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United States Forest Service, Payette National Forest
Attn: Linda Jackson, Payette Forest Supervisor
500 North Mission Street
McCall, ID 83638

Subject: Comments on the Stibnite Gold Project Supplemental Draft Environmental Impact Statement: Fisheries and Aquatics Resources

Dear Ms. Jackson,

Perpetua Resources Idaho, Inc., (Perpetua Resources) appreciates the opportunity to provide comments on the Supplemental Draft Environmental Impact Statement (SDEIS), and specifically in this comment letter on the fisheries and aquatics resources. The SDEIS is a well written and concise document. Perpetua Resources applauds the substantial effort by the multitude of individuals that contributed to the compilation of the very large volume of information and analysis regarding the Perpetua Resources proposed Stibnite Gold Project (SGP). The synthesis of hundreds of documents developed from a much greater multitude of data values, analyses and modeling projections into a single draft product is a noteworthy accomplishment. Perpetua Resources is pleased to have been a stakeholder in its development.

Specific to fisheries and aquatic resources, Perpetua Resources prepared this comment letter to support its perspective and insight to assist in clarifying and improving content for the Final Environmental Impact Statement (FEIS). Our comments are below, and for your convenience, comments have been provided in a tabulated format (included as Attachment A that references each appropriate subsection heading, page number and paragraph).

Bull Trout Analysis and Interpretation

The SDEIS (United States Forest Service [USFS] 2022a) reports an 8.5-kilometer (km) net loss in thermally suitable habitat for bull trout. Two components were used to calculate thermally suitable habitat including (1) temperature, and (2) available habitat. However, these methods were not consistently applied, resulting in contradictory results. In addition, it wasn't clear if "available habitat" and "accessible habitat" can be considered interchangeable terminology for the bull trout analysis.

Documenting a reduction in thermally suitable habitat suggests that temperatures increase and/or available habitat is reduced, but conclusions elsewhere in the document generally report decreased temperatures and increased habitat access (see Temperature Examples and Available Habitat Examples below). Ultimately, the loss of 8.5 km of thermally suitable "available habitat" was apparently based on the assumption that bull trout would be extirpated from the area upstream of the proposed tailings storage facility (TSF) Buttress as identified in SDEIS (USFS 2022a): (P.4-343):

"Based on the current known extent of bull trout occupancy, bull trout may be extirpated from the reaches upstream from the TSF when the reaches within the [TSF] footprint would be dewatered and flow would be diverted into the diversions that route water around the facilities."

This statement is provided without discussion or rationale for the conclusion, which should be added in the FEIS. Additionally, excluding areas based on the presence or absence of fish is not applied consistently for different species or metrics throughout the SDEIS (USFS 2022a). For example, steelhead are currently extirpated from the area upstream of the Yellow Pine pit (YPP) cascade barrier, but thermally suitable available habitat was identified for this species upstream of the barrier. Chinook salmon were extirpated upstream of the YPP cascade barrier, but a stocking program has enabled that species to occupy otherwise unavailable habitat. If bull trout become extirpated upstream of the TSF Buttress during operations, mitigation measures such as those used to reestablish Chinook salmon could be implemented to reestablish bull trout after upper Meadow Creek has been restored on the TSF. Finally, all other habitat surrogates in the SDEIS (USFS 2022a) (i.e., Intrinsic Potential, Occupancy Model, Flow/Productivity, Physical Habitat Simulation [PHABSIM]) evaluated conditions regardless of fish presence/absence based on the premise that the habitat persists regardless of fish use. The only instance of excluding *"habitat"* due to predicted fish presence/absence is for proposed bull trout thermally suitable habitat.

We recommend that thermally suitable available habitat for bull trout consider all stream segments with potential bull trout occupancy, including those upstream of the proposed TSF Buttress barrier and other shorter stream segments with barriers such as Fiddle and Garnet Creeks. This would make the bull trout habitat analysis methods consistent with other species evaluated and would provide results of thermally suitable habitat extents that are consistent with overall stream temperature conclusions.

Temperature Examples

Less thermally suitable habitat for bull trout suggests temperatures increase due to the Project, but temperatures generally decrease in the summer and fall evaluation periods as reported from other analyses throughout the SDEIS (USFS 2022a). The following are all excerpts documenting temperature improvements (lower stream temperature) as opposed to higher stream temperatures suggested by the bull trout analysis:

- P.4-337: *"Water temperatures in the warmer summer and fall months in Meadow Creek downstream from East Fork Meadow Creek substantially decrease relative to the baseline conditions during mine operations and closure/reclamation activities (Mine Year 6 through Mine Year 18), though there is an increase at Mine Year 27, which then continues to decline until Mine Year 112."*
- P.4-337: *"The East Fork South Fork Salmon River (SFSR) between Meadow Creek and YPP experiences decreases in summer maximum water temperatures relative to baseline conditions. There is a slight increase in temperatures, still lower than baseline, after Mine Year 22 once the low-flow piping along*

the TSF is removed, and temperatures continue to decrease once the revegetation efforts take effect."

- P.4-337: The effects of the SGP on fish caused by changes to water temperature are expected to *be "permanent, localized, and beneficial for Meadow Creek downstream from the East Fork Meadow Creek, and for the East Fork SFSR between Meadow Creek and YPP."*
- P.4-339: Table 4.12-2 shows both summer and fall maximum weekly water temperatures largely lower than baseline during operations and post-closure, with the exception of post-closure Meadow Creek on the TSF, and during tunnel operation on the East Fork SFSR between YPP and Sugar Creek. Note that Perpetua Resources has identified many temperature values in the SDEIS (USFS 2022a) that are different (higher) than reported in the Stream and Pit Lake Network Temperature (SPLNT) report (see section below called *"Issues/Potential Errors with Water Temperature Analysis").*
- P.4-357 to 4-358; Table 4.12-6 Temperature Watershed Condition Indicator (WCI) changes are negligible or positive for all stream segments across the life of the project.

