MEMO

Subject:	Red Mountain Underground Gold Project - Responses to the Canadian Environmental Assessment Agency's Information Request #1
Prepared for:	Andrea Raska, Project Manager, Pacific and Yukon Region, Canadian Environmental Assessment Agency
Prepared by:	IDM Mining Ltd.
Date:	January 16, 2018

On December 22, 2017, the Canadian Environmental Assessment Agency (the Agency) provided IDM Mining Ltd. (IDM) with Information Request #1 (IR1) for the proposed Red Mountain Underground Gold Project (the Project). IR1 is comprised of Annex 1 (Information Requests) and Annex 2 (Technical Review Comments). This memo is intended to respond to Annex 1; a separate submission will be prepared to respond to Annex 2.

Annex 1 is divided into 15 information requests (IR1-01 through IR-15). This memo outlines each information request and provides IDM's response.

Also included with this response are the following appendices:

- Appendix IR1-03-A: Updated Soil Screening Levels and References;
- Appendix IR1-04-A: Attachment 5 of the Action Item Response memo dated November 29, 2017;
- Appendix IR1-05-A: Plant and Fish BCFs;
- Appendix IR1-07-A: Toxicity Profiles for PM and NO2;
- Appendix IR1-09-A: May 2017 Field Visit Report;
- Appendix IR1-09-B: Fall 2017 Field Visit Report;
- Appendix IR1-11-A: Photos of Bitter Creek;
- Appendix IR1-11-B: Access Road Hydrotechnical Drawings;
- Appendix IR1-11-C: Supplemental Photos for the Bitter Creek Hydrotechnical Assessment Study Area;
- Appendix IR1-11-D: Bitter Creek Hydrotechnical Assessment Report;
- Appendix IR1-12-A: Representativeness of WR Dataset; and
- Appendix IR1-15-A: TMF Closure Objectives.

1 IR1-01: SPECIFICITY OF MITIGATION MEASURES

1.1 Agency Information Request IR1-01

Rationale: The EIS Guidelines state that "mitigation measures should be specific, achievable, measurable and verifiable, and described in a manner that avoids ambiguity in intent, interpretation, and implementation." The EIS identifies a mitigation hierarchy and outlines a number of mitigation measures in the effects assessment chapters and in the Summary of Mitigation Measures (section 31.3). Many mitigation measures are conceptual, non-specific, and/or vague. For example, the EIS makes reference to the implementation of certain mitigation measures "where required" or "where practicable", the use of "standard best practices", and the understanding that certain activities "will be minimized." Please note that follow-up, monitoring, and/or management plans may be useful in the context of implementing mitigation measures, but the Agency does not consider them to be mitigation in and of themselves.

The Agency has identified the following mitigation measures as examples where further details or clarification is required:

- The EIS identifies the following mitigation measure related to noise (section 8.6.3): "Impulse events, such as blasting, will be limited to certain times of day. Instantaneous charge per delay will be minimized to suit blast." Further detail is required including the time of day in which blasting would be permitted, and the blast charge.

- The EIS identifies the following mitigation measure for air quality and health (section 22.6.1.1.1): "Installing windbreaks or fences where practicable around known problem areas or stockpiles to limit the dispersion of dust emissions from equipment and stockpiles, or activities likely to generate dust." Further detail is required including the location of windbreaks and problem areas.

- The EIS identifies the following mitigation measure for air quality and health (section 22.6.1.1.1): "Water sprays and/or dust suppression measures will be used to the extent practical considering the temperature to suppress dust generation by equipment in the crushing facility" and "Water or other dust suppressant to be used on roads if needed to minimize dust from ore and waste rock haulage and grading, as needed and when ambient air temperatures permit." Further detail is required including the ambient air temperatures which would permit use of this mitigation measures.

- The EIS identifies two unnamed watercourses located where the Tailings Management Facility (TMF) would be located (section 17.5.3.1), but there do not appear to be any specific mitigation measures for diversion or isolation of the non-contact water from these watercourses other than the generic mitigation measure: "Diverting non-contact water to the natural environment so that it does not mix with contact water." Clarify if and how the generic mitigation measure of diverting non-contact water to the natural environment would apply for the diversion of the two unnamed watercourses located where the TMF would be located.

- The EIS identifies the following mitigation measure for hydrology and fish (section 12.6.3): "Water withdrawal will follow provincial regulatory requirements and standard best practices to avoid adverse impacts to stream flows, fish and fish habitat." Further detail is required is needed on which best practices will be used, and when, to avoid adverse impacts.

- The EIS identifies the following mitigation measure for hydrology and fish (section 12.6.3): "Discharge from the TMF will, to the extent possible, match the receiving environment hydrograph." Further detail is required on how the discharge will be matched to the hydrograph.

- The EIS identifies the following mitigation measure for soil quality and fish (section 9.6.2.2): "The use of PAG material for construction will be minimized. For roads, pads and rock cuts, minimize cut and fill in areas with ML/ARD potential." Further detail is required to clarify and quantify what is meant by "minimized."

- The EIS identifies the following mitigation measure for water quality and fish (section 13.6.1.3): "Refuelling and maintenance activities will not occur within 15 m of a watercourse except where required due to equipment breakdown or approved activities near water." Further detail is required on who is approving the activities or what the approved activities are.

- The EIS (section 17.6.1.5) says that "blasting activities will be limited to the Mine Site during operations, so there is no potential for effects on benthic invertebrates from explosive shockwaves as the blasting zone will not be near any fish-bearing watercourses." However, section 18.5.3.4.3 identifies that blasting would occur along the road right-of-way, and that Fisheries and Oceans Canada's Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters document would be used for mitigation. Clarify whether blasting may occur near fish-bearing waters and identify the specific mitigation measures which would apply.

- The EIS identifies the following mitigation measure for wildlife (section 16.6.1.4): "Measures will be implemented to minimize potential Project effects in identified high-quality wildlife habitats and movement corridors, including signage along Project roads in high-value wildlife areas or known wildlife travel corridors to warn vehicle operators of the potential to encounter wildlife." Provide a description or maps of high-quality wildlife habitats, high-value wildlife areas, and movement corridors. In addition, the Agency recommends use of a consistent term, as it is not clear how high quality wildlife habitats and high value wildlife areas might be different.

- The EIS identifies the following mitigation measures for wildlife (section 16.6.1.7): "Deterrents (e.g. fencing, noise makers, wire barricades) will be used to discourage wildlife from entering Project infrastructure for refuge, shelter, nesting, roosting opportunities and potentially becoming entrapped" and "Deterrents (e.g. fencing, noise makers will be used to prevent wildlife from becoming entrapped in on-site settling sumps, holding ponds, or the TMF." Clarify if and where these deterrent methods would be used, and provide additional information about the deterrents.

- The EIS indicates that direct mortality of migratory birds would be reduced through best practices related to transmission lines (section 16.7.9), and that making transmission lines more visible could further reduce mortality risk (section 16.7.12.1.1), but no additional information is provided about what these best practices are.

Requested Information: Review and revise mitigation measures throughout the EIS to remove ambiguity and ensure that proposed mitigation measures are specific (including timing, location, circumstances, and measureable outcome or threshold). Where mitigation measures remain non-specific, describe and assess the residual effects which would result should the mitigation measures not be applied.

1.2 IDM Response to IR1-01

Throughout the Application/EIS, IDM has identified numerous mitigation measures or actions that will be taken to avoid, minimize, and restore effects on environmental values and associated components resulting from project activity and development. These measures can be generally categorized based on the timing of application of mitigation measures, such as design mitigation, Project activity mitigation, and an adaptive response measure. Meaning some mitigation measures are applied during the design phase of the infrastructure, some applied during Project activities on site, and others applied following monitoring or inspection where a potential effect is identified that requires further response and management. Furthermore, some mitigation measures are Project-specific while others are industry standards or best management practice. Importantly, IDM is providing this clarification as we believe that not all mitigation measures at this phase of development should be as prescriptive as the Agency notes above. IDM acknowledges that certain mitigation measures, particularly Project key measures associated with decreasing adverse residual effects, should be specific, achievable, measurable, and verifiable. However, some measures in certain applications, such as industry standards, best management practices, and adaptive response measures, cannot be absolute as the location, timing, and process of implementation are site-specific and applied based on contextual circumstances when and where deemed necessary or not by on-site qualified professionals. Thus, IDM believes language such as 'where required' or 'where practicable' are relevant to certain mitigation measures.

With regards to the Agency's comment that follow-up, monitoring, and management plans are not considered mitigation, IDM respectfully disagrees. IDM notes that Chapter 29 (Management Plans) of the EIS/Application provides 24 separate plans (not including process-related plans, such as the Environmental Management System and Adaptive Management Plan) that include IDM's commitments to mitigation and monitoring, including specific measures that will be carried out to minimize (meaning partially avoid or reduce) the level of effects on environmental components resulting from Project activity and development.

That being said, IDM acknowledges that context and clarification are lacking for those mitigation measures identified by the Agency and has included additional information responding to each bullet.

During the discussion between IDM and the Agency on January 5, 2018, the Agency requested IDM to develop a streamlined mitigation table to provide key mitigation measures that are specific (as noted above) rather than potential or adaptive management mitigation to support and inform discussions with the Working Group. This updated table will be built on Table 31.5-2 in the Application/EIS and, based on IDM's understanding, is intended to be provided to the Agency shortly following this IR submission.

Table 1-1: IDM Responses to IR1-01 Bullets

Agency IR	IDM Response
The EIS identifies the following mitigation measure related to noise (section 8.6.3): "Impulse events, such as blasting, will be limited to certain times of day. Instantaneous charge per delay will be minimized to suit blast." Further detail is required including the time of day in which blasting would be permitted, and the blast charge.	Mining and mineral exploration blasting activities in BC are regulated under the Mines Act by the Health, Safety and Reclamation (HSR) Code for Mines in British Columbia (2017). This includes a requirement (Section 8.6.1 of the HSR Code) for the time of blasting to be set to protect workers from exposure to dust, fumes, smoke, as well as noise. The actual time of day will vary and be communicated throughout site to ensure the blast danger zone is clear of all persons. The type and strength of the blast is based on the rock type, blast volume, hole length, type, and amount of explosives, among other things, and thus the blast charge will vary for each blast. All blasts will be prepared and charge holes fired in proper sequence by a person with a blasting certificate, as per industry standards and HSR Code requirements.
The EIS identifies the following mitigation measure for air quality and health (section 22.6.1.1.1): "Installing windbreaks or fences where practicable around known problem areas or stockpiles to limit the dispersion of dust emissions from equipment and stockpiles, or activities likely to generate dust." Further detail is required including the location of windbreaks and problem areas.	Installation of windbreaks or fences around stockpiles or identified problem areas is an adaptive response measure and part of a suite of best management practice mitigation options to limit the dispersion of dust emissions. No areas of concern have been identified at this time. Such an adaptive response measure will only be applied if an area of concern is identified during construction or operations and, based on a site assessment by the Environmental Manager, the placement of a windbreak or fence is selected as the option to mitigate the source of fugitive dust. However, application of water or dust suppressant will be IDM's primary mitigation measure to minimize dust generation and dispersal. Fugitive dust deposition will be monitored through the implementation of dustfall monitoring stations and compared against provincial air quality objectives as outlined in the Air Quality and Dust Management Plan (Section 29.4 of the Application/EIS). Results of monitoring will be reviewed and, should the air quality indicator approach the provincial air quality objective threshold, an adaptive management response will be applied as per the approach outlined in the Adaptive Management Plan (Section 29.2 of the Application/EIS).

