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MEMORANDUM

To: Robert Grosvenor, Custer Gallatin National Forest; Minerals Administrator/AML Coordinator; submitted to: https://www.fs.usda.gov/project/?project=61385
From: Ann Maest, PhD; Buka Environmental
Date: 15 July 2022
Re: Scoping comments for Stillwater Mining Company, East Boulder Mine Amendment 004 Expansion EIS

1. Introduction

The following scoping comments for the East Boulder Mine Expansion Environmental Impact Statement (EIS) are submitted for your consideration. I hope these comments will help the Montana Department of Environmental Quality (MDEQ) and the Custer Gallatin National Forest (CGNF) identify issues that should be analyzed in the Draft EIS, identify alternatives or mitigation measures that should be considered, and provide new and relevant information relevant to the analysis. My comments address geochemical characterization, baseline environmental characteristics, water quality, and monitoring issues related to the proposed mine expansion.

2. Geochemical characterization

Relatively little geochemical characterization work has been conducted on Stillwater and East Boulder ore, waste rock, and tailings. No long-term leach testing (i.e. kinetic or humidity cell tests) has been conducted at all. The rationale for the lack of long-term testing is explained using the results from acid-base accounting (ABA) tests, which have shown that the acid rock drainage (ARD) potential is low (Kirk et al., 2006). This follow-up investigation examined whether the assumption of low ARD potential from the 1980s was justified. However, only six to 16 samples from each major rock type were tested for their acid generation potential. According to the Plan of Operation (POO; p. 117; Sibanye-Stillwater, 2022a), for every 100 tons of ore fed to the mill, the mine generates approximately 98 tons of tailings. Therefore, the extracted ore is approximately 98% waste; this estimate does not include the amount of waste rock removed to access the ore. The current 10-year mine plan projects a maximum annual production rate of 1.4 million tons of ore + waste rock (POO, p. 118), or a total of approximately 14 million tons of mined material over the life of the mine, nearly all of which will become waste. Using the minimum number of samples for geochemical testing recommended by Price (2009), as a starting point 80 samples should be tested for mined materials <10,000,000 metric tons.[1] The number of samples tested annually is not included in the POO or in the 2021 waste rock/tailings characterization report (Sibanye-Stillwater, 2021).

Kirk et al. (2006) and the POO use a percent sulfur (%S) cutoff of 0.3% for mined material that will not produce acid drainage – in other words, if the material has a %S value of <0.3%, it is considered non-acid generating. All the samples tested to date have had %S values <0.3. However, using only the %S value

[1] 14,000,000 tons is 12,700,586 metric tons.

does not take the neutralizing potential or the mineralogy of the neutralizing minerals into account. According to Price (2009, p. 14-1), a %S cut-off should not be used as the only means of assessing ARD potential unless the minimum NP value is known. The potential to neutralize acid depends on the magnitude of the effective neutralizing potential, which is a function of the mineralogy. The mineralogy of the waste rock and tailings is not reported in the POO. The waste rock characterization plan (CORP, Appendix E4) should include a requirement for periodic mineralogic analysis of the waste rock and tailings. . Calcite is the most reliable neutralizer of acid drainage (Price, 2009), and it is likely that the neutralizing potential in the ore and the waste derives instead from the calcium or magnesium feldspars and pyroxenes rather than calcite, which is not mentioned as being present in the ore body.

Price (2009, p. 14-1) further notes that the onset of ARD may take a few years or hundreds of years – the absence of ARD in the present does not prove that ARD will not occur in the future. For example, long-term leach tests on waste rock from the Duluth Formation, another PGE deposit in Minnesota, were extended to 150 weeks to examine the production of acid (Lapakko and Antonson, 1994). Some differences in geology and mineralization exist between the two deposits, but the overall rock types and acid-producing sulfide minerals[2] are very similar (British Geological Survey; Kirk et al., 2006; Lapakko and Antonson, 1994).

Even if acid drainage is not produced, metals and metalloids can still leach from the East Boulder ore and the wastes and potentially affect downgradient water resources. The tests conducted to evaluate metal(oid) leaching have primarily been the short-term leach tests known as synthetic precipitation and toxicity characteristic leaching procedures (SPLP and TCLP, respectively; Sibanye-Stillwater, 2021; Enviromin and Stillwater Mining Company, 2007; Kuipers & Associates, 2006). One problem with using these tests is the large amount of dilution – the solution:solid ratio is 20:1 for both tests (US EPA, 1994a and 1992). And the TCLP test was designed for characterization of municipal landfill materials, not mine wastes. The SPLP test is more appropriate and was designed for mine wastes. In terms of dilution, the meteoric water mobility procedure (MWMP; ASTM, 2021) is more appropriate but does use a larger clast size that could minimize leaching in such short tests, as noted by Environmin and Stillwater Mining Company (2007). The MWMP test uses a 1:1 solution:solid ratio (less dilution), and its use may allow better understanding of potential contaminants of concern to carry forward for monitoring and possible treatment.

