Unit 103 – 4622 Greig Avenue, Terrace, British Columbia, Canada, V8G 1M9
Tel: 250.638.0998 **Email:** info@skeenawild.org **Web:** www.skeenawild.org

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Heather Noble
Project Assessment Director
Environmental Assessment Office
PO Box 9426 Stn Prov Govt
Victoria BC V8W 9V1
Heather.Noble@gov.bc.ca

Re: Technical Review of the Tenas Project Application for an Environmental Assessment Certificate

Please accept this submission to the Environmental Assessment Office of two technical reviews of the Tenas Project Application for an Environmental Assessment Certificate, conducted by SkeenaWild Conservation Trust.

The first was performed by Adrienne Berchtold, M.Sc., regarding Tenas Project effects to water quality, aquatic resources, and fish and fish habitat. The second was performed by Daphnee Tuzlak, M.Sc., P.Geo., regarding Tenas Project effects to groundwater, water quantity, disasters, and cumulative effects.

Sincerely,

Greg Knox
Executive Director
SkeenaWild Conservation Trust
gregk@skeenawild.org

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Technical Review #1

Overview

A third-party review of the Tenas Project (the Project) Application for an Environmental Assessment Certificate (the Application), submitted by Telkwa Coal Limited (the Proponent), was conducted by SkeenaWild Conservation Trust.

The primary aims of this review were to assess:

1. Has the Project has been designed to appropriately mitigate potential effects to the environment and the public? (Mine Design/Mitigation Planning)
2. Have residual Project effects been fully characterized and appropriately assessed by the Proponent? (Effects Assessment)
3. Will the Project result in impacts of concern relevant to the consideration of the Environmental Assessment Office (EAO) at this stage? (Impacts of Concern)

This portion of the review was prepared by Adrienne Berchtold, M.Sc., Ecologist, who has experience in marine and freshwater ecology, fish biology, and B.C. mining practices and policy. The focus of this portion of the review is on potential Project impacts to receiving streams and river systems, with a specific focus on the Surface Water Valued Component (VC) – Water Quality subcomponent (hereinafter referred to as the "Water Quality VC"), Aquatic Resources VC, and Fish and Fish Habitat VC. A few additional comments are made regarding Project waste management design and risks of dam failure, as they relate to risks to the aquatic environment and local residents.

Sections of the Application reviewed for the purposes of this review (available from the Environmental Assessment Office Project Information Center, EPIC) include:

- 0.0 Application Summary
- 1.0 Project Overview
- 3.0 Assessment Methodology
- 4.3 Surface Water VC
- 4.5 Aquatic Resources VC
- 4.6 Fish and Fish Habitat
- Appendix 4.3-A Water and Load Balance Modeling Report
- Appendix 13.5-C Aluminum SPO Memo
- Appendix 13.5-D Cadmium SPO Memo
- Appendix 13.5-E Cobalt SPO Memo
- Appendix 13.5-F Nitrite SPO Memo
- Appendix 13.5-G Selenium SPO Memo
- Appendix 13.5-H Thallium SPO Memo
- Appendix 13.5-I Sulphate SPO Memo

The findings from this review highlight that the Proponent has not appropriately planned for the mitigation of Project effects (including not following British Columbia Ministry of Environment Technical Guidance), has inadequately quantified, characterized, and assessed several potential Project effects, and has proposed a Project that will result in significant impacts of concern to the Water Quality, Aquatic Resources, and Fish and Fish Habitat VCs.

Key findings supporting this conclusion include:

- Insufficient baseline sampling for water quality, aquatic resources, and fish and fish habitat has been performed by the Proponent to characterize long-term and seasonal variability, and to fully capture possible Project effect pathways. This has resulted in ineffective characterization, and likely underestimation, of Project effects. This is particularly true for Fish and Fish Habitat, where important sampling was only performed during an unusually dry year and was not replicated, and where inadequate site selection and replication has resulted in remaining about use of Project-affected areas by species such as bull trout, steelhead, and coho salmon.
- Both the effects assessments and cumulative effects assessments (CEAs) presented in the Application do not appropriately consider past anthropogenic impacts to the Project area, which then contributes to an underestimation of Project effects and their significance. This is particularly true for Water Quality and Fish and Fish Habitat, where clear pre-existing impacts are described in the Application, but simply incorporated into "Existing Conditions". In the case of cumulative effects, this approach is inconsistent with federal guidance on the performance of CEAs.
- The Project's waste management design includes a number of dams that experts suggest will ultimately fail, as they will be expected to remain on the landscape in perpetuity. The consequences of this failure are estimated to be Very High, including loss of human life and environmental and cultural damage that will be impractical to restore. These dam failures put local communities and environments at great risk, and should not be considered acceptable by the EAO.
- The Project's proposed use of Initial Dilution Zones (IDZs) and Science-Based Environmental Benchmarks (SBEBs) is inconsistent with BC Ministry of Environment (MOE) Technical Guidance, because additional options for Best Available Technology (BAT) are available but have not been implemented. The Proponent's development of SBEBs has also not followed BC MOE Technical Guidance, and contains a number of scientific limitations. Site Performance Objectives (SPOs) proposed for the Project area – which exceed BC Water Quality Guidelines (WQGs), often substantially – should not be accepted.
- The Project's water and load balance model underestimates groundwater attenuation rates, thereby creating substantial uncertainty regarding the timing and duration of water quality impacts. This underestimates the significance of water quality effects of the Project, the Project's contribution to cumulative effects, and creates uncertainty as to whether the Proponent will be able to appropriately monitor and mitigate these impacts.
- Values outside of natural baseline conditions can cause shifts in habitat, changes in biological communities, altered nutrient and metals cycling, or more severe impacts, and should not be disregarded in the Environmental Assessment (EA). Overall, the Application disregards Project effects that will arise from causing receiving environment conditions to deviate from natural

background variability. The Proponent should be doing more to maintain Project area conditions closer to background, and the assessment of both residual Project effects and the Project's contribution to cumulative effects should be made based on changes from background variability.

- The Application predicts that a number of constituents, including selenium, nitrite, dissolved cadmium, and sulphate, will become elevated over background conditions and over WQGs in receiving waters as a result of the Project. These effects may result in sublethal and lethal effects to aquatic life. These effects to water quality are significant and have been overlooked in the Application.
- In multiple cases, there inadequate assessment is provided – including key effect pathways disregarded and zero quantitative studies or detailed rationales offered – to support conclusions in the Application of a lack of residual Project effects. This is true for Aquatic Resources and Fish Health.
- There are multiple probable overlooked Project effects to Aquatic Resources. Permanent residual Project effects are predicted to water quality and quantity, and it is unreasonable to expect that these effects will not interact meaningfully with aquatic resources.
- Inadequate information has been collected, and inadequate effects assessment performed, regarding Project effects to steelhead and bull trout. The Application certainly underestimates effects to steelhead, which could be significant at a population-level, and may be underestimating effects to bull trout as well (depending on their presence in the Project area).
- Effects to Fish and Fish Habitat likely to occur as a result of the Project include: extirpation of Dolly Varden from Four Creek, lost steelhead spawning habitat and winter steelhead kills resulting in a potential population sink, reduced prey availability for fish populations, and sublethal effects to fish (e.g., steelhead, bull trout) due to elevated contaminant concentrations in water and aquatic resources. These effects are significant and have been overlooked in the Application.
- The habitat offset project proposed in the Application is not sufficiently planned, does not currently account for all lost fish habitat productivity that will result from the Project, and, based on BC and Canadian trends, will likely fail. The proposed habitat offset should not be relied on to compensate for losses of Fish Habitat due to the Project.

Detailed review findings are provided below in sections according to each VC (i.e., Water Quality, Aquatic Resources, and Fish and Fish Habitat), with a "General" section at the beginning to address comments that are not specific to a particular VC. Comments are also divided into subsections as they relate to each of the key questions (Mine Design/Mitigation Planning, Effects Assessment, and Impacts of Concern) described above.

General Comments

Mine Design/Mitigation Planning

- A number of alternatives assessments are detailed for the Project design. The disturbance footprint of various options being considered is used to assess effects to the natural environment.

  - While disturbance footprint does act as an appropriate proxy for assessing effects to the environment in many ways, it is a general indicator and does not consider site-specific factors. The Project area is largely fish-bearing, including providing habitat for some important anadromous fish species. Proximity to fish and fish habitat should also be used by the Proponent as a measure by which to evaluate Project design options, including consideration for specific fish species that have high cultural, ecological, or economic significance.
  - Volume of waste generated is also an important predictor of mine effects to the environment, and would be a relevant consideration when evaluating many Project design options (e.g., mining method, processing method, etc.)
- The Proponent plans to breach a number of water storage ponds throughout the life of the mine, including sedimentation ponds and the Tenas Control Pond. Specific details of when and how these breaches will occur, and what rates at which discharge will enter the environment during breaches, are not clearly provided in the Application. The Tenas Control Pond will have a storage capacity of 850,000 m^3 and this water will have selenium concentrations of 0.017 mg/L at the time of the breach.
  - Breaches of storage ponds, especially the Tenas Control Pond, have the potential to cause significant short-term impacts to water quality, aquatic resources, and fish via erosion and sedimentation, and sudden increases to contaminant loadings in receiving creeks. These breaches are important events with respect to potential Project impacts, and the Proponent should provide more detailed planning and discussion of how these breaches will be managed to mitigate impacts.
  - At the time of the proposed Tenas Control Pond breach, selenium concentrations will be at their peak in the pond's water. Breaching the pond at this time, with no additional mitigations, such as water treatment, to reduce loadings to the receiving environment presents unnecessary risks and should not be accepted by the EAO.
- The Post-Closure period proposed for the Project is 25 years, including 10 years of active post-closure and 15 years of passive post-closure activities. The water and load balance model assumes a delay in seepage migration from waste management ponds to the receiving surface waters of 25 years, which the model authors acknowledge is an underestimate of actual groundwater attenuation rates at the Project. The model predicts that mine-affected seepage will continue discharging to creeks, and surface water quality effects from the mine will still be evident, past the year 2100. Waste management facilities will remain on the Project site indefinitely after closure.
  - The Proponent is not adequately planning for the Post-Closure period, and the proposed period of 25 years is too short. Because groundwater seepage will take longer to reach receiving creeks than modeled, the Proponent is proposing to end post-closure monitoring before water quality impacts will likely have even peaked. Even under the model assumptions, some constituent concentrations in receiving areas are still at their peak when the proposed post-closure period ends. This is not an appropriate time for the Proponent to propose relinquishing responsibility of the Project.
  - The presence of waste facilities, containing potentially acid-generating (PAG) waste, with earth and rock dams on site presents a perpetual risk that the Proponent should be held responsible for managing in the Post-Closure period.

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Effects Assessment

- The Application establishes current conditions of water quality, aquatic resources, and fish and fish habitat in the project area, based on baseline sampling. This baseline sampling is used to identify, among other things, the range of natural variability in various water quality and sediment quality parameters, benthic invertebrate community structure and abundance, fish habitat structure and quality, and fish species presence and composition, to compare predicted mine effects with and to determine the significance of those effects. Baseline sampling data will also be used to inform future monitoring for Project-related effects. In general, the Application states that baseline sampling was performed from 2017-2019, with some additional fish sampling in 2020.
    - Monitoring for ecological trends and to establish the full range of natural variability in indicators such as stream flow and water quality concentrations (which then interact with aquatic resources and fish) can often require as many as ten years. Though this length of time is unreasonable to expect of mine proponents, many experts agree that 3-5 years of monthly baseline sampling should be performed to inform project Environmental Assessments (EAs). While the general timeframe of 2017-2020 meets this requirement, most baseline parameters and sites were not actually sampled by the Proponent in all years or on a monthly, nor even seasonal, basis throughout the years. Thus, the baseline dataset collected by the Proponent likely does not reflect true background conditions and seasonal variability in the Project area.
    - At a large number of baseline monitoring sites, complementary water, aquatic resource, and fish and fish habitat data were not collected. Obtaining data for all indicators from the same sites is advisable to understand and assess effect pathways, to quantify predicted effects, and to perform Before-After-Control-Impact (BACI) design monitoring studies to quantify actual Project effects. The lack of these complementary datasets compromises both the Project's EA and the Proponent's future ability to monitor and manage aquatic impacts.
- For Water Quality, Aquatic Resources and Fish and Fish Habitat VCs, the Proponent presents a Cumulative Effects Assessment (CEA). All Project effects the Proponent has deemed residual for each VC are carried forward to the CEA, and are evaluated in the context of any ongoing or reasonably foreseeable future projects that could interact with those effects. The Application states that existing environmental effects of past and existing activities are captured in the Project's baseline conditions. In all cases, the Proponent concludes that the Project will not contribute to cumulative effects.
    - Deviations from the natural background range represent degradations to the local environment that will contribute to cumulative effects. These effects are not considered residual by the Proponent, resulting in an underestimate of the Project's potential to contribute to cumulative effects.
    - Some mitigation measures implemented by the Proponent will take time to take effect. These delays should be considered in the CEA.
    - Many drainages affected by the Project are moderately to highly impacted already, including anthropogenic disturbances to flows, water quality, fish assemblage, and fish habitat. By considering these past disturbances as baseline conditions from which to measure cumulative effects, the Proponent has undermined the purpose of cumulative

effects assessment, which is to assess the incremental, combined effects on VCs of "[human] actions that **have occurred**, exist, or may yet occur which may also affect those same VCs"[1] [emphasis added]. Historical data should be used to assess actual natural background conditions for the Project area, and effects of past disturbances should be considered in the CEA as sources of impact along with ongoing and reasonably foreseeable future activities.

