Upper Lillooet Hydro Project

Weekly Environmental Monitoring Report #81

Reporting Period: November 22 – November 28, 2015

Upper Lillooet River Hydroelectric Facility (Water File No. 2002561, Water licence No. C130613), Boulder Creek Hydroelectric Facility (Water File No. 2003049, Water licence No. C129969) & Transmission Line (TX Line)

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Owner Construction Permits and Approvals

Environmental Assessment Certificate No. E13-01 (Amendment 1, 2, 3, 4, 5, 6, 7)
Fisheries Act Subsection 35(2)(b) Authorization No. 09-HPAC-PA2-000303 (Amendment 1, 2)
Letter of Advice for the Transmission Line No. 09-HPAC0-PA2-000303
Leave To Commence Construction (ULRHEF) File No. 2002561
Leave To Commence Construction (BDRHEF) File No. 2002453
Leave To Commence Construction (TX Line) File No. 2002561/2002453
Conditional Water Licence (ULRHEF C130613) File No. 2002561
Conditional Water Licence (BDRHEF C129969) File No. 2002453
Conditional Water Licence (BDRHEF C131153) File No. 2003601
Licence of Occupation (ULRHEF #232384) File No. 2409871
Licence of Occupation (BDRHEF #232386) File No. 2409998
Licence of Occupation (TX Line #2423386) File No. 2410654
Occupant Licence to Cut (ULRHEF) No. L49717(Amendments 1, 2, 3, 4, 5, 6, 7)
Occupant Licence to Cut (BDRHEF – KM 38 laydown) No. L49698
Occupant Licence to Cut (BDRHEF) No. L49816 (Amendments 1, 2, 3)
Occupant Licence to Cut (TX Line) No. L49697 (Amendments 1, 2, 3, 4, 5, 6, 7, 8, 9)
General Wildlife Measure Exemption Approval Letter (TX Line & BDRHEF) File No. 78700-35/06 UWR and 39585-20 WHA
Heritage Conservation Act – Alteration Permit (ULRHEF) File No. 11200-03/2014-0033
Road Use Permit No. 6123-13-02 (Lillooet River FSR); 5673-13-01 (Rutherford Creek FSR); 7977-13-01 (Lillooet South FSR); 8015-13-01 (Ryan River); 8188-13-01 (Pemberton Creek FSR); and 9717-13-01 (Miller Bench FSR)
Junction Permit (ULRHEF & BDRHEF) File No. 11250-32/6123 (Amendment 1)
Aeronautical Obstruction Approval (Tx Line - Lillooet River Crossing) File No. 2013-004
Aeronautical Obstruction Approval (Tx Line - Ryan River) File No. 2013-005
Aeronautical Obstruction Approval (Tx Line - North Miller) File No. 2013-006
Aeronautical Obstruction Approval (Tx Line - South Miller) File No. 2013-007
Aeronautical Obstruction Approval (Tx Line - Pemberton Creek) File No. 2013-008
Aeronautical Obstruction Approval (Tx Line - Lillooet River near Pemberton) File No. 2013-009
Aeronautical Obstruction Approval (Tx Line - Lillooet River near Meager Creek) File No. 2013-010
Navigable Water Protection Act (ULRHEF) File No. 8200-2009-500434-001
Navigable Water Protection Act (BDRHEF) File No. 8200-2012-501-032-001
Navigable Water Protection Act (Tx Line – North Creek) File No. 8200-2013-500103-001
Navigable Water Protection Act (Tx Line – Lillooet River) File No. 8200-2013-500101-001
Navigable Water Protection Act (Tx Line – Lillooet River) File No. 8200-2013-500102-01
Navigable Water Protection Act (Tx Line – Ryan River) File No. 8200-2013-500104-001
Navigable Water Protection Act (Tx Line – South Miller River) File No. 8200-2013-500100-001
Navigable Water Protection Act (Tx Line – Boulder Creek) File No. 8200-2013-500099-001
Navigable Water Protection Act – Extension Approval (ULRHEF, BDRHEF, Tx Line)
Navigable Water Protection Act (Bridge – Ryan River) File No. 8200-2013-500381
Navigable Water Protection Act (Bridge – Upper Lillooet Side Channel; Extension Approval) File No. 8200-2013-500383
Section 57 Authorization (ULRHEF) File No. 16660-20/REC202717
SLRD Temporary Use Permit No. 34 – Boulder Creek HEF
SLRD Temporary Use Permit No. 35 – Upper Lillooet River HEF
SLRD Building Permit (10864) – Upper Lillooet River HEF Powerhouse
SLRD Building Permit (10865) – Boulder Creek HEF Powerhouse
Works Permit for Construction within FSR Right-of-Way No. 6123-14-01
Works Permit for Construction within FSR Right-of-Way No. 7977-15-01
Section 52(1)(b) FRPA Authorization for Ryan River Wet Crossing File No. FOR-19400-01/2014
MOTI Permit to Construct, Use and Maintain Works Upon the Right-Of-Way of a Provincial Public Highway No. 2014-06099
Magazine Licence File No. UL76018 (Renewal 1)
Section 8 Approval – Short Term Use of Water File (Lillooet River and Tributaries) No. A2006123 (Amendment 1)
Section 8 - Special Use Permit issued for the operation of an avalanche weather station on Crown land (File No. S25988)

Contractor Construction Permits and Approvals

Waste Discharge under the Code of Practice for the Concrete and Concrete Products Industry under the Environmental Management Act (Authorization No. 107204) Tracking No. 326969 (Renewal 1)
Wildlife Act Permits – Pacific Tailed Frog Salvage Permit # SU15-164805; Fish Salvage Permit # SU15-174722
Fisheries and Oceans Canada – Anadromous Fish Salvage Permit #XR 178 2015
BC Safety Authority – Temporary Construction Electrical Service Permit EL-140698-2014
Municipal Wastewater Regulation - Authorization # 107032
Water Supply System Construction Permits – VCH-14-613 for Main Camp
Water Supply System Permit to Operate Issued July 30th, 2014 for Main Camp
Section 6(3) and Schedule 3 Wildfire Regulations Fire Exemption for Ryan River Bridge File No. 14350-07
SLRD Building Inspection Report dated August 13, 2014 - Construction Camp Building Permit No. 10830
Lillooet River FSR Temporary Road Closures Approval File No. 11250-32/6123 (Amendment 1, 2)
Lillooet South FSR Temporary Road Closures Approval File No. 11250-32/7977
SLRD Building Permits for Mechanic Shop (10862) and Carpentry Shop (10836) March 18, 2015
SLRD Building Permit Stages 1 - 4 – Boulder Powerhouse Architectural, Electrical and Mechanical (10865) October 8, 2015
SLRD Building Permit Stages 1 - 4 – Upper Lillooet Powerhouse Architectural and Mechanical (10864) October 6, 2015

ACRONYMS:

