P.O. Box 7186 Missoula, MT 59807 (406) 543-0054

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Craig Jones
Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901

Re: Montana Trout Unlimited/Trout Unlimited comments on the Draft Environmental Impact Statement for the Black Butte Copper Project

Montana Trout Unlimited (MTU) represents over 4,000 conservation-minded anglers in the state. For decades many have demonstrated an interest in conservation of Montana's Smith River and its tributaries, including those directly affected by the Black Butte Mine Project. Among our members and constituents, it is fair to say that the Smith River might be the most recognized and prized destination trout stream. Protecting, conserving, and restoring this great fishery has been a regular and high priority for our organization and members. The same is true of our national Trout Unlimited organization, which includes numerous staff in Montana and tens of thousands of members nationwide who care for and have invested in the Smith River. This comment letter represents the interest of both MTU and TU.

MTU and our members have invested in the Smith River. We fought for and have helped ensure proper use of the Smith River Corridor Enhancement Account, which uses permit fees to fund projects that benefit the Smith watershed habitat and fishery. We have contributed to research in the Smith watershed, including a recent fish movement study conducted under Montana Fish, Wildlife & Parks. Additionally, we provided direct funding for a Montana State University graduate student to help complete the fish movement study as part of his thesis project. MTU, as well as some of our chapter leaders, pushed for and supported the recent algae bloom study by the Montana Department of Environmental Quality (DEQ). We are also invested in this current mine proposal through our long track-record of evaluating hardrock mine proposals in Montana as part of our work to protect clean water in this state. That has included engaging with highly respected experts in geochemistry, hydrology, mine engineering, and aquatic biology in relation to mining. Our members, like the tens of thousands of people how have applied for permits to float the Smith River, are deeply concerned about the Black Butte mine and the impacts it

could have on water resources in this extremely valuable and beloved watershed. Regardless of the understandably high emotions surrounding this proposal, the comments MTU offers herein are strictly based on scientific evaluation of the project and relevant peer-reviewed literature.

MTU offers the following comments on the Draft Environmental Impact Statement (DEIS) under the general principle that the Montana Department of Environmental Quality (DEQ) should be able to guarantee with near 100-percent certainty the long-term health of the Smith River watershed before permitting any mine being proposed for its headwaters. Thank you in advance for your time and interest in our comments. Our comments represent our reading of the DEIS, analysis provided to us in five expert reviews of the DEIS, as well as the reviewers' experience and review of relevant literature. Whereas our comments are general, we recommend that the DEQ pay particular attention to the detailed data gaps, flaws and recommendations found in expert reviews provided directly to the department as part of the comment period by Dr. David Chambers (Center for Science in Public Participation), Ken Knudson, Ann Maest, Dr. Tom Myers (including Myers, 2018, hydro model), and Kendra Zamzow. As per the comments MTU submitted for the scoping process of this proposal, these independent experts are highly-educated, deeply-experienced, and well-respected in their fields of geochemistry, mine engineering, geohydrology, and aquatic biology.

The opening to chapter 3, "Geology and Geochemistry," of the DEIS states that "hydrology, geology, and mineralogy determine the potential impact of mining on water resources (DEIS 3.6-1)." While those three aspects of mining are critical to water or environmental impacts, so is the mine plan, mine infrastructure, best management practices, and the attention to how all of these interact. Given the risk that some of the singular errors and data gaps we find within the DEIS pose to water resources, as well as the cumulative risks this mine proposal presents, MTU unequivocally recommends that the Department of Environmental Quality chose the "No Action" alternative for this project.

Hydrogeology and Water Resources

Our comments apply equally to the Proposed Action and the Agency Modified Alternative, as there appears to be no appreciable difference to hydrogeological and water resource risks between the two. Throughout our comments we refer to the groundwater model used by Sandfire to estimate mine dewatering (Hydrometrics 2016) and the groundwater model (Hydrometrics 2018) used to assess the discharge and return of effluent to the alluvium near Sheep Creek via the recently modified plans for Underground Injection Gallery (UIG), as well as an independent groundwater model we contracted to test the Hydrometrics 2016 model (Myers 2018).

Big picture, the DEIS begins with a flawed definition of the regional study area (RSA) by limiting the RSA to the portion of the basin that would "experience groundwater drawdown of more than 2 feet due to mine dewatering (3.4-1)." This ignores the standard definition of an RSA as being inscribed by natural, no-flow boundaries. A true RSA for this mine proposal would likely include a large area that could experience groundwater drawdown of *up to* 2 feet due to mine dewatering, which could entail a significant amount of water and, hence, dewatering. By arbitrarily limiting the RSA, the DEIS fails to provide a realistic prediction of mine dewatering.

The DEIS ignores linear defects in the mine workings, which means that it assumes almost no seepage and little or no possibility of groundwater quality being impacted within the mine workings. The assumption that the mine workings and engineering will operate flawlessly, without defects that lead to leakage, is highly unrealistic and grossly underestimates the risks of groundwater and surface water contamination. The 25 pump or slug tests used to understand hydraulics and flow within the underground area of the mine site do not provide enough information to understand the overall formation or even small portions within it (Hydrometrics 2016). In short, how water is and will move underground in the mine area remains mostly a proverbial black box. The DEIS assumption that there will be little or no seepage or possibility of groundwater quality impacts is, thus, based on paltry information. The DEIS also relies on small-scale flow tests, rather than large-scale tests, even though the operating mine would have impacts at the regional (large-scale) hydrologic level (Myers review of DEIS, pg. 3-5). The Myers 2018 hydrologic modeling (provided to DEQ with Myers DEIS review), estimates that mine dewatering could be as high as ***two to three times*** greater than what is being predicted by the current DEIS. Given the impacts this amount of mine dewatering could have on pumping, water treatment, water storage, and return of effluent to the UIG, the possible large underestimation of dewatering in the DEIS alone should be reason to consider selecting the "No Action" alternative. (Also see, Myers DEIS review, pg 21, for analysis of the inability of the water treatment facility to handle the chemistry associated with the higher-than-anticipated amount of water that is likely to occur from mine dewatering).