Agency IR	IDM Response
The EIS identifies the following mitigation measure for air quality and health (section 22.6.1.1.1): "Water sprays and/or dust suppression measures will be used to the extent practical considering the temperature to suppress dust generation by equipment in the crushing facility" and "Water or other dust suppressant to be used on roads if needed to minimize dust from ore and waste rock haulage and grading, as needed and when ambient air temperatures permit." Further detail is required including the ambient air temperatures which would permit use of this mitigation measures.	IDM will apply water sprays and/or dust suppressants when dusty conditions are visibly present and where dustfall monitoring determines suppression is required. Application of water or other approved dust suppressants to minimize dust generation and dispersal from sources, such as roads, equipment, and machinery, crushing, or stockpiles, is an industry standard best management practice as per guidance such as the Aggregate Operators Best Management Practices Handbook for BC Volume II Best Management Practices (BC Ministry of Energy and Mines, 2002) and the Heath, Safety and Reclamation Code for Mines in BC (BC Ministry of Energy, Mines and Petroleum Resources, 2008; Section 6.24). Water spray systems require consideration of temperature to avoid damage during freezing temperatures and may not be practicable during winter months. The durability of dust suppressants depends upon the type of product used, its application, amount of rainfall, temperature, and amount of traffic (for roads). For example, water spray would not be applied to roads during freezing temperatures, whereas some dust suppressant products work best when applied in warm weather and others are easily applied in below freezing weather. Timing of application of dust suppressant products will follow manufacturer's guidance to ensure product performance.
The EIS identifies two unnamed watercourses located where the Tailings Management Facility (TMF) would be located (section 17.5.3.1), but there do not appear to be any specific mitigation measures for diversion or isolation of the non-contact water from these watercourses other than the generic mitigation measure: "Diverting non-contact water to the natural environment so that it does not mix with contact water." Clarify if and how the generic mitigation measure of diverting non-contact water to the natural environment would apply for the diversion of the two unnamed watercourses located where the TMF would be located.	The Aquatic Resources Effect Assessment (Section 17.5.3.1 of the Application/EIS) identifies the two unnamed Bromley Humps watercourses as non-fish-bearing that are connected to Bitter Creek. Based on their location under the TMF footprint, it is anticipated that approximately 520 m^2 of non-fish-bearing habitat will be lost due to Project development. Non-contact water will be diverted away from the TMF by means of a diversion channel and routed to the natural catchment draining watercourses. The water management structures for the Bromley Humps TMF are detailed in Figure 29.18-2 and Section 28.18.5.3 of the Site Water Management Plan, with more specifics in Section 29.22 (Tailings Management Plan) and associated Appendix 1-H (Tailings and Water Management Feasibility Study Design Report) of the Application/EIS. Specifically, non-contact water from the upstream catchment on the eastern side of the TMF will be collected and diverted around the TMF via a diversion channel for discharge to the downstream environment. The channel, constructed to a 0.5% grade, will outlet to the existing drainage path that reports to Bitter Creek downstream of the North TMF Embankment. A plan and profile for the non-contact water diversion channel is provided on Drawing C103 and Drawing C104 of Appendix 1-H of the Application/EIS.

Agency IR	IDM Response
The EIS identifies the following mitigation measure for hydrology and fish (section 12.6.3): "Water withdrawal will follow provincial regulatory requirements and standard best practices to avoid adverse impacts to stream flows, fish and fish habitat." Further detail is required is needed on which best practices will be used, and when, to avoid adverse impacts.	The BC *Water Sustainability Act* (2014) and associated regulations oversee the diversion and use of water. A fresh water supply pipeline will withdraw water from Bitter Creek for use in the Process Plant. The water source selected and amount of water withdrawal will follow *Water Sustainability Act* authorization requirements to minimize the potential for drawdown and downstream effects to fish habitat and the aquatic environment. Additionally, site water management involves a water reclaim system where water required for processing will be reclaimed from the TMF supernatant pond throughout operations. The volume of water in the supernatant pond will be managed to ensure sufficient water is available throughout periods of low flow and during winter months to maintain the reclaim rate to the Process Plant, to monitor flows in and out of the system, and to minimize freshwater withdrawal from Bitter Creek.
The EIS identifies the following mitigation measure for hydrology and fish (section 12.6.3): "Discharge from the TMF will, to the extent possible, match the receiving environment hydrograph." Further detail is required on how the discharge will be matched to the hydrograph.	Based on the detailed water balance modelling (reference to Appendix 1-H of the Application/EIS), a water surplus is expected to develop in the TMF based on annual precipitation estimates. Surplus water will be pumped from the water reclaim tank to the water treatment plant for treatment and discharge. Two water balance models were developed for the Project using two mean annual precipitation estimates: the 'base case', which assumes that climatic conditions result in greater precipitation at the TMF than at Stewart, and the 'adjusted case', which assumes that orographic conditions result in greater precipitation at the TMF than at Stewart. The TMF surplus will be managed by discharging between 10,200 m^3 and 44,400 m^3 per month under the base case average conditions and between 30,000 m^3 and 65,000 m^3 per month under the adjusted case average conditions. As a contingency, the system has been sized to discharge only during peak flow months of Bitter Creek (i.e., March to October) to account for potential low-flow winter months and align with the receiving environment hydrograph to minimize the effects on Bitter Creek and associated environmental components of hydrology, fish, and aquatic habitat.

Agency IR	IDM Response
The EIS identifies the following mitigation measure for soil quality and fish (section 9.6.2.2): "The use of PAG material for construction will be minimized. For roads, pads and rock cuts, minimize cut and fill in areas with ML/ARD potential." Further detail is required to clarify and quantify what is meant by "minimized."	Operationally, where it is possible to do so, IDM has chosen construction materials with low risk for ML/ARD. Between the start of the road and Km 13, quarry materials include the monzonite unit at Km 1 of the road (Highway 37A Quarry) and gabbro unit near Bromley Humps at Km 13 (Gabbro Quarry). Likewise, the borrow samples are from surficial borrow sources located along the access road at Km 8 and Km 11. Use of these materials will minimize the potential of encountering material with potential for ML/ARD. As stated in the Material Handling & ML/ARD Management Plan (Section 29.15 of Application/EIS), cut and fill activities through geochemically unfavourable materials after Km 13 of the road will be avoided to the extent practical. For example, the Otter Creek borrow area shown on some figures in the Application/EIS (e.g., PDF page 9 of Volume 7, Appendix 1-I) was identified as having a higher potential for ML/ARD than the Gabbro quarry located immediately to the south of the Bromley TMF, and, based on these findings, IDM is no longer proposing to use the Otter Creek quarry for construction. However, it is acknowledged that there will be instances when complete avoidance of ML/ARD materials will not be possible, particularly along sections of the road beyond the Bromley Humps TMF.

<table>
<tr><th>Agency IR</th><th>IDM Response</th></tr>
<tr><td>The EIS identifies the following mitigation measure for water quality and fish (section 13.6.1.3): “Refuelling and maintenance activities will not occur within 15 m of a watercourse except where required due to equipment breakdown or approved activities near water.” Further detail is required on who is approving the activities or what the approved activities are.</td><td> Clarification and correction with regards to this mitigation measure is as follows:
IDM will follow the Health, Safety and Reclamation (HSR) Code for Mines in BC (2017) with regards to machinery fueling or service within riparian areas. Specifically, Section 9.9.1 of HSR Code states that ground-based machinery shall not be fueled or serviced within the riparian setback distances of 5 to 50 m (depending on the riparian type and stream width, as per Table 9.1 of the HSR Code), other than in cases where: pumps and machinery are hand held, required for firefighting, broken down and requiring fueling or servicing to be moved, or authorized by an inspector to be fueled or serviced in the area.
For ease of reference, Table 9.1 setback distances for refueling or service are as follows:
<table>
<tr><th>Riparian Type</th><th>Setback Distance</th></tr>
<tr><td>Stream width >20 m</td><td>50 m</td></tr>
<tr><td>Stream width >5≤20 m</td><td>30 m</td></tr>
<tr><td>Stream width 1.5≤5 m</td><td>20 m</td></tr>
<tr><td>Stream width <1.5</td><td>5 m</td></tr>
<tr><td>Wetland</td><td>10 m</td></tr>
<tr><td>Lake</td><td>10 m</td></tr>
</table>
Reference HSR Code, Table 9.1 and Section 9.9.1 </td></tr>
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Agency IR	IDM Response
The EIS (section 17.6.1.5) says that "blasting activities will be limited to the Mine Site during operations, so there is no potential for effects on benthic invertebrates from explosive shockwaves as the blasting zone will not be near any fish-bearing watercourses." However, section 18.5.3.4.3 identifies that blasting would occur along the road right-of-way, and that Fisheries and Oceans Canada's Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters document would be used for mitigation. Clarify whether blasting may occur near fish-bearing waters and identify the specific mitigation measures which would apply.	Underground mining and mine development, including excavation of each portal entrance and access tunnel, construction of the TMF, and road construction, will require some degree of blasting. As stated in the Aquatic Effects Assessment (Section 17.6.1.5 of the Application/EIS) and the Fish and Fish Habitat Effects Assessment (Section 18.5.3.7 of the Application/EIS) two potential effects from blasting can occur on these components: 1) through blasting residue; and 2) vibration and shockwaves from detonation of explosives. On the Mine Site, where the majority of blasting will occur, there is no potential for effects on fish from vibration and shockwaves from detonation of explosives as the blast zone will not be near any fish-bearing watercourses. Studies have shown that due to their physiology (i.e., lack of swim bladder) benthic invertebrates are insensitive to pressure related damage from underwater explosions and therefore any effects from blasting is considered highly unlikely (Gaspin, 1975; Gaspin et al., 1976; Keevin and Hempen, 1997). Along the Access Road, there are some sections that encroach on Bitter Creek. As detailed in Section 1.6.3.2.3 of the Application/EIS, the right-of-way interference within riparian area totals 4.14 ha, which is 8.9% of the total Access Road. Total disturbed area within riparian zones is 3.63 ha and total disturbed area within the Bitter Creek high water line is 1.14 ha. Blasting may occur to construct cuts in these sections of the Access Road, and, if so, will follow Fisheries and Oceans Canada's Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters document. Section 29.3.8.2.1 of the Application/EIS specifically identifies the following mitigation measures for blasting near fish-bearing waters: • No explosive is to be detonated in or near fish habitat that produces, or is likely to produce, an instantaneous pressure change greater than 100 kilopascals in the swim bladder of a fish; • No explosive is to be detonated that produces, or is likely to produce, a peak particle velocity greater than 13 millimetres (mm) per second in a spawning bed during the period of egg incubation; and • Blast mats must be used to prevent fly-rock from entering the watercourse. Gaspin, J. B. 1975. Experimental investigations of the effects of underwater explosions on swimbladder fish. 1. 1973 Chesapeake Bay tests. Technical Report NSWC/WOL/TR-75-58. Naval Surface Weapons Center, White Oak Laboratory, Silver Spring, MD. Gaspin, J. B., M. L. Wiley, and G. B. Peters. 1976. Experimental investigations of the effects of underwater explosions on swimbladder fish. II: 1975 Chesapeake Bay tests. Technical Report NSWC/WOL/TR 76-61. Naval

Agency IR	IDM Response
	Surface Weapons Center, White Oak Laboratory, Silver Spring, MD. Keevin, T.M. and G.L. Hempen. 1997. The environmental effects of underwater explosions with methods to mitigate impacts. Washington, D.C: U.S. Army Corps of Engineers.
The EIS identifies the following mitigation measure for wildlife (section 16.6.1.4): "Measures will be implemented to minimize potential Project effects in identified high-quality wildlife habitats and movement corridors, including signage along Project roads in high-value wildlife areas or known wildlife travel corridors to warn vehicle operators of the potential to encounter wildlife." Provide a description or maps of high-quality wildlife habitats, high-value wildlife areas, and movement corridors. In addition, the Agency recommends use of a consistent term, as it is not clear how high quality wildlife habitats and high value wildlife areas might be different.	Clarification as to terminology: The term 'high quality wildlife habitat' and 'high value wildlife areas' are equivalent in this context and relate to the wildlife habitat modelling completed for the Project. Wildlife habitat suitability was modelled using Terrestrial Ecosystem Mapping and Predictive Ecosystem Mapping and rated following techniques outlined in the British Columbia Wildlife Habitat Rating Standards (RIC 1999). Maps of wildlife habitat and associated ratings are provided in Appendix 16-A (Baseline Wildlife Resources Report) of the Application/EIS. For additional context and clarity: prior to construction IDM has also committed to clearly mark known wildlife habitat features or sensitive areas, including appropriate no-disturbance buffers, on site plans and in the field by a qualified environmental professional, as per Section 29.26 Wildlife Management Plan of the Application/EIS. The term wildlife habitat features refers to important wildlife resources, such as natal/denning sites, nests, mineral licks, and wildlife trees; whereas sensitive habitats refer to wildlife habitats, such as riparian areas, wetlands, steep slopes, or old forest.