Available Habitat Examples

The report (Table 4.12-13) identifies a total "available habitat" reduction of 8.5 km between Baseline and Mine Year 112. This 8.5 km reduction in "available habitat" contradicts results of other analyses reporting increased habitat availability, as indicated by the following SDEIS (USFS 2022a) excerpts related to available habitat:

- P.4-344, Table 4.12-3: Length of bull trout habitat is shown to increase relative to baseline for all reaches with bull trout present including +1.31 km based on critical habitat and +1.96 km based on occupancy potential.
- P.4-377: *"The East Fork SFSR upstream from the YPP lake and the Meadow Creek drainage all have increased occupancy probabilities for bull trout over time."*
- P.4-378: *"Overall, the SGP is expected to result in minor, permanent, and localized benefits to occupancy probability and the available habitat occupancy potential for bull trout."*
- P.4-379: *"There would be a minor net increase in occupancy potential for bull trout."*
- P.4-386, Summary of Action Alternatives states that *"in the long-term restoring fish passage upstream of the YPP would result in an increase in available habitat for anadromous and resident fish in the analysis area."*
- It appears none of the newly formed Hennessy and Midnight Creek habitat on the backfilled YPP has been accounted for as *"available"* habitat. From the Rio Applied Science and Engineering (Rio ASE) 2021 Stream Design Report, these streams were specifically designed to provide off-channel rearing habitat for all 4 key fish species including 0.23 km and 0.27 km of accessible habitat for Midnight Creek and Hennessy Creek respectively.

Integration of Effects

Integration of effects refers to how the results of different analyses were combined to reach conclusions about the impacts on the species. The SDEIS (USFS 2022a) provides several analyses where an integration of effects was completed to assess potential impacts. However, neither the methods nor rationale for the integration are provided, making it difficult to understand how the conclusions were reached. Also, the integration of effects does not appear to be consistent between species within the report, nor does it follow precedents and guidance in other reports including the Forest Plan Appendix B (i.e., Table B-1). Below is a summary of the integration of effects for each of the four species evaluated.

- P.4-366: Chinook salmon includes 7 metrics evaluated with 6 identified as providing a net benefit including water chemistry, barriers, enhancements to the East Fork SFSR, thermally suitable habitat, Intrinsic Potential (IP) habitat, and access to critical habitat, and 1 identified as an adverse impact (flow). The resulting determination is a "*net increase in available habitat, however, flows and temperatures make the additional habitat less optimal"* (P.4-367). It is unclear how the integration of results was conducted and especially unclear how thermally suitable habitat increases, yet temperature is identified as making habitat *"less optimal."*
  - Chinook summary: 7 metrics = 6 beneficial + 1 adverse = net benefit

- P.4-374: Steelhead includes 5 metrics evaluated with all but one (flow/productivity) identified as providing benefit. Flow/productivity is characterized as adverse, despite there being no (zero) steelhead productivity currently. Any reduction in flow/productivity should be reported as a reduced benefit, not a reduction to what is already zero productivity for steelhead. Water chemistry, physical structure, temperature, and intrinsic potential habitat all increase. The resulting determination *is "the net effect would be an increase in both the quantity and quality of habitat"* (P.4-375). As with the other species, it is unclear how the metrics were combined to achieve the reported result. Also, the magnitude and duration of impacts/benefits is not described for many metrics as with other species.
  - Steelhead summary: 5 metrics = 4 beneficial + 1 adverse = net benefit

- Bull trout includes 8 metrics evaluated with a mix of results including 4 beneficial (water chemistry, barriers, enhancements to the East Fork SFSR, occupancy potential), 2 negligible (YPP lake habitat and flow), and 2 impacts (thermally suitable habitat, critical habitat). The overall determination is *that "Post-closure, a net decrease in quality and quantity of bull trout habitat would occur despite removal of passage barriers and an increase of lake habitat"* (P.4-378). How was the integration of effects compiled to result in an overall negative impact despite only 25 percent of the metrics identified as negative, 25 percent negligible, and 50 percent positive? The two negative impacts (temperature and critical habitat) appear to be a result of a determination that certain stream segments would be unavailable to bull trout, yet the barriers summary is that there would be a *"net increase in accessibility to habitat"* (P.4-379). What is causing the negative impacts and how do those out-weight the positive impacts given there are more benefits identified than impacts?
  - Bull trout summary: 8 metrics = 4 beneficial + 2 negligible + 2 adverse = net impact

- Cutthroat trout includes 6 metrics evaluated with 4 beneficial (water chemistry, habitat, temperature, barriers) and 2 with negligible change (flow and occupancy potential), yet the overall conclusions is that *"Following reclamation, the net effect would be a minor loss of both quantity and quality of habitat for westslope cutthroat trout"* (P.4-383). How was the integration of effects done such that 4 benefits and 2 negligible evaluations result in a net negative impact?
  - Cutthroat trout: 6 metrics = 4 beneficial + 2 negligible = net impact

The integration of effects should describe the methods by which different metrics where integrated over the lifespan of the project. It is recommended that a summary table or similar graphic be developed that outlines the metrics evaluated for each species and life stages, including a summary of results across key time periods of the project. If metrics are weighted differently or some are considered limiting factors, that information should be explained. The method for quantifying results should be provided, including professional judgment if applied, so the results could be replicated. Finally, changes in effects over time should be more clearly stated such that the duration of these effects is accounted for in the results. Whereas offsets of these impacts by beneficial components to the project are not necessarily evident in the effects, it is recommended that those Modified Mine Plan (MMP) components be included in the results as well. We suggest applying numerical scores and weights to each metric then combining those mathematically over time such that the analysis is repeatable, defensible, and transparent.

Guidance for the integration process is available that incorporates the indicators that have been identified (i.e., Specialist Report-Section 6.1.3 p. 40) as potential impacts due to the SGP. The guidance also provides both a process and rationale for evaluating and integrating key indicators. See Potyondy and Geier (2011) and USFS and USFWS (2013).

Flow-Productivity Analysis and Interpretation

This section addresses the flow-productivity analyses potential issues we've previously commented on in regard to the interpretation of those analyses.

