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Re: Perpetua Resources Ltd Supplemental Draft Environmental Impact Statement

Executive Summary

The SDEIS lists the environmental impacts related to implementation of the 2021 MMP for the extraction of gold and other resources. Effects to habitat for ESA-listed Chinook salmon, steelhead, and bull trout were discussed along with effects to Westslope cutthroat trout, which are considered a sensitive species by the Forest Service and Idaho Fish and Game. While effects from reclamation are generally positive and commendable, they fail to return the area to even the sorry baseline condition, which is the result of nearly a century of mining impact. The SDEIS indicates that for Chinook salmon, "Following closure and reclamation, the overall net effect from the SGP would be a net increase in available habitat; however, flows and temperatures make the additional habitat less optimal." Steelhead fare somewhat better, but bull trout and Westslope cutthroat trout fare worse as "Effects for trout species differ from Chinook salmon following closure and reclamation, as there would be a net increase in both the quantity and quality of habitat for steelhead trout and net decreases in both quantity and quality of habitat for bullhead trout [I assume this means bull trout] and Westslope cutthroat trout." This slightly beneficial outcome, for at least one species, would occur assuming the models are correct (which is questionable) and the habitat restoration is done appropriately and to the extent modeled. In this optimistic scenario, habitat is returned to nearly the same quantity and quality as baseline, which is, again, the result of a century of mining.

In general, mining typically causes stream habitat simplification, decreased water quality and quantity, increased water temperature, migration barriers, and introduction of non-native species. The SDEIS discusses these impacts but fails to define the interrelationship of these and other stressors and does not adequately consider their cumulative effects.

The SDEIS fails to analyze impacts to non-salmonid fishes and inadequately evaluates impacts to salmonids. Pacific lamprey, whose abundance throughout the Pacific Northwest has declined precipitously, are present in the South Fork Salmon River drainage and were not considered in even a cursory way. This species, while not an ESA-listed species, has been petitioned for listing and is a species of concern for the Forest Service, BLM, and Idaho Fish and Game. Impacts to other non-game fish were also completely disregarded. Models used to predict fish habitat conditions (including flow and temperature) used output from other models for input into these models, constituting an estimate of an estimate. Or, as in the case of the PHABSIM model, 30-year-old data from another area was used to predict changes in the mining area. The validity of the model results should be viewed with skepticism.

The SDEIS failed to evaluate how mining-related changes to habitat (including flow and temperature) would affect winter conditions and survival of even ESA-listed fish species. This is especially problematic given that winter temperature and flow, both affected by mining operations, have been shown to strongly correlate with winter survival and, thus, population abundance and, ultimately, persistence. The interaction of groundwater to fish habitat and fish distribution, a vitally important component of bull trout winter and spawning habitat, which also affects other salmonid species, was completely ignored.

Multiple contaminants of significant concern to salmonids and other aquatic life received little consideration. The SDEIS also completely disregarded effects to water quality and flow that will occur downstream of the analysis area and suggests an effect to population persistence, without analysis, only for Westslope cutthroat trout.

The SDEIS is not consistent with Forest planning documents and recovery documents for Chinook salmon, steelhead, and bull trout. The timeline for mine operation is approximately 12 years with reclamation and closure of approximately 5 years. Due to the nature of proposed SGP activities, impacts to aquatic, terrestrial, and watershed resource conditions would be expected to occur for the length of the proposed SGP. This impact time length is in excess of the Forest Plan direction, which indicates that "Management actions, including salvage harvest, may only degrade aquatic, terrestrial, and watershed resource conditions in the temporary time period (up to 3 years). The SDEIS also requests to a waiver so they do not have to provide upstream and downstream fish passage at diversions within the mine footprint during mining operations. These requests are not consistent with the Forest plans and are injurious to fish.

The SDEIS states that "bull trout may be extirpated from the reaches upstream from the TSF when the reaches within the footprint would be dewatered and flow would be diverted into the diversions that route water around the facilities. With the gradient barrier that would be created along the TSF, there would be no mechanism by which bull trout would be able to volitionally (i.e., naturally) recolonize the reaches upstream from or on top of the TSF." This is not consistent with bull trout recovery plan actions which include: 1) Protect, restore, and maintain suitable habitat conditions for bull trout, and 2) Minimize demographic threats to bull trout by restoring connectivity or populations where appropriate to promote diverse life history strategies and conserve genetic diversity. Additionally, during the mining period, flow will largely be lower and temperature will largely be higher than baseline (see SDEIS Figure 4.12-3 and Table 4.9-24). These conditions are inconsistent with the Chinook salmon and steelhead recovery plan (NMFS 2017), which lists improving degraded water quality and maintaining unimpaired water quality as a strategy to address factors limiting recovery of Chinook salmon and steelhead populations.

A substantial length of both perennial and non-perennial streams are listed to be impacted in both the focus and off-site focus areas. Work window timing is unclear as it is listed to avoid individual species, but when taken together, there is no time of the year when some non-mobile salmonid life form is not present and proposed work 300 feet upstream from redds is inadequate to protect redds from impacts of turbidity generated that short distance upstream.

The SDEIS reports substantial impacts to fisheries and their habitats throughout the mining period. For example, "Across the rest of the CEA [Cumulative Effects Area], future actions that could impact surface water quality would mainly affect stream temperatures and stream sediment concentrations. Other RFFAs in the CEA would mainly contribute sediment loading to adjacent streams. Although most of these future actions would likely have sediment control measures in place, the cumulative effect across the watershed may still include higher sediment loads in the East Fork SFSR and its tributaries." And, "…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." These impacts during mining operations and cleanup are of particular concern for Chinook salmon and steelhead, where 20 years of impact, particularly when combined with the plethora of other impacts on the population, could affect population persistence.

I. BACKGROUND

Sarah O'Neal has over 20 years of international experience in freshwater ecology of salmonid ecosystems spanning the Pacific Rim and the southern Atlantic Ocean. Her expertise includes water quality, freshwater foodwebs, resident and anadromous fishes, and interactions between them in lakes and streams. She has worked for private and public agencies, tribes, and non-governmental organizations. She has a Bachelor's Degree in conservation biology from the University of Washington, a Master's Degree in freshwater ecology from the University of Montana's Flathead Lake Biological Station, and is currently a Ph.D. Candidate in the School of Aquatic and Fisheries Sciences at the University of Washington conducting research specific to characterizing temporal and spatial variability of multiple aspects of salmon habitat.

Jim Gregory has over 30 years of experience in fisheries in Idaho. His experience includes research, monitoring, and habitat improvement project management working with trout and salmon in the Rocky Mountains. Jim also has over a decade of experience conducting habitat restoration in an area that was mined in the mid-1900s. Jim has a bachelor's degree in wildlife resources from the University of Idaho and a Master's degree in biology, with an emphasis in fisheries, from Idaho State University. His primary research has been related to the ecology of salmonids during the winter.

II. SCOPE OF REVIEW

This review was requested by Idaho Rivers United (IRU) for the purpose of providing fisheries information and analysis of the Stibnite Gold Project. It includes an assessment of data validity and assumptions in fisheries and associated models that affect predictions of mining impacts to fish and their habitat. It also includes identifying any deficiencies, weaknesses, and omissions in the SDEIS analyses, an assessment of proposed mitigation measures for adequacy, feasibility, and effectiveness and support for conclusions. Materials reviewed, all or in part included, are summarized in Table 1. Sarah O'Neal wrote comments related to the DEIS and Jim Gregory edited and included a portion of those comments that were still relavant to the SDEIS. Additional comments on the SDEIS were provided by Jim Gregory.

Table 1. Stibnite Gold Project materials reviewed for the purposes of this document.

Author	Date	Title	Section/s if applicable
US Forest Service	2022	Stibnite Gold Project, Supplemental Draft, Environmental Impact Statement	
Brown and Caldwell	2021	Fisheries and Aquatic Resources Mitigation Plan	
US Forest Service	2022	Fisheries and Aquatic Habitat (Including Threatened, Endangered, Proposed, and Sensitive Species) Report	
US Forest Service	2020	Stibnite Gold Project Draft Environmental Impact Statement	Chapter 3.12
US Forest Service	2020	Stibnite Gold Project Draft Environmental Impact Statement	Chapter 4.12

US Forest Service	2020	Stibnite Gold Project EIS Appendix D	
US Forest Service	2020	Stibnite Gold Project EIS Appendix J	
MWH Americas, Inc.	2017	Aquatic Resources 2016 Baseline Study	
Brown and Caldwell	2018	Final Stibnite Gold Project Stream and Pit Lake Network Temperature Model Existing Conditions Report	
Brown and Caldwell and others	2019	Draft Fishway Operations and Management Plan	
Brown and Caldwell and others	2019	Final Fisheries and Aquatic Resources Mitigation Plan	
GeoEngineers	2017	Aquatic Resources 2016 Baseline Study Addendum Study	

III. GENERAL FINDINGS

This review of the Stibnite Mine Supplemental Draft Environmental Impact Statement (SDEIS) and associated documents focused on the evaluation of baseline conditions and predicted impacts to fish and their habitat. All four species of salmonids (Family *Salmonidae*) evaluated in the SDEIS are of conservation concern, with Chinook salmon (*Oncorhynchus tshawytscha*), steelhead (*O. mykiss*), and bull trout (*Salvelinus confluentus*) listed under the US Endangered Species Act, and Westslope cutthroat trout (*O. clarki lewisi*) federally designated as a sensitive species. In general, with some exceptions, especially for steelhead, the SDEIS predicts Stibnite Mine development will result in increases in habitat quantity and but a decrease in habitat quality relative to current baseline conditions for the species evaluated. However, **the habitat decreases predicted in the SDEIS are vast underestimates of direct, indirect, and cumulative impacts that would result from mining** due to the currently impacted nature of the habitat, mischaracterization of current baseline conditions, underpredictions of impacts to water quantity and quality, and glaring omissions of physical, chemical, and biological components of fish habitat and productivity. Moreover, **mitigation methods proposed are not sufficient to reliably reverse impacts**, much less improve existing, impaired habitat during or after additional mining occurs.

Salmonids in the proposed Stibnite Gold Project Area exhibit diverse life histories and habitat exploitation, though all species are highly migratory and require habitat complexity for population persistence. The maintenance of both habitat and life history diversity are essential to the sustainability of salmonid populations—a concept widely recognized as the portfolio effect (Schindler et al. 2010). The importance of the portfolio effect—and the ability to mitigate for or restore it—is generally overlooked by the SDEIS. While mining and associated development impacts are extensively (if inaccurately) evaluated in the document, it assumes little interaction between impacts which ultimately work to simplify habitat and, subsequently life history diversity.

III-A. IMPACTS OF MINING AND ASSOCIATED DEVELOPMENT

Very little literature describes the spatial and temporal extent or variability of mine and associated development impacts, but there are general conceptual models describing far-reaching and long-lasting impacts (Figure 1). Although dozens of specific impacts have been described, most are interrelated, and many fall within the broad categories briefly described below.

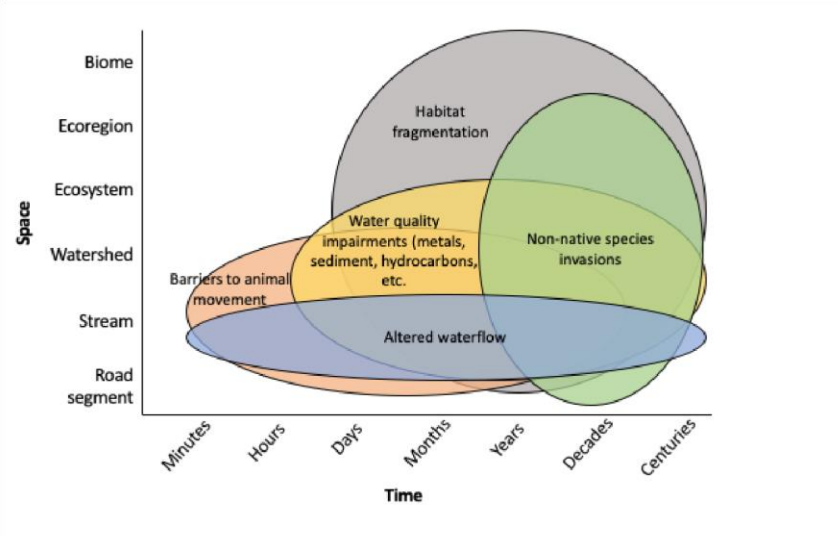


Figure 1. Temporal and spatial dimensions of ecological effects of mine and road development. Adapted from Angermeier et al. 2004 and NRC 2005.