The detection limits used by Sibanye-Stillwater were not low enough to detect the presence of the metal(oid)s in the diluted samples. As shown in Sibanye-Stillwater (2021), the reporting limits for the primary metals of concern (based on the reported ore mineralogy) are: 500 μg/L for chromium, copper, lead, and nickel and 1,000 μg/L for zinc. These values are many times higher than any relevant water quality criteria. The detection limits for these tests should be on the order of 1 μg/L or less to avoid uncertainty around the detection limit, and those values are easily attainable using inductively coupled plasma-mass spectrometry (ICP-MS; US EPA Method 200.8, US EPA, 1994b). Sample analysis conducted by ACZ Labs, which was used by Kuipers & Associates (2006), did provide better detection limits, but the dilution problem still exists.

Although a thorough comparison between the geochemical characteristics of the Stillwater vs. the East Boulder portions of the ore body has not been conducted, limited sampling suggests there are some differences, and more testing is needed. Kuipers & Associates (2006) conducted limited sampling and

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[2] Chalcopyrite, pyrrhotite, pentlandite, and minor pyrite

geochemical characterization of mined materials, including waste rock, ore, and tailings from both mines. Table 1 provides a comparison of the results for waste rock, tailings, and ore for the two mines. Based on the limited sampling results, East Boulder waste rock may have higher %S, copper, and nickel values than waste rock from the Stillwater Mine. More sampling is needed to evaluate differences in the ability of waste rock, tailings, and ore to generate acid and leach contaminants of concern, which include but are not limited to chromium, copper, nickel, nitrate, sulfate, and total dissolved solids (TDS).

Ore has higher %S, acid potential, and total copper and nickel concentrations than waste rock, as shown in Table 1. Due to the potential for decreased platinum group elements (PGEs) demand in the future related to increased demand for electric vehicles that do not require a catalytic convertor, the profitable ore grade could be increased, which could produce waste rock with more “ore-like” characteristics. The POO (p. 64) notes that sulfide minerals are present in relatively low concentrations (0.05 to 1 weight percent) in the ore, and the sulfide-bearing rock is, “for the most part,” mined as ore. Additional sampling of material currently considered to be ore should be required to more fully understand the potential for leaching of low-grade ore remaining in the underground mine or placed in the WRSA.

Based on leaching of nitrate from the existing tailings storage facility (TSF) due to the use of run-of-mine (ROM) waste rock to construct the embankment, ROM waste rock will not be used for construction of the proposed Lewis Gulch TSF. Instead, native, in-place borrow materials from under the impoundment will be used, but no information is provided on the geochemical characteristics of this material. The geochemical characteristics of the borrow materials should be included in the Draft EIS. In addition, non-nitrate bearing ROM waste rock can be used to construct the Dry Fork waste rock storage area (WRSA) containment berm, if required (Knight Piésold, 2022, p. 9). No estimates are provided for the amount of ROM waste rock that could be used to create the containment berm or the methods used to determine if the material is non-nitrate bearing. The methods used to determine if waste rock used for WRSA construction is non-nitrate bearing should be included in the Draft EIS. Predictions of the leachate produced from the Dry Fork WRSA should also be included in the Draft EIS.

Table 1. Comparison of limited geochemical testing results for Stillwater and East Boulder mine samples

Material (n)	Test	Units	Stillwater Mine	East Boulder Mine
Waste rock (n=11 for Stillwater, n=5 for East Boulder)	Total S	%S	<0.01 – 0.03	0.02 – 0.08
	ABA (NP:AP)	t $CaCO_3$/Kt	15-84:0	72-99:0-3
	Total metals: Cr, Cu, Ni	mg/kg	Cr 37-258 Cu 11-45 Ni 21-228	Cr 132-265 Cu 29-118 Ni 109-262
Tailings (n=1 each for Stillwater and East Boulder)	Total S	%S	0.04	0.06
	ABA (NP:AP)	t $CaCO_3$/Kt	34:1	91:2
	Total metals: Cr, Cu, Ni	mg/kg	Cr 133 Cu 37 Ni 310	Cr 83 Cu 68 Ni 248
Ore (n=1 each for Stillwater and East Boulder)	Total S	%S	0.24	0.25
	ABA (NP:AP)	t $CaCO_3$/Kt	40:8	94:8
	Total metals Cr, Cu, Ni	mg/kg	Cr 127 Cu 410 Ni 1,040	Cr 64 Cu 476 Ni 1,010
Source: Kuipers & Associates, 2006. tons; NP neutralization potential; AP acid production potential; n number of samples; S sulfur				

Little attention is paid to the processing of smelter slag material. According to the POO (p. 128), smelter slag from the Columbus Smelter is being processed for metal recovery through the East Boulder Concentrator (p. 128). Spent slag material reports to the tailings impoundments or is used as backfill in the underground East Boulder Mine. Geochemical characterization of the slag before and after processing (before if the materials are being held on "ore" piles) should be conducted and presented in the Draft EIS.