Perpetua Resources Previous Comments on Flow-Productivity

Perpetua Resources has commented on the flow-productivity analysis a number of times since 2018, yet these comments have not been addressed in the 2022 SDEIS (USFS 2022a). Perpetua Resources began commenting on the flow-productivity analysis in 2018 during Endangered Species Act (ESA) Section 7 informal consultation (Brown and Caldwell[BC]/BioAnalysts 2018), when the analysis and flow-productivity spreadsheet was first proposed by National Oceanic and Atmospheric Administration (NOAA) Fisheries (Morrow 2018) for the SGP. Perpetua Resources discussed its concerns with the flow-productivity analysis with the USFS, NOAA Fisheries, and other agencies during ESA Section 7 informal consultation and about that time submitted a letter outlining its concerns (BC/BioAnalysts 2018). Following the publication of the 2020 Draft Environmental Impact Statement (DEIS), Perpetua Resources submitted comments again highlighting its concerns about the flow-productivity analyses, and especially about the lack of explanation about the assumptions of the model and the insufficient explanation about the meaning of the results. Despite these repeated comments on the flow-productivity analysis, little has been done in the SDEIS (USFS 2022a) to address them. We request that these technical issues on flow-productivity be explicitly addressed in the FEIS.

Explanation of the Meaning of the Flow-Productivity Modeling Results

Our single most important concern about the presentation of the Flow-Productivity Analysis in SDEIS (USFS 2022a) Section 4.14, the Specialist Report, and the supporting technical reports (Ecosystem Sciences [ESS] 2019) is the lack of a plain understandable explanation of the analysis and absence of interpretation of the flow-productivity analysis results. This leaves the impacts on productivity open to misinterpretation or misuse. Perpetua Resources believes that a clear presentation of the flow-productivity analysis and models, the assumptions used, the transferability of the models from Johnson Creek (Chinook salmon) and the Lemhi River (steelhead) to the upper East Fork SFSR, and the baseline population and population affected would go a long way towards addressing our concerns and would improve SDEIS (USFS 2022a) readers' understanding. Addressing these issues would not require re-analysis and could be effectively addressed by adding explanatory text and supporting facts, and stating assumptions, thereby providing readers and reviewers with a sound understanding upon which to make their comments. From Perpetua Resources' perspective, these and the following points should be made clear in the FEIS.

Transferability of Flow-Productivity Models to the Mine Area Streams

The flow-productivity analyses in the SDEIS (USFS 2022a) were based on the use of models developed in Johnson Creek (Chinook salmon) (Morrow 2018) and from the Lemhi River (steelhead) (National Marine Fisheries Service [NMFS] 2013). These *"source basin"* flow-productivity models were developed in streams with considerably different physical stream conditions and size, different habitat and flow conditions, and different population densities of Chinook salmon and/or steelhead. These models were *"transferred"* to the upper East Fork of the South Fork of the Salmon River (EFSFSR) with the assumption that these differences had little or no effect on the results and that the model transfers were valid, yet that description and this important assumption are not stated in the SDEIS[1] (USFS 2022a). Recognizing the uncertainty in the application of the models should be plainly stated in the FEIS, as is best practice under National Environmental Policy Act (NEPA). Perpetua Resources requests that this be explained and recognized as a source of uncertainty and that caution should be used in their rote application to the streams in the Mine Area.

Steelhead Productivity is Incorrectly Represented

In regard to steelhead flow-productivity analysis, we believe that there is a very basic error in the analysis and presentation of production, which is inconsistent with other interpretations of productivity in the SDEIS (USFS 2022a) and ESS (2019). Steelhead have not been documented in the EFSFSR upstream of the fish passage barrier caused by the cascade immediately upstream of the YPP lake. As there are no spawning adults in these reaches, steelhead productivity and production in these reaches can only be accurately characterized as zero. The application of this logic is consistent with ESS (2019, original version, p.5 and p.6) where it is stated that because Chinook salmon would not be able to access and spawn in a certain area of Meadow Creek, then there would be zero productivity:

"Therefore, the productivity would go to zero, based on the slope of the face of the TSF preventing volitional fish passage."

"The Meadow Creek site would be within the footprint of the TSF/development rock storage facility (DRSF), and therefore, the productivity would be reduced by 100 percent, because there would be no volitional fish passage to Upper Meadow Creek."

It also follows that when steelhead are able to access these reaches during and after mining,

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[1] ESS (2019) does include the sentence "*The productivity analysis used was designed to represent the productivity of the Johnson Creek watershed, a relatively unaltered watershed compared to the Headwaters of the East Fork of the South Fork. It is also based on the number of spawning fish estimated to exist in Johnson Creek (this is important because changes in productivity are density dependent)*." However, this two-sentence explanation is buried in many pages of an appendix and is itself insufficient to explain the potential sources of error and uncertainty in *"transferring"* the models from one basin to another.

productivity and production would then be greater than zero in these reaches. The SDEIS (USFS 2022a) characterizes most of the flow-related project impacts as negative because it incorrectly assumes that there is greater than zero baseline productivity, which is not correct and inconsistent with the statements in ESS (2019). Here again, specifying the population that is being assumed and analyzed and the number of fish represented in the analysis is crucial to the analysis and its interpretation. Perpetua Resources requests that this information and any assumptions be stated in the FEIS. Certain points made here for the steelhead flow-productivity analysis also apply to Chinook salmon.

Opening Access Increases Salmonid Productivity

In further support of the issue above regarding characterization of productivity, a recent study by the Idaho Department of Fish and Game (Copeland et. al. 2020) on the Pahsimeroi River in central Idaho observed that opening additional habitat increased productivity of the Pahsimeroi population. The restoration efforts increased accessible habitat 246 percent and had an immediate, detectable effect on spawning adults and juvenile productivity. The effect is also well supported by other studies of salmonid production. Opening previously blocked areas can have relatively quick benefits to salmonid production, by either creating more opportunities for fish to move from high density to low density areas or by allowing access to more suitable habitat for spawning or rearing (Birnie-Gauvin et al., 2018; Roni et al., 2008; Uthe et al., 2017; cited in Copeland et. al. 2020). Restoration efforts that remove barriers expand spatial distribution and increase the likelihood of production (Koed et al. 2020; Nieland et. al. 2015; cited in Copeland et. al. 2020). Also recognized by NOAA (2013) is that generally speaking, greater habitat availability results in greater carrying capacities of a watershed, which could in turn lead to greater population productivity. The SDEIS (USFS 2022a) and its supporting documents fail to describe and reflect the high likelihood that opening new habitats in the upper EFSFSR by increasing volitional habitat access will improve productivity. Perpetua Resources request that information from other studies of increasing access to previously blocked spawning and rearing habitats having a demonstrably positive effect of salmonid productivity, ignored in the SDEIS (USFS 2022a), be included in the FEIS.

