2020 Annual Mining and Reclamation Report
Humboldt Mill
Mine Permit MP 01 2010

March 15, 2021

Revised September 28, 2021

– Sections 7.1.2, 7.4, 7.4.1, 7.4.2, 7.5.4
– Appendices I, M, N, O, P, Q, R

Contents

Appendices

Acronyms and Abbreviations

AEM	Advanced Ecological Management
BMPs	best management practices
COSA	Coarse Ore Storage Area
CLO	Concentrate Load-Out Facility
CN	Canadian National
COI	Constituents of Interest
DO	dissolved oxygen
Eagle	Eagle Mine LLC
EGLE	Michigan Department of the Environment, Great Lakes & Energy
EMT	Emergency Medical Technician
gpm	gallons per minute
HDPE	high-density polyethylene
HTDF	Humboldt Tailings Disposal Facility
KME	King and MacGregor Environmental
MER	Middle Branch Escanaba River
MDNR	Michigan Department of Natural Resources
MG	million gallons
MRR	Mining and Reclamation Report
µg/L	micrograms per liter
mg/L	milligrams per liter
MNFI	Michigan Natural Features Inventory
MSL	mean sea level
NPDES	National Pollution Discharge Elimination System
NREPA	Natural Resources & Environmental Protection Act
NTU	Nephelometric Turbidity Units
ORP	Oxidation Reduction Potential
Q1	Quarter 1
QAL	quaternary unconsolidated formation
SESC	Soil Erosion and Sedimentation Control
SU	standard units
SWPPP	Storm water Pollution Prevention Plan
t	metric ton (tonne)
TDS	total dissolved solids
TSS	total suspended solids
TIE	Toxicity Identification Evaluation
UFB	upper fractured bedrock
WBR	Black River
WTP	Water Treatment Plant
WRD	Water Resources Division

1. Document Preparers and Qualifications

This Mining and Reclamation Report (MRR) was prepared by the Eagle Mine-Humboldt Mill Environmental Department and incorporates information prepared by other qualified professionals. Table 1 provides a listing of the individuals and organizations who were responsible for the preparation of this MRR as well as those who contributed information for inclusion in the report.

Table 1. Document Preparation – List of Contributors

Organization	Name	Title
Individuals responsible for the preparation of the report		
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2. Introduction

Eagle Mine officially began the remediation and reconstruction of the Humboldt Mill located in Humboldt Township in October 2008. Processing of ore from the Eagle Mine commenced in September 2014. Due to the commencement of milling operations, Eagle Mine is required per Part 632 to submit an annual Mining and Reclamation Report (MMR) as detailed in R 425.501.

The MRR is required to provide a description of mining and reclamation activities, updated contingency plan, monitoring results, tonnage of material processed, and a list of incident reports that created, or may create a threat to the environment, natural resources, or public health and safety at the Eagle Mine Site. In addition, this MRR will also memorialize the decisions and/or modifications that have been approved throughout the process.

3. Site Modifications and Amendments

Two notifications were submitted in 2020, both of which were related to water treatment plan (WTP) projects; the new water intake system and various improvements around the WTP building itself.

The changes to the plant do not impact facility discharge or the water treatment process at the WTP. Proper notifications were submitted and approved by the Michigan Department of Environment, Great Lakes & Energy (EGLE), and the necessary zoning permits were obtained through Humboldt Township. The 2020 changes include:

- Construction of a new water intake system, including a generator, intake barge, and electrical building on the south side of the Humboldt Tailings Disposal Facility (HTDF).
- Expansion of the driveway near the WTP loading dock to improve delivery driver accessibility.
- An office trailer installed on piers along the northwest corner of the WTP. The 23.5-foot by 56-foot office trailer has an electrical power hook up and is connected to the existing septic system. The septic system design has been evaluated and is able to accommodate flows from the additional fixtures, and as such no additional permits were required by the Marquette County Health Department. This office trailer takes the place of a smaller, rented office trailer previously on site.


New office trailer installed at the WTP, Weather wall visible in left picture, December 2020

- A 12-foot by 15-foot concrete pad was constructed to accommodate a CO_2 tank for a remineralization system that is set to be added to the water treatment process early in 2021. The pad is located on the North side of the WTP, and the addition will be enclosed by a steel frame and roof structure to protect the tank from snow and ice. Other remineralization system components will be located within the existing plant structure. Updated process flow diagrams for the WTP will be provided once they become available and prior to commissioning of the system per the requirements of the National Pollutant Discharge Elimination System (NPDES) permit.

- Additionally, a weather wall and roof structure were built to join a preexisting mobile office space that was located on the west side of the WTP. This weather wall encloses the west (main) entrance of the building and allows for the addition of an employee wellness room inside of the mobile office space.

Table 3 summarizes the submittals that were provided to the Department in 2020 as required under the Part 632 Mining Permit.

Table 3. Submittals and Approvals Required Under Part 632

Date	Description	Approval
3/13/20	2019 Annual Mining and Reclamation Report	N/A
5/8/20	Notification of water intake construction	6/5/20
6/12/20	Q1 groundwater and surface water monitoring data	N/A
10/15/20	Q2 groundwater and surface water monitoring data	N/A
11/24/20	Notification of water treatment plant construction	12/22/20
1/4/21	Q3 groundwater and surface water monitoring data	N/A
3/12/21	Q4 groundwater and surface water monitoring data	N/A

Table 4. Non-Routine Submittals and Approvals Required Under Other Permits

Date	Description	Approval
1/10/20	Submitted the revised Storm Water Pollution Prevention Plan	N/A
3/13/20	Submitted Michigan Air Emissions Reporting System (MARES) Report	N/A
4/16/2019 – 2/20/2020	Correspondence on the EGLE compliance communication (Toxicity TIE)	N/A
12/16/2020	Humboldt Township zoning permit for addition of the CO_2 tank structure	12/18/20

4. Processing Activities and Data Report

As of September 23, 2014, the mill was officially operating and producing concentrate. The commencement of milling activities initiated all monitoring programs per the Part 632 Mining Permit. A description of the 2020 monitoring activities can be found in Section 7 of this report.

4.1. Processing Report

In 2020, 770,246 wet metric tonnes of ore was transported from the Eagle Mine to the Humboldt Mill by over the road haul trucks. Table 4.1 below summarizes the dry tonnes of ore crushed and milled and the total volume of nickel and copper concentrate produced in 2020.

Table 4.1 Volume of Ore Crushed, Milled, and Concentrate Produced in 2020

Month	Ore Crushed (dry tonnes)	Ore Milled (dry tonnes)	Copper Concentrate Produced (dry tonnes)	Nickel Concentrate Produced (dry tonnes)
January	67,429	67,618	4,028	8,371
February	60,874	60,387	4,749	8,193
March	64,983	65,642	3,877	9,287
April	62,261	61,721	3,837	9,160
May	65,375	65,696	4,474	8,500
June	55,722	55,480	3,682	7,566
July	65,712	64,865	6,003	12,441
August	60,907	62,881	5,124	13,063
September	53,017	51,300	3,643	9,760
October	67,528	67,720	5,347	11,428
November	66,612	66,919	4,992	11,375
December	71,532	70,864	4,052	12,502
2020 Annual Total	761,952	761,093	50,808	121,646

Source: Mill Operations Year End Reconciled

In 2020, approximately 50,808 dry tonnes of copper and 121,646 dry tonnes of nickel were shipped offsite via rail. Mineral Range manages rail shipments from the Humboldt Mill to the Ishpeming Rail Yard. From that point Canadian National (CN), and to a lesser extent, Quebec Gatineau Railway transports the material to its final destination.

4.1.1. Tailings

Tailings are the waste material that is generated when processing ore. At the Humboldt Mill, tailings are sub-aqueously disposed in the Humboldt Tailings Disposal Facility (HTDF) which is an industry best practice to minimize the risk of oxidation of sulfide bearing material. The tailings slurry is comprised of finely ground waste rock, water, and process effluents and is deposited in the HTDF via a double-walled high-density polyethylene (HDPE) pipeline. At the shoreline of the HTDF, the pipeline splits and the tailings can be routed to one of the subaqueous outfalls located within the HTDF. In 2020, two pit floor locations and 2 elevated line deposition points were utilized for the sub-aqueous disposal of approximately 209,233,041 gallons of tailings slurry. The use of multiple outfalls allows for better control of the depth of tailings in an area and optimizes the storage volume that is available.

During the winter months, tailings were deposited at the pit floor in the south west of the pit to avoid interfering with the WTP intake stream. During summer months tailings were deposited in several locations at 100ft depth to achieve optimal filling of the pit volume. In the winter of 2020, deposition went back to pit floor deposition at the center of the pit to deposit until spring. Based on 2020 bathymetry survey results, the maximum tailings peak measured was in September 2020 at 1446 MSL with the majority of the tailings stored below elevation 1430 MSL. In the late summer of 2020, a barge was installed on the pit to allow tailings deposition points to be moved without installing new lines. A new tailings deposition plan was developed in 2020, based on the most recent bathymetry and requirements for brine storage and water treatment line placement. Further updates are expected in 2021 to adapt to changing water treatment requirements.

Aerial view of tailings lines and shore vault at HTDF, October 2018

In accordance with permit condition, F-7, an annual bathymetry survey is required to be conducted in order to accurately monitor tailings placement and calculate changes in HTDF water storage. However, in order to better understand the settling characteristics of the tailings, two surveys were completed in 2020. The surveys were conducted in May and September and focused on the entire HTDF as tailings were dispersed to multiple areas in 2020. Copies of the bathymetry surveys are available in Appendix B.

Photo of the Bathymetric Survey Being Completed, September 2020

The Metallic Minerals Lease (No. M-00602) requires the lessee to furnish a mill waste reject report on an annual basis. In 2020, 637 dry metric tonnes of copper and 2,601 dry metric tonnes of nickel were deposited in the HTDF as tailings.

5. Site Water Usage, Treatment and Discharge

Three separate sources supply water to the mill site to support various operational activities and the site water balance is comprised of well water, process water, precipitation, groundwater infiltration, and storm water runoff. With the exception of potable water, which is discharged to the onsite septic system, all of the other water sources are captured in the HTDF and are treated by the WTP before being discharged.

5.1. Supply Water Sources and Use

Three separate sources supply water to the mill site to support various operational activities. These sources include the potable well, industrial well, and reclaim water from the HTDF. Utilizing the detailed water use logs maintained on site, the following summary of average water use from each source has been compiled.

The domestic well is mainly used to supply potable water to the facility. In 2020, approximately 0.60 million gallons (MG) of water was drawn from the domestic water well which is a decrease from the 2019 total of 0.72 MG.

The industrial well is no longer used to supplement seal water and is only used to keep the fire water tank full, limiting consumption from this source. In 2020, approximately 0.22 MG of water was utilized from the industrial well. This is a slight increase from the 0.07 MG withdrawn in 2019, but an overall decrease from the 0.35 MG withdrawn in 2018.

The third source of water at the mill site is the reclaim water which is pumped from the HTDF. This water is used throughout the process with the volume that is not consumed being recycled back to the HTDF via tailings. Where possible, reclaim water usage in the mill has been replaced with internally recycled process water and the volume of water sent to the HTDF has been reduced to match the reduction in reclaim water brought into the mill. In 2020, approximately 179.5 MG of reclaim water was pumped from the HTDF for use in processing ore. Apart from approximately 4.4 MG of water that was contained in the concentrate and shipped offsite, the remainder of the water was recycled back to the HTDF for eventual reuse or treatment by the WTP.

5.2. Storm Water Control

A site grading plan was developed with the purpose of keeping all storm water onsite and directing run-off to one of two locations: the HTDF or storm water retention basin. The majority of site grading, paving, and curbing was previously completed to direct water to the series of catch basins that were installed along the length of the main facility from the rail spur to the security building. These catch basins direct storm water from the main mill facility to the HTDF. Water which falls south of the main site access road, is directed to the storm water retention basin via a drainage ditch or series of catch basins in the administrative building parking lot. A copy of the Humboldt Mill Storm Water Drainage map is included in Appendix C.

Storm water control at the Humboldt Mill is managed under NPDES permit (MI00058649) and in accordance with Part I.B of the permit a storm water pollution prevention plan (SWPPP) has been developed. The SWPPP describes the Humboldt Mill site and its operations, identifies potential sources of storm water pollution at the facility, recommends appropriate best management practices

(BMPs) or pollution control measures to reduce the discharge of pollutants in storm water runoff, and provides for periodic inspections of pollution control measures. The plan must be reviewed, and updated if necessary, on an annual basis and a written report of the review must be maintained and submitted to EGLE on or before January 10th of each year. The 2020 SWPPP annual review was completed and submitted to the Department on January 7th, 2021. A copy of the plan is available upon request.

5.3. Water Treatment Plant Operations and Discharge

Effluent discharges are regulated under the NPDES permit MI0058649 with analytical results and discharge volume reported to EGLE monthly through the MiWaters electronic reporting system. Throughout 2020, Eagle continued discharging treated effluent water to Outfall 004, located at the Escanaba River, which was permitted and constructed in late 2018. Eagle also continued using the Escanaba River intake system to supply water and maintain optimal hydrologic conditions in wetlands adjacent to the Humboldt WTP and within the wetlands north of U.S. Hwy 41 via Outfall 003. Outfalls 001, 002, and 003 were not used to discharge treated effluent during 2020.

In summer 2020 a new WTP intake system was constructed consisting of an intake barge system, electrical building, and backup generator. The system was constructed on the south side of the HTDF, which was necessary due to the limited flow from the current intake with reduced suction capacity and to increase the intake distance from tailings deposition. With this improved intake system, Eagle has the ability to control the depth of the intake line. The system intakes water from a floating barge on the HTDF to a pump barge that pumps water six feet below the surface of the HTDF to the WTP where it is tied into the existing Plug Flow Reactor (PFR) on the North side of the HTDF. The system was commissioned in August 2020.


Left: Floating intake barge, October 2020. **Right:** Pump barge, September 2020

In November 2020, the temporary Nalco reverse osmosis trailer was removed from site. This treatment trailer had been a rental added to the WTP facility to increase the amount of RO permeate that could be produced so that additional water could be discharged and the HTDF water level lowered. Water levels had decreased as planned, so the trailer was no longer needed.

In 2020, approximately 443.3 MG of water was treated and discharged from the water treatment plant.

Table 5.3 below summarizes the monthly flow rate from each WTP outfall in 2020.

Table 5.3 Volume of Water Discharged in 2020

Month	Outfall 001 Volume of WTP Effluent Water Discharged (MG)	Outfall 002 Volume of WTP Effluent Water Discharged (MG)	Outfall 003 Volume of WTP Effluent Water Discharged (MG)	Volume of Escanaba River Water Recirculated through Outfall 003 (MG)	Outfall 004 Volume of WTP Effluent Water Discharged (MG)
January	0	0	0	15	39.8
February	0	0	0	13.7	33.9
March	0	0	0	13.8	34.6
April	0	0	0	12.4	35.6
May	0	0	0	13	31.3
June	0	0	0	15.6	39.5
July	0	0	0	3.4	40.1
August	0	0	0	16.9	38.1
September	0	0	0	19.3	40
October	0	0	0	21.9	35.7
November	0	0	0	20	37.1
December	0	0	0	20.4	37.6
2020 Total	**0**	**0**	**0**	**185.4**	**443.3**

Source = WTP Operators log

To accomplish near term and longer-term operating objectives Eagle continues to evaluate the equipment capacities in the WTP. The agency will be notified appropriately in advance of process changes under the NPDES program permit requirements.

The water treatment process generates one solid waste stream derived from solids in the clarifier, which is primarily comprised of aluminum, iron, calcium, sodium, magnesium, and nickel. Waste characterization samples are required by the landfill prior to acceptance of the material. Samples from the filter press waste stream were collected in January 2020 and sent to ALS Laboratory for analysis. Laboratory results confirmed the waste stream is non-hazardous. In 2020, approximately 158.76 tons of filter press waste was disposed of at the Marquette County Landfill.

Following the completion of the 2019 Toxicity Evaluation Investigation (TIE) that that identified the cause of reproductive toxicity to *ceriodaphnia dubia* (i.e., water flea), Eagle changed blended effluent designs to prevent further exceedances. No exceedance of the effluent limit for chronic toxicity occurred in 2020 (or since September 2019). Eagle continued to design effluent blends that contain more hardness so that nickel related reproductive toxicity does not occur. A record of 2020 correspondence with EGLE Water Resources Division (WRD) on the compliance communication and all previous toxicity studies can be found in MiWaters.

5.4. Water Balance

The main components of the water balance are reclaim water/WTP intake, off-spec WTP water, process water, well water, precipitation, groundwater infiltration, and storm water runoff all of which are captured or otherwise managed in the HTDF and treated by the WTP before discharging to a nearby wetland. Permit condition F-2 requires that the site water balance be updated on a quarterly basis to ensure the water level of the HTDF is managed in a manner that minimizes risk to the environment. The target operating water elevation of the HTDF is between 1529.5 and 1530.5 ft MSL which is significantly lower than originally planned during the permitting process. The lower operating level mitigates risks associated with overflow situations and provides excess capacity to manage various operational situations.

Eagle returns off-specification water from the WTP plant in a single line depositing the water in the same area as tailings are being discharged. The off-specification water includes backwash from the UF system, filter press filtrate, and water from the PFR that did not meet plant influent specifications for oxidation status. This water exhibits a moderate concentration of dissolved solids similar to that of tailings. Brine is discharged at or below the elevation of tailings disposal.

Throughout 2020 the area received average precipitation in the form of rainfall and snowfall. Owing to a successful water management plan designed to consistently discharge 1.3 MGD, which is above the typical annual average water treatment rate of 600 GPM required to maintain water levels, in 2020 the water level of the HTDF decreased by approximately four feet. In December 2019, the level had been lowered to 1536.9 ft MSL, and at the end of December 2020, the water level was 1532.7 ft MSL. This exceeded the short-term target water level of 1535.0 ft MSL which was expected to be reached in 2020. In 2021, Eagle will again focus on stabilizing the water level at the target operating level of 1529.5 and 1530.5 ft MSL.

Eagle continues to use an integrated groundwater, surface water, and water balance model to estimate the water balance based on several years of operational data. The model estimates the water balance for the HTDF and surrounding watershed for both current watershed conditions and those consistent with pre-existing conditions prior to redevelopment of the Humboldt Mill. In 2020, a refinement was finalized to update the geologic information in the geodatabase, and an area previously outside of the model boundary was added to the model after installation of groundwater piezometers. As a result, there were slight adjustments in the total groundwater inflows to the HTDF, an increase over what had been predicted previously. All 2020 water balances reflect the new model results.

Eagle continued to maintain the water balance to Wetland EE and the downstream wetland systems by discharging water from the Middle Branch of the Escanaba River to Outfall 003. In 2019, the pump system was unable to reach the design flows despite improvement efforts. In 2020, additional efforts were employed which successfully improved the output of the system. The improvements included the following:

- Inspection of the intake line with a wheeled camera to determine if restrictions were present.
- Excavation of sections of the piping at the inlet and outlet of the valve house to replace the piping with larger diameters and reduce friction losses from bends and valves.

- Occasional cleaning of valves to remove material that would plug them and reduce flow through the system.

Outfall 003 is supplied with water year-round.

Despite periodic deviations from the flow model, the wetland hydrology was maintained year-round with no major flooding or drought conditions experienced in the downstream areas. This may indicate that the downgradient wetland mitigation bank and other wetland culvert systems are robust and mature enough to handle a variety of water conditions, which will be useful information to consider for closure planning and design. The wetland response information is continually tracked for the purpose of a closure design for a passively controlled discharge structure on the HTDF.

Copies of the 2020 quarterly water balance diagrams and HTDF water elevation data are included in Appendix D.

6. Materials Handling

6.1. Fuel Handling

A 3,000-gallon double-walled stationary bulk diesel tank with leak detection located on the east side of the COSA is the only bulk fuel storage on site. The bulk tank is refueled as necessary by an offsite fuel provider.

6.2. Bulk Chemical Handling and Storage

It is the goal of Eagle Mine to create a culture of environmental awareness throughout the workforce. Therefore, all employees and subcontractors are trained to immediately respond and report any spills that occur. In 2020, the Humboldt Mill had zero reportable spills under the Part 5 Rules of Part 31, Water Resources Protection of NREPA, 1994 PA 451 as amended (Spillage of Oil and Polluting Materials).

The Michigan SARA Title III Program requires reporting of onsite chemicals being stored above certain threshold quantities. Due to the volume of chemicals stored/used at the site for processing and water treatment, a Tier II Report was submitted in February 2020 via the online Tier II Reporting System to the State Emergency Response Commission (SERC). Copies of the report were also mailed to the

Marquette County Local Emergency Planning Committee (LEPC) and Humboldt Township Fire Department.

7. Monitoring Activities

7.1. Water Quality Monitoring

A significant amount of surface water and groundwater quality monitoring is required on the mill site and surrounding areas. The following is a summary of the water quality monitoring activities.

7.1.1. Quarterly Groundwater Quality Monitoring

Groundwater quality is monitored through a network of monitoring wells located inside the perimeter fence line of the mill site. The monitoring wells are classified as either compliance, leachate, facility, or monitoring. Compliance wells are located on the north-side of the cut-off wall, outside of the influence of the HTDF; leachate wells are located on south-side of the cut-off wall and generally represent HTDF water quality; facility monitoring wells are located downgradient of each operating facility; the remaining monitoring wells are located north of the cut-off wall but are not used to confirm effectiveness of the cut-off wall as the compliance and leachate wells are. A map of the well locations can be found in Appendix E. Four rounds of quarterly sampling were completed in March, May, August, and November 2020. The Eagle Mine Permit prescribes both a long parameter list for annual monitoring events (conducted in Q3 2020) and a short list to be used quarterly (Q1, Q2, Q4 2020). Samples were collected in accordance with the Eagle Project Quality Assurance Project Plan and Standard Operating Procedures (North Jackson, 2004a and 2004b) and the results are summarized and compared to benchmarks in the tables found in Appendix F.

Monitoring Locations MW-704 DBA, and MW-707 QAL Aug 2020

Monitoring Results

Twenty-four monitoring well samples were collected by TriMedia Environmental & Engineering (TriMedia) during each of the four quarterly sampling events. Samples were collected using low-flow sampling techniques, and field parameters (dissolved oxygen (DO), oxidation-reduction potential

(ORP), pH, specific conductivity, temperature, turbidity) are collected and analyzed using a flow-through cell and YSI probe. All samples are shipped overnight to Pace Analytical Services in Grand Rapids, Michigan, for analysis.

In accordance with Part 632, R426.406 (6) when a result is greater than a benchmark for two consecutive sampling events, at a compliance monitoring location, the permittee is required to notify EGLE and determine the potential source or cause resulting in the deviation from the benchmark. Fluctuations in groundwater elevation, the potential impact by road salt/sand applications, and/or shifts in the redox conditions of groundwater are the likely drivers of these conditions that occurred throughout the year. The following is a summary of the events that occurred in 2020:

- Due to turbidity levels that exceeded 3 NTU, 15 of the 24 monitoring locations required field filtering for at least one quarter in 2020 and therefore the values are reported as dissolved concentrations. The remaining locations/quarters reported turbidity below 3 NTU and are reported as total concentrations. The sample summary denotes whether the sample values are total or dissolved.
- Four of the monitoring locations (i.e., MW-702 UFB, MW-703 UFB, HW-1L, and HW-1U) are very slow to recharge and are pumped down in advance of sampling in order to ensure that the samples collected are representative of the groundwater at the monitoring location. Locations MW-702, MW-703, and HW-1L take approximately one month to recover while HW-1U takes approximately four months to fully recover due to the tight formation in which it is located. The presence of bentonite has also been observed in proximity to the screened interval of the monitoring well and may also contribute to the slow recharge rate at HW-1U. Samples from these locations follow low-flow sampling procedures (with the exception of HW-1U) after the recharge period. The results from these wells may not accurately characterize the true water quality of the location and are also likely to be pulling the same water from the well every quarter (i.e., causing dependent sample measurements). Eagle will evaluate if another sampling frequency is the best for water quality sampling at this location propose changes to the department.
- The major cation parameters analyzed (calcium, magnesium, potassium, and sodium) were detected at all locations with most of the detections below the calculated benchmarks. Among major anion parameters analyzed, bicarbonate alkalinity and sulfate were detected in most samples, and chloride was detected in many of the samples. Concentrations were frequently but not always below the calculated benchmarks. Nitrogen species (ammonia, nitrate, and nitrite) were detected more irregularly. Carbonate alkalinity, fluoride, and sulfide were rarely detected. A summary of wells that have had one or more parameters exceed a benchmark value can be found in Appendix F.
- The majority of the metals analyzed reported values below the analytical reporting limit and are listed as non-detect.
- For several years, Eagle employees have used a gravel roadway from the mill property to the WTP that traverses the cut off wall and passes by the PFR reactor area. This was commonly used by warehouse, maintenance and WTP employees for activities such as delivering supplies or moving mobile equipment that cannot be driven over the road (such as a man lift). However, in order to keep that road surface safe for use year-round, the road periodically was treated with sand/salt mixtures. The typical salt used is sodium chloride, containing

readily soluble calcium and sulfate, along with trace amounts of soluble magnesium. As an example, one salt product used contains 98% NaCl with 0.81% SO4 and 0.31% Ca. The road salt minerals are designed to dissolve in water, so represent a potentially significant source of these elements to shallow groundwater and soils in the vicinity of the cut-off wall; in addition to these direct changes, road salts have the potential to affect general nutrient cycling (such as for nitrogen/ammonia) and cation exchange reactions within the affected soil profiles. Changes in these parameters in groundwater measurements are characteristic of the sand/salt application activities taking place nearby causing ion exchange processes to occur in the clays and other minerals in contact with shallow groundwater. As this is a potential complicating factor to interpreting the results in the monitoring water quality in these wells, the road was closed to vehicle traffic beginning in December 2020 to limit the application of sand/salt. Access to the Fenton's reactor area is still maintained for chemical deliveries and personnel, so some well sets will continue to be influenced by vehicle traffic and sand/salt application. These influences have been discussed in Q1-Q4 benchmark reports and are summarized below. The majority of these parameters are not characteristically related to milling operations. Trend monitoring will continue in 2021.

- Sodium and chloride were elevated at HW-1L, a well positioned along the cut-off road, for three quarters in 2020.
- HW-1U LLA had elevated levels of chloride for three quarters in 2020.
- Calcium, chloride, magnesium, sodium, and associated hardness were detected above their respective benchmarks at HW-1U UFB, MW-704 QAL, MW-704 UFB, and MW-705 UFB. Due to their location near the water treatment plant, the MW-704 series and MW-705 series of wells will still see an impact from the sand/salt application needed to ensure safety of employees and contractors working on site.
- HW-2 had elevated chloride, sulfate, and sodium for all quarters of 2020. Located outside of the cut-off wall, sulfate is significantly lower than that of the HTDF.
- Nitrogen as ammonia and nitrate are raised at HYG-1. As stated, road salts have the potential to affect general nutrient cycling.
- KMW-5R is a well located by the COSA building on site. It is an area impacted by sand/salt application throughout the winter months and has shown elevated sodium since 2018.
- Chloride, sulfate, calcium magnesium, potassium, sodium, and associated hardness were detected above the corresponding benchmarks at MW-701 QAL and MW-701 UFB in 2020. Both of these wells are inside of the cut-off wall and are located near the location of the March 2019 sulfuric acid spill. This location is still subject to the application of sand/salt to maintain safe working conditions.
- MW-704 LLA has elevated calcium, magnesium, and hardness. This appears to be a seasonal trend occurring since 2018.
- MW-704 DBA is trending with slightly elevated hardness for the four quarters of 2020.

- Nitrogen as ammonia as well as sodium were elevated at MW-705 QAL, indicating an impact to general nutrient cycling and the leeching of sodium from salt used on the roadway.

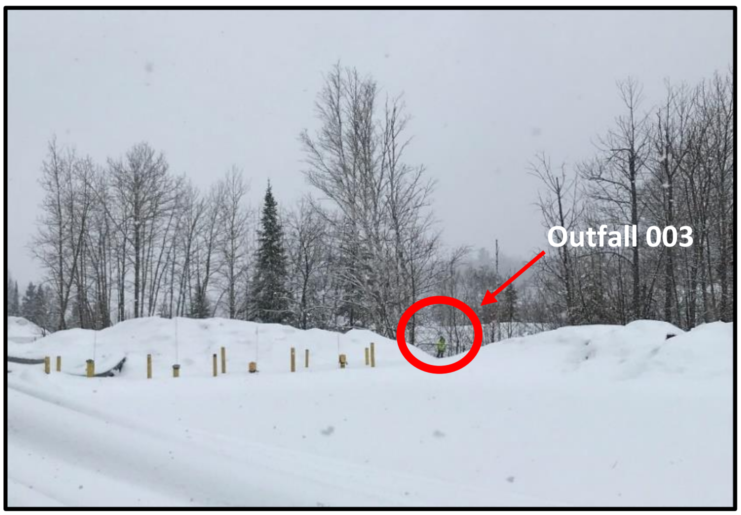
- Early in 2020, dissolved oxygen at multiple wells remained lower than previous quarters, and static water levels had fluctuated, up to several feet in some cases, compared to Q2 2019. The effects of the wet weather conditions that persisted from late 2018, through 2019, continue to be observed in the water quality field parameters and chemistry. These weather conditions can also readily mobilize soluble salts and redox-sensitive metals that were once stored above the water table (phreatic zone). An example of the impact of these types of precipitation-related effects could be seen in wells HW-2 and HYG-1 where static water levels were approximately 2 feet lower in Q1 2020 than the previous quarter. Lower DO in these wells was likely the cause of the iron and manganese increases. Iron and manganese can become soluble in increasingly anaerobic groundwater. Both iron and manganese naturally occur in the host soil and rock surrounding the HTDF. Due to differences in geology between the wells, and slight differences in the water-rock processes occurring near the monitoring well, the concentrations would also be expected to vary. In wells HW-2 and HYG-1, a rise in iron and/or manganese is primarily believed to be due to a rising water table and the prolonged saturation of soils beneath the water table. Iron and manganese exceeded the benchmark value at MW-704 UFB, a shallower well set outside the cutoff wall for three quarters. As mentioned, iron and manganese vary in groundwater, and are also sensitive to sampling techniques (especially those that affect the oxygen content in samples), so these are not considered indicative of groundwater contamination. Similar trends were seen at another shallow well on the inside of the cutoff wall, MW-701 UFB.

- Mercury in groundwater at MW-701 QAL, a well set inside the cut off wall and affected by the sulfuric acid spill in 2019, has been above benchmark for three consecutive quarters (Q2-Q4 2020), with the highest results in Q3. Mercury concentrations are higher than water analyses in the HTDF, and atmospheric mercury (9.3 ng/L in from a sample collected on site in September 2020) is not sufficient to have this effect alone. In some cases, commercial sulfuric acid feedstocks are known to contain mercury; manufacturers are only required to report impurities over 10,000 ppm, so it is possible that the mercury that was present in the sulfuric acid could have sorbed into soil initially and could now be desorbing, re-mobilizing mercury that was a part of the localized acid spill.

- Multiple parameters at location MW-701 UFB changed rapidly due to the sulfuric acid release that occurred in March 2019. After the changes peaked during Q3 2019, all major ions, except for chloride, decreased. The continued presence of chloride, sulfate, calcium, magnesium, potassium, sodium, and related hardness can likely be explained by a compounded effect of the use of winter road sand/salt and the slow continued flushing of the acid spill impacts. Eagle provided detailed analysis of the changes in the well chemistry in its Q2-Q4 2019 and 2020 benchmark reports.

- MW-701 QAL was installed for the purpose of monitoring shallow groundwater inside the cut off wall. Water in this vicinity is expected to be indicative of either HTDF water quality, or, when water levels are low in the HTDF, the water in this well may be derived from the infiltration of precipitation that falls within the cut off wall. During 2020 water levels generally decreased in the HTDF as well as MW-701 QAL. As such, water quality in MW-701 QAL saw a shift to an ionic balance that is dissimilar to the HTDF water quality while remaining under the influence of quarterly seasonal trends. This is a different trend than we saw in 2018 and 2019 due to higher water levels of the HTDF during those years.

- Sulfate at MW-704 QAL exceeded the benchmark in all four quarters in 2019 and Q1 2020. Sulfate returned below benchmark in Q2 2020 and continued to show a decreasing trend through Q4. Since 2017, results for sulfate fluctuated between monitoring events. The MW-704 QAL well was installed for the purpose of leachate monitoring downgradient of the HTDF. Sulfate results in MW-704 QAL are not consistent with sulfate levels in the HTDF, and do not show a traceable trend when compared to MW-701 QAL. Sulfate detected in MW-704 QAL in 2019 could have been sourced from the former discharge of treated plant water at nearby Outfall 003. WTP discharge was below NPDES permit levels, but higher than the river water. The change observed in sulfate levels at MW-704 QAL could be an effect of Escanaba River water being discharged at Outfall 003. This relationship continues to be evaluated on a quarterly basis.



Location of MW-704 wells with respect to Outfall 003.

- Water quality at MW-702 QAL is intended to be influenced by the HTDF, or when HTDF water levels are particularly low, the well water quality would be generally reflective of the precipitation that infiltrates within the cut off wall. This well had no results besides pH which varied from the benchmark during 2019. Prior to 2019, the pH value in this well varied seasonally, but in late 2019 through Q1 2020, pH values reached a new equilibrium that generally reflects the pH of water of the HTDF rather than varying seasonally.

- In Q1-Q4 2020, sodium concentrations at KMW-5R, which is located near the COSA, were above established benchmarks. This trend has been consistent since 2018 when benchmark values were established. Aluminum, lithium, and manganese were also higher than the benchmarks at KMW-5R during the annual sampling event. Lithium, and manganese were only slightly above benchmark values, within a typical range of analytical uncertainty. Aluminum is commonly found in wells with high turbidity levels because clays and other small particles suspended in turbid water contain aluminum in their mineral structures. Turbidity in KMW-5R has typically been higher than in other wells. KMW-5R is a low recharge well that is pumped down a day in advance of sampling to help ensure the sample is accurately representing the water quality of the location, and a bailer is used to sample which can increase sediment disturbance during sample collection.

- MW-9R had levels of nickel (Q3, Q4) and zinc (Q4) recorded above benchmark values. All of these wells are located on the main property outside of the milling facilities. Observations of the MW-9R area show impermeable surfaces maintained around the well casing, this location will continue to be monitored.

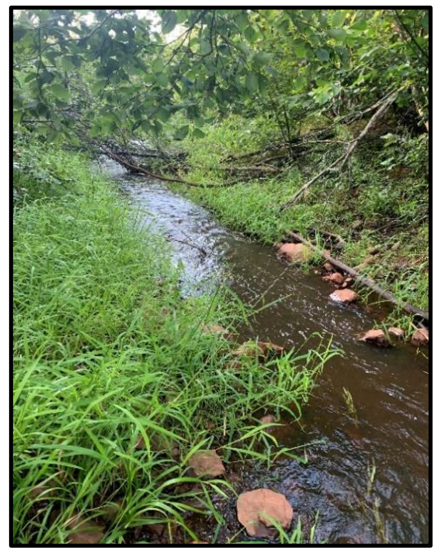
- Trend testing was conducted using the Mann-Kendall test with Sen's slope estimator. The Mann-Kendall test is a non-parametric evaluation for increasing or decreasing trend, and Sen's slope estimator provides an indication of the magnitude of the trend. Although the Mann-Kendall test can be computed in most cases, guidance suggests that it is not appropriate to use for evaluating trend when there are fewer than eight (8) to twelve (12) detected measurements and/or the highest reporting limit is greater than the majority of observations (USEPA, 2009[1]). The trend testing was conducted only on parameters for which most of the wells had eight or more samples above detection limits. Well-parameter pairs with fewer than 50% of samples above reporting limits were excluded. Based on these criteria, the parameters that were considered were bicarbonate alkalinity, calcium, chloride, hardness, iron, magnesium, manganese, pH, potassium, sodium, and sulfate. For data with a single reporting limit, non-detect values were set to the reporting limit. For data with two or more reporting limits, non-detect values were set to the highest reporting limit, unless the highest reporting limit was greater than the majority of the reported values. In that case, the high detection limits were removed as outliers, and the highest detection limit less than most of the reported values was used. As an example, reporting limits for manganese ranged from 50 µg/L to 10,000 µg/L. If the manganese samples from a particular well generally ranged between 300 µg/L and 400 µg/L, reported values of <500 µg/L, <1,000 µg/L, etc. were removed, and values reported as <50 and <250 µg/L or any detected concentration below 250 µg/L were replaced with 250 µg/L.

  A table summarizing the results of the trend analyses are shown in Appendix G. The p-value determines whether a monotonic trend exists at 95% confidence. For this test, "no trend" is indicated when the p-value is >0.05. When the p-value is ≤0.05, there is either a "POSITIVE" (increasing with time) or "NEGATIVE" (decreasing with time) trend indicated. The potential reasons for trends are discussed in the quarterly and annual groundwater monitoring reports.

7.1.2. Quarterly Surface Water Quality Monitoring

Surface water sampling was conducted on a quarterly basis in 2020 at eight surface water locations by TriMedia. Four locations are associated with surface water resources in the subwatershed containing the HTDF and four are associated with the subwatershed of the milling facility. The samples collected represent winter base flow, spring snowmelt/runoff, summer base flow, and the fall rain season. Samples were collected in March (Q1), June (Q2), August (Q3), and December (Q4) in 2020. A map of the surface water sampling locations is found in Appendix H. Samples are collected in accordance with the Eagle Project Quality Assurance Project Plan and Standard Operating Procedures (North Jackson, 2004a and 2004b) and the results are summarized and compared to benchmarks (i.e., upper prediction limit) and are located in the tables found in Appendix I. Measured water levels in HMP-009 (Wetland EE) are also included in Appendix I.

As stated in the groundwater quality monitoring section above (7.1.1), the surface water benchmark values were also recalculated in 2018 using results that were not determined to be trending based on statistical analysis. A sufficient data set was also available which allowed the establishment of benchmarks for each season which will help to account for seasonal variability. Benchmarks were not updated at locations HMP-009 and HMWQ-004 as they did not have enough data points to revise the benchmarks at this time. Results for HMP-009 will continue to be compared to the initial benchmark values established in 2014. HMWQ-004 was a new surface water reference location that was added in 2020. For the remaining locations, results will now be compared based on season variation (i.e., Q1 2017 compared to Q1 2018) per Special Permit Condition L2 of the Humboldt Mill Part 632 Mining Permit (MP 01 2010).



Black River Monitoring Location WBR-002, and Middle Branch Escanaba River Monitoring Location MER-001, Aug 2020

<u>Monitoring Results</u>

The Humboldt Mill Surface Water and Sediment Monitoring Plan prescribes a long parameter list surface water samples that are collected annually (Q3 2020) and a shorter list to be used during the remaining quarterly monitoring events (Q1, Q2, Q4 2020). In addition to grab samples, field measurements (DO, pH, specific conductivity, temperature, and turbidity) were collected and determined using a YSI multiparameter water quality meter. Flow measurements were obtained, where conditions allowed, using a wading rod and current meter. Flow rates for location MER-002 were recorded from the USGS website for the station located adjacent to the monitoring location (i.e., 04057800 Middle Branch Escanaba River Humboldt Mill location). Water quality samples were shipped overnight to Pace Analytical Services in Grand Rapids, Michigan, for analysis. Parameters requiring low-level analysis were sent to Eurofins Frontier Global Sciences in Bothell by subcontract of White Water Associates Laboratory in Amasa, MI.

The following is a summary of field observations that occurred at compliance monitoring locations in 2020:

- Similar to previous years, water samples were unable to be collected in Q1 at WBR-001 due to frozen conditions.

- HMWQ-004 is located in an area in which the only contributions are related to precipitation and storm water run-off from the adjacent roadway, therefore sampling from this location is dependent upon precipitation. Similar to previous years, there was insufficient water to collect samples from this location in 2020.
- Due to low water levels and frozen conditions, samples were only collected at HMP-009 in Q3 2020. Water is typically stagnant and shallow in this area and could influence these results. pH was slightly below 2018 benchmark values during this sampling, with iron and mercury over the benchmark in Q3. Mercury also exceeded benchmark values for three quarters in 2019. Considering the low water levels, atmospheric mercury (9.3 ng/L in September 2020) could have an effect on this area.
- pH results at MER-002 have been above the Q3 and Q4 seasonal benchmark from 2019 to 2020 and are currently trending down towards benchmark values. pH results at MER-003 were above 2019 and 2020 seasonal benchmarks for Q2-Q4, however they are trending near the seasonal benchmark in Q4 2020. Although the pH results at MER-003 have been slightly higher, the pH results at reference monitoring station MER-001 followed a similar trend as MER-003 indicating the results are likely related to regional influences not mining activities.
- Based on the Q4 seasonal benchmark, sodium has increased at MER-003. Sodium is a non-toxic ion found in effluent discharges from the WTP, which is permitted to discharge at a point in the river that is located between MER-002 and MER-003
- Although not above seasonal benchmarks each quarter, sulfate has continued to rise at both MER-002 and MER-003, sulfate is permitted for discharge under Eagle's NPDES permit.
- The discharge of copper is also allowed by our NPDES permit. For reference, Eagle's WTP discharge in Q4 2020 had an average concentration of 2.1 ug/L of copper. Copper at MER-003 was at 0.79 ug/L in Q4 which shows that copper is being well managed by the mixing zone in the river per permit conditions.
- WBR-002 was above the seasonal benchmark in Q4 for alkalinity bicarbonate. Calcium was elevated in the Q3 seasonal benchmark at this location as well. Calcium returned to below the seasonal benchmark in Q4 at this location.
- Alkalinity bicarbonate was above the seasonal Q4 benchmark at WBR-003. Also, at this location, arsenic and copper were above the seasonal Q3 benchmark from 2019-2020. Total suspended solids (TSS) were also elevated in the Q3 seasonal benchmark and could explain the increase of these parameters. Arsenic, copper, and TSS levels returned to below seasonal benchmarks in Q4.
- In 2020 trend testing was conducted using the Mann-Kendall test with Sen's slope estimator for the surface water monitoring locations as well. The Mann-Kendall test is a non-parametric evaluation for increasing or decreasing trend, and Sen's slope estimator provides an indication of the magnitude of the trend. Although the Mann-Kendall test can be computed in most cases, guidance suggests that it is not appropriate to use for evaluating trend when there are fewer than eight (8) to twelve (12) detected measurements and/or the highest reporting limit is greater than the majority of observations (USEPA, 2009). The trend testing was conducted only on parameters for which most of the locations had eight or more samples above detection limits. Parameter pairs with fewer than 50% of samples above reporting

limits were excluded. Based on these criteria, the parameters that were considered were bicarbonate alkalinity, calcium, chloride, hardness, iron, magnesium, manganese, pH, potassium, sodium, and sulfate. For data with a single reporting limit, non-detect values were set to the reporting limit. For data with two or more reporting limits, non-detect values were set to the highest reporting limit, unless the highest reporting limit was greater than the majority of the reported values. In that case, the high detection limits were removed as outliers, and the highest detection limit less than most of the reported values was used.

A table summarizing the results of the trend analyses are shown in Appendix J. The p-value determines whether a monotonic trend exists at 95% confidence. For this test, “no trend” is indicated when the p-value is >0.05. When the p-value is ≤0.05, there is either a “POSITIVE” (increasing with time) or “NEGATIVE” (decreasing with time) trend indicated.

7.2. Sediment Sampling

Sediment sampling is required on a biennial basis and was conducted on December 29, 2020. Sediment monitoring stations are co-located with surface water monitoring stations and consist of reference stations MER-001 and WBR-001, HTDF sub-watershed monitoring stations MER-002, MER-003, and HMP-009 and Mill sub-watershed monitoring stations HMWQ-004, WBR-002, and WBR-003. As required by the Part 632 Mining Permit, the sediment sample results were compared to the Consensus-Based Probable Effect Concentrations found in MacDonald et al., 2000. This included comparison to the threshold effects concentration (TEC) and probable effects concentration (PEC). A result below the TEC indicates that it is unlikely that harmful effects would be observed in sediment-dwelling organisms. In contrast, a result above the PEC indicates that harmful effects would likely be observed in sediment-dwelling organisms. To remove some of the uncertainty in effects, the Wisconsin DNR recommends calculating a Midpoint Effect Concentration (MEC) which is the calculated average between the TEC and PEC (i.e., TEC+PEC/2). Using the TEC, MEC, and PEC values, the WI DNR also established a rating system to better understand the level of concern the concentrations merit. The ranking is from one to four, with Level 1 being least concerning and Level 4, most concerning. This ranking system was used to help interpret the findings of the 2020 sediment sampling event which are summarized below.

- Three parameters at two different sampling locations had results that fell between the TEC and PEC. There were no instances where results were above PEC values. This is a decrease from 2018 when six parameters at four different sampling locations were between TEC and PEC.
- The arsenic result at location MER-001 was found to be between the TEC and PEC in 2020. MER-001 is a reference monitoring location that is located outside of the immediate influence of milling operations. Arsenic concentrations at MER-001 after milling operations began were below TEC. The ranking for this location is a Level 2 in which there is low level of concern that harmful effects would be observed in sediment-dwelling organisms.
- Copper and nickel at MER-003 was found above the TEC and below the PEC. The copper concentrations decreased significantly in relation to 2018 results and the nickel result was only 0.2 mg/kg above the TEC. The ranking for this location is a Level 2 indicating a low level of concern that harmful effects would be observed in sediment-dwelling organisms.

A summary of the sediment results is provided in Appendix K.

7.3. Regional Hydrologic Monitoring

7.3.1. Continuous Groundwater Elevations

Monitoring wells MW-701, MW-702, MW-703, MW-704, MW-705, HYG-1, HW-2, HW-1U, HW-1L, HW-8U are instrumented with continuous water level meters and downloaded quarterly by TriMedia field technicians. Permit condition F-9 requires that water levels are continuously monitored in Wetland EE and the HTDF. HTDF water level readings were recorded using a stilling well containing a pressure transducer which was installed in the HTDF to collect continuous water level measurements. To ensure accurate readings in the winter, an “ice eater” was installed to prevent the water surrounding the stilling well from freezing. A map of monitoring locations can be found in Appendix E.

Special Condition F-9a requires continuous monitoring of water levels on each side of the cutoff wall and a comparison of the gradient changes actually measured versus earlier predictions. In 2020, there was a continued effort to lower the HTDF water level from the high levels that resulted from excess precipitation and low water production in 2018-2019. The focus of the first half of 2020 was to continue to lower the water level and the second half of the year was focused on maintaining current levels. The effort was successful, because as of the time of this writing, the HTDF water level is approximately 4.5 feet lower than the wetland water level and therefore the gradient is once again inward toward the HTDF.

Continuous groundwater elevation results are reported by water year (October 1 – September 30). Water year is the preferred approach for reporting water levels because the hydrographs demonstrate the effect of late fall and winter precipitation, which melts and drains in spring, in one 12-month hydrologic cycle. Copies of groundwater hydrographs are located in Appendix L. A review of the hydrographs found the following:

- The hydrographs clearly illustrate when the wells are pumped down in advance of, or during, sampling and the rate at which they recharge.
- Equipment malfunctions which resulted in data gaps of continuous water level data occurred at two locations over the course of the year. All water level meters were replaced as soon as possible after discovery of the malfunction. Table 7.3.1 summarizes the locations, duration, and potential cause of equipment malfunctions:

Table 7.3.1 Summary of Continuous Monitoring Equipment Malfunctions

Location(s)	Date Equipment Malfunction Occurred	Reason for Malfunction
HW-1U LLA	8/17/19 – 11/21/19	Battery Failure
MW-702 UFB	3/17/20 – 6/15/20	Battery Failure
MW-705 QAL	11/05/19 - 3/18/20	Battery Failure

- HW-1L, HW-1U LLA, MW-702 UFB, and MW-703 UFB are located in a tight formation and are very slow to recharge. MW-702 UFB, and MW-703 UFB takes approximately one month to recharge and HW-1L and HW-1U LLA takes almost four months to fully recharge.
- Water levels in the HTDF rose in late 2019 which caused a rise in groundwater elevations of QAL wells inside the cutoff wall. In 2020, as HTDF water levels lowered, the QAL wells inside the cut off wall returned to a similar elevation as the QAL wells outside of the cutoff wall.
- Similar to previous years, most of the shallower, quaternary aquifer wells displayed signs of seasonal influence as groundwater elevations decreased during the winter months and increased again in during the onset of spring melt.

7.3.2. Continuous Surface Water Monitoring

In accordance with permit condition F-9, Wetland EE is required to be instrumented with a meter to continuously monitor water levels. However, due to the presence of the cut-off wall, recharge is now primarily based on precipitation (i.e., rain and snow melt) and the recirculation of Escanaba River water as managed by Eagle Mine. The purpose of the continuous water level measurements is to monitor the effectiveness of the cut-off wall and record seasonal variations. However, in accordance with NPDES permit MI0058649, Eagle is required to maintain the hydrology of the wetland and deliver water flows that represent post-closure flows. This is currently accomplished through the use of a river water intake/recirculation system and due to this requirement, the monitoring objective can no longer be met and therefore continuous readings are not being collected. However, surface water grab samples and field parameters will be collected quarterly when possible although results will be strongly influenced by Escanaba River water quality.

7.4. Cut-Off Wall Effectiveness Review

In accordance with permit condition F-9, Eagle is required to monitor the effectiveness of the cut-off wall in terms of hydraulic containment. This condition includes the requirement for collecting and analyzing water levels in wells, Wetland EE, and in the HTDF in comparison to predicted water levels; comparisons of groundwater quality between upgradient and downgradient wells, and analysis of the water balance of the facility to aid in evaluation of the data.

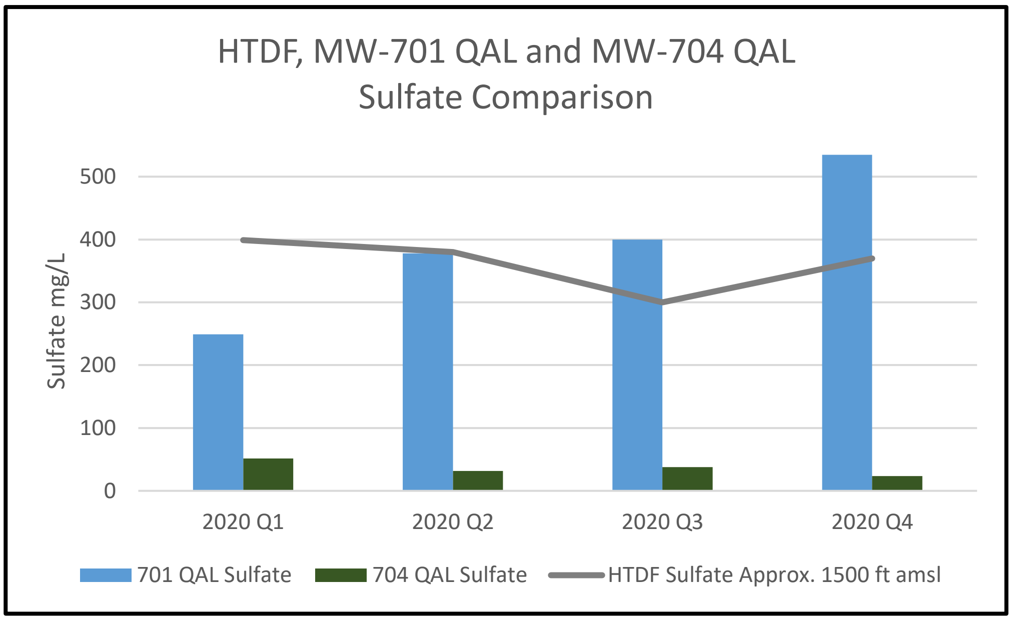
Prior to operations, Eagle's consultants prepared predictions of water gradients that would exist in the facility over a 10-year period of operation. The expectation was that water levels in the HTDF would rise to approximately 1540 ft amsl, and a gradient of up to 9 feet of hydraulic head would develop in paired wells over many years of operation. However, the water balance of the facility has not followed the trajectory that was used in that prediction. Initially, Eagle purposely lowered the water level of the HTDF by approximately 10 feet below that which was used to develop the gradient prediction, and over the past three years the facility water level has fluctuated by several feet (up and down) due to extreme weather and subsequent drawdown periods. As such, it is challenging to complete a direct comparison of the prediction to the actual gradients. Fortunately, the water quality, static water elevations, and other water balance observations are useful to demonstrate that the cut off wall continues to perform well to hydraulically contain the tailings disposal facility despite nuances related to seasonal water balance.

