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Upper Lillooet Hydro Project

Independent Environmental Monitoring Final Summary Report

Upper Lillooet River Power LP & Boulder Creek Power LP – Innergex Renewable Energy Inc.

Water Files: 2003601, 2002453, 2002561; Land Files: 2409998, 2408971, 2410654



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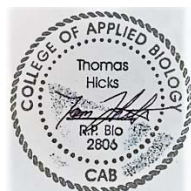
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Endorsement and Disclosure

SEI has prepared this memorandum to fulfil the requirement to provide MFLNRO with an IEM final summary report as outlined in Section 9.5.3 of the CEMP, and at the request of the Owners. The material and recommendations contained herein reflect the professional judgement of SEI following experience in the role of IEM on the Upper Lillooet Hydro Project. Any use which a third party makes of this memorandum, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Decisions made or actions taken as a result of our work shall be the responsibility of the parties directly involved in the decisions or actions.

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Table of Acronyms

Andritz	Andritz Hydro Canada Inc.	IEM	Independent Environmental Monitor
ANFO	Ammonia nitrate fuel oil (industrial explosive)	INX	Innergex Renewable Energy Inc.
ARD M/L	Acid Rock Drainage and Metal Leaching	ITM	Environmental Issue Tracking Matrix
BCEAO	British Columbia Environmental Assessment Office	JEM	JEM Energy Ltd. (Delegate Independent Engineer)
BCCOS	British Columbia Conservation Officer Service	LTC	Leave to Construct
BCWQG	British Columbia Water Quality Guidelines	MFLNRO	Ministry of Forests, Lands and Natural Resource Operations
BDRHEF	Boulder Creek Hydroelectric Facility	MOE	Ministry of Environment
CE	CRT-EBC s.e.n.c.	MOTI	Ministry of Transportation and Infrastructure
CEMP	Construction Environmental Management Plan	OLTC	Occupational License to Cut
CTF	Coastal Tailed Frog	PAG	Potentially Acid Generating
DFO	Fisheries and Oceans Canada	QP	Qualified Professional
EPP	Environmental Protection Plan	ROW	Right of Way
EAC	Environmental Assessment Certificate	RVMA	Riparian Vegetation Management Area
EAO	Environmental Assessment Office	SEI	Sartori Environmental Inc.
Ecofish	Ecofish Research Ltd.	SLRD	Squamish-Lillooet Regional District
EIR	Environmental Incident Report	TX Line	Transmission Line
ESC	Erosion and Sediment Control	ULRHEF	Upper Lillooet Hydroelectric Facility
FAM	Field Advice Memorandum	UWR	Ungulate Winter Range
FSR	Forest Service Road	VC	Valued Component
Golder	Golder Associates	WEL	Westpark Electric Ltd.
Hedberg	Hedberg and Associates Ltd.	WEMR	Weekly Environmental Monitoring Report
HWM	High water mark	WHA	Wildlife Habitat Area
IE	Independent Engineer (True North Energy)		

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1.0 Introduction

The Upper Lillooet River Power Limited Partnership and Boulder Creek Power Limited Partnership (collectively the “Partnerships”, the “Licencee”, the “Owners” or the “Certificate Holders”) own and operate the Upper Lillooet Hydro Project (the “Project”) which is comprised of two separate run-of-river hydroelectric facilities constructed within the headwaters of the Lillooet River, northwest of Pemberton, British Columbia, specifically the Upper Lillooet River Hydroelectric Facility (ULRHEF) and the Boulder Creek Hydroelectric Facility (BDRHEF). Electricity produced from the two facilities is transmitted along a shared 72 km long, 230 kV transmission line (TX Line) and interconnects to the BC Hydro grid at the Tisdall Capacitor Station, located 10 km southwest of Pemberton. The two hydroelectric facilities and the TX Line were constructed between October 2013 and November 2017, following issuance of the Conditional Water Licences (Files: 2003601, 2002453, 2002561), and subject to Leaves to Commence Construction (LTCC) issued by the Ministry of Forests Lands and Natural Resource Operations (MFLNRO) for construction of the ULRHEF, BDRHEF, and TX Line. Additional pre-construction approvals for the project included, but were not limited to the Environmental Assessment Certificate #E13-01 (EAC) granted by the British Columbia Environmental Assessment Office (EAO), General Wildlife Measure Exemption Approval (GWME) for the BDRHEF and TX Line (File No. 78700-35/06 UWR and 39585-20 WHA), Canada *Fisheries Act* Sec. 35(2)(b) Letter of Advice and Authorization No. 09-HPAC-PA2-00303, and BC *Lands Act* Licences of Occupation (Files: 2409998, 2408971, 2410654). The Project lies within the sole unceded traditional territory of the Lil’wat Nation.

As the prime civil contractor for the Project, CRT-EBC s.e.n.c. (CE) conducted and oversaw all phases of civil works construction of both hydroelectric facilities. Andritz Hydro Canada Inc. (Andritz) completed the balance of plant electrical and turbine-generator installation for both hydroelectric facilities. TX Line construction was completed by Westpark Electric Ltd. (WEL) with TX Line alignment clearing and access roads completed by a forestry sub-contractor (Mumleqs: a joint venture between the Lil’wat Nation and Lizzie Bay Logging). WEL served as prime contractor for the TX Line portion of the Project.

George Steeves, of True North Energy, was identified as the Independent Engineer (IE) under the Project LTCC. Jennifer McCash was named as the delegated IE. The IE Team was responsible for reviewing all work plans and design drawings issued for construction and for issuing Leaves to Construct (LTC) prior to the construction of any component of the Project works. The IE conducted monthly site visits and provided monthly construction status reports to MFLNRO.

J. Alex Sartori, Sartori Environmental Inc. (SEI), formerly Sartori Environmental Services G.P., was named as the Independent Environmental Monitor (IEM) under the Project LTCC. Stephen Sims was named the delegate IEM and Tom Hicks was named the lead field monitor. The IEM Team conducted routine construction monitoring throughout the construction phase of the Project and reported findings to regulatory agencies in publicly accessible environmental monitoring reports (EMR) at regular intervals. SEI has prepared this Independent Environmental Monitoring Final Summary Report for the Upper Lillooet Hydro Project (this report) to satisfy the final condition of the Construction Environmental Management Plan (CEMP; Section 9.5.3) and to serve as the final reporting requirement of the IEM following completion of the construction phase of the Project. The intent of this report is not to summarize or repeat information contained within the 115 EMRs prepared and submitted by the IEM to date. Instead, this report will serve as a general summary of the following:

- Routine environmental mitigation measures implemented during construction activities within environmentally sensitive areas and recommended improvements;
- Environmental incidents and concerns encountered during the Project construction phase; and,
- Lessons learned by performing the duties of the IEM.

Appendix A provides a photographic summary of works completed at each job site and temporary work space.

2.0 Environmental Mitigation Measures: Successes and Recommended Improvements

Environmental mitigation measures were employed within areas identified as environmentally sensitive or of high value during the Project's construction period. The following section presents the environmental mitigation measures routinely monitored by the IEM during the construction period and provides an evaluation of how successful these mitigations were in avoiding, minimizing or mitigating adverse effects. Where possible, the IEM has provided recommendations to improve the effectiveness of routinely monitored mitigation measures while considering implementation practicability and potential impacts to construction schedule. The key mitigation measures discussed in this report have been divided into sub-sections for ease of reference and include:

- Pre-Construction Planning;
- Construction Timing Windows;
- Water Quality Protection Measures;
- Material Management (Including Potential Acid Generating (PAG) Rock testing & Acid Rock Drainage (ARD) management);
- Soil Stabilization – Erosion and Sediment Control Measures;
- Noise Reduction Strategies and Construction Noise Level Monitoring;
- Dust Control and Dust Abatement;
- Wildlife Surveys, Salvages, and Monitoring;
- Environmental Protection and Archeological Site Setbacks; and,
- Access Road Maintenance.

2.1 Pre-Construction Planning

The civil and TX Line Contractors were responsible for preparing task specific work plans for each phase of work prior to initiating the works; specific construction methodologies, safety hazards and environmental risks/mitigations were clearly identified. Each work plan was reviewed by the IEM and the Owners to ensure that activities were scheduled and staged to reduce environmental risk to the extent possible, and to ensure that all environmental commitments (*e.g.* permits, authorizations, certificates, licences, agreements, *etc.*) would be satisfied during the planned works. Comments, errors or omissions identified by the Owners and IEM were addressed as part of an iterative process, when required. Once the work plan was approved by the IEM and Owners, it was submitted to the IE with sealed engineering drawings for final approval and issuance of a LTC. Construction hold points were often included in the work plans and/or were listed as conditions of the LTCs issued by the IE. The work plan hold points and LTC conditions served to clearly state the conditions that needed to be met prior to starting a new phase of work. Throughout construction and commissioning a total of 140 work plans were approved, resulting in the issuance of 100 LTCs.

A pre-work meeting was held at the start of each new phase of work to review the approved work plan and LTC, including any hold points identified therein. The pre-work meetings were attended by the site supervisor, field engineer, site foreman, IEM, Owners representative and sub-contractors involved in the new phase of work. The pre-work meetings were held to confirm that the information contained in the Work plan and LTC was effectively conveyed to the crews performing the works, and to identify any potential changes to the work plans that needed to be made based on the site conditions. Participation in the pre-work meetings was documented through the signing of a pre-work meeting attendance sheet, which confirmed that the crews performing the works had been

given the necessary information and were familiar with the environmental mitigation measures to be implemented throughout and/or prior to beginning the new phase of works.

Work plans and pre-work meetings served to effectively communicate to all parties (Owners, IEM, IE, Contractors, sub-contractors, crews) the methods and procedures to be used while performing the upcoming new phase of works. Both of these communication tools were effective ways for the IEM to verify that all works were planned proactively, and that the Contractors were effectively communicating information from the office to the field. Although the iterative review process of work plan preparation/review between the Owners, Contractors, and IEM was lengthy in the early phases of the Project, it became more efficient over time. The work planning process allowed the IEM and Owners to comment on work procedures and to identify potential environmental concerns associated with the work in a proactive way, thereby avoiding environmental issues that may otherwise have arisen. An added benefit of the pre-construction planning phase was that it helped to foster a team approach by pooling the combined experience of all parties involved in effectively and successfully planning the Project works. The pre-work meetings helped to assign accountability and responsibility to the crews performing the works and provided crews with an open channel of communication to discuss the work plan with the field engineer, supervisor, IEM and/or Owners' representative, so that questions could be addressed before work commenced. Based on the experience of the IEM, these two tools were extremely beneficial to the Project, and should be adopted for all future projects. Through proactive construction planning and by fostering strong communication among all Project levels/teams, significant time savings can be realized by increasing construction efficiency and by avoiding shutdowns from preventable environmental incidents.

2.2 Construction Timing Windows

During the Project's environmental assessment phase, a total of 33 Environmental and Heritage Valued Components (VCs) were identified. Potential adverse effects to these VCs as a result of the Project were assessed, and mitigation measures were developed to avoid, minimize or mitigate potential adverse effects. To avoid or reduce potential adverse effects to VCs during sensitive life history stages (such as; breeding, critical foraging, migration, incubation or rearing, overwintering, etc.), it is common to prescribe an avoidance period when construction activities are prohibited or when additional mitigations measures must be implement before the works can proceed (e.g. breeding bird and raptor surveys, fish and wildlife salvages, wildlife monitoring, water quality sampling, etc.). The time outside of the sensitive/avoidance period is commonly referred to as the construction timing window or least risk window.

The Project was required to adhere to a long list of construction timing restrictions¹, which combined with uncontrollable environmental factors (wildfire, landslide risk, floods, extreme rain events, avalanches and avalanche hazard, significant snowfalls, etc.), greatly reduced the number of days when construction was possible, especially in certain critical work areas. The timing restrictions combined with environmental factors restricting work, as well as the technically challenging nature of the works, posed a significant challenge to Project scheduling; thereby increasing the number of mobilizations and demobilizations from certain areas, and thus resulting in an overall extension of the Project schedule. Two key examples of timing restrictions that resulted in an extension of the overall construction schedule, were the sunrise/sunset and two-week shutdown timing restrictions at the ULRHEF lower tunnel portal and Truckwash Creek mountain goat migration corridor. The sunrise/sunset timing

¹ For a complete list of timing restrictions please refer to the Human-Wildlife Interaction Management Plan – Appendix A (Lacroix & Newbury, 2013).

restriction required that construction activities halt for one hour before and two hours after sunrise and for two hours before and one hour after sunset during the months of November and May. The two-week shutdown period was a shutdown of construction activities and travel at the onset of winter (first snow depth accumulation of >30cm), and at the beginning of spring (snow depth receding to <10cm). These two timing restrictions significantly impacted the number of available working hours at the ULRHEF lower tunnel, during the spring and fall, thus extending the overall work schedule. The effectiveness of these two timing restrictions is difficult to determine, since these same restrictions did not apply to other user groups (e.g. mining operators, forestry companies, public, etc.) operating in the area; who did travel through the mountain goat migration corridor throughout these Project shutdown periods.

Several amendments to timing restrictions specified in the EAC and the GWMEA were required to allow construction works to proceed during a restricted time period. In addition, the effectiveness of the project-specific construction timing restrictions could be improved. The IEM recommends implementing the following three changes and providing sufficient clarifications in the Project documents to improve the overall effectiveness of project specific timing restrictions on future projects.

Firstly, when prescribing construction timing restrictions, it is recommended that the language contained in permits, approvals, and project-specific documents [CEMP and associated Environmental Protection Plans (EPPs)] allow the Project team the flexibility to create and develop a mitigation strategy or revised work method that can be implemented by a team of qualified professionals (QPs) to avoid or reduce identified potential adverse effects to the resource (VC) while performing works during a sensitive timing or avoidance period. Under the proposed professional reliance model, a revised mitigation strategy could be developed by a team of QPs to modify the timing restriction, which the IEM would review and grant approval or consult with regulators prior to granting approval. In the case of the Project, a total of six amendments to the EAC were sought and granted by the EAO, three of which were related to amending construction timing restrictions. In addition, four GWME Approval amendments associated with timing were sought and approved. Based on the experience of the IEM, amending conditions of the EAC and/or GWME Approval is an onerous and unnecessary process if the pursued amendment will continue to uphold the original intent of the EAC Condition, during the amendment period. The IEM suggests relying on a professional reliance model to modify construction timing windows when required to allow construction activities to proceed while maintaining the protection of valuable resource(s), as discussed above.

Secondly, we recommend a clear definition of what constitutes “construction activity” be explicitly provided in the project documents. During the construction period, what fell under the definition of construction activity was open to interpretation which led to different points of view. Some examples include: snow plowing and snow clearing; travel on constructed or existing access roads; road maintenance on existing roads; avalanche control; conductor stringing, tension, and clipping; etc. None of these activities fall under the definition of construction activity provided by EAO, subsequent to the issuance of the EAC, which defines construction as “works and associated activities including vegetation clearing, earthworks, building and installation that modifies the land, vegetation and/or natural environment related to the building of the proposed Project”. It is recommended that any activities exempt from a timing restriction be explicitly described in the mitigation prescription to clarify the desired intent of the restriction. Recognizing that it may prove difficult to predict and define all types of activities that may occur over the course of the project, it is recommended that when situations arise that are not well defined in the Project documents, that the IEM be consulted, and a professional reliance model used to assess the potential for adverse effects to VCs and determine what mitigation measures are appropriate to avoid or reduce the potential for adverse effects.

Thirdly and perhaps the greatest challenge was that the restrictions were not applicable to other users (industrial and public) in the area. For example, when the TX Line contractor was restricted from working in the Ryan River drainage to mitigate potential impacts to sensitive grizzly bear forage areas, meanwhile the forest licensee was able to conduct active heli-logging in the area that was explicitly restricted in the case of the Project. Also, all Project construction activities were restricted above the ULRHEF powerhouse from March 1 – April 30 of each year during the wolverine den emergence period, during a time that the local trapper was active in the area. These were not isolated occurrences and a number of examples of these inconsistencies were highlighted in the EMRs and are discussed in the yearly Noise Monitoring Summary Reports prepared by the IEM (Hicks T. , 2015); (Hicks T. , 2016); (Hicks T. , 2017), and more extensively in the memorandum discussing the effectiveness and adherence to EAC Conditions related to grizzly bears and grizzly bear habitat (see Appendix B). In order for timing restrictions to be effective at avoiding impacts to the VC in question, consistency across user groups and industries operating in the area is essential.

2.3 Water Quality Protection Measures

Water management and water quality protection proved to be one of the greatest challenges during the construction phase of the Project. Complex dewatering systems; systems injecting flocculant and coagulant to reduce turbidity; CO₂ injection systems for pH treatment; ponds and tank systems designed and installed to provide adequate settling time; all of these components were used to treat water to within the BC Water Quality Guidelines for the Protection of Aquatic Life (BCWQGs) prior to discharging to surface waters (e.g. streams, drainages, etc.). This type of complex water treatment system was designed and used at the ULRHEF intake and downstream tunnel portal to treat effluent during tunnel construction and intake construction operations. A similar type of complex water treatment system was installed at the BDRHEF intake and was used to treat water during the tunnel excavation and construction of the intake structures. At the BDRHEF downstream tunnel portal, a series of infiltration ponds were used and maintained to capture effluent from the tunneling operation, preventing untreated water from making connection with surface waters. The water treatment systems used during the construction phase were essential. Without, it would have been impossible to maintain adherence to BCWQGs during tunnelling and intake construction. Although these systems sometimes experienced mechanical failures and infrequent maintenance issues, regular monitoring of the systems discharge by the IEM determined that they were highly effective at treating water during the vast majority of their time in service.

For culvert installations and other activities involving water management, the IEM was present to monitor water quality throughout the works as detailed in the EMRs. One of the requirements during instream works was the use of synthetic bio-degradable or vegetable-based hydraulic fluid in the machinery operating within the riparian zone (within 30m of a watercourse). This CEMP condition proved difficult to enforce on all machinery. The Prime civil Contractor clarified that only excavators could be equipped with this grade of hydraulic fluid, whereas rock trucks, dozers, feller-bunchers, and graders could not be equipped with this fluid. Based on the number of hydraulic hose failures that are experienced while operating excavators, it is recommended that the use of synthetic bio-degradable or vegetable-based hydraulic fluid in excavators become industry standard.

During blasting, the use of soluble ammonium nitrate-fuel oil (ANFO) mixtures was not permitted to be used when contact with water was possible due to the production of toxic by-products (ammonia) during incomplete combustion and solubility; however, ANFO was required for tunneling where significant groundwater infiltration was present. The IEM required that sampling be conducted to confirm that blast rock generated by the use of ANFO was washed and tested for contamination prior to using it on site. Laboratory results from the washed rock showed no significant levels of ammonia contamination, and therefore the material was permitted to be used

onsite after it was washed. On future Projects, the IEM recommends testing for residual toxic by-products of blasting with ANFO in all blast rock, prior to using blast rock for armouring applications (ditch or stream bank armouring and/or for use in areas exposed to run-off).

Prior to commissioning the penstock, the civil Contractor thoroughly cleaned the penstock and flushed it with freshwater or “test flush”. The test flush water was sampled by the IEM to verify potential contamination levels. Sampling of the test flush water was not a Project requirement, but the IEM performed sampling and analyzed the sampling results to ensure that no residual contaminants remained in the penstock that could pose a threat to downstream receiving waters during commissioning of the penstock. At minimum, the IEM recommends collecting four samples throughout the flush (background of flush water, first flush, last flush, background of receiving water), to test for light and heavy extractable hydrocarbons (LEPH & HEPH), polycyclic aromatic hydrocarbons (PAH), dissolved metals, and total metals, and confirm that concentrations captured are within BCWQGs and/or show a downward trend between the first flush sample and the last flush sample suggesting that BCWQGs will be met during the first release of water from the penstock during commissioning. Follow-up sampling of the first release of water from the penstock during the commissioning phase should also be performed and the result analyzed to document adherence BCWQGs.

The IEM was responsible for conducting instream acoustic water pressure testing for all blasts deemed to be at risk of causing overpressure in fish bearing waters. The IEM conducted instream acoustic water pressure testing for all blasts occurring within 30m of a fish-bearing watercourse. Based on the monitoring results, it is recommended that instream acoustic pressure monitoring only be conducted for blasts occurring within the wetted width, and at the start of concussive activities (e.g. pile driving) that occur within the bankfull width.

Water quality was measured weekly at seven designated sampling stations (two in Boulder Creek and five in the Upper Lillooet River). The data collected at the designated sampling stations served only to document the natural variability of the systems being sampled. Based on our experience, the effort spent conducting weekly water quality sampling at designated sampling stations downstream of construction areas, did not provide useful or valuable information. Data that was much more valuable was collected at the point of discharge of the water treatment systems, or downstream of active instream construction works. The collection of water quality data from these point of discharge locations serves to inform whether changes are required to the water treatment system or if the construction activities being performed need to be altered. An effective water quality monitoring program should identify specific activities with the potential to impact downstream water quality, and develop a sampling plan that involves, at minimum, a sample of the background condition and a downstream sample at the mixing point. It is also often helpful to sample as near as possible to the point of discharge and further downstream within the attenuation zone. This data can be used to help inform construction practice and ensure the BCWQGs are being maintained during short term and long term (>24hours) discharges. It is important to clearly state the water quality guidelines that the Project is required to uphold for short term and long term increases in turbidity. Based on the IEM experience in the field, it is more practical to sample frequently over short periods and adjust water treatment or construction practice until water quality parameters trend towards background condition rather than collect samples every hour over a 24-hour period to determine if the guidelines were exceeded.

