority (BC Hydro)
Salmon River Diversion Ceasing of Operations Project (Project)
Compliance with Commission Order No. G-96-17 Directive 3
PUBLIC Completion Report**

BC Hydro writes in compliance with Commission Order No. G-96-17 Directive 3, to provide its public Project Completion Report (the **Report**). Commercially sensitive and contractor-specific information has been redacted pursuant to section 42 of the *Administrative Tribunals Act* and Part 4 of the Commission's Rules of Practice and Procedure.

A confidential version of the Report is being filed with the Commission only under separate cover.

For further information, please contact Chris Sandve at 604-974-4641 or by email at bhydroregulatorygroup@bhydro.com.

Yours sincerely,



Chris Sandve
Chief Regulatory Officer

bh/rh

Enclosure

**Salmon River Diversion Ceasing of Operations
Project**

Project Completion and Evaluation Report

May 31, 2021

PUBLIC

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1 Introduction

The following is BC Hydro's Project Completion and Evaluation Report for the Salmon River Diversion Cease of Operations Project (**Project**), which involved the decommissioning of the facility and remediation of the site. To avoid duplication of effort, this report has been prepared to fulfill both BC Hydro's own internal Project completion reporting as well as to serve as the Project Final Completion Report for the BCUC. For ease of readability and completeness, this document incorporates Project update information previously provided to the Commission in a report following substantial completion of the Project in late 2018 (**Substantial Completion Report**). Text reproduced directly from the Substantial Completion Report is displayed in orange text.

1.1 Background

The Salmon River Diversion (**Diversion**) was a run-of-river diversion facility located on eastern Vancouver Island about 30 km west of Campbell River, which diverted water from the Salmon River into the Lower Campbell Reservoir where it augmented water flows through the Ladore and John Hart Generating Stations. The diversion consisted of a rock-filled timber crib diversion dam (Dam) and canal between the Dam and Brewster Lake (**Canal**) built in 1957-1958. BC Hydro considered an investment to refurbish the Diversion, including improvements to fish passage, which would have allowed continuing operation, but determined in April 2016 that the economic case was marginal, and did not weigh favourably in comparison to ceasing operations and the associated safety, ecological and social benefits.

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Figure 1 Map of Former Salmon River Diversion



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1.2 Project Objectives

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The planned scope of work included removal of the Dam, the mechanical equipment at the Headworks, the fish screen and the Paterson Creek flume (the **Flume**), as

4

5

well as providing a naturalized streambed at the Dam Site. Removal of the Dam also necessitated removal of materials that had potentially been contaminated by

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7

creosote leaching from the timber crib over the life of the Dam. With the exception of

8

the need to decommission four groundwater wells at the Paterson Creek site,¹ the

9

work has been completed and the Project objectives have been achieved. To

10

demonstrate that the site remediation has been completed to the necessary

11

standards, BC Hydro received two Certificates of Compliance in April 2021 from the

12

Ministry of Environment and Climate Change Strategy (**MoE**): one for the former

13

Salmon River Diversion Dam site and another for the former Paterson Creek flume

14

site. The Certificates of Compliance and the associated application process is

15

described further in sections [2](#) and [8.2](#). The Certificates are provided as [Appendix A](#)

16

to this report.

¹ The four groundwater wells at the Paterson Creek site were undertaken for the purposes of testing and monitoring. BC Hydro plans to complete this work by September 30, 2021, prior to the Financial Close of the Project. See section 12.

2 BCUC Application, Decision and Progress Reporting

On March 7, 2017, BC Hydro submitted an application to the BCUC requesting permission to permanently cease operation of the Diversion pursuant to section 41 of the Utilities Commission Act and to remove the Dam, associated infrastructure at the Dam (**Headworks**), and portions of the Canal (**Application**). On June 16, 2017, the BCUC issued Order No. G-96-17 (**Order**) and Decision which granted BC Hydro permission to permanently cease operation of the Diversion and decommission the Dam, the Headworks, and portions of the Canal. In the decision the Commission found that the Project was cost-effective and in the public interest, with an expected cost of \$15.04 million and an authorized cost of \$17.27 million. Section 3 of the Order included the following reporting requirements: *“BC Hydro is directed to file a report with the Commission within six months of substantial completion of the cease operations and decommission work, summarizing the costs of the work and its accounting treatment, and providing explanation and justification of any material variances from the project plan, scope, schedule, budget or quality. BC Hydro is to also file a final completion report including similar information to the Heber Diversion Cease of Operations project Final Completion Report after obtaining the Certificate of Compliance issued by the Ministry of Environment, which may take 18 months to two years from substantial completion.”* On November 1, 2018, BC Hydro submitted the Substantial Completion Report after the construction work was complete. In accordance with section 3 of the Order, the Substantial Completion Report summarized the cost of work and its accounting treatment and provided explanation and justification of any material variances from the Project plan, scope, schedule, budget or quality. The Substantial Completion Report also contained comprehensive information on the implementation of the Project.

As described on pages 11 and 12 of the Substantial Completion Report, the conditions at each site required different and more extensive environmental remediation than originally anticipated because of significantly higher levels of

1 contaminated materials and the need to manage much higher volumes of water than
2 expected at the site. At the time of the Substantial Completion Report, it was
3 believed that the Dam site conformed with the MoE Contaminated Site Regulation
4 Schedule 3.4 numerical standards for sensitive sediments. Additional investigations
5 and monitoring at the Flume at Paterson Creek² site were also required to determine
6 whether the site qualified for a numeric standards based Certificate of Compliance or
7 whether a risk assessment for a risk-based Certificate was required. After further
8 investigation and testing at both sites, it was determined that a more extensive
9 risk-based Certificate of Compliance application was required to meet MoE's
10 Contaminated Sites Regulation at the former Salmon River Dam site whereas a
11 numeric standards-based Certificate of Compliance process could be followed for
12 the Paterson Creek Flume site. These additional requirements led to the schedule
13 delays, which are further discussed in sections [5](#) and [8.2](#). On December 14, 2020,
14 BC Hydro submitted the Certificates of Compliance applications for the Salmon
15 River and Paterson Creek Flume sites to the MoE.³ On April 7, 2021, the two
16 requested Certificates of Compliance were issued and are included in [Appendix A](#).

17 The need for additional planning, testing and documentation to support the
18 risk-based Certificate of Compliance application for the Salmon River Dam site, and
19 the need to prepare documentation for two separate Certificates of Compliance
20 applications resulted in an increase to the overall cost of the Project and a material
21 delay in the submission of this report to the BCUC beyond the period expected in the
22 Order, and also delays in Project completion and Project financial close. These
23 impacts are described in sections [4](#), [5](#), and [8.2](#).

² The Flume extends the canal over Paterson Creek, which itself discharges into the Salmon River downstream of the Diversion. The Paterson Creek flume was 83m long and included a 55 m elevated trestle section which passed about 6m above Paterson Creek. The substructure and framing timbers were creosote treated.

³ Certificate of Compliance applications are submitted to the MoE via the Contaminated Sites Approved Professionals of British Columbia (**CSAP Society**), an independent organization that accredits professionals to review environmental certification applications.

3 Engineering and Construction Management

The key engineering and construction successes and challenges are summarized below.

Success Factors

1. Early Engagement with Contractors –The Project engaged with Klohn Crippen Berger + Hatch (**KCB+H**), the design consultant, early in Feasibility stage and, shortly thereafter, with Kwikw Construction Limited Partnership (Kwikw), the primary construction contractor. Kwikw was engaged on the basis of an “Open-Book” process, in which BC Hydro and the Contractor jointly review the proposed schedule of prices, including the underlying construction methodology, equipment utilization, expected productivity and labour force to determine a construction plan and price. The early engagement between the Design Consultant, Contractor, and Owner, facilitated knowledge sharing and timely development of construction plans for decommissioning. Furthermore, there was a collaborative understanding of the work and methods between KCB+H, Kwikw and BC Hydro, which facilitated a timely and considered response to issues arising during construction. Revisions to the water diversion scheme and the handling and treatment of significant increases in the amount of contaminated water and soil during the Project are examples of situations where BC Hydro, Kwikw, and KCB+H collaboratively understood the risk and how to address the challenging conditions on the ground.
2. Early First Nation and Stakeholder Engagement – Early and regular engagement with potentially impacted First Nations and government agencies facilitated early input into the Project design. This minimized changes at critical times in the Project. Two examples are the establishment of fish passage criteria for Salmon River and the naturalization of riprap on the banks of Salmon River.

1 *Challenging Developments*

2 The area of contaminated soils at the Salmon River Dam site was larger than
3 anticipated and planned, leading to the need to manage larger volumes of water,
4 remove a larger volume of contaminated soil and treat a larger amount of
5 contaminated water than planned. Key challenges contributing to the level of
6 remediation being larger than anticipated include:

- 7 3. **Limitations of Pre-construction Field Testing – Portions of the site were**
8 **contaminated with [Polycyclic Aromatic Hydrocarbon] (PAH), resulting from**
9 **creosote leaching from the dam’s timber cribbing. Since the site was located in**
10 **and adjacent to a flowing river, it was not possible to perform the testing**
11 **required to establish the extent and degree of contamination [before**
12 **construction work began]. In future [projects], the limitations of extrapolating**
13 **experience from similar projects should also be recognized.**
- 14 4. **Managing Unanticipated Contamination – Test-pitting during construction may**
15 **have allowed for earlier de-lineation of the contamination and smoother**
16 **management of removal and disposal. However, it is considered that the**
17 **reduced [constrained] window for construction would have been unlikely to**
18 **accommodate both additional investigation and remediation in this case. Future**
19 **projects should consider the trade-off between the time to undertake test pitting**
20 **during construction and the value of information potentially gained.**
- 21 5. **Planning for Field Reviews – A field review plan was not in place and**
22 **responsibilities for inspection and field direction were not clearly defined. As per**
23 **new Engineers and Geoscientists British Columbia and Portfolio Management**
24 **policies, a field review plan considering the roles of Contract and Construction**
25 **Management, Engineering, and external consultants would have improved the**
26 **understanding of site inspection and contractor communication on site.**
- 27 6. **Work Planning – Challenges arose on site because work planning (particularly**
28 **for the dewatering and excavation scope) was conducted under significant time**

1 pressure, largely because of unforeseen conditions. The volume of
2 contaminated water to be treated was much higher than anticipated, and with
3 water continuing to flow in the work area, a response plan had to be developed
4 and implemented immediately. The need for such a rapid response limited the
5 opportunity for oversight and engineering review [oversight, engineering and
6 work activities were undertaken in real time].