Impacts of Concern

- The proposed Project includes three permanent waste management ponds, containing PAG waste and water, retained by earth and rock dams. Foundation analysis has identified weaker foundation zones and the risk of liquefaction at some waste management ponds. However, alternatives assessments performed by the Proponent concluded that water cover storage of PAG materials in the pond locations proposed is the best option for the Project. Another large water management pond (the Tenas Control Pond), also retained by an earth and rock dam, is proposed that will exist during Operations but be breached during Post-Closure. Other mine infrastructure, including PAG coal and waste stockpiles, hydrocarbon and hazardous material storage, explosive storage, mine workers, and sedimentation ponds, will be located in the vicinity of these management ponds. The waste management ponds proposed by the Proponent are structurally and functionally equivalent to tailings storage facilities (TSFs), and are considered as such by the Proponent in the Application. All pond dams have been rated as Very High consequence, indicating potential for loss of human life and environmental and/or cultural damage that would be impractical to restore in the event of a dam failure.[2]
    - Waste storage dams that are required to remain on the landscape in perpetuity, as the Proponent is proposing, require ongoing inspection, maintenance, and monitoring to prevent failure. Because this level of oversight is not feasible over a perpetual time frame, experts argue that dam failure should be considered inevitable over the long-term and that *consequence* is the only component of risk that matters (as opposed to likelihood and consequence).[3] Thus, the Project includes at least three separate facilities that are guaranteed to fail at some point, with Very High consequences when they do. The timing of failure may also be even sooner than expected at ponds where foundation materials have been identified as weak or at risk of liquefaction. This guaranteed dam failure puts local communities and environments at great risk, and should not be considered acceptable by the EAO.

[1] Hegmann, G. et al. 1999. Cumulative Effects Assessment Practitioner's Guide. Prepared for the Canadian Environmental Assessment Agency. https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/cumulative-effects-assessment-practitioners-guide.html

[2] Ministry of Forests, Lands, and Natural Resource Operations. 2017. Downstream Consequence of Failure Classification Interpretation Guideline. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/dam-safety/con_class_guidelines_for_owners-2017.pdf

[3] Vick, S.G. 2014a. The use and abuse of risk analysis: PowerPoint presentation at Tailings and Mine Waste Conference 2014, 17 slides.
Vick, S.G. 2014b. The use and abuse of risk analysis: In Tailings and Mine Waste '14 Proceedings of the 18th International Conference on Tailings and Mine Waste, Keystone, Colorado, USA, October 5 – 8, 2014, pp. 49-56. Available online at: https://tailingsandminewaste.com/wp-content/uploads/TMW2014_proceedings.pdf
Oboni, F. and Oboni, C. 2020. Tailings dam management for the twenty-first century—What mining companies need to know and do to thrive in our complex world: Springer Nature Switzerland, 278 p.

- Impacts of a dam failure – which will be impractical or impossible to restore, based on the dams' Very High consequence rating – are likely to include physical destruction of habitat and killing of aquatic life in the floodpath (which is likely to be Four Creek, Goathorn Creek, and Telkwa River); a large sedimentation event in Bulkley River that would destroy spawning grounds; exposure of PAG materials and resulting production of ARD into the environment; mobilization of hazardous materials, hydrocarbons, and explosives into the receiving environment; and killing of up to 100 people (based on the Very High consequence rating), and "affecting" up to 200 people, including local residents (based on the Application, Appendix 1.0-AA Dam Breach Analysis). Though some of these effects could be mitigated now, such as by adjusting the location of mine infrastructure so it is not in the dam breach flood path, the Proponent has indicated that many aspects of their waste management design – therefore, many of the impacts described here – are considered the best possible option. Again, these are unacceptable impacts that should not be considered acceptable by the EAO.

Water Quality

Mine Design/Mitigation Planning

- Groundwater seepage from the Project's waste management ponds is a primary driver of predicted mine-related changes to surface water quality in the receiving environment. The use of pond liners is proposed as a mitigation measure.
  - The water and load balance model assumes a much faster rate of groundwater seepage than will actually be the case, so there is a high degree of uncertainty regarding how long pond liners will need to be functional to appropriately mitigate seepage. Liners may well be required for much longer than the liner lifespan provided in the Application of 50 years. An alternatives assessment should be performed to assess pond liner options, including increased liner thickness and/or alternate liner materials. This assessment should not be based on groundwater seepage rates assumed in the water and load balance model, as these are not reflective of true conditions.
  - The Proponent's contingency plan in the event of liner failure would require removing PAG waste and draining the ponds in order to repair, thicken, or replace liners. This is not realistic, and creates unacceptable risks from exposing PAG materials and possibly discharging large volumes of wastewater to the receiving environment in order to drain the ponds. A more appropriate contingency plan needs to be developed for potential liner failure.
- The Application predicts residual effects to surface water quality, including elevations of constituents over current conditions and BC Water Quality Guidelines for the protection of aquatic life (hereinafter referred to simply as "WQGs") in multiple creeks surrounding the mine. The Application predicts these effects will primarily occur post-closure, and will reach their peak and begin reversing before the year 2100; however, this time frame is based on highly overestimated seepage migration rates. The only structural mitigations proposed in the Application for water quality effects are pond liners and settling of solid materials prior to

discharge. Discharges from Goathorn Creek will also be controlled by the Proponent to mitigate water quality effects.

- Additional water treatment, particularly for removal of selenium and for dissolved metal species, needs to be considered in order to reduce the mine's effects on water quality downstream. There are many options available – and in commercial use at other coal mines in BC – that align with BC's definition of Best Achievable Technology (BAT). According to BC Ministry of Environment and Climate Change (MOE) guidance, these technologies should thus be implemented before the Proponent can propose the use of Initial Dilution Zones (IDZs),[4] or Science-Based Environmental Benchmarks (SBEBs) for the purpose of establishing Site Performance Objectives.[5]
- Seepage capture interception measures should also be considered to mitigate downstream water quality effects. Again, these measures are available and already implemented at many other mines in BC.
- Implementation of additional mitigation measures now, prior to permitting, is especially important given the long delay anticipated before mine effects to surface water quality will reach the receiving environment. Appropriate mitigations will be difficult, if not impossible, to implement if the Proponent waits for effects to be identified first.
- Seepage management and water treatment measures should be planned and implemented in a manner that does not exacerbate impacts to water quantity, the reductions of which due to the Project will be a primary driver of effects to fish and fish habitat.
- The Proponent's plan to control discharges to Goathorn Creek once it is recognized that discharge or receiving water concentrations are elevated is reactive, will not eliminate short-term discharges with high concentrations, and will not be effective during Post-Closure or when high flows result in discharge occurring via spillway. Overall, this approach does not represent an adequate mitigation strategy, and additional mitigations are needed.

- The Application proposes the use of Site Performance Objectives (SPOs) where receiving water quality is expected to exceed BC and/or Canadian Council of Ministers of the Environment WQGs. These SPOs are based on SBEBs developed for the Project area. SPOs are proposed for seven constituents, including selenium, cadmium, nitrite, and sulphate. In the vast majority of cases, the proposed SPO is multiple times greater than that constituent's WQG and even further above background concentrations in the affected watercourses – which, for some constituents, are currently at or below detection limits.
  - The use of SBEBs/SPOs without first implementing BAT is inappropriate, contradicts BC MOE Technical Guidance,[5] and should not be accepted by the EAO.

[4] Ministry of Environment and Climate Change. 2019. Technical Guidance 11. Development and Use of Initial Dilution Zones in Effluent Discharge Authorizations. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/dam-safety/con_class_guidelines_for_owners-2017.pdf

[5] Ministry of Environment and Climate Change. 2016. Technical Guidance 8. A Framework for the Development and Use of Freshwater Science-Based Environmental Benchmarks for Aquatic Life in *Environmental Management Act* Permitting for Mines. https://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/mining-smelt-energy/guidance-documents/tg8_framework_for_sbebs.pdf

- If there were to be SBEBs/SPOs derived for the Project, there are numerous ways in which with those currently proposed do not meet the requirements contained in BC's Technical Guidance document related to SBEBs[5] and, therefore, should not be accepted:
  - Site-specific lines of evidence are not provided to support the proposed SBEBs (with the exception of nitrite)
  - Uncertainty factors are not applied to any proposed SBEBs, and there is no rationale provided for why not
  - Inadequate baseline sampling in the Project area has been performed on water quality, sediment quality and biota for most sensitive species and life stage to support SBEB/SPO development (see comments below)
  - In multiple cases, the SBEB is developed according to other toxicity-modifying factors in the water based on the projected water quality resulting from the mine. Essentially, the Proponent uses the fact that mine seepage and discharges will degrade surrounding water to then rationalize SPOs that are well above background conditions and WQGs. This does not align with BC's guidance, which specifies that toxicity-modifying factors considered in SBEB development should be *natural background* conditions (i.e., without anthropogenic influence). This issue applies to the aluminum and sulphate SPOs (which are calculated relative to mine-affected hardness), and to the selenium Tier 2 SPO (which is calculated according to mine-affected sulphate concentrations).
  - In multiple cases, the SBEB is derived based on assumed receiving water conditions that are higher than what has been observed in some mine-affected reaches, and in the upper bounds of what has been observed in others. This is a problem because these conditions – specifically, hardness and chloride – are incorporated as a toxicity-modifying factors that result in increased SBEB/SPO estimates. This issue applies to the cobalt (hardness-dependent) and nitrite (hardness- and chloride-dependent) SPOs.
- Additional issues with the proposed selenium SBEB/SPO include:
  - There is no appropriate rationale provided for the use of an SPO, because:
    - The SBEB memo only cites one relevant peer-reviewed paper published since the last selenium WQG update, and it is a paper written by the same authors as the SBEB memo; no additional scientific, peer-reviewed support is provided.
    - There are no site-specific characteristics described that would make a site-specific assessment more appropriate than the WQG for the Project area. (The only rationale provided is that the receiving waters in question are lentic environments, which is not a unique aspect to the Project site, and applies to many other environments in which the selenium WQG is applied throughout BC.)
  - The water quality, invertebrate toxicity, and fish toxicity data used to support the selenium SBEB model are taken from other sites in BC and Alberta (which may have different relevant environmental characteristics than the Project site) and the datasets are not co-located. Additionally, the model proposed would be impossible to apply based on site-specific data for the Project, as the Proponent has not collected invertebrate tissue samples in baseline sampling.