2.4 Material Management (Including Potential Acid Generating (PAG) Rock testing & Acid Rock Drainage (ARD) management)

The stockpiling of organic soils and woody debris separately from mineral soils and rock proved to be a very valuable Project requirement. Through the appropriate planning and handling of material during the stripping, grubbing, bulk excavation, and tunnelling phases of the Project, the Contractors were able to segregate organic soils and woody debris for use in the project reclamation phase. Segregated mineral soils and rock were also used as fill or as rock armouring in a number of applications which saved the civil Contractor from sourcing and mining some of this material. Based on our observations, we recommend that those responsible for planning stockpile locations consider how stockpiled and segregated organic material will be accessed for later use (*e.g.* site reclamation). On the Project site, most of the stockpiled organic material was placed around the edge of the spoil pile. As the spoil pile grew, it inevitably overlapped and buried the organic soils stockpiles along the perimeters, making recovery of the material more time consuming and difficult.

Working within the spoil area limits also proved difficult in a few instances, since stockpiled organic soils and spoil material was pushed to the edge of spoil area limits during operation of the spoil area, which prevented access for maintenance along the spoil area perimeter. To avoid these problems on future Projects, the IEM recommends the installation of a silt fence or perimeter berm inside the limits of the spoil area with a perimeter ditch installed within this perimeter control. The spoiling of material should then be offset a minimum of 1m from the inside edge of the perimeter ditch. This configuration allows for machine access around the base of spoil area to conduct any additional erosion and sediment control maintenance that is required. Another advantage of this configuration is that the slopes angles of the spoil pile edges can be reduced to a more stable configuration during spoil area reclamation by using machinery to push material into the perimeter ditch and up to the spoil area limit.

An acid-rock drainage (ARD) and metal leachate (ML) monitoring and control plan was developed to ensure material excavated during tunnelling operations was tested for the presence of potentially acid generating (PAG) rock. All tunneling material was tested and monitored by a QP and results were provided to the IEM upon request during tunnelling operation. Material that was sampled and classified as PAG rock was stockpiled in a spoil area designed by a QP and constructed to prevent leaching of ARD/ML.

The area specified for permanent storage of PAG rock was sited and sized once PAG rock was discovered during the tunnelling operation. On future projects that involve construction of a tunnel or blasting where the potential to encounter PAG rock exists, the IEM recommends that the permanent PAG spoil location be determined during the early Project planning phases, and that its size be adaptively increased to accommodate volumes of PAG rock as they are encountered.

2.5 Soil Stabilization – Erosion and Sediment Control Measures

Erosion and sediment control (ESC) was often the subject of outstanding environmental issues and Field Advice Memos (FAMs) but did not directly result in an environmental incident or stop work order during the construction period (See Section 3.0). The civil Contractor generally employed a reactionary rather than a proactive approach to ESC. Nevertheless, all Contractors were able to adequately manage the site throughout the construction period. Hydro-seeding was applied to many of the cut slopes and slope breaks were installed on the cut slope at the Upper Lillooet River HEF intake. In future, we recommend that the final reclamation prescription for cut slopes be required immediately following excavation to permanently stabilize the slope *in lieu* of temporary hydro-seeding, as grass is often not the final desired condition of the slope and is not likely to thrive on slopes greater than 2:1.

2.6 Noise Reduction Strategies and Construction Noise Level Monitoring

During the Project's assessment phase, it was determined that seasonal mountain goat migrations occurs through the Truckwash Creek drainage, between the upper elevation summer range on Mt. Athelstan and lower elevation overwintering and kidding range at Keyhole Falls. Construction noise level monitoring was required to mitigate potential impacts to mountain goats when works were occurring within 500 m of mountain goat ungulate winter ranges during the sensitive winter and spring periods, and within the Truckwash Creek migration corridor during the late fall and spring mountain goat migration periods. The IEM recorded construction noise levels throughout the spring and fall sensitive periods and provided feedback to the civil Contractor when noise levels exceeded the 75dBA threshold at the monitoring stations. When noise level thresholds were exceeded, alterations to work procedures were discussed to reduce construction related noise to the extent possible. Results of the noise level monitoring program have been summarized in yearly reports (Hicks T. , 2015), (Hicks T. , 2016), (Hicks T. , 2017). The construction noise level monitoring program recorded relatively few instances of noise level exceedances when compared to the overall duration of monitoring. The majority of the exceedance were attributed to blasting associated with tunnelling works and avalanche control. The civil Contractor was able to reduce construction related noise to the extent possible within the Truckwash Creek mountain goat migration corridor, by modifying blasting procedures (*e.g.* minimum number of holes per blast, blast hole stemming, minimizing charge weights, appropriate use of delays, use of blast mats, *etc.*).

In hindsight, similar results could have been achieved with a more directed noise level monitoring approach rather than recording noise levels continuously. For example, noise level monitoring could have been performed at the start of each new phase of work (*e.g.* clearing, bulk excavation, equipment travel, penstock construction, *etc.*) and during all loud construction activities (*e.g.* blasting, rock hammering, *etc.*) to record noise levels generated by the works, and through the simultaneous observation of mountain goats, determine whether these levels have an effect on nearby mountain goat behaviours. One disadvantage of this approach is that non-construction related noise level exceedances (*e.g.* those caused by natural events or by other industrial/public users operating in the area) would not have been captured or considered in the analysis of the noise level monitoring results. Despite this disadvantage, it is recommended that future noise monitoring programs adopt a more directed approach, to increase to effectiveness and applicability of the noise monitoring program.

The construction noise level threshold of 75 dBA was determined based on noise levels generated by a helicopter operating at the recommended distances from UWRs during sensitive time periods (2000 m horizontal distance; 400 m vertical distance). Based on the Project's mountain goat monitoring program and, more specifically, the noise level monitoring results, the IEM suggests that the threshold level set (75 dBA) may have been too conservative as mountain goats did not typically display behaviours indicative of distress or disturbance when construction related noise was recorded above the threshold levels at the monitoring locations. We found from approximately 13 months of noise monitoring and behavioural observations over three years of construction that the source and position of the construction noise affects mountain goat behaviour to a greater degree than the overall noise level. It is recommended that instead of prescribing noise level thresholds in the future, that construction noise level thresholds be adjusted based on observed behaviours of mountain goats in response to recorded construction noise levels and/or the source and position of the noise.

2.7 Dust Control and Dust Abatement

Dust control on access roads was generally managed using water trucks; however, during periods of hot dry weather and heavy traffic, a dust suppressant (CaCl or MgCl) was required. The effectiveness of the dust suppression was limited in areas where dust suppressant free zones were required (*i.e.*, watercourse crossings

and within 5 m of a watercourse). Water was extracted under a short term water use permit (*Water Act*: Section 8) for use in water trucks, for use in concrete production and concrete dust suppression, and for dust suppression during aggregate production. As water was extracted from fish bearing waters, an end-of-pipe fish screen conforming to Fisheries and Oceans Canada specifications was required at the water withdrawal points. On future projects, it may be more efficient to include the short term use of water in the Conditional Water Licence for the construction phase of the Project.

2.8 Wildlife Surveys, Salvages, and Monitoring

Significant effort was expended by all Contractors to mitigate potential impacts to identified avian VCs by conducting pre-clearing surveys (*e.g.* raptor nesting surveys, active migratory songbird nesting surveys, harlequin duck nesting surveys, sharp-shinned hawk nesting survey, *etc.*) within the Project area (including the facility footprints, temporary works areas, and the length of the 72km TX Line right-of-way) during identified avoidance periods. Surveys were required prior to clearing vegetation during the breeding bird period (May 1 – July 31) and prior to clearing within the vicinity of areas identified as potentially suitable raptor nesting habitat (March – August). In addition, the IEM or a QP was required to be present onsite during clearing within prescribed buffers to potentially suitable raptor species habitats during the nesting period, to ensure clearing areas were minimized. Pre-clearing surveys in forested habitat often required three consecutive days of surveys with a minimum effort of 1 hr/ha, and clearing initiation was required to occur within 24 hours of the last survey. The coordination required to complete pre-clearing surveys combined with the requirement for IEM monitoring during certain clearing activities presented a significant logistical challenge to the Project. However, the Contractors were able to complete the necessary surveys, and environmental monitoring was successfully coordinated throughout the construction period.

Incidental take of a migratory bird, its nest, and/or its eggs is unlawful as it violates the *Migratory Bird Convention Act* under Section 6(a) of the Migratory Birds Regulations. By performing pre-clearing nesting surveys, the TX Line and civil Contractors were able to reduce the risk of incidental take and demonstrate due diligence; however, had an incidental take occurred, the Contractors would have been in violation of Migratory Bird Regulations despite the implementation of best management practices prescribed in the Project documents. Performing pre-clearing nest surveys does reduce the risk of impacting a migratory bird, its nest, or its eggs during land clearing activities; however, it does not fully eliminate the risk as detecting active nesting sites is inherently difficult. A national level approach to managing incidental take of migratory bird nests during authorized land clearing activities is currently lacking and should be developed to provide guidance to the renewable energy industry, as well as all other industries involved in land clearing activities (*e.g.* transportation, land development, forestry, mining, *etc.*). The approach developed should be consistent across industries to ensure adequate protection for migratory birds from all land clearing activities that occur during the nesting period.

In addition to pre-clearing surveys, IEM or QP presence was required to oversee land-clearing activities performed within suitable or potentially suitable habitat and within prescribed buffer distances of these habitats. The IEM was present to monitor clearing within suitable or potentially suitable habitats for a number of identified VCs (*e.g.* grizzly bears, spotted owl, western screech-owl, northern goshawk, coastal tailed frog, and western toad) to ensure clearing areas were minimized, and to provide direction to the Contractor in the event that a VC was detected during clearing activities. Based on the experience of the IEM, the requirement to physically monitor clearing within sensitive wildlife habitats and buffers is not recommended. The requirement of being physically present during works can present logistical and safety issues for the IEM and workers. In place of physically monitoring clearing activity, the IEM should be required to review all clearing plans and verify all clearing

boundaries in the field within identified sensitive wildlife habitats with the clearing contractor during a pre-work meeting. This may help ensure that the appropriate clearing boundaries are clearly delineated in the field, and a follow-up audit of the falling boundary would serve to verify that the clearing boundaries were respected.

Wildlife salvages were required when working instream within identified fish and amphibian habitats. The Contractor's QP was responsible for performing the necessary fish and amphibian salvages under the supervision of the IEM and according to conditions of fish and coastal tailed frog salvage permits. These standard mitigation measures were successfully employed during the construction period. It is recommended that the responsibility for completing necessary wildlife salvages be assigned prior to the start of the construction period, to ensure that necessary lead time is provided to the QP responsible to seek wildlife salvage permits. The coastal tailed frog has recently been provincially downgraded to apparently secure status (S4) and not at risk (yellow listed), but remain listed as a species of concern federally (under *Species at Risk Act*). It will be important on future projects to clearly define when work in coastal tailed frog streams can occur and when activities are not permitted.

The IEM implemented a mountain goat monitoring program to observe and record the behaviours of mountain goats occupying two ungulate winter range (UWR) habitats in the Project area. The mountain goat monitoring program was designed to prevent construction related disruptions to the migration of mountain goats through the Truckwash Creek migration corridor. Results of the mountain goat monitoring program and construction related noise monitoring program were summarized in yearly reports prepared by the IEM (Hicks T. , 2015), (Hicks T. , 2016), (Hicks T. , 2017). Based on the results of the mountain goat monitoring program, the IEM was able to conclude that construction activities did not impede the migration of mountain goats through the Project area, during the construction period. The mountain goat monitoring program produced a large data set, which has provided insight into mountain goat migration behaviour in the area. For example, the data suggests that mountain goat migration occurs in the Mt. Athelstan/Keyhole Falls population based on the time of the year (obligate migration) rather than in response to environmental conditions (facultative migration).

An audio-visual berm was designed and constructed to isolate construction activities at the ULRHEF lower tunnel portal from the Truckwash Creek mountain goat migration corridor. The audio-visual berm proved to be an effective mitigation strategy, based on the evidence that successful mountain goat migration continued to occur seasonally, throughout the construction period. Based on the experience of the IEM and the data collected during the monitoring program, mountain goats displayed a high level of tolerance to construction activity and construction related noise, provided construction related noise levels were reduced to the extent possible. As discussed in Section 2.6, the IEM recommends that construction noise level thresholds be adjusted based on observed behaviours of mountain goats in response to recorded construction noise levels and/or the source and position of the noise. It is recommended that future mountain goat monitoring programs focus on periods of migration (if applicable to the potentially affected population) and during periods of active blasting and helicopter use during the construction phase to ensure construction related noise does not adversely affect mountain goats.

The level of effort and cost associated with the implementation of mitigation measures for the protection of mountain goats occupying the Mt. Athelstan and Keyhole Falls ungulate winter ranges, was not consistent with the fact that the same population was open to a limited entry hunt during the construction period. In addition, the implementation the sunrise/sunset timing restrictions were not required across all interest groups, and regulatory agencies operating within the Project area during the active construction period. This inconsistency reduced the effectiveness of the mitigation measure as discussed in Section 2.2. A similar inconsistency in wildlife management is highlighted by the non-reward grizzly bear hair-snaag traps that were set by MFLNRO biologists adjacent to the Project area during the first two years of construction. The hair-snaag traps attracted grizzly bears

within the Project area, at a time when the Project was responsible for actively managing wildlife attractants to prevent human-bear conflict in the Project area. On future projects, it is highly recommended that environmental mitigation measures be prescribed and applied consistently across all user groups operating in the Project area during the construction period to avoid and/or reduce potential adverse effects to identified VCs.

2.9 Environmental Protection and Archeological Site Setbacks

Buffer distance and setbacks were commonly prescribed and implemented as a means to provide protection for environmentally sensitive areas and archeologically significant sites during the construction period. All watercourse crossings were assigned a riparian area buffer distance of 30 m, within which the following mitigation measures were implemented:

- Riparian vegetation management area (RVMAs) along the TX Line right-of-way were assigned a specific clearing prescription based on the clearance height required for the conductors;
- Trees were topped rather than felled within RVMAs, when conductor clearance and tree heights permitted;
- Trees were felled away from the stream crossing location, where possible;
- Bio-degradable chain oil was used in all chainsaws operating within 15 m of a watercourse;
- Machine-free zones were prescribed within 15 m of all watercourses crossed by the TX Line, where construction of an access road crossing was not required; and
- IEM oversight occurred for all works occurring within 30 m of a watercourse.

The above mitigation measures were successfully implemented to protect water quality and stream banks integrity. Environmental setbacks and IEM monitoring were also implemented for works occurring within 100 m of identified coastal tailed frog habitats and within 150 m of wetland areas to protect western toad habitats. In areas where an existing forest service road or access road occurred within the 150 m setback area, the buffer distance was reduced to the distance to the closest edge of road. Color-coded flagging tape was used to delineate these buffer distances in the field. The color-coded flagging tape was much more practical and time efficient to install and maintain than silt fencing or snow fencing, and served as an effective visual reminder of the need to respect the buffer distance. Snow fencing was installed as a visual and physical barrier to prevent unauthorized human and machine access to archeologically significant sites.

2.10 Access Road Maintenance

Access to the Project site along the Lillooet River Forest Service Road was governed under a Road Use Permit (RUP). Under the RUP, the Licensees were required to enter into a Road Use Agreement with the Primary RUP Holder, the forest licensee in the area was listed as the primary road-user. All road maintenance and water management works completed by the TX Line Contractor and the civil Contractor were performed under IEM supervision and was subject to the Projects environmental protection measures. Works performed by the forest licensee were not required to be monitored by the IEM and were required to adhere to different set of environmental standards. The IEM recommends that a single standard should apply to all user groups operating in the Project area, or more generally to all user maintained roads within the Province.

3.0 Summary of Environmental Incidents and Concerns

3.1 Environmental Issue Tracking Matrix and Field Advice Memorandums

The Environmental Issue Tracking Matrix (EITM) was a tool used throughout the construction phase to document and communicate environmental concerns observed or recorded by the IEM and track the concerns until they were resolved by the Contractor (See Table 1). The EITM was updated and appended to each EMR to provide a summary of the closed environmental issues and concerns and those that remained outstanding at the end of the reporting period. In general, an environmental concern was first communicated to the site foreman or superintendent in the field upon identification. If the Contractor was able to resolve the concern before the end of the reporting period, then the concern was often omitted from the EITM. Environmental concerns listed in the EITM were generally concerns that needed to be addressed in a timely manner in order to mitigate a potential environmental risk. The majority of the 68 concerns identified and tracked in the EITM resulted from the following: failure to communicate the scheduling of works to the IEM, a temporary failure to maintain water quality objectives (*i.e.*, BCWQGs) in water discharging from treatment systems, or erosion and sediment control concerns.

Field Advice Memorandums (FAMs) were generally produced by the IEM to recommend changes or actions to be implemented to address and correct a recurring or outstanding environmental concern or issue. The majority of the 13 FAMs issued provided erosion and sediment control recommendations or highlighted required changes to water quality treatment methods. The standalone nature of the FAMs provided the IEM the flexibility to issue them at any time during the reporting period and to stress the importance of implementing the recommended changes. The FAMs required the Contractor to acknowledge the IEMs' recommendations and to provide a timeline to respond to the outstanding environmental issues or concerns. All FAMs were appended to the applicable EMR and were also tracked in the EITM.

The two aforementioned communication methods were described and implemented from the onset of the Project and proved successful in resolving outstanding environmental concerns and issues in an effective and timely manner. The IEM recommends employing these types of communication tools on future projects. Nevertheless, it should be noted that neither of the above documents have the power to direct the Contractor to complete the recommended mitigation measures. For future projects, it may be beneficial to provide the IEM with the authority to implement environmental directives to proactively protect environmental features or infrastructure, when the corrective actions recommended remain outstanding for an extended period. For example, had ESC and drainage concerns identified by the IEM been proactively managed at the large penstock fill near marker 2+800 prior to significant rain events in November 2014, significant erosion of the fill slope and substantial repair work may have been avoided (See EMR #44 – 46 for further details). Significant time savings can be realized by proactively managing ESC and site drainage, rather than the IEM waiting for a foreseen incident to occur before issuing EIRs or stop work orders requiring the implementation of recommended corrective actions.