7 **4 Cost Variance Explanations**

8 [Table 1](#) below shows the Expected Amount as set out in the BCUC Order (**BCUC**
9 **Reference Estimate**) in column A, the current Project Estimate at Completion
10 (**EAC**) in column B, and the actual costs to March 30, 2021 in column F.

11 Notes aligning with the numbers in column E are provided below the table. Detailed
12 cost information is commercially sensitive and has been redacted in the public
13 version of this document.

1
2
3

Table 1 Project Expenditure Summary – Comparison of the EAC and the BCUC Reference Estimate Amount

\$M (Nominal \$ unless specified otherwise)		A	B	C	D	E	F	G	H
Row	Description	BCUC Reference Estimate (BCUC Order G-96-17)	Estimate at Completion (EAC)	\$ Variance (B - A)	% Variance (C / A)	Notes	Actual Costs to Date (to March 30, 2021)	% Complete	Remaining Forecast Amount (B-F)
[Redacted Content]									
13	BC Hydro Expected Amount	15.0	19.9	4.9	32%		19.7	99%	0.2
14	Project Reserve	2.2	0.2	(2.0)	-90%				
15	BC Hydro Authorized Amount	17.3	20.1	2.9	17%				

4 *Material Cost Variance Explanations:*

5 In [Appendix B](#) of the Substantial Completion Report, BC Hydro provided a project
6 cost variance table by driver for the cost variance. These variance notes are
7 structured to allow comparison between the Substantial Completion Report and this
8 Project Completion and Evaluation Report.

9 Note 1 Pre-Implementation costs were about [REDACTED] lower in Definition phase
10 than the original forecast. Approximately [REDACTED] of the variance is for
11 early work that was originally planned to be undertaken prior to
12 Implementation including site preparation and access but was incurred as
13 an Implementation Phase cost. As well, the Project spent approximately

1 [REDACTED] less on Engineering, Environmental, Stakeholder Engagement
2 and Indigenous Relations costs.

3 Note 2 In total, actual Direct construction costs were [REDACTED] than the
4 original forecast.⁴ [REDACTED] of the increase is primarily attributed to
5 unforeseen ground conditions which resulted in: i) a higher than expected
6 volume of contaminated soil to be remediated and replaced, and
7 ii) additional efforts to manage water at both sites, including revisions to the
8 planned diversion scheme and an increased volume of water requiring
9 treatment.

10 **Contaminated Soil Remediation and Replacement** - During removal of
11 the dam, river bed soils were found to be contaminated much further
12 upstream than had been expected, resulting in the need to remove, store,
13 treat and backfill higher than expected quantities of contaminated soil. As
14 described in the Substantial Completion Report, this factor increased direct
15 Implementation Phase Project costs by [REDACTED].

16 **Water Handling and Infiltration** - Operational and environmental
17 constraints did not permit field investigations at the site, therefore plans
18 were based on available data, informed by lessons learned from the Heber
19 Decommissioning Project. Field conditions encountered during construction
20 rendered the proposed diversion unfeasible due to the increase in the
21 volume of water to be handled and problems related to seepage under both
22 the upstream and downstream coffer dams in their planned forms and
23 location. This resulted in water infiltration in the work area, including the
24 contaminated portions of the Dam site. A new diversion scheme was
25 developed in the field, which included an extension of the diversion to

4 [REDACTED]

1 discharge further upstream from the work site, and an elaborate pumping
2 scheme to by-pass the site and draw down the local water table to reduce
3 groundwater infiltration.

4 Additionally, there was a substantial increase in the amount of
5 contaminated water requiring treatment. The increased amount of
6 contaminated soil directly exposed a greater amount of water to
7 contamination. Further, an extensive clay layer upstream of the Dam was
8 discovered. The fine clay particulate significantly increased the amount of
9 contaminated water produced as contaminants tend to bind to the fine
10 particulates in sediment and clay. This simultaneously reduced the capacity
11 of the water treatment upstream, since fine particles reduce the efficiency
12 of water treatment plants.

13 BC Hydro estimates that the need to design and implement the new
14 diversion scheme plus the treatment of increased level of contaminated
15 water increased direct costs on the Project by about [REDACTED].

16 Of the remaining [REDACTED] cost variance in direct Implementation Phase
17 costs, [REDACTED] pertains to Early Works activities: [REDACTED] was
18 budgeted as a Pre-Implementation activity and [REDACTED] was the result of
19 an increase in Project early work scope. An additional [REDACTED] variance
20 was caused by additional Project scope related to the intake structure
21 demolition, [REDACTED] was the result of partial canal demolition and study⁵
22 and [REDACTED] was the result of an increase in general Project
23 requirements driven by the added complexity experienced by the Project.
24 The remaining minor difference is due to rounding.

⁵ The study work at the canal involves research and monitoring of various restoration options for future decommissioning of the canal and other BC Hydro facilities. See also section 12 and Appendix C of the Substantial Completion Report.

1 Note 3 Indirect construction costs for project management and engineering costs
2 are [REDACTED] higher than anticipated at the time of the BCUC Application.
3 [REDACTED] is the result of additional engineering work to address water
4 management issues for the Project. The remaining [REDACTED] is for the
5 additional project management effort required to close the Project, including
6 meeting internal and regulatory (BCUC and MoE) requirements.

7 Note 4 Indirect costs associated with environmental work, stakeholder
8 engagement and First Nations engagement during Implementation Phase
9 are [REDACTED] higher than the original forecast. BC Hydro had initially
10 planned to submit one standards-based CoC application for the whole
11 Project site. However, monitoring of the site after completion of the
12 decommissioning work identified that a risk-based assessment was
13 required for the Salmon River site, which took longer and required more
14 resources to support than the planned standards-based CoC application.
15 Further, it was determined that BC Hydro needed to prepare and submit
16 two separate CoC applications (one standards-based application for
17 Paterson Creek and a risk-based application for Salmon River) as opposed
18 to a single CoC as planned. Refer also to section [8.2](#).

19 Note 5 The majority of project contingency was used and assigned during the
20 Implementation Phase. Due to the drivers outlined above, the total
21 contingency was insufficient to fund cost variances. An increase to the
22 approved Expected and Authorized Amounts for the Project was therefore
23 necessary to complete the Project scope of work.

24 **5 Project Schedule Milestones**

25 In the Application, BC Hydro provided planned milestone dates up to the point that
26 the facility was decommissioned, and major restoration activities were completed.
27 [Table 2](#) provides the planned and actual completion dates for Project milestones and

1 includes two additional milestones: Certificates of Compliance Issued and Project
2 Completion Date, which were not included in the Application.

3 **Table 2 Project Milestones**

No.	Description	Original Plan or BCUC Order Date (From FFF, MMM YYYY)	Actual (A) or Forecast Date (MMM YYYY)	Impact on Schedule	Ref.
1.	Decision Issued	June 15, 2017	June 16, 2017	Completed Late (1 Day)	
2.	Definition Phase Complete	June 20, 2017	June 23, 2017	Completed Late (3 Days)	
3.	Start of Site Work	June 26, 2017	June 24, 2017	Completed Early (2 Days)	
4.	Completion of in-stream Work	September 15, 2017	September 11, 2017	Completed Early (4 Days)	
5.	Project In-Service Date	November 30, 2017	September 29, 2017	Completed Early (62 Days)	A
6.	Substantial Completion of Main Contract	NA	December 11, 2017	NA	
7.	Substantial Completion Report submitted to BCUC	6 Months from Project Substantial Completion (See No. 6)	November 1, 2018	Completed Late (5 Months)	B
8.	Certificates of Compliance Issued	July 10, 2018	April 7, 2021	Completed Late (33 Months)	C
9.	Project Completion and Evaluation Report submitted to BCUC	18 to 24 Months from Project Substantial Completion (See No. 6)	May 31, 2021	Completed Late (19 Months)	D
10.	Project Complete	October 19, 2018	June 4, 2021	Completed Late (31 Months)	C
11.	Project Financial Close	December 3, 2018	November 30, 2021	Missed (37 Months)	C

4 Ref. Comments

- 5 A Construction was originally expected to be completed in September 2017, with project acceptance
6 documentation expected to take approximately eight weeks to complete. Documentation processing was
7 completed earlier than expected.
- 8 B Section 3 of the Order states that a Substantial Completion Report is to be filed six months following
9 substantial completion of the Project. The main dismantling and removal contract reached substantial
10 completion on December 11, 2017. BC Hydro's Substantial Completion Report to the Commission was
11 delayed by about five months beyond the six-month window to allow for additional time to develop the report.
12 This included a discussion of Project lessons learned with First Nations.
- 13 C The Certificates of Compliance Issuance, Project Completion and Project Financial Close milestones have
14 been delayed by 33, 31 and 37 months respectively. The Project schedule at the time of the Application
15 allowed for about ten months (September 15, 2017 to July 10, 2018) from substantial completion to the
16 issuance of a Certificate of Compliance for the site. It was originally expected that it would take around five
17 months to complete water sampling and to prepare the Certificate application plus another five months for
18 the review and issuance by MoE. However, due to the extent and locations of contaminated materials, the

1 need to undertake extensive monitoring and testing at both Salmon River and Paterson Creek sites and the
2 need to follow a risk-based standards Certificate of Compliance process for the Salmon River site as
3 required by the MoE's Contaminated Sites Regulation, a more extensive process than originally planned was
4 required. This process commenced in October 2018 and completed in April 2021 with the receipt of two
5 Certificates of Compliance for the remediated Project sites. The steps undertaken and the time required to
6 complete the work is described in detail in section [8.2](#).

7 Following receipt of the two Certificates, BC Hydro has revised the Project Financial Close date to
8 November 30, 2021 to allow sufficient time to undertake and pay for the decommissioning of groundwater
9 wells, a requirement of the Certificate of Compliance for the Paterson Creek site and to complete financial
10 close activities.

11 D. Section 3 of BCUC Order No. G-96-17 states that a final completion report is to be filed with the Commission
12 between 18 months and two years after substantial completion and is to include the Certificate of
13 Compliance issued by MoE. This report has been delayed by about 19 months beyond the 18 to 24-month
14 window. This delay is due to the additional actions and information required to prepare and submit the two
15 Certificate of Compliance applications for the remediated Project sites, which is described in detail in
16 section [8.2](#).

17 **6 Procurement Strategy and Outcomes for Individual** 18 **Contracts Exceeding \$3 million**

19 Potential contractors were pre-qualified (and the successful contractor was selected)
20 for the rehabilitation alternative under consideration prior to April 2016. The
21 pre-qualification process included issues such as their bonding capacity,
22 demonstrated capability, and references by other owners, all focussed on their
23 suitability for a rehabilitation project, not a demolition and removal project.