1. Habitat Simplification

Particularly in the floodplain (but in many if not most) stream habitats, simplified flow patterns resulting from mining-related water withdrawals and road crossings prevent and/or restrict the migration of river channels across their valley bottom, and thus their connection to riparian, wetland, other groundwater-influenced, and headwater habitats crucial to their overall function (Vannote 1980, Stanford and Ward 1993, Forman and Alexander 1998, Hancock 2002, Colvin et al. 2019; Figure 2). River channel migration creates and manages side channels, pools, surface water and groundwater interactions, and nutrient dynamics, creating the habitat complexity essential to the productivity and sustainability of all native aquatic life (Stanford et al. 2005, Whited et al. 2012, Luck et al. 2015, Bellmore et al. 2017). In undeveloped watersheds, channel migration and associated cut and fill of riverbanks and instream habitat, respectively, are further facilitated by beaver and debris dams, and ice processes (e.g., Malison et al. 2015). These natural processes combine to create the complex habitat that Pacific salmon and associated fishes have relied upon for their millennia-long sustainability. Most often, bridge and especially culvert widths do not span the zone of channel migration, in spite of permitting requirements and best management practices. While the up and downstream up and downstream extent of habitat simplification remains difficult to quantify, impacts last far beyond the construction, use, and even closure of mines and roads.

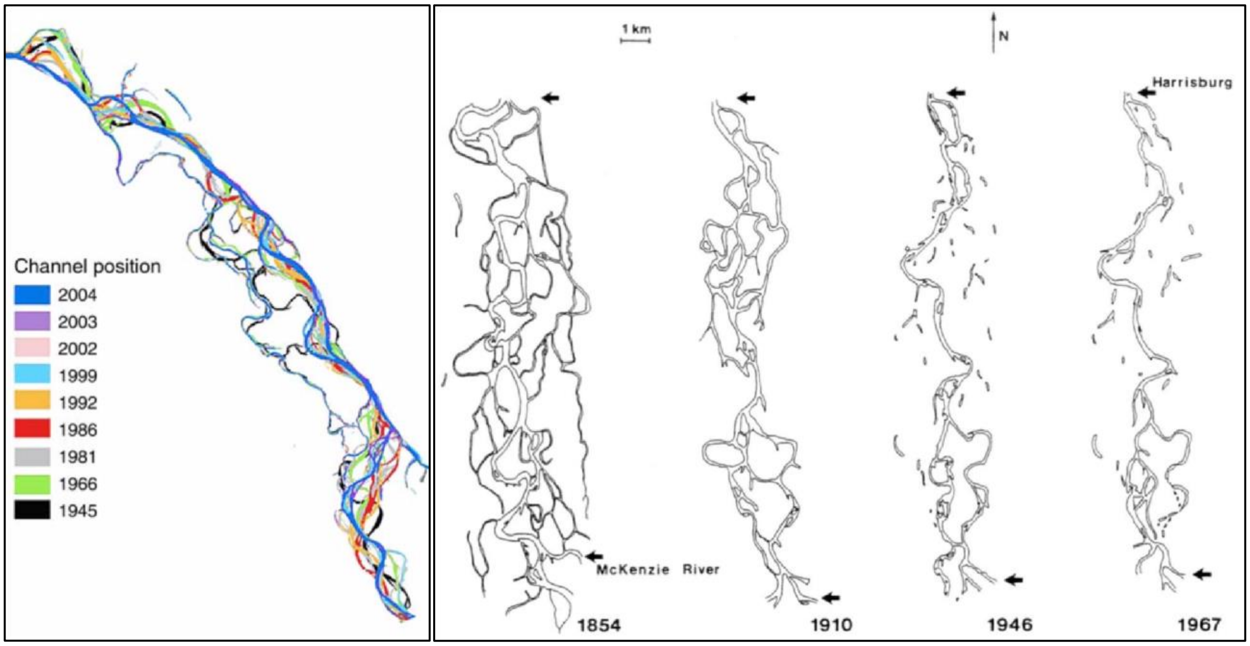


Figure 2. Habitat complexity driven by channel movement over time in the undeveloped Nyack River, MT floodplain (left), compared to habitat simplification driven by development in a Willamette River, OR floodplain (right). Images from Whited et al. 2007, and Sedell and Froggatt 1984.

Because streams simplified by reduced flows and/or encumbered by culverts and bridges become disconnected from the valley bottoms they historically migrated across, they often become incised into a narrower, deeper channel than occurs in undeveloped watersheds (Figure 3). This alters stream hydrology (frequently increasing stream velocity), channel structure, and generally leads to increased fine sediment deposition in the vicinity of the crossing (Figure 3). These changes can lead to velocity barriers, lack of resting habitat, and direct loss of salmonid spawning and incubation habitat which requires gravel to cobble-sized substrates. The velocity and sediment influences of road crossings alone can extend about 0.5 km (0.3 mi) upstream and 1 km (0.6 mi) downstream of (Forman and Alexander 1998), alter groundwater and surface water interactions, nutrient dynamics, and ultimately biological productivity. Ultimately, habitat simplification resulting from Stibnite mine development would last beyond the end of the mine and road operation.

Figure 3. Examples of complex, free flowing habitat in an undeveloped watershed (A, B), compared to simplified, incised habitat in a developed watershed (C, D). The undeveloped stream reach illustrates ideal fish spawning, incubating, and rearing habitat, while that in the developed stream reach is impaired habitat resulting from disconnection from its floodplain, a lack of complexity and shade from riparian vegetation, and imbedded substrates resulting from fine sediment deposition. From Whited et al. 2017.

2. Decreased water quality

The United States Environmental Protection Agency (USEPA 2000) estimates 40% of western US headwater streams are contaminated by hard rock mining. Persistent impacts of mining to aquatic insects, fish including salmon, and habitat are widely documented (e.g., Kemble et al. 1994, Pascoe et al. 1994, Farag et al. 1998, Maret and McCoy et al. 2002). Metals can be toxic to fish and other aquatic life at lethal and sublethal levels, and through direct and indirect pathways. Impacts to water quality from mine and associated road development alone include: altered temperatures, decreased surface water and groundwater interactions; increased turbidity and, potential acid and metals generation from the road cut itself; and spills, runoff, and dust deposition of metals, hydrocarbons, reagents, and deicing salts). Many of these pollutants will deter, impair, or kill migrating salmonids and other aquatic species, depending on their concentrations. Very little existing data describe the spatial extent of these impacts, though acid and metals from road cuts have been documented over 7 km (4.3 mi) downstream of road crossings (Morgan et al. 1984). Impacts can persist for decades to millennia (e.g., Davis et al. 2000).

In addition to impacts to from increased metals concentrations, mining and associated road construction will increase sediment inputs causing cascading effects through aquatic foodwebs that negatively impact salmonid growth, survival and reproduction. Sediment deposition can impair instream spawning and incubation conditions by filling interstitial spaces between gravels used for egg deposition and incubation, thus decreasing availability of oxygen to incubating embryos and altering thermal regimes influenced by groundwater (Bisson and Bilby 1982, Hartman et al. 1996, Malcom et al. 2003, Stanford et al. 2005, Sear et al. 2008). Embryo survival decreases with increased sedimentation in spawning redds (Greig et al. 2005). Suspended sediments generated from soil disturbance and erosion caused by mining and road construction on floodplains and other near-stream locations increase turbidity and decrease growth and survival of fishes (Newcombe and MacDonald 1991, Newcombe and Jensen 1996). Mechanisms of impact caused by elevated suspended sediment include: alteration of behavior and reduced physiological health of juvenile steelhead and coho salmon (Berg and Northcote 1985, Michel et al. 2013); decreased productivity of stream food webs, which can deplete the aquatic food sources that support fish growth (Newcombe and MacDonald 1991, Henley et al. 2000); and interference with foraging by trout and salmon, increasing feeding costs and reducing growth (Platts et al. 1989, Barrett et al. 1992, Waters 1995, Shaw and Richardson 2001).

3. Migration barriers

Tailings dams, road crossings, and other mine infrastructure frequently become barriers to migratory salmon, resident fishes, and lamprey migration because of physical, chemical, and biological factors. In addition to the physical factors described above (habitat simplification, increased velocities and sedimentation), mine infrastructure and associated stream crossings may become physically impassable to fish. The Yellow Pine Pit Lake is already a permanent migration barrier, and other proposed mine-associated features could become permanent barriers—i.e., bridges and culverts planned for fish passage could become temporarily blocked (e.g. with wood, ice, or overflowing water; Figure 4). For example, one recent evaluation in Montana indicated 7685% of culverts acted as migration barriers during low flow (Blank et al. 2005). Impacts of blocked migration extend to the upstream and downstream ranges of anadromous and resident migrating fishes—potentially miles up and downstream, collectively accumulating dozens of stream miles in total. The duration of impact would equal that of the blockage, which could be hours (until inspection or repair) to years (after the mine and/or roads are abandoned).

Figure 4. Examples of common causes of culvert blockages: beaver activity (left), ice on Alaska's North Slope (middle), and flooding (right). Images from lizottesolutions.com, Michael Baker International 2019, and thurstontalk.com.

Even without blockage, culverts can delay upstream migration by 1-20 days by funneling high flows (and thereby exceeding velocity thresholds), or during low flows (when water depth becomes insufficient; Lang et al. 2004). Although culvert design has improved with increased consideration for fish passage, passage effectiveness is still mixed, and depends heavily on information describing species presence and stream flows. Even culverts appropriately designed according to modern standards intended to allow for fish passage still fail because:

- Some culverts are still installed incorrectly or improperly maintained,

- After a culvert is installed, stream geomorphology changes, so the culvert design no longer allows fish passage, and
- Opportunities for improving fish passage are lost due to the "emergency" status of culvert replacements following a flood or other culvert failure (Lang et al. 2004).

4. Introduction of non-native species

Increased human traffic of any kind increases the likelihood of non-native species introduction and/or proliferation. Brook trout (*Salvelinus fontinalis*) are an existing non-native species in the Stibnite Gold Project Area that impact native salmonids and aquatic foodwebs in general. Not only do brook trout compete for local food resources, they can hybridize with bull trout making field identification difficult and compromising the genetic integrity of a species of conservation concern (USFS 2000, Appendix J). Other aquatic species of potential concern include (but are not limited to) terrestrial and wetland plant species which may simplify and alter important riparian habitat, e.g., sweetclover, (*Melilotus alba*), Canadian waterweed (*Elodea canadensis*), salmon and other fish pathogens (e.g., whirling disease, *Myxobolus cerebralis*). The upstream and downstream extent of the impact of non-native species is not known, but could extend at least meters to kilometers from the mine and associated infrastructure. Invasive species inevitably cause cascading impacts to entire terrestrial and aquatic food webs and are considered amongst the largest threats to global species and habitat diversity (Vander Zanden et al. 1999, White et al. 2017). Given the difficulty of eradicating non-native species, impacts would likely last for decades to centuries.

5. Indirect and cumulative impacts

Multiple stressors in combination (e.g., increased metals concentrations and sediment, increased temperatures, altered stream flows, channelization of habitat and associated loss of floodplain and other habitat connectivity) accumulate through developed river networks. This can result in a loss of spawning, incubating, and rearing habitat for all fish species over time and space. Because Chinook salmon, steelhead, bull trout, and Westslope cutthroat trout are migratory, adverse impacts can accumulate even when fish are absent from a particular reach. Not only does mine development directly impact habitat coincident with the mine footprint, impacts propagate through trophic levels, time, and space. These cascading effects are largely overlooked in the DEIS. The overall result of similar indirect and cumulative effects throughout the Pacific Northwest and other salmon habitat has resulted in the reduction and in some cases extinction of many salmonid populations (NRC 1996).

III-B. SHORTCOMINGS OF THE STIBNITE GOLD PROJECT DEIS

1. **Failure to analyze project impacts on Lamprey.** Lamprey are mentioned only three times in the SDEIS. They are indicated to be found within the analysis area (Sectiion 3.12.4.1 page 3-266), historically harvested and dried by the Nez Perce Tribe (Section 3.24.4.1 page 3-504), and culturally important (Section 3.24.4.4 Page 3-515). However, no analysis of the extent, duration, or scale of impacts to individuals, populations, or habitat was provided.

   Pacific Lamprey were historically widespread along the West Coast of North America, though their abundance has declined (Close et al. 1995; Moser and Close 2003), and their distribution is contracting throughout Oregon, Washington, Idaho, and California (Luzier et al. 2009). The declines were extensive enough that, in January 2003, the USFWS received a petition to list Pacific Lamprey as threatened or endangered under the Endangered Species Act of 1973, as amended. In December 2004, the USFWS found that the petition and additional information in their files did not present substantial scientific or commercial information indicating that listing the species was warranted (DEPARTMENT OF THE INTERIOR, Fish and Wildlife Service, 50 CFR Part 17, Endangered and Threatened Wildlife, and Plants; 90-Day Finding on a Petition To List Three Species of Lampreys as Threatened or Endangered). However, recent advancements in the understanding of Pacific lamprey ecology and causes of population declines support a renewed look at listing lamprey under the Endangered Species Act (Wicks-Arshack et al. 2018).

Like salmon, Pacific lamprey are a tribal trust resource, and thu,s the federal government has a heightened responsibility to ensure the continued existence of the species (As cited in Wicks-Arshack et al. 2018). Pacific lamprey are also classified as a Species of Greatest Conservation Need Tier 1, a Bureau of Land Management Sensitive Species Type 2, a US Forest Service Northern Region Sensitive Species, and Endangered and Protected Nongame by the state of Idaho (https://idfg.idaho.gov/species/taxa/17473).