AMBNS	Active Migratory Bird Nesting Survey
Andritz	Andritz Hydro Canada Inc.
ANFO	Ammonia nitrate fuel oil (industrial explosive)
ASMP	Archaeological Sites Management Plan
ARD M/L	Acid Rock Drainage and Metal Leaching
BCEAO	British Columbia Environmental Assessment Office
BCWQG	British Columbia Water Quality Guidelines
BDRHEF	Boulder Creek Hydroelectric Facility
BG	Background
BKL	BKL Consultants Ltd.
CE	CRT-ebc Construction Inc.
DFO	Fisheries and Oceans Canada
DS	Downstream
EAC	Environmental Assessment Certificate
EAO	Environmental Assessment Office
Ecofish	Ecofish Research Ltd.
Ecologic	Ecologic Consulting
EIR	Environmental Incident Report
ESC	Erosion and Sediment Control
FAM	Field Advice Memorandum
FSR	Forest Service Road
Golder	Golder Associates
GWR	Mountain Goat Winter Range
Hedberg	Hedberg and Associates Ltd.
HWM	High water mark
IE	Independent Engineer (True North Energy)
IEM	Independent Environmental Monitor
INX	Innergex Renewable Energy Inc.
ISW	Instream Works
ITM	Environmental Issue Tracking Matrix
JEM	JEM Energy Ltd. (Delegate Independent Engineer)
LTC	Leave to Construct
MFLNRO	Ministry of Forests, Lands and Natural Resource Operations
MOE	Ministry of Environment
MOTI	Ministry of Transportation and Infrastructure
NCD	Non Classified Drainage
OLTC	Occupational License to Cut
PAG	Potentially Acid Generating
ROW	Right of Way
RVMA	Riparian Vegetation Management Area
SES	Sartori Environmental Services
SLRD	Squamish-Lillooet Regional District
Stringer Line	Temporary Backfeed Transmission Line
TX Line	Transmission Line
ULRHEF	Upper Lillooet Hydroelectric Facility
UWR	Ungulate Winter Range
VC	Valued Component
WEL	Westpark Electric Ltd.
WEMR	Weekly Environmental Monitoring Report
WHA	Wildlife Habitat Area
WQ	Water Quality

1.0 Summary of Site Inspections for Reporting Period

The table presented below summarizes the IEM team site presence, weather and monitoring locations by component:

Date	IEM Team Personnel	Weather Conditions	Key Monitoring Locations & Activities
Sunday, November 22	SE, DA, TH, MN	Cloudy	***Construction Camp, Laydown Areas and the Lillooet River FSR*** • Snow clearing on the Lillooet River FSR ***ULRHEF Intake & Upstream Tunnel*** • Standpipe installation in ULRHEF upstream tunnel ***ULRHEF Downstream Tunnel Portal*** • Closed for Fall Two-Week Mountain Goat Shutdown Period ***ULRHEF Penstock*** • Winterization works • ASTR04 crossing construction ***ULRHEF Powerhouse*** • Superstructure construction • Manifold installation (including concrete pour) ***BDRHEF Intake Access Ramp and Diversion Tunnel*** • Diversion works and upstream cofferdam construction ***BDRHEF Downstream Tunnel Portal*** • Closed due to work related accident and follow-up investigation ***BDRHEF Powerhouse*** • Component installation inside the powerhouse ***TX-Line*** • No activity
Monday, November 23	SE, DA, TH	Light snow	***Construction Camp, Laydown Areas and the Lillooet River FSR*** • Snow clearing on the Lillooet River FSR ***ULRHEF Intake & Upstream Tunnel*** • Standpipe installation in ULRHEF upstream tunnel ***ULRHEF Downstream Tunnel Portal*** • Closed for Fall Two-Week Mountain Goat Shutdown Period ***ULRHEF Penstock*** • Winterization works • ASTR04 crossing construction ***ULRHEF Powerhouse*** • Superstructure construction • Manifold installation (including concrete pour) ***BDRHEF Intake Access Ramp and Diversion Tunnel*** • Upstream cofferdam construction ***BDRHEF Downstream Tunnel Portal*** • Closed due to work related accident and follow-up investigation ***BDRHEF Powerhouse*** • Component installation inside the powerhouse ***TX-Line*** • Segment 16 ➢ Groundworks for pole foundations
Tuesday, November 24	BA, TH, DA	Clear	***Construction Camp, Laydown Areas and the Lillooet River FSR*** • Snow clearing on the Lillooet River FSR ***ULRHEF Intake & Upstream Tunnel*** • Standpipe installation in ULRHEF upstream tunnel

Date	IEM Team Personnel	Weather Conditions	Key Monitoring Locations & Activities
			ULRHEF Downstream Tunnel Portal • Closed for Fall Two-Week Mountain Goat Shutdown Period ***ULRHEF Penstock*** • Winterization works ***ULRHEF Powerhouse*** • Superstructure construction • Manifold installation (including concrete pour) ***BDRHEF Intake Access Ramp and Diversion Tunnel*** • Upstream cofferdam construction ***BDRHEF Downstream Tunnel Portal*** • Closed due to work related accident and follow-up investigation ***BDRHEF Powerhouse*** • Component installation inside the powerhouse ***TX-Line*** • Segment 16 ➢ Groundworks for pole foundations
Wednesday, November 25	BA, DA	Snow	***Construction Camp, Laydown Areas and the Lillooet River FSR*** • Snow clearing on the Lillooet River FSR ***ULRHEF Intake & Upstream Tunnel*** • Standpipe installation in ULRHEF upstream tunnel ***ULRHEF Downstream Tunnel Portal*** • Closed for Fall Two-Week Mountain Goat Shutdown Period ***ULRHEF Penstock*** • Winterization works ***ULRHEF Powerhouse*** • Superstructure construction • Manifold installation (including concrete pour) ***BDRHEF Intake Access Ramp and Diversion Tunnel*** • Upstream cofferdam construction ***BDRHEF Downstream Tunnel Portal*** • Closed due to work related accident and follow-up investigation ***BDRHEF Powerhouse*** • Component installation inside the powerhouse ***TX-Line*** • Segment 16 ➢ Groundworks for pole foundations
Thursday, November 26	BA, DA	Snow	***Construction Camp, Laydown Areas and the Lillooet River FSR*** • Snow clearing on the Lillooet River FSR ***ULRHEF Intake & Upstream Tunnel*** • Standpipe installation in ULRHEF upstream tunnel ***ULRHEF Downstream Tunnel Portal*** • Closed for Fall Two-Week Mountain Goat Shutdown Period ***ULRHEF Penstock*** • Winterization works ***ULRHEF Powerhouse*** • Superstructure construction • Manifold installation (including concrete pour) ***BDRHEF Intake Access Ramp and Diversion Tunnel*** • Upstream cofferdam construction ***BDRHEF Downstream Tunnel Portal*** • Closed due to work related accident and follow-up investigation

Date	IEM Team Personnel	Weather Conditions	Key Monitoring Locations & Activities
			BDRHEF Powerhouse • Component installation inside the powerhouse ***TX-Line*** • Segment 16 ➢ Groundworks for pole foundations
Friday, November 27	BA, DA	Snow	***Construction Camp, Laydown Areas and the Lillooet River FSR*** • Snow clearing on the Lillooet River FSR ***ULRHEF Intake & Upstream Tunnel*** • Standpipe installation in ULRHEF upstream tunnel ***ULRHEF Downstream Tunnel Portal*** • Closed for Fall Two-Week Mountain Goat Shutdown Period ***ULRHEF Penstock*** • Winterization works ***ULRHEF Powerhouse*** • Superstructure construction • Manifold installation (including concrete pour) ***BDRHEF Intake Access Ramp and Diversion Tunnel*** • Upstream cofferdam construction • Test pitting at intake structure site ***BDRHEF Downstream Tunnel Portal*** • Closed due to work related accident and follow-up investigation ***BDRHEF Powerhouse*** • Component installation inside the powerhouse ***TX-Line*** • Segment 16 ➢ Groundworks for pole foundations
Saturday, November 28	BA, AS	Overcast	***Construction Camp, Laydown Areas and the Lillooet River FSR*** • Snow clearing on the Lillooet River FSR ***ULRHEF Intake & Upstream Tunnel*** • Grout injection at the ULRHEF upstream tunnel ***ULRHEF Downstream Tunnel Portal*** • Crew and equipment mobilization in preparation for hydrojacking testing ***ULRHEF Penstock*** • Winterization works ***ULRHEF Powerhouse*** • Superstructure construction • Manifold installation (including concrete pour) ***BDRHEF Intake Access Ramp and Diversion Tunnel*** • Downstream cofferdam construction ***BDRHEF Downstream Tunnel Portal*** • Closed due to work related accident and follow-up investigation ***BDRHEF Powerhouse*** • Component installation inside the powerhouse ***TX-Line*** • Segment 16 ➢ Groundworks for pole foundations