Agency IR	IDM Response
The EIS identifies the following mitigation measures for wildlife (section 16.6.1.7): “Deterrents (e.g. fencing, noise makers, wire barricades) will be used to discourage wildlife from entering Project infrastructure for refuge, shelter, nesting, roosting opportunities and potentially becoming entrapped” and “Deterrents (e.g. fencing, noise makers will be used to prevent wildlife from becoming entrapped in on-site settling sumps, holding ponds, or the TMF.” Clarify if and where these deterrent methods would be used, and provide additional information about the deterrents.	Wildlife deterrents, such as fences, noise makers, and wire barricades, that aim to discourage wildlife from entering infrastructure that may potentially entrap the animal will be considered as part of a suite of adaptive response measures whereby monitoring and inspection will determine whether additional measures are warranted to exclude wildlife from infrastructure areas or areas identified as a wildlife hazard. Section 29.26 (Wildlife Management Plan) of the Application/EIS includes specific mitigation measures with regards to wildlife exclusion in relation to either a deterrent or prevention of entrapment as follows: • Buildings will be designed and maintained to exclude wildlife (e.g., covering vents with mesh and skirting buildings to prevent wildlife from entering); • Bear-proof receptacles will be used for all waste and wildlife attractants, to prevent bears from accessing facility wastes, contaminated areas, and attractants; • Additional wildlife exclusion measures may be implemented if waste storage areas are frequently accessed by bears, wolverine, or other wildlife; • Petroleum products will be stored in holding tanks or closed facilities that exclude wildlife; • Snow bank height along Project roads will be managed and will include periodic breaks to minimize the potential for Project roads to act as physical barriers or filters to wildlife movement. Creating escape pathways (i.e., gaps) in snowbanks will allow wildlife (e.g., moose) to exit road areas; • Mine portals and underground workings will be designed to minimize the potential for bats to gain access. Measures will also be taken to reduce the risk of bats gaining access to underground infrastructure, such as tight mesh and use of artificial light and motion. If bats gain access and use the substructure for maternal roosts or hibernacula, adaptive measures will be incorporated for their protection and continued access, and BC MFLNRO will be contacted and made aware of the use. A wildlife effects monitoring program, as detailed in Section 29.26.8 of the Application/EIS, will be developed and shall include monitoring wildlife use of the Project area, among other things; with one of the two monitoring components being facility monitoring. This will include monitoring of Project infrastructure and activities associated with site facilities that pose potential risks to wildlife, wildlife entrapment, and obstacles to wildlife movement. If a problem area is identified, the selection and type of additional deterrents or measures would consider the location of the hazard or concern, wildlife species at risk, and whether the application of the deterrent would create any additional hazards (e.g., fences sometimes cause entanglement

Agency IR	IDM Response
	concerns). The implementation of any deterrents will be monitored regularly during construction and operation, and adaptive management would be undertaken as necessary to address any issues that may arise.
The EIS indicates that direct mortality of migratory birds would be reduced through best practices related to transmission lines (section 16.7.9), and that making transmission lines more visible could further reduce mortality risk (section 16.7.12.1.1), but no additional information is provided about what these best practices are.	As stated in Section 29.26.5.1 (Wildlife Management Plan) of the Application/EIS, Project infrastructure design consideration includes: "Power line design and location will include consideration of guidelines for bat and bird protection to minimize strikes and electrocutions (APLIC 2006). Measures will be taken where practicable and reasonable to discourage birds, particularly raptors, from nesting on power poles." The Avian Power Line Interaction Committee provides guidance as per their document Reducing Avian Collisions with Power Lines: The State of the Art in 2012 (2012) with regards to options for minimizing collision risk for siting new power lines, such as line placement, line orientation, line configuration, and line marking. As noted in the guidance, line routing is primarily a function of the origin and destination of the power being carried by these lines, and not all options are technically feasible in power line development. Other options, such as line marking in areas of higher collision risk, require consideration of location, bird species, accessibility of the line, product availability and durability, ease of installation, costs, spacing and positioning, safety codes related to ices and wind loading, corona effects, esthetics, and potential for vandalism. During detailed design, IDM will consider guidance as per Reducing Avian Collisions with Power Lines: The State of the Art in 2012 (APLIC 2012) in the final alignment and design of the transmission line.

2 IR1-02: CONTINGENCY MEASURES FOR WATER TREATMENT

2.1 Agency Information Request IR1-02

Rationale: The EIS Guidelines state that "mitigation measures should be specific, achievable, measurable and verifiable, and described in a manner that avoids ambiguity in intent, interpretation, and implementation."

The Agency understands that IDM Mining Ltd. has proposed water treatment for discharge from the TMF and that "IDM will consider the potential for contingency water treatment at the Portal Collection Pond, should monitoring suggest that it is necessary" (section 13.6.1.1 of the Surface Water Quality Effects Assessment).

The success of water treatment affects the assessment of potential effects to fish and fish habitat.

The Agency notes that IDM Mining Ltd.'s November 20, 2017 response to the EAO "Expectations letter" indicates that a water treatment plant, if required, would take two weeks to become effective.

Requested Information: Provide a description of any interim contingency mitigation measures that would be considered in between the time that the need for additional water treatment would be required and the successful operation of any water treatment plant.

2.2 IDM Response to IR1-02

The Portal Collection Pond will collect pumped surplus water from underground dewatering during construction and operations, as well as runoff from the waste rock storage area and lower laydown area. The pond is conservatively sized to contain runoff and precipitation from a 1 in 200 year 24-hr precipitation event. It will fill over a period of 10 months and then will remain at its maximum capacity of 13,800 m^3 for the remainder of the mine life. Inflows to the pond will be dominated by the dewatering of the underground mine, and the retention time in the pond is expected to be as short as two days. Water quality predictions were developed based on the Water and Load Balance Model (Appendix 14-C of the Application/EIS) for the Base Case of P50 (expected case, or the best estimate based on available information), intermediate case of P75, and the Reasonable Upper Limit Case of P90 (which has 10% chance of occurring, worst case). Predicted effluent from the Portal Collection Pond were compared to MMER. MMER will not be exceeded by the water in the Portal Collection Pond during operations for the base case or intermediate case. Dissolved zinc will exceed MMER for the upper case. It should be noted that the water quality model is a conservative assessment of predicted water quality. As such, there is high confidence that water quality will be as good or better than predicted for the base case.

IDM will monitor the discharge as per the Site Water Management Plan, and any discharge will be required to meet MMER criteria. Monitoring and adaptive management strategies for water quality will be implemented as described in the Site Water Management Plan, Aquatic Effects Management and Response Plan (AEMRP), and Adaptive Management Plan. These management plans have been designed to mitigate the risk related to residual effects or unanticipated effects on Surface Water Quality. The objectives of the AEMRP is to minimize the risk of effects to the aquatic environment through Project design, monitoring, and adaptive management. The AEMRP includes an Aquatics Effects Monitoring Program (AEMP) that will provide feedback via the receiving environment on the performance of IDM's management and mitigation during the Construction, Operations, Reclamation and Closure, and Post-Closure Phases of the Project. The AEMRP also includes management response measures (additional assessment, monitoring, and mitigation measures) which would be implemented in response to an unanticipated effect on Surface Water Quality. For example, additional assessment and mitigation tools include:

- Water trigger (assessment tool): bioavailability study, receiving environment toxicity tests using pore or surface water;
- Water trigger (assessment and mitigation tools): water treatment studies to determine if the water treatment plant can be operated differently to address the trigger;
- Water Management (mitigation tool): determine if additional holding time or redirecting water address the trigger; and
- Biological trigger: additional studies to quantify the magnitude of effects and spatial extent.

In the case of the Portal Collection Pond, the combination of the 10-month filling period and water quality and aquatic effects monitoring will provide sufficient time to adaptively manage an unexpected scenario where water quality requires treatment prior to discharge. In the unlikely case monitoring determines MMER exceedances following the 10-month fill period and there is a waiting period for treatment, contingency measures may include water management mitigation tools such as holding, storing, or redirecting water without releasing to the receiving environment. Management response strategies and action plans within the AEMRP will be further developed during the permitting process.

3 IR1-03: IDENTIFICATION OF COPCS FOR THE HUMAN HEALTH RISK ASSESSMENT

3.1 Agency Information Request IR1-03

Rationale: The EIS Guidelines (section 6.3.4) state that the EIS must provide a description and analysis of how changes to the environment would affect human health of Indigenous people.

The screening levels for some Contaminants of Potential Concern (COPCs) in the Human Health Risk Assessment (Appendix 22-A), and supplemental document "2017-11-20 IDM Let to EAO re Responses to Supplemental Info Requests" appear to be incorrect. The correct screening levels would result in the identification of more COPCs and may change conclusions about effects to human health. The following issues were identified:

- An incorrect Health Canada drinking water screening level was provided for vanadium, and the guideline for uranium (0.02 mg/L) is not reported (Appendix 22-A, Table A6).

- An incorrect air quality screening level appears to have been used. The most stringent air quality screening level 1h SO_2 provided in Table 4-1 is 183 $\mu g/m^3$, however this value was not used in the screening (Appendix 22-A, Table A1).

- No references for the soil screening levels identified in the updated screening in Table 2 from "2017-11-20 IDM Let to EAO re Responses to Supplemental Info Requests".

- All COPCs have not been identified in the updated soil screening presented in "2017-11-20 IDM Let to EAO re Responses to Supplemental Info Requests." For example, the screening level for gallium is not identified in Table 1, and chloride is missing from Table 2.

- For soil, the United States Environmental Protection Agency Regional Screening Levels used for screening should be adjusted to provide a value equivalent to a hazard quotient of 0.2. Screening levels for aluminium, ammonia, nitrogen (missing), beryllium, chromium, cyanide (total) (missing), cyanide (WAD) (missing), iron, manganese, nickel, silver, strontium, thallium, tin, uranium, vanadium should be adjusted in Appendix 22-A Table A6, and aluminium, barium, beryllium, boron, chromium, cobalt, iron, manganese, molybdenum, nickel, selenium, strontium, vanadium and zinc should be adjusted in Table 1 in "2017-11-20 IDM Let to EAO re Responses to Supplemental Info Requests".

- The EIS states that "as there are no sediment screening levels for direct contact with humans, the soil screening levels were used as surrogates for sediment screening levels" (section 6.3.5.3 of Appendix 22-A) and refers to Table A4 of Appendix 22-A for sediment screening levels. In accordance with Health Canada's Supplemental Guidance on Human Health Risk Assessment of Contaminated Sediments: Direct Contact Pathway (attached), only health-based guidelines (excluding inhalation) should be used for screening of COPCs. The following sources should not be used for screening of sediment: BC Background (protocol 4), BC Contaminated Sites Regulation Schedule 4, CCME soil quality guidelines (SQG) without a factsheet, CCME SQGHH for inhalation.

- A factor of 0.2 was used the calculation of screening levels for country foods, which would assume that the particular food contributes 20% of total consumption. It is unclear why this 0.2 factor was applied.

- The source for the Toxicity Reference Value (TRV) for titanium (3 mg/kg bw/day) could not be located.

- No TRV for bismuth is provided, and therefore it is unclear why it was screened out from the COPC identification process.

Requested Information: Provide an updated Health Effects Assessment (i.e. chapter 22) and Human Health Risk Assessment (i.e. Appendix 22-A) that considers the correct COPC screening levels, including the levels identified above.

3.2 IDM Response to IR1-03

Responses to IR1-03 are provided in the table below. None of the corrections change the conclusions regarding potential effects to Human Health presented in the Application/EIS.

Table 3-1: IDM Responses to IR1-03 Bullets

CEAA Comment	IDM Response
An incorrect Health Canada drinking water screening level was provided for vanadium, and the guideline for uranium (0.02 mg/L) is not reported (Appendix 22-A, Table A6).	Acknowledged. For vanadium, 0.03 mg/L was used as a screening level based on USEPA Regional Screening Level guidance. The provincial screening level for uranium that was used in the analysis (0.02 mg/L) is the same as the federal guideline.
An incorrect air quality screening level appears to have been used. The most stringent air quality screening level 1h SO2 provided in Table 4-1 is 183 μg/m^3, however this value was not used in the screening (Appendix 22-A, Table A1).	As listed in Table A1, Attachment A, Appendix 22-A of the Application/EIS, SO2 was evaluated using existing provincial guidelines. This was established by the province as an interim guideline to accommodate a stepwise approach to management of SO2 in anticipation of the new Canadian Standards coming out for this parameter. The Canadian Standards that have since been released for SO2 are only slightly lower than the interim provincial objective. Furthermore, there is uncertainty with regards to how the Canadian Standards will ultimately be used and applied (e.g., between various jurisdictions, by the regulatory authorities, at a project vs air shed level). As a result of this uncertainty, IDM's use of the interim provincial objectives is an appropriate approach for the HHRA and associated Human Health Effects Assessment. 1 h SO2 concentrations are below current and future guidelines. IDM will consider future guidelines when permitting and managing air quality for the Project.
No references for the soil screening levels identified in the updated screening in Table 2 from "2017-11-20 IDM Let to EAO re Responses to Supplemental Info Requests"	References are provided in updated tables in Appendix IR1-03-A (Updated Soil Screening Levels and References).