Rationale for Assumed Baseline Productivity Values is Unsupported

The flow-productivity analyses in the SDEIS (USFS 2022a) for Chinook salmon and steelhead use the concept of a baseline productivity. From the Fisheries and Aquatic Habitat (Including Threatened, Endangered, Proposed, and Sensitive Species) Report:

> "*The baseline Chinook salmon productivity of 1.06 was derived from productivity data collected on Johnson Creek (Morrow 2018)." AND "The baseline steelhead productivity value of 1.24 was derived from productivity data collected on the Lemhi River (NMFS 2013).*"

These statements are made with no explanation, no definition of baseline productivity, and unstated assumptions. These baseline values are taken from different river systems with considerably different watersheds, habitat conditions, fish populations, and different carrying capacities, and no attempt was made to adjust to these differences, resulting in considerable uncertainty.

Also, productivity changes from year to year, and so using a static baseline productivity value is a poor assumption and also contributed to uncertainty of the model applications for Chinook salmon and steelhead.

Provide Meaningful, Understandable Interpretation of the Flow-Productivity Results

Whereas an EIS is intended to be understandable by the public, the flow-productivity results and the meaning of those results should be explained in terms that readers can understand – the number of fish and the population affected. This explanation should include the assumptions made for the population size used in the flow-productivity analysis for which the analysis is being completed, and by describing the specific *"population"* and numbers of fish that are likely or assumed to be affected. The SDEIS (USFS 2022a) states that *"Annual flow productivity was determined as the long-term percent change from the existing or baseline conditions for each Mine Year."* Yet no explanation is provided about what this means. An explanation should be provided in the FEIS. In the Morrow (2018) model for Chinook, the flow-productivity multiple linear regressions all use the independent variable x2 to represent the number of brood year spawners, yet no numbers of brood year spawners in any of the Mine Area reaches were presented. What number of brood year spawners was used in the SDEIS (USFS 2022a) analysis? How did they change in subsequent years when there is the confounding variable of stocking of spawning-ready Chinook adults?

Provide Chinook Salmon Context and "Population"

The reaches being analyzed for flow-productivity changes are limited to the Mine Area stream segments in the upper EFSFSR. Chinook salmon cannot naturally access these reaches because of the passage barrier at the YPP. The Chinook salmon population in these stream segments have been *"maintained"* through stocking of spawning-ready adults into Meadow Creek by the Nez Perce Tribe in years when excess spawning fish are available. There is sufficient information in the SDEIS (USFS 2022a) and supporting reports to document the number of fish stocked and for some years, the number of redds is known through redd surveys. These data provide information important for the SDEIS (USFS 2022a) as to the context and to describe what the baseline population is *assumed* for use in the analysis and interpretation. The SDEIS (USFS 2022a) Sections 3.12 and 4.12, should describe and connect these important data inferences to the results of the flow-productivity analysis so that the reader can understand how many fish and spawning pairs are likely to be affected.

NOAA's flow-productivity spreadsheet that was used for the SDEIS (USFS 2022a) analysis requires that a starting abundance be specified and the *"population size (spawners)"* be provided for the analysis – it is a required input to the model. This means that fish abundance has a meaningful effect on productivity (Morrow 2018). However, nowhere in the SDEIS (USFS 2022a) or its supporting documents is the *"population size (spawners)"* reported. What population size was used? This is very important information for the reader, but also for the analysis because the population size has an effect on the estimated productivity (Morrow 2018). Some assumption must have been made as to the number of fish that would spawn in the reaches of the EFSFSR during mining, after the fishway is operational, because this is a required input into the spreadsheet-based analyses provided by NOAA Fisheries. This beginning population abundance should be clearly stated in the FEIS and the basis for it explained. Also, during mining, the Nez Perce Tribe may continue stocking, and additional Chinook salmon would make their way through the fishway to the reaches analyzed, and this should be described in the FEIS as well, including any assumption in the flow-productivity about how that may affect the spawning population of Chinook salmon in the Mine Area reaches.

Other Factors Affect Productivity

The flow-productivity analyses for Chinook salmon and steelhead are based on flow alone and does not consider other factors that may affect productivity and that would be affected during mining (ESS 2019). These factors could include changes in access, changes in habitat quality (via mining actions or stream enhancement) proposed by Perpetua Resources as part of the SGP. Yet the SDEIS (USFS 2022a) is silent on this matter, which leads the reader to assume that flow is the only or most important factor in productivity. The effect of other factors other than flow on productivity should be explained in the FEIS and identified as a source of uncertainty in the flow-productivity analyses and results.

Describe the Meaning of Productivity in Terms of Fish Numbers

The result of the flow-productivity analyses is expressed in the SDEIS (USFS 2022a) and supporting materials as *"percent change"* in productivity. This manner of expressing the change is vague at best and misleading at worst. It has no meaning unless tied to a population density/number of fish. Due to the lack of descriptive context in SDEIS (USFS 2022a) Section 4.12 or its supporting documentation, most readers will not understand and will instead rely on the percent change in productivity as an index of impact when it is not connected to potential changes in fish or spawner abundance. Due to the lack of a clear description of productivity, it is unclear if the results are intended to mean a reduction in several hundred adult steelhead to the subwatershed or perhaps only a reduction in a few returning adults, which may be a small fraction of the upper EFSFSR steelhead population. That is, what is the biological consequence to the population being evaluated in terms of potential abundance. NOAA's analysis of flow-productivity (for Chinook salmon for example) is based on *"adult"* productivity or *"whole life cycle"* productivity defined as the ratio of adult retuning fish number to the spawning *population "returning adults / brood year spawners"* (Morrow 2018). This means that a productivity of 1.0 represents one-to-one replacement of the spawning population. This should be clarified in the FEIS.