The tabular summary provided in Appendix M provides commentary on various observations that the cut off wall continues to meet hydraulic containment performance standards. Based on this data there is sufficient information to show that the cut-off wall is functioning as expected.

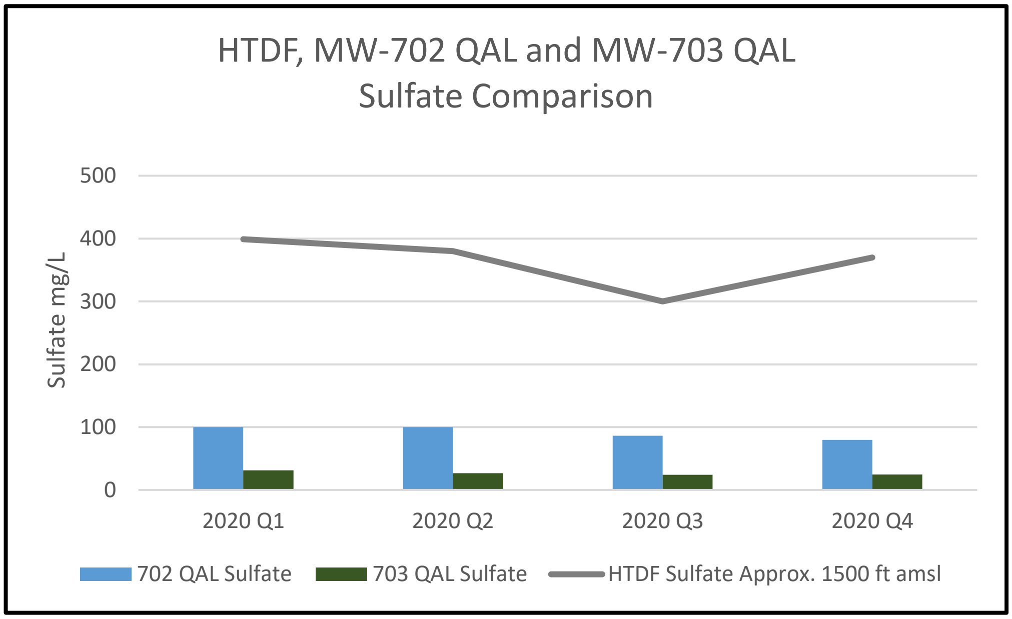
7.4.1. Water Quality

The effectiveness of the cut-off wall was also evaluated by comparing sulfate levels. As shown in the graphs below, the water quality at the leachate monitoring well pairs is distinct and shows that the cut-off wall is functioning as expected.

Sulfate levels at MW-701 QAL, a well inside the cut-off wall, continue to elevate, indicating the influence of water from the HTDF, as expected. Sulfate levels at MW-704 QAL, the well outside of the cut-off wall, do not correlate with levels found in its leachate monitoring pair or the HTDF. This suggests overall water quality of the HTDF is not communicating with this well.

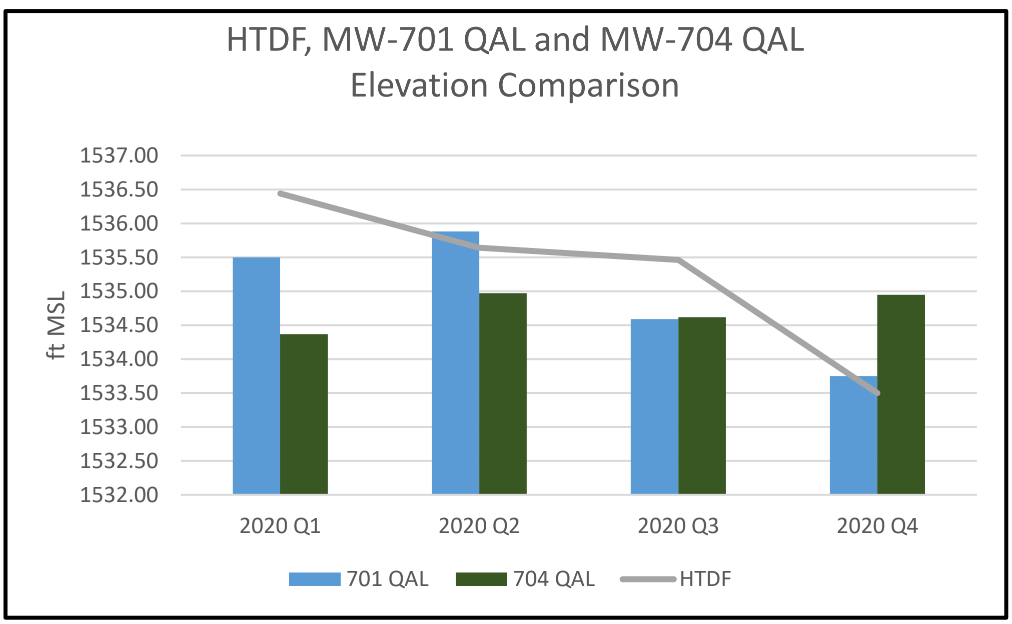


Though sulfate levels in MW-702 QAL, a well located within the cut-off wall, are lower than sulfate levels seen in the HTDF, they are still higher than what is seen in MW-703 QAL, the well located outside of the cut-off wall. This further suggests that the cut-off wall is functioning as expected.

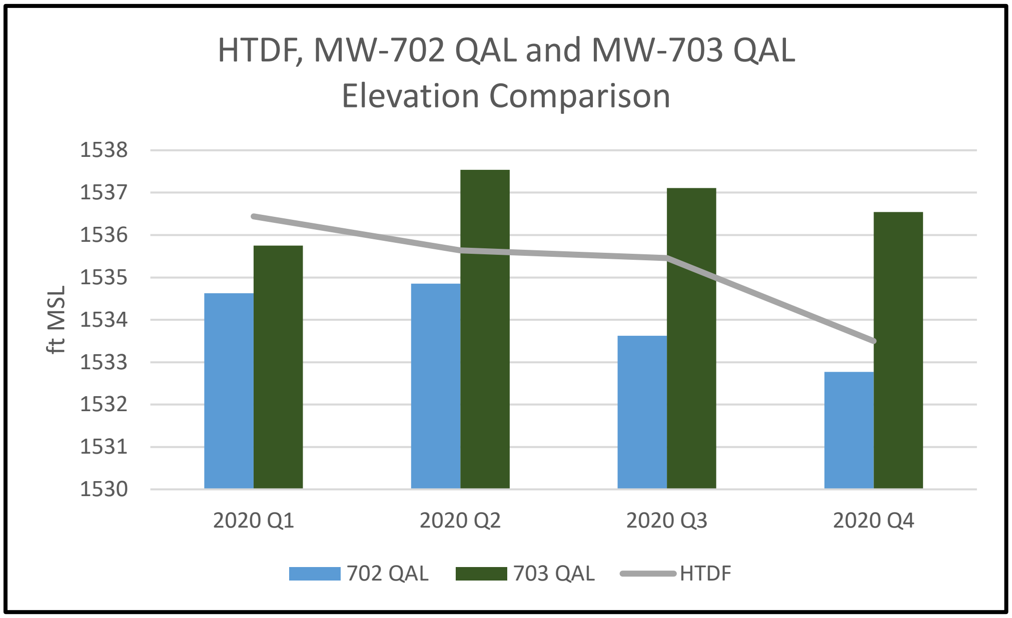


7.4.2. Water Levels

Monitoring groundwater elevations compared to HTDF elevations demonstrate that the cut-off wall is functioning as expected.



Decreases in groundwater elevation in MW-701 QAL were similar to what was seen in the HTDF, as expected, whereas groundwater elevations in MW-704 QAL stayed more consistent and appeared to act independently from the HTDF water level fluctuations. Due to its location outside of the cut-off wall, MW-704 QAL may also be under local influence of discharges made to Outfall 003 at Wetland EE and due to proximity and depth relative to the wetland.



Throughout most of 2020, MW-702 QAL followed HTDF decreases from Q2-Q4 as expected. Though MW-703 QAL also decreased from Q2-Q4, it remained at a higher elevation throughout the year, indicating that it was not influenced by HTDF fluctuations.

7.5. Biological Monitoring

Biological monitoring events conducted in 2020 included surveys of birds, large and small mammals, frogs, toads, fish, and macro invertebrates. Results from each survey have been compiled into annual reports which are available upon request. A brief summary of each survey is provided below.

7.5.1. Flora and Fauna Report

The 2020 flora, fauna, and wetland vegetation surveys were conducted by Barr Engineering (formerly King & MacGregor Environmental, Inc. (KME)). Table 7.5.1 below outlines the type and duration of the surveys that were conducted in 2020. A map of the survey locations can be found in Appendix N.

Table 7.5.1 Type and Duration of 2019 Ecological Investigation

Survey Type	Survey Date
Birds	June 15, 16; September 14-16
Small Mammals	September 15-17
Large Mammals	April - September
Toads/Frogs	April 30; May 26; June 8
Threatened and Endangered Species	April - September

The wildlife and plant species identified during the 2020 surveys within the Study Area are similar to those identified during previous KME surveys. Following is a summary of the survey results:

- A combined total of 633 birds representing 59 species were identified during 2020 bird surveys. Blue jay, (*Cyanocitta cristata*), song sparrow (*Melospiza melodia*), and American robin (*Turdus migratorius*) were the most abundant birds observed during the June 2020 survey, while blue jay, chipping sparrow (*Spizella passerina*), and white-throated sparrow (*Zonotrichia albicollis*) were the most abundant during the September 2020 survey. The bird species identified in 2020 are similar to those bird species identified in previous surveys conducted within the Study Area and are consistent with the bird species expected to be found in the habitats present.
- Forty-one small mammals representing five species were collected during the September survey period. The most common small mammal identified during the survey was the least chipmunk (*Tamias minimus*). The total number of individuals captured, and species richness recorded in 2020 are consistent with those in previous years, with a small increase in number of individuals and a small decrease in number of species. No threatened, endangered, or special concern small mammals were observed during any of the surveys. The small mammals encountered within the Study Areas during the 2020 surveys are typical of those expected in the habitats present and are consistent with previous survey results.
- During the 2020 surveys, no large mammals were directly observed, however, tracks and scat of Whitetail deer (Odocoileus virginianus) were present. Previously observed or other regionally common species possibly present within the Study Area, but not observed during the 2020 surveys include the American black bear, bobcat, coyote, and federally endangered gray wolf (Canis lupus), and red fox (Vulpes vulpes). The large mammal species detected during the 2020 surveys are regionally common large mammal species and are expected to utilize the habitats present.
- Five frog species were observed during the 2020 surveys: American toad (Bufo Americanus), gray treefrog (Hyla versicolor), green frog (Rana clamitans), mink frog (Lithobates septentrionalis), northern spring peeper (Pseudacris crucifer). Calling activity included Call Index Values of 1, 2, and 3. As in most years, the spring peeper was the most frequently recorded species in 2020. The 2020 observations are consistent with previous surveys.

7.5.2. Threatened and Endangered Species

The Michigan Natural Features Inventory (MNFI) maintains a database of rare plants and animals in Michigan. Barr requested a Rare Species Review to determine if any protected species had been found within 1.5 miles of the Study Area. Table 7.5.2 lists the species identified during the MNFI review process.

Table 7.5.2 MNFI Review Results of Study Area

Species	Classification
Canada rice grass	State threatened species
American bittern	State special concern species
Bald eagle	State special concern species
pickerel frog	State special concern species
Great blue heron rookery	Rare natural feature

In accordance with Michigan Department of Natural Resources (MDNR) guidelines (MDNR 2001), Barr surveyed for any MNFI listed species and their habitats during the appropriate season. The exception is Canada grass which is no longer surveyed on an annual basis as there is no suitable habitat within the study area. Following are the results of the threatened and endangered species survey:

- Pickerel frogs have not been observed at any times since the surveys began in 2014, however suitable habitat may exist within the study area.
- American bittern was observed near Survey Points 2 and 5 in June 2020.
- In May and July 2020, the bald eagle nest on the north shore of Lake Lory was occupied by at least one adult.
- In May and July 2020, seven unoccupied nests were identified in the heron rookery. This figure is significantly lower than previous years, however the usage of the rookery has varied considerably since observations began.

A copy of the 2020 Humboldt Mill flora and fauna report is available upon request.

7.5.3. Fisheries and Macro Invertebrate Report

The 2020 Fisheries and Macro-Invertebrate annual surveys were conducted by Advanced Ecological Management (AEM). A total of six stations were surveyed in June 2020, including two stations on the Middle Branch of the Escanaba River (MBER), one station on a tributary of the Middle Branch of the Escanaba, one station on an unnamed tributary of the Black River (WBR), one station in Wetland Complex EE located northeast of the HTDF, and Lake Lory. A map of the survey locations can be found in Appendix O.

Stream Stations

A total of 169 fish representing 18 species were collected in 2020 from all stream stations, which is 11 more fish than were observed in 2019. The central mudminnow (*Umbra limi*) was the most frequently collected species (85) followed by the common shiner (*Notropis cornutus*) (17). No threatened, endangered, or special concern fish species were observed at any of the stream stations in 2020. The following is a summary of the findings:

- The community composition of fish species was generally consistent over the past six years.
- A beaver dam located near Station 1 that has been observed since 2014, continues to influence the hydrology and potentially the number of fish collected during the surveys at that location.
- The number and species of fish observed at Station 5 decreased in 2020, from 74 in 2019, to 13 in 2020. The decrease was due to a large number of central mudminnows found in 2019. In 2018, 16 fish were observed at Station 5, showing 13 to be on trend.
- MBER1 saw a significant increase in number and slight increase in species in 2020. In 2019, 23 fish were collected representing 8 species and in 2020, 80 fish were collected representing 10 species. This increase is primarily associated with the number of central mudminnows found in 2020.

- One hundred and twenty fish were collected between MBER1 and MBER2, which is 67 more than was collected in 2019. This difference is associated with the number of central mudminnows observed. Sixty-six central mudminnows noted in 2020 compared to 14 in 2019. Making the central mudminnow the most frequently observed species at MBER1 and MBER 2 in 2020.

Station MBER2 – Downstream Extent, June 2020

Using the P-51 protocol, a total of 934 macro-invertebrates were collected from all four stream stations investigated in 2020. The total number of macro-invertebrates collected in 2020 increased by 132 specimens compared to 2019. MBER1 experienced the greatest change with 91 more specimens collected in 2020 compared to 2019, the difference primarily being an increase in the number of true flies and true bugs observed. Station 5 followed the increase shown in MBER1 with 79 more specimens collected in 2020 compared to 2019. MBER2 was the only sampling point below 2019 levels, with 42 less macroinvertebrates collected during the 2020 study, these were mostly made up of true flies. Considering the increase in macroinvertebrates collected, the numbers and taxa observed remain consistent with previous surveys. No threatened, endangered, or special concern macroinvertebrate species were observed at any of the stream stations in 2020.

A summary of the fish, macroinvertebrate, and habitat ratings for the four stream stations are displayed in Table 7.5.3 below. Stream habitat was considered "excellent" in stations MBER1 and MBER2 and "good" at station 1 and 5 which mimics 2019 ratings. Similar to 2019, Stations 1, MBER1 and MBER2 were rated as "poor" fish communities. Because one brook trout was present in Station 5 in 2019, the fish community rating was not determined, this year due to the lack of brook trout, Station 5 was also rated poor. The macroinvertebrate community ratings at Station 5, MBER1, and MBER2 remained consistent with 2019 results with all Stations classified as "acceptable." In 2020, Station 1 was classified as "poor". The macroinvertebrate community at Station 1 was rated as "acceptable" in 2018 and 2019, "poor" in 2017, and the 2016 macroinvertebrate community was rated as "acceptable". Station 1 is a low gradient system that is frequently affected by beaver activity, which has impounded water. The low gradient coupled with the beaver activity impounding water has likely contributed to the fluctuation between "poor" and "acceptable" macroinvertebrate community ratings.

Table 7.5.3 2020 Habitat Ratings

	Station 1	Station 5	Station MBER1	Station MBER2
Fish Community	Poor	Poor	Poor	Poor

Macroinvertebrate Community	Poor	Acceptable	Acceptable	Acceptable
Stream Habitat	Good	Good	Excellent	Excellent

Lake Lory

A total of 193 fish were collected from Lake Lory in 2020 representing eight different taxa. A total of 294 fish were collected from Lake Lory in 2019, and a total of 165 fish were collected from Lake Lory in 2018. However, the community composition was generally consistent among years surveyed by AEM. Yellow perch, bluegills (Lepomis macrochirus), and largemouth bass (Micropterus salmoides) were the most frequently collected species among all sample gear in 2020 and 2019. Many of the fish observed in Lake Lory appear to be in good condition, but similar to previous years, it was found that black spot, which is caused by a natural parasite (larval trematode) that burrows into the skin of the fish, was observed in several species. Review of the MDNR website found that black spot is a common disease in earthen bottom ponds and lakes.

Aquatic macroinvertebrate sampling was conducted on June 6, 2020 within Lake Lory where a total of 183 macroinvertebrates were collected, which is 47 fewer than the 230 that were collected in 2019. Snails, odonates (damselflies and dragonflies), true flies were the most abundant macroinvertebrates collected from Lake Lory in 2020 and the community composition was generally consistent with the 2015 through 2019 macroinvertebrate communities. No threatened, endangered, or special concern macroinvertebrate species were observed in Lake Lory.

Lake Lory – North facing view, June 2020

Wetland EE

One brook stickleback (*Culaea inconstans*) and one central mudminnow were collected from Wetland EE during the 2020 study. Two brook sticklebacks were collected here in the 2018 and 2019 studies. No fish were collected during the 2015 or 2017 studies and one juvenile brook stickleback was collected from this location in 2016.

Aquatic macroinvertebrate sampling was conducted on June 5, 2020, where a total of 89 macroinvertebrates were collected, which is 20 greater than was found in 2019 (69 total). Odonates, true flies, and mayflies were the most frequently collected species in 2020. These species observed have been consistent between survey years. No threatened, endangered, or special concern macroinvertebrate species were observed in Wetland Complex EE. The 2020 aquatic vegetation density appeared to be consistent with conditions observed in the previous three aquatic surveys

(2017-2019). Cattails have grown in most of the areas of Wetland Complex EE that were previously open water.

Wetland EE – North of the HTDF, June 2020

A copy of the 2020 Humboldt Mill Aquatic Survey Report is available upon request.

7.5.4. Fish Tissue Survey

Similar to the baseline fish tissue survey completed in 2014, and duplicated in 2017, two lakes were selected for the 2020 survey; Lake Lory which is located within the vicinity of the Humboldt Mill and Squaw Lake which was selected as the reference lake outside of the influence of the Mill. Smallmouth bass collections for metals analyses were conducted in accordance with the MDEQ Nonferrous Metallic Mineral Mining Permit Number: MP O1 2007, following the GLEAS *Procedure #31 Fish Collection and Processing Procedure* (MDEQ, 1997).

Ten smallmouth bass were collected from both Lake Lory on June 6th, 2020 and Squaw Lake on June 5th, 2020 for metals analyses. Seven out of ten smallmouth bass in Lake Lory were males and five out of ten smallmouth bass in Squaw Lake were males. Both the fish fillets and livers were analyzed for metal content. Average metals concentrations were similar within smallmouth bass fillet samples for lead, mercury, molybdenum, and zinc, and were similar within smallmouth bass liver samples for copper and nickel among the 2020 Lake Lory and Squaw Lake data. The average metals concentrations in smallmouth bass fillet samples were lower in Lake Lory compared to Squaw Lake for barium, beryllium, manganese, nickel, selenium, and zinc. The average metals concentrations in smallmouth bass liver samples were higher in Lake Lory compared to Squaw Lake for cadmium, lead, and silver.

A table summarizing the metal results can be found in the 2020 Humboldt Mill Smallmouth Bass Metals Report which is available upon request. The next survey will be conducted in 2023.

Miscellaneous Monitoring

7.6.1 Soil Erosion Control Measures

Soil erosion and sedimentation control (SESC) measures related to the construction of mining facilities now falls under the purview of Part 632. Due to the 2019 WTP expansion project, earthwork was needed to be performed on the east side of the existing building. Silt fence and rip-rap was maintained where the risk of soil erosion and sedimentation was present, primarily near the adjacent wetland boundary areas.

In summer 2020, the water intake project was constructed on the South side of the HTDF. Earth work was completed for the electrical building, a backup generator, and tailings line crossing. Silt fence was installed along this area and maintained while construction activities were taking place.

Maintained silt fence on the South side of the HTDF during construction activities, Summer 2020

Left: Erosion on access road corner, July 2020. **Right:** Retaining Wall, Silt Fence, and Guard Rail Additions and Improvements at the WTP Loading Dock, December 2020.

In the Fall of 2020, improvements were made to the WTP unloading dock area and access road to allow for safer access of delivery vehicles and to eliminate erosion that had been occurring. A retaining wall was constructed with pre-cast concrete blocks along the access road corner on the East side of the WTP. The retaining wall has been installed in order to increase the drivable area in front of the WTP loading dock. Riprap was installed along the retaining wall for erosion control in the area. Silt fence that was already installed in this area was maintained during the construction process. This construction did not result in any new environmental impacts as the wetland was properly protected by silt fence installation and follow-up inspections, and construction activities did not occur within the wetlands.

Silt fence remains along the HTDF where additional work on the cut-off wall may occur in the future. The Department will be notified in the event that any construction activities occur in which soil erosion measures are necessary and all inspections will be completed as required.

7.6.2. Impermeable Surface Inspections

The Impermeable Surface Inspection and Surface Repair Plan outlines the requirements of integrity monitoring of surfaces exposed to site storm water and areas of ore, concentrate and chemical handling/storage. Areas inspected in 2020 included sumps and floors of the coarse ore storage area (COSA), concentrator building, concentrate load out facility, and WTP. Monitoring was conducted monthly as required by the plan.

Floors are inspected for cracks and overall general condition and the sumps are evaluated for any areas of cracking, pitting, or other surface deficiencies, and accumulation of material. All inspection results are recorded on the impermeable surface inspection form by Environmental Department staff and stored in the compliance binder at the Mill Administration Building. Any issues identified during the inspections are immediately reported and fixed by onsite staff. Follow-up inspections are completed to ensure the repairs were made. No notable issues were identified in 2020. As a preventative maintenance precaution, a section of the concrete COSA floor was replaced in 2020 where the over the road haul trucks deliver ore to the building.

7.6.3. Tailings Line Inspection

In accordance with Mining Permit Condition E-12, the double-walled HDPE pipeline is monitored by mill operators and Environmental Department staff. Any concerns identified during the inspections would be immediately reported to the Mill operations and maintenance departments who would complete any necessary repairs. The following items were identified in 2020:

- Weekly inspections of the tailings lines found that in cold weather months minor amounts of water was introduced into the sump located in the shore vault building. Similar to previous years, this likely results from condensation which builds up within the outer pipe and not the result of a leak in the tailings lines.
- A soil berm was also constructed over the tailings lines so that vehicles can safely drive across the lines to access to the new intake electrical building. Weekly inspections of the tailings line and the berm are performed.

7.6.4. Geochemistry Program

In accordance with Permit Condition F-1, Eagle continued implementation of the comprehensive HTDF geochemistry monitoring program which was prepared by Hatch Associates in 2015 and subsequent revisions by Golder Associates. In 2020, the monitoring program included collecting high resolution physiochemical profiles, limnological modeling, water quality monitoring, characterization of watershed input chemistry, tailings pore water sampling and analysis, and interpretation of the effects of changes in water management, water treatment, and tailings deposition on the chemistry and layer dynamics within the facility.

Physiochemical Monitoring

Eagle continued to conduct physiochemical monitoring of the HTDF using various multiparameter reading instruments either lowered over the side of the boat (or through the ice) to multiple depths, or via the YSI EXO auto-profiler that was installed in 2018. In 2020, profiles were manually collected on April 30, May 13, August 6, and September 6 using multiparameter probes. The profiling device was re-installed on the HTDF in 2020 and was operational during ice off conditions from May 21 through October 30. The YSI auto-profiler collected four profiles per day and data was regularly analyzed by geochemists to assess layer characteristics and physics.

Aerial view of HTDF, March 2019

The HTDF continued to be stratified in 2020 owning to the water management activities designed to treat deep water from the HTDF. In 2020, Eagle improved isolation of waste streams from the WTP and discharged them to specific depths of the HTDF to minimize unnecessary dilution of dense fluids and create distinct layers that could be managed according to their chemistry in the future. Geochemists continued studying vertical profiles and at present, the HTDF exhibits five distinct layers:

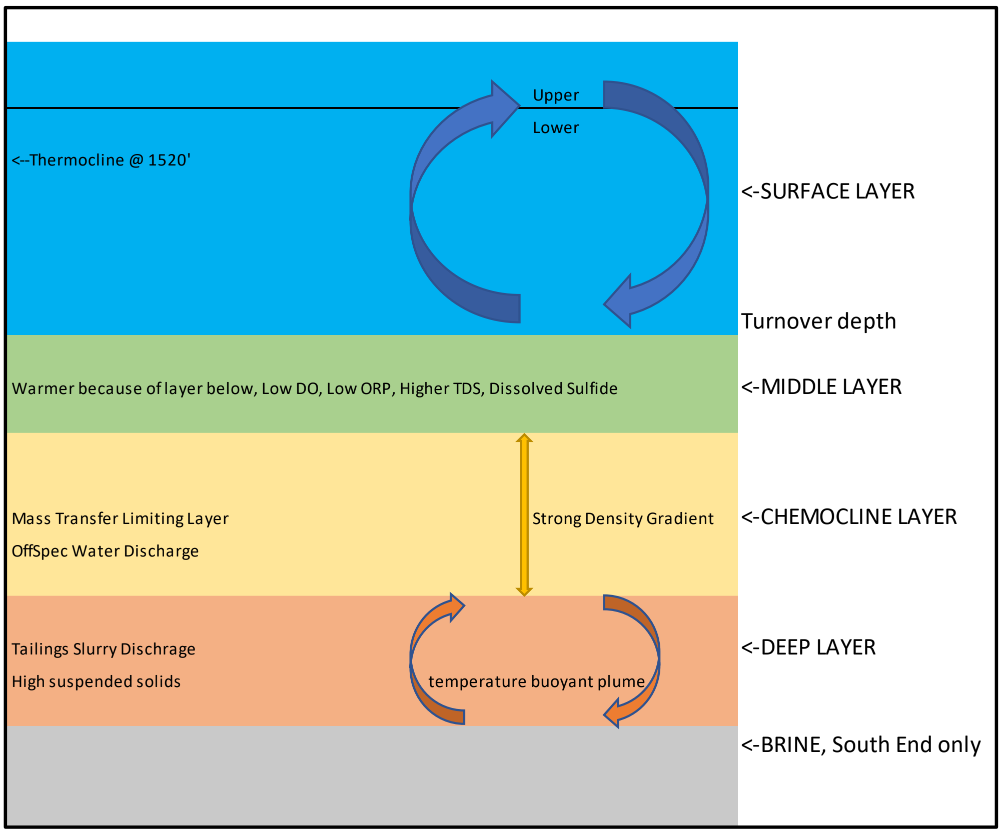
1) A mixolimnion seasonally divided into an epilimnion and a hypolimnion from elevation 1,496 ft AMSL to surface.

2) A layer from approximately 1,496 ft AMSL to 1,474 ft AMSL marked by increased water temperature, low dissolved oxygen, low oxygen reduction potential, and notable specific conductance. Circulation, or convection, of water within this layer that had previously occurred was not evident in the physical monitoring during 2020.

3) A layer characterized as a “chemocline” extending from elevation 1,474 ft AMSL to 1,451 ft AMSL. This layer presents a strong density gradient and receives some mass transfer from the layer below it. Off-specification water (Fenton’s reaction recirculation water, filter, and membrane cleaning solutions) from the WTP is placed in this layer. This layer became thicker by approximately 15 feet in 2020 primarily due to isolating off-specification water to this layer. Off-spec discharges had previously been combined with reverse osmosis brine resulting in unwanted dilution of the brine.

4) From approximately 1,450 ft AMSL to 1,430 ft AMSL or, in places, the floor of the HTDF (varies in depth based on tailings deposition areas) consists of tailings slurry water or "deep water" as is referred to in water treatment process flow diagrams. This layer receives solids and process water from the tailings slurry. Convection also occurs in this layer due to thermal buoyancy of the tailings solids. This layer became thinner during 2020 by about 30 feet due to volume displacement caused by injection of tailings slurry and increased treatment efficiency at the WTP.

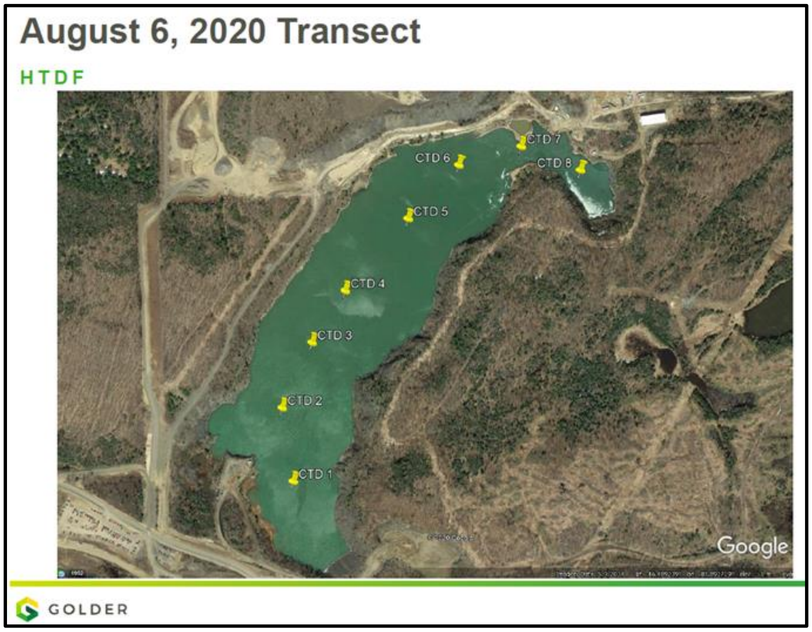
5) A brine layer approximately 10 feet thick formed in the deepest area of the southern section of the HTDF. This area had not received tailings discharges according to the tailings deposition design in order to reserve space for brine storage. After off-specification water was separated from brine, a separate brine line was installed to discharge the brine at elevations intended to stay below tailings water. Due to strong density differences between the brine and tailings water, brine has successfully formed its own distinct layer. In late 2020, Eagle conducted a field verification program to delineate the extent and thickness of brine, and samples were collected to visually verify that brine is being deposited in an isolated fashion. Clear brine samples were retrieved from beneath tailings water.

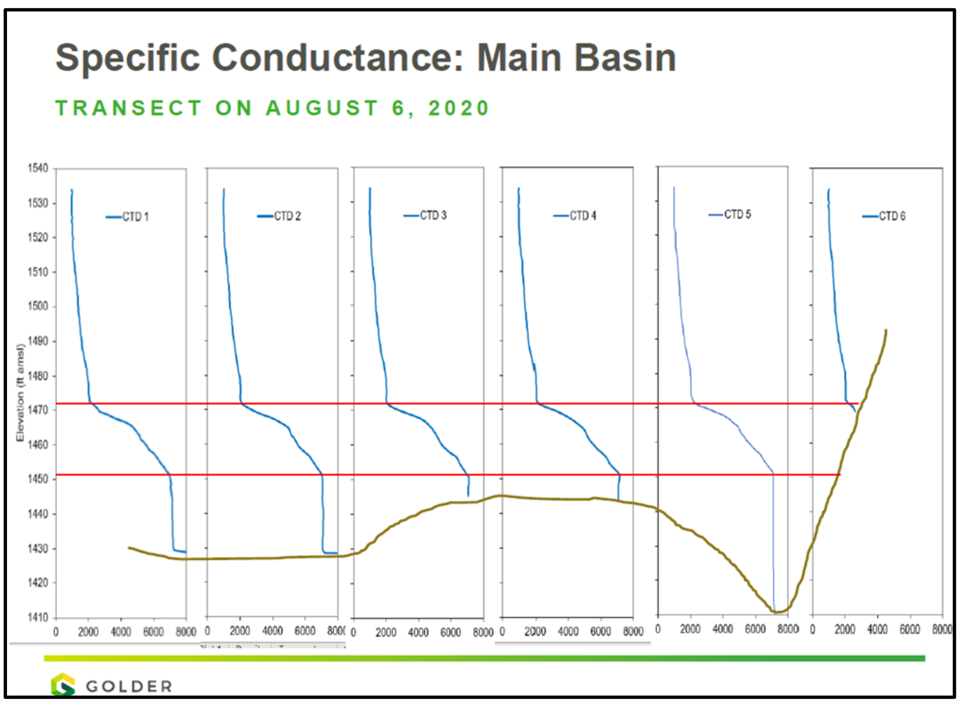


Simplified layer diagram of the HTDF, 2020.

As previously experienced, in the spring and fall there were thermodynamically driven shallow turnover events within the mixolimnion with some partial erosion of the upper layer of the chemocline, but complete mixing of the entire water body did not occur. Limnological models predict that the HTDF will remain strongly stratified in 2021.

Eagle collected a transect of eight profiles along the North-South axis of the HTDF to confirm the assumption that the HTDF is homogenous in the lateral (x and y) direction and only varies in the vertical (z) direction, and this confirmation was important so that modelers could continue using twodimensional hydrodynamic models to simulate the HTDF. With the exception of data collected in the brine storage area, each profile indicates consistently similar trends in key parameters.





Specific Conductance profiles along the length of the main basin. Transects 7 and 8 are not shown due to the water column being significantly shallower.

As is done annually, several modeling efforts were conducted to understand HTDF limnology for both short-term and long-term stability. Short term modeling focused on spring and fall turnover predictions of the surface water layer quality, since this water is an integral part of the WTP operations strategy. As was described in the 2019 annual report, Eagle and its consultant have demonstrated ample confidence in the density-driven physical stability of the HTDF. The vertical position of inputs and outputs influenced the layering of the HTDF as predicted, and model calibration exercised continued to reproduce changes in the HTDF that were measured in-situ, so in 2020, the majority of modeling focused on longer-term water quality predictions and incremental improvements in those future water quality predictions.

The main modeling activity completed in 2020 was a geochemical assessment of the HTDF. In 2019, Eagle had obtained another set of total and dissolved constituents of interest to add to the existing dataset. A sufficient dataset was then available for geochemical modeling. Previous CE-QUAL-W2 limnology and water quality models had conservatively assumed that no chemical reactions remove mass or add mass to the water column. So, in 2020, the geochemical modeling in PHREEQC was used to identify inorganic reactions that could be occurring in the HTDF, the depths at which these reactions could occur, and the likely impact that the reactions have on HTDF water quality. A summary of the findings is as follows:

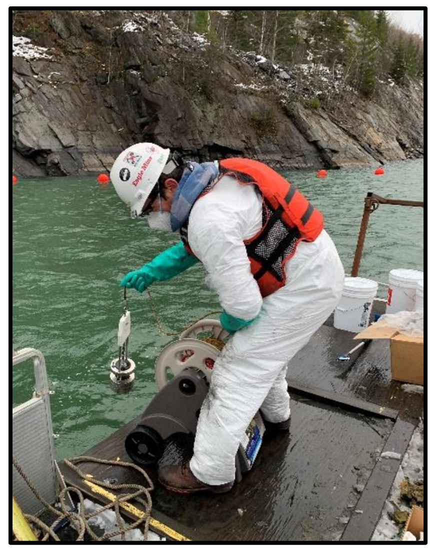
1) Oxygen from the atmosphere diffuses in the surface water and is mixed by wave activity throughout the surface water.
2) Oxygen entrainment in surface water creates an oxidizing condition where manganese and iron contributed primarily by groundwater inflows to the HTDF are precipitated as colloidal particles, which can adsorb constituents such as Cu, Ni, and As.
3) As colloids grow, they become large enough to overcome buoyant forces and settle downward through the water column.
4) Along the boundary between the surface layer and the middle layer exists a redox boundary at which place the Fe^{3+} solids can dissolve, along with adsorbed constituents such as Cu, Ni, and As.
5) During fall turnover, some metals from the boundary will re-mix upward and cause a seasonal increase in metals concentration of the surface water.
6) Alternatively, some Fe^{3+} is reduced to Fe^{2+} and does not mix upward, precipitating in the form of metal sulfide minerals that settle to the bottom of the HTDF.
7) Reducing conditions in the deep layer ensure stability of sulfide material and encourage precipitate of additional new sulfides at depth. This acts as a natural attenuation process for metals removal in the deep layer.

Other modeling efforts in 2020 included:

- Testing various assumptions on the limitations of brine storage based on mass transport properties of the layers (i.e., wind driven vertical diffusion) in CE-QUAL-W2.
- Modeling to explore the hypothesis that brine would tend to migrate into tailings porewater due to its density properties in MODFLOW with SEAWAT. Preliminary models indicated that some (but not all) brine would flow downward into tailings porewater.

Tailings Pore Water Chemistry

The tailings pore water chemistry sampling program that began in 2019 continued in 2020. Three cores of “young” (recently deposited) tailings, and three cores of “old” tailings (deposited about 1 year prior) were sampled under the program on October 29, 2020. Core samples were summitted to Eurofins TestAmerica in Pittsburgh who centrifuged the cores to extract pore water for analysis for key constituents of interest (COI). In 2019, old tailings were not possible to sample, but some hypotheses were made based on what was occurring in “young” tailings, primarily that a variety of precipitates occurring in the water column may absorb metals. Collection of both old and young tailings in 2020 allowed for an important comparison. In 2020, both young and old tailings had approximately the same concentration of ions, but old tailings had less copper, nickel, and selenium than young tailings, implying that geochemical reactions that were predicted in PHREEQC modeling to remove metals from porewater over time are occurring.



Left: Tailings Pore Water Chemistry Samples prepared for shipment **Right:** sampling event, October 2020

While Eagle collected six tailings pore water samples, attempts were made to collect tailings that were placed beneath brine. Two cores were collected beneath a delineated brine zone, and the tailings porewater from those cores indicated dissolved solids concentrations two times higher than the concentrations found in other tailings, which confirmed modeling of the density-driven flow properties of brine. In 2021, Eagle will continue efforts to characterize the pore water chemistry with its geochemical consultants and use this information for annual updates to the geochemical modeling predictions.

Sulfur Gas Analyses

In response to sulfur gas odors detected in previous years, Eagle continued to take measures needed to monitor for sulfur gasses. As had been previously observed, the middle layer of the HTDF tended to have the highest concentrations of dissolved sulfide, and geochemists theorized that gasses would be generated there by decomposition of sulfate compounds which were primarily derived from xanthate degradation within the deep layer. Another hypothesis was that convection of this layer resulted in ongoing degasification of the layer. However, convection ceased in 2020 and sampling in August did not indicate buildup of dissolved sulfides. This could be due to a change in microbial activity or salinity affecting microbial processes, or another reason that is not yet understood. Eagle’s health and safety staff and workers on the HTDF used H_2S monitoring devices throughout turnover and while working on the water, and detections of both odor and H_2S were rarely encountered. During spring and fall 2021 Eagle will continue monitoring for H_2S gasses during the turnover timeframe and continue to track the relationship between concentration of dissolved sulfide present in the layer and sulfur odors and ensure that any changes are detected and addressed promptly.

Water Chemistry

Similar to previous years, water chemistry profile samples were collected on August 6, 2020 from a vertical profile at multiple depths in the HTDF to monitor changes in total and dissolved concentrations and COI over time. Most COI concentrations increase with depth through the water column. All water samples collected were sent to a certified lab for analysis.

Key observations regarding water quality are divided between each layer of the HTDF:

General observations (entire basin)

- The pH at all layers is above 6.6, so there is no evidence of acidification due to acid rock drainage.
- Concentrations of Thiosalts diminished greatly, at the lowest since initially measured in 2018. This indicates that use of the Fenton's reaction water treatment process may be unnecessary.
- Concentrations of xanthate breakdown products are lower than in the two previous years.
- The metals Sb and Mo have steadily decreased over time.
- Nitrates remain depleted since 2018.

Surface Layer

- Mn is elevated owning to groundwater contributions to the surface water.
- There is a distinct change in dissolved oxygen below an elevation of 1500 ft AMSL.
- Nickel becomes seasonally elevated and tends to increase year over year due to upward re-mixing described in the PHREEQC model.

Middle Layer

- Mn is elevated and dissolved oxygen is low.
- Dissolved hydrogen sulfide is present.

Chemocline and Deep Layers

- Due to continued tailings and RO Brine placement, water quality in these layers deteriorated over time.
- TDS, Cu, Ni, Sulfate, Se, Al, As, Ba, Bo, Cd, Cr, Co, Pb, phosphorous, and Zn hare increased compared to 2019, but may have resulted from high TSS and metals associated with a sample retrieval issue where tailings suspended particles were inadvertently brought into the sampling chamber. Sampling in 2021 will need to be compared to determine whether these metals increases were due to this interference.

- Total Organic carbon (TOC) which is generally indicative of the presence of xanthate and alcohol biodegradation products is less than what was measured in 2019. This could be due to a change in microbial community (i.e., microbiota is thriving on available TOC).
- Chemical oxygen demand is high.

Biofouling

No additional biofouling characterization occurred in 2020. Rather, WTP operators focused on cleaning regimens that improve the performance of the membranes and extend membrane life. Clean-in-place (CIP) chemicals containing bleach are used to accomplish bacterial control, and cleaning solutions are neutralized prior to completing backwashes which are recycled into the HTDF. Despite neutralization being achieved, residual chlorine has been detected in some layers of the HTDF including the surface water. Until further engineering can be done in 2021 to reduce, treat, or eliminate this waste stream, residual chlorine is further neutralized in the influent to the WTP to control concentrations in the effluent to limits of the NPDES permit.

Tailings Deposition and Brine Storage

A new tailings deposition model accounting for an extension of milling through the end of 2025 was completed in late 2019. Work in 2020 focused on refining this design to maximize space for storage of brine in the HTDF. Brine is currently being stored in a depression of tailings found on the south side of the HTDF. While brines are dense and relatively immobilized in the HTDF due to the volume of overlying freshwater cap, Eagle considers the storage of all brine that will be generated during the operational period to be a temporary operating plan.

Approximate location of brine, Fall 2020

Closure Scenarios

Due to the changes in the life of mine that were announced in September 2019, modeling efforts for the likely closure scenarios for water treatment that began in early 2019 were put on hold and scheduled for revision based on the new life of mine. In 2020 Eagle placed emphasis on studying closure scenarios that would ensure plans are consistent with the requirements of Part 632, specifically related to long term groundwater and surface water quality of the HTDF.

Closure related studies that occurred in 2020 included:

- Preliminary draft mass balance and limnology modeling for the life of mine brine storage needs was completed. The preliminary results indicate that brine can be successfully stored during the operational timeframe, but that not all brine that would be generated would be advisable to store indefinitely. The limits of the long-term storage quantity will be further refined in 2021.
- Scoping for brine water concentrating, removal and/or treatment system upgrades began. Eagle's water services team conducted successful pilot studies which included in-situ brine collection and treatment at a facility in Vancouver, BC.
- Eagle initiated waste characterization studies and initial identification of vendors who may have beneficial re-use opportunities for brine solids generated through the future brine treatment system.
- A consultant was contracted to begin preparing draft civil restoration plans for the mill site. Regrading plans are being prepared for two closure scenarios. Though Eagle has not identified a party interested in re-purposing the mill, one civil restoration plan will be made for the property to be sold to another industrial user, and a separate restoration plan will be developed for complete demolition of the facility. These plans will be finalized as drafts in 2021. Financial assurance will remain allocated for the complete demolition scenario until a viable re-use has been identified and modifications to the reclamation plan have been formally approved.
- A consultant was contracted to further develop conceptual designs for the spillway that will be used for passive discharge at closure of the HTDF. The design will be finalized as a draft in 2021.

8. Reclamation Activities

No reclamation activities occurred in 2020 and there are currently no plans to conduct any reclamation activities in 2021. The Department will be notified, in advance, if any activities do commence in 2021.

Closure planning continued in 2020 and included detailed planning, closure team workshops, and continued technical studies needed to support closure planning for the facility. This process was initiated in 2017 due of the Lundin corporate requirement to have a written closure plan in place five years in advance of anticipated closure. The closure planning team anticipates completing a draft of the closure implementation plan by the end of 2021.

9. Contingency Plan Update

One element of the contingency plan is to test the effectiveness on an annual basis. Testing is generally comprised of two components. The first component is participation in adequate training programs for individuals involved in responding to emergencies and the second component is a mock field test. Unlike previous years where a mock test was scheduled, in March 2020, the COVID-19 pandemic required Eagle to activate their contingency plan, specifically the Crisis Management Team (CMT), to manage the situation and oversee necessary planning and implementation of controls. At the onset of the pandemic, the Eagle CMT met on a daily basis and established three strategic objectives: employee health and safety, site safety, and business continuity. These objectives were the basis of the actions and decisions that were taken by the CMT. The Eagle CMT continued to meet at least weekly throughout 2020 with a continued focus on risk mitigation.

The Humboldt Mill Emergency Response Team (ERT) continued to be active in 2020. This team is not required by the Mine Safety Health Administration (MSHA) but was established to assist first responders in the event of an emergency. The focus of the team is to act as the liaison with first responders as well as the Eagle CMT, providing assistance where needed as they are considered the site experts. Generally, ERT training occurs on a monthly basis, however due to the pandemic and social distancing requirements the number of training sessions decreased in 2020. Trainings that did occur focused on review of rope rescue knots and techniques, medical and trauma treatment, patient packaging, site evacuation, scene safety, and the fire water system. Three employee evacuation drills occurred in which the ERT team conducted building sweeps to ensure complete evacuations to the muster point.

In addition to the ERT, security personnel are EMTs and paramedics who are trained in accordance with state and federal regulations. This allows for immediate response to medical emergency situations.

As stated above, a mock training or table-top exercise is generally completed on an annual basis to test the Eagle CMT to ensure they know how to respond in the event of an emergency or crisis. Since the CMT was activated throughout 2020, an exercise was not conducted, instead in May 2020, a third-party consultant developed a virtual training session for the team. The session focused on sharing successes and learnings to date from Eagle's CMT response to the pandemic and exploring ways of mitigating risks that may arise in the next phases of the crisis. Once the session was complete, the consultant and crisis management team held a debrief session to capture feedback from each participant. The overall feedback and recommendations for improvement were compiled into a summary report and shared with the team.

An updated contingency plan can be found in Appendix P. This plan will also be submitted to the Local Emergency Management Coordinator.

10. Financial Assurance Update

Updated reclamation costs can be found in Appendix Q. It is understood that the EGLE will notify Eagle if these updated costs require re-negotiation of the current bond for financial assurance.

11. Organizational Information

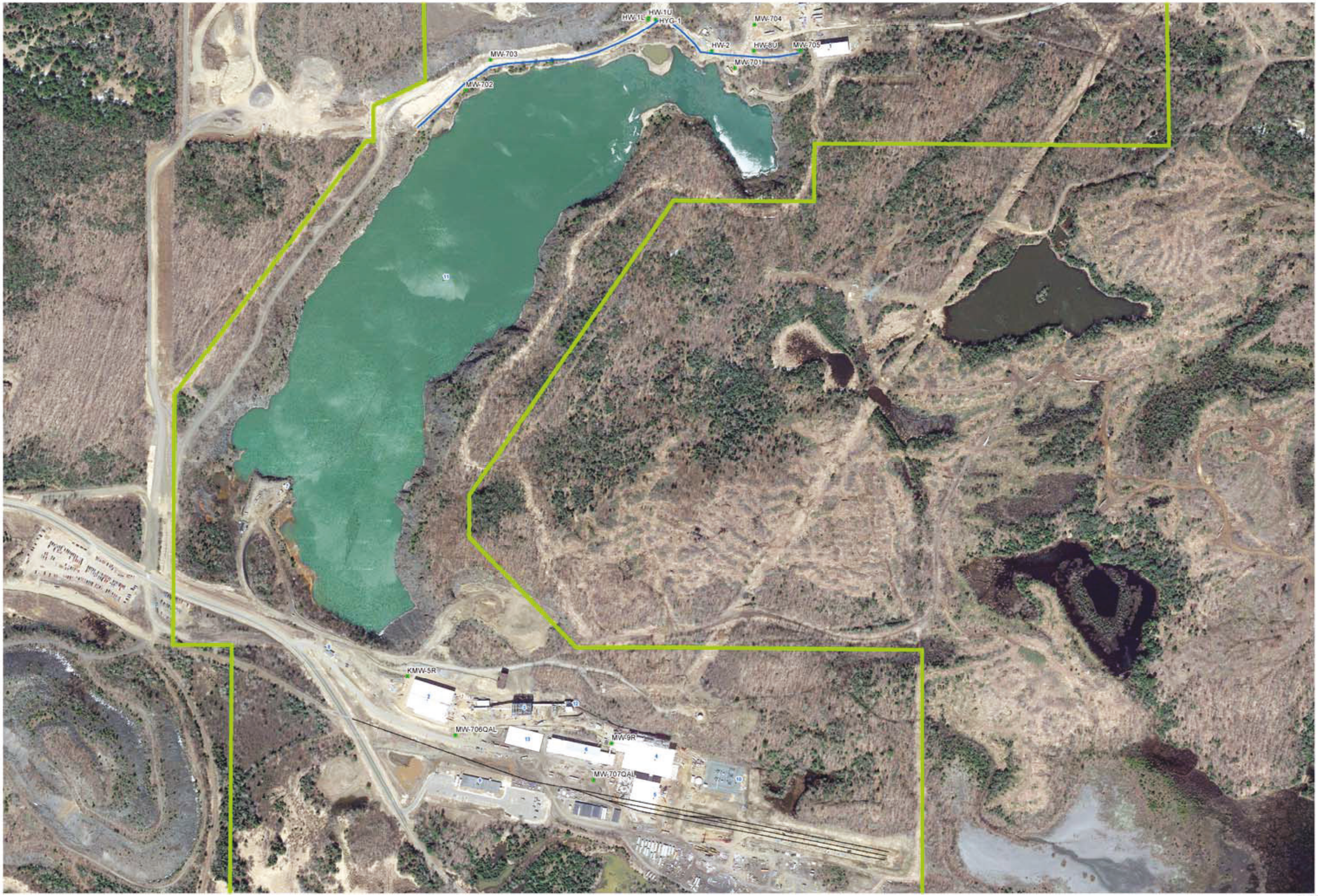
An updated organization report can be found in Appendix R.