Threats to Pacific Lamprey include restricted mainstem and tributary passage; reduced flows; dewatering of streams; stream and floodplain degradation; degraded water quality; invasive species and predation; and changing marine and climate conditions (Anamouous 2022). Several of these impacts are anticipated within the mine and analysis areas (SDEIS).

Since 2012, the Nez Percee Tribe has been planting lamprey in the South Fork Salmon River and screw traps downstream from those locations in the South Fork Salmon River have captured numerous juvenile lamprey outmigrants. https://idfg.idaho.gov/blog/2020/10/thousands-lamprey-south-fork-salmon-river. The SDEIS did not indicate whether lamprey were present in the analysis area or what impacts might occur to the species or to their habitat that would be caused by implementation of the MMP 2021.

2. **Failure to analyze project impacts to salmonid winter habitat and its effect on winter survival of salmonids in more than a cursory way.** The SEDIS notes that “A subpopulation of bull trout using an adfluvial life history strategy uses the Yellow Pine pit lake for overwintering…” and that “…bull trout overwintered in the large rivers downstream of the East Fork SFSR…” Baseline watershed condition indicators in Table 3.12-15 and 3.12-16 of the SDEIS lists “Large Pools/Pool Quality (all fish species in adult holding, juvenile rearing, and overwintering reaches)” largely as “No Data” and only functioning at acceptable risk for Curtis Creek.

   The SDEIS further states that “Some habitat conditions could not be quantitatively evaluated due to a lack of available data or a suitable site-specific model (e.g., impacts of stream flow reductions on overwintering fish, and a site-specific stream flow/productivity model).” However, the lack of data and lack of a model does not mean that the impacts do not occur. But, the defacto conclusion to lack of analysis, is a lack of impact, which is certainly not true.

   Conditions salmonids face in streams during the winter are severe and how salmonids react to those conditions are complex, including how and when their survival is affected (Huusko et al. 2007). Winter is a stressful period for salmonids (Berg and Bremset 1998; Huusko et al. 2007) and there are documented interaction between habitat availability and survival, and winter temperature and survival (Smith and Griffith 1994). Additionally, flow affects both habitat availability and temperature and thus survival (Mitro et al. 2003). Below is a brief review of some of the literature specifically related to the flow/survival and cold/survival relationship. I have also included information on the effects of ice, which is affected by temperature and flow, and winter fish movement.

Flow/Survival

In 2003, Mitro et al. (2003) published a positive flow/abundance relation that predicted, based on the mean river discharge in the second half of winter, the spring abundance of sub-adult rainbow trout in Box Canyon on the Henrys Fork of the Snake River, a river section that contains complex bank habitat. They considered, and rejected, a scenario wherein autumn abundance determined spring abundance. They speculated that higher discharge in the second half of winter may have provided more bank habitat at a critical time for survival. Cunjak et al. (1998) also observed a positive flow/survival relationship for juvenile Atlantic salmon and speculated that the mechanism behind the relationship was increased habitat availability at higher winter flows. This winter flow/survival relationship has also been verified in the Henrys Fork at Box Canyon by Garren et al. (2006) and Van Kirk (unpublished; Figure 7) and also exists in the South Fork Snake River (Van Kirk unpublished; Figure 8). Hvidsten et al. (2015) also found a positive relationship between winter discharge and smolt production of juvenile Atlantic Salmon in the River Orkla in central Norway. In a study using data from 29 tailwaters across western North America spanning 1-19 years, Dibble et al. (2015) found that rainbow trout recruitment was primarily correlated with high winter flow combined with low spring flow, whereas brown trout recruitment was most related to low water velocity. Dibble et al. (2015) interpreted the low water velocity relationship by explaining that low-velocity, shallow water habitats near river margins during early life stages, permit energetically efficient foraging while providing protection from predation. Interestingly, Dibble et al. (2015) defined the winter period as 1 October – 31 January, and Spring as 1 February – 31 May. Therefore, this critical time period only slightly overlaps with the findings of Mitro (1999) who found that first winter survival of Rainbow Trout in the Henrys Fork was related to late winter (15 January – 31 March) flows.

Bradford and Heinonen (2008) reviewed the impacts of low flows in Canadian streams and cited several studies where positive correlations between winter flows and survival or abundance of juvenile fish had been identified. However, they concluded "…that there remains substantial uncertainty in the prediction of impacts of flow reductions or diversions [on fish populations]. Some of this uncertainty is due to a lack of understanding of the relationship between flow and fish populations, but much is probably due to site- and time-specific variation in how stream biota responds to habitat changes." Huusko et al. (2007) cited studies that showed "…that salmonid survival may be lowest in spring (Elliott 1993), in autumn and early summer (Carlson and Letcher, 2003), in winter (Letcher et al. 2002) or that survival does not differ appreciably between seasons (Olsen and Vollestad 2001; Lund et al. 2003)." Huusko et al. (2007) further stated that, "These studies indicate that there may be a complexity of physical and biological factors affecting the survival of fish. In some rivers, the set of prevailing conditions in winter, such as the severity and duration of the cold season, together with the quality and suitability of habitats, may act as a bottleneck to survival, whereas in other river conditions during other seasons may be more limiting." This may also be the case in Box Canyon of the Henrys Fork under certain conditions as Garren et al. (2006) found that a second factor with substantial impacts to year-class strength is spring flow. They stated that "population estimates of age-two rainbow trout are higher during years when spring flows are constant as opposed to years when flows are reduced over a period of one to ten days." Stable flow and ice conditions during winter have been seen to be beneficial to juvenile salmonid survival in other rivers (Cunjak et al. 1998; Linnansarri and Cunjak 2010; Hedger et al. 2013). Mitro et al. (2003) speculated that the reason for the late winter flow/survival relationship in Box Canyon may have been that the "Higher discharge in the second half of winter may therefore have provided more bank habitat in Box Canyon at a critical time for survival. Trout from other river sections may move upstream to find available bank habitat (Mitro and Zale 2002) as macrophytes become unsuitable for winter survival and trout begin to move to bank habitat (Griffith and Smith 1995)."

One thing is certain, the availability of cover influences the number of fish that overwinter in particular areas (Tschaplinski and Harman, 1983; Meyer and Griffith, 1997; Harvey et al., 1999). During the winter, as water temperatures decline below about 10° C, juvenile salmonids begin to seek cover (Taylor 1988) where they can conceal during the day and come out at night as light levels decrease (Contor and Griffith 1995). This behavior appears to be related to predator avoidance (Gregory and Griffith 1996) rather than seeking shelter from the current (Taylor 1988; Valdimarsson and Metcalfe 1998). Concealment cover consists of interstitial spaces between cobble and boulders (Hillman et al. 1987), or woody debris (Swales et al. 1986; Schrader and Griswold 1992). Bank habitat that provides concealment habitat is critical to the winter survival of age-0 river salmonids (Griffith and Smith 1993; Cunjak 1996; Mäki-Petäys et al. 1997). For example, Mitro and Zale (2002) found that simple bank habitat did not support age-0 rainbow trout throughout the winter in the Henrys Fork, while complex bank habitat did. When these habitats are available, juvenile salmonids are more likely to survive (Smith and Griffith 1994; Giannico and Hinch 2003), and where it is not available or not complex enough, juvenile salmonids are likely to emigrate (Bjornn 1971; Hillman et al. 1987; Meyer and Griffith 1997, Mitro and Zale 2002; Huusko et al. 2007) or die (Mitro and Zale 2002).

Movement/Survival

Mitro and Zale (2002) tracked winter movement of juvenile Rainbow Trout and detected movement from areas of simple bank habitat or mid-channel areas to areas of complex bank habitat. They also detected winter movement between river sections, primarily, but not exclusively, in a downstream direction. Jakober et al. (1998) observed movement of bull trout during periods of anchor ice formation and Hillman et al. (1987) observed mid-winter movement of Chinook salmon in Red River, an Idaho stream highly embedded with silt. As water temperatures dropped from 8 – 4° C, 80% of the juvenile Chinook formerly present emigrated from the study area, apparently because suitable winter habitat was not available. Meyer and Griffith (1997) found that as rock substrate configuration was changed to create more concealment cover, the number of fish remaining in their enclosures increased significantly. Gregory (2001) observed that telemetered juvenile trout could average upstream movement of over 150 m/day and downstream movement of over 500 m/ day over a 5-day winter period. Giannico and Hinch (2003) observed extensive juvenile Coho Salmon movement in early and late winter, with little fish movement from January through March. Linnansaari and Cunjak (2010) tracked PIT-tagged juvenile Atlantic Salmon that emigrated from their study area and found them all (n=9) alive in the spring.

Researchers suggest that winter movements of juvenile trout appear to be related to their seeking appropriate winter habitat or exiting inadequate habitat (Meyer and Griffith 1997; Gregory 2001, Mitro and Zale 2002, Hillman et al. 1987). The probability of survival for juvenile trout that move during the winter in most streams is unknown, although clearly some fish survive winter movement (Mitro and Zale 2002; Gregory 2001; Dare et al. 2002; Linnansaari and Cunjak 2010). If they survive the movement itself, further winter survival likely depends on their finding adequate winter habitat (Smith and Griffith 1994) as described above.

Ice/Survival

Recently, researchers have noted that surface ice also plays a role in providing winter habitat and, therefore, affecting winter survival. Surface ice has been shown to function as winter habitat for juvenile salmonids (Gregory and Griffith 1996; Waltz et al. 2015) and has also been shown to increase winter survival (Linnansaari and Cunjak 2010) even over warmer areas (average temperature 0.00° vs. 0.23° C) without ice (Hedger et al. 2013). Juvenile salmonids grow more, use a broader range of habitats, are more active during the day, deplete their energy reserves at a slower rate, and have a reduced stress response (Hedger et al. 2013; Linnansaari et al. 2009; Waltz et al. 2015) in the presence of surface ice than in its absence. Cunjak et al. (1998) suggest that the benefit of surface ice is additive to the benefit of higher flows. Linnansaari and Cunjak (2010) PIT tagged 83 juvenile Atlantic Salmon and found that they survived episodes of anchor ice by concealing themselves in the substrate where the hyporheic water temperature was > 1° C. Huusko et al. (2007) speculated that "more stable conditions presumably occur during periods of ice cover than during periods without ice cover and this may partly explain why survival was generally high or stable in mid-winter." Waltz (2007) noted that ice cover reduces predation risk from piscivorous mammals and birds and that increased daytime activity under ice cover likely carries a relatively low risk of predation.

Cold/Survival

As with the flow/survival relationship discussed above, the relationship between water temperature and survival of juvenile salmonids has not been extensively studied. The difficulty associated with conducting survival studies, in combination with the inhospitable conditions that occur during winter research, make these studies rather rare. However, Smith and Griffith (1994) found a positive relationship between winter survival and winter water temperature in instream-caged juvenile rainbow trout with survival of 100%, 90%, and 70% in cages with cover and average winter water temperatures of 4.4, 2.2, and 0.8° C respectively. When cover was not present in the cages, survival was significantly lower. Smith and Griffith (1994) also found that water temperature within cover was as much as 1° C higher than in the water column, which may be one reason survival is higher in cover. Meyer and Griffith (1997) found that winter survival (January - March) differed between their warm (average 3.5° C) and cold (average 2.5° C) site from 90 – 60% respectively for caged rainbow trout, but was not significantly different for brook trout. These studies were conducted in cages, which produced higher survival rates than the apparent survival rates (mortality and emigration) generally observed in those areas (Mitro et al. 2003). Because of those types of differences, Huusko et al. (2007) speculated that predation may be an important source of mortality during winter. While that may be true, emigration also likely plays a role. Regardless, the temperature/survival relationship may be even more pronounced when natural predation or risks associated with movement are present. Giannico and Hinch (2003) in an open cage study observed juvenile coho salmon survival rates that were higher during a mild winter trial than during a cold winter trial, indicating that the temperature/survival relationship does not reverse when more natural conditions are present.

Given the large effect that flow, temperature, and habitat have on survival of salmonids suggests that changes in flow, temperature, and habitat, discussed in the SDEIS could have substantial influence on salmonid populations, and therefore need to be analyzed. Additionally, the complex interaction between salmonids, and habitat and environmental conditions suggests that simplifying those relationships to a model that considers only velocity, depth, and substrate, such as PHABSIM, are overly simplistic and likely to be wrong.