IEM Team Personnel: *TH – Tom Hicks; SS – Stephen Sims; BA – Blake Aleksich; DA – Danita Abraham; SE – Stephanie Ellis; AS – Anne Sutherland; MN – Mike Nichol*

2.0 Administrative Summary

Key communications and meetings the IEM team had with the licensees, contractors and/or environmental authorities:

Date	Communication Type	Participants	Issues Discussed	ITM ID No.
November 22-24	*Emails*	INX, SES, JEM	INX provided updates for the second and third days of the BDRHEF intake diversion works and upstream cofferdam construction.	-
November 24	*Email*	INX, CE, SES, JEM	The IEM was provided with a memo prepared by Golder (QP) which indicates that stockpiled blast rock at KM44.5 are non-PAG and do not require a cover over the winter.	ULR#36
November 25	*Email*	SES, INX, JEM	SES provided an update for the fourth day of the BDRHEF intake diversion works and upstream cofferdam construction.	-
	Email	SES, INX, CE, Snowline Safety	SES provided Snowline Safety with the results of instream acoustic pressure monitoring during avalanche control blasting conducted at KM 41 on the Lillooet River FSR. The monitoring showed that the blasting did not cause pressure to exceed Project guidelines and future avalanche control blasting could proceed without instream acoustic pressure monitoring.	-
	Email	SES, CE, INX	SES informed CE that a technician had observed three vehicles passing through the Goat Migration Corridor during the sunset shutdown period. SES provided CE with the vehicle details and requested a response in the form of and environmental incident report (EIR 018) outlining a plan to prevent a reoccurrence.	EIR 018
	Email	SES, CE, INX	CE provided SES with the technical data sheet and MSDS for Specton Pump Flush to be used to clean the pumps used for polyurethane injection in the ULRHEF upstream tunnel during standpipe installation.	-
November 26	*Email*	INX, SES, CE, Ecofish	INX distributed Amendment No. 07 to the Upper Lillooet Hydro Project's Environmental Assessment Certificate. This amendment approved the following two key timing restrictions that will allow continued works at the ULRHEF tunnel portals from now until the end of December 2016. • The one-time removal of the March and April 2016 Wolverine den emergence timing restriction. • The removal of fall 2015, spring 2016 and fall 2016 two-week mountain goat timing restriction triggered by snow depth.	-
November 26-27	*Emails*	INX, SES, CE	CE provided a draft of EIR 018 to SES ad INX, who reviewed and finalized the report on November 27.	EIR 018
November 27	*Site inspection*	JEM, SES, INX	The IE completed the monthly site inspection of all open and active project areas. During the inspection, the IE requested an update on the	-

Date	Communication Type	Participants	Issues Discussed	ITM ID No.
			construction of the BDRHEF downstream cofferdam. Discussions between CE, INX, JEM and SES ultimately resulted in the agreement that a preliminary downstream cofferdam should be constructed to ensure the intake footprint remains isolated from Boulder Creek during the spring freshet.	
November 28	*Email*	SES, INX, CE, JEM	SES provided an update on the progress at the BDRHEF intake and the downstream cofferdam construction.	-

3.0 Current Work Restrictions and Timing Windows

The table presented below outlines work restrictions applicable during the reporting period for each active Project component location:

Component	Location	Wildlife/Archeology Concern	Construction/Timing Restrictions & Mitigations
TX Line	Segments 7 – 16	Within 150m of wetlands or 100m of Coastal Tailed Frog Streams	IEM presence is required when clearing within 150m of wetlands or 100m of CTF Streams, to ensure clearing areas are minimized.
		Riparian Vegetation Management Areas (RVMA)	IEM monitoring is required during clearing within RVMAs.
		Surface Water Quality	IEM monitoring is required during culvert installation activities in non-fish bearing waters to document adherence to the Surface Water Quality Protection Plan objectives.
		Suitable Class 1 & 2 Grizzly Bear forage habitat	IEM monitoring is required when clearing within identified Class 1 & 2 Grizzly Bear forage habitat, to ensure clearing areas are minimized.

Component	Location	Wildlife/Archeology Concern	Construction/Timing Restrictions & Mitigations
Lillooet River FSR & ULRHEF	Access roads above the lower limit of the 200m buffer Truckwash Creek Migration Corridor to the ULRHEF intake	Mountain Goat UWR & Migration Corridor	IEM was onsite to oversee daily construction equipment shutdowns (November 1 - 30) beginning one hour before and two hours after sunrise as well as two hours before and one hour after sunset. Noise monitoring equipment is in place to monitor background noise levels and exceedances of the 75dbA noise level maximum resulting from blasting activities. Adaptive drilling/blasting noise mitigation strategies will be developed and implemented should activities show persistent exceedances of the noise level threshold. A two-week shutdown of all construction at the ULRHEF lower tunnel portal began on November 13, due to snowfall accumulations measured within the Truckwash Creek Migration Corridor, according to the Project's Mountain Goat Management Plan. The two-week shutdown ended on November 26 upon receipt of EAC amendment #7. Mountain Goat monitoring activities will occur daily throughout the winter and spring (November 1 – June 15) when construction activities are occurring at the ULRHEF lower tunnel portal and/or the ULRHEF intake. If a mountain goat is observed within 500m line of sight of construction operations, construction must cease for at least 48 hours. The IEM must record and submit all goat observations to FLNR within 48 hours.
BDRHEF intake	Portion of intake access road and crane pad within UWR	Mountain Goat UWR	During winter months (November 1 – April 30), access to BDRHEF intake must be gated at least 500 m from UWR to restrict motorized use within the UWR, unless otherwise directed by MFLNRO. An Exemption to the General Wildlife Measures for UWR u-2-002 UL 12 permits the following works to occur at the BDRHEF intake works beyond November 15, 2015. • Helicopter activity can occur up until December 15. • Blasting activity, including avalanche control, can occur up until December 15. • All other construction related activities can occur up until December 21. If a mountain goat is observed within a 500 m line of site of a construction activity within UWR u-2-002 UL 12, construction activities will cease for at least 48 hours. Approval from the IEM must be obtained prior to recommencing construction activities.

4.0 Upper Lillooet River HEF – Monitoring Results

4.1 *Construction Camp, KM 38 Laydown, Access Roads & Lillooet River FSR*

Activities:

- Routine maintenance of construction equipment within the mechanic shop and fuel management continued at the KM 38 laydown. All hazardous substance materials (waste oil, contaminated soil, used oil/hydraulic fluid containers, etc.) were stored temporarily for off-site disposal in a designated area at the laydown. The materials were all well contained and protected from the weather.
- The electric fences surrounding the construction camp were maintained and operational throughout this reporting period.
- Snow removal on the Lillooet River FSR and site access roads continued.