        - The model does not incorporate particulate matter, which can be an important pathway for selenium bioaccumulation
        - The model does not consider exposure concentration partitioning (i.e., the potential for other forms of selenium to be present in the environment). This is a very risky oversight, as other forms of selenium can be much more toxic to aquatic life
        - The data presented demonstrate an extremely steep concentration-response relationship for selenium in rainbow trout eggs (i.e., an EC10 of 24.5 ug/g dw to a EC50 of 27.4 ug/g dw)[6]; this should have motivated the use of an uncertainty factor or other methods of conservatism in developing the SBEB/SPO.
    - Additional issues with the sulphate SPO include:
        - There is no appropriate rationale provided for the use of an SPO, because:
            - No new peer-reviewed scientific literature is provided beyond the date of the last sulphate WQG update to support the use of an SBEB
            - No site-specific characteristics are described that would make a site-specific assessment more appropriate than the WQG in the Project area. (The only rationale provided is based on *mine-affected* elevations in hardness levels acting as a toxicity-modifying factor, which is not appropriate according to BC guidance.)
        - The proposed SPO is developed from a model that uses EC20 as the effect threshold, which is less conservative than BC's approach to developing WQGs (which is typically to use either the EC10 or the Lowest Observed Effect Concentration)
        - The proposed SPO is derived using a model based on toxicity tests that were primarily performed under water hardness conditions that are much higher than natural background (or even modeled mine-affected hardness) in the Project area, which likely has resulted in the SBEB/SPO being overestimated
- The Application proposes wastewater discharge targets of 35 mg/L Total Suspended Solids (TSS) from sedimentation ponds. Additional mitigations are not planned unless discharge exceeds 50 mg/L TSS. With the exception of freshet conditions, 35 mg/L is well above natural background TSS concentrations in the Project area. Even during freshet, 50 mg/L is above natural background variability for most of the Project area. It is not clear whether these discharge thresholds have been calculated based on in-stream conditions or objectives for receiving watercourses.
    - Quantifiable in-stream objectives should be based on the range of natural variability and include targets to maintain conditions at or below the existing natural range. Discharge targets should then be calculated that will maintain in-stream conditions within the natural range.
- The Application proposes wastewater discharge targets of 18.8 mg/L nitrate and 0.05 mg/L selenium in Project discharges to an unnamed tributary on Goathorn Creek and to the Bulkley River. The nearest downstream prediction node/monitoring location on Goathorn Creek,

[6] ECx is the effect concentration at which x% toxicity occurs, so EC10 is the concentration at which 10% of the exposed population experiences toxicity effects and EC50 is the concentration at which 50% of the exposed population experiences toxicity effects.

WQS06, appears to be ~3 km from the point of confluence with the unnamed tributary, which is another 1.6 km from the point of effluent discharge. These discharge concentrations are over 100 and 500 times the maximum concentrations observed at WQS06 for nitrate and selenium, respectively. These discharge concentrations also exceed proposed Canada Coal Mining Effluent Regulations (CMER). The Application states that discharge targets have been calculated to achieve in-stream objectives of 0.008 mg/L selenium (the proposed Tier 1 SPO) and 3 mg/L nitrate (the BC WQG) in Goathorn Creek.

- The distance of nearly 5 km between the point of effluent discharge to the nearest prediction node/monitoring site on Goathorn Creek, on which in-stream objectives and discharge targets have been based, is unusually far. This poses risks to aquatic life exposed to elevated effluent concentrations in Goathorn Creek and its tributary upstream of WQS06. An appropriate near-field site needs to be chosen for Goathorn Creek, and in-stream and discharge objectives determined for that site. Even selecting the point of confluence between the tributary and Goathorn Creek as the in-stream objective site would allow the Proponent an IDZ of 1.6 km, which is significantly larger than the 100 m IDZ length recommended by BC Technical Guidance[4].
- Quantifiable in-stream objectives should be based on the range of natural variability and include targets to maintain conditions at or below the existing natural range. Discharge targets should then be calculated that will maintain in-stream conditions within the natural range.
- Barring the above recommendation to develop discharge targets that maintain receiving water quality within natural range, discharge targets should, at minimum, not exceed the proposed CMER requirements.
- Barring the above recommendation to develop discharge targets that maintain receiving water quality within natural range, the proposed selenium SPO is inappropriate and should not be accepted as a basis for determining Project discharge targets.

Effects Assessment

- In addition to the issues identified in the General Comments section regarding Project baseline sampling, there are issues specific to water quality baseline sampling:
  - There is no near-field impact site on Goathorn Creek near the point of Project discharge, which prevents accurate prediction of mine-related effects for the purposes of the EA and would prevent appropriate monitoring of surface discharge impacts in the future
  - Key impact and reference sites, including WQS03-DS on Four Creek (impact) and WQS13 and WQS06-US on Goathorn Creek (reference) were only sampled for two years, which does not meet the recommended 3-5 years
  - Even at sites that were sampled during all three years (2017-2019), key seasons were missed entirely in some years (e.g., winter low flows in 2017 and spring runoff in 2019). Again, this does not meet the recommended 3-5 years. This is especially important, given that predicted Project effects to surface water are seasonal in nature.
  - 5-in-30 measurements were only taken during freshet and autumn rains. These measurements need to be taken during summer and winter baseflow periods to capture true seasonal variability. Again, this is important given that predicted Project effects are seasonal in nature, and primarily occur during low flow periods.

- A water and load balance model is used to predict changes to surface water quality at prediction nodes/monitoring sites in the receiving environment to the year 2100 under the influence of the Project. This model provides the basis for predicted effects to water quality and significance determination of those effects in the EA. The model is calibrated and compared to natural background conditions. In order to fit within the bounds of climate model inputs, the rate of groundwater seepage from the mine site to the receiving environment in the model is accelerated over expected rates. A "project case" (i.e., expected case) and multiple "alternative cases" (i.e., cases where things do not go exactly as planned) for the Project are modeled.
    - Insufficient baseline sampling for water quality has taken place for the Project to support predictions of long-term trends. There are limitations both in terms of sites chosen and frequency of sampling (see above comments). As a result, the model is calibrated with, and its results screened against, a baseline dataset that likely does not reflect true long-term variability in the Project area.
    - Some key prediction nodes are unusually far from the point of mine impacts. In particular, the model predicts impacts to water quality on Goathorn Creek ~3 km from the confluence with its tributary, and nearly 5 km from the point of mine discharge to that tributary. Typically, mine impact predictions include a near-field site that is within hundreds of metres from the point of impact, not thousands. This needs to be rectified, as allowing such a great distance between point of impact and predicted effects results in artificially reduced impacts predictions, thereby feeding into reduced significance determinations for the Water Quality VC. While not as extreme, this is also an issue on Telkwa River, where the prediction node is a full km from the confluence with Goathorn Creek.
    - It is not clearly stated in the model that mine-impacted inputs from adjoining creeks are integrated into model predictions for receiving creeks. This is important because elevated contaminant concentrations in one creek will be carried forward to the next both by accumulating loadings and reducing dilution capacity down the system. For example, it is not clear that predicted mine-affected water quality in Four and Tenas Creeks – which let out into Goathorn Creek – is then integrated into modeled Goathorn Creek water quality. The model states "The in-stream water quality is calculated based on mixing of Project discharge with background loading estimated from baseline monitoring" (Appendix 4.3-A pg. xi). If water quality has simply been modeled for each watercourse based on mixing with baseline water quality, this does not reflect conditions that will actually occur as a result of the Project, and water quality effects have been underestimated.
    - Similarly, it is not clearly stated in the model that mine-affected hydrology is integrated into water quality predictions. This is important because the primary impacts of the Project will be to reduce flows, which reduces dilution capacity. Again, if water quality has simply been modeled for each watercourse based on mixing with baseline water quantity, this does not reflect conditions that will actually occur as a result of the Project, and water quality effects have been underestimated.
    - Accelerating seepage rates in the model results in overconfidence regarding the timing and extent of water quality impacts from the Project, and regarding the Proponent's ability to adequately monitor and manage these impacts.

Building a global model

- Accelerating seepage rates in the model results in false statements in the Application that surface water concentrations in the receiving environment will have reduced below WQGs and SPOs by 2100; these inaccuracies then feed into inaccurate statements regarding the duration and reversibility of impacts for the Water Quality VC significance determination. Because groundwater seepage will have longer attenuation rates than modeled, the prediction that all water quality exceedances will have returned below WQGs by the year 2100 is very unlikely to be true. The long-term water quality model projections therefore cannot be relied on, and water quality effects from the Project cannot be confidently assumed to be short-term or reversible, as the Application suggests in the Water Quality VC significance determination.
- Mine projects do not go as planned. There are inevitably deviations from the expected case regarding source terms, weather, groundwater behaviour, etc. Thus, it is unrealistic to refer to the "project case" as the "expected case"; the results of "alternative cases" should be more heavily relied on in terms of predicting potential residual effects and determining the significance of those effects. Additionally, it is realistic that more than one aspect may deviate from expected; therefore, alternative cases should be evaluated for these aspects in combination (e.g., higher geochemical source terms + higher seepage rates, higher source terms + consecutive wet or dry years, etc.)
- Other issues with the water and load balance model include:
  - Explosives-related sedimentation ponds are not considered in the model; thus, deposits of nitrogen-based species to the receiving environment will be greater than modeled
  - Parameters such as temperature, pH, and TSS are not very thoroughly assessed for the "project case", and effects to these parameters are not discussed at all for "alternative" model cases
  - It is unclear how well – if at all – climate change is incorporated into the 100-year wet and dry year model inputs. This is important, as temperature and precipitation regimes will continue to change and/or become more extreme, and inputs for extreme periods based on historical records alone are insufficient.
  - Water quality predictions are screened against a WQG for total copper that is three years out-of-date. Results should instead be screened against the dissolved copper WQG using the full Biotic Ligand Model published in 2019.[7]

- In the Application, predicted surface water concentrations in the Project area are screened against WQGs and proposed SPOs, in the context of natural background variability. Residual effects are identified and carried forward to a significance determination when predicted concentrations exceed SPOs (or WQGs if SPOs are not proposed) while also exceeding the range of natural background variability. Residual effects to water quality are considered "Significant" if they are of High Magnitude, Regional or Greater in Extent, and Long-term Duration. The Proponents acknowledge that past activities, including mining and drilling at the Project site, have previously impacted water quality in the receiving area.

[7] Ministry of Environment and Climate Change. 2019. Copper Water Quality Guideline for the Protection of Aquatic Life Technical Report. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/copper/bc_copper_wqg_aquatic_life_technical_report.pdf

- Proposed SPOs for the Project are inappropriate and should not be considered effect thresholds in the EA. The residual effects assessment and significance determination should be revised based on background water quality and WQGs alone.
- Values outside of natural baseline conditions can cause shifts in habitat, changes in biological communities, altered nutrient and metals cycling, or more severe impacts, and should not be disregarded in the EA. Predicted changes to water quality due to the Project should be screened against natural background variability, and changes from background should be considered a residual effect, regardless of whether changes result in exceedances of WQGs.
- Past anthropogenic influences are not meaningfully incorporated into the Water Quality effects assessment. Current conditions are assumed to be "natural" background for the purposes of effect assessment, when in fact, true natural background variability is likely lower for some parameters. Appropriately incorporating past anthropogenic influences into the effects assessment is required in order to accurately assess the level of stress the receiving environment will experience as a result of the Project.
- Evaluating water quality effects against WQGs and SPOs, within the context of the Regional Study Area (RSA), and requiring effects to be Regional or Greater to be considered "Significant", does not reflect the importance of local water quality to local communities and First Nations, including the fish populations they depend on. Characteristics of water quality effects of the Project should be evaluated relative to the Local Study Area (LSA), not the RSA only, and should consider changes from background water quality. For example, Magnitude should be rated according to the degree of change and/or the proportion of area affected in the LSA by changes from baseline concentrations.

- In addition to the issues identified in the General Comments section regarding the Project CEA, there are issues specific to the Water Quality CEA:
  - The CEA for water quality does not consider the fact that delays to groundwater seepage migration have been underestimated. Effects to water quality are likely to arise and persist later than the Proponent has predicted, and this creates considerable uncertainty regarding potential for the Project's contribution to cumulative effects.