As per the Myers DEIS review, MTU recommends additional test for large-scale data sets to be collected. Borehole data used in the DEIS also is flawed because it includes sampling from mineralized zones that have very low permeability, which fails to predict the ways and amounts of water that could flow into mine workings once mining begins in those mineralized zones. The DEIS should include more thorough sampling of shale surrounding mineralized zones. Similarly, the DEIS uses average permeability from too few samples of the four major faults in the mine site area to estimate the permeability across the entirety of all these faults. This completely ignores the reality that faults are not homogeneous and contain areas of high permeability mixed with zones of very low or zero permeability. Using an average value across a fault is virtually meaningless. Additionally, the DEIS dismisses tests that Tintina did conduct in 2017, which showed a large range of high permeability in some of the faults (Myers DEIS review, pg. 6). Ignoring these

permeability results and averaging fault permeability allows the DEIS to report much lower mine dewatering results than are, in reality, likely to occur (Myers, 2018). The faults should not be considered a flow barrier and the Myers 2018 alternative modeling, which estimated dewatering rates as high as 2000gpm should be considering in all other mine operations that involve dealing with water in the mine workings – pumping, storing, treating and injecting plans/infrastructure. Commenting on the necessity of a map of leakage within the bedrock aquifer, Myers provides the sobering consideration that "if there is insufficient data to complete a map, there is insufficient information to form an accurate conceptual flow model and to predict the impacts of the project (Myers DEIS review, pg. 6)." DEQ should not permit a mine that lacks such information, model, and map.

Flaws in the DEIS prediction about permeability have significant surface water quantity and quality impacts. The problems with the way the DEIS estimates permeability (small-scale tests instead of large-scale ones) translates into inaccurate estimations of groundwater flow rates. Permeability is a factor in the Darcy's Law method of calculating flow rates used in the DEIS (3.4-21). So, the low permeability (mis)calculated in the DEIS translates into low flow rates from groundwater to the surface water of Sheep Creek. If there are areas of high permeability that contribute much higher flow from groundwater to Sheep Creek surface water, then the amount of the creek's baseflow dependent on groundwater will be higher than accounted for in the DEIS. This means that mine dewatering will equate to larger impacts on Sheep Creek base flow than anticipated. This could also risk contamination of Sheep Creek water by the known exceedances of elements in the alluvial and shallow bedrock for antimony, arsenic, iron, lead, manganese, strontium, and thallium (Myers DEIS review, pg. 7-8). Compounding the problems with how the DEIS estimates the amount groundwater contributes to Sheep Creek stream flow, the DEIS also relies on Sandfire's highly flawed method of calculating baseflow as a function of recharge from precipitation. Baseflow should be calculated using a regression analyses of sufficient surface water flow data from multiple gauges and a true hydrograph (Myers DEIS review, pg. 9-10).

Mine plans regularly underestimate dewatering and geochemical reactivity. That common flaw appears to hold true for this DEIS and the Black Butte mine plan. MTU's uncertainty about mine dewatering as presented in Hydrometrics (2016) prompted us to engage an independent expert to review that model and to run an alternate, more thorough one. Myers hydrologic model (2018) demonstrates numerous flawed assumptions in the Hydrometrics model and, therefore, provides much higher estimates of mine dewatering throughout the expected life the the mine. We strongly recommend that DEQ address the discrepancy in these hydrologic models and re-evaluate the full host of possible environmental impacts if mine dewatering were to reflect the Myers 2018 predictions. DEQ should also re-evaluate how mine infrastructure and plans for pumping, storing, treating and injecting the additional water would need to be changed (Myers 2018 and Myers DEIS review, page. 10-12). Suggestions in the DEIS that grouting could solve any potential occurrences of increased dewatering are not supported by appropriate

evidence (DEIS, 3.4-56). We echo the recommendation made by Myers (DEIS review, pg. 12-13) that if grouting is the proposed solution for unexpected dewatering rates, then it should be evaluated as a separate alternative within the DEIS.

We fully support the use of hydraulic plugs to prevent upward flow into the shallow aquifer. Unfortunately, the DEIS leaves latitude for Sandfire not to install these plugs based on its operational decisions, rather than on protecting the shallow aquifer and surface water from contamination. In the fractured and partially open environment of the shafts, for which these plugs are intended, oxidation of surrounding materials is increased such that there's high likelihood of long-term creation of acidic water that would be likely to leach heavy metals. Therefore, even the seemingly small difference in flow that the DEIS predicts between plugged and unplugged shafts, over long periods of time, constitutes significant quantities of highly contaminated water potentially entering the shallow aquifer and then the surrounding surface water of the Sheep Creek drainage (Myers DEIS review, pg. 13; DEIS Appendix D). Hydraulic plugs *should be required* throughout the mine site to prevent or decrease the upward flow of water post-closure. This is especially true because the DEIS provides no analysis or evidence to substantiate the plan to flood the mine workings between six and ten times before backfilling them with cemented tailings to rinse soluble minerals from mine surfaces. How has it been determined rinsing underground surfaces six to ten will adequately reduce oxidizing minerals (see Myers DEIS review, pg. 21-22)? In situ evidence of this being an effective method of significantly reducing acid and contaminant generation should be required in the DEIS. More importantly, we recommend that the plan to rinse mine working surfaces be abandoned because it presents the risk of failing to capture the highly contaminated rinse water, for which the DEIS provides very few specifics. Instead, the DEIS should reconsider the alternative of shotcreting all mineralized surfaces to better reduce the formation of metal-sulfide compounds that would likely create acid mine drainage (Maest, DEIS review, pg. 1, 11).