Table 1. Environmental Issue Tracking Matrix

ID No.	Location	Issue Description	Action Taken/Recommended	Date of Identification	Targeted/ Completion Date	Date Completed
TL1	Within 100m of left bank of Boulder Creek	Hand fallers cleared trees within the 100m Coastal Tailed Frog buffer (outside the 30m buffer) without notifying the IEM or having the IEM onsite on October 10, 2013	This issue created low environmental impact. The feller buncher had previously worked in the area and the IEM was present and walked the site prior to the initial clearing activities. The issue arose as a result of a scheduling error and miscommunication between WEL and Mumleqs. The IEM has asked for a weekly work schedule that identifies where work activities that require IEM presence.	October 10, 2013	N/A	October 11, 2013
Tx#1	Segment 2 – Stream 30A RVMA	Work was completed within the Stream 30A RVMA prior to notifying the IEM and without a monitor onsite. (EIR009)	The IEM was informed by WEL's environmental manager that all works have been ceased. Work activities within Stream 30 RVMA will resume once the IEM is available to monitor the works. WEL to prepare an EIR detailing the cause, description and actions items related to the incident. IEM to review and approved the EIR. WEL employees were reminded of the need for IEM presence for all activities located within RVMAs and the need for 48hr notification prior to working within RVMAs	June 25, 2014	June 28, 2014	June 28, 2014
TX#2	Segment 8 – Access road 197.2/ tributary to Hillaby Creek	Wood box culvert failure during road upgrade works	Prepare and submit EIR#014 outlining the root cause of the incident and how it will be avoided in future.	November 28, 2014	November 30, 2014	December 8, 2014
ULR#1	ULRHEF intake and powerhouse; BDRHEF powerhouse	The IEM was informed of a seismic survey program during a pre-activity meeting on November 5. The IEM noted the following deficiencies: 1. Lack of an IEM approved work plan. 2. Lack of an IEM approved environmental orientation. As a result of these deficiencies the IEM issued a verbal stop work order prior to the start of works to enforce work planning processes and the requirement for an IEM approved environmental orientation.	CRT-EBC submitted a work plan and environmental orientation for IEM and Owners review and comment. The revised work plan and environmental orientation were approved by the IEM on November 7 th , 2013. The verbal Stop Work Order was lifted on November 8 th following IEM attendance of the environmental orientation provided to work crews by CRT-EBC, and a seismic testing kick-off plan.	November 5, 2013	November 8, 2013	November 8, 2013
ULR#2	35.5km – 37.5km Lillooet River FSR	Snow melt/runoff travelling over road surface and ponding creating erosion and potential for sediment introduction to Alena Creek. No water quality concerns were noted.	Installation of water bars/cross ditching completed at regular intervals to direct runoff into vegetated areas along the FSR and prevent sediment laden water from reaching Alena Creek.	April 4, 2014	April 5, 2014	April 5, 2014
ULR#3	BDRHEF powerhouse access road	Tree fallen containing potentially active bird nest (see EIR001).	1. CRT-ebc to prepare an EIR detailing the cause, description and actions items related to the incident. 2. IEM to review and approved the EIR. 3. Flagging standard confirmation and re-orientation of fallers and operators. 4. CRT-ebc presence during sub-contractor clearing operations when active nests are identified. 5. Field report communication protocols and sign-off.	May 23, 2014	May 26, 2014	May 26, 2014
ULR#4	47km – Lillooet River FSR	A log box structure failed while being crossed by an excavator (EIR002).	1. CE to prepare an EIR detailing the cause, description and actions items related to the incident.	May 23, 2014	May 26, 2014	September 11, 2014

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ID No.	Location	Issue Description	Action Taken/Recommended	Date of Identification	Targeted/Completion Date	Date Completed
			<ol style="list-style-type: none"> 2. IEM to review and approve the EIR. 3. CE employees will be reminded of spill response procedures and how to use the spill kits in a potential future event. 4. CRT-ebc to confirm that load ratings of equipment adhere to maximum crossing structure load ratings. 			
			<ol style="list-style-type: none"> 5. Complete FSR and temporary access road crossing assessment by a QP. 6. Determine the requirements for crossing structure remediation or replacement. 		June 26, 2014	
			<ol style="list-style-type: none"> 7. Develop a work plan to remediate the failed log box structure and execute the approved plan during the 2014 instream works window. 8. Complete box culvert repair. 		September 15, 2014	
ULR#5	39.9km – Lillooet River FSR	Rock truck rollover and spill (EIR003).	<ol style="list-style-type: none"> 1. CRT-ebc to prepare an EIR detailing the cause, description and actions items related to the incident. 2. IEM to review and approved the EIR. 3. CRT-ebc employees will be reminded of spill response procedures and how to use the spill kits in a potential future event. 4. Road shoulder delineation (where applicable). 5. CRT-ebc to develop and implement communication protocols for environmental incident response. 	May 27, 2014	June 3, 2014	June 26, 2014
			<ol style="list-style-type: none"> 6. Road stability assessment to be completed on Lillooet River FSR and temporary roads. 		July 15, 2014	
ULR#7	34.9km – Lillooet River FSR	Silva Creek log structure failed while being crossed by a Megaton Truck (EIR005).	<ol style="list-style-type: none"> 1. CRT-ebc to prepare an EIR detailing the cause, description and actions items related to the incident. 2. IEM to review and approved the EIR. 3. CRT-ebc employees will be reminded of spill response procedures and how to use the spill kits in a potential future event. 4. CRT-ebc to confirm that load ratings of equipment adhere to maximum crossing structure load ratings. 	May 27, 2014	June 3, 2014	July 7, 2014
			<ol style="list-style-type: none"> 5. Complete FSR and temporary access road crossing assessment by a QP. 6. Complete repairs of the crossing structure as per MFLNRO recommendations (May 30, 2014) in accordance with appropriate work planning protocols and construction procedures. 		June 26, 2014	
					July 7, 2014	
ULR#8	39.7km – Lillooet River FSR	Stream 9 – log box structure failure (EIR004).	Develop a work plan to remediate the failed log box structure and execute during the 2014 instream works window. On July 19, 2014 CRT-ebc confirmed that this crossing structure will be repaired or replaced during the 2014 instream works window following MFLNRO approval.	May 28, 2014	September 15, 2014	September 13, 2014
ULR#9	Truckwash Creek at new bridge crossing of Lillooet River FSR	Rock into Truckwash Creek (see EIR006).	<ol style="list-style-type: none"> 1. CRT-ebc to prepare an EIR detailing the cause, description and actions items related to the incident. 2. IEM to review and approved the EIR. 3. CRT-ebc employees will be reminded of spill response procedures and how to use the spill kits in a potential future event. 4. CRT-ebc to develop and implement communication protocols for environmental incident response. 5. CRT to reiterate and communicate the requirement for IEM notification and on-site presence for works within riparian areas to engineers, superintendents and foremen. 	May 28, 2014	June 6, 2014	June 6, 2014

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ID No.	Location	Issue Description	Action Taken/Recommended	Date of Identification	Targeted/ Completion Date	Date Completed
ULR#10	Lillooet River FSR	Innergex issued stop work order for heavy hauling on Lillooet River FSR	Recommendations have been submitted to MFLNRO for review and approval. Work plan submission and repairs to be completed prior to September 15 for crossing structures at 39.7km and 47km of the Lillooet River FSR.	May 28, 2014	September 15, 2014	September 13, 2014
ULR#11	CRT-ebc Project site	SES issued FAM#1 Improvement of environmental incident response communication protocols	<ol style="list-style-type: none"> CRT-ebc to prepare environmental incident response protocols specific to communications CRT-ebc to complete and document training of environmental incident communication protocols for on-site personnel by CRT-ebc environmental staff CRT-ebc to prepare environmental incident response protocols specific to communications CRT-ebc to complete and document training of environmental incident communication protocols for on-site personnel by CRT-ebc environmental staff 	May 29, 2014	May 30, 2014	June 2, 2014
ULR#12	Lillooet River FSR	Inadequate dust suppression between 0-37.5km of the Lillooet River FSR	<ol style="list-style-type: none"> CRT-ebc has confirmed that dust control product (Lignosulfonate) will be applied to the Lillooet River FSR beginning on July 22, 2014, and will be completed by July 25, 2014. 	May 31, 2014	July 25, 2014	July 28, 2014
ULR#13	Boulder Intake Access Road	Clearing beyond AMBMS limits (see EIR007)	<ol style="list-style-type: none"> CRT-ebc to prepare an EIR detailing the cause, description and actions items related to the incident. IEM to review and approved the EIR. Flagging standard confirmation and re-orientation of fallers and operators. CRT-ebc presence during sub-contractor clearing operations when active nests are identified. Field report communication protocols and sign-off. 	June 5, 2014	June 7, 2014	June 7, 2014
ULR#14	Near 43 KM – Lillooet River FSR	MOE is maintaining and baiting a non-reward hair bait station located within the core construction zone to collect Grizzly Bear hair samples as part of the long-term monitoring.	<ol style="list-style-type: none"> Innergex contacted the province to request exact location of the bait station and to address concerns regarding potential human-bear conflict. Innergex requesting to immediately stop baiting the station located near 43 km Lillooet River FSR. 	June 3, 2014	June 13, 2014	June 11, 2014
ULR#15	North side (left bank) of the ULRHEF intake	Stripping and grubbing proceeded without an approved work plan or LTC (EIR008)	<ol style="list-style-type: none"> The IEM reported the incident to CRT-ebc environmental personnel. No further unauthorized construction activities occurred after the initial detection of the incident. CRT-ebc to prepare an EIR detailing the cause, description and actions items related to the incident. IEM to review and approved the EIR. CRT-ebc has committed to preparing and submitting a work plan for bulk excavation of the left bank for review and LTC issuance prior to resuming work on the left bank. 	June 12, 2014	action items 1-3 completed June 15, 2014	July 5, 2014
ULR#16	BDR Intake Access Road	Culvert installed without IEM presence or notification	<ol style="list-style-type: none"> Prepare and submit EIR#010 outlining the root cause of the incident and how it will be avoided in future. 	July 23, 2014	July 28, 2014	July 31, 2014
			<ol style="list-style-type: none"> A Communication Plan will be submitted and enacted to prevent a reoccurrence. 	July 26, 2014	August 4, 2014	August 4
ULR#17	BDR Intake Access Road	Damage to standing timber and impacts outside of minimized clearing boundary & approved OLTC limit (both within and adjacent to UWR)	<ol style="list-style-type: none"> Prepare and submit EIR#011 outlining the root cause of the incident and how it will be avoided in future. 	July 25, 2014	July 30, 2014	August 1, 2014
			<ol style="list-style-type: none"> Assess damage to standing timber and impacts outside of the minimized clearing boundaries and approved OLTC (both within and adjacent to UWR). A damaged timber assessment was prepared by Hedberg and Associates and was provided to the IEM and IE on October 24, 2014. The report indicates impacts outside of the OLTC boundary and within UWR polygon UL 12. Further assessments will be required to develop an appropriate reclamation, compensation, or replacement strategy to satisfy permitting conditions. As all conditions of the original Stop work order issued by the IE have now been met and no outstanding environmental risk 	Confirmed in Hedberg report July 25, 2014	October 17, 2014	October 24, 2014

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ID No.	Location	Issue Description	Action Taken/Recommended	Date of Identification	Targeted/ Completion Date	Date Completed
			<i>remain this issue will be considered closed. The Owners will be responsible for ensuring documentation is provided to regulators demonstrating compliance with applicable clearing permits and the General Wildlife Measure Exemption in relation to UWR, upon completion of a project wide clearing assessment.</i>			
ULR#18	BDR Intake Access Road	STOP WORK ORDER for Boulder Creek Intake Access Road and Crane Pad	Based on the recommendations by Hedberg Associates and the lack of following work plans the IE requests the following prior to re-authorizing the commencement of work on the Boulder Creek intake access:	July 26, 2014	July 30, 2014	August 1, 2014
			1. Complete an Environmental Incident Report ("EIR") within 48 hours. The EIR should describe/quantify both the damage to standing merchantable and the impacts to the area outside the Occupant Licence to Cut ("OLTC").	July 26, 2014	August 10, 2014	Stop Work Order rescinded August 10, 2014
			2. Submit to the IE a new/updated work plans prior to the IE removing the Stop Work Order and reissuing the Leave to Construct Authorization the following: a. encompasses the repair/remediation of the works completed to date; b. implements the recommendations by Hedberg Associates; and c. includes methods to execute to ensure that the road construction meets the approved "Issued for Construction" design.			
			3. A QP must be onsite 2 to 3 times a week to assist with the direction and inspection of the road construction.	July 26, 2014		
			4. Provide as-built drawings of the clearing and impacted boundaries to date for both the access road and crane pad area.	July 26, 2014		
			5. Submission to the IE all site wide ARD rock testing results complete volumes, tracking records and a summary of mitigation where results were positive.	July 26, 2014	August 9, 2014	August 9, 2014
6. Provide a work plan communication plan that ensures all staff are aware of the approved work plans and adhere to hold points.	July 26, 2014	August 4, 2014	August 4, 2014			
ULR#19	Lillooet River FSR	CRT-ebc subcontractor (Summit Camps) hit a moose while driving at 12km resulting in the death of the moose (EIR012).	<ol style="list-style-type: none"> CE to prepare an EIR detailing the cause, description and actions items related to the incident. IEM to review and approve the EIR. Crew members to be reminded of obligation to follow speed limits, be attentive and be cautious, as well as the repercussions of non-compliance. Project specific speed limits and warnings of frequent wildlife crossings will be posted at 9 km and 37.5km. The IEM has discussed this with CE and signs will be up by September 15th. In the event signs are not up by that time he IEM will reopen this issue. 	August 22, 2014	August 26, 2014	August 26, 2014
ULR#20	Various location at ULRHEF, BDRHEF and along the Lillooet FSR	FAM04 was issued to the contractor to address ESC concerns at HEF component sites	<ol style="list-style-type: none"> ULRHEF Intake (north and south sides) <ol style="list-style-type: none"> Ditch installation/maintenance Slope protection Spoil area winterization (plan submitted October 17, 2014) 	September 29, 2014	October 17, 2014	November 17, 2014
ULR#21	38km Laydown	Reportable spill – 300L of diesel spilled to ground at the fueling station	<ol style="list-style-type: none"> Prepare and submit EIR#013 outlining the root cause of the incident and how it will be avoided in future. Provide confirmation that the spill has been fully remediated through the lab analyses of the confirmatory samples. Lab results were submitted to INX and the IEM along with a draft EIR on October 25, 2014. (Oct 31) 	October 6, 2014	October 21, 2014	October 31, 2014
ULR#22	ULRHEF intake	Written Stop Work Order issued by INX – CE must cease all work at the ULRHEF intake	<ol style="list-style-type: none"> Submission of a long-term plan for an active dewatering treatment plan for review and approval by the IE, IEM and INX. 	October 21, 2014	October 28, 2014	October 28, 2014

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ID No.	Location	Issue Description	Action Taken/Recommended	Date of Identification	Targeted/ Completion Date	Date Completed
		(north side) and upstream tunnel portal excavation following prolonged inadequate ESC measures and a second failure of the settling pond.	2. Implementation of an approved dewatering treatment system to the satisfaction of the IE, IEM and INX.			
ULR#23	BDRHEF intake access road	Gate to restrict public access on the BDRHEF intake access road within 500m of UWR was unlocked and unmanned	1. The gate was manned once the IEM communicated to the Environmental Management team and Superintendent that is was required immediately. No public access occurred beyond the unmanned/unlocked gate; therefore this was not considered an environmental incident. A documented repeat of this occurrence will require a formal environmental incident report.	May 1, 2015	May 1, 2015	May 1, 2015
ULR#24	BDRHEF intake access road	An excavator was removing debris generated by a slope failure within a ditch line conveying water without water management measures in place and without prior IEM notification. The work to remove debris from the ditch line caused the generation of turbid water that was discharged offsite without treatment.	1. The IEM informed the CE environmental manager onsite that works were required to halt until pumps were in place to isolate the work area from flowing water. Works were halted a pump was brought in to divert the flow around the work area. 2. Prepare and submit EIR#015 outlining the root cause of the incident and how it will be avoided in future.	May 1, 2015	May 3, 2015	May 2, 2015
BDR#25	Boulder Powerhouse water treatment ponds	Water from the fourth cell of the water treatment ponds is seeping out of the edge of the pond, flows over an active haul path, and along the edge of the powerhouse access road before infiltrating to ground	1. Remove sediment accumulations from cells 1 – 3 of the treatment ponds to promote infiltration as outlined in the work plan. OR 2. Ensure all flowing surface water seeping from the fourth pond is conveyed in armoured ditch lines and through road culverts.	October 26, 2015	November 7, 2015	November 1, 2015
BDR#26	Boulder Intake Access Road 4 – 5KM	Ditch installation and maintenance is required to ensure runoff is directed away from the running surface and is conveyed offsite clean, without being impacted by vehicle traffic	1. Install and armour ditch line from 4-5KM 2. Repair all damaged or infilled culvert inlets from 4-5KM	October 26, 2015	November 7, 2015	November 3, 2015
BDR#27	Boulder Intake Access Ramp	Ditches outlined in the work plan have not been installed and the haul path is conveying sediment and sediment laden water along the length of the ramp	Install ditches on either side of the access ramp and crown/cap road to ensure runoff is conveyed in the ditch lines and not along the running surface	October 26, 2015	November 7, 2015	November 13, 2015
ULR#28	Lillooet River FSR – KM41	The road edge eroded significantly during scaling activities and during the last major rain event and requires bank stabilization (above the HWM), ditch installation/maintenance, and silt fence repair.	1. Stabilize the road edge (above HWM) and rebuild the road in the eroded sections 2. Clean out and install ditch line along inside edge of the road and convey water across the running surface in drainage structures as needed 3. Repair silt fence along outer road edge	October 26, 2015	November 7, 2015	October 29, 2015
ULR#29	Lillooet River FSR ~ KM42 – KM42.5	Water in the ditch line is eroding the road edge, and the access road culvert at the entrance to the PAG site has been damaged	1. Formalize and armour the ditch line to protect the road edge from further erosion 2. Repair the inlet to the access road culvert at the entrance to the PAG site.	October 26, 2015	November 7, 2015	October 31, 2015
ULR#30	ASTR04 – Haul road crossing	The silt fence on the downstream side of the WBC/road has failed. Runoff from the surface of the haul road is not conveyed in a ditch. As a	1. Repair the haul road drainage to direct water away from ASTR04 2. Remove failed silt fence ensuring material does not enter ASTR04, and replace it.	October 26, 2015	November 7, 2015	November 13, 2015

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		<i>result flows concentrate in this location, which led to the silt fence failure.</i>				
ULR#31	ULRHEF- Downstream Tunnel Portal access road drainage ditches	<i>Ditches are not collecting and transporting road runoff as intended due to the road grading along the lower ULRHEF tunnel portal access road and infilling of the ditch line.</i>	<ol style="list-style-type: none"> <i>Clean out ditch line and re-grade road to convey water to the ditch line</i> <i>Ensure water from the laydown area is drained/conveyed into the re-established ditch line.</i> 	October 26, 2015	November 7, 2015	November 13, 2015
ULR#32	Lillooet River FSR – KM48	<i>The silt fence on the upstream side of the second WBC is 95% infilled with sediment and has previously failed.</i>	<i>Removed the sediment accumulation captured by the silt fence and replace the silt fence.</i>	October 26, 2015	November 7, 2015	October 30, 2015
ULR#33	River Right – ULRHEF intake	<i>Infilled ditches require maintenance</i>	<ol style="list-style-type: none"> <i>Clean-out the ditch above the river right cut slope to prevent further riling</i> <i>Remove material that has infilled the ditch in sections along the access road</i> 	October 26, 2015	November 7, 2015	October 26, 2015
ULR#34	ULRHEF intake – Water treatment ponds	<i>The flocculant treatment component of the water treatment ponds are not currently installed</i>	<i>Install flocculant treatment component of the ponds as outlined in the work plan to prevent further exceedances of BCWQGs when water discharges to the Lillooet River. Note: Turbidity of the discharge temporarily exceeded BCWQGs on October 25, 2015.</i>	October 25, 2015	November 7, 2015	October 28, 2015
ULR#35	Lillooet River FSR – KM45	<i>Stockpiles along the edge of the FSR at ~KM45 of the Lillooet River FSR near the crushing/screening plant are not protected according to the ESC Plan.</i>	<ol style="list-style-type: none"> <i>Install a ditch line along the forested edge of the stockpile (edge of the FSR) and install silt fencing to prevent the migration of sediment into the ditch line and/or the Mountain Goat replacement area immediately adjacent to the stockpile. Closed November 2, 2015</i> <i>Remove accumulated sediment that has infilled the existing ditch line between the new spoil pile access road and the stockpiled material.</i> <i>Clean out blocked culvert at the entrance to the active KM45 spoil area. (Identified October 30, 2015)</i> 	October 27, 2015	November 7, 2015	November 10, 2015
ULR#36	Covered Stockpiles at KM44.5 of the Lillooet River FSR	<i>The stockpile tarp coverings are deteriorating and are no longer serving their original intent as a potential PAG rock temporary storage measure.</i>	<ol style="list-style-type: none"> <i>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.</i> <p>OR</p> <ol style="list-style-type: none"> <i>Repair the tarps if they are still required (pending clarification on PAG vs non-PAG status)</i> 	October 27, 2015	November 7, 2015	November 24, 2015
ULR#37	Lillooet River FSR – KM44 to KM43.5	<i>Ditches have been infilled with sediment and are missing in some sections</i>	<ol style="list-style-type: none"> <i>Remove accumulated sediment and restore the ditch line in areas where it is no longer continuous and/or where runoff is likely to erode the running surface.</i> 	Oct. 27, 2015	Nov. 7, 2015	Nov. 6, 2015
ULR#38	Truckwash Creek mountain goat migration corridor	<i>A concrete truck travelled through the Truckwash Creek migration corridor during the sunset shutdown period on November 3, 2015. See FAM #6 for additional details</i>	<ol style="list-style-type: none"> <i>Station two CE crew members to block the road to project related traffic at KM44 and KM48 of the Lillooet River FSR during the sunrise and sunset shutdown periods. Completed November 4, 2015.</i> <p>1. <i>Respond in writing that this has been completed.</i></p>	November 4, 2015	November 4, 2015	November 6, 2015

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ULR#39	ASTR04 – Downstream side of Haul road crossing	Material placed on the embankment surrounding the culvert outlet is unconsolidated and requires armouring or other form of ESC stabilization.	2. Assess the material place around the culvert outlet, determine the appropriate form of ESC stabilization, and installed stabilization measures with the IEM present to monitor the work. UPDATE: A few loose rocks with the potential to fail into the watercourse were removed. Site conditions are stable for the time being and will be reassessed in the spring.	November 14, 2015	November 16, 2015	November 16, 2015
ULR#40	ULRHEF intake – Treatment of high pH water generated by grouting activities	The IEM prepared FAM#7 requesting that CE provide a protocol for shutting down the water treatment system. This protocol should ensure that if pH approaches 9, there is a mechanism for preventing this water from discharging and causing an exceedance from occurring, and/or a way to stop the continued discharge of high pH water to the receiving environment in the event an exceedance is recorded.	1. Prepare a protocol for shutting down the water treatment system if it is overcome by the amount of high pH water and will/does result in the discharge of water above pH 9. Update: CE provided a protocol for shutting down the treatment system if water is near to or above pH 9 at the discharge from pond 7. They also are working on improving the pH treatment system.	December 4, 2015	December 4, 2015	December 4, 2015
ULR#41	ULRHEF downstream tunnel water treatment ponds at Truckwash Creek	The infiltration capacity of the ponds is no longer sufficient to treat water from the lower tunnel. Access water is flowing offsite presenting an ESC concern. See FAM#8 for further details.	1. Provide the IEM with a description of the water treatment plan for the lower tunnel portal seepage and process water. 2. Implement the plan to prevent discharging water to a vegetated area susceptible to erosion and sediment transport	January 18, 2016	January 23, 2016	January 27, 2016
ULR#42	Lillooet River FSR – KM21	Road drainage works completed by the CRT-ebc within Moose Winter Range Forage Management Zone UWR U-2-005 J55/54-204-RE at 21KM of the Lillooet River FSR during the November 1 - May 15 winter timing restriction. See EIR#019 for further details.	1. Complete ditch line stabilization as soon as possible (ditch profile re-shaping, rock armouring, culvert replacement), to prevent the transport of sediment laden water to the Lillooet River and potential Western Toad breeding pond located downstream. 2. Complete works within the Moose Winter Range winter timing restriction (November 1 – May 15), but prior to the Western Toad breeding period timing restriction (March 1 – August 31) by employing the following mitigation measures under IEM supervision: a. Full-time IEM monitoring of the works to ensure moose are not occupying the work area or 200 m buffer surrounding the work area. b. If a moose is observed within 200 m of the work area, all equipment and works must be halted until the moose has left the area. c. Vehicle traffic associated with the repair work within the Moose Winter Range Forage Management Zone, must adhere to a 40km/h speed limit to prevent vehicular collisions. d. The work must be coordinated and completed within the shortest amount of time possible and should be continuous once started. e. Work should be completed during daylight hours only to minimize impacts to moose from construction noise and additional light that would be generated during a typically quiet period. f. Temporarily disturbed areas away from road verges (outside of the FSR ROW) should be replanted with at least 50% native forage species for moose (e.g. red-osier dogwood, willow sp.). Revegetation will be completed	February 15, 2016	February 22, 2016	February 24, 2016