Flow-Productivity Estimated by Reach

Another important facet of the interpretation of the flow-productivity analyses that should be briefly explained in the SDEIS (USFS 2022a) Section 4.12 are that it assumes that adult Chinook salmon or steelhead would spawn in each of the flow-affected reaches and would spawn in the same areas regardless of the flow conditions in that reach. This is an assumption that is not described or defended in the SDEIS (USFS 2022a) or supporting document. A more supportable assumption would be that spawning Chinook salmon or steelhead would select the best locations among the reaches and would spawn less in flow-affected reaches, and the same would likely be true for juvenile rearing. Notably, Chinook salmon are known to vary their spawning location in response to changing conditions (Brennan et. al. 2019a; Brennan et. al. 2019b) and in the upper EFSFSR upstream of Sugar Creek, redd surveys show that spawning locations change from year to year. Recognizing these facts would provide important information to reviewers of the SDEIS (USFS 2022a).

Were Flows "Normalized" per NOAA Flow-Productivity?

Morrow (2018) stated that in using their analysis for quantifying impacts of altering flow that flow measures should be normalized to facilitate application of the relationships to different stream reaches. We see no mention of this in the methods described in the Specialist Report or the ESS Technical Memorandum (ESS 2019), and we ask that the normalized flows that were used be reported in the FEIS.

Recognize Sources of Uncertainty in Flow-Productivity Models

Finally, good NEPA practice includes the identification of uncertainty in analyses and conclusions. Above, we have identified several factors that create uncertainty in the application of the flow-productivity models, including transferability, the effect of factors other than flow on productivity, and potential sources of error identified by Morrow (2018). These should be reflected in the FEIS.

Issues with Combined Variable Analysis

Similar to the integration of effects comments provided above, the SDEIS (USFS 2022a) provides analyses by combining variables. However, within this analysis, the SDEIS (USFS 2022a) does not account for or distinguish between useable, accessible, and modeled habitat variables (i.e., IP). It is recommended that these variables be more thoroughly defined and applied in this analysis to be clearer as to the effects being assessed by combining variables. In addition, the comparison between the No-action and MMP isn't clear in the results provided in Section 4.12. It is recommended that the analysis clearly show the analytical differences between the two alternatives and demonstrate the effects of this analysis.

The following excerpts from Section 4.12 to support improvements that aren't incorporated with the combined variable analysis -

> *"Incremental improvements in fish passage and habitat quality would occur through the restoration process leading to an improved permanent condition relative to baseline as described below."* P 4-334
>
> *"Restoration of stream and lake habitats and riparian vegetation within the active mine area after reclamation would result in a net increase in stream length and accessible fish habitat post-closure relative to baseline conditions and volitional fish access to habitats upstream of the Yellow Pine pit lake (Rio ASE 2021)."* P 4-334
>
> *"The restoration activities, particularly providing volitional passage in the East Fork SFSR, would result in a major, permanent, regional, and beneficial effect on Chinook salmon, steelhead, bull trout, and westslope cutthroat trout within the vicinity of the mine."* P 4-334

The SDEIS (USFS 2022a) points out loss of habitat for volitional access from the TSF, which is correct; however, the SDEIS (USFS 2022a) does not appear to account for the gain in access from the YPP barrier removal, tunnel, and eventual habitat restoration over the YPP backfill when combining variables for effects analysis. It is recommended that these analyses account for accessibility in the analyses. Table 4.12-9 in the SDEIS does not indicate which lengths are accessible versus non-accessible, which is important for assessing not only which habitat is suitable but also which habitat is accessible. In addition, not all habitat is equally suitable as indicated by habitat metrics collected during baseline studies and from modeling results from intrinsic potential and occupancy modeling. The data presented do not adequately assess the levels of suitable habitat and how that could affect the potential impacts to fish species.

Issues/Potential Errors with Water Temperature Analysis

This section addresses the temperature analyses in regard to inconsistencies, sufficient information to confirm some data, and consistency of terminology in many locations, which all could affect the interpretation of those analyses.

Reported stream temperatures are inconsistent with table titles and footnotes, and sufficient information is not provided to confirm the values

Stream temperatures for baseline and the 2021 MMP presented in Table 7-5 (Fisheries Report) and Table 4.12-2 appear to be incorrect regardless of whether reported values are the maximums (as the table title indicates) or length-averaged (as indicated for the Meadow Creek area table footnotes).

Table 1 (below) shows an example of these discrepancies for East Fork Meadow Creek (EFMC). The table includes (1) the maximum daily temperatures simulated for each reach in EFMC for No Action and the Mine Years simulated for the 2021 MMP, and (2) length-averaged values based on the lengths and simulated temperatures provided in the SPLNT model reports (BC 2021). The values reported in the SDEIS (USFS 2022a) are also included and compared to the length-average values based on the SPLNT reports. The differences between the length-averaged values are provided. For baseline/No Action, the SDEIS (USFS 2022a) reports temperatures that are similar to the No Action values simulated by SPLNT (BC, 2021). However, for the 2021 MMP, the SDEIS (USFS 2022a) reports temperatures that up to 1.3 degrees Celsius (°C) higher than the SPLNT models simulated using a length-averaged value. The values in the SDEIS (USFS 2022a) also do not match the warmest temperatures reported for the reach, so it is unclear what the values are based on. These should be corrected in the FEIS.

For EFMC, the text in the SDEIS (USFS 2022a) states that *"EFMC experiences an increase in summer and fall maximum water temperatures during mine operations and closure/reclamation activities (Mine Year 6 through 18) and post-closure until Mine Year 52, at which point the temperatures decline compared to the baseline conditions (Table 4.12-2). Restoration activities on the EFMC is slated to begin in Mine Year 1, with the construction of the rock drain starting in Mine Year 3. EFMC flowing through the rock drain would reduce its exposure to solar radiation, thus resulting in a decrease in change in water temperatures between the meadow and the lower section of EFMC during the summer and fall months. By Mine Year 112, the difference in water temperature between the meadow and the lower EFMC is around 0.5 degrees Celsius (°C) for both the summer and fall maximums."*

Based on the values in Table 1 for EFMC, maximum weekly summer condition, EFMC does not experience an increase in water temperatures during any Mine Year if a length-averaged comparison is made. If the maximum temperatures of all the reaches in EFMC are compared, then EFMC does have an increase of 0.3 °C and only for Mine Year 6. Thus, the statement that temperatures increase through Mine Year 18 is incorrect. The last statement of the paragraph is also incorrect and misleading because it refers to a *"difference"* of 0.5 °C. Temperature decreases should be labeled *"decreases,"* and the return to baseline has occurred by EOY12, not EOY112. By EOY112, simulated length-averaged temperatures are 0.8 °C cooler than baseline and the warmest simulated reach is 2.2 °C cooler.