Appendix A

Humboldt Mill

Site Map

Eagle Mine LLC Humboldt Mill Monitoring Map



Legend

- RailSpur
- Cut Off Wall
- Eagle Mine LLC Ownership
- Humboldt Mill Part 632 Wells

1 - Water Treatment Plant
2 - Coarse Ore Storage Building
3 - Secondary Crusher
4 - Concentrator
5 - Concentrate Loadout Facility
6 - Mill Services Building
7 - Tailings Pump House
8 - Guardhouse
9 - Administration Building
10 - UPPCO Powerstation
11 - Humboldt Tailings Disposal Facility
12 - Transfer Building
13 - Cold Storage Building

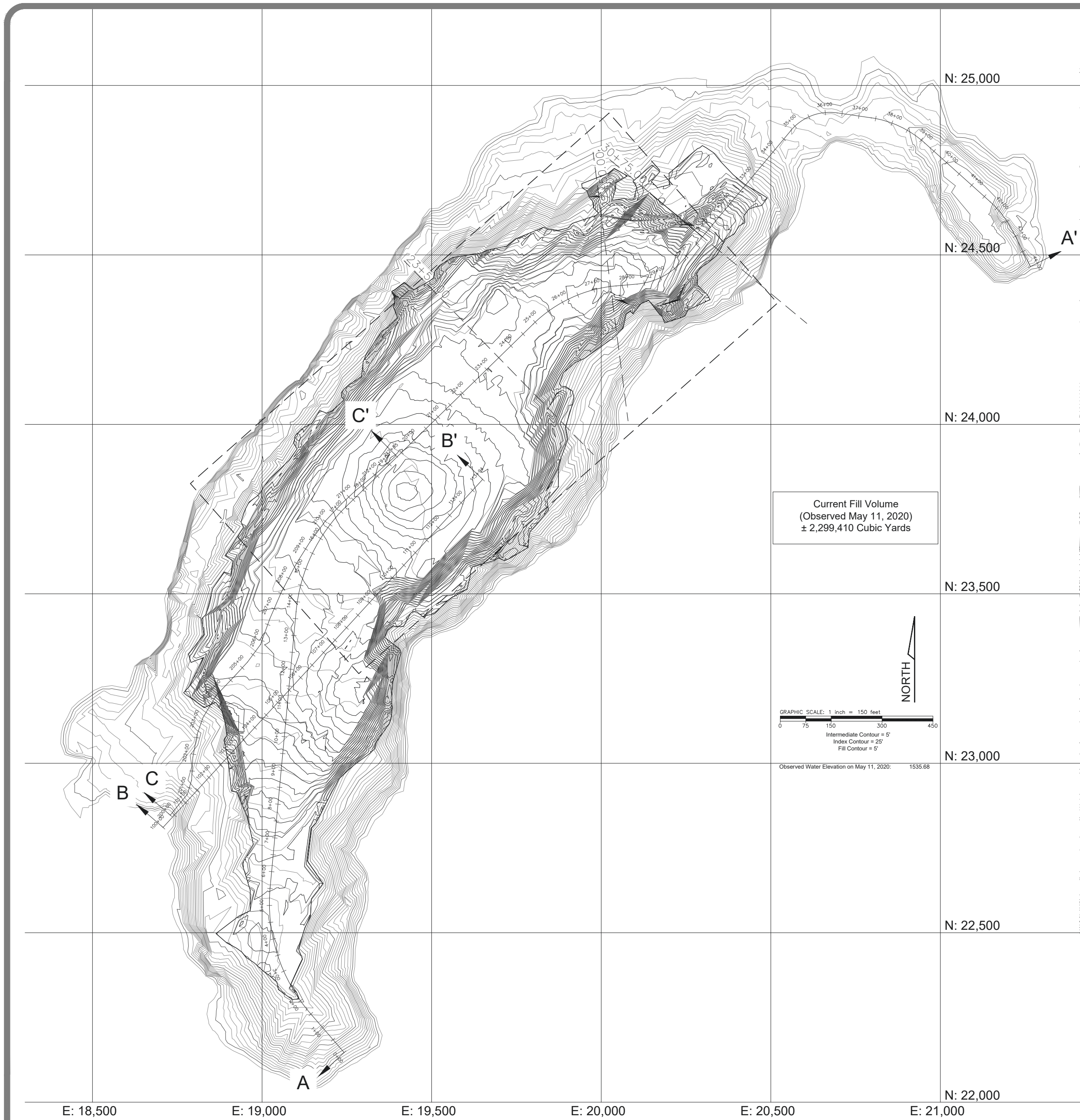
0 0.05 0.1 0.2 0.3 0.4 0.5 Miles

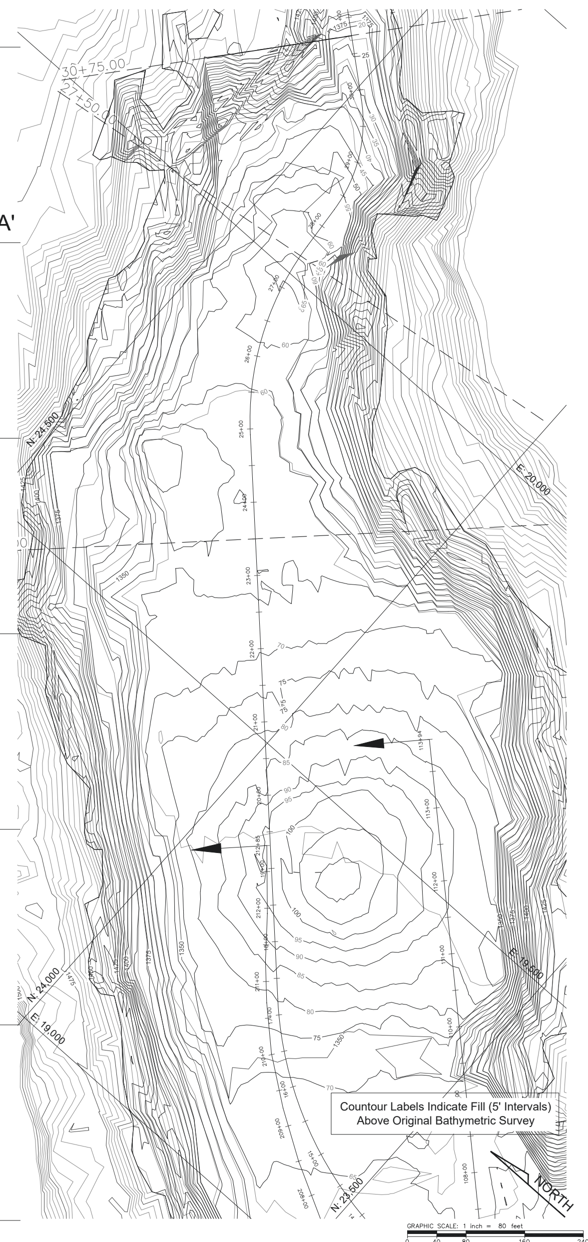
N W E S

Appendix B

Humboldt Mill

Bathymetry Maps





TRIMEDIA
ENVIRONMENTAL & ENGINEERING

Eagle Mine - Humboldt Mill
May 11, 2020 Bathymetric Survey
Champion, MI

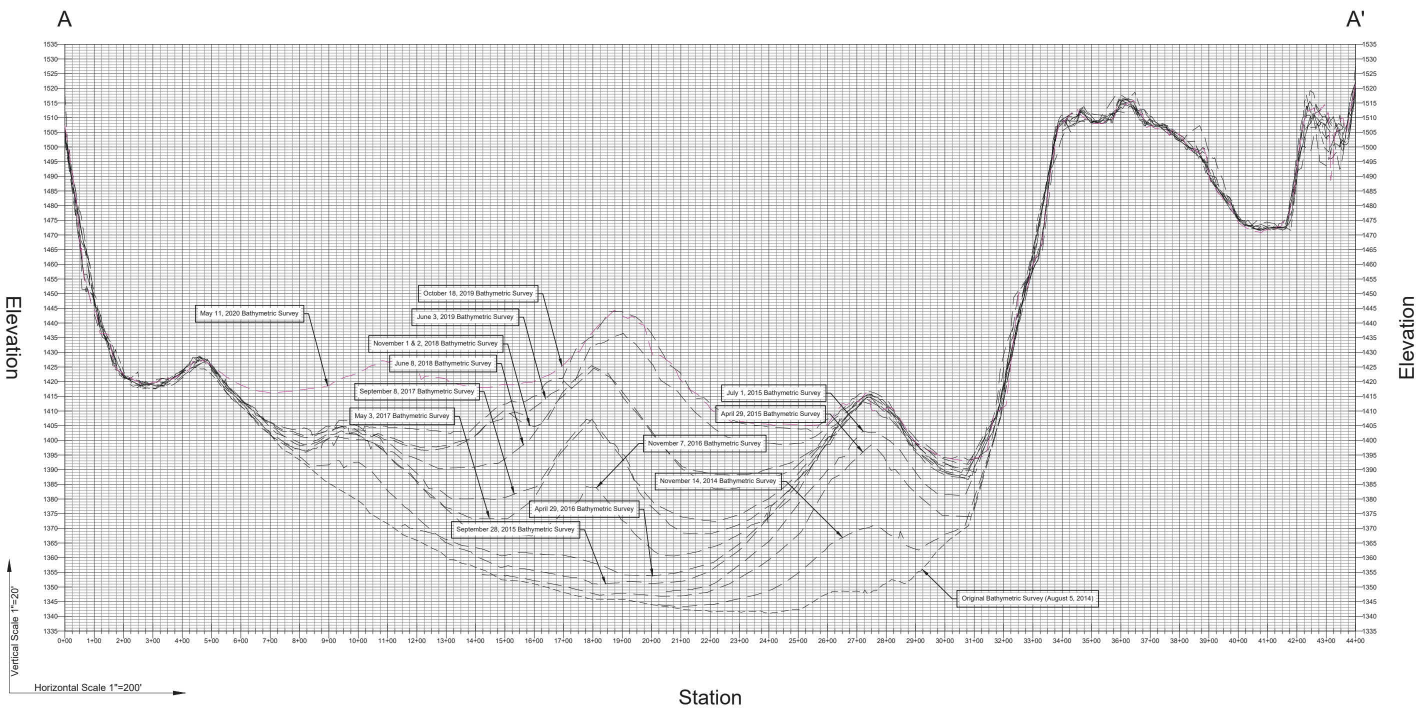
DATE	DESCRIPTION	ISSUED

DESIGNED:
DRAWN: JWM
CHECKED: EJR
APPROVED: GWM

TRIMEDIA JOB NUMBER: 2014-100

SHEET TITLE: Tailings Basin Product Fill Map

SHEET NUMBER: 1.0



TRIMEDIA
ENVIRONMENTAL & ENGINEERING

Eagle Mine - Humboldt Mill
May 11, 2020 Bathymetric Survey
Champion, MI

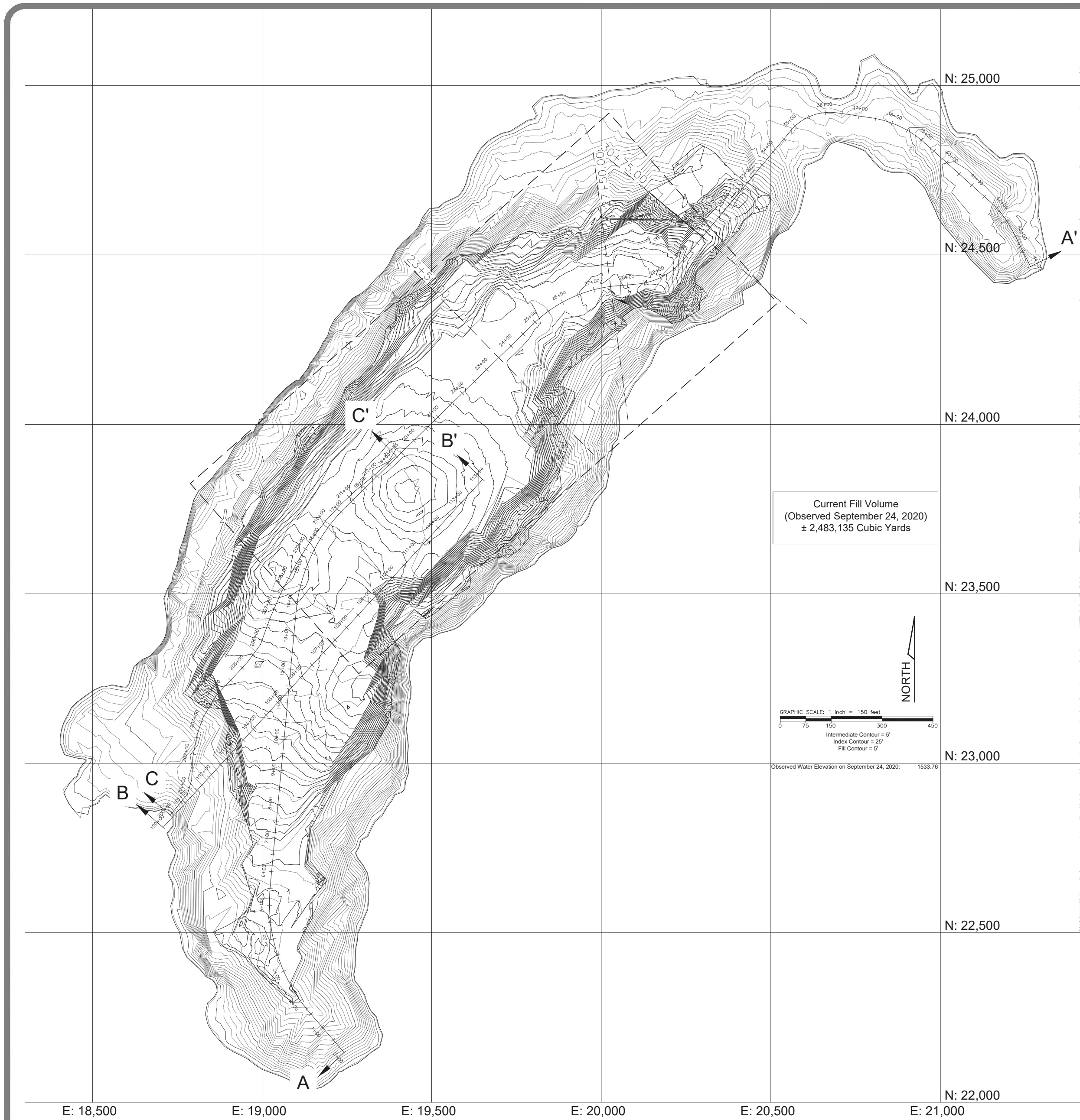
DATE	DESCRIPTION	ISSUED

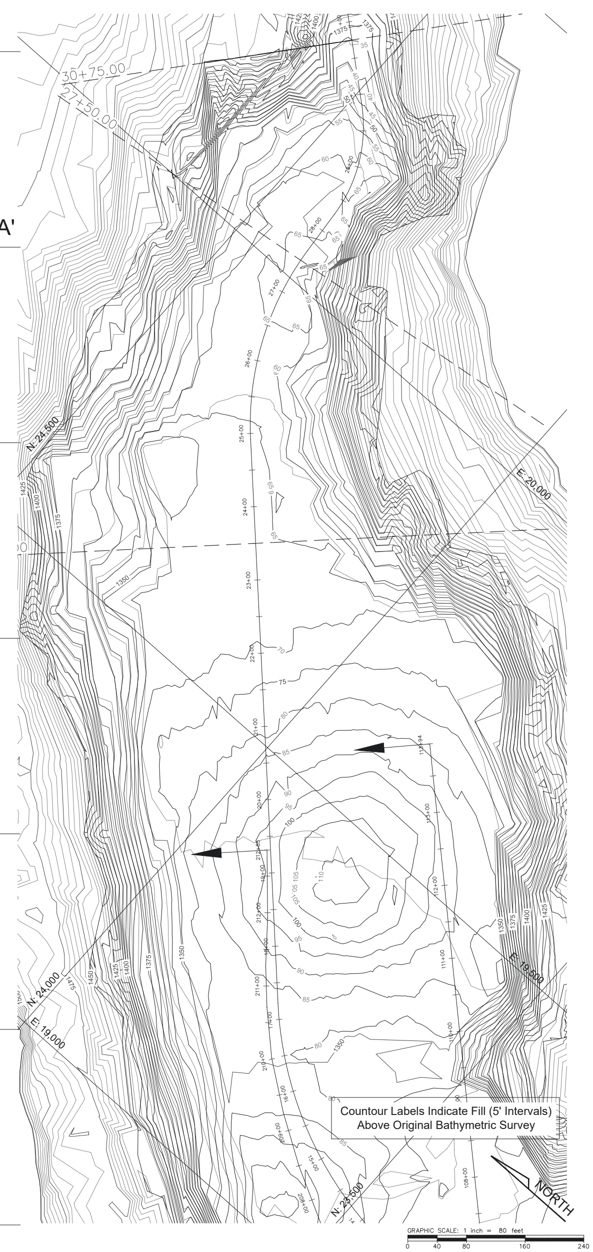
DESIGNED:
DRAWN: JWM
CHECKED: PGC
APPROVED: GWM

TRIMEDIA
JOB NUMBER:
2014-100

SHEET TITLE:
Tailings Basin 2020
Profile
(Cross Section A)

SHEET NUMBER:
2.0





TRIMEDIA
ENVIRONMENTAL & ENGINEERING

Eagle Mine - Humboldt Mill
September 24, 2020 Bathymetric Survey
Champion, MI

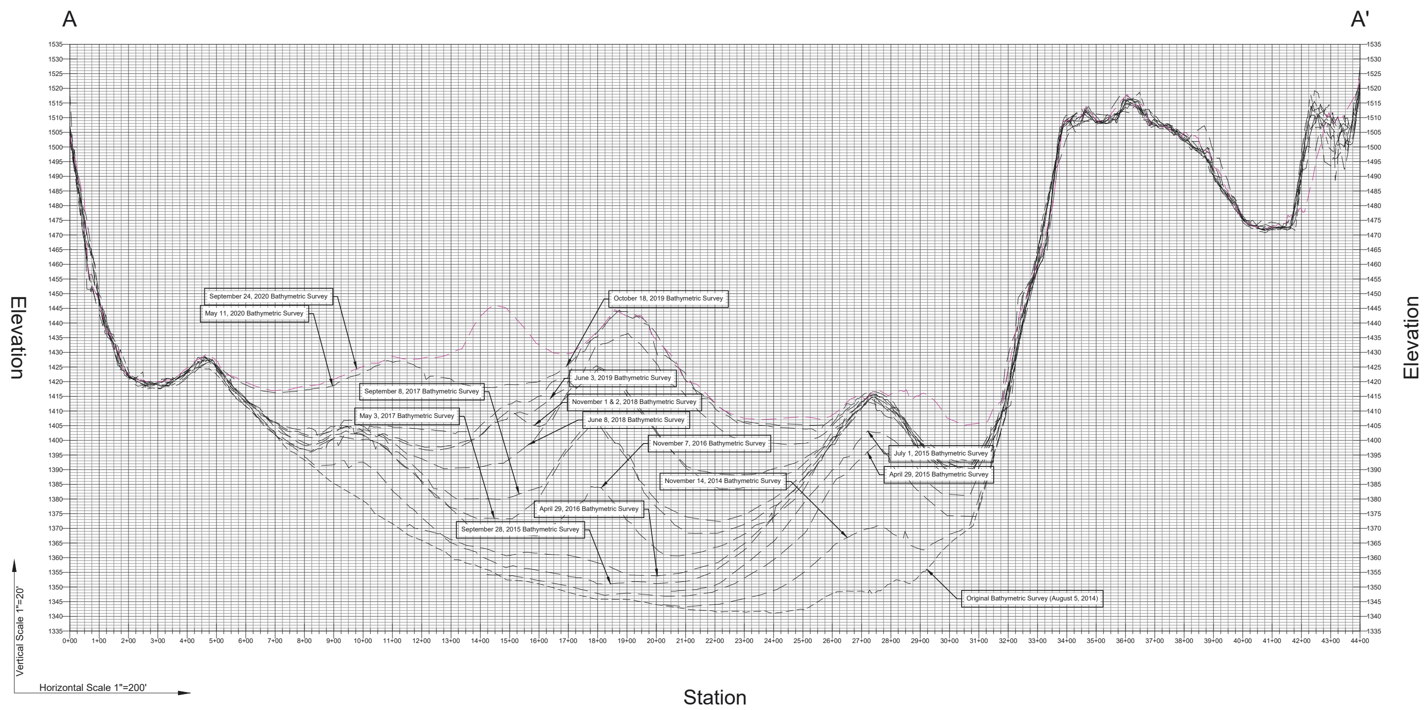
DATE	DESCRIPTION	ISSUED

DESIGNED:
DRAWN: JWM
CHECKED: EJR
APPROVED: GWM

TRIMEDIA JOB NUMBER: 2014-100

SHEET TITLE: Tailings Basin Product Fill Map

SHEET NUMBER: 1.0



TRIMEDIA ENVIRONMENTAL & ENGINEERING

Eagle Mine - Humboldt Mill
September 24, 2020 Bathymetric Survey
Champion, MI

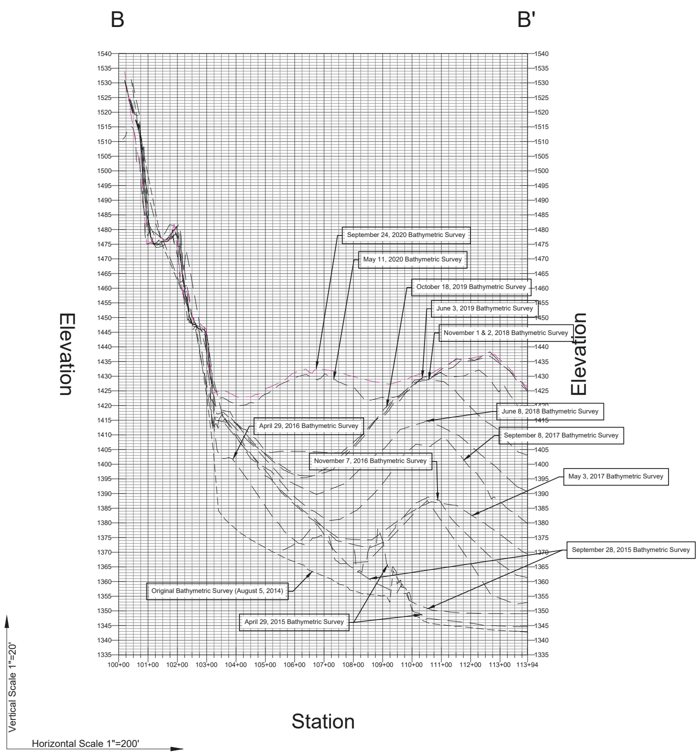
DATE	DESCRIPTION	ISSUED

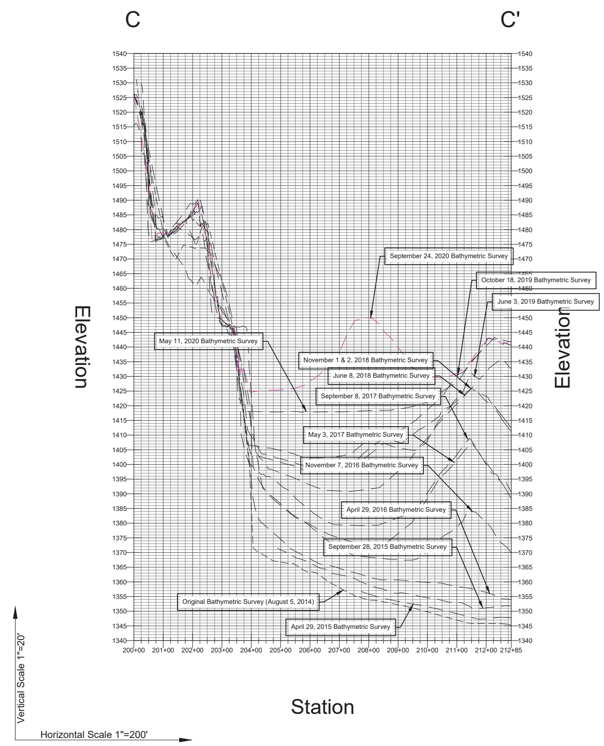
DESIGNED:
DRAWN: JWM
CHECKED: PGC
APPROVED: GWM

TRIMEDIA JOB NUMBER: 2014-100

SHEET TITLE: Tailings Basin 2020 Profile (Cross Section A)

SHEET NUMBER: 2.0





TRIMEDIA
ENVIRONMENTAL & ENGINEERING

Eagle Mine - Humboldt Mill
September 24, 2020 Bathymetric Survey
Champion, MI

DATE	DESCRIPTION	ISSUED

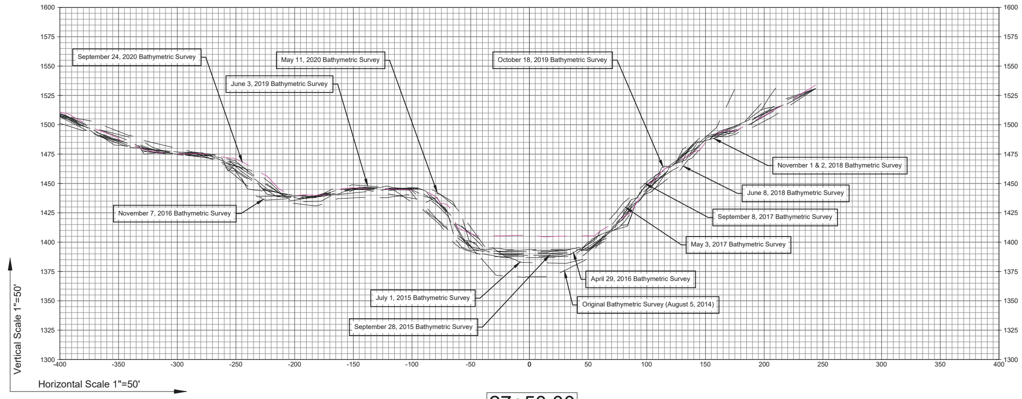
DESIGNED:
DRAWN: JWM
CHECKED: PGC
APPROVED: GWM

TRIMEDIA JOB NUMBER:
2014-100

SHEET TITLE:
Tailings Basin 2020 Profiles (Cross Section B & C)

SHEET NUMBER:
3.0

30+75.00



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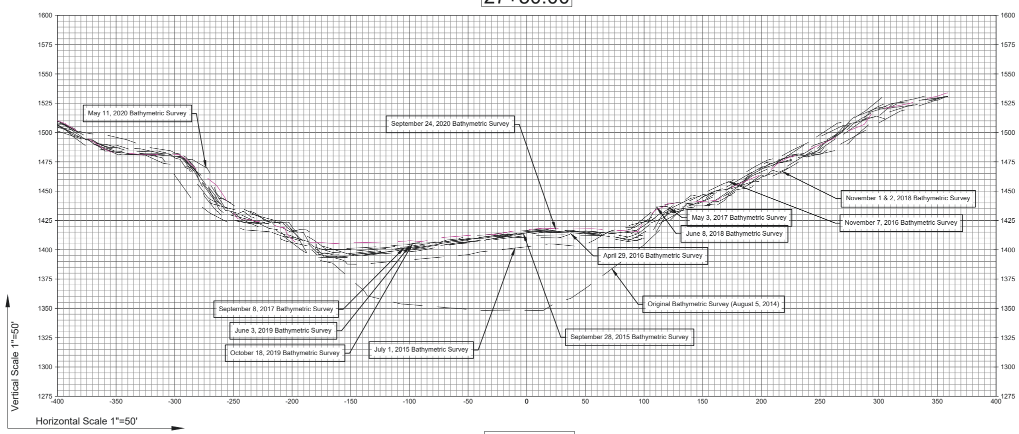

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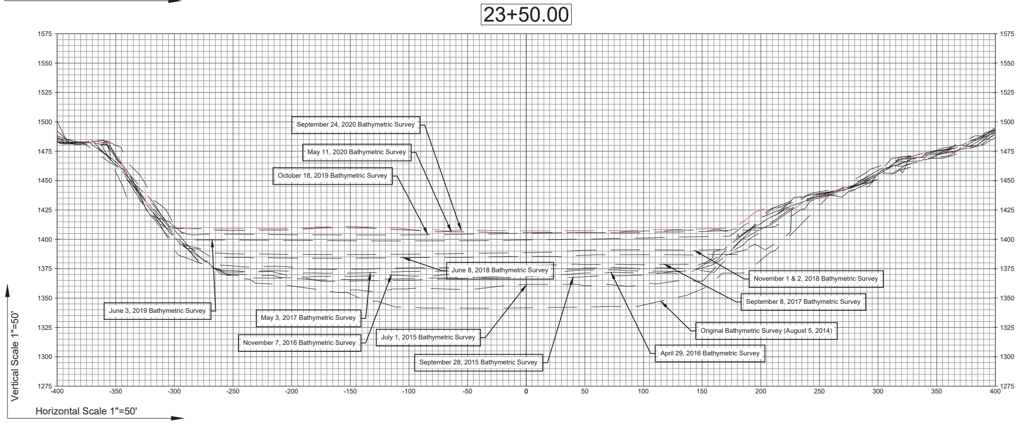


TRIMEDIA
ENVIRONMENTAL & ENGINEERING

Eagle Mine - Humboldt Mill
September 24, 2020 Bathymetric Survey
Champion, MI

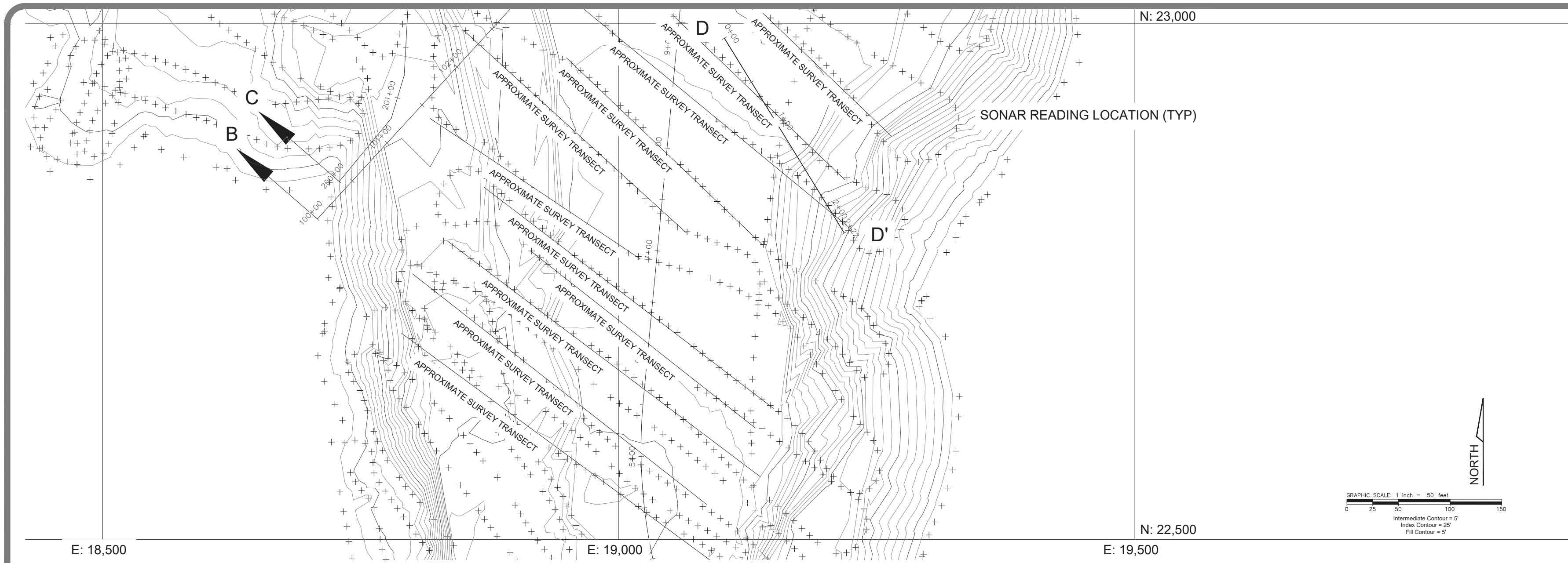
ISSUED	DESCRIPTION	DATE

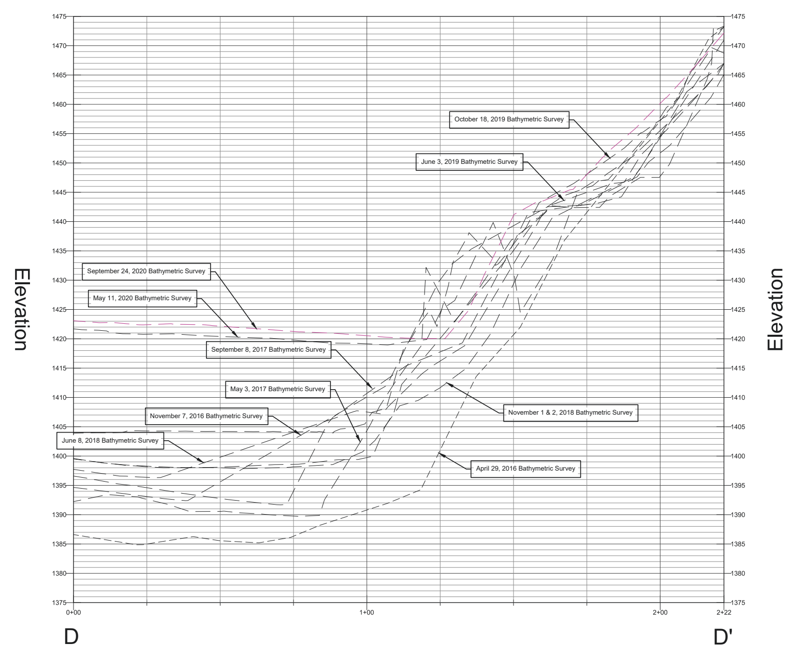
DESIGNED:
DRAWN: JWM
CHECKED: PGC
APPROVED: GWM

TRIMEDIA
JOB NUMBER:
2014-100

SHEET TITLE:
Tailings Basin 2020 Cross Sections

SHEET NUMBER:
4.0





TRIMEDIA ENVIRONMENTAL & ENGINEERING

Eagle Mine - Humboldt Mill
September 24, 2020 Bathymetric Survey
Champion, MI

DATE	DESCRIPTION	ISSUED

DESIGNED:
DRAWN: JWM
CHECKED: PGC
APPROVED: GWM

TRIMEDIA JOB NUMBER: 2014-100

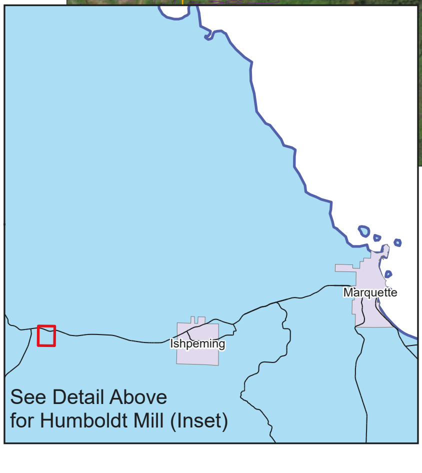
SHEET TITLE: Tailings Basin 2020 Cross Section D

SHEET NUMBER: 5.0

Appendix C

Humboldt Mill

Storm Water Drainage Map



0 0.05 0.1 0.2 0.3 0.4 Miles

Legend

- Cut Off Wall
- Eagle Mine Property Boundary
- Catch Basins
- Berm
- Stormwater Conduit
- Surface Water Flow
- Contours 10ft
- Humboldt Facilities
- Humboldt Tailings Disposal Facility
- Main Roads

Humboldt Mill Site Map

Figure 1

Edited on November 2, 2018 Created on October 9, 2015	Locations and Coordinates based on UTM Zone 16N NAD83

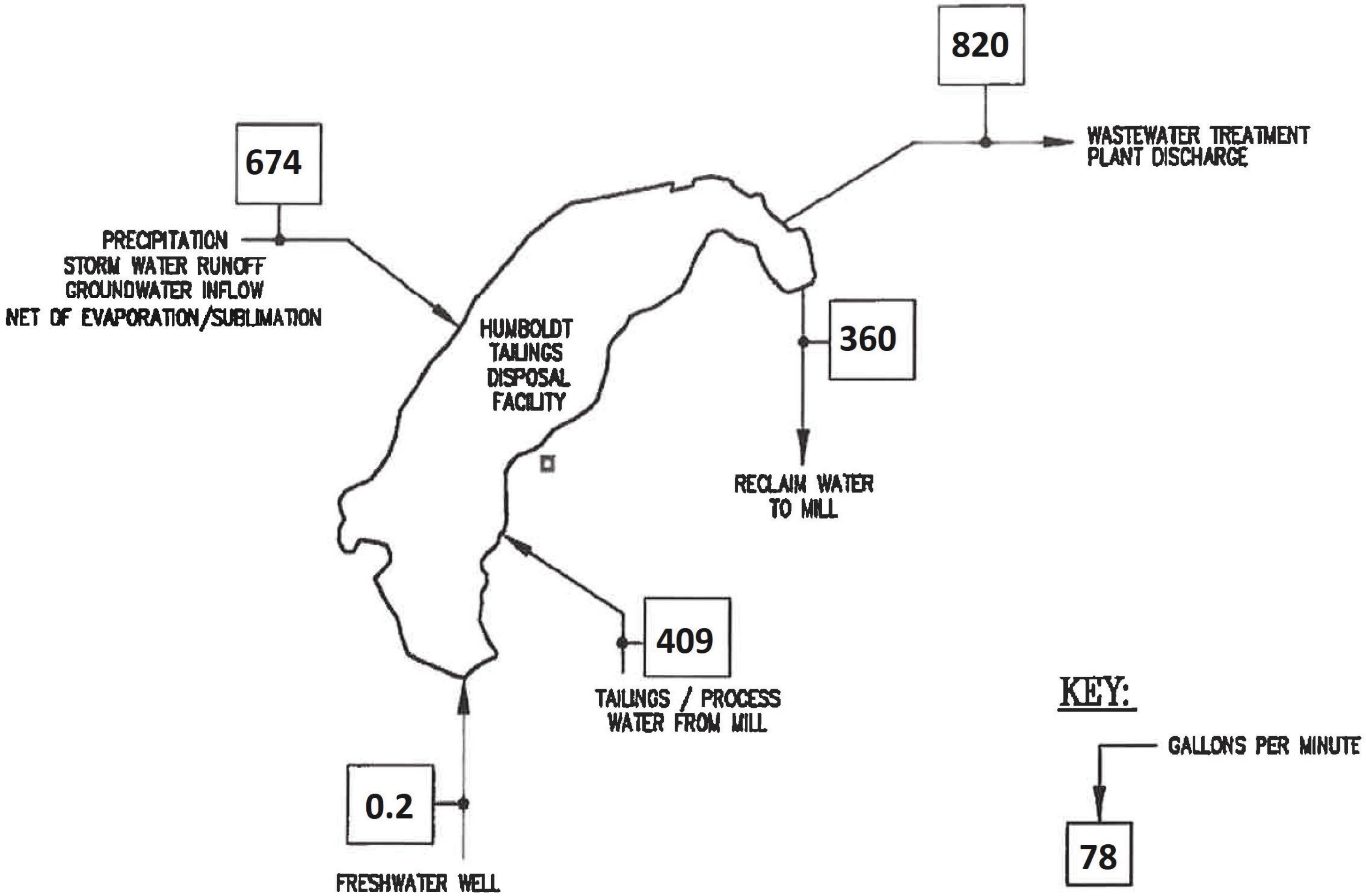
Eagle Mine
a subsidiary of lundin mining

Author: JRE

Appendix D

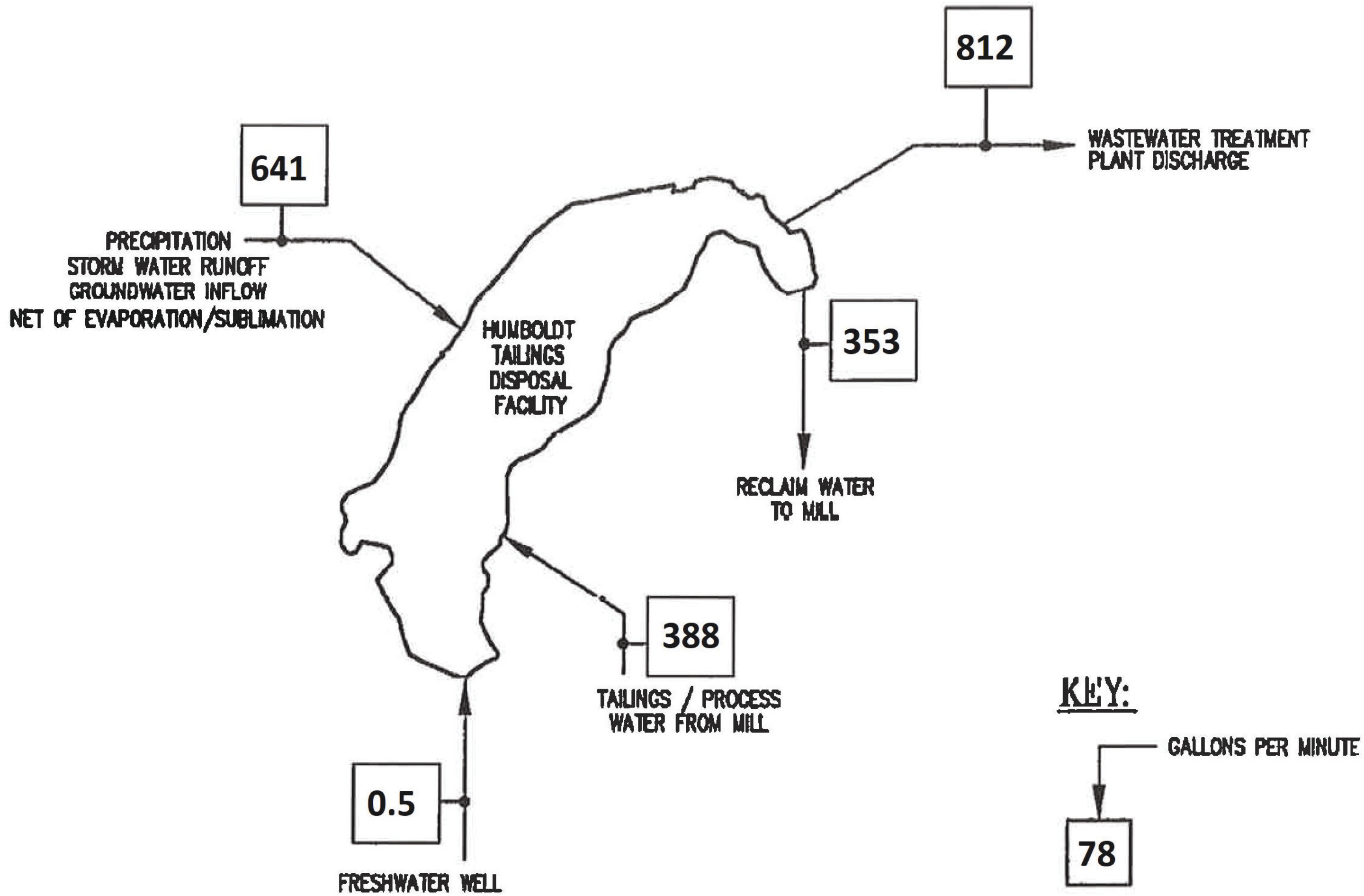
Humboldt Mill

Water Balance Diagrams



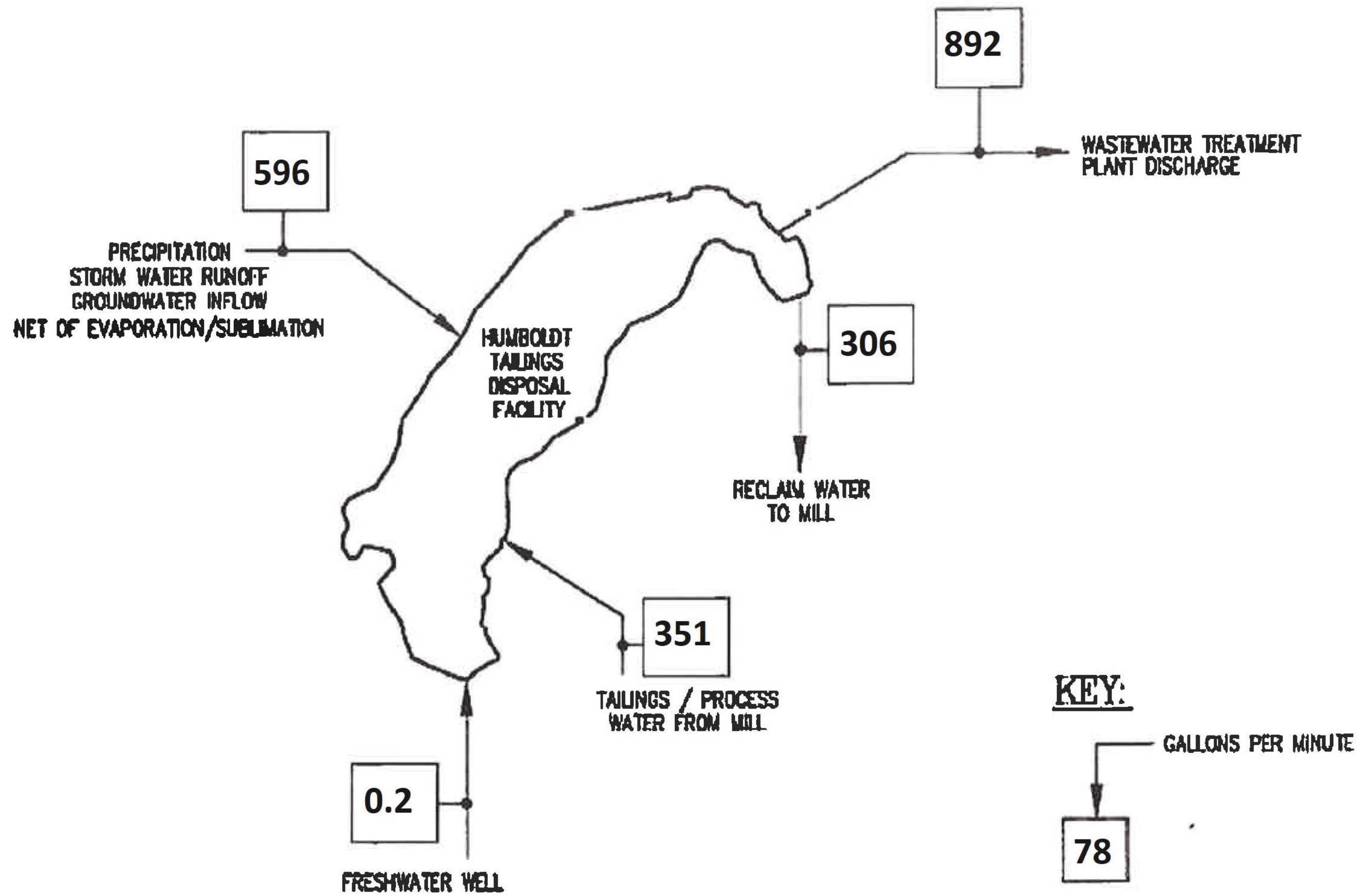
Tailings total includes the dry tailings volume. As such, this diagram illustrates a volume balance rather than a pure water balance.

Eagle Mine, LLC - Humboldt Mill Facility Humboldt Township, Marquette County, Michigan		PROJECT NUMBER: KEX–0102
WATER BALANCE HUMBOLDT TAILINGS DISPOSAL FACILTY (January 1st - March 31, 2020)		FIGURE: 1



Eagle Mine, LLC - Humboldt Mill Facility Humboldt Township, Marquette County, Michigan	PROJECT NUMBER: KEX-0102
WATER BALANCE HUMBOLDT TAILINGS DISPOSAL FACILTY (April 1 - June 30, 2020)	FIGURE: **1**

Tailings total includes the dry tailings volume. As such, this diagram illustrates a volume balance rather than a pure water balance.

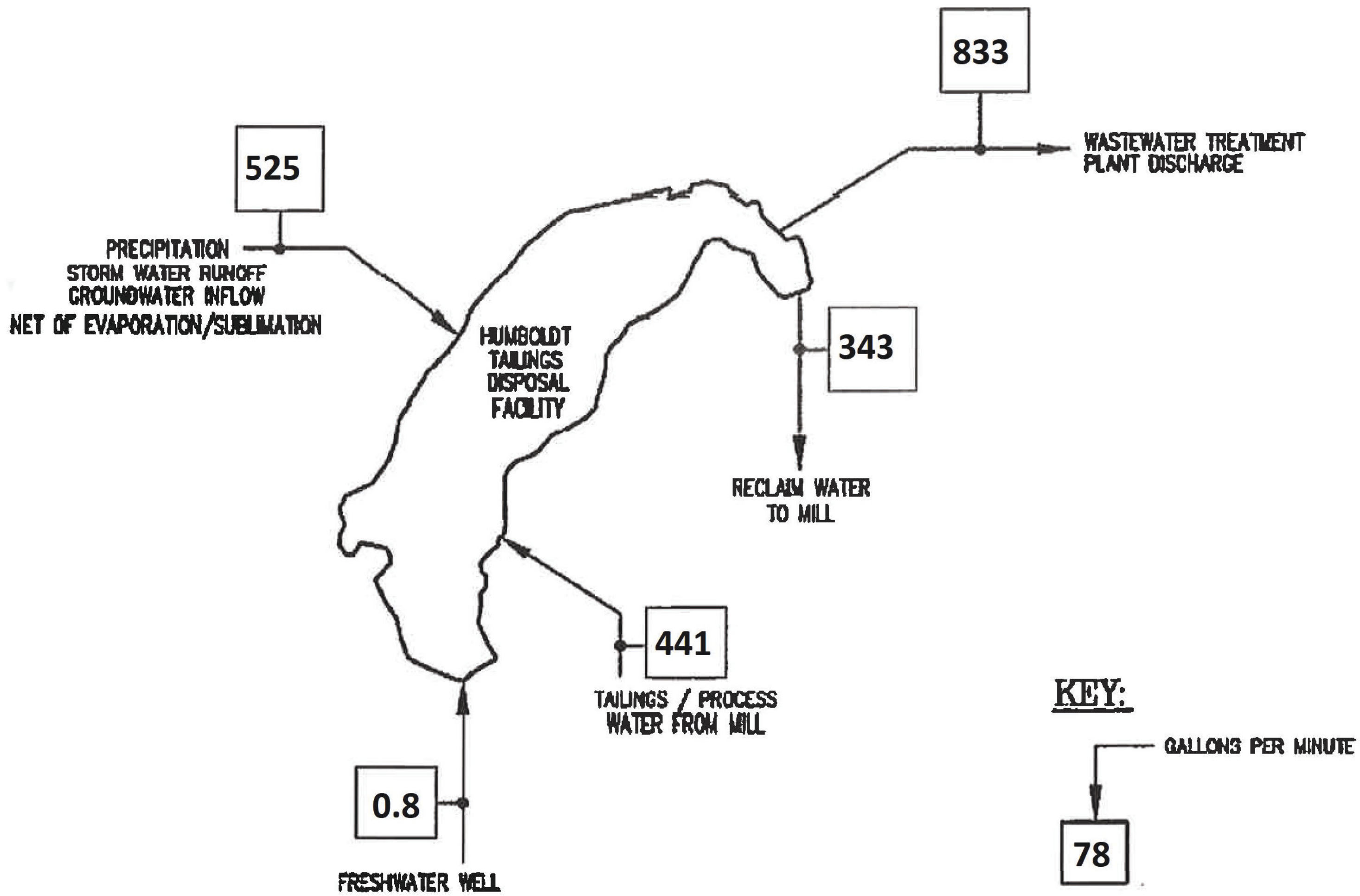


Eagle Mine, LLC - Humboldt Mill Facility
Humboldt Township, Marquette County, Michigan

WATER BALANCE
HUMBOLDT TAILINGS DISPOSAL FACILTY
(July 1 - September 30, 2020)

PROJECT NUMBER: KEx–0102

FIGURE: 1



Tailings total includes the dry tailings volume. As such, this diagram illustrates a volume balance rather than a pure water balance.