Impacts of Concern

- A large number of constituents in surface water are predicted to rise above background levels due to the Project, and stay that way indefinitely. Among these constituents are selenium, cadmium, arsenic, lead, zinc, sulphate, and nitrogen-based species (ammonia, nitrite, and nitrate). Many of these will be elevated in the Telkwa River, in addition to the mine's smaller receiving creeks. Selenium and nitrite are modeled to nearly reach the WQG in winter months over the long-term in Tenas Creek. Additional parameters, such as water temperature, are not modeled in detail.
  - Values outside of natural baseline conditions result in some level of degradation. Many of the constituents that will become elevated due to the Project are known to cause sublethal and lethal effects to fish and other aquatic life. WQGs provide an *upper* bound for toxicity to sensitive species, are not perfect, and may at times not be adequately protective of aquatic life, particularly when additive or multiplicative effects of multiple

elevated contaminants in the are considered; therefore, sublethal and lethal effects to aquatic life may still occur in the Project area even if water quality does not exceed WQGs. Additionally, while water quality in the Project area is currently suitable for aquatic life, it has been previously impacted and already experiences WQG exceedances, so further degradation should be avoided. Deviations from background conditions in water quality caused by the Project will be effectively permanent (lasting hundreds of years), and there is significant uncertainty as to when these effects will occur, and whether the Proponent will still be managing the site by that time. Worsened water quality over background conditions is an impact of concern; the Proponent should do more to reduce these effects, and these effects should be considered in the EAO's current review of the Project.

  - Shifting water sources and changing seasonal proportions of groundwater contributions due to the Project will impact seasonal and spatial thermal regimes in the receiving environment. This is an effect that has not been fully characterized by the Proponent and should be considered in the EAO's current review of the Project.

- A number of constituents in surface water are predicted to exceed WQGs as a result of the Project, including selenium, nitrite, dissolved cadmium, and sulphate. In the case of selenium, mine-affected concentrations are modeled to be nearly 3x the WQG, and WQG exceedances will persist for at least 30-40 years. Pre-existing WQG exceedances in the Project area (e.g., of aluminum) may also be heightened or made more frequent by mine impacts.
  - Exposure to parameters above WQG criteria can have deleterious sublethal or lethal effects on aquatic life. The SPOs suggested by the Proponent to replace WQGs in receiving creeks are inappropriate; thus, it should be assumed that the mine will cause detrimental aquatic effects due to WQG exceedances. This will be of particular concern in fish spawning areas due to the sensitivity of fish eggs and larvae to metal contaminants, and of concern to all species and stages of life due to the extremely toxic nature of selenium in elevated quantities. Additionally, there is significant uncertainty as to when these effects will occur, how long they will last, and whether the Proponent will still be managing the site by that time. The Proponent should do more to reduce these effects now, and these effects should be considered in the EAO's current review of the Project.
- Alternative cases presented in the water and load balance model predict additional and/or worsened WQG exceedances of a wide variety of constituents (e.g., aluminum, copper, cadmium, selenium, zinc, sulphate, nitrite, and nitrate) due to the Project. The receiving area affected by these exceedances would be larger (including additional watercourses, like Goathorn Creek, and impacts further upstream on Tenas and Four Creeks), and the duration longer (e.g., exceedances occurring earlier in the mine life). There is little discussion provided in the Application regarding the potential for upset conditions and/or temporary shutdowns, or for mitigations not functioning as planned, and how these situations will be addressed.
  - The mine plan presented in the Application is generally an optimistic design, based on limited geochemical data, and with poorly developed contingency planning. Water quality modeling derived from this mine plan is thus similarly optimistic. At least some aspects of the alternative case models should be considered likely to be a reality, which will exacerbate sublethal and/or lethal effects to aquatic life as a result of the Project.

- Additionally, while the proposed SPOs are inappropriate, it is notable that the Proponent expects SPOs to be exceeded in the alternative cases. Given the lack of appropriate contingencies incorporated into the Project plans, the risk of SPO exceedances occurring in the receiving environment seems considerable.

- The Proponent will discharge surface water in to a tributary to Goathorn Creek. The Application does not characterize effects to immediate discharge receiving waters.
  - The nearest prediction node to discharge on Goathorn Creek is nearly 5 km from the point of discharge, and 3 km from the point of confluence with the discharge tributary. Near-field effects to water quality, which may then interact with aquatic life and fish, will undoubtedly occur in this stretch of Goathorn Creek that have not been considered. These effects are particularly concerning as they have the potential to interact with bull trout and steelhead populations.

Aquatic Resources

Effects Assessment

- In addition to the issues identified in the General Comments section regarding Project baseline sampling, there are issues specific to aquatic resource baseline sampling:
  - No aquatic plant, periphyton, or invertebrate tissue chemistry sampling was performed. Tissue chemistry in these indicators likely should have been considered in the EA given the potential for transfer of contaminants to fish via their prey, reduction in prey populations due to sublethal effects of mine-affected tissue chemistry, and – in particular – bioaccumulation of selenium. Plant and invertebrate chemistry baseline sampling would have been needed to properly assess these factors, and may prove to be an important component of monitoring for mine effects, but a proper BACI design will now be impossible to perform on these indicators.
  - A number of key sites for Project effect prediction and future monitoring were not sampled at all for sediment quality or other aquatic resource indicators. In particular, WQS06, which is the closest monitoring site to Project discharge and is already quite far from the point of impact, was not sampled. Other key sites missing from the baseline dataset include: WQS03 (Four Creek reference site), WQS13 (Goathorn reference site), and WQS11 (Bulkley River impact site).
  - Aquatic resource sampling was only performed once per year, and always during the same time of year, meaning that seasonal fluxes have not been assessed. Seasonal fluxes would be expected in some indicators, such as invertebrate community and abundance, or sediment chemistry. These are relevant for the EA because these seasonal fluxes may contribute to effects to fish or water quality and/or exacerbate the effects already identified in the Application.
  - At a number of key sites, aquatic resource sampling was only performed once or twice. Sites sampled one time include: WQS04 (Tenas Creek impact site), WQS03-DS (Four Creek impact site), and WQS06-US (Goathorn Creek reference site). Sites sampled twice include: WQS01 (Tenas Creek reference site), WQS02 (Tenas Creek impact site), WQS05 (Goathorn Creek impact site), WQS08 (Telkwa River reference site), WQS09 (Telkwa

River impact site), WQS11-US (Bulkley River reference site), and WQS12 (Bulkley River impact site). This does not represent adequate sampling replication, as it is highly possible there is inter-annual variation in many aquatic resource indicators that depends on factors such as temperature and flow. This oversight is especially concerning for impact sites sampled once, as it will make accurately tracking Project effects very difficult.

- Effects to aquatic resources, including sediment chemistry and periphyton and aquatic invertebrate communities, are assessed in the Application. The Proponent acknowledges the importance of these indicators for their interactions with water quality and fish, and for their sensitivity to environmental change. Sediment chemistry is screened against BC Working Water Quality Guidelines (WWQGs). The Proponent reaches the conclusion that no residual effects will exist to any aquatic resource indicators as a result of the Project, based primarily on the rationale that changes to water quality in Project receiving watercourses will remain below WQGs and SPOs.
    - The Proponent acknowledges that sediments can entrain metal contaminants from the water column; however, the potential for entrainment in sediment and future uptake from sediment back to water or to aquatic plants and invertebrates is not explicitly addressed in the effects assessment. Given that elevations of multiple constituents in surface water are predicted as a result of the Project, including elevations over WQGs, this effect pathway should be given greater consideration.
    - Changes in tissue chemistry of aquatic plants, periphyton, and benthic invertebrates may occur as a result of elevated concentrations in water and sediment due to the Project. Aquatic resource tissue chemistry, particularly for those species that comprise fish prey populations, should have been considered as an indicator in the effects assessment.
    - There is the potential for increased nutrient deposition in Goathorn Creek from the proposed sewage treatment plant discharge, which may result in effects to algal communities and/or eutrophication. These potential effects are not addressed in the Application.
    - The Application details a high amount of variability in baseline sampling for aquatic resources, both in terms of areas sampled and the frequency of sampling. The aquatic resource baseline sampling effort appears to have been patchy, and this has surely hampered efforts at making clear impact predictions.
    - Values outside of natural baseline conditions can cause shifts in habitat, changes in biological communities, altered nutrient and metals cycling, or more severe impacts, and should not be disregarded in the EA. Predicted changes to sediment chemistry as a result of the Project should be screened against natural background variability, and changes from background should be considered a residual effect in the effects assessment, regardless of whether predicted sediment chemistry exceeds WWQGs.
    - There are zero quantitative assessments, predictive models, or detailed rationales provided in the Application to support the Proponent's conclusion that residual effects to aquatic resources will not occur. This lack of detailed assessment is especially concerning given the importance of aquatic resources for potential impacts to fish. The Proponent should provide more detailed considerations specific to aquatic resource

indicators, and descriptions of *how* proposed mitigations will interact with aquatic resources to eliminate residual effects.
- The proposed SPOs are inappropriate, and the aquatic resources effects assessment needs to be re-considered based on how aquatic resources will interact with water quality changes from background and/or exceedances of WQGs, not SPOs.

Impacts of Concern

- The Project will release contaminated water (e.g., containing elevated selenium and heavy metals) and reduce flows in the Project area, both of which could conceivably impact aquatic resources via contaminant transfer and reduction of habitat productivity. Although the Proponent does not predict such effects as a result of the Project, very little rationale and zero quantitative assessments are provided to support this conclusion.
  - Due to inadequate effect thresholds in assessing effects to water quality in the Application (i.e., not measuring effects of changes from background concentrations, and screening against SPOs that are inappropriate), it is highly likely that effects to aquatic resources of the Project have been overlooked. Even under the Proponent's inadequately conservative effect thresholds, permanent residual effects are predicted to water quality, and it is unreasonable to expect that these effects will not interact meaningfully with aquatic resources. (This may be particularly relevant at confluences of multiple impacted watercourses, such as confluences of Four and Tenas Creeks with Goathorn Creek, and the confluence of Goathorn Creek with Telkwa River). Elevated contaminant concentrations in sediment and tissues of plants, periphyton, and benthic invertebrates are potential effects of the Project that have not been adequately characterized and should be considered by the EAO in its current review. This is particularly important as elevated contaminant concentrations in fish prey sources (e.g., selenium and many heavy metals) will impact fish populations by accumulating in fish tissues.
  - Reduced flows in receiving creeks and the complete elimination of smaller tributaries by the Project will undoubtedly affect overall stream productivity, thereby reducing and/or changing the composition of aquatic resource populations. This effect has not been considered in the Application, and should be considered by the EAO in its current review of the Project. This is particularly important, as aquatic resources that fish populations depend on for food may be affected.

Fish and Fish Habitat

Effects Assessment

- In addition to the issues identified in the General Comments section regarding Project baseline sampling, there are issues specific to fish and fish habitat baseline sampling:
  - Spawning surveys were not conducted for a number of species that have been known to spawn historically in the Project area. These species include pink salmon (known to spawn in Tenas Creek), steelhead, and bull trout. Steelhead are one of the most abundant species in the Project area, and past studies have suggested that Tenas and

Goathorn Creeks are both important steelhead producers. (Though the Application does not distinguish between rainbow trout and steelhead in the Project area, past studies have provided well-reasoned arguments to assume that the majority of *Oncorhynchus mykiss* individuals in the Project area are indeed steelhead.)[8] Bull trout, a provincially blue-listed species, has been historically observed spawning in both Tenas and Goathorn Creeks. Without current, robust information about where (or whether) these species spawn in the Project area, it is impossible to accurately quantify Project effects to fish and fish habitat.