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			during the appropriate planting season in conjunction with the planting of the TX-Line ROW.			
ULR#43	Road Drainage along the Lillooet River FSR between KM44.5 – KM49	Road run-off caused by rain and snow melt is not being directed to road side ditches and is eroding the running surface/contributing sediment to watercourses.	<ol style="list-style-type: none"> 1. Address road drainage concerns between KM47.5 and KM48 to prevent further turbid water inputs to the fish bearing stream at KM48. Update: CE installed a temporary cross-ditch to divert water away from the watercourse on February 19. 2. Address road drainage concerns between KM44.5 - KM46 and along the ULRHEF downstream tunnel portal access road to prevent further turbid water inputs to Truckwash Creek. Update February 27: CE has opened up the ditch line, which is now conveying road runoff to the ephemeral drainage and road culvert and away from the lower portal access road. Work remains to be completed along the lower portal access road to restore the ditch line and direct water off of the running surface. March 6: A ditch and cross ditching has been installed along the downstream tunnel portal access road and drainage is being directed to the oil/water separator and water treatment system. 3. Address road drainage concerns between KM48 and KM49 to prevent further turbid water inputs to the Lillooet River at Keyhole Bridge. Update: March 6 CE has installed a sump adjacent to the Keyhole Bridge; however turbid water discharge at this location continues to result in exceedance of the BCWQGs. March 26: Ditch armouring remains outstanding. Update April 14, 2016: CE has armouring ditch lines between KM48.5 to KM49 	February 19, 2016	February 26, 2016	April 14, 2016
ULR#44	Culvert at KM43.5 of the Lillooet River FSR	Road runoff and snow melt has eroded the headwall/armouring at the culvert outlet of this CTF bearing stream.	<ol style="list-style-type: none"> 1. Repair the culvert outlet. If instream works are required consult a QP and conduct a CTF salvage in conjunction with any dewatering activity. Update March 6: CE installed a cross-ditch to divert turbid water away from the CTF stream, and a silt fence was installed around the culvert to stop sediment from flowing into the CTF stream until a salvage can be planned and performed and the culvert properly re-armoured. This temporary repair has addressed the immediate concern; however, the culvert armouring still needs to be completed. As the area is temporarily stabilized the issue is considered closed. The culvert armouring was completed on April 7, 2016 	March 6, 2016	March 12, 2016	March 6, 2016
ULR#45	Construction waste bin at KM48 of the Lillooet River FSR	Improperly stored food waste in the construction waste bin was attracting pine martins. See FAM#9 for further details.	<ol style="list-style-type: none"> 1. Notification that the bin at KM48 has been emptied and cleaned of all food waste and that all wildlife attractants have been removed from the ULRHEF intake work areas. 2. Post signs at the KM48 construction waste bin to visually remind crews that no domestic wastes is permitted to be deposited in the bin. 3. Conduct a review of all construction waste storage areas onsite to ensure they are free of wildlife attractants. 4. Review waste management procedures with all crews to remind them of the importance of proper waste management practices as we move into the spring and bears begin to emerge from winter hibernation. 	March 8, 2016	March 10, 2016	March 9, 2016
ULR#46	ULRHEF lower tunnel water treatment system	The active water treatment system at Truckwash creek is not sufficiently sized to treat all water emanating from the ULRHEF lower tunnel	<ol style="list-style-type: none"> 1. Address turbid & high pH water discharging to vegetation that is not being captured in the water treatment system. Update April 2: A new treatment system was installed and discharge is directed to ASTR-03. 2. Water out letting from the ponds and down the bank may cause erosion and impact the Lillooet River Trail downstream. Assess and confirm that necessary repair work 	March 6, 2016	March 14, 2016	April 2, 2016

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			<i>will be completed to stabilize areas that have been eroded due to runoff from this excess discharge. Update April 2: This assessment is pending snow melt and will be tracked in the recommendation section of the weekly monitoring report.</i>			
ULR#47	KM41 of the Lillooet River FSR	Drainage and ditching requires maintenance to prevent turbid road run-off from discharging to the Lillooet River	<ol style="list-style-type: none"> 1. Repair ditches between KM40.5 – KM41.2 and ensure road runoff is directed to repaired ditch lines. 2. Install silt fencing along the river side edge of the FSR between KM41.2 to –KM40.75. Update March 14: a berm has been placed along the road edge as a temporary measure until the ground thaws in this section and silt fencing can be installed. 	March 6, 2016	March 14, 2016	March 14, 2016
ULR#48	ULRHEF lower portal access road ditch	<u>FAM#10</u> ULRHEF lower portal access road ditch discharging turbid water through mountain goat UWR replacement area and creating erosion of a steep bank prior to entering into Truckwash Creek. Discharging water does not meet BCWQGs.	<ol style="list-style-type: none"> 1. CE armour ditches with clean angular rock and install velocity checks at spacing and configurations appropriate to the grade of the ditch line to settle suspended sediment and meet BCWQG criteria for turbidity prior to discharging water to Truckwash creek at a location that does not present erosion risk. Update March 25: CE installed two large infiltration sumps at the base of the ditch line. Should their capacity be insufficient a pump will be installed to direct flows to the water treatment system. <u>The ditch line armoring remains to be completed and will be tracked in the recommendation section of the report until it is completed.</u> <p>OR</p> <p>Redirect turbid flows to the ULRHEF lower tunnel water treatment system once the capacity issue is resolved.</p>	March 16, 2016	March 23, 2016	March 25, 2016
ULR#49	ULRHEF lower portal and water treatment system	<u>FAM#11</u> <ol style="list-style-type: none"> 1. It appears that CE may have pushed debris and snow beyond the work area limits and into the mountain goat UWR replacement area adjacent to the ULRHEF lower tunnel laydown. 2. Turbid water continues to transport sediment into the mountain goat UWR replacement area which ultimately ends up in Truckwash Creek. The temporary ditch work that CE has completed is not functioning to ensure water quality meets the objective of the surface water quality protection plan. 3. The active water treatment system at the ULRHEF downstream portal is not capable of handling the volume of water emanating from the tunnel and the excess water is discharging off-site in an untreated state. Water quality of this discharge is regularly above surface water quality guidelines for turbidity and pH. This water is also eroding a portion of the Lillooet River Trail. 	<ol style="list-style-type: none"> 1. Please assess whether any material has been deposited within the mountain goat UWR replacement area. If there has been an encroachment, please ensure this material is removed and provided an assessment of any damaged caused to the area that may impact its use as suitable UWR replacement area. Update March 25: CE removed some snow and debris and have placed lock blocks to prevent further encroachment into this area. An assessment will be completed once the snow fully melts. CE will remove any debris and proceed with reclamation of the area based on the results of the assessment. <u>This issue will be tracked in the recommendation section of the weekly environmental monitoring report until it is completed.</u> 2. Please prevent sediment laden water from discharging to Truckwash Creek through the mountain goat UWR replacement area. Direct this water to the active water treatment system until work to armour the ditch line is performed and WQ flowing through it meets surface water quality objectives. All turbid water from the work area requires treatment prior to discharging to Truckwash Creek. Update March 25: CE installed two large infiltration sumps at the base of the ditch line. Should their capacity be insufficient a pump will be installed to direct flows to the water treatment system. 3. The installation of a new system should be treated as a top priority. Until this new water treatment system is installed and functioning the IEM acknowledges that some turbid water will be continuously discharging from the treatment ponds. As this water reaches the Lillooet River via surface connection, please ensure that a CO2 diffuser is installed to treat the pH of water prior to discharging off-site. Additionally, please perform all measures 	March 24, 2016	March 31, 2016	April 2, 2016

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			possible to treat turbidity in the discharge water. The IEM suggests installing Curlex wattles (not matting) as check dams along the drainage path at the base of the penstock fill slope. The check dam spacing should be determined according to the grade of the drainage path. Update March 25: A CO2 diffuser was installed to buffer elevated pH discharge that occurs during shotcrete application in the tunnel. Installation of the treatment system completed on April 2, 2016			
ULR#50	ASTR04 Woodbox Culvert at penstock access road crossing	A failure of the outside edge of the road has occurred and the whole woodbox structure appears to be compromised. Water is now ponding on the upstream side of the crossing.	1. Assess the culvert and develop a plan to replace the woodbox culvert with an appropriately sized crossing structure. Reminder that appropriate CTF isolation and salvage will be required.	April 7, 2016	April 21, 2016	May 20, 2016
ULR#51	Woodbox Culvert at KM41.2 if the Lillooet River FSR	The watercourse over topped the woodbox culvert requiring emergency works to install an additional culvert next to the woodbox to handle the additional flow. The woodbox culvert may have been compromised by the additional flows and the temporary culvert installed as an emergency measure may need to be extended.	1. Assess the woodbox culvert and develop a plan to replace it with QP designed crossing structure during the instream work window or according to the recommendations of a QP if it has been compromised. Update June 8, 2016 – CE is working on a revised design for drainage currently being diverted to the crossing structure at KM41.2. A drainage plan and/or crossing structure repair or replacement remains outstanding. The IEM understands that the repairs must be completed prior to the delivery of the ULRHEF generators. This item will continue to be tracked until repairs are completed and the drainage design finalized; however, the current conditions do not present an imminent risk to the environment. The ditch lines remain sufficiently armoured against erosion and the IEM has been informed that the crossing structure is currently stable. Update July 14, 2016 – Ecofish provided CE with an e-mail stating that the construction of this culvert does not need to be completed within the 2016 instream works window (August 1 – September 15), provided that there is no water flowing through the stream substrates and there are no species at risk present. CE installed a temporary culvert on July 19 th to accommodate the delivery of the ULRHEF generators. Final design of the 41.2 km culvert remains outstanding. This item will continue to be tracked until the drainage design is finalized and installed; however, the current conditions do not present an imminent risk to the environment.	April 8, 2016	April 22, 2016	July 19, 2016
ULR#52	Pebble Creek Main Road, KM42.5 to KM 41.5 of the Lillooet River FSR	1. The first 100m of the Pebble Creek Main Road, where it leaves the camp road, is quite eroded - cut slope, road surface and fill are damaged. 2. MFLNRO is concerned with the substantially amount of flow in the ditch between KM42.75 – KM41.5 of the Lillooet River FSR.	1. Protect slopes from erosion caused by run-off from the camp road ditch line and install an appropriate permanent crossing structure where the road surface has been eroded. Once completed repair the road surface as needed. Update April 18, 2016 – Installed culvert and armoring was not executed according to best management practice and requires repair work before the IEM considers the repairs completed to the Forest Road Engineering Guidebook, CEMP and EPPs.. Update April 25 – CE removed and re-installed the culvert and rip-rap armoring. The installation was inspected by the IEM and found to meet the objectives of the FPC, CEMP and EPPs. 2. Assess drainage patterns in this section to ensure ditch lines and crossing structures are appropriately sized to accommodate additional flows now that two previously installed road crossing structures have been removed to accommodate the penstock installation. Update April 18 – CE indicated that they will be reviewing the permanent	April 12, 2016	April 26, 2016	April 25, 2016

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			<i>drainage plan in this area and will distribute the plan to the IE, IEM, and INX for approval once the permanent design is finalized.</i>			
ULR#53	ULRHEF tailrace excavation water treatment ponds	<i>On April 14, 2016 the IEM directed CE to cease pumping to the ULRHEF tailrace excavation water treatment ponds as significant piping out of the side walls was observed.</i>	<ol style="list-style-type: none"> 1. <i>Provide the IE with confirmation from a QP on the stability of the ponds as well as sign-off from a QP on the design of the ponds for the purposes of sediment retention prior to resuming their operation. Update May 6 – CE confirmed that these ponds will not be used and that a separate water treatment is being sourced for the ULRHEF powerhouse excavation works</i> 	April 14, 2016	April 21, 2016	May 6, 2016
ULR#54	ULRHEF intake concrete sump pumping capacity & pumping shutdown	<i>The IEM issued FAM#12 as untreated water that did not meet BCWQGs was discharged directly to the Lillooet River to prevent overtopping of the concrete sump.</i>	<ol style="list-style-type: none"> 1. <i>Upgrade the pumping capacity in the concrete sump to ensure all water from the BEBO wall excavation, intake and upstream tunnel can be directed to the treatment ponds simultaneously when water quality conditions require. Update May 20 – CE has ordered pumps and will upgrade the pumping capacity once the material arrive. Update June 30, 2015 – Pumping capacity upgrades have yet to be finalized.</i> 2. <i>Stage work activities at the intake, sluiceway, tunnel and BEBO wall to ensure that all water not meeting BCWQGs can be pumped to the treatment ponds through the concrete sump. This may require that some work activities remain on hold until the pumping capacity of the system is increased. Update May 20 – CE confirmed that works will be staged to prevent exceeding the existing pumping capacity.</i> <p><i>Update July 18, 2016: CE continues to stagger tunnel, intake, and BEBO wall works, which allows the concrete sump pumps to keep up with the volume of water pumped from construction activities. A third pump was installed in the sump on July 18, 2016.</i></p>	May 17, 2016	May 24, 2016	July 18, 2016
ULR#55	Water treatment facilities at the ULRHEF intake, downstream tunnel, powerhouse and BDRHEF intake	<i>In response to FAM#12 and EIRs #20, #21, & #22, on May 19 the IE requested updates to all work plans involving water treatment system</i>	<p><i>Provide a step-by-step work plan outlining:</i></p> <ol style="list-style-type: none"> 1. <i>Contact information for personnel to be reached if a problem with each of the systems is observed.</i> 2. <i>The step-by-step procedure for stopping water feeding the treatment systems, or other measures to be implemented if the systems overflow or if water quality discharging from the system does not meet the intent of the Surface Water Quality Protection Plan.</i> 3. <i>A step-by-step procedure should be outlined for all active onsite treatment systems (ULRHEF intake, downstream tunnel, powerhouse, and BDRHEF intake. The contact information and shut-off procedures should be posted as a reference near all of the treatment systems.</i> 	May 19, 2016	May 26, 2016	June 1, 2016
ULR#56	All ULRHEF and BDRHEF work areas.	BC EAO Inspection & Section 34 Order	<ol style="list-style-type: none"> 1. <i>Improper waste management – Prepare EIR025 to document pine martin attraction to waste in the KM48 construction waste bin AND Prepare a Waste Management Protocol/Strategy to clean-up all mis-managed waste onsite and improve onsite waste management procedures. Update June 12 – INX submitted EIR024 regarding pine martin attractants. Update June 21 – The IEM discovered areas of waste mis-management and requested that CE clean-up the waste, which was addressed within 24hrs. Update June 29 – INX submitted the WEL and CE Waste Management and Wildlife Attractant Protocols in response to the BC EAO Section 34 Order.</i> 2. <i>Improve equipment maintenance and storage practices to prevent soil contamination from small leaks (use spill trays/tarps/absorbent pads, etc) and perform regular clean-</i> 	June 9, 2016	June 30, 2016	July 10, 2016

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			<p>up of any leaks or spills that reach the ground. Update June 30 – All parking areas have been cleaned of hydrocarbons resulting from leaking equipment. CE will maintain equipment to prevent chronic leaks or will use drip trays/tarps/containment to manage small leaks in parking areas.</p> <p>3. Improve ditches and road run-off management along the BDRHEF intake access road. Update June 30 – Ditch improvements remain outstanding</p> <p>Update July 14, 2016: All ditches from 3.5 – 4.5 km of the Boulder Creek intake access road have been lined with rock. The down slope ditch from the lunch room needs to be connected to the outlet of the culvert crossing the access road at ~4.75 km.</p>			
ULR#57	Batch plant and ULRHEF intake concrete wash pits	Concrete washing in occurring outside of designated wash pits or in wash pits that are not properly lined to contain cement waste. Maintenance and/or repairs to these pits are required.	<p>1. Line wash pit at the ULRHEF intake with geo-textile to contain all cement powder waste. Concrete waste should be used to make lock blocks at the batch plant or should be cured in designated areas to prevent cement laden runoff. This wash pit should not be used until repairs are completed.</p> <p>2. Restore capacity of the batch plant concrete wash pit. The IEM recommends removing cured concrete from within the wash pit, and re-lining the wash pit with geotextile. Cured concrete and cement laden runoff along the edge of the access road adjacent to the wash pit should be removed, broken into smaller pieces, and buried in a designated spoil area.</p> <p>Update: The concrete sump at ULRHEF was cleaned out and lined with geotextile on July 13, 2016. The sump at the batch plant was also cleaned out and will be emptied on an as needed basis. The IEM will continue to monitor these two areas to ensure compliance.</p>	July 6, 2016	July 9, 2016	July 13, 2016
ULR#58	All work areas	Conservation Officer and BCEAO Compliance and Enforcement Officer Inspection noted non-compliance with regard to wildlife attractant management.	<p>1. Develop, implement and document internal waste and attractant management auditing tool. Tool will be available for use by the IEM and CE's EM Team. Records of inspections and noted non-compliances should be tracked internally with clean-up documented in each report. This tracking tool will be available to agencies upon request. This tool should be used similarly to the Spill Reporting tool currently being employed onsite.</p> <p>2. Repair and adjust the electric fences and charged entrance mats at the construction camp (perimeter fence, camp kitchen fence, and waste compactor fence) and surrounding the septic field.</p> <p>3. Install self-closing door hinges in all site lunch rooms and anywhere food is being stored temporarily (lunch rooms, kitchen storage area) OR adjust how food is transported, stored and consumed onsite to eliminate the possibility of food and food waste attractants onsite.</p> <p>4. Perform maintenance to clean-up grease and liquid waste around and underneath the garbage compactor</p> <p>5. Install berms surrounding parking areas that are lined with impermeable fabric in areas where tunneling equipment is parked. All leaks could be considered wildlife attractants; therefore all leaky equipment should be repaired and leaks or spills to ground in parking areas must be cleaned up daily and be disposed of in appropriate contaminated soil bins.</p>	July 6, 2016	July 9, 2016	July 14, 2017

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			Update July 14 – CE provide a memo from their QP (Cascade Environmental) confirming that the temporarily stockpiled the material in the mechanics yard has been removed and buried at the appropriate depth in the Boulder Spoil pile, and that the remaining soils under the stockpiled material are free of contamination.			
ULR#59	ULRHEF Powerhouse	Maintenance is required on a section of the 10" discharge hose for the clean water sump at the ULRHEF powerhouse. A hole has developed in the discharge hose resulting from normal wear.	1. The section of hose with a hole should be replaced or patched to prevent enlargement and potential sediment and erosion issues at the ULRHEF. CE provided photo documentation of the fixed hose.	August 8, 2016	August 14, 2016	August 10, 2016
ULR#60	Lillooet River FSR from 46 – 48 Km	The road fill slope of the Lillooet River FSR between KM46 – KM48 requires ESC measures to ensure slope stability and prevent rill erosion from transporting material into the forested area below.	1. Assess the road fill slope conditions following conduit installation in the Lillooet River FSR in this section. Update September 30, 2016: CE and the IEM have assessed areas of concern and have discussed ESC stabilization/reclamation of the slopes by hydro-seeding with alder and hydro-mulch of appropriate strength (BFM) and at sufficient application rate. Provide and implement an agreed upon plan to protect the slope from an erosion and sediment transport perspective and/or a plan to initiate reclamation of the impacted area. Update May 25, 2017 – CE removed material from the road edge and hydro-seeded the road slopes with alder seed and bonded fiber matrix.	August 8, 2016	August 16, 2016	May 25, 2017
ULR#61	Access roads and general ESC measures	ESC improvements are required to ensure the site performs well during the imminent fall rain events, and to maintain adherence to conditions of the CEMP, Ditch Management Plan, Erosion Prevention and Sediment Control Plan, and Surface Water Quality Protection Plan	1. The IEM has prepared FAM13 which describes ESC and ditch management improvements, some of which have been in discussion since August 18, 2016. Individual items are outlined in FAM13, which was provided to the contractor on September 30.	September 30, 2016	October 7, 2016	
			a. Ditches and checks dams between KM48.5 and the Keyhole Bridge are in need of maintenance. CE should ensure these ditches are continuous, armored against erosion (appropriately spaced check dams/armor), and able to receive and convey runoff. Update: CE has installed pumps to temporarily divert sediment laden water to a vegetated area for infiltration until final road capping and drainage structures can be installed.			October 25, 2016
			b. The Lillooet River FSR drainage from KM47-48 must adequately convey runoff away from the stream at KM48. Update: CE has installed a pump to direct water away from the bridge deck and the fish bearing stream as a temporary measure to protect the watercourse. A temporary culvert has also been placed in the FSR to collect water flowing down the road surface and direct it away from the fish bearing stream.			October 25, 2016
			c. The temporary ULRHEF intake access road has no ditch installed and the upstream side of the laydown adjacent to the intake structure is likely to pool water or result in unmitigated runoff to the Lillooet River. Provide and implement a temporary drainage solution until this area is reclaimed. Cross ditches and berms have been installed to prevent turbid water from entering the Lillooet River,			October 21, 2016
			d. Ditching along the ULRHEF lower portal access road requires maintenance and the drainage pattern at the base of the road has changed since the installation of the Truckwash Creek penstock crossing. Provide temporary repairs to the ditch to			October 25, 2016