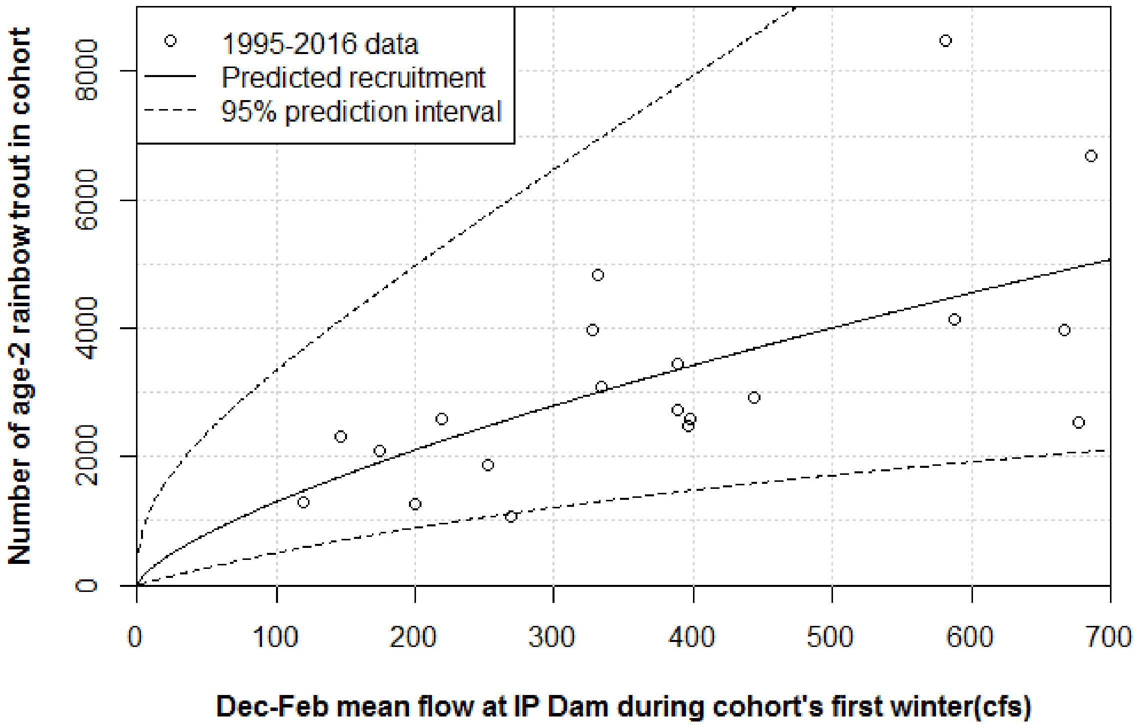


Figure 1. Recruitment (age-2 fish present in spring sampling) versus winter flow (at USGS gauge 13042500) two years previous on the Henrys Fork of the Snake River (Van Kirk unpublished; Recruitment data from Idaho Fish and Game Upper Snake Region various annual reports including Schoby et al. 2014)

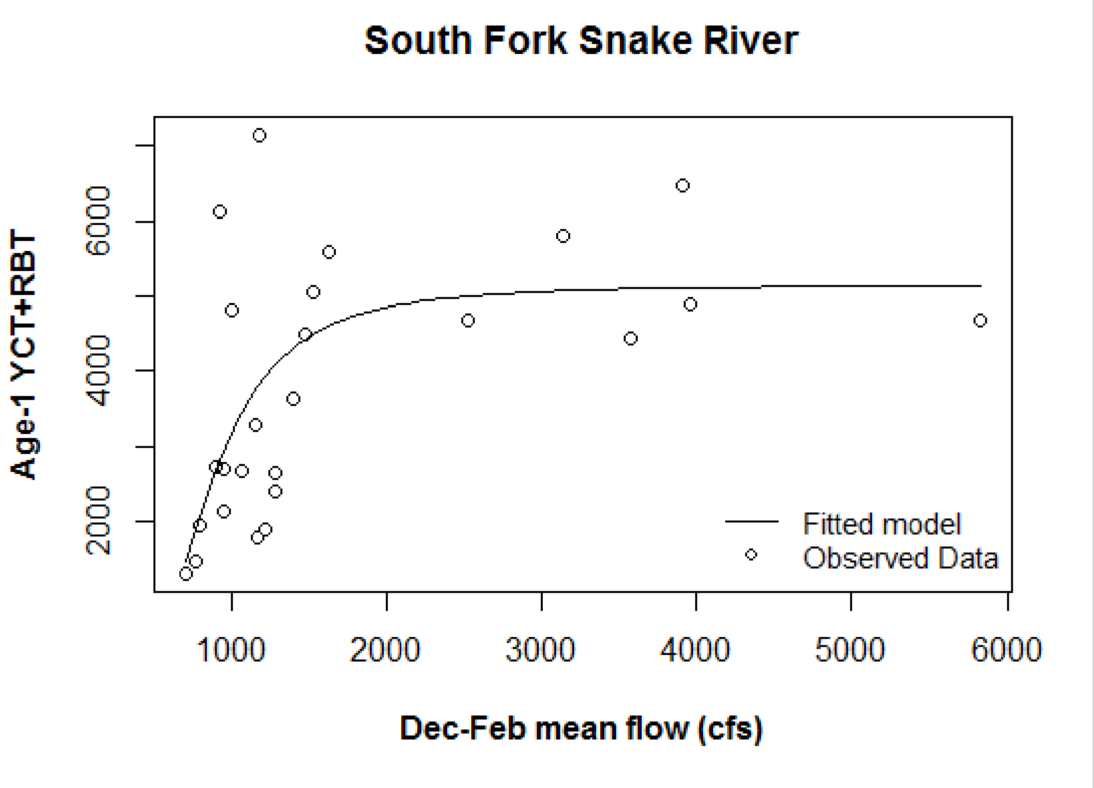


Figure 2. Recruitment (age-1 fish present in fall sampling) versus previous winter flow on the South Fork Snake River (Van Kirk unpublished; Recruitment data from Idaho Fish and Game Upper Snake Region various annual reports including Schoby et al. 2014).

3. **Increases in water temperature predicted to occur due to mine operations, particularly when combined with inevitable climate change, would decrease the survival of juveniles.** Crozier et al. (2021), in their assessment of the climate change threat to Chinook salmon throughout their life cycle, concluded that "…dramatic increases in smolt survival are needed to overcome the negative impacts of climate change for this threatened species." Temperature increases in the analysis area were outlined as follows. Meadow Creek upstream from the East Fork of Meadow Creek is expected to have temperature increases for up to 52 years, with predicted temperature increases up to 6.8 °C above baseline (Table 4.12-12 of the SDEIS). Additionally, "…stream temperatures are increased in restored stream channels until revegetation establishes to provide riparian shading for the streams" (SDEIS) and "Following closure and reclamation, the overall net effect from the SGP would be a net increase in available habitat; however, flows and temperatures make the additional habitat less optimal" (SDEIS). These increases were predicted in addition to climate change which is "…predicted to increase average August stream temperatures by "an average of 0.72°C (1.3°F) by 2040 and 1.4°C (2.6°F) by 2080 (Isaak et al. 2017)" (SDEIS).

Water temperature is fundamental to salmonid growth and survival during multiple (and for some species all) aspects of their freshwater life history. Therefore, seemingly small increases in temperature could result in drastic impacts to these species. In addition to temperature, climate change is expected to reduce summer flows, which further impacts stream temperatures. Tonina et al. (2022) found that climate-induced changes in flow resulted in large reductions in useable habitat area and connectivity between the main channel and adjacent off-channel habitats. These reductions decrease the capacity of freshwater habitats to support historical salmon abundances and could pose risks to population persistence in some areas.

Given the negative relationship between summer temperature and survival and flow and survival for juvenile Chinook salmon (Walters et al. 2013), permitting a project that is predicted to increase stream temperature and decrease flow, in the face of imminent climate change, which will also increase stream temperature and decrease flow, will undoubtedly negatively impact salmonid species of concern in the analysis area and downstream.

4. **Comparing impacts to current habitat conditions drastically underestimates cumulative impacts of mining.** In the SDEIS, mine impacts are compared to current baseline conditions. Habitat considered in the SDEIS is already severely impacted by historic mining in the area and other development activities. Undoubtedly, historic mining impacts contributed to the current conservation status of all species evaluated. While the proposed alternatives describe some remediation of historic impacts, mine cleanup efforts simply cannot restore habitat to pre-mining conditions and cannot outweigh impacts from currently proposed mining. Previous domestic and global efforts have shown habitat restoration and mitigation is difficult, expensive, and often ineffective. Impacts should be predicted relative to estimated habitat conditions prior to mine development.

   The historic Stibnite/Yellow Pine mining site was located in the same watershed as the newly proposed Stibnite Mine described by the SDEIS. The historic site was mined from the early 1900s to the late 1990s largely for antimony (Sb) and gold (Au). Contaminants associated with those operations resulted in heavy metals and cyanide contamination in area soils, groundwater, seeps, sediments, and thus surface waters (USEPA 2020). An initial assessment conducted by the US Environmental Protection Agency (USEPA) in 1985 determined habitat impairments in the watershed significant enough to consider it among the US's most contaminated sites in (USEPA 2020). Despite some cleanup efforts, the site remains contaminated, with designation as a Superfund site. Moreover, numerous streams in the East Fork drainage of the South Fork Salmon River (EFSFSR) as well as the South Fork Salmon River (SFSR) exceed Idaho standards for drinking water and aquatic habitat, and thereby are considered 'impaired.' Exceedances are documented for arsenic (As), Sb, mercury (Hg), temperature, and sediment in watersheds and subwatersheds that will be impacted by mining (IDEQ 2018). While the SDEIS indicates that water quality will be improved by treatment associated with the proposed Stibnite mining project, ground and surface water flows are poorly characterized and treatment is neither sufficiently described nor tested for effectiveness (see Prucha 2020, Semmens 2020, Zamzow 2020).

5. **Current baseline conditions are insufficiently—and frequently inaccurately—characterized, rendering predictions of impact unreliable.**

   a. Hydrologic models lack appropriate spatial and temporal resolution, fail to robustly integrate groundwater and surface water interactions, and include additional flaws and inadequacies, ultimately resulting in <u>mischaracterization of existing hydrologic conditions</u> (see Prucha 2020, Semmens 2020, Zamzow 2020).
   b. With the exception of descriptions of proposed mitigation methods, <u>physical habitat characteristics—past or present—are virtually ignored in the SDEIS</u> despite their fundamental role in fish population productivity. Besides stream channel dimensions, gradient, stream flow and substrate, off-channel habitat, floodplain connectivity, and other habitat elements known to influence salmonid productivity receive little consideration in the main body of the document or the main appendix regarding fish resources and habitat.

c. While current water quality may be accurately described, many area waters are considered impaired due to high temperatures and excessive sedimentation, As, Sb, and HG. As discussed above, <u>the current state of impaired water quality should not be measured as baseline from</u> <u>which to predict allowable impact</u>.
d. <u>Multiple models used to describe various aspects of habitat are flawed oversimplifications of salmonid ecosystems</u>, and/or rely on model inputs generated by other flawed and inaccurate models. This renders their utility for predicting and measuring impact questionable at best. Flawed models include the Stream and Pit Lake Network Temperature (SPLNT), Intrinsic Potential (IP), Occupancy (OMs), and Physical Habitat Simulation (PHABSIM) models. See detailed comments below for specifics.
e. Salmonid distribution, abundance, and density estimates use flawed methodology and interpretation, and lack the spatial and temporal resolution to characterize baseline variability. Consequently, <u>adequate characterization of existing, listed salmon and trout populations are lacking</u>. The SDEIS concludes that Population-level effects are not expected from construction, but after reclamation, the net effect would be: a loss of habitat quality and quality for Chinook salmon, bull trout, and cutthroat trout, a net gain of habitat quality and quantity for steelhead trout, and Water quality improvements from removal of legacy mine materials would partially, but not completely, offset geochemical impacts associated with the SGP (US Forest Service 2020).

f. Metals concentrations of tissue from fish and other aquatic species can be a useful indicator of baseline conditions and an early indicator of low-level, chronic and/or indirectly accumulating increases of metals concentrations that may go undetected by routine monitoring. The DEIS evaluation of baseline metals concentrations in tissues are limited to a very small number of highly mobile Westslope cutthroat trout specimens, and two sculpin specimens. Because of their mobility, cutthroat trout are a poor indicator of local conditions. Sculpin tend to more closely reflect their environment, though sample size is vastly insufficient for any utility in characterizing baseline or measuring future impacts. Moreover, metals concentrations in tissues of biota inhabiting lower trophic levels is absent in the SDEIS. The SDEIS indicated that "In 2015, fish tissue was collected to check for metal concentrations …" but no metal concentrations in fish tissue data was reported or referenced. More baseline metals concentration data from area biota should be required prior to any permitting decisions.

6. **Physical habitat impacts from mining are underestimated in the SDEIS**. While some important aspects of habitat complexity and connectivity were characterized in baseline assessments referenced in the document (e.g., off-channel and riparian habitat, existing large woody debris, zones of groundwater and surface water exchange, etc.), they are ignored in the SDEIS predictions of impacts. Degradation of those habitats from decreased flows, road crossings, increased sediment loads, spills, and other activities associated with mine development will inevitably impact salmonid populations.