- Given the historic importance of the Project area for steelhead production, an estimate of current adult steelhead production from the Project area should be made in addition to spawning surveys to appropriately quantify Project effects

- No determinate sampling (e.g., genetic testing) was performed to identify bull trout, and it is possible that juvenile bull trout were mistaken for Dolly Varden in the field, as they are difficult to distinguish visually at that life stage. Determining where bull trout use the Project area is essential baseline information, especially given the species' status of special concern.
- Key areas impacted by the Project, and where fish species have been observed historically, such as areas of Tenas and Goathorn Creeks where steelhead and bull trout have been observed, were not sampled for fish community. Again, this is essential baseline information for adequately assessing Project effects that has been overlooked.
- The Proponent states that fish and fish habitat sampling was performed at receiving and reference sites; however, for the most part, receiving and reference sites were not sampled on the same streams, and receiving sites for fish sampling were sometimes not at key surface water monitoring sites, near key points of impact, or in areas where historical records indicate current sampling should have taken place. This lack of adequate baseline information means that Project effects to the Fish and Fish Habitat VC have been inadequately characterized.
    - Fish and fish habitat sampling was not performed at WQS04 or WQS22, the two downstream impact sites on Tenas Creek where water quantity and quality effects will be greatest. Essential data regarding Project effects to fish species like steelhead and bull trout was very likely missed as a result of not sampling these sites.
    - Fish and fish habitat sampling was not performed at WQS13 or WQS06-US (Goathorn reference sites), nor at WQS06 (the closest current impact monitoring site to Project discharge). Again, sampling in these areas would have been needed to appropriately assess how water quality effects from the Project may affect fish such as Dolly Varden, steelhead and bull trout. A nearer-field site on Goathorn Creek to the point of Project discharge is also needed – this stretch of the creek will experience greater water quality changes and should have been sampled for fish and fish habitat.
    - Adequate fish/fish habitat sampling was not performed in the Bulkley River along the rail loadout, where the Project will discharge wastewater. This area

[8] Bustard, D. 1984. Assessment of Benthic Invertebrate and Juvenile Fish Populations in Goathorn and Tenas Creeks and the Lower Telkwa River, 1983. Smithers, BC. Prepared for Telkwa Coal Ltd. by David Bustard and Associates Ltd.

contains gravel banks that provide ideal spawning habitat for chinook, and there are reports of chinook and other species spawning and rearing in the area. More fulsome sampling is required in this area to ensure Project discharge does not negatively impact key fish habitat.

- The majority of fish and fish habitat baseline sampling was only performed in 2017 and 2018, and many sites were only sampled once. This does not meet the 3-5 year recommendation. In particular:
  - Fish community sampling was only performed in Fall 2017 and Spring 2018. Interannual conditions can affect species presence, so there should have been seasonal replications. The lack of this replication is especially problematic given that 2018 was an unusually dry year, and low flows may have prevented fish from returning to areas that they normally use.
  - Salmon spawning surveys were only conducted in 2018. The Application notes that the unusually dry conditions of that year may have been why chinook and coho spawning was not observed. Additional surveys during normal precipitation years should have taken place to verify spawning presence in the Project area.
  - Four Creek (WQS03 and WQS03-DS) was only sampled during 2018, a dry year. This likely led to an underestimate of habitat and community metrics, on which productivity estimates have been based to support the effects assessment and habitat offset plan.
  - Watercourse crossings along the Tenas Access Corridor (TAC) were only sampled during 2018, a dry year. Some of these crossings have past records of use by char, trout, and salmon species; however, conditions during sampling may have limited habitat availability and community composition during 2018. This impacts effects predictions for the Project, as well as Project planning for road construction (i.e., the use of clear span bridges vs. culverts, depending on whether watercourses are deemed fish-bearing or not).

- In the Application's effects assessment for the Fish and Fish Habitat VC, current fish habitat availability and quality, and fish habitat use in the Project area is detailed. Any past disturbances that have altered the indicators measured are incorporated into the description of existing conditions. The primary effects to fish habitat are assessed for the Construction phase of the Project. Residual effects of the Project to fish habitat are predicted, based on changes to water quantity in Dolly Varden habitat on Four Creek and non-fish bearing tributaries to Tenas Creek. No residual effects to fish health are predicted. Based on the proposal for a habitat offsetting plan, residual effects to Fish and Fish Habitat are deemed "Not Significant".
  - Due to issues previously identified with baseline sampling efforts, a number of questions remain regarding fish use of the Project area, which make it impossible to adequately quantify Project effects and have likely resulted in an underestimation of Project effects. These include:
    - The presence and/or type and extent of habitat use of Goathorn Creek by bull trout, coho salmon, pink salmon, and steelhead is unclear. This is particularly the case for reaches close to the point of Project discharge. Due to inadequate spawning survey replication, it is unclear whether coho still use Goathorn Creek to spawn.

- The presence and/or type and extent of habitat use of watercourses near the TAC (e.g., Helps and Hubert Creeks) is unclear. These creeks have been found to provide spawning, rearing, and overwintering habitat for species such as Dolly Varden, coho salmon, Chinook salmon, and steelhead in the past.
- The overall presence of bull trout in the Project area is unclear due to inappropriate site selection and non-determinate sampling methods. It is unknown whether bull trout still use Tenas or Goathorn Creeks.
- The overall use of the Project area for spawning habitat by a number of species, including pink salmon, steelhead and bull trout, is unclear. Beyond Dolly Varden, effects to spawning habitat have not been effectively characterized.

- Past development activities have reduced the baseline availability of fish habitat in the Project area. The fish and fish habitat effects assessment should, as much as possible, measure predicted effects of the Project against natural conditions. Thus, historical data and robust baseline sampling should be used to assess how past disturbance has changed current conditions, and this should be incorporated into the effects assessment.
  - In particular, the Application identifies a culvert is present on Four Creek that blocks fish passage. The lower reach of Four Creek, Reach 1 (below the culvert), contains steelhead. This culvert does not represent natural background conditions and could be removed, allowing steelhead to use more of the creek. Fish habitat in Four Creek has thus been underestimated, and the effects assessment should be reconsidered based on removal of the culvert. This would also affect the Environmental Flow Needs (EFN) assessment performed for Four Creek, as steelhead should then be considered beyond Reach 1.
- Water quality values outside of natural baseline conditions have the potential to result in sublethal effects to fish. Because the Proponent has not discussed water quality changes from the Project in the context of appropriate thresholds (i.e., comparing to background conditions and WQGs, and not to SPOs), effects to fish health from the Project have likely been underestimated.
- Any changes to aquatic prey organism productivity and/or tissue chemistry resulting from the Project may have effects on fish and fish habitat. More detailed assessment and discussion of these factors is needed in the Application. For example:
  - The Proponent does not address whether the destruction of upstream watercourses (e.g., non-fish bearing tributaries to Tenas and Goathorn Creeks) will impact downstream fish populations by reducing prey availability
  - The Proponent does not adequately address potential effects of elevated contaminant concentrations in water, which may transfer to fish prey tissue and then to fish. It is important to note that these effects could arise in fish populations where prey with mine-impacted tissue levels have drifted from further upstream, closer to the Project.
- There are zero quantitative assessments, predictive models, or detailed rationales provided in the Application to support the Proponent's conclusion that residual effects to fish health will not occur. The Proponent should provide more detailed considerations specific to fish health indicators, and descriptions of *how* proposed mitigations will interact with fish health to eliminate residual effects.

- In the evaluation of residual effects to Four Creek fish habitat as the result of reduced flows, Reach 1 of Four Creek is not addressed and only the elimination of Dolly Varden habitat further upstream is considered. Reach 1 of Four Creek is habitat for steelhead, and effects of flow changes to this portion of Four Creek and to steelhead should factor into the Fish and Fish Habitat residual effects assessment.
- Reduced flows are predicted on Tenas Creek as a result of the Project, including a reduction up to 10% in dry years. This is an effect of the Project that may impact fish by eliminating overwintering habitat, which is already constrained in Tenas Creek. Reduced flows to Tenas Creek should be brought forward as a residual effect in the effects assessment. (This should include performing a winter survey in Tenas Creek for the purposes of EFN assessment.)
- Focusing the fish habitat effect assessment on the Construction phase of the Project disregards Project effects that will occur during Operations and Post-Closure. In particular, some key effects are most heightened outside the Construction phase; these include reduction of steelhead spawning habitat in Four Creek during Operations, contaminant concentrations in water peaking during Post-Closure, and overall reduced flows in the Project area during Operations.
- The habitat offsetting plan, which has not been adequately planned yet and has a high likelihood of failure based on BC and Canadian trends (see below), should not be relied on to compensate for residual effects of the Project. The EAO cannot be confident that habitat offsetting will indeed result in a net gain, or even no net loss, of fish habitat productivity; thus, the significance determination for the Fish and Fish Habitat VC should be revised to not account for the offsetting plan.
- Overall, the Application does not adequately address potential impacts to steelhead. This is particularly relevant given their local importance to communities and First Nations, and the Project area's known importance for them as spawning, rearing, and overwintering habitat. Importantly, this underestimation of impacts to steelhead results in under-characterization of residual effects; not only should additional portions of the Project area be considered affected by the Project in terms of impacts to steelhead, the extent of those effects must also be considered Regional or Greater in Extent due to steelhead's migration in and out of the RSA.

- Residual effects to fish habitat are predicted as a result of the Project. The Application focuses primarily on losses to Dolly Varden habitat in Four Creek. A habitat offsetting plan is proposed to compensate for these effects, which results in the Project's effects to fish habitat being deemed "Not Significant". This offsetting plan will compensate for non-fish bearing habitat lost in tributaries to Tenas Creek, and fish-bearing habitat on Four Creek. The offsetting plan has not been designed yet.
  - Offsetting plans have a high rate of failure. For example, Quigley & Harper (2006) found that 63% of fish habitat compensation projects in Canada (of 16 projects studied) resulted in net losses of habitat productivity.[9] A more recent study in the Fraser River Estuary found that, similarly, only 33% of offsetting sites (of 73 sites assessed) implemented from 1983-2010 achieved their intended goals in terms of area

[9] Quigley, J.T. and Harper, D.J. 2006. Effectiveness of fish habitat compensation in Canada in achieving no net loss. Environ Manage 37(3): 351-66. https://pubmed.ncbi.nlm.nih.gov/16456631/

established and establishment of native species, and that increased time did not improve their success.[10] Given the high likelihood of failure based on BC and Canadian trends, a habitat offsetting plan cannot be relied on to compensate for fish habitat losses due to the Project. The Project's EA should be re-considered, and a revised significance determination made for the Fish and Habitat VC, without the inclusion of the offsetting plan to compensate for residual effects.

- Barring the above recommendation to dismiss offsetting plans as appropriate compensation measures in the EA due to their high failure rates, the offsetting plan for this Project should be further designed before it can be appropriately considered in the Project's EA. Even basic ground-truthing measures necessary to assess plan success likelihood, such as performing site visits or LiDAR surveys to establish suitability of the proposed site along Goathorn Creek, have not been performed. Without further design detail, the conceptual offsetting plan cannot be relied on as feasible. The offsetting plan is key to the Proponent's approach for mitigating the Project's predicted effects; therefore, this planning needs to be done now to assist the EAO and Minister in deciding on the Project's EA Certificate.
- Barring the above recommendation to dismiss offsetting plans as appropriate compensation measures in the EA due to high failure rates, the Proponent should also be required at this stage to specify more clearly what 'productivity' the offsetting plan will aim to replace. Though not explicit in the Application, it seems fairly clear the Proponent's focus is to offset Dolly Varden impacts on Four Creek. However, other species and reaches will be affected by the Project. For example, steelhead habitat on Four Creek will also be heavily impacted (e.g., up to 47% reduction of steelhead spawning habitat in Four Creek Reach 1), and should be accounted for in mitigation and/or compensation planning. Tenas Creek – which is used by steelhead, and potentially bull trout and pink salmon – will also be impacted by reduced flows and elevated contaminant concentrations. Abundance assessments should be performed for these other species (steelhead, bull trout, pink) and other mine-affected reaches (Tenas Creek) to inform the Fish and Fish Habitat effects assessment and the Proponent's habitat offsetting plan.

- In addition to the issues identified in the General Comments section regarding the Project CEA, there are issues specific to the Fish and Fish Habitat CEA:
  - The Application's CEA for fish and fish habitat does not consider any cumulative effects to fish health. As mentioned above, residual effects to fish health should be re-considered, and these effects should be brought forward to the CEA.
  - The Application's CEA for fish and fish habitat does not consider cumulative effects to steelhead. As mentioned above, residual effects to steelhead should be re-considered, and these effects should be brought forward to the CEA. Because steelhead are anadromous, the region of study for CEA related to steelhead should be much larger than other indicators.