24 As part of the Impact Benefits Agreement with the Wei Wai Kum and We Wai Kai
25 First Nations related to the John Hart Replacement Project, BC Hydro agreed to
26 co-manage improvements to fish passage at the Dam. As the intended rehabilitation
27 project neared implementation, BC Hydro agreed to contract the Project works with
28 Kwikw Construction Limited Partnership, a joint venture between Ketza Pacific
29 Construction (1993) Ltd and the Wei Wai Kum First Nation. This contract was
30 awarded under a "direct award" and in this situation BC Hydro typically contracts
31 through an "Open-Book" process, in which BC Hydro staff and the contractor jointly
32 review the proposed schedule of prices, including the underlying construction
33 methodology, equipment utilization, expected productivity and labour force to
34 determine an acceptable bid price. A list of all contracts greater than \$3 million is
35 provided below.

1
2

Table 3 Summary of Contracts Exceeding \$3.0 million

\$ M	A	B	C	D
Description Supplier and Scope of Supply	Initial Contract Value ¹	Forecast Contract Cost	Actuals	Variance from Initial Contract Value
				[B-A]
Kwikw Construction Limited Partnership				
Demolition and removal of the Dam, Headworks, Flume and portions of the Canal				
Total Contracts				

3 1. Estimated value at the time the contract was signed.

4 *Contract Variances*

5 [Table 4](#) below shows a breakdown of the key cost variances from the original Kwikw
6 base contract amount of [REDACTED] to the actual contract cost of [REDACTED]. The
7 cost changes are grouped to be comparable to the variance explanation shown in
8 section 4 and in the Substantial Completion Report.

9 Note that the variance amounts, and explanations described in [Table 3](#) and [Table 4](#)
10 serve a different purpose to [Table 1](#). [Table 3](#) and [Table 4](#) compare the final costs to
11 the signed contract value of the primary decommissioning contract.⁶ In contrast,
12 [Table 1](#) compares the Expected At Completion cost for the entire Project to the
13 Expected Cost for the Project that was reviewed during the Application regulatory
14 process and noted in the Order. This amount is referred to as the BCUC Reference
15 Estimate.

16 Of the [REDACTED] in additional charges, [REDACTED] resulted from the
17 discovery of significantly greater volumes of contaminated soils than originally
18 anticipated, requiring excavation/infill, temporary storage, removal, and treatment.
19 Contract pricing for the scope of work related to contaminated materials was
20 originally calculated as a provisional sum based on expected values. The actual

⁶ The primary contract was released in two parts. Stage 1 (Early Works) was awarded on May 4, 2017 and Stage 2 (Remainder of Work) was released as a change order on June 22, 2017.

1 volume of contaminated materials was significantly greater than the amount
2 originally expected (24,000 metric tonnes versus 6,000 metric tonnes budgeted).

3 [REDACTED] in additional contractual costs resulted from the need to
4 make changes to the water management scheme at the Dam site due to water
5 infiltration at the work area, including the contaminated portions of the Dam site. This
6 work included extending the length of the temporary diversion of Salmon River and a
7 significant increase in the amount of contaminated water to be treated.

8 The remaining [REDACTED] resulted from other contractual claims and
9 adjustments, including safety and minor design modifications.

10 **Table 4 Kwikw Demolition & Removal Contract**
11 **Variations**

Variance Driver	Contract Variance (\$000's)	% of Total
[REDACTED]		

12 **7 Indigenous Relations Engagement Activities**

13 A Fish Technical Committee was tasked with identifying the preferred alternative for
14 improving upstream fish passage at the Salmon River Diversion Dam. The
15 Committee was comprised of First Nations (including Wei Wai Kum, We Wai Kai,
16 and K'ómoks), BC Hydro, Ministry of Forests, Land and Natural Resources
17 Operations & Rural Development, Fisheries and Oceans Canada and the
18 Comptroller of Water Rights.

1 During the Project, site visits, regular engagement meetings and information
2 exchanges occurred with Wei Wai Kum, We Wai Kai, and K'ómoks First Nations to
3 provide updates on the Project's progression, answer questions about the Project
4 and address concerns regarding environmental impacts. The meetings included the
5 various Project team members and senior management of BC Hydro. First Nations
6 participated in key environmental matters such as review of Environmental Plans
7 and hands on monitoring post-decommissioning.

8 Prior to Project implementation, all three First Nations provided letters of support for
9 decommissioning the dam. First Nations subsequently participated in media events,
10 stories, and on-site visits. First Nations procurement on the Project provided
11 opportunities for immediate benefits to First Nations. Over the life of the Project First
12 Nations relationships improved and are now formalized in Relationship Agreements.

13 **Table 5 First Nations Sub-Contract Amounts**

Items	Amounts (\$ million)
First Nation Contracts / Services	
First Nation Employment - hours	

14 Notes:

- 15 1. BC Hydro does not track hours worked by First Nations members associated with First Nations contracts.
- 16 2. The [redacted] million shown above is different to the [redacted] million shown in Table 3 because it includes two
17 additional small contracts for tree clearing and monitoring.

18 **8 Key Areas of Environmental and Archaeological** 19 **Management**

20 The following is a summary of pertinent environmental mitigation measures and
21 notable activities carried out for the Project:

22 **Preliminary Site Investigation** - A Stage 1 Preliminary Site Investigation (**PSI**) was
23 prepared by Qualified Contaminated Site Professionals from KCB+H to identify all
24 potential sources of contamination and Areas of Potential Environmental Concern
25 (**APECs**), with samples collected in accessible areas. The PSI identified the Dam,
26 the Head Works and the Flume as APECs, but no direct investigation under the

1 Diversion dam was feasible without de-watering the site, which was not practicable
2 prior to the Implementation Phase.

3 **Environmental Management Plan** - An Environmental Management Plan (**EMP**)
4 was prepared, identifying key environmental actions and mitigations, including
5 permit requirements, water management and disposal of contaminated or process
6 waste water, in-stream work, riparian zone management, animal and migratory bird
7 protection/management, chemical and chemical waste management, construction
8 debris storage and disposal, safe handling and leak containment of oils and
9 hydrocarbons, removal and disposal of lead and asbestos, exposure and
10 containment of silica dust, and the protection of the Salmon River, Paterson Creek
11 and surrounding vegetation. As required, Kwikw submitted an Environmental
12 Protection Plan (**EPP**) conforming to the requirements of the EMP.

13 **Fish Impacts Mitigation** – In-stream Project work was undertaken during the period
14 in the year when the risk to fish was expected to be the lowest. In addition, a fish
15 isolation netting was deployed in designated work zones in Salmon River and
16 Paterson Creek, and fish salvages were carried out when work areas were
17 dewatered. Effective mitigation measures to prevent mobilization of sediment-laden
18 or creosote contaminated water were applied throughout the Project.

19 **Riprap Naturalization** – After consultation with member First Nations and agencies
20 of the Upstream Fish Passage Technical Committee, a decision was taken to
21 naturalize the riprap on the banks of the Salmon River, which provided a more
22 natural look to the rebuilt river banks, while still meeting the erosion design
23 objectives of the original design.

24 **8.1 Environmental Monitoring**

25 Environmental monitoring during and following construction was a topic of interest to
26 First Nations, the Department of Fisheries and Oceans and the Ministry of Forests,

1 Land Resource Operations & Rural Development (**FLNRORD**). Environmental
2 monitoring Project activities are described in sections [8.1](#) and [8.2](#).

3 **Construction Environmental Monitor** - BC Hydro retained Ecofish Research
4 Limited (**Ecofish**) as the Environmental Monitor for the decommissioning work to
5 ensure that the requirements of the EMP and EPP developed for the Project were
6 fulfilled. The Construction Environmental Monitor monitored site activities, performed
7 regular part-time site inspections throughout the Project and was also present at the
8 start and during sensitive and high-risk activities.

9 During the Project, 31 contractor environmental incident report forms were received.
10 Of the incidents reported, 20 were related to minor spills: 18 hydrocarbons, one
11 potentially contaminated creosote water, and one antifreeze. All spills were below
12 quantities requiring notification to regulators. All spills were to the ground with the
13 exception of one spill of two to three drops of biodegradable oil to water downstream
14 of the Dam. Of the remaining 11 reported incidents, 10 related to elevated
15 watercourse turbidity and one wildlife mortality (small mammal). Appropriate
16 corrective actions were taken in response to all incidents. No long-term impacts to
17 fish or fish habitat were observed or anticipated from the short duration, low intensity
18 of turbidity events incurred. Based on the results of environmental monitoring, the
19 Project was completed in conformance with BC Hydro's project environmental
20 requirements.

21 **Contaminants Environmental Monitor** - As the Project areas were known to be
22 contaminated with creosote, assessment and delineation of the extent of
23 contamination, where accessible, was included in KCB+H's scope of work, as well
24 as provision of an Environmental Monitor specifically to deal with contaminated site
25 remediation (**Contaminants Environmental Monitor**). The Contaminants
26 Environmental Monitor was on site full time through the duration of the Project.

1 **Post-Construction Fish Passage Monitoring** - Following completion of the
2 decommissioning work, in September 2017, Ecofish and the A-Tlegay Fisheries
3 Society⁷ completed a short-duration fish passage monitoring program. Fish were
4 observed within the remediated channel, and no impedances were recorded.

5 **8.2 Ministry of Environment and Climate Change Strategy** 6 **Certificates of Compliance**

7 Following the dismantling and removal of contaminated materials, including the
8 creosoted timber crib dam (Salmon River) and creosoted timber Flume (Paterson
9 Creek), the contaminated site professionals from KCB+H retained by BC Hydro
10 proceeded with preparing to apply for a Certificate of Compliance from MoE in
11 accordance with the *Environmental Management Act*. KCB+H also hired a
12 Contaminated Sites Approved Professional to independently verify that all
13 investigation and remediation meets regulatory standards and to prepare the
14 necessary documentation for the Certificate of Compliance on BC Hydro's behalf.

15 Following decommissioning and site remediation at the Salmon River and Paterson
16 Creek sites, the Contaminated Sites Approved Professional approved a required
17 program of monitoring and sampling of environmental media from both sites to
18 demonstrate that the Project sites had been remediated to applicable standards.

19 The original Project schedule estimated that monitoring and testing activities
20 required for the Certificate of Compliance application process would be completed
21 by November 2018. However, due to high water flows which prohibited safe access
22 for sampling, particularly at Salmon River, testing and monitoring took about one
23 year to complete (October 2018 to October 2019). From October 2019 to
24 December 2020, BC Hydro's consultant Clohn Krippen Berger + Hatch (**KCB+H**)
25 then prepared the necessary reporting required for the two Certificate of Compliance

⁷ The A-Tlegay Fisheries Society is a collaboration of five member nations: We Wai Kai, Wei Wai Kum, K'omoks, Tlowitsis and Kwiakah Nation. The organization provides various aquatic fish-related environmental services.

