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"Technical Support for Grassroots Public Interest Groups"

May 22, 2023

Juneau Ranger District
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Re: Comments on the Draft Supplemental Environmental Impact Statement (DSEIS) for the Greens Creek North Extension Project #57306

DSEIS Alternatives Not Evaluated

2.4.4.3 Removal of Pyrite from Tailings

In the SDEIS it is explained that the 2013 FEIS determined that pyrite removal was "*impracticable and infeasible*" because to "*remove pyrite from tailings prior to placement in the TDF would not address the pyrite already present in the TDF*." (USDA 2023, p. 2-41). It is certainly "feasible" to remove pyrite from the tailings. This is routinely done at other mines.

There are several advantages for pyrite removal, even though the existing tailings contain pyrite.

First, and perhaps most important, pyrite removal would remove metal contaminants from dust blowing off the tailings. Dust blowing off the tailings contaminates nearby surface waters, and has been a long-standing problem that has not been effectively controlled or mitigated despite considerable time and effort to do so. Essentially removing the contaminants from the tailings would significantly lessen, or perhaps eliminate, the dust contamination problem.

Second, pyrite removal from tailings now until the end of mining would lower the concentration of metal in water to the treatment plant. This would reduce long-term water treatment costs, and the load of contaminants discharged into Hawk Inlet.

Third, the pyrite concentrate that is created by the pyrite removal circuit does have some potential commercial viability. There are several commercial industrial uses for pyrite, none of which is of particularly high-value, but there is commercial potential. If the pyrite concentrate could not be sold, then disposal of the pyrite could be made into selected parts of the existing tailings impoundment because the tailings impoundment already provides isolation from the environment.

The primary disadvantage of pyrite removal would be the cost associated with an additional floatation circuit in the mill. Although it might be claimed that the expense of the additional floatation circuit would make pyrite removal "impractical", failure to evaluate the advantages of removing the contaminants from the dust blowing off the tailings impoundment, whether removing pyrite is impracticable or not, cannot be determined.

The EIS should include a detailed evaluation of pyrite removal for the tailings.

2.4.4.4 Flow Augmentation as Contact Water Treatment

Flow augmentation is a technique that essentially moves a mixing zone from a surface water to a site where the mixing takes place before the mixed water enters a surface water environment.

Flow augmentation is presently being utilized at the Pogo Mine in Alaska. The off-river flow augmentation mixing at Pogo is done in a large off-river pond. Water is diverted from the Goodpaster River and fed into the mixing pond. After mixing, the water is returned to the Goodpaster River.

A mixing zone is an area where water quality standards are allowed to be exceeded. Aquatic organisms will either avoid these areas, or if they enter these zones they risk suffering chronic (temporary), or acute (fatal) impacts. The mixing zone presently allowed for Greens Creek has zones of both acute and chronic toxicity. With flow augmentation, aquatic organisms are not exposed to acute and chronic toxicity.

In the DSEIS the Forest Service states that it "*… considers the approved discharge to be protective of water quality for purposes of this analysis (36 CFR 228.8(h))*." (USDA 2023, p. 2-41). While this is legally correct, it does not recognize the additional environmental protection that could be provided to Hawk Inlet by flow augmentation.

In the DSEIS, the rationale for not analyzing flow augmentation in detail is that "*Would require increased use of freshwater to dilute Mine contact and stormwater*." (USDA 2023, Table 2.4-2. Summary of alternatives considered but not analyzed in detail). This is wrong. Freshwater for dilution is not required, nor even desired, because it would exacerbate buoyancy problems when the treated water is discharged into the saltwater in Hawk Inlet.

The implementation of flow augmentation at Greens Creek would not be like that at Pogo. Because the final discharge at Greens Creek is to saltwater, a simple saltwater/freshwater mixing chamber could be designed close to tidewater. This would minimize the cost of pumping saltwater into the chamber for mixing, and the amount of saltwater available for mixing is essentially unlimited. Flow augmentation at Greens Creek could be done with only a minor capital investment.

Table 1 – Comparison of Greens Creek and Red Dog Water Treatment Discharge Requirements

	Alaska Marine Water Quality[1]		Greens Creek Permit Limits[2]		Red Dog Permit Limits[3]		USEPA Maximum Allowed[4]	
	Acute Standard (mg/L)	Chronic Standard (mg/L)	Maximum for 1 day (mg/L)	Average Value for 30 days (mg/L)	Maximum for 1 day (mg/L)	Average Value for 30 days (mg/L)	Maximum for 1 day (mg/L)	Average Value for 30 days (mg/L)
Cadmium	0.040	0.085	0.100	0.050	0.004	0.001	-	-
Copper	0.006	0.004	0.099	0.039	0.052	0.021	0.300	0.150
Lead	0.217	0.008	0.327	0.123	0.018	0.008	0.600	0.300
Mercury	0.00206	0.00005	0.00190	0.00100	0.00002	0.00001	0.00200	0.00100
Zinc	0.095	0.086	1.000	0.500	0.388	0.221	1.500	0.750
TSS	-	-	30	20	30	20	30	20
Cyanide	0.001	1.001	0.019	0.009	measure	measure	-	-

[1] Alaska Pollutant Discharge Elimination System Fact Sheet Permit Number: AK0043206, Alaska Department of Environmental Conservation, August 18, 2015

[2] Alaska Pollutant Discharge Elimination System Individual Permit Number: AK0043206, Alaska Department of Environmental Conservation, October 1, 2015

[3] Alaska Pollutant Discharge Elimination System Individual Permit Number: AK0038652, Alaska Department of Environmental Conservation, September 1, 2017

[4] 40 CFR 440 - USEPA Technology-Based Effluent Limits, Subpart J - Copper, Lead, Zinc, Gold, Silver, and Molybdenum Ores Subcategory

The current Greens Creek Mine APDES Permit, which expired September 30, 2020, is now approximately 3 years overdue for renewal. This permit authorizes a chronic mixing zone with a width of 165 feet centered along the 160 feet long diffuser, and an acute mixing zone, which is 160.5 feet wide and 63.4 feet long (ADNR 2015). An acute mixing zone is an area where a toxin is fatal to some aquatic organisms. Flow augmentation eliminates these mixing zones, which are harmful to marine life.

It is also instructive to compare the APDES discharge requirements for the Greens Creek and Red Dog mines (Table 1). The Greens Creek Mine operations began in August 1989. The Red Dog mine also began operation in 1989. Both mines produce both lead and zinc concentrate, which are transported by ship to international sites for final processing. The mines are of the same age, which means the same basic technologies were available to each mine, and importantly, they produce the same product.

However, in Table 1 it can be seen that the discharge requirements for Greens Creek are significantly less strict than for Red Dog. This is primarily because the stream that is the receiving water for the discharge of the Red Dog water treatment plant does not have as much water available as does Hawk Inlet to dilute the discharge from the Greens Creek water treatment plant. Comparing the discharge requirements for Red Dog and Greens Creek in Table 1, it is evident that the technology to treat water from similar ore bodies by mines of similar age is being more rigorously applied at Red Dog. By allowing more dilution at Greens Creek, not only is the State putting aquatic life at greater risk, but it is also giving Greens Creek a competitive advantage because it is requiring a higher level of water treatment at Red Dog.

Another consideration that should be addressed in the SDEIS, in addition to flow augmentation, is the implementation of treatment requirements for Greens Creek that reflect those required at Red Dog.

Need to include an updated financial assurance calculation.

As a result of any tailings facility expansion, and the associated mine life extension, there will be a need to revise the financial assurance for the mine. The DSEIS does not address changes to the financial assurance.

It is important to emphasize that it is essential to not only have as many checks on the financial assurance calculation as possible, but it is also important to have some discussion and consideration of how the public might face financial risk even when all government and company efforts are being done in good faith. Company and regulator financial assurance calculations typically assume all specified activities will work as planned.

In order to demonstrate why evaluating the financial assurance as a part of the EIS process, I provide the following analysis.

According ADNR's 2020 approval of the Greens Creek Reclamation Plan and Financial Assurance, "*The total financial assurance amount of $92,176,539 has been approved for the Hecla Greens Creek Mine. This amount has been adjusted annually to account for inflation based on the Anchorage CPI*" (ADNR 2020).

In order to understand how the Greens Creek financial assurance amount was calculated, I reproduced both the spreadsheet HGCMC used in its 2020 Reclamation Plan to calculate the total reclamation and water treatment costs over time, as well as a spreadsheet to calculate the net present value and inflation-adjusted value of the financial assurance. These calculations utilized the Nevada Standard Reclamation Cost Estimator (SRCE) model.

The HGCMC's Closure Cost Estimate User 20 table, on the following page, is part of the financial assurance calculation from the 2020 Reclamation Plan (HGCMC 2020). In this table, HGCMC summarizes the calculated inflation-adjusted value of the financial assurance for both reclamation and long-term water treatment.

Closure Cost Estimate
User 20

Project Name: Reclamation Plan Update 2019 - Reclamation Plan
Date of Submittal: April 2019
File Name: 20191120 HGCMC SRCE Model V1.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: 2019 SRCE Cost Data File Version 7.xlsm
Cost Estimate Type: Surety **Cost Basis: Greens Creek 2019 - November :**

User Sheet 20 - Fiancial Responsibility

SRCE Model Cost Summary $127,447,590

ROR		3.97%			
Inflation		1.28%			
Calander Year				**2020**	**2021**
Reclamation year				0	1
SRCE Costs	$	192,430,904	$	7,076,031	$ 23,717,686
Reclamtation (years 1-4)					
NPV Total	$	72,721,614			
1 year of inflation	$	73,652,451			
2 year of inflation	$	74,595,202			
3 year of inflation	$	75,550,021			
4 year of inflation	$	76,517,061			
5 year of inflation	$	77,496,480			
Water Treatment (5-200)					
NPV Total	$	13,775,562			
1 year of inflation	$	13,951,889			
2 year of inflation	$	14,130,474			
3 year of inflation	$	14,311,344			
4 year of inflation	$	14,494,529			
5 year of inflation	$	14,680,059			
Grand NPV Total	**$**	**86,497,177**	Some of cells C30 and C22		
Inflation Adjusted Total	**$**	**92,176,539**	Some of cells C35 and C27		
Investment Growth					
Invested in year 2	$	13,775,562			
1 year of growth	$	14,322,452			
2 years of growth	$	14,891,053			
3 years of growth	$	15,482,228			

I have been able to reproduce the HGCMC value for the SRCE Costs of $192 million, and the subsequent inflation-proofed Reclamation and Water Treatment Net Present Value (NPV) Total values for years 1-5. However, I believe there is a significant error in HGCMC's calculation of the value for "Water Treatment 5-200" in the Cost Closure Estimate User 20 shown on the next page (from HGCMC 2020).

HGCMC's net present value of Water Treatment is $13,775,562. Using a Real Rate of Return of 2.69%, the difference between the 3.97% Rate of Return, and Inflation Rate of 1.28% used by HGCMC in its SRCE cost analysis, the NPV cost for water treatment for the 200-year period used by HGCMC, is $20.9 million, not $13.8 million.

I can reproduce the $13.8 million figure over 200-years by using a Rate of Return of 3.97%, instead of the Real Rate of Return of 2.69%. The $13.8 million, using the HGCMC total cost spreadsheet, would be exhausted after 50-years of mine closure, leaving water treatment unfunded beyond 2070.

If the NPV calculation is terminated at 200-years, there is still an additional $155,372 that would be required to fund water treatment "in perpetuity" according my NPV calculation. While this $155,372 may initially seem to be inconsequential in comparison to the total amount of the bond calculated for 200-years, $93,610,344, it takes this amount invested for 200-years to provide funding for water treatment from year 200 to "perpetuity". This means that even if the NPV calculation assumptions are all correct, money to pay for long-term water treatment will run out in 2219. The taxpayer must then pay for water treatment from 2220 onward. This shows the peril, and consequence, of underestimating long-term treatment costs.

I believe using the Interest Rate instead of the Real Rate of Return was an honest mistake. But, it also means that neither the ADNR or USFS checked HGCMC's calculations. Quite frankly, that is a problem.

I also want to point out that there is no information available in the 2020 Reclamation Plan to verify that the assumed replacement cost for the water treatment plant is reasonable. This is major ongoing cost, and the assumptions used to develop this cost need to be explained.

The ADNR used the exact value calculated by HGCMC of $92,176,639 as the inflation-adjusted value for the 2020-2025 financial assurance. The inflation-adjusted financial assurances for the 200-year and "perpetuity" (600-year) calculations are shown in the tables below. Using all of HGCMC's assumptions and spreadsheet values, I estimate the true inflation-adjusted financial assurance should be $99,922,327, as summarized in the 600-year Financial Assurance table.

Net Present Value of Financial Assurance	
Cost Calculation Period	**Present Value***
100 Years	$91,556,726
200 Years	$93,610,344
300 Years	$93,758,779
400 Years	$93,765,230
500 Years	$93,765,684
600 Years	$93,765,716
Inflation = 1.28%	
Rate of Return = 3.97%	
Real Rate of Return = 2.69%	
*Results do not calculate PV for years 1-4	

5-Year Inflation-Proofed 200-year Financial Assurance	
Year	Reclamation FA
2020	$93,610,344
2021	$94,808,557
2022	$96,022,106
2023	$97,251,189
2024	$98,496,005
2025	$99,756,753
Inflation = 1.28%	

5-Year Inflation-Proofed 600-year Financial Assurance	
Year	Reclamation FA
2020	$93,765,716
2021	$94,965,917
2022	$96,181,481
2023	$97,412,604
2024	$98,659,485
2025	$99,922,327
Inflation = 1.28%	

The use of a pre-determined period of time, for example 200-years, to make a present value calculation is totally arbitrary. The actual determining factor is the period of time when no significant value is added to the present value. The Net Present Value calculation actually adds an additional $1 in year-600 to pay for the water treatment plant replacement in that year. So by adding 400-years on to the calculations we can get to a mathematically defensible "no additional value" point for the present value calculation. It very simple and easy to run the calculation to a point where no additional value is added. It involves only a matter of copying and pasting columns in an Excel spreadsheet. It is thorough – no guestimates.

The difference between the ADNR/USFS required inflation-adjusted financial assurance of $92.2 million, and the inflation-adjusted financial assurance calculated in the tables above is $7.7 million. That is the nominally the discounted amount of the public liability for the financial assurance.

But, undervaluing a financial assurance means that it will be depleted before the water treatment operation is ceased. That means that at some point future generations will be responsible for paying those costs, at then present-day prices.

Assuming a $7.7 million deficit (only an 8% underestimation of the $92.2 million now required), means the financial surety will run out in year-50, instead of lasting until year-200, or in perpetuity (which is the theoretical endpoint). In this case, centuries of water treatment would either be forgone, or the then public would need to pick up the tab. In today's costs, we are leaving a $1.3 million/year liability to a future generation.

The reason underfunding causes the financial assurance to be depleted so quickly is that beyond a hundred years or so each additional year adds only a relatively small amount to the present value compared to the cost requirements of early years. As an example, if the inflation-adjusted present day financial assurance is $100 low, the last century of the anticipated treatment goes unfunded. Adding the additional cost from each year of a present value calculation is a necessary and critical addition. Making a conservative estimate of the required financial assurance is both safe and not very costly mine operator. Estimating low could be very costly to future generations.

Underestimating a financial assurance has real consequences. It is only that those consequences will become apparent long after everyone associated with establishing the financial assurance is gone.

As a part of the EIS, the USFS must explain and document the reasons and calculations that justify a financial assurance amount. Both Alaska and US taxpayers are liable, should the financial assurance be underfunded.

<u>Another financial assurance assumption that should have been discussed as a part of public review</u>

In addition, in the 2014 Reclamation Plan the relocation of waste rock to the TSF was not anticipated, or included in the financial assurance estimate. The 2018 Environmental Audit includes a discussion of moving onsite topsoil for reclamation a distance of 1.4 miles, at a cost of $22/yd^3 (HDR 2019), but the 2020 Reclamation Plan uses a cost of $8.58/yd^3 to move Site 23 material to the TSF (HGCMC 2020). Why does this significant disparity in cost estimates exist?

The distance between Site 23 and the TSF is over 6 miles, so a discussion of this disparity in moving costs is warranted. If the cost of moving waste rock 6+ miles is similar, and possibly more expensive than the cost of moving topsoil 1.4 miles, the cost of relocating 1.5 million cubic yards of waste rock would be over $30 million. Since this is a large cost item in the reclamation calculation, it should be carefully characterized and calculated for the EIS.

Background of the Reviewer

David Chambers has 45 years of experience in mineral exploration and development – 15 years of technical and management experience in the mineral exploration industry, and for the past 30+ years he has served as an advisor on the environmental effects of mining projects both nationally and internationally. He has Professional Engineering Degree in physics from the Colorado School of Mines, a Master of Science Degree in geophysics from the University of California at Berkeley, and is a registered professional geophysicist in California (# GP 972). Dr. Chambers received his Ph.D. in Environmental Planning from Berkeley. His recent research focuses on tailings dam failures, and the intersection of science and technology with public policy and natural resource management.

Thank you for the opportunity to comment on this Draft SEIS.

Sincerely;

David M. Chambers, Ph.D., P. Geop

References

ADNR 2015. Alaska Pollutant Discharge Elimination System Individual Permit Number: AK0043206

ADNR 2020. Hecla Greens Creek Mine Reclamation Plan Approval, No. J20202682RPA, Department of Natural Resources, Division of Mining, Land and Water, February 20, 2020

HDR 2019. Greens Creek Mine Environmental Audit, HDR, for Hecla Greens Creek Mining Company, January 2019

HGCMC 2020. General Plan of Operations Greens Creek Mine, Hecla Greens Creek Mining Company, June 2020

USDA 2023. Greens Creek Mine North Extension Project Draft Supplemental Environmental Impact Statement, USDA Forest Service, Tongass National Forest, March 2023