Table 1. Comparison of Maximum Weekly Summer Values Reported in SDEIS versus the SPLNT Report (BC, 2021) for EFMC for No Action (Baseline) and the ModPRO2 Simulated Mine Years

Alternative	Reach (upper model where applicable)	Length (km)	Maximum Temperature from SPLNT Reports (°C)	Length-Averaged Maximum Temp from SDEIS (Table 7-5 (Fisheries Report) and Table 4.12-2)	Difference
No Action	17	2.76	13.39	-	-
No Action	18	1.65	16.84	-	-
No Action	Length-averaged temperature		14.68	14.6	-0.08
EOY6	17	2.76	13.63	-	-
EOY6	18	0.58	15.16	-	-
EOY6	19	0.41	15.04	-	-
EOY6	20	0.67	17.15	-	-
EOY6	Length-averaged temperature		14.50	15.8	1.30
EOY12	17	2.76	13.63	-	-
EOY12	18	0.58	15.03	-	-
EOY12	19	0.41	14.85	-	-
EOY12	20	0.67	16.39	-	-
EOY12	Length-averaged temperature		14.35	15.4	1.05
EOY18	17	2.76	13.73	-	-
EOY18	18	0.58	15.1	-	-
EOY18	19	0.41	14.85	-	-
EOY18	20	0.67	16.07	-	-
EOY18	Length-averaged temperature		14.37	15.3	0.93
EOY22	17	2.76	13.72	-	-
EOY22	18	0.58	15.04	-	-
EOY22	19	0.41	14.81	-	-
EOY22	20	0.67	15.83	-	-
EOY22	Length-averaged temperature		14.31	15.2	0.89
EOY27	19	2.76	13.66	-	-
EOY27	20	0.58	14.88	-	-
EOY27	21	0.41	14.62	-	-
EOY27	22	0.67	15.35	-	-
EOY27	Length-averaged temperature		14.17	14.9	0.73
EOY32	19	2.76	13.66	-	-
EOY32	20	0.58	14.81	-	-
EOY32	21	0.41	14.53	-	-
EOY32	22	0.67	14.99	-	-
EOY32	Length-averaged temperature		14.09	14.8	0.71
EOY52	19	2.76	13.66	-	-

Alternative	Reach (upper model where applicable)	Length (km)	Maximum Temperature from SPLNT Reports (°C)	Length-Averaged Maximum Temp from SDEIS (Table 7-5 (Fisheries Report) and Table 4.12-2)	Difference
EOY52	20	0.58	14.67	-	-
EOY52	21	0.41	14.37	-	-
EOY52	22	0.67	14.08	-	-
EOY52	Length-averaged temperature		13.92	14.4	0.48
EOY112	19	2.76	13.66	-	-
EOY112	20	0.58	14.63	-	-
EOY112	21	0.41	14.34	-	-
EOY112	22	0.67	13.67	-	-
EOY112	Length-averaged temperature		13.85	14.2	0.35

Source: USFS 2022b

Table 7-5 and Table 4.12-2 (USFS 2022b) included footnotes for the Meadow Creek part of the system to indicate two variations on length-averaging the SPLNT results to calculate the values in the tables. It does not appear that evaluation metrics were used consistently across the project area; inconsistencies in methodology have the appearance of bias:

- Section 4.12.2.2 states that "Predicted temperatures during the early years of restored flow across the TSF and TSF Buttress are higher than average temperatures over the entirety of Meadow Creek because early revegetation efforts have not reached their riparian shading potential. However, the difference from existing conditions is smaller because the TSF area has a higher temperature under existing conditions than Meadow Creek as a whole."
- The area of analysis should remain consistent when calculating and comparing metrics between baseline and proposed conditions, and the method of calculating metrics should remain consistent from one area of the system to another. All values needed to calculate these metrics should be provided (see Table 1 example above).
- "East Fork SFSR between Yellow Pine pit and Sugar Creek, and similarly the East Fork SFSR roughly 1 km downstream from Sugar Creek, experiences an increase in summer and fall maximum water temperatures at Mine Year 6 because of the draining of the Yellow Pine pit lake followed by active mining and mine dewatering that removes cooling influences of upstream shading and groundwater discharge to surface water (Table 4.12-2). By Mine Year 112, summer maximum water temperatures in the East Fork SFSR between Yellow Pine pit and Sugar Creek are about 0.4°C higher than baseline conditions, but fall maximum temperatures, and summer maximum and fall maximum temperatures below Sugar Creek end up between 0.1 and 0.6°C below baseline conditions (Table 4.12-2)."

Similar to the EFMC values, the values in Tables 7.5 and Table 4.12-2 appear incorrect. See Table 2 below for the summer maximum temperatures in each reach and the length-averaged value for comparison to values in Tables 7.5 and Table 4.12-2. As with EFMC, Tables 7.5 and Table 4.12-2 report higher temperatures (up to 1.4 °C) than those simulated with the SPLNT model for EOY12 through EOY112.

All values in these tables (every area and Mine Year and resulting differences from baseline) should be quality assured, and all necessary information needed to calculate these metrics should be provided. All text that relies on these values should be reviewed and revised as needed. For example, by EOY52 for EFSFSR between the lake and Sugar Creek, simulated temperatures are lower than baseline, but the paragraph quoted above indicates that temperatures are 0.4 °C higher even at EOY112. Temperatures are below baseline by EOY52 regardless of which metric is evaluated (warmest temperature or length-averaged temperature).