[10] Lievesley, M., Stewart, D., Knight, R., and Mason, B. 2017. Marsh and Riparian Habitat Compensation in the Fraser River Estuary: A Guide for Managers and Practitioners. https://cmnbc.ca/wp-content/uploads/2018/11/Lievesley-et-al-2016_Marsh-riparian-habitat-compensation-in-the-Fraser-River-Estuary.pdf

Impacts of Concern

- Flows will be markedly reduced in Four Creek by the Project. This effect will result in the following impacts of concern to the Fish and Fish Habitat VC:
    - Dolly Varden are likely to be extirpated from Four Creek due to loss of overwintering habitat, and lack of in-migration due to the culvert at the upstream limit of Reach 1. This extirpation is not explicitly acknowledged in the Application, and should be considered by the EAO in its current review of the Project.
    - Productivity of aquatic resources that serve as prey for fish populations further downstream (i.e., in lower reaches of Four Creek and in Goathorn Creek) will be affected by reduced Four Creek flows. This effect has not been considered in the Application, and should be considered by the EAO in its current review of the Project.
    - Alteration and destruction of fish habitat in Four Creek will eliminate an opportunity to remove the culvert currently blocking fish passage, which could be done to increase anadromous fish habitat. This lost potential fish habitat should be considered an effect of the Project.
- Steelhead are one of the most abundant and widespread species in the Project area, and will be heavily impacted by the Project. Steelhead are important locally and regionally for cultural, economic, and recreational reasons. In recent years, they have experienced extremely low returns (5,461 total spawners returned to the Skeena in 2021 – the lowest return ever). The Telkwa River is known for its steelhead population, and past studies suggest the Project area contains the "most productive steelhead tributaries in the Telkwa system"[11] (i.e., Tenas and Goathorn Creeks). Historical data from 1983 estimated the Project area produced 880 adult steelhead.[8] In Four Creek, steelhead spawning and overwintering juvenile habitat will be reduced by the Project, with up to 47% of spawning habitat lost. In Tenas Creek, where high densities of steelhead are present, reduced flows will affect overwintering habitat availability. Steelhead will additionally be exposed to elevated contaminant concentrations in all affected reaches, including Tenas, Four and Goathorn Creeks – all of which provide steelhead spawning habitat. Most, if not all of these effects, will be irreversible.
    - Tenas Creek overwintering habitat is already constrained. The Project may thus result in winter kills to steelhead in this watercourse, and although re-population will be possible in future years, frequent winter kills can act as a population sink. This effect has not been considered in the Application, and should be considered by the EAO in its current review of the Project.
    - As discussed previously, elevated contaminant concentrations in water – which will be exposed to steelhead at all life stages – may cause sublethal or lethal effects. Due to inadequate effect thresholds in assessing effects to water quality in the Application (i.e., not measuring effects of changes from background concentrations, and screening against SPOs that are inappropriate), these effects to steelhead have been under-characterized in the Application.
    - Though steelhead production of the Project area may have changed since it was last estimated, the estimate of 880 adults does provide important context for assessing significance of Project effects. The Project area is clearly a very important contributor to

[11] Bustard, D. 1998. Aquatic Resource Baseline Studies: Telkwa Coal Project, 1997. Prepared by David Bustard and Associated Ltd. And Limnotek Research and Development Inc. for Manalta Coal.

the Telkwa steelhead population. Project effects to steelhead, which will be permanent, will likely result in impacts that are significant on population-level for both the Telkwa and the overall Skeena steelhead populations. Recently, the Morrison mine EA Certificate was rejected due to that project's vicinity and potential effects to important fish habitat. The same may need to be considered by the EAO in the case of Tenas Coal to adequately protect steelhead.

- Bull trout are a provincially blue-listed species that have been historically observed to spawn and reside in the Project area, including Tenas and Goathorn Creeks. Due to insufficient current data, it is unclear as to whether and where bull trout still use habitat in the Project area.
    - Inadequate surveying and sampling have been performed by the Proponent to identify bull trout in the Project area. Without current robust data regarding presence of this species of special concern, the EAO should assume bull trout still reside and spawn in the Project area for the purpose of its review.
    - As discussed previously, elevated contaminant concentrations in Project receiving waters – which would be exposed to bull trout at all life stages – may cause sublethal or lethal effects. Due to inadequate effect thresholds in assessing effects to water quality in the Application (i.e., not measuring effects of changes from background concentrations, and screening against SPOs that are inappropriate), these effects to bull trout have been under-characterized in the Application.
    - Historical records indicate bull trout spawning in Goathorn Creek near the location of the proposed haul road crossing. Erosion and sedimentation caused by the haul road crossing may result in smothering of eggs. This effect has not been considered in the Application, and should be considered by the EAO in its current review of the Project.
- The Proponent will discharge surface water in to a tributary to Bulkley River. The Application does not characterize effects to immediate discharge receiving waters.
    - The proposed surface discharge to Bulkley River is in the vicinity of potential salmon spawning habitat, where multiple species have been observed spawning and rearing. Near-field effects in the vicinity of this discharge to spawning fish, including Chinook salmon, are possible that have not been adequately considered.

Summary

The primary aims of this review were to assess:

1. Has the Project has been designed to appropriately mitigate potential effects to the environment and the public? (Mine Design/Mitigation Planning)
2. Have residual Project effects been fully characterized and appropriately assessed by the Proponent? (Effects Assessment)
3. Will the Project result in impacts of concern relevant to the consideration of the Environmental Assessment Office (EAO) at this stage? (Impacts of Concern)

This review focused on the Surface Water VC – Water Quality subcomponent, Aquatic Resources VC, and Fish and Fish Habitat VC.

Unit 103 – 4622 Greig Avenue, Terrace, British Columbia, Canada, V8G 1M9
Tel: 250.638.0998 **Email:** info@skeenawild.org **Web:** www.skeenawild.org

Overall, the findings from this review highlight that the Proponent has not appropriately planned for the mitigation of Project effects (including not following British Columbia Ministry of Environment Technical Guidance), has inadequately quantified, characterized, and assessed several potential Project effects, and has proposed a Project that will result in significant impacts of concern to the Water Quality, Aquatic Resources, and Fish and Fish Habitat VCs.

Sincerely,

Adrienne Berchtold, M.Sc.
Ecologist

Unit 103 – 4622 Greig Avenue, Terrace, British Columbia, Canada, V8G 1M9
Tel: 250.638.0998 **Email:** info@skeenawild.org **Web:** www.skeenawild.org

Technical Review #2

Overview

A third-party review of the Tenas Project (the Project) was conducted by SkeenaWild Conservation Trust to assess whether potential impacts to the receiving environment and the public are fully characterized and presented by the proponent. The review focuses on the potential impacts to streams and river systems and how the potential effects of the proposed project may impact the Skeena River Watershed. This portion of the review was prepared by Daphnee Tuzlak, M.Sc., P.Geo., Geoscientist, who has experience in geohazards, hydrology, fluvial geomorphology, and fish habitat restoration. This section of the review is focused on potential impacts to groundwater and water quantity, disaster planning and preparedness, and cumulative effects related to the Project proposed by Telkwa Coal Limited (TCL).

This review focused on sections of the Tenas Project Application available from the Environmental Assessment Office Project Information Center (EPIC) that include:

- 01.0 Project Overview
- 04.2 Terrain and Soils
- 04.3 Surface Water
- 04.4 Groundwater
- 04.6 Fish and Fish Habitat
- Appendix 01.0-AA Dam Breach Assessment Report
- Appendix 01.0-AC Liner Design and Construction Methodology
- Appendix 01.0-F Water Management Report
- Appendix 01.0-Q PAG Management Alternatives
- Appendix 01.0-U Groundwater Technical Hydrogeology Report
- Appendix 01.0-Z Rail Loadout Geotechnical Investigation
- Appendix 04.3-A Water Balance Report
- Appendix 04.6-D Phase 1 Offsetting

The findings from this review highlight that the proponent has not quantified and characterized several potential environmental impacts that may be associated with the Project, and that proposed mitigation options are not well developed and may not be feasible once the Project has started. Potential environmental impacts that have not been adequately characterized by the proponent include:

- Groundwater seepage from the management ponds will cause water quality to worsen post-closure and these impacts may last for several hundred years. The duration of groundwater seepage impacts has been underestimated, and feasible mitigation and adaptive management strategies for managing groundwater seepage impacts have not been included in the application.
- The application does a poor job of connecting the anticipated changes to streamflow associated with the Project with resulting impacts on fish habitat, and those impacts were not quantified

for Tenas Creek and Goathorn Creek. Additionally, the application does not consider the potential impacts of using Goathorn Creek as a contingency water source during extreme dry conditions, and the resulting impacts that would occur to fish habitat. Because these potential effects are not quantified, the impacts of the potential changes in water quantity to fish habitat have been underestimated.

- The plans proposed by TCL are deficient for addressing unlikely catastrophic events that could have significant impacts (including the potential for loss of life) to the local and greater environment, mine workers, and population of Telkwa. These events include potential containment pond breach at one or more of the Management Ponds (tailings facilities), a liner failure at a Management Pond, flooding and associated spills at the rail loadout facility, or other extreme events associated with climate change (such as unusually wet or dry years, heat waves, floods, or fires).
- The cumulative effects assessments associated with groundwater, surface water, and fish and fish habitat do not evaluate how Project-related residual effects may interact with a changing climate, and do not quantify or adequately include several other relevant components (see below), meaning they underestimate many potential cumulative impacts that could lead to ecosystem degradation in the region, especially for aquatic life.

Details associated with these limitations, and recommendations regarding the Project's environmental assessment, are outlined in the sections below.

Comments on the Application

Groundwater:

Groundwater dominates stream baseflows during winter months in the Project area, and groundwater seepage may impact surface water quality, especially during winter months and in late summer. Groundwater modeling for the Project is based on a limited dataset, and the modeling assumes groundwater seepage will reach receiving streams after 25 years. However, based on groundwater flow modeling presented in the application, the average time predicted for 50% of particles to reach the nearby creeks from the mine site varies from 65 years for Tenas Creek, 95 years for Four Creek, 320 years for Goathorn Creek, to over 400 years for the Telkwa River. Overall, the potential impacts to groundwater presented by the proponent underestimate the duration of the potential seepage effects and provide limited feasible mitigation options to constrain impacts to groundwater if they are worse than expected. Additionally, because groundwater impacts will likely not occur until post-closure, and after TCL plans to end its post-closure responsibilities, few options will be available to mitigate impacts when the greatest impacts are likely to occur.

Recommendations:

- The water quantity and quality modeling assume that groundwater seepage will reach receiving streams after 25 years. The proponent notes that this assumption is a conservative estimate;

however, there are some issues with this assumption that are not clearly addressed. For example, the proponent claims that any expected changes to surface water quality will be mitigated. However, the true expected attenuation rate of loads could mean that changes are not observed until well past closure when there are few mitigation options possible. Surface water quality models were developed for the Project to the year 2100, and suggest that most contaminant loads will have decreased by the end of the modeled period. As a result, the proponent does not characterize the duration of residual effects to water quality as being long term. However, the proponent does not clarify that because inaccurate attenuation rates are modeled, modeling may not account for some long-term impacts beyond Year 2100. The proponent and EAO should both consider that the duration of the Project's surface water quality impacts is likely being underestimated.

- Liners have been designed to cover the entire internal footprints of all ponds, except West Management Pond where approximately 57% of the pond will be lined. A full options analysis should be considered for liners, including consideration of their associated seepage rates. Increasing the efficiency of liners in the Management Ponds and Tenas Control Pond should be investigated (as recommended by SRK 2022) to reduce the amount of load entering the receiving environment via groundwater pathways.
- Changes to stream baseflows that are dominated by groundwater quality post-closure were deemed by the project to be "Not Significant" based on proposed Site Performance Objectives (SPOs) that exceed water quality guidelines. The significance rating for groundwater quality post-closure should be based on BC Approved Water Quality Guidelines, or BC AWQG (ENV 2017), and the BC Working Water Quality Guidelines, or BC WWQG (ENV 2015).
- The proponent states that if groundwater predictions are not as expected, adaptive management principles and strategies will be implemented. Groundwater quality is not expected to worsen until post-closure, so it is possible that groundwater quality could worsen after the proponent has stopped managing the site. Feasible mitigation strategies for managing groundwater seepage impacts have not been included in the application and need to be included at this stage.