1 applications. The applications were then submitted to the Contaminated Sites
2 Approved Professional, who reviewed the applications and provided their
3 recommendations to the MoE.

4 The application process was more extensive and took longer than originally forecast.
5 It was initially expected that BC Hydro would apply for one Certificate of Compliance
6 for the entire Project site under the numeric standards-based process based on an
7 expectation that following remediation, levels of contaminants would be below
8 regulatory standards. While all media at the Paterson Creek site met regulatory
9 standards and therefore a standards-based process could be followed, the media
10 test results at the Salmon River site found that pyrene levels in water downstream of
11 the former diversion dam location marginally exceeded regulatory standards. Based
12 on these results, following a risk-based assessment process was the only avenue
13 available to obtain a Certificate of Compliance for the Salmon River site under the
14 MoE's Contaminated Sites Regulation. The need to follow a risk assessment
15 process was verified by the Contaminated Sites Approved Professional. A
16 pre-approval from the MoE was also deemed necessary by the Contaminated Sites
17 Approved Professional in relation to the interpretation of the pyrene exceedance.
18 Overall, the risk-based Certificate of Compliance assessment process was more
19 complex and required additional time and resources from BC Hydro, KCB+H, the
20 Contaminated Sites Approved Professional as well as for MoE to provide the
21 pre-approval of the interpretation of pyrene exceedance and to review the
22 submission.

23 On December 14, 2020, the Contaminated Sites Approved Professional
24 acknowledged the receipt of BC Hydro's Certificates of Compliance applications for
25 the Salmon River and Paterson Creek sites and on April 7, 2021, the MoE issued
26 Certificates of Compliance for both sites. For the Paterson Creek site Certificate of
27 Compliance, BC Hydro is required to decommission groundwater wells that were
28 dug for the purposes of testing and monitoring, of which there are four. BC Hydro

1 plans to have this work completed prior to September 30, 2021. This is discussed
2 further in section [12](#).

3 For the reasons stated above, the process to obtain the two Certificates of
4 Compliance for the Salmon River Dam and Paterson Creek Flume sites took an
5 additional 33 months to complete than initially forecast for the process at the time of
6 the Application and is the main reason for the delays experienced between the
7 substantial completion date and final completion date for the Project.

8 **8.3 Water Act Approval**

9 On June 16, 2017, BC Hydro received an order from the Deputy Comptroller of
10 Water Rights (**Comptroller**), pursuant to section 93 of the *Water Sustainability Act*,
11 authorizing approval to proceed with the decommissioning of the Salmon River
12 Diversion Dam.

13 BC Hydro intends to relinquish its current water license for the Salmon River
14 Diversion site to the Comptroller following the issuance of the Certificates of
15 Compliance for the Salmon River and Paterson Creek sites.⁸

16 **8.4 Archaeological and Heritage Risk**

17 A Preliminary Field Reconnaissance assessment was carried out to assess the
18 archaeological resource potential of the Project area. The assessment found that no
19 known archaeological resources would be impacted by the Project and
20 recommended that no further archaeological work was required. No chance finds
21 occurred during the Project.

22 **9 Stakeholder Engagement**

23 As described in section 8 of BC Hydro's original application to the Commission for
24 the Salmon River Diversion Dam Cease of Operations Application, in the years

⁸ BC Hydro's Water License is described in section 2.1 of the Application.

1 leading up to the Project (2006 to 2016), First Nations, FLNRORD and other
2 stakeholders raised concerns about fish passage issues and potential solutions at
3 the Salmon River Diversion Dam, which generated media attention at the local and
4 regional level. Thorough community stakeholder engagement was undertaken
5 through BC Hydro's Campbell River Hydroelectric Facilities Liaison Committee,
6 which consists of about two-dozen member organizations. The committee was
7 established in 2007 and provides community engagement in the Campbell River
8 area on all BC Hydro projects as well as operations on the Campbell River System.
9 As a result of our work with First Nations, FLNRORD and various stakeholders, the
10 Project received over a dozen stakeholder letters supporting the Project, which were
11 included in the Application. By developing the Project in consideration of external
12 concerns and by successfully completing the decommissioning and restoration
13 works on schedule in one construction season, BC Hydro demonstrated an ability to
14 listen to and act on stakeholder concerns. Over an 18-month period through the
15 Project lifecycle, the Project has generated significant positive exposure generating
16 22 media stories across Vancouver Island.

17 **10 Safety Activities**

18 **10.1 Safety Risk Management**

19 The Project involved demolition near water and included the removal of hazardous
20 and combustible materials (including silica, lead, asbestos and creosote). The work
21 was carried out in a remote area with significant travel required to/from site, potential
22 wildlife/wildfire hazards and no cellphone reception. A Safety Minimum
23 Requirements document was developed by BC Hydro's Occupational Safety and
24 Health specialist, which outlined potential safety issues for review during
25 construction. Construction was completed by Kwikw, which prepared and
26 implemented a Site-Specific Safety Management Plan in response to BC Hydro's
27 Safety Minimum Requirements document. The Site-Specific Safety Management

1 plan set out how Kwikw mitigate the hazards at site and provides site-specific work
2 procedures. BC Hydro monitors and audits adherence to these procedures.

3 The Project had a strong focus on safety throughout all phases of the work, including
4 attention to hazard identification and “good catch” incident submittals. A site safety
5 verification inspection was carried out by BC Hydro’s Occupational Safety and
6 Health Specialist between June 2017 and October 2017. During implementation of
7 the Project, the project team actively identified and responded to changes in safety
8 hazards as they arose. The following are two notable examples:

9 **Forest Fire Risk Mitigation** – The period during which the work took place was very
10 dry, which triggered restrictions on construction activities requiring the operation of
11 equipment required to complete the scope of work. Kwikw applied for and received
12 an exemption from the restriction on high risk activities from the BC Wildfire Service
13 on July 11, 2017, which was in effect through October 27, 2017. Demonstration of
14 worker training, availability of fire fighting resources, fire watch, amongst other best
15 practices for managing fire risk were necessary to obtain the exemption. The
16 ongoing application of these practices enabled Kwikw to address the forest fire risk
17 while meeting the Project construction schedule.

18 **Air quality during dismantling of timber crib structures** – When dismantled, the
19 timber crib structures released creosote vapours which stung the eyes of workers in
20 the area and caused a few workers to feel nauseous while in close proximity to the
21 creosote. Although Kwikw had procedures in place to address this hazard, an
22 incident occurred which prompted a review of the safety procedure. The procedure
23 was modified to reduce the potential of exposure and no issues arose after new
24 procedures were implemented.

1 **10.1.1 Safety Inspections and Orders**

2 WorkSafeBC conducted two inspections over the construction period from June to
3 October 2017. No orders were issued. No Ministry of Energy, Mines and Petroleum
4 Resources inspections were required or performed as part of the Project.

5 **10.1.2 Incident Summary**

6 Near Miss – The Project had 10 near misses with the most severe being a roll away
7 truck and an extension cord catching fire.

8 Minor Incident – The Project had 13 minor safety incidents. Most incidents were
9 either physical incidents of a temporary nature such as sprains, strains, and finger
10 injuries.

11 Moderate Incident – The Project had one moderate safety incident, involving one
12 employee experiencing nausea after exposure to fumes during the removal of
13 creosote-treated materials (see section [10.1](#)). A work stop was initiated and safety
14 protocols relating to working near creosote-treated materials were revisited with
15 construction staff following the incident. No further incidents of this nature were
16 observed.

17 Major Incident – The Project had no major incidents.

18 **11 Risk Management**

19 The key Project risks and their treatments are tabulated below.

1

Table 6 Project Risk Table

Risk ID	Risk Drivers, Event and Consequences	Treatment Plan	Residual Consequence Severity and Probability during the Project ⁹	Outcome
4	Unforeseen Site Conditions - There is a risk of more extensive environmental contamination and that the existing profile of the river channel is not as expected.	Create cost contingency for increased scope and seek extended in-stream work window to allow for extended schedule duration.	Consequence Type: Financial Loss Consequence Severity: S3 million - \$1 million to \$10 million Probability of Consequence: L6 – 10 per cent (Possible - could well occur)	This risk materialized and resulted in Project costs being higher than planned. More extensive environmental contamination was found during decommissioning. This significantly increased the quantities of soils removed and requirements for water treatment. While these challenges were managed, the materialization of this risk increased the overall cost of the Project and contingencies were insufficient to accommodate the additional costs. As well, key milestones including Project completion and Project financial close were materially delayed.
1	Site-Specific Worker Safety Issues - Remoteness of site creates risk in terms of awareness of incidents and ability to respond. Also, work is in the vicinity of a fast-flowing river and heavy equipment could cause safety risks if not managed properly.	Utilize existing safety practices and controls. If there is a need to deviate from normal practices, develop site specific safety management plan that responds to the safety risks for those tasks.	Consequence Type: Worker Safety Consequence Severity: S3 - Temporary Disability Probability of Consequence: L5 – 1 per cent (Remote - May occur)	Workers experienced minor injuries such as cuts, sprains, strains, and the temporary effects of exposure to creosote fumes. These incidents were treated with first aid and modifications to procedures. Higher consequence worker hazards were managed safely, and no major incidents occurred.

⁹ Residual consequence severity and probability of consequence scores are based on BC Hydro's Project Delivery Risk Matrix, which is derived from BC Hydro's Corporate Risk Matrix. For each consequence severity score (begins with an "S") and probability of consequences score (begins with a "L"), a description of the score meaning as it relates to the potential consequence is provided for each risk item in [Table 6](#).

Risk ID	Risk Drivers, Event and Consequences	Treatment Plan	Residual Consequence Severity and Probability during the Project ⁹	Outcome
3	Relations with First Nations Partners - Risk of deteriorating relationship with First Nations partners which could impact schedule, cost and reputation.	Continue transparent consultation with the We Wai Kai, Wei Wai Kum and K'omoks First Nations.	Consequence Type: Reputational Consequence Severity: S3 - Small but vocal minority of customers critical. Probability of Consequence: L5 1 per cent (Remote - May occur)	Regular and transparent consultation with First Nations was an effective means to maintain and strengthen relationships. Risk did not materialize.
7	Certificate of Compliance Process - Risk that Environmental Risk Assessment may be required due to investigation of contaminated soils.	Identify with risk with service provider (e.g. may need additional resources) and provide contingency for additional cost.	Consequence Type: Financial Consequence Severity: S2k - \$100k to \$1 million Probability of Consequence: L6 - 10 per cent (Possible - Could well occur)	This risk materialized and resulted in a larger impact to the Project scheduled than anticipated. Refer to section 5 of this report. On April 7, 2021, two separate Certificates of Compliance were issued for the Salmon River diversion dam area and for the flume at Paterson Creek. The Certificates of Compliance do not require further action by the Project except for the decommissioning of groundwater wells, which is a relatively minor requirement. See section 12 of this report.