ID No.	Location	Issue Description	Action Taken/Recommended	Date of Identification	Targeted/ Completion Date	Date Completed
			<p>ensure it can receive and convey road drainage and/or install final drainage (note: sediment laden water should not be directed to the UWR replacement area). Update: Water ponding in the work area has saturated the haul road; however, sediment laden water is contained within the work area and is not flowing offsite. Final drainage solutions will be installed at a later date,</p> <p>e. The access road at ASTR-04 crossing pools road runoff and discharges sediment laden water to ASTR-04 during rain events. CE has indicated that they are aware of this concern and are working on developing and implementing a final solution for road drainage.</p> <p>f. The steep penstock access road leading down towards the powerhouse from PI-12 (~3+950) requires measures to protect the running surface. The IEM suggest implementing seasonal deactivation measures or installing a combination of cross ditching and ditch line check dams to prevent transporting sediment laden water to the base of the slope.</p> <p>g. The ULRHEF powerhouse access road ditch is not continuous, specifically the section along the toe of the spoil area. Install the appropriate drainage solution. This ditch is not yet installed; however, ESC has not yet been a concern in this area</p> <p>h. The BDRHEF intake access road requires ditch maintenance, especially where ditches have been impacted by conduit installation. The access road also requires repair/grading where wheel ruts have resulted in water channelizing along the road alignment. Update November 14: CE has completed ditch line improvements, road grading, and seasonal road de-activation.</p>			<p>October 21, 2016</p> <p>October 21, 2016</p> <p>October 25, 2016</p> <p>November 14, 2016</p>
ULR #62	Lillooet River FSR drainage between KM42.5 – KM43.5-	Sediment laden road run-off discharging to watercourses and causing erosion of road edges.	<ol style="list-style-type: none"> 1. Assess and repair road drainage and erosion issues observed at KM43 of the Lillooet River FSR. 2. Ditching between KM43 and KM43.5 of the Lillooet River FSR should be assessed and repaired to convey clean water to CTF bearing streams in this area. 	October 25, 2016	October 29, 2016	October 27, 2016
ULR #63	Conduit alignment between the BDRHEF intake access road and BDRHEF powerhouse along TX Line ROW.	Drainage paths interrupted by conduit installation have resulted in significant erosion and does not conform to the work plan or design.	The work plan and design of the power and tech cable conduit between the BDRHEF intake access road and the BDRHEF powerhouse called for the installation of swales at all ephemeral drainage paths. The work plan and design were not implemented resulting in substantial erosion along the conduit alignment and along two of the TX Line temporary access roads. An updated drainage plan should be prepared and installed to prevent further erosion. Update May 18, 2017 – Rock armoured over-drains were installed at six identified ephemeral drainage paths. All over-drains empty to an engineered drainage ditch that convey water across the Lillooet River FSR through an upgraded culvert. This work was completed under IEM supervision.	November 10, 2016	November 17, 2016	May 18, 2017
ULR #64	Penstock access road and riparian area on the left bank of	Organics, mineral soils, and snow were mixed during construction of an access path on the left bank of Truckwash Creek.	<ol style="list-style-type: none"> 1. Soils (organics and mineral soil) were mixed with snow and placed on an access path constructed to perform Truckwash Creek over-drain repairs. This material is placed on the permanent penstock access road and in the riparian area of Truckwash creek, which will need to be reclaimed in 2017. The mixed material (organics, soils, and 	December 1, 2016	Upon completion of Truckwash Creek over-drain repairs	June 5, 2017

ID No.	Location	Issue Description	Action Taken/Recommended	Date of Identification	Targeted/Completion Date	Date Completed
	Truckwash Creek		<p>snow) are to be removed upon completion of the penstock over-drain repair works, to eliminate the ESC risk.</p> <p>Update June 5, 2017 – This material appears stable from an ESC perspective. Some minor planting remains to be completed in the area; however, as the material does not currently pose an ESC risk the item has been closed.</p>			
ULR#65	Construction Camp	Improperly stored wildlife attractants and lack of electric fence maintenance.	<ol style="list-style-type: none"> 1. Waste management: Food waste was improperly stored in bins outside at dorms A, B and C, as well as outside of the kitchen. This food waste has attracted pine martins to the area as a number of prints were observed. Please ensure the food waste is not stored where it can be accessed by martins or other wildlife and ensure that food waste bins are always kept shut. Update January 25, 2017 – Management of the waste bins on Pad #1 and in the temporary bins on Pad#4 is improved, and no pine martins were observed. The inside of the recycling bins were burned with a torch and small amounts of ammonia and water mixture was sprayed inside the bins to discourage pine martins from entering the bins. 1. Electric fences: While most of the electric fences were observed to be cleared of snow, the gates at the pad 1, 3 and 4 entrances and the kitchen delivery entrance were not being used. Also, the electric fence around the kitchen was not cleared of snow and did not appear to be functional. Please restore the function of the electric fences as soon as possible. January 25, 2017 – CE continues to dig out the electric fence following snow storms to the best of their abilities. The conditions at the camp pose minimal risk of attracting bears as they are currently in hibernation and attractants are being well managed. This item is considered closed. 	January 3, 2017	January 6, 2017	January 25, 2017

3.2 *Environmental Incidents*

An environmental incident was deemed to have occurred when an environmental commitment was inadvertently violated during the construction period. In total, 34 environmental incident reports were prepared, most of which related to a failure to communicate the scheduling of works to the IEM or a failure to follow an established work procedure. The root cause and corrective action required to address each environmental incident is summarized in Table 2. Following identification of an environmental incident, the IEM required that the Contractor's Environmental Coordinator draft an environmental incident report for review and approval by the IEM prior to the Owners submitting the report to the appropriate agency. The Contractor, Owners, IEM, and IE were all involved in the submission of each environmental incident report to the regulatory agencies, which helped to ensure that the information was effectively communicated to each member of the Project team. The environmental incidents assessed as having a moderate to high level of potential impact with a high likelihood of being repeated where required to be reported to the regulatory agencies immediately; however, most of the environmental incidents that occurred were deemed to be of a moderate to low level of environmental impact with low to moderate likelihood of repeatability and, thus were reported to agencies within 48 hours and within the EMRs.

3.3 *Stop Work Orders*

Internal halt work orders were issue by the Owners or were self-imposed by the Contractor on two separate occasions. The first halt work order was issued in June 2014 when the Contractor initiated stripping and grubbing activities at the ULRHEF intake prior to issuance of an LTC and without an approved work plan (see environmental monitoring report #26 for further detail). The second halt work order was issued as a result of continued failure of the ULRHEF intake water treatment system in October of 2014 (See environmental monitoring report #44 & #45 for further detail). In July of 2014, the Owners and the IE issued a stop work order for works on the BDRHEF intake access road, when it became apparent that the Contractor had failed to follow the engineered road design prescriptions (see environmental monitoring report #32 for further detail).

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Table 2. Environmental Incident Summary

Incident Report Number	Date Reported	Environmental Monitoring Report Number	Incident Description	Root Cause	Corrective Action
1	May 26, 2014	23	Accidental clearing of a tree containing a potentially active songbird nest.	Communication breakdown	Assessed fallen tree to determine if nest was active. Worker education and review of flagging procedures.
2	May 27, 2014	23	Excavator travelling over a box culvert caused the culvert to collapse, introducing sediment and woody debris to a fish bearing watercourse.	Bridge capacity was not assessed prior to use	Repaired box culvert.
3	June 3, 2014	24	Rock Truck rolled down the road embankment after the road edge collapsed in a narrow section of road.	Failure to communicate KMs over the radio	Review of VHF radio calling procedure and speed limits.
4	June 3, 2014	24	Rock truck caused a box culvert to collapse when it travelled at the edge of the culvert to let a vehicle pass.	Failure to communicate KMs over the radio	Installation of a traffic light to manage public and worker traffic through the narrow section of road.
5	June 3, 2014	24	A truck hauling sand caused a box culvert to collapse at KM 34. Vehicle exceeded the bridge rating by ~10T.	Failure to adhere to bridge weight restrictions	Repaired box culvert and assessed bridge load rating capacity.
6	June 6, 2014	24	Work within the Truckwash Creek riparian area without notification to the IEM.	Communication breakdown	Worker education and review of IEM notification requirements.
7	June 7, 2014	24	Clearing of brush along an old road alignment proceeded past the approved clearing limits where songbird nesting surveys had not been completed.	Communication breakdown	Worker education and review of clearing flagging prescriptions.
8	June 15, 2014	26	Stripping and grubbing within the riparian area at the Upper Lillooet intake before issuance of an approved work plan and without IEM notification.	Failure to follow standard work procedure	Voluntary stop work initiated until a work plan was developed and approved.
9	June 28, 2014	27	The IEM was not notified of works within the Stream 30A riparian area, located within Segment 2 of the Tx Line. Works proceeded without an IEM onsite.	Communication breakdown	Worker education and review of IEM notification requirements.
10	July 31, 2014	32	Failure to notify the IEM of instream work and completion of a road culvert installation without IEM presence, within three small non-fish, non-CTF bearing watercourse crossing the BDRHEF intake access road.	Communication breakdown	Worker education and review of IEM notification requirements.
11	August 1, 2014	32	Deviation from an approved work plan and LTC during construction of the Boulder Creek Intake access road.	Communication breakdown: Failure to follow an approved work plan and standard road construction prescriptions	IE and Owners issued Stop Work Orders. Removal of side cast material and reworking of the access road. Assessment of timber damaged outside of the LTC.
12	August 26, 2014	36	Moose Struck and killed on the Lillooet River FSR.	Failure to follow standard work procedure - Speed limits	Worker education and review of speed limits. Notification provided to the Conservation Officer Service.
13	October 31, 2014	45	A spill of >300L of diesel occurred when an operator fueling a fuel truck stepped away from the pump.	Failure to follow standard work procedure - Re-fueling	Spill response initiated immediately; reported to the Provincial Environmental Emergency Program.

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Incident Report Number	Date Reported	Environmental Monitoring Report Number	Incident Description	Root Cause	Corrective Action
14	December 4, 2014	50	A rock truck travelling unloaded caused a wood-box culvert to fail, which temporarily obstructed stream flow. An overflow swale was dug in the road surface in the dry to prevent erosion.	Unforeseen incident	Repaired wood box structure under IEM supervision.
15	March 4, 2015	60	An excavator removed debris from within a ditch line conveying flowing water along the BDRHEF intake access road without IEM notification or presence onsite.	Failure to follow standard work procedures, failure to notify the IEM of instream works	Worker education and review of IEM notification requirements.
16	October 20, 2015	76	Instream work completed within Boulder Creek prior to issuance of an approved work plan, and without IEM notification or presence onsite.	Failure to follow standard work procedures, failure to notify the IEM of instream works	Worker education and review of IEM notification requirements.
17	November 22, 2015	81	High pH discharge to the Lillooet River.	Ineffective water treatment and communication breakdown	Worker education and review of water treatment procedures.
18	November 27, 2015	81	Travel through mountain goat corridor during restricted period.	Failure to respect a construction timing restriction	Worker education and stationing of gate keepers during the restricted time periods.
19	February 19, 2016	88	Unauthorized drainage repairs within a Moose Winter Range Forest Management Zone during a project specific construction timing restriction	Failure to follow standard work procedures, failure to notify the IEM of instream works, communication breakdown	Repaired drainage works to armor drainage to protect against future erosion under IEM supervision.
20	May 5, 2016	93	Discharge hose from the ULRHEF lower tunnel portal water treatment system broke free of its' anchoring resulting in significant erosion to the access road surface and turbid water discharge to stream ASTR-03.	Equipment failure (discharge hose anchor)	Corrected failed equipment and constructed overflow swale.
21	May 8, 2016	94	The ULRHEF lower tunnel water treatment system overflowed and caused significant erosion of the access road surface and turbid water input to stream ASTR-03.	Equipment failure (generator)	Worker education and review of refueling procedure.
22	May 19, 2016	94	Second and Third Incidents - The ULRHEF lower tunnel water treatment system overflowed and caused significant erosion of the access road surface and turbid water input to stream ASTR-03.	Equipment failure (generator failure)	Installation of a second generator to provide back-up power in case of failure and repairs to the access road.
23	June 7, 2016	96	Mountain Goat sighting - lack of immediate communication to IEM and shutdown of works.	Failure to respect a construction timing restriction	Worker education during weekly safety and coordination meetings. IEM verified that mountain goat were absent from the work area before works resumed.
24	June 10, 2016	96	Pine Martins trapped in waste bin.	Failure to follow standard work procedure - improper wildlife attractant management	Worker education during weekly safety and coordination meeting to remind workers of proper attractant management.

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Incident Report Number	Date Reported	Environmental Monitoring Report Number	Incident Description	Root Cause	Corrective Action
25	June 17, 2016	97	Bear inside gear storage container at ULR lower tunnel portal - no wildlife attractants observed within sea can.	Failure to secure work area to prevent wildlife access	Worker education during weekly safety and coordination meetings. Notification provided to the Conservation Officer Service.
26	June 17, 2016	96	Pine Martin fatalities within uncovered TX-line pole excavations.	Failure to secure work area to prevent wildlife access	Adjusted work procedures to prevent wildlife entrapment.
27	July 13, 2016	98	Deer fatality - vehicle collision.	Failure to follow standard work procedure - speed limits	Worker education during weekly safety and coordination meetings.
28	July 17, 2016	99	Deer fatality - vehicle collision.	Failure to follow standard work procedure - Speed limits	Worker education during weekly safety and coordination meetings.
29	August 24, 2016	101	Minor bio-oil spill to water during BDR tailrace excavation.	Equipment failure (hydraulic hose)	Spill response initiated immediately; reported to the Provincial Environmental Emergency Program.
30	September 12, 2016	103	Minor bio-oil spill to water during ULR intake cofferdam removal.	Equipment failure (hydraulic hose)	Spill response initiated immediately; reported to the Provincial Environmental Emergency Program.
31	October 18, 2016	105	Reportable diesel spill (>100L).	Failure to follow standard work procedure	Spill response initiated immediately; reported to the Provincial Environmental Emergency Program.
32	November 16, 2016	107	Travel through mountain goat corridor during restricted period.	Failure to respect a construction timing restriction	Worker education and stationing of gate keepers during the restricted time periods.
33	November 26, 2016	108	Lack of communication - water management.	Communication breakdown	Worker education during weekly safety and coordination meetings.
34	November 26, 2016	108	Travel through mountain goat corridor during restricted period.	Failure to respect a construction timing restriction	Worker education and stationing of gate keepers during the restricted time periods.

4.0 Lessons Learned during the Performance of IEM Duties

The IEM took note of ways to help improve the implementation of environmental monitoring duties on future projects throughout the active construction period. The following section provides a summary of the lessons learned while performing the role of the IEM on the Project. Small improvements in the areas suggested below would help to streamline the duties of the IEM and would increase the overall effectiveness of the role.

4.1 Authority and Responsibilities of the IEM

The IEM is assigned authority under the *Water Sustainability Act* (formerly the *Water Act*) to monitor and report on construction activities, while ensuring that all applicable environmental mitigation measures are implemented to meet every Project commitment. To be successful in this role, the IEM must balance the interests of the Owners, Contractor, and the regulatory agencies represented by the IEM to protect all environmental aspects of the Project, while helping to advance the Project. As the IEM is responsible for monitoring compliance with the environmental commitments, which must be upheld throughout the construction phase, it would be beneficial to consult with the IEM during the Project planning phase, specifically to provide comments and directions on the CEMP before it is finalized. An experienced IEM would provide insight into the practicability, constructability, and/or enforceability of various conditions stated in the CEMP.

In some instances, the IEM discovered that the responsibility for a given task was not clearly outlined in the CEMP. The following are examples of environmental tasks that were performed by the IEM and/or others, that the IEM recommends be clearly defined and included in the CEMP of future Projects:

- Responsibility for materials sampling and analysis of sampling results to confirm successful remediation post spill clean-up, and prior to starting reclamation activities;
- Definition of environmental quality standards to confirm that successful remediation was achieved;
- Requirement to document successful cleaning of the penstock prior to commissioning, through sampling and analysis of the sampling results;
- Requirement to conduct tests for PAG during tunnel excavation (if applicable);
- Clarification on process for granting approval of reclamation strategies and prescriptions; and,
- Processes for approving changes to defined project mitigation measures based on the recommendations of a QP.

Clear delegation of these responsibilities within the CEMP would provide the IEM with the necessary lead time to prepare for and perform the required tasks, and to verify that they were completed to the extent required.

Defining the limits of the authority of the IEM to approve changes to the CEMP and/or EPPs, timing windows, prescribed environmental mitigation measures, and/or work plan procedures is also critically important. It is recommended that the CEMP include mechanisms for modifying and adopting changes to environmental protection measures based on the recommendation of a QP, and approval of the IEM. By employing professional reliance with regard to changes to mitigation measures that are determined to have the same intent and offer a similar or greater degree of protection as the initial mitigation measure, the Project team and regulatory agencies could avoid the lengthy and intensive processes required to amend conditions of the EAC and the General Wildlife Measures Exemption on future Projects.

4.2 Defining the Goals of Reclamation and Pre-Construction Surveys

The Project would have greatly benefitted from having clear reclamation objectives, timelines and a set of success criteria defined prior to the start of the construction, as the implementation of ULHP reclamation activities was delayed until the final approval of the Site Reclamation Work Plan was granted in October 2016. The Contractor completed reclamation activities in accordance with prescriptions outlined in the Site Reclamation work plan, which were prepared by a leading professional in the field of industrial site reclamation; however, the ultimate success of these prescriptions may not be measurable until many years after the five year long-term monitoring period has ended. For example, the civil Contractor's site reclamation specialist, recommended planting and seeding with deciduous trees in areas devoid of topsoil to begin a natural succession process of site reclamation with the goal of supporting a mature coniferous in the future. Determining if reclamation activities have been successful will be difficult in these areas considering the success criteria (stems/ha; percent cover; species diversity) identified within the Operational Environmental Management Plan (OEMP) will be measured within a relatively short five-year monitoring period, compared to the 20+ years required for conifers to re-establish through a succession based reclamation strategy. Aligning the reclamation strategy with the long-term monitoring success criteria outlined in the OEMP, would provide all parties with a clear objective from the start of the construction period, and may help to ensure reclamation activities are performed earlier in the construction schedule, rather than postponing reclamation to the end of the construction period.

Steep cut slopes are often protected by spraying hydro-seed and tackifier to the slope as a temporary erosion and sediment control protection measure. On future projects, it is recommended that a desired final condition be prescribed for cut slopes, and that reclamation activities be implemented as soon as possible following bulk excavation of these slopes, rather than applying grass seed and waiting until the end of the construction period to begin reclamation activities.

4.3 Unforeseen Environmental Features and/or Changes to Environmental Conditions

The Project area was dramatically altered throughout the construction period by a series of unforeseen environmental events including the Boulder Creek Wildfire of 2015, extreme flooding events, landslides and stream channel redirection during heavy rain events, and large destructive avalanches. These environmental events resulted in significant changes to identified wildlife habitats in the Project area. There were no methods outlined in the CEMP for addressing unforeseen landscape changes as a result of natural events. It is likely most appropriate that a professional reliance model be adopted to re-assess identified wildlife habitats after a habitat altering event, to determine if a revised mitigation strategy is appropriate given the changes in environmental conditions.

4.4 Communications Between Regulatory Agencies and the IEM

As the IEM is responsible for representing the interests of regulatory agencies during a project's construction phase, it is recommended that more emphasis be placed on the communication between the IEM and regulatory bodies during the construction period. This recommendation is derived mainly from the differences in expectations experienced with regards to attractant management between the EAO and the IEM. The EAO issued an Order to Remedy to the Project in 2016 with regard to attractant management following a site audit. The EAO Order to remedy was issued during the third year of construction, even though the Project had been successfully managing wildlife attractants during that time period without incident. Better communication between the regulatory agencies and IEM would ensure that the expectations of the auditors, occasionally visiting the site, are in line with the expectations of the IEM who is onsite daily or weekly.