As for mitigation measures to re-water Coon Creek, Black Butte Creek, Moose Creek and Sheep Creek using the Non-Contact Water Pond or as-of-yet unsecured water rights, the DEIS fails to provide adequate information both about the degree mine dewatering will lead to drawdown of flows in these surface waters, as well as the method of determining when reduced flows are due to mining activities versus dry period, irrigation, or diversion of water. It appears that all of the above-mentioned surface waters, plus surrounding wetlands, are highly likely to experience much higher rates of drawdown than predicted in the DEIS (Myers 2018 and Myers DEIS review, pg. 13-16). The DEIS, nor the mine operating plan (MOP) provide any clear mitigation plans for stream drawdowns that include a method of knowing when or how much that drawdown is due to the mine workings. Such determinations and the specific plans for recharging these surface waters with water that *meets all water quality standards* is essential to this DEIS. The DEIS also fails to include any mitigation needs of wetlands, even though the wetlands are, according to the DEIS,

fed by groundwater and, therefore, susceptible to drawdown due to mine dewatering.

Given the risks we have presented herein that mine dewatering could be much greater than predicted in the DEIS and that that could lead to correspondingly higher rates of surface water drawdown in the creeks within or adjacent to the project area, it is critical that the DEIS include a proper water balance – an accurate and realistic account of how the mine operators will mitigate for decreases in surface water. Where will they obtain sufficient water? How will they ensure the quality of that mitigation water does not impair surface water into which it is being added or the aquatic life therein? This second question specifically could pertain to using NCWR as the source of water to mitigation flows in Coon Creek. The NCWR water will be drawn from Sheep Creek during high flows. The DEIS recognizes that that water exceeds standards for iron and aluminum (DEIS, 3.5-9). Putting that water in Coon Creek means that it will likely exceed nondegradation standards (see Myers DEIS review, pg. 22-25 for detailed analysis of shortcomings in the DEIS on this issue). In addition, the DEIS does not confirm that the company has numerous water right changes or new water rights secured that are necessary to operations and mitigation. We believe it is essential that the water balance, especially mitigation water, be legally secured before considering permitting this mine. Permitting and attaining necessary water right changes for this mine should be parallel processes. The DEQ should not allow one to be completed without the other.

There are numerous risks to water quantity and quality associated with the Underground Injection Galleries and the modeling performed to evaluate them (Hydrometrics 2018) presented in the DEIS. First, the UIGs have been moved in the mine plan since the scoping process. The new location of the UIG, basically running from near the cemented tailings facility (CTF) toward, and then along the edge of Sheep Creek, means that the UIG crosses ephemeral stream channels and both surveyed wetlands and wetland functional assessment areas (DEIS Figures 2.2-1 and 3.14-6). These changes in the UIG siting and the possible impacts to surface waters should, we believe, compel Sandfire to consult with the US Army Corps of Engineers on an updated or new 404 permit application. There is no indication in the DEIS that that has or is being done. The 404 permitting, including revisions due to the changes in the UIG, should be completed *before* DEQ considers the DEIS complete.

A similar omission in the DEIS is any evidence of the Montana Department of Natural Resources and Conservation authorizing Sandfire to mine under Sheep Creek. During scoping MTU commented on the need for DNRC to make that determination (please refer to MTU's scoping comments, submitted to DEQ 2017-11-15). Ore bodies the company has identified as viable for future mining, as well as possible mining outlined in the current DEIS pass beneath Sheep Creek, a navigable waterway that we believe falls under DNRC authority in respect to accessing mineral resources under the streambed. In a letter from Tintina Resources to DNRC,

the company stated that the footprint of the Black Butte Copper Project includes a stretch under Sheep Creek, yet tried to persuade the department that discussion of the need for state (DNRC) authority to mine that stretch would be "unproductive" until after the permit process is finished (Letter from Jerry Zieg to DNRC, Re: Black Butte Copper project, Sheep Creek mineral interest, January, 23, 2017). We strongly disagree and urge DEQ to make sure that DNRC determination on mining beneath Sheep Creek is completed before there is further consideration of this mine plan.

A second concern with the UIG is the poor modeling of the ability of this system to handle the full discharge that is likely to be put into it. The model (Hydrometrics 2018) overestimates the drawdown of the alluvium into which treated water would be discharged. If drawdown of the alluvium is less than the model predicts (Myers DEIS review, pg. 16-17) then even the predicted discharge to the UIG will mean water levels will be well above ground, hence running directly into surface water. That would constitute an essential failure of the UIG. Compounding that potential risk is the likelihood (already described above) that dewatering will be much greater than predicted in the DEIS, so the amount of water being discharged into the UIG would need to be much greater. In short, the UIG is likely not capable of handling the amount of water this mine will need to discharge back into the alluvium, nor will the alluvium be drawn down to a degree that it has the capacity for the discharge water that can reasonably be expected.

Overburdening the UIG and alluvium into which it injects water risks degrading surface water quality. As stated by Myers on this issue: "Dewatering would remove ambient groundwater with low total N concentrations which would result in mixed groundwater with higher total N (Myers DEIS review, pg. 17). The DEIS has incorrectly dismissed concerns about increased nitrogen levels in surface or groundwater due to this potential mine operation. An inadequate UIG located near or within known wetlands and adjacent to Sheep Creek, as well as being directly connected to the shallow alluvium, presents one specific example of the DEIS failing to recognize nutrient pollution risks.

Discharging from a reservoir to the UIG or directly to Coon Creek risks significantly raising the temperature of shallow groundwater and the receiving surface waters. The DEIS does not calculate or take into account the likely high rise in temperature of water stored in a reservoir before being discharged to mitigation surface water drawdown. The temperature and volume of stored water need to be closely estimated then used to determine the amount it would raise surface and shallow groundwater temperatures based on injection or discharge rates (see Myers, DEIS review, pg. 26).