12 Remaining Work to be Completed

With the exception of the need to decommission four groundwater wells at the Paterson Creek site, the Project is now complete, and no additional Project work is anticipated at the two Project sites. This activity is straightforward and will be undertaken by a qualified person. The process involves filling the well throughout its depth with layers of sealant and backfill materials in accordance with the *Water Sustainability Act's* Groundwater Protection Regulation.

As described during the Application review process, BC Hydro will incur some residual operational expenses related to maintaining the remaining Salmon River

1 Diversion assets not removed by the Project, namely the concrete diversion canal,
2 excluding the Flume at Paterson Creek. Maintenance costs were estimated at
3 \$0.02 million per annum and BC Hydro believes this estimate remains accurate.¹⁰

4 As well, BC Hydro is expecting to incur additional ongoing monitoring costs related
5 to planned activities consistent with the restoration research and monitoring program
6 associated with the License of Occupation for the remaining portion of the concrete
7 diversion canal.¹¹ This work is expected to cost around \$17,000 per year plus an
8 extra \$2,000 per year to administer the activities. Also, once every five years,
9 BC Hydro expects to incur around \$2,000 for administration expense related to the
10 contract review and renewal.

11 **13 Lessons Learned**

12 The Project was planned based on experience gained in the decommissioning of the
13 Heber River Diversion, undertaken in summer 2012 and completed that fall.

14 Additional lessons learned during this Project included:

15 **Limitations of Pre-construction Field Testing** - Portions of the site were
16 contaminated with PAHs resulting from creosote leaching from the dam's timber
17 cribbing since the original construction. Unexpected contamination was also
18 discovered upstream of the dam. It is believed that the source of this contamination
19 was a creosote bath for timbers dating back to the time of original construction.

20 However, since the[se] site was located in and adjacent to a flowing river, it was not
21 possible to perform the testing required to establish the extent and degree of

¹⁰ Refer to Exhibit B-3, BC Hydro's response to BCUC IR 1.7.6.

¹¹ In September 2018, FLNRORD issued a License of Occupation for the remaining portions of the concrete diversion canal, which were excluded from the scope of the Project. The License of Occupation allows BC Hydro to retain the existing canal in place and was issued to support BC Hydro undertaking research and monitoring of various restoration options for future decommissioning of the canal and other BC Hydro facilities. BC Hydro's planned activities are consistent with the restoration research and monitoring program described in Appendix C of the Substantial Completion Report. This monitoring will also provide an opportunity for local First Nations to further educate their members on the restoration process and to be involved with monitoring restoration on a project that has demonstrated positive ecological gains.

1 **contamination** [before project construction]. This occurrence resulted in an
2 underestimation of the cost and scope required to address the higher levels of
3 contamination and water management. It also resulted in an underestimation of the
4 overall time required to complete the Certificates of Completion application
5 development process, project completion and financial close. **The access and**
6 **inspection constraints can only be managed by establishing an adequate**
7 **contingency, accepting that when working in a flowing river with a limited**
8 **construction window, situations can evolve rapidly and unpredictably, and preparing**
9 **to act promptly to address cost or schedule impacts should they materialize. In**
10 **future, the limitations of extrapolating experience from similar projects should also be**
11 **recognized.**

12 **Establishing a Collaborative Relationship** - A contractor's capability may be
13 tested when confronted by unforeseen site conditions, and this may threaten the
14 successful achievement of project goals. Working collaboratively with the contractor
15 assisted them to overcome project challenges and respond to the conditions
16 encountered, avoid delays, and reduce the potential for drawn-out dispute
17 resolution.

18 **Planning for Field Reviews** - A field review plan was not in place and
19 responsibilities for inspection and field direction were not clearly defined. As per new
20 Engineers and Geoscientists British Columbia and BC Hydro Project and Portfolio
21 Management policies, a field review plan considering the roles of Contract and
22 Construction Management, Engineering, and external consultants would have
23 improved the understanding of site inspection and contractor communication on site.

24 **Work Planning** - Challenges arose on site because work planning (particularly for
25 the dewatering and excavation scope) was conducted under significant time
26 pressure, largely because of unforeseen site conditions. The volume of
27 contaminated water to be treated was much higher than anticipated and, with water
28 continuing to flow into the work area, a response plan had to be developed and

1 implemented immediately. The need for such a rapid response limited the
2 opportunity for oversight and engineering review.

3 **Managing Unanticipated Contamination** - Pre-construction investigation was
4 limited to accessible areas, such that it was not possible to confirm conditions under
5 and adjacent to the dam. Test-pitting during construction may have allowed for
6 earlier de-lination of the contamination and smoother management of removal and
7 disposal. However, it is considered that the reduced window for construction would
8 have been unlikely to accommodate both additional investigation and remediation in
9 this case. Future projects should consider the trade-off between the time to
10 undertake test-pitting during construction and the value of information potentially
11 gained.

12 **Contractor Pre-Qualification** - Potential contractors were pre-qualified (and the
13 successful contractor was selected) for the rehabilitation alternative under
14 consideration prior to April 2016. The pre-qualification process included issues such
15 as their bonding capacity, demonstrated capability, and references by other owners,
16 all focussed on their suitability for a rehabilitation project, not a demolition and
17 removal project. A more detailed assessment of the contractor capability is
18 recommended, but this may not be well documented (particularly when dealing with
19 small contractors) or may not differentiate them. Furthermore, a paper-based
20 pre-qualification process has limited benefits, and it may be better to rely on past
21 experiences with BC Hydro or use a relationship-building approach of gradual entry
22 into larger work packages and contracts.

23 **Contract Open-Book Process** - The key benefit of an Open-Book approach is to
24 allow BC Hydro an understanding of the contractor's costs and gain assurance that
25 the cost is reasonable, to improve the contractor's capability through discussion of
26 methodology, and to improve the understanding of the assignment of project risks by
27 both parties. The Open-Book process engaged-in with the contractor primarily
28 addressed the highest-risk issues but did not address all contracting issues. Future

1 projects should consider more fulsome engagement to establish expectations
2 (e.g., identification of key risks and assignment of responsibility) with non-standard
3 contracting methods. Future projects should be aware that an Open-Book approach
4 may not save time relative to a standard contracting approach, and sufficient time
5 should be allocated for this engagement and subsequent review during the
6 Open-Book phase.

7 **Managing First Nations Relationships** - BC Hydro works to build and maintain
8 long term relationships with First Nations, and this can complicate the contractual
9 relationship when BC Hydro contracts with a First Nations designated company
10 (contractor). While the contractor and project team focus on the current project,
11 BC Hydro and the First Nation also focus on their long-term relationship, and these
12 two interests and time-frames can be in conflict. Future projects should consider
13 steps to establish clear expectations and protocols for addressing contractual issues
14 that may arise and which have the potential to impact ongoing higher level
15 relationships. These protocols may be unique to each First Nation, each project, or
16 each contracting party.

17 **Project Uncertainty** - Uncertainty in field conditions (due to the inability to conduct
18 investigations in a flowing river) posed a significant risk to a project that already had
19 a very tight timeline. The added scope of contamination upstream was a significant
20 challenge. A unit rate contract was implemented for this work to provide a
21 mechanism for risk transfer and to get certainty on cost competitiveness. However, a
22 lump sum or unit rate contract limits BC Hydro's ability to manage construction risks.
23 To minimise risk in similar circumstances, future projects should consider mitigation
24 strategies such as: (1) Use a "Time and Materials" contracting methodology, or
25 (2) Be prescriptive on means and methods – for example the contractor was
26 responsible to design and implement the diversion of the Salmon River around the
27 work site at the Dam, although BC Hydro may have been better-able to manage the
28 design risk.

1 **Response to Changing Conditions** - Between the unexpected extent of
2 contaminated materials and the difficulty in dewatering the work area the Project
3 presented significant challenges that required very rapid responses. All parties
4 involved (BC Hydro, our external engineers, and the contractor and their engineering
5 consultants) were able to coordinate and collaborate effectively to develop and
6 implement those responses. In part this was due to the understanding of the project
7 requirements and the contractor's capabilities developed in the Open-Book phase of
8 the contract, and in part due to a high level of trust between the parties and their
9 willingness to collaborate, rather than adopting adversarial stances. Future projects
10 should consider this as a potential benefit when evaluating whether to adopt
11 Open-Book or conventional contracting approaches. Irrespective of the contracting
12 approach taken, future projects should attempt to foster a collaborative mind-set
13 between the project and the contractor and their advisors.

14 **14 Photographs**

15 BC Hydro's Substantial Completion Report contained a number of photographs
16 showing different vantages of the Project site during decommissioning activities and
17 following completion. The following are photos of the Dam site during construction
18 and following restoration not previously submitted to the BCUC.

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Figure 2 Salmon River Diversion Dam
Decommissioning Site during
Construction and Following Restoration
of River Channel (Looking Downstream)



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Figure 3 Salmon River Diversion Dam
Decommissioning Site during
Construction and Following Restoration
of River Channel (Side Profile)



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Figure 4 Salmon River Diversion Dam
Decommissioning Site Following
Restoration of River Channel (Looking
Upstream)



**Salmon River Diversion Ceasing of Operations
Project**

Project Completion and Evaluation Report

Appendix A

Certificates of Compliance



EMAIL ONLY

Victoria File: 26250-20/20688
Site ID: 20688

April 7, 2021

Zeljko Cecic
BC Hydro and Power Authority
6911 Southpoint Drive, 11th floor
Burnaby, BC V3N 4X6
By Email: Zeljko.Cecic@bchydro.com

Dear Zeljko Cecic:

**Re: Certificate of Compliance – Paterson Creek, Strathcona Regional District of
Central Vancouver Island, British Columbia**

Please find enclosed a Certificate of Compliance respecting the site referenced above.

In addition to the conditions set out in Schedule B of the Certificate of Compliance, please be advised of the following:

1. Information about the site will be included in the Site Registry established under the *Environmental Management Act*.
2. The provisions of this Certificate of Compliance are without prejudice to the right of the Director to make orders or impose requirements as the Director may deem necessary in accordance with applicable laws. Nothing in this Certificate of Compliance will in any way restrict or impair the Director's power in this regard.
3. A qualified environmental consultant should be available to identify, characterize and appropriately manage:
 - (a) any environmental media that may be contaminated, or
 - (b) soil which may exceed the standards triggering a Contaminated Soil Relocation Agreement set out in section 40 of the Contaminated Sites Regulation and may be encountered during any future subsurface work at the site.
4. Groundwater wells that are no longer required must be properly decommissioned in accordance with the *Water Sustainability Act's* Groundwater Protection Regulation.

