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Friday, March 13, 2020

Ms. Melanie Humphrey
Michigan Department of Environment, Great Lakes, and Energy
1504 W. Washington St.
Marquette, MI 49855

Subject: Annual Mining and Reclamation Report, Eagle Mine, LLC
Nonferrous Metallic Mineral Mining Permit (MP 01 2010), Humboldt Mill

Dear Ms. Humphrey:

Eagle Mine, LLC has an approved Mining Permit (MP 01 2010) dated February 9, 2010. General Permit Condition F-2 states, "The permittee shall file with the MMU supervisor a Mining and Reclamation Report on or before March 15 of each year, both during milling operations and post closure monitoring as required by Section 324.63213 and R 425.501. The report shall include a description of the status of mining and reclamation operations, an update of the contingency plan, monitoring results from the preceding calendar year, tonnage totals of material mined, and amount of metallic product by weight."

Please find enclosed, the 2019 Annual Mining and Reclamation Report for the Humboldt Mill.

Should you have any questions about this report, please do not hesitate to contact me at 906-339-7171.

Sincerely,

David Bertucci
Environmental Compliance Supervisor

Cc: Humboldt Township

enclosure

2019 Annual Mining and Reclamation Report
Humboldt Mill
Mine Permit MP 01 2010

March 15, 2020

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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
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		
Eagle Mine LLC	Amanda Zeidler	HSE & Permitting Manager
Eagle Mine LLC	Jennifer Nutini	Environmental Superintendent
Eagle Mine LLC	David Bertucci	Environmental Compliance Supervisor
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King & MacGregor Environmental, Inc.	Matt MacGregor	Wetland Scientist/Biologist

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

One notification and zero amendment requests were submitted in 2019. The notification was related to the construction of a bulk sulfuric tank near the water treatment plant. Table 3. below summarizes the submittals that were provided to the Department in 2019 as required under the Part 632 Mining Permit.

Eagle completed construction activities on the concentrate loadout building in April 2019. The modifications involved construction of an all-weather permanent structure surrounding the lime and soda ash silos to prevent freezing in the winter and a 3-sided canopy over the tailings and nickel thickeners to promote safer working conditions in winter.

Enclosure around the lime and soda ash facility, 2019

Three-sided enclosure surrounding the thickeners, 2019

Table 3. Submittals and Approvals Required Under Part 632

Date	Description	Approval
3/15/19	2018 Annual Mining and Reclamation Report	N/A
5/23/19	Q1 groundwater and surface water monitoring data	N/A
8/7/19	Q2 groundwater and surface water monitoring data	N/A
12/10/19	Q3 groundwater and surface water monitoring data	N/A
12/23/19	Notification of bulk sulfuric acid tank construction	N/A
2/19/20	Q4 groundwater and surface water monitoring data	N/A

Table 3. Submittals and Approvals Required Under Other Permits

Date	Description	Approval
1/23/2019	General permit application for maintenance of the Escanaba River Intake	3/8/2019
3/22/2019	Notification of sulfuric acid spill	
4/16/19	Submitted the required NPDES permit renewal application	N/A
4/16/2019 – 2/20/2020	Correspondence on the EGLE compliance communication	
6/19/19	Submitted a PTI application for changes to the annual trucking limit.	N/A
7/25/19	Notification of HTDF surface water discharge to a wetland	
10/28/19	Notification of off-specification water discharge	
Jan-Dec	Submitted monthly WTP effluent discharge results (NPDES permit)	N/A
February, March, June, September	Reported toxicity events to EGLE WRD	

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 2019 monitoring activities can be found in Section 7 of this report.

4.1. Processing Report

In 2019, 757,765 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 2019.

Table 4.1 Volume of Ore Crushed, Milled, and Concentrate Produced in 2019

Month	Ore Crushed (dry tonnes)	Ore Milled (dry tonnes)	Copper Concentrate Produced (dry tonnes)	Nickel Concentrate Produced (dry tonnes)
January	62,621	61,602	3,138	10,485
February	45,292	46,510	3,301	8,491
March	57,464	57,190	3,609	11,640
April	66,712	66,323	3,893	9,555
May	60,277	60,386	3,488	7,482
June	68,000	67,722	3,282	7,652
July	66,132	66,291	3,187	7,379
August	65,264	65,217	2,953	8,432
September	65,314	65,933	2,899	7,951
October	60,893	61,412	2,862	4,827
November	67,129	66,332	3,669	5,862
December	61,957	62,144	4,006	7,436
2019 Annual Total	747,054	747,061	40,288	97,193

Source: Mill Operations Year End Reconciled

In 2019, approximately 40,235 dry tonnes of copper and 97,167 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 2019, two pit floor locations and 2 elevated line deposition points were utilized for the sub-aqueous disposal of approximately 219,282,000 gallons of tailings slurry at an average rate of 417 gallons per minute. 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 bottom, near the center and north of the HTDF, and at various locations along the east and west edges of the HTDF in the fall according to the deposition plan. Following approval of the permit amendment request in October 2018, the maximum permitted elevation for tailings storage was increased from an elevation 1420 MSL to 1515 MSL. The maximum tailings peak measured in October 2019 was 1445 MSL with the majority of the tailings stored below elevation 1400 MSL. Due to safety concerns related to operating the spigot system that was installed in 2016, new lines were installed in 2019. The new lines currently discharge tailings approximately 100’ below the water surface. A new tailings deposition plan was developed in 2019, based on the most recent bathymetry and information available.

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 2019. The surveys were conducted in June and October and focused on the entire HTDF as tailings were dispersed to multiple areas in 2019. Copies of the bathymetry surveys are available in Appendix B.

The Metallic Minerals Lease (No. M-00602) requires the lessee to furnish a mill waste reject report on an annual basis. In 2019, 573 dry metric tonnes of copper and 2,526 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 is treated by the water treatment plant (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 2019, approximately 0.72 million gallons (MG) of water was drawn from the domestic water well which is a decrease from the 2018 total of 0.87 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 2019, approximately 0.07 MG of water was utilized from the industrial well. This is a significant reduction compared to the 0.87 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 2019, approximately 139 MG of reclaim water was pumped from the HTDF for use in processing ore. With the exception of approximately 4.2 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 a National Pollutant Discharge Elimination System (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 the Michigan Department of the Environment, Great Lakes & Energy (EGLE) on or before January 10th of each year. The 2019 SWPPP annual review was completed and submitted to the Department on January 10th, 2020. A copy of the plan is available upon request.

In 2019, two separate events occurred at the WTP which were considered unintended discharges of water entering stormwater or groundwater. Both events were reported to EGLE under the NPDES permit program requirements. A description of the events are as follows:

- In July 2019, approximately 2,360 gallons of untreated surface water from the HTDF overflowed from secondary containment beneath a rented reverse osmosis trailer when a drain valve was not closed following a filter change. The water ran to a wetland adjacent to the eastern perimeter of the site. The water quality of the surface water in the HTDF met the discharge requirements of the permit.
- In October 2019, approximately 14,000 gallons of water leaked from door seals of man-doors and overhead access doors in the WTP when sumps and tanks in the WTP overflowed due to a restriction in the off-specification discharge line that returns to the HTDF. Incident review determined that the off-specific line became plugged during a routine startup procedure. Operators were able to collect water that had been present in the plant during the overflow incident and it was compared to the discharge limits for the nearby wetland. The water did not meet the discharge requirements for TDS and nickel.

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 2019, Eagle continued discharging treated effluent water to Outfall 004 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 2019.

In 2019, approximately 329.8 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 2019.

Table 5.3 Volume of Water Discharged in 2019

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	16.2	25.1
February	0	0	0	13.2	21.5
March	0	0	0	14.8	20.4
April	0	0	0	14.2	26.4
May	0	0	0	13.9	32.7
June	0	0	0	13.8	30.6
July	0	0	0	15.0	32.2
August	0	0	0	14.2	28.8
September	0	0	0	13.6	23.8
October	0	0	0	15.8	21.1
November	0	0	0	15.2	26.4
December	0	0	0	15.4	40.8
Total	**0**	**0**	**0**	**175.3**	**329.8**

Source = WTP Operators log

In 2019, Eagle completed construction of the WTP expansion project and continued with operational modifications intended to de-bottleneck the WTP so that design flows could be achieved through the more involved process steps of treating "deep water" (i.e. tailings process water stored deep in the HTDF). The changes brought the plant up to near nameplate capacity (approximately 850-1,000 gpm) under the current operating conditions. As required under the NPDES permit requirements (Part II C.12), Eagle supplied notifications of changes in facility operations to the local district water quality division. Those changes included:

- Installation of a "concentrator RO" which is used to treat brine from the three RO units that had been installed in July 2018. The additional RO unit generates approximately 100 gpm of additional permeate. (March 2019)
- Installation of a fourth ultrafiltration (UF) unit to keep throughput in the UF system steady when one of the other three units is undergoing a cleaning. (March 2019).
- Installation of a rented reverse osmosis (RO) trailer to treat surface water so that an additional volume of 200 gpm of permeate could be produced when surface water was being treated. This system operates intermittently depending on the season. (May 2019)
- Installation of a second lamella clarifier to provide more appropriately clarified feedwater to the UF units. (September 2019).
- Installation of upgrades to the filter press system, including automated plate movement, higher capacity, and higher pressure feed pumps. This system dewaters the clarifier underflow for offsite disposal of residual solids (December 2019).

Interior of the new WTP expansion including installed equipment for the concentrator RO and clarifier, 2020.

Other changes to the plant included installation of a 8,700-gallon bulk tank for the storage of sulfuric acid. Sulfuric acid is used in the Fenton's reaction and was being used in quantities that are large enough to justify storage of the product in bulk, rather than in totes. Furthermore, the bulk tank was also a risk mitigation that was pursued in response to a spill of sulfuric acid that occurred on the property in March 2019. The tank is constructed of double-walled HDPE on a concrete slab, and is equipped with heat trace, insulation, seismic restraints, and electronic leak detection to reduce the risks encountered during chemical handling. The tank was commissioned in November 2019.

New sulfuric acid tank installed near former acid tote storage building, 2020.

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.

Water Treatment Plant Expansion, 2020.

The water treatment process generates one solid waste stream derived from solids in the clarifier which is primarily comprised of aluminum, iron, calcium, 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 and December 2019 and sent to ALS Laboratory for analysis. Laboratory results confirmed the waste stream is non-hazardous. In 2019, approximately 92 tons of filter press waste was disposed at the Marquette County Landfill.

Late in 2018 Eagle began to encounter increased incidences where the effluent limit for chronic toxicity to *ceriodaphnia dubia* (e.g. water flea) was not met. Eagle immediately began investigating the reasons for the reproductive toxicity to *c. dubia* by beginning a process called a Toxicity Evaluation Investigation (TIE). By March 2019, Eagle knew that nickel was responsible for the test results, though the upper limit and conditions under which nickel could produce these effects required more investigation. In April 2019, EGLE Water Resources Division (WRD) provided a formal compliance communication to Eagle requiring that Eagle complete a Phase III TIE to determine the source, cause, and corrective actions needed to prevent future occurrences of toxicity in the WTP effluent. Eagle completed the TIE in September 2019 and provided several communications with EGLE regarding the results and corrective measures that were taken to prevent the toxicity exceedances. The last reported toxicity exceedance occurred in September 2019. The results of the TIE indicated that even low levels of nickel (8-10 ug/L) could cause the reproductive effects in *c. dubia* unless sufficient hardness was present in the water. Due to the effluent containing a high percentage of RO water, Eagle's effluent was typically too low in hardness to compensate for the relatively low concentrations of nickel present. Eagle has taken steps to create effluent blends that contain more hardness so that nickel related reproductive toxicity does not occur. A record of correspondence with EGLE WRD on the compliance communication and the 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 is 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 is 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 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.

Until October 2019, Eagle returned 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, water from the PFR that did not meet plant influent specifications for oxidation status, and RO system brine. This water, when combined, exhibited a moderate concentration of dissolved solids. To improve the efficiency of water treatment and maximize the separation of brine from fresh surface water, Eagle separated the RO brine from the remainder of the fresh water off-spec components. Brine is now being discharged at or below the elevation of tailings disposal, while other off-spec water is being discharged at a slightly higher elevation of 1,440 ft AMSL.

Throughout 2019 the area received higher than average precipitation in the form of rainfall and snowfall (above average precipitation also occurred in late 2017 through 2018). Due to this above average water balance input, as well as lower than average treatment throughput while equipment was being installed, the HTDF water level rose through much of 2019. A typical annual average water treatment rate of 600 GPM is required to maintain water levels, but throughout 2019, the average seasonal input to the basin was, at times, 1,000 GPM due to heavy rain, heavy snow, and increased groundwater and surface water run-off inputs. The maximum rated treatment capacity of the WTP did not approach 1,000 GPM until late in 2019, and for much of the year the average discharge was 600 GPM. As such, the HTDF was water positive for the majority of the year. The peak water level measured in July 2019 was approximately 1537.5 feet MSL, and as of December 2019, the level had been lowered to 1536.9 ft MSL. The short-term target water level is 1535.0 ft MSL, which is expected to be reached in 2020, and the longer term target operating level of 1529.0 ft MSL is currently projected to be reached by the end of 2021.

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 2019 the model was refined by updating 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. This model was completed early in 2020, therefore all of the water balance reporting for 2019 was completed using the previous GoldSim model, any future water balances will reflect the new model results. A copy of the updated integrated groundwater/surface water balance model report is available upon request.

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. The pump system suffered from lower than designed flows after the first months of use due to apparent restrictions and plugging from sediment from the river entering the system. To address the issue, maintenance and mechanical engineers did the following: conducted a design, engineering, and as-built system review to determine if system flaws were preventing proper flow; reviewed pump curves; operated both pumps in parallel; upgraded pump and electric motors horsepower capacity by 33%; suctioned the sump of sediments; flushed the lines using a high flow pump; and removed sediment, vegetation, and debris blocking the intake to the pumphouse under a General Permit for maintenance of the intake. These activities did not make a substantial difference in the system's ability to reach the design flows, making it impossible to deliver exactly the amount of water to Outfall 003 required by the Goldsim model.

The next step in 2020 will be to inspect the pipeline using a motorized pipe camera to determine if there is a restriction along the length of the pipe. Since the pipe needs to be accessed at its midpoint to do this, the work may be completed following the spring thaw and snowmelt. Eagle is considering work on a design modification to the pumphouse to prevent sediment uptake which will continue to be explored in 2020. Despite the lower flows, the wetland hydrology was maintained year-round with no major flooding or drought conditions experienced in the downstream areas. The wetland response information is continually tracked for the purpose of a closure design for a passively controlled discharge structure on the HTDF.

Outfall 003 is supplied with water year-round.

Copies of the 2019 quarterly water balance diagrams and HTDF water elevation data are included in Appendix D.

Aerial view of WTP and HTDF, October 2018

6. Materials Handling

6.1. Fuel Handling

In February 2019, the bulk fuel truck, previously used for refueling mobile equipment onsite, was replaced with a 3,000 gallon stationary bulk diesel tank which was installed on the east side of the COSA. The bulk tank is double-walled with leak detection and 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 2019, the Humboldt Mill had one reportable spill under the Part 5 Rules of Part 31, Water Resources Protection of NREPA, 1994 PA 451 as amended (Spillage of Oil and Polluting Materials). A description of the spill that occurred and the subsequent follow up actions are described below.

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 2019 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.

6.2.1. Part 5 Spill Incident Description and Response Measures

On March 11, 2019, a tote of sulfuric acid, staged near the Mill WTP Fenton Reactor, was inadvertently punctured by a forklift causing approximately 150 gallons sulfuric acid to leak onto the ground. The location of the spill was inside the cut-off wall of the HTDF which is designated as secondary containment in the Humboldt Mill Pollution Incident Prevention Plan (PIPP). The topography within this area is such that flow would be directed towards the HTDF which is classified as a waste disposal facility. A combination of Eagle Mine employees as well as TriMedia Environmental initially responded to the spill on the afternoon of March 11th.

Mill WTP Fenton Reactor Area - Location of Spill, March 2019

At the time of the sulfuric acid spill, the ground was frozen and covered in heavy ice/snowpack due to traffic compaction. The ground was stripped of snow and ice in the spill area, but caution was taken to minimize cross contamination of the snow and ice cover with the area surrounding the spill location. Initially, the pH of the apparently affected soils was approximately 1-2 S.U. Snow and ice readily melted at the spill site making the impacted area easily identifiable. A 6% soda ash solution (not a listed chemical under 324.2009) was applied to the spill area in an attempt to neutralize the sulfuric acid between March 12 and 13th. The conditions in the immediate spill area were still considered acidic following pH testing on March 14th. On March 15th, additional equipment resources in the form of two excavators were used to assist with excavation and mechanical agitation of the soil with a 6% soda ash solution. During that process a frost line was encountered at 18”-24” and there was no observable contamination below that line. Following these activities, the pH was again sampled on March 15th in numerous locations around the spill location and conditions were found to be within pH range from 6.1 to 6.9. Eagle planned to conduct follow up pH testing and remediation efforts as needed following snowmelt.

Eagle returned to conduct further confirmation testing after snowmelt on May 8th 2019. Background soil samples were collected with an auger in an unimpacted area topographically higher than the spill location. Background pH is approximately 5.25-5.75. Additional samples were collected in the neutralized area, as well as to the south, west, and north of the spill location. The samples at depths of 3 feet to the north of the spill location had a pH range of 3-4, while soil at the spill location, south, and west were neutral or slightly higher than a pH of 7. At the suggestion of EGLE Water Resources Division, Eagle made additional plans to address the lower pH soils through excavation of impacted materials.

Soil in the identified low pH area was removed in two-foot lifts, with soil pH readings collected from perimeter locations at each lift. Soil was excavated until pH readings were above the 3.0-4.0 S.U. range. After the four-foot depth was sampled, one of the perimeter locations ranged from pH 6.74 to 7.14 S.U. This location was not excavated below four feet. The remaining perimeter locations were excavated to a depth of eleven feet until pH readings were above the range pH range 3.0-4.0 S.U. Soil sample readings at the 11-foot depth were pH 5.12-6.00 S.U. Approximately 80 cubic yards of low-pH soil was removed from the spill area and disposed of at the Marquette County Landfill. The excavation was backfilled with offsite borrow material and the clean-up action was closed out.

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 2019. The Eagle Mine Permit prescribes both a long parameter list for annual monitoring events (conducted in Q3 2019) and a short list to be used quarterly (Q1, Q2, Q4 2019). 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 QAL, Aug 2019

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. The following is a summary of the events that occurred in 2019:

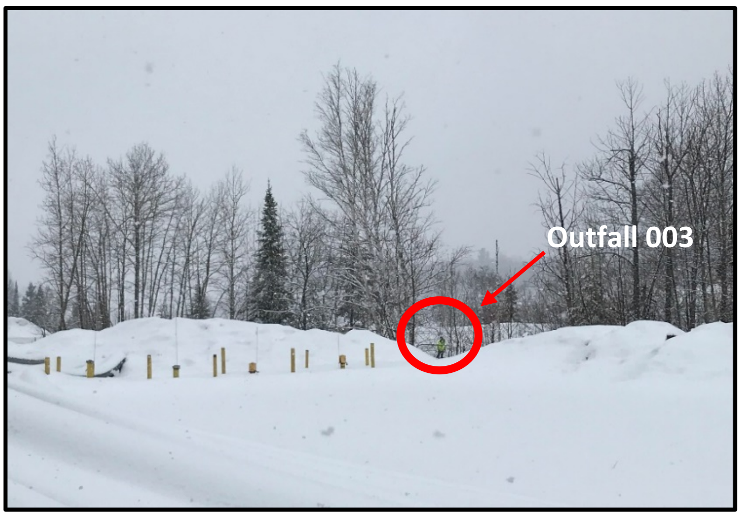
- Due to turbidity levels that exceeded 3 NTU, nineteen of the twenty-four monitoring locations required field filtering for at least one quarter in 2019 and therefore the values are reported as dissolved concentrations. The remaining locations/quarters reported turbidity below 3 NTU and are reported 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 LLA) 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 after the recharge period.
- The majority of the metals and anion parameters analyzed reported values below the analytical reporting limit and are listed as non-detect. The cation parameters analyzed were detected at all locations with most of the detections below the calculated benchmarks. A summary of wells that have had one or more parameters exceed a benchmark value can be found in Appendix F.
- As previously stated, HW-1U takes approximately four months to fully recover due to the tight formation in which it is located therefore low-flow sampling techniques cannot be used and results may not accurately characterize the true water quality of the location.
- After having multiple parameters detected above their respective benchmarks in the first quarter of 2018, HW-1U LLA had zero parameters exceeding benchmarks in 2019.
- MW-701 QAL is installed for the purpose of monitoring shallow groundwater inside the cut off wall. Water in this vicinity is expected to be signatory 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 in 2018 and 2019 water levels generally increased in the HTDF. As such, water quality in MW-701 QAL shifted to an ionic balance that is similar to the HTDF water quality yet is still influenced by quarterly seasonal trends. Additionally, surface activities near this well increased over the course of 2019 since deliveries and other traffic required to operate the Fenton's reactor were far greater than they had been one year prior. This shallow well in the cluster was relatively unaffected by the nearby sulfuric acid spill.
- Multiple parameters at location MW-701 UFB changed beginning in Q2 due to the sulfuric acid release that occurred in March 2019. After the changes peaked during the Q3 monitoring

event, all results, except for iron and manganese, decreased in Q4. Eagle provided detailed analysis of the changes in the well chemistry in its Q2-Q4 benchmark reports, and this information is repeated below for thoroughness in reporting.

- The increase in sulfate was attributed to the dissociation of sulfuric acid (H_2SO_4) into water (H_2O) and sulfate (SO_4).
- Since sulfuric acid has a higher density than water, the acid would migrate via density driven flow to the level in which it would be detected in MW-701 UFB at a greater magnitude than the relatively shallow screened interval of MW-701 QAL.
- The slight decrease in pH was attributed to the presence of a diluted acid in the vicinity of the well.
- Upon introduction of sulfuric acid to the soil, ion exchange processes promoted the dissolution of calcium and magnesium from carbonates in the sediments into ionic salts.
- Carbonates are present in the sediments, which would have readily been dissolved and release calcium and magnesium concentrations.
- One of the carbonates in the native materials is ankerite, which has iron in the cation position. This would have been dissolved and released the iron (and likely manganese) to solution, contributing to increased iron and manganese concentrations.
- The increase in hardness was attributed to the increase in cationic salts containing calcium and magnesium from carbonate dissolution.
- The slight decrease in bicarbonate alkalinity was attributed to the alkalinity having been consumed by acid.
- A slight drop in pH coupled with an increase in specific conductance in the MW-701 UFB well were indicative of the presence of diluted acid and an increase in total dissolved solids (TDS) associated with sulfate, cationic salts, and increased chloride.
- The application of a soda ash ($NaCO_3$) solution was a source of dissolved sodium.
- Silica monitoring was added at the location to indicate weather/dissolution of feldspars due to acid interaction. Silica initially increased as would be expected in the presence of acid, and began decreasing by the end of year, which is consistent with the neutralization of acid.

Location of MW-701 well cluster relative to the sulfuric acid spill location.

- Sulfate results at MW-704 QAL were greater than benchmarks in all four quarters in 2019 and returned to just above baseline levels in Q4. Since 2017, results for sulfate tended to fluctuate up and down between monitoring events. The MW-704 QAL well is 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. However, until Q4 2018, Eagle discharged treated water to Outfall 003 which is in the vicinity of the MW-704 well cluster. Over the course of 2018, the plant water quality that was discharged met the NPDES permit requirements, though it contained more sulfate than precipitation or natural groundwaters would have. Sulfate detected in MW-704 QAL could be sourced from the former discharge of treated plant water at Outfall 003. Now that Escanaba River water is being discharged at Outfall 003, possibly the sulfate will be flushed from this area and water quality at MW-704 QAL would begin to be seasonally reflect changes in MBER river water quality. This will continue to be evaluated on a quarterly basis.



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

- After beginning the year under their respective benchmark values, results for iron, chloride, magnesium and hardness were above the values for the final three quarters at location MW-704 UFB. Piper diagrams for this well location were developed and the water chemistry classification has remained similar over the sampling history at this well, therefore no major trends are indicated.

- Groundwater at MW-704 LLA had results for manganese, calcium, magnesium, hardness and bicarbonate alkalinity that were greater than benchmarks levels in Q1, Q3 and Q4. Although the results were above the benchmark limit for two consecutive quarters, they remained consistent with little change occurring. This well, along with MW-704 DBA had no overall trend changes when reviewing data collected since installation.

- 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 2019 reached a new equilibrium that generally reflects the pH of water of the HTDF rather than varying seasonally. This is consistent with expectations that when water levels are higher in the HTDF, the water quality in this shallow well will be driven by HTDF water quality.

- MW-702 UFB had no reported changes in water quality during 2019.
- Monitoring location MW-703 QAL is a compliance monitoring well located outside of the cut-off wall and therefore outside of the influence of the HTDF. With the exception of nitrogen, nitrate and pH all other results were found to be within the established benchmarks for the location. The results from MW-703 QAL were compared to leachate monitoring location MW-702 QAL to determine if there were any correlations. This well does not show a similar pattern of pH to MW-702 QAL, rather it has shown a regular pattern of annual increase throughout Q1-Q3 and a drop in pH in Q4. The 2019 results are generally consistent with past patterns, though pH is lower overall. This could be due to higher than normal rainfall and snowmelt affecting the area. Rain and snow typically have lower pH values. The water chemistry between the locations does not indicate that the water quality at MW-703 QAL is being influenced by the HTDF.
- MW-703 DBA had pH results outside of the benchmark range since Q2 2018, however, only once has the result been more than 0.5 SU outside of the recommended values. With no other major constituents changing and a consistent pH value for over one year, this well is considered stable and does not indicate an adverse trend is occurring.
- The results for sodium and sulfate at monitoring location HW-2 were slightly above the established benchmarks for at least three of the four sampling quarters in 2019. Iron, manganese and chloride also increased towards the end of the year at this location. HW-2 is close to the access road to the WTP and Fenton Reactor area where sand/salt mixture is added to the roadway which would result in shifts in chloride, sodium, and potentially other ions.
- KMW-5R, which is located near the COSA, had reported values of sodium, copper, arsenic and iron in Q1-Q2 2019 that were above established benchmarks. These parameters, with the exception of sodium, receded back to the benchmark level during the second half of the year. Aluminum was also higher than the benchmark at KMW-5R during the annual sampling event. Aluminum is commonly found in wells with high turbidity levels because clay present in the turbid water contains the mineral aluminum. KMW-5R is a low capacity 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.
- The manganese concentration at HYG-1 continued to rise throughout 2019 after dropping in late 2018. In several wells sitewide the manganese concentrations increased during the year, which could be due to overall increase in precipitation and water levels causing naturally occurring manganese to enter the groundwater system from previously unsaturated areas. No other parameters at this location were found to be trending in 2019.
- Six parameters (calcium, magnesium, manganese, chloride, hardness, and sodium) at MW-705 UFB were outside of their respective benchmark values in 2019. Of these, manganese and magnesium were slightly over the benchmark during all four quarters. The majority of

these parameters are not characteristically related to milling operations. Trend monitoring will continue in 2020.

- HW-8U had groundwater concentrations of sulfate, potassium, and chloride, sodium above the benchmark at some quarters in 2019. Changes in potassium, chloride, and sodium are characteristic of the sand/salt application activities taking place nearby causing ion exchange processes to occur in shallow water. Sulfate in this well is much lower in comparison to the sulfate found in surface water in the HTDF, so does not appear to be directly related.
- Wells MW-706 QAL, MW-707 QAL, and MW-9R which are located on the main property outside of the milling facilities had no reportable shifts from the benchmark criteria in 2019.

A Mann-Kendall trend analysis was conducted for all groundwater locations. A parameter was considered to be trending if analysis determined a minimum confidence of 95%. Possible trends, either positive or negative, were identified for one or more parameters at ten compliance locations, four leachate monitoring wells, and ten monitoring locations (includes facility monitoring locations), using data collected from baseline sampling events (i.e. 2014) through December 2019. Many of the results reported as potentially trending were summarized above. A table summarizing the potential groundwater trends can be found in Appendix G. For compliance and monitoring locations in which results were outside of established benchmarks for at least two consecutive quarters and a potential trend was identified, the trend charts are also provided in Appendix G. One limitation of the Mann-Kendall trend analysis is that the method is not intended to be used for water quality that has seasonal influences. Shallow groundwater wells are considered influenced by seasonal environmental changes. In 2020 Eagle may reconsider the use of the Mann-Kendall trend analysis for wells that have seasonal impacts, and another statistical method of determining trends may be substituted. However, Eagle will continue to conduct a trend analysis after each quarterly monitoring event in 2020 and results will be reviewed to determine if the trends are attributable to milling operations.

7.1.2. Quarterly Surface Water Quality Monitoring

Surface water sampling was conducted on a quarterly basis in 2019 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 November (Q4) in 2019. 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.

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 these locations will continue to be compared to the initial benchmark values established in 2014. 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, Aug 2019

Monitoring Results

The Humboldt Mill Surface Water and Sediment Monitoring Plan prescribes a long parameter list surface water samples that are collected annually (Q3 2019) and a shorter list to be used during the remaining quarterly monitoring events (Q1, Q2, Q4 2019). 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 2019:

- Water samples were unable to be collected in Q1 at locations HMP-009 and WBR-001 due to frozen conditions. Mercury was the only parameter at HMP-009 that exceeded a benchmark value for two consecutive seasonal sampling quarters. Water is typically stagnant and shallow in this area and could influence these results.
- 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 2019.

- MER-002 had pH outside of the benchmark range for two quarters of 2019 and had very similar results to upstream reference location MER-001 indicating the results are likely related to regional influences and not mining activities.
- MER-003 had pH values that were greater than the established benchmark range during Q2 – Q2 2019. Although the sample results were slightly above the benchmark ranges, the pH values observed are within the neutral range. Of note, water quality at MER-003 now reflects the mixing zone that was created when Outfall 004 was permitted for discharge on the MBER. Trend changes beginning in late 2018 could be considered to be within permitted water quality values for the approved mixing zone.
- Results at all of the Black River locations fluctuated from quarter to quarter, WBR-003 had copper and total suspended solids outside of benchmarks for two consecutive Q3 2018 and Q3 2019 summer base flow sampling events and arsenic for two consecutive Q2events. WBR-002 also had a water quality result for TSS outside of two consecutive Q1 2018 and Q1 2019 winter base flow sampling events. Results returned to baseline levels in the sampling quarters following the deviations.
- A Mann-Kendall trend analysis was also conducted for the surface water monitoring locations in 2019. Possible trends, positive or negative, were identified for one or more parameters at four compliance and two reference monitoring locations using data collected from baseline sampling events (May 2014) through December 2019. These trends are summarized in Appendix J. A parameter was considered to be trending if analysis determined a minimum confidence of 95%. In general, the results and associated trends return to baseline levels in subsequent quarters showing that the results are likely due to seasonal variation, for example during snowmelt the runoff from surrounding areas have historically resulted in temporary deviations from baseline. In 2020 Eagle may reconsider the use of the Mann-Kendall trend analysis for locations that have seasonal impacts, and another statistical method of determining trends may be substituted. However, Eagle will continue to conduct a trend analysis after each quarterly monitoring event in 2020 and results will be reviewed to determine if the trends are attributable to milling operations.

7.2. Sediment Sampling

Sediment sampling was not conducted in 2019. The next sediment sampling event will occur in 2020 as required.

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. As previously reported, the operating level of the HTDF was lowered from what was originally planned resulting in the HTDF water elevation being lower than the wetland elevation located outside of the cut-off wall. As of the time of this writing, there is a near neutral gradient between the wetland and the HTDF, therefore, the gradients cannot be measured in either direction. If at any time during operations the water level rises to levels above the elevation of the downstream wetland, gradient changes will again be measured and discussed.

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 K. 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 in which they recharge.
- Equipment malfunctions which resulted in data gaps of continuous water level data occurred at three 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	8/27/19 – 11/21/19	Battery Failure
MW-701 QAL	6/11/19 – 8/22/19	Battery Failure
MW-703 DBA	11/28/18 – 4/17/19	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. The slow recharge rates are an indication that the integrity of the cut-off wall is intact.
- Due to the rising water levels in the HTDF, later in 2019, the groundwater elevations in the QAL wells inside the cutoff wall range from 1.12 – 1.81 feet above the wells outside of the 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 Water Quality 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 is best accomplished by review of water levels and chemical signatures between the leachate (i.e. MW-701 and MW-702) and compliance monitoring wells (MW-703, MW-704). Focus of the review is on water levels in the quaternary unconsolidated formation (QAL) and chemical signature in the upper fractured bedrock zone (UFB).

Leachate wells are located on the south side of the containment wall (HTDF side) and should show similar water levels and chemical signatures of the HTDF. The compliance wells are downgradient of the leachate wells and are located on the north side of the containment wall and should be outside the influence of the HTDF. Results from leachate monitoring location MW-701 are compared to compliance location MW-704 and results from leachate monitoring location MW-702 are compared to compliance location MW-703.

<u>Chemical Signature Review</u>

- The majority of the metals and anion parameters were consistently non-detect at both the compliance and leachate monitoring locations. The most relevant parameter used as a signature of HTDF water quality is sulfate.
- MW-704 QAL and MW-704 UFB wells underwent additional review due to observed changes in iron concentration. Piper diagrams and other charts were used to explore potential trends in the data and connections with other water on the site. For the QAL well, there were distinct seasonal trends within the range of "normal" occurring in those parameters typically connected to redox conditions, but there were no strong signatures relating to HTDF water quality or that quality found in the MW-701 well series. Furthermore, the changes in MW 701 UFB water quality related to the sulfuric acid spill were not present in any of the MW-704 wells. Eagle hypothesizes that either water signature differences between the Escanaba River water being discharged at nearby Outfall 003, or changes in seasonal precipitation trends are most responsible for those fluctuations in MW 704 QAL and UFB. For both the 704 QAL MW 704 UFB, there were no significant changes from 2018 to 2019. Importantly, there were no sulfate signature correlations which indicate that the containment wall is performing as expected.

- As discussed earlier in this report, monitoring location MW-703 QAL is a compliance monitoring well located outside of the cut-off wall and therefore outside of the influence of the HTDF. The results from MW-703 QAL were compared to leachate monitoring location MW-702 QAL to determine if there were any correlations. MW-702 QAL had mercury, bicarbonate alkalinity, sulfate, hardness, and major cations at higher results than MW-703 QAL. Additionally, the pH at MW-702 QAL has begun to mimic the pH of the HTDF and be uninfluenced by seasonal conditions (snowmelt, rainfall, etc) which is evidently different when compared to the pH trend in MW-703 QAL. As expected, MW-702 QAL has developed it's own signature relative to the HTDF, and the water chemistry difference between the locations does not indicate that the water quality at MW-703 QAL is being influenced by the HTDF.
- As reported previous years, iron, manganese, and sulfate were greater at compliance location MW-703 UFB than compared to leachate monitoring location MW-702 UFB. Additionally, the Q1 and Q4 pH results were distinctly different between these two locations as well. If there were a hydraulic connection between these locations, the results would be more consistent with one another.

Water Level Review

- As previously stated in Section 5.4 of this report, the HTDF water elevation and groundwater elevations rose through 2019. The rise in HTDF elevation is due to operational changes at the water treatment plant coupled with above average precipitation in the fall of 2019. The same is true of the elevations found in the MW-702 and 703 QAL wells.
- Compliance monitoring location MW-703 UFB has a groundwater elevation that is consistently 11-12 ft greater than leachate well MW-702 UFB. Groundwater elevations at MW-702 UFB continue to trend closely with HTDF water levels.
- Compliance monitoring location MW-703 QAL and leachate location MW-702 QAL have similar water level readings which is expected due to the current elevation of the HTDF.
- The groundwater elevations at compliance monitoring locations MW-704 QAL and UFB are approximately 2-3 feet lower than those reported at leachate monitoring locations MW-701 QAL and UFB. As expected, the water elevations recorded at MW-701 are closer to elevations reported in the HTDF. The distinct separation between the leachate and compliance monitoring wells show that the containment wall is functioning as designed.

Based on the review of the chemical signature and groundwater elevations of the leachate and compliance monitoring wells there is sufficient evidence to show that the cut-off wall is functioning as expected. The variability in the detected parameters, difference in reported results, and groundwater elevations all demonstrate that the effectiveness and integrity of the containment wall are intact.

7.5. Biological Monitoring

Biological monitoring events conducted in 2019 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 2019 flora, fauna, and wetland vegetation surveys were conducted by King & MacGregor Environmental, Inc. (KME). Table 7.5.1 below outlines the type and duration of the surveys that were conducted in 2019. A map of the survey locations can be found in Appendix L.

Table 7.5.1 Type and Duration of 2019 Ecological Investigation

Survey Type	Survey Date
Birds	June 13, 19; September 23-24
Small Mammals	September 24-26
Large Mammals	May - September
Toads/Frogs	May 15; June 7, 20
Threatened and Endangered Species	May - September

The wildlife and plant species identified during the 2019 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 583 birds representing 65 species were observed during the 2019 (June and September) surveys. In June, the Nashville warbler and American robin, while the blue jay and white-throated sparrow were the most abundant species observed during the September 2019 survey. The bird species identified in 2019 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.
- Thirty-three small mammals representing eight species were collected during the September survey period. The total number of individuals captured in 2019 decreased by two compared to 2018 and the species richness decreased by one species. The most common small mammal identified during the survey was the deer mouse followed by the least chipmunk (*Tamias minimus).* 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 2019 surveys are typical of those expected in the habitats present and are consistent with previous survey results.
- During the 2019 surveys, no large mammals were directly observed, however, tracks and scat of Whitetail deer and tracks of moose were present. Previously observed or other regionally common species possibly present within the Study Area, but not observed during the 2019 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 2019 surveys are regionally common large mammal species and are expected to utilize the habitats present.
- Six frog species were heard during the 2019 survey which is an increase of two from the 2018 survey; none of which are threatened or endangered. Breeding frog calls were heard at all five sampling points. Similar to 2018, the most frequently heard species during the surveys in 2019 was the northern spring peeper. As stated in previous studies, elevated noise levels related to operations were noted at survey points 2 and 3, potentially diminishing the observer's ability to hear and distinguish calls. All of the frog species identified are typical of those expected in the habitats present in the Study Area.

7.5.2. Threatened and Endangered Species

The Michigan Natural Features Inventory (MNFI) maintains a database of rare plants and animals in Michigan. KME 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
osprey	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), KME 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 Point 5 in June, 2019.
- In May and June 2019, the bald eagle nest on the north shore of Lake Lory was occupied by at least one adult.
- Although suitable habitat for osprey is present in the study area, no birds have been directly observed since observations began in 2014.
- In May and June 2019, 17 nests were identified as active in the heron rookery. The great blue heron rookery appears to be robust and unaffected by Mill operations.

A copy of the 2019 Humboldt Mill flora and fauna report is available upon request.

7.5.3. Fisheries and Macro Invertebrate Report

The 2019 Fisheries and Macro-Invertebrate annual surveys were conducted by Advanced Ecological Management (AEM). A total of six stations were surveyed in June 2019, 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 M.

Stream Stations

A total of 158 fish representing 18 species were collected in 2019 from all stream stations, which is 38 more fish than were observed in 2018. The reason for the dramatic increase in fish totals is due to 85 central mudminnows being detected this year, compared to 57 in 2018; 71 of the 85 were observed at Station 5. The Central mudminnow was the most frequently collected species (85) followed by the Northern redbelly dace (19). No threatened, endangered, or special concern fish species were observed at any of the stream stations in 2019. 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 increased in 2019, from 16 in 2018, to 74 in 2019. The increase was associated with Central mudminnows. One brook trout was also observed in 2019 similar to 2017 results.
- Fifty-three fish were collected between MBER1 & 2, which is 23 less than was collected in 2018. This difference is associated with the number of Central mudminnows observed. Forty-three in 2018 compared to 14 in 2019. The central mudminnow was still the most frequently observed species at MBER1 while the Blacknose dace was the most frequently observed at MBER2 in 2019.

Station MBER1 – Downstream Extent, June 2019

Using the P-51 protocol, a total of 802 macro-invertebrates were collected from all four stream stations investigated in 2019. The total number of macro-invertebrates collected in 2019 decreased by 137 specimens compared to 2018. Stations 5 experienced the greatest change with 134 less specimens collected in 2019 compared to 2018, the difference being in the number of mayflies observed. Although the total number of macro-invertebrates was down in 2019, the numbers and taxa observed are consistent with previous surveys. No threatened, endangered, or special concern macroinvertebrate species were observed at any of the stream stations in 2019.

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. Similar to 2018, 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. The macroinvertebrate community ratings remained consistent with 2018 results with all Stations classified as "acceptable."

Table 7.5.3 2019 Habitat Ratings

	Station 1	Station 5	Station MBER1	Station MBER2
Fish Community	Poor	N/A	Poor	Poor
Macroinvertebrate Community	Acceptable	Acceptable	Acceptable	Acceptable
Stream Habitat	Good	Good	Excellent	Excellent

<u>*Lake Lory*</u>

A total of 294 fish representing nine taxa were collected from Lake Lory in 2019 which is greater than the 165 fish that were captured in 2018. The community composition has remained consistent at this location. In 2019, largemouth bass (*Micropterus salmoides*) and yellow perch (*Perca flavescens*) were the most frequently collected species followed by bluegills (*Lepomis macrochirus*). 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 Michigan Department of Natural Resources website found that black spot is a common disease in earthen bottom ponds and lakes.

Aquatic macroinvertebrate sampling was conducted on June 6, 2019 within Lake Lory where a total of 230 macroinvertebrates were collected, which is 73 greater than the 157 macroinvertebrates that were collected in 2018. Snails, true flies, and mayflies were the most abundant macroinvertebrates within Lake Lory, and the 2019 community composition was generally consistent with the 2015 through 2018 macroinvertebrate communities. No threatened, endangered, or special concern macroinvertebrate species were observed in Lake Lory.

<u>*Wetland EE*</u>

Two brook stickleback (*Culaea inconstans*) were collected from Wetland EE during the 2019 study which is consistent with results from the 2018 study. 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, 2019, where a total of 69 macroinvertebrates were collected, which is 25 greater than was found in 2018 (44 total). *Odonates* (damselflies and dragonflies) and true flies were the most collected species in 2019. These species observed have been consistent between survey years. No threatened, endangered, or special concern macroinvertebrate species were observed in Wetland Complex EE. The 2019 aquatic vegetation density appeared to be consistent with the observations made in 2018 in that cattails have grown in most of the areas of Wetland Complex EE that were previously open water. A copy of the 2019 Humboldt Mill Aquatic Survey Report is available upon request.

7.5.4. Fish Tissue Survey

No fish tissue survey was completed in 2019. The next survey will be conducted in 2020.

7.6. Miscellaneous Monitoring

8.6.1. 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 WTP expansion project, earthwork was needed to be performed on the east side of the existing building. Silt fence and rip-rap was installed where the risk of soil erosion and sedimentation was present, primarily near the adjacent wetland boundary areas. Silt fence remains along the HTDF where additional work on the cut-off wall is scheduled to 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 2019 included sumps and floors of the coarse ore storage area, 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 Services 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. Other than minor, superficial cracks within the Concentrator building, no notable issues were identified in 2019.

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 2019:

- 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.

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. In 2019, the monitoring program included collecting high resolution physiochemical profiles, limnological modeling, water quality monitoring, characterization of watershed input chemistry, 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. On five occasions, a sampling crew was able to collect profiles manually (March 7, July 1, September 4, October 24, and October 31, 2019) using multiparameter probes. During the summer the YSI profiling device was installed (May to July) which collected four profiles per day, but on July 17th, the profiling device encountered a program error which caused the multiparameter probe to become lodged in tailings, and it could not be retrieved. The equipment will be replaced and re-installed in the summer of 2020. While the equipment was out of service Eagle again used a multiparameter probe lowered over the side of a boat to collect measurements for consultant review.

Aerial view of HTDF, March 2019

The HTDF continued to be stratified in 2019 owning to the water management activities designed to treat deep water from the HTDF. Geochemists continued studying vertical profiles and confirmed that the HTDF continued to exhibit three distinct layers:

1) a mixolimnion seasonally divided into an epilimnion and a hypolimnion from elevation 1,500 ft AMSL to surface;

2) a thermohaline convection cell from 1,500 ft AMSL to 1,460 ft AMSL. This layer is marked by increased water temperature, low dissolved oxygen, notable specific conductance, and circulation of water within the convection cell on a vertical temperature gradient; and

3) A deep layer separated from the middle layer by the “chemocline” extending from elevation 1,460 ft AMSL to the floor of the HTDF (varies in depth based on tailings deposition areas). This layer receives solids and process water from the tailings slurry as well as RO brine. Convection also occurs in this layer which has the highest specific conductance and TDS of the three layers. This layer became thicker during 2019 by about 15 feet due to volume displacement caused by injection of tailings slurry. Since water quality below the chemocline continued to become more saturated with dissolved solids, this water could not be treated through the water treatment plant at the same rate as it was treated

in 2018, therefore the chemocline was higher at the end of the year. This does not negate the significance of having continued to increase the density of the water below the chemocline, which causes the layers to be even more resistant to mixing. 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 stratified in 2020.

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 two-dimensional hydrodynamic models to simulate the HTDF. With the exception of data collected below 1,510 ft AMSL in the shallow basin on the north side of the HTDF, each profile indicates consistently similar trends in key parameters. The shallow basin, also referred to as the "northeast basin" is not used for tailings deposition, so this being different is not relevant to the modeling exercise.

As is done annually, Golder used CE-QUAL-W2 to model HTDF limnology for both short-term and long-term stability. This is relevant and re-modeled when necessary since Eagle makes regular adjustments to the locations of tailings disposal points and occasionally makes changes to the location of the WTP intake and off-specification discharge return locations. The most important findings of the modeling effort were:

- The lateral (x,y) positions of inputs and outputs do not influence the chemocline or deep water circulation
- Changing the vertical (z) position of the inputs and outputs does influence the elevation of the chemocline
- The model can produce a good match between predicted and observed conditions from 2018-2019, giving certainty to predictions going forward
- The model can be used to determine the effect of specifying concentrations of TDS for certain inputs and outputs and produce an accurate geochemistry prediction, giving certainty to predictions around density stratification going forward.

Tailings Pore Water Chemistry

To improve predictions of long-term water quality, Golder Associates developed a procedure for sampling tailings pore water chemistry using a gravity coring device. Six cores of "young" (recently deposited) tailings were sampled under the program on October 14, 2019. Due to constraints with equipment, Eagle was unable to collect enough core from "older" (several years in age) tailings to provide a full analysis of the pore water in tailings that had been deposited early in the life of Eagle Mine. 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). The important finding was that for several COI, the tailings slurry concentrations were different (both increased or decreased for different parameters) than the porewater concentrations, which indicates that chemistry processes within the settled tailings take place over time and can be used to simulate the impact of tailings consolidation on future HTDF water quality. Because the chemistry of the "young" porewater was different than the slurry water chemistry, Eagle will need to collect tailings porewater from older tailings in order to explore additional diagenesis reactions occurring over additional years of consolidation. Preliminary PHREEQC geochemical modeling that suggested that a variety of minerals may precipitate in the water column (oxides, sulfides, and carbonates), and that many metals will directly precipitate or absorb onto hydroxide or clay-mineral surfaces, which appears to be occurring already in the "young" tailings. In 2020 Eagle will continue efforts to characterize the future pore water chemistry with its geochemical consultants and use this information for annual updates to the geochemical modeling predictions.

Sulfur Gas Odors

In response to sulfur gas odors detected in previous years, Eagle collected additional dissolved sulfide measurements in water within the HTDF, assuming this represents dissolved hydrogen sulfide (H_2S) gas. As had been previously observed, the middle layer (from 1,485 feet to 1,468 ft AMSL) 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. Due to this information and the relative increase in dissolved sulfide measured in the layer during June and July 2019, Eagle anticipated that the fall 2019 event would produce sulfur gas odors as had occurred during the fall of 2018. In 2019, however, sulfur gas odors were significantly less pronounced and infrequent even on low pressure days. Eagle's health and safety staff used a low level H_2S monitoring device and continued monitoring for detectable levels of sulfur gasses throughout turnover and detections of both odor and H_2S were rarely encountered. Since one major difference from 2018 to 2019 was that convection cell containing the most sulfide gasses continued its convection behavior throughout the summer, one theory is that gasses would have been unable to build up and concentrate during the summer and then release during a single fall wind event. During spring and fall 2020 Eagle will continue monitoring for H_2S gasses during turnover timeframe and continue to track the relationship between the convection cell and sulfur odors. Should convection in the layer stop in the future, manual degasification of the layer is possible, but likely unneeded.

Water Chemistry

Similar to previous years, water chemistry profile samples were collected on July 1, 2019 from a vertical profile at multiple depths in the HTDF to monitor changes in total and dissolved concentrations and constituents of interest (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.

The geochemist made the following key observations regarding water quality:

- As, Fe, Cr, Cu, Mn, Ni, and Zn are being removed from the water column by various mineral precipitation, coprecipitation, biogeochemical, or adsorption reactions.
- Total concentrations of TDS, sodium, sulfate, ammonia, and boron have increased over time and with depth. Of the major ionic components of TDS, chloride notably decreased by an order of magnitude. This is due to the potential reasons:
    - Tailings slurry in fact has lower concentrations of chloride in 2019, or more likely;
    - An artifact of changing the chloride test methods as recommended by Golder in 2018 from method SM-4500-Cl E to USEPA Method 300.0
- Al, Cr, Cu, Hg, and thiosulfate decreased throughout the water column.
- Total cyanide, nitrite, Cd, Pb, Li, and Mo were below detection at all depths.

- Total copper decreased to 3.4 ug/L from 7.3 ug/L observed at the same depth in 2018.
- Total nickel concentrations decreased in the deep layer but slightly rose in the surface water layer. In 2019 the maximum concentration in the water column was 85.5 ug/L while the maximum was 1117 ug/L in 2018. This is an overall positive trend due to water quality treatment controls.
- Total mercury concentrations decreased at the bottom of the HTDF and are found at less than 1 ng/L compared to a concentration of 4.96 ng/L found in 2018. In shallower layers, mercury varies from 0.5 ng/L to 0.81 ng/L.
- In shallower layers, selenium concentrations are below the method detection limit of 1 ug/L. Selenium is found at concentrations between 1 ug/L and 5 ug/L in the deep layer. Selenium is a redox-sensitive species, and reducing conditions are found in the deep layer.

Biofouling

In the 2018 annual report Eagle described work being completed by a specialty biology lab to characterize biofouling present in the water treatment plant and mill process. The microbiology firm used DNA-extraction methods to classify the microbes present on several filtering systems throughout the plant. The general findings are as follows:

- Two stages of growth were present
    - Strains of basic bacillus strains are found on ultrafiltration membranes were decomposing xanthates found in the influent water, producing alcohols.
    - RO membranes were colonized with the bacteria *zoogloea* which are capable of forming fatty elastic biofilms that are difficult to clean.
- The lab had success testing membrane cleaners and found hydrogen peroxide as the ideal cleaner.

Eagle also had success mitigating bacterial growth in the membrane systems by adopting improved cleaning practices, but in 2020 will be considering additional methods to control the impacts of biological growth on the treatment system processes.

Tailings Deposition

Late in 2019 Eagle announced the addition of mine life and subsequently the need to place additional tailings within the HTDF. Engineers from Golder began re-modeling tailings deposition plans to determine the best configuration of tailings that would meet the existing permit limits for tailings elevation while also continuing to allow for long term storage of brine rejected by the WTP process. This plan aligns with the permitted concept of closure of the facility with a permanently density-stratified environment. Late in 2019, the deposition plan concept was completed showing sufficient volume to store all the tailings that are expected to be produced through the end of 2025. Additional water quality modeling and optimizations to the draft deposition plan are scoped for 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 will continue to select water treatment options that ensure a closure scenario that is consistent with the requirements of Part 632.

8. Reclamation Activities

No reclamation activities occurred in 2019 and there are currently no plans to conduct any reclamation activities in 2020. The Department will be notified, in advance, if any activities do commence in 2020.

Closure planning continued in 2019 and included detailed planning 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 describing, logistically, how the facilities will be closed at a greater level of detail (i.e. construction/demolition details, schedules, scopes of work, decommissioning plans, revegetation design, civil regrading plans, etc).

9. Contingency Plan Update

One element of the contingency plan is to test the effectiveness on an annual basis. Testing is 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.

In 2015, the Humboldt Mill Emergency Response Team (ERT) was formed to assist in emergency response situations should they arise. This team is not required by the Mine Safety Health Administration (MSHA) but was established to help ensure the safety of employees while at work. The team is comprised of 11 individuals and training occurs on a monthly basis and in 2019 included first aid, patient packaging, development of confined space rescue plans, assisting with fire drills, extrication from various facilities and equipment, and completion of a 40-hour high angle rescue training. The monthly trainings include scenarios that facilitate response from the Emergency Response Team.

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.

A mock field test was conducted in May 2019 and was a desktop exercise which tested the emergency response measures of the contingency plan and crisis management plan in place at Eagle Mine. With the assistance of Eagle Mine employees, a third-party consultant developed an emergency scenario. The scenario generally involves a situation in which both safety and environmental risks are considered and in 2019 the emergency involved a traffic accident involving a loaded over the road haul truck. The crisis management team was aware that a test would occur but were unaware of the nature of the emergency. Two rooms were utilized during the exercise, the first contained the crisis management team and the second contained the "actors" playing roles of employees, regulators, local politicians, media outlets, and concerned citizens and family members. The actors had a loose script developed by the consultant which ensured that certain elements were included and that the scenario progressed at a pre-determined pace. During the crisis management exercise, the third-party consultant observed the activity to identify strengths, weaknesses and opportunities for improvement. Once the exercise was complete, the consultant and crisis management team held a debrief session to capture feedback from each participant. Following this session, the consultant captured the overall feedback and prepared a report with actions for improvement. Throughout the following 12-month period, the crisis management team meets on a quarterly basis to review and update the status on those actions in preparation for the annual exercise.

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

10. Financial Assurance Update

Updated reclamation costs can be found in Appendix O. 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

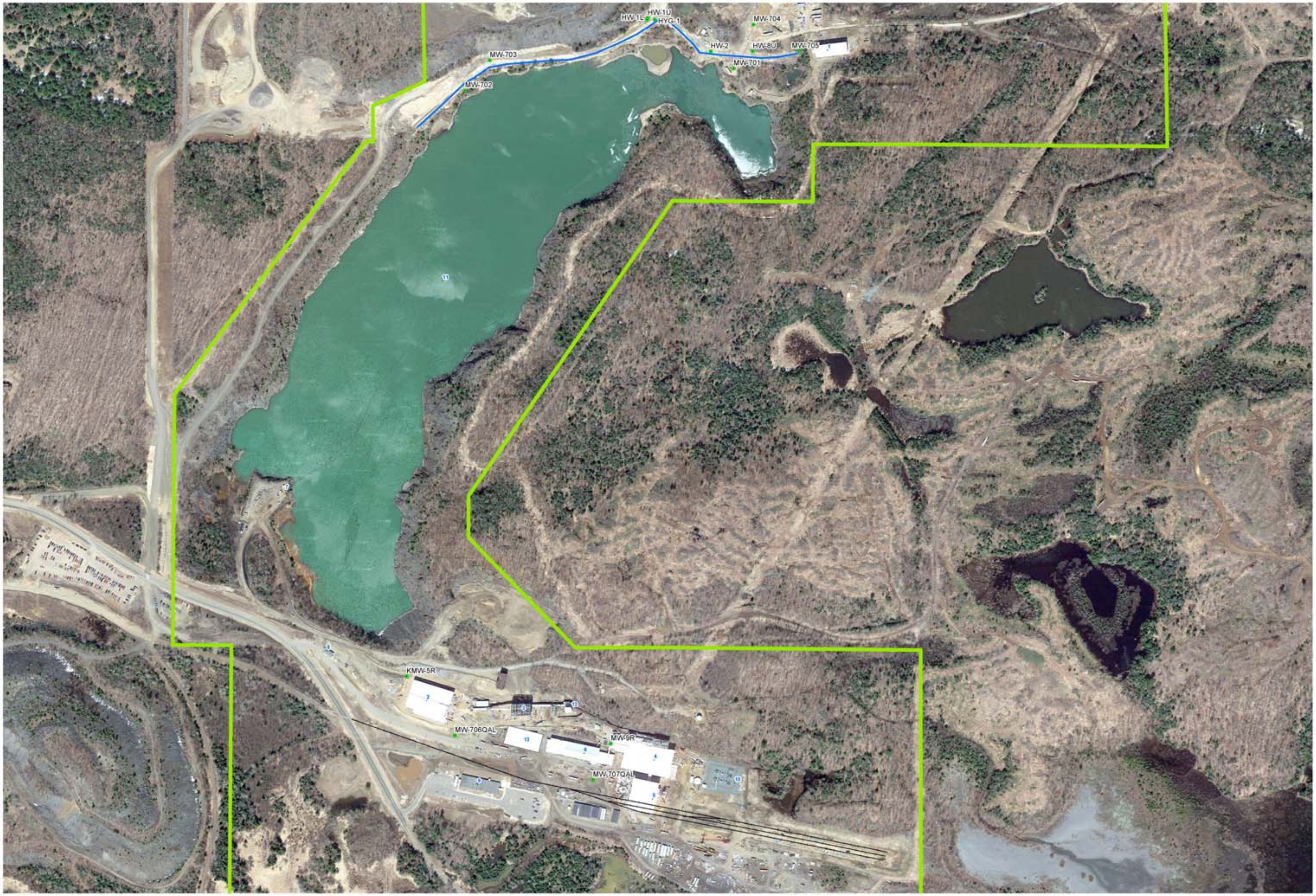
An updated organization report can be found in Appendix P.

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

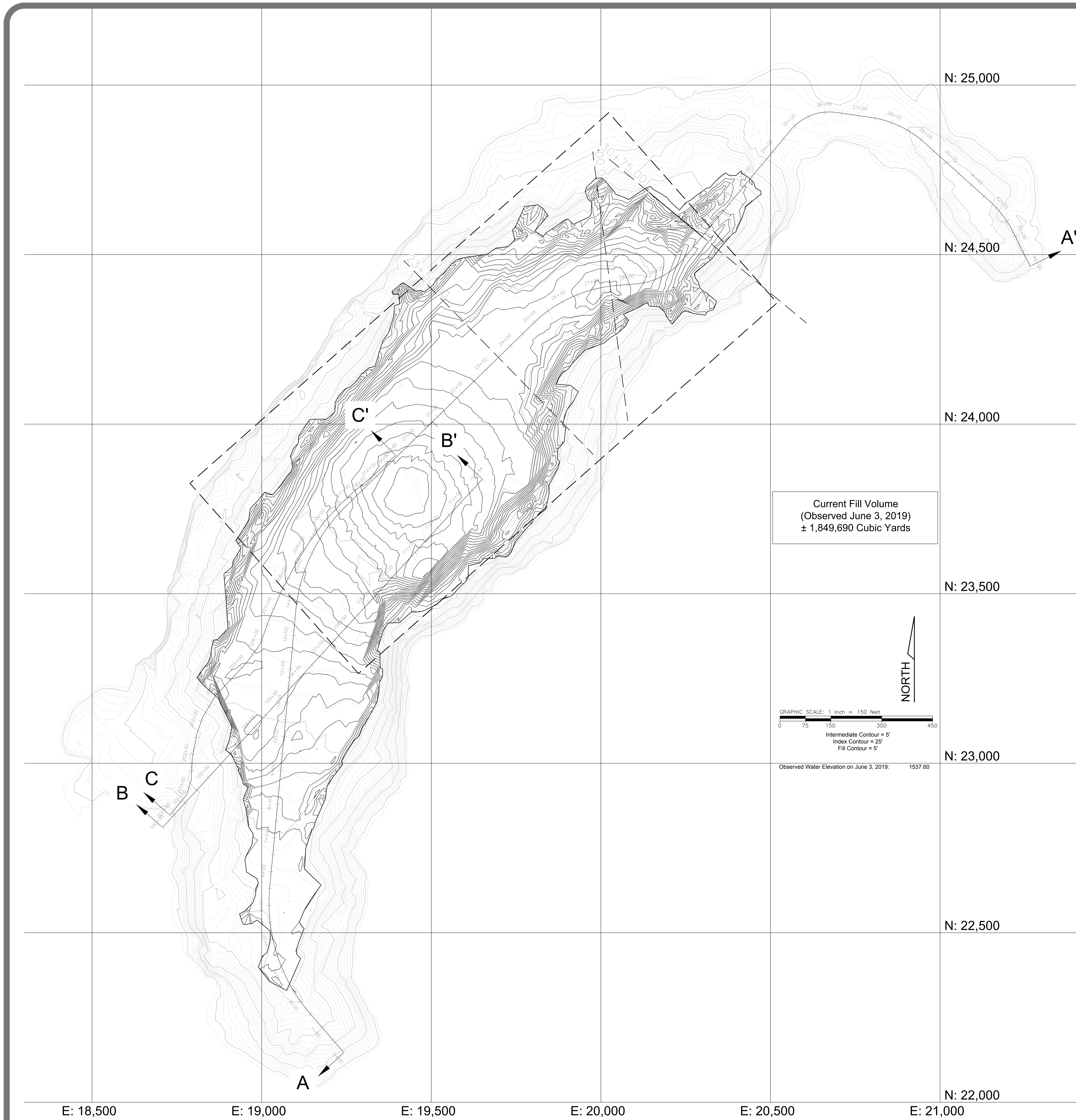
0 0.05 0.1 0.2 0.3 0.4 0.5 Miles

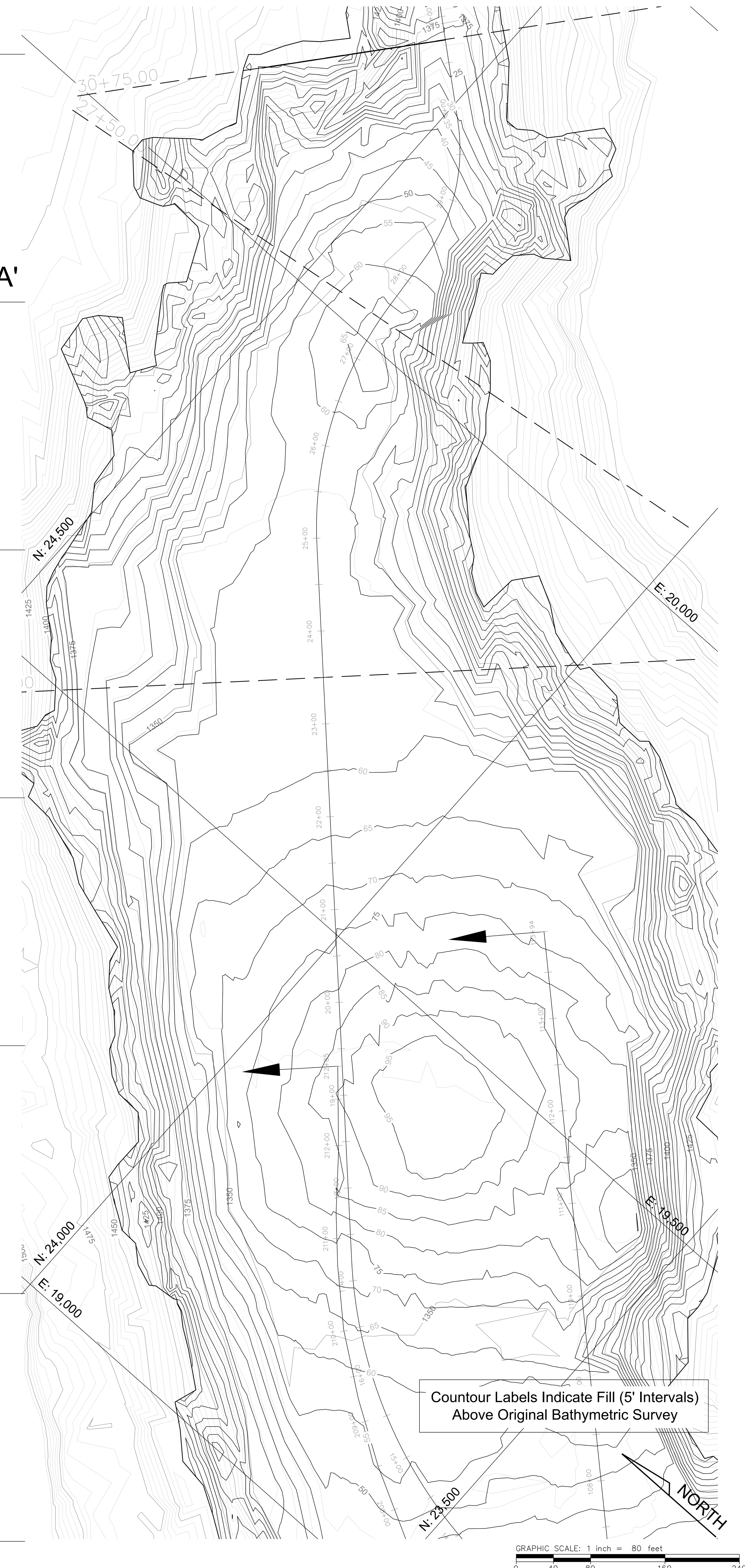
N W E S

Appendix B

Humboldt Mill

Bathymetry Maps





TRIMEDIA
ENVIRONMENTAL & ENGINEERING

Eagle Mine - Humboldt Mill
June 3, 2019 Bathymetric Survey
Champion, MI

DATE	DESCRIPTION	ISSUED

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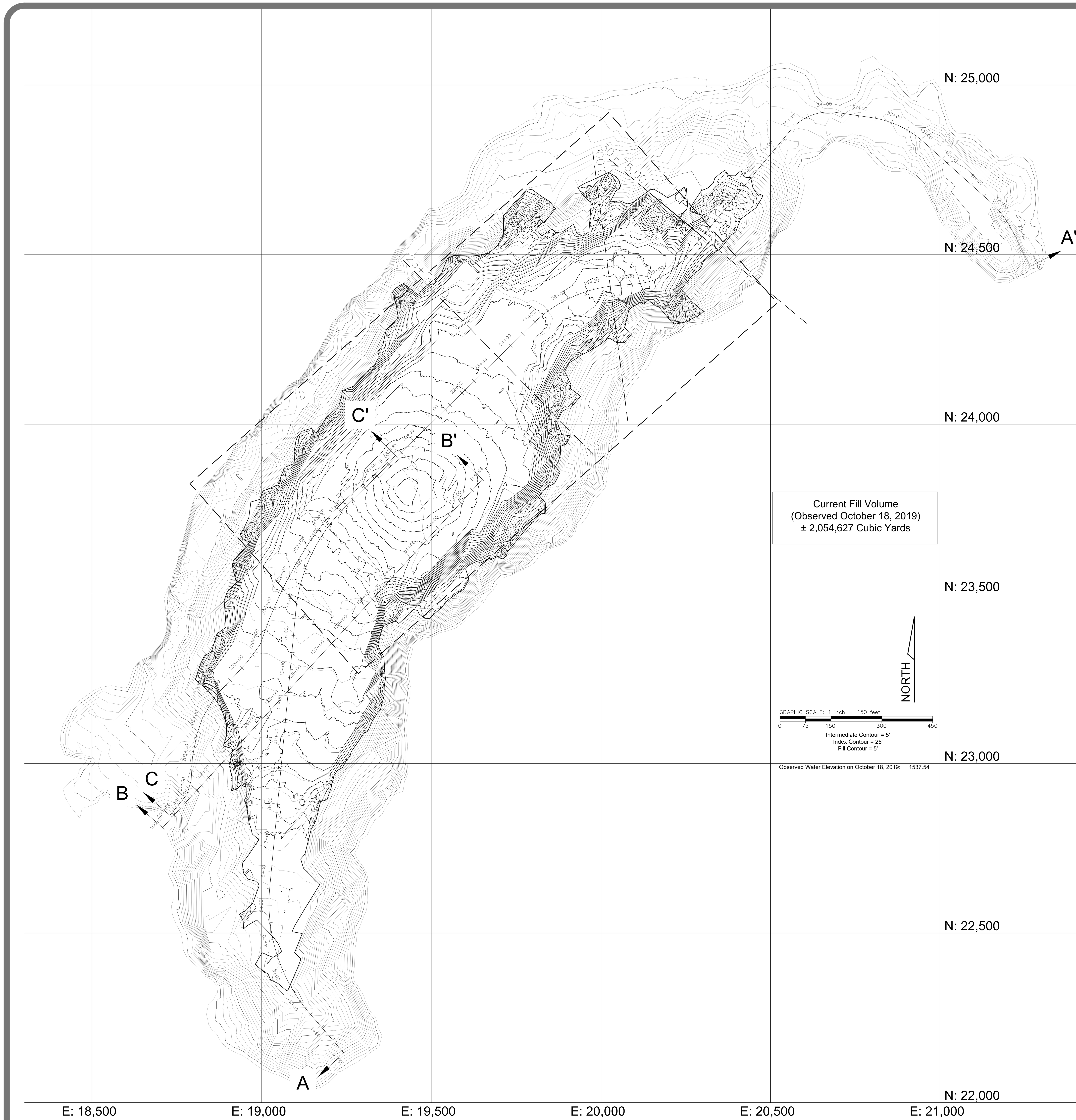
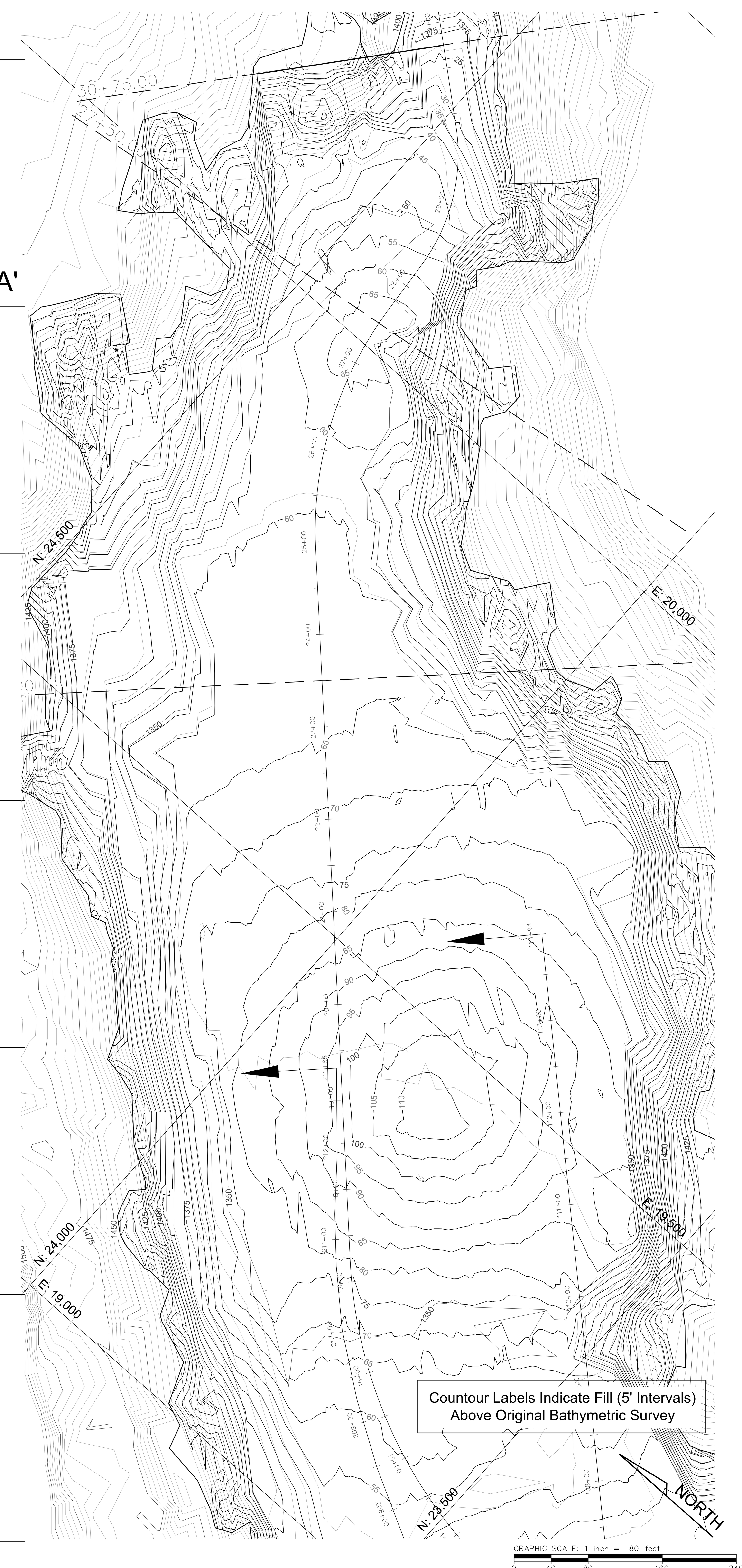
DRAWN: JWM
CHECKED: PGC
APPROVED: GWM

TRIMEDIA
JOB NUMBER:
2014-100

SHEET TITLE:
Tailings Basin
Product Fill Map

SHEET NUMBER:
1.0





TRIMEDIA
ENVIRONMENTAL & ENGINEERING

Eagle Mine - Humboldt Mill
October 18, 2019 Bathymetric Survey
Champion, MI

DATE	DESCRIPTION	ISSUED

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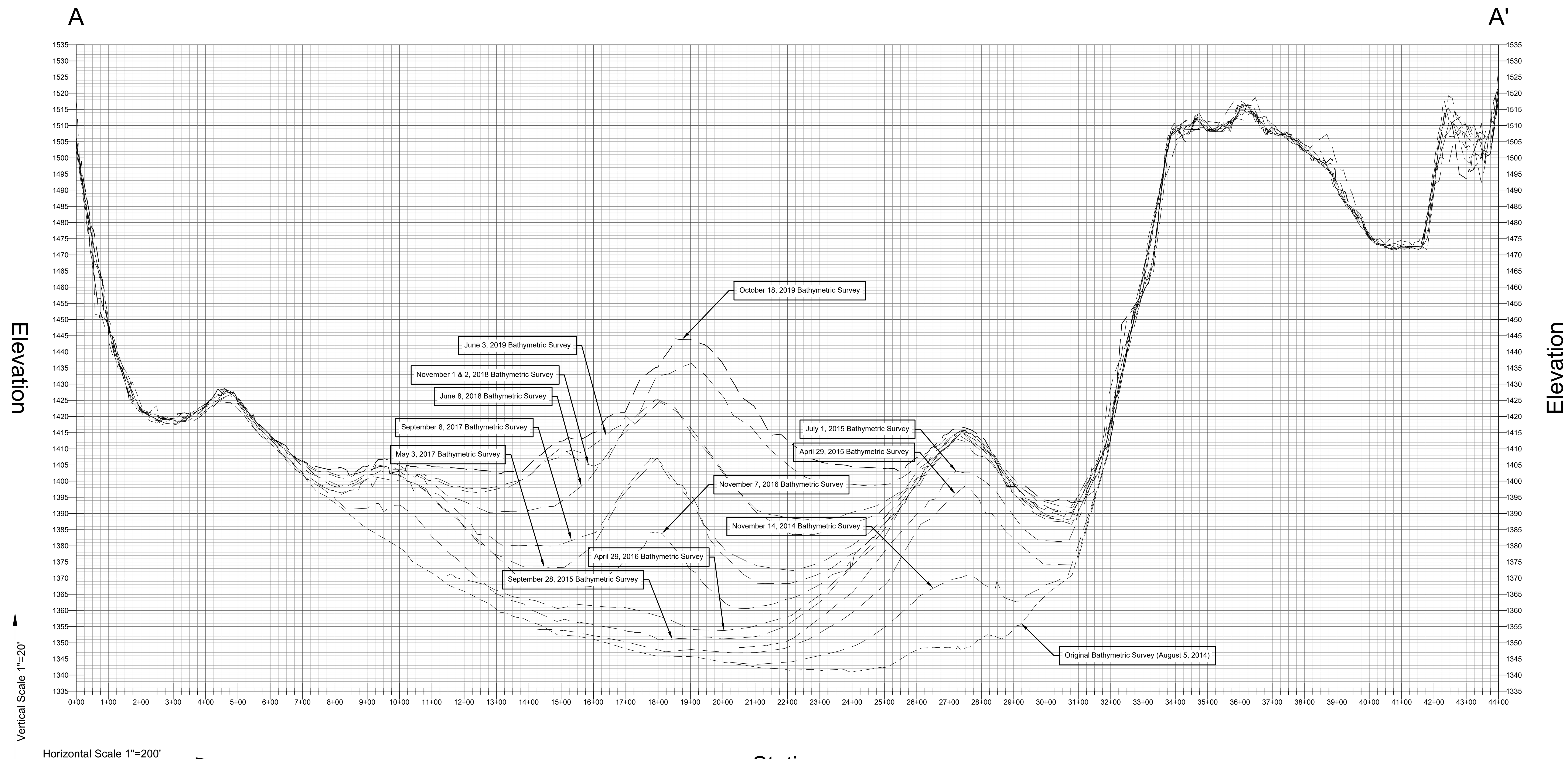
DRAWN: JWM
CHECKED: EJR
APPROVED: GWM

TRIMEDIA
JOB NUMBER:
2014-100

SHEET TITLE:
Tailings Basin
Product Fill Map

SHEET NUMBER:
1.0



TRIMEDIA ENVIRONMENTAL & ENGINEERING

Eagle Mine - Humboldt Mill
October 18, 2019 Bathymetric Survey
Champion, MI

DATE	DESCRIPTION	ISSUED

DESIGNED:
DRAWN: JWM
CHECKED: PGC
APPROVED: GWM

TRIMEDIA
JOB NUMBER:
2014-100

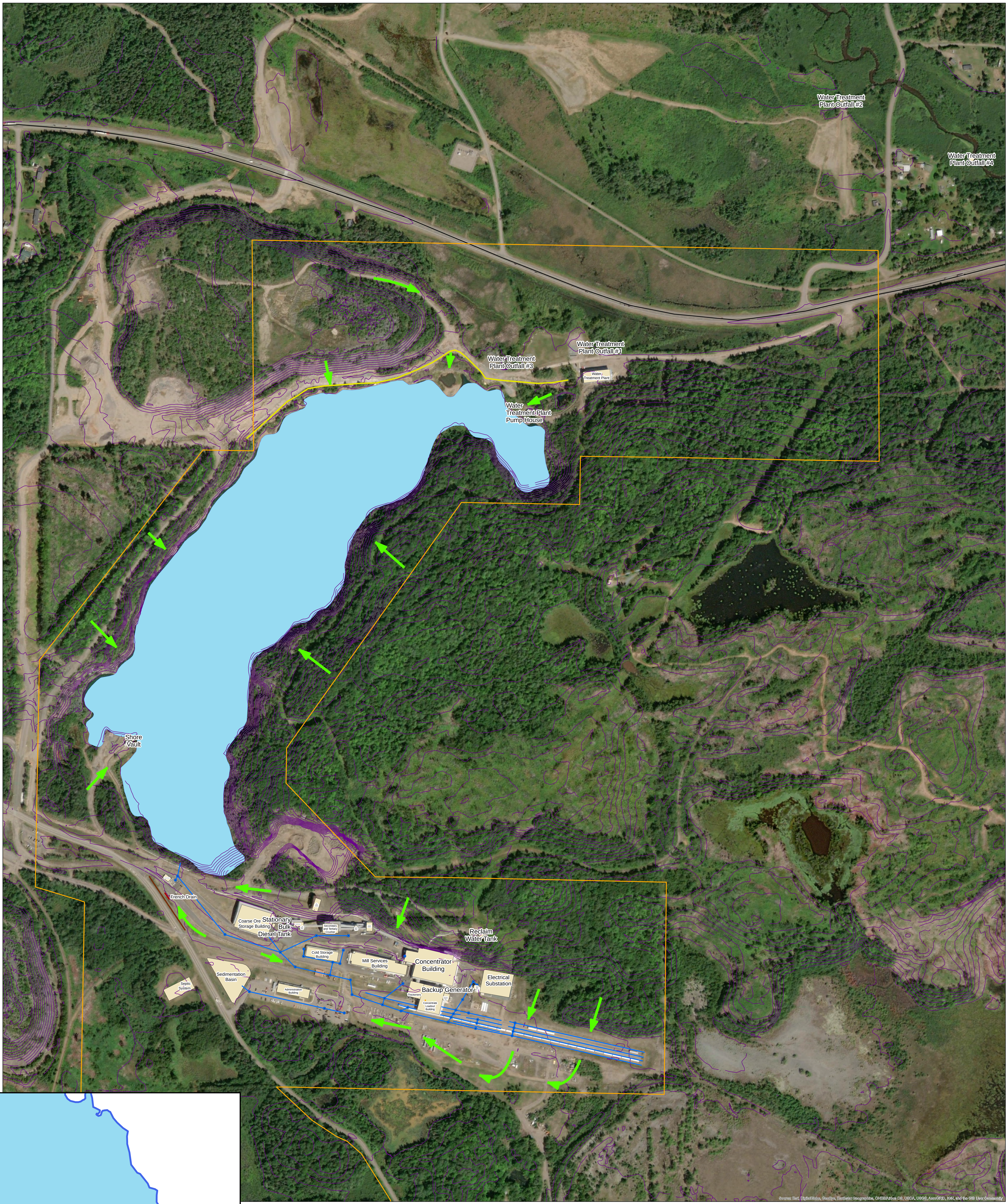
SHEET TITLE:
Tailings Basin 2019 Profile (Cross Section A)

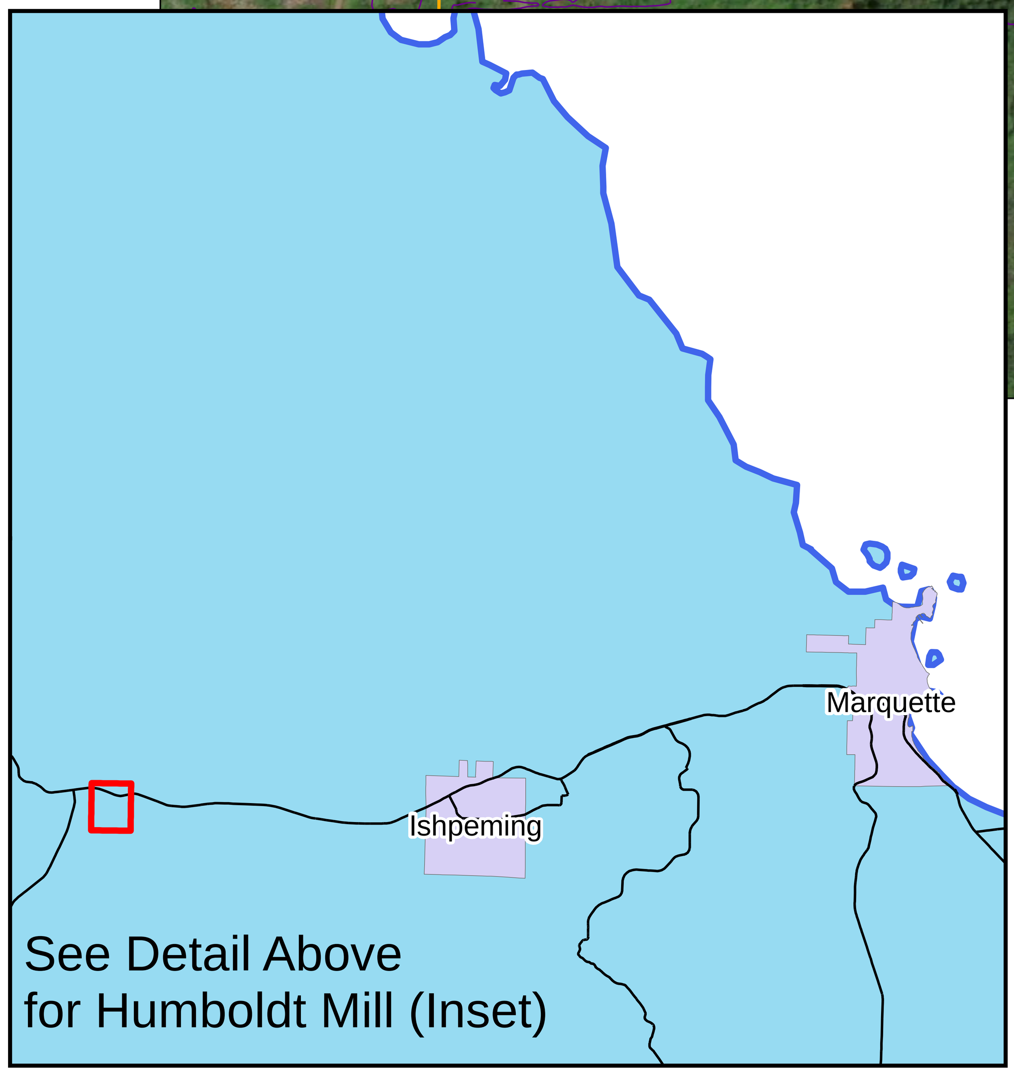
SHEET NUMBER:
2.0

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

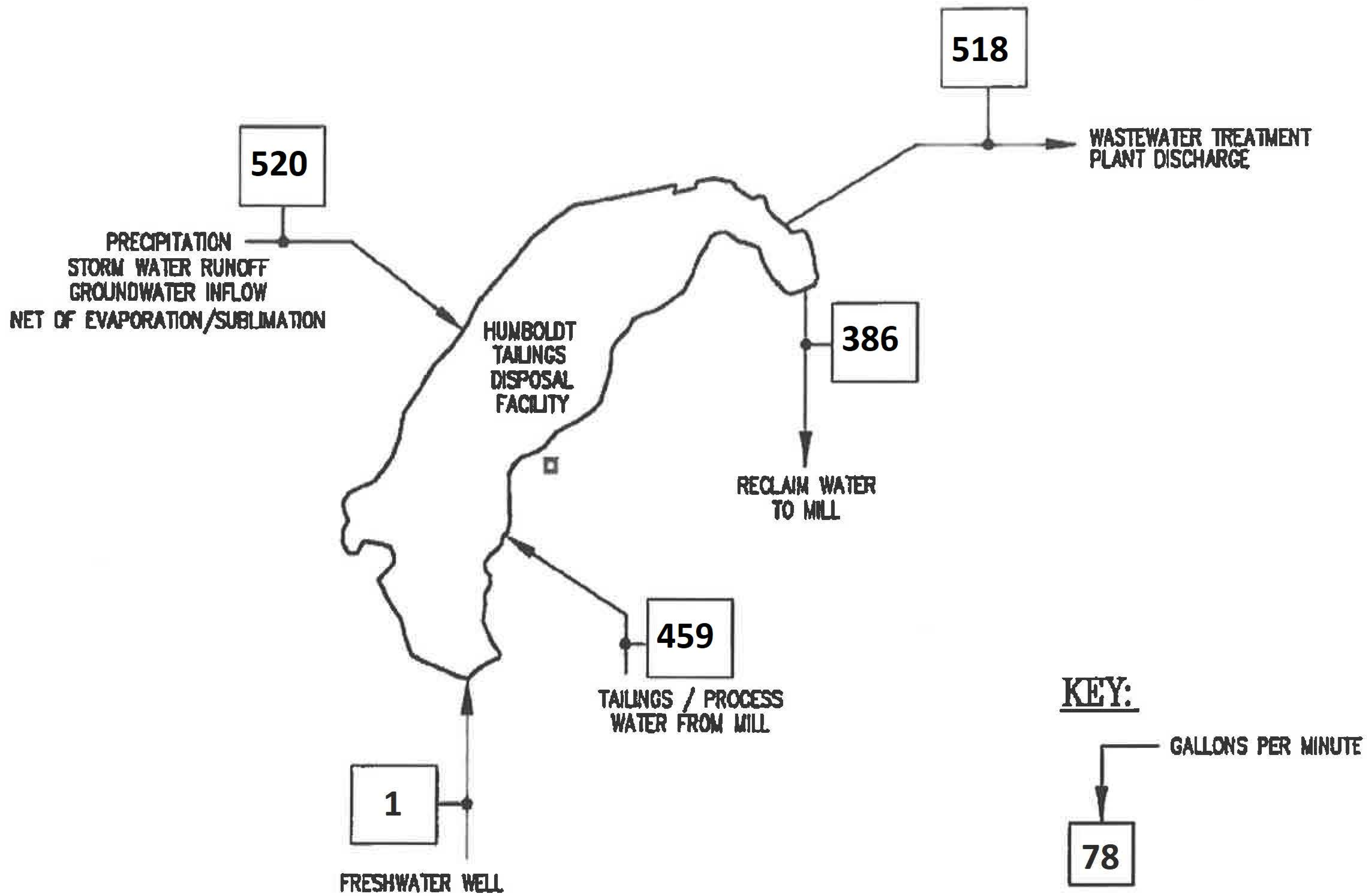
Eagle Mine
a subsidiary of lundin mining

Author: JRE

Appendix D

Humboldt Mill

Water Balance Diagrams



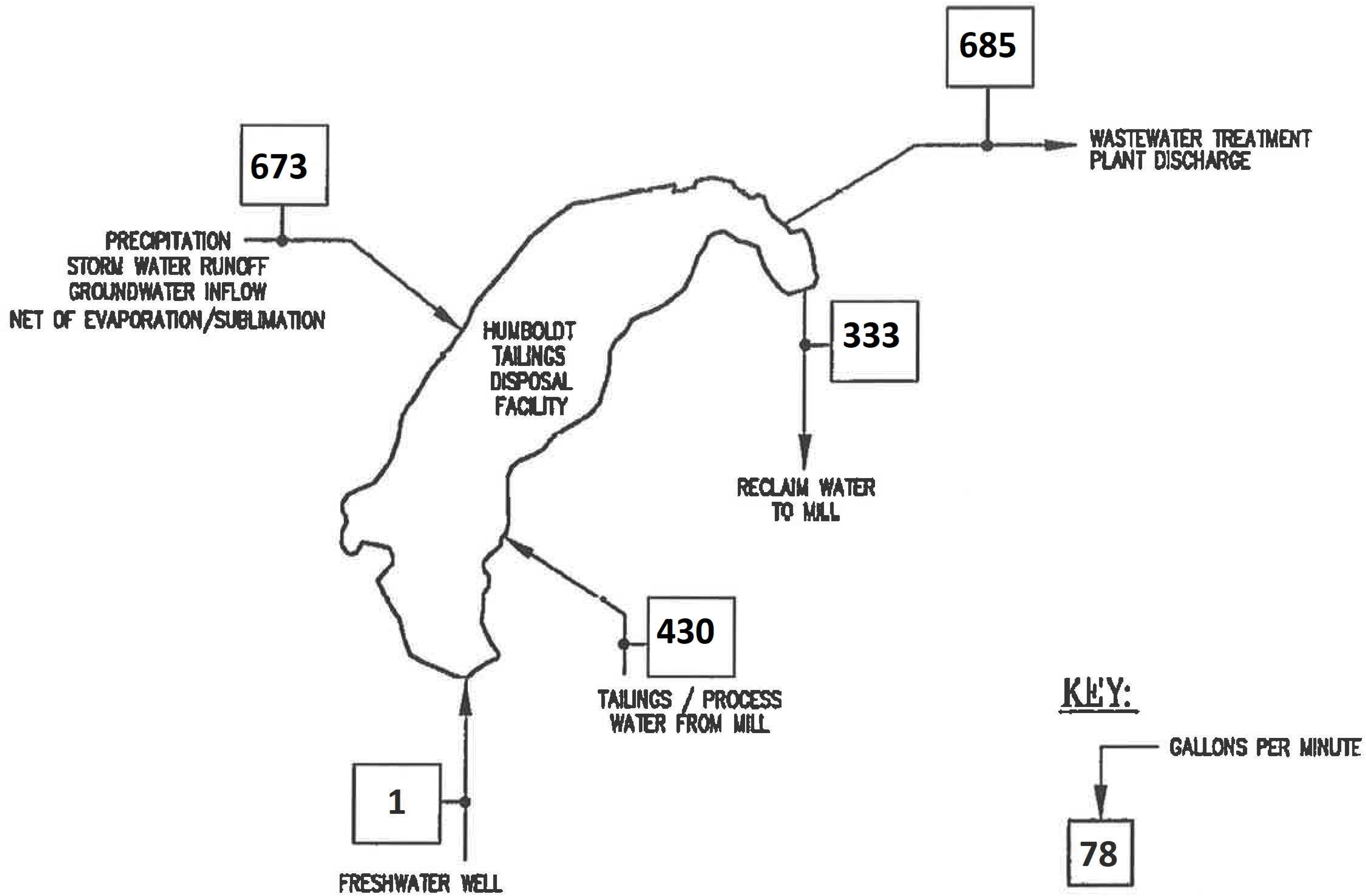
PROJECT NUMBER: KEX–0102

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

WATER BALANCE
HUMBOLDT TAILINGS DISPOSAL FACILTY
(January 1 - March 31, 2019)

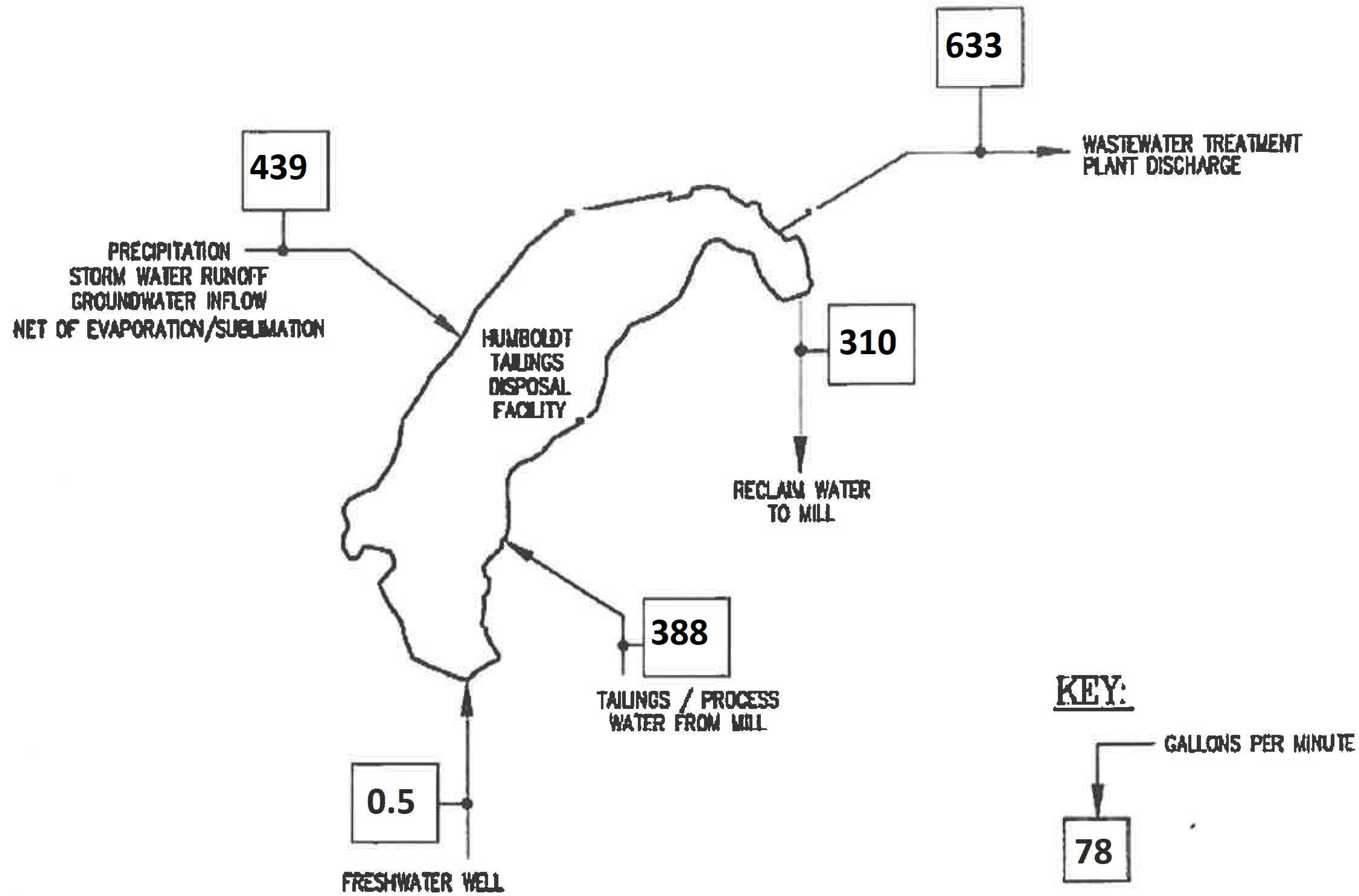
FIGURE: 1

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



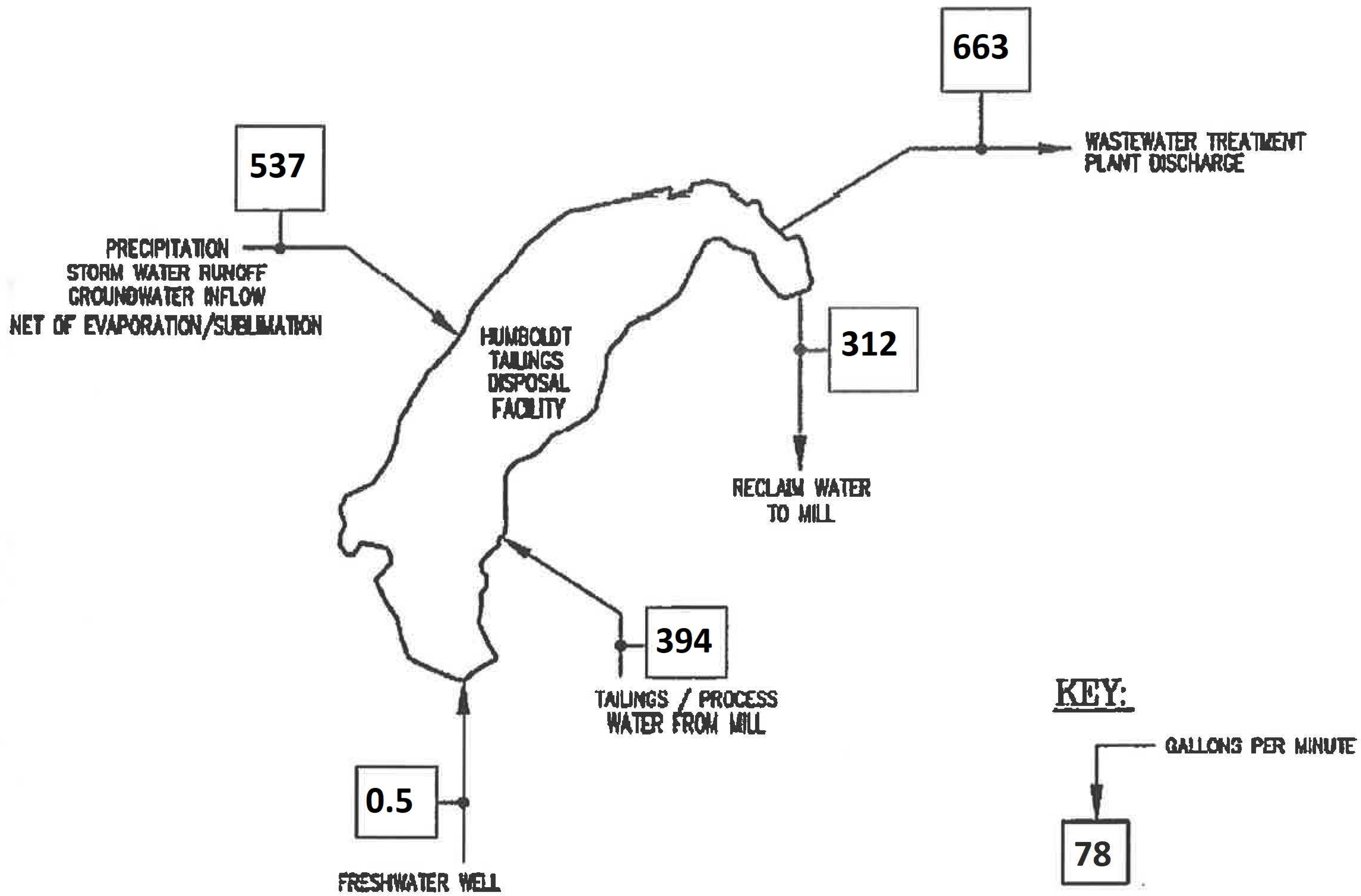
Tailings total includes the dry tailings volume. As such, this diagram illustrates a volume balance rather than a pure water balance.

	PROJECT NUMBER: KEX–0102
Eagle Mine, LLC - Humboldt Mill Facility Humboldt Township, Marquette County, Michigan	FIGURE:
WATER BALANCE HUMBOLDT TAILINGS DISPOSAL FACILTY (April 1 - June 30, 2019)	1



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

Eagle Mine, LLC - Humboldt Mill Facility Humboldt Township, Marquette County, Michigan	PROJECT NUMBER: KEx-0102
WATER BALANCE HUMBOLDT TAILINGS DISPOSAL FACILTY (July 1 - September 30, 2019)	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, 2019)	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 1401484 | Rev. 0 | FIGURE **01**

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

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

Appendix F

Humboldt Mill

Groundwater Monitoring Well Results

&

Benchmark Summary Table

Humboldt Mill
2019 Mine Permit Groundwater Monitoring
Benchmark Comparison Summary

Location	Location Classification	Q1	Q2	Q3	Q4
HW-1L	Monitoring				iron
HW-1U LLA	Monitoring				
HW-1U UFB	Monitoring				
HW-2	Monitoring	**sodium**	manganese, **sodium**	iron, **manganese,** sulfate, **sodium**	**iron, manganese,** chloride, potassium, **sodium**
HW-8U	Monitoring	**chloride, sulfate, potassium, sodium**	**sulfate, potassium, sodium**	**sulfate**	sodium
HYG-1	Monitoring	**manganese**	**manganese**	antimony, **manganese**	**manganese**
KMW-5R	Monitoring	arsenic, copper, iron, **sodium**	pH, **arsenic**, **copper, iron, sodium**	aluminum, **sodium**	**sodium**
MW-701 QAL	Monitoring	**chloride, sodium**	**chloride,** calcium, magnesium, **sodium,** hardness	**chloride, calcium, magnesium,** potassium, **sodium, hardness**	**chloride, calcium, magnesium,** potassium, **sodium, hardness**
MW-701 UFB	Monitoring	calcium	pH, iron, chloride, sulfate, **calcium,** magnesium, sodium, hardness	**iron,** lithium, manganese, mercury, alkalinity bicarbonate, **chloride, sulfate, calcium, magnesium,** potassium, **sodium, hardness**	**iron, manganese, alkalinity bicarbonate, chloride, sulfate, calcium, magnesium, potassium, sodium, hardness**
MW-702 QAL	Monitoring	**pH**	**pH,** magnesium	**pH**	**pH**
MW-702 UFB	Monitoring	sulfate	pH		sodium
MW-703 QAL	Monitoring	**pH**	**pH,** nitrogen nitrate	**pH, nitrogen nitrate**	**pH, nitrogen nitrate**
MW-703 UFB	Monitoring	sulfate		manganese, sulfate	**sulfate**
MW-703-LLA	Monitoring				pH
MW-703-DBA	Monitoring	**pH**	**pH,** calcium	**pH**	**pH,** calcium
MW-704 QAL	Monitoring	sulfate	pH, nitrogen ammonia, **sulfate,** magnesium	chloride, **sulfate, magnesium**	**chloride,** nitrogen ammonia, **sulfate,** calcium, **magnesium,** hardness
MW-704 UFB	Monitoring		iron, chloride, sulfate, calcium, magnesium, hardness	**iron,** mercury, **chloride, magnesium, hardness**	**iron,** manganese, **chloride,** calcium, **magnesium, hardness**
MW-704 LLA	Monitoring	pH, manganese, alkalinity bicarbonate, calcium, magnesium, hardness		manganese, alkalinity bicarbonate, calcium, magnesium, hardness	pH, **manganese, alkalinity bicarbonate, calcium, magnesium, hardness**
MW-704 DBA	Monitoring		pH, manganese	**manganese**	pH, **manganese,** hardness
MW-705 QAL	Monitoring	**chloride,** nitrogen ammonia	iron, **chloride, nitrogen ammonia,** sulfate, sodium	arsenic	mercury, sodium
MW-705 UFB	Monitoring	manganese, chloride, **magnesium**	**manganese,** calcium, **magnesium**	**manganese,** chloride, **calcium, magnesium,** sodium, hardness	**manganese, chloride, calcium, magnesium,** potassium, **sodium, hardness**
MW-706 QAL	Monitoring				
MW-707 QAL	Monitoring				sodium
MW-9R	Monitoring				

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. N/A means there were no parameters outside of benchmark values for that quarter. 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.

2019
Mine Permit Groundwater Quality Monitoring Data
HW-1L (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[T]	Q2 2019[T]	Q3 2019[T]	Q4 2019[T]
Field						
D.O.	ppm	-	**0.44**	**0.30**	**1.2**	**0.38**
ORP	mV	-	-239	-300	-242	-291
pH	SU	**8.14-9.14**	**8.44**	**8.55**	**8.51**	**8.12**
Specific Conductance	uS/cm	-	**353**	**294**	**345**	**381**
Temperature	C	-	**7.1**	**9.3**	**11**	**7.4**
Turbidity	NTU	-	**3.0**	**3.3**	**2.9**	**1.7**
Water Elevation	ft MSL	-	**1467.56**	**1445.58**	**1444.77**	**1444.70**
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**	-	-	**598**	-
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	**1187**	**957**	**606**	**480**	**1190**
Lead	ug/L	**9.0**	< 3.0	<3.0	<3.0	<3.0
Lithium	ug/L	**23**	-	-	**13**	-
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	**40**	< 10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**109**	**79**	**82**	**81**	**77**
Alkalinity, Carbonate	mg/L	**7.8**	< 2.0	<2.0	<2.0	<2.0
Chloride	mg/L	**57**	**42**	**35**	**36**	**39**
Fluoride	mg/L	**2.5**	< 1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	**0.10**	< 0.025	< 0.025	< 0.025	< 0.025
Nitrogen, Nitrate	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Nitrogen, Nitrite	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Sulfate	mg/L	**33**	**30**	**26**	**28**	**26**
Sulfide	mg/L	**0.80**	< 0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	**34**	**27**	**25**	**24**	**25**
Magnesium	mg/L	**15**	**11**	**10**	**10**	**10**
Potassium	mg/L	**6.2**	**1.8**	**1.9**	**1.7**	**1.9**
Sodium	mg/L	**28**	**23**	**20**	**21**	**28**
General						
Hardness	mg/L	**156**	**113**	**103**	**104**	**105**

2019
Mine Permit Groundwater Quality Monitoring Data
HW-1U LLA (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[D]	Q2 2019[T]	Q3 2019[D]	Q4 2019[D]
Field						
D.O.	ppm	-	0.45	2.0	1.3	1.4
ORP	mV	-	-234	-217	-241	-257
pH	SU	8.06-9.06	8.50	8.44	8.47	8.45
Specific Conductance	uS/cm	-	405	346	398	407
Temperature	C	-	7.6	9.7	10	7.9
Turbidity	NTU	-	7.8	3.1	4.7	9.6
Water Elevation	ft MSL	-	1518.62	1486.75	1415.26	-
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	8.6	< 4.0	<4.0	<4.0	<4.0
Iron	ug/L	56770	344	595	293	560
Lead	ug/L	15	< 3.0	<3.0	<3.0	<3.0
Lithium	ug/L	17	-	-	12	-
Manganese	ug/L	673	< 50.0	<50.0	<50.0	<50.0
Mercury	ng/L	14	< 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	< 10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	157	100	106	104	97
Alkalinity, Carbonate	mg/L	64	< 2.0	<2.0	<2.0	<2.0
Chloride	mg/L	61	18	18	18	18
Fluoride	mg/L	2.5	< 1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.30	0.16	0.17	0.10	0.12
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	66	58	63	56
Sulfide	mg/L	0.80	< 0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	61	26	22	27	27
Magnesium	mg/L	26	9.9	7.9	9.7	9.5
Potassium	mg/L	17	2.9	3.1	3.3	3.2
Sodium	mg/L	134	39	43	40	37
General						
Hardness	mg/L	171	106	86	106	108

2019
Mine Permit Groundwater Quality Monitoring Data
HW-1U UFB (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[D]	Q2 2019[D]	Q3 2019[D]	Q4 2019[D]
Field						
D.O.	ppm	-	**1.23**	**1.15**	**1.25**	**1.34**
ORP	mV	-	-362	-244	-294	-341
pH	SU	**8.40-9.40**	**8.96**	**8.63**	**8.76**	**8.62**
Specific Conductance	uS/cm	-	**238**	**139**	**219**	**246**
Temperature	C	-	**7.1**	**9.0**	**9.6**	**7.7**
Turbidity	NTU	-	**4.7**	**22**	**4.4**	**5.3**
Water Elevation	ft MSL	-	**1534.68**	**1536.77**	**1536.05**	-
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**	**352**	**234**	**352**	**733**
Lead	ug/L	**9.0**	< 3.0	<3.0	<3.0	<3.0
Lithium	ug/L	**17**	-	-	<10.0	-
Manganese	ug/L	**80**	**51**	<50.0	<50.0	**67**
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	**122**	**88**	**68**	**75**	**99**
Alkalinity, Carbonate	mg/L	**17**	**5.6**	<2.0	<2.0	<2.0
Chloride	mg/L	**96**	< 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	**0.10**	< 0.025	< 0.025	< 0.025	< 0.025
Nitrogen, Nitrate	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Nitrogen, Nitrite	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Sulfate	mg/L	**72**	**5.4**	**3.2**	**12**	**5.3**
Sulfide	mg/L	**2.5**	< 0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	**34**	**24**	**18**	**23**	**27**
Magnesium	mg/L	**16**	**7.2**	**4.5**	**6.5**	**7.2**
Potassium	mg/L	**21**	**4.4**	**2.5**	**4.1**	**3.2**
Sodium	mg/L	**68**	**6.8**	**4.8**	**8.4**	**6.2**
General						
Hardness	mg/L	**147**	**90**	**63**	**85**	**96**

2019
Mine Permit Groundwater Quality Monitoring Data
HW-2 (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[D]	Q2 2019[D]	Q3 2019[D]	Q4 2019[D]
Field						
D.O.	ppm	-	**1.3**	**0.28**	**1.3**	**1.3**
ORP	mV	-	-238	-229	-175	-211
pH	SU	**7.29-8.29**	**8.13**	**7.54**	**7.46**	**7.63**
Specific Conductance	uS/cm	-	**501**	**377**	**649**	**809**
Temperature	C	-	**7.1**	**7.4**	**9.4**	**8.9**
Turbidity	NTU	-	**67**	**56**	**56**	**64**
Water Elevation	ft MSL	-	**1531.54**	**1538.84**	**1538.22**	**1538.76**
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	**2595**	**662**	**2290**	**2950**	**4580**
Lead	ug/L	**9.0**	< 3.0	<3.0	<3.0	<3.0
Lithium	ug/L	**40**	-	-	<10.0	-
Manganese	ug/L	**333**	**264**	**457**	**602**	**661**
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**	**81**	**81**	**71**	**75**
Alkalinity, Carbonate	mg/L	**8.0**	< 2.0	<2.0	<2.0	<2.0
Chloride	mg/L	**35**	**26**	**21**	**28**	**97**
Fluoride	mg/L	**2.5**	< 1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	**0.08**	**0.04**	< 0.025	< 0.025	< 0.025
Nitrogen, Nitrate	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Nitrogen, Nitrite	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Sulfate	mg/L	**175**	**160**	**173**	**207**	**128**
Sulfide	mg/L	**0.52**	< 0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	**72**	**38**	**34**	**41**	**50**
Magnesium	mg/L	**26**	**18**	**16**	**17**	**21**
Potassium	mg/L	**6.1**	**4.9**	**5.4**	**6.0**	**7.9**
Sodium	mg/L	**30**	**42**	**57**	**54**	**62**
General						
Hardness	mg/L	**297**	**171**	**149**	**174**	**213**

2019
Mine Permit Groundwater Quality Monitoring Data
HW-8U (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[D]	Q2 2019[T]	Q3 2019[D]	Q4 2019[T]
Field						
D.O.	ppm	-	**1.3**	**0.21**	**2.3**	**1.5**
ORP	mV	-	-105	-124	-85	-129
pH	SU	**6.4-7.4**	**6.65**	**6.81**	**6.88**	**6.85**
Specific Conductance	uS/cm	-	**445**	**385**	**387**	**377**
Temperature	C	-	**7.3**	**9.1**	**11**	**8.0**
Turbidity	NTU	-	**3.8**	**3.1**	**4.6**	**0.52**
Water Elevation	ft MSL	-	**1533.32**	**1537.62**	**1536.52**	**1537.30**
Metals						
Aluminum	ug/L	**200**	-	-	<50.0	-
Antimony	ug/L	**4.0**	-	-	<2.0	-
Arsenic	ug/L	**8.8**	**7.8**	**7.0**	**6.0**	**5.5**
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	**22049**	**10200**	**10300**	**8740**	**7960**
Lead	ug/L	**9.0**	< 3.0	<3.0	<3.0	<3.0
Lithium	ug/L	**14**	-	-	<10.0	-
Manganese	ug/L	**6268**	**6110**	**5530**	**4720**	**4240**
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	**27**	< 10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**214**	**155**	**153**	**142**	**132**
Alkalinity, Carbonate	mg/L	**8.0**	< 2.0	<2.0	<2.0	<2.0
Chloride	mg/L	**18**	**20**	**18**	**15**	**14**
Fluoride	mg/L	**2.5**	< 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	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Nitrogen, Nitrite	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Sulfate	mg/L	**12**	**15**	**14**	**14**	**12**
Sulfide	mg/L	**0.80**	< 0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	**46**	**46**	**44**	**39**	**38**
Magnesium	mg/L	**19**	**14**	**14**	**13**	**13**
Potassium	mg/L	**3.6**	**3.7**	**3.8**	**3.6**	**3.3**
Sodium	mg/L	**4.3**	**4.8**	**4.7**	**4.2**	**4.5**
General						
Hardness	mg/L	**203**	**172**	**166**	**150**	**148**

2019
Mine Permit Groundwater Quality Monitoring Data
HYG-1 (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019^T	Q2 2019^T	Q3 2019^T	Q4 2019^T
Field						
D.O.	ppm	-	**1.4**	**1.5**	**1.3**	**1.4**
ORP	mV	-	**11**	**25**	**94**	**99**
pH	SU	**6.29-7.29**	**6.98**	**6.75**	**6.65**	**6.50**
Specific Conductance	uS/cm	-	**610**	**608**	**682**	**740**
Temperature	C	-	**7.1**	**10**	**9.2**	**8.4**
Turbidity	NTU	-	**2.0**	**2.5**	**2.2**	**0.54**
Water Elevation	ft MSL	-	**1532.35**	**1535.31**	**1534.79**	**1534.26**
Metals						
Aluminum	ug/L	**200**	-	-	<50.0	-
Antimony	ug/L	**4.0**	-	-	**7.4**	-
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	<4.0	<4.0	<4.0
Iron	ug/L	**482**	< 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**	**711**	**841**	**981**	**1090**
Mercury	ng/L	**37**	**10**	**6.9**	**20**	**14**
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**	< 10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**373**	**155**	**243**	**238**	**257**
Alkalinity, Carbonate	mg/L	**8.0**	< 2.0	<2.0	<2.0	<2.0
Chloride	mg/L	**22**	**17**	**13**	<10.0	<10.0
Fluoride	mg/L	**2.5**	< 1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	**0.56**	**0.23**	**0.22**	**0.31**	**0.28**
Nitrogen, Nitrate	mg/L	**0.08**	< 0.10	< 0.10	< 0.10	< 0.10
Nitrogen, Nitrite	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Sulfate	mg/L	**137**	**133**	**109**	**95**	**96**
Sulfide	mg/L	**0.80**	< 0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	**65**	**51**	**60**	**49**	**60**
Magnesium	mg/L	**34**	**26**	**28**	**25**	**29**
Potassium	mg/L	**13**	**10**	**12**	**9.9**	**11**
Sodium	mg/L	**80**	**26**	**38**	**43**	**46**
General						
Hardness	mg/L	**322**	**234**	**266**	**226**	**267**

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

2019
Mine Permit Groundwater Quality Monitoring Data
KMW-5R (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[D]	Q2 2019[D]	Q3 2019[D]	Q4 2019[D]
Field						
D.O.	ppm	-	**6.7**	**2.7**	**7.4**	**4.9**
ORP	mV	-	**233**	**66**	**127**	**24**
pH	SU	**6.67-7.67**	**6.96**	**6.62**	**7.05**	**6.76**
Specific Conductance	uS/cm	-	**813**	**691**	**834**	**813**
Temperature	C	-	**9.2**	**11**	**11**	**7.7**
Turbidity	NTU	-	**1087**	**746**	**148**	**119**
Water Elevation	ft MSL	-	**1560.13**	**1567.71**	**1564.29**	**1563.83**
Metals						
Aluminum	ug/L	**200**	-	-	**1500**	-
Antimony	ug/L	**4.0**	-	-	<2.0	-
Arsenic	ug/L	**7.5**	**12**	**7.8**	<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	**28**	**37**	**28**	**6.0**	**5.3**
Iron	ug/L	**52956**	**128000**	**77000**	**8860**	**8840**
Lead	ug/L	**9.0**	**5.3**	**3.1**	<3.0	<3.0
Lithium	ug/L	**31**	-	-	**13**	-
Manganese	ug/L	**2789**	**1610**	**1980**	**718**	**1800**
Mercury	ng/L	**15**	**6.7**	<3.1	**1.6**	**5.3**
Molybdenum	ug/L	**200**	-	-	<50.0	-
Nickel	ug/L	**80**	**45**	**38**	<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	**24**	**21**	**15**	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**481**	**374**	**371**	**383**	**381**
Alkalinity, Carbonate	mg/L	**8.0**	< 2.0	<2.0	<2.0	<2.0
Chloride	mg/L	**192**	< 10.0	<50.0	<10.0	<10.0
Fluoride	mg/L	**2.5**	< 1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	**0.06**	<0.025	<0.025	<0.025	<0.025
Nitrogen, Nitrate	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Nitrogen, Nitrite	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Sulfate	mg/L	**139**	**76**	**66**	**76**	**67**
Sulfide	mg/L	**0.80**	< 1.0	<1.0	<0.20	<0.20
Major Cations						
Calcium	mg/L	**166**	**105**	**105**	**107**	**108**
Magnesium	mg/L	**65**	**60**	**53**	**42**	**42**
Potassium	mg/L	**8.3**	**8.2**	**7.9**	**7.1**	**7.2**
Sodium	mg/L	**7.7**	**9.9**	**10**	**9.9**	**16**
General						
Hardness	mg/L	**757**	**511**	**479**	**441**	**441**

2019
Mine Permit Groundwater Quality Monitoring Data
MW-701 QAL (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019 T		Q2 2019 T		Q3 2019 T		Q4 2019 D	
Field										
D.O.	ppm	-	**0.75**		**2.4**		**2.8**		**0.66**	
ORP	mV	-	**226**		**232**		**238**		**164**	
pH	SU	**5.46-6.46**	**5.78**		**5.57**		**5.47**		**5.48**	
Specific Conductance	uS/cm	-	**381**		**1220**		**1278**		**1370**	
Temperature	C	-	**5.1**		**7.7**		**13**		**6.5**	
Turbidity	NTU	-	**1.3**		**1.7**		**2.8**		**18**	
Water Elevation	ft MSL	-	**1532.35**		**1537.70**		**1536.81**		**1536.11**	
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**	-		-		**162**		-	
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	**498**	< 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	**5263**	**102**		**236**		**307**		**381**	
Mercury	ng/L	**8.4**	< 1.0		**1.4**		**1.5**		**1.2**	
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		**16**		<10.0		<10.0	
Major Anions										
Alkalinity, Bicarbonate	mg/L	**118**	**51**		**65**		**62**		**60**	
Alkalinity, Carbonate	mg/L	**8.0**	< 2.0		<2.0		<2.0		<2.0	
Chloride	mg/L	**23**	**63**		**345**		**333**		**333**	
Fluoride	mg/L	**2.5**	< 1.0		<1.0		<1.0		<1.0	
Nitrogen, Ammonia	mg/L	**0.40**	< 0.025		<0.050		< 0.025		< 0.025	
Nitrogen, Nitrate	mg/L	**1.9**	**1.2**		**1.3**		**1.4**		**0.99**	
Nitrogen, Nitrite	mg/L	**0.40**	< 0.10		< 0.10		< 0.10		< 0.10	
Sulfate	mg/L	**86**	**21**		**20**		**34**		**43**	
Sulfide	mg/L	**0.80**	< 0.20		<0.20		<0.20		<0.20	
Major Cations										
Calcium	mg/L	**43**	**30**		**74**		**59**		**60**	
Magnesium	mg/L	**19**	**12**		**26**		**19**		**20**	
Potassium	mg/L	**9.0**	**4.1**		**8.9**		**9.4**		**10**	
Sodium	mg/L	**12**	**21**		**111**		**136**		**147**	
General										
Hardness	mg/L	**199**	**123**		**290**		**227**		**232**	
Silica	mg/L	-	-		-		**18**		**18**	

2019
Mine Permit Groundwater Quality Monitoring Data
MW-701 UFB (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[D]		Q2 2019[D]		Q3 2019[D]		Q4 2019[D]	
Field										
D.O.	ppm	-	**0.24**		**0.25**		**1.3**		**1.3**	
ORP	mV	-	**223**		-114		-153		-229	
pH	SU	**6.71-7.71**	**7.55**		**6.57**		**6.98**		**7.23**	
Specific Conductance	uS/cm	-	**366**		**1868**		**5543**		**5298**	
Temperature	C	-	**7.6**		**7.4**		**9.5**		**7.2**	
Turbidity	NTU	-	**42**		**41**		**24**		**19**	
Water Elevation	ft MSL	-	**1532.63**		**1537.95**		**1537.02**		**1539.69**	
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**	-		-		<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**	< 4.0		<4.0		<4.0		<4.0	
Iron	ug/L	**24958**	**17500**		**48800**		**197000**		**201000**	
Lead	ug/L	**9.0**	< 3.0		<3.0		<3.0		<3.0	
Lithium	ug/L	**13**	-		-		**15**		-	
Manganese	ug/L	**4677**	**1790**		**1870**		**16400**		**19300**	
Mercury	ng/L	**4.0**	< 1.0		**3.4**		**4.4**		**2.1**	
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	**14**	< 10.0		<10.0		<10.0		<10.0	
Major Anions										
Alkalinity, Bicarbonate	mg/L	**162**	**147**		**112**		**259**		**242**	
Alkalinity, Carbonate	mg/L	**8.0**	< 2.0		<2.0		<2.0		<2.0	
Chloride	mg/L	**49**	**14**		**238**		**576**		**615**	
Fluoride	mg/L	**2.5**	< 1.0		<1.0		<1.0		<1.0	
Nitrogen, Ammonia	mg/L	**1.8**	< 0.025		**0.09**		**0.10**		**0.10**	
Nitrogen, Nitrate	mg/L	**0.40**	< 0.10		< 0.10		< 0.10		< 0.10	
Nitrogen, Nitrite	mg/L	**0.40**	< 0.10		< 0.10		< 0.10		< 0.10	
Sulfate	mg/L	**52**	**2.9**		**619**		**1950**		**1650**	
Sulfide	mg/L	**1.9**	< 0.20		<0.20		<0.20		<0.20	
Major Cations										
Calcium	mg/L	**39**	**39**		**181**		**504**		**449**	
Magnesium	mg/L	**16**	**14**		**71**		**162**		**151**	
Potassium	mg/L	**8.5**	**4.3**		**8.2**		**19**		**18**	
Sodium	mg/L	**33**	**6.1**		**90**		**530**		**430**	
General										
Hardness	mg/L	**163**	**154**		**747**		**1930**		**1740**	
Silica	mg/L	-	-		-		**33**		**20**	

2019
Mine Permit Groundwater Quality Monitoring Data
MW-702 QAL (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[T]	Q2 2019[D]	Q3 2019[D]	Q4 2019[D]
Field						
D.O.	ppm	-	**0.65**	**1.1**	**1.7**	**1.9**
ORP	mV	-	**217**	**221**	**70**	**160**
pH	SU	**8.81-9.91**	**7.30**	**6.83**	**6.92**	**6.73**
Specific Conductance	uS/cm	-	**364**	**380**	**406**	**437**
Temperature	C	-	**6.5**	**7.0**	**8.1**	**6.9**
Turbidity	NTU	-	**1.8**	**97**	**67**	**171**
Water Elevation	ft MSL	-	**1534.49**	**1537.05**	**1536.48**	**1537.11**
Metals						
Aluminum	ug/L	**123**	-	-	<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	**196**	-	-	<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	**4.5**
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	**546**	< 50.0	<50.0	**59**	**62**
Mercury	ng/L	**3.6**	**1.5**	<1.0	**2.5**	**3.0**
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	**160**	**111**	**112**	**114**	**114**
Alkalinity, Carbonate	mg/L	**41**	< 2.0	<2.0	<2.0	<2.0
Chloride	mg/L	**18**	< 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	**0.04**	< 0.025	< 0.025	< 0.025	< 0.025
Nitrogen, Nitrate	mg/L	**1.2**	**0.21**	**0.44**	**0.19**	**0.22**
Nitrogen, Nitrite	mg/L	**0.18**	<0.10	<0.10	<0.10	<0.10
Sulfate	mg/L	**133**	**66**	**91**	**79**	**91**
Sulfide	mg/L	**0.80**	< 0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	**79**	**28**	**29**	**31**	**30**
Magnesium	mg/L	**14**	**10**	**14**	**12**	**12**
Potassium	mg/L	**22**	**7.5**	**5.4**	**4.6**	**4.0**
Sodium	mg/L	**60**	**28**	**34**	**33**	**43**
General						
Hardness	mg/L	**251**	**112**	**130**	**127**	**122**

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

2019
Mine Permit Groundwater Quality Monitoring Data
MW-702 UFB (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[D]	Q2 2019[T]	Q3 2019[D]	Q4 2019[T]
Field						
D.O.	ppm	-	**2.6**	**0.26**	**3.0**	**1.4**
ORP	mV	-	-147	-264	-151	-151
pH	SU	**7.11-8.11**	**7.91**	**8.19**	**7.92**	**7.53**
Specific Conductance	uS/cm	-	**279**	**219**	**265**	**310**
Temperature	C	-	**5.3**	**8.5**	**9.3**	**7.1**
Turbidity	NTU	-	**4.8**	**3.2**	**4.9**	**2.3**
Water Elevation	ft MSL	-	**1515.42**	**1509.57**	**1510.72**	**1523.54**
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**	**669**	**1280**	**536**	**844**
Lead	ug/L	**9.0**	< 3.0	<3.0	<3.0	<3.0
Lithium	ug/L	**13**	-	-	<10.0	-
Manganese	ug/L	**118**	**92**	**97**	**84**	**86**
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**	< 10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**112**	**90**	**87**	**93**	**92**
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	**0.09**	< 0.025	< 0.025	< 0.025	< 0.025
Nitrogen, Nitrate	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Nitrogen, Nitrite	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Sulfate	mg/L	**36**	**37**	**33**	**35**	**36**
Sulfide	mg/L	**0.80**	< 0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	**39**	**31**	**29**	**32**	**32**
Magnesium	mg/L	**12**	**9.7**	**8.8**	**9.9**	**9.7**
Potassium	mg/L	**11**	**3.1**	**3.3**	**3.1**	**3.0**
Sodium	mg/L	**5.2**	**3.2**	**3.0**	**3.3**	**9.0**
General						
Hardness	mg/L	**140**	**117**	**107**	**121**	**121**

2019
Mine Permit Groundwater Quality Monitoring Data
MW-703 QAL (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[T]	Q2 2019[T]	Q3 2019[T]	Q4 2019[T]
Field						
D.O.	ppm	-	**5.5**	**6.0**	**6.1**	**6.7**
ORP	mV	-	**312**	**298**	**182**	**261**
pH	SU	**6.30-7.30**	**5.69**	**5.98**	**6.11**	**5.82**
Specific Conductance	uS/cm	-	**176**	**148**	**185**	**193**
Temperature	C	-	**5.7**	**6.9**	**7.3**	**6.0**
Turbidity	NTU	-	**2.3**	**2.4**	**2.8**	**0.67**
Water Elevation	ft MSL	-	**1534.86**	**1536.49**	**1536.39**	**1535.66**
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	**287**	< 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	**107**	< 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**	**51**	**48**	**47**	**48**
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	**0.08**	< 0.025	< 0.025	< 0.025	< 0.025
Nitrogen, Nitrate	mg/L	**1.8**	**1.8**	**1.9**	**1.9**	**2.2**
Nitrogen, Nitrite	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Sulfate	mg/L	**41**	**28**	**19**	**27**	**32**
Sulfide	mg/L	**0.80**	< 0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	**31**	**19**	**17**	**17**	**19**
Magnesium	mg/L	**9.8**	**8.0**	**6.9**	**7.8**	**8.5**
Potassium	mg/L	**2.6**	**1.6**	**1.5**	**1.4**	**1.5**
Sodium	mg/L	**7.7**	**2.0**	**1.7**	**1.7**	**2.4**
General						
Hardness	mg/L	**116**	**79**	**70**	**75**	**83**

2019
Mine Permit Groundwater Quality Monitoring Data
MW-703 UFB (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[D]		Q2 2019[T]		Q3 2019[D]		Q4 2019[T]	
Field										
D.O.	ppm	-	**1.4**		**0.31**		**2.0**		**0.40**	
ORP	mV	-	-240		-238		-198		-244	
pH	SU	**7.44-8.44**	**8.32**		**8.20**		**8.07**		**7.91**	
Specific Conductance	uS/cm	-	**294**		**244**		**286**		**325**	
Temperature	C	-	**5.4**		**7.1**		**9.3**		**6.8**	
Turbidity	NTU	-	**3.4**		**1.9**		**3.7**		**2.0**	
Water Elevation	ft MSL	-	**1532.03**		**1536.57**		**1530.25**		**1535.72**	
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	**1903**	**1290**		**1130**		**1510**		**1280**	
Lead	ug/L	**9.0**	< 3.0		<3.0		<3.0		<3.0	
Lithium	ug/L	**40**	-		-		<10.0		-	
Manganese	ug/L	**200**	**187**		**195**		**207**		**188**	
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**	**77**		**77**		**80**		**78**	
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	**0.40**	< 0.10		< 0.10		< 0.10		< 0.10	
Nitrogen, Nitrite	mg/L	**0.40**	< 0.10		< 0.10		< 0.10		< 0.10	
Sulfate	mg/L	**49**	**52**		**39**		**51**		**50**	
Sulfide	mg/L	**0.80**	< 0.20		<0.20		<0.20		<0.20	
Major Cations										
Calcium	mg/L	**43**	**31**		**32**		**33**		**32**	
Magnesium	mg/L	**14**	**10**		**10**		**11**		**10**	
Potassium	mg/L	**4.2**	**2.3**		**2.3**		**2.4**		**2.2**	
Sodium	mg/L	**17**	**2.9**		**2.8**		**3.1**		**3.5**	
General										
Hardness	mg/L	**173**	**121**		**121**		**129**		**123**	

2019
Mine Permit Groundwater Quality Monitoring Data
MW-703 LLA (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[D]	Q2 2019[D]	Q3 2019[D]	Q4 2019[D]
Field						
D.O.	ppm	-	**0.24**	**1.3**	**1.3**	**0.27**
ORP	mV	-	-229	-237	-228	-234
pH	SU	**8.08-9.08**	**8.28**	**8.83**	**8.30**	**8.00**
Specific Conductance	uS/cm	-	**265**	**245**	**279**	**314**
Temperature	C	-	**5.9**	**7.4**	**8.2**	**6.8**
Turbidity	NTU	-	**4.1**	**29**	**5.1**	**11**
Water Elevation	ft MSL	-	**1532.56**	**1538.59**	**1537.42**	**1537.52**
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	**16**	< 4.0	<4.0	<4.0	<4.0
Iron	ug/L	**2082**	**467**	<200	**618**	**556**
Lead	ug/L	**9.0**	< 3.0	<3.0	<3.0	<3.0
Lithium	ug/L	**28**	-	-	<10.0	-
Manganese	ug/L	**95**	**70**	<50.0	**89**	**83**
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**	**76**	**81**	**78**	**75**
Alkalinity, Carbonate	mg/L	**10**	< 2.0	<2.0	<2.0	<2.0
Chloride	mg/L	**97**	**11**	**26**	**12**	**11**
Fluoride	mg/L	**2.5**	< 1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	**0.08**	< 0.025	< 0.025	< 0.025	< 0.025
Nitrogen, Nitrate	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Nitrogen, Nitrite	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Sulfate	mg/L	**43**	**37**	**13**	**35**	**37**
Sulfide	mg/L	**0.80**	< 0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	**34**	**26**	**16**	**27**	**28**
Magnesium	mg/L	**12**	**11**	**8.3**	**11**	**11**
Potassium	mg/L	**7.7**	**3.2**	**6.4**	**3.5**	**3.2**
Sodium	mg/L	**51**	**7.6**	**20**	**7.6**	**7.3**
General						
Hardness	mg/L	**135**	**108**	**74**	**112**	**113**
*- Diver failed on 3/22/18, replaced 5/16/18						

2019
Mine Permit Groundwater Quality Monitoring Data
MW-703 DBA (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[D]	Q2 2019[T]	Q3 2019[T]	Q4 2019[T]
Field						
D.O.	ppm	-	**1.4**	**0.22**	**1.3**	**0.27**
ORP	mV	-	-303	-262	-214	-251
pH	SU	**8.89-9.89**	**10.18**	**8.43**	**8.60**	**8.47**
Specific Conductance	uS/cm	-	**293**	**254**	**295**	**334**
Temperature	C	-	**5.2**	**7.0**	**8.2**	**6.8**
Turbidity	NTU	-	**23**	**1.7**	**2.5**	**1.0**
Water Elevation	ft MSL	-	**1532.25**	**1535.23**	**1534.30**	**1534.55**
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**	< 200	**231**	<200	<200
Lead	ug/L	**9.0**	< 3.0	<3.0	<3.0	<3.0
Lithium	ug/L	**20**	-	-	<10.0	-
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**	< 10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**88**	**53**	**81**	**79**	**76**
Alkalinity, Carbonate	mg/L	**39**	**21**	<2.0	<2.0	<2.0
Chloride	mg/L	**20**	**15**	**15**	**14**	**14**
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	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Sulfate	mg/L	**73**	**30**	**38**	**39**	**41**
Sulfide	mg/L	**1.3**	**0.29**	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	**27**	**19**	**28**	**27**	**27**
Magnesium	mg/L	**17**	**7.8**	**10**	**11**	**11**
Potassium	mg/L	**30**	**20**	**3.8**	**4.4**	**5.0**
Sodium	mg/L	**16**	**12**	**6.5**	**6.6**	**7.2**
General						
Hardness	mg/L	**140**	**79**	**113**	**111**	**112**

2019
Mine Permit Groundwater Quality Monitoring Data
MW-704 QAL (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[D]		Q2 2019[D]		Q3 2019[D]		Q4 2019[D]	
Field										
D.O.	ppm		1.4		1.3		1.2		1.4	
ORP	mV		142		-7.6		192		77	
pH	SU	5.43-6.43	5.68		6.51		5.73		5.69	
Specific Conductance	uS/cm		392		449		538		608	
Temperature	C		6.2		7.5		11		9.3	
Turbidity	NTU		5.4		4.7		21		5.2	
Water Elevation	ft MSL		1532.48		1535.35		1534.58		1535.04	
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	< 200		21600		<200		11300	
Lead	ug/L	9.0	< 3.0		<3.0		<3.0		<3.0	
Lithium	ug/L	40	-		-		<10.0		-	
Manganese	ug/L	8783	622		2870		815		2080	
Mercury	ng/L	35	< 1.0		3.8		2.6		3.8	
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	38	< 10.0		<10.0		<10.0		<10.0	
Major Anions										
Alkalinity, Bicarbonate	mg/L	264	60		128		87		124	
Alkalinity, Carbonate	mg/L	8.0	< 2.0		<2.0		<2.0		<2.0	
Chloride	mg/L	24	22		20		66		76	
Fluoride	mg/L	2.5	< 1.0		<1.0		<1.0		<1.0	
Nitrogen, Ammonia	mg/L	0.19	<0.050		0.70		<0.050		0.59	
Nitrogen, Nitrate	mg/L	1.5	0.71		0.33		0.11		0.60	
Nitrogen, Nitrite	mg/L	0.40	< 0.10		< 0.10		< 0.10		< 0.10	
Sulfate	mg/L	45	97		57		68		48	
Sulfide	mg/L	0.80	< 0.20		<0.20		<0.20		<0.20	
Major Cations										
Calcium	mg/L	47	38		45		47		52	
Magnesium	mg/L	15	14		16		18		18	
Potassium	mg/L	6.1	2.6		3.7		3.2		4.2	
Sodium	mg/L	32	16		19		23		26	
General										
Hardness	mg/L	191	152		177		191		205	

2019
Mine Permit Groundwater Quality Monitoring Data
MW-704 UFB (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[D]	Q2 2019[D]	Q3 2019[D]	Q4 2019[T]
Field						
D.O.	ppm		**1.4**	**1.3**	**1.4**	**1.4**
ORP	mV		-148	-167	-119	-151
pH	SU	**6.40-7.40**	**6.79**	**6.87**	**6.76**	**6.88**
Specific Conductance	uS/cm		**562**	**583**	**852**	**900**
Temperature	C		**7.1**	**7.7**	**9.5**	**8.7**
Turbidity	NTU		**8.0**	**5.8**	**3.9**	**3.1**
Water Elevation	ft MSL		**1533.00**	**1535.90**	**1535.13**	**1535.66**
Metals						
Aluminum	ug/L	**5824**	-	-	<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	**44052**	**893**	**44800**	**69100**	**69100**
Lead	ug/L	**9.0**	< 3.0	<3.0	<3.0	<3.0
Lithium	ug/L	**30**	-	-	<10.0	-
Manganese	ug/L	**1384**	**51**	**1200**	**1380**	**1410**
Mercury	ng/L	**1.4**	< 1.0	<1.0	**1.5**	<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**	**119**	**187**	**166**	**190**
Alkalinity, Carbonate	mg/L	**8.0**	**2.2**	<2.0	<2.0	<2.0
Chloride	mg/L	**24**	< 10.0	**32**	**86**	**81**
Fluoride	mg/L	**2.5**	< 1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	**0.78**	< 0.025	< 0.025	< 0.025	< 0.025
Nitrogen, Nitrate	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Nitrogen, Nitrite	mg/L	**0.18**	< 0.10	< 0.10	< 0.10	< 0.10
Sulfate	mg/L	**45**	< 1.0	**46**	**32**	**11**
Sulfide	mg/L	**0.49**	< 0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	**67**	**22**	**68**	**66**	**73**
Magnesium	mg/L	**14**	**11**	**18**	**21**	**22**
Potassium	mg/L	**5.3**	**2.6**	**3.5**	**3.6**	**3.8**
Sodium	mg/L	**43**	**10**	**19**	**26**	**28**
General						
Hardness	mg/L	**226**	**102**	**244**	**252**	**271**

2019
Mine Permit Groundwater Quality Monitoring Data
MW-704 LLA (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[D]		Q2 2019[D]		Q3 2019[D]		Q4 2019[T]	
Field										
D.O.	ppm	-	0.24		1.4		1.2		1.3	
ORP	mV	-	-247		-258		-251		-246	
pH	SU	8.20-9.20	8.09		8.28		8.28		8.15	
Specific Conductance	uS/cm	-	349		254		401		413	
Temperature	C	-	7.1		10		10		9.0	
Turbidity	NTU	-	16		14		16		2.1	
Water Elevation	ft MSL	-	1533.45		1532.96		1531.84		1532.61	
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	3309	1190		943		1390		1560	
Lead	ug/L	9.0	< 3.0		<3.0		<3.0		<3.0	
Lithium	ug/L	28	-		-		15		-	
Manganese	ug/L	95	136		73		161		161	
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	153	158		110		165		168	
Alkalinity, Carbonate	mg/L	13	< 2.0		2.6		<2.0		<2.0	
Chloride	mg/L	40	13		10		15		16	
Fluoride	mg/L	2.5	< 1.0		<1.0		<1.0		<1.0	
Nitrogen, Ammonia	mg/L	0.10	< 0.025		< 0.025		< 0.025		< 0.025	
Nitrogen, Nitrate	mg/L	0.40	< 0.10		< 0.10		< 0.10		< 0.10	
Nitrogen, Nitrite	mg/L	0.40	< 0.10		< 0.10		< 0.10		< 0.10	
Sulfate	mg/L	21	12		9.2		14		14	
Sulfide	mg/L	0.80	< 0.20		<0.20		<0.20		<0.20	
Major Cations										
Calcium	mg/L	33	41		24		45		45	
Magnesium	mg/L	16	17		15		19		18	
Potassium	mg/L	12	5.7		6.4		5.8		5.6	
Sodium	mg/L	15	4.9		4.8		4.9		10	
General										
Hardness	mg/L	157	172		121		188		187	

2019
Mine Permit Groundwater Quality Monitoring Data
MW-704 DBA (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[D]	Q2 2019[D]	Q3 2019[D]	Q4 2019[D]
Field						
D.O.	ppm	-	**0.25**	**1.7**	**1.3**	**1.4**
ORP	mV	-	-263	-217	-245	-137
pH	SU	**8.13-9.13**	**8.18**	**8.00**	**8.44**	**7.68**
Specific Conductance	uS/cm	-	**232**	**246**	**265**	**265**
Temperature	C	-	**7.3**	**9.2**	**10**	**8.5**
Turbidity	NTU	-	**80**	**83**	**25**	**17**
Water Elevation	ft MSL	-	**1529.94**	**1529.62**	**1529.72**	**1529.95**
Metals						
Aluminum	ug/L	**200**	-	-	<50.0	-
Antimony	ug/L	**8.0**	-	-	<2.0	-
Arsenic	ug/L	**20**	< 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**	**882**	**930**	**950**	**805**
Lead	ug/L	**12**	< 3.0	<3.0	<3.0	<3.0
Lithium	ug/L	**40**	-	-	**13**	-
Manganese	ug/L	**58**	**51**	**59**	**61**	**58**
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**	**119**	**126**	**129**	**124**
Alkalinity, Carbonate	mg/L	**32**	**2.6**	<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	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Nitrogen, Nitrite	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Sulfate	mg/L	**6.0**	< 1.0	<1.0	**1.0**	**1.1**
Sulfide	mg/L	**0.80**	< 0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	**27**	**23**	**23**	**23**	**25**
Magnesium	mg/L	**14**	**11**	**11**	**12**	**12**
Potassium	mg/L	**4.0**	**2.6**	**2.6**	**2.6**	**2.6**
Sodium	mg/L	**14**	**11**	**11**	**11**	**12**
General						
Hardness	mg/L	**111**	**103**	**104**	**107**	**112**
* - Diver failed 9/6/17, replaced 3/15/18						

2019
Mine Permit Groundwater Quality Monitoring Data
MW-705 QAL (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[T]	Q2 2019[T]	Q3 2019[T]	Q4 2019[T]
Field						
D.O.	ppm	-	**1.0**	**0.47**	**1.2**	**1.4**
ORP	mV	-	-8.3	-64	-27	-29
pH	SU	**5.67-6.67**	**6.51**	**6.29**	**6.31**	**6.02**
Specific Conductance	uS/cm	-	**277**	**370**	**200**	**237**
Temperature	C	-	**4.2**	**8.9**	**13**	**8.3**
Turbidity	NTU	-	**2.0**	**2.3**	**2.4**	**1.1**
Water Elevation	ft MSL	-	**1536.78**	**1537.96**	**1536.33**	**1537.31**
Metals						
Aluminum	ug/L	**200**	-	-	<50.0	-
Antimony	ug/L	**4.0**	-	-	<2.0	-
Arsenic	ug/L	**7.5**	< 5.0	<5.0	**7.6**	<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	**5.1**
Iron	ug/L	**12957**	**10100**	**13600**	**5300**	**8250**
Lead	ug/L	**9.0**	< 3.0	<3.0	<3.0	<3.0
Lithium	ug/L	**40**	-	-	<10.0	-
Manganese	ug/L	**1535**	**1000**	**1470**	**498**	**830**
Mercury	ng/L	**1.8**	< 1.0	<1.0	**1.4**	**4.3**
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**	< 10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**85**	**69**	**31**	**38**	**55**
Alkalinity, Carbonate	mg/L	**8.0**	< 2.0	<2.0	<2.0	<2.0
Chloride	mg/L	**52**	**53**	**72**	**24**	**22**
Fluoride	mg/L	**2.5**	< 1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	**0.13**	**0.14**	**0.19**	**0.07**	**0.09**
Nitrogen, Nitrate	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Nitrogen, Nitrite	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Sulfate	mg/L	**21**	**6.1**	**24**	**10**	**9.0**
Sulfide	mg/L	**0.80**	< 0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	**24**	**18**	**23**	**12**	**14**
Magnesium	mg/L	**11**	**8.0**	**9.6**	**4.6**	**5.7**
Potassium	mg/L	**3.0**	**2.8**	**2.7**	**2.6**	**2.3**
Sodium	mg/L	**17**	**16**	**25**	**14**	**19**
General						
Hardness	mg/L	**110**	**77**	**97**	**48**	**58**

2019
Mine Permit Groundwater Quality Monitoring Data
MW-705 UFB (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[D]	Q2 2019[D]	Q3 2019[D]	Q4 2019[T]
Field						
D.O.	ppm	-	0.77	0.29	1.3	1.5
ORP	mV	-	-70	-180	-132	-124
pH	SU	6.59-7.59	7.19	7.20	7.15	7.04
Specific Conductance	uS/cm	-	303	287	346	345
Temperature	C	-	6.1	9.1	11	7.5
Turbidity	NTU	-	20	5.4	3.4	2.3
Water Elevation	ft MSL	-	1536.82	1540.24	1538.45	1539.24
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	7740	10400	9750	8620
Lead	ug/L	9.0	< 3.0	<3.0	<3.0	<3.0
Lithium	ug/L	13	-	-	<10.0	-
Manganese	ug/L	973	1060	989	1050	1010
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	< 10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	118	77	90	88	84
Alkalinity, Carbonate	mg/L	8.0	< 2.0	<2.0	<2.0	<2.0
Chloride	mg/L	36	36	33	39	41
Fluoride	mg/L	2.5	< 1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	0.10	< 0.025	0.03	0.03	0.03
Nitrogen, Nitrate	mg/L	0.40	< 0.10	< 0.10	< 0.10	< 0.10
Nitrogen, Nitrite	mg/L	0.40	< 0.10	< 0.10	< 0.10	< 0.10
Sulfate	mg/L	14	2.4	3.3	3.0	4.2
Sulfide	mg/L	0.80	< 0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	26	26	27	29	29
Magnesium	mg/L	13	13	14	15	14
Potassium	mg/L	4.0	3.8	3.3	3.8	4.1
Sodium	mg/L	3.4	3.2	3.0	3.5	3.9
General						
Hardness	mg/L	127	119	125	132	130

2019
Mine Permit Groundwater Quality Monitoring Data
MW-706 QAL (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[D]	Q2 2019[D]	Q3 2019[D]	Q4 2019[T]
Field						
D.O.	ppm	-	**1.9**	**0.50**	**1.8**	**2.1**
ORP	mV	-	**69**	**80**	**90**	**58**
pH	SU	-	**5.95**	**5.80**	**5.78**	**5.81**
Specific Conductance	uS/cm	-	**874**	**831**	**882**	**830**
Temperature	C	-	**8.1**	**9.5**	**10**	**8.1**
Turbidity	NTU	-	**4.2**	**3.4**	**5.7**	**1.7**
Water Elevation	ft MSL	-	**1561.82**	**1566.96**	**1563.44**	**1562.77**
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**	-	-	**23**	-
Copper	ug/L	**16**	< 4.0	<4.0	<4.0	<4.0
Iron	ug/L	**8029**	**2760**	**3280**	**2540**	**2860**
Lead	ug/L	**9.0**	< 3.0	<3.0	<3.0	<3.0
Lithium	ug/L	**17**	-	-	<10.0	-
Manganese	ug/L	**23484**	**11600**	**11000**	**11600**	**11000**
Mercury	ng/L	**4.0**	< 1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	**200**	-	-	<50.0	-
Nickel	ug/L	**27**	< 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	**4.8**	-	-	<4.0	-
Zinc	ug/L	**77**	< 10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**132**	**73**	**79**	**74**	**74**
Alkalinity, Carbonate	mg/L	**8.0**	< 2.0	<2.0	<2.0	<2.0
Chloride	mg/L	**165**	**123**	**118**	**118**	**111**
Fluoride	mg/L	**2.5**	< 1.0	<1.0	<1.0	<1.0
Nitrogen, Ammonia	mg/L	**0.88**	**0.39**	**0.51**	**0.42**	**0.43**
Nitrogen, Nitrate	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Nitrogen, Nitrite	mg/L	**0.40**	< 0.10	< 0.10	< 0.10	< 0.10
Sulfate	mg/L	**434**	**189**	**176**	**191**	**168**
Sulfide	mg/L	**0.80**	< 0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	**133**	**68**	**61**	**66**	**65**
Magnesium	mg/L	**44**	**27**	**25**	**26**	**25**
Potassium	mg/L	**5.6**	**4.6**	**4.0**	**4.6**	**4.5**
Sodium	mg/L	**140**	**45**	**43**	**47**	**55**
General						
Hardness	mg/L	**619**	**283**	**253**	**273**	**265**

2019
Mine Permit Groundwater Quality Monitoring Data
MW-707 QAL (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[T]		Q2 2019[T]		Q3 2019[T]		Q4 2019[T]	
Field										
D.O.	ppm	-	**1.6**		**0.37**		**1.6**		**1.6**	
ORP	mV	-	-123		-132		-113		-116	
pH	SU	**6.43-7.43**	**6.90**		**7.13**		**7.04**		**6.97**	
Specific Conductance	uS/cm	-	**360**		**304**		**329**		**320**	
Temperature	C	-	**6.7**		**7.5**		**9.3**		**6.6**	
Turbidity	NTU	-	**2.6**		**1.8**		**3.2**		**0.56**	
Water Elevation	ft MSL	-	**1583.73**		**1583.63**		**1581.74**		**1581.76**	
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**	**4350**		**4290**		**3980**		**4110**	
Lead	ug/L	**9.0**	< 3.0		<3.0		<3.0		<3.0	
Lithium	ug/L	**40**	-		-		<10.0		-	
Manganese	ug/L	**1128**	**970**		**892**		**893**		**917**	
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**	< 10.0		<10.0		<10.0		<10.0	
Major Anions										
Alkalinity, Bicarbonate	mg/L	**168**	**158**		**163**		**158**		**157**	
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**	**0.26**		**0.29**		**0.29**		**0.30**	
Nitrogen, Nitrate	mg/L	**0.40**	< 0.10		< 0.10		< 0.10		< 0.10	
Nitrogen, Nitrite	mg/L	**0.40**	< 0.10		< 0.10		< 0.10		< 0.10	
Sulfate	mg/L	**9.4**	**1.4**		<1.0		<1.0		<1.0	
Sulfide	mg/L	**0.80**	< 0.20		<0.20		<0.20		<0.20	
Major Cations										
Calcium	mg/L	**46**	**43**		**42**		**43**		**43**	
Magnesium	mg/L	**13**	**12**		**12**		**11**		**12**	
Potassium	mg/L	**2.9**	**2.2**		**2.2**		**2.4**		**2.5**	
Sodium	mg/L	**3.6**	**3.0**		**3.0**		**3.1**		**9.0**	
General										
Hardness	mg/L	**162**	**155**		**152**		**154**		**156**	

2019
Mine Permit Groundwater Quality Monitoring Data
MW-9R (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2019	Q1 2019[D]	Q2 2019[D]	Q3 2019*	Q4 2019[D]
Field						
D.O.	ppm	-	**1.7**	**3.1**	NM	**2.1**
ORP	mV	-	**34**	**100**	NM	**7.5**
pH	SU	**5.40-6.40**	**6.03**	**6.11**	NM	**5.98**
Specific Conductance	uS/cm	-	**329**	**201**	NM	**356**
Temperature	C	-	**7.5**	**8.3**	NM	**8.8**
Turbidity	NTU	-	**3.7**	**273**	NM	**23**
Water Elevation	ft MSL	-	**1596.33**	**1595.50**	**1590.99**	**1594.49**
Metals						
Aluminum	ug/L	**200**	-	-	NM	-
Antimony	ug/L	**4.0**	-	-	NM	-
Arsenic	ug/L	**7.5**	< 5.0	<5.0	NM	<5.0
Barium	ug/L	**400**	-	-	NM	-
Beryllium	ug/L	**2.5**	-	-	NM	-
Boron	ug/L	**1200**	-	-	NM	-
Cadmium	ug/L	**3.0**	-	-	NM	-
Chromium	ug/L	**40**	-	-	NM	-
Cobalt	ug/L	**80**	-	-	NM	-
Copper	ug/L	**39**	< 4.0	<4.0	NM	<4.0
Iron	ug/L	**4099**	**3190**	**1510**	NM	<200
Lead	ug/L	**9.0**	< 3.0	<3.0	NM	<3.0
Lithium	ug/L	**40**	-	-	NM	-
Manganese	ug/L	**1376**	**99**	**92**	NM	**54**
Mercury	ng/L	**10**	< 1.0	<1.0	NM	<1.0
Molybdenum	ug/L	**200**	-	-	NM	-
Nickel	ug/L	**186**	**91**	**91**	NM	**176**
Selenium	ug/L	**20**	-	-	NM	-
Silver	ug/L	**0.80**	-	-	NM	-
Thallium	ug/L	**2.0**	-	-	NM	-
Vanadium	ug/L	-	-	-	NM	-
Zinc	ug/L	**38**	**14**	**26**	NM	**33**
Major Anions						
Alkalinity, Bicarbonate	mg/L	**85**	**33**	<2.0	NM	**50**
Alkalinity, Carbonate	mg/L	**8.0**	< 2.0	<2.0	NM	<2.0
Chloride	mg/L	**185**	**16**	**19**	NM	<10.0
Fluoride	mg/L	**2.5**	< 1.0	<1.0	NM	<1.0
Nitrogen, Ammonia	mg/L	**0.22**	< 0.025	< 0.025	NM	< 0.025
Nitrogen, Nitrate	mg/L	**3.8