Leakage from any of the lined ponds or impoundments in this mine plan proposal also constitute risks to groundwater and surface water that have been ignored or downplayed in the DEIS. Except for with the non-contact water reservoir (NCWR), the DEIS assumes that liners will work perfectly. This assumption runs in contrast to the literature on lined water reservoirs and impoundments at hardrock and other

mining sites worldwide. Liners eventually leak. The DEIS needs to account for that eventuality with all of the lined facilities in this mine plan, not just the NCWR. Which raises the question: why does the DEIS accept eventual leakage of the NCWR but not the process water pond (PWP) nor the cemented tailings facility nor recently added, 20-acre treated water storage pond? A leak or seepage from the PWP could lead to contamination of shallow groundwater and surface water with any or all of the contaminants the DEIS acknowledges will be present in high concentrations in this facility – nitrates, copper, nickel, lead, antimony, strontium, and thallium (DEIS, Table 3.5-9). The DEIS presents a particularly inaccurate assessment of seepage through the temporary waste rock dump. It appears that the seepage rate is based on an erroneous assumption that seepage will only occur in seven months during the two years that waste rock will be stored in this facility before being moved to the CTF. It also assumes that the waste rock will be moved to the CTF all at one time, rather than the reality that it will be moved over the course of months, hence more seepage will continue to occur. This is a concern because, as the DEIS identifies through testing, the waste rock has the potential to generate acid, as well as the potential to release metals in exceedance of groundwater standards, including nickel, thallium, copper, lead, uranium and arsenic (DEIS 3.6-11). As Maest describes in reviewing the DEIS: "The total metals results are presented in Enviromin (2017), Table 4-1. The copper content of the tailings is approximately 3,000 ppm, and the arsenic content is nearly as high (2,160 ppm in the raw tailings). The cobalt concentration is also impressive: 1,580 ppm in the raw tailings. The high concentrations suggest that the tailings contain toxic constituents that could leach under acidic (metals) and non-acidic (arsenic, selenium, uranium, etc) conditions (Maest, DEIS review, pg. 5)." As in the Maest review, the DEIS needs much more extensive testing of the potential for metals leaching both in acidic and non-acidic conditions. The risk of contaminating ground and surface water with toxic metals appears much higher than the current DEIS acknowledges.

Perhaps our biggest concern in regards to long-term water contamination risks posed by the Black Butte mine, as proposed, is with the cemented tailings facility. The DEIS section on "Tailings Geochemistry" is unequivocal that "tests indicate that the tailings would have a strong potential to generate acid regardless of cement addition (DEIS, 3.6-12)." It goes on to state that the addition of cement at 2% to 4% "is not sufficient to neutralize the sulfide in the tailings." This high, undeniable potential for the tailings to go acidic underlie many of the following sections of our comments and constitute both a real potential for the creation of long-lasting, if not permanent source of water pollution necessitating permanent water treatment for this mine, which warrants the DEQ's consideration (and our strong recommendation) of a "No Action" alternative.

Mine Engineering and Geochemistry

The DEIS does not fully recognize the risks of mining this particularly volatile sulfide ore body. The high sulfide content of the deposits targeted by the Black Butte

project are comparable to other mines in the western United States that have and are producing extremely contaminated, acid water. The Iron Mountain Mine in California, which has mined a deposit very similar to what is present at Black Butte, "has the most acidic water ever measured," according to literature on the correlation of this kind of sulfide-bearing ore and severe water contamination (Maest, DEIS review, pg. 2). The exact same kind of rock and sulfide-bearing deposits that are at Black Butte have led to "extensive contamination" in the Coeur d'Alene mining district of Idaho, including the designation of a Superfund site complex (Maest, DEIS review, pg. 2).

MTU also strongly recommends the "No Action" alternative in the DEIS because it lacks engineering and/or operations analyses of additional, appropriate alternatives. The DEIS fails to consider removing pyritized material from tailings and storing this highly reactive material off-site or somewhere that is truly out of the water table (see Chambers, DEIS review). According to the DEIS, there is already a point in the process of concentrating ore on-site when pyrite is removed from tailings, but it is then recombined with tailings for placement in the CTF. The DEIS fails to justify why this highly acidic, or acid-generating material is mixed back into otherwise less reactive material (Chambers review of DEIS, pg 1-2). Barring de-pyritizing the tailings, the long-term analysis of the CTF is gravely insufficient. The DEIS contains no evidence or extensive literature review on the long-term neutralizing or stabilizing nature of cemented tailings. Our research shows that world-wide there are no large-scale examples of above-ground cemented tailings facilities with high-sulfide material, which have been in place long-enough to draw conclusions about how effective they are at maintaining stability or preventing oxidation. In contrast, Chambers (DEIS review) concludes that the acid in the tailings for this proposed project will "neutralize/dissolve the cement" in a short amount of time. Therefore, the DEIS should analyze plans to manage the CTF after the cement degrades and it becomes a wet-closure facility. As such the DEIS must recognize and evaluate plans for long-term, if not permanent draining and treatment of highly acidic effluent from the CTF.

A separate, independent analysis of the cemented tailings and their use in both underground backfill, as well as the CTF, makes even stronger claims about the risks of these tails to become acid, leach metals, and enter ground or surface water (Zamzow, CSP^2, DEIS review, 5/2019). The DEIS provides the estimate that the tails will have a very high, 26% sulfide content, which is considered "extremely acidic (Zamzow, pg2; Tintina 2017, Appendix D, Table 4-2)." The addition of cement (actually a combination of Portland cement and slag) in a concentration of up to 4% for the backfill and 2% for the CTF only provides a slight delay in the generation of acid and the leaching of metals from the tailings. The addition of cement is largely to provide structural stability. But, the DEIS fails to include proper, longer-term testing of both the stability and the acid neutralizing property of the proposed cement tails. The tests conducted to assess the neutralizing character of the backfill only lasted 11 days, whereas the DEIS acknowledges that the cement could take more than twice that long to harden. Even after 11 days, the pH of the materials was

