

**Utah Division of Water Quality
Statement of Basis
ADDENDUM
Wasteload Analysis and Antidegradation Level I Review**

Date: August 12, 2020

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UPDES No. UT0023540

This addendum summarizes the wasteload analysis that was performed to determine water quality based effluent limits (WQBEL) for this discharge. Wasteload analyses are performed to determine point source effluent limitations necessary to maintain designated beneficial uses by evaluating projected effects of discharge concentrations on in-stream water quality. The wasteload analysis also takes into account downstream designated uses (UAC R317-2-8). Projected concentrations are compared to numeric water quality standards to determine acceptability. The numeric criteria in this wasteload analysis may be modified by narrative criteria and other conditions determined by staff of the Division of Water Quality.

Discharge

Outfall 005: Discharge of mine water to Electric Lake; 1,000-5,000 gpm design flow as provided with the Skyline Mine UPDES application information.

Receiving Water

Outfall 005: Electric Lake

Per UAC R317-2-3.3, Electric Lake is a Category 2 anti-degradation water body:

- *A point source discharge may be permitted provided that the discharge does not degrade existing water quality.*
- *Waters of the state designated as Category 2 Waters are listed in R317-2-12.2.*

Antidegradation Level I Review

The objective of the Level I ADR is to ensure the protection of existing uses, defined as the beneficial uses attained in the receiving water on or after November 28, 1975. No evidence is known that the existing uses deviate from the designated beneficial uses for the receiving water. Therefore, the beneficial uses will be protected if the discharge remains below the WQBELs presented in this analysis.

A Level II Antidegradation Review (ADR) is required if new discharge points requested in the permit renewal have higher concentration and loading limits. The purpose of the Level II ADR is to minimize degradation. The proposed discharge location is Electric Lake. A Level II ADR is not required for this facility because the proposed discharge will not have higher concentration or loading limits than the previous permit and is not allowed to degrade water quality.

Parameters of Concern

Based upon previous and current UPDES permit development, the parameters of concern identified for the discharge/receiving water were total dissolved solids (TDS) and iron. Additional metals, nutrients, and in-situ parameters, such as dissolved oxygen, were also evaluated as determined in consultation with the UPDES Permit Writer.

Anti-Degradation Analysis Methods

Water quality data were supplied by Skyline Mine and PacifiCorp as well as Division of Water Quality (DWQ) database sources. Sixteen water quality sampling locations were used in this analysis. These monitoring locations included: UPL-1, UPL-2, UPL-3, UPL-4, UPL-10, UPL-11, and PG-1 in Upper Huntington Creek; UPL-EL-1 and UPL-EL-3 (at multiple depths), JC-1, MLID 4931190, and MLID 4931200 for Electric Lake; and H-1, H-2, UPL9, and UPL-9A in Lower Huntington Creek. To provide increased precision in the distribution of specific analyte concentrations, all of the monitoring locations were grouped as Upper Huntington Creek, Electric Lake, and Lower Huntington Creek samples. Statistical analysis of the three groups was performed to evaluate reasonable representative background conditions corresponding to these regions.

In consultation with the UPDES Permit Writer, it was evaluated that a daily maximum concentration limit consistent with the 80th percentile of the Upper Huntington Creek sample will be implemented. Furthermore it is recommended that the arithmetic mean of the Lake sample is to be used for an annual average concentration limit through the annual running average of bi-monthly sampling results.

Table 1: TDS (mg/l) background statistical description by region

region	count	min	20%	mean	median	80%	max	std	var	skew
Lake	1266	108	151	167.34	164	183	451	23	529.16	3.4
Lower	1242	26	230	303.18	292	369	763	83.53	6977.37	0.94
Upper	1392	105	175	202.36	201	235	301	34.12	1164.08	0.08

Table 2: Total Iron (mg/l) background statistical description by region

region	count	min	20%	mean	median	80%	max	std	var	skew
Lake	1258	0	0.05	0.08	0.05	0.08	3.11	0.18	0.03	14.66
Lower	1240	0.03	0.11	0.95	0.2	0.72	48.22	4.71	22.18	9.64
Upper	1392	0	0.08	0.38	0.21	0.45	12.01	0.84	0.71	8.24

Table 3: Dissolved Iron (mg/l) background statistical description by region

region	count	min	20%	mean	median	80%	max	std	var	skew
Lake	1262	0	0.03	0.03	0.03	0.03	0.34	0.01	0	9.52
Lower	1240	0	0.03	0.04	0.03	0.03	1.69	0.11	0.01	13.02
Upper	1392	0	0.03	0.03	0.03	0.03	0.43	0.03	0	7.38

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The Upper Huntington Creek region displays some seasonal variability, particularly in TDS. Total iron concentration concentrations also display multi-annual trends, suggestive of variable groundwater flowpaths and associated geochemical influence. Furthermore, total iron in Electric Lake typically increases between two and ten-fold through the fall and winter, while dissolved iron remains near detection limit. Therefore, the dissolved iron fraction drops from a high of 60 percent to between 6 and 20 percent through the fall, winter, and spring with the lowest concentration in May or June.

Dissolved iron in Electric Lake was generally at the detection limit of 0.03 mg/l. The dissolved iron fraction ranges between 9 and 14 percent of total iron in the Upper Huntington Creek but is relatively stable in Electric Lake at 60 percent. This indicates that iron is predominately in the particulate fraction for the Upper region, while the dissolved fraction dominates Electric Lake.

Effluent Limits

The water quality based effluent limits for the proposed Outfall 005 are summarized in Table 4.