Recommendations for scoping:

- Geochemical characterization methods and planning should be re-evaluated for the Draft EIS. Short-term leach testing using TCLP and SPLP methods is unlikely to provide relevant information on the short- or long-term leaching potential of mined material. The MWMP test could be a better substitute for the short-term leach testing. Long-term leach testing of all mined materials should also be required. Lower detection/reporting limits should be required than are currently in use for short-term leach testing of East Boulder wastes.
- The geochemical evaluations for the East Boulder expansion rely on existing results for the Stillwater and East Boulder Mines to conclude that no long-term leach testing is needed and the acid-generation and contaminant leaching potential of the proposed mining will be minimal. Based on the limited sampling results, East Boulder waste rock may have higher %S, copper, and nickel values than waste rock from the Stillwater Mine, and little is known about the new part of the East Boulder deposit that is proposed to be mined. More sampling is needed to evaluate the ability of waste rock, tailings, and ore to generate acid and leach contaminants of concern, which include but are not limited to chromium, copper, nickel, nitrate, sulfate, and TDS. Predictions of the leachate produced from the Dry Fork WRSA, including nitrate concentrations, should be included in the Draft EIS.
- Geochemical characterization of the borrow material proposed to be used for constructing the Lewis Gulch TSF and the slag material should be conducted and the results included in the Draft EIS. Periodic mineralogic analysis of the waste rock and tailings should also be required and discussed in the Draft EIS.
- The geochemical characteristics of the borrow materials used to construct the proposed TSF and WRSA should be included in the Draft EIS. The methods used to determine if waste rock used for WRSA construction is non-nitrate bearing should be included in the Draft EIS, and predictions of the leachate produced from the Dry Fork WRSA should also be included in the Draft EIS.
- Additional sampling of material currently considered to be ore should be required to more fully understand the potential for leaching of low-grade ore remaining in the underground mine or placed in the Dry Gulch WRSA as the profitability and therefore target ore grades of PGEs change over time.

3. Baseline Water Resources

An updated baseline hydrogeologic evaluation was released by Hydrometrics (2021) and is included as Appendix B in the POO. The report presents water flow, groundwater elevation, and water quality data for Lewis Gulch, Dry Fork Creek, and the areas around the proposed Lewis Gulch TSF and the Dry Fork WRSA. Baseline water resource sampling was conducted in 2015 and 2016, and updated studies included installing a replacement groundwater monitoring well and two new monitoring wells and an evaluation of ongoing water level and water quality monitoring between 2016 and 2020.

In the Hydrometrics (2021) report, Lower Lewis Gulch is described as ephemeral. The Clean Water Act lowered its protection of ephemeral streams and water bodies under the previous Administration; protections may be restored, but some uncertainty and legal challenges persist. According to the Hydrometrics (2021 report (p. 3-8) flow monitoring was conducted in 2015 from the onset of snowmelt (May 14) and weekly from June 1 – June 22. Flow at the upper sites in Lewis Gulch (LGU and LGT; LGT is a tributary to upper Lewis Gulch) continued through August 15. On August 25 no flow was observed at LGT, and "a flow measurement could not be collected at LGU on that date." This implies there was flow at LGU, but the team could not determine how to measure it.

These results describe an intermittent, not an ephemeral stream because it was observed to flow for months after snowmelt as a seasonal flow. The ephemeral designation applies to streams that flow only for a short time after storm events. In the following year, 2016, surface water monitoring began on May 17 and went weekly through June 28, then biweekly in July. No flow was visible at LGT (the upper tributary) on July 12 of that year, but flow at LGU was <70 gpm by July 26. Again, these results indicate that Lewis Gulch is an intermittent rather than an ephemeral stream. The POO describes Lewis Gulch as ephemeral (p. 35), stating that surface water only reaches the East Boulder River during high discharge years. The implications of Lewis Gulch being intermittent vs. ephemeral need to be understood in terms of required monitoring, applicable standards, and protections. Additional sampling may be needed.