Table 2. Compare Values and Metrics in SDEIS versus SPLNT Reports (BC, 2021) for EFSFSR between Yellow Pine pit and Sugar Creek

Alternative	Reach (lower model where applicable)	Length (km)	Maximum Temp °C	Length-Averaged Maximum Temp from SDEIS	Difference
No Action	12	1.12	14.12	14.1	-0.02
EOY6	43	1.63	16.1	-	-
EOY6	44	0.49	16.09	-	-
EOY6	Length-averaged temperature		16.10	16.1	0.00
EOY12	14	0.06	13.75	-	-
EOY12	15	1.13	14.4	-	-
EOY12	Length-averaged temperature		14.37	15.8	1.43
EOY18	11	0.06	13.82	-	-
EOY18	12	1.13	14.48	-	-
EOY18	Length-averaged temperature		14.45	15.7	1.25
EOY22	11	0.06	13.82	-	-
EOY22	12	1.13	14.47	-	-
EOY22	Length-averaged temperature		14.44	15.6	1.16
EOY27	11	0.06	13.96	-	-
EOY27	12	1.13	14.54	-	-
EOY27	Length-averaged temperature		14.51	15.6	1.09
EOY32	11	0.06	13.75	-	-
EOY32	12	1.13	14.34	-	-
EOY32	Length-averaged temperature		14.31	15.4	1.09
EOY52	11	0.06	13.4	-	-
EOY52	12	1.13	14	-	-
EOY52	Length-averaged temperature		13.97	14.8	0.83
EOY112	11	0.06	13.16	-	-
EOY112	12	1.13	13.76	-	-
EOY112	Length-averaged temperature		13.73	14.5	0.77

- If length-averaging was used to develop values for other areas in the tables, they should be lower than the maximum values reported in the SPLNT reports, but often they are higher (see examples in Table 1 and Table 2). These tables and resulting statements of impact need to be thoroughly QA/QC'd and better explained in the text.

Need to Use Consistent Terminology When Discussing Changes to Stream Temperature

Throughout the SDEIS (USFS 2022a), when temperatures are predicted to increase relative to baseline, the text uses the word *"increase."* When temperatures decrease relative to baseline, the text refers to this as a *"difference."* Because these statements of *"differences"* follow statements about *"increases,"* the reader will infer the difference remains higher than baseline. For most of the system in the out years, temperatures are predicted to be lower than baseline, and this is important for the reader to understand the duration and extent of changes in water temperature. For example, the EFMC paragraph quoted above*: "EFMC experiences an increase in summer and fall maximum water temperatures* ***during mine operations and closure/reclamation activities*** *(Mine Year 6 through 18) and post-closure until Mine Year 52, at which point the temperatures decline compared to the baseline conditions (Table 4.12-2). Restoration activities on the EFMC is slated to begin in Mine Year 1, with the construction of the rock drain starting in Mine Year 3. EFMC flowing through the rock drain would reduce its exposure to solar radiation, thus resulting in a decrease in change in water temperatures between the meadow and the lower section of EFMC during the summer and fall months. By Mine Year 112, the difference in water temperature between the meadow and the lower EFMC is around 0.5 °C for both the summer and fall maximums."* The increase in temperature (0.3 °C) only occurs in EOY6; by EOY12 (not EOY112), temperatures are predicted to be approximately 0.5 °C lower than baseline.

Failure to Characterize Small Differences in Temperature as not Discernable with the SPLNT Model

Differences of 0.1 °C are well within the uncertainty of the model and the accuracy of temperature sensors. That is, changes of less than 0.1 °C based on the SPLNT model cannot be accurately stated as a real difference. The SDEIS (USFS 2022a) should include the magnitude of stated increases and consider excluding statements of long-term changes when the differences are less than the certainty level of the SPLNT model. An example is this statement from Section 4.9*: "Predicted temperatures above the confluence of Meadow Creek and the East Fork SFSR are predicted to be comparable to the existing condition within approximately 10 years after reclamation and then continue to cool over time."* This is misleading as the simulated increase is only 0.1 °C which is within the uncertainty of the model and the accuracy of temperature sensors; changes of 0.1 °C would be imperceptible to aquatic life.

Another example appears in Section 4.9.2.2, where the SDEIS (USFS 2022a) says *"With the exception of the West End Creek segment below the pit area, predicted temperatures return to existing conditions over a period of approximately 100 years as stream restoration and riparian plantings along with the moderating effect of the Stibnite Lake feature take effect."* This statement appears to apply to every stream at the SGP (i.e., with the exception of West End Creek). The only other area that temperatures are significantly warmer than baseline by EOY112 is Meadow Creek on the TSF. Everywhere else, temperatures return to baseline or are below baseline much earlier in the project due to the restoration plantings and increased shade.

The SDEIS fails to mention in summary statements or the executive summary that most of the stream temperatures in the analysis area decrease or are similar to baseline

The 2021 MMP includes Project components and mitigation measures to mimic or improve stream temperatures in most of the streams relative to baseline including improvements to stream shading, development of Stibnite Lake, and use of piped diversion channels during operations. Stream temperatures decrease or remain near baseline in most of the stream segments during operations and post closure (EFMC, Meadow Creek downstream of EFMC, EFSFSR above Meadow Creek, and EFSFSR between Meadow Creek and Fiddle Creek).

In earlier paragraphs of Section 4.9, the following statements are made which address these benefits; benefits should be summarized along with adverse impacts, so the reader has a non-biased understanding of changes associated with the project. These benefits are also shown on Figures 4.9-27 and 28.

- *"Development of the Stibnite Lake feature to mimic the thermal characteristics of the existing pit lake would restore that dampening effect and promote the return of water temperatures toward existing conditions"* [by EOY12, water temperatures are within 0.3 °C warmer than baseline and decrease below baseline by EOY52]
- *"Following closure, predicted temperatures between the TSF and the confluence of Meadow Creek and EFMC (Blowout Creek) decrease as a net effect of increases in riparian shading plus recovery of groundwater discharge and surface water inflow."* Note that below EFMC, stream temperatures in the remaining sections of Meadow Creek and through the length of the EFSFSR remain below baseline during operations and post closure until the water reaches the restored streams on the YPP backfill. There is a short length of stream (0.6 km) on the backfill with temperatures simulated 0. °5 to 1 °C warmer than baseline; water temperatures in the warmest of these reaches (0.24 km) decrease to baseline by EOY32 and continue to decrease such that simulated temperatures are 1.3C less than baseline by EOY112.