CEAA Comment	IDM Response
All COPCs have not been identified in the updated soil screening presented in "2017-11-20 IDM Let to EAO re Responses to Supplemental Info Requests." For example, the screening level for gallium is not identified in Table 1, and chloride is missing from Table 2.	There are no toxicity estimates for gallium, and therefore no entries in Table 1. The COPC cell in Table 2 for gallium should read 'No' rather than 'NA'. Gallium was not carried through screening because the concentrations present at site are less than its average crustal abundance of 19 mg/kg. Chloride should have 1000 mg/kg in Table 1; however, chloride did not screen in and, therefore, is not listed in Table 2.
For soil, the United States Environmental Protection Agency Regional Screening Levels used for screening should be adjusted to provide a value equivalent to a hazard quotient of 0.2. Screening levels for aluminium, ammonia, nitrogen (missing), beryllium, chromium, cyanide (total) (missing), cyanide (WAD) (missing), iron, manganese, nickel, silver, strontium, thallium, tin, uranium, vanadium should be adjusted in Appendix 22-A Table A6, and aluminium, barium, beryllium, boron, chromium, cobalt, iron, manganese, molybdenum, nickel, selenium, strontium, vanadium and zinc should be adjusted in Table 1 in "2017-11-20 IDM Let to EAO re Responses to Supplemental Info Requests"	Updated values have been provided in Appendix IR1-03-A (Updated Soil Screening Levels and References) for metals in soil detected at site.

CEAA Comment	IDM Response
The EIS states that "as there are no sediment screening levels for direct contact with humans, the soil screening levels were used as surrogates for sediment screening levels" (section 6.3.5.3 of Appendix 22-A) and refers to Table A4 of Appendix 22-A for sediment screening levels. In accordance with Health Canada's Supplemental Guidance on Human Health Risk Assessment of Contaminated Sediments: Direct Contact Pathway (attached), only health-based guidelines (excluding inhalation) should be used for screening of COPCs. The following sources should not be used for screening of sediment: BC Background (protocol 4), BC Contaminated Sites Regulation Schedule 4, CCME soil quality guidelines (SQG) without a factsheet, CCME SQGHH for inhalation.	IDM acknowledges the validity of the comment. However, the sediment contact pathway is still considered as incomplete. The presence of contamination at a location does not necessarily mean that the health of people is at risk. For there to be risk from a source of contamination, there must be a receptor potentially exposed to that contamination, and there must be a reasonable likelihood of exposure to that contamination. Exposure to sediment and associated risks are dependent on the characteristics of the specific waterbody, the use of that waterbody, and the nature of the natural resources that are present. Characterization of exposure with sediment is a little more complex and less proscribed than risk assessments for other media, such as soil and groundwater. Exposure to sediment is usually related to recreation and/or subsistence use of a waterbody. Chemicals (metals) were identified in sediments in excess of guidelines/standards. However, there is no evidence of people using the creeks in the Bitter Creek valley for playing or swimming. This is likely due to the depth (shallow), flow rate (fast), and temperature of these creeks (cold). Sediment exposure may also occur as a result of harvesting shellfish. Shellfish were not identified as being present in the creeks of Bitter Creek valley. Minor sediment dermal exposure to hands may occur when handling fish during fishing. However, sediment exposure while fishing for Dolly Varden was considered to be negligible. Exposures were evaluated for contamination via the food chain and suspended sediment as part of the exposure to surface water.

CEAA Comment	IDM Response
A factor of 0.2 was used the calculation of screening levels for country foods, which would assume that the particular food contributes 20% of total consumption. It is unclear why this 0.2 factor was applied.	A factor of 0.2 should not have been applied to screening of country foods for carcinogenic effects. Updated calculations are found in Attachment 5 of Action Item Response memo dated November 29, 2017. A factor of 0.2 was applied to screening of country foods for non-carcinogenic effects. To rationalize this approach, IDM presents the following paragraph from Federal Contaminated Site Risk Assessment in Canada, Part V: Guidance on Human Health Detailed Quantitative Risk Assessment for Chemicals (DQRAChem) (Health Canada 2011), section 3.4.2.1: "Where the criteria adopted for screening purposes are obtained from sources other than CCME or Health Canada, they should be adjusted as necessary to be consistent with the health protection endpoints prescribed by Health Canada and CCME. For example, if the health-based guidelines for carcinogens (non-threshold substances) are derived based on a target incremental cancer risk of 1 x 10-6 (1 in 1 million), the criteria can be adjusted to a target incremental risk of 1 x 10-5 in accordance with Health Canada's essentially negligible risk level. For non-carcinogens (threshold substances), guidelines from other jurisdictions, such as the U.S. EPA, are commonly based on 100% of the tolerable daily intake (TDI) or reference dose (RfD). These guidelines should be divided by 5 to make them approximately equivalent to CCME guidelines that are based on only 20% of the TDI or RfD."
The source for the Toxicity Reference Value (TRV) for titanium (3 mg/kg bw/day) could not be located.	NSF (NSF International), 2017. Cited in International Toxicity Estimates for Risk Assessment (ITER). Available online at: https://iter.ctc.com/publicURL/p_report_l2_non.cfm?crn=7440-32-6&type=NCO. Last accessed on Aug. 30, 2017.
No TRV for bismuth is provided, and therefore it is unclear why it was screened out from the COPC identification process.	There is no TRV for bismuth, and it was not screened out from the COPC identification process (as shown in Table 2 in "2017-11-20 IDM Let to EAO re Responses to Supplemental Info Requests").

4 IR1-04: TOXICITY ASSESSMENT FOR THE HUMAN HEALTH RISK ASSESSMENT RATIONALE

4.1 Agency Information Request IR1-04

Rationale: The EIS Guidelines (section 6.3.4) state that the EIS must provide a description and analysis of how changes to the environment would affect human health of Indigenous people.

Health Canada defines Tolerable Daily Intakes (TDIs) for copper, molybdenum, and selenium on an age-group specific basis. The Human Health Risk Assessment appears to have applied adult TDIs for non-adult receptor groups. In the particular case of molybdenum, the Health Canada TDI for the toddler receptor is almost 1000 times lower than that employed by the proponent (28 mg/kg bw/day). Given the magnitude of the difference between TDIs employed by Health Canada and used in the EIS, this has the potential to change conclusions with respect to effects to human health.

Requested Information: Provide an updated Human Health Risk Assessment that uses Health Canada TDIs for copper, molybdenum and selenium.

4.2 IDM Response to IR1-04

This information was provided to the BC Environmental Assessment Office (EAO) in Attachment 5 of the Action Item Response memo dated November 29, 2017. This has been provided as Appendix IR1-04-A.

5 IR1-05: EXPOSURE ASSESSMENT FOR THE HUMAN HEALTH RISK ASSESSMENT

5.1 Agency Information Request IR1-05

Rationale: The exposure assessment (Appendix 22-A, section 7.2.2) appears to have averaged short term exposures for each receptor over a longer long period. This appears to be the case for the assessment for both carcinogens and noncarcinogens.

The bioconcentration factors (BCF) used to predict the concentration of COPCs in fish and plants were calculated based on the average concentrations from sampled location in the local and regional study areas, rather than co-located samples. Given that there is a large variation in the concentration of COPCs at different sampling locations (ex., arsenic concentration was 12.9 µg/g at AC-02 and 1110 µg/g at BC-03), averaging the BCF would underestimate the BCF at specific locations.

Health Canada's Supplemental Guidance on Human Health Risk Assessment for Country Foods recommends co-location of soil and plant samples, and soil and fish samples. From Figure 11, it appears as if the location of plant samples were independent of soil samples

Requested Information: Provide an updated Health Effects Assessment (i.e. chapter 22) and Human Health Risk Assessment (i.e. Appendix 22-A) that includes:

a) A description of the exposure averaging period used in the assessment, including a rationale for the averaging period.

b) Use of site-specific BCFs or the most conservative BCF for the exposure assessment. Alternatively, provide a rationale for the current approach, including a description whether the approach would underestimate the BCF in some areas, and clarify whether samples were co-located in accordance with Health Canada guidance.

5.2 IDM Response to IR1-05

5.2.1 IDM Response to IR1-05(a)

IDM applied the following average periods:

- The 3-week recreational exposure was averaged over 12 weeks;
- The 2-month hunter/trapper/fisher exposure was averaged over 3 months; and
- The 3-month summer resident exposure was averaged over 6 months.

The averaging used was considered to be a more conservative approach than other commonly applied options (e.g., the use of sub-acute toxicity values).

5.2.2 IDM Response to IR1-05(b)

IDM reviewed the risk calculations for country foods and reviewed the BCF calculations and subsequent BCF values. A few calculation errors were identified for about a dozen individual HQ values where a formula was referencing the incorrect cell. None of these corrections affected the conclusions.

IDM has reviewed the Wet Weight BCF calculations. These calculations were originally completed to better match human consumption. Wet weight BCFs for plants were calculated by dividing wet weight plant concentrations by soil concentrations. Calculated soil to plant BCF values were compared to plant BCFs from the literature, and the values were consistent. Table 1 in Appendix IR1-05-A presents soil concentrations and measured plant concentrations used to calculate BCFs, calculated BCFs, and calculated plant COPC concentrations. Dry weight BCFs were also calculated. When dry weight BCFs were used to predict future dry weight plant concentrations using average predicted concentrations, all predicted exposure concentrations and HQs for moose, hare, and rabbit were greater than the baseline concentrations. However, when the dry weight to wet weight conversion factor was applied to estimate the predicted wet weight for the consumption of plants by human receptors, the predicted weight concentration was less than the baseline concentrations about half of the time. This happened because the wet weight to dry weight conversion was based on an average concentration (i.e., samples were not co-located), and because the difference between baseline and predicted soil concentrations were very small. 95% of the time, predicted soil concentration on which the predicted plant concentrations was calculated was less than 1% greater than the baseline concentration. When the predicted 90th percentile soil concentrations were used to calculate the predicted plant concentrations, the majority of the predicted plant concentrations were less than the baseline concentrations. This was a result of the variability in the plant COPC concentrations.

The calculated water to fish BCFs were reviewed, and they were also compared literature-based values. BCFs were calculated using four difference scenarios:

1) A quasi-co-located sample BCF (i.e., water sampling conducted in same reach as fish sampling);

2) The average fish concentration of fish caught in Bitter Creek divided by the average concentration of water samples collected down gradient of the Bitter Creek fish break;

3) The average fish concentration of fish caught in Bitter Creek and the Bear River divided by the average concentration of water samples collected in down gradient of the Bitter Creek fish break and in the Bear River; and

4) The average COPC concentration in all fish tissue samples divided by the average concentration in all water samples collected near these locations.

Table 2 in Appendix IR1-05-A presents surface water concentrations and measured fish tissue concentrations used to calculate BCFs, calculated BCFs, and predicted plant COPC concentrations. Calculated BCF values were compared to BCFs from the literature, and the values were consistent. BCFs were greatest when the highest number of tissue sample and water sample locations was used. BCFs were the lowest when Bitter Creek and Bear River sample locations were considered. BCFs fell between these two extremes when the co-located sample locations were used. IDM suggests that the relationship between water sample concentrations in Bitter Creek and fish tissue concentrations in Bitter Creek is weak. Uncertainty in three ecological factors contribute to this assessment: 1) how much time Dolly Varden spend in Bitter Creek versus other locations; 2) how many Dolly Varden in Bitter Creek are anadromous, and 3) how many Dolly Varden over winter in Bitter Creek. The less time spent by Dolly Varden in Bitter Creek, the weaker the relationship between Bitter Creek water chemistry and Dolly Varden fish tissue chemistry.

6 IR1-06: PREDICTED CHANGES TO SURFACE WATER QUALITY

6.1 Agency Information Request IR1-06

Rationale: The EIS Guidelines (section 6.3.4) state that the EIS must provide a description and analysis of how changes to the environment would affect human health of Indigenous people.

The EIS notes that Bitter Creek would be affected but that changes to COPCs in surface water would be minimal. It is unclear where the predicted changes to surface water would be, and whether those predicted changes are in areas potentially used as a drinking water source, recreation, or fishing. The assessment of changes to surface water quality is likely to affect the assessment of potential effects to human health of Indigenous peoples.

Requested Information: Describe the locations associated with predicted changes to COPCs in surface waters used as potential drinking water sources, recreation, and fishing.

6.2 IDM Response to IR1-06

Elevated concentrations of some metals in Surface Water Quality are predicted to occur within middle reaches (just below the barrier to fish passage just downstream of Hartley Gulch; Figure 18.4-1 in Volume 3, Chapter 18 of the Application/EIS) and upper reaches (between the TMF and mine site) of Bitter Creek.