beginning to drop precipitously. According to Zamzow, lab tests "indicates pH of tailings with 2% binder began dropping within 2 weeks, and was at pH 3.6 by week 4 (Zamzow, DEIS review, pg. 8; Tintina 2017, Appendix D, Subappendix D, Table D-2; also see Maest, DEIS review, pg. 10-12)." That means that tests ended before the cement will likely be solid and already the formation of acid was rapidly beginning (Tintina 2017, Appendix D, Sec 4.1.2 and Table 4-3; Fig 4-1). The cemented tailings for the CTF will have less binder (cement) and, hence, become acidic much quicker, plus they will cure or harden slower, leaving a much longer window of time for acid generation (Zamzow, DEIS review, pg. 8-10). The geochemical testing included in the DEIS clearly show that the tailings, as well as ore and some waste rock from the mine, will contaminate water such that the use of cementation will only very temporarily forestall the production of acid mine drainage. The tests presented in the DEIS also "underestimate potential concentrations for most constituents in the underground mine" that could lead to ground- and, eventually, surface water contamination (Maest, DEIS review, pg. 2-3, 10-12)."

Once acid is generated it both risks leaching toxic metals from the material and quickly breaking down the structural integrity of the cement. The DEIS even agrees that "the rates of Al, Cu, Cd, Ni, and Tl release from the 2% cement paste HCT (humidity cell tests) approached those of the unsaturated raw tailings after 4 weeks (Tintina 2017, Appendix D, Section 5.2)." The DEIS also states that "all of the the cemented tailings samples had potential to oxidize and to release at least some sulfate, acidity, and metals if left exposed to air and water…Increasing surface area and exposure to air/water drives the sample reactivity (DEIS, 3.6-13)." In short, the 2% cement tailings will break down quickly, become acidic and leach toxic metals. Once that happens, the CTF will essentially be a wet tailings facility. The DEIS should evaluate it as such.

As MTU has stated at numerous opportunities, the CTF would constitute a completely experimental undertaking. There are NO real-world examples of cemented paste tailings being stored in an above-ground CTF as being proposed at Black Butte, much less one that is sited below the water table (Zamzon, DEIS review, pg. 3). The literature on the few above-ground CTF are mostly void of acid-generating material or they have built in much more robust safeguards than what is being proposed at Black Butte. Plus, all of those (three) examples in the literature did much more extensive pilot project testing that has or will happen for Black Butte. Even so, these CTFs documented in the literature have experienced numerous problems. The unknowns and high-risk of the currently-planned CTF at Black Butte alone should warrant DEQ selecting the "No Action" alternative for this proposed project. The CTF is fraught with unknowns. This is especially concerning since the Failure Modes and Effects Analysis (FMEA) presented in Appendix R (Tintina, 2017) rates the consequences of failures for the CTF (and the PWP) due to overtoping or discharge as "Catastrophic," which would lead to severe contamination of Coon or Brush Creek and, hence, Sheep Creek (Maest, DEIS review, pg. 12-13).

The DEIS lacks an analysis of the many complexities in processing tailings with cement, slag and water, such as mixing to achieve a homogenous paste of the very high thickness (79% tailings) that is being proposed. The DEIS lacks proper analysis of the risks of pumping this extremely dense paste to both the mine workings for backfill and the CTF. Pump pressure, corrosion, freeze-thaw integrity, and flushing with water are some of the as-of-yet poorly analyzed and untested elements of delivering the tail paste via a pump system and pipelines. Specifically, the DEIS does not require the project to invest in a positive displacement (PD) pump, even though it acknowledges that pumping a paste of high density, such as 79% tails, "often required" a PD pump. Instead of requiring a PD pump the DEIS states that doing so would "significantly impact capital and operating costs (Tintina 2017, Appendix K, Sections 3.2 and 3.2.4)." The risks of rupture or complete malfunction posed by an inadequate pump system meant to handle highly acid-generating tails far outweighs cost-cutting measures for Sandfire (also see: Zamzow, DEIS review, pg 4-6). Similarly, it appears that other options to reduce the potential reactivity of the CTF were eliminated for cost savings reasons, such as using 4% cement and 10% waste rock alternative (DEIS, 3.6-17).

Even if the plan includes proper infrastructure to deliver paste tails to the CTF, that facility has design flaws. The CTF is designed so that the paste is pumped into the site and disperses evenly at a gentle, consistent slope (tailings beach slope of 1-2 degrees). The placement of the reclaimed water from a sump, which would be pumped to the process water pond for use in milling, as well as the size and layout of the top and bottom liner systems for the CTF are based on this oversimplified design. Literature shows that paste tailings, especially of the density proposed for Black Butte, will vary in their beach slope (possibly higher than 6%) and the surface of the tailings will not be even, rather it will have mounds and depressions. All of these asymmetries will be greatly exaggerated as the cement degrades naturally or, more likely, from the acid within the tails. As cement degrades the CTF will have fractures, become more porous throughout, and collapse or slump in places. All of these fluctuations in the stored tails will affect the flow of water within the CTF and, of perhaps greater concern, will risk tearing or compromising the liner systems above and below the tailings. None of this has been addressed in the DEIS (Zamzow, DEIS review, pg. 6-8, 11; Tintina 2017, Figure 3.33).

Another flaw in the CTF design is in the timing of pumping fresh cemented paste tails. According to the DEIS the plan would be to add a new top-layer of paste tails about every week or so. By layering, the lower level of paste will have time to cure or harden, while limiting exposure to air and moisture. The flaw in this is that one or two weeks is not likely enough time for the 2% cement paste tails to harden. Thus adding new paste atop an unhardened layer will further extend the drying time of the underlayers. In that scenario, acid generation will likely outpace cement hardening, thus there will be even less buffering of acid by cured cement. The DEIS fails to analyze how these dynamics could be exacerbated by any delays or temporary shutdowns. Any interruption in the process would likely leave tailings

exposed to air and precipitation or, in the underground workings, to air and dewatering (Zamzow, DEIS review, pg. 8-10).