Recommended opportunities to strengthen communication between regulatory agencies include:

- Holding a pre-project planning meeting attended by the Owners, IE, IEM and all regulatory agencies involved in the project. The meeting would have the goal of reviewing expectations and would provide an opportunity for introductions and the fostering of collaboration among the IE, IEM, and regulators;
- Holding bi-annual or quarterly update meetings;
- Encouraging regulators and auditors to coordinate and discuss site conditions with the IEM in advance of audits or site visits; and,
- Requiring weekly reporting of all relevant communications in the EMRs (as was completed on the ULHP).

5.0 Conclusion

The IEM monitored construction activities associated with the ULHP from October 2013 to September 2017. Wet commissioning commenced for the ULRHEF in February 2017 whereas the BDRHEF started wet commissioning in April 2017. Throughout the construction period, SEI, as the IEM oversaw the works, documented adherence to the CEMP and associated EPPs, maintained communication with appropriate regulatory agencies, and worked with the Project Owners and Contractors to plan and adjust active works to ensure environmental compliance was achieved. While performing these duties as the IEM, SEI noted how certain communication procedures and environmental mitigations measures could be better defined, prescribed, implemented, communicated and adjusted on future projects to increase their overall effectiveness. These notes evolved into specific recommendations that are discussed throughout the report. Table 3 summarizes the recommendations provided in each section of the report and identifies the intended audience for each recommendation.

Project construction was generally well organized, and potential environmental effects were well mitigated. The majority of environmental issues and incident generally resulted from failures to effectively communicate or failures to adhere to approved work plans and/or procedures. Despite considerably challenging construction works, such as the ULRHEF intake and tunnel excavation, the BDRHEF intake, and TX Line Segments 4 and 6, observed environmental issues were short-lived, and without acute or chronic deleterious effects to local fish, wildlife, or other valuable resources.

Upon completion of final reclamation activities, the IEM prepared and submitted a memorandum confirming that all reclamation activities were completed to the satisfaction of the IEM and that no outstanding issues remained onsite (Appendix C). Meeting the environmental expectations imposed on the Project, with its high public profile, difficult terrain, and environmental sensitivities proved very challenging, especially at the start of the Project; however, through continued effort, and ongoing meaningful communications, the Project team (Owners, Contractors, sub-contractors, IE, and IEM) were able to work collaboratively to achieve the environmental objectives throughout the construction period.

Table 3. Summary of Recommendations to be Implemented on Future Projects

Summary of Recommendations	
To Government	<ul style="list-style-type: none"> • Ensure environmental requirements, including species and habitat specific mitigations and timing restrictions are consistently applied to all stakeholder groups operating in the Project area during the construction period, or future projects are permitted and approved with conditions consistent with the current industry users in the region. • Provide clear definitions of what types of construction activities are permitted and which are not during specified construction timing windows. • Migratory Birds – A national level approach to managing incidental take of migratory bird nests during authorized land clearing activities is currently lacking and should be developed to provide guidance to the renewable energy industry as well as all other industries involved in land clearing activities (e.g. transportation, land development, forestry, mining, etc.). The approach developed should be consistent across industries to ensure adequate protection of breeding migratory birds. • Access Road Maintenance – Apply a single standard with regard to road maintenance and water management across all user groups operating in the project area, or more generally on all user-maintained roads in the Province.
For Projects with IEM's	<ul style="list-style-type: none"> • Incorporate iterative environmental mitigation (e.g. CEMP, EPP) and work planning review processes that involves the IEM throughout project construction phases, as well as pre-construction phases. • Include language in species and habitat specific timing restrictions to allow an adaptive management approach, under the Professional Reliance model, to be prepared by a QP with endorsement from the IEM. • Vegetation Clearing – Specify the requirement for the IEM to review all clearing plans and verify all clearing boundaries in the field within identified sensitive wildlife habitats with the clearing contractor during a pre-work meeting. • Specify the requirement for the IEM to use communication tools such as an Environmental Issue Tracking Matrix and Field Advice Memorandums to effectively track and communicate environmental issues to the Contractors before they result in environmental incidents. • Consider providing the IEM with the authority to implement environmental directives to proactively protect environmental features or infrastructure when the corrective actions recommended remain outstanding for an extended period instead of waiting for an incident to occur that may cause environmental damage and result in stop work orders. • Assign responsibility for all environmental tasks that are anticipated to be required for the course of the construction period within the CEMP. • Include mechanisms for modifying and adopting changes to environmental protection measures specified in the CEMP based on the recommendation of a QP, and approval of the IEM. • Strengthen the level of communication between the IEM and regulatory bodies during the construction period by: <ul style="list-style-type: none"> ○ Holding a pre-project planning meeting attended by the Owners, IE, IEM and all regulatory agencies involved in the project. The meeting would have the goal of reviewing expectations and would provide an opportunity for introductions and the fostering of collaboration among the IE, IEM, and regulators; ○ Holding bi-annual or quarterly update meetings; ○ Encouraging regulators and auditors to coordinate and discuss site conditions with the IEM in advance of audits or site visits; and, • Requiring weekly reporting of all relevant communications in the environmental monitoring reports (as was completed on the ULHP).
For All Resource Projects	<ul style="list-style-type: none"> • Water Quality Protection <ul style="list-style-type: none"> ○ The use of synthetic bio-degradable or vegetable-based hydraulic fluid was prescribed for all machinery operating within the riparian area; however, this prescription should be limited to excavators operating within riparian areas only. It is also recommended that this requirement become industry standard. ○ Testing for residual toxic by-products of blasting with ANFO in all blast rock, prior to using blast rock for on site armouring applications. ○ Conduct instream acoustic pressure monitoring for blasts occurring within 30 m of the wetted perimeter of watercourses, and at the start of concussive activities (e.g. pile driving) that occur within the bankfull width.

Summary of Recommendations

<p>For All Resource Projects (continued)</p>	<ul style="list-style-type: none"> • Material Management (Including PAG rock testing & ARD management) <ul style="list-style-type: none"> ○ Spoil areas should be well designed and demarcated to accommodate maintenance and appropriate reclamation. For example, install a silt fence or a perimeter berm inside the limits of the spoil area, a perimeter ditch inside of the spoil area within the perimeter control, offset spoil material a minimum of 1 m from the inside edge of the perimeter ditch, <i>etc.</i> ○ Cite any required permanent PAG spoil location early in the Project planning phases, and adaptively increase its size to accommodate volumes of PAG rock as they are encountered. • Soil Stabilization <ul style="list-style-type: none"> ○ Specify the final reclamation prescription for cut slopes and require that they be applied immediately following excavation to permanently stabilize the slope in lieu of applying temporary hydro-seeding, as grass is often not the final desired condition of the slope and unlikely to thrive on slopes greater than 2:1. • Noise Reduction Strategies <ul style="list-style-type: none"> ○ Develop a directed approach to construction noise level monitoring and adjust noise level thresholds based on observed behaviours of mountain goats or other VCs in response to recorded construction noise levels and/or the source and position of the noise. • Dust Control and Dust Abatement <ul style="list-style-type: none"> ○ Explore the option to include the short-term use of water in project permitting (e.g. Conditional Water Licence) for the construction and operations phases. • Wildlife Surveys, Salvages and Monitoring <ul style="list-style-type: none"> ○ Specify the responsibility for completing necessary wildlife salvages prior to the start of the construction period, to ensure that necessary lead time is provided to the QP responsible to seek wildlife salvage permits. ○ Clearly define when work in coastal tailed frog (CTF) streams can occur and when activities within CTF bearing stream are not permitted. • Environmental Protection Buffers <ul style="list-style-type: none"> ○ Use color-coded flagging tape and signage in place of fencing to delineate environmentally sensitive areas and/or buffer distance to serve as an effective visual reminder of the need to respect the buffer distance. • Reclamation <ul style="list-style-type: none"> ○ Prior to the start of the construction period, specify the objectives and goals of the reclamation strategy and align them with the long-term monitoring success criteria outlined project approvals. • Unforeseen Environmental Features and/or Changes to Environmental Conditions <ul style="list-style-type: none"> ○ Adopt a professional reliance model to re-assess identified wildlife habitats after a naturally occurring, habitat altering event, to determine if a revised mitigation strategy is appropriate given the changes in environmental conditions.
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Appendix A – Photographic Summary of Construction Activities Organized by Work Area
(11 Pages)

Upper Lillooet Hydroelectric Facility Intake Structure



Photo 1 – Clearing river left (June 5, 2014)



Photo 2 – Bulk excavation river left (September 23, 2014)



Photo 3 – Diversion Channel Excavation (September 11, 2014)



Photo 4 – Intake diversion channel in use (December 2, 2014)



Photo 5 – Intake structure construction (June 14, 2016)



Photo 6 – Overview of the final condition of the intake (July 14, 2017)

Upper Lillooet Hydroelectric Facility – Upstream Tunnel Portal



Photo 7 – Bulk excavation (September 11, 2014)



Photo 8 – Bulk Excavation (September 22, 2014)



Photo 9 – Active tunneling works (May 10, 2016)



Photo 10 – Dewatering treatment ponds (June 15, 2016)



Photo 11 – Buried Concrete Arch Support Installation (October 29, 2016)



Photo 12 – Reclamation and Operation (June 22, 2017)

Upper Lillooet Hydroelectric Facility – Intake Temporary Work Areas



Photo 13 – Clearing right bank (June 6, 2014).



Photo 14 – Spring fed stream channelization and installation of a temporary access track and crossing to access the river right spoil area (June 12, 2014).



Photo 15 – Operation of Right Bank Spoil Areas (August 16, 2014)



Photo 16 – Operation of Left Bank Spoil Area (November 8, 2014).



Photo 17 – Final Condition of Right Bank Temporary Work Spaces (July 14, 2017).



Photo 18 – Final Condition of Left Bank Temporary Work Spaces (July 14, 2017).

Upper Lillooet Hydroelectric Facility – Downstream Tunnel Portal



Photo 19 – Clearing and test pit excavation (June 13, 2014)



Photo 20 – Bulk Excavation of downstream portal (July 14, 2014)



Photo 21 – Start of downstream tunneling and portal consolidation (August 16, 2014)



Photo 22 – Dewatering system (May 23, 2016)



Photo 23 – Audio Visual Berm Specified as a Mountain Goat Mitigation Measure



Photo 24 – Final conditions following reclamation (June 22, 2017)

Upper Lillooet Hydroelectric Facility – Penstock



Photo 25 – Penstock right of way clearing (October 1, 2014)



Photo 26 – Fill Placement and penstock installation (June 15, 2016)



Photo 27 – Penstock staged near ASTR-04 stream crossing (June 16, 2015).



Photo 28 – Reclaimed status of stream ASTR-04 at penstock crossing (July 14, 2017)



Photo 29 – Stream ASTR-03/ Penstock Overdrain (May 25, 2016)



Photo 30 – Truckwash Creek Encased Concrete Penstock Crossing protected with rip-rap (May 20, 2017)

Upper Lillooet Hydroelectric Facility – Powerhouse



Photo 31 – Processing felled timber at the powerhouse location (April 23, 2014)



Photo 32 – Bulk excavation of powerhouse footprint (August 26, 2014)



Photo 33 – Completed structure exterior (September 28, 2016)



Photo 34 – Inside Completed Powerhouse Structure (March 2, 2017)



Photo 35 – Tailrace in Operation (April 14, 2017)



Photo 36 – Reclamation within riparian area (September 26, 2017)

Boulder Creek Hydroelectric Facility Intake Structure



Photo 37 – Clearing and start of bulk excavation (September 25, 2014)



Photo 38 – Excavation of diversion tunnel (May 11, 2015)



Photo 39 – Water treatment system (May 23, 2016)



Photo 40 – Intake construction during river diversion (July 29, 2016)



Photo 41 – Final grouting following installation of the Coanda screen (November 5, 2016)



Photo 42 – Completion of intake structure construction (November 11, 2016)

Boulder Creek Hydroelectric Facility – Upstream Tunnel Portal



Photo 43 – Start of bulk excavation at the intake access ramp (May 9, 2015)



Photo 44 – Bulk Excavation (May 25, 2016)



Photo 45 – Tunneling (May 23, 2016)



Photo 46 – Dewatering system (May 26, 2016)



Photo 47 – Regulation chamber and intake structure construction (August 19, 2016)



Photo 48 – Boulder Creek flowing through the sluice gate near completion of the intake structure (October 16, 2016)

Boulder Creek Hydroelectric Facility – Downstream Tunnel Portal



Photo 49 – Clearing the downstream tunnel portal (May 13, 2014)



Photo 50 – Bulk Excavation and Slope Stabilization (June 5, 2014)



Photo 51 – Beginning of lower tunnel portal excavation (June 24, 2014)



Photo 52 – Entrance to the downstream tunnel (October 16, 2014)



Photo 53 – Boulder downstream tunnel infiltration ponds (September 21, 2015)



Photo 54 – Steel Liner and Tunnel Plug inside the BDRHEF tunnel (December 9, 2016)

Boulder Creek Hydroelectric Facility – Powerhouse



Photo 55 – Clearing footprint for the Boulder Powerhouse and tailrace (May 15, 2014)



Photo 56 – Bulk excavation of the powerhouse footprint (June 12, 2014)



Photo 57 – Powerhouse foundation (August 31, 2014)



Photo 58 – Powerhouse structure construction (September 7, 2015)



Photo 59 – Construction of Boulder tailrace (May 17, 2016)



Photo 60 – Completed Boulder powerhouse and tailrace (September 2, 2016)

Transmission Line Photos



Photo 61 - Example of tree topping within an RVMA (June 12, 2014)



Photo 62 – Installation of the Ryan River clear span bridge (August 16, 2014)



Photo 63 – Hand falling steep areas of the Segment 5 right of way (August 29, 2014)



Photo 64 – Excavating pole structure foundations in steep terrain (August 30, 2014)



Photo 65 – Setting pole structures in Segment 4 (October 28, 2014)



Photo 66 – Stringing conductor in Segment 5 (May 26, 2015)

Appendix B – Summary of Effectiveness and Adherence to Environmental Assessment Certificate Conditions Related to Grizzly Bears and Grizzly Bear Habitat During the Construction Phase of the Upper Lillooet Hydro Project

(12 pages)



MEMORANDUM

FILE: Water Files: 2003601, 2002353, 2002561; Land Files: 2409998, 2408971, 2410654
Environmental Assessment Certificate: #E13-01: Condition 1 & Condition 12

DATE: December 11, 2017

TO: **Upper Lillooet River Power Limited Partnership & Boulder Creek Power Limited Partnership
c/o Julia Mancinelli – Environmental Manager - Innergex Renewable Energy Inc.**

FROM: Thomas Hicks, R.P.Bio – Sartori Environmental Inc.
on behalf of J. Alex Sartori, R.P.Bio, IEM – Sartori Environmental Inc.

RE: **Summary of Effectiveness and Adherence to Environmental Assessment Certificate
Conditions Related to Grizzly Bears and Grizzly Bear Habitat During the Construction Phase
of the Upper Lillooet Hydro Project**

1. Introduction

Measures to reduce potential impacts to grizzly bears and their habitats were included as Conditions of the Environmental Assessment Certificate (EAC; #E13-01 Amendments 1 – 6) issued for construction and operation of the Upper Lillooet Hydro Project (the Project). This memorandum has been prepared by the Independent Environmental Monitor (IEM), to summarize how the Project adhered to grizzly bear related Conditions of the EAC during the construction phase, and provides comment on the effectiveness and implementation of each grizzly bear related mitigation measure prescribed within the relevant EAC Conditions.

2. Construction Phase Grizzly Bear Related EAC Conditions

Mitigation measures to avoid or minimize potential impacts to grizzly bears and field verified suitable habitats within the Project area are specified under Conditions 1 and 12 of Schedule B (Table of Conditions) of the EAC. Preparation and approval of a Construction Environmental Management Plan, a Human-Wildlife Interaction Management Plan, and a Human-Bear Conflict Management Plan were requirements of these EAC Conditions. Many of the measures to protect grizzly bears overlap within the EAC Conditions and these three documents, and therefore to discuss adherence to Conditions of the EAC that relate to grizzly bears and their habitats, it is useful to group all grizzly bear mitigation measures into seven categories. Specific mitigation measures are outlined and discussed in Table 1 for each of the seven categories, which include:

- Construction Timing Windows
- Vegetation Clearing Prescriptions
- Worker Education
- Waste and Attractant Management
- Project Facility Design
- Habitat Restoration & Revegetation
- Reporting of all Bear Sightings and Early Identification of Problem Bears

Table 1. Summary of EAC Conditions, the Implementation Actions during the Construction Phase, and the Evaluation of the Effectiveness of the EAC Conditions to Reduce Potential Impacts to Grizzly Bears and Grizzly Bear Habitats

Mitigation Measure Category	EAC Condition	Project Implementation and Actions	IEM Evaluation of the Effectiveness of the EAC Conditions
EAC Condition 12 – Mitigations measures to reduce potential impacts to grizzly bears and suitable grizzly bear foraging habitats. These mitigation prescriptions are also stated in the Project’s Human-Bear Conflict Management Plan (Regehr, et al., 2013).			
Construction Timing Windows	<p>A Qualified Professional (QP) must ground-truth suitable forage habitat that overlaps with the Project prior to clearing. The QP or the IEM must identify appropriate measures that must be taken by the Proponent to avoid or minimize impacts to suitable Class 1 and Class 2 Grizzly Bear seasonal forage habitats, if the habitat is confirmed as suitable Class 1 or Class 2 habitat by the QP, the IEM or the Province.</p>	<p>A QP performed field verification of suitable Class 1 and 2 grizzly bear foraging habitats and recommended avoiding construction during the spring and fall at four suitable Class 1 and Class 2 forage habitats that overlapped the project footprint (Regehr, et al., 2013). The QP determined that clearing and construction <u>should</u> avoid the spring (April 1 – May 31) and fall (September 2 – November 1) seasons to avoid displacing bears from the following Class 1 and Class 2 habitats:</p> <ul style="list-style-type: none"> • ULH-GB26 – near pole 148 – Segment 6 • ULH-GB33 – near pole 186 – Segment 8 • ULH-GB53 – near pole 322 – Segment 14 • ULH-GB59 – near pole 376 – Segment 15 <p>An adaptive approach was used during the construction phase in regard to recommended construction avoidance periods outlined above. Recommended avoidance periods for ULH-GB26 and ULH-GB53 were respected throughout the construction phase of the project. Mitigation measures and recommendations prepared by a QP were presented to the IEM to allow some activities to occur within ULH-GB33 and ULH-GB59, during the recommended avoidance periods. Further details are presented in Section 4.</p>	<p>The additional construction avoidance periods proposed to mitigate the risk of displacing grizzly bears from field verified forage habitat, required the Contractor to schedule construction and clearing activities during approved time periods, which presented some logistical challenges, and extended the construction period over multiple years rather than concentrating the construction time to the shortest extent possible. Additional construction timing restrictions to those explicitly stated in EAC Condition 12 were presented in the Human-Bear Conflict Management Plan; however, the language associated with these timing restrictions allowed the flexibility to modify the timing restrictions. The use of “should” avoid, rather than “must” or “will” avoid, permitted the Owner/Contractor the opportunity to assess the habitat and present additional QP prepared mitigation measures to prevent displacing grizzly bears from these areas, if work were to occur during the recommended avoidance periods.</p> <p>This permitted the Contractor the flexibility to enlist the services of a QP to prepare recommendations to allow works to proceed under an adaptive management strategy, based on an assessment of the habitat prior to beginning works during the avoidance periods. In each case, a QP prepared a mitigation strategy which was reviewed by the IEM and approval to do the work was granted by the IEM based on these strategies, without seeking an amendment to the EAC.</p> <p>The IEM recommends that language regarding timing restrictions be explicit in allowing or preventing the flexibility to alter timing restrictions based on QP assessed ground conditions and adaptive mitigation strategies. The flexible approach adopted by the Project was used effectively and the collaboration between Owner, Contractor, QP, and IEM. While the IEM recognizes this may not be suitable for all situations and will depend greatly on the Project team involved, it does present an example of an effective adaptive management approach model that EAO may consider when specifying timing restrictions on future projects. Further details are presented in Section 4.</p>
	<p>Construction of the Transmission Line must not occur through Grizzly Bear Wildlife Habitat Area (WHA 2-399) during the spring forage period (April 1 – June 1) or during the late fall salmon spawning period (October 15 – December 31).</p> <p>This Condition was amended on June 2014 as part of Amendment #4 to the EAC, which was applied for on behalf of the Certificate Holders to allow for conditions of the certificate to align with revised provincial best management practices and conditions of post environmental assessment permits. The revised condition reads;</p> <p>Construction of the transmission line through the Wildlife Habitat Area (WHA) 2-399 must not take place during April 1 to June 1 (spring forage).</p>	<p>This timing restriction was included in the clearing plans and construction work plans for Segments 6 of the transmission line. All construction activities were scheduled and occurred in Segment 6 outside of the timing restrictions.</p>	<p>This timing restriction presented logistical challenges to the Contractor undertaking the works, as the timing period to complete construction activities in Segment 6 was shorter. The wording of the EAC condition was clearly presented and was not subject to interpretation. This requirement was also stipulated within the Project’s General Wildlife Exemption to WHA-2-399 (39585-20).</p> <p>This Project- specific condition was not enforced on other users in the area (public and industrial) who were able to drive through the Wildlife Habitat Area (WHA-2-399) along the South Lillooet FSR during the restricted periods. Forestry operations used the South Lillooet FSR for travel with heavy equipment during periods when Project related access and construction was not permitted. No signage was posted in the area regarding the sensitivity of WHA 2-399 which is protected under Provincial Order under the Government Actions Regulation of the <i>Forest and Range Practices Act</i>, and no gates were installed to prevent access to this area during the restricted period. The IEM suggests that all industries and users be subjected to the same restrictions in regards to Wildlife Habitat Areas protected under provincial orders.</p>