Eagle Mine, LLC - Humboldt Mill Facility Humboldt Township, Marquette County, Michigan	PROJECT NUMBER: KEX-0102
WATER BALANCE HUMBOLDT TAILINGS DISPOSAL FACILTY (October 1 - December 31, 2020)	FIGURE: 1

Appendix E

Humboldt Mill

Groundwater Map

CUT-OFF WALL MONITORING WELL NETWORK LOCATIONS

Legend

- Monitoring Well
- Leachate Monitoring Well per R425.406(5)(a)
- Compliance Monitoring Well per R425.406(5)(b)
- Containment Wall
- Estimated Limit of Aquifer
- Flow Divide
- Highway
- Bedrock Outcrop

Reference

Data provided by: Eagle Mine and North Jackson Company
Projection & Datum: UTM NAD 83 Zone 16N
Aerial Photo: 2006

0 200 400 Feet

1:3,500

Eagle Mine
a subsidiary of lundin mining

North Jackson Company
ENVIRONMENTAL SCIENCE & ENGINEERING

LEGEND

New Compliance Monitoring Wells

NOTES

1. SCALE OF AERIAL IMAGERY IS APPROXIMATE.
2. THIS FIGURE HAS BEEN TRANSLATED AND SCALED TO THE HORIZONTAL DATUM NAD83 MICHIGAN STATE PLANE COORDINATE SYSTEM.
3. FOR REFERENCE PURPOSES ONLY. NOT TO BE USED FOR REPORTING.

REFERENCE

1. BASE MAP TAKEN FROM GOOGLE EARTH, 2014

CLIENT
EAGLE MINE
HUMBOLDT MILL

PROJECT
GROUNDWATER MONTIORING

TITLE
EAGLE MINE HUMBOLDT MILL
COMPLIANCE MONITORING LOCATIONS

DRAFT

CONSULTANT

Golder Associates

YYYY-MM-DD	2014-08-14
PREPARED	CJS
DESIGN	CJS
REVIEW	MAC
APPROVED	GJD

PROJECT	Rev.	FIGURE
1401484	0	01

Path: C:\Users\CStacey\Documents\Eagle\1401484 Eagle Mill Monitoring\GIS\Eagle Mill MW Location Map Portrait.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 0 1 in

Appendix F

Humboldt Mill

Groundwater Monitoring Well Results

&

Benchmark Summary Table

Humboldt Mill
2020 Mine Permit Groundwater Monitoring
Benchmark Comparison Summary

Location	Location Classification	Q1	Q2	Q3	Q4
HW-1L	Monitoring		chloride, sodium	**chloride, sodium**	**chloride, sodium**
HW-1U LLA	Monitoring		chloride, sodium, hardness	**chloride**	**chloride,** sodium, hardness
HW-1U UFB	Monitoring	iron, manganese, chloride, calcium, magnesium, sodium, hardness	**manganese, chloride, calcium, sodium, hardness**	**manganese, chloride, calcium,** magnesium, **hardness**	iron, **chloride, calcium, magnesium,** sodium**, hardness**
HW-2	Monitoring	**iron, manganese, chloride,** sulfate, magnesium, **potassium, sodium**	**iron, manganese, chloride, sulfate,** calcium, **magnesium, potassium, sodium,** hardness	**manganese, chloride, sulfate, magnesium, potassium, sodium, hardness**	**manganese, chloride, sulfate, sodium, hardness**
HW-8U	Monitoring				potassium
HYG-1	Monitoring	**manganese**	**manganese**	**antimony, manganese,** nitrogen (ammonia, nitrate)	pH, **manganese, nitrogen (ammonia, nitrate)**
KMW-5R	Monitoring	**sodium**	**sodium**	**aluminum,** copper, lithium, manganese, **sodium**	**sodium**
MW-701 QAL	COSA	**chloride,** sulfate, **calcium, magnesium, potassium, hardness, sodium**	mercury, alkalinity bicarbonate**, chloride, sulfate, calcium, magnesium, potassium, sodium, hardness**	pH, manganese, **mercury, alkalinity bicarbonate, chloride, sulfate, calcium, magnesium, potassium, sodium, hardness**	**pH, manganese, mercury, chloride, sulfate, calcium, magnesium, potassium, sodium, hardness**
MW-701 UFB	Monitoring	**iron, manganese, alkalinity bicarbonate, chloride, sulfate, calcium, magnesium, potassium, sodium, hardness**	**iron, manganese, chloride, sulfate, calcium, magnesium, potassium, sodium, hardness**	**iron, manganese,** alkalinity bicarbonate**, chloride, sulfate, calcium, magnesium, potassium, sodium, hardness**	**iron, manganese, alkalinity bicarbonate, chloride, sulfate, calcium, magnesium, potassium, sodium, hardness**
MW-702 QAL	Leachate	**pH**	**pH**	**pH**	**pH**
MW-702 UFB	Leachate				
MW-703 QAL	Compliance	**pH, nitrogen nitrate**	**pH**	**pH**	**pH,** nitrogen nitrate
MW-703 UFB	Compliance	manganese			manganese
MW-703-LLA	Monitoring				
MW-703-DBA	Compliance	**pH**	**pH,** calcium		pH, calcium
MW-704 QAL	Compliance	zinc, **chloride, sulfate, calcium, magnesium, hardness**	**chloride,** nitrogen ammonia, **calcium, magnesium,** sodium, **hardness**	pH,**chloride, calcium, magnesium, sodium, hardness**	**chloride,** nitrogen ammonia, **calcium, magnesium,** potassium, **sodium, hardness**
MW-704 UFB	Compliance	**chloride,** nitrogen nitrate, **calcium, magnesium, hardness**	iron, manganese, **chloride, calcium, magnesium, hardness**	**iron, manganese, chloride, calcium, magnesium,** sodium, **hardness**	**iron, manganese, chloride, calcium, magnesium, sodium, hardness**
MW-704 LLA	Compliance	**pH, manganese, alkalinity bicarbonate,** calcium, magnesium, **hardness**	**pH, manganese, alkalinity bicarbonate, calcium, magnesium, hardness**	**pH, manganese, alkalinity bicarbonate, calcium, magnesium, hardness**	**pH, manganese, alkalinity bicarbonate, calcium, magnesium, hardness**
MW-704 DBA	Compliance	**manganese,** alkalinity bicarbonate**, calcium, magnesium, hardness**	**manganese, alkalinity bicarbonate,hardness**	pH, **manganese, alkalinity bicarbonate,hardness**	**pH, manganese, alkalinity bicarbonate,hardness**
MW-705 QAL	Cut-off Wall Key In		chloride, nitrogen ammonia, sodium	**chloride, nitrogen ammonia, sodium**	**nitrogen ammonia, sodium**
MW-705 UFB	Cut-off Wall Key In	**chloride, calcium, magnesium, potassium, sodium, hardness**	manganese, **chloride, calcium, magnesium, hardness**	**manganese, chloride, calcium, magnesium,** sodium, **hardness**	**manganese, chloride, calcium, magnesium, sodium, hardness**
MW-706 QAL	Mill Services Building/ Secondary Crusher		nickel		
MW-707 QAL	Concentrator/CLO				
MW-9R	Concentrator			nickel	**nickel**, zinc

Parameters listed in this table had values reported that were equal to or greater than a site-specific benchmark. Parameters in BOLD are instances in which the Department was notified because benchmark deviations were identified at compliance monitoring locations for two consecutive quarters. If the location is classified as background, Department notification is not required for an exceedance. Blank data cells indicate that no benchmark deviations occurred at the location during the specified sampling quarter.

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
HW-1L (Monitoring)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[D]	Q2 2020[D]	Q3 2020[T]	Q4 2020[T]
Field						
D.O.	ppm	-	**1.5**	**0.92**	**1.41**	**1.50**
ORP	mV	-	-256.4	-249.8	-270.9	-291.8
pH	SU	8.14-9.14	**8.42**	**8.39**	**8.35**	**8.17**
Specific Conductance	uS/cm	-	**418.7**	**498.6**	**487.0**	**442.8**
Temperature	C	-	**7.16**	**10.72**	**10.28**	**9.75**
Turbidity	NTU	-	**4.07**	**81.8**	**1.67**	**1.5**
Water Elevation	ft MSL	-	**1444.71**	**1444.80**	**1444.72**	**1444.71**
Metals						
Aluminum	ug/L	200	-	-	<50.0	-
Antimony	ug/L	4.0	-	-	<2.0	-
Arsenic	ug/L	7.5	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	<100	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	745.21	-	-	614	-
Cadmium	ug/L	3.000	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	16	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	1186.83	**1070**	**287**	**1020**	**768**
Lead	ug/L	9.0	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	23.04	-	-	**19.4**	-
Manganese	ug/L	200	<50.0	<50.0	<50.0	<50.0
Mercury	ng/L	4.0	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	<20.0	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.8	-	-	<0.20	-
Thallium	ug/L	2.0	-	-	<2.0	-
Vanadium	ug/L	-	-	-	<4.0	-
Zinc	ug/L	40	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	109.06	**78.6**	**77.6**	**74.5**	**80.4**
Alkalinity, Carbonate	mg/L	7.8	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	57.2	**40.1**	**68.2**	**77.4**	**65.1**
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.1	< 0.025	< 0.025	< 0.025	<0.025
Nitrogen, Nitrate	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Nitrogen, Nitrite	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	33.01	**28.3**	**24.9**	**24.9**	**27.7**
Sulfide	mg/L	0.8	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	34.39	**26.2**	**31.7**	**29.0**	**28.8**
Magnesium	mg/L	14.63	**10.9**	**11.8**	**11.6**	**11.5**
Potassium	mg/L	6.17	**1.9**	**2.3**	**2.2**	**2.2**
Sodium	mg/L	28.01	**23.7**	**37.4**	**40.5**	**34.6**
General						
Hardness	mg/L	155.68	**111**	**128**	**120**	**119**

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
HW-1U LLA (Monitoring)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020^T	Q2 2020^T	Q3 2020^T	Q4 2020^D
Field						
D.O.	ppm	-	**1.48**	**0.95**	**1.44**	**1.66**
ORP	mV	-	-291.4	-259.2	-264.8	-274.6
pH	SU	8.06-9.06	**8.58**	**8.33**	**8.25**	**8.11**
Specific Conductance	uS/cm	-	**511.3**	**1598.4**	**1054.7**	**1364.3**
Temperature	C	-	**6.86**	**12.76**	**9.55**	**7.24**
Turbidity	NTU	-	**1.94**	**2.43**	**2.19**	**3.69**
Water Elevation	ft MSL	-	**1472.41**	**1473.15**	**1472.96**	**1473.27**
Metals						
Aluminum	ug/L	200	-	-	<50.0	-
Antimony	ug/L	4.0	-	-	<2.0	-
Arsenic	ug/L	9.6	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	<100	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3.0	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	8.56	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	56769.6	**774**	**842**	**1200**	**898**
Lead	ug/L	15.0	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	17.39	-	**-**	**15.2**	**-**
Manganese	ug/L	672.84	<50.0	**63.2**	**62.5**	**78.9**
Mercury	ng/L	14.2	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	<20.0	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.80	-	-	<0.20	-
Thallium	ug/L	2.0	-	-	<2.0	-
Vanadium	ug/L	-	-	-	<4.0	-
Zinc	ug/L	44.15	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	156.67	**99.1**	**75.1**	**84.6**	**85.2**
Alkalinity, Carbonate	mg/L	64.24	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	61.2	32.1	**408**	**218**	**405**
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.299	**0.07**	**0.116**	**0.129**	**0.116**
Nitrogen, Nitrate	mg/L	0.57	< 0.10	< 0.10	< 0.10	<0.10
Nitrogen, Nitrite	mg/L	0.78	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	395.42	**58.8**	**46.1**	**58.4**	**54.0**
Sulfide	mg/L	0.80	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	61.29	**31.0**	**49.5**	**43.5**	**52.8**
Magnesium	mg/L	25.82	**11.1**	**15.1**	**14.2**	**15.8**
Potassium	mg/L	16.88	**3.3**	**6.7**	**5.2**	**6.4**
Sodium	mg/L	134.27	**40.1**	**232**	**124**	**176**
General						
Hardness	mg/L	170.91	**123**	**186**	**167**	**197**

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
HW-1U UFB (Monitoring)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[D]	Q2 2020[D]	Q3 2020[D]	Q4 2020[T]
Field						
D.O.	ppm	-	**1.44**	**0.31**	**1.37**	**1.54**
ORP	mV	-	-351.3	-351.3	-343.8	-335.1
pH	SU	8.4-9.4	**8.43**	**8.44**	**8.72**	**8.42**
Specific Conductance	uS/cm	-	**5057.8**	**3641.3**	**3549.6**	**3076.2**
Temperature	C	-	**6.82**	**10.25**	**10.53**	**7.95**
Turbidity	NTU	-	**18.87**	**9.51**	**4.17**	**2.64**
Water Elevation	ft MSL	-	**1535.55**	**1535.46**	**1534.44**	**1534.20**
Metals						
Aluminum	ug/L	200	-	-	<50.0	-
Antimony	ug/L	4.0	-	-	<2.0	-
Arsenic	ug/L	9.3	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	<100	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3.0	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	16	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	1364.17	**2110**	**976**	**552**	**1410**
Lead	ug/L	9.0	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	16.74	-	-	<10.0	-
Manganese	ug/L	80.14	**210**	**133**	**82.1**	**69.1**
Mercury	ng/L	4.0	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	<20.0	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.80	-	-	<0.20	-
Thallium	ug/L	2.0	-	-	<2.0	-
Vanadium	ug/L	-	-	-	<4.0	-
Zinc	ug/L	40	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	121.72	**58.1**	**57.6**	**49.4**	**49.6**
Alkalinity, Carbonate	mg/L	17.08	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	96.09	**1270**	**1320**	**1050**	**1230**
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.097	< 0.025	< 0.025	**0.120**	**0.0896**
Nitrogen, Nitrate	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Nitrogen, Nitrite	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	72.34	**35.5**	**29.5**	**26.9**	**23.7**
Sulfide	mg/L	2.47	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	34.03	**89.8**	**79.8**	**69.6**	**61.7**
Magnesium	mg/L	15.63	**16.3**	**14.9**	**16.2**	**16.7**
Potassium	mg/L	20.91	**9.2**	**8.8**	**8.6**	**9.3**
Sodium	mg/L	67.74	**717**	**588**	**570**	**447**
General						
Hardness	mg/L	146.74	**291**	**261**	**240**	**223**

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
HW-2 (Monitoring)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[D]	Q2 2020[D]	Q3 2020[D]	Q3 2020[D]
Field						
D.O.	ppm	-	**0.28**	**1.52**	**0.41**	**0.39**
ORP	mV	-	-180.6	-251.3	-223.7	-202.3
pH	SU	7.29-8.29	**7.42**	**7.39**	**7.95**	**7.51**
Specific Conductance	uS/cm	-	**919.8**	**1007.5**	**1087.5**	**801.5**
Temperature	C	-	**6.93**	**8.41**	**9.52**	**10.02**
Turbidity	NTU	-	**178.94**	**87.88**	**68.08**	**70.31**
Water Elevation	ft MSL	-	**1536.89**	**1537.26**	**-**	**1535.07**
Metals						
Aluminum	ug/L	200	-	-	<50.0	-
Antimony	ug/L	4.0	-	-	<2.0	-
Arsenic	ug/L	7.5	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	<100	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3.0	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	16	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	2594.79	**4990**	**6090**	**1560**	**1230**
Lead	ug/L	9.0	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	40	-	-	<10.0	-
Manganese	ug/L	333.37	**712**	**713**	**367**	**526**
Mercury	ng/L	4.0	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	<20.0	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.80	-	-	<0.20	-
Thallium	ug/L	2.0	-	-	<2.0	-
Vanadium	ug/L	-	-	-	<4.0	-
Zinc	ug/L	40	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	141.40	**95.1**	**92.4**	**82.5**	**126**
Alkalinity, Carbonate	mg/L	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	34.7	**55.4**	**52.2**	**57.2**	**59.1**
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.083	< 0.025	< 0.025	**0.0392**	<0.025
Nitrogen, Nitrate	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Nitrogen, Nitrite	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	175.33	**259**	**298**	**289**	**202**
Sulfide	mg/L	0.52	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	71.88	**65.1**	**86.4**	**71.5**	**68.4**
Magnesium	mg/L	26.49	**30.4**	**38.5**	**33.4**	**26.4**
Potassium	mg/L	6.12	**8.8**	**12.0**	**10.7**	**5.9**
Sodium	mg/L	29.55	**54.4**	**65.6**	**79.0**	**50.8**
General						
Hardness	mg/L	296.9	**288**	**374**	**316**	**280**

Explanations of abbreviations are included on the final page of this table.

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
HW-8U (Monitoring)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[D]	Q2 2020[T]	Q3 2020[T]	Q4 2020[T]
Field						
D.O.	ppm	-	**0.33**	**1.34**	**3.60**	**2.41**
ORP	mV	-	-144.3	-134.9	-101.7	-138.0
pH	SU	6.4-7.4	**7.26**	**6.92**	**6.89**	**6.83**
Specific Conductance	uS/cm	-	**379**	**440**	**358.7**	**350.0**
Temperature	C	-	**6.11**	**9.8**	**10.54**	**10.69**
Turbidity	NTU	-	**6.01**	**2.58**	**1.04**	**0.96**
Water Elevation	ft MSL	-	**1535.76**	**1536.41**	**1535.04**	**1534.91**
Metals						
Aluminum	ug/L	200	-	-	<50.0	-
Antimony	ug/L	4	-	-	<2.0	-
Arsenic	ug/L	8.8	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	<100	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	16	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	22048.83	**13800**	**11300**	**9720**	**10300**
Lead	ug/L	9	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	14.39	-	-	**11.9**	-
Manganese	ug/L	6267.76	**3870**	**3580**	**3390**	**3550**
Mercury	ng/L	4	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	<20.0	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.8	-	-	<0.20	-
Thallium	ug/L	2	-	-	<2.0	-
Vanadium	ug/L	-	-	-	<4.0	-
Zinc	ug/L	26.73	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	214.17	**133**	**128**	**126**	**135**
Alkalinity, Carbonate	mg/L	8	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	18.35	**12.3**	**11.4**	**10.9**	**11.2**
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.041	< 0.025	< 0.025	**0.0337**	<0.025
Nitrogen, Nitrate	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Nitrogen, Nitrite	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	12.26	**8.3**	**8.6**	**8.8**	**8.9**
Sulfide	mg/L	0.8	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	45.93	**36.8**	**37.8**	**34.0**	**36.0**
Magnesium	mg/L	18.68	**12.7**	**12.4**	**12.5**	**12.4**
Potassium	mg/L	3.64	**3.2**	**3.2**	**3.4**	**3.8**
Sodium	mg/L	4.26	**3.6**	**3.8**	**3.7**	**3.9**
General						
Hardness	mg/L	203.47	**144**	**146**	**136**	**141**

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
HYG-1 (Monitoring)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[T]	Q2 2020[T]	Q3 2020[T]	Q4 2020[T]
Field						
D.O.	ppm	-	**0.01**	**1.58**	**0.44**	**0.42**
ORP	mV	-	**114.4**	**169.3**	**125.7**	**150.6**
pH	SU	6.29-7.29	**6.61**	**6.64**	**6.38**	**6.16**
Specific Conductance	uS/cm	-	**647.0**	**427.0**	**571.3**	**501.1**
Temperature	C	-	**6.45**	**8.48**	**7.38**	**8.19**
Turbidity	NTU	-	**0.98**	**0.20**	**1.41**	**1.72**
Water Elevation	ft MSL	-	**1532.41**	**1531.52**	**1531.13**	**1531.34**
Metals						
Aluminum	ug/L	200	-	-	<50.0	-
Antimony	ug/L	4.0	-	-	**6.2**	-
Arsenic	ug/L	7.5	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	<100	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3.0	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	9.22	<4.0	**6.2**	**5.9**	<4.0
Iron	ug/L	481.9	<200	<200	<200	<200
Lead	ug/L	9.0	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	40	-	-	<10.0	-
Manganese	ug/L	627.41	**1600**	**801**	**1970**	**2850**
Mercury	ng/L	37.3	**19.6**	**11.6**	**9.29**	**8.03**
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	<20.0	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.80	-	-	<0.20	-
Thallium	ug/L	2.0	-	-	<2.0	-
Vanadium	ug/L	-	-	-	<4.0	-
Zinc	ug/L	25.31	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	372.91	**249**	**154**	**169**	**164**
Alkalinity, Carbonate	mg/L	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	21.5	<10.0	<10.0	<10.0	<10.0
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.56	**0.489**	**0.394**	**0.604**	**0.644**
Nitrogen, Nitrate	mg/L	0.08	< 0.10	< 0.10	**0.338**	**0.237**
Nitrogen, Nitrite	mg/L	0.40	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	136.69	**79.2**	**56.5**	**45.9**	**53.0**
Sulfide	mg/L	0.80	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	65.21	**59.6**	**40.6**	**43.3**	**45.2**
Magnesium	mg/L	34.32	**28.9**	**18.5**	**19.1**	**18.3**
Potassium	mg/L	12.96	**11.3**	**8.8**	**9.1**	**9.0**
Sodium	mg/L	80.47	**36.6**	**21.8**	**14.7**	**16.3**
General						
Hardness	mg/L	321.93	**268**	**177**	**187**	**188**

Explanations of abbreviations are included on the final page of this table.

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
KMW-5R (COSA)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[D]	Q2 2020[D]	Q3 2020[D]	Q4 2020[D]
Field						
D.O.	ppm	-	**3.02**	**2.96**	**2.76**	**1.55**
ORP	mV	-	-33.7	4.6	-34.1	-112.2
pH	SU	6.67-7.67	**6.85**	**6.72**	**6.83**	**6.89**
Specific Conductance	uS/cm	-	**774.1**	**837.1**	**848.8**	**939.5**
Temperature	C	-	**8.15**	**9.41**	**8.43**	**7.83**
Turbidity	NTU	-	**176.75**	**62.18**	**170.3**	**73.32**
Water Elevation	ft MSL	-	**1560.10**	**1565.26**	**1563.73**	**1561.49**
Metals						
Aluminum	ug/L	200	-	-	**10700**	-
Antimony	ug/L	4	-	-	<2.0	-
Arsenic	ug/L	7.5	<5.0	<5.0	**7.4**	<5.0
Barium	ug/L	400	-	-	<100	-
Beryllium	ug/L	2.5	-	-	**1.5**	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3	-	-	<1.0	-
Chromium	ug/L	40	-	-	**10.8**	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	28.32	**4.7**	**4.2**	**29.4**	**4.0**
Iron	ug/L	52956	**12600**	**4120**	**39900**	**3520**
Lead	ug/L	9	<3.0	<3.0	**3.1**	<3.0
Lithium	ug/L	31.39	-	-	**35.1**	-
Manganese	ug/L	2789	**1710**	**1770**	**2790**	**2090**
Mercury	ng/L	14.89	**1.09**	**<1.0**	**2.45**	**1.48**
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	<20.0	**35.5**	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.8	-	-	<0.20	-
Thallium	ug/L	2	-	-	<2.0	-
Vanadium	ug/L	-	-	-	**7.1**	-
Zinc	ug/L	23.65	<10.0	<10.0	**13.8**	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	480.97	**367**	**346**	**359**	**376**
Alkalinity, Carbonate	mg/L	8	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	191.74	<10.0	<10.0	<10.0	<10.0
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.063	<0.025	<0.025	<0.025	<0.025
Nitrogen, Nitrate	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Nitrogen, Nitrite	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	138.86	**65.9**	**55.8**	**57.0**	**60.6**
Sulfide	mg/L	0.8	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	166.39	**108**	**105**	**102**	**104**
Magnesium	mg/L	65.48	**42.3**	**37.1**	**48.2**	**38.3**
Potassium	mg/L	8.30	**7.0**	**6.3**	**7.2**	**6.9**
Sodium	mg/L	7.71	**9.0**	**8.8**	**8.8**	**8.9**
General						
Hardness	mg/L	757.06	**443**	**414**	**453**	**418**

Explanations of abbreviations are included on the final page of this table.

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
MW-701 QAL (Monitoring)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[T]	Q2 2020[T]	Q3 2020[T]	Q4 2020[T]
Field						
D.O.	ppm	-	**0.15**	**1.98**	**0.56**	**0.59**
ORP	mV	-	**183.0**	**94.9**	**190.0**	**121.3**
pH	SU	5.46-6.46	**5.58**	**5.52**	**5.28**	**5.29**
Specific Conductance	uS/cm	-	**2134.6**	**3962.5**	**4516.1**	**3951.5**
Temperature	C	-	**2.93**	**11.1**	**11.40**	**8.06**
Turbidity	NTU	-	**0.56**	**0.38**	**2.09**	**2.54**
Water Elevation	ft MSL	-	**1532.36**	**1536.18**	**1534.79**	**1533.98**
Metals						
Aluminum	ug/L	200	-	-	73.5	-
Antimony	ug/L	4	-	-	<2.0	-
Arsenic	ug/L	7.5	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	143	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3	-	-	**2.9**	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	16	<4.0	<4.0	**4.5**	<4.0
Iron	ug/L	497.99	<200	<200	<200	<200
Lead	ug/L	9	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	40	-	-	<10.0	-
Manganese	ug/L	5262.51	**643**	**2750**	**8060**	**9990**
Mercury	ng/L	8.44	**5.42**	**19.8**	**28.3**	**24.2**
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	**34.0**	**64.4**	**66.3**
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.8	-	-	<0.20	-
Thallium	ug/L	2	-	-	<2.0	-
Vanadium	ug/L	-	-	-	<4.0	-
Zinc	ug/L	40	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	117.82	**81.4**	**123**	**133**	**112**
Alkalinity, Carbonate	mg/L	8	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	22.96	**480**	**1010**	**1100**	**1060**
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.402	< 0.025	< 0.025	< 0.025	<0.025
Nitrogen, Nitrate	mg/L	1.87	**0.716**	**0.513**	**0.161**	**0.288**
Nitrogen, Nitrite	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	85.65	**249**	**378**	**400**	**535**
Sulfide	mg/L	0.8	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	43.04	**124**	**197**	**191**	**172**
Magnesium	mg/L	18.63	**44.0**	**64.9**	**58.9**	**50.0**
Potassium	mg/L	8.95	**12.7**	**17.5**	**17.7**	**17.6**
Sodium	mg/L	11.68	**218**	**517**	**590**	**512**
General						
Hardness	mg/L	199.04	**491**	**760**	**720**	**634**
Silica	mg/L	-	**18.2**	**17.1**	**18.2**	**19.0**

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
MW-701 UFB (Monitoring)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[D]	Q2 2020[D]	Q3 2020[D]	Q4 2020[D]
Field						
D.O.	ppm	-	**0.3**	**1.47**	**0.38**	**0.42**
ORP	mV	-	-148.4	-262.5	-160.9	-195.6
pH	SU	6.71-7.71	**6.97**	**7.39**	**6.82**	**6.61**
Specific Conductance	uS/cm	-	**5020.1**	**4889.0**	**5103**	**4602.2**
Temperature	C	-	**6.34**	**8.73**	**8.93**	**7.89**
Turbidity	NTU	-	**82.91**	**47.77**	**35.55**	**31.46**
Water Elevation	ft MSL	-	**1532.65**	**1536.49**	**1535.07**	**1534.28**
Metals						
Aluminum	ug/L	200	-	-	<50.0	-
Antimony	ug/L	4.0	-	-	<2.0	-
Arsenic	ug/L	7.5	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	157.47	-	-	<100	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3.0	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	45.38	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	24957.73	**145000**	**203000**	**177000**	**139000**
Lead	ug/L	9.0	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	12.91	-	-	**14.6**	-
Manganese	ug/L	4677.42	**13700**	**16700**	**15600**	**15500**
Mercury	ng/L	4.0	**1.18**	**1.54**	**1.29**	<1.0
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	<20.0	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.80	-	-	<0.20	-
Thallium	ug/L	2.0	-	-	<2.0	-
Vanadium	ug/L	-	-	-	<4.0	-
Zinc	ug/L	13.83	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	161.71	**204**	**132**	**201**	**167**
Alkalinity, Carbonate	mg/L	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	48.85	**651**	**784**	**800**	**867**
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	1.75	**0.041**	**0.1**	**0.0912**	**0.138**
Nitrogen, Nitrate	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Nitrogen, Nitrite	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	52.19	**1670**	**1310**	**1320**	**1300**
Sulfide	mg/L	1.86	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	38.59	**414**	**432**	**417**	**395**
Magnesium	mg/L	16.16	**151**	**133**	**140**	**128**
Potassium	mg/L	8.53	**18.8**	**20.0**	**18.0**	**17.4**
Sodium	mg/L	33.46	**382**	**411**	**407**	**363**
General						
Hardness	mg/L	163.25	**1660**	**1630**	**1620**	**1510**
Silica	mg/L	-	**17.4**	**15.9**	**17.1**	**20.2**

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
MW-702 QAL (Leachate)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[D]	Q2 2020[T]	Q3 2020[D]	Q4 2020[D]
Field						
D.O.	ppm	-	**0.24**	**2.36**	**1.05**	**0.76**
ORP	mV	-	**136.0**	**175.6**	**-160.9**	**50.2**
pH	SU	8.81-9.91	**6.96**	**6.63**	**6.82**	**6.53**
Specific Conductance	uS/cm	-	**515.1**	**482.1**	**543**	**434.5**
Temperature	C	-	**5.99**	**2.36**	**6.87**	**7.31**
Turbidity	NTU	-	**70.3**	**1.9**	**35.55**	**5.16**
Water Elevation	ft MSL	-	**1531.00**	**1535.32**	**1533.94**	**1532.97**
Metals						
Aluminum	ug/L	122.72	-	-	<50.0	-
Antimony	ug/L	4.0	-	-	<2.0	-
Arsenic	ug/L	7.5	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	195.71	-	-	<100	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3.0	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	16	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	800	<200	<200	<200	<200
Lead	ug/L	9.0	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	40	-	-	<10.0	-
Manganese	ug/L	545.68	**61.8**	**53.9**	<50.0	**54.8**
Mercury	ng/L	3.55	**2.74**	**2.37**	**1.61**	**1.69**
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	<20.0	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.80	-	-	<0.20	-
Thallium	ug/L	2.0	-	-	<2.0	-
Vanadium	ug/L	-	-	-	<4.0	-
Zinc	ug/L	40	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	160.17	**131**	**120**	**114**	**123**
Alkalinity, Carbonate	mg/L	40.7	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	17.58	<10.0	<10.0	<10.0	<10.0
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.042	< 0.025	< 0.025	< 0.025	<0.050
Nitrogen, Nitrate	mg/L	1.24	**0.345**	**0.473**	**0.382**	**0.300**
Nitrogen, Nitrite	mg/L	0.18	<0.10	<0.10	<0.10	<0.10
Sulfate	mg/L	133.19	**100**	**100**	**86.0**	**79.7**
Sulfide	mg/L	0.80	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	78.82	**32.9**	**37.0**	**36.3**	**35.7**
Magnesium	mg/L	14.06	**13.0**	**13.0**	**14.0**	**12.7**
Potassium	mg/L	22.00	**3.8**	**3.6**	**3.8**	**3.7**
Sodium	mg/L	60.14	**46.9**	**45.3**	**36.4**	**36.8**
General						
Hardness	mg/L	251.25	**136**	**146**	**148**	**141**

Explanations of abbreviations are included on the final page of this table.

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
MW-702 UFB (Leachate)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[D]	Q2 2020[D]	Q3 2020[T]	Q4 2020[T]
Field						
D.O.	ppm	-	**2.60**	**1.01**	**2.42**	**3.61**
ORP	mV	-	-226.3	-208.6	-188.6	-192.2
pH	SU	7.11-8.11	**8.02**	**7.98**	**7.85**	**7.68**
Specific Conductance	uS/cm	-	**263.4**	**297.6**	**277**	**266.8**
Temperature	C	-	**0.5**	**8.37**	**8.53**	**9.19**
Turbidity	NTU	-	**3.33**	**4.56**	**2.15**	**1.92**
Water Elevation	ft MSL	-	**1514.66**	**1521.23**	**1521.69**	**1519.50**
Metals						
Aluminum	ug/L	200	-	-	<50.0	-
Antimony	ug/L	4.0	-	-	<2.0	-
Arsenic	ug/L	7.5	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	<100	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3.0	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	16	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	1328.38	**982**	**555**	**769**	**744**
Lead	ug/L	9.0	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	12.91	-	-	<10.0	-
Manganese	ug/L	118.08	**102**	**83.4**	**87.1**	**84.5**
Mercury	ng/L	4.0	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	<20.0	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.80	-	-	<0.20	-
Thallium	ug/L	2.0	-	-	<2.0	-
Vanadium	ug/L	-	-	-	<4.0	-
Zinc	ug/L	76.03	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	111.84	**90.3**	**87.6**	**90.1**	**92.2**
Alkalinity, Carbonate	mg/L	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	40	<10.0	<10.0	<10.0	<10.0
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.087	< 0.025	< 0.025	< 0.025	< 0.025
Nitrogen, Nitrate	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Nitrogen, Nitrite	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	36.1	**31.2**	**32.5**	**31.5**	**33.7**
Sulfide	mg/L	0.80	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	38.98	**32.8**	**33.5**	**30.6**	**32.3**
Magnesium	mg/L	11.74	**10.5**	**9.7**	**9.7**	**9.7**
Potassium	mg/L	11.24	**3.1**	**3.1**	**3.0**	**2.9**
Sodium	mg/L	5.20	**3.3**	**3.4**	**3.2**	**3.1**
General						
Hardness	mg/L	139.94	**125**	**124**	**116**	**121**

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
MW-703 QAL (Compliance)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[T]	Q2 2020[T]	Q3 2020[T]	Q4 2020[T]
Field						
D.O.	ppm	-	**4.94**	**5.53**	**3.44**	**3.98**
ORP	mV	-	**226.2**	**115.8**	**154.3**	**222.6**
pH	SU	6.3-7.3	**6.05**	**5.85**	**5.73**	**5.54**
Specific Conductance	uS/cm	-	**192.2**	**182.6**	**237.2**	**193.2**
Temperature	C	-	**5.48**	**6.37**	**6.56**	**6.28**
Turbidity	NTU	-	**1.66**	**0.44**	**2.11**	**2.06**
Water Elevation	ft MSL	-	**1534.87**	**1535.89**	**1535.25**	**1534.85**
Metals						
Aluminum	ug/L	200	-	-	<50.0	-
Antimony	ug/L	4.0	-	-	<2.0	-
Arsenic	ug/L	7.5	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	<100	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3.0	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	16	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	286.57	<200	<200	<200	<200
Lead	ug/L	9.0	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	40	-	-	<10.0	-
Manganese	ug/L	106.54	<50.0	<50.0	<50.0	<50.0
Mercury	ng/L	4.0	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	<20.0	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.80	-	-	<0.20	-
Thallium	ug/L	2.0	-	-	<2.0	-
Vanadium	ug/L	-	-	-	<4.0	-
Zinc	ug/L	40	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	92.34	**50.9**	**47.1**	**47.4**	**53.6**
Alkalinity, Carbonate	mg/L	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	40	<10.0	<10.0	<10.0	<10.0
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.082	< 0.025	< 0.025	< 0.025	<0.050
Nitrogen, Nitrate	mg/L	1.81	**2.03**	**1.76**	**1.78**	**2.150**
Nitrogen, Nitrite	mg/L	0.4	< 0.10	< 0.10	<0.10	<0.10
Sulfate	mg/L	40.56	**31.3**	**26.4**	**24.0**	**24.5**
Sulfide	mg/L	0.80	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	31.29	**21.1**	**19.1**	**17.7**	**18.9**
Magnesium	mg/L	9.83	**9.4**	**8.2**	**7.9**	**7.9**
Potassium	mg/L	2.57	**1.6**	**1.5**	**1.5**	**1.6**
Sodium	mg/L	7.74	**1.9**	**1.8**	**1.7**	**1.8**
General						
Hardness	mg/L	115.53	**91.2**	**81.5**	**76.8**	**79.9**

Explanations of abbreviations are included on the final page of this table.

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
MW-703 UFB (Compliance)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[T]	Q2 2020[T]	Q3 2020[T]	Q4 2020[T]
Field						
D.O.	ppm	-	**1.71**	**0.91**	**2.12**	**1.85**
ORP	mV	-	-233.5	-240.2	-212.9	-231.5
pH	SU	7.44-8.44	**8.18**	**7.98**	**7.99**	**7.73**
Specific Conductance	uS/cm	-	**331.2**	**315.1**	**281.6**	**288.0**
Temperature	C	-	**4.76**	**7.61**	**10.46**	**6.86**
Turbidity	NTU	-	**2.23**	**2.19**	**1.16**	**1.89**
Water Elevation	ft MSL	-	**1531.74**	**1534.58**	**1534.20**	**1533.48**
Metals						
Aluminum	ug/L	200	-	-	<50.0	
Antimony	ug/L	4.0	-	-	<2.0	
Arsenic	ug/L	7.5	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	<100	
Beryllium	ug/L	2.5	-	-	<1.0	
Boron	ug/L	1200	-	-	<300	
Cadmium	ug/L	3.0	-	-	<1.0	
Chromium	ug/L	40	-	-	<10.0	
Cobalt	ug/L	80	-	-	<20.0	
Copper	ug/L	16	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	1902.7	**1860**	**1390**	**1400**	**1500**
Lead	ug/L	9.0	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	40	-	-	<10.0	
Manganese	ug/L	199.79	**208**	**196**	**196**	**202**
Mercury	ng/L	4.0	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	200	-	-	<50.0	
Nickel	ug/L	80	<20.0	<20.0	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	
Silver	ug/L	0.80	-	-	<0.20	
Thallium	ug/L	2.0	-	-	<2.0	
Vanadium	ug/L	-	-	-	<4.0	
Zinc	ug/L	40	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	111.44	**76.9**	**76.4**	**75.0**	**80.5**
Alkalinity, Carbonate	mg/L	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	40	<10.0	<10.0	<10.0	<10.0
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.75	< 0.025	< 0.025	< 0.025	<0.025
Nitrogen, Nitrate	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Nitrogen, Nitrite	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	49.32	**49.3**	**45.5**	**44.3**	**46.3**
Sulfide	mg/L	0.80	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	42.87	**32.6**	**32.3**	**31.4**	**33.8**
Magnesium	mg/L	13.90	**11.1**	**10.6**	**10.5**	**10.5**
Potassium	mg/L	4.23	**2.2**	**2.2**	**2.2**	**2.3**
Sodium	mg/L	17.31	**3.0**	**2.9**	**3.1**	**3.0**
General						
Hardness	mg/L	173.44	**127**	**124**	**122**	**128**

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
MW-703 LLA (Monitoring)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[D]	Q2 2020[D]	Q3 2020[D]	Q4 2020[D]
Field						
D.O.	ppm	-	**1.50**	**0.37**	**1.54**	**1.63**
ORP	mV	-	-245.7	-297	-259.9	-270.8
pH	SU	8.08-9.08	**8.44**	**8.92**	**8.63**	**8.09**
Specific Conductance	uS/cm	-	**319.3**	**276.3**	**261.0**	**275.6**
Temperature	C	-	**5.28**	**7.27**	**8.01**	**6.71**
Turbidity	NTU	-	**1.48**	**19.7**	**7.37**	**3.38**
Water Elevation	ft MSL	-	**1532.56**	**1536.89**	**1535.42**	**1535.41**
Metals						
Aluminum	ug/L	200	-	-	<50.0	-
Antimony	ug/L	4	-	-	<2.0	-
Arsenic	ug/L	7.5	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	<100	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	16	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	2081.98	632	<200	<200	362
Lead	ug/L	9	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	28.08	-	-	**17.7**	-
Manganese	ug/L	94.53	**78.2**	<50.0	<50.0	**58.4**
Mercury	ng/L	4	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	<20.0	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.8	-	-	<0.20	-
Thallium	ug/L	2	-	-	<2.0	-
Vanadium	ug/L	-	-	-	<4.0	-
Zinc	ug/L	40	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	92.11	**74.7**	**63.4**	**68.9**	**75.1**
Alkalinity, Carbonate	mg/L	10.41	<2.0	**2.4**	<2.0	<2.0
Chloride	mg/L	96.57	**11.2**	**26.0**	**18.7**	**14.9**
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.076	< 0.025	< 0.025	< 0.025	<0.025
Nitrogen, Nitrate	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Nitrogen, Nitrite	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	43.42	**34.9**	**5.6**	**19.3**	**27.3**
Sulfide	mg/L	0.8	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	**33.74**	**25.9**	**11.7**	**19.3**	**25.3**
Magnesium	mg/L	**12.29**	**10.9**	**5.3**	**8.6**	**10.0**
Potassium	mg/L	**7.73**	**3.7**	**9.1**	**6.2**	**5.0**
Sodium	mg/L	**51.07**	**7.9**	**24.0**	**14.2**	**10.5**
General						
Hardness	mg/L	**134.66**	**110**	**51.1**	**83.7**	**105**

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Humboldt Mill 2020

Mine Permit Groundwater Quality Monitoring Data

MW-703 DBA (Compliance)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[T]	Q2 2020[T]	Q3 2020[T]	Q4 2020[T]
Field						
D.O.	ppm	-	**1.72**	**1.24**	**1.76**	**1.65**
ORP	mV	-	-260.4	-203.3	-250.2	-268.9
pH	SU	8.89-9.89	**8.82**	**8.14**	**8.94**	**8.27**
Specific Conductance	uS/cm	-	**345.8**	**324.1**	**297.3**	**302.7**
Temperature	C	-	**5.76**	**7.42**	**9.07**	**6.53**
Turbidity	NTU	-	**0.28**	**1.24**	**0.62**	**0.56**
Water Elevation	ft MSL	-	**1532.19**	**1533.79**	**1532.38**	**1532.41**
Metals						
Aluminum	ug/L	200	-	-	<50.0	-
Antimony	ug/L	4.0	-	-	<2.0	-
Arsenic	ug/L	7.5	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	<100	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3.0	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	16	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	861.32	<200	<200	<200	<200
Lead	ug/L	9.0	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	19.81	-	-	**14.1**	-
Manganese	ug/L	200	<50.0	<50.0	<50.0	<50.0
Mercury	ng/L	4.0	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	<20.0	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.80	-	-	<0.20	-
Thallium	ug/L	2.0	-	-	<2.0	-
Vanadium	ug/L	-	-	-	<4.0	-
Zinc	ug/L	26.21	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	87.85	**76.3**	**74.4**	**70.4**	**80.1**
Alkalinity, Carbonate	mg/L	38.7	<2.0	<2.0	4.2	<2.0
Chloride	mg/L	20	**14.5**	**13.9**	**14.2**	**14.4**
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.12	< 0.025	< 0.025	< 0.025	<0.025
Nitrogen, Nitrate	mg/L	0.86	< 0.10	< 0.10	< 0.10	<0.10
Nitrogen, Nitrite	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	72.78	**39.2**	**38.4**	**35.4**	**38.5**
Sulfide	mg/L	1.27	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	27.00	**26.2**	**29.5**	**26.8**	**28.2**
Magnesium	mg/L	17.28	**10.4**	**11.5**	**10.5**	**10.5**
Potassium	mg/L	29.63	**9.7**	**3.1**	**7.7**	**5.1**
Sodium	mg/L	16.16	**8.6**	**6.5**	**8.0**	**7.0**
General						
Hardness	mg/L	139.55	**108**	**121**	**110**	**114**

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
MW-704 QAL (Compliance)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[T]	Q2 2020[T]	Q3 2020[T]	Q4 2020[T]
Field						
D.O.	ppm		**0.28**	**0.38**	**0.47**	**0.37**
ORP	mV		**146**	**31.1**	**180.4**	**8.0**
pH	SU	5.43-6.43	**5.66**	**5.71**	**5.29**	**5.58**
Specific Conductance	uS/cm		**717.2**	**1143.4**	**1205.6**	**927.4**
Temperature	C		**6.02**	**7.69**	**8.75**	**10.39**
Turbidity	NTU		**1.42**	**1.23**	**2.75**	**1.92**
Water Elevation	ft MSL		**1532.57**	**1534.73**	**1534.16**	**1534.46**
Metals						
Aluminum	ug/L	200	-	-	<50.0	-
Antimony	ug/L	4.0	-	-	<2.0	-
Arsenic	ug/L	7.5	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	<100	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3.0	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	16	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	84519.23	<200	**25700**	<200	**17600**
Lead	ug/L	9.0	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	40	-	-	<10.0	-
Manganese	ug/L	8782.76	**1090**	**3670**	**1730**	**5210**
Mercury	ng/L	34.7	**1.98**	**4.01**	**2.72**	**5.33**
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	**25.4**	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.80	-	-	<0.20	-
Thallium	ug/L	2.0	-	-	<2.0	-
Vanadium	ug/L	16	-	-	<4.0	-
Zinc	ug/L	37.8	**55.7**	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	264.36	**72.5**	**120**	**64.5**	**140**
Alkalinity, Carbonate	mg/L	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	23.77	**132**	**199**	**269**	**170**
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.19	<0.125	**0.881**	<0.025	**1.29**
Nitrogen, Nitrate	mg/L	1.47	**0.773**	**0.405**	**0.612**	**0.259**
Nitrogen, Nitrite	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	44.8	**51.6**	**31.9**	**37.6**	**23.7**
Sulfide	mg/L	0.80	<0.20	<0.20	<0.20	<0.20
Calcium	mg/L	47.35	**60.8**	**84.0**	**84.8**	**76.7**
Magnesium	mg/L	14.76	**23.3**	**30.1**	**32.2**	**24.8**
Potassium	mg/L	6.10	**3.5**	**4.9**	**4.5**	**6.3**
Sodium	mg/L	32.26	**31.8**	**39.7**	**48.6**	**38.9**
General						
Hardness	mg/L	191.15	**248**	**334**	**344**	**294**

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
MW-704 UFB (Compliance)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[D]	Q2 2020[D]	Q3 2020[D]	Q4 2020[D]
Field						
D.O.	ppm		**0.11**	**0.48**	**0.64**	**0.48**
ORP	mV		-87.7	-169.0	-139.6	-169.4
pH	SU	6.4-7.4	**6.53**	**6.93**	**6.72**	**6.69**
Specific Conductance	uS/cm		**879.8**	**1205.9**	**1407.8**	**1488.2**
Temperature	C		**7.34**	**7.96**	**7.62**	**9.31**
Turbidity	NTU		**4.77**	**3.94**	**3.37**	**4.46**
Water Elevation	ft MSL		**1533.08**	**1535.36**	**1534.69**	**1535.01**
Metals						
Aluminum	ug/L	5824.36	-	-	<50.0	-
Antimony	ug/L	4.0	-	-	<2.0	-
Arsenic	ug/L	7.5	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	<100	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3.0	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	16	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	44051.82	**35300**	**57600**	**61200**	**75200**
Lead	ug/L	9.0	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	30.14	-	-	<10.0	-
Manganese	ug/L	1384.15	**1320**	**1580**	**1860**	**1980**
Mercury	ng/L	1.4	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	<20.0	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.80	-	-	<0.20	-
Thallium	ug/L	2.0	-	-	<2.0	-
Vanadium	ug/L	16	-	-	<4.0	-
Zinc	ug/L	40	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	198.18	**122**	**146**	**161**	**144**
Alkalinity, Carbonate	mg/L	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	24.46	**134**	**177**	**256**	**434**
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.78	< 0.025	< 0.025	**0.0263**	<0.025
Nitrogen, Nitrate	mg/L	0.4	**204**	< 0.10	< 0.10	<0.10
Nitrogen, Nitrite	mg/L	0.18	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	45.37	**28.5**	**6.0**	**8.1**	**3.3**
Sulfide	mg/L	0.49	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	66.63	**68.2**	**81.9**	**98.3**	**110**
Magnesium	mg/L	14.04	**24.0**	**25.8**	**32.7**	**36.3**
Potassium	mg/L	5.28	**3.8**	**3.8**	**4.6**	**5.4**
Sodium	mg/L	43.16	**33.8**	**36.0**	**49.7**	**65.3**
General						
Hardness	mg/L	226.12	**269**	**311**	**380**	**425**

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
MW-704 LLA (Compliance)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[D]	Q2 2020[D]	Q3 2020[D]	Q4 2020[D]
Field						
D.O.	ppm	-	**1.58**	**1.58**	**1.47**	**1.46**
ORP	mV	-	-258.7	-224.9	-239.4	-269.8
pH	SU	8.2-9.2	**8.09**	**8.04**	**8.05**	**7.85**
Specific Conductance	uS/cm	-	**422.4**	**497.8**	**439.3**	**445.9**
Temperature	C	-	**6.4**	**9.94**	**10.17**	**10.61**
Turbidity	NTU	-	**3.99**	**8.60**	**10.57**	**4.52**
Water Elevation	ft MSL	-	**1533.54**	**1532.38**	**1531.07**	**1531.97**
Metals						
Aluminum	ug/L	200	-	-	<50.0	-
Antimony	ug/L	4.0	-	-	<2.0	-
Arsenic	ug/L	7.5	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	<100	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3.0	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	16	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	3308.59	**1670**	**1370**	**1470**	**1690**
Lead	ug/L	9.0	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	28.25	-	-	**20.1**	-
Manganese	ug/L	95.14	**193**	**170**	**172**	**168**
Mercury	ng/L	4.0	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	<20.0	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.80	-	-	<0.20	-
Thallium	ug/L	2.0	-	-	<2.0	-
Vanadium	ug/L	16	-	-	<4.0	-
Zinc	ug/L	40	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	152.81	**167**	**171**	**173**	**179**
Alkalinity, Carbonate	mg/L	13.4	**8.2**	<2.0	<2.0	<2.0
Chloride	mg/L	40	**17.9**	**18.1**	**18.9**	**20.6**
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.1	< 0.025	< 0.025	< 0.025	**0.0545**
Nitrogen, Nitrate	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Nitrogen, Nitrite	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	20.79	**13.0**	**12.2**	**11.5**	**11.9**
Sulfide	mg/L	0.80	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	33.39	**50.7**	**47.2**	**49.1**	**50.6**
Magnesium	mg/L	15.62	**21.2**	**19.3**	**20.5**	**20.2**
Potassium	mg/L	12.01	**6.8**	**5.9**	**6.4**	**6.7**
Sodium	mg/L	15.49	**5.4**	**5.0**	**5.2**	**5.2**
General						
Hardness	mg/L	156.51	**214**	**197**	**207**	**210**

Explanations of abbreviations are included on the final page of this table.