The DEIS erroneously dismisses the alternative of raising the CTF *above* the water table. The justifications for not doing so are that a raised CTF would mean that the reclaimed impoundment would be visible as a mound, rather than replicate the original contour of the site. Having a mounded hill after mine closure and reclamation of the CTF is an insignificant impact compared to placing tailings with a high risk of generating acid mine drainage below the local water table. In fact, the entire CTF could be relocated to avoid having it sited within the water table or causing any deleterious visual impacts. The other, equally unsupportable justification for not bringing the CTF above the water table is that the liner system is intended to prevent groundwater flow into the tailings. As we have previously insisted, no matter how well-planned or effectively-installed these liner systems are, the literature confirms that they eventually fail. As Zamzow states:

> "If groundwater entered the CTF through tears, abrasion, or degradation of the bottom liner over time, the tailings and waste rock material would be exposed to the fluctuations of a water table rising and falling seasonally. These are conditions that are similar to laboratory HCT conditions, and could result in metal release within a matter of weeks (Zamzow, DEIS review, pg. 10)."

Long-term prevention of shallow groundwater and surface water contamination by potentially permanent acid mine drainage generated in the CTF demands that this facility be placed above the water table. Furthermore, we highly recommend controls, such as fencing and a no-entry easement, be placed on the CTF so that they remain undisturbed forever (also see Chambers, DEIS review).

The plans for the water treatment plant (WTP) present another major weakness of the DEIS. The WTP has been designed to handle 588gpm. While that *might* accommodate the *annual average* flow of water into the WTP, it grossly fails to account for the high likelihood that the facility will have to handle up to 3,000gpm due to the predictable periods of high dewatering rates (Myers, 2018; Zamzow, DEIS review, pg. 12). Ignoring the predictions for extremely high dewatering rates allows for a dangerously inadequate WTP and the associated risk of large volumes of untreated water backing up in the mine workings or overflowing storage facilities. The DEIS also fails to provide an adequate post-closure and post-reclamation plan for long-term monitoring and maintenance, costs associated with these activities, and the real likelihood that these activities could include long-term water treatment. Another concern we have with the lack of post-reclamation plans is the absence of a bond calculation for reclamation and long-term activities. How much it could cost the mine operator, the state of Montana, Meagher County, or landowners due to long-term or perpetual activities, especially water treatment is a critical element that should be included in the economic impacts section of the DEIS.

Fisheries and Aquatic Biology

Because MTU's mission is to protect, conserve and restore coldwater fisheries and their habitats in Montana, all of the water quality and water quantity impacts that we have identified associated with the Black Butte mine are of greatest concern to our organization relative to how they might affect trout and aquatic biota. Understanding the impacts a project like the one being proposed could have on aquatic organisms demands accurate baseline data. This DEIS generally lacks such data.

According to our review of the sections of the DEIS (especially Aquatic Biology, chapter 3.16) dealing with fisheries and aquatic organisms, as well as the review provided to MTU by Ken Knudson ("A Critique of the Aquatic Biology Section of the Draft Environmental Impact Statement for the Proposed Black Butte Coper Project in Meagher County, Montana," May 1, 2019, submitted to DEQ) "the existing conditions for the aquatic communities of Sheep Creek and the Smith River are incomplete, poorly presented and, in some cases, inaccurate." We base this general assessment of the DEIS on the fact that it lacks critical fish length-frequency or biomass information throughout, both of which are essential for determining the actual health of the fishery. There are large data gaps, such as a complete lack of information on aquatic macroinvertebrates in the 2017 sampling period. And there is no data for Smith River aquatic macroinvertebrates. Chlorophyll-a data is also completely absent, except from the year 2015.

During the Completeness and Compliance review period of the Black Butte mine permitting process, MTU submitted comments and suggestions for improving fish population sampling. We appreciate that some of our suggestions are reflected in the DEIS, such as increasing the length of electrofishing sections, using block nets in the sampling sections, and basing calculations on an iterative process to better reflect population counts. The DEIS also now includes expanded redd counts (into October) and fish tissue sampling for metals, among other improvements in calculating baseline data. But, the DEIS fails to provide a clear baseline condition because the presentation of the information is poor and incomplete (Knudson pages 3-4). Lack of information and poor presentation of redd count data – survey date, length of survey section, number of redds by species, and redd density - will be especially important to address.

Section 3.16 mentions that each fish surveyed was weighed and measured for length but the DEIS does not present any information about the number of fish in each age/size class. This information is essential to determining how a species population is changing or being affected at different sizes and, hence, age classes. Fluctuations in size class can also be an indicator of fish health and reproductive success. Changes in reproduction or recruitment of young age classes is an especially important early indicator of impacts to a stream, such as environmental contamination from a mine.

Knudson's review of the DEIS provides a thorough evaluation of the problems with the monitoring of macroinvertebrates in Sheep Creek and the Smith River. While the addition of monitoring sites is helpful, there remain significant data gaps to establish a true macroinvertebrate baseline. The poor presentation of the existing data in the DEIS compounds the lack of a proper baseline. Similarly, data gaps and presentation problems are prevalent in the DEIS for periphyton communities, which are indicators of nutrient loading and potentially harmful algae blooms. The DEIS dismisses any concern that the Black Butte mine could contribute to algae bloom issues, which the DEQ is well aware already plague the Smith River. Poor baseline data in the DEIS on periphyton communities, especially chlorophyll-A, mean that it would be very difficult to properly assess whether the mine, if permitted and operating, began impacting algae growth. Specifically, mine operations would include the use of thousands of pounds of explosives that contain high levels of nitrogen compounds. It is well-known that these compounds are present in mine waste water. The Black Butte project plan recently added a 20-acre Treated Water Storage Pond to impound nitrogen-rich water for subsequent treatment. The TWSP has possible surface and groundwater connections to Sheep Creek. The DEIS has not properly addressed the risk of water from the TWSP entering Sheep Creek and the poor baseline for chlorophyll-A and the periphyton community will make it nearly impossible to determine if surface waters are being impacted by nitrogen compounds associated with mining.