Mitigation Measure Category	EAC Condition	Project Implementation and Actions	IEM Evaluation of the Effectiveness of the EAC Conditions
	<p>Construction of the transmission line into and across the Ryan River drainage must occur from June 1 – September 1.</p>	<p>This timing restriction was included in the clearing plans and construction work plans for Segments 9b, 10, & 11 of the transmission line. All construction activities were scheduled and occurred outside of the Ryan River Drainage timing restriction.</p>	<p>This timing restriction presented logistical challenges to the Contractor undertaking the works, as the timing period to complete construction activities within the Ryan River drainage was short. The wording of the EAC condition was clearly presented and was not subject to interpretation.</p> <p>No construction occurred within suitable grizzly bear foraging habitats within the Ryan River drainage or first 1KM of the Ryan South road, to ensure the EAC condition was satisfied during transmission line construction. Adherence to this timing restriction required that the Contractor mobilize and demobilize from the area multiple times over multiple years, extending the overall disturbance in the area rather than condensing works to a shorter overall duration. The IEM agreed that travel on existing access roads did not involve construction; however no stopping, parking, or staging was permitted within 1 KM of the Ryan River FSR to 1 KM of the Ryan South Road, outside of the allowable construction period. EAO's definition of construction was important in evaluating this decision, and should continue to be clearly defined when issuing EACs in the future.</p> <p>This Project-specific condition was not enforced on other users in the area (forest licensees) who were able to drive the Ryan River FSR and conduct clearing work in the Ryan River drainage during the restricted periods. No signage was posted in the area regarding the sensitivity of grizzly bear habitat in the Ryan River drainage. A gate was used to prevent public access to this area; however, forest licensees were able to access the area and conduct works during the restricted period. The IEM suggests that all industries and users be subjected to the same restrictions in regards to sensitive wildlife habitats.</p>
	<p>Construction of the transmission line within 500m of identified salmon spawning tributaries of the Lillooet River must occur outside of the salmon migration period:</p> <ul style="list-style-type: none"> • Leanna (aka Alena) Creek, 29.2 km Tributary, South Creek and Rohb Creek: No construction October 15 – December 31; and • Sampson Creek and Railroad Creek: No construction August 15 – December 31. 	<p>An amendment to this EAC was issued (Amendment #2) following application to MFLNRO and EAO to allow minor works to occur within 500m of Rohb Creek in December of 2013; however, field conditions prevented the authorized minor works from occurring. See Section 3 for further details.</p> <p>All construction activities were completed outside of the salmon migration period within 500m of identified salmon spawning tributaries of the Lillooet River.</p>	<p>This timing restriction was implemented to minimize potential impacts to grizzly bear forage habitat based on avoidance of the area. The avoidance of construction activities within 500m of streams where salmon migration and spawning was confirmed in previous years is a conservative approach that was effectively implemented during the construction period. In future projects, it may be possible to recommend that construction activities within a sensitive area be restricted once the availability of forage is confirmed by a QP or the IEM. In practice this may require daily field assessments for the presence of targeted forage food source, requiring construction to cease once the availability of the targeted forage food source is confirmed.</p>
<p>Vegetation Clearing Prescriptions</p>	<p>The IEM must oversee clearing within suitable Class 1 and Class 2 grizzly bear habitat to ensure that clearing boundaries are minimized.</p>	<p>Prior to initiating clearing of the Project footprint, including the transmission line, a clearing plan was prepared outlining where clearing would occur within identified suitable grizzly bear foraging habitats. The IEM reviewed each plan to ensure clearing boundaries were minimized to the extent possible within each identified suitable grizzly bear foraging habitat. Once the clearing plan was approved, all clearing boundaries were flagged in the field by a surveyor. Once all boundaries were flagged, a pre-works meeting was held to review the boundaries with the clearing contractor and to ensure that the clearing boundary was clearly visible. The IEM was onsite to monitor all clearing that occurred within suitable Class 1 and Class 2 grizzly bear foraging habitat and/or performed an audit post clearing to ensure clearing was performed according to the approved clearing plan.</p>	<p>The IEM worked collaboratively with the Proponent and Contractors during the clearing phase of the Project to ensure clearing within suitable grizzly bear foraging habitats was minimized to the extent possible. The IEM reviewed all clearing plans prior to issuance of a Leave to Construct, to ensure that the Contractor specified how clearing boundaries were minimized within suitable grizzly bear forage habitats at the planning stage. This allowed streamlined communication between the Owner, Contractor, Clearing Contractor, and IEM once the plans were ready to be executed in the field. A pre-work meeting to review the work plan in the field and the presence of the IEM during clearing within identified suitable grizzly bear foraging habitat provided two additional checks to ensure clearing boundaries were minimized.</p> <p>For future projects, the IEM recommends removing the requirement to physically monitor clearing within sensitive wildlife habitats, by clearly defining what is intended by the requirement to "oversee" clearing, since it is neither safe nor practical to be</p>

Mitigation Measure Category	EAC Condition	Project Implementation and Actions	IEM Evaluation of the Effectiveness of the EAC Conditions
	<p>A buffer of at least 5 m, of either existing or managed vegetation, must be left adjacent to all suitable Class 1 and Class 2 forage habitats identified by the 1:20,000 Terrestrial Ecosystem Mapping data or field verified, unless otherwise approved by EAO.</p> <p>Vegetated screens, either existing or managed vegetation, must be maintained between Class 1 and 2 suitable forage habitats along roads and transmission line rights-of-way and construction sites, unless otherwise approved by EAO. EAO must be informed of locations where it is deemed not feasible.</p> <p>A visual vegetated screen must be maintained where the transmission line right-of-way intersects WHA 2-399.</p>	<p>Clearing buffers of at least 5m and/or vegetation screens were specified for all clearing areas adjacent to/within suitable Class 1 and Class 2 forage habitat where possible. Where clearing within suitable foraging habitat was required along the transmission line right-of-way, or within temporary construction areas, restoration activities were initiated following construction (including the planting of suitable grizzly bear forage species) to promote suitable vegetation re-growth. Note that suitable grizzly bear forage species were not permitted near road ways and a vegetative screen was implemented as an alternative restoration measure.</p> <p>Two vegetative screens were specified in the transmission line clearing plans (Segment 1 between poles 3-4; Segment 6 within WHA 2-399 between poles 141-142) where the transmission line right-of-way crosses the FSR within Class 1 or Class 2 suitable forage habitat. The vegetative screens were prescribed to disrupt sight lines into important forage habitat from the FSR.</p>	<p>close to active falling. In place of physically monitoring clearing activity, the IEM may be required to review all clearing plans, and verify all clearing boundaries within identified sensitive wildlife habitats with the clearing contractor during a pre-work meeting. This may help ensure that the appropriate clearing boundaries are in place, and a follow-up audit of the falling boundary would serve to verify that the clearing boundaries were respected.</p> <p>The two vegetative screens prescribed and protected during the Project clearing phase, were damaged by natural weather events (Boulder Creek Wildfire in 2015; November 2016 debris flow through South Creek, respectively) and required planting to promote regrowth following the construction period.</p> <p>The goal of these EAC Conditions was to address increased sight lines into important grizzly bear foraging habitats that would otherwise result from clearing of the transmission line right-of-ways. The creation of the vegetation screens was effective at reducing sight lines until the screens were damaged by natural weather events. These screens have been replanted and will become effective once again, once vegetation reaches suitable heights. An important consideration to note regarding this condition is the continued vegetative maintenance required to ensure line hazards are removed as plant heights increase, since the vegetative screens are within the transmission line right-of-way.</p>
<p>EAC Condition 1 & 12 - Mitigations measures to reduce potential impacts to grizzly bears and grizzly bear habitats resulting from human – bear conflicts as outlined in the Construction Environmental Management Plan (Innergex Renewable Energy Inc., 2013), Human-Wildlife Interaction Management Plan (Lacroix, et al., 2013), and the Human-Bear Conflict Management Plan (Regehr, et al., 2013).</p>			
<p>Worker Education</p>	<p>All personnel (including: on-site staff, contractors, and all individuals retained by the Contractor or Owner to conduct work in the Project area) must be provided with bear safety training in the form of a bear awareness and bear safety course. Details pertaining to the minimum course requirements are included in the Human-Bear Conflict Management Plan.</p>	<p>All personnel received an environmental and safety orientation prior to beginning onsite work. The environmental orientation was reviewed with the Owner and IEM to ensure that the orientation included the minimum requirements outlined in the Human-Bear Conflict Management Plan prior to the Contractor delivering the orientation to construction personnel. In addition, all workers attended a bear awareness component of the orientation and a Bear Aware Video was played continuously on a screen in the Construction Camp lunch room throughout the construction period as a constant reminder to manage attractant appropriately. Yearly refresher bear awareness courses were required, and waste management discussions were a regular topic of the weekly safety meetings.</p>	<p>Educating the work force in regard to bear biology and behaviours proved highly valuable and successful for encouraging buy-in from construction staff to promote proper attractant and waste management onsite. Following identification of improperly managed waste, regular reminders at daily tailboard meetings and at weekly safety meetings also proved to be effective means of reminding crews of proper etiquette to be followed in bear country. Similar training and learning opportunities could become a requirement for all industries working in and around bear habitats.</p>
<p>Waste and Attractant Management</p>	<p>Food and food waste must be disposed of in bear proof containers stored behind an electric fence until the attractant is removed from site.</p> <p>No food waste or litter is permitted in construction areas.</p> <p>Food storage is permitted in designated food preparation area and eating areas, and/or within sealed containers inside secured vehicles.</p> <p>Proper storage and management of other non-food source wildlife attractants (grey and black water, waste oils, equipment leaks, hydraulic oils, coolant, carrion, etc.)</p>	<p>The IEM regularly audited compliance with regard to wildlife attractants throughout the construction period. Following the discovery of any improperly managed food waste, the IEM either removed the potential wildlife attractant and informed the Contractor, or notified the Contractor that removal of the attractant was required immediately. Generally, within the three year construction period, the construction sites associated with the two hydroelectric facilities and the over 70 km transmission line was maintained free of wildlife attractants during the construction period.</p> <p>Inspections by the EAO Compliance and Enforcement team, discovered improperly managed wildlife attractants at various construction site</p>	<p>The regular inspection and auditing of wildlife attractant management on the Project site was essential in reducing the potential for human-bear conflict during the construction phase. The waste and attractant management practices employed on the Project sites were effective for two full years of construction, prior to receiving an Order to Remedy from the EAO Compliance and Enforcement Team in June of 2016. The IEM suggests that additional collaboration between EAO Compliance and Enforcement Branch and the IEM occur on future projects, as onsite presence of the IEM is intended to enforce compliance with the intent of all EAC Conditions.</p> <p>Although the Project did receive an Order to Remedy for non-compliance with respect to wildlife attractant management, the Project did not cause the human habituation</p>

Mitigation Measure Category	EAC Condition	Project Implementation and Actions	IEM Evaluation of the Effectiveness of the EAC Conditions
		<p>locations on June 9, 2016 and during a follow-up inspection on July 6, 2016. An Order to Remedy the non-compliance with respect to wildlife attractants was issued to the Certificate Holder by the EAO on June 17, 2016. In response to the order, the IEM increased the level of auditing to daily checks of construction waste bins, remote construction site offices, and work areas, until attractant management returned to within compliance levels. The Contractor also implemented changes to the availability of disposable coffee cups and juice boxes as a result of the improper waste management associated with these items.</p> <p>The only instance of a Project related human-bear encounter occurred on June 17, 2016 when three cinnamon coloured black bear cubs were observed inside and around the seacan at the Upper Lillooet River Hydroelectric Facility downstream tunnel portal laydown area. Upon investigation of the area, the IEM discovered no wildlife attractants inside the seacan, however the seacan had been and found left open and accessible to wildlife. An Environmental Incident Report (EIR #25) was issued the same day the incident occurred to address this specific concern and bear encounter. Remedial actions implemented immediately included posting signs on all seacan doors reminding workers to ensure all doors remained shut and inaccessible to wildlife. Signs were also posted at the Lillooet River trail entrance, kiosk, and parking area to notify public of the presence of bears in the area and the need to manage wildlife attractants. No further Project related human-bear conflicts were reported at Project site locations.</p> <p>In addition to food waste, leaking equipment and resultant patches of fluid (e.g. mechanical and hydraulic oils, coolant, and fuel) were also listed as wildlife attractants in the Human-Bear Conflict Management Plan. The Contractor had some difficulty maintaining parking areas free of small fluid leaks and chose to line parking areas with impermeable liners to trap contaminated soils and prevent the mobilization of the contaminants. No evidence of bears or wildlife being attracted to these small patches of leaked fluids was observed during the three year construction period, and therefore this practice was permitted until reclamation of the parking areas removed all the material contaminated by leaked fluids.</p>	<p>of any bears, and no bears were killed as a result of Project related activities during the construction phase. In contrast, improper food and waste management by public users at the Pebble Creek/Keyhole hot springs and within the Lillooet River Trail parking area resulted in documented cases of human-conditioned bears and aggressive bear activity, which forced Recreational Sites and Trails BC (RSTBC) to temporarily close the hot springs site and Lillooet River Trail on June 23, 2016, and again on May 10, 2017.</p> <p>In 2014, the IEM became aware that MFLNRO Ecosystem Biologists were monitoring and operating non-reward grizzly bear baiting stations adjacent to the Project footprint. The bait stations were installed to collect DNA and photographs, as part of MFLNRO's regional grizzly bear study. These bait stations may have posed an increased risk to both bears and humans by increasing the likelihood of encounters in and around the Project footprint.</p> <p>Inconsistencies with regard to how the Project was required to manage wildlife attractants versus how other users in the project area managed wildlife attractants, is apparent in the above two examples. The IEM suggests that EAO attempt to reduce inconsistencies across user groups when issuing and enforcing future EAC Conditions.</p>
<p>Project Facility Design</p>	<p>The temporary construction camp and waste facilities (garbage compactors and recycling bins, septic lines and septic field, kitchen storage, etc.) should be designed to prevent attracting or habituating bear to human presence.</p>	<p>The temporary construction camp location was originally chosen to avoid suitable grizzly bear forage habitat and was located in an area of high human activity (near an area used for helicopter staging and refueling). The ultimate location chosen for the temporary construction camp was different than the location identified in the Human-Bear Conflict Management Plan because of landslide safety concerns; however, the intent to avoid suitable grizzly bear foraging habitat was maintained in the selection of the final camp location. Note that EAC amendment #3 was sought by the Certificate Holders in early 2014 to allow changes to the intake design, the location and specifications of the temporary construction camp and the operator's residence location. The amendment application considered impacts to suitable grizzly bear foraging habitats.</p>	<p>The electrified fence maintenance proved to be difficult during winter operations as the fence needed to be unburied by hand following each snowfall, resulting in unavoidable temporary outages. The multiple entrances and exits to the camp, also proved difficult to manage. Electrified mats were used at entrance points in the summer, and manually operated electrified gates were used in the winter months. A taller more robust electrified fencing system would require less maintenance during winter operations, and reducing the number of entrance exit points to the extent possible are design considerations that may be considered for future Projects.</p> <p>Successful design and operation of the temporary construction camp and septic field is confirmed by zero instances of human-bear conflict at the camp or septic field location. The location of the camp, operation of the electric fence, and implementation and auditing of the waste management protocols, are factors that</p>

Mitigation Measure Category	EAC Condition	Project Implementation and Actions	IEM Evaluation of the Effectiveness of the EAC Conditions
		<p>An electrified fence was installed around the camp perimeter to prevent bears and wildlife from accessing the camp area. A secondary perimeter of electrified fencing was installed around the bear-proof garbage compactor and recycling bin storage area, as well as the camp kitchen. An electrified fence was also installed and maintained around the water treatment area/septic field. The electrified fencing was maintained year round, and testing records were kept by the Contractor responsible for maintaining the electrified fence. Some periods of outage occurred following snowfall during winter operations. Testing records were available and were audited by the IEM to ensure the electrified fence was working as intended. No instance of Project related human-bear conflict or of bears accessing the camp area were documented or reported during operation of the temporary camp and septic field operation.</p>	<p>contributed to the successful operation of the camp and associated facilities during the construction period.</p>
<p>Habitat Restoration & Revegetation</p>	<p>All field verified suitable grizzly bear foraging habitats impacted during construction must be reclaimed by re-planting and seeding with suitable forage species in areas which are sufficiently away from human presence.</p> <p>No use of herbicide is permitted for vegetation management.</p>	<p>The following field verified Class 1 and Class 2 grizzly bear foraging habitats are those areas that were temporarily impacted during construction and sufficiently away from human use, and thus required re-vegetation plans that included the planting of and seeding of suitable forage species;</p> <p>Upper Lillooet Hydroelectric Facility</p> <ul style="list-style-type: none"> • ULL-GB03 & ULL-GB04 – Intake spoil areas • ULL-GB05 – Downstream Tunnel Portal spoil areas <p>Transmission Line Temporary Access Roads:</p> <ul style="list-style-type: none"> • ULH-GB01 – Segment 1 • ULH-GB15 – Segment 4 • ULH-GB16 – Segment 4 • ULH-GB42 – Segment 11 • ULH-GB44 – Segment 11 <p>All planting and seeding of suitable forage species was performed as outlined in the Project reclamation and rehabilitation plans for the above listed areas.</p> <p>In areas where suitable grizzly bear forage habitat was identified next to permanent roads, the areas were seeded with fall rye grass to promote re-vegetation and to provide a vegetative screen. Suitable forage species were not planted along road edges to prevent attracting grizzly bears to high traffic areas.</p>	<p>Based on experience on the Project and on a number of large scale construction projects with reclamation requirements in the South Coast region, the IEM suggests that the goals of reclamation and the metrics by which the goals are measured be agreed upon prior to initial site disturbance. If reclamation targets are understood from the start of construction, it would allow the savvy contractor to budget appropriately and may provide incentive to minimize the size of temporary work spaces to the extent possible, so that reclamation costs can be reduced.</p> <p>Moreover, discussions with stakeholder groups in the Project area during the project consultation phase may help inform the goals of reclamation and the desired future condition of reclaimed temporary work spaces, although the IEM recognizes that this may impose unrealistic expectations on the Certificate Holder and the EAO.</p>
<p>Reporting of all Bear Sightings and Identification of Problem Bears</p>	<p>Encounters with bears or signs of bears in construction areas or in areas frequented by personnel will be communicated to the Conservation Officer Service (COS), within 24 hours, so that corrective action can be taken, if required.</p> <p>The project must initiate the emergency conflict and response plan outlined in (Regehr, et al., 2013) in the event of a negative human-bear interaction.</p>	<p>The following bear sightings were reported to the COS and MFLNRO during the construction period:</p> <ul style="list-style-type: none"> • 2014 = 9 sightings (May =7; June=1; September = 1) • 2015 = 6 sightings (May =3; June=3) • 2016 = 3 sightings (April =2; May =1; August =1) • 2017 = 1 sightings (May =2) <p>A number of the above listed sightings were confirmed to be black bears; however, these sightings were reported as grizzly bear sightings. Black bear sightings were much more common and were reporting in the wildlife sighting logs attached to the Environmental Monitoring Reports. The</p>	<p>Mandatory reporting of all bear sightings to the Construction Safety Manager and IEM by Project staff, in particular any bear activity perceived as human-habituated or food-conditioned behavior, was effective at preventing human-bear conflict within project work spaces.</p> <p>This requirement combined with bear awareness training was highly effective at keeping project personnel alert to the potential dangers posed by negative interactions with bears. The sighting of a bear of any kind was useful regardless of the correct identification, as it reminded construction workers of the need to prevent creating food conditioned or human habituated bears in the project footprint.</p>

Mitigation Measure Category	EAC Condition	Project Implementation and Actions	IEM Evaluation of the Effectiveness of the EAC Conditions
		<p>correct identification of a grizzly bear versus a cinnamon or brown phase black bear was not often possible given the lack of identification experience of most construction workers submitting the sighting reports.</p> <p>Following multiple reports from public users of the Pebble Creek hot springs and Lillooet River Trail, the Certificate Holders initiated the emergency response plan out of concern for public and worker safety. The Certificate Holders reported to the COS and RSTBC that food/human conditioned bears were seen acting aggressively in the vicinity of the hot springs parking lot and hot springs site. The COS investigated, which ultimately resulted in the temporary closure of the hot springs site and Lillooet River Trail on June 23, 2016, and again on May 10, 2017.</p>	

3. Evaluation of Effectiveness of Amendments to Grizzly Bear Related EAC Conditions

The Certificate Holders sought and were issued six separate amendments to the EAC during the Project construction period. Three of these amendments (EAC Amendment 2, 3, and 4) involved changes to grizzly bear related mitigation measures. A discussion of the effectiveness of the application process for seeking an EAC amendment and the overall effectiveness of the amended EAC Conditions from the IEM's perspective is presented below.