7. **Multiple other contaminants of significant concern to salmonids and other aquatic life receive little consideration in the SDEIS**. Some overlooked impacts of metals considered, in addition to impacts of several other EXISTING contaminants at the site most likely related to historic mining activities (Al—aluminum, Cd—cadmium, Fe—iron, Mn—manganese, Se—selenium, and Zn—zinc; see Zamzow 2020). Other metals are likely to increase as a result of Stibnite Gold Project development, but given the certainty of increases in these metals, some potential impacts of lesser-considered metals are described below. In particular, because they biomagnify, Hg and Se should both be considered in much more depth than they are in the SDEIS. Moreover, information regarding

toxicity (direct, indirect, lethal, and/or sublethal) of Sb (antimony) is widely lacking (Eisler 2000). Given the near certainty of increases in Sb concentrations resulting from Stibnite Mine development, laboratory toxicity testing (including laboratory tests using site-specific waters) should be required prior to permitting.

a. Aluminum

Aluminum (Al) is geologically abundant but serves no known biological function and exposure to Al could potentially be deleterious to all forms of aquatic life (Gensemer and Playle 1999). Aluminum contamination is typically associated with acid rain or deliberate addition of Al for algae or other plant control purposes, however elevated Al levels occur in the Stibnite mining area (Zamzow 2020).

Acute and Chronic Toxicity

Mechanisms of Al toxicity to fish are either:

1. Ionoregulatory, meaning they disrupt salt and water balances across the gill and other cellular membranes, and/or
2. Respiratory, leading to clogging of gills by mucus at high Al concentrations and insufficient oxygen exchange (hyperventilation and eventually suffocation).

Like most metals, Al toxicity increases in the acidic environments associated with metal-sulfide mines. Calcium, or increased hardness, provides some protection against Al toxicity (Gensemer and Playle 1999). Larvae emerging from gravels may be the most sensitive salmonid life stage to Al (Delonay et al. 1993), which is concerning given that salmonid species including Chinook, steelhead, bull trout, and cutthroat trout incubate in the gravels around and downstream of the Sibnite Mine site. Salmonids have demonstrated an ability to acclimate to increased Al concentrations in laboratory environments (Orr et al. 1986), however a metabolic cost may be associated with acclimation (Wilson and Wood 1992).

Sublethal Toxicity of Aluminum

Below levels known to induce mortality, Al can have sublethal impacts on salmonid physiology and behavior. When Al accumulates on the gill surface, mucous production can increase by up to four times normal levels, inhibiting respiration (Wilson et al. 1994). Stress associated with impaired respiration can inhibit the ability of salmonids to deal with additional stressors, including natural stressors like smoltification for anadromous (i.e., Chinook and steelhead salmon) species (Dennis and Clair 2012). For example, juvenile Atlantic salmon exposed to Al exhibited a 20-30% reduction in survival and reduced seawater tolerance (Krogland and Finstad 2003, Monette et al. 2008). In addition, Al can reduce salmonid growth rates and swimming speeds. Aluminum can also impair salmonid olfaction which is critical to locating predators and prey, mates and kin, and homing to natal streams. Interference with any of these processes essential to survival and successful reproduction could ultimately lead to populations level impacts.

Indirect Effects of Aluminum

Although less toxic to invertebrates than fish, Al does have deleterious effects on zooplankton and insects known to be important diet items for salmonids (Wilson and Wood 1992, Wilson et al., 1994). Aluminum is also toxic to algal species which form the base of the aquatic foodweb and are a main diet item for many macroinvertebrate species. Consequently, deleterious effects of Al can reverberate throughout the foodweb with ultimately negative impacts on salmonid growth and survival, particularly for those species which spend time rearing in freshwater (i.e., Chinook, rainbow/steelhead, westlsope cutthroat, and bull trout).

b. Cadmium

Like Al, Cadmium (Cd) is biologically non-essential. Although it occurs at low concentrations in aquatic systems, it commonly occurs in sulfide-ore bodies. Historic mine sites are frequently contaminated with cadmium exceeding background levels by as much four orders of magnitude— the Stibnite area exhibits occasional exceedances of Cd standards (Farag et al. 2006, Mebane et al. 2012, Johnson et al. 2016; Zamzow 2020). Cadmium is extremely toxic to aquatic life.

Acute and Chronic Toxicity

Exposure to cadmium (Cd) in fish occurs primarily through water in the gill and kidney (waterborne exposure) or in the intestine (dietary exposure; Franklin et al. 2002b). Cadmium mimics calcium (which *is* biologically essential), inhibiting its uptake which can lead to death (McGeer et al. 2011). Consequently, waters naturally high in Ca (naturally hard) waters ameliorate the toxic effects of Cd. Dissolved organic matter can also decrease the bioavailability or overall toxicity of Cd. Salmonids are more sensitive to acute levels of Cd toxicity than aquatic macroinvertebrates or other fishes (Farag et al. 2003, Mebane et al. 2012). However invertebrates (particularly amphipods) are more sensitive to chronic exposures of Cd (Mebane 2010). Less is known about mechanisms of dietary exposure to cadmium, though dietary uptake has been proven more toxic than waterborne exposure for some invertebrate species (Mebane 2010). Cadmium also induces neurotoxic effects in fish including hyperactivity leading to decreased growth and increased detection by predators (Mebane 2010). Examinations of life-stage sensitivity suggest that emerging fry are most sensitive in Chinook salmon, while emerging fry and rearing parr are equally sensitive to Cd in rainbow/steelhead (Chapman 1978).

Sublethal Toxicity of Cadmium

Sublethal physiological impacts of Cd include reduced growth and condition factor (unit weight per unit growth—an index of fish health; Riddell et al. 2005, Lizardo-Daudt and Kennedy 2008). Reproduction is also impacted, with impaired egg development and premature hatching (LizardoDaudt and Kennedy 2008). Furthermore, immune response may be depressed after Cd exposure as evidenced by elevated stress chemicals in exposed salmonids (Ricard et al. 1998). Documented behavioral effects of Cd on salmonids include a diminished ability to avoid predators—possibly due to olfactory inhibition (Scott et al. 2003), diminished foraging success (Riddell et al. 2005), and altered social behavior including less aggressive competition (Sloman et al. 2003). At extremely elevated Cd levels, salmonids have been documented avoiding waters altogether (Mebane 2010). If contamination from groundwater, a tailings dam breach, storage water spill, or treatment plant failure occurred at Stibnite Mine, particularly during salmon spawning, spawners could fail to reproduce altogether, or stray to nearby streams, potentially eroding the diversity essential to maintaining overall sustainability.

Indirect Effects of Cadmium

Deleterious effects of Cd can reverberate throughout the foodweb with ultimately negative impacts on salmonid growth and survival, particularly for those species which spend time rearing in freshwater (i.e., Chinook, rainbow/steelhead, and bull trout). Although invertebrates are less sensitive to acutely toxic levels of Cd, some invertebrates exhibit increased sensitivity to Cd at chronic levels of toxicity. Because dietary exposure is a known pathway of Cd contamination to fishes, indirect effects of Cd through food is poorly understood but highly likely.

c. Copper

Copper (Cu) is a naturally occurring, essential element that frequently increases in areas with active sulfide mining. It is one of the most pervasive and toxic elements to aquatic life and has been documented at levels one to three orders of magnitude greater than background in mining areas (Grosell 2011). Copper is utilized in growth and metabolism of all aerobic organisms.

Acute and Chronic Toxicity

Copper toxicity increases in acidic conditions, soft waters (low hardness), and in waters depauperate of dissolved organic matter. Exposure to Cu in fish occurs primarily through water in the gill, kidney, olfactory receptors, and lateral line cilia (waterborne exposure), or in the intestine (dietary exposure; Grosell 2011). Because it is essential to biological function, it is readily incorporated into fish tissues. Olfactory inhibition resulting from Cu exposure occurs within minutes and lasts for weeks or longer, with the potential to affect all aspects of salmonid biology (Grosell 2011). It is known to reduce growth, immune response, reproduction, and survival (Eisler 2000). Specific examples of toxic effects include disrupted migration; altered swimming; oxidative damage; impaired respiration; disrupted osmoregulation and pathology of kidneys, liver, gills, and other stem cells; impaired mechanoreception of lateral line canals; impaired function of olfactory organs and brain; and altered behavior, blood chemistry, enzyme activity, corticosteroid, metabolism, and gene transcription and expression (Hodson et al. 1979, Knittel 1981, Rougier et al. 1994, Eisler 2000, Craig et al. 2010, Tierney et al. 2010). The effects have been demonstrated for juvenile and adult life stages primarily of coho and Chinook salmon and rainbow trout.

Sublethal Toxicity of Copper

Many sublethal effects of Cu are identical to those causing mortality. Physiological effects of Cu exposure include decreased growth, swimming speed or activity, and feeding rates (Waiwood and Beamish 1978a, Waiwood and Beamish 1978b, Marr et al. 1996). Coho salmon exhibit diminished immune response after exposure to Cu (Stevens 1977, Schreck and Lorz 1978). Reproductive performance also decreases in adult salmonid (Jaensson and Olsen 2010). Very slight increases in Cu concentrations (5-25 parts per billion) inhibit olfaction in coho and Chinook salmon and rainbow trout, with potential to inhibit recognition of predators, prey, mates, kin, and natal streams (Hansen et al. 1999a, Hansen et al. 1999b, Sandahl et al. 2007, Baldwin et al. 2011, McIntyre et al. 2012). Chinook salmon and rainbow trout avoid Cu contaminated waters altogether, except after long-term sublethal Cu exposure, after which their avoidance response may be impaired (Hansen et al. 1999a, Meyer and Adams 2010). Avoidance can lead to degradation of spawning patterns and resulting genetic diversity which are essential to maintaining overall population structure and sustainability. Adult spawning migrations are delayed or interrupted in Cu contaminated streams, and downstream smolt migration is likewise delayed and osmoregulation of smolts in seawater is impaired (Lorz and McPherson 1976, Schreck and Lorz 1978, Hecht et al. 2007). Copper-exposed salmon are also more vulnerable to predation (Sandahl et al. 2007, McIntyre et al. 2012).

Indirect Effects of Copper

Numerous studies document adverse effects of Cu on freshwater algae, zooplankton, mussels, and other invertebrates, which could result in reduced prey abundance and quality to support fish growth and reproduction (Wootton 1990, Scannell 2009). Copper is one of the most toxic metals to algae, which form the base of the salmonid food chain. Algae production can decline at Cu increases of only 1-2 parts per billion (ppb; Franklin et al. 2002). Zooplankton and other invertebrates that rely on algae for food suffer decreased growth and reproduction when primary production decreases (Urabe 1991). Zooplankton and lotic macroinvertebrates are also extremely sensitive to Cu increases (Farag 1998, Zipper et al. 2016).

d. Iron

Iron (Fe) is an essential element involved in oxygen transfer, DNA synthesis, and immune function in all life. Like other metals, it is frequently associated with mining activity and its effects tend to increase in the presence of acidic conditions and the absence of dissolved organic matter. Relatively little is known about mechanisms of Fe toxicity.

Acute and Chronic Toxicity

Primary mechanisms of Fe exposure are waterborne and dietary. On the gills, iron precipitate accumulates causing physical damage and clogging. Resulting respiratory impairment is likely the main toxic effect of Fe contamination to salmonids (Dalzell and MacFarlane 1999). Additionally, elevated Fe concentrations during fertilization caused hardening of eggs.

Sublethal toxicity of Iron

Little information is available regarding sublethal effects of Fe. Coho salmon actively avoided Feenriched water in one study, which has implications for degradation of genetic diversity and population structure and sustainability (Updegraff and Sykora 1976). In studies of other vertebrates, Fe had impacts on brain function and social behavior (Bury et al. 2011).

Indirect Effects of Iron

Similar to fish gills, red-colored Fe-precipitate commonly associated with mine waste also settles on aquatic insect gills, resulting in decreased insect abundance and diversity, ultimately decreasing food resources for rearing fishes (Gray and Delaney 2010).

e. Mercury

Mercury is a metal which is non-essential to physiologic functions of life. While mercury occurs naturally at low levels in the environment, anthropogenic actions including mining have increased background mercury levels by two to four times in the aquatic environment even in remote places due to atmospheric deposition (Jewett and Duffy 2007, Kidd and Batchelar 2011).

Acute and chronic toxicity

While mercury can be acutely toxic, its toxicity to wild fish is more commonly related to chronic exposure to methylmercury (a bioavailable form of mercury) via diet (Kidd and Batchelar 2011). Like selenium, methylmercury bioaccumulates up aquatic food webs, with highest concentrations generally occurring in largest, oldest, piscivorous fish (e.g., Northern pike—*Esox lucius,* Arctic grayling—*Thymallus arcticus*, Dolly Varden—*Salvelinus malma*; Jewett and Duffy 2007). In freshwater environments, methylmercury bioaccumulates in both lakes and streams (McIntyre and Beauchamp 2007, Kwon et al. 2012), though mercury concentrations in fish in rivers generally exceed those of fish in lakes in the western US and Canada (Eagles-Smith et al. 2016). Chronic methylmercury exposure has impacts at very low levels (muscle or whole-body concentrations of 0.5-1.2 µg/g; Kidd and Batchelar 2012), including: neurotoxicity causing brain lesions and organ damage that impairs abilities to locate and capture prey and avoid predation; inhibition of reproductive success and growth; damage to intestines, digestion, cellular metabolism, organs; and alteration of stress hormones (Kidd and Batchelar 2012).