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
MW-704 DBA (Compliance)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[D]	Q2 2020[D]	Q3 2020[D]	Q4 2020[T]
Field						
D.O.	ppm	-	**1.42**	**0.84**	**2.96**	**2.00**
ORP	mV	-	-280.8	-239.8	-206.9	-237.9
pH	SU	8.13-9.13	**8.27**	**8.24**	**7.97**	**7.99**
Specific Conductance	uS/cm	-	**275.5**	**336.2**	**286.6**	**273.2**
Temperature	C	-	**7.4**	**9.64**	**9.36**	**10.47**
Turbidity	NTU	-	**90.91**	**10.90**	**23.32**	**1.10**
Water Elevation	ft MSL	-	**1548.31**	**1529.81**	**-**	**1529.87**
Metals						
Aluminum	ug/L	200	-	-	<50.0	-
Antimony	ug/L	8.0	-	-	<2.0	-
Arsenic	ug/L	20.0	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	<100	-
Beryllium	ug/L	4.0	-	-	<1.0	-
Boron	ug/L	1480	-	-	<300	-
Cadmium	ug/L	4.0	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	16	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	9645	**816**	**743**	**811**	**617**
Lead	ug/L	12.0	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	40	-	-	**17.7**	-
Manganese	ug/L	58	**70.3**	**67.0**	**75.0**	**62.2**
Mercury	ng/L	4.0	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	<20.0	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.80	-	-	<0.20	-
Thallium	ug/L	8.0	-	-	<2.0	-
Vanadium	ug/L	16	-	-	<4.0	-
Zinc	ug/L	11	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	129	**135**	**134**	**131**	**137**
Alkalinity, Carbonate	mg/L	32.0	3.4	<2.0	<2.0	**2.0**
Chloride	mg/L	40	<10.0	<10.0	<10.0	<10.0
Fluoride	mg/L	4.0	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.04	< 0.025	< 0.025	< 0.025	<0.025
Nitrogen, Nitrate	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Nitrogen, Nitrite	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	6	<1.0	<1.0	<1.0	<1.0
Sulfide	mg/L	0.80	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	27.00	**28.2**	**25.2**	**26.7**	**25.4**
Magnesium	mg/L	14.00	**14.2**	**12.5**	**13.2**	**12.2**
Potassium	mg/L	4.00	**2.8**	**2.5**	**2.7**	**2.6**
Sodium	mg/L	14.00	**12.2**	**11.3**	**11.9**	**10.6**
General						
Hardness	mg/L	111.00	**129**	**114**	**121**	**114**

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
MW-705 QAL (Cut-off Wall Key In)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[T]	Q2 2020[T]	Q3 2020[T]	Q4 2020[T]
Field						
D.O.	ppm	-	**0.23**	**1.59**	**0.44**	**0.43**
ORP	mV	-	-33.7	-49.3	-18.2	-37.1
pH	SU	5.67-6.67	**6.27**	**6.37**	**6.13**	**5.94**
Specific Conductance	uS/cm	-	**198.8**	**366.3**	**539.1**	**329.7**
Temperature	C	-	**4.89**	**9.15**	**11.86**	**9.67**
Turbidity	NTU	-	**0.93**	**0.65**	**1.63**	**2.21**
Water Elevation	ft MSL	-	**-**	**1537.86**	**1536.18**	**1536.44**
Metals						
Aluminum	ug/L	200	-	-	<50.0	-
Antimony	ug/L	4.0	-	-	<2.0	-
Arsenic	ug/L	7.5	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	<100	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3.0	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	16	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	12956.53	**8250**	**11300**	**9680**	**8920**
Lead	ug/L	9.0	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	40	-	-	<10.0	-
Manganese	ug/L	1535.09	**728**	**1130**	**948**	**822**
Mercury	ng/L	1.8	**1.54**	<1.0	**1.09**	<1.0
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	<20.0	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.80	-	-	<0.20	-
Thallium	ug/L	2.0	-	-	<2.0	-
Vanadium	ug/L	16	-	-	<4.0	-
Zinc	ug/L	283.42	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	85.4	**45.7**	**46.3**	**54.7**	**56.3**
Alkalinity, Carbonate	mg/L	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	51.62	**15.8**	**66.8**	**73.1**	**49.8**
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.132	0.096	**0.149**	**0.159**	**0.160**
Nitrogen, Nitrate	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Nitrogen, Nitrite	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	21.2	**8.3**	**11.2**	**7.3**	**6.5**
Sulfide	mg/L	0.80	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	23.88	**11.9**	**18.3**	**18.4**	**15.2**
Magnesium	mg/L	10.91	**5.3**	**8.1**	**8.1**	**6.3**
Potassium	mg/L	3.03	**1.8**	**2.4**	**3.0**	**2.6**
Sodium	mg/L	16.56	**11.1**	**26.7**	**30.5**	**26.8**
General						
Hardness	mg/L	109.66	**51.4**	**78.8**	**79.2**	**63.7**

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
MW-705 UFB (Cut-off Wall Key In)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[D]	Q2 2020[D]	Q3 2020[T]	Q4 2020[T]
Field						
D.O.	ppm	-	**1.49**	**0.35**	**1.45**	**1.62**
ORP	mV	-	-147.3	-146.5	-135.9	-142.7
pH	SU	6.59-7.59	**7.03**	**7.12**	**6.94**	**6.78**
Specific Conductance	uS/cm	-	**317.2**	**432.8**	**392.1**	**380.6**
Temperature	C	-	**6.94**	**10.02**	**10.83**	**8.00**
Turbidity	NTU	-	**7.03**	**4.51**	**1.83**	**2.66**
Water Elevation	ft MSL	-	**1537.42**	**1539.03**	**1537.01**	**1537.78**
Metals						
Aluminum	ug/L	200	-	-	<50.0	-
Antimony	ug/L	4.0	-	-	<2.0	-
Arsenic	ug/L	7.5	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	<100	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3.0	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	16	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	13309.31	**6070**	**8770**	**8490**	**8610**
Lead	ug/L	9.0	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	13.19	-	-	<10.0	-
Manganese	ug/L	972.64	**959**	**1120**	**1570**	**1170**
Mercury	ng/L	4.0	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	<20.0	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.80	-	-	<0.20	-
Thallium	ug/L	2.0	-	-	<2.0	-
Vanadium	ug/L	16	-	-	<4.0	-
Zinc	ug/L	34.43	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	117.78	**75.8**	**83.0**	**91.5**	**85.0**
Alkalinity, Carbonate	mg/L	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	35.98	**41.4**	**41.4**	**42.0**	**47.2**
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.1	<0.125	**0.029**	**0.0475**	**0.0508**
Nitrogen, Nitrate	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Nitrogen, Nitrite	mg/L	0.4	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	14.23	**2.5**	**3.1**	**3.1**	**3.9**
Sulfide	mg/L	0.80	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	26.00	**28.5**	**28.2**	**32.4**	**32.2**
Magnesium	mg/L	13.29	**14.6**	**14.4**	**17.2**	**15.4**
Potassium	mg/L	4.01	**4.3**	**3.4**	**3.6**	**3.8**
Sodium	mg/L	3.37	**3.6**	**3.2**	**3.5**	**3.6**
General						
Hardness	mg/L	127.17	**131**	**130**	**152**	**144**

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
MW-706 QAL (Mill Services Building/Secondary Crusher)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[T]	Q2 2020[T]	Q3 2020[T]	Q4 2020[T]
Field						
D.O.	ppm	-	**0.54**	**0.56**	**1.38**	**1.43**
ORP	mV	-	**78.0**	**65.8**	**79.4**	**49.1**
pH	SU	-	**5.90**	**5.80**	**5.61**	**5.57**
Specific Conductance	uS/cm	-	**881.3**	**975.9**	**1024.1**	**899.4**
Temperature	C	-	**7.81**	**11.04**	**9.78**	**9.92**
Turbidity	NTU	-	**2.76**	**2.95**	**2.73**	**2.97**
Water Elevation	ft MSL	-	**1560.59**	**1564.21**	**1562.74**	**1563.13**
Metals						
Aluminum	ug/L	200	-	-	<50.0	-
Antimony	ug/L	4.0	-	-	<2.0	-
Arsenic	ug/L	7.5	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	<100	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3.0	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	31.38	-	-	**20.8**	-
Copper	ug/L	16	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	8029.11	**2650**	**2910**	**2430**	**2600**
Lead	ug/L	9.0	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	17.21	-	-	<10.0	-
Manganese	ug/L	23484.14	**11400**	**12000**	**11400**	**11600**
Mercury	ng/L	4.0	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	27.04	<20.0	**30.4**	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.80	-	-	<0.20	-
Thallium	ug/L	2.0	-	-	<2.0	-
Vanadium	ug/L	4.77	-	-	<4.0	-
Zinc	ug/L	77.08	<10.0	<10.0	<10.0	21.2
Major Anions						
Alkalinity, Bicarbonate	mg/L	131.77	**70.5**	**67.8**	**70.7**	**75.9**
Alkalinity, Carbonate	mg/L	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	165.11	**137**	**138**	**141**	**139**
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.88	**0.373**	**0.405**	**0.401**	**0.402**
Nitrogen, Nitrate	mg/L	0.4	< 0.10	< 0.10	<0.10	<0.10
Nitrogen, Nitrite	mg/L	0.4	< 0.10	< 0.10	<0.10	<0.10
Sulfate	mg/L	433.53	**146**	**135**	**138**	**139**
Sulfide	mg/L	0.80	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	132.61	**63.8**	**65.4**	**63.8**	**68.2**
Magnesium	mg/L	43.54	**25.8**	**26.5**	**25.8**	**27.2**
Potassium	mg/L	5.64	**4.5**	**4.6**	**4.4**	**4.7**
Sodium	mg/L	139.93	**49.1**	**49.6**	**47.5**	**49.5**
General						
Hardness	mg/L	619.10	**265**	**273**	**266**	**282**

Explanations of abbreviations are included on the final page of this table.

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
MW-707 QAL (Concentrator/CLO)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020[T]	Q2 2020[T]	Q3 2020[T]	Q4 2020[T]
Field						
D.O.	ppm	-	**1.66**	**0.41**	**0.55**	**0.48**
ORP	mV	-	**-129.4**	**-139.4**	**-121.7**	**-134.5**
pH	SU	6.43-7.43	**7.10**	**7.16**	**6.94**	**6.73**
Specific Conductance	uS/cm	-	**312.1**	**402.5**	**412.7**	**325.0**
Temperature	C	-	**6.74**	**9.74**	**9.10**	**10.20**
Turbidity	NTU	-	**0.39**	**1.75**	**1.93**	**2.02**
Water Elevation	ft MSL	-	**1581.52**	**1582.46**	**1581.71**	**1582.02**
Metals						
Aluminum	ug/L	200	-	-	<50.0	-
Antimony	ug/L	4.0	-	-	<2.0	-
Arsenic	ug/L	7.5	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	<100	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3.0	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	16	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	7115.36	**4110**	**4270**	**3950**	**4080**
Lead	ug/L	9.0	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	40	-	-	<10.0	-
Manganese	ug/L	1127.81	**939**	**974**	**920**	**926**
Mercury	ng/L	4.0	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	80	<20.0	<20.0	<20.0	<20.0
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.80	-	-	<0.20	-
Thallium	ug/L	2.0	-	-	<2.0	-
Vanadium	ug/L	16	-	-	<4.0	-
Zinc	ug/L	29.27	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	168.29	**153**	**148**	**149**	**154**
Alkalinity, Carbonate	mg/L	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	40	<10.0	<10.0	<10.0	<10.0
Fluoride	mg/L	2.5	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.32	**0.285**	**0.259**	**0.289**	**0.286**
Nitrogen, Nitrate	mg/L	0.4	< 0.10	< 0.10	<0.10	<0.10
Nitrogen, Nitrite	mg/L	0.4	< 0.10	< 0.10	<0.10	<0.10
Sulfate	mg/L	9.35	<1.0	<1.0	<1.0	<1.0
Sulfide	mg/L	0.80	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	45.91	**43.8**	**43.5**	**41.2**	**42.9**
Magnesium	mg/L	13.49	**11.8**	**11.7**	**11.0**	**11.2**
Potassium	mg/L	2.93	**2.2**	**2.3**	**2.2**	**2.4**
Sodium	mg/L	3.62	**2.9**	**3.0**	**2.8**	**2.7**
General						
Hardness	mg/L	162.23	**158**	**157**	**148**	**153**

Explanations of abbreviations are included on the final page of this table.

Humboldt Mill 2020
Mine Permit Groundwater Quality Monitoring Data
MW-9R (Concentrator)

Parameter	Unit	Recommended Benchmark 2018	Q1 2020^{T}	Q2 2020^{D}	Q3 2020^{T}	Q4 2020^{T}
Field						
D.O.	ppm	-	**0.48**	**1.70**	**1.43**	**2.08**
ORP	mV	-	**155.9**	**20.3**	**230.7**	**188.2**
pH	SU	5.4-6.4	**6.17**	**6.01**	**5.76**	**5.99**
Specific Conductance	uS/cm	-	**226.3**	**237.7**	**282.6**	**279.9**
Temperature	C	-	**7.93**	**11.9**	**13.98**	**14.00**
Turbidity	NTU	-	**0.57**	**6.24**	**1.15**	**1.89**
Water Elevation	ft MSL	-	**1596.48**	**1595.85**	**1594.61**	**1595.52**
Metals						
Aluminum	ug/L	200	-	-	<50.0	-
Antimony	ug/L	4.0	-	-	<2.0	-
Arsenic	ug/L	7.5	<5.0	<5.0	<5.0	<5.0
Barium	ug/L	400	-	-	<100	-
Beryllium	ug/L	2.5	-	-	<1.0	-
Boron	ug/L	1200	-	-	<300	-
Cadmium	ug/L	3.0	-	-	<1.0	-
Chromium	ug/L	40	-	-	<10.0	-
Cobalt	ug/L	80	-	-	<20.0	-
Copper	ug/L	38.92	<4.0	<4.0	<4.0	<4.0
Iron	ug/L	4098.78	<200	1320	<200	<200
Lead	ug/L	9.0	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	40	-	-	<10.0	-
Manganese	ug/L	1376.02	<50.0	61.9	<50.0	<50.0
Mercury	ng/L	10.07	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	200	-	-	<50.0	-
Nickel	ug/L	185.91	**95.4**	**130**	**204**	**284**
Selenium	ug/L	20	-	-	<5.0	-
Silver	ug/L	0.80	-	-	<0.20	-
Thallium	ug/L	2.0	-	-	<2.0	-
Vanadium	ug/L	-	-	-	<4.0	-
Zinc	ug/L	38.14	**23.3**	**19.4**	**23.3**	**57.9**
Major Anions						
Alkalinity, Bicarbonate	mg/L	**85.44**	**33.5**	**17.8**	**56.4**	**45.2**
Alkalinity, Carbonate	mg/L	**8.0**	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	**184.87**	**18.2**	**19.1**	<10.0	<10.0
Fluoride	mg/L	**2.5**	<1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	**0.22**	< 0.025	< 0.025	<0.025	<0.050
Nitrogen, Nitrate	mg/L	**3.8**	**0.44**	< 0.10	**0.171**	**0.322**
Nitrogen, Nitrite	mg/L	**0.4**	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	**334.5**	**39.9**	**26.8**	**60.1**	**68.2**
Sulfide	mg/L	**0.80**	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	**116.03**	**20.5**	**15.3**	**27.9**	**31.7**
Magnesium	mg/L	**41.43**	**6.5**	**5.1**	**9.3**	**10**
Potassium	mg/L	**5.21**	**1.9**	**1.5**	**2.0**	**2.3**
Sodium	mg/L	**47.56**	**10.8**	**6.2**	**6.9**	**5.3**
General						
Hardness	mg/L	**479.44**	**77.8**	**59.0**	**108**	**120**

Humboldt Mill 2020
Mine Permit Groundwater Monitoring Data
Abbreviations and Data Qualifiers

Explanations of abbreviations are included on the final page of this table. *Abbreviations & Data Qualifiers*

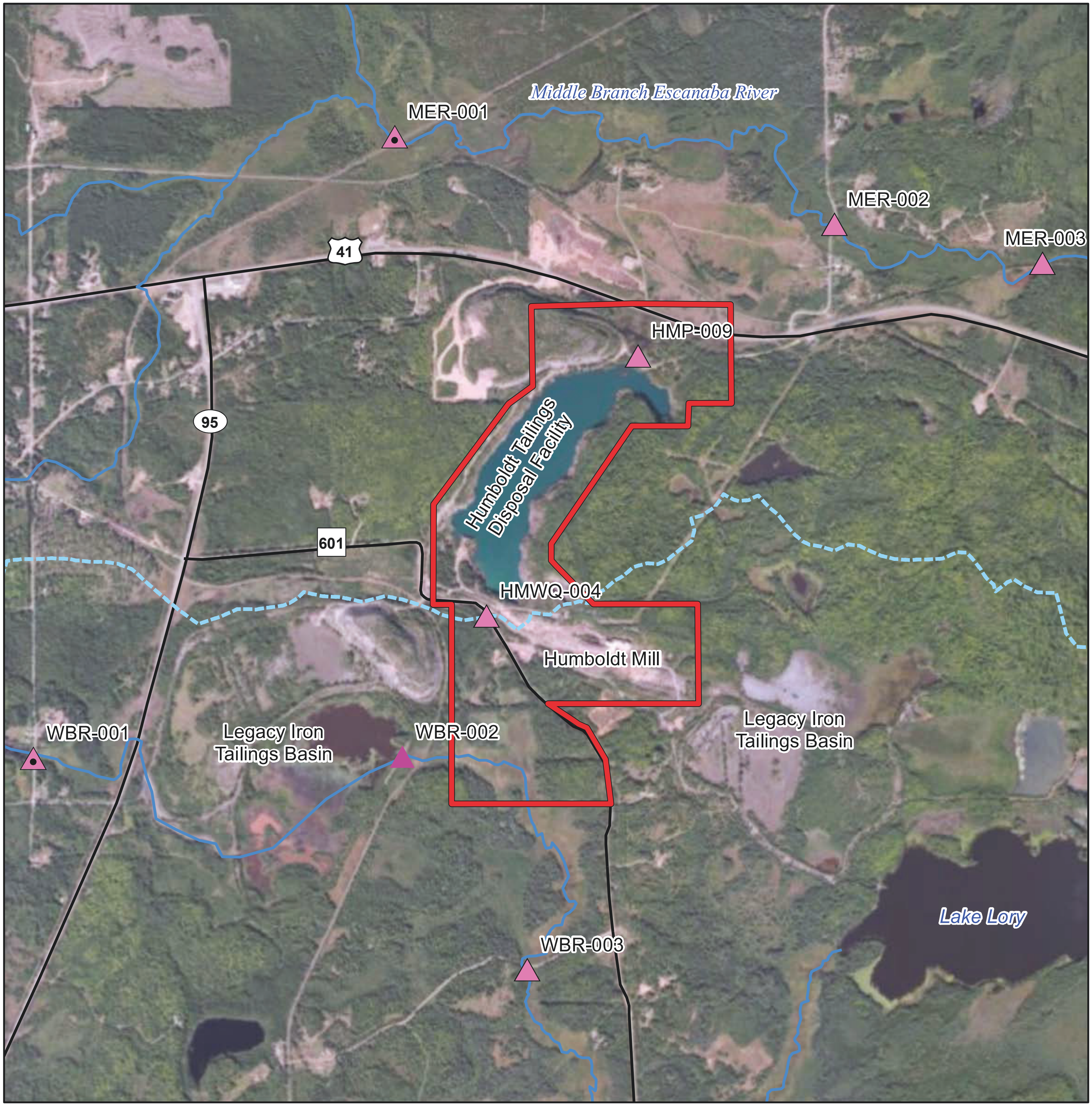
Notes:
Benchmarks are calculated based on guidance from Eagle Mine's Development of Site Specific Benchmarks for Mine Permit Water Quality Monitoring.
Results in **bold** text indicate that the parameter was detected at a level greater than the laboratory reporting limit.
Highlighted Cell = Value is equal to or above site-specific benchmark. An exceedance occurs if there are 2 consecutive sampling events with a value equal to or greater than the benchmark at a compliance monitoring location.
(p) = Due to less than two detections in baseline dataset, benchmark defaulted to four times the reporting limit.
- Denotes no benchmark required or parameter was not required to be collected during the sampling quarter.
NM = Not mesured during the sampling event.
^{T} = Sample was not filtered and all values are total concentrate.
^{D} = Sample for metals and major cation parameters was filtered and values are dissolved concentrations.

Appendix H

Humboldt Mill

Surface Water Map

HUMBOLDT MILL
PROPOSED SURFACE WATER AND SEDIMENT MONITORING LOCATIONS



Legend

- Reference Monitoring Station
- Surface Water and Sediment Monitoring Location
- Road
- River
- Watershed Boundary
- Humboldt Mill Property

Reference:

Data provided by: Eagle Mine, ESRI, and North Jackson Company

Projection & Datum: NAD 1927 UTM Zone 16N

Aerial Photo: 2010

0 2,000 4,000 Feet

1:32,000

Eagle Mine
a subsidiary of lundin mining

North Jackson Company
ENVIRONMENTAL SCIENCE & ENGINEERING

Figure 1

Appendix I

Humboldt Mill

Surface Water Results

&

Benchmark Summary Table

2020
Mine Permit Surface Water Quality Monitoring Data
Benchmark Summary Table
Humboldt Mill

Location	Location Classification	Q1	Q2	Q3	Q4
HMWQ-004	Compliance - Mill Subwatershed	NM	NM	NM	NM
HMP-009	Compliance - HTDF Subwatershed	NM	NM	pH, iron, **mercury,** TSS	NM
MER-001	Reference - HTDF Subwatershed	copper	lead, manganese, calcium		
MER-002	Compliance - HTDF Subwatershed		pH, lead, manganese, alkalinity bicarbonate, calcium	**pH**	**pH,** lead, copper
MER-003	Compliance - HTDF Subwatershed	pH, nickel, sulfate, sodium	**pH**, iron, manganese, sulfate, calcium, magnesium, **sodium**	**pH,** arsenic, nickel, **boron, sodium**, sulfate	**pH, copper**, nickel, sulfate, **sodium**
MER-004*	Monitoring - HTDF Subwatershed				
WBR-001	Reference - Mill Subwatershed	NM	**manganese**	zinc	copper, iron, **manganese**, zinc
WBR-002	Compliance - Mill Subwatershed		arsenic, iron, manganese, calcium, magnesium, potassium, hardness	**calcium**	manganese, **alkalinity bicarbonate**
WBR-003	Compliance - Mill Subwatershed	NM	**arsenic**, iron, alkalinity bicarbonate, hardness, TSS	**arsenic**, boron, **copper**, **TSS**	iron, manganese, **alkalinity bicarbonate**, calcium, magnesium, hardness

Parameters listed in this table had values reported that were equal to or greater than a site-specific benchmark. Parameters in BOLD are instances in which the Department was notified because benchmarks deviations were identified at compliance monitoring locations for two consecutive seasonal (e.g. Q1 2019 and Q1 2020) sampling events. If the location is classified as background or reference, Department notification is not required for an exceedance.
Blank data cells indicate that no benchmark deviations occurred at the location during the specified sampling quarter.
NM = Not measured during the sampling event due to insufficient water volume or frozen conditions.
* Eagle added MER-004 as a monitoring location in 2020, however it is not considered a compliance monitoring location. No benchmarks have been established due to insufficient data.

Humboldt Mill 2020
Mine Permit Surface Water Quality Monitoring Data
MER-001 (Reference - HTDF Subwatershed)

Parameter	Unit	MER-001 Seasonal Benchmarks				MER-001 2020 Quarterly Data			
		Q1	Q2	Q3	Q4				
		Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain	Q1 2020[T]	Q2 2020[D]	Q3 2020[T]	Q4 2020[T]
Field									
D.O.	ppm	-	-	-	-	**13**	**7.9**	**7.1**	**12**
ORP	mV	-	-	-	-	**245**	**73**	**212**	**154**
pH	SU	6.2-7.2	5.7-6.7	6.1-7.1	5.4-6.4	**6.7**	**6.6**	**7.0**	**6.3**
Specific Conductance	uS/cm	-	-	-	-	**67**	**135**	**125**	**83**
Temperature	C	-	-	-	-	**0.29**	**17**	**16**	**0.079**
Turbidity	NTU	-	-	-	-	**0.35**	**3.1**	**0.57**	**2.8**
Flow	cfs	-	-	-	-	**25**	**35**	-	-
Metals									
Aluminum	ug/L	-	-	200	-	-	-	<50	-
Antimony	ug/L	-	-	3.5	-	-	-	<1.0	-
Arsenic	ug/L	3.6	4.0	2.8	1.78	<1.0	1.5	**2.5**	<1.0
Barium	ug/L	-	-	11	-	-	-	**11**	-
Beryllium	ug/L	-	-	2.5	-	-	-	<1.0	-
Boron	ug/L	-	-	40	-	-	-	<10	-
Cadmium	ug/L	-	-	0.08	-	-	-	-	-
Chromium	ug/L	-	-	1.1	-	-	-	<1.0	-
Cobalt	ug/L	-	-	0.38	-	-	-	-	-
Copper	ug/L	0.62	0.98	0.68	1.6	**0.72**	**0.59**	< 0.5	**0.64**
Iron	ug/L	2413	1206	3532	2136	**1030**	**1960**	**2510**	**1290**
Lead	ug/L	0.21	0.18	0.35	0.66	**0.11**	**0.20**	**0.16**	**0.14**
Lithium	ug/L	-	-	32	-	-	-	<8.0	-
Manganese	ug/L	149	101	242	124	**51**	**170**	**202**	**84.8**
Mercury	ng/L	5.8	6.9	8.1	4.6	**2.8**	**3.02**	**2.1**	**1.52**
Molybdenum	ug/L	-	-	4	-	-	-	<1.0	-
Nickel	ug/L	1.1	0.68	1.5	0.74	**0.44**	**0.33**	**0.67**	**0.45**
Selenium	ug/L	-	-	0.13	-	-	-	-	-
Silver	ug/L	-	-	0.8	-	-	-	<0.20	-
Thallium	ug/L	-	-	1.5	-	-	-	<1.0	-
Vanadium	ug/L	-	-	4	-	-	-	<1.0	-
Zinc	ug/L	39	9.3	5.5	6.3	**1.2**	**1.9**	**1.4**	**1.6**
Major Anions									
Alkalinity, Bicarbonate	mg/L	41	26	48	24	**17**	**25**	**35**	**24**
Alkalinity, Carbonate	mg/L	8	8	8	8	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	13	8.4	16	14	**4.6**	**5.9**	**8.3**	**6.4**
Fluoride	mg/L	0.4	0.4	0.4	0.4	<0.10	<0.10	<0.10	<0.10
Nitrogen, Ammonia	mg/L	2.0	2.0	2.0	2.0	<0.025	<0.025	<0.025	0.03
Nitrogen, Nitrate	mg/L	0.17	2.0	2.0	2.0	**0.114**	< 0.10	< 0.10	<0.10
Nitrogen, Nitrite	mg/L	2.0	2.0	2.0	2.0	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	9.0	4.0	4.0	6.4	**3.3**	**3.1**	**2.5**	**3.9**
Sulfide	mg/L	20	20	20	20	<0.20	<0.20	<0.20	<0.20
Major Cations									
Calcium	mg/L	14	7.6	15	10	**6.9**	**9.2**	**14**	**7.6**
Magnesium	mg/L	3.8	2.4	4.1	3.0	**2.0**	**2.5**	**3.5**	**2.2**
Potassium	mg/L	0.93	0.69	1.1	1.4	**0.60**	**0.69**	**0.82**	**0.55**
Sodium	mg/L	6.7	5.1	8.5	6.7	**3.2**	**3.3**	**5.0**	**3.5**
General									
Hardness	mg/L	51	31	59	44	**25**	**33**	**48**	**28**
Total Dissolved Solids	mg/L	106	113	200	200	**59**	**55**	**76**	**61**
Total Suspended Solids	mg/L	3.4	7.6	13	20	<2.5	<2.5	<2.5	<2.5

Explanations of abbreviations are included on the final page of this table.

Humboldt Mill 2020
Mine Permit Surface Water Quality Monitoring Data
MER-002 (Reference HTDF Subwatershed)

Parameter	Unit	MER-002 Seasonal Benchmarks				MER-002 2020 Quarterly Data			
		Q1	Q2	Q3	Q4				
		Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain	Q1 2020[T]	Q2 2020[D]	Q3 2020[D]	Q4 2020[D]
Field									
D.O.	ppm	-	-	-	-	**13**	**7.36**	**6.93**	**12**
ORP	mV	-	-	-	-	**226**	**32**	**199**	**56**
pH	SU	6.2-7.2	5.7-6.7	5.9-6.9	5.3-6.3	**7.0**	**7.4**	**7.2**	**6.6**
Specific Conductance	uS/cm	-	-	-	-	**85**	**142**	**144**	**97**
Temperature	C	-	-	-	-	**0.43**	**15**	**16**	**0.06**
Turbidity	NTU	-	-	-	-	**0.74**	**4.3**	**8.3**	**5.4**
Flow	cfs	-	-	-	-	**41**	**42**	**-**	**-**
Metals									
Aluminum	ug/L	-	-	461	-	-	-	**68**	-
Antimony	ug/L	-	-	3.5	-	-	-	<1.0	-
Arsenic	ug/L	2.8	0.59	5.3	2.1	<1.0	**2.1**	**2.8**	**1.2**
Barium	ug/L	-	-	21	-	-	-	**11**	-
Beryllium	ug/L	-	-	2.5	-	-	-	<1.0	-
Boron	ug/L	-	-	40	-	-	-	<10	-
Cadmium	ug/L	-	-	0.08	-	-	-	-	-
Chromium	ug/L	-	-	4.0	-	-	-	<1.0	-
Cobalt	ug/L	-	-	0.4	-	-	-	-	-
Copper	ug/L	1.1	0.97	1.4	0.72	**0.73**	**0.41**	< 0.50	**0.76**
Iron	ug/L	3081	1679	6901	2831	**1270**	**2920**	**3280**	**2130**
Lead	ug/L	0.34	0.19	0.34	0.15	**0.11**	**0.23**	**0.17**	**0.19**
Lithium	ug/L	-	-	1.4	-	-	-	<8.0	-
Manganese	ug/L	212	134	628	347	**82**	**216**	**175**	**133**
Mercury	ng/L	5.1	6.6	7.5	4.3	**3.0**	**3.3**	**2.5**	**2.1**
Molybdenum	ug/L	-	-	4.0	-	-	-	<1.0	-
Nickel	ug/L	1.2	0.71	2.1	0.82	**0.50**	**0.37**	**0.79**	**0.56**
Selenium	ug/L	-	-	0.80	-	-	-	-	-
Silver	ug/L	-	-	0.80	-	-	-	<0.20	-
Thallium	ug/L	-	-	4.0	-	-	-	<1.0	-
Vanadium	ug/L	-	-	4.7	-	-	-	<1.0	-
Zinc	ug/L	6.3	7.6	2.0	5.3	**1.2**	**2.1**	**1.1**	**1.7**
Major Anions									
Alkalinity, Bicarbonate	mg/L	46	25	54	31	**21**	**27**	**38**	**27**
Alkalinity, Carbonate	mg/L	8.0	4.0	8.0	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	14	7.4	17	18	**6.6**	**7.4**	**10**	**7.9**
Fluoride	mg/L	0.40	0.40	0.40	0.40	<0.10	<0.10	<0.10	<0.10
Nitrogen, Ammonia	mg/L	2.0	2.0	2.0	2.0	< 0.025	< 0.025	< 0.025	**0.06**
Nitrogen, Nitrate	mg/L	0.52	0.21	2.0	2.0	**0.11**	< 0.10	< 0.10	**0.66**
Nitrogen, Nitrite	mg/L	2.0	2.0	2.0	2.0	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	14	7.9	16	4.0	**5.2**	**4.9**	**4.4**	**5.6**
Sulfide	mg/L	20	20	20	20	<0.20	<0.20	<0.20	<0.20
Major Cations									
Calcium	mg/L	17	9.2	18	15	**8.0**	**10**	**15**	**9.1**
Magnesium	mg/L	4.6	2.7	5.2	4.1	**2.3**	**2.8**	**3.9**	**2.7**
Potassium	mg/L	1.3	0.68	1.4	1.6	**0.69**	**0.74**	**0.97**	**0.76**
Sodium	mg/L	8.5	5.1	9.9	9.1	**4.3**	**4.2**	**6.3**	**4.8**
General									
Hardness	mg/L	60	34	70	53	**30**	**37**	**53**	**34**
Total Dissolved Solids	mg/L	210	104	200	200	**57**	**62**	**82**	**64**
Total Suspended Solids	mg/L	5.6	7.8	21	123	<2.6	**3.0**	**3.0**	**5.0**

Humboldt Mill 2020
Mine Permit Surface Water Quality Monitoring Data
MER-003 (Compliance - HTDF Subwatershed)

Parameter	Unit	MER-003 Seasonal Benchmarks				MER-003 2020 Quarterly Data			
		Q1	Q2	Q3	Q4				
		Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain	Q1 2020[T]	Q2 2020[D]	Q3 2020[D]	Q4 2020[T]
Field									
D.O.	ppm	-	-	-	-	**13**	**7.6**	**7.3**	**12**
ORP	mV	-	-	-	-	**220**	**34**	**200**	**42**
pH	SU	6.3-7.3	5.6-6.6	5.7-6.7	5.4-6.4	**6.9**	**6.8**	**7.1**	**6.6**
Specific Conductance	uS/cm	-	-	-	-	**128**	**195**	**220**	**201**
Temperature	C	-	-	-	-	**0.93**	**16**	**17**	**0.51**
Turbidity	NTU	-	-	-	-	**1.2**	**4.4**	**6.9**	**3.6**
Flow	cfs	-	-	-	-	**33**	**41**	-	-
Metals									
Aluminum	ug/L	-	-	200	-	-	-	<50	-
Antimony	ug/L	-	-	3.5	-	-	-	<1.0	-
Arsenic	ug/L	2.6	1.8	2.6	2.7	<1.0	**1.8**	**2.7**	**1.0**
Barium	ug/L	-	-	15	-	-	-	**11**	-
Beryllium	ug/L	-	-	2.5	-	-	-	<1.0	-
Boron	ug/L	-	-	18	-	-	-	**87**	-
Cadmium	ug/L	-	-	0.08	-	-	-	-	-
Chromium	ug/L	-	-	4.0	-	-	-	<1.0	-
Cobalt	ug/L	-	-	0.4	-	-	-	-	-
Copper	ug/L	2.9	0.97	0.65	0.67	<0.40	**0.93**	< 0.50	**0.79**
Iron	ug/L	3007	1873	3749	3493	**1390**	**2820**	**2850**	**1750**
Lead	ug/L	0.35	0.24	0.18	1.9	**0.12**	**0.21**	**0.13**	**0.13**
Lithium	ug/L	-	-	32	-	-	-	<8.0	-
Manganese	ug/L	223	157	273	326	**141**	**257**	**195**	**167**
Mercury	ng/L	5.2	6.7	7.2	7.0	**2.8**	**3.0**	**2.5**	**1.7**
Molybdenum	ug/L	-	-	4.0	-	-	-	<1.0	-
Nickel	ug/L	1.5	1.2	1.8	1.5	**1.9**	**1.6**	**2.2**	**2.1**
Selenium	ug/L	-	-	0.28	-	-	-	-	-
Silver	ug/L	-	-	0.80	-	-	-	**<0.20**	-
Thallium	ug/L	-	-	1.5	-	-	-	<1.0	-
Vanadium	ug/L	-	-	4.0	-	-	-	<1.0	-
Zinc	ug/L	7.5	8.5	2.7	13	**1.4**	**1.9**	**1.5**	**2.0**
Major Anions									
Alkalinity, Bicarbonate	mg/L	50	31	58	33	**23**	**29**	**40**	**32**
Alkalinity, Carbonate	mg/L	8.0	8.0	8.0	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	15	11	23	21	**9.7**	**9.8**	**13**	**13**
Fluoride	mg/L	0.20	0.50	0.40	0.40	<0.10	<0.10	<1.0	<0.10
Nitrogen, Ammonia	mg/L	2.0	2.0	2.0	2.0	< 0.025	< 0.025	**0.08**	**0.16**
Nitrogen, Nitrate	mg/L	0.2	2.0	2.0	2.0	**0.11**	< 0.10	< 0.10	<0.10
Nitrogen, Nitrite	mg/L	2.0	2.0	2.0	2.0	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	17	15	21	26	**18**	**15**	**27**	**35**
Sulfide	mg/L	20	20	20	20	<0.20	<0.20	<0.20	<0.20
Major Cations									
Calcium	mg/L	17	11	18	13	**9.3**	**11**	**16**	**10**
Magnesium	mg/L	4.7	3.3	5.8	4.2	**3.0**	**3.5**	**4.8**	**3.5**
Potassium	mg/L	1.3	0.94	1.7	1.7	**1.0**	**1.0**	**1.5**	**1.3**
Sodium	mg/L	8.8	7.4	12	9.3	**10**	**10**	**16.8**	**21**
General									
Hardness	mg/L	63	38	78	57	**36**	**43**	**60**	**40**
Total Dissolved Solids	mg/L	134	54	200	200	**34**	**74**	**126**	**115**
Total Suspended Solids	mg/L	4.0	9.8	13	20	<2.5	**3.0**	<2.5	<2.5

Explanations of abbreviations are included on the final page of this table.

Humboldt Mill 2020
Mine Permit Surface Water Quality Monitoring Data
MER-004 (Monitoring - HTDF Subwatershed)

Parameter	Unit	MER-004 Seasonal Benchmark*	MER-004 2020 Quarterly Benchmark			
			Q1 2020[T]	Q2 2020[D]	Q3 2020[D]	Q4 2020[D]
Field						
D.O.	ppm	-	**13**	**7.5**	**7.7**	**13**
ORP	mV	-	**231**	**58**	**220**	**46**
pH	SU	-	**6.0**	**6.7**	**7.3**	**6.6**
Specific Conductance	uS/m	-	**130**	**58**	**216**	**198**
Temperature	C	-	**0.98**	**16**	**17**	**0.42**
Turbidity	NTU	-	**1.1**	**4.3**	**7.2**	**7.0**
Flow	cfs	-	-	**35**	-	-
Metals						
Aluminum	ug/L	-	-	-	<50	-
Antimony	ug/L	-	-	-	<1.0	-
Arsenic	ug/L	-	<1.0	**2.0**	**2.6**	**1.1**
Barium	ug/L	-	-	-	**11**	-
Beryllium	ug/L	-	-	-	<1.0	-
Boron	ug/L	-	-	-	**86**	-
Cadmium	ug/L	-	-	-	-	-
Chromium	ug/L	-	-	-	<1.0	-
Cobalt	ug/L	-	-	-	-	-
Copper	ug/L	-	**0.79**	**0.40**	**0.41**	**0.80**
Iron	ug/L	-	**1260**	**2700**	**2790**	**1850**
Lead	ug/L	-	**0.11**	**0.22**	**0.15**	**0.17**
Lithium	ug/L	-	-	-	<8.0	-
Manganese	ug/L	-	**142**	**259**	**205**	**175**
Mercury	ng/L	-	**2.9**	**3.0**	**2.5**	**2.2**
Molybdenum	ug/L	-	-	-	<1.0	-
Nickel	ug/L	-	**1.9**	**1.6**	**2.2**	**2.1**
Selenium	ug/L	-	-	-	-	-
Silver	ug/L	-	-	-	<0.20	-
Thallium	ug/L	-	-	-	<1.0	-
Vanadium	ug/L	-	-	-	<1.0	-
Zinc	ug/L	-	**1.2**	**1.9**	**1.3**	**1.7**
Major Anions						
Alkalinity, Bicarbonate	mg/L	-	**23**	**28**	**41**	**31**
Alkalinity, Carbonate	mg/L	-	< 2.0	<2.0	<2.0	<2.0
Chloride	mg/L	-	**9.6**	**9.3**	**12**	**12**
Fluoride	mg/L	-	< 0.10	<0.10	<1.0	<0.10
Nitrogen, Ammonia	mg/L	-	< 0.025	< 0.025	**0.07**	**0.14**
Nitrogen, Nitrate	mg/L	-	**0.044**	< 0.10	< 0.10	<0.10
Nitrogen, Nitrite	mg/L	-	< 0.10	< 0.10	< 0.10	<0.10
Sulfate	mg/L	-	**18**	**16**	**27**	**36**
Sulfide	mg/L	-	< 0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	-	**9.4**	**11**	**16**	**10**
Magnesium	mg/L	-	**3.1**	**3.5**	**4.7**	**3.5**
Potassium	mg/L	-	**1.1**	**1.1**	**1.5**	**1.3**
Sodium	mg/L	-	**10**	**9.2**	**16**	**20**
General						
Hardness	mg/L	-	**36**	**42**	**59**	**40**
Total Dissolved Solids	mg/L	-	**48**	**69**	**115**	**119**
Total Suspended Solids	mg/L	-	< 2.5	**2.5**	<2.5	**5.0**

*Seasonal benchmarks are not calculated for this location due to insufficient data available.

Humboldt Mill 2020
Mine Permit Surface Water Quality Monitoring Data
WBR-001 (Reference Mill Subwatershed)

Parameter	Unit	WBR-001 Seasonal Benchmarks				WBR-001 2020 Quarterly Data			
		Q1	Q2	Q3	Q4				
		Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain	Q1 2020	Q2 2020[T]	Q3 2020[D]	Q4 2020[T]
Field									
D.O.	ppm	-	-	-	-	NM	**5.0**	**4.9**	**9.1**
ORP	mV	-	-	-	-	NM	**142**	**165**	**231**
pH	SU	4.97-5.97	4.7-5.7	5.7-6.7	4.6-5.6	NM	**5.4**	**6.1**	**5.6**
Specific Conductance	uS/cm	-	-	-	-	NM	**145**	**110**	**64**
Temperature	C	-	-	-	-	NM	**14**	**16**	**0.57**
Turbidity	NTU	-	-	-	-	NM	**1.9**	**7.1**	**2.2**
Flow	cfs	-	-	-	-	-	-	-	-
Metals									
Aluminum	ug/L	-	-	200	-	NM	-	**216**	-
Antimony	ug/L	-	-	3.5	-	NM	-	<1.0	-
Arsenic	ug/L	6.6	1.8	3.2	1.5	NM	**1.9**	**2.5**	**1.2**
Barium	ug/L	-	-	17	-	NM	-	**13**	-
Beryllium	ug/L	-	-	2.5	-	NM	-	<1.0	-
Boron	ug/L	-	-	40	-	NM	-	<10.0	-
Cadmium	ug/L	-	-	0.08	-	NM	-	-	-
Chromium	ug/L	-	-	1.6	-	NM	-	<1.0	-
Cobalt	ug/L	-	-	0.4	-	NM	-	-	-
Copper	ug/L	3.3	1.1	1.4	0.66	NM	< 1.0	**0.46**	**0.80**
Iron	ug/L	11518	1759	4873	1900	NM	**2340**	**3140**	**2020**
Lead	ug/L	4.3	1.1	2.3	1.3	NM	**1.0**	**0.68**	**1.2**
Lithium	ug/L	-	-	32	-	NM	-	<8.0	-
Manganese	ug/L	363	106	770	122	NM	**218**	**592**	**199**
Mercury	ng/L	15	11	16	11	NM	**3.1**	**2.7**	**3.0**
Molybdenum	ug/L	-	-	4	-	NM	-	<1.0	-
Nickel	ug/L	3.1	0.97	3.0	0.98	NM	**0.46**	**1.1**	**0.65**
Selenium	ug/L	-	-	0.28	-	NM	-	-	-
Silver	ug/L	-	-	0.8	-	NM	-	<0.20	-
Thallium	ug/L	-	-	1.5	-	NM	-	<1.0	-
Vanadium	ug/L	-	-	1.7	-	NM	-	<1.0	-
Zinc	ug/L	16	12	13	8.2	NM	**6.1**	**18**	**13**
Major Anions									
Alkalinity, Bicarbonate	mg/L	9	5	16	6	NM	**4.2**	**8.4**	**4.0**
Alkalinity, Carbonate	mg/L	8.0	8.0	8.0	8.0	NM	<2.0	<2.0	<2.0
Chloride	mg/L	24	25	28	23	NM	**20**	**17**	**10**
Fluoride	mg/L	0.40	0.40	0.40	0.40	NM	<0.10	<0.10	<0.10
Nitrogen, Ammonia	mg/L	2.0	2.0	2.0	2.0	NM	< 0.025	**0.18**	**0.08**
Nitrogen, Nitrate	mg/L	0.24	2.0	2.0	2.0	NM	< 0.10	< 0.10	<0.10
Nitrogen, Nitrite	mg/L	2.0	2.0	2.0	2.0	NM	< 0.10	< 0.10	<0.10
Sulfate	mg/L	11	4.0	4.0	4.0	NM	<1.0	<1.0	**1.1**
Sulfide	mg/L	20	20	20	20	NM	<0.20	<0.20	<0.20
Major Cations									
Calcium	mg/L	7.6	4.8	7.9	5.6	NM	**4.6**	**6.2**	**3.4**
Magnesium	mg/L	3.0	1.9	3.1	2.5	NM	**1.7**	**2.3**	**1.3**
Potassium	mg/L	2.7	0.94	1.6	1.6	NM	**0.84**	**1.1**	**0.79**
Sodium	mg/L	11	12	13	11	NM	**10**	**10**	**6.0**
General									
Hardness	mg/L	37	21	39	39	NM	**19**	**25**	**14**
Total Dissolved Solids	mg/L	211	211	200	200	NM	**84**	**128**	**90**
Total Suspended Solids	mg/L	55	13	13	13	NM	<5.3	**5.0**	**7.0**

Humboldt Mill 2020
Mine Permit Surface Water Quality Monitoring Data
WBR-002 (Compliance - Mill Subwatershed)

Parameter	Unit	WBR-002 Seasonal Benchmarks				WBR-002 2020 Quarterly Data			
		Q1	Q2	Q3	Q4				
		Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain	Q1 2020[D]	Q2 2020[D]	Q3 2020[D]	Q4 2020[T]
Field									
D.O.	ppm	-	-	-	-	**5.9**	**2.7**	**7.1**	**6.4**
ORP	mV	-	-	-	-	**139**	**-14**	**87**	**186**
pH	SU	5.9-6.9	6.04-6.94	6.2-7.2	5.4-6.4	**6.1**	**6.2**	**6.7**	**5.9**
Specific Conductance	uS/cm	-	-	-	-	**231**	**258**	**215**	**172**
Temperature	C	-	-	-	-	**0.63**	**15**	**20**	**1.4**
Turbidity	NTU	-	-	-	-	**13**	**5.0**	**15**	**20**
Flow	cfs	-	-	-	-	**1.0**	-	-	-
Metals									
Aluminum	ug/L	-	-	200	-	-	-	<50	-
Antimony	ug/L	-	-	3.5	-	-	-	<1.0	-
Arsenic	ug/L	7.1	3.0	7.2	4.6	**5.8**	**8.1**	**3.7**	**4.0**
Barium	ug/L	-	-	16	-	-	-	**11**	-
Beryllium	ug/L	-	-	2.5	-	-	-	<1.0	-
Boron	ug/L	-	-	18	-	-	-	**14**	-
Cadmium	ug/L	-	-	0.08	-	-	-	-	-
Chromium	ug/L	-	-	4.0	-	-	-	<1.0	-
Cobalt	ug/L	-	-	0.69	-	-	-	-	-
Copper	ug/L	1.4	2.5	1.9	2.0	-	< 1.0	< 0.5	**0.90**
Iron	ug/L	16421	4819	12928	9123	**13900**	**8490**	**5500**	**7860**
Lead	ug/L	0.44	0.55	0.49	0.61	-	**0.20**	**0.07**	**0.27**
Lithium	ug/L	-	-	32	-	-	-	<8.0	-
Manganese	ug/L	1550	262	709	458	**789**	**1180**	**316**	**603**
Mercury	ng/L	4.5	3.6	3.0	4.7	**1.2**	**1.2**	<0.50	**1.3**
Molybdenum	ug/L	-	-	4.0	-	-	-	<1.0	-
Nickel	ug/L	3.3	2.5	2.6	3.2		**0.96**	**0.84**	**1.4**
Selenium	ug/L	-	-	0.28	-	-	-	-	-
Silver	ug/L	-	-	0.80	-	-	-	<0.20	-
Thallium	ug/L	-	-	1.5	-	-	-	<1.0	-
Vanadium	ug/L	-	-	4.0	-	-	-	<1.0	-
Zinc	ug/L	20	25	2.5	4.8		**1.6**	**1.3**	**3.1**
Major Anions									
Alkalinity, Bicarbonate	mg/L	105	18	38	20	**28**	**30**	**31**	**25**
Alkalinity, Carbonate	mg/L	8.0	8.0	8.0	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	60	42	48	59	**40**	**34**	**33**	**31**
Fluoride	mg/L	0.29	0.40	0.40	0.40	<0.10	<0.10	<0.10	<0.10
Nitrogen, Ammonia	mg/L	2.0	2.0	2.0	2.0	<0.025	<0.025	<0.025	**0.06**
Nitrogen, Nitrate	mg/L	2.0	2.0	2.0	2.0	<0.10	<0.10	<0.10	<0.10
Nitrogen, Nitrite	mg/L	2.0	2.0	2.0	2.0	<0.10	<0.10	<0.10	<0.10
Sulfate	mg/L	10	9.1	4.0	4.0	**2.2**	**1.9**	<1.0	**2.5**
Sulfide	mg/L	20	20	20	20	<0.20	<0.20	<0.20	<0.20
Major Cations									
Calcium	mg/L	13	7.0	9.7	9.8	**8.9**	**9.4**	**9.8**	**7.4**
Magnesium	mg/L	5.9	3.5	4.5	5.1	**4.4**	**3.8**	**4.2**	**3.4**
Potassium	mg/L	2.6	2.0	1.4	2.1	**1.8**	**2.2**	**1.4**	**1.6**
Sodium	mg/L	28	22	25	27	**24**	**18**	**22**	**18**
General									
Hardness	mg/L	57	33	46	44	**41**	**39.0**	**42**	**33**
Total Dissolved Solids	mg/L	170	278	200	200	**96**	**101**	**114**	**138**
Total Suspended Solids	mg/L	13	13	32	16	<25	**10**	**6**	**5**

Humboldt Mill 2020
Mine Permit Surface Water Quality Monitoring Data
WBR-003 (Compliance - Mill Subwatershed)

Parameter	Unit	WBR-003 Seasonal Benchmarks				WBR-003 2020 Quarterly Data			
		Q1	Q2	Q3	Q4				
		Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain	Q1 2020	Q2 2020[D]	Q3 2020[D]	Q4 2020[D]
Field									
D.O.	ppm	-	-	-	-	NM	**1.4**	**2.5**	**4.6**
ORP	mV	-	-	-	-	NM	**-32**	**-12**	**196**
pH	SU	5.8-6.8	5.8-6.8	6.2-7.2	4.9-5.9	NM	**6.4**	**6.2**	**5.9**
Specific Conductance	uS/m	-	-	-	-	NM	**219**	**223**	**171**
Temperature	C	-	-	-	-	NM	**16**	**17**	**0.11**
Turbidity	NTU	-	-	-	-	NM	**15**	**42**	**37**
Flow	cfs	-	-	-	-	-	-	-	-
Metals									
Aluminum	ug/L	-	-	200	-	NM	-	**138**	-
Antimony	ug/L	-	-	3.5	-	NM	-	<1.0	-
Arsenic	ug/L	4.0	1.7	6.3	2.1	NM	**4.7**	**6.5**	**2.1**
Barium	ug/L	-	-	27	-	NM	-	**20**	-
Beryllium	ug/L	-	-	2.5	-	NM	-	<1.0	-
Boron	ug/L	-	-	13	-	NM	-	**14**	-
Cadmium	ug/L	-	-	0.08	-	NM	-	-	-
Chromium	ug/L	-	-	4.0	-	NM	-	<1.0	-
Cobalt	ug/L	-	-	2.6	-	NM	-	-	-
Copper	ug/L	0.67	0.74	0.20	1.1	NM	< 1.0	**0.88**	**0.83**
Iron	ug/L	12988	5033	19898	4248	NM	**8630**	**16500**	**5320**
Lead	ug/L	0.40	0.26	0.29	0.28	NM	**0.23**	**0.25**	**0.20**
Lithium	ug/L	-	-	32	-	NM	-	<8.0	-
Manganese	ug/L	2261	374	2794	235	NM	**757**	**939**	**266**
Mercury	ng/L	6.1	3.4	5.7	6.9	NM	**1.3**	**2.1**	**1.1**
Molybdenum	ug/L	-	-	4.0	-	NM	-	<1.0	-
Nickel	ug/L	3.5	1.8	2.4	1.7	NM	**0.7**	**1.2**	**1.2**
Selenium	ug/L	-	-	0.28	-	NM	-	-	-
Silver	ug/L	-	-	0.80	-	NM	-	<0.20	-
Thallium	ug/L	-	-	1.5	-	NM	-	<1.0	-
Vanadium	ug/L	-	-	4.0	-	NM	-	<1.0	-
Zinc	ug/L	17	15	4.5	18	NM	**2.5**	**2.4**	**2.0**
Major Anions									
Alkalinity, Bicarbonate	mg/L	51	34	88	22	NM	**35**	**47**	**33**
Alkalinity, Carbonate	mg/L	8.0	8.0	8.0	8.0	NM	<2.0	<2.0	<2.0
Chloride	mg/L	43	32	42	37	NM	**21**	**23**	**27**
Fluoride	mg/L	0.30	0.34	0.19	0.40	NM	<0.10	**0.11**	<0.10
Nitrogen, Ammonia	mg/L	2.0	2.0	2.0	2.0	NM	**0.07**	**0.11**	**0.06**
Nitrogen, Nitrate	mg/L	0.26	2.0	2.0	2.0	NM	<0.10	<0.10	<0.10
Nitrogen, Nitrite	mg/L	2.0	2.0	2.0	2.0	NM	<0.10	<0.10	<0.10
Sulfate	mg/L	17	20	4.0	4.0	NM	<1.0	<1.0	**3.0**
Sulfide	mg/L	20	20	20	20	NM	<0.20	<0.20	<0.20
Major Cations									
Calcium	mg/L	15	11	24	8.4	NM	**10**	**14**	**9.0**
Magnesium	mg/L	6.1	4.5	9.6	3.9	NM	**4.2**	**5.5**	**4.0**
Potassium	mg/L	2.2	1.7	2.3	2.7	NM	**1.2**	**1.1**	**1.3**
Sodium	mg/L	19.9	15.1	21.5	19.7	NM	**12**	**16**	**15**
General									
Hardness	mg/L	64	43	109	36	NM	**43**	**59**	**39**
Total Dissolved Solids	mg/L	177	120	200	200	NM	**102**	**125**	**113**
Total Suspended Solids	mg/L	19	9.8	27	13	NM	**15**	**33**	<2.5

Explanations of abbreviations are included on the final page of this table.