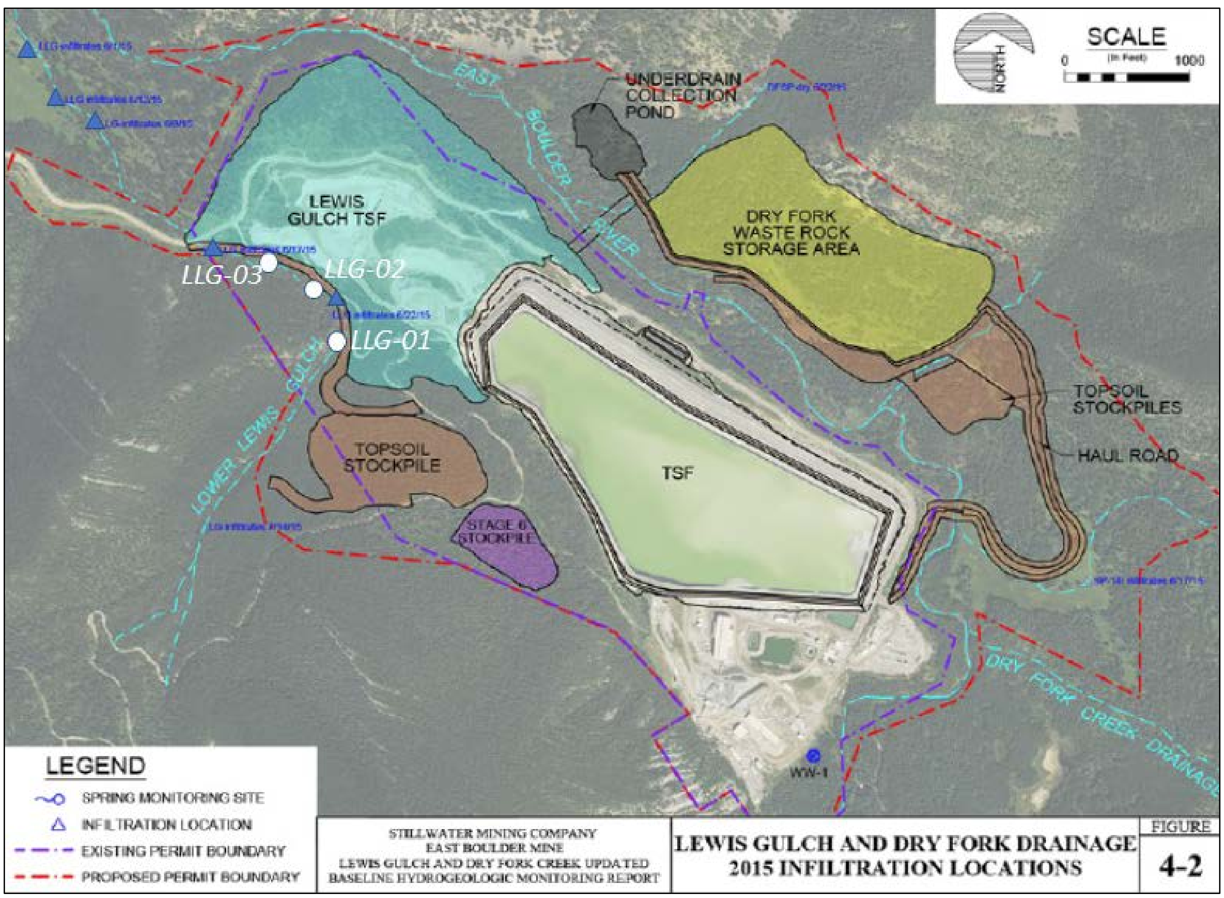
During synoptic sampling in 2015 and 2016, a large amount of surface water in Lower Lewis Gulch was found to infiltrate to groundwater, as shown in Figure 1 for 2015. Two areas of observed infiltration are on the southwestern side of the proposed Lewis Gulch TSF. Approximately 300 to 600 gpm of stream flow infiltrated to groundwater between LLG-1 and LLG-2; about 1,800 to 2,400 gpm of stream flow infiltrated to groundwater between LLG-2 and LLG-3; and about 2,100 to 3,300 gpm infiltrated to groundwater below LLG-3. The estimated total infiltration of Lower Lewis Gulch surface water to groundwater in 2015 is ~25 million cubic feet or ~190 million gallons (Hydrometrics, 2021, p. 403). The implications of this infiltration to the stability of the proposed Lewis Gulch TSF are not discussed, but it is possible that surface water could infiltrate and pool under the proposed expanded TSF – especially between LLG-01 and where the Lewis Gulch TSF covers the stream downstream of LLG-03 (see Figure 1). Figure 4-6 in Hydrometrics (2021) shows groundwater elevations in screened wells are substantially below the base of the proposed TSF. But could water infiltrating from Lower Lewis Gulch (see above) move through the vadose zone and underneath the TSF as perched groundwater? Perched groundwater would not be evident in a monitoring well that is screened at certain depths. As part of preparation for the Draft EIS, a geophysical study should be conducted during snowmelt to determine if water is moving through the vadose zone from Lower Lewis Gulch to under the proposed TSF.