Table 4: Water Quality Based Effluent Limits Summary for Outfall 005

Effluent Constituent	Water Quality Limit (WQBEL)	
	Daily Maximum	Recommended Annual Average
Total Dissolved Solids (TDS mg/l)	235	167
Total Iron (mg/l)	0.45	0.08
Dissolved Iron (mg/l)	0.03	0.03

Additional analytes reviewed for background conditions in each of the regions include total and dissolved: aluminum, arsenic, boron, cadmium, calcium, chromium, copper, lead, magnesium, mercury, nickel, phosphorous, potassium, selenium, silver, zinc. Furthermore, pH, temperature, dissolved oxygen, total suspended solids, nitrate, nitrite, ammonia,

Analytes reviewed solely in Electric Lake include: dissolved barium, dissolved beryllium, dissolved manganese, dissolved sodium, the carbonate sequence (i.e.: hardness, alkalinity), conductance, turbidity, chloride, and sulfate.

Based on the 80th percentile of the distribution for each water quality parameter, Table 5 presents the current background conditions.

Table 5: Water Quality additional analyte background conditions for Outfall 005

Background Constituent	Upper	Lake
Total Aluminum (mg/l)	0.35	0.06
Dissolved Aluminum (mg/l)	0.03	0.03
Total Arsenic (mg/l)	0.01	0.01
Dissolved Arsenic (mg/l)	0.01	0.01
Total Boron (mg/l)	0.01	0.02
Dissolved Boron (mg/l)	0.01	0.01
Total Cadmium (mg/l)	< 0.01	< 0.01
Dissolved Cadmium (mg/l)	< 0.01	< 0.01
Total Calcium (mg/l)	60.0	44.0
Dissolved Calcium (mg/l)	57.0	43.0

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Total Chromium (mg/l)	< 0.01	< 0.01
Dissolved Chromium (mg/l)	< 0.01	< 0.01
Total Copper (mg/l)	0.01	0.01
Dissolved Copper (mg/l)	0.01	0.01
Total Lead (mg/l)	0.01	0.01
Dissolved Lead (mg/l)	0.01	0.01
Total Magnesium (mg/l)	20.0	10.0
Dissolved Magnesium (mg/l)	19.0	10.0
Total Mercury (mg/l)	0.0002	0.0002
Dissolved Mercury (mg/l)	0.0002	0.0002
Total Nickel (mg/l)	< 0.01	< 0.01
Dissolved Nickel (mg/l)	< 0.01	< 0.01
Total Phosphorous (mg/l)	0.06	0.05
Dissolved Phosphorous (mg/l)	0.05	0.05
Total Potassium (mg/l)	1.2	1.2
Dissolved Potassium (mg/l)	1.1	1.1
Total Selenium (mg/l)	0.02	0.02
Dissolved Selenium (mg/l)	0.02	0.02
Total Silver (mg/l)	< 0.01	< 0.01
Dissolved Silver (mg/l)	< 0.01	< 0.01
Total Zinc (mg/l)	< 0.01	< 0.01
Dissolved Zinc (mg/l)	< 0.01	< 0.01
pH	8.3 – 8.6	8.0 – 8.6
Temperature (deg C)	11.9 – 17.2	14.0 – 18.7
Dissolved Oxygen (mg/l)	8.0 – 10.4	7.4 – 9.0
Total Suspended Solids (mg/l)	31.0	5.0
Nitrate (mg/l)	0.36	0.54
Nitrite (mg/l)	0.05	0.05
Ammonia (mg/l)	0.1	0.1
Hardness (mg/l)	NA	152.0
Alkalinity (mg/l)	NA	122.0
Turbidity (mg/l)	NA	1.28
Chloride (mg/l)	NA	9.1
Sulfate (mg/l)	NA	20

Analysis Caveats

- No effluent discharge or water quality information was provided for this analysis to determine the load-based influence of individual constituents on Electric Lake.
- The Upper Huntington Creek grouped sampling locations are generally weighted heavier on one specific tributary. Therefore, the analyte distribution for grouped sites is more heavily weighted on a specific tributary.
- While the background analysis statistically robust and well justified, the WQBEL and background concentrations are based on available data results, which may not fully represent water quality under all flow conditions. No paired flow data measurements, hydrogeologic flowpaths, or soil and bedrock-based geochemical boundary conditions were used during this analysis.
- The Division recommends that the Permittee acquire a consulting agency to construct a geochemical mixing model that will be used to predict potential hydrogeochemical changes at the discharge point in Electric Lake and verify that water quality degradation

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will not occur. A static model that incorporates the range in individual monitoring constituents is recommended; however, a rate-kinetic model may also be utilized. Benefits of this hydro-geochemical modeling approach include: paired water quality sampling with in-stream flow for loading calculations; understand spatial and temporal variability in Electric Lake flow inputs; predict geochemical processes that occur with mixing of mine water into the system; identify the Electric Lake hydrologic balance and the lake retention time; and define uncertainties in source contributions and hydro-geochemical reactions that would prevent lake degradation. The Division recommends that the modeling results and a report describing the geochemical modeling be provided to the Director within one year.

Documents:

Background Anti-Degradation Document: *SkylineMineWLA_2020-CLS-Outfall005.docx*

Background Anti-Degradation Analysis: *SkylineMine-ElectricLake.ipynb*

References:

Utah Division of Water Quality. 2012. *Utah Wasteload Analysis Procedures Version 1.0*.

DWQ-2020-016648