EAC Amendment #2

On November 25, 2013 the Certificate Holders applied to amend Condition 12 of Schedule B (Table of Conditions) of the EAC to allow minor works to occur within 500m of Rohb Creek during the fall salmon migration period (October 15 – December 31). The amendment provided rationale supporting the request and included a monitoring strategy prepared by a QP to minimize potential impacts to grizzly bears, bald eagles, and moose, during the proposed works. The monitoring strategy included winter tracking surveys, snow depth monitoring, and environmental monitoring of the work activities. An amendment to the EAC (Amendment #2) was granted by the EAO on December 2, 2013 to permit construction of a foot access trail and up to twelve helicopter landings within 500m of Rohb Creek in December of 2013. Due to difficult weather and field conditions, construction works authorized by the EAC amendment were abandoned during the first day of work. Implementation of the EAO approved monitoring strategy was employed in advance of the start of works as outlined in the amendment request; however, as no works were completed under Amendment #2 of the EAC, a discussion of the implementation of the amended conditions of the EAC is not possible. Had works proceeded under the amended EAC Condition, they would have proceeded based on a methodology prepared by a QP with intimate knowledge of the area, under the supervision of an MFLNRO approved IEM, according to an approval issued by EAO, and in the opinion of the IEM would have been effective at upholding the originally intent of the EAC condition, to avoid and minimize impacts to grizzly bears and suitable Class 1 and Class 2 grizzly bear foraging habitat.

EAC Amendment #3

On January 23, 2014 the Certificate Holder applied to amend the Certified Project Description to allow changes to the intake design, the location and specifications of the temporary construction camp, and the operator's residence location. The application package considered how the newly proposed temporary construction camp location would minimize or avoid potential impacts to grizzly bears. The EAO granted Amendment #3 of the EAC on April 3, 2014, more than two months after the application package was received by the EAO. It is evident from the length of time between the application for and issuance of the EAC amendment that the process to amend the EAC is onerous and time consuming from both the Certificate Holder and EAO's perspective.

EAC Amendment #4

On January 23, 2014 the Certificate Holder applied to amend Schedule B (Table of Conditions) of the EAC to allow for conditions of the Certificate to align with revised provincial best management practices and conditions of post environmental assessment permits. This included changes to the timing window

associated with grizzly bear Wildlife Habitat Area 2-399, which removed the requirement to avoid the fall forage period, while maintaining the requirement to avoid the spring forage period. The revised condition reads;

Construction of the transmission line through the Wildlife Habitat Area (WHA) 2-399 must not take place during April 1 to June 1 (spring forage).

The EAO granted Amendment #4 of the EAC on June 20, 2014, more than four months after the application package was received by the EAO. It is evident from the length of time between the application for and issuance of the EAC amendment that the process to amend the EAC is onerous and time consuming from both the Certificate Holder's and EAO's perspective.

In summary, it is the opinion of the IEM that seeking to amend EAC Conditions is an onerous and unnecessary process if the pursued amendment will continue to uphold the original intent of the EAC Condition. The same result can be achieved by employing a professional reliance model. For example, EAC amendment #2 was granted based on the professional reliance model. An application was submitted to the EAO that was based on a QP assessment of the current site conditions and works to be performed, endorsement of a QP prepared mitigation strategy by the IEM, and a monitoring and reporting program to be implemented by the IEM once the works proceeded. By removing the requirement to amend specific language or timing restrictions outlined in the Conditions of the EAC, and relying instead on the professional reliance model, significant time, effort, and money would have been saved both by the Owner and the EAO, and would have allowed works to proceed much faster. Instead, in the case of amendment #2, minor works were not able to proceed as site conditions had changed by the time the EAC amendment was granted, a full week following the Certificate Holders submission of the application for the EAC amendment.

4. Evaluation of Effectiveness of Construction Timing Windows for Field Verified Suitable Grizzly Bear Forage Habitats and Adaptive Management Approach Employed During Construction

The recommended avoidance periods (construction timing windows) associated with ground-truthed suitable Class 1 and Class 2 grizzly bear forage habitats (specifically: ULH-GB59 and ULH-GB33), were managed based on a model of professional reliance. In each of the four cases presented below, an adaptive management strategy was developed by a QP, which was endorsed and overseen by the IEM to advance construction activities during a recommended avoidance period.

ULH-GB59 – September - October 2016

An aerial and ground-based survey of the available suitable foraging habitat within ULH-GB59 was conducted on September 28, 2016 by the Transmission Line Contractor's QP. The QP survey found that the ULH-GB59 habitat was not particularly suitable or valuable in terms of fall forage for grizzly bears at the time, and discovered that the polygon was incorrectly mapped. The actual high value habitat was located in a "Rich avalanche track site interspersed with slide alder and Indian hellebore", which supports important forage species for grizzly bears. This habitat was located outside of the clearing area for pole structures 375 and 376. Based on the findings from the QP assessment, the IEM agreed that work to string conductors could proceed during the suggested avoidance period for ULH-GB59. On October 17,

2016, in advance of stringing the conductor, the IEM and the Transmission Line Contractor's Environmental Manager conducted a second aerial survey of grizzly bear habitat polygon ULH-GB59 to determine whether the habitat was currently occupied, as part of the adaptive mitigation plan. No grizzly bears were observed during the aerial survey. The IEM determined that the potential for displacing grizzly bears from the area as a result of the minor works was minimal given the information presented above and therefore authorized the stringing of conductor by helicopter and pulling of the conductor by ground based equipment located well away from the sensitive grizzly bear habitat. The conductor stringing was completed on October 18, 2016 and no grizzly bears were observed during helicopter flights to/from the work area or during ground based works.

ULH-GB59 – September 2017

A request was submitted to the IEM to install a permanent helicopter pad in the vicinity of ULH-GB59 within the suggested avoidance period in September 2017. Based on the helicopter pad location being located away from the suitable forage habitat in ULH-GB59 within a previously cleared area, and the short duration of works, the IEM determined that works could proceed according to an adaptive mitigation strategy. An aerial survey of the habitat was conducted by the IEM prior to the works to confirm that the habitat was unoccupied, and to develop a flight plan that would avoid flying over the habitat. It was also stipulated in the work plan that any grizzly bear sightings during helicopter flights to/from the work area or during ground based works would result in suspension of work activities and immediate reporting to the IEM. No grizzly bears were observed during construction of the helicopter pad which was completed from September 8 - 15, 2017.

ULH-GB33 – October 2014

Following a vegetation assessment of the habitat and extended discussions between the Owner, Contractor, QP, IEM and subsequently MFLNRO pertaining to the management of ULH-GB33 Class 1 fall forage habitat, it was determined that construction activities in Segment 8 could proceed within the construction restriction window of September 2 – October 31, 2014 provided road building and transmission line clearing/installation was completed within ULH-GB33 by October 15, and works consolidated to consecutive construction days. Rationale behind the alteration to Project mitigations were based on the opinion of the Owner's QP and through discussions with MFLNRO's Ecosystem Biologist (Region 2); who both agreed that the habitat in polygon ULH-GB33 did not represent critical forage habitat at the time.

ULH-GB33 – October 2016

Installation of fiber optic cable through habitat polygon ULH-GB33 was permitted to occur over two days from October 11-15, 2016. The rationale to permit the cable installation was that berry production and suitable forage habitat was no longer present within the habitat polygon and therefore the area did not represent critical foraging habitat at the time as deemed by the Contractor's QP. Works involved pulling ropes and conductors, and clipping the conductors by hand and did not involve any ground disturbance.

In summary, by building flexibility into the construction timing windows recommended for works within suitable Class 1 and Class 2 grizzly bear forage habitats, the Project was able to employ a professional reliance model to advance construction activities in a timely manner, while maintaining the original intent mitigation measure. The IEM recommends that EAO consider adopting this approach when specifying

construction timing restrictions on future projects. This could be achieved by including wording in the EAC that allows for modification of construction timing windows based on the recommendations of a QP, and review and endorsement of those recommendations by the IEM.

5. Summary Statement

The primary goal of zero project related bear mortalities was achieved during construction of the Project through the effective implementation of the intent of grizzly bear related EAC Conditions (including measures outlined in the CEMP and EPPs) and the adaptive management approaches developed and implemented by the Project team. The Project area overlapped with a number of different industrial and public stakeholder groups, and it was evident throughout the construction period that not all stakeholders were held to the same standard in relation to the protection of grizzly bears and suitable grizzly bear foraging habitat. Forest licensees and pumice mine operators were permitted to operate at times when the EAC Conditions restricted Project related activities to occur within suitable Class 1 and 2 grizzly bear foraging habitats. The inconsistency in the implementation and enforcement of grizzly bear related mitigation measures was most apparent in relation to the mismanagement of bear attractants by the public, which ultimately resulted in the closure of the Pebble Creek (aka Keyhole Falls) hot springs due to dangerous human-bear interactions. Based on this front country experience, had the Project failed to implement effective wildlife attractant management; it is highly likely that human habituated bears would have become a problem on the Project site.

By employing a professional reliance approach to managing construction timing windows, the Project was able to advance construction activities, while achieving the original intent of the EAC Conditions. It is the opinion of the IEM that significant time and money can be saved in the future, by both the Certificate Holders and EAO, by including wording in future EAC Conditions that allows for modification of construction timing windows without seeking formal amendments to the EAC.

The Project was constructed based on a holistic and successful approach to managing human-bear interactions during construction of a large, multi-year project. By enforcing the same standard of care that the Upper Lillooet Hydro Project was required to meet, the same successes can be expected from all industries and stakeholder groups that operate in and around bear habitats.

6. Disclaimer and Closure

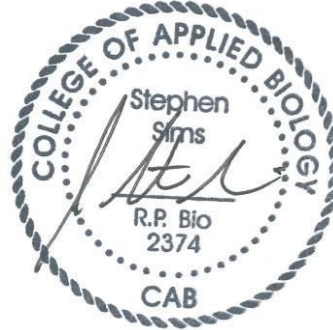
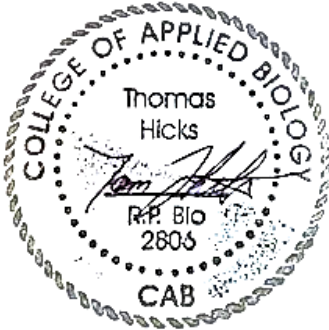
Sartori Environmental Inc. (Sartori) has prepared this memorandum at the request of the Certificate Holders. The material and recommendations contained herein reflect the professional judgement of Sartori following experience in the role of the Independent Environmental Monitor on the Upper Lillooet Hydro Project. Any use which a third party makes of this memorandum, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Decisions made or actions taken as a result of our work shall be the responsibility of the parties directly involved in the decisions or actions.

If you have any questions/comments regarding the above, do not hesitate to contact the undersigned at your convenience.

Kind regards,

Authored by:

Reviewed and Endorsed by:



Thomas Hicks, R.P.Bio., IEM Lead Monitor
Email: tom@sartorienv.com

J. Stephen Sims, R.P.Bio – Delegate IEM
Email: steve@sartorienv.com

References

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Regehr Heidi [et al.] Human-Bear Conflict Management Plan [Report]. - [s.l.] : Ecofish Research Ltd. & Ecologic Consulting, 2013.

Appendix C – Upper Lillooet Hydro Project: Final Update on the Status of Reclamation Efforts and Outstanding Environmental Monitoring Issues – Condition 18 of the ULRHEF LTCD and Condition 17 of the BDRHEF LTCD

(4 pages)



MEMORANDUM

FILE: Water Files: 2003601, 2002353, 2002561; Land Files: 2409998, 2408971, 2410654

DATE: October 27, 2017

TO: **Upper Lillooet River Power Limited Partnership & Boulder Creek Power Limited Partnership
c/o Julia Mancinelli – Environmental Manager - Innergex Renewable Energy Inc.**

CC: Grant Lindemulder – Innergex Renewable Energy Inc.
Jennifer McCash, Delegate IE – JEM Energy Inc.
George Steeves, IE, True North Energy

FROM: Thomas Hicks, R.P.Bio – Sartori Environmental Inc.
on behalf of J. Alex Sartori, R.P.Bio, IEM – Sartori Environmental Inc.

RE: **Upper Lillooet Hydro Project: Final Update on the Status of Reclamation Efforts and
Outstanding Environmental Monitoring Issues – Condition 18 of the ULRHEF LTCD and
Condition 17 of the BDRHEF LTCD**

Introduction

According to the conditional issuance of Leaves to Commence Diversion (LTCD) for the Upper Lillooet River Hydroelectric Facility (ULRHEF) and the Boulder Creek Hydroelectric Facility (BDRHEF), the office of the BC Ministry of Forests, Lands, and Natural Resource Operations (MFLNRO) has stipulated the following:

“The IEM must provide a final update on the status of reclamation efforts and any other issues considered outstanding from environmental monitoring during project construction, including requisite habitat compensation, prior to the issuance of Leave to Commence Operations.”

This memorandum serves to provide final confirmation from the Independent Environmental Monitor (IEM) that ULRHEF, BDRHEF, and Transmission Line (TX Line) reclamation works have been completed and that all identified environmental issues have been resolved.

Status of Reclamation Efforts and Fish Habitat Enhancement Project

The IEM and Independent Engineer (IE) conducted an inspection of all ULRHEF and BDRHEF temporary work areas on July 14, 2017 to confirm successful completion of reclamation activities. During the site inspection one outstanding area remained to be reclaimed (KM 39 laydown), which has since been addressed and has now been reclaimed. In addition to the IEM and IE inspection conducted to confirm completion of reclamation activities at the ULRHEF and BDRHEF, the IEM has been provided with supporting documentation prepared by appropriately qualified professionals (QPs), confirming

remediation and reclamation of all temporary work spaces. The IEM has reviewed the provided documents and a list of these documents is provided in Table 1.

All temporary work spaces used for equipment maintenance or fuel storage have had soil sampling performed to confirm that soils present were below contaminant threshold levels (BC CSR – Wildland Standards) prior to implementing reclamation prescriptions. Following confirmation of soil remediation (where applicable), all temporary works areas were reclaimed according to prescriptions outlined in the Upper Lillooet Hydro Project Master Reclamation Work Plan (Revision 4), and the Works Plan for Transmission Line Access Roads Deactivation and Rehabilitation (North and South Zones). These reclamation work plans were prepared by the Contractor’s Environmental Representative, endorsed by a QP (Polster Environmental Services Ltd., and Hedberg Associates Consulting Ltd., respectively), and were accepted by the IEM and Owner prior to initiating reclamation works.

In addition to the above outlined supporting documentation, Table 1 lists the QP prepared memorandums and email correspondence with Fisheries and Oceans Canada that have been reviewed by the IEM, and which confirm that the Alena Creek fish habitat enhancement project has been designed and constructed to meet the Project’s *Fisheries Act* Authorization (09-HPAC-PA2-00300) requirement to construct 2,310 m² of instream habitat to offset habitat losses of 1,935 m² incurred by the construction of the ULRHEF intake.

Table 1. List of Supporting Documentation

Date	Title of Document	Author
Confirmation of Remediation of Areas of Potential Concern (Equipment and Fuel Storage Areas) According to the BC Contaminated Site Regulation (BC CSR) - Wildland Standards		
October 28, 2016	Upper Lillooet River Hydroelectric Project Soil Sampling Results V.2 (KM 49, KM 44.7, KM 45 and KM 38)	Cascade Environmental Resource Group Ltd.
November 1, 2016	Follow-up Soil Sampling (Event 2) Results at KM 44.7, Upper Lillooet River Hydroelectric Project	Cascade Environmental Resource Group Ltd.
November 14, 2016	Soil Sampling (Event 3) Results from KM 49 and KM 38, Upper Lillooet River Hydroelectric Project	Cascade Environmental Resource Group Ltd.
November 22, 2016	Soil Sampling (Event 4) Results from KM 48.5, Upper Lillooet River Hydroelectric Project	Cascade Environmental Resource Group Ltd.
April 13, 2017	Soil Sampling (Event 5) Results from Boulder Mechanic Shop Area, Upper Lillooet River Hydroelectric Project	Cascade Environmental Resource Group Ltd.
May 10, 2017	Soil Sampling (Event 6) Results from Pad 2 Laydown Yard, Upper Lillooet River Hydroelectric Project	Cascade Environmental Resource Group Ltd.
May 31, 2017	Soil Sampling (Event 7) Results from Pad 2 Laydown Yard, Upper Lillooet River Hydroelectric Project	Cascade Environmental Resource Group Ltd.
July 14, 2017	Final Soil Sampling Results from KM 38 Garage Area and KM 38.5 Boulder Mechanic Shop, Upper Lillooet River Hydroelectric Project	Cascade Environmental Resource Group Ltd.
August 28, 2017	Pre-Reclamation Soil Contamination Assessment – 39KM Laydown	Westpark Electric Ltd.
Confirmation of Adherence to Soil Salvage, Site Reclamation and Landscape Restoration Plans		
September 26, 2016	Closure Inspection – Spoil Area BDR-SP-08	Western Geotechnical Consultants Ltd.

Date	Title of Document	Author
October 20, 2016	Closure Inspection – Spoil Area BDR-SP-07	Western Geotechnical Consultants Ltd.
October 20, 2016	Closure Inspection – Spoil Area BDR-SP-02	Western Geotechnical Consultants Ltd.
October 20, 2016	Closure Inspection – Spoil Area BDR-SP-03	Western Geotechnical Consultants Ltd.
April 4, 2017	Closure Update – Spoil Area BDR BDR-SP-07	Western Geotechnical Consultants Ltd.
May 24, 2017	Slope conformity at UL Intake	BPR
June 5, 2017	KM 42 Drainage Channel Design and Construction Summary	Knight Piesold Consulting
June 29, 2017	Forestry Road Compliance Inspection for KM 49	Hedberg and Associates Consulting Ltd.
July 6, 2017	Upper Lillooet Hydro Project – Confirmation of Reclamation and Revegetation Works at Designated Riparian Sites	Ecofish Research Ltd.
July 7, 2017	Fire Damage Survey in UWR u-2-002 UL12 (aka Planting of UWR from Boulder Intake Road Damage Assessment)	Hedberg and Associates Consulting Ltd.
July 6, 2017	Upper Lillooet Hydro Project – Confirmation of Reclamation and Revegetation Works at Designated Riparian Sites	Ecofish Research Ltd.
July 28, 2017	Restoration Progress at Upper Lillooet Power Project	David Polster, Polster Environmental Services Ltd.
August 24, 2017	Boulder Creek Power LP Access Road Conformance Assessment	Hedberg and Associates Consulting Ltd.
September 2, 2017	Email – Confirmation of soil testing of KM39 Laydown and Restoration	Westpark Electric Ltd.
September 19, 2017	Upper Lillooet River Power LP Access Road Conformance Assessment	Hedberg and Associates Consulting Ltd.
October 13, 2017	Inspection of completed deactivation and rehabilitation works, Upper Lillooet Power Project transmission line, North Zone	Hedberg and Associates Consulting Ltd.
October 13, 2017	Inspection of completed deactivation and rehabilitation works, Upper Lillooet Power Project transmission line, South Zone	Hedberg and Associates Consulting Ltd.
October 19, 2017	Boulder Creek Hydroelectric Facility Drill Access Track Deactivation Assessment	Hedberg and Associates Consulting Ltd.
October 19, 2017	Upper Lillooet River Hydroelectric Facility Drill Access Track Deactivation Assessment	Hedberg and Associates Consulting Ltd.
Confirmation of Completion of the Alena Creek Fish Habitat Enhancement Project		
March 7, 2017	Alena Creek Fish Habitat Enhancement Project As-Built Survey	Ecofish Research Ltd.
March 17, 2017	Release of Letter of Credit for Fisheries Act Authorization #09-HPAC-PA2-00300 IPP (Independent Power Project), Upper Lillooet River – Boulder Creek – North Creek	Fisheries and Oceans Canada

Status of Project Related Environmental Issues

As of July 14, 2017 all environmental issues identified by the IEM during the course of construction have been adequately addressed and are considered closed. The IEM confirms that no open or outstanding environmental issues related to the ULRHEF, BDRHEF, or TX Line currently exist. All environmental issues identified by the IEM were tracked to completion in the Environmental Issue Tracking Matrix (EITM), which was appended to each environmental monitoring report issued by the IEM.

Summary Statement

The IEM confirms that reclamation of all temporarily disturbed work areas is complete. The IEM has inspected the reclaimed areas and has reviewed QP prepared documentation, confirming the successful reclamation of all temporary Project related work spaces. Successful completion the Alena Creek fish habitat enhancement project has been confirmed through supporting documentation and through field inspections. Further, all temporary mitigation measures have been removed, and no outstanding environmental issues pertaining to construction remain onsite.

Closure

If you have any questions/comments regarding the above, do not hesitate to contact the undersigned at your convenience.

Kind regards,

<p>Authored by:</p>  <p>Thomas Hicks, R.P.Bio., IEM Lead Monitor Email: tom@sartorienv.com</p>	<p>Reviewed and Endorsed by:</p>  <p>J. Stephen Sims, R.P.Bio – Delegate IEM Email: steve@sartorienv.com</p>
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