Finally, the analytical methods and detection limits for the baseline water quality sampling effort described in Hydrometrics (2021) are listed in Table 3-3 of their report. It is unclear which method(s) are being used for the metals and major cations. Method 200.7 is ICP-AES (US EPA, 1994c), and Method 200.8 is ICP-MS, which has better (lower) detection limits. Some limits listed look like ICP-AES was being used, while others are lower and suggest that ICP-MS was being used. Especially because the study is intended to reflect baseline (non-mining influenced) conditions, at least at some locations, better detection limits are needed for copper, nickel, and zinc (listed as 2, 2, and 8 μg/L, respectively in Table 3-3), which are contaminants of potential concern (COPCs), given the geochemical characteristics of the ore body described in the previous section. Detection limits for these and other metal(oid) COPCs should be 1 μg/L or lower, which can be easily attained using ICP-MS.

Recommendations for scoping:

- The implications of Lewis Gulch being intermittent vs. ephemeral need to be understood in terms of required monitoring, applicable standards, and protections. Additional sampling may be needed.
- The implications of the large amount of surface water infiltration to groundwater on the southwestern side of the proposed Lewis Gulch TSF to the stability of the impoundment need to be better understood. It is possible that surface water could infiltrate and pool under the proposed expanded TSF – especially between LLG-01 and where the Lewis Gulch TSF covers the stream downstream of LLG-03. As part of preparation for the Draft EIS, a geophysical study should be conducted during snowmelt to determine if water is moving through the vadose zone from Lower Lewis Gulch to underneath the proposed TSF.
- The poor detection limits for certain metals of potential concern make the water quality results of the baseline hydrologic study questionable for locations that are not influenced by mining activity. Baseline surface water and groundwater samples, and those in areas affected by mining, should use the lowest detection limits available to commercial laboratories, which would include ICP-MS for most metal(oid)s.

Figure 1. Infiltration locations in Lower Lewis Gulch, 2015. The blue triangles indicate locations where infiltration of surface water was measured in Lower Lewis Gulch.



Source: Modified from Hydrometrics, 2021. Fig. 4-2.

4. Water Quality and Discharge Permits

According to the current Montana pollutant discharge elimination system (MPDES) permit for the East Boulder Mine, three outfalls exist: Outfall 001, Process Wastewater to East Boulder River; Outfall 002, Process Wastewater through Ground Water to East Boulder River; and Outfall 003, Septic Drain field (MDEQ, 2020). The receiving waters are the East Boulder River and alluvial groundwater. The current MPDES permit[3] became effective on November 1, 2015 and expired on October 31, 2020. However, the permit has been administratively extended until September 1, 2023 for all three outfalls, at the request of Sibanye-Stillwater Mining Company (SMC) to allow time to complete the wastewater system upgrades, ensure stable operation of the 10-µm disc filtration, and collect at least 12 months of effluent data (MDEQ, 2020).

The revised permit will include a mixing zone for Outfall 002 and revised effluent limits (SMC applied for these modifications in 2020 but decided to put them on hold until 2023). A mixing zone was allowed for Outfall 002 in September 2017 to accommodate the increased nitrate concentrations in groundwater downgradient of the existing TSF embankment due to releases of nitrate related to blasting residue in the waste rock used to create the embankment (POO, p. 30). The size and allowable concentrations in the groundwater mixing zone should be re-evaluated in the revised MPDES permit and in the Draft EIS. The size of the mixing zone should be as small as possible and take into account the improvements in groundwater quality that have resulted from the mitigation measures.

A mixing zone is also allowed for surface water discharges to Outfall 001 (MDEQ, 2000). An instantaneous mixing zone is assumed, based on the use of effluent diffuser. However, the current permit allows the discharge of acute concentrations of metals into the East Boulder River. The effects of discharging acute concentrations of metals on aquatic life, including macroinvertebrates that live in sediment that will accumulate discharged metals, should be evaluated in the Draft EIS.

Nitrate concentrations are decreasing in certain wells, but a nitrate plume map showing changes in the dimensions of the groundwater plume over time does not exist. Nitrate plume maps should be included in the Draft EIS.

The major source of mine-influenced water at the mine is adit discharge. The current treatment focuses on nitrate and sediment removal and does not remove sulfate or metals, with the possible exception of particulate metals (POO, p. 41). A permitted, back-up, 150-gpm reverse osmosis (RO) system exists and can be used for treatment if an upset or maintenance is required. After treatment, the adit water can be discharged to the percolation pond (Outfall 002), to surface water (Outfall 001), reused in operations (major discharge location currently, with the remainder sent to the percolation pond), or injected into the Boe Ranch UIC well. The quality of untreated adit water is presented in Table 2-2 of the POO. Elevated concentrations of ammonia, nitrate, specific conductance, sulfate, and TDS are evident, but no metals concentrations are listed, even though they are required to be determined (Stillwater Mining Company and Hydrometrics, 2018, Table 4-4). Discharge of treated water to the percolation pond or surface water could cause increased concentrations of sulfate, TDS, and other parameters or constituents that are not removed in the treatment process.