Assessing the fishery baseline data and monitoring of fisheries should include fish tissue samples of sculpin, not just trout species. Because sculpin are more abundant and less migratory, their tissue samples provide more precise and timely information on fish health and any changes in a host of potential mine contaminants (metals).

MTU largely agrees with the DEIS's assessment that sediment loading during mine and road construction would not affect Sheep Creek beyond some small, localized impacts ***IF*** Montana's Fish, Wildlife and Parks staff is, as planned, directly involved with overseeing best management practices (via the 310 process of the MT Stream Protection Act) for preventing sediment from entering surface water. However, MTU has serious concerns about the DEIS predictions that Sheep Creek base flows will only be reduced by 2% and no more than 7cfs during flows greater than 84cfs. If both of these parameters are not exceeded, Sheep Creek's wetted perimeter and, hence, aquatic habitat would not be significantly impacted. But we maintain that the DEIS fails to accurately predict possible flow impairments to Sheep Creek that could result from much higher levels of mine dewatering than the DEIS (see our comments herein related to Tom Myers's model, which predicts up to 2-3 times the amount of mine dewatering documented in the DEIS).

Similarly, water quality impacts as per our comments above are gravely underestimated in the DEIS and therefore fail to account for the risks this project holds for aquatic life in Sheep Creek and the Smith River. To reiterate, all the water

that passes through the project area would be altered in terms of chemistry and temperature. Geochemistry, hydrology, and engineering-related reviews of the DEIS submitted to DEQ by Chambers, Zamzow, Myers, and Maest all offer ample evidence that the DEIS is erroneous in stating that "The quality of groundwater reporting to Sheep Creek would be the same if not better than baseline conditions (3.16-31)." The DEIS acknowledges, although downplays, the high levels of nitrogen compounds from blasting and the high sulfide ores that will be exposed to and impact water quality within the mine site. As Knudson states in his review of the DEIS, the acid produced by mining this high sulfide ore "would dissolve heavy metals from the exposed ore (i.e., cadmium, copper, lead and zinc), which are toxic to aquatic life (Knudson, page 8)." The DEIS accepts the prediction that ALL of the nitrogen-, acid- and heavy metal-laden water produced in the mining process will be fully treated on site before being returned to ground and surface water. This prediction ignores the long and recent history, as well as a wealth of scientific literature confirming Knudson's conclusion that "underground workings are rarely, if ever, closed and impervious systems (Knudson, page 8)." Potential and likely pathways for highly acidic water containing heavy metals, nutrients or other elements that are toxic to aquatic life are numerous and common at active and closed mines. Underground fractures, both natural and those created or exacerbated by blasting, provide ready pathways for contaminated water to enter groundwater and move to adjacent surface waters, especially Sheep Creek. Similarly, surface water runoff and precipitation will, at times, overburden or undermine the mine infrastructure meant to contain all contaminated surface water. As with groundwater, contaminated surface water entering Sheep Creek and moving down into the Smith River is a matter of when, not if. The DEIS fails to account for all the likely ways this will happen. As discussed previously in our comments, overburdening the water treatment facility and UIGs due to much higher rates of dewatering than the DEIS predicts is of special concern, especially combined with the highly reactive geochemistry of the ore, contact water, and tailings. (Also see, Myers DEIS review, pg 21, for analysis of the inability of the water treatment facility to handle the chemistry associated with the higher-than-anticipated amount of water that is likely to occur from mine dewatering).

The risks of water quality degradation post-closure are also poorly and inaccurately addressed in the DEIS. To reiterate our comments above, there is very little scientific evidence in the DEIS, nor in the literature on above-ground tailings, about how quickly the cemented tailings will break down, which will leave the surface tailings less stable and highly reactive. In fact, there is no good evidence that the addition of cement to these tailings will abate the creation of acid in the first place. Meanwhile, there is ample evidence of lined, surface tailings facilities leaking over time. Because the DEIS contains no plans for treating water post-closure, when leakage from the tailings impoundment or surface breaching of it does occur, it is highly likely that contaminated water will enter Sheep Creek and the Smith River perpetually. This risks serious impacts to the watershed's fishery and aquatic community and downstream irrigation. It also would lead to the state of Montana

being responsible for the costs and responsibility of treating contaminated water for generations.

In summary, the DEIS incorrectly predicts that aquatic impacts would be short-term, local, and minor; whereas solid scientific evidence shows just the opposite. As currently planned, the Black Butte mine poses serious risk of long-term, basin-wide, significant negative impacts to water quantity and water quality, which could result in comparable damage to the system's fishery and aquatic life.

Cumulative Impacts

> Chapter 4 of the DEIS begins:
>
> "Cumulative impacts described in this section are changes to resources that can occur when incremental impacts from one project combine with impacts from other past, present, and future projects. Montana defines cumulative impacts as 'the collective impacts on the human environment within the borders of Montana of the proposed action when considered in conjunction with other past, present, and future actions related to the proposed action by location or generic type (DEIS, 4-1).'"