The HHRA assumed that, over time, persons could be exposed to most areas of the site. For example, trappers attending their different trap lines would access water close to the various locations where the trap lines are located; a similar pattern may occur with hunters. Fishers would access water between the Bear River and the upper limit of fish occupancy in Bitter Creek, located a short distance down gradient of Otter Creek's convergence with Bitter Creek. A conservative estimate of surface water concentrations was used. As stated in Appendix 22-A, Section 10.3 (pg. 69): "Due to the limited data set, the 90th percentile concentration was used, which may result in an overestimate of the true mean. Underestimation of the true mean is unlikely." It was assumed that the future hiker may choose to go to the Mine Site area and access Goldslide Creek. Hunters, trappers, or hikers close to Goldslide Creek may also use it for drinking water. However, Goldslide Creek is considered relatively inaccessible for drinking water purposes given rugged terrain and accessibility of the creek (it is a 13 km and 1500 m climb from the TMF).

7 IR1-07: PREDICTED CHANGES TO NON-THRESHOLD CONTAMINANTS

7.1 Agency Information Request IR1-07

Rationale: The EIS Guidelines (section 6.3.4) state that the EIS must provide a description and analysis of how changes to the environment would affect human health of Indigenous people and that "residual effects, even if very small or deemed insignificant will be described" (section 6.5).

The total predicted NO2 1-h (187 ug/m^3) is very close to the selected air quality objective (188 µg/m3), and exceeds the Canadian Ambient Air Quality Standard (CAAQS) (113 µg/m^3) which would come into effect in 2020 during the mine's operational period. Given the uncertainty inherent in the air quality modelling a discussion potential health impacts of NO2 is warranted.

There is no population health threshold for human health effects for NO2 and PM2.5, meaning that health effects may occur at any level of exposure.

Requested Information: Discuss the residual effects from exposure to NO2 and PM2.5.

7.2 IDM Response to IR1-07

As listed in Volume 8, Appendix 22-A, Attachment A, Table A1 of the Application/EIS, NO2 was evaluated using the existing provincial guideline. This guideline was established by the province as an interim guideline to accommodate a stepwise approach to management of NO2 in anticipation of the new Canadian Standards. There is uncertainty with regards to how the Canadian Standards will ultimately be used and applied (e.g., between various jurisdictions, by the regulatory authorities, at a project vs air shed level). As a result of this uncertainty, IDM's use of the interim provincial objectives is an appropriate approach for the HHRA and associated Human Health Effects Assessment.

The Air Quality and Dust Management Plan (Volume 5, Chapter 29) will include monitoring programs for PM (2.5 and 10) and NO2 that will allow for real-time verification of the air quality modelling results and the effectiveness of applied mitigation measures. IDM is committed to further discussions regarding air quality objectives as they relate to human health concerns through the permitting phase as the Air Quality and Dust Management Plan is further developed and finalized. All reasonable efforts will be made to reduce the levels of PM and NO2 during Project activities.

Predicted PM (2.5 and 10) and NO2 concentrations were compared to existing and interim provincial guidelines and, as a result, were not screened into the HHRA. Discussion was also provided in Section 6.3.1.3 of Appendix 22-A regarding what would be considered reasonable

NO_2 and PM concentrations based on consideration of latest literature (Health Canada 2016; US EPA 2016; Elliott and Copes 2017). However, we acknowledge that even though NO_2 and PM exposure concentrations related to the Project are low, these concentrations are in the range where there is some uncertainty regarding effects. Toxicity profiles for PM and NO_2 have been developed and are provided in Appendix IR1-07-A.

8 IR1-08: HYDROGEOLOGICAL MODEL

8.1 Agency Information Request IR1-08

Rationale: The EIS Guidelines (section 6.1.4) state that the EIS must provide an appropriate hydrogeologic model for the Project area, which includes sensitivity analyses to test model sensitivity to hydrogeologic parameters. A better understanding of the conceptual hydrogeological model is needed for both the mine site (Appendix 10-A) and Bromley Humps (Appendix 10-B) in order to better understand potential effects to surface water and, in turn, fish and fish habitat.

<u>Mine site (Appendix 10-A):</u>

- Hydraulic conductivity is known to vary significantly in the environment, and this variation is well demonstrated in Figures 10 and 11 (Figure 10: Hydraulic conductivity with depth and Figure 11: Hydraulic conductivity with elevation). In the sensitivity analysis of the numerical model, only a 67% increase and decrease in hydraulic conductivity (KH and KV) was used. Simulations should be conducted using at least a difference of an order of magnitude.

- The EIS states (section 7 of Appendix 10-A): "The Base Case calibrated model predicted a base-flow along Goldslide Creek of 5,500 m^3/d during low-flow winter conditions, higher than the base-flow of 1,800 m^3/d inferred from a base-flow separation analysis using regional data." The value(s) of recharge imposed in the numerical model (as presented in Table 10 in Appendix 10-A) appears to be high (1467 mm/y, representing nearly 80% of total precipitation) and out of phase relative to baseflows found using river hydrographs (Figures 23 and 24 in Appendix 10-A).

- It appears that the recharge imposed/assumed in the model (for transient scenarios) is earlier in the year than field data would suggest. The EIS (Appendix 10-A, section 6.4.4) states: "The [net available recharge] estimates suggest the peak of recharge occurs between May and June as a result of freshet melt". However, Figure 14 shows that groundwater levels peak around August, and Figures 23 and 24 shows that baseflows obtained from stream hydrographs peak around July. In addition, Table 1 of Appendix G shows that temperatures typically do not rise above zero until June.

- The hydraulic conductivity of the backfill material during mine closure was not provided.

- Section 6.8.2 of Appendix 10-A summarizes the sensitivity of the mine flood time at closure to parameter variations, including horizontal hydraulic conductivity (KH). Table 18 indicates that a reduction in KH is associated with a reduction in mine flood time, which seems counter-intuitive.

Bromley Humps (Appendix 10-B):

- It is unclear which precipitation scenario (base case or adjusted) was used to estimate infiltration into and leakage from the TMF at Bromley Humps. This would make a substantial difference (annually: 1457 vs 2084 mm, presented in Table 2.2-3 and Table 2.2-4 of Appendix 10-B).

- Table 2.3-1 in Appendix 10-B provides information on the active hydrometric stations in the area. The forest cover and glacier cover associated with three of the stations exceeds 100%.

Requested Information for the Mine Site:

a) Provide a rationale for the variation of the K value used for the sensitivity analysis and an analysis for the new values of inflow/outflow and extent of the drawdown cone using ± 1 order of magnitude.

b) Explain the threefold difference between modelled and estimated baseflow values

c) Explain the difference in recharge obtained with net available recharge (NAR) equation and stream hydrographs.

d) Provide the hydraulic conductivity (K) of the backfill material used for the hydrogeological model for the closure/post-closure period.

e) Explain how a reduction of horizontal hydraulic conductivity (KH) corresponds to a reduction in the mine flood time.

Requested Information for Bromley Humps:

a) Identify which precipitation scenario (base case or adjusted) was used to estimate infiltration into and leakage from the TMF at Bromley Humps.

b) Provide a rationale for the percentage of forest and glacier cover associated with the watershed for each of the four hydrometric stations, given that the forest and glacier cover exceeds 100%.

8.2 IDM Response to IR1-08

8.2.1 Mine Site

8.2.1.1 IDM Response to IR1-08-Mine Site(a)

The sensitivity analysis uses a 67% increase and decrease in hydraulic conductivity (Kh, Kv) to match the K variations applied to the Lower Case and Upper Case scenarios. Even though these may be considered small relative to the variations of K measurements, they are sufficient to demonstrate that variations to Kh and Kv affects significantly the model calibration and predictions. If sensitivity models used an order of magnitude increase and decrease of Kh and/or Kv, the same conclusion would be drawn. The sensitivity analysis is only meant to demonstrate the sensitivity of each parameter and since these models are not re-calibrated, their predictions do not portray correctly the potential effects from the mine to the groundwater system.

From the perspective of the modelled K uncertainty, the Lower Case and Upper Case scenarios represent scenarios calibrated to baseline hydraulic heads and either low or high estimated baseflows. The Kh, Kv, and recharge rate were decreased or increased to simulate an annual recharge rate to the groundwater system equivalent to 10% and 50% of MAP (i.e., Lower and Upper Case scenarios, respectively).

8.2.1.2 IDM Response to IR1-08-Mine Site(b)

The threefold difference during low flow period can be explained by the fact that the Base Case scenario shown in Figure 28 of Appendix 10-A is actually calibrated to the estimated annual average baseflows using an equivalent recharge of 30% of MAP. The Lower Case scenario is calibrated to baseflows estimated for low flow periods using an equivalent recharge of 10% of MAP and the Upper Case scenario is calibrated using an equivalent recharge of 50% of MAP. Table 8-1 below shows the estimated baseflow targets and the steady state baseflow predictions.

Table 8-1: Comparison between Estimated Baseflows and Steady State Baseflow Predictions

Scenario	Estimated Baseflows	Steady State Predicted Baseflows
Lower Case	1,811 m^3/d (Low flow period)	1,800 m^3/d
Base Case	5,527 m^3/d (Annual average)	5,452 m^3/d
Upper Case	14,540 m^3/d (High flow period)	9,105 m^3/d *(This scenario was bound to a maximum recharge equivalent to 50% of MAP)*

As indicated in IDM's response to Working Group comment ID #219, the predictions on water quantity and quality are not expected to be influenced by the seasonal bias in the groundwater model.

From the perspective of underground flow predictions, the evaluation carried in the water and load balance is based on the predicted yearly average underground inflows. The groundwater model assumes during operations that a year of underground development is excavated at the beginning of each model year (e.g., at the start of model year 1, the development for year 1 is excavated), which leads to an overestimation of the annual inflow rate in the underground development and an overestimation of the dewatering cone footprint.

From the perspective of baseflow reduction to the creeks, the evaluation is based on the predicted maximum reduction to baseflow at end of mine expressed as relative percent difference of baseflows between end of mine and baseline conditions. If the current conditions winter baseflows were lower, the end of mine winter baseflows would in turn be lower. Reciprocally, if the current conditions summer baseflows were higher, the end of mine summer baseflows would be higher. Therefore, relative percent differences would not be expected to change.

From the perspective of water quality, the evaluation is based on steady state predictions of the Closure and Post-Closure Phases. Seasonal variations in the system does not influence the predicted proportion of groundwater flow originating from the mine and contributing to the creeks.

8.2.1.3 IDM Response to IR1-08-Mine Site(c)

Contrary to what is stated in this information request, the value(s) of recharge imposed in the numerical model are not presented in Table 10 in Appendix 10-A and do not sum up to 1,467 mm/y, nearly 80% of total precipitation. Instead:

- The Net Annual Recharge (NAR) indicated in Table 10 represents the total water available from precipitation or snow melt minus evapotranspiration. The NAR is assumed to include surface runoff, near-surface runoff and recharge to the groundwater system;
- The monthly estimated baseflow values obtained by the separation technique of Nathan and McMahon integrate discharges from near-surface runoff and discharges from the groundwater system. Estimated baseflow values are assumed to be dominated by near-surface runoff considering and the steep mountain slopes;
- The modeled recharge values represent only the recharge to the groundwater system; the near-surface runoff is not simulated by the groundwater numerical model. The modeled recharge values represent a fraction of the NAR (about 37% of NAR, or 29.4% of MAP). Figure 8-1 below provides an amendment to Figure 29 in Appendix 10-A to show the differences between NAR and modeled recharge.