[3] MPDES permit No. MT0026808

Another important source of mine-influenced water is “process water” which derives from four sources: TSF supernatant, underground mine sandfill decant, TSF underdrain water, and TSF embankment underdrain water. Process water quality is presented in Table 2-3 in the POO. Ammonia concentrations are highest in the TSF supernatant and the TSF underdrain, nitrate concentrations are highest in the TSF embankment underdrain (up to 622 mg/L), and sulfate concentrations are highest in the TSF supernatant (up to 1,380 mg/L). The elevated sulfate concentrations indicate that sulfide minerals in the tailings are oxidizing. Again, no metal concentrations are included in the table even though they are required to be determined (Stillwater Mining Company and Hydrometrics, 2018, Table 4-4).

The monitoring requirements for the outfalls, adit water, and process water are listed in Table 4-4 of the updated water resource monitoring plan (WRMP; Stillwater Mining Company and Hydrometrics, 2018). US EPA Method 200.7 (ICP-AES; US EPA, 1994c) is the method listed for total recoverable metals in the outfalls, which will not provide low enough detection limits for metals determinations. For dissolved metals in the adit and process water, US EPA 200.7 or 200.8 are the methods listed, but the required reporting limits are the same as for the total recoverable metals. As noted above, ICP-MS (US EPA Method 200.8) should be used for the determination of most metal(oid)s and all water samples. The WRMP should be updated to include this requirement as part of the Draft EIS.

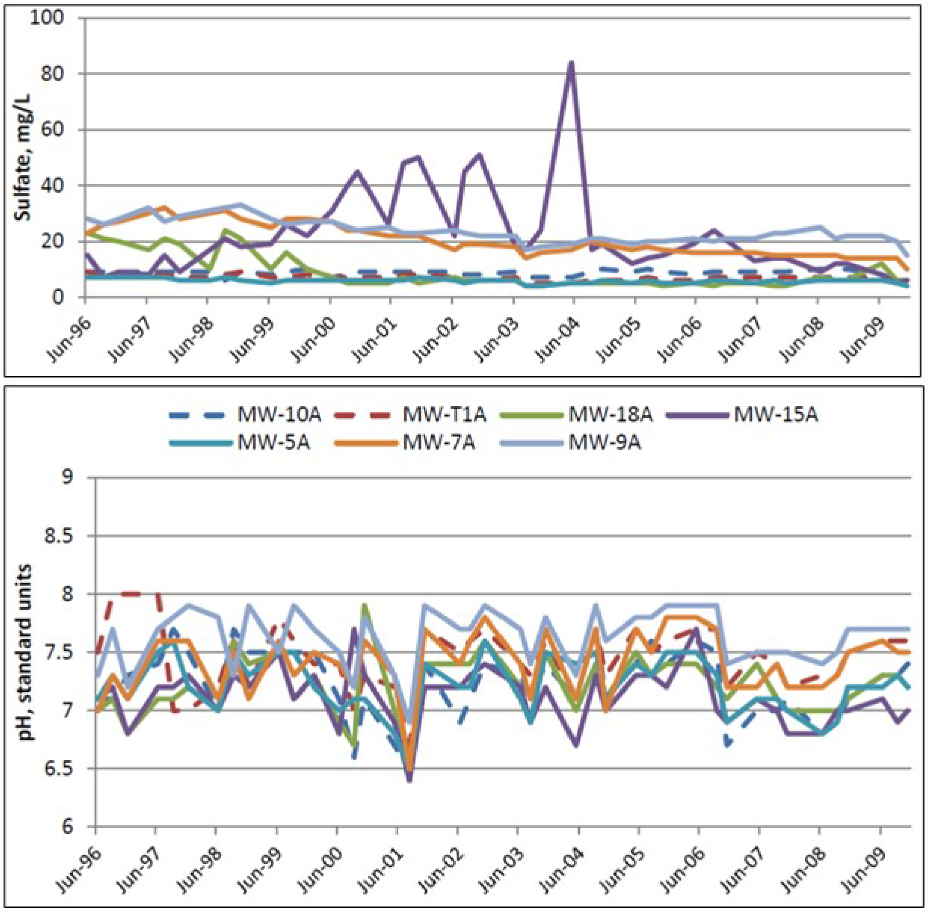
No monitoring requirements exist for treatment plant influent, untreated adit water, or untreated process water during operations, with the exception of quarterly monitoring of tailings underdrain water during operations. Minimal sampling requirements for adit and processing water exist during closure and post-closure (Sibanye-Stillwater, 2022b, p. 5). Monitoring and reporting of treatment plant influent sources should be required and discussed in the Draft EIS.