Page 2

5. Please note that the attached Certificate of Compliance does not address obligations of employers regarding worker health and safety under the *Workers Compensation Act* and Occupational Health and Safety Regulation. Development of site-specific work procedures in accordance with Workers' Compensation Board regulations may be warranted. Please direct related questions to Worksafe BC.

Issuance of this Certificate of Compliance is a decision that may be appealed under Part 8 of the *Environmental Management Act*.

If you require clarification of any aspect of this Certificate of Compliance, please contact the undersigned at 236 468-2258 (toll free via Enquiry BC at 1-800-663-7867).

Yours truly,



Vincent Hanemayer, P.Eng.
Sr. Contaminated Sites Officer

Enclosure

cc: Ted White, Director, Ministry of Forests, Lands and Natural Resource Operations and Rural Development, PO Box 9340 Stn Prov Govt, Victoria, BC V8W 5K7
Ted.White@gov.bc.ca

Michael Sloan, Approved Professional, SLR Consulting (Canada) Ltd.
9 – 6421 Applecross Road, Nanaimo, BC V9V 1N1 msloan@slrconsulting.com

CSAP Society, apopova@csapsociety.bc.ca

Site Information Advisor, ENV, Victoria Advisor.SiteInformation@gov.bc.ca



Ministry of
Environment and
Climate Change Strategy

CERTIFICATE OF COMPLIANCE
(Pursuant to Section 53 of the *Environmental Management Act*)

THIS IS TO CERTIFY that as of the date indicated below, the site identified in Schedule A of this Certificate of Compliance has been satisfactorily remediated to meet the applicable Contaminated Sites Regulation remediation standards and criteria.

This Certificate of Compliance is qualified by the requirements and conditions specified in Schedule B.

The substances for which remediation has been satisfactorily completed and for which this Certificate of Compliance is valid are listed in Schedule C.

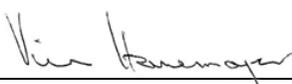
I have issued this Certificate of Compliance based on a review of relevant information including the documents listed in Schedule D. I, however, make no representation or warranty as to the accuracy or completeness of that information.

A Director may rescind this Certificate of Compliance if requirements and conditions imposed in the Certificate of Compliance are not complied with or any fees payable under Part 4 of the Act or regulations are outstanding.

This Certificate of Compliance should not be construed as an assurance that there are no hazards present at the site.

2021-04-07

Date Issued



Signing Authority
For Director, *Environmental Management Act*

Schedule A

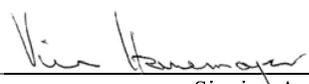
The site covered by this Certificate of Compliance is located at the Paterson Creek in the Strathcona Regional District of Central Vancouver Island, British Columbia which is more particularly known and described as:

Those parts of District Lot 110 and Block H of District Lot 10, all within Sayward District as described by the UTM Coordinates (10U) for this Certificate of Compliance prepared by BC Land Surveyor David Lundquist of McElhanney and dated June 9, 2020.

POINT #	EASTING (10U)	NORTHING (10U)
75	309934.274	5552549.010
76	309937.068	5552541.696
77	309937.102	5552540.968
78	309930.127	5552533.384
79	309928.908	5552533.232
80	309924.404	5552533.367
81	309919.596	5552534.586
82	309917.480	5552534.637
83	309915.990	5552536.719
84	309914.348	5552539.462
85	309911.352	5552542.678
86	309907.492	5552546.708
87	309907.339	5552547.469
88	309898.231	5552556.036
89	309894.032	5552561.809
90	309891.578	5552566.329
91	309890.122	5552569.292
92	309892.136	5552571.662
93	309894.439	5552574.168
94	309898.451	5552577.824
95	309902.768	5552576.030
96	309903.191	5552575.454
97	309920.036	5552560.556
98	309923.321	5552558.338
99	309925.877	5552558.592
100	309928.586	5552556.324
101	309930.059	5552553.293
102	309931.041	5552551.329

PIN: 60721

2021-04-07
Date Issued



Signing Authority
For Director, *Environmental Management Act*

Appendix A

The approximate centre of the site using the NAD (North American Datum) 1983 convention is:

Latitude: 50° 05' 41.33"
Longitude: 125° 39' 27.89"

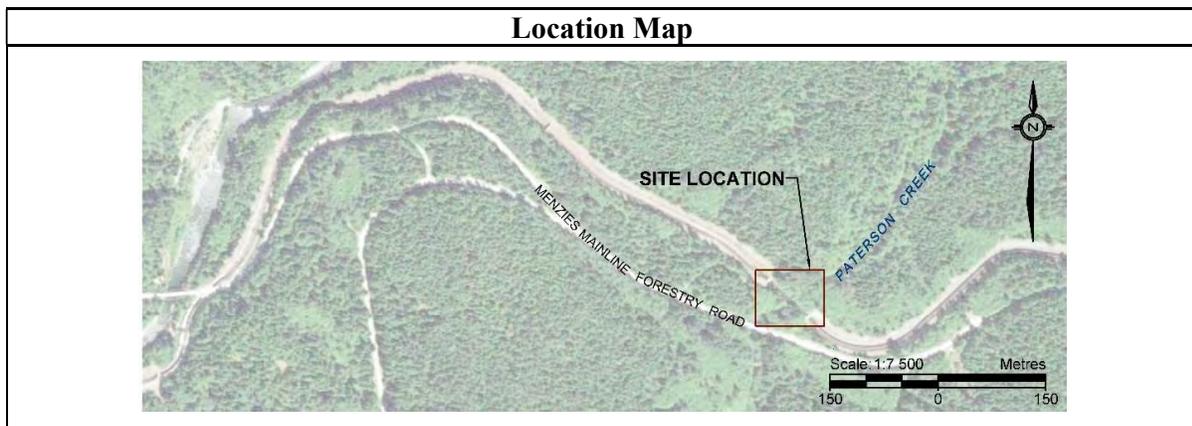
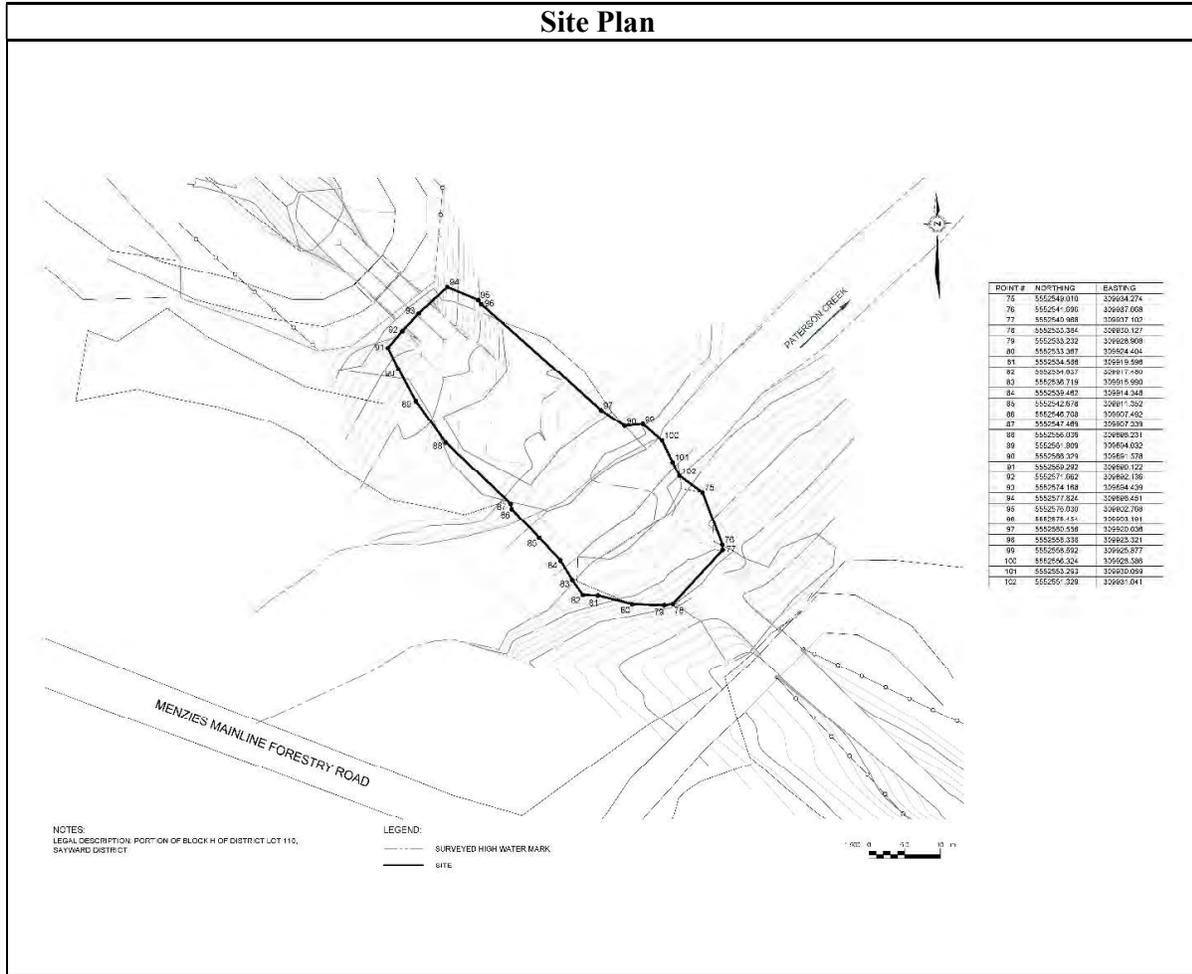
2021-04-07

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2021-04-07
Date Issued

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 For Director, Environmental Management Act

Site Identification Number 20688
Version 9.0 R

4 of 7

Schedule B

Requirements and Conditions

1. Any changes in land, vapour, water or sediment uses must be promptly identified by the responsible persons in a written submission to the Director. An application for an amendment or new Certificate of Compliance may be necessary. The uses to which this condition applies are described in Schedule C and in the site investigation documents listed in Schedule D.