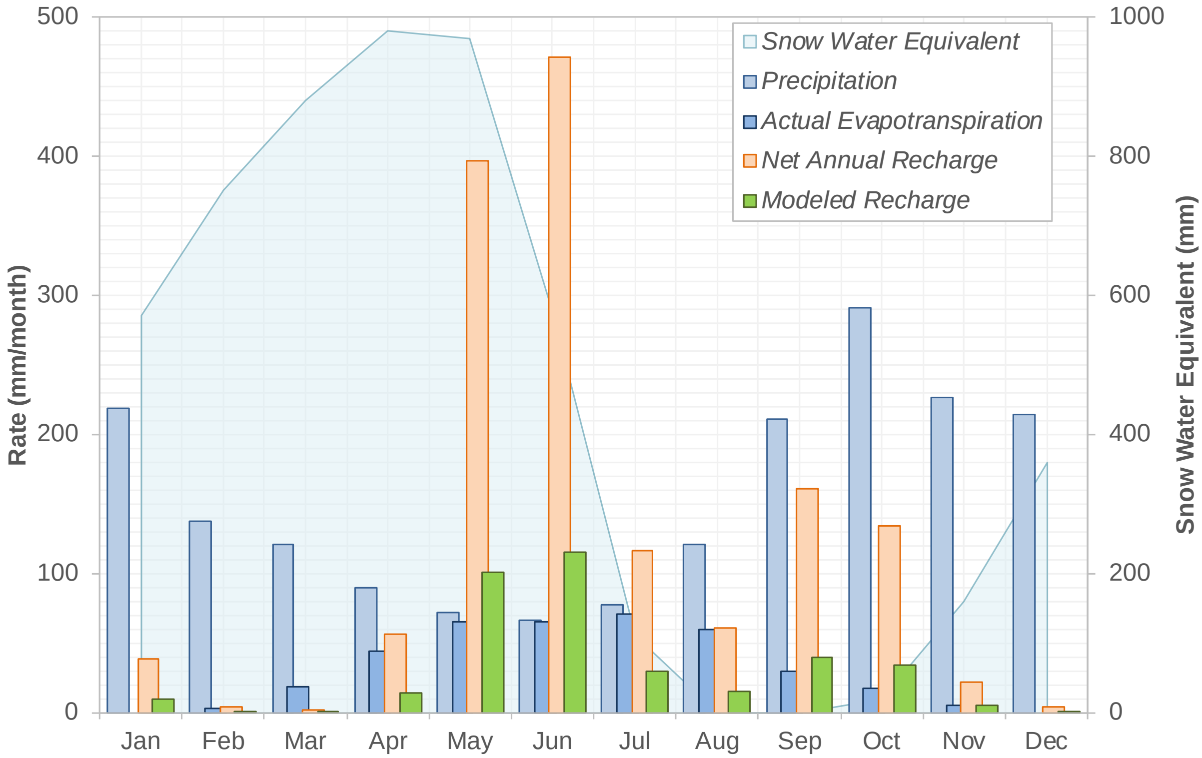
8.2.1.4 IDM Response to IR1-08-Mine Site(d)

The hydraulic conductivity (K) of the backfill material used for the hydrogeological model for the closure/post-closure period is 3.5×10^{-6} m/s.

8.2.1.5 IDM Response to IR1-08-Mine Site(e)

The mine flood time is linked to the groundwater inflow discharging into the mine. A reduction of horizontal hydraulic conductivity (Kh) causes a reduction of the mine inflow, which leads to a reduction in the mine flood time. Note that errors were found in Table 18 of Volume 8, Appendix 10-A of the Application/EIS. The reported mine inflow of 1,220 m^3/d for the scenario where Kh was increased by 67% is incorrect; the actual prediction for this sensitivity scenario was 4,690 m^3/d. An updated version of Volume 8, Appendix 10-A, Table 18 is provided in memo "2018 01 16 Red Mtn-ENV-GW Model Sensitivity-Comment 221".

Figure 8-1: Simulated Transient Groundwater Recharge Profile



8.2.2 For Bromley Humps

8.2.2.1 IDM Response to IR1-08-Bromley Humps(a)

Infiltration to and leakage from the TMF was not based on precipitation events, rather it was based on estimates of leakage through defects in the geomembrane liner during construction and operations and through the upper liner as part of the closure cover during the Post-Closure Phase.

The adjusted case, as the more conservative of the two precipitation estimates presented, was used in the sizing and design of the TMF and associated water management structures (i.e., Environmental Design Flood for the TMF, Seepage Collection Ponds, Non-Contact Water Diversion Channel, etc.)

8.2.2.2 IDM Response to IR1-08-Bromley Humps(b)

IDM acknowledges the differences between Forest and Glacier Cover results shown in Table 2.3-1 in Appendix 10-B of the Application/EIS. This information was obtained from Table 5-1 in

Appendix 12-A, which was prepared to support a regional hydrology analysis. The areas do not add up to 100% because they are from different sources of data. The Forest and Lake areas are from the ECCC CANVEC database (GOC 2016), while the glacial extent is from Project GLIMS (Global Land Ice Measurements from Space; https://www.glims.org/, downloaded on July 28, 2015). The former likely calculates the distribution of forested area outside of glaciated areas, while the latter is based on the total land area including glaciers.

Reference:

[GOC] Government of Canada 2016, Geospatial Data Extraction, CANVEC, webpage: http://maps.canada.ca/czs/index-en.html

9 IR1-09: 2017 FISHERIES ASSESSMENT

9.1 Agency Information Request IR1-09

Rationale: The proponent has indicated that further fisheries assessments were conducted during 2017. Some of this information was provided to Fisheries and Oceans Canada through a regulatory request for review process however it has not yet been included in the EIS. All of the fisheries assessment work should be included for review as part of the environmental assessment process to ensure a complete analysis of potential effects from the Project on fish and fish habitat.

Requested Information: Provide a report describing the additional fisheries baseline assessment work conducted in 2017 including methodology, results and analysis.

9.2 IDM Response to IR1-09

Fisheries assessment work in 2017 occurred during May 15-18 and on two dates in the fall (October 18 and November 8).

9.2.1 May 15-18, 2017, Field Visit

The primary objectives of the May field visit was to assess fish habitat where the proposed Access Road encroaches on Bitter Creek and ground-truth the fish-bearing status of road crossing sites with a DFO representative in attendance. The intent was to provide DFO with an overview of the proposed Access Road and potential effects on fish habitat. The second objective of the field visit was to ascertain the fish-bearing status of the larger of two unnamed tributaries to Bitter Creek, a section of which will be lost under and upstream of the Tailings Management Facility. The confluence of the tributary is downstream of the first fish barrier on Bitter Creek (i.e., within the fish-bearing section of Bitter Creek). Following an aerial assessment by the crew (three Palmer Environmental Consulting Group (PECG) biologists and a DFO representative) that identified potential barriers to fish passage in the lower reach of tributary, two PECG crew members conducted a gradient assessment on the ground. The tributary was determined to be non-fish-bearing, owing to a series of drops and chutes in the lower reach that prohibit fish passage. The report from the May field visit is attached as Appendix IR1-09-A.

9.2.2 October and November 2017 Field Visits

The purpose of the fall field work was to conduct spawning assessments on Bitter Creek. The assessments (October 18 and November 8, 2017) targeted the Dolly Varden spawning period. The objectives of the assessments were to record potential spawning activity in Bitter Creek and collect supporting data (e.g., stream velocities, water temperature, substrate). The assessments entailed aerial surveys along the length of the fish-bearing section of Bitter Creek and ground surveys at locations identified during baseline studies as potential spawning habitat. No evidence of spawning activity was found on either date. The report from the fall spawning assessments is attached as Appendix IR1-09-B.

10 IR1-10: BITTER CREEK AND BEAR RIVER FLOW CHANGES

10.1 Agency Information Request IR1-10

Rationale: Section 6.3.1 of the EIS Guidelines request that the proponent identify any potential adverse effects to fish and fish habitat as defined in Subsection 2(1) of the Fisheries Act including consideration of the geomorphological changes and their effect on hydrodynamic conditions and fish habitats.

More information is needed to fully assess and characterize potential impacts to fish and fish habitat from flow changes that would result as part of the Project.

Increases in water supply to the receiving environment, in particular to fish bearing reaches of Bitter Creek and the Bear River, have been characterized in percentage change in water quantity or flow.

Requested Information:

a) Provide a table showing the linear length (m) and areal extent (m2) of the maximum flow changes as a result of water supply changes (increases and decreases) in the affected streams (e.g., 0, 5, 10, 15, 20% contours).

b) Provide an analysis of what these changes would mean to available fish habitat (quality and quantity) during the seasons when relative changes would be greatest, for example overwintering.

10.2 IDM Response to IR1-10

(a) Changes in flow at specific locations are provided in the Hydrology Effects Assessment (Volume 3, Chapter 12, Tables 12.7-3 and 12.7-4 of the Application/EIS) and in Water Load and Balance Model (Appendix 14-C, Tables 4.1-1 and 4.1-2). These results were sufficient to assess effects from changes in flow on other valued components, namely Fish and Fish Habitat.

(b) Changes in flow were carried forward as a residual effect for Fish and Fish Habitat. The residual effect analysis (i.e., what these changes would mean for Fish and Fish Habitat) is provided in Volume 3, Chapter 18, Section 18.7.3.3.1 of the Application/EIS:

During operations, increases in flow will occur in Bitter Creek as result of mine discharge into Goldslide Creek.

- The maximum predicted increase in flow in January and December is 5% and 4% of baseline conditions at BC06 and BC02 respectively. During freshet and summer (May to September) the change in flow is negligible in Bitter Creek.

- The increased flow during operations for the winter is much less than the peak flows during the summer in Bitter Creek, so the increase in flow during the winter is not expected to have any effect on the geomorphology of the stream channel.

Under natural conditions, winter is a low flow period. Dolly Varden egg incubation occurs over the winter period, and increases in flow could therefore affect incubating eggs and fry emergence timing. Increased winter flows are also expected to improve the availability of overwintering habitat (deeper areas that do not freeze to bottom) for juveniles.

11 IR1-11: EFFECTS TO FISH HABITAT FROM THE ACCESS ROAD, TRANSMISSION LINE, AND TAILINGS MANAGEMENT FACILITY

11.1 Agency Information Request IR1-11

Rationale: Section 6.3.1 of the EIS Guidelines outlines the details that should be considered in the assessment of potential adverse effects to fish and fish habitat as defined in Subsection 2(1) of the Fisheries Act. This includes the geomorphological changes from Project works and their effects on hydrodynamic conditions and fish habitats, the modifications of hydrological and hydrometric conditions on fish habitat and on the fish species' life cycle activities, and potential impacts on riparian areas. More information is needed to fully assess and characterize potential impacts to fish and fish habitat from the access road, transmission line, and TMF.

Access road:

Construction of the Access Road is the one component of mine infrastructure that could potentially result in habitat loss for fish in Bitter Creek. According to the EIS, one 150 m section of the access road would require re-alignment of Bitter Creek and involves the realignment of the Bitter Creek channel and construction of a road prism with bank armouring. The EIS states that no net loss of habitat would be anticipated; however 1.14 ha of habitat would be altered. An additional 2.7 ha of riparian habitat would be disturbed during construction of the Access Road.

Detailed maps showing the location of the habitat alterations were not provided in the EIS and no site-specific habitat and fish use data was presented in the effects assessment or baseline data to support a determination of no effects to fish or fish habitat.

Power line:

The EIS (Table 18.5-1) identifies, "Install powerline from substation tie-in to the Lower Portal laydown area" as an interaction between the Project and fish and fish habitat. No further mention of the construction of the transmission line is discussed or described in the EIS. The access road, and therefore transmission line, would cross 64 unnamed streams as well as 5 named streams, all tributaries to Bitter Creek, en route to the mine site. Transmission line construction typically requires ground disturbance for the installation of electrical pole structures as well as vegetation clearing and maintenance to ensure no interaction between vegetation and electrical wires. This type of construction can impact streams through ground disturbance and increased sediment and erosion loading as well as riparian habitat through vegetation losses or alteration.

TMF:

As identified in Section 17.5.3.1 of the EIS, approximately 520 m2 of aquatic habitat would be lost under the TMF footprint. This appears to be the only direct loss of aquatic habitat predicted in the EIS. This area, however, is estimated and the two streams that would be lost in the construction of this mine infrastructure were not sampled during any baseline sampling events that are documented in the EIS. Although neither watercourse is fish bearing, they are both connected to Bitter Creek.

No data or mitigation measures were provided in relation to seepage or runoff from the TMF entering these streams, nor were the potential effects to Bitter Creek fish and fish habitat assessed.

Requested Information: Provide an updated assessment with impacts to fish habitat from road construction, construction of the transmission line, and construction of the TMF, including:

a) Detailed maps showing areas of road construction that overlap with Bitter Creek and Bitter Creek tributary habitat, site-specific habitat (i.e., habitat unit composition, bed substrates, depth, velocity, etc.) and fish use (i.e., species, life history stage) data for the areas proposed for alteration/loss so that potential project related effects can be fully understood.

b) A summary of the areas of fish habitat, including riparian habitats, which would be altered through the different components of road construction.

c) An assessment of the impacts to fish and fish habitat based on the construction of the transmission line, including changes to surface water quality and riparian habitat losses.

d) d) Mitigation measures that would be applied during the construction of the transmission line to avoid impacts to fish and fish habitat.

e) An assessment of impacts to Bitter Creek fish and fish habitat from the construction of the TMF including mitigation measures to prevent seepage and flow changes from impacting Bitter Creek.

f) A rationale for not directly sampling the two watercourses that would be lost.