Environmental Summary:

- No environmental issues were observed or reported at the construction camp, KM 38 laydown area, access roads or the Lillooet River FSR.

4.2 *Intake (North & South Sides), and Upstream Tunnel Portal*

Construction Activities:

- Standpipe installation and grout injection at the ULRHEF upstream tunnel portal.
- Dewatering to ULRHEF intake sediment basins (Photo 1).

Environmental Summary:

- All turbid or alkaline water resulting from activities at the ULRHEF upstream tunnel portal is pumped directly to the ULRHEF intake sediment basins (Photo 1).
- On November 28, the IEM was at the ULRHEF intake to conduct water quality monitoring during grout injection in the tunnel. All seepage water from the tunnel was directed to the ULRHEF intake sediment basins for treatment during grouting. Prior to works, CE's environmental management team activated the CO2 injection component of the water treatment system (Photo 2 and Photo 3) and prepared the flocculant injection system to be used if necessary. During works, the IEM conducted sampling in the first cell of the basins (Photo 4), in the cell downstream of the treatment system, in the lower basins and at the outlet to the Lillooet River (compliance point). On November 28, water quality sampling during grouting showed that the CO2 injection system successfully treated high pH water and sediment basin water remained within Project water quality guidelines (<pH 9). Water was measured to have a high pH entering the ponds (10.4 – 12.2) and a reduced pH following treatment (7.2 – 7.3). Please see Section 4.6 Water Quality Results for data related to the grout injection works.
- On November 29, grouting works at the upstream tunnel continued. The water treatment system successfully treated the grouting water but pH was measured to increase within the

sediment basins. Water entering the basins was measured to have a high pH (10.9 – 11.9) throughout the day. Beginning at 13:45, the water following treatment had reduced pH levels but remained elevated (8.6 – 9.3). No water quality exceedances were recorded in the last cell of the sediment basins or at the compliance point but the water remained at a pH of 8.6 – 8.8 at point of discharge. The increased alkalinity of the water in the second day was due to increased amounts of grout used in the tunnel. Following the second day of grouting the IEM met with CE's environmental management team and recommended that additional water treatment measures be installed to treat the water. Please see Section 4.6 Water Quality Results for data related to the grout injection works.

Photos:

Photo 1 – Alkaline water pumped to ULRHEF intake sediment basins during grout injection (November 28, 2015).

Photo 2 – Active water treatment system with CO_2 tanks at ULRHEF intake (November 28, 2015).

Photo 3 – Orange hose (foreground) conveying water to CO_2 treatment system and hose (background) pumping water through diffuser pipe and back to ponds (November 28, 2015).

Photo 4 – pH sampling at the compliance point downstream of the ULRHEF intake sediment basins outlet (November 28, 2015).

4.3 *Downstream Tunnel Portal*

Construction Activities:

- Mobilization of equipment and personnel to the tunnel began on November 28, in preparation for drilling and hydrojacking testing.

Environmental Summary:

- All tunnel seepage water was pumped to the downstream tunnel portal infiltration ponds.

4.4 *Penstock*

Construction Activities:

- ASTR04 crossing construction (Photo 5 - Photo 10).

Environmental Summary:

- On November 23, CE began of ASTR-04 over-drain following hand placement of CTF microhabitat structures under the direction of Ecofish (QP). Initially CE placed a 2" bypass pump to divert clean water through the constructed channel, while continuing to bypass the majority of flow around the constructed channel with a 6" pump (Photo 5). Once the flow in the newly watered channel was visibly clear and connected downstream, CE began installing the impermeable geo-membrane and backfilling of the sump. Once half of the backfill was placed, the 6" pump was removed (flow was maintained with the 2" bypass pump) and the last half of the backfill placement occurred simultaneously (Photo 6). Once the backfill placement was complete and natural flow restored, water quality began to improve in the newly constructed channel (Photo 7); however, at 10:00 sub-surface flow was noticed on stream right near the downstream end of the constructed channel (Photo 8).
- Once subsurface flow was discovered, CE placed a 2" pump to divert the turbid flow to vegetation and began to discuss options to eliminate the subsurface flow. In consultation with SES and INX, CE determined that the installation of the impermeable geotextile membrane at the upstream end of the channel was ineffective and needed to be enlarged.
- The 6" pump was replaced to divert clean water around the work area through the newly constructed channel while CE excavated the upstream section and placed additional membrane to ensure an effective seal (Photo 9). Again, once half of the backfill was placed, the 6" pump was removed and the second half of the backfill was placed simultaneously. Once the backfill placement was complete for the second time natural flow was restored. Water quality began to improve in the newly constructed channel (Photo 10) and subsurface flow was reduced. The IEM recommends that an inspection occur in the spring to ensure that all subsurface flow has been eliminated.
- Water quality was monitored by the IEM throughout work activity and communication between the CE crew and IEM occurred during each step of the work. Turbidity exceeded BCWQGs for approximately nine hours on November 23. The prolonged period of high turbidity occurred because the initial placement of the impermeable membrane failed to achieve a watertight seal, which created the subsequent subsurface flows observed. To stop

subsurface flow and prevent undermining of the ASTR-04 over-drain CE notified the IEM that re-working of the impermeable membrane was required as quickly as possible to prevent further damages. CE worked directly with the IEM to mitigate further damage to ASTR-04 to the extent possible and the secondary placement of impermeable membrane was successful in eliminating the majority of subsurface flow. Near the end of the day, it was evident that water quality was showing a trend toward returning to within BCWQGs; therefore, the IEM made the decision to return to site the following morning to verify that water quality had improved. The IEM returned on the morning of November 24, and verified that subsurface flow had reduced and that turbidity levels had returned to within BCQWGs. Please see Appendix A for detailed water quality sampling data.

Photos:

Photo 5 – Initial re-watering of ASTR-04 overdrain by bypass pump to permit working on the placement of an impermeable geotexile membrane and backfilling to grade (November 23, 2015).

Photo 6 – Placement of impermeable geotexile membrane and backfill of the existing bypass sump while continuing to bypass the majority of flows (November 23, 2015).

Photo 7 – Backfill of sump completed and natural flows restored to ASTR-04 (November 23, 2015).

Photo 8 – Seepage noticed at downstream end of reconstructed channel indicative of sub-surface flows (November 23, 2015).

Photo 9 – Replacement of impermeable geotextile membrane to prevent subsurface flow (November 23, 2015).

Photo 10 – Natural flows restored following membrane replacement and sump backfill (November 23, 2015).

4.5 *Powerhouse & Access Road*

Construction Activities:

- Superstructure construction (Photo 11 and Photo 12).
- Dewatering to Lillooet River.

Environmental Summary:

- No environmental issues were observed or reported at the ULRHEF powerhouse during this reporting period.

Photos:

Photo 11 – Current conditions at the ULRHEF powerhouse (November 26, 2015).

Photo 12 – Current conditions at the ULRHEF powerhouse (November 27, 2015).