Indirect effects of Mercury

Indirect effects of methylmercury exposure which alter behavior and ultimately survival include decreased competitive feeding abilities, swimming performance, and predator avoidance (Kidd and Batchelar 2012). Of additional concern is the bioaccumulation of methylmercury in important subsistence species (e.g., Northern pike and Arctic grayling) which can lead to increased risk of heart disease, higher miscarriage rates, lower female fertility, decreased coordination, brain damage *in utero*, and higher blood pressure in children of adult consumers (Loring et al. 2010).

f. Selenium

Selenium (Se) is an essential trace element important to protein synthesis, but is one of the most hazardous elements to fish. The margin between essentiality and toxicity of Se is very slim (Janz 2012), and successful methods of water treatment are not yet developed. Unlike other metals, decreased water temperatures increase Se toxicity. Some metals mining operations and ore smelting are commonly associated with Se contamination. There are no examples of modern, operating mines which have successfully treated selenium to biologically acceptable levels.

Acute and Chronic Toxicity

Acute Se toxicity rarely results from anthropogenic activity. Chronic Se exposure, however, is teratogenic (causing malformation) to early life stages of fish (i.e., embryos, alevins, and fry; Lemly 2004). Unlike other metals, toxic effects occur primarily through dietary as opposed to waterborne pathways. Adult life stages are relatively tolerant of dietary Se intake, but can pass its effects to their offspring (Janz 2012). Selenium is deposited into eggs during their formation resulting in deformations typically in the skeleton, skull, or fins (Janz 2012).

Sublethal Toxicity of Selenium

Few studies have investigated sublethal Se effects. Avoidance of Se contaminated waters has not been documented, nor have changes in reproductive behavior of fishes in increased Se concentrations (Janz 2012). In one study, swimming speed, frequency, and distance were reduced after Se exposure in non-salmonid fishes (Janz 2012).

Indirect Effects of Selenium

Unlike most trace elements, selenium bioaccumulates (accumulates faster than metabolic or excretory loss) and sometimes biomagnifies (increases in animal tissue at successively higher levels of the food chain). Bioaccumulation and biomagnification cannot be predicted from Se concentrations, making sufficiently protective water quality guidelines exceedingly difficult to estimate. Since diet is the primary source of Se to fish, its efficient uptake by algae and macroinvertebrates contributes to Se toxicity. Interestingly, algae and invertebrates themselves exhibit little sensitivity to Se exposure (Janz 2012). Consequently, relatively low Se concentrations can lead to fish toxicity via bioaccumulation. Population level effects of Se contamination have been documented in multiple freshwater ecosystems, though further investigation is needed. In multiple case studies, the majority of fish species have been extirpated as a result of Se exposure (Lemly 2004, Janz 2012).

g. Zinc

Zinc (Zn) is an essential element used by vertebrates in protein (including hemoglobin) synthesis. It is a common contaminant associated with mining activity. Like Cd, Zn mimics calcium, inhibiting its uptake which ultimately leads to death (McGeer et al. 2011). Consequently, waters naturally high in Ca (naturally hard) waters ameliorate the toxic effects of Zn.

Acute and Chronic Toxicity

Dietary uptake poses lower risk to fish than waterborne exposure primarily through gills. Waterborne exposure competitively inhibits Ca, binding to sites on fish gills and leading to impaired gas exchange, gill inflammation, and ultimately suffocation, or decreased survival, growth, reproduction, and hatching (Hogstrand 2011). Dissolved organic matter can also decrease the bioavailability or overall toxicity of Zn. Fish kills and/or the absence of fish (including salmonid) species are commonly associated with elevated Zn, Cu, and Cd concentrations downstream of mining activity (Farag et al. 2003, Hogstrand 2011).

Sublethal Toxicity of Zinc

Increased stress and decreased immune response has been attributed to Zn exposure in rainbow trout (Wagner and McKeown 1982, Sanchez-Darden et al. 1999). Juvenile rainbow trout and other salmonids have also been documented avoiding Zn-contaminated waters (Hogstrand 2011). Other effects of Zn on behavior include increased ventilation and cough rates, altered swimming patterns, and decreased growth (Hogstrand 2011).

Indirect Effects of Zinc

Like other metals, effects of Zn can reverberate throughout the foodweb with ultimately negative impacts on salmonid growth and survival, particularly for those species which spend time rearing in freshwater (i.e., Chinook, trout, and bull trout). Invertebrates are more sensitive to acutely toxic levels of Zn than fish, so decreased feeding opportunities are a likely pathway for indirect effects of Zn (Santore et al. 2002).

8. **Impacts to salmonids from project-related groundwater changes are ignored in the SDEIS.** Groundwater and hyporheic inputs increase salmonid incubation and emergence success, and often support higher densities of fish due to their temperature and oxygen profiles relative to surface waters. Not only are groundwater flows poorly predicted in the SDEIS, their role in salmonid survival and resulting impacts to it from changing groundwater levels is unaddressed.

9. **Impacts to all non-salmon/trout species—fish and other aquatic life that support them—are ignored in the SDEIS.** Mountain whitefish (*Prosopium williamsoni*), suckers (*Catostomus* sp.), anadromous Pacific lamprey (*Entosphenus tridentatus*) and other important fish, freshwater insects, algae, and other primary producers are all critical elements of the foodwebs supporting salmonids considered in the EIS. Ignoring impacts to salmonid foodwebs is equivalent to ignoring impacts to salmonids at large.

10. **The SDEIS assumes no interactions among impacts**. By considering fish species, stream reaches, and limited habitat impacts (e.g., stream dewatering, temperature increases, increases of metals concentrations, migration barriers) all separately, the SDEIS fails to acknowledge the broad ecological understanding that multiple stressors will amplify one another's effects on the ecosystem. This assumption ignores volumes of peer-reviewed and other literature contradicting it, particularly that related to the so-called "death of a thousand cuts" leading to salmon population declines (NRC 1996). It results in a serious underestimate of impacts to fish and their habitat.

11. **Loss of headwater streams is falsely assumed to have no downstream impacts**. While loss of stream miles are estimated for the project area itself, those estimates exclude consideration of the function of upstream, contributing waterbodies, and downstream, receiving waterbodies. Headwater and/or upstream habitats are fundamental drivers of physical, chemical, and biological characteristics of their downstream receiving waters. Intact headwaters and wetlands comprise fundamental elements of thriving salmon habitat, and their fragmentation is considered a leading cause of global salmon declines (Colvin et al. 2019). Both long-term small scale and short-term largescale development fragment and simplify the complex physical habitat mosaics upon which all fish and aquatic life depend, introduce contaminants into the environment, and ultimately degrade the biological interactions that support robust fish populations. Failure to incorporate those impacts in the DEIS result in a substantial underestimation of project development.

12. **The SDEIS assumes that mitigation and restoration efforts are possible and effective.** The SDEIS assumes that mitigation for historic mining efforts will offset impacts from proposed mining efforts. Experience has shown that habitat restoration and mitigation are difficult, expensive, and often ineffective. Restoration activities to restore salmon, trout, lamprey, and other fish restoration are ongoing and extremely expensive. The US General Accounting Office estimates approximately $1.5 billion were spent on Columbia River salmon and steelhead restoration activities from 1997 to

2001 (USGAO 2002). Multi-billion dollar expenditures continue, although no Pacific salmon population has been removed from the ESA list of threatened and endangered species. Even modern fish passage design simply cannot account for spatial and temporal variability of historic baseline conditions, current conditions, and future conditions that will result from mining and associated development activity in addition to climate change. Moreover, other mitigation methods proposed rely heavily on unspecified and/or unproven habitat "improvements," fish salvage, and trap and haul operations. Trap and haul operations are well documented inducing significant stress (e.g., increased cortisol levels, gill flaring, etc.), disorientation (particularly in salmon homing to natal rivers and streams), deleterious changes to migration timing, increased mortality, and direct injury (e.g., Lusardi and Moyle 2017). Experience throughout Pacific salmon habitat, and particularly in the Columbia River basin indicates beyond question that trap and haul operations and most other restoration techniques are simply palliative. Already threatened salmonid populations will not be restored by (and may not survive) mining activity and the mitigation methods proposed in the SDEIS.

13. **The SDEIS is not consistent with the Forest Plan, and making the plan consistent with the SDEIS negates the purpose of the Forest Plan**. The SGP has a proposed timeline of construction of approximately 3 years, operations of approximately 12 years, and closure and reclamation of approximately 5 years. Due to the nature of proposed SGP activities, impacts to aquatic, terrestrial, and watershed resource conditions would be expected to occur for the length of the proposed SGP. This impact time length is in excess of the Forest Plan direction, which indicates that "Management actions, including salvage harvest, may only degrade aquatic, terrestrial, and watershed resource conditions in the temporary time period (up to 3 years), and must be designed to avoid resource degradation in the short term (3-15 years) and long term (greater than 15 years)" (SDEIS Appendix A). Further, the Forest Plan states, "In fish-bearing waters, do not authorize new surface diversions unless they provide upstream and downstream fish passage and, if needed, include either fish screens or other means to prevent fish entrapment/entrainment." The SDEIS Appendix A requests to "Waive the requirement of new surface diversions to provide upstream and downstream fish passage within the footprint of mining operations."

    The SDEIS Appendix A indicates that when a project is not consistent with Forest Plan standards, the Forest Service has the following options: (1) modify the proposed project to make it consistent with the Forest Plan; (2) reject the proposal; (3) amend the Forest Plan so that the project would be consistent with the Forest Plan as amended; or (4) amend the Forest Plan contemporaneously with the approval of the project so the project would be consistent with the Forest Plan as amended. This begs the question, - Why have a Forest Plan if the Forest Plan can simply be amended to fit the projects? The Forest plan is in place to protect resources and the "project" should be modified to fit the plan, not the plan modified to fit the projects. The Final Forest Plan Revision Payette National Forest states the following. "The purpose of the Plan is to provide management direction to ensure sustainable ecosystems and resilient watersheds that are capable of providing a sustainable flow of beneficial goods and services to the public. The Plan is the implementing guide for fulfilling the Forest Service mission of "Caring for the land and serving people." This purpose can not be met if projects control the plan instead of the plan controlling the projects.

IV. SPECIFIC COMMENTS

SDEIS Page 3-281: "Steelhead occur throughout much of the analysis area (Figure 3.12-7), but within the areas affected by construction and operation, their distribution in the East Fork SFSR, up to Yellow Pine pit where a steep high gradient riffle/cascade caused by past mining activities

> is thought to preclude upstream migration. Steelhead can maneuver through higher gradients than Chinook salmon; however, genetic sampling suggest such migration does not occur above the Yellow Pine pit lake."
> Figure 3.12-7 notes that "The two "Present" observations in Meadow Creek and East Fork Meadow Creek may be golden trout released in the upper watershed."

Comment: While the interpretation of these data may be true, it should be verified with either on-the-ground sampling or the use (and development if needed) of more specific eDNA primers. Moreover, any occurrence of rainbow trout (but not cutthroat trout or golden trout) should be considered occurrence of steelhead given the exceptional life history flexibility of rainbow/steelhead. Given the conservation status of steelhead in the study area, it is essential to determine the baseline distribution of rainbow/steelhead trout prior to EIS finalization.