11.2 IDM Response to IR1-11

11.2.1 Access Road (Requests A and B)

The proposed Access Road for the Project follows Bitter Creek along its right bank for 14 kilometres (km) from Highway 37A to Bromley Humps, where the tailings management facility is proposed. Where possible, the Access Road will follow an existing right-of-way developed by LAC Minerals in 1994. In a few areas, the proposed Access Road encroaches on the Bitter

Creek channel. The primary area of impact on Bitter Creek is between road station 4+550 m to 4+840 m, approximately 6.3 km upstream from the Bear River, along a sinuous meander of the creek. A channel realignment and rip rap placement within the high-water mark is required for road construction through this section of the creek.

The Access Road crosses 64 unnamed right bank tributaries of Bitter Creek as well as 5 named tributary creeks: Lim Creek, Radio Creek, Roosevelt Creek, Cambria Creek, and Hartley Gulch. There will be no instream fish habitat loss at watercourse crossings along the Access Road because only two crossings, Roosevelt Creek and Hartley Gulch, are fish-bearing, and these two crossings will use clear span bridges.

There is potential for fish habitat loss where infilling for the Access Road is required within the Bitter Creek channel. The proposed road alignment along the north/northeast bank of Bitter Creek follows an abandoned existing road at the toe of steep hillside on the north side of Bitter Creek. To avoid destabilizing sensitive slopes and putting road users and workers in an unsafe position, portions of the access road will encroach on the Bitter Creek channel.

A further 13 km of new road (referred to as the Haul Road) is also proposed to connect Bromley Humps to the Mine Site, located at the upper elevations of Red Mountain (1950 masl). The Haul Road will not interact with Bitter Creek. The proposed new Haul Road from the Process Plant to the Mine Site crosses 47 unnamed watercourses and two named creeks: Otter Creek and Rio Blanco Creek. All crossings would occur above non-fish bearing watercourses. The haul road is not discussed further as it will not impact fish habitat.

PECG submitted a review package (the proposal) to Fisheries and Oceans Canada (DFO), on behalf of IDM, for construction of the Project's Access Road in the Bitter Creek valley, on September 18, 2017. DFO requested additional information from IDM to complete their review on November 10 and November 20, which was provided to DFO. The proposal to DFO contained a complete review form (including a description of proposed works for construction of the Access Road, description of the aquatic habitat, potential effects, mitigation measures, and residual effects), design drawings, a map showing the road crossings and areas of interference with Bitter Creek, photographs, and quantification of habitat areas that will be lost or altered.

To fulfill the request for detailed maps showing areas of road construction overlap with Bitter Creek and Bitter Creek tributary habitat, please see the hydrotechnical drawings for the road construction prepared by OnSite Engineering in Appendix IR1-11-B.

The hydrotechnical drawings show the road alignment (proposed road edge and centreline), cut/fill slope, and riprap infill areas relative to the Q2, Q10, and Q200 high water level, as well as the present water level.

As mentioned above, the Access Road crosses 64 unnamed right bank tributaries of Bitter Creek and 5 named tributaries. In May 2017, 21 watercourse crossings with a mapped gradient of less than 20% were field surveyed and confirmed as non-fish-bearing based on steep gradients, lack of a visible channel or channel length < 100 m (non-classified drainage), or having no connection to Bitter Creek. Please see IDM's response to IR01-09 for additional detail from this field program. Culverts will be installed (or replaced at some crossings where the original culvert is still in place) at non-fish-bearing crossings, except for one location (Radio Creek) where a modified ford is proposed.

The road alignment has been located to avoid fish habitat where possible and follow a historical road. However, the steep terrain within the Bitter Creek watershed has resulted in 8 specific locations where infilling within the annual high-water mark cannot be avoided. At the largest of the infill areas (road station 4+550 m to 4+840 m), a minor channel realignment of Bitter Creek is proposed. 174 m of the channel will be realigned following placement of rip-rap along the right and left banks. This number (174 m) has been refined since the Application submission. The purpose of the channel realignment is to protect the road and the adjacent existing ravelling slopes from scour while maintaining the channel cross section and stream velocities at all flow levels. The realignment work will be completed away from current stream flows by staging the construction from left to right banks. The remainder of the infill areas are mostly bank protection works and the creek will naturally flow along the rock works.

The site of the proposed Bitter Creek channel realignment (road station 4+550 m to 4+840 m) is approximately 6.3 km upstream from the Bear River along a sinuous meander of the creek. Fish habitat at the site was assessed by PECG in May 2017 and during subsequent visits in October and November 2017. There is an island mid-stream at this location, and the majority of the flow passes on river left (looking upstream) (Appendix IR1-11-A, photos 1 and 3). During high flows, this is less pronounced (Appendix IR1-11-A, photo 2). Habitat in the main thalwag is primarily deeper run habitat, with some shallower, slow-water habitat along the margins (Appendix IR1-11-A, photo 4). The side channel on river right (looking upstream) is generally shallower compared to the main channel, and consists primarily of riffle/run habitat (Appendix IR1-11-A, photos 5, 6, and 7). Substrate within the channel was cobble dominant with approximately equal amounts of gravel and boulder. During field visits in October and November 2017, it appeared that some of the gravel observed within the side channel in May had been washed out during high flows, such that the side channel was dominated by larger substrate in October/November. The channel slope ranges from 0.1% up to 6%, with Q2 flow velocity ranging between 2-3 m/s. Riparian vegetation on both banks is coniferous forest.

Dolly Varden are the only fish species which occur in Bitter Creek. Baseline fish sampling (electrofishing, 2,291 seconds, 3, 000 m^2 area) at a site approximately 1 km downstream from the realignment location, in late August 2014, captured ten Dolly Varden (average fork length = 126 mm, maximum fork length = 188 mm, minimum fork length = 80 mm). Fish aging conducted on Dolly Varden aging structures sampled in August 2014 from sites within Bitter Creek, including one site referred to above, found fish age (n=32) ranged from 1+ to 4+, with the majority of fish being 2+ or 3+.

The habitat at the site (road station 4+550 m to 4+840 m) is commonly found throughout the Bitter Creek watershed. Fish use is likely limited to migration, and juvenile rearing within the slow-moving areas along the stream margins and in the side channel.

To further aid in the fulfillment of request (a), the following documents are also provided:

- Supplemental Photos for the Bitter Creek Hydrotechnical Assessment Study Area (Appendix IR1-11-C); and
- The Bitter Creek Hydrotechnical Assessment Report (Appendix IR1-11-D).

The Access Road right-of-way will be cleared, grubbed, and stripped prior to construction. Trees will be cleared to a distance 3 m upslope of the road prism. The road alignment has been located to avoid fish habitat where possible and follow the historical road. However, the steep terrain within the Bitter Creek watershed has resulted in 8 specific locations where infilling of the creek cannot be avoided. The road station range and area of road fill inside the annual high-water mark for each of the 8 infill areas is provided in Table 11-1.

Table 11-1: Areas of the proposed Access Road within the Bitter Creek Annual High-water Mark

Road Station Range	Planar Area of Road Fill inside High-water Mark* (m^2)
2+152m TO 2+271.2m	645
3+400m TO 3+485m	484
4+013m TO 4+174	797
4+175m TO 4+239m	299
4+243m TO 4+258m	12
4+262m TO 4+331m	120
4+550m TO 4+840m	3,190
5+054m TO 5+073m	86

* High water mark taken as the Q2 high water mark

Road construction will also require clearing and grubbing of the Bitter Creek riparian zone in some areas.

Disturbance to riparian areas will include earthworks, armouring, cut/fill slope, and road surface. Some areas can be re-vegetated but only to a maximum height in order to need to maintain sight lines and access for snow removal. The area of riparian habitat loss was estimated for the effects assessment as those areas at watercourse crossings and riparian areas along Bitter Creek that overlapped with the Access Road right-of-way. Riparian buffers of 15 m and 5 m were applied to fish-bearing and non-fish-bearing watercourses, respectively, and multiplied by the road right-of-way (25 m). Approximately 2.7 ha of riparian habitat will be disturbed adjacent to fish-bearing streams (e.g., earthworks, armouring, slope cut and fill, roadway surface, crossings); the majority of this occurs where the road right-of-way overlaps with the Bitter Creek riparian buffer zone. Riparian habitat disturbance at non-fish bearing crossings will be approximately 1.68 ha.

11.2.2 Transmission Line (Requests C and D)

The proposed Powerline for the Project will follow the Access Road alignment. The Access Road will include adequate drainage and cleared right-of-way space to accommodate the Powerline. The Access Road overall right-of-way is typically 25 m. In sections that encroach on Bitter Creek, the right-of-way is 10 m towards the creek and 15 m on the high side, for a total of 25 m. The additional 5 m on the high side will accommodate the Powerline running to the Mine Site. Accordingly, potential effects to fish and fish habitat from the Powerline are accounted for in the assessment of potential effects from the road (i.e., same right-of-way). Site-specific conditions may necessitate a wider right-of-way where cut and fill slopes extend beyond the typical right-of-way. In these locations, the right-of-way will increase 3 m beyond the typical toe of the fill or crest of the cut. This has been accounted for in the areas where cut and fill slopes encroach on fish habitat in Bitter Creek.

The road/powerline alignment has two sections: between the Highway 37A junction and Bromley Humps (Access Road) and between Bromley Humps and the Mine Site (Haul Road). As for the Haul Road, the powerline between Bromley Humps and the Mine Site is not expected to interact with Fish and Fish Habitat because it is not near any fish-bearing watercourse.

The potential effect of powerline construction on Surface Water Quality will be limited to an increase in total suspended solids (TSS) concentrations due to ground disturbance. This effect will be effectively mitigated by the mitigation measures proposed for changes in Surface Water Quality from road runoff and non-contact water run-off (which also apply to the powerline), provided in Volume 3, Chapter 13, Sections 13.6.1.3 and 13.6.1.4 of the Application/EIS, respectively.

The Powerline will span all watercourses that need to be crossed (i.e., no infrastructure will be located instream or in riparian areas). Some riparian habitat loss will be incurred where the road/powerline right-of-way overlaps with the riparian zone of Bitter Creek.

Approximately 2.7 ha of riparian habitat will be disturbed adjacent to fish-bearing streams (e.g., earthworks, armouring, slope cut and fill, roadway surface, crossings). The majority of this (and the portion associated with the powerline) occurs where the road/powerline right-of-way intersects with the Bitter Creek riparian buffer zone. Some of the disturbed riparian area will be re-vegetated post construction, although maintenance of a maximum canopy height will be necessary to maintain slight lines along the road. The road and powerline will be deactivated prior to the end of the Closure and Reclamation Phase using forestry practices, and therefore riparian vegetation will revert to near baseline conditions.

Mitigation measures proposed for changes in Surface Water Quality from road runoff and non-contact water run-off (which also apply to the powerline), are provided in Volume 3, Chapter 13, Sections 13.6.1.3 and 13.6.1.4 of the Application/EIS, respectively.

Riparian vegetation at or under the road/powerline right-of-way will be managed in accordance with Approved Work Practices for Managing Riparian Vegetation (BC Hydro *et al.*, 2003[1]). This will include:

- Retaining as much vegetation as possible within a 15 m-wide buffer around fish-bearing streams;
- Pruning or topping trees growing near the powerline cable, while leaving the stumps and root wads in place; and
- Re-vegetating disturbed areas with native species as soon as possible after disturbance.

11.2.3 Tailings Management Facility (Requests E and F)

The proposed Tailings Management Facility (TMF), along with the Process Plant and Water Treatment Plant, is in an area called Bromley Humps, near the lower reaches of Otter Creek (a right bank, non-fish bearing tributary of Bitter Creek), at about 500 metres above sea level (masl). The TMF has a footprint of 108,500 m^2.

Construction of the TMF has potential to interact with and lead to effects on Fish and Fish Habitat. The potential interactions between TMF construction activities and the Fish and Fish Habitat VCs are identified in Volume 3, Chapter 18, Table 18.5-1 of the Application/EIS. The potential effects identified are: direct mortality and habitat loss due to mine footprint development and associated infrastructure; and changes to water and sediment chemistry from erosion, sedimentation. and dust deposition.

TMF construction will not result in direct mortality and/or loss of fish habitat because the TMF footprint does not overlap with fish-bearing watercourses. Changes to water and sediment chemistry from erosion, sedimentation, and dust deposition are assessed in Volume 3, Chapter 18, Section 18.5.3 of the Application/EIS.