Water Quantity:

Predicted changes in water quantity were assessed in relation to their impacts to water covers on Management Ponds and changes to streamflow in the receiving environment. In the application, changes to streamflow are discussed in Section 4.0 Chapter 3 Surface Water, without considering the value of streamflows to fish habitat in the Significance rating. Impacts to fish habitat are discussed in Section 4.0 Chapter 6 Fish and Fish Habitat.

Water Covers:

Water balance modeling results were used to determine whether the minimum water cover thickness of 1 m could be maintained in all Management Ponds within 6-months of PAG rock placement throughout

the life of the mine and closure. The maintenance of water covers is important for minimizing potential Acid Rock Drainage (ARD) from the management ponds. The modeling shows that a minimum water cover of 1.0 m within 6 months of PAG rock placement can be maintained in all the Management Ponds during operations and post-closure. However, temporary water reductions may be experienced under extreme dry conditions. A contingency water supply taken from Goathorn Creek, based on 2.5% of Goathorn Creek's mean annual monthly flow, may be needed to manage water covers. The Project does not adequately address the potential impacts to fish habitat in Goathorn Creek (including the proposed habitat offset) if contingency water from Goathorn Creek is used during extreme dry conditions to maintain water covers.

Recommendations:

- During extreme dry conditions, flows in Goathorn Creek are expected to be lower than usual, and an Environmental Flow Needs (EFN) assessment[12] should be completed for Goathorn Creek to establish water limits during dry conditions. The EFN risk assessment and instream flow analysis should be conducted for Goathorn Creek to include consideration of extreme dry conditions, as impacts to fish habitat under these conditions may impact the feasibility of Goathorn Creek as a contingency flow source, and the ability of the Project to maintain water covers over PAG areas during extreme dry conditions.
- The fish habitat offsetting plans described in Appendix 4.6D propose to construct an off-channel pond and channel complex in Lower Goathorn Creek. Off-channel habitat is sensitive to low flows, and water withdrawals from the mine to maintain water covers during dry periods may limit the effectiveness of the fish habitat offset suggested. Potential impacts of water withdrawals, including during dry periods when the contingency water supply may be necessary, should be considered in the habitat offset plan.

Changes to Streamflow:

Changes in streamflow are expected as a result of the Project, with the greatest effects predicted for Four Creek and Tenas Creek, and lesser effects predicted for Goathorn Creek, Telkwa River, and Bulkley River. The largest change in streamflow is expected to occur in Four Creek; monthly streamflow during operations in Four Creek may decrease by up to 34% and increase up to 45%. Tenas Creek flow may decrease by up to 10% during low flow periods (April and August) during operations because of groundwater drawdown and catchment area reductions. Goathorn Creek flows are expected to be reduced by up to 6% during low flow periods during operations. Flows in Goathorn Creek downstream of the Project may also increase by up to 19% during operations and 8% after closure due to routing of flows that otherwise would have reported to the Tenas Creek catchment. Both Telkwa and Bulkley Rivers will experience less than 1% change relative to baseline conditions.

[12] BC ENV (British Columbia Ministry of Environment), 2022. Environmental Flow Needs Policy. File 76940- 00. Available at: https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/waterlicensing-rights/water-policies/environmental-flow-needs

The impact of water quantity changes described in Section 4.0 Chapter 3 Surface Water to fish habitat are discussed in Section 4.0 Chapter 6 Fish and Fish Habitat. An assessment of risk to fish and fish habitat associated with predicted changes to base flows was completed for Tenas Creek and Four Creek using guidance from the BC Environmental Flow Needs policy[12]. A more detailed instream flow assessment was conducted for Four Creek; however, these assessments were not conducted for Tenas Creek or Goathorn Creek.

Overall, the application does a poor job of connecting the changes to streamflow described in Section 4.0 Chapter 3 Surface Water with the impacts on fish habitat described in Section 4.0 Chapter 6 Fish and Fish Habitat. Additionally, detailed assessments were only conducted for Four Creek, meaning that potential impacts to fish and fish habitat in Tenas Creek and Goathorn Creek are not quantified in the application, so overall impacts may be underestimated.

Recommendations:

- Alternative assessment cases modeled show significant changes to streamflow, particularly in the case of high groundwater seepage. Results from the model show that flows in Four Creek could be reduced by 100% during winter months (i.e., no flows), Tenas Creek flows would be reduced by more than 10% in Dec-April, and August during operations, and that post-closure higher management pond seepage would result in increases of up to 35% in Tenas Creek winter flows. The high seepage case shows significant adverse effects to flows, and feasible mitigation options for a high seepage case must be included in the application so that this can be adequately managed if it occurs.
- When determining the significance of residual effects on the surface water quantity subcomponent in Section 4.0 Chapter 3 Surface Water, the ratings for the Magnitude characteristic are “Low,” “Moderate,” and “High”, based on whether the affected area is less than 5% of the regional study area (RSA), between 5-10% of the RSA, and greater than 10% of the RSA, respectively. This rating is not meaningful for fish habitat and aquatic life. For example, if there are relatively small changes in flows in key spawning areas, that could have a much greater impact on fish and aquatic life than if larger changes in flows occur in areas with no fish presence. The ratings should indicate the value of affected areas as a component of the significance rating in the Surface Water VC section, in addition to being considered in Section 4.0 Chapter 6 Fish and Fish Habitat.
- The significance rating of residual effects to surface water quantity in Section 4.0 Chapter 3 Surface Water do not include whether changes in multiple directions occur in streamflow. For example, Tenas Creek monthly flows during operations decrease more than 10% for most months (except freshet and early fall), and this effect reverses post-closure when higher management pond seepage will result in increases of up to 35% in Tenas Creek winter flows. The biological effects of first reducing and then increasing flows should be assessed as aquatic life will have to adapt to multiple different conditions depending on the stage of mining.
- Residual surface water effects in Section 4.0 Chapter 3 Surface Water are only deemed Significant if the effect results in a change in the Regional Study Area (RSA), and significance is

defined as having High Magnitude Effects, Regional or greater in Extent, with a Long-term Duration. The significance determination does not consider whether areas within the local study area (LSA) have special importance or serve particular biological functions to fish and other aquatic life. Although the proponent defines that the Project's residual effects to the Surface Water VC are "Not Significant", that rating is based on the percentage of area impacted, but not based on the value of certain areas for fish habitat. The ratings should indicate the value of affected areas as a component of the significance rating in the Surface Water VC section, in addition to being considered in Section 4.0 Chapter 6 Fish and Fish Habitat.

- The design of the Coal Processing Plant (CPP) allows for introduction of additional equipment to be installed within 18 months to further reduce water consumption in the Operations phase, if required. This mitigation should be included at the onset of the project to reduce water consumption of the project as much as possible, so that contingency water sources are not used.
- In Section 4.0 Chapter 6 Fish and Fish Habitat, a more detailed instream flow assessment was conducted for Four Creek, but not for Tenas or Goathorn Creeks, based on expected average changes in flows. Given that flows in Tenas Creek may decrease by up to 10% during low flow periods (April and August) during operations because of groundwater drawdown and catchment area reductions, an instream flow assessment should be conducted for Tenas Creek. Additionally, Goathorn Creek is planned as a contingency water source and an instream flow assessment should be conducted for Goathorn Creek assuming very dry conditions, which is when the contingency water source would be needed. Completing these two more detailed assessments will more fully quantify potential impacts to fish habitat.
- The instream flow assessment conducted for Four Creek assumed that the fish passage barrier on Telkwa Coal Mine Road marks the upstream limit for anadromous fish; however, that fish passage barrier is a culvert that should be replaced. TCL notes that clear-span bridges will be installed for fish bearing streams, with abutments located outside of the bankfull water level of the stream. Since Four Creek is a fish bearing stream, a clear-span bridge should be installed, which would result in the culvert no longer presenting a fish passage barrier. The instream flow analysis for Four Creek should assume removal of the culvert, and consider presence of anadromous fish further upstream to reflect those changes and to fully quantify the Project's potential impacts to fish habitat.
- The proponent uses the results of the instream flow analysis in Four Creek to quantify the total area of affected fish habitat in Four Creek. Instream flow analyses were not conducted for Tenas Creek or Goathorn Creek because the anticipated changes in streamflow are less than for Four Creek; however, there are still anticipated changes predicted to streamflow, so it is unlikely that the predicted changes in habitat structure will be zero in these watercourses. Not accounting for these non-zero potential changes in habitat structure in Tenas and Goathorn Creek underestimates the total area of harmful alteration, destruction, or disruption of fish habitats (HADDs) that would occur from this proposed project. The areas of impacted fish habitat in Tenas and Goathorn Creek should be quantified and included in the estimate of HADD and in the significance ratings for the Fish and Fish Habitat VC.

Unit 103 – 4622 Greig Avenue, Terrace, British Columbia, Canada, V8G 1M9
Tel: 250.638.0998 **Email:** info@skeenawild.org **Web:** www.skeenawild.org

Disaster Planning and Preparedness

The plans proposed by TCL are deficient for addressing unlikely events that could have significant impacts to the local and greater environment, mine workers, and population of Telkwa. These events include potential containment pond breach at one or more of the Management Ponds (tailings facilities), a liner failure at a Management Pond, flooding and associated spills at the rail loadout facility, or other extreme events associated with climate change (such as unusually wet or dry years, heat waves, floods, or fires). Recommendations are provided below to address uncertainties associated with a potential Management Pond (tailings facility) failure, Management Pond liners, and flood risks associated with the rail loadout facility.

Management Pond Failure

The Management Pond waste storage facilities at the mine site (four total) are held back by earthen dams up to 30 m tall. In a worst-case case dam failure scenario, TCL estimates up to 200 mine workers and local residents in Telkwa could be affected, including the potential for lives lost; acid-generating waste, contaminated water, explosives, and other hazardous chemicals could also be mobilized into the Telkwa and Bulkley Rivers, the environmental impacts of which TCL does not fully consider in its risk evaluations. Despite these significant risks, TCL has chosen not to design its waste facilities to withstand the most extreme weather events (e.g., the probable maximum flood), and has not provided details on the mine's Emergency Preparedness Plan for review with its EA application, which undermines public trust and shows that disaster planning is not being adequately prioritized.

Recommendations:

- The proposed locations of the Waste Management Ponds, which the proponent acknowledges are functionally equivalent to tailings facilities, do not follow best practices for public safety, as the Village of Telkwa is located only approximately 11 km downstream of the proposed facilities. The inundation study indicates that the Tenas Control Dam could empty in as little as 12 to 30 minutes, leaving inadequate time for people to move out of the path of the floodwave. The Safety First Guidelines[13], written by a team of experts regarding tailings safety, recommend to "Ban new tailings facilities immediately upstream from inhabited areas." Additionally, mine standards in Brazil and Ecuador do not allow for tailings facilities to be constructed close to populated areas[14]. Waste management for the Project should be designed such that it aligns with these best practices.
- TCL must properly communicate potential risks of a Management Pond failure to the public, and the Emergency Preparedness Plan must be included in the application materials at the time of

[13] Morrill, J., Sampat, P., Lapointe, U., Kneen, J., Chambers, D., Emerman, S.H., Maest, A., & Milanez, B. (2020). Safety First: Guidelines for responsible mine tailings management. Earthworks and MiningWatch Canada. https://earthworks.org/resources/safety-first-guidelines-for-responsible-mine-tailings-management/

[14] Emerman, Steven H., (2021). Bridging the Gap: Towards Best International Standards on Mine Waste Safety in British Columbia. BC Mining Law Reform and MiningWatch Canada. https://reformbcmining.ca/wp-content/uploads/2022/01/BCMLR-Bridging-the-Gap-report.pdf

public consultation so that the public can ensure that appropriate safety measures and plans are in place. Additionally, the design for the waste facilities should follow the recommended revision to HRSC Guidance Document 2016 Section 3.2 Risk Assessment provided in the Bridging the Gap report[14] that: "... new tailings facilities must not be constructed if the operating company is not capable of ensuring the safe and timely evacuation of the communities who live downstream," and that "Affected communities must not be expected to be evacuated without professional support. Even if operating companies carry out training and emergency drills, there are specific social groups (elderly, small children, people with disabilities, etc.) that require special assistance. Based on the principle of zero harm to people, companies must ensure that outside support from professional teams during an emergency is able to reach all affected populations. Minimum distance between communities and new dams must be defined on a case-by-case basis." Because the potential for lives lost exists if a waste facility were to fail at the Project, the proponent should provide professional support to the Village of Telkwa for an evacuation and the extent of that support must be clearly outlined at this stage of the application.