In identifying the geographic extent within which cumulative impacts should be considered, the DEIS includes "reasonable and rational spatial boundaries (e.g., hydrologic unit codes, wildlife management units, sub-basins, areas of unique recreational opportunity, viewshed) (DEIS, 4-1). Yet, the DEIS has completely dismissed evaluating the impacts of mine expansion, especially on to adjacent public lands. As MTU has repeatedly urged the DEQ, including in the scoping process, the department should thoroughly evaluate environmental impacts of a future mine expansion encompassing the hundreds of mining claims the company has filed and maintained on more than 10,000 acres of public land, which crosses numerous Sheep Creek tributaries. These mining claims are hard evidence of potential "future actions related to the proposed action." Furthermore, Sandfire (previously Tintina) has informed potential investors of the opportunity and intent to build a large mining complex through expansion that could last upwards of 50 years. The Black Butte mine proposal and investment in it will likely be the proverbial tip of the spear. It is unreasonable that the DEIS includes the Gordon Butte Pumped Storage Project, the Castle Mountains Restoration Project, and the Portable aggregate crushing and screening operation in Great Falls as projects that warrant consideration for cumulative impacts but ignores the nearly inevitable expansion of the Black Butte mine itself (DEIS, Sec. 4.2.2, pg. 4-7). Early exploration for the Black Butte Copper Project have already identified additional ore bodies, such as the Lowry deposit.

The DEIS allows for either Townsend or Livingston (or both) to be used as railheads for the shipping of ore from containerized trucks to trains. The decision about

which location to use (or both) will, ostensibly, be left to the mine operator. The DEIS provides little information about how or when the operator will make shipping route determinations. The DEIS estimates that 18 round-trip per day will be made by trucks transporting mine concentrate in sealed containers to the MRL rail yards in one of those locations. It assumes that shipping containers used for the ore concentrate would not result in spills or leakage except, in the case of an accident severe enough to compromise the integrity of the container. Yet there is no good analysis of the likelihood, severity and impacts of an accident along the Deep Creek canyon of US 12 from White Sulfur Springs to Townsend. This is a water quality and fisheries risk that deserves a more thorough Failure Modes and Effects Analysis. That is especially true considering that the DEIS includes the following information on the Deep Creek route:

> "Road Segment of U.S. Route 12 through Deep Creek Canyon (Helena National Forest): 60 crashes, of which 53 were single-vehicle crashes. Wet, icy, or snow covered roads or dark conditions contributed to 41 of these crashes. The overall vehicle crash rate through Deep Creek Canyon is 2.13 per million vehicle miles traveled, which is higher than the average rate of crashes on most rural highways. The roadway was improved in 2016 with new bridges, signage, and guardrails. As a result, it is not yet known whether these upgrades have improved safety conditions on this road segment (DEIS, 3.12-8)."

Anyone familiar with the road in question understands the risk of a severe truck accident, as well as the many places along this road where such an accident could lead to the rupture or failure of a sealed container and, hence, the contamination of Deep Creek with ore concentrate. The DEIS fails to properly assess and acknowledge this risk and to evaluate the consequences therein to Deep Creek water quality, habitat and aquatic life. A similar evaluation of risk and consequences is also lacking in the DEIS for the Livingston transportation route and the adjacent Shields River.

Although it falls outside the MTU mission, reading the Cumulative Impacts section of the DEIS compels us to highly recommend that DEQ consult with Montana Fish, Wildlife and Parks on a re-evaluation of impacts of the current proposed mine, as well as future expansion, in regard to wildlife. The DEIS curtails consideration of wildlife impacts to the mine site proper, which disregards how that mine site might interrupt wildlife migration. DEQ's consultation with FWP should emphasize movement patterns and data for species of concern such as grizzly bears, as well as highly valued game such as elk and mule deer.

Finally, the DEIS needs to address the potential cumulative impacts of climate change. In regards to water issues, this means considering changes in flow, water availability, timing of seasonal high and low flows and water temperature. Mine facilities or infrastructure could also be impacted by changes in climate. For example, the vulnerability of the CTF to increasingly frequent and intense wildfires

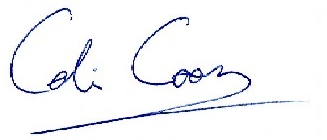
deserves close consideration. In July of 2017 a wildfire threatened the Zortman-Landusky mine site, including its water treatment system. The impact of such events, exacerbated by climate change, should be part of the mine plan analysis for Black Butte. There is a growing literature on the risks that climate change poses to the mining industry. For example, the Bureau of Land Management has recently determined that designing a stormwater facility that can accommodate a 24-hour/100-year storm event at Zortman-Landusky is inadequate due to the increased likelihood and severity of large runoff or rain on snow events that climate change modeling predicts (Williams, BLM, "Climate Change: Extreme Conditions: Do Plans of Operations Need to Include an Ark? Presented at the 20th Annual Mine Design, Operations & Closure Conference, April 29-May 3, 2012. https://www.mtech.edu/mwtp/2012_presentations/Dave%20Williams.pdf). Currently the Black Butte mine plan estimates peak outfall flows based on a 10-year storm event and the stormwater drainage structures have been designed for a 24-hour/100-year event, which should no longer be considered best practices. Climate change prediction demand a re-evaluation of all site facilities that include water management, especially the CTF and stormwater systems. On the low flow side of the spectrum, the DEIS fails to consider the impacts of extreme low flows due to higher summer temperatures and drought on Sheep Creek and its tributaries, as well as the main Smith River. Climate impacted low flows will increase the risks posed by the mine's reduction of stream flows in tributaries such as Black Butte Creek, Coon Creek, and Sheep Creek.

In conclusion, we appreciate the opportunity to comment on the Draft Environmental Impact Statement for the Black Butte Copper Project. MTU also appreciates the time constraints that state law compels upon the DEQ to complete this DEIS. Those constraints are one reason for the many problems and gaps in the DEIS. Regardless of those constraints and the deficiencies within this DEIS, it's clear that the risks this mine poses to water resources warrants our full support of the "No Action" alternative. Please contact me if you have any questions or thoughts on the comments submitted on behalf of Montana Trout Unlimited and Trout Unlimited.

Sincerely

David Brooks
Executive Director, Montana Trout Unlimited

Sharon Sweeney-Fee
Chair, Montana Council of Trout Unlimited



Colin Cooney
Montana Field Coordinator, Trout Unlimited