Regarding seepage and flow changes (assumed in Bitter Creek), these are not expected to occur from construction of the TMF. Non-contact water (including flow from the two unnamed tributaries) will be directed away from developed areas by means of diversion channels and routed to the natural catchment draining watercourses.

The two unnamed tributaries to Bitter Creek within the TMF footprint are small, non-fish bearing, headwater tributaries to Bitter Creek. An assessment of the larger of the two tributaries was conducted in May 2017, with the primary objective of determining fish-bearing

[1] BC Hydro. 2003. Approved Work Practices for Managing Riparian Vegetation. Available at: https://www.bchydro.com/content/dam/hydro/medialib/internet/documents/bctc_documents/work_practices_riparian.pdf *[Accessed January 2017]*

status, as the confluence of this tributary with Bitter Creek is downstream of the first of the fish barriers in Reach 5 of Bitter Creek. The results of the assessment, including the field memo, are provided in Appendix IR1-09-A. Although both tributaries are non-fish-bearing, aquatic habitat within these tributaries will be lost under or upstream of the TMF (i.e., effect is direct aquatic habitat loss). This effect was carried forward as a residual effect for the Aquatic Resources VC (Chapter 17) and was assessed based on the assumption that the tributaries support a benthic community (benthic invertebrates and periphyton). The residual effect was characterized based on available information on the two unnamed tributaries; namely that these are small, headwater streams with limited productive capacity given their small size and high elevation. The effect on Aquatic Resources from habitat loss in these tributaries will be localized and have no far-reaching effects on regional productivity or diversity.

12 IR1-12: GEOCHEMICAL CHARACTERIZATION

12.1 Agency Information Request IR1-12

Rationale: Section 6.1.2 of the EIS Guidelines sets out the requirement to provide "the geochemical characterization of expected mine material such as waste rock, ore, low grade ore, tailings, overburden and potential construction material in order to predict metal leaching and acid rock drainage". This information is required to inform the assessment of predicted changes to fish and fish habitat.

Figure 3-1 in Appendix 1-B provides the location of waste rock and ore samples. It is unclear from this figure whether the ABA sampling is spatially and geologically comprehensive, and as a result, whether conclusions are substantiated.

Requested Information:

a) Provide a map showing waste rock and ore sample locations overlaid with boundaries of mine workings, rock units, and types of alteration (geologic units, pyrite-pyrrhotite and sphalerite halos).

b) Describe the potential for ML/ARD in work areas where sampling was not conducted, and the assumptions with respect to ML/ARD potential of these areas made in the effects assessment. Further detail is required on the uncertainty associated with geochemical characterization as well as measures that would be taken to address and manage the uncertainty.

12.2 IDM Response to IR1-12

Please see the memo in Appendix IR1-12-A (Representativeness of WR Dataset) as IDM's comprehensive response to this information request.

13 IR1-13: EFFECTS OF AIR ENTRY ON ML/ARD

13.1 Agency Information Request IR1-13

Rationale: The EIS Guidelines (section 6.2.2) set out the requirement to provide "estimates of the potential for mined material to be sources of acid rock drainage or metal leaching." The Agency notes that, as temperatures increase, ice that occupies rock pores may melt and increase air entry into the underground. Waste rock and tailings have high sulphide concentration and, with significant air entry, only carbonate is likely to be capable of neutralizing sulphide oxidation in waste rock and tailings.

It is unclear whether the data from the field tests and monitoring of the legacy stockpiles may have accounted for the effects of increased temperatures and associated air entry to the underground.

Requested Information: Describe the potential changes to the rate of sulphide oxidation, depletion of neutralizing potential, and time to onset of net acidic weather conditions, and metal concentration in mine water drainage from increased temperatures and associated increased air entry to the underground.

Alternatively, describe how the existing analysis accounted for increased temperatures and associated air entry to the underground.

13.2 IDM Response to IR1-13

At closure, the underground mine will be flooded and all backfill below the 1,790 m elevation will be saturated, therefore not oxidizing. The closure source term for the underground, for backfill below the 1,790 m elevation, includes the flushing of soluble products from backfill. A total of 238,000 tonnes of unsaturated backfill would be above the 1,790 m elevation and subject to oxidation during the Closure and Reclamation Phase.

The source term for the underground backfill was based on leaching rates derived from lab data representing acidic conditions observed in some of the tests. As discussed in Section 2.3.3 of Appendix D of Volume 8, Appendix 14-C of the Application/EIS, SRK has applied a scaling factor to correct for temperature differences between the lab and site using the Arrhenius equation. For source term, a scaling factor of 0.3 was based on internal temperatures of 2 to 5°C in the underground mine.

In terms of air ingress into the mine, the humidity cell test method, and therefore leaching rates, includes aeration of the samples with air. Although some restriction of oxygen in the unsaturated part of the workings is expected, leaching rates were conservatively not adjusted (decreased) to account for a reduction in oxygen exposure within the underground mine.

14 IR1-14: CONTINGENCY MEASURES FOR ML/ARD

14.1 Agency Information Request IR1-14

Rationale: The EIS Guidelines state that "the EIS will describe safeguards that have been established to protect against [the occurrence of accidents and malfunctions] and the contingency and emergency response procedures in place if such events do occur."

In the event of an unanticipated temporary or permanent closure of the mine, or a delay in flooding the underground workings due to other circumstances, such as an extended mine life, contingency measures should be in place to ensure appropriate management of the TMF and waste rock.

Requested Information: Provide a description of contingency measures that would be considered to prevent significant sulphide oxidation due to unforeseen circumstances such as an unplanned permanent or temporary closure of the mine. These contingency measures should include explicit consideration of any time constraints that would be placed on tailings exposure.

14.2 IDM Response to IR1-14

Contingency measures for temporary closure have been identified in Chapter 5 (Closure and Reclamation) of the Application/EIS.

In order to prevent significant sulphide oxidation under temporary TMF closure circumstances, the supernatant pond will be managed so that approximately half of the tailings surface area would be covered by the pond. Lime would be slurried over the tailings beaches and/or to the supernatant pond to maintain neutral pH conditions. Furthermore, should changing water quality in the supernatant pond develop, the water treatment plant process can be modified to accommodate this through ongoing treatment (SRK, November 29, 2017; response to Action Item #2).

Contingency measures to prevent significant sulphide oxidation at the TMF under a scenario of unplanned permanent closure would simply be the implementation of the operationalized closure and reclamation plan. Per Volume 2, Chapter 5 of the Application/EIS, the tailings would be consolidated, primarily through the underdrains, with the supernatant pond pumped out and treated prior to release. The HDPE liner would be placed on the surface of the tailings, following by the soil and rock cover that would be graded east to west. A spillway would be constructed at Bromley Humps. No specific additional measures to prevent significant sulphide oxidation would be required under an unplanned permanent closure situation more than those defined in the closure and reclamation plan.

The underground workings under a temporary closure scenario could be allowed to partially flood to reduce any sulphide oxidation of the waste rock that had been used for structural backfill. If the length of the temporary closure was likely to be prolonged (i.e., years or decades), then the backfill of waste rock on surface would be considered to areas that would flood. Furthermore, interim bulkheads to assist in flooding low-head portions of the underground workings could be investigated. Contingency measures to prevent significant sulphide oxidation for an unplanned permanent closure scenario would involve backfill of waste rock that remains on surface, if any, prior to the installation of the hydrostatic plugs and subsequent flooding of the underground workings, much like the closure and reclamation plan for the planned conclusion of operations.

15 IR1-15: TMF CLOSURE OBJECTIVES

15.1 Agency Information Request IR1-15

Rationale: The EIS Guidelines state that "mitigation measures should be specific, achievable, measurable and verifiable, and described in a manner that avoids ambiguity in intent, interpretation, and implementation."

The TMF dramatically changes the pre-existing landform. The primary objective of closure and reclamation initiatives, as presented in Appendix 1-H, is to "return the TMF site to a self-sustaining condition with pre-mining usage and capability". Proposed closure mitigation measures include the use of a geomembrane to cover the tailings. Geomembrane covers are challenging to construct and eventually deteriorate.

Requested Information:

a) Conceptually, describe how the TMF design would prevent ponding on top of the geomembrane cover when the tailings consolidate;

b) Describe the source and availability of soil volumes required for the cover;

c) Provide information on the construction and life expectancy of the geomembrane cover;

d) Describe contingencies for achieving the critical function of the geomembrane should it deteriorate; and

e) Discuss the potential for air entry and oxidation of tailings during the post-closure phase, including whether monitoring of air entry is appropriate.

15.2 IDM Response to IR1-15

15.2.1 IDM Response to IR1-15(a)

The upper HDPE geomembrane liner will not be installed until after tailings consolidation is completed. One of the key functions of the underdrain system is to enhance consolidation of the tailings mass, both during operations and immediately following the cessation of tailings deposition. Should additional consolidation be required, other methods can be utilized, such as wick drains. After installation of the liner, the closure cover (a combined soil and rock cover) will be constructed on top of the liner, which will be graded towards a permanent closure spillway to facilitate the shedding of all precipitation and runoff and prevent ponding of water on surface. This cover will be encapsulated with a layer of topsoil from stockpiled material and revegetated in accordance with the approved Project revegetation strategy.

15.2.2 IDM Response to IR1-15(b)

Material for construction of the closure cover will be sourced from the identified soil and rock borrow locations (i.e., Topsoil Stockpile, Hartley Gulch Borrow Pit, Roosevelt Creek Borrow Pit, Gabbro Quarry). Approximately 35,000 m^3 of topsoil is anticipated to be salvaged during construction, of which 20,000 m^3 will be used as part of the TMF closure cover.

15.2.3 IDM Response to IR1-15(c)

The service life of an HDPE geomembrane liner is defined as its half-life (i.e., the point at which 50% of the geomembrane has degraded). Lining systems that have reached their half-life will still continue to function at a decreased level of performance.

Liner degradation is caused by oxidation, which is promoted by exposure to heat and UV radiation. The liners for the Bromley Humps TMF (top and bottom) will be covered by tailings (bottom) and fill materials (top) by the end of the mine life and within the closure timeframe, creating optimal conditions to maximize the service life of the geomembrane liners.

Average (monthly) field temperatures at the Project site are anticipated to range from -10°C to 10°C. The temperature variations that the lining system will be exposed to will be considerably less than this range due to the buried nature of the liners. The service life of the TMF liners (lower and upper) is therefore expected to be in excess of 400 years for ambient temperatures within this range.

For more information, please refer to Appendix IR1-15-A (TMF Closure Objectives).

15.2.4 IDM Response to IR1-15(d)

Although the industry standard for the service life of geomembrane liners is defined as the half-life, the geomembrane still exists and functions (although at a reduced performance level) beyond the 50% degradation point.

As referenced above, the service life of the TMF liners is expected to be in excess of 400 years for the upper and lower geomembrane liners at the Bromley Humps TMF.

Given the information presented above on the service life of HDPE liners and the covered nature of both liners, there are no plans to replace the HDPE geomembrane liners for the Bromley Humps TMF at any point during Operations, Closure, or Post-Closure.

For more information, please refer to Appendix IR1-15-A (TMF Closure Objectives).

15.2.5 IDM Response to IR1-15(e)

The monitoring program for the TMF is outlined in Section 29.22.6.2 of the Application/EIS and states that requirements for monitoring, inspection, and reporting on the TMF performance will follow CDA and BC Mines Health Safety and Reclamation Code guidelines for monitoring. The monitoring plan is further described in Section 30.5.3 of the Application/EIS.

One key objective of the closure cover selected for the TMF is to minimize water infiltration as well as create conditions to prevent oxidation of the underlying tailings. The HDPE liner, as well as the soil and rock cover, are intended to achieve this objective (see KP memo dated November 29, 2017, regarding examples of other projects and/or peer-reviewed research that have similar TMF closure plans applied in a similar ecological area, issued as a response to Action Item #1 from the November 21, 2017, Working Group Meeting). The generation of ML/ARD conditions and sulphidic oxidation will be monitored through performance monitoring of the TMF, which includes water quality and effluent monitoring downstream of the TMF. Evolving techniques exist to monitor infiltration of water and/or oxygen ingress (O'Kane, 2011). These techniques and others will be evaluated as part of the reclamation research programs during the operating life of the mine, which are a requirement of the *Mines Act* Permit for BC.

Reference:

O'Kane, M, 2011. State-of-the-art performance monitoring of cover systems – moving from point scale to macro scale approaches. Proceedings of the 7th Australian Workshop on Acid and Metalferrous Drainage, L.c. Bell and B. Braddock (eds). June 21-24, 2011. Darwin, NT, Australia.