- The proposed mine design places mine infrastructure in locations that could be impacted by a dam failure at the East Management Pond. This puts mine workers at risk and increases the likelihood that a dam failure would mobilize additional hazardous materials to the receiving environment. It is recommended that mine design follow the proposed revision to HRSC Guidance Document 2016 Section 3.2 Risk Assessment provided in the Bridging the Gap report[14] that: "Operating companies must not build infrastructure in which workers are likely to be present—offices, cafeterias, warehouses—in the path of a possible tailings dam failure."
- The dam breach analysis included in the application assumes that restoration and clean up of terrestrial and aquatic habitats impacted from this catastrophic event would be possible because it assumes that only water loss would occur from the impoundments in the event of failure. This assessment does not fully consider the potential impacts to water quality associated with water cover loss over potentially acid generating tailings. These potential impacts of a dam breach must be considered in the design stage to ensure that appropriate measures are in place to reduce these potential negative environmental impacts.
- The dam consequence classification for the Tenas Control Pond, North Management Pond, East Management Pond, and West Management Pond is "Very High." The selected design flood for the facilities is 2/3 between the 1,000 year flood and the Probable Maximum Flood (PMF). The Safety First Guidelines[13] recommend that, "Any potential loss of life is an extreme event and construction design must respond accordingly." Given that there is a potential for loss of life for mine workers and residents in Telkwa, the seismic and flood design criteria for the Project's waste facility dams should follow the proposed revision to HRSC 2017 Section 10.1.8(1) provided in the Bridging the Gap report[14] which states that: "a) for tailings storage facilities for which failure would result in the potential loss of human life, (i) the minimum seismic design criterion shall be the Maximum Credible Earthquake, (ii) the minimum flood design criterion shall be the Probable Maximum Flood, and (iii) a facility that stores the inflow design flood shall use a minimum design event duration of 72 hours."

Management Pond Liners

The construction methodology for Management Ponds liners was selected to reduce seepage rates to meet SRK's site water balance, but not to achieve water quality objectives. TCL has not provided a realistic contingency plan (i.e., a plan B) for preventing contaminated seepage if the liners do not function as planned.

Recommendations:

- Water quality objectives (at minimum, to maintain receiving water quality below WQGs) should be considered in selection of the liner design including the protective layer, and an alternatives assessment that considers receiving water quality should be undertaken for liner design.
- The liners designed for Management Ponds at the Project require specific weather conditions during installation, and once potentially acid-generating mine wastes are placed over them it will be extremely difficult to locate and repair liner failures. Feasible contingency plans for liner failures must be included in the application at this stage.

Rail Loadout:

In the Overview (1.21.9) TCL notes that "A portion of the Rail Infrastructure is within the 1 in 200-year flood plain for the Bulkley River, however, so is the entire main CNR rail line which has been in place for over 100 years without any flood event that has caused a disruption to rail services in the region." Floodplain mapping is not presented in the application, so the extent of the 1 in 200-year floodplain is not defined within the application materials. A more rigorous approach to managing flood risk is needed than comparing the site conditions to existing infrastructure. TCL says that plans for flooding will be included in the emergency response plan including a triggered response plan for events greater than the 1 in 150-year flood event forecast in the upcoming 48 hours. This response plan will involve inflating temporary diversion dams to divert water away from coal stockpiles and the loading area (which includes chemical storage). There are several limitations to TCL's risk assessments for the floodplain and emergency response plans.

Recommendations:

- Provide floodplain maps and a hazard assessment for flooding to the rail infrastructure. Coal stockpiles and chemicals storage should be located outside of the floodplain to limit potential spills and adverse environmental impacts during a flood.
- Comparing the infrastructure risk to the CNR rail line is not adequate. Standards have changed and climate impacts have worsened since the rail line was constructed.
- The Emergency Response Plan was not included with the application, meaning that the public does not have the opportunity to comment on potential emergency response plans for flooding at the rail infrastructure location, nor on whether those plans are adequate for limiting environmental risk from coal spills and spills from other chemical storage during a flood.

- The proponent plans to trigger the Emergency Response Plan once precipitation events are predicted to be greater than the 1 in 150-year flood event; however, by that time bridges and access roads to the site may be flooded. The Emergency Response Plan needs to be presented now, so that the public can assess whether the Project's contingencies are sufficient to minimize risks.
- The Bukley River is prone to flooding by ice-jams, and ice-jam flood events have occurred as recently as December 2021. The response plan described by TCL does not explain what the strategy for ice-jam flooding will be and whether temporary dams will work in icy conditions.

Cumulative Effects:

Cumulative effects assessments were reviewed for the following chapters: Section 3.0 Chapter 1 Assessment Methodology, Section 4.0 Chapter 3 Surface Water, Section 4.0 Chapter 4 Groundwater, and Section 4.0 Chapter 6 Fish and Fish Habitat. Overall, the cumulative effects analysis is optimistic and likely underestimates many effects the Project will contribute to, that may lead to ecosystem degradation in the region, especially for aquatic life.

Recommendations:

- The proponent does not evaluate climate change as a component of the cumulative effects assessment. This overlooks consideration of how Project-related residual effects may interact with a changing climate and make it more difficult for the affected environment to adapt. Potential interactions with a changing climate, and the cascading effects these interactions may cause, should be considered in order to fully characterize the impacts of the Project.
- In Section 4.0 Chapter 3.6.2, several additional mitigation measures are proposed to improve water quality and minimize potential cumulative effects. Some of these measures, such as increasing the thickness on the bentonitic liners to reduce seepage volumes from management ponds will be difficult to implement once the Project has already started. All proposed mitigation measures in this section should be fully considered and planned for at this stage of the Project so that their implementation is feasible. The impact of the proposed mitigation measures on surface water quantity should also be considered at this stage.
- For several subcomponents of the cumulative effects assessment related to surface water, the proponent states that the Context of the effect is expected to be Moderate because the streams have high resilience to small-scale changes in land use. This statement is not supported by data or studies and underestimates the Context of these effects.
- In some cases, such as in Four Creek, winter streamflow is expected to be reduced during operations and increased after mine closure. Multiple shifts in direction (i.e., decreasing then increasing) may be more harmful to the ecosystem, as aquatic life has to adapt to multiple changing conditions; however, the proponent does not assess or characterize this effect in the cumulative effects assessment.

- The cumulative effects assessment for Section 4.0 Chapter 3 Surface Water for the surface water quantity subcomponent does not address the potential changes to fish habitat that may occur from flow changes. The proponent argues that the Magnitude of the effects in flow changes are expected to be Low, with the expectation that less than 5% of the RSA would be affected; however, the importance of those areas relative to fish habitat is not considered. The proponent has not completed detailed EFN and instream flow analyses for Tenas or Goathorn Creeks, so this issue is not addressed in the Section 4.0 Chapter 6 Fish and Fish Habitat cumulative assessment either. As a result, the potential cumulative effects contributed to by changes in flow to fish and fish habitat as a result of the Project are underestimated.
- The cumulative effects assessment for Section 4.0 Chapter 3 Surface Water for the surface water quality subcomponent (6.3.2.1) underestimates potential cumulative effects in several ways. The Duration of the potential effects are deemed Short-term since the proponent notes that any potential change in water quality parameters above water quality guidelines would only be expected for a period of years before additional mitigation measures were implemented. However, changes in water quality parameters are expected to be highest after closure when mitigation measures will be more difficult to implement. As a result, it is likely that the duration of these changes would be much longer than the proponent states. The Magnitude is deemed Low, as it is expected that less than 5% of the RSA would be affected; however, the proponent does not consider whether changes to water quality will occur in areas that are important for specific biological functions. Additionally, the Reversibility of the effect is deemed Partially Reversible since the effect is not expected to continue beyond the year 2100; however, the modeling this conclusion is based from does not account for true expected attenuation rates of loads through groundwater pathways. As a result, the modeling underestimates the time for contaminant loads to move through groundwater pathways, and it is likely that the effects will continue past the year 2100, making the effects Irreversible. The proponent indicates that the Project's contribution to cumulative effects from change in modelled parameter concentrations in receiving waters will be Not Significant; however, given the above limitations to the proponent's characterization, this conclusion is unlikely to be true.
- In the methods section for the cumulative effects assessment (Section 3.0 Chapter 1), the proponent indicates that the assessment follows the methodology provided by the Province in which cumulative effects assessment considers whether residual effects will overlap in space and time with residual effects of other past, present, and future activities. Water quality has been impacted by previous mining activities in the region, including the Project area; constituents that have exceeded water quality guidelines include aluminum, iron, and copper. In Section 4.0 Chapter 3 Table 4.1-4, the proponent notes that sites WQ03-DS and WQS06-US may be potentially influenced by historical workings. Although water quality has likely been impacted by previous activities, this is not clearly quantified, and the past effects of mining are not considered in the cumulative effects assessment. Because the baseline conditions presented in this application include residual effects of mining, the ways in which the Project will exacerbate these water quality issues, and contribute to cumulative effects, have been underestimated and should be more fully considered.

- In the cumulative effects assessment for Section 4.0 Chapter 6 Fish and Fish Habitat, the proponent notes that the Project's contribution to cumulative effects to changes in fish habitat are limited to the LSA and will not extend downstream into the Telkwa and Bulkley Rivers. Streams within the LSA such as Tenas Creek provides habitat for spawning and rearing of steelhead who spend part of their life cycle in the Telkwa and Bulkley Rivers (and beyond). As a result, cumulative changes may impact the overall Skeena steelhead population and the cumulative effects analysis should reflect that fish populations within the RSA (and beyond) will be impacted.
- The proponent notes that all changes in fish habitat resulting in a change in habitat productivity will be offset, and that a net increase in habitat productivity is predicted. This is not supported by scientific literature showing that across Canada approximately 63% of compensation projects resulted in net losses in habitat productivity[15]. Considering the results of this study, the cumulative effects assessment should estimate the Project's potential contribution to impacts to fish and fish habitat without accounting for habitat offsets. Given that a net increase in habitat productivity, as the proponent predicts, is an unlikely outcome, the Project's potential contribution to cumulative effects have likely been underestimated.
- In the cumulative effects assessment for Section 4.0 Chapter 6 Fish and Fish Habitat, the proponent assumes that because changes to monthly flows in Tenas Creek are below the thresholds for significance the proponent has selected (i.e., an increase of more than 30% or reduction of more than 10%), that the changes to fish habitat will be Not Significant. However, Tenas Creek flow may decrease by up to 10% during low flow periods (April and August) during operations because of groundwater drawdown and catchment area reductions. Because some changes in flows are expected to occur, it is likely that there will be some resulting impacts to fish and fish habitat, yet those impacts have not been quantified in the application. As a result, the Project's contribution to cumulative impacts based on changes to fish habitat in Tenas Creek have not been accurately characterized.

Summary:

The application presented by TCL indicates that the risks associated with the Project for environmental impacts to valued components including Surface Water, Groundwater, and Fish and Fish Habitat are "Not Significant." As discussed in this review, there are several ways in which the potential environmental risks have not been fully characterized or quantified by the proponent in the application. Feasible mitigation strategies to address the environmental risks and have also not been fully developed, and potential catastrophic events such as a tailings dam failure that could lead to loss of life were not presented to the public. As a result, the overall impacts of the project have not been fully characterized at this stage of the environmental assessment process, and the environmental impacts of this project will likely be greater than presented by TCL.

[15] Quigley, J. T., & Harper, D. J. (2006). Effectiveness of fish habitat compensation in Canada in achieving no net loss. *Environmental management*, *37*(3), 351-366.

Unit 103 – 4622 Greig Avenue, Terrace, British Columbia, Canada, V8G 1M9
Tel: 250.638.0998 **Email:** info@skeenawild.org **Web:** www.skeenawild.org

Sincerely,

Daphnee Tuzlak, M.Sc., P.Geo.
Geoscientist