2021-04-07

Date Issued



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For Director, *Environmental Management Act*

Schedule C

Substances and Uses

Substances remediated in soil for natural wildlands soil use:

To meet numerical remediation standards:

benz(a)anthracene	[56-55-3]
benzo(b)fluoranthene	[205-99-2]
benzo(k)fluoranthene	[207-08-9]
indeno(1,2,3-c,d)pyrene	[193-39-5]
phenanthrene	[85-01-8]
pyrene	[129-00-0]

Substances remediated in water for freshwater aquatic life water use:

To meet numerical remediation standards:

phenanthrene	[85-01-8]
pyrene	[129-00-0]

Substances remediated in sediment for freshwater sensitive sediment use:

To meet numerical remediation standards:

acenaphthene	[83-32-9]
acenaphthylene	[208-96-6]
anthracene	[120-12-7]
benz(a)anthracene	[56-55-3]
benzo(a)pyrene	[50-32-8]
chrysene	[218-01-9]
copper	[7440-50-8]
dibenz(a,h)anthracene	[53-70-3]
fluoranthene	[206-44-0]
fluorene	[86-73-7]
2-methylnaphthalene	[91-57-6]
naphthalene	[91-20-3]
phenanthrene	[85-01-8]
pyrene	[129-00-0]

2021-04-07

Date Issued



Signing Authority
For Director, Environmental Management Act

Schedule D

Documents

- *Summary of Site Condition*, prepared by Michael Sloan and Michelle Anderson, SLR Consulting (Canada) Ltd., dated 30 October 2020.
- *Site Investigation and Confirmation of Remediation - Salmon River Diversion Dam Decommissioning Project*, prepared by Klohn Crippen Berger + Hatch, dated October 2020.
- *Record of AG11 Correspondence with the Ministry of Forests, Lands and Natural Resource Operations and Rural Development*. BC Hydro and Klohn Crippen Berger + Hatch, October 2020
- *Approval No. 108913: Water Treatment Plant Closure Report, Salmon River Diversion Dam Decommissioning Project*, prepared by Klohn Crippen Berger + Hatch, dated 3 January 2018.
- *Approval No. 108913 to BC Hydro and Power Authority, Salmon River Diversion Dam Decommissioning Project*, prepared by Peter Kickham for Director, *Environmental Management Act*, Authorization – South Region, BC Ministry of Environment and Climate Change Strategy, dated 12 July 2017.

2021-04-07

Date Issued



Signing Authority

For Director, *Environmental Management Act*



EMAIL ONLY

Victoria File: 26250-20/20688
Site ID: 20688

April 7, 2021

Zeljko Cecic
BC Hydro and Power Authority
6911 Southpoint Drive, 11th floor
Burnaby, BC V3N 4X6
By Email: Zeljko.Cecic@bchydro.com

Dear Zeljko Cecic:

**Re: Certificate of Compliance – Salmon River, Strathcona Regional District of
Central Vancouver Island, British Columbia**

Please find enclosed a Certificate of Compliance respecting the site referenced above.

In addition to the conditions set out in Schedule B of the Certificate of Compliance, please be advised of the following:

1. Information about the site will be included in the Site Registry established under the *Environmental Management Act*.
2. The provisions of this Certificate of Compliance are without prejudice to the right of the Director to make orders or impose requirements as the Director may deem necessary in accordance with applicable laws. Nothing in this Certificate of Compliance will in any way restrict or impair the Director's power in this regard.
3. A qualified environmental consultant should be available to identify, characterize and appropriately manage:
 - (a) any environmental media that may be contaminated, or
 - (b) soil which may exceed the standards triggering a Contaminated Soil Relocation Agreement set out in section 40 of the Contaminated Sites Regulation and may be encountered during any future subsurface work at the site.
4. Please note that the attached Certificate of Compliance does not address obligations of employers regarding worker health and safety under the *Workers Compensation Act* and Occupational Health and Safety Regulation. Development of site-specific work procedures in accordance with Workers'

Page 2

Compensation Board regulations may be warranted. Please direct related questions to Worksafe BC.

Issuance of this Certificate of Compliance is a decision that may be appealed under Part 8 of the *Environmental Management Act*.

If you require clarification of any aspect of this Certificate of Compliance, please contact the undersigned at 236 468-2258 (toll free via Enquiry BC at 1-800-663-7867).

Yours truly,



Vincent Hanemayer, P.Eng.
Sr. Contaminated Sites Officer

Enclosure

cc: Ted White, Director, Ministry of Forests, Lands and Natural Resource Operations and Rural Development, PO Box 9340 Stn Prov Govt, Victoria, BC V8W 5K7
Ted.White@gov.bc.ca

Michael Sloan, Approved Professional, SLR Consulting (Canada) Ltd.
9 – 6421 Applecross Road, Nanaimo, BC V9V 1N1 msloan@slrconsulting.com

Michelle Anderson, Approved Professional, SLR Consulting (Canada) Ltd.
200 – 1620 West 8th Avenue, Vancouver, BC V6J 1V4 manderson@slrconsulting.com

CSAP Society, apopova@csapsociety.bc.ca

Site Information Advisor, ENV, Victoria Advisor.SiteInformation@gov.bc.ca



Ministry of
Environment and
Climate Change Strategy

CERTIFICATE OF COMPLIANCE
(Pursuant to Section 53 of the *Environmental Management Act*)

THIS IS TO CERTIFY that as of the date indicated below, the site identified in Schedule A of this Certificate of Compliance has been satisfactorily remediated to meet the applicable Contaminated Sites Regulation remediation standards and criteria.

This Certificate of Compliance is qualified by the requirements and conditions specified in Schedule B.

The substances for which remediation has been satisfactorily completed and for which this Certificate of Compliance is valid are listed in Schedule C.

I have issued this Certificate of Compliance based on a review of relevant information including the documents listed in Schedule D. I, however, make no representation or warranty as to the accuracy or completeness of that information.

A Director may rescind this Certificate of Compliance if requirements and conditions imposed in the Certificate of Compliance are not complied with or any fees payable under Part 4 of the Act or regulations are outstanding.

This Certificate of Compliance should not be construed as an assurance that there are no hazards present at the site.

2021-04-07
Date Issued



Signing Authority
For Director, *Environmental Management Act*

Schedule A

The site covered by this Certificate of Compliance is located at the Salmon River in the Strathcona Regional District of Central Vancouver Island, British Columbia which is more particularly known and described as:

Those parts of District Lot 110 and Block H of District Lot 10, all within Sayward District as described by the UTM Coordinates prepared by BC Land Surveyor David Lundquist of McElhanney and dated June 9, 2020.

POINT #	EASTING (10U)	NORTHING (10U)	POINT #	EASTING (10U)	NORTHING (10U)
1	308718.869	5552206.724	26	308608.412	5552176.622
2	308714.932	5552194.319	27	308608.623	5552177.977
3	308715.355	5552187.376	28	308608.793	5552179.078
4	308714.043	5552178.782	29	308609.216	5552181.830
5	308704.221	5552168.028	30	308610.020	5552183.396
6	308699.564	5552164.599	31	308610.783	5552185.767
7	308697.743	5552160.958	32	308611.841	5552187.461
8	308691.435	5552156.216	33	308612.899	5552188.942
9	308669.420	5552149.865	34	308613.661	5552189.916
10	308629.242	5552147.029	35	308614.720	5552191.102
11	308626.109	5552147.791	36	308615.567	5552191.694
12	308624.288	5552149.484	37	308618.234	5552193.303
13	308621.621	5552152.151	38	308619.081	5552193.515
14	308620.181	5552154.057	39	308620.859	5552194.616
15	308617.768	5552157.274	40	308631.782	5552197.198
16	308616.879	5552158.460	41	308656.930	5552211.508
17	308615.313	5552159.984	42	308661.079	5552218.409
18	308614.212	5552162.439	43	308660.317	5552221.754
19	308613.323	5552164.895	44	308662.519	5552228.824
20	308612.053	5552167.351	45	308665.101	5552232.126
21	308611.164	5552169.086	46	308670.351	5552238.646
22	308610.486	5552170.399	47	308674.542	5552240.170
23	308609.385	5552171.923	48	308676.532	5552241.949
24	308608.496	5552173.828	49	308678.395	5552245.463
25	308608.242	5552175.268	50	308681.105	5552248.850

2021-04-07
Date Issued



 Signing Authority
 For Director, *Environmental Management Act*

Appendix A

POINT #	EASTING (10U)	NORTHING (10U)
51	308683.052	5552252.364
52	308685.592	5552260.196
53	308689.995	5552266.335
54	308691.774	5552267.732
55	308709.979	5552257.867
56	308717.345	5552254.142
57	308715.398	5552246.902
58	308713.323	5552239.705
59	308711.122	5552232.550
60	308726.144	5552219.525
61	308725.158	5552220.046
62	308726.509	5552223.416
63	308723.678	5552224.848
64	308722.769	5552222.928
65	308722.346	5552222.818
66	308722.085	5552223.350
67	308723.022	5552225.172
68	308719.938	5552226.533
69	308719.010	5552224.402
70	308718.505	5552224.182
71	308717.437	5552226.426
72	308714.255	5552225.437
73	308714.847	5552223.490
74	308714.234	5552222.876

PIN: 60721

The approximate centre of the site using the NAD (North American Datum) 1983 convention is:

Latitude: 50° 05' 30.00"

Longitude: 125° 40' 29.05"

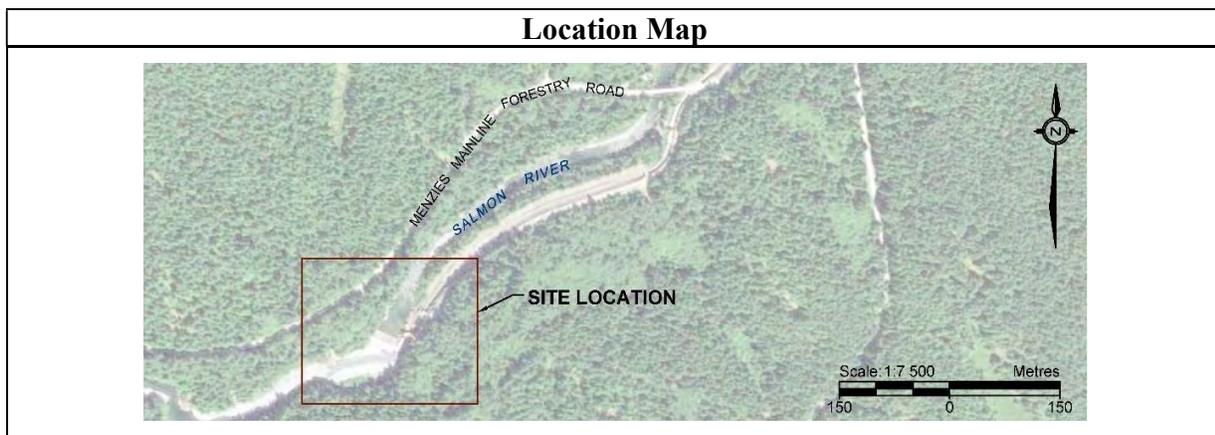
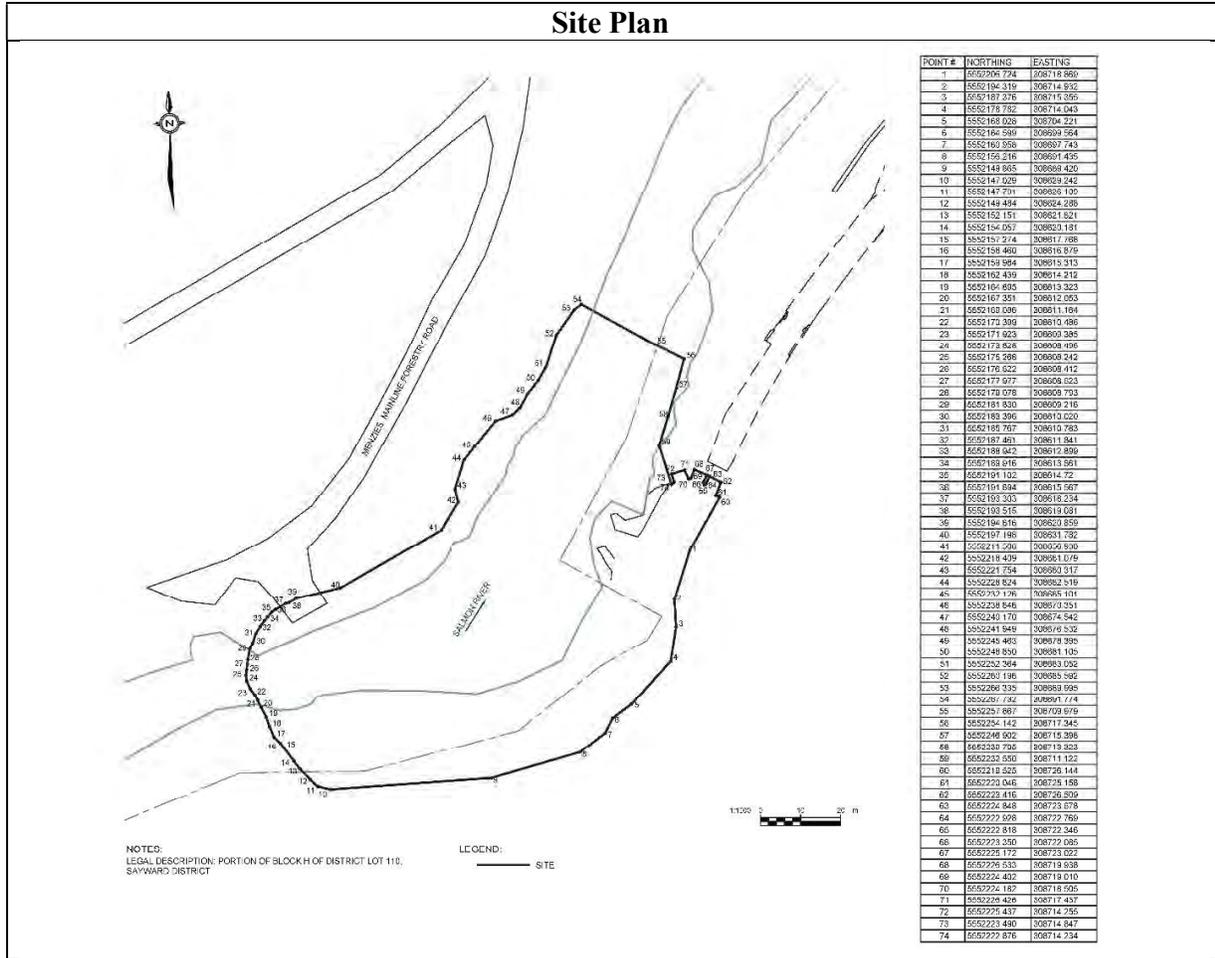
2021-04-07

Date Issued



Signing Authority

For Director, *Environmental Management Act*



2021-04-07
Date Issued


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 For Director, Environmental Management Act

Schedule B

Requirements and Conditions

1. Any changes in land, vapour, water or sediment uses must be promptly identified by the responsible persons in a written submission to the Director. An application for an amendment or new Certificate of Compliance may be necessary. The uses to which this condition applies are described in Schedule C and in the site investigation documents listed in Schedule D.

2021-04-07

Date Issued



Signing Authority

For Director, *Environmental Management Act*

Site Identification Number 20688

Version 9.0 R

5 of 7

Schedule C

Substances and Uses

Substances remediated in water for freshwater aquatic life water use:

To meet risk-based remediation standards:

pyrene [129-00-0]

Substances remediated in sediment for freshwater sensitive sediment use:

To meet numerical remediation standards:

acenaphthene	[83-32-9]
anthracene	[120-12-7]
benz(a)anthracene	[56-55-3]
fluoranthene	[206-44-0]
fluorene	[86-73-7]
2-methylnaphthalene	[91-57-6]
naphthalene	[91-20-3]
phenanthrene	[85-01-8]
pyrene	[129-00-0]

2021-04-07

Date Issued



Signing Authority

For Director, *Environmental Management Act*

Schedule D

Documents

- *Summary of Site Condition*, prepared by Michael Sloan, SLR Consulting (Canada) Ltd., dated 30 October 2020.
- *Site Investigation and Confirmation of Remediation - Salmon River Diversion Dam Decommissioning Project*, prepared by Klohn Crippen Berger + Hatch, dated October 2020.
- *Human Health and Ecological Risk Assessment - Salmon River Diversion Dam Decommissioning Project*, prepared by SLR Consulting (Canada) Ltd., dated October 2020.
- *Record of AG11 Correspondence with the Ministry of Forests, Lands and Natural Resource Operations and Rural Development*. BC Hydro and Klohn Crippen Berger + Hatch, October 2020.
- *[Decision for] Request for P6 approval for the derivation of a toxicity reference value for pyrene in porewater, Salmon River, BC*, prepared by Heather Osachoff for Director, *Environmental Management Act*, BC Ministry of Environment and Climate Change Strategy, dated 27 March 2020.
- *Request for P6 approval for the derivation of a toxicity reference value for pyrene in porewater, Salmon River, BC*, prepared by SLR Consulting (Canada) Ltd., dated January 2020.
- *Approval No. 108913: Water Treatment Plant Closure Report, Salmon River Diversion Dam Decommissioning Project*, prepared by Klohn Crippen Berger + Hatch, dated January 2018.
- *Approval No. 108913 to BC Hydro and Power Authority, Salmon River Diversion Dam Decommissioning Project*, prepared by Peter Kickham for Director, *Environmental Management Act*, Authorization – South Region, BC Ministry of Environment and Climate Change Strategy, dated 12 July 2017.

2021-04-07

Date Issued



Signing Authority

For Director, *Environmental Management Act*

**Salmon River Diversion Ceasing of Operations
Project**

Project Completion and Evaluation Report

Appendix B

Project Impacts and Benefits Tabulation

1 The Project is delivering the target benefits identified at the time that Implementation
2 phase funding was approved, which are tabulated below. In addition to these
3 benefits, the Project has resulted in the successful environmental remediation at the
4 Salmon River diversion and Paterson Creek flume site as described in section [8.2](#).

5 **Table B-1 Project Benefits Tabulation**

Impact / Benefit Name	Criteria	Actual Measurement Methodology (if different)	Benefit Recipient (Business Group)	Baseline	Estimated	Actual	Variance
Eliminate risk of failure of dam or flume (Notes 1-2)	Dam in place or removed.	Observation	Dam Safety	In Place	Removed	Removed	None
Eliminate obstruction to fish passage	Dam in place or removed	Observation	Stations Field Operations	In Place	Removed	Removed	None
	Naturalized streambed	Observation	Stations Field Operations	Altered Streambed	Naturalized Streambed	Naturalized Streambed	None

6 Notes

- 7 1. Direct Cost (Energy Reduction Opportunity Cost) – As described in the Application, the decommissioning of
8 the Salmon River Diversion will result in a reduction of energy output on the Campbell River system of
9 approximately 46 GWh. ¹ Assuming average water conditions, the actual and mid-range forecast value of the
10 foregone energy over the period 2018 to 2037 is currently calculated at between \$1.1 million and \$2.3 million
11 per year. This amount is lower than the range of \$1.2 million to \$4.7 million per year over the 20-year period
12 2018 to 2037 as identified in the BCUC proceeding for the Application. ²
- 13 2. Direct Cost (Infrastructure remaining in place) – In the Application, BC Hydro estimated that the ongoing
14 operations and maintenance cost associated with refurbishment versus decommissioning of Salmon River
15 diversion facilities was around \$0.08 million per annum versus \$0.02 million per annum. ³ BC Hydro's current
16 forecast of operations maintenance and expenses for the remaining elements remains around \$0.02 million
17 per annum. These costs are necessary to perform ongoing inspection and maintenance activities at the
18 concrete diversion canal and small dam at the canal outlet which remain following completion of the Project.

¹ As noted in BC Hydro's response to BCUC IR 1.13.5, Exhibit B-3, from the BCUC Application review proceeding for the Project, the 46GWh reduction in annual energy is 71% offset by a 33GWh increase in energy from improvements in efficiency at the John Hart Generating Station. However, the efficiency improvements at John Hart do not affect the valuation of the energy lost to the Campbell River system due to the decommissioning of the Salmon River Diversion.

² All figures are shown in F2020 Real dollars. For the annual foregone energy range, if the low-end of the low reference price forecast range and the high end of the high reference price forecast range is included, the foregone energy values currently range between \$1.0 and \$2.4 million per year for the period 2018 to 2037. Refer also to Exhibit B-3, BC Hydro's response to BCUC IR 1.13.2, Attachment 1.

³ Refer to Exhibit B-3, BC Hydro's response to BCUC IR 1.7.6

1 In addition, BC Hydro is undertaking a long-term (30-year) study to maintain a
2 License of Occupation for the concrete diversion dam. A License of Occupation for
3 the remaining facilities was issued by FLNRORD on the basis of BC Hydro
4 conducting long-term monitoring work, which will be used to evaluate various means
5 of decommissioning the canal in the future. This work is forecast to cost around
6 \$0.02 million per year (around \$17,000 for contracted monitoring services plus
7 around \$2,000 in internal administration expenses). Also, once every five years,
8 BC Hydro expects to incur around \$2,000 for administration expense related to the
9 contract review and renewal.