A total maximum daily load (TMDL) analysis for the Boulder River was published by the MDEQ in 2009 (MDEQ, 2009). Three East Boulder River segments, MT43B004-141, -142, and -143, were included in the TMDL evaluation, and in 1996 all three reaches were impaired for nutrients from resource extraction. In 2006, East Boulder River segments MT43B004-141 and -142 were listed as impaired for chlorophyll-a (algal growth), which impaired beneficial uses for aquatic life, cold-water fisheries, and recreation, and they remain on the 303(d) list as impaired for nutrients. A nutrient assessment for the East Boulder River was released in 2007, but a revised TMDL has not been completed. A revised TMDL should be completed in concert with the EIS to determine if nutrient loading from the East Boulder Mine expansion to the East Boulder River will need to change.

As shown in Figure 2, sulfate concentrations were elevated in monitoring well MW-15A, which is downgradient of the Stillwater Valley Ranch percolation ponds and the former East Side center pivot north land application and disposal (LAD) system area (MDEQ and USFS, 2012, Appendix E). The intermittent sulfate peaks likely resulted from seasonal disposal of mine water at the LAD and use of the Stillwater Valley Ranch percolation ponds while the Hertzler Rand LAD storage pond was being constructed. Concentrations since decreased to close to background values. The pH in MW-15A is lowest of those shown in Figure 2 below. The elevated sulfate concentrations and somewhat depressed pH values suggest that sulfide minerals are oxidizing and could eventually form acid drainage. As noted above, neither the treatment system currently in use nor the proposed system will remove sulfate; the RO system will remove sulfate, but it is only kept as a back-up system, and discharge to Outfalls 001 or 002 could increase concentrations of sulfate and other constituents in groundwater and surface water, including dissolved metals. As noted in the 2009 TMDL for the Boulder River, permitted point source discharges from the East

Boulder Mine are a source of metals to the Boulder River (MDEQ, 2009, p. 38). An alternative of using RO treatment for all mine-influenced water should be evaluated in the Draft EIS.

Figure 2. Sulfate and pH trends in Stillwater Mine groundwater. Upgradient wells are dashed.



Source: MDEQ and USFS, 2012. Appendix E, Figs. 2 and 3.

Recommendations for scoping:

- Nitrate plume maps showing nitrate concentrations over time in groundwater should be included in the Draft EIS.
- Current adit and process water quality *after* treatment is not presented in the POO but should be included in the Draft EIS. Projected improvements in treated effluent quality should also be included in the Draft EIS. Monitoring and reporting of treatment plant *influent* sources should also be required and discussed in the Draft EIS.
- Metals concentrations in adit and process water should be included and discussed in the Draft EIS. ICP-MS (US EPA Method 200.8) should be used for the determination of metal(oid)s and all water samples to ensure that lower detection limits are attained. The WRMP should be updated to include this requirement as part of the Draft EIS.
- The size of the permitted groundwater mixing zone should be as small as possible and take into account the improvements in groundwater quality that have resulted from the mitigation measures.

- A revised TMDL should be completed in concert with the EIS to determine if nutrient loading from the proposed expansion to the East Boulder River will need to change. The Draft EIS must take a hard look at the impacts of nutrient loading on water quality, algal growth, and aquatic life.
- The elevated concentrations of sulfate in adit and process water indicate that sulfide minerals in the ore and wastes are oxidizing. The groundwater well with occasional sulfate peaks at the Stillwater Mine (MW-15A) also had the lowest pH values, suggesting that acid drainage could be forming very slowly at the site. The potential for very long-term formation of acid drainage should be evaluated in the Draft EIS.
- Neither the current nor the proposed treatment systems will remove sulfate, TDS, or certain other mine-related contaminants, including dissolved metals. The RO system will remove sulfate and dissolved metals, but it is only kept as a back-up system. The discharge of treated mine water to Outfalls 001 or 002 could increase concentrations of sulfate, dissolved metals, and other constituents in groundwater and surface water. An alternative of using RO treatment for all mine-influenced water should be evaluated in the Draft EIS.
- The Draft EIS must take a hard look at the potential impacts to water quality and aquatic life from the discharge of chronic and acute concentrations of zinc, nickel, and ammonia into the East Boulder, as authorized in the existing MPDES permit. The effects of discharging acute concentrations of metals on sediment quality and the health and survival of macroinvertebrates should be examined in the Draft EIS.