Fisheries and Aquatic habitat report Page 134:

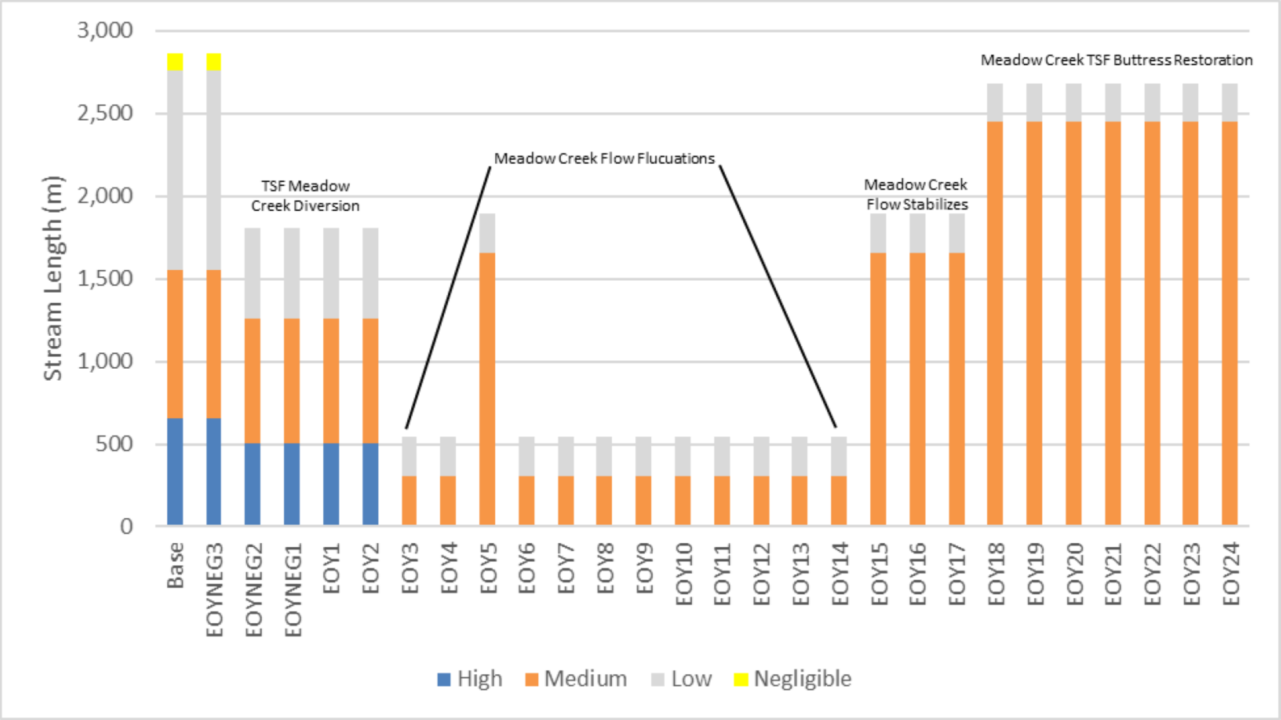


Figure 7-6 **Chinook Salmon Intrinsic Potential Habitat in Meadow Creek for 28 Years (Mine Years - 4 to 24)**

Comment: As a rule, ecological models are oversimplifications of the temporal and spatial variability that comprise natural systems. The intrinsic potential (IP) models used in the analysis, for example, reduce the intricate complexities of salmon habitat to stream flow, valley constraint, and stream gradient (compare to the comment above that outlines the intricacies of salmonids interactions with conditions and habitat during the winter). While these are all driving factors combining to create "potential" salmon habitat, they entirely overlook the chemical and biological/foodweb processes which will be altered by mining activity. Moreover, the IP model relies on model inputs (specifically stream flow) which were poorly predicted by hydrologic models also produced for the SDEIS (see Prucha 2020). With that said, the IP models still predict a decrease in the amount and quality/"potential" of Chinook salmon habitat in the upper reaches of the EFSFSR. Given the uncertainty involved with mathematical models in general, combined with the unreliability of stream flow estimates used as model inputs, the IP predictions could be off by orders of magnitude. Additionally, the large decrease in all types of habitat for all fish species during the mining period is concerning.

> **SDEIS Page ES-19**: For Chinook Salmon "Following closure and reclamation, the overall net effect from the SGP would be a net increase in available habitat; however, flows and temperatures make the additional habitat less optimal."
> For steelhead trout, bull trout, and Westslope cutthroat trout – "Effects for trout species differ from Chinook salmon following closure and reclamation, as there would be a net increase in both the quantity and quality of habitat for steelhead trout and net decreases in both quantity and quality of habitat for bullhead trout [I assume this means bull trout] and Westslope cutthroat trout."

Comment: In spite of major shortcomings of virtually every factor used to evaluate impacts to fish (particularly, intrinsic potential, streamflow productivity, barrier, and stream temperature models), the SDEIS still concludes negative impacts to Chinook salmon, bull trout, and Westslope cutthroat trout habitat. It does so without consideration of climate change, accidents and spills, and the cumulative and synergistic effects of overall habitat simplification and degradation. In general, the conclusion of negative impacts to habitat quantity and quality is oversimplified and underestimated.

Additionally, loss of habitat quantity and quality during the mining period is reported (e.g., see Figures 7-5 and 7-6 in the Fisheries and Aquatic Habitat Report) but disregarded in analysis of effects to the various species. This displays an underlying assumption that several years of reductions in habitat for endangered species is inconsequential.

> **SDEIS Page ES-1**: "…cooperating agencies including the U.S. Army Corps of Engineers (USACE), U.S. Environmental Protection Agency (EPA), Idaho Governor's Office of Energy and Mineral Resources (OEMR), Idaho Department of Lands (IDL), Idaho Department of Environmental Quality (IDEQ), and Valley County, Idaho."

Comment: Given the potential for this project to affect multiple ESA-listed species, it seems that the Idaho Governor's Office of Species Conservation should also be a cooperating agency.

> **SDEIS Page ES-8**: "…SGP is estimated to recover, over 15 years of mill production, 4.238 million ounces of gold, 1.710 million ounces of silver, and 115.342 million pounds of antimony."

Comment: This take is equal to almost 7.5 billion dollars in 15 years. This return warrants restoration of the mine site not to pre-MMP 2021 conditions, as indicated in the SDEIS, but to pre-mine conditions.

> **SDEIS Page ES-14**: "The SGP would result in stream flow impacts under both action alternatives. Low flow would be reduced at some locations during some periods of the SGP operations up to 14 percent in the East Fork SFSR and up to 40 percent in Meadow Creek."

Comment: This highlights the importance of the winter flow/survival relationship discussed in the discussion of winter habitat in these comments.

> **Page ES-14**: "Dewatering of the pits would lower groundwater levels in the alluvial and bedrock formations during the mining and post-closure periods and would reduce flows in local surface water streams that receive groundwater discharge. Additional seep and spring locations fed primarily by groundwater discharge from the dewatered aquifer may also observe flow reductions as an effect of dewatering."

Comment: Groundwater temperature, as it enters streams, has been seen to be an important component affecting bull trout distribution (Baxter 1997; Baxter and Hauer 2000; Gamett 2002; DFO 2017). Lowering the groundwater can be expected to negatively affect bull trout habitat and distribution and needs to be analyzed.

> **SDEIS Page 5-22**: "Across the rest of the CEA [Cumulative Effects Area], future actions that could impact surface water quality would mainly affect stream temperatures and stream sediment concentrations. Other RFFAs in the CEA would mainly contribute sediment loading to adjacent streams. Although most of these future actions would likely have sediment control measures in place, the cumulative effect across the watershed may still include higher sediment loads in the East Fork SFSR and its tributaries."

Comment: Conservation Recommendations from the Upper Snake Recovery Unit Implementation Plan for Bull Trout (USFWS 2015a) include: 1) Reduce general sediment production. Stabilize roads, road stream crossings, and other known sources of fine sediment delivery (South Fork Salmon River, Upper East Fork South Fork Salmon River, Lake Creek to Loon Lake, Sugar, Krassel-Indian, Curtis, Johnson [headwaters to mouth], and Cow-Oompaul creeks). 2) Clean up mine waste at active, inactive, and orphan sites (Cinnabar and Stibnite Mine) (Meadow Creek and Blowout Creek). 3) Implement brook trout removal efforts wherever feasible and biologically supported. 4) Coordinate bull trout recovery with listed anadromous fish species recovery in the Salmon River Geographic Region.
The proposed Stibnite Gold project is not in accordance with the Upper Snake Recovery Unit Implementation Plan (USFWS 2015a) for item 1 nor item 2, at least to the extent that additional mine waste and disturbance will be created.

> **SDIES Page 3-260**: "…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."

Comment: Interim effects (temporary effects) during mining are outlined, (e.g., water temperature as given above), but downstream impacts of these temporary (several years) effects are ignored.

> **Page 4-325**: "Construction and operation of mine infrastructure may impact the quality and quantity of water, and habitat for Chinook salmon, steelhead, bull trout, and Westslope cutthroat trout. Project activities may also affect fish behavior and reproductive success and may result in injury or mortality of Chinook salmon, steelhead, bull trout, and Westslope cutthroat trout in the analysis area."

Comment: Based on the analysis, "may" in the above summary should undoubtedly be replaced with "will."

> **SDEIS Page 4-342**: "Brook trout are known to compete with bull trout for resources and habitat (USFWS 2008a). Brook trout also are known to hybridize with cutthroat trout, ….."

Comment: Actually, brook trout hybridize with bull trout and compete with, but do not hybridize with, cutthroat trout.

> **SDEIS Page 4-342**: "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 footprint would be dewatered and flow would be diverted into the diversions that route water around the facilities. With the gradient barrier that would be created along the TSF, there would be no mechanism by which bull trout would be able to volitionally (i.e., naturally) recolonize the reaches upstream from or on top of the TSF. Based on the current known extent Westslope cutthroat trout occupancy, fish in the upper headwaters of Meadow Creek would remain isolated. The effects of the SGP on fish access for Chinook salmon and steelhead, to upstream habitat are expected to be major, permanent, and localized benefits, but for bull trout and Westslope cutthroat trout the effects are expected to be major, permanent, and localized impacts."
>
> **And SDEIS Page 4-348:** "The West End pit lake would not be reclaimed or restored and would therefore have impacts on fish in perpetuity."

Comment: Given the two items above, The proposed Stibnite Gold project is not in accordance with the Recovery Plan for the Coterminous United States Population of Bull Trout (USFWS 2015b) which reads as follows. "Recovery of bull trout will entail effectively managing threats to ensure the long-term persistence of populations and their habitats…" Two of the recovery actions listed for bull trout were: 1. Protect, restore, and maintain suitable habitat conditions for bull trout. 2. Minimize demographic threats to bull trout by restoring connectivity or populations where appropriate to promote diverse life history strategies and conserve genetic diversity. The above statements are in direct opposition to these two recovery actions.

> **SDIES Page 4-384**: The 2021 MMP may indirectly impact Westslope cutthroat trout individuals but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area.

Comment: This is the only statment of actual affect to fish species that I have seen, although it was made without actual supporting data of how many individuals would be affected vs. the population. No similar statement was given for Chinook salmon, steelhead, or bull trout.

> **SDIES Page 5-2**: Cumulative Effects area for Fisheries as outlined in Table 5.1-1– "All of the watercourses and waterbodies in the HUC 6th field (10-digit code) watersheds that overlap potential SGP disturbance areas. SFSR hydrological subbasin and the North Fork Payette River hydrological subbasin."

Comment: The action described in the SDEIS is described to have a net decrease in quantity and quality of habitat for Chinook salmon (see **Page ES-19).** This species is cumulatively affected by impacts throughout its life cycle: in tributaries, the Snake and Columbia River migration corridor, and in the estuary, plume, and ocean. NMFS (2017) outlines threats to Snake River Spring-Summer Chinook Salmon to include: "Habitat-related threats… … that cause or contribute to limiting factors." Since the MMP is one of the cumulative effects to the species, the cumulative effects area should be extended to the home range of the species.

> **SDEIS Page 4-330**: "Fish salvage work would require prior state and federal agency consultations and would follow USFWS Recommended Fish Exclusion, Capture, Handling, and Electroshocking Protocols and Standards (USFWS 2012)."

Comment: There was no analysis of the effects of salvage and move on individuals or populations.

> **SDEIS Page 3-266**: "Other native fish species found within the analysis area include mottled sculpin (Cottus bairdii), longnose dace (Rhinichthys cataractae), speckled dace (Rhinichthys osculus), redside shiner (Richardsonius balteatus), mountain whitefish (Prosopium williamsoni), Pacific lamprey (Entosphenus tridentatus), and mountain sucker (Catostomus platyrhynchus)."

Comment: There was no, or only cursory, analysis of these native species. While they are typically under-studied (Luzier 2009; Meyer et al. 2009; Young et al. 2022), they are important native species that will likely experience impacts from the MMP.

> **SDEIS Page 4-309 – 4-313**: Table 4.11-1 lists impacts to 50,192 feet of perennial stream and 19,082 feet of non-perennial streams in the focus area and Table 4.11-2 lists impacts to 23,464 feet of perennial stream and 14,665 feet of non-perennial streams in the off-site focus area.

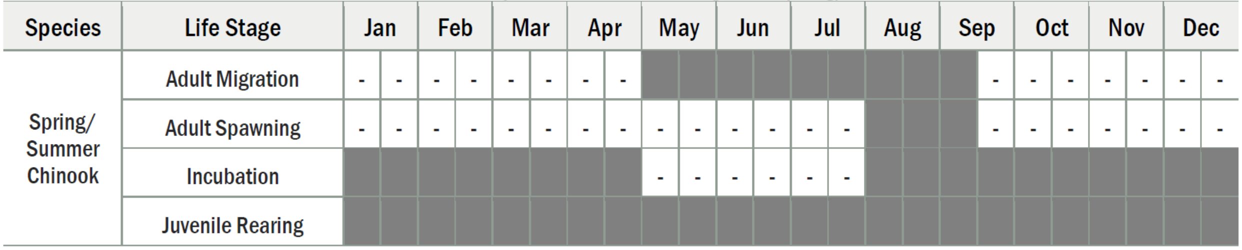
Comment: Impacts to wetlands in these tables are discussed in the adjacent text, but no explanation of impacts to streams references these tables. The type and extent of these impacts is unclear, although the SDEIS does discuss piping, diversion, mining, and blocking (with barriers) several streams. This impact is large and will undoubtedly have consequences to fish within the analysis area and downstream.