Misleading statements in the SDEIS, that across the analysis area, temperatures increase by up to 6.6C and take 100 years to return to baseline

These statements appear in multiple sections and reports in the description of the analysis area, not in the impact sections, and sometimes in Section 3, which should be discussing existing conditions. For example, Section 3.12.2 is the Fisheries and Aquatic Habitat Resources Area of Analysis. One of the paragraphs in this section states the following:

> *"The SGP affects watersheds within the analysis area differently depending on the activities proposed for each area. The majority of the mining activity occurs within the headwaters of the East Fork SFSR subwatershed (HUC 170602080201). In this subwatershed, surface water conditions are affected by ground disturbance, development of mine facilities, and water abstraction for mine dewatering, contact water management, and consumptive use (see Section 4.12.2.2). As a result, stream flows in the watershed would be reduced by up to 30 percent during operations. While project design features and regulatory requirements maintain water*

chemistry conditions, removal of riparian shading increases predicted stream temperatures by up to 6.6°C until a time that restoration efforts would effectively shade stream flows and reduce temperatures toward baseline conditions. When the tools utilized to evaluate fish habitat (e.g., intrinsic potential, occupancy, and flow productivity modeling) are applied to these to the forecasted flow and temperature conditions in the headwaters of the East Fork SFSR watershed, they indicate a change from existing conditions."

The introductory sentence in this paragraph refers to the entire HUC, but this statement only applies to a small part of the system. Most water temperatures in the study area decrease relative to baseline conditions, and summary paragraphs should include this information as well. Analysis of impacts (flow, temperature, or otherwise) do not belong in Section 3, and do not belong in the description of analysis areas.

In Meadow Creek downstream from EFMC and in EFMC, water temperatures in the summer and fall months substantially decrease relative to baseline throughout the operations and closure periods. In the East Fork SFSR from the headwaters to the YPP area, predicted maximum water temperatures are less than 0.5 °C warmer than baseline during part of the project and return to baseline or cooler by Mine Year 32. In the East Fork SFSR below the YPP area and below Sugar Creek, development of the Stibnite Lake feature by Mine Year 12 results in predicted maximum and average summer and fall water temperatures comparable to existing conditions (within 0.3 °C).

SDEIS states in several locations that climate change was ignored and infers that temperatures may be 2 °C higher than predicted

Perpetua Resources has commented on this text in past versions of the DEIS; referred the agencies to sensitivity analyses on air temperature, stream flow, and diffuse flow in the SPLNT modeling existing conditions report; and provided context regarding the limitations of the NorWeST models (e.g., they assume no additional vegetation growth through time). Perpetua Resources also requested during the drafting of the DEIS to meet with the reviewing agencies to discuss how they would like to address climate change in the EIS and based on what models or analyses.

Anywhere climate change is discussed in the sections or specialist reports, the reader should understand that the 2021 MMP includes riparian plantings and required mitigation measures if shade is not adequate, and temperatures are higher than predicted. These measures will help mitigate against the effects of climate change where the No Action alternative would not include these plantings or mitigation. As stated in the Executive Summary, *"Closure and reclamation activities under the alternatives could reduce climate change impacts by improving soil quality and implementing best management practices [e.g., riparian tree plantings] during all phases of the SGP."* This context needs to be added to the Fisheries Specialist Report and Sections 3.12 and 4.12 so the reader understands the potential benefits of this project toward mitigating stream temperatures against climate change. The NorWeST models are not a reasonable assessment of temperature increases for the 2021 MMP which includes extensive restoration plantings and mitigation measures if plantings do not achieve the stream temperatures simulated.

The NorWeST models rely on percent canopy derived from the NLCD 2011 USFS Tree Canopy[2] Cartographic land use data to estimate percent canopy for stream reaches; the percent canopy was then reduced based on USFS burn severity data to account for wildfires that occurred between 2001 and 2008. The NorWeST models predicting out to 2099 do not account for natural or human-assisted regrowth and revegetation along streams and rather assume that percent canopy remains at current conditions. In areas recently affected by wildfires, the NorWeST models may overpredict stream temperatures due to rising air temperatures if percent canopy under current conditions is low. The SGP includes planting of trees along enhanced and restored channels that would increase stream shading over time. The SPLNT model did account for climate change in the sensitivity analyses conducted using the existing conditions model. Considering the site-specific data on diffuse flow temperatures, stream flows, and canopy cover at a much more refined scale than the NorWeST models, increasing air temperature every hour of the day by 5 °C had the effect of raising water temperatures by 0.5 °C for the baseline condition.

NorWeST is a large-scale model, and these are traditionally not appropriate to use at the site scale. As shown in Table 3.12-19, there are some areas at the SGP where NorWeST predicts existing conditions fairly well (like the reach downstream of YPP lake and Upper East Fork SFSR at Rabbit Creek) where NorWeST simulations are within 0.5 °C of SPLNT simulations which were calibrated to baseline temperature data. However, at Meadow Creek, NorWeST predicts temperatures that are 1.4 °C cooler than baseline and at Sugar Creek, NorWeST predicts temperatures that are 1.6 °C warmer than baseline. For a regional model, these are expected differences when applied to a specific site. However, using it to infer that the simulated temperatures for the SGP may be underpredicted by up to 2 °C is not a fair assessment. In addition to the differences in the scale of the models, the SPLNT model accounts for project elements and mitigation measures that are required to ensure simulated stream shading and predicted water temperatures are met. Our modeling and the literature indicate that inputs of solar radiation are the most important factor for determining stream temperatures. The 2021 MMP mitigates against the effects of climate change by including riparian plantings throughout much of the site; these plantings would not occur under a No Action scenario. If the plantings are not successful, the 2021 MMP requires mitigation.

[2] National Land Cover Database (NLCD) tree canopy cover is a 30 m raster geospatial dataset decadal Landsat satellite imagery that is available for the conterminous United States, coastal Alaska, Hawaii, and Puerto Rico. https://www.mrlc.gov/data/nlcd-2011-usfs-tree-canopy-cover-conus.

Thank you for considering Perpetua Resources' comments. Please contact me if you any questions.

Sincerely,

Alan Haslam
PERPETUA RESOURCES IDAHO, INC.
Vice President – Permitting
Enclosure:
Attachment A

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