Humboldt Mill 2020
Mine Permit Surface Water Quality Monitoring Data
HMWQ-004 (Compliance - Mill Subwatershed)

Parameter	Unit	HMWQ-004 Seasonal Benchmark*	HMWQ-004 2020 Quarterly Data			
			Q1 2020	Q2 2020	Q3 2020	Q4 2020
Field						
D.O.	ppm	-	NM	NM	NM	NM
ORP	mV	-	NM	NM	NM	NM
pH	SU	5.69-6.69	NM	NM	NM	NM
Specific Conductance	uS/m	-	NM	NM	NM	NM
Temperature	C	-	NM	NM	NM	NM
Turbidity	NTU	-	NM	NM	NM	NM
Flow	cfs	-	-	-	-	-
Metals						
Aluminum	ug/L	200 (p)	NM	NM	NM	NM
Antimony	ug/L	2.3	NM	NM	NM	NM
Arsenic	ug/L	35	NM	NM	NM	NM
Barium	ug/L	118	NM	NM	NM	NM
Beryllium	ug/L	4.0 (p)	NM	NM	NM	NM
Boron	ug/L	36	NM	NM	NM	NM
Cadmium	ug/L	0.10	NM	NM	NM	NM
Chromium	ug/L	14	NM	NM	NM	NM
Cobalt	ug/L	3.0	NM	NM	NM	NM
Copper	ug/L	11	NM	NM	NM	NM
Iron	ug/L	73409	NM	NM	NM	NM
Lead	ug/L	2.1	NM	NM	NM	NM
Lithium	ug/L	16	NM	NM	NM	NM
Manganese	ug/L	2541	NM	NM	NM	NM
Mercury	ng/L	43	NM	NM	NM	NM
Molybdenum	ug/L	4.7	NM	NM	NM	NM
Nickel	ug/L	5.6	NM	NM	NM	NM
Selenium	ug/L	0.44	NM	NM	NM	NM
Silver	ug/L	0.35	NM	NM	NM	NM
Thallium	ug/L	4.0 (p)	NM	NM	NM	NM
Vanadium	ug/L	39	NM	NM	NM	NM
Zinc	ug/L	44	NM	NM	NM	NM
Major Anions						
Alkalinity, Bicarbonate	mg/L	68	NM	NM	NM	NM
Alkalinity, Carbonate	mg/L	8.0 (p)	NM	NM	NM	NM
Chloride	mg/L	68	NM	NM	NM	NM
Fluoride	mg/L	0.23	NM	NM	NM	NM
Nitrogen, Ammonia	mg/L	1.9	NM	NM	NM	NM
Nitrogen, Nitrate	mg/L	2.0 (p)	NM	NM	NM	NM
Nitrogen, Nitrite	mg/L	2.0 (p)	NM	NM	NM	NM
Sulfate	mg/L	4.0 (p)	NM	NM	NM	NM
Sulfide	mg/L	20 (p)	NM	NM	NM	NM
Major Cations						
Calcium	mg/L	21	NM	NM	NM	NM
Magnesium	mg/L	8.1	NM	NM	NM	NM
Potassium	mg/L	3.3	NM	NM	NM	NM
Sodium	mg/L	49	NM	NM	NM	NM
General						
Hardness	mg/L	88	NM	NM	NM	NM
Total Dissolved Solids	mg/L	209	NM	NM	NM	NM
Total Suspended Solids	mg/L	353	NM	NM	NM	NM

*Seasonal benchmarks are not calculated for this location due to insufficient data available.

Humbold Mill 2020
Mine Permit Surface Water Quality Monitoring Data HMP-009
(Compliance - HTDF Subwatershed - Wetland EE)

Parameter	Unit	HMP-009 Seasonal Benchmark*	HMP-009 2020 Quarterly Benchmark			
			Q1 2020	Q2 2020	Q3 2020[D]	Q4 2020
Field						
D.O.	ppm	-	NM	NM	**5.8**	NM
ORP	mV	-	NM	NM	**171**	NM
pH	SU	6.6-7.6	NM	NM	**6.4**	NM
Specific Conductance	uS/m	-	NM	NM	**445**	NM
Temperature	C	-	NM	NM	**16**	NM
Turbidity	NTU	-	NM	NM	**5.2**	NM
Flow	cfs	-	NM	NM	-	NM
Elevation	ft MSL	-	NM	1535.38	1534.14	1534.36
Metals						
Aluminum	ug/L	-	NM	NM	<50	NM
Antimony	ug/L	-	NM	NM	**2.9**	NM
Arsenic	ug/L	6.0	NM	NM	**1.4**	NM
Barium	ug/L	-	NM	NM	**23**	NM
Beryllium	ug/L	-	NM	NM	<1.0	NM
Boron	ug/L	-	NM	NM	**128**	NM
Cadmium	ug/L	-	NM	NM	-	NM
Chromium	ug/L	-	NM	NM	<1.0	NM
Cobalt	ug/L	-	NM	NM	-	NM
Copper	ug/L	1300	NM	NM	-	NM
Iron	ug/L	1759	NM	NM	**3480**	NM
Lead	ug/L	6.4	NM	NM	-	NM
Lithium	ug/L	-	NM	NM	<8.0	NM
Manganese	ug/L	856	NM	NM	**15**	NM
Mercury	ng/L	1.2	NM	NM	**3.6**	NM
Molybdenum	ug/L	-	NM	NM	**4.4**	NM
Nickel	ug/L	172	NM	NM	-	NM
Selenium	ug/L	-	NM	NM	-	NM
Silver	ug/L	-	NM	NM	<0.20	NM
Thallium	ug/L	-	NM	NM	<1.0	NM
Vanadium	ug/L	-	NM	NM	<1.0	NM
Zinc	ug/L	64	NM	NM	-	NM
Major Anions						
Alkalinity, Bicarbonate	mg/L	101	NM	NM	**59**	NM
Alkalinity, Carbonate	mg/L	8	NM	NM	<2.0	NM
Chloride	mg/L	37	NM	NM	**10**	NM
Fluoride	mg/L	2.7	NM	NM	<0.10	NM
Nitrogen, Ammonia	mg/L	2.0	NM	NM	**0.06**	NM
Nitrogen, Nitrate	mg/L	0.16	NM	NM	<0.10	NM
Nitrogen, Nitrite	mg/L	2.0	NM	NM	<0.10	NM
Sulfate	mg/L	207	NM	NM	**0.12**	NM
Sulfide	mg/L	20	NM	NM	<0.20	NM
Major Cations						
Calcium	mg/L	77	NM	NM	**45**	NM
Magnesium	mg/L	66	NM	NM	**15**	NM
Potassium	mg/L	87	NM	NM	**1.8**	NM
Sodium	mg/L	37	NM	NM	**15**	NM
General						
Hardness	mg/L	342	NM	NM	**17**	NM
Total Dissolved Solids	mg/L	529	NM	NM	**260**	NM
Total Suspended Solids	mg/L	13	NM	NM	**15**	NM

*Seasonal benchmarks are not calculated for this location due to insufficient data available.

Humbold Mill 2020
Mine Permit Surface Water Quality Monitoring Data
Abbreviations and Data Qualifiers

Notes:
Benchmarks are calculated based on guidance from Eagles Mine's Development of Site Specific Benchmarks for Mine Permit Water Quality Monitoring.
Results in **bold** text indicate that the parameter was detected at a level greater than the laboratory reporting limit.
Highlighted Cell = Value is equal to or above site-specific benchmark. An exceedance occurs if there are 2 consecutive sampling events with a value equal to or greater than the benchmark at a compliance monitoring location.
(p) = Due to less than two detections in baseline dataset, benchmark defaulted to four times the reporting limit.
--Denotes no benchmark required or parameter was not required to be collected during the sampling quarter.
e = estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.
NM = Not measured.

Appendix J

Humboldt Mill

Surface Water Trend Analysis Summary

2020
Surface Water Trend Analysis
Humboldt Mill

Location	Parameter	Number of Samples	Number of Detects	Percent Detected	Number of Outlier RLs	Minimum	Maximum	Mean	Median	Standard Deviation	Coefficient of Variation	M-K Test Value (S)	Approximate p-value	Trend at 95% Confidence	Theil-Sen Slope	Theil-Sen Slope, yearly
HMP-009	Alkalinity, Bicarbonate	8	8	100%	0	89	123	98.21	94.85	10.95	0.112	**-17**	**0.023**	NEGATIVE	-0.00374	-1.37
HMP-009	Calcium	8	8	100%	0	45	55000	25589	24284	27368	1.07	**-17**	**0.023**	NEGATIVE	-17.93	-6548.93
HMP-009	Chloride	8	8	100%	0	10.6	29	15.6	12	6.739	0.432	**21**	**0.005**	POSITIVE	0.00427	1.56
HMP-009	Hardness	8	8	100%	0	192	240	217.3	218	16.19	0.0745	-6	0.268	no trend	-0.00538	-1.97
HMP-009	Iron	9	9	100%	0	83	18000	3541	237	6472	1.828	10	0.174	no trend	0.632	230.84
HMP-009	Magnesium	9	9	100%	0	20	25000	12319	8700	11279	0.916	**-22**	**0.014**	NEGATIVE	-7.635	-2788.68
HMP-009	Manganese	9	9	100%	0	23	590	163.2	71.1	200.3	1.227	8	0.233	no trend	0.0832	30.39
HMP-009	pH	9	9	100%	0	6.58	8.12	7.304	7.17	0.494	0.0676	-12	0.126	no trend	-0.0001919	-0.07
HMP-009	Potassium	8	8	100%	0	6.7	8700	4152	3919	4438	1.069	-14	0.054	no trend	-2.935	-1072.01
HMP-009	Sodium	8	8	100%	0	10.6	33	15.48	13.15	7.277	0.47	9	0.159	no trend	0.00106	0.39
HMP-009	Sulfate	8	8	100%	0	118	180	133.4	130	19.56	0.147	11	0.101	no trend	0.00473	1.73
MER-001	Alkalinity, Bicarbonate	29	29	100%	0	6.7	45.5	23.06	22	9.831	0.426	-40	0.232	no trend	-0.0018	-0.66
MER-001	Calcium	29	29	100%	0	4.28	15.1	7.927	6.9	2.794	0.352	-77	0.077	no trend	-0.0005344	-0.20
MER-001	Chloride	28	28	100%	1	2.3	15	7.061	6.75	3.042	0.431	-77	0.067	no trend	-0.0008979	-0.33
MER-001	Hardness	29	29	100%	0	15.6	55000	6729	36	13395	1.991	**172**	**0.001**	POSITIVE	0.0214	7.82
MER-001	Iron	29	29	100%	0	380	3300	1436	1200	651.9	0.454	-65	0.115	no trend	-0.144	-52.60
MER-001	Magnesium	29	29	100%	0	1.2	4.2	2.26	2.2	0.728	0.322	-69	0.100	no trend	-0.0001393	-0.05
MER-001	Manganese	29	29	100%	0	12.5	1900	152.4	81	339	2.224	-11	0.426	no trend	-0.00146	-0.53
MER-001	pH	20	20	100%	0	5.22	7.19	6.415	6.4	0.532	0.0829	-13	0.348	no trend	-0.00007477	-0.03
MER-001	Potassium	29	26	90%	0	0.5	1.2	0.673	0.61	0.177	0.264	12	0.418	no trend	0	0.00
MER-001	Sodium	29	29	100%	0	1.16	7.9	3.821	3.6	1.558	0.408	-73	0.088	no trend	-0.0003275	-0.12
MER-001	Sulfate	29	13	45%	3											
MER-002	Alkalinity, Bicarbonate	28	28	100%	0	8.9	51.4	25.55	24.5	11.15	0.436	-36	0.244	no trend	-0.00108	-0.39
MER-002	Calcium	28	28	100%	0	3.79	17.7	9.253	8.65	3.576	0.387	-58	0.130	no trend	-0.0006332	-0.23
MER-002	Chloride	28	28	100%	1	4	16	8.186	7	3.253	0.397	-55	0.143	no trend	-0.0004208	-0.15
MER-002	Hardness	29	29	100%	0	13.9	64400	7661	38	15377	2.007	**155**	**0.002**	POSITIVE	0.0262	9.57
MER-002	Iron	28	28	100%	0	337	6400	1925	1600	1148	0.596	-60	0.122	no trend	-0.153	-55.88
MER-002	Magnesium	28	28	100%	0	1.09	4.9	2.651	2.4	0.961	0.362	-48	0.176	no trend	-0.0001256	-0.05
MER-002	Manganese	28	28	100%	0	10.9	580	144.7	131.5	104.2	0.72	-28	0.297	no trend	-0.00678	-2.48
MER-002	pH	21	21	100%	0	5.41	7.2	6.384	6.39	0.535	0.0838	24	0.244	no trend	0.00016598	0.06
MER-002	Potassium	28	28	100%	0	0.5	1.2	0.768	0.695	0.233	0.303	29	0.290	no trend	0.000012842	0.00
MER-002	Sodium	28	28	100%	0	1.74	9.6	4.965	4.35	1.906	0.384	-28	0.297	no trend	-0.0001514	-0.06
MER-002	Sulfate	29	20	69%	1	1	13.1	5.664	5.3	3.977	0.702	-11	0.421	no trend	0	0.00
MER-003	Alkalinity, Bicarbonate	29	29	100%	0	6.7	105	29.43	25	18.42	0.626	-15	0.396	no trend	-0.0004298	-0.16
MER-003	Calcium	29	29	100%	0	4.27	16.7	9.537	9.3	3.431	0.36	-55	0.155	no trend	-0.0006814	-0.25
MER-003	Chloride	28	28	100%	1	4.5	20	10.13	9.1	3.819	0.377	-19	0.361	no trend	-0.000194	-0.07
MER-003	Hardness	29	29	100%	0	12	61800	7970	42	15620	1.96	**125**	**0.010**	POSITIVE	0.0273	9.97
MER-003	Iron	29	29	100%	0	349	3200	1802	1600	758.3	0.421	-44	0.210	no trend	-0.0884	-32.29
MER-003	Magnesium	29	29	100%	0	1.25	5.1	2.907	2.8	0.993	0.342	-42	0.220	no trend	-0.000137	-0.05
MER-003	Manganese	29	29	100%	0	12	270	132.5	137	58.16	0.439	12	0.418	no trend	0.00287	1.05
MER-003	pH	20	20	100%	0	5.53	7.42	6.382	6.365	0.633	0.0993	21	0.258	no trend	0.00011678	0.04
MER-003	Potassium	29	29	100%	0	0.5	1.4	0.89	0.87	0.254	0.285	55	0.155	no trend	0.000035473	0.01
MER-003	Sodium	29	29	100%	0	1.92	14.9	6.798	6.2	2.81	0.413	**110**	**0.020**	POSITIVE	0.00094094	0.34
MER-003	Sulfate	29	22	76%	0	1	24	9.024	9.1	6.077	0.673	78	0.073	no trend	0.00133	0.49
WBR-001	Alkalinity, Bicarbonate	31	29	94%	0	3.2	44.7	9.948	5.5	9.84	0.989	**132**	**0.013**	POSITIVE	0.00165	0.60
WBR-001	Calcium	25	25	100%	0	2.7	9.1	4.759	4.4	1.433	0.301	**-99**	**0.011**	NEGATIVE	-0.0005324	-0.19
WBR-001	Chloride	25	25	100%	0	9.2	38.3	18.49	18	5.731	0.31	-25	0.287	no trend	-0.0003644	-0.13
WBR-001	Hardness	25	25	100%	0	12	40900	3424	22.5	9250	2.701	47	0.141	no trend	0.0027	0.99
WBR-001	Iron	25	25	100%	0	711	21800	3073	1680	4435	1.443	-33	0.227	no trend	-0.184	-67.21
WBR-001	Magnesium	25	25	100%	0	1.1	4.4	1.928	1.8	0.685	0.355	**-91**	**0.018**	NEGATIVE	-0.0002089	-0.08
WBR-001	Manganese	25	25	100%	0	45	989	180.7	104	209.5	1.159	-26	0.280	no trend	-0.00826	-3.02
WBR-001	pH	19	19	100%	0	4.72	7.36	5.563	5.49	0.68	0.122	11	0.363	no trend	0.000048005	0.02
WBR-001	Potassium	25	25	100%	0	0.51	2.66	0.907	0.76	0.484	0.534	25	0.287	no trend	0.000022589	0.01
WBR-001	Sodium	25	25	100%	0	4.5	20	8.358	8.1	2.905	0.348	-45	0.152	no trend	-0.0003259	-0.12

2020
Surface Water Trend Analysis
Humboldt Mill

WBR-001	Sulfate	25	19	76%	6	2	30	5.558	2	8.432	1.517	-20	0.228	no trend	0	0.00
WBR-002	Alkalinity, Bicarbonate	23	23	100%	0	3.9	98	25.15	25	17.94	0.713	56	0.073	no trend	0.00216	0.79
WBR-002	Calcium	23	23	100%	0	4.7	11.2	8.39	8.6	1.858	0.221	9	0.416	no trend	0.00015546	0.06
WBR-002	Chloride	23	23	100%	0	25	51	39.43	40.7	7.248	0.184	-15	0.356	no trend	-0.0007082	-0.26
WBR-002	Hardness	23	23	100%	0	22	41600	4949	40	13046	2.636	56	0.073	no trend	0.00356	1.30
WBR-002	Iron	23	23	100%	0	2300	14800	7066	7200	3269	0.463	16	0.346	no trend	0.161	58.81
WBR-002	Magnesium	23	23	100%	0	2.2	5.2	3.89	3.8	0.858	0.221	17	0.336	no trend	0.00007297	0.03
WBR-002	Manganese	23	23	100%	0	56	1200	427.1	310	350.4	0.82	33	0.199	no trend	0.0388	14.17
WBR-002	pH	19	19	100%	0	5.61	7.4	6.43	6.29	0.504	0.0783	-31	0.147	no trend	-0.0001419	-0.05
WBR-002	Potassium	23	23	100%	0	0.72	2.45	1.557	1.6	0.429	0.275	0	n/a	no trend	0	0.00
WBR-002	Sodium	23	23	100%	0	12.6	25	20.4	21.1	3.103	0.152	13	0.375	no trend	0.000098135	0.04
WBR-002	Sulfate	23	10	43%	2											
WBR-003	Alkalinity, Bicarbonate	25	25	100%	0	11.1	80	31.77	31	15.39	0.484	35	0.214	no trend	0.00153	0.56
WBR-003	Calcium	25	25	100%	0	5.3	22	10.03	10	3.63	0.362	-5	0.463	no trend	-0.00009674	-0.04
WBR-003	Chloride	25	25	100%	0	16.2	37.5	27.88	27	6.146	0.22	-44	0.157	no trend	-0.00108	-0.39
WBR-003	Hardness	25	25	100%	0	24	58800	5669	40	15844	2.795	39	0.187	no trend	0.00266	0.97
WBR-003	Iron	25	25	100%	0	1830	18000	6478	4900	4301	0.664	63	0.074	no trend	0.944	344.80
WBR-003	Magnesium	25	25	100%	0	2.6	9	4.358	4.2	1.356	0.311	-5	0.463	no trend	-0.00001541	-0.01
WBR-003	Manganese	25	25	100%	0	22.4	2500	641.9	324	640.8	0.998	11	0.408	no trend	0.0141	5.15
WBR-003	pH	21	21	100%	0	4.31	7.53	6.24	6.26	0.685	0.11	-2	0.488	no trend	-0.000004587	0.00
WBR-003	Potassium	25	24	96%	0	0.5	2.3	1.396	1.3	0.377	0.27	27	0.270	no trend	0.000032077	0.01
WBR-003	Sodium	25	25	100%	0	8	19	14.22	15	2.69	0.189	8	0.435	no trend	0	0.00
WBR-003	Sulfate	25	7	28%	1											

Appendix K

Humboldt Mill

Sediment Monitoring Results

2020
Sediment Monitoring Data
HMP-009 (Compliance)
Humboldt Mill

Parameter	Unit	Threshold Effects Concentration	Probable Effects Concentration	Q3 2018 9/4/2018	Q4 2020 12/29/2020
Metals					
Aluminum	mg/kg	-	-	**10500**	**9100**
Antimony	mg/kg	-	-	<0.55	**0.29**
Arsenic	mg/kg	9.8	33.0	**4.0**	**7.9**
Barium	mg/kg	-	-	**39**	**39**
Beryllium	mg/kg	-	-	<0.92	**0.71 J**
Boron	mg/kg	-	-	**6.8**	**7.2 J**
Cadmium	mg/kg	0.99	4.98	<0.37	<0.12
Chromium	mg/kg	43.4	111	**18**	**18**
Cobalt	mg/kg	-	-	**9.0**	**5.6**
Copper	mg/kg	31.6	149	**43**	**29**
Iron	mg/kg	-	-	**16600**	**17200**
Lead	mg/kg	35.8	128	**13**	**14**
Lithium	mg/kg	-	-	<17.8	**6.4 J**
Manganese	mg/kg	-	-	**297**	**241**
Mercury	mg/kg	0.18	1.06	<0.092	<0.13
Molybdenum	mg/kg	-	-	<1.8	**1.5 J**
Nickel	mg/kg	22.7	48.6	**37**	**22**
Selenium	mg/kg	-	-	**5.6**	**1.8 J**
Silver	mg/kg	-	-	<0.18	**0.089 J**
Thallium	mg/kg	-	-	<0.92	**0.12 J**
Vanadium	mg/kg	-	-	**22**	**19**
Zinc	mg/kg	121	459	**62**	**38**
Major Anions					
Sulfide	mg/kg	-	-	**67**	<39
Major Cations					
Magnesium	mg/kg	-	-	**10100.0**	**6830**

2020
Sediment Monitoring Data
HMWQ-004 (Compliance)
Humboldt Mill

Parameter	Unit	Threshold Effects Concentration	Probable Effects Concentration	Q3 2018 9/4/2018	Q4 2020 9/4/2018
Metals					
Aluminum	mg/kg	-	-	NM	NM
Antimony	mg/kg	-	-	NM	NM
Arsenic	mg/kg	9.79	33	NM	NM
Barium	mg/kg	-	-	NM	NM
Beryllium	mg/kg	-	-	NM	NM
Boron	mg/kg	-	-	NM	NM
Cadmium	mg/kg	0.99	4.98	NM	NM
Chromium	mg/kg	43.4	111	NM	NM
Cobalt	mg/kg	-	-	NM	NM
Copper	mg/kg	31.6	149	NM	NM
Iron	mg/kg	-	-	NM	NM
Lead	mg/kg	35.8	128	NM	NM
Lithium	mg/kg	-	-	NM	NM
Manganese	mg/kg	-	-	NM	NM
Mercury	mg/kg	0.18	1.06	NM	NM
Molybdenum	mg/kg	-	-	NM	NM
Nickel	mg/kg	22.7	48.6	NM	NM
Selenium	mg/kg	-	-	NM	NM
Silver	mg/kg	-	-	NM	NM
Thallium	mg/kg	-	-	NM	NM
Vanadium	mg/kg	-	-	NM	NM
Zinc	mg/kg	121	459	NM	NM
Major Anions					
Sulfide	mg/kg	-	-	NM	NM
Major Cations					
Magnesium	mg/kg	-	-	NM	NM

Explanations of abbreviations are included on the final page of this table.

2020
Sediment Monitoring Data
MER-001 (Reference)
Humboldt Mill

Parameter	Unit	Threshold Effects Concentration	Probable Effects Concentration	Q3 2018 9/4/2018	Q4 2020 12/29/2020
Metals					
Aluminum	mg/kg	-	-	**5830**	**6470**
Antimony	mg/kg	-	-	<0.34	<0.026
Arsenic	mg/kg	9.79	33	**9.6**	**12**
Barium	mg/kg	-	-	**26**	**18**
Beryllium	mg/kg	-	-	<0.57	**0.18 J**
Boron	mg/kg	-	-	**2.1**	**0.72 J**
Cadmium	mg/kg	0.99	4.98	<0.23	<0.054
Chromium	mg/kg	43.4	111	**34**	**32**
Cobalt	mg/kg	-	-	**7.2**	**4.5**
Copper	mg/kg	31.6	149	**9.5**	**7.2**
Iron	mg/kg	-	-	**25000**	**17900**
Lead	mg/kg	35.8	128	**4.8**	**1.9**
Lithium	mg/kg	-	-	**14**	**14**
Manganese	mg/kg	-	-	**215**	**258**
Mercury	mg/kg	0.18	1.06	<0.056	<0.059
Molybdenum	mg/kg	-	-	<1.1	**0.13 J**
Nickel	mg/kg	22.7	48.6	**21**	**19**
Selenium	mg/kg	-	-	**2.3**	**0.32**
Silver	mg/kg	-	-	<0.11	**0.014 J**
Thallium	mg/kg	-	-	<0.57	**0.022 J**
Vanadium	mg/kg	-	-	**36**	**24**
Zinc	mg/kg	121	459	**44**	**34**
Major Anions					
Sulfide	mg/kg	-	-	**40**	<19
Major Cations					
Magnesium	mg/kg	-	-	**3530**	**4530**

2020
Sediment Monitoring Data
MER-002 (Compliance)
Humboldt Mill

Parameter	Unit	Threshold Effects Concentration	Probable Effects Concentration	Q3 2018 9/4/2018	Q4 2020 12/29/2020
Metals					
Aluminum	mg/kg	-	-	**9020**	**7090**
Antimony	mg/kg	-	-	<0.34	**0.071 J**
Arsenic	mg/kg	9.79	33	**11**	**6.4**
Barium	mg/kg	-	-	**26**	**11**
Beryllium	mg/kg	-	-	<0.57	**0.14 J**
Boron	mg/kg	-	-	**2.5**	**1.1 J**
Cadmium	mg/kg	0.99	4.98	<0.23	<0.054
Chromium	mg/kg	43.4	111.0	**20**	**18**
Cobalt	mg/kg	-	-	**6.2**	**4.5**
Copper	mg/kg	31.6	149	**32**	**27**
Iron	mg/kg	-	-	**18600**	**16100**
Lead	mg/kg	35.8	128	**5.8**	**2.9**
Lithium	mg/kg	-	-	**13**	**11**
Manganese	mg/kg	-	-	**102**	**98**
Mercury	mg/kg	0.18	1.06	<0.057	<0.060
Molybdenum	mg/kg	-	-	<1.1	**0.47 J**
Nickel	mg/kg	22.7	48.6	**22**	**18**
Selenium	mg/kg	-	-	**1.6**	**0.61**
Silver	mg/kg	-	-	<0.11	**0.045 J**
Thallium	mg/kg	-	-	<0.57	**0.033 J**
Vanadium	mg/kg	-	-	**22**	**20**
Zinc	mg/kg	121.0	459.0	**42**	**29**
Major Anions					
Sulfide	mg/kg	-	-	**33**	<19
Major Cations					
Magnesium	mg/kg	-	-	**6380**	**3730**

2020
Sediment Monitoring Data
MER-003 (Compliance)
Humboldt Mill

Parameter	Unit	Threshold Effects Concentration	Probable Effects Concentration	Q3 2018 9/4/2018	Q4 2020 12/29/2020
Metals					
Aluminum	mg/kg	-	-	**5210**	**10400**
Antimony	mg/kg	-	-	<0.33	**0.056 J**
Arsenic	mg/kg	9.79	33	**2.4**	**3.2**
Barium	mg/kg	-	-	**19**	**9.2**
Beryllium	mg/kg	-	-	<0.56	**0.20 J**
Boron	mg/kg	-	-	**2.3**	**1.4 J**
Cadmium	mg/kg	0.99	4.98	<0.22	**0.059**
Chromium	mg/kg	43.4	111.0	**20**	**24**
Cobalt	mg/kg	-	-	**7.1**	**8.9**
Copper	mg/kg	31.6	149	**132**	**57**
Iron	mg/kg	-	-	**11700**	**22200**
Lead	mg/kg	35.8	128	**8.5**	**2.9**
Lithium	mg/kg	-	-	<10.4	**4.7 J**
Manganese	mg/kg	-	-	**203**	**424**
Mercury	mg/kg	0.18	1.06	<0.057	<0.057
Molybdenum	mg/kg	-	-	<1.1	<0.046
Nickel	mg/kg	22.7	48.6	**20**	**23**
Selenium	mg/kg	-	-	**1.6**	**0.39 J**
Silver	mg/kg	-	-	<0.11	**0.11**
Thallium	mg/kg	-	-	<0.56	**0.021 J**
Vanadium	mg/kg	-	-	**30**	**32**
Zinc	mg/kg	121	459	**25**	**25**
Major Anions					
Sulfide	mg/kg	-	-	**28**	<18
Major Cations					
Magnesium	mg/kg	-	-	**3780**	**8460**

2020
Sediment Monitoring Data
MER-004 (Monitoring)
Humboldt Mill

Parameter	Unit	Threshold Effects Concentration	Probable Effects Concentration	Q3 2018* 9/4/2018	Q4 2020 12/29/2020
Metals					
Aluminum	mg/kg	-	-	NM	**4430**
Antimony	mg/kg	-	-	NM	**0.034 J**
Arsenic	mg/kg	9.79	33	NM	**8.3**
Barium	mg/kg	-	-	NM	**13**
Beryllium	mg/kg	-	-	NM	**0.13 J**
Boron	mg/kg	-	-	NM	**0.72 J**
Cadmium	mg/kg	0.99	4.98	NM	<0.058
Chromium	mg/kg	43.4	111.0	NM	**12**
Cobalt	mg/kg	-	-	NM	**3.4**
Copper	mg/kg	31.6	149	NM	**3.8**
Iron	mg/kg	-	-	NM	**14000**
Lead	mg/kg	35.8	128	NM	**1.8**
Lithium	mg/kg	-	-	NM	**5.6 J**
Manganese	mg/kg	-	-	NM	**202**
Mercury	mg/kg	0.18	1.06	NM	<0.063
Molybdenum	mg/kg	-	-	NM	**0.26 J**
Nickel	mg/kg	22.7	48.6	NM	**9.0**
Selenium	mg/kg	-	-	NM	**0.37 J**
Silver	mg/kg	-	-	NM	**0.0074 J**
Thallium	mg/kg	-	-	NM	**0.016 J**
Vanadium	mg/kg	-	-	NM	**16**
Zinc	mg/kg	121	459	NM	**27**
Major Anions					
Sulfide	mg/kg	-	-	NM	<20.3
Major Cations					
Magnesium	mg/kg	-	-	NM	**2370**

Explanations of abbreviations are included on the final page of this table.

2020
Sediment Monitoring Data
WBR-001 (Reference)
Humboldt Mill

Parameter	Unit	Threshold Effects Concentration	Probable Effects Concentration	Q3 2018 9/4/2018	Q4 2020 12/29/2020
Metals					
Aluminum	mg/kg	-	-	**7900**	**4160**
Antimony	mg/kg	-	-	<0.41	**0.057 J**
Arsenic	mg/kg	9.79	33	**5.7**	**6.7**
Barium	mg/kg	-	-	**32**	**24**
Beryllium	mg/kg	-	-	<0.69	**0.12 J**
Boron	mg/kg	-	-	**1.8**	**2.0 J**
Cadmium	mg/kg	0.99	4.98	<0.28	**0.20**
Chromium	mg/kg	43.4	111	**15**	**10**
Cobalt	mg/kg	-	-	**4.8**	**2.0**
Copper	mg/kg	31.6	149	**13**	**6.8**
Iron	mg/kg	-	-	**42800**	**9170**
Lead	mg/kg	35.8	128	**3.8**	**16**
Lithium	mg/kg	-	-	<13.8	**3.5 J**
Manganese	mg/kg	-	-	**1240**	**86**
Mercury	mg/kg	0.18	1.06	<0.071	<0.10
Molybdenum	mg/kg	-	-	<1.4	**0.58 J**
Nickel	mg/kg	22.7	48.6	**14**	**7.2**
Selenium	mg/kg	-	-	**1.4**	**0.77**
Silver	mg/kg	-	-	<0.14	**0.027 J**
Thallium	mg/kg	-	-	<0.69	**0.065 J**
Vanadium	mg/kg	-	-	**25**	**16**
Zinc	mg/kg	121	459	**25**	**18**
Major Anions					
Sulfide	mg/kg	-	-	**44**	<31.6
Major Cations					
Magnesium	mg/kg	-	-	**4970**	**1500**

2020
Sediment Monitoring Data
WBR-002 (Compliance)
Humboldt Mill

Parameter	Unit	Threshold Effects Concentration	Probable Effects Concentration	Q3 2018 9/4/2018	Q4 2020 12/29/2020
Metals					
Aluminum	mg/kg	-	-	**2880**	**7900**
Antimony	mg/kg	-	-	<0.37	**0.046 J**
Arsenic	mg/kg	9.79	33	**5.4**	**7.1**
Barium	mg/kg	-	-	**10**	**24**
Beryllium	mg/kg	-	-	<0.61	**0.37 J**
Boron	mg/kg	-	-	**1.7**	**1.2 J**
Cadmium	mg/kg	0.99	4.98	<0.24	<0.053
Chromium	mg/kg	43.4	111.0	**6.2**	**13**
Cobalt	mg/kg	-	-	**2.8**	**4.0**
Copper	mg/kg	31.6	149	**7.0**	**26**
Iron	mg/kg	-	-	**8350**	**27900**
Lead	mg/kg	35.8	128	**2.0**	**17**
Lithium	mg/kg	-	-	<12.3	**9.0**
Manganese	mg/kg	-	-	**62**	**147**
Mercury	mg/kg	0.18	1.06	<0.064	<0.057
Molybdenum	mg/kg	-	-	<1.2	**8.7**
Nickel	mg/kg	22.7	48.6	**9.0**	**12**
Selenium	mg/kg	-	-	**1.2**	**0.38 J**
Silver	mg/kg	-	-	<0.12	**0.009 J**
Thallium	mg/kg	-	-	<0.61	**0.032 J**
Vanadium	mg/kg	-	-	**17**	**51**
Zinc	mg/kg	121	459	**27**	**16**
Major Anions					
Sulfide	mg/kg	-	-	**22**	<18
Major Cations					
Magnesium	mg/kg	-	-	**1350**	**3400**

2020
Sediment Monitoring Data
WBR-003 (Compliance)
Humboldt Mill

Parameter	Unit	Threshold Effects Concentration	Probable Effects Concentration	Q3 2018 9/4/2018	Q4 2020 12/29/2020
Metals					
Aluminum	mg/kg	-	-	**6300**	**7710**
Antimony	mg/kg	-	-	<0.33	**0.035 J**
Arsenic	mg/kg	9.79	33	**13**	**5.6**
Barium	mg/kg	-	-	**15**	**20**
Beryllium	mg/kg	-	-	<0.56	**0.23 J**
Boron	mg/kg	-	-	**1.9**	**2.1 J**
Cadmium	mg/kg	0.99	4.98	<0.22	<0.053
Chromium	mg/kg	43.4	111.0	**24**	**17**
Cobalt	mg/kg	-	-	**4.5**	**4.4**
Copper	mg/kg	31.6	149	**18**	**23**
Iron	mg/kg	-	-	**19900**	**22500**
Lead	mg/kg	35.8	128	**3.0**	**2.3**
Lithium	mg/kg	-	-	<12	**11**
Manganese	mg/kg	-	-	**119**	**191**
Mercury	mg/kg	0.18	1.06	<0.058	<0.056
Molybdenum	mg/kg	-	-	<1.1	**1.6**
Nickel	mg/kg	22.7	48.6	**21**	**18**
Selenium	mg/kg	-	-	**1.4**	**0.98 J**
Silver	mg/kg	-	-	<0.11	**0.025 J**
Thallium	mg/kg	-	-	<0.56	**0.11**
Vanadium	mg/kg	-	-	**21**	**41**
Zinc	mg/kg	121	459	**53**	**49**
Major Anions					
Sulfide	mg/kg	-	-	**26**	<19
Major Cations					
Magnesium	mg/kg	-	-	**3290**	**20400**

Sediment Monitoring Data
Abbreviations Data Qualifiers
Humboldt Mill

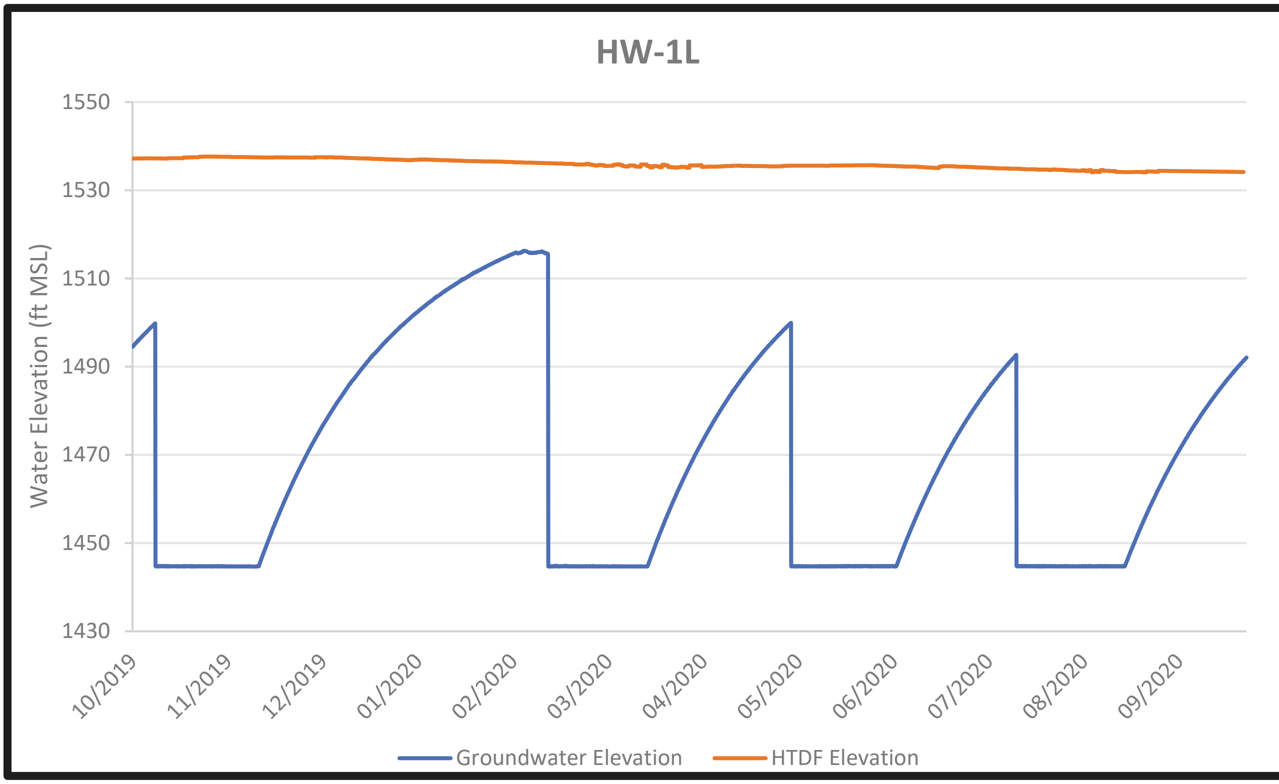
Notes:
Threshold Effects Concentration (TEC) and Probable Effects Concentration (PEC) are consensus based guidelines developed by D.D. MacDonald, C.G. Inersol, T.A. Berger and published in the Archives of Environmental Contamination and Toxicology, "Development and Evaluation of Consensus Based Sediment Quality Guidelines for Freshwater Ecosystems, " January 2000.
Results in **bold** text indicate that the parameter was detected at a level greater than the laboratory reporting limit.
Highlighted Cell = Value is equal to or greater than the TEC or PEC established for the parameter.
--Denotes no TEC or PEC is established for the parameter
NM = Not measured during the sampling event
* MER-004 was added as a monitoring location in 2020 and therefore no sediment data is available from prior sampling events.
J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

Appendix L

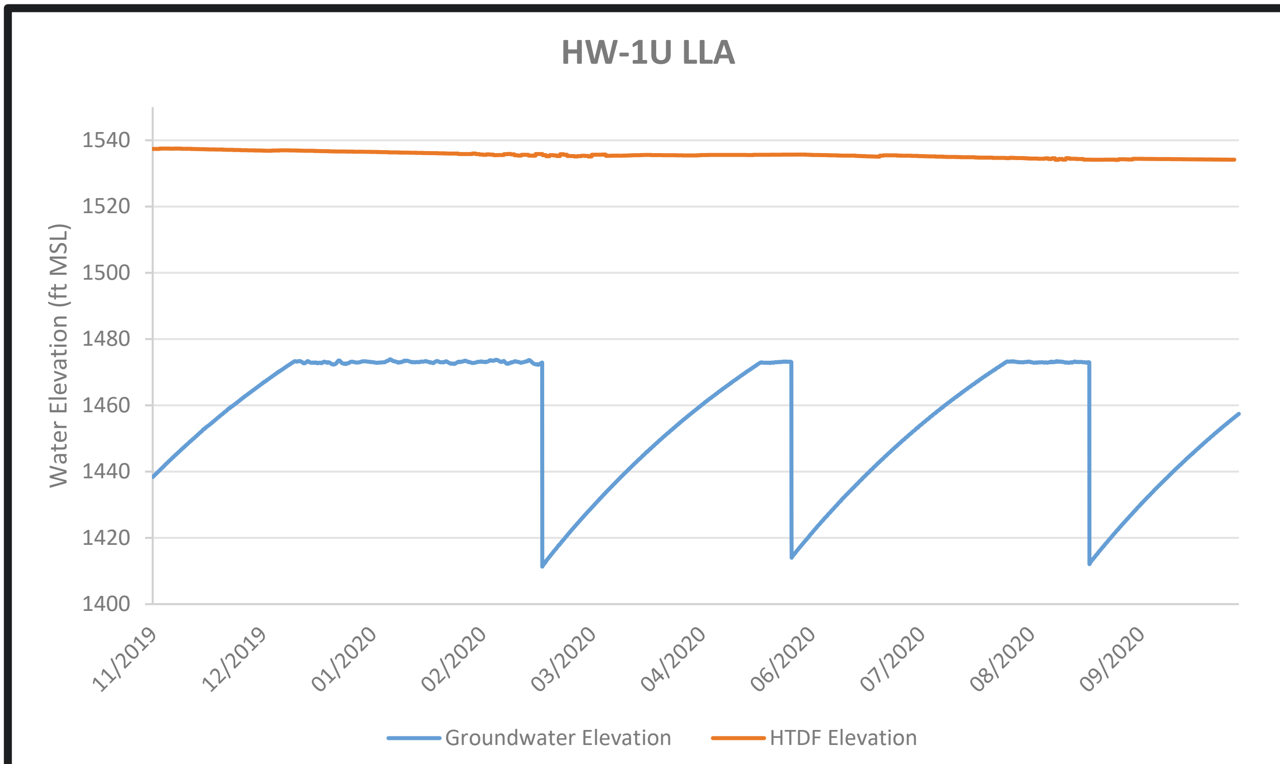
Humboldt Mill

Groundwater Hydrographs

2020 Groundwater Hydrographs
Humboldt Mill

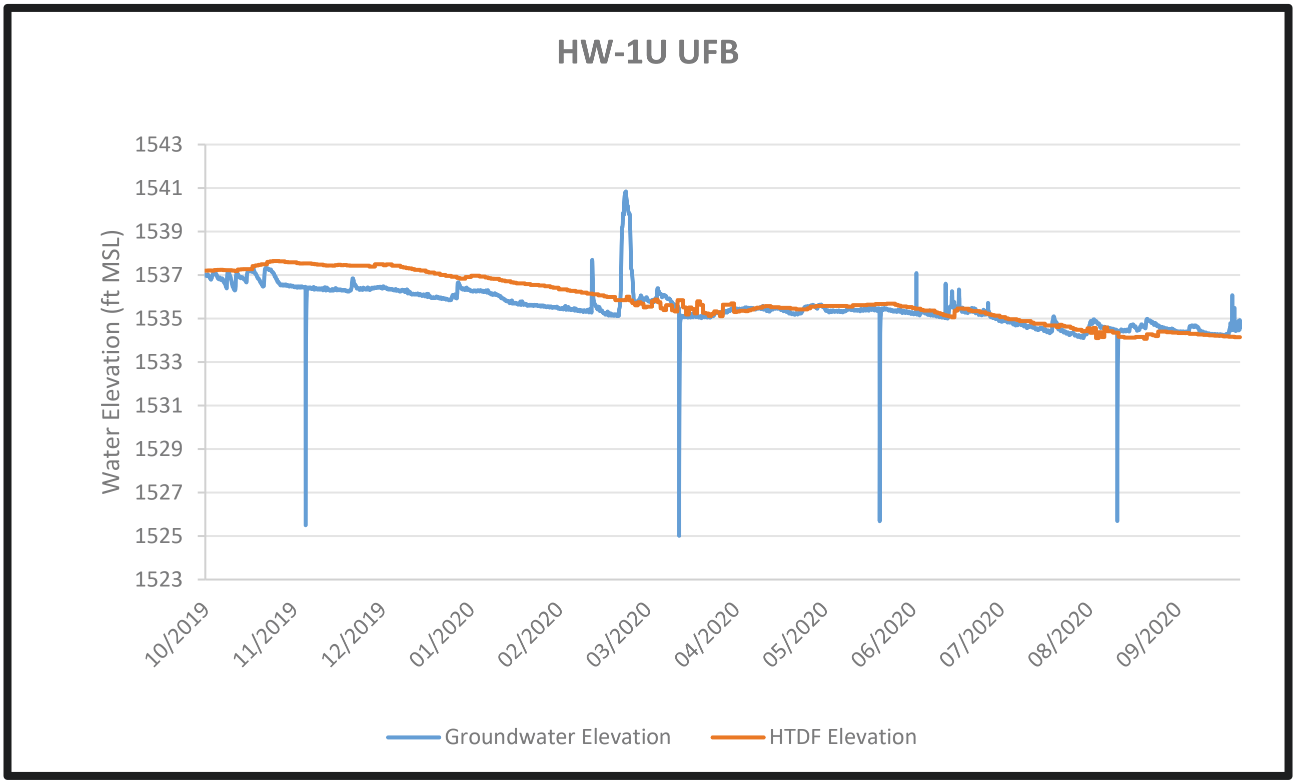


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.