> **Fish and Aquatic Resources Management Plan (Brown and Caldwell 2021) Page 5-6**: "From September 15 to April 30 represents an alternate work window that would avoid spawning adults and minimize impacts to juvenile salmon as long as there is no documented spawning (i.e., redds) and therefore no incubation occurring in the affected stream section. Spawning nests called redds should be documented and avoided (300 feet) to reduce potential effects to developing embryos and sac fry during the incubation period."

Comment: An avoidance area of 300 feet between stream impacts and redds is an insufficient distance, as turbid water can be mobilized downstream for much longer distances than that.

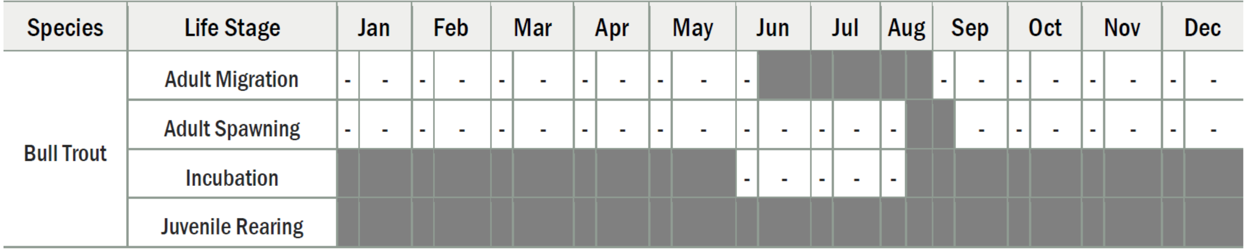
> **Page 5-5 to 7 of FMP (Brown and Caldwell 2021)**: Fish periodicity tables used to determine work windows show no time of the year when some non-mobile salmonid life form is not present (See below).

Table 5-2. General Periodicity for Different Life Stages of Spring/Summer Chinook



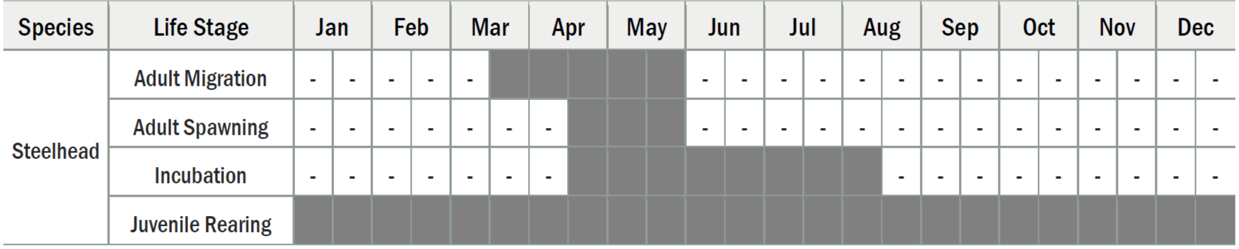
Species	Life Stage	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Spring/ Summer Chinook	Adult Migration	-	-	-	-	-	-	-	-	▨	▨	▨	▨	▨	▨	▨	▨	▨	-	-	-	-	-	-	-
	Adult Spawning	-	-	-	-	-	-	-	-	-	-	-	-	-	-	▨	▨	▨	-	-	-	-	-	-	-
	Incubation	▨	▨	▨	▨	▨	▨	▨	▨	-	-	-	-	-	-	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
	Juvenile Rearing	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨

Table 5-3. General Periodicity for Different Life Stages of Bull Trout



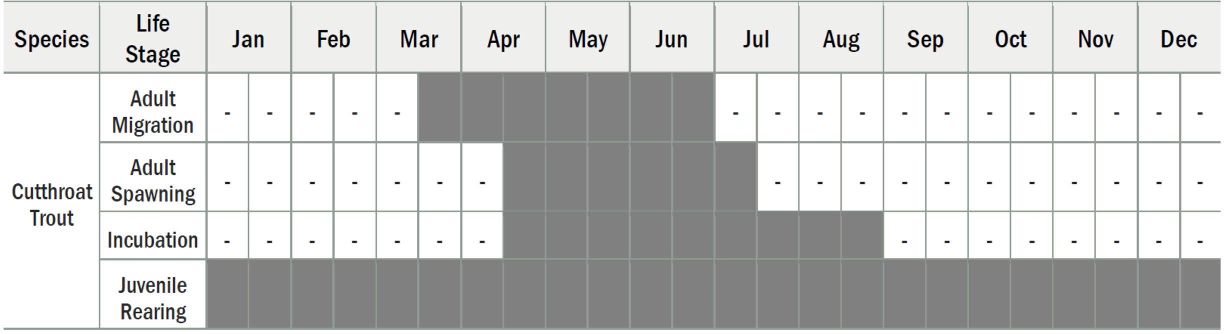
Species	Life Stage	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Bull Trout	Adult Migration	-	-	-	-	-	-	-	-	-	-	-	■	■	■	■	■	-	-	-	-	-	-	-	-
	Adult Spawning	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	■	■	-	-	-	-	-	-	-
	Incubation	■	■	■	■	■	■	■	■	■	■	-	-	-	-	-	■	■	■	■	■	■	■	■	■
	Juvenile Rearing	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Table 5-4. General Periodicity for Different Life Stages of Steelhead



Species	Life Stage	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Steelhead	Adult Migration	-	-	-	-	-	■	■	■	■	■	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Adult Spawning	-	-	-	-	-	-	-	■	■	■	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Incubation	-	-	-	-	-	-	-	■	■	■	■	■	■	■	■	-	-	-	-	-	-	-	-	-
	Juvenile Rearing	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Table 5-5. General Periodicity for Different Life Stages of Westslope Cutthroat Trout



Species	Life Stage	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Cutthroat Trout	Adult Migration	-	-	-	-	-	■	■	■	■	■	■	■	-	-	-	-	-	-	-	-	-	-	-	-
	Adult Spawning	-	-	-	-	-	-	-	■	■	■	■	■	■	-	-	-	-	-	-	-	-	-	-	-
	Incubation	-	-	-	-	-	-	-	■	■	■	■	■	■	■	■	■	-	-	-	-	-	-	-	-
	Juvenile Rearing	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Comment: There was no overall work window proposed for areas where multiple or all fish species are present.

Additional Comments

Comment: The SDEIS indicates that after implementation of the MMP 2021, stream conditions (flow, temperature, accessability, and others) will be better in some situations but overall are largely similar or slightly worse than existing "baseline" conditions. However, baseline conditions are the result of almost a century of mining in the area and were described in the Fisheries Mitigation Plan (Brown and Caldwell 2021) as having " …been subject to more than a century of prior mining activity, leading to degraded and highly disturbed ecosystems." These degraded and highly disturbed ecosystem conditions should not be the baseline used for comparison or for the target for restoration.

Additionally, during the mining period, flow will largely be lower and temperature will largely be higher than baseline (see SDEIS Figure 4.12-3 and Table 4.9-24). These conditions are inconsistent with the Chinook salmon and steelhead recovery plan (NMFS 2017), which lists improving degraded water quality and maintaining unimpaired water quality as a strategy to address factors limiting recovery of Chinook salmon and steelhead populations.

Comment: PHABSIMs predict habitat area by modeling stream hydraulics at stream cross sections (e.g. streamflow depths and velocities across said transect) and translating these into habitat quality with habitat suitability criteria (HSC) curves. Transects are divided into cells, each represented by a depth and average velocity at a given discharge. The longitudinal (upstream-downstream) extent of these cells is controlled by a weighting scheme that is based on the mesohabitat type represented by the transect and the distribution of that mesohabitat (e.g. riffles, runs, pools, glides, and tailouts). The area of these cells is used to calculate what is called weighted usable area (WUA), which is the surface area of the cell multiplied by the combined suitability of the cell. As such, WUA combines habitat quantity and quality. The hydraulics of the cell are represented by the transect, the area of the cell represents habitat quantity, and the quality of habitat is a translation of the hydraulics based on HSC curves.

The PHABSIMs used in the Stibnite DEIS are spatially and temporally limited (relied on partial datasets for limited locations throughout the study site, and were conducted between 1986 and 1990 as per Appendix J-8). Although physical habitat characteristics may be less variable than chemical and biological characteristics, channel structure, flow regimes, and other factors are highly like to have changed over a period of three decades. The models also assume substrate will remain constant over time—an unlikely assumption under any circumstances, but particularly in light of mine and road development and operation which will inevitably introduce sediment into area streams, thereby decreasing the suitability of habitat. Moreover, PHABSIMs are overly simplified in many ways, but perhaps most importantly, ignore the critical role of groundwater influence on intragravel water temperature and dissolved oxygen. Bull trout in particular are likely to spawn in zones of upwelling groundwater which likely plays at least as important a role in habitat selection as simple surface water hydraulics (Baxter and Hauer 2000).

Another major issue with habitat modeling in PHABSIM is that there is usually no real connection between hydraulic modeling and habitat utilization because modeling transects are usually selected based on hydraulic criteria. Not only, then, is there a potential disconnect between the locations where habitat is modeled and the distribution of fish, the models ignore seasonal movements of fish. As such, modeling habitat at hydraulic modeling transects substitutes an evaluation of habitat in time, at fixed locations, with one that should be conducted in space, over time. In order to indiscriminately characterize habitat in terms of stream hydraulics, modelers must (essentially) assume habitat to be uniform throughout stream reaches. They must also assume that this pattern of uniformity remains true in all seasons (Railsback 2016). Overall, PHABSIMs are outdated and overly simplistic models that fail to consider habitat complexity now known to influence the habitat selection and the overall sustainability of fish populations. PHABSIMs lack the spatial and temporal resolution to produce biologically meaningful results, thereby underestimated (and/or simply mischaracterizing) potential impacts of project development.

Comment: Temperature modeling relies on erroneous results from the water balance and hydrologic models (Prucha 2020). Temperature modeling also eliminates stream reaches considered unsuitable as salmonid habitat according to intrinsic potential, occupancy, and watershed condition models and fails to incorporate climate change. Climate change is a known factor contributing to the conservation status of salmonids, and particularly for bull trout and Westslope cutthroat trout, mine impact resulting from barriers will eliminate habitat most likely to have provided summer refugia from warming (Isaak et al., 2015).

Comment: The cumulative effects analysis in the SDEIS fails to consider the additive and synergistic impacts of each individual aspect of habitat evaluated for fishes. For example, the increased stress from a combination of altered metals concentrations, higher temperatures, lower flows, and altered food webs could have dramatic impacts to salmonids and other fishes that are largely ignored by the SDEIS.

Comment: There are a substantial number of "weasel words" throughout the document that suggest that natural resources will be protected while not ensuring their protection and not outlining who will make the decision regarding whether or not something **may** be done or be done if is **feasible**. Likewise, impacts that are eminent are often described as possibilities using words such as **could** or **may**. A few examples follow.

> **Page 1-8**: Purpose and Need for Federal Action Consider approval of Perpetua's 2021 MMP for development of the SGP to mine gold, silver, and antimony deposits that, **where feasible**, would minimize adverse environmental impacts on NFS surface resources; and ensure that measures are included that provide for mitigation of environmental impacts and reclamation of the NFS surface disturbance.
>
> **Page 1-16**: Construction and operation of mine infrastructure **may** impact the quality and quantity of water, habitat for Chinook salmon, steelhead, and bull trout.
>
> **Page 2-107**: To protect fish residing in, using, or potentially using the Yellow Pine Pit lake (Chinook salmon, steelhead trout, bull trout, Westslope cutthroat trout, mountain whitefish), Perpetua has developed a Fish Salvage and Release Plan [**no citation**] to isolate the lake from upstream movement into the lake and salvage and release fish. The Fish Salvage and Release Plan would be refined in coordination with federal, state, and tribal agencies. [**not finalized – no way to evaluate**].
>
> **Page 2-120**: Trap and haul protocols at the fishway (**if needed**) **[throughout the SDEIS and FMP (Brown and Caldwell 2021) trap and haul is indicated as if needed, but no criteria are given as to how "needed" will be determined or who will be responsible for the Trap and Haul operation].**
>
> **Page 2-107**: Low-energy lighting would be provided in the fishway to determine if it aids in fish passage and to provide light for tunnel and fishway inspections. The system would be configured so that it mimics the photoperiod of the region, run manually on a dimming system, **or be completely turned off at the option of the operator**.
>
> **Page 4-343**: The fishway **may** be a partial barrier by discouraging migration of some fish, but the extent of this is unknown. [**Constructing a "fishway" that "may be a partial barrier" seems like a problem**].
>
> **Page 5-1 of FMP (Brown and Caldwell 2021)**: Maintaining **to the extent practicable** appropriate streamflows and streamflow monitoring in natural or restored channels where fish are present.

Page 4-368: The direct mortality of fish would be an irreversible impact that **could** occur under the Action Alternatives.

V. REFERENCES

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