5. Water Monitoring, Management, and Plans

The location of groundwater monitoring wells after the expansion is currently unknown (POO, App. B, p. B-3). The remaining groundwater monitoring network may be inadequate to identify releases of mine contaminants from the facilities or to apply protective adaptive management measures. According to the POO (p. 26), monitoring wells EBMW-3, EBMW-7A, EBMW-8, EBMW-9, EBMW-10, EBMW-12B, and EBMW-13 will need to be relocated or eliminated to accommodate the proposed Lewis Gulch TSF. These wells are located downgradient of the existing TSF in an area that showed increased nitrate concentrations in groundwater. Monitoring wells EBMW-2, EBMW-6, and EBMW-7 had exceedances of groundwater nitrate concentrations resulting from releases of blasting residue from ROM waste rock used to create the TSF embankment. Nitrate concentrations have been decreasing, and these wells are not proposed to be removed, but it is unclear how the presence of the Lewis Gulch TSF will affect the monitoring ability of these and any other wells in the area. With the removal of seven groundwater monitoring wells and the possible adverse impacts on existing wells downgradient of the TSF, an effective plan for groundwater monitoring with additional wells is needed as soon as possible.

In addition, wells EBMW-7 (now EBMW-7A), EBMW-8, and EBMW-9 are also the monitoring wells for the permitted groundwater mixing zone from Outfall 002 (percolation ponds) in the alluvial aquifer along the East Boulder River (MDEQ, 2000, p. 5).

The surface water monitoring network includes six locations on the East Boulder River and one on Dry Fork Creek – but no surface water monitoring locations on Lewis Gulch. Two downgradient springs in Lewis Gulch, SP-11 and SP-12, are included in the monitoring plan (Stillwater Mining Company and Hydrometrics, 2018, p. 4-10). Lewis Gulch was only monitored during 2015 and 2016 as part of the hydrologic baseline evaluation, and surface water monitoring locations are needed in the headwaters as part of baseline water quality and in the lower reaches – even if it is considered ephemeral or intermittent. Additional surface water monitoring locations should be included in Lewis Gulch and downgradient of the Lewis Gulch TSF and the Dry Fork WRSA.

Several important plans and models appear to be missing from the POO. According to the POO (p. 168), the Boe Ranch LAD water storage impoundment will be 35 feet deep, including a 6-ft freeboard that includes room for storage of a 25-year, 24-hr precipitation event. The design for this relatively small precipitation event does not take climate change into account (or the recent large storm event that temporarily suspended operations at the Stillwater Mine[4]) and will effectively ensure a future overtopping event. In addition, although the Montana DNR determined that the LAD storage pond is a high-hazard dam, neither an Operation and Maintenance Plan nor an Emergency Preparedness Plan will be required "as long as SMC maintains an approved mine operating permit." An Operation and Maintenance Plan and an Emergency Preparedness Plan for the LAD water storage impoundment is critically needed, and the design of the facility should be reevaluated to consider projected climate change impacts in the area.

If a TSF failure occurs, SMC must immediately implement Best Available Technologies (BAT) to mitigate impacts to water quality, fisheries, and downstream users (POO, p. 188; from the 1992 EIS/ROD). However, as far as I can tell, no adaptive management plan (AMP) exists, and the specific BAT to be employed are not listed. In addition to the lack of an AMP for the tailings impoundments, it appears that an AMP for water quality and quantity does not exist. A water quality/quantity AMP should be prepared that includes trigger levels (values below relevant standards but above background levels) and required actions for exceeding trigger levels for nitrate, ammonia, sulfate, and metal(oid)s of concern. The TMDL (MDEQ, 2009, p. 65) requires taking into account the seasonal variability of pollutant loads and adaptive management strategies to address the uncertainties inherent in environmental analyses.

Finally, a conceptual site model (CSM) does not exist. CSMs are very useful for helping to understand groundwater-surface water interactions in and around the proposed expansion areas, where monitoring wells and stream sampling locations should be placed, and mine contaminant sources, pathways, and receptors. A CSM for the East Boulder Mine and the proposed expansion should be included in the Draft EIS.

Recommendations for scoping:

- Seven groundwater monitoring wells are proposed to be removed, and the possible adverse impacts of the Lewis Gulch TSF on existing wells downgradient of the TSF are unknown. It is likely that additional monitoring wells are needed to ensure that an adequate groundwater monitoring network exists to identify contaminant releases from the facilities and apply protective adaptive management measures.
- Additional surface water monitoring locations are needed in Lewis Gulch and potentially downgradient of the Lewis Gulch TSF and the Dry Fork WRSA.
- An Operation and Maintenance Plan and an Emergency Preparedness Plan for the LAD water storage impoundment is critically needed, and the design of the facility should be reevaluated to consider projected climate change impacts in the area.
- A water quality/quantity AMP should be prepared that includes trigger levels (values below relevant standards but above background levels) and required actions for exceeding trigger levels for nitrate, ammonia, sulfate, and metal(oid)s of concern.
- A conceptual site model for the East Boulder Mine and the proposed expansion should be included in the Draft EIS.

[4] https://www.miningweekly.com/article/unprecedented-flooding-erodes-road-to-sibanyes-stillwater-mine-2022-06-14

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