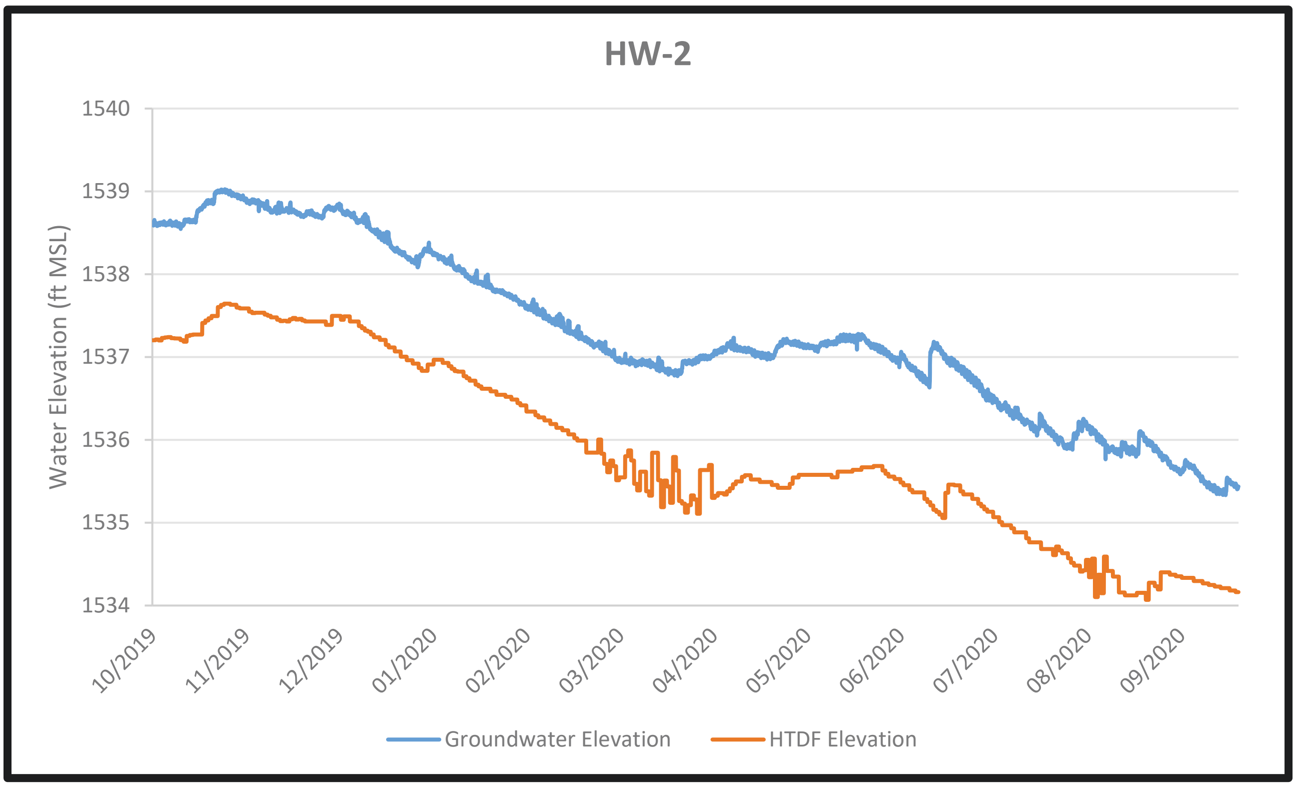


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.
Note: GW elevation data from 8-17-19 through 11-21-19 was unavailable due to equipment malfunction.

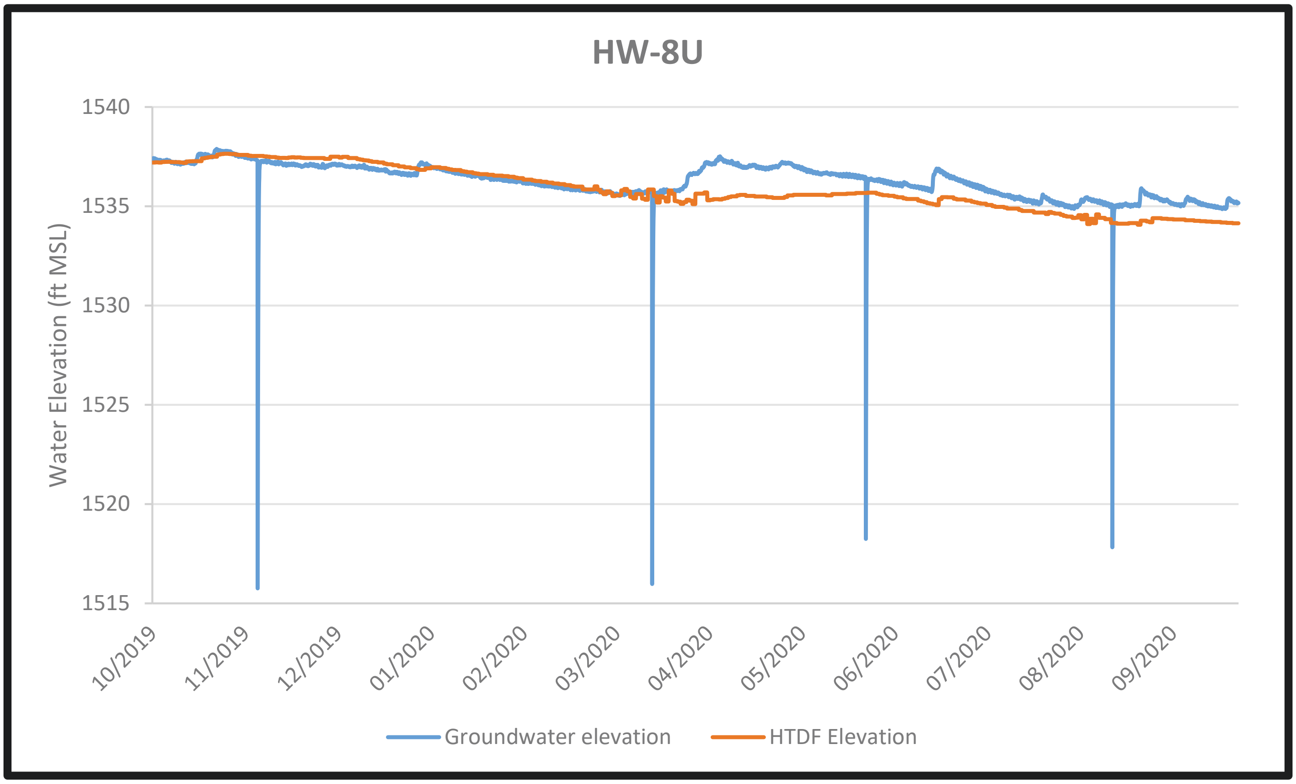
2020 Groundwater Hydrographs
Humboldt Mill



Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.



2020 Groundwater Hydrographs
Humboldt Mill



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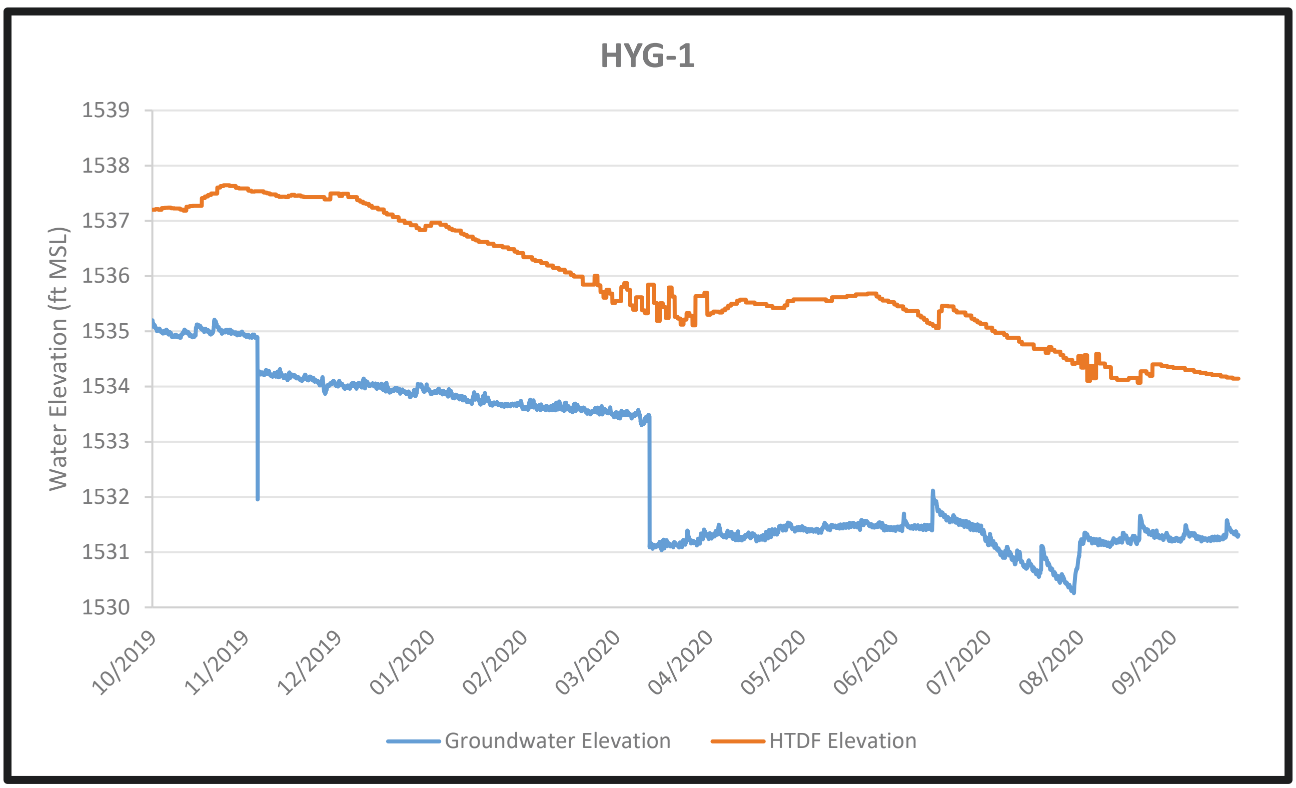
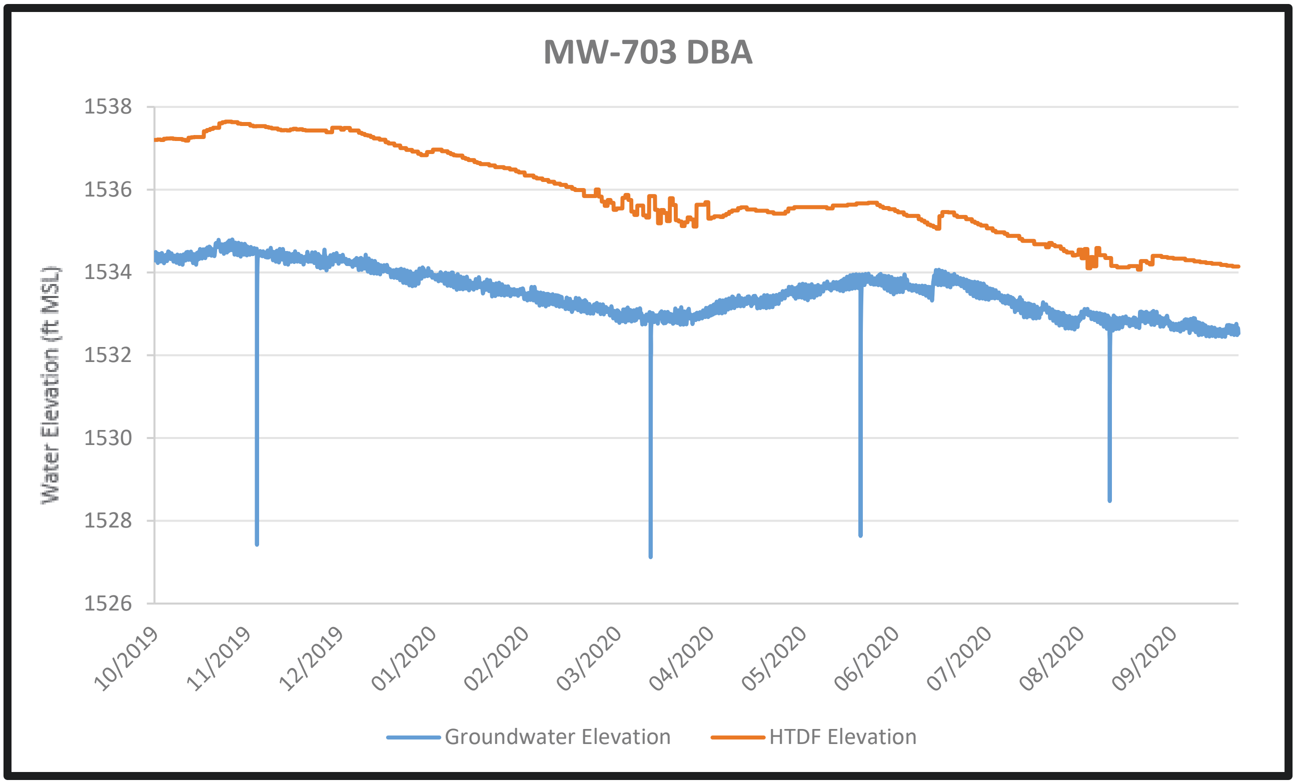


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.

2020 Groundwater Hydrographs
Humboldt Mill



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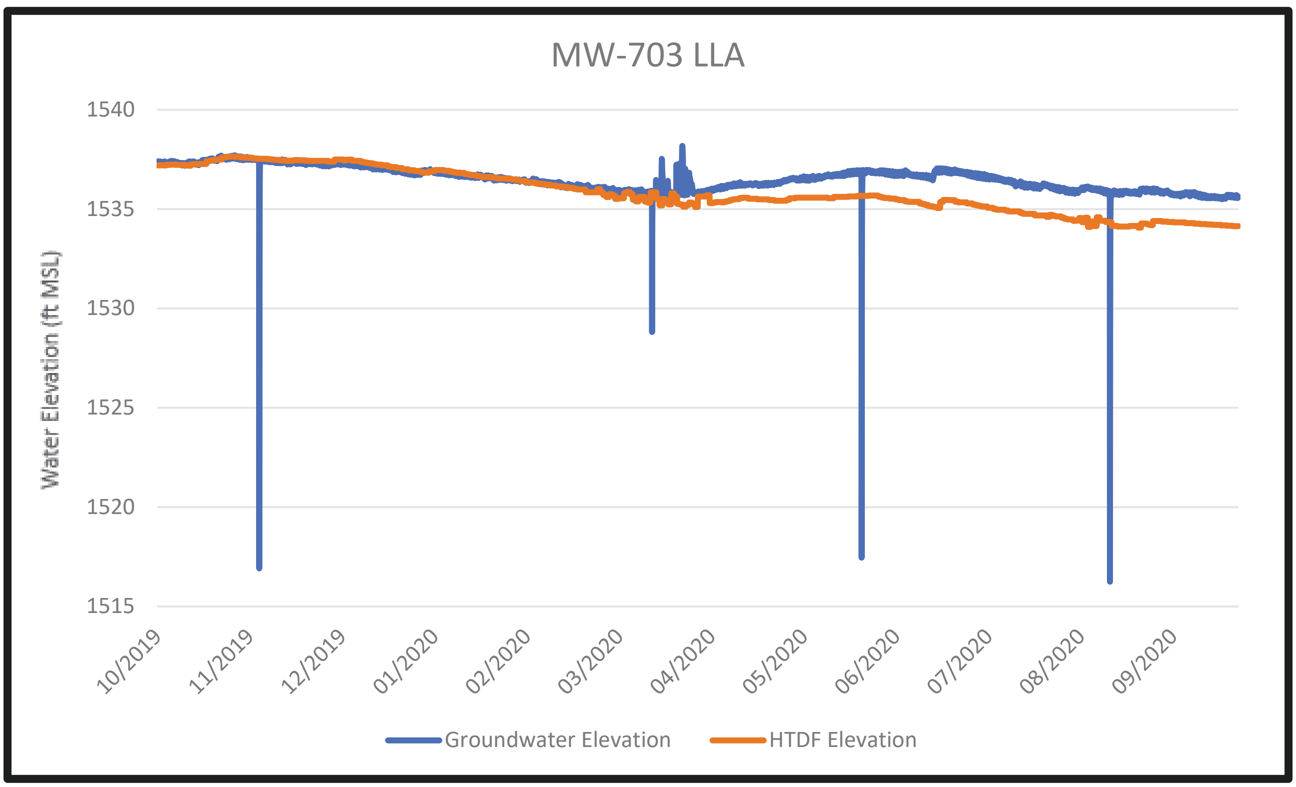
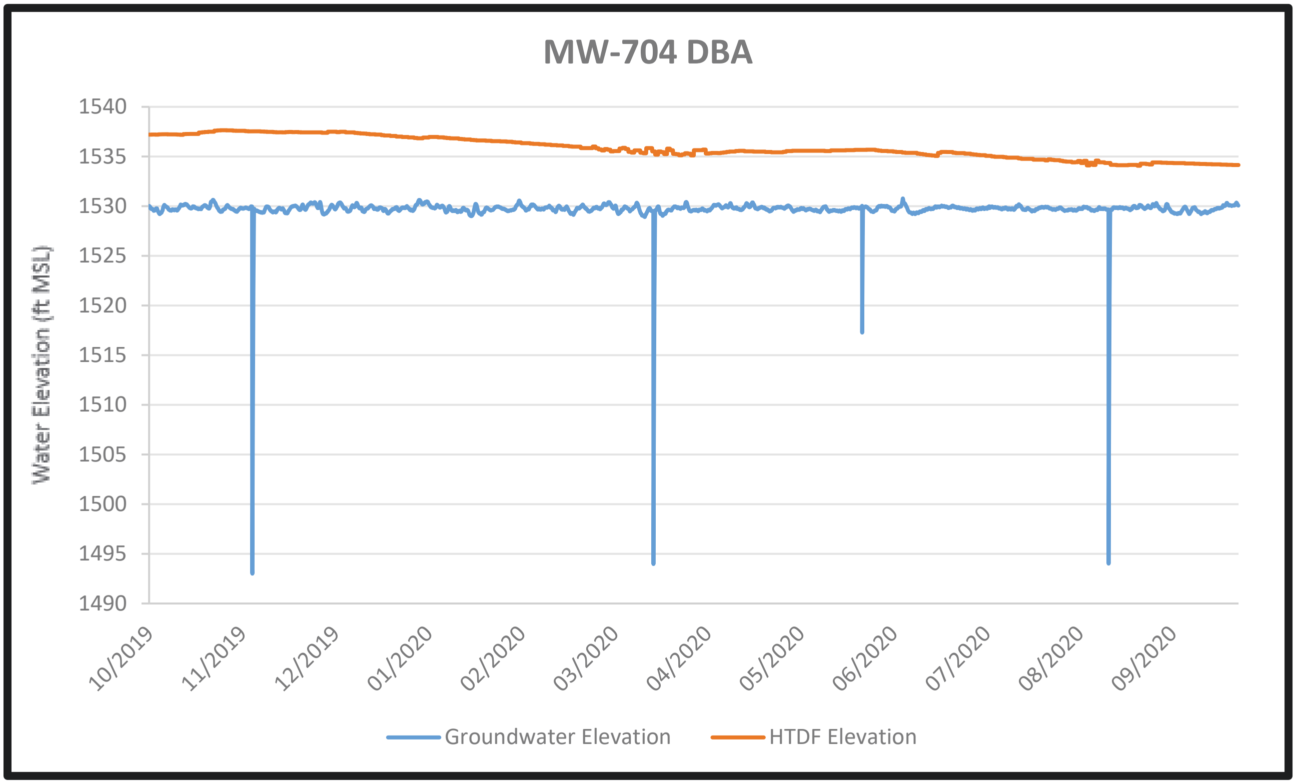


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.

2020 Groundwater Hydrographs
Humboldt Mill



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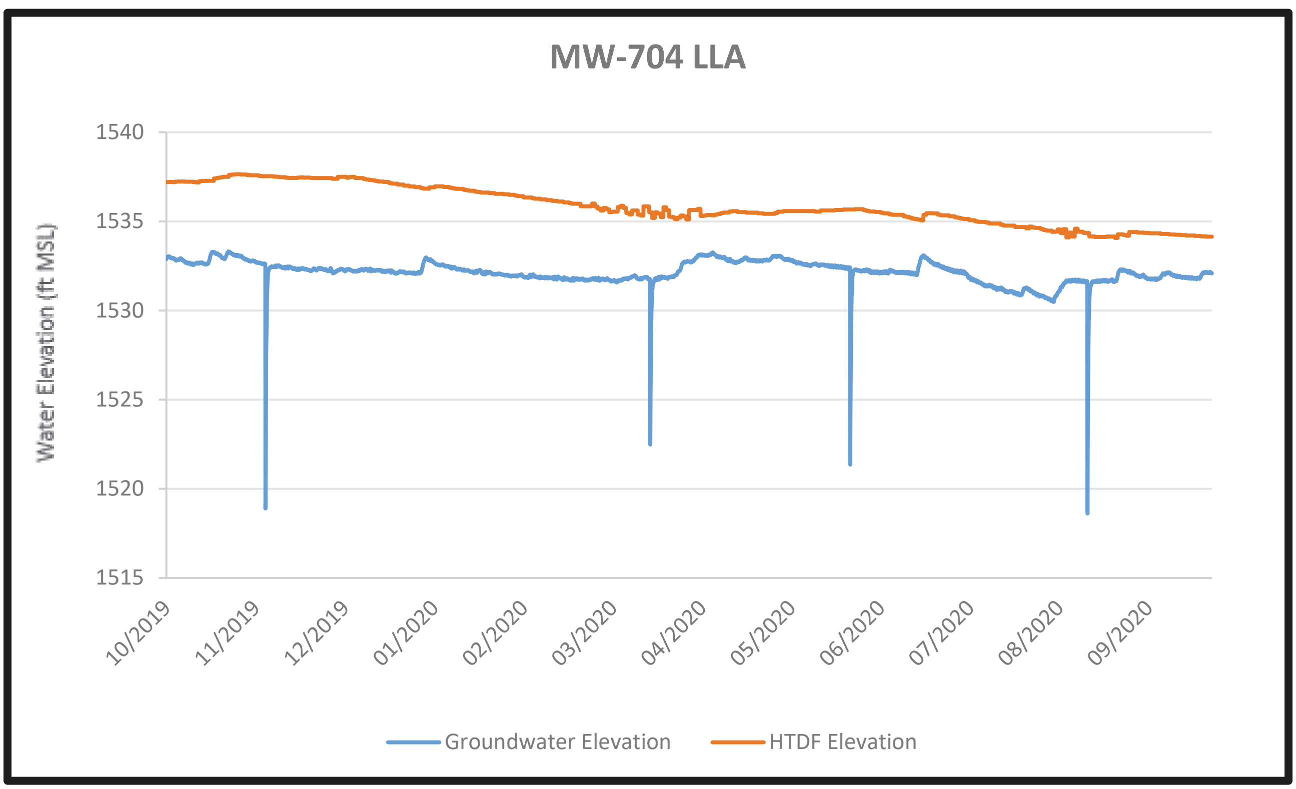
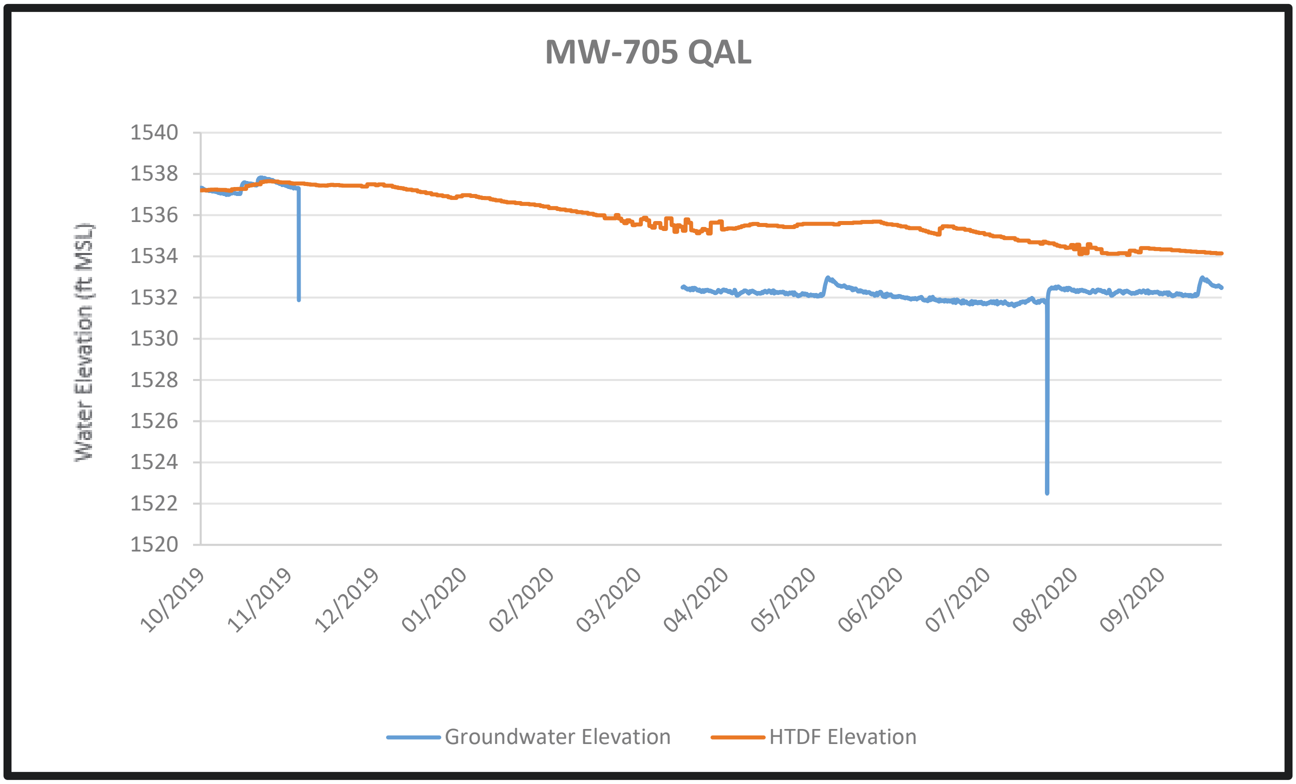
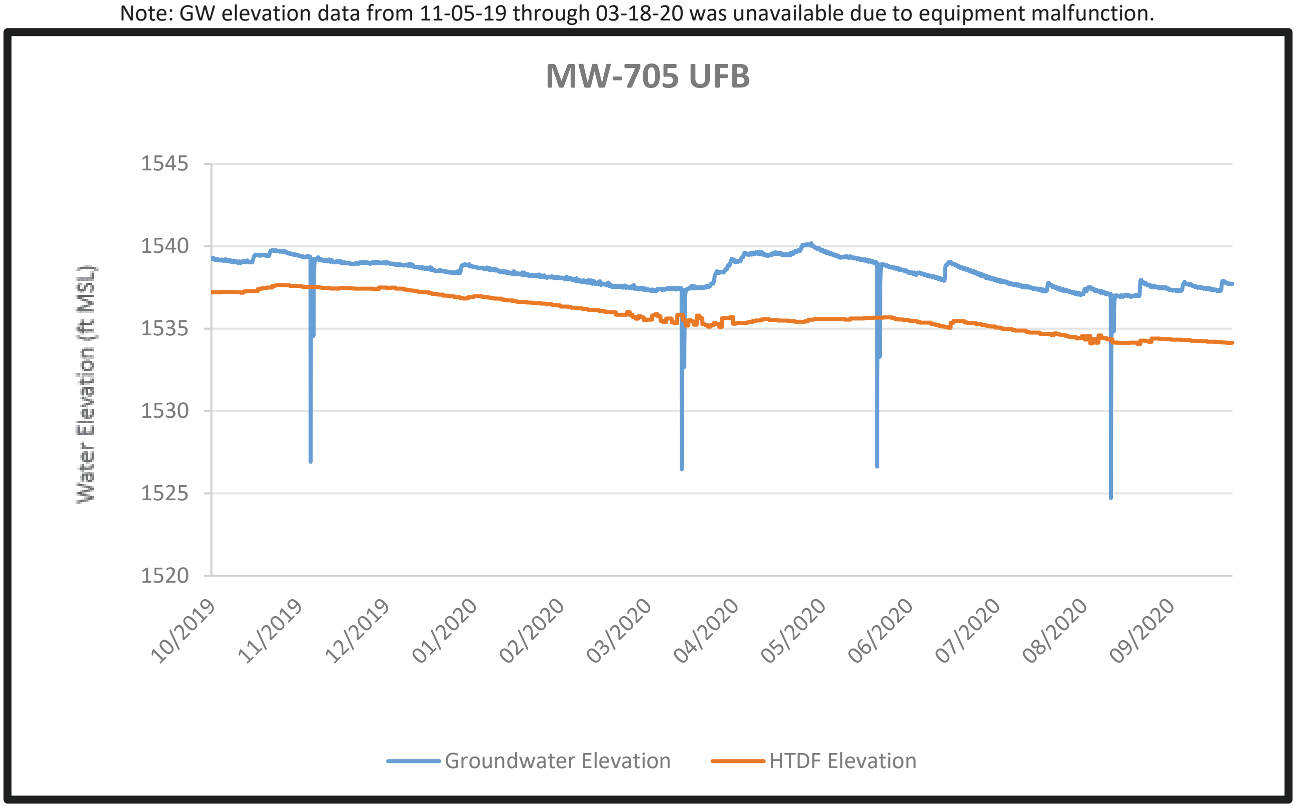


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.

2020 Groundwater Hydrographs
Humboldt Mill

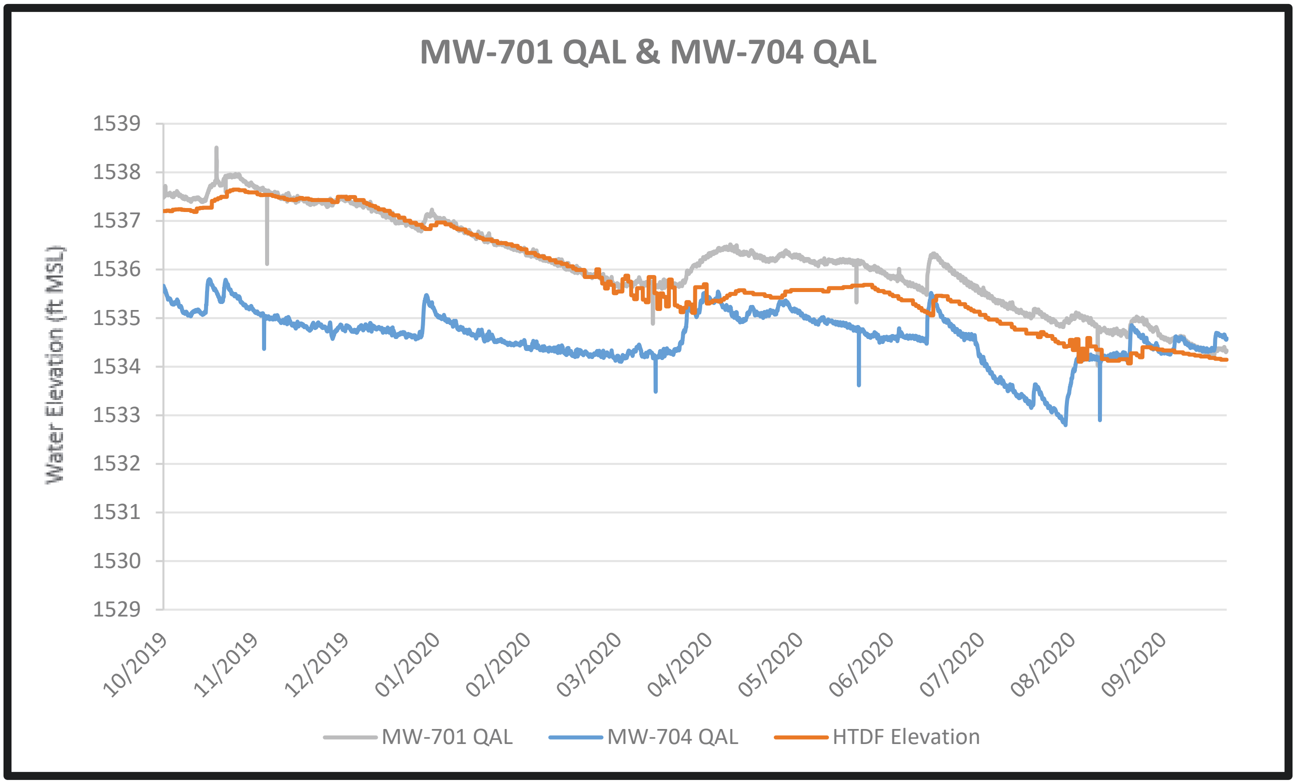


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.
Note: GW elevation data from 11-05-19 through 03-18-20 was unavailable due to equipment malfunction.

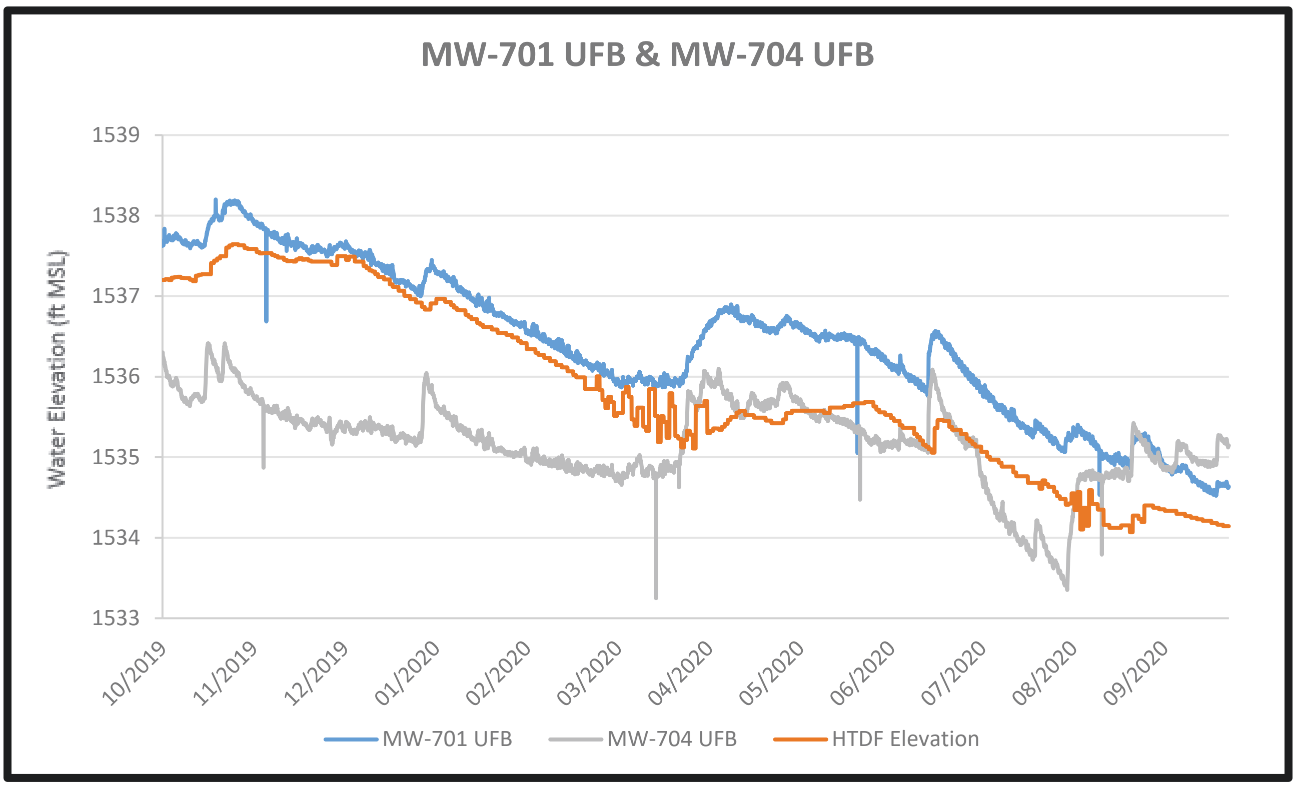


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.

2020 Groundwater Hydrographs
Humboldt Mill

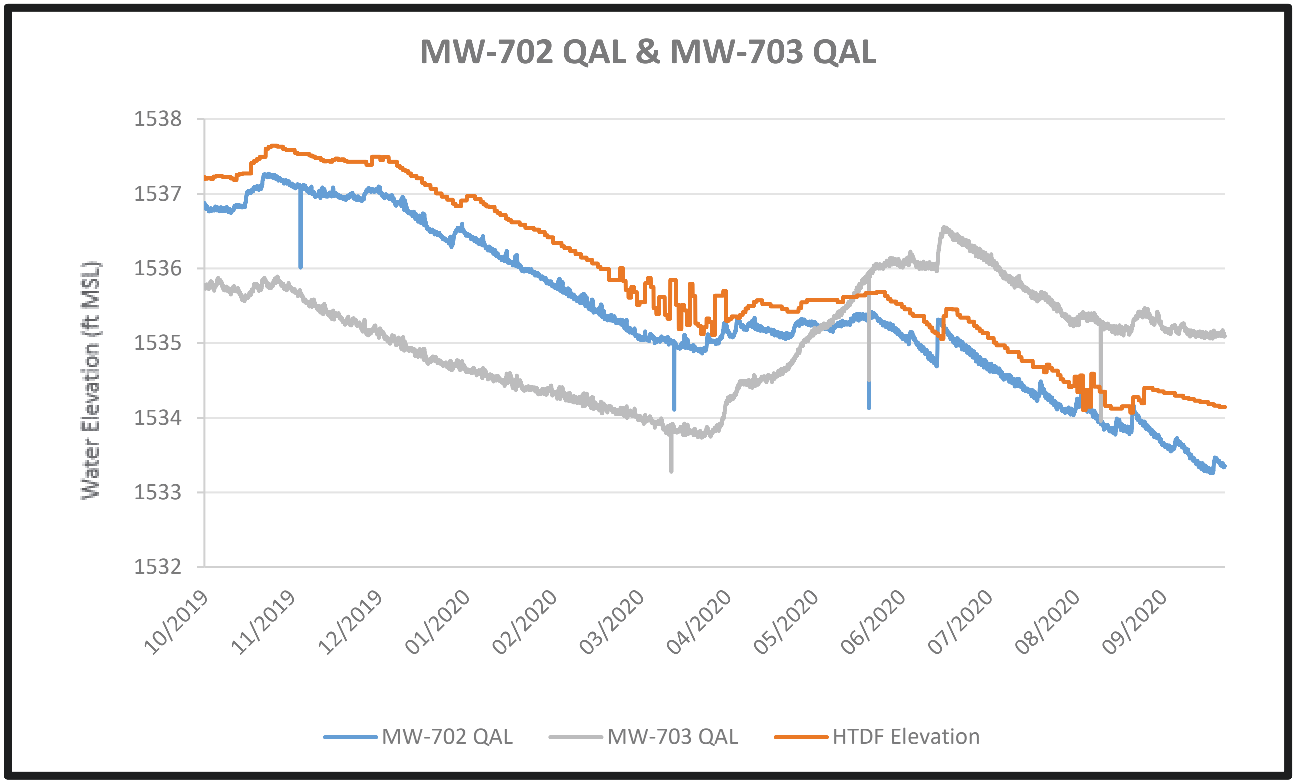


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.



Note: The large drops in water level are associated with the location being pumped down in preparation of sampling

2020 Groundwater Hydrographs
Humboldt Mill



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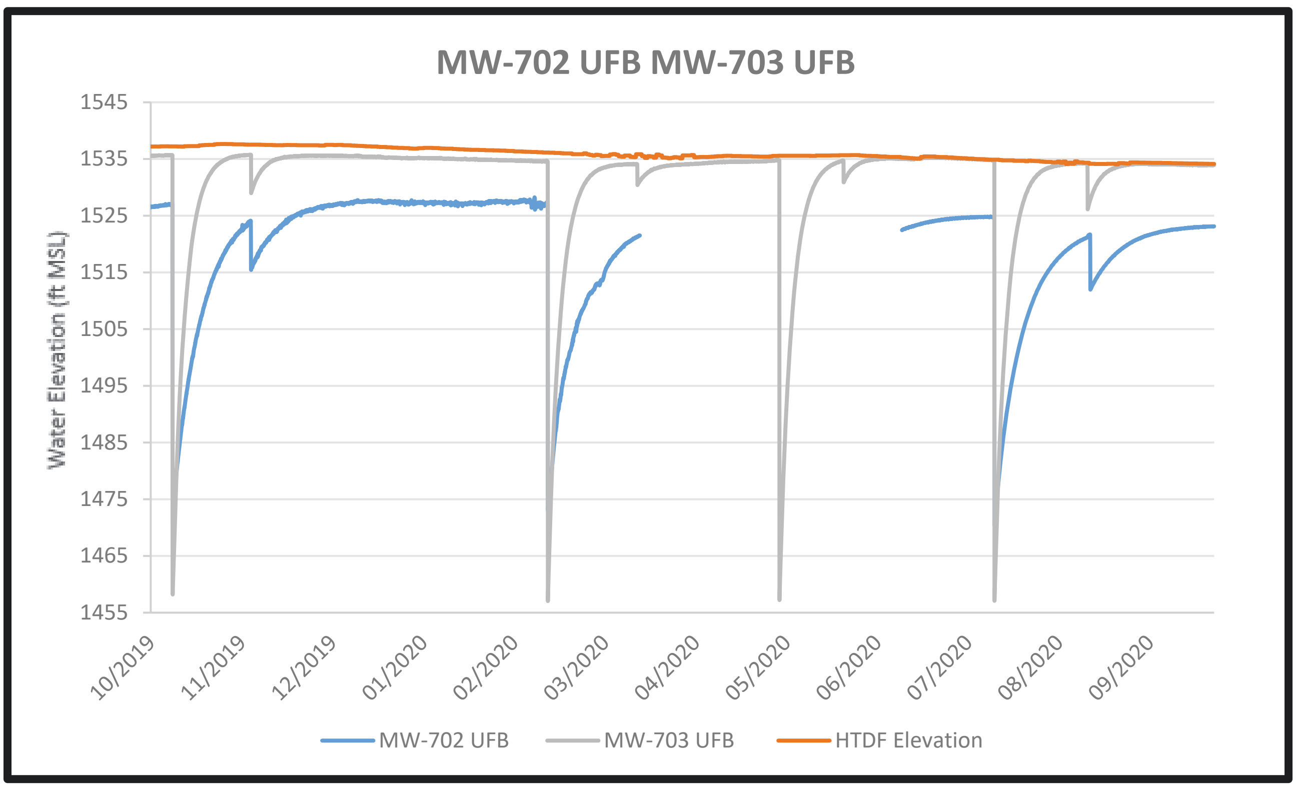


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling
Note: GW elevation data from 03-17-20 through 06-15-20 was unavailable due to equipment malfunction.

Appendix M

Humboldt Mill

Cut-off Wall Monitoring Well

Tabular Summary

2020 Cut-off Wall Monitoring Well Tabular Summary

Monitoring Well	Location	Quarter	Groundwater Level (ft MSL)	Commentary	Sulfate in Wells mg/L
HTDF		Q1	1536.44	Sulfate measured at approx. 1500 ft MSL.	399.0
		Q2	1535.64		380.0
		Q3	1535.46		300.0
		Q4	1533.50		370.0
HW-1L	Outside Cut-off Wall	Q1	1444.71	Sulfate levels are lower in this well then seen in the HTDF. These levels are similar to HW-1U UFB, both are located outside of the cut off wall and different from HW-2.	28.3
		Q2	1444.80		24.9
		Q3	1444.72		24.9
		Q4	1444.71		27.7
HW-1U LLA	Outside Cut-off Wall	Q1	1472.41	Sulfate levels are similar to other wells outside of the cut off wall, and show separation from levels within the HTDF.	58.8
		Q2	1473.15		46.1
		Q3	1472.96		58.4
		Q4	1473.27		54.0
HW-1U UFB	Outside Cut-off Wall, Compared to HW-2	Q1	1535.55	Sulfate levels at this well do not correlate with those found in HW-2 demonstrating the effectiveness of the cut-off wall.	35.5
		Q2	1535.46		29.5
		Q3	1534.44		26.9
		Q4	1534.20		23.7
HW-2	Inside Cut-off Wall	Q1	1536.89	The magnitude and changes in water level in HW-2 closely follow the magnitude and changes in water level of the HTDF as expected given it's close proximity to the HTDF and location south of the cut-off wall.	259.0
		Q2	1537.26		298.0
		Q3	-		289.0
		Q4	1535.07		202.0
HW-8U	Outside Cut off Wall, Compared to HW-2	Q1	1535.76	Sulfate levels are much lower at this well then observed in the HTDF, showing the effectiveness of the cut off wall.	8.3
		Q2	1536.41		8.6
		Q3	1535.04		8.8
		Q4	1534.91		8.9
HYG-1	Outside Cut off Wall, Compared to HW-2	Q1	1532.41	After the cut off wall was installed there increased head difference between HW-2 and HYG-1 by approximately 5 feet. There remains a 6-7 foot head difference between the two indicating conditions have not changed.	79.2
		Q2	1531.52		56.5
		Q3	1531.13		45.9
		Q4	1531.34		53.0
MW-701 QAL	Inside-Cut off Wall	Q1	1535.50	Sulfate at this well has become elevated indicating influence of water from the HTDF as predicted. The magnitude and changes in water level in MW-701 QAL closely follow the magnitude and changes in water level of the HTDF as expected given it's close proximity to the HTDF and location south of the cut-off wall.	249.0
		Q2	1535.88		378.0
		Q3	1534.59		400.0
		Q4	1533.75		535.0
MW-701 UFB	Bedrock, Inside-Cut off Wall	Q1	1532.65	Sulfate levels in this well are significantly higher than levels seen at the 1500 msl Level of the HTDF due to sulfuric acid spill.	1670.0
		Q2	1536.49		1310.0
		Q3	1535.07		1320.0
		Q4	1533.98		1300.0
MW-702 QAL	Inside Cut-off Wall	Q1	1534.63	The magnitude and changes in water level in MW-702 QAL closely follow the magnitude and changes in water level of the HTDF as expected given it's close proximity to the HTDF and location south of the cut-off wall. The sulfate in this well is lower than we see in the HTDF, but it is higher then what is seen in MW-703 QAL, the leachate monitoring pair.	100.0
		Q2	1534.85		100.0
		Q3	1533.62		86.0
		Q4	1532.77		79.7
MW-702 UFB	Inside Cut-off Wall	Q1	1514.66	The behavior of 702 and 703 UFB is similar to what it has been the entire time, so no apparent changes show that the wall is behaving similar to its performance in the past despite water level changes in the basin over the years.	31.2
		Q2	1521.23		32.5
		Q3	1521.69		31.5
		Q4	1519.50		33.7

MW-703 QAL	Outside Cut-off Wall	Q1	1535.75	The sulfate in MW-703 QAL is lower than inside of the cut off wall and is similar to levels seen in other wells outside of the cut off wall. This shows the effectiveness of the wall. During periods of higher HTDF elevation in 2019 and early 2020, the water level in MW-703 QAL was approximately 1.5 feet lower than the elevation of the HTDF, indicating the cut-off wall was effective at limiting flow from the HTDF to the north. As the HTDF elevation was reduced, the water level in MW-703 QAL showed changes independent of HTDF elevations.	31.3
		Q2	1537.54		26.4
		Q3	1537.11		24.0
		Q4	1536.54		24.5
MW-703 UFB	Outside Cut-off Wall	Q1	1531.74	The behavior of 702 and 703 UFB is similar to what it has been the entire time, so no apparent changes show that the wall is behaving similar to its performance in the past despite water level changes in the basin over the years.	49.3
		Q2	1534.58		45.5
		Q3	1534.20		44.3
		Q4	1533.48		46.3
MW-703 LLA	Outside Cut-off Wall	Q1	1532.56	Sulfate levels lower than the HTDF show evidence of cut-off wall effectiveness.	34.9
		Q2	1536.89		5.6
		Q3	1535.42		19.3
		Q4	1535.41		27.3
MW-703 DBA	Outside Cut-off Wall	Q1	1532.19	Sulfate levels lower than the HTDF show evidence of cut-off wall effectiveness.	39.2
		Q2	1533.79		38.4
		Q3	1532.38		35.4
		Q4	1532.41		38.5
MW-704 QAL	Leachate Monitoring Well for MW-701 QAL Outside Cut-off Wall	Q1	1534.37	Sulfate levels in this well do not correlate with those found in its leachate monitoring pair, indicating overall that water quality of the HTDF is not communicating with this well. Water quality in MW-704 QAL may be locally under the influence of discharges of Escanaba River irrigation water to Outfall 003 at Wetland EE. During periods of higher HTDF elevation in 2019 and early 2020, the water level in MW-704 QAL was approximately 2 feet lower than the elevation of the HTDF, indicating the cut-off wall was effective at limiting flow from the HTDF to the north. As the HTDF elevation was reduced, the water level in MW-704 QAL remained relatively consistent.	51.6
		Q2	1534.97		31.9
		Q3	1534.62		37.6
		Q4	1534.95		23.7
MW-704 UFB	Leachate Monitoring Well for MW-701 QAL Outside Cut-off Wall	Q1	1533.08	Water levels in the UFB wells generally follow the water level trend in the HTDF, however, in the fall of 2020 when water level was lowered by several feet, the 704 UFB water level acted independently of the HTDF, which would be appropriate given the lack of direct connection due to the grouting along the cut off wall. Sulfate levels in this well do not correlate with those found in its leachate monitoring pair and are also lower seen at the 1500 msl level of the HTDF, indicating overall that water quality of the HTDF is not communicating with this well.	28.5
		Q2	1535.36		6.0
		Q3	1534.69		8.1
		Q4	1535.01		3.3
MW-704 LLA	Outside Cut-off Wall	Q1	1533.54	Sulfate levels significantly lower than the HTDF show evidence of cut-off wall effectiveness.	13.0
		Q2	1532.38		12.2
		Q3	1531.07		11.5
		Q4	1531.97		11.9
MW-704 DBA	Outside Cut-off Wall	Q1	1529.51	Lack of sulfate found shows no communication with the HTDF at this groundwater depth.	<1.0
		Q2	1529.81		<1.0
		Q3	-		<1.0
		Q4	1529.87		<1.0

Appendix N

Humboldt Mill

Flora & Fauna Survey Location Maps

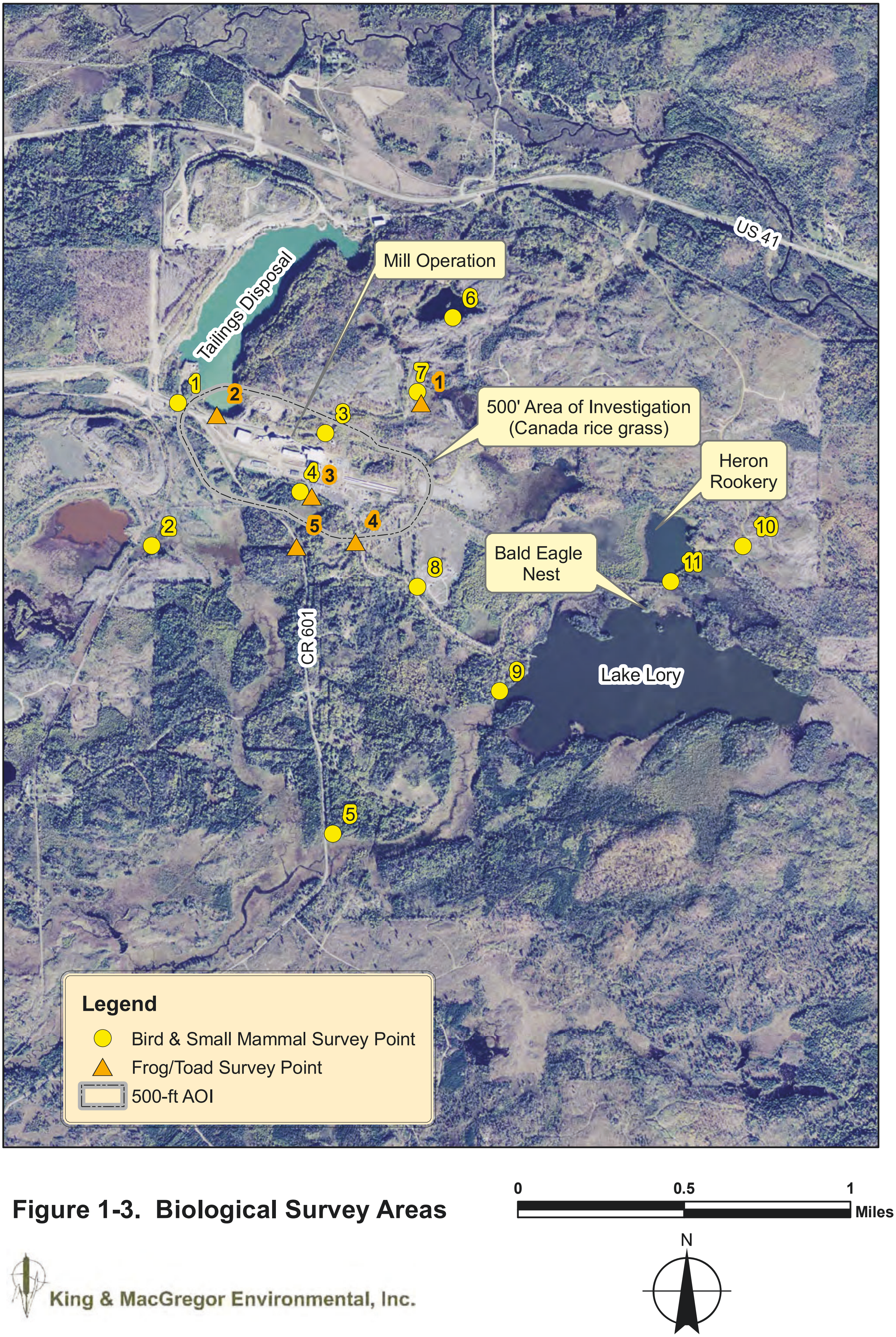


Figure 1-3. Biological Survey Areas

King & MacGregor Environmental, Inc.