4.6 *Water Quality Results*

The following table presents the results of the routine WQ sampling program for the ULRHEF. The IEM is undertaking a weekly monitoring program according to the conditions outlined in the Surface Water Quality Protection Plan. The regular monitoring sites quantify WQ conditions within the Lillooet River upstream and downstream of active construction areas. The IEM acknowledges the natural variability of instream WQ conditions in the Lillooet River due to seasonal melt fluctuations and large tributary inputs. In the event that an exceedance of *in-situ* WQ (turbidity and/or pH) is deemed to be caused by project-related activities, the IEM will highlight the exceedance, discuss the cause, and outline measures undertaken by the Contractor to correct the issue. When an exceedance cannot be attributed to project related activities, the exceedance will be marked by an asterisk (*).

Date	Time	Sample Location Description	pH	Turbidity (NTU)	Cond (*u*S)	Temp (°C)
Routine Water Quality						
November 28, 2015	13:40	ULR Background – ULRHEF Intake	7.3	7.9	77	-
	16:28	ULR #0.5 – Downstream of ULRHEF intake at Keyhole Bridge	7.4	7.5	73	-
	13:32	ULR # 1 – Upstream of ULRHEF Powerhouse	7.4	9.3	84	-
	-	ULR #2 – Downstream of ULRHEF Powerhouse between KM 40.5 and KM 41 (sampling not conducted due to avalanche risk)	-	-	-	-
	11:55	ULR #3 – Lillooet River FSR KM 38 Laydown – D/S of Boulder confluence	7.3	9.6	79	-
	11:38	ULR #4 – Lillooet River FSR KM 24 – D/S of all works and Meager confluence	7.2	11.1	92	-
ULRHEF Intake sediment basins during grout injection at upstream tunnel						
November 28, 2015	13:40	ULR Background – ULRHEF Intake	7.3	7.9	77	-
	15:11	Pond 1 (prior to CO2 treatment)	7.4	7.5	-	-
	15:35		10.4	14.9	-	-
	15:41		10.3	7.6	-	-
	16:20		11.2	-	-	-
	16:39	Pond 2 (downstream of CO2 treatment)	8.2	-	-	-
	16:50	Pond 1 (prior to CO2 treatment)	12.2	146	-	-
	17:10	Pond 2 (downstream of CO2 treatment)	7.2	11.78	-	-
	17:35		7.3	8.18	-	-
	17:49	Pond 7 (lower basins)	7.2	7.08	-	-
	17:55		7.3	-	-	-
	18:03	Discharge to Lillooet River (compliance point)	7.3	7.81	-	-
	18:15		7.2	-	-	-

4.7 *Recommendations*

IEM recommendations for the ULRHEF are as follows:

- Additional water treatment measures should be installed at the ULRHEF intake sediment basins to treat high pH water resulting from grouting activities.
- All seepage water in the intake excavation and portal should be conveyed to the sediment basins unless approved for discharge directly to the Lillooet River by the IEM or CE environmental manager.
- The ULRHEF powerhouse sump water should be monitored regularly. Alkaline or turbid water should be pumped to the settling ponds for treatment.

4.8 *Upcoming Works*

The following new and/or environmentally sensitive construction activities are scheduled to occur at the ULRHEF in the upcoming reporting period(s):

- Grout injection will continue at the ULRHEF upstream tunnel portal.
- Dewatering to the ULRHEF intake sediment basins will continue.
- Superstructure construction will continue at the ULRHEF powerhouse.

5.0 Boulder Creek Hydroelectric Facility – Monitoring Results

5.1 *Intake & Diversion Tunnel*

Construction Activities:

- Intake diversion works and upstream cofferdam construction (Photo 13 to Photo 20).
- Test pitting below upstream cofferdam (Photo 21).
- Downstream cofferdam construction (Photo 22 and Photo 23).

Environmental Summary:

- On November 22 and 23, diversion and upstream cofferdam instream works continued at the BDRHEF intake.
- Works began at 9:30 on November 22 with the excavation of a trench and geomembrane anchoring at the diversion tunnel entrance for the upstream cofferdam (Photo 13). The trench excavation caused two pulses of turbidity downstream which quickly (<40 minutes) cleared to within 8 NTU of background levels. The turbidity observed at the mixing zone station (15m downstream of the diversion tunnel) equated to a temporary (<30 minutes) pulse with a peak of 21.5 NTU at the compliance station (240m upstream of the powerhouse).
- Beginning at 11:50, diversion pad removal and berm construction required that an excavator (equipped with biodegradable hydraulic oil) work instream for brief periods causing intermittent downstream turbidity (Photo 14). At 16:20, the excavator removed the upstream

plug to redirect the majority of flow into the diversion tunnel (Photo 15 to Photo 17). The plug removal caused a spike of turbidity at the mixing zone of 776 NTU which resulted in peak of 145 NTU at the compliance station (18:10). Instream works were completed at 16:55. Turbidity at the mixing zone station returned to within 8 NTU of background levels by 17:10 and at the compliance station by 19:20.

- On November 23, the final instream works for the upstream cofferdam were completed. Beginning at 8:40, an excavator dug a trench on the upstream side of the cofferdam to prepare the key (Photo 18). The excavation caused a pulse of turbidity measured in the mixing zone which quickly (<10 minutes) cleared to within 8 NTU of background levels. The works had no effect on water quality at the compliance station.
- On November 22 at 16:30, Ecofish crews conducted a Coastal Tailed Frog salvage in the dewatered section of Boulder Creek following diversion of the majority of flow to the tunnel (Photo 24). No frogs or tadpoles were found during the salvage.
- From November 23 to 26, the remaining stages of upstream cofferdam construction were completed above the high water mark with no effect on water quality (Photo 19 and Photo 20).
- On November 28, BDRHEF intake downstream cofferdam construction commenced (Photo 22). The works required the excavator to work instream to redirect flows towards the left bank of Boulder Creek to prepare the cofferdam site. Instream works caused intermittent pulses of turbidity measured at the mixing zone station. At 8:40, the IEM requested that CE slow the pace of works to reduce the intensity of the turbid pulse observed downstream. Downstream turbidity persisted for 40 minutes before returning to within 8 NTU of background levels at the mixing zone. Peak turbidity at the mixing zone was recorded to be 749 AU and equated to a peak of 55.4 NTU at the compliance station. The remaining cofferdam construction was conducted above the high water mark and did not have an effect on water quality (Photo 23).
- During works instream for the upstream cofferdam construction/diversion and downstream cofferdam construction, the IEM conducted water quality sampling at established water quality monitoring stations at the mixing zone and compliance station (Photo 25 to Photo 27). Sampling for turbidity was conducted at both stations until works were completed and the flows had cleared to within 8 NTU of background. Please see Appendix A for water quality data and monitoring notes.
- The IEM worked closely with CE throughout the Boulder Creek diversion works to ensure the duration of instream work activities was minimized and that works were executed according to the work plan. Based on the turbidity levels measured at the compliance point (max = 145 NTU) during main river diversion works and the short duration of exceedance of BCWQGs (approximately 2.5 hours), the IEM concluded that the Boulder Creek diversion works were unlikely to have resulted in serious harm to fish or fish habitat.

Photos:

Photo 13 – Upstream cofferdam with geomembrane and rock armouring (November 22, 2015).

Photo 14 – Excavator equiped with biodegradable hydraulic oil removing upstream end of diversion channel (November 22, 2015).

Photo 15 – Upstream cofferdam with excavator removing plug releasing majority of creek flow to diversion tunnel (November 22, 2015).

Photo 16 – View looking upstream at dewatered creek channel following plug removal and diversion of flow (November 22, 2015).

Photo 17 – Diversion tunnel exit following plug removal and creek diversion (November 22, 2015).

Photo 18 – Excavator placing mega-bags in trench for upstream cofferdam construction (November 24, 2015).

Photo 19 – The upstream cofferdam near completion with rock armouring (November 25, 2015).

Photo 20 – Final stage of upstream cofferdam construction (November 26, 2015).

Photo 21 – Test pit below upstream cofferdam to assess bedrock conditions (November 27, 2015).

Photo 22 – Instream works for downstream cofferdam construction (November 28, 2015).

Photo 23 – Final stage of downstream cofferdam construction (November 28, 2015).

Photo 24 – Ecofish conducting a Coastal Tailed Frog salvage in dewatered creek channel (November 22, 2015).

Photo 25 – The IEM conducting water quality sampling downstream of the diversion tunnel in the mixing zone during diversion (November 22, 2015).

Photo 26 – Water quality sampling downstream of the diversion tunnel during downstream cofferdam construction (November 28, 2015).

Photo 27 – Flows clearing in Boulder Creek at the water quality compliance station following downstream cofferdam construction (November 28, 2015).

5.2 *Downstream Tunnel Portal and Powerhouse*

Construction Activities:

- No tunneling activity due to work related accident and follow-up investigation (Photo 28).
- BDRHEF powerhouse component and generating equipment installation (Photo 29).
- Dewatering of the tunnel and powerhouse to the oil water separator and settling ponds continued (Photo 30).

Environmental Summary:

- All wastewater related to the BDRHEF tunnelling works continued to be contained and conveyed to the downstream portal settling ponds for treatment (Photo 30).

Photos:

Photo 28 – BDRHEF tunnel portal closed during this reporting period due to blasting restrictions (November 27, 2015).

Photo 29 – BDRHEF powerhouse structure (November 27, 2015).

Photo 30 – BDRHEF tunnel portal settling ponds (November 27, 2015).

5.3 *Water Quality Results*

The following table presents the results of the routine WQ sampling program for the BDRHEF. The IEM is undertaking a weekly monitoring program according to the conditions outlined in the Surface Water Quality Protection Plan. The regular monitoring sites have been selected to quantify WQ conditions within the Lillooet River upstream and downstream of active construction areas. The IEM acknowledges the natural variability of instream WQ conditions in Boulder Creek due to seasonal fluctuations in snowmelt. In the event that an exceedance of *in-situ* WQ (turbidity and/or pH) is deemed to be caused by project-related activities, the IEM will highlight the exceedance, discuss the cause, and outline measures undertaken by the Contractor to correct the issue. When an exceedance cannot be attributed to project related activities, the exceedance will be marked by an asterisk (*).

Date	Time	Sample Location Description	pH	Turbidity (NTU)	Cond (uS)	Temp (°C)
Routine Water Quality						
November 28, 2015	8:12	BDR BG – Upstream of BDRHEF intake	7.3	1.1	86	-
	9:10	BDR #1 – Downstream of BDRHEF intake	7.2	6.7	92	-
	10:10	BDR #2 – Upstream of BDRHEF Powerhouse	7.2	6.8	99	-
	9:50	BDR #3 – Downstream of BDRHEF Powerhouse at Pebble Creek Bridge	7.3	5.4	95	-

5.4 *Recommendations*

IEM recommendations for the BDRHEF are as follows:

- All wastewater related to the BDRHEF tunnelling works should continue to be contained and conveyed to the downstream portal settling ponds for treatment. Regular inspections of the treatment ponds should be performed to ensure the necessary maintenance activities outlined in the work plan are performed.

5.5 *Upcoming Works*

The following new and/or environmentally sensitive construction activities are scheduled to occur at the BDRHEF in the upcoming reporting period(s):

- Demobilization at the BDRHEF intake.
- BDRHEF downstream portal tunnelling works will resume upon release of the blasting stop work order.
- Component/generation equipment installation will continue at the BDRHEF powerhouse.

6.0 Transmission Line – Monitoring Results

6.1 *Transmission Line Construction Activities*

Right-of-Way Clearing:

- No activity.

Existing Road Upgrades and Access Road Construction

- No activity.

Transmission Line Pole Installation, Line Stringing and Clipping

- Groundworks for pole foundations in Segment 16.

Environmental Summary:

- No environmental issues were observed or reported during work in Segment 16.

6.2 *Water Quality Results*

Date	Time	Sample Location Description	pH	Turbidity (NTU)	Cond (uS)	Temp (°C)
No construction activities involving water management were conducted during this reporting period.						

6.3 *Recommendations*

- The IEM has no recommendations at this time.

6.4 *Upcoming Works*

- Groundworks for pole foundations in Segment 16.

7.0 Wildlife Sightings

As per the CEMP, a wildlife sightings record has been implemented and will be updated regularly by Project Personnel. It is mandatory for all personnel to report wildlife sightings including, but not limited to bears, cougars, mountain goats and deer. Wildlife sighting will be reported and recorded by the contractor(s). Wildlife Observation forms will be included in first reporting period following month end. Observation or detection of the following species will trigger notification to identified parties according to the following table.

Species Observed or Detected	Notification Period	Agencies to be Notified
Northern rubber boa	Immediately	IEM, Owner
Grizzly bear	24hrs	IEM, Safety Officer, Conservation Officer, Owner
Wolverine den	24hrs	IEM, MFLNRO, Owner
Spotted owls	24hrs	IEM, MOE, Owner
Mountain goats	48hrs	IEM, MFLNRO, Owner

8.0 Mountain Goat Monitoring Program

The following mitigation measures related to mountain goats were implemented during this monitoring period:

- On November 13, the IEM conducted snow depth measurements and the Two-week Mountain Goat Shutdown Period was enacted. The shutdown period ended upon receipt of EAC amendment #7 on November 26 and workers began to mobilize back to the ULRHEF downstream tunnel portal on November 28.
- Access to the BDRHEF intake is gated and locked or guarded fulltime to restrict motorized use within the UWR from November 1 – April 30.
- IEM was onsite to audit daily construction equipment shutdowns (November 1 - 30) beginning one hour before and two hours after sunrise as well as two hours before and one hour after sunset.

- Noise level monitoring data continued to be collected and used to adaptively manage construction noise and ensure that the 75db noise level threshold is not exceeded as outlined in the Mountain Goat Management Plan.
- The IEM or designate was on site to monitor Mountain Goat activity within 500m of construction activities at the ULRHEF intake and the ULRHEF downstream tunnel portal. Mountain goats were monitored from four sites:
- Truckwash Creek viewing river right of the Migration Corridor– MG-OBS01 (10U 467955 5612773):
- Keyhole Falls viewing the south side u-2-002 UL11 – MG-OBS02 (10U 466593 5613988); and,
- Garibaldi Pumice mine site viewing u-2-002 UL 19 – MG-OBS03 (10U 467388 561408); and,
- Salal Creek monitoring site viewing u-2-002 UL 8 – MG-OBS04 (10U 466133 5613991).

  Monitoring effort was split between all sites during daylight hours, unless safety concerns or weather conditions interfered. The order of site visits rotated daily. Construction activities must cease if a goat(s) are observed moving towards the ULRHEF intake and/or if a goat(s) are observed within a 500m line of site of a construction activity. No goats were observed within 500m line of sight of construction activities and no work stoppages were required.

9.0 Environmental Issues Tracking Matrix (ITM)

9.1 *Hydroelectric Facilities (ULRHEF & BDRHEF)*

ITM Tracking Legend:	*Work Item Open*
	Work Item Complete
	Issue Closed

Issue Tracking		Environmental Issue		Mitigation Measures			
ID No.	**Status**	**Location**	**Issue Description**	**Action Taken/Recommended**	**Date of Identification**	**Targeted Date for Completion**	**Date Completed**
ULR#36	*CLOSED*	*Covered Stockpiles at KM44.5 of the Lillooet River FSR*	*The stockpile tarp coverings are deteriorating and are no longer serving their original intent as a potential PAG rock temporary storage measure.*	*1. Remove the tarps if they are no longer required. Update November 24, 2015 – The IEM has been provided with memo provided by Golder (QP) which indicates that these materials are non-PAG and do not require a cover over the winter.* *OR* *Repair the tarps if they are still required (pending clarification on PAG vs non-PAG status)*	*Oct. 27, 2015*	*Nov. 30, 2015*	*Nov. 24, 2015*
No outstanding environmental issues (next ITM – BDR#28 & ULR#40)							

9.2 *Transmission Line*

ITM Tracking Legend:	*Work Item Open*
	Work Item Complete
	Issue Closed

Issue Tracking		Environmental Issue		Mitigation Measures			
ID No.	**Status**	**Location**	**Issue Description**	**Action Taken/Recommended**	**Date of Identification**	**Targeted Date for Completion**	**Date Completed**
No outstanding environmental issues (next ITM – Tx#3)							

Environmental Incident Reporting Form

General Information

Project Name: Upper Lillooet Hydro Project	**Project Component**: Migration Corridor on the FSR @ 44 km
Time/Date of Incident Start: 2015-11-25 around 2:15 PM	**Time/Date Incident Stopped**: 2015-11-25 around 2:30 PM
Date of Report: 2015-11-26	**Project Incident Report Number**: 2015-11-25 CE-EIR-018
Report Prepared By: Jean M. Pelletier	
Contractors Environmental Manager: Jean M. Pelletier	
Independent Environmental Monitor: Tom Hicks	
Licensee's Environmental Coordinator: Julia Mancinelli	

Contact Information for Company Involved in Incident

Company: CRT-ebc, s. e. n. c.	**Address**: PO Box 585, Pemberton BC – V0N 2L0
Phone #: 604-*894-5002	**Email**: jdrapeau@crtconstruction.ca
Contact Person: Jonathan Drapeau	**Position**: Ass. Project Manager

Incident Type *(check all that apply)*

Encroachment of an Environmentally Sensitive Area (*e.g.* Riparian/Wildlife Buffer) **Please provide details in "Description" section below.**	☑	**Adverse Impacts to Fish/Wildlife** **(*e.g.* Mortality/Injury)** **Please provide details in "Description" section below.**	☐
Water Quality/Quantity **Please provide details in "Description" section below.**	☐	**Hazardous Material Spills (to ground or water)** **Please provide details in description section in regards to:** • Perceives extent of damage • Type, quantity and area of the spill • Containment Procedures • Environmental features in close proximity to the spill	☐
Disturbance of known or unknown archeological /heritage site **Please provide details in "Description" section below.**	☐	**Air Quality** **Please provide details in "Description" section below.**	☐
Spill reported to external agencies **If yes, describe the receiving environment and substance/quantity spilled.**	☐	**Other** **Please provide details in "Description" section below.**	☑

Incident Profile

Weather at time of incident	 ☑ Clear	 ☐ Partly Cloudy/ Variable	 ☐ Cloudy	 ☐ Showers/ Periods of Rain	 ☐ Rain	 ☐ Heavy Rain *(>25mm in 24hr)*	 ☐ Storm *(Heavy rain and high winds)*	 ☐ Snow

Specific Location: FSR @ 44 - 48 km

Description and Cause of Incident:

Description: 3 pick-ups traveled through the mountain goat migration corridor during the sunset shutdown hours. Sunset shutdown was between 2:16 PM and 5:16 PM. The 3 pick-ups went through from 2:23 to 2:26 PM

Cause: The supervisor in charge of setting up the road block at 48 km was late to set-up a worker at the road blockade. In the meantime, 3 persons (3 pick-ups) went through the mountain goat migration corridor before a CE Env. Manager up at 49 km noticed the problem. He then blocked the road himself.

Incident Witness: Danita Abraham, Goat Monitor for SES

Were there any Potential Environmental impacts as a result of the incident? (e.g., surface contamination, storm sewers, or fish/wildlife mortalities)	**Yes** ☐	**None Observed** ☑

If Yes, please describe:

Has Wildlife Salvage Protocol been followed?	**Yes** ☐	**No** ☐	**N/A** ☑

If No, please explain:

Water Quality Samples Collected?	**Yes** ☐	**No** ☐	**N/A** ☑

If yes, attach results of water quality analysis to report in table format. Include Laboratory analysis if completed.
If No please explain:

Have applicable photos and/or drawings been attached to the incident report?	**Yes** ☐	**No** ☐	**N/A** ☑

Incident Response Measures

1. The 3 workers driving the pick-up will face disciplinary measures (to be determined).
2. An Environmental Manager, present at 49 km, manned the road blockade himself when he noticed the assigned worker did not show up

Actions to Prevent Incident Recurrence

Before the incident, these measures were in place:

1. Information about the daily shutdowns hours will continue to be transmitted to all superintendent and foremen at the morning meeting, with emphasis on how important it is to comply with them.
2. Offenders are now informed that they will face disciplinary sanction if not in compliance with the shutdown, including dismissal.

Since the accident, this additional measure will be implemented

1. CE Env Team will ensure, 15 minutes prior to shutdown times, that road blockade are in place and manned.

Notification Record

Agency Reported to	Contact Information	Agency Contacted		Date and Time Reported	Reported By	Method of Reporting
		Yes	No			
External						
Authority	Justin Carlson, BCEAO	☐	☐			Email within 48 hours of the EIR being finalized.
	James Davies, MFLNRO	☐	☐			Email within 48 hours of the EIR being finalized.
Lil'wat Nation	Harriet VanWart					Email within 48 hours of the EIR being finalized.
PEP	1-800-663-3456	☐	☑			
MOE Staff		☐	☑			
DFO		☐	☐			
Environment Canada	604-666-6100	☐	☐			
Canadian Coast Guard	604-666-6011	☐	☐			
Local Fire Rescue	911	☐	☐			
Internal						
EC	Julia Mancinelli	☑	☐	Nov 25 17:35	Tom Hicks	Email
IEM	Tom Hicks	☑	☐	Nov 25 16:59	Blake Aleksich	Phone call and Email
CRT-ebc	Env. Management Team	☑	☐	Nov 25 17:35	Tom Hicks	Email
		☐	☐			
		☐	☐			
		☐	☐			

Independent Environmental Monitor:

Print Name	Position and Company	Signature	Date
Tom Hicks	Lead Monitor - SES		2015-11-26

Contractor's Manager:

Print Name	Position and Company	Signature	Date
Jonathan Drapeau	Project Manager – CRT-ebc	 Jonathan Drapeau 2015.11.26 18:07:37 -08'00'	2015-11-26

Appendix A

Location	Time (24hr)	Turbidity (NTU)	Notes
November 23rd - ASTR04 Penstock Crossing Construction (Re-watering Channel)			
Background	7:50	1.67	pH = 7.6; Temp = 2.5°C; µS = 85
40m downstream of re-watering site (upstream end of ASTR04 penstock crossing)	8:00	1.02	
	8:15	2.26	Stopped pump
	8:30	**41.3**	
	8:45	**47.4**	
	9:00	***4648***	Filled in sump
	9:15	***2413***	
	9:30	***624***	
	9:45	**23**	Seepage was noticed on river right
	10:00	**39**	
	10:15	**33**	
	10:30	**42.7**	
	10:45	***768***	Seepage was significant; re-dug sump and installed diversion with 6" pump
	11:00	***1669***	
	11:15	***1492***	
	11:30	***683***	Created second sump at seepage point and pumped water to vegetaion for bioinfiltration with 2" pump
	11:45	***2642***	
	12:00	**63.9**	
	12:15	**30.7**	
	12:30	**27.7**	Water runs clear through the constructed channel, beomes dirty d/s in covered vegetation
	12:45	**21.2**	
	13:00	**76.3**	Pulse of dirty water - Increased sump depth
	13:15	**54.3**	Turned off 6" pump
	13:30	**27.1**	
	13:45	**21.3**	
	14:00	**64.4**	23NTU = pool where geomembrane ends 6.14NTU = constructed streambed (still turbid downstream)
	14:15	**47.6**	
	14:30	***1813***	Started 6" pump for 3rd time; attemping to see if seepage is due to membrane not pulled wide enough at channel intake
	14:45	**80**	
	15:00	**55.6**	
	15:15	**38.8**	
	15:30	***3819***	Placed 0-300 to RE-fill sump that was dug out
	15:45	**81.4**	
	16:00	**38**	
	16:15	**61**	
	16:30	**46.9**	
	16:45	**67**	

Appendix A

ASTR04 crossing outlet to natural channel	16:45	**15**	
40m downstream of re-watering site	17:00	**31.5**	Still turbid downstream; main channel clearing up quickly
ASTR04 crossing outlet to natural channel	17:00	**11.5**	
November 24th - ASTR04 Penstock Crossing Construction (Follow-up inspection)			
Background	9:11	1.67	
40m downstream of re-watering site	9:18	4.51	Minimal subsurface flow seeping from same area as yesterday

November 22nd, 2015 - BDRHEF Intake Diversion and Cofferdam Construction				
	Turbidity (NTU)			
Time (24hr)	Mixing Zone (15m downstream of diversion tunnel	Compliance Station (240m Upstream of Powerhouse)	Temp (°C)	Notes
9:00	Background = 3.85	-	-	
9:30	4.36	-	-	Work started. pH = 7.35; µS = 95; Temp - 0.8°C
9:40	4.08	-	-	
9:50	10.31	-	-	Instream work started
10:00	***630***	-	-	
10:10	**91**	-	-	
10:20	**31.4**	-	-	
10:30	**41.5**	-	-	
10:40	4.54	4.47	1.4	
10:50	10.24	1.36	1.3	
11:00	5.74	3.2	1.3	
11:10	5.34	4.08	1.3	
11:20	4.36	3.64	1.3	
11:30	3.53	5.95	1.3	
11:40	2.1	**15.3**	1.3	
11:50	3.94	**19.9**	1.3	
12:00	**15.3**	**21.5**	1.3	
12:10	**27.4**	**12.3**	1.3	
12:20	**16.4**	7.11	1.5	
12:30	**16**	5.84	1.3	
12:40	**12**	4.29	1.4	
12:50	8.7	4.31	1.4	
13:00	**10.8**	3.26	1.4	
13:10	**18.3**	2.17	1.5	
13:20	9.12	2.89	0.9	Started excavation instream at 13:15 (Small pulse)
13:30	**14.32**	-	-	
13:40	6.19	3.39	1.3	
13:50	7.04	3.78	1.3	
14:00	3.27	-	-	
14:10	**37.4**	3.96	1.3	
14:20	**37.6**	3.79	1.4	
14:30	28	-	-	
14:40	**62.7**	3.29	1.4	Moved large rock; increased flow in diversion tunnel

14:50	**63**	3.26	1.3	
15:00	**33.5**	-	-	Started instream excavation (turbid pulse)
15:10	**52.5**	4.16	1.4	River appeared visually turbid, but low NTU
15:20	***174***	3.91	1.2	
15:30	**63.3**	3.42	1.3	
15:40	**46.6**	3.97	1.1	15:40-16:30 visually turbid conditions
15:50	**88.3**	5.11	1.2	
16:00	**64**	5.69	1.6	
16:10	***161***	4.92	1.3	
16:20	***776***	4.19	1.2	Diversion channel opened completely
16:30	***119***	8.38	1.2	
16:40	**28.3**	**15.4**	1.1	
16:50	**81.2**	**13.9**	-	
17:00	**38.2**	**25.6**	1.2	
17:10	10.72	**29.3**	1.2	Within BCWQGs at mixing zone (<8 NTU over background)
17:20	**-**	**21**	1.2	
17:30	**-**	**26.8**	-	
17:40	**-**	**32.3**	-	
17:50	**-**	**61.2**	-	
18:00	**-**	**70**	-	
18:10	**-**	***145***	-	
18:20	**-**	**92**	-	
18:30	**-**	**48.3**	-	
18:40	**-**	**33.6**	-	
18:50	**-**	**18.4**	-	
19:00	**-**	**11.1**	-	
19:10	**-**	**10.2**	-	
19:20	**-**	7.27	-	

November 24th, 2015 - BDRHEF Upstream Cofferdam Construction			
Location	**Time (24hr)**	**Turbidity (NTU)**	**Notes**
Background	7:58	5.97	
Mixing zone (15m downstream of diversion tunnel)	8:42	45.7	Peak turbididty due to excavation of trench for cofferdam
	8:52	11.4	Water quickly cleared
	9:12	6.62	
	9:15 - 10:35		Preparing and installing impermeable membrane
Mixing zone	10:45	6.87	Installing mega-bags in key
	12:21	8.31	Placing rock at creek edge for cofferdam armouring
	12:41	7.04	
	13:01	8.2	
	13:25	9.31	
	13:50	7.47	

Appendix A

November 28th, 2015 - BDRHEF Downstream Cofferdam Construction			
Location	**Time (24hr)**	**Turbidity (NTU)**	**Notes**
Background	8:12	1.09	
10m downstream of active works	8:25	**194**	Not mixing zone because further downstream was not safely accessible.
	8:30	**92**	
	8:35	**932**	
Mixing zone (15m downstream of diversion tunnel)	8:40	**39**	Excavator paused for 3-4 mins at 8:37 at request of IEM
	8:45	**749 AU**	
	8:50	**19**	
	8:55	**58.2**	
	9:00	**85**	
	9:05	**25.7**	
	9:10	6.72	Instream works complete; within BCWQGs
Compliance station (240m upstream of powerhouse)	9:55	3.22	
	10:10	6.69	
	10:15	**9.33**	
	10:20	**22.8**	
	10:25	**38.9**	
	10:30	**42**	
	10:35	**41.6**	
	10:40	**48.5**	
	10:45	**55.4**	
	10:50	**43.1**	
	10:55	**41.7**	
	11:00	**22.6**	
	11:05	**17.3**	
	11:10	**11.28**	
	11:15	**10**	
	11:20	7.19	Turbidity returned to within BCWQGs