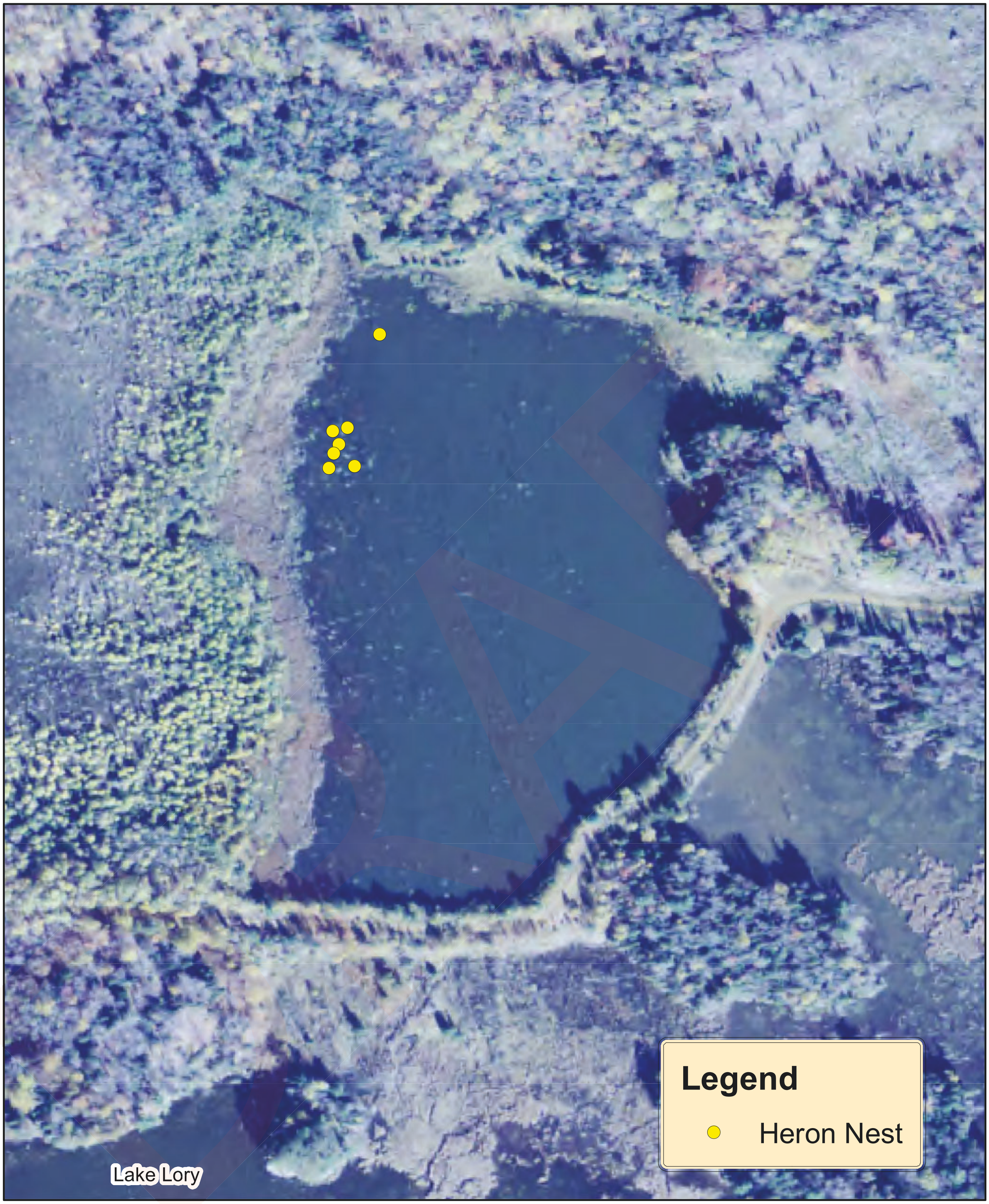


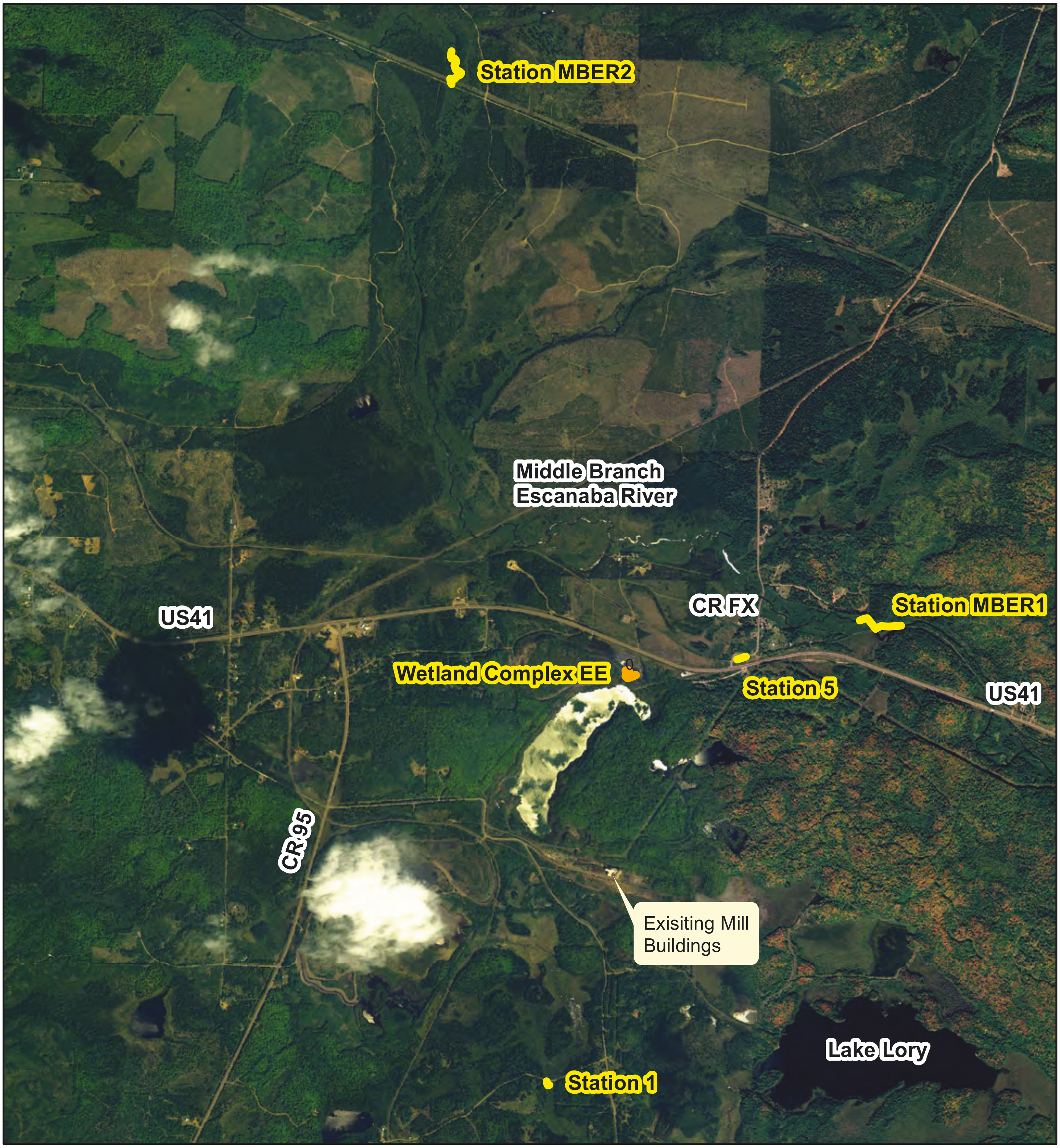
Figure 5-1. Great Blue Heron Rookery

BARR

Appendix O

Humboldt Mill

Aquatic Survey Location Maps



Legend

Wetland Complex EE Station

Stream Sample Station Locations

Feet
0 875 1,750 3,500 5,250 7,000

N

Aerial imagery obtained from Michigan Center for Geographic Information (http://www.michigan.gov/cgi/)

AEM ADVANCED ECOLOGICAL MANAGEMENT

PROJECT	Humboldt Mill - Eagle Mine
TITLE	Sample Station Locations
FIGURE	1-2

Aerial imagery obtained from Michigan Center for Geographic Information (http://www.michigan.gov/cgi/)

Legend

- Fyke Net Locations
- Gill Net Locations
- Electroshocker Transect Locations

0 275 550 1,100 1,650 2,200 Feet

N

AeM ADVANCED ECOLOGICAL MANAGEMENT

PROJECT	Humboldt Mill - Eagle Mine
TITLE	Lake Lory Gear Locations
FIGURE	1-3

Appendix P

Humboldt Mill

Mill Contingency Plan

1 Contingency Plan – Humboldt Mill

This contingency plan addresses requirements defined in R 425.205. This includes a qualitative assessment of the risk to public health and safety or the environment (HSE risks) associated with potential accidents or failures involving activities at the Humboldt Mill. Engineering or operational controls to protect human health and the environment are discussed in Section 4 and Section 5 of this document. The focus of this contingency plan is on possible HSE risks and contingency measures. Possible HSE risks to on-site workers will be addressed by Eagle Mine through HSE procedures in accordance with Mine Safety and Health Administration (MSHA) requirements.

The Humboldt Mill involves processing ore, as well as storing and treating by-products of that process. The milling, storage, and treatment facilities have been designed, constructed, and are operated in a manner that is protective of the environment through the use of proven technologies and engineering practices.

1.1 Contingency Items

This contingency plan addresses the items listed below in this Section in accordance with R 425.205 (1)(a)(i) - (xii).

- Release or threat of release of toxic or acid-forming materials
- Storage, transportation and handling of explosives
- Fuel storage and distribution
- Fires
- Wastewater collection and treatment system
- Air emissions
- Spills of hazardous substances
- Other natural risks defined in the EIA
- Power disruption, and
- Leaks from containment systems for stockpiles or disposal and storage facilities.

For each contingency item, a description of the risk is provided, followed by a qualitative assessment of the risk(s) to the environment or public health and safety. Next, the response measures to be taken in the event of an accident or failure are described.

1.1.1 Release of Toxic or Acid-Forming Materials

Potentially reactive materials generated as a result of processing operations include ore concentrate and tailings. Both materials have the potential to leach metals constituents when exposed to air and water. As described in the following sub-sections, handling and temporary storage of both the ore concentrate and tailings have been carefully considered in the design of the Humboldt Mill so as to prevent the uncontrolled release of acid rock drainage (ARD).

1.1.1.1 Coarse Ore Storage Area (COSA) and Concentrate Load-Out (CLO) Areas

Potential environmental risks associated with the COSA is the release of contact water to the environment via cracks in the floor areas or collection sumps. The COSA is a steel sided building with a full roof that is used for temporary storage of stockpiled coarse ore that has been transported from the mine and is awaiting crushing. The COSA has a concrete floor that is sloped to keep any water associated with the ore inside the facility. The lower level of the facility is equipped with an epoxy lined sump and any water collected is pumped to the Humboldt Tailings Disposal Facility (HTDF) for eventual treatment by the water treatment plant.

Contingency planning for this facility includes timely repair of cracks in the floors and walls that could allow the release of material into the environment. An impermeable surface inspection plan has been developed and describes procedures for routine impermeable surface inspections, preventative and remedial actions as well as documentation procedures. Also, in accordance with Air Permit (No. 405-08) all overhead doors must be closed during loading or unloading of ore and a sweeping program is in place to minimize the generation of dust.

1.1.1.2 Concentrate Load-Out (CLO)

Potential environmental risks associated with the CLO is the release of acid generating material via track out and fugitive emissions. The CLO is a steel sided building with a full roof that is used for temporary storage of stockpiled nickel and copper concentrate prior to loading the material into railcars destined for customers. The CLO has concrete floors and does not contain any floor drains as water use is discouraged in this area.

Contingency planning for this facility includes timely repair of cracks in the floors and walls that could allow the release of material into the environment. An impermeable surface inspection plan has been developed and describes procedures for routine impermeable surface inspections, preventative and remedial actions as well as documentation procedures. Also, in accordance with Air Permit (No. 405-08) all overhead doors must be closed during loading operations and a sweeping program in place to minimize the generation of dust and track out of material. Track out is also managed in accordance with procedures outlined in the facilities standard operating procedures and includes inspecting and removing any residual concentrate from the exterior of the railcars prior to leaving the facility.

1.1.1.3 Humboldt Tailings Disposal Facility (HTDF)

Potential contaminant release from the HTDF could be waters having elevated metal concentrations that impact surface water or groundwater quality. The HTDF is a former open pit mine that was allowed to fill with water. Process tailings are sub-aqueously disposed which is industry best practice for materials that could be potentially acid generating. The anoxic environment minimizes the potential for generation of ARD.

The HTDF was originally comprised of bedrock walls on three sides and alluvial soils on the north end in which water was allowed to naturally flow into the nearby wetland. A cut-off wall has been installed on the north end to prevent the release of water from the HTDF through the alluvial soils. Therefore, groundwater quality surrounding the HTDF will not be influenced by HTDF operations. Natural discharges from the HTDF have been essentially eliminated and any water that leaves the HTDF must now pass through the water treatment plant prior to discharge into the environment. Surface water discharge from the HTDF will be treated through the water treatment plant prior to discharge to the Escanaba River and/or nearby wetland. In addition, the installation of the cut-off wall in the alluvial soils along the north perimeter of the HTDF will prevent release to the groundwater.

Groundwater seeps from the HTDF are not expected to occur due to the low permeability of the surrounding Precambrian geologic formation. Furthermore, groundwater and surface water quality and elevations/flow are routinely monitored in accordance with the Part 632 Mining and NPDES permits and will quickly identify changes to surrounding water quality that would be indicative of groundwater release from the HTDF. Contingency planning from an unlikely groundwater release from the HTDF includes:

- Identify the nature and extent of the release,
- Implement additional monitoring to ascertain extent of release,
- Develop a remedial action plan to bring facility back into compliance,
- Implement remedial action plan.

Specific details of the remedial action plan would be developed based upon the nature of the release and with agreements with the Michigan Department of Environment, Great Lakes, and Energy (EGLE).

Eagle will monitor water quality in the HTDF during operations and post-closure. The WTP and associated infrastructure will remain in place after tailings disposal has ceased until water quality meets applicable standards. If future monitoring indicates there are elevated metals in the HTDF that could impact surface water one of the following treatment options may be implemented:

- Continue the treatment of the HTDF water through the WTP until water quality conditions in the HTDF meet surface water standards; and/or
- Amend the HTDF with appropriate reagents to reduce elevated metal parameters in order to meet surface water standards.

Specific reagents and application rate(s) would be identified upon determination of elevated metal parameters of concern. Past phosphate seeding of HTDF by previous owners was shown to be effective for nickel concentration reduction.

1.1.1.4 **Tailings Transport System**

Tailings are transported to the HTDF via slurry contained within a double-cased HDPE pipe conveyance system. The pipe conveyance system consists of a 4-in diameter carrier pipe within an 8-in outer containment pipe. Two tailings lines are available for use, but only one is utilized at a time. In addition, the tailings lines are equipped with a leak detection system; any water released into the outer piping would drain to the shore vault and trigger an alarm, notifying operations of a potential system breach. The shore vault is also visually inspected twice per day (once per shift) by operators and the Environmental Department checks the tailings lines for signs of leakage once per week.

If a breach is identified, the slurry pumps will be shut-down until the source of breach is identified and repaired. The contingency plan for moving tailings to the HTDF facility is to use the second set of tailings lines that are already in place. In the event both lines were down, they could either be pumped into a truck with a sealed cargo area or the tailings will be held within the plant thickener vessel until the pipeline is repaired.

1.1.2 Storage, Transportation and Handling of Chemicals

Potential risks associated with chemical use include surface and groundwater quality impacts. Chemicals are brought to the site by certified chemical haulers, meeting Michigan Department of Transportation (MDOT) transportation requirements. Storage of these chemicals is in secure locations within building(s) or outdoor bulk storage silos designed for that application. Transferring chemicals is conducted by qualified site personnel. Bulk granular products are conveyed pneumatically to the storage silos. Specific procedures for chemical storage and emergency response procedures are included in the facilities Pollution Incident Prevention Plan (PIPP).

Because chemicals will be stored in secure areas, the potential for release into the environment is very remote. If a breach of contaminant vessel does occur, the chemical will be contained within the secondary containment area. The spill or release will be immediately cleaned using appropriate methods specified in the Safety Data Sheets (SDS). SDS are maintained on-site for all chemicals.

1.1.3 Fuel Storage and Distribution

There is currently one 3,000 gallon stationary bulk diesel tank located onsite. This tank is used to fuel all mobile equipment onsite. A fuel provider refills the tank on an as needed basis. The stationary tank is located on an asphalt surface in which any spills or leaks would be captured in a catch basin and routed to the HTDF.

In addition to the above, additional equipment containing fuel include a back-up diesel generator (2,000 gallon capacity) located at the northeast corner of the concentrate loadout facility, a back-up diesel generator (1335 gallons capacity) located by the shore vault, and two refueling tanks located in the beds of pickup trucks (38 and 96 gallon capacities).

In general, fuel spills and leaks will be minimized by the following measures:

- A Spill Prevention Control and Countermeasures Plan (SPCC) has been written and implemented.
- Training of personnel responsible for handling fuel in proper procedures and emergency response;
- Regular equipment inspections and documentation of findings, and
- Staging of on-site emergency response equipment to quickly respond to unanticipated spills or leaks.

Specific procedures have been prepared as part of the project's SPCC Plan. In addition, a Pollution Incident Prevention Plan (PIPP) has been prepared which addresses potential spillage of fuels and other polluting materials such as water treatment chemicals and mill processing reagents.

Diesel fuel and propane (fuels) are transported to the Eagle Project by tanker truck from local distributors. The probability of an accidental release during transportation will be dependent on the location of the supplier(s) and the frequency of shipment. A fuel release resulting from a vehicular accident during transportation is judged to be a low probability event. Transport of fuel in tanker trucks does not pose an unusual risk to the region since tanker trucks currently travel to the region on a regular basis to deliver fuels to gasoline stations located in the communities surrounding the Humboldt Mill.

Three potential release events associated with the surface-stored fuels are a bulk tank failure, mishandling/leaking hoses, and a construction/reclamation phase release.

Bulk Tank Failure – A release may result from a failure of the stationary diesel tank. This type of release is judged to be low probability as it is a double-walled (i.e. secondary containment) fireproof tank that is inspected on a daily basis prior to use for signs of leakage or potential failure. In addition, as stated above the tank is parked and utilized in a location where asphalt is present and any spills would be directed to the HTDF and not to an offsite or unprotected surface location. In addition, a spill response trailer is located onsite and contains spill containment and clean-up equipment in the event of a spill. Eagle also has a spill response contractor on call to immediately respond to situations that cannot be handled by onsite personnel.

Mishandling/Leaking Hoses - A release might result from leaking hoses or valves, or from operator mishandling. This type of release is likely to be small in volume and is judged to be a low probability event given that operators will be trained to manage these types of potential releases. Mitigation measures include, fueling on an asphalt surface and using secondary containment under connection/fill points. In addition, these small spills will be cleaned up using on-site spill response equipment such as absorbent materials and/or by removing impacted soils.

Construction/Reclamation Phase Release - A major fuel spill during the construction or reclamation phases could occur from a mobile storage tank failure or mishandling of fuels. Such a release is also considered to be a low probability event given that operators will be trained to manage these types of potential releases and all tanks are required to have secondary containment. As with mishandling or leaking hoses, these small spills will be cleaned up by using on-site spill response equipment such as absorbent materials and/or removing impacted soils.

Absorptive materials may be used initially to contain a potential spill. After the initial response, soil impacted with residual fuel would be addressed. Remedial efforts could include, if necessary, the removal of soil to preclude migration of fuel to groundwater or surface water. The project's PIPP and SPCC plans addresses fueling operations, fuel spill prevention measures, inspections, training, security, spill reporting, and equipment needs. In addition, standard operating procedures have been developed which cover fueling operations and spill response activities. All responses to a fuel spill, both large and small, will follow the guidelines dictated by the spill response plan and be reported internally. The tanks will be inspected regularly, and records of spills will be kept and reported to EGLE or other agencies as required.

Contingency plans for responding to fuel spills from tanker trucks are required of all mobile transport owners as dictated by MDOT regulation 49 CFR 130. These response plans require appropriate personnel training and the development of procedures for timely response to spills. The plan must identify who will respond to the spill and describe the response actions to potential releases, including the complete loss of cargo. The plan must also list the names and addresses of regulatory contacts to be notified in the event of a release.

1.1.4 Fires

Surface fires can be started by a variety of causes including vehicular incidents, accidental ignition of fuels or flammable chemical reagents, and lightning strikes. Smoking is only allowed in designated areas on the site. Contingency measures include having the required safety equipment, appropriate personnel training and standard operating procedures. In addition, muster points have been established and all employees and visitors are trained on their location. Given these measures, uncontrolled or large surface fires are considered a low probability event with negligible risk.

Because the Humboldt Mill is situated in a forested region, forest fires started off-site could potentially impact the mill site. The cleared area in the vicinity of the surface facilities serves as a fire break to protect surface facilities. Contingency measures discussed below can be implemented in the event of an off-site forest fire.

In order to minimize the risk of a fire on-site, stringent safety standards are being followed. All vehicles/equipment are required to be equipped with fire extinguishers and all personnel trained in their use. Fire extinguishers are also located near each building exit door and personnel are required to complete a "hot work" permit for tasks involving open flames, heat, and/or sparks. A network of fire hydrants are installed throughout the site and the Mill Emergency Response Team is trained in defensive firefighting techniques to help stop the spread of a fire if it was safe to do so.

On-site firefighting equipment includes:

- An above ground water storage tank and distribution system for fire suppression
- Five stocked and maintained fire equipment cabinets
- 29 occupant-use fire hose stations throughout the facility
- Dry chemical fire extinguishers located throughout the site
- FireWorks system with multiple heat and smoke detectors that notifies site Security immediately of any fire.

In addition, a Wildfire Response Guideline has been developed in conjunction with Michigan DNR Fire Division to ensure the best possible response to a wildland fire.

Contingency planning for managing materials that oxidize includes training equipment operators on the material characteristics. The temperature of the material is routinely measured and any material exhibiting signs of self-heating is immediately compacted or exposed and spread out depending on the situation. Both methods are proven to mitigate the risks associated with self-heating.

1.1.5 Wastewater Collection and Treatment

The major source of water from the facility requiring treatment includes process water and tailings, groundwater infiltration into the HTDF, precipitation, and storm water runoff. The HTDF is sized to provide wastewater storage and equalization capacity. Water from the HTDF is conveyed to the WTP which is comprised of several unit processes, including: oxidation, metals precipitation, ultra-filtration and reverse-osmosis filtration. The final product water is discharged to the Escanaba River and/or nearby wetland area. This discharge is authorized by the State of Michigan under an National Pollutant Discharge Elimination

System (NPDES) permit (MI0058649).

The water treatment system is designed to handle various process upset conditions such as power disruption (Section 1.1.9) or maintenance of the various process units. The effluent is continually monitored for key indicator parameters to verify the proper operation. Effluent not meeting treatment requirements is pumped back to the HTDF for re-treatment. The water level of the HTDF is maintained at a level that provides ample storage capacity that would allow for sufficient time to correct a process upset condition. Potential hazards and chemical reagents associated with the WTP are discussed in Section 1.1.7.

1.1.6 Air Emissions

The operation and reclamation phases of the project will be performed in a manner to minimize the potential for accidents or failures that could result in off-site air quality impacts. All phases of the project will incorporate a combination of operating and work practices, maintenance practices, emission controls and engineering design to minimize potential accidents or failures. Below is a description of identified areas of risk and associated contingency measures that may be required. As part of a comprehensive environmental control plan, these contingency measures will assist in minimizing air impacts to the surrounding area.

1.1.6.1 Air Emissions during Operations

During operation of the mill, potential emissions from the facility will be controlled as detailed in the Mill's current Michigan Air Use Permit (No. 405-08). These controls include use of building enclosures for material handling, installation of dust collection or suppression systems to control dust during ore crushing and transfer operations and following prescribed preventive maintenance procedures for the facility. Tailings generated during the milling process are transported to the HTDF via slurry and therefore will not generate particulate matter. Ore brought from off-site is transported in covered trucks to minimize dust emissions. Below is a more detailed discussion of potential airborne risks associated with proposed operations at the facility.

To minimize dust emissions from the COSA and concentrate load-out building, these areas are fully enclosed. Ore transported from the mine site may only be dumped in the COSA when the doors are closed to minimize dust emissions from the building. A sweeping and housekeeping program is in place in the COSA and throughout the crushing circuit including the primary crusher, rock breaker, and conveyor transfer points located in the conveyor transfer station and mill building.

Fabric filter baghouses are used throughout the facility to minimize emissions of dust. Bag houses are located in the Secondary Crusher building and the Fine Ore Bins. Two insertable filter systems are installed in the transfer building. Baghouse malfunction is a possibility and can include a bag break or offset and excessive dust loading. These potential malfunctions are addressed in the malfunction prevention and abatement plan. The plan includes regular inspections and maintenance activities of dust collection and suppression systems which is accomplished through monitoring of pressure drop across the bags, monitoring of gas flow, and visual observations of stack emissions to assess opacity per permit conditions. In the event the monitoring program indicates a malfunction, a thorough investigation of the cause will occur. If necessary, ore processing operations will be shut down until the problem is corrected.

During facility operations, Eagle Mine will utilize certain pieces of mobile equipment to move material about the site. Equipment includes front end loaders, product haul trucks, and miscellaneous delivery trucks. Although the movement of most vehicles across the site is on asphalt surfaces, a comprehensive on-site sweeping and watering program has been developed to control potential fugitive sources of dust. If excessive dust emissions should occur, the facility will take appropriate corrective action, which may include intensifying and/or adjusting the sweeping/watering program to properly address the problem.

1.1.6.2 Air Emissions during Reclamation

Once milling operations are completed at the site, reclamation will commence in accordance with R 425.204. Similar to construction activities, there is a moderate risk that fugitive dust emissions could be released during certain re-vegetation activities and during temporary storage of materials in stockpiles. Similar to controls employed during the construction phase, areas that are reclaimed will be re-vegetated to stabilize soil and reduce dust emissions. If severe wind or an excessive rain event reduces the effectiveness of these protective measures, appropriate action will take place as soon as possible to restore vegetated areas to their previous effectiveness and replace covers as necessary.

To the extent necessary, areas being reclaimed will be kept in a wet state by continuing the watering program. It is anticipated this program should minimize the possibility of excessive dust associated with mobile equipment. In the event fugitive dust is identified as an issue, corrective action will determine the cause of the problem and appropriate action will occur.

1.1.7 Spills of Hazardous Substances

Chemical reagents onsite are primarily used for the ore flotation and water treatment plant processes. Table 1.1.7 includes a list of reagents reported under the SARA Tier II Emergency and Hazardous Chemical Inventory that are being used onsite along with the approximate storage volumes and storage location. The storage volume is the calculated volume of chemical within each solution based on percentage.

Table 1.1.7 Chemical Reagents Used at the Water Treatment Plant & Mill Building

Item No.	Chemical Name	Trade Name	CAS No.	Storage Volumes	Storage Areas
1	Hydrochloric Acid/Hydrogen Chloride 31.5%	Muriatic Acid	7647-01-0	900 gal	WTP chemical storage
2	Sodium Bisulfite 40%	Sodium Bisulfite	7631-90-5	900 gal	WTP chemical storage
3	Sodium Hydroxide 25%	Sodium Hydroxide/ Caustic Soda	1310-73-2	900 gal	WTP chemical storage
4	Sodium Hypochlorite 12.5%	Chlorine/Bleach	7681-52-9	900 gal	WTP chemical storage
5	1) Ferric Chloride 35% 2) Hydrochloric Acid 1%	Ferric Chloride	1) 7705-08-0 2) 7647-01-0	7,500 gal	WTP Reactor Area (West of WTP)
6	1) Sodium Hydroxide 50% 2) Sodium Chloride 5%	Sodium Hydroxide/ Caustic Soda	1) 1310-73-2 2) 7647-14-5	8,400 gal	WTP chemical storage
7	Sulfuric Acid 93.19%	Sulfuric Acid, 66 Deg	7664-93-9	7,600 gal	WTP sulfuric bulk tank
8	Aluminum chloride hydroxide sulphate	Nalco 8136/PAC	39290-78-3	2,200 gal	WTP chemical storage
9	1) Sodium Chloride 2) Sodium Sulphide, 3) Sodium Hydroxide	Nalmet 1689	1) 7647-14-5 2) 1313-82-2 3) 1310-73-2	550 gal	WTP chemical storage
10	Hydrotreated Light Distillate	Nalclear 7766 Plus/Flocculant	64742-47-8	110 gal	WTP chemical storage

11	Hydrogen Peroxide 50%	Hydrogen Peroxide	7722-84-1	7,000 gal	WTP reactor Area
12	Low pH RO cleaner	Citric Acid	77-92-9	4,000 lbs	WTP chemical storage
13	High pH RO cleaner	Hydrex 4501	Unknown	1,600 lbs	WTP chemical storage
14	PERMACLEAN-56	Biocide PC-56	10377-60-3 26172-55-4 2682-20-4	550 gal	WTP chemical storage
15	Sodium carboxymethyl cellulose	CMC/Finnfix 300	9004-32-4	20 tons	Reagent storage area
16	Calcium Hydroxide	Hydrated Lime	1305-62-0	29 tons	Lime silo
17	Optimer 83949	Flocculant	Unknown	2 tons	Reagent storage area
18	Methyl isobutyl carbinol (MIBC)	MIBC/Frother	108-11-2	2.2 tons	MIBC tank
19	Sodium isopropyl xanthane (SIPX)	SIPX	140-93-2	15 tons	Reagent storage area
20	Sodium carbonate	Soda Ash	497-19-8	54 tons	Soda ash silo

Chemical storage and delivery systems follow current standards that are designed to prevent and to contain spills. All areas in which chemicals are used or stored have been designed and constructed with environmental protection in mind. This includes development of secondary containment areas for liquids. The secondary containment area is constructed of materials that are compatible with and impervious to the liquids that are being stored. A release in the WTP or concentrator building from the associated piping would be contained within the plant area, neutralized, and sent to the HTDF for disposal. Absorbent materials are available to contain acid or caustic spills. Eagle Mine has an emergency response contractor on call to immediately respond to environmental incidents, assist with clean-up efforts, and conduct environmental monitoring associated with any spills.

Spill containment measures for chemical storage and handling will reduce the risk of a spill from impacting the environment. Due to the low volatility of these chemicals, fugitive emissions from the WTP or concentrator building to the atmosphere during a spill incident are likely to be negligible. Off-site exposures are not expected. It is therefore anticipated that management and handling of WTP and processing reagents will not pose a significant risk to human health or the environment.

1.1.8 Other Natural Risks

Earthquakes – The Upper Peninsula of Michigan is in a seismically stable area. The USGS seismic impact zone maps show the maximum horizontal acceleration to be less than 0.1 g in 250 years at 90% probability. Therefore, the mine site is not located in a seismic impact zone and the risk of an earthquake is minimal. Therefore, no contingency measures are discussed in this section.

Floods - High precipitation events have been discussed previously in the section that describes the HTDF. High precipitation could also lead to the failure of erosion control structures. The impacts of such an event would be localized erosion. Contingency measures to control erosion include sandbag barriers and temporary diversion berms. Long term or off-site impacts would not be expected. Failed erosion control structures would be repaired or rebuilt. Impacts from high precipitation are reversible and off-site impacts are not expected to occur. Given the considerable planning and engineering efforts to manage high precipitation events, the risk posed by high precipitation is considered negligible.

Severe Thunderstorms or Tornadoes – Severe thunderstorms or tornadoes are addressed in the emergency procedures developed for the Eagle Mine and Humboldt Mill. Storm shelters have been designated and evacuation procedures practiced on an annual basis.

Blizzard – The mill site is designed to accommodate the winter conditions anticipated in the Upper Peninsula of Michigan. The Marquette County Road Commission is responsible for maintaining roadways near the Humboldt Mill. If road conditions deteriorate beyond the capability of the county or township maintenance equipment, employees can be housed onsite in the administrative offices and conference rooms as needed.

Forest Fires – Forest fires were discussed in Section 1.1.4.

1.1.9 Power Disruption

Electrical power for the Humboldt Mill is provided by two utility power companies; Wisconsin Electric (WE) Energies and Upper Peninsula Power Company (UPPCO). The mill facility and production buildings are presently served by a 69 kV overhead electric feeder to an on-site UPPCO electrical substation. The substation supplies three underground 13.8 kV feeders; two to our main mill switchgear and one to our fire water system.

The production support buildings and Water Treatment Plant infrastructure for the mill are fed from a WE Energies 25 kV overhead line. These buildings include the Security Building, Administration Building, Mill Services Building, Water Treatment Plant Building which includes Water Treatment Plant Intake Pump Building.

In the event that power is disrupted, backup generators are installed to ensure mill critical loads remain energized. The buildings where "critical loads" have been identified and generators have been installed are Concentrator Building; which powers essential loads in the Concentrator and Concentrate Load Out Buildings, Coarse Ore Storage Area, Tailings Vault/Reclaim Pump Structure, Administration Building, Mill Services Building, Security Building and Water Treatment Plant.

In the event the WTP would need to be temporarily shut down during power disruptions, the water level of the HTDF is maintained at a level that provides enough capacity to store water for an extended period of time if necessary.

1.2 Emergency Procedures

This section includes the emergency notification procedures and contacts for the Humboldt Mill Site. In accordance with R 425.205(2), a copy of this contingency plan will be provided to each emergency management coordinator having jurisdiction over the affected area (i.e. Marquette County).

Emergency Notification Procedures – An emergency will be defined as any unusual event or circumstance that endangers life, health, property or the environment. If an incident were to occur, all employees are instructed to contact Security via radio or phone. Security then makes the proper notifications to the facility managers and activates the Eagle Mine Emergency Response Guideline as needed. If personnel on site need to be notified of such an event an emergency toned broadcast via radio and all-call speakers will be made with instructions.

Eagle Mine has adopted an emergency response structure that allows key individuals to take immediate responsibility and control of the situation and ensures appropriate public authorities, safety agencies and the general public are notified, depending on the nature of the emergency. A brief description of the key individuals is as follows:

- Health & Safety Officer: The facility H&S manager and H&S staff are responsible for monitoring activities in response to any emergencies. During an emergency, H&S representatives will manage special situations that expose responders to hazards, coordinate emergency response personnel, mine rescue teams, fire response, and ensure relevant emergency equipment is available for emergency service. This individual will also ensure appropriate personnel are made available to respond to the situation.

- Environmental Officer: The facility environmental manager will be responsible for managing any environmental aspects of an emergency situation. This individual will coordinate with personnel to ensure environmental impact is minimized, determine the type of response that is needed and act as a liaison between environmental agencies and mine site personnel.
- Public Relations Officer: The facility external relations manager will be responsible for managing all contacts with the public and will coordinate with the safety and environmental officers to provide appropriate information to the general public.

In addition to the emergency response structure cited above, Eagle Mine has a Crisis Management Team (CMT) and Plan developed to manage situations that may result in multiple injuries, loss of life, environmental damage, property or asset loss, or business interruption. If a situation is deemed a "crisis" the CMT immediately convenes to actively manage the situation. The CMT meets on a quarterly basis to review and practice plan implementation and annually a third party develops a desktop exercise to challenge and ensure preparedness of the CMT. The following is a description of the core members and their roles:

Crisis Management Team – Core Members and Roles

Core Members	Role
Team Leader	Responsible for strategy and decision making by the CMT during a crisis and maintaining a strategic overview.
Coordinator	Ensures a plan is followed and all logistical/administrative support required is provided.
Administrator	Records key decisions and actions and provides appropriate administrative supports to the CMT.
Information Lead	Gathers, shares, and updates facts on a regular basis.
Emergency Services and Security	Liaises with external response agencies and oversees requests for resources. Maintains a link between the ERT and CMT and oversees and necessary evacuations.
Communications Coordinator	Develops and implements the communications plan with support from an external resource.
Spokesperson	Conducts media interviews and stakeholder briefings.

Evacuation Procedures – While the immediate surrounding area is sparsely populated, if it is necessary to evacuate the general public, this activity will be handled in conjunction with emergency response agencies. The Public Relations Officer will be responsible for this notification, working with other site personnel, including the H&S and environmental officers.

In the event evacuation of mill personnel is required, Eagle Mine has developed emergency response procedures for all surface facilities. All evacuation procedures were developed in compliance with MSHA regulations. In addition, the Mill Emergency Response Team (ERT) was formed to assist in emergency response situations should they arise. This team is not required by MSHA but was established to help ensure the safety of employees while at work. The Humboldt Mill Emergency Response Team (ERT) saw a decline in monthly trainings due to social distancing restrictions during periods of high local Covid-19 virus activity. Trainings that did occur focused on review of rope rescue knots and techniques, medical and trauma treatment, patient packaging, site evacuation, scene safety, and the fire water system. Three live evacuation drills occurred in which the ERT team conducted building sweeps to ensure complete evacuations to the muster point.

In addition to the ERT, security personnel are EMTs and paramedics who are trained in accordance with state and federal regulations. This allows for immediate response to medical emergency situations. Security saw a flurry of contingent activity, both through their secondary function as the site emergency medical service (EMS), and as the site's primary initial contact with the outside world. Being a Michigan licensed EMS agency, several state-mandated procedures were implemented for patient care to keep them safe as health care providers. Numerous policies and procedures were also developed to aid Security in keeping our site safe by screening for employees and visitors with potential Covid-19 infections. Site access, and even access to the Security Building, was limited to essential people only. Covid-19 screening questions were developed, a random temperature taking program was implemented, mask mandates were instated, and methods of insuring compliance with state and site rules were developed.

In addition to the Emergency Response Team, security personnel are EMTs and paramedics who are trained in accordance with state and federal regulations. This allows for immediate response to medical emergency situations.

Emergency Equipment – Emergency equipment includes but is not limited to the following:

- ABC Rechargeable fire extinguishers
- Fire cabinets located throughout the site containing hose, nozzles, hydrant wrenches, etc.
- Radios
- First aid kits, stretchers, backboards, and appropriate medical supplies
- Gas detection monitors that detect five gases and LEL
- High angle rescue ropes
- Self-Contained Breathing Apparatus (SCBA)
- Spill Kits (hydrocarbon and chemical)
- Certified EMT's Basic and Paramedics are on site at all times to respond in the event of an emergency.
- A trained Emergency Response Team.

This equipment is located throughout the surface facilities. Fire extinguishers are located at appropriate locations throughout the facility, in accordance with MSHA requirements. Surface facility personnel are also equipped with radios for general communications and emergencies. Other emergency response equipment is located at appropriate and convenient locations for easy access for response personnel.

Emergency Telephone Numbers – Emergency telephone numbers are included for site and emergency response agencies, as required by R 425.205(1)(c). They are as follows:

- Mill Security: (906) 339-7017
- Local Ambulance Services: UP Health Systems Bell. Contact Security at Extension 7017, or by radio using the Emergency Channel, or by dialing 911.
- Hospitals: Marquette General Hospital – (906) 225-3560
  Bell Hospital – (906) 485-2200
- Local Fire Departments: Humboldt Township, Ishpeming Township – 911
- Local Police: Marquette County Central Dispatch – 911
  Marquette County Sheriff Department – (906) 225-8435
  Michigan State Police – (906) 475-9922
- Trimedia 24-hr emergency spill response: (906) 360-1545
- EGLE Marquette Office: (906) 228-4853

- Michigan Pollution Emergency Alerting System: (800) 292-4706
- Federal Agencies: EPA Region 5 Environmental Hotline: (800) 621-8431
  EPA National Response Center: (800) 424-8802
  MSHA North Central District: (218) 720-5448
- MDNR Marquette Field Office: (906) 228-6561
- Humboldt Township Supervisor: (906) 339-4477

1.3 Testing of Contingency Plan

During the course of each year, the facility will test the effectiveness of the Contingency Plan. Conducting an effective test will be comprised of two components. The first component will include participation in adequate training programs on emergency response procedures for those individuals that will be involved in responding to emergencies and the second component is completion of a mock field or desktop exercise.

Training will include participation of the Safety Officer, Environmental Officer, Public Relations Officer and other individuals designated to respond to emergencies including the Mill ERT. Individuals will receive appropriate training and information with respect to their specific roles, including emergency response procedures and use of applicable emergency response equipment.

The second component of an effective Contingency Plan is to conduct desktop exercises or mock field tests. At least one desktop exercise or mock field test will be performed each year which will test the emergency response measures of the contingency plan and crisis management plan in place at Eagle Mine. The Safety Officer will work with the Environmental Officer and Emergency Response Coordinator to first define the situation that will be tested. The types of test situations may include responding to a release of a hazardous substance, fire or natural disaster such as a tornado. A list of objectives will be developed for planning and evaluating each identified test situation. A date and time will then be established to carry out the test. Local emergency response officials may be involved, depending on the type of situation selected.

Once the test is completed, members of the crisis management team and emergency response team will evaluate the effectiveness of the response and make recommendations to improve the system. These recommendations will then be incorporated into a revision of the facility Contingency Plan and Crisis Management Plan.

Appendix Q

Financial Assurance

EAGLE MINE AND HUMBOLDT MILL CLOSURE

2020 CLOSURE PLAN ESTIMATE

Description	SLR Estimate November 2018	Difference from Previous Estimate	Comments
Functional Currency	USD		
Current Day Cost	2020		
Expected Operations Completion Date	2025		Previous was 2023
Expected Closure Completion Date	2028/29		SLR provides 2 years for Mine Closure and 3 years for Mill Closure (winter work is avoided)
Expected Post-Closure Completion Date	2029		SLR provides for an initial post-closure period of 5 years to allow Sites to come to equlibriam.
Post-Closure Monitoring Completion Date	2049		SLR provides 15 years to demonstrate no further action is required including monitoring.

Code	Description	Estimated Cost (USD)	Contingency (USD)	Closure Estimate (USD)	
	Closure at Life of Mine				
1000	**Eagle Mine and Related Facilities Closure**				
1100	**Eagle Mine Underground**				
1110	Underground Mine Equipment	$220,367	$26,444	$246,811	Decontaminate, Prepare for Transport, Load and Haul all Mining Equipment from Site
1130	Demolition of Underground Infrastructure	$1,097,368	$131,684	$1,229,052	Underground Infrastructure Demolition, Load, Haul to Surface Processing Area
1160	Backfill of Mine (Backfill of Stopes Complete at Start of Closure)	$105,990	$15,899	$121,889	(The estimate assumes that backfilling of the mine stopes has been completed upon start of closure)
1170	Closure Elements Construction	$2,485,000	$308,500	$2,793,500	
1200	**Surface Facilities and Infrastructure**				
1210	Mobile Equipment	$17,619	$2,643	$20,262	Allow for Surface Equipment at 50 percent of the UG Equipment (Excluding Loaders, Haul Units and Drills)
1220	Building Demolition	$2,876,566	$345,188	$3,221,754	Mine Building Demolition, Load, Haul to Processing Area
1230	Demolition of Mine Surface Infrastructure	$877,657	$131,648	$1,009,305	Mine Surface Infrastructure Demolition, Load, Haul to Processing Area
1240	Concrete and Asphalt Demolition	$678,132	$81,376	$759,507	(Recycle for Mine Fill)
1250	Drainage Facilities and Road Removal	$749,467	$112,420	$861,887	Water Basins, TDRSA, Drainage Channels and Road Removal
1260	Site Backfill, Grading and Preparation for Revegetation	$1,262,697	$189,405	$1,452,102	Regrade the Site Using Material from Site Berms
1270	Closure Elements Construction	$636,000	$95,400	$731,400	Permanent Drainage Facilities (provide for drainage channels, sediment basins and drainage infrastructure)
1280	General Site Planting and Revegetation	$1,277,555	$191,633	$1,469,188	(Total Site Area for Revegetation equals Approximately 160 Acres)
1290	Other Miscellaneous Closure Requirements	$0	$0	$0	
2000	**Humboldt Mill Closure**				
2200	**Surface Facilities and Infrastructure**				
2210	Mobile Equipment	$17,619	$2,643	$20,262	Decommission, Prepare for Transport and Load Equipment
2220	Building Demolition	$4,004,980	$480,598	$4,485,577	Mill Building Demolition, Load, Haul to Processing Area
2230	Demolition of Surface Infrastructure	$1,119,326	$167,899	$1,287,225	Mill Surface Infrastructure Demolition, Load, Haul to Processing Area
2240	Concrete and Asphalt Demolition	$876,097	$131,414	$1,007,511	Concrete SOG and Foundation Removal and Asphalt
2250	Drainage Facilities and Road Removal	$111,445	$16,717	$128,162	Fill Stormwater Basins
2260	Site Backfill, Grading and Preparation for Revegetation	$1,016,951	$122,034	$1,138,985	Import Topsoil
2270	Closure Elements Construction	$379,375	$45,525	$424,900	Permanent Drainage Facilities (provide for drainage channels, sediment basins and drainage infrastructure)
2280	General Site Planting and Revegetation	$507,051	$76,058	$583,109	(Total Site Area for Revegetation equals Approximately 60 Acres)
2290	Other Miscellaneous Closure Requirements	$896,893	$134,534	$1,031,427	Fencing, signage, soil removal, spillways, increase FS for Rock Face north of mill building
	Subtotal Direct Closure Costs	$21,214,154	$2,809,661	$24,023,816	
5000	**Contractor's Indirect Costs**				
5100	Mine Closure	$2,905,814	$372,437	$3,278,251	
5200	Humboldt Mill Closure	$3,704,897	$462,062	$4,166,958	
	Summary				
	Eagle Mine Subtotal	$15,190,231	$2,004,677	$17,194,908	
	Humboldt Mill Subtotal	$12,634,634	$1,639,483	$14,274,117	
	Total Direct Closure Construction Cost	**$27,824,865**	**$3,644,160**	**$31,469,025**	
7000	**Site Operations, Maintenance and Monitoring (OM&M)**				
	Provide OM&M (5 yr Mine WTP, 4 Yr Mill WTP)				
7100	Eagle Mine (5 years) *	$4,554,268	$0	$4,554,268	2020 Using same as 2018 & 2019 of 5 year operating level w/ updated costs
7200	Humboldt Mill (4 years) *	$10,253,927	$0	$10,253,927	2020 Using same 2019 of 4 year operating plan w/ updated costs
	Post-Closure Phase I - Five Year Period Following Completion of Closure Construction				
7300	Eagle Mine (5 year)	$3,500,162	$350,016	$3,850,178	Adjusted out Lundin oversight
7400	Humboldt Mill (5 year)	$1,556,541	$155,654	$1,712,195	Adjusted out Lundin oversight
	Provide 15 Years of Care, Maintenance and Monitoring				
	Long Term Care and Maintenance				
	Eagle Mine	$4,749,120	$474,912	$5,224,032	Adjusted out Lundin oversight
	Humboldt Mill	$3,922,915	$392,292	$4,315,207	Adjusted out Lundin oversight
	Eagle Mine Subtotal	$27,993,781	$2,829,605	$30,823,386	
	Humboldt Mill Subtotal	$28,368,017	$2,187,429	$30,555,446	
	Total	$56,361,798	$5,017,034	$61,378,832	
	Total for Project before inflation	$56,361,798	$5,017,034	$61,378,832	
	Escalation Factor - Detroit CPI estimate as prepared with 2018 year-end dollars except as noted above * Water Treatment costs at current dollars and excluded from CPI Calculation	$581,750	$70,238	$651,989	
ADD	**ADD** - Fill Open Stopes with CRF & Clear TDRSA of waste material	$967,720	$0	$967,720	Mine site cost only in 2020 Dollars-Do not inflate
	Total for Project including inflation (excludes Contingency)	$57,911,268	$5,087,272	$62,998,540	
	EGLE Adminstrative Oversight	$5,983,860	$0	$5,983,860	2016 Added by MDEQ as Part 425.301 (b) of the permit notes "The department (MDEQ) may require financial assurance in an amount larger than calculated by operator…" Breakout was $2,589,102 Mill Site and $3,394,758 Mine Site
	Estimate to EGLE - Total for Project	**$63,895,128**	**$5,087,272**	**$68,982,400**	

Breakdown by Mine and Mill for Bonding Valuation of Each

Mine Site Total Estimate	$30,823,386
CPI Escation Apportionment	$367,768
ADD - Fill Open Stopes with CRF & Clear TDRSA of waste material	$967,720
Portion of EGLE Adminstrative Oversight per note above	$3,394,758.00
2020 Estimate for Mine Site Apportionment	$35,553,631
Mine Site Total Estimate	$30,555,446
CPI Escation Apportionment	$284,221
Portion of EGLE Adminstrative Oversight per note above	$2,589,102.00
2020 Estimate for Mill Site Apportionment	$33,428,769

Appendix R

Humboldt Mill

Organizational Chart

Eagle Mine
4547 County Road 601
Champion, MI 49814, USA
Phone: (906) 339-7000
Fax: (906) 339-7005
www.eaglemine.com

Organizational Information

Eagle Mine LLC

January 05, 2021

Registered Address:	Eagle Mine, LLC 1209 Orange Street Wilmington, DE 19801	**Business Address:**	Eagle Mine, LLC 4547 County Road 601 Champion, MI 49814

Board of Directors

Darby Stacey	4547 County Road 601 Champion, MI 49814
Peter Richardson	4547 County Road 601 Champion, MI 49814
Scott Manninen, CFO	4547 County Road 601 Champion, MI 49814

Eagle Mine
a subsidiary of lundin mining

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Officers

Jinhee Magie	Treasurer	4547 County Road 601 Champion, MI 49814
Annie Laurenson	Secretary	4547 County Road 601 Champion, MI 49814
Darby Stacey	President/Managing Director	4547 County Road 601 Champion, MI 49814
Scott Manninen	CFO	4547 County Road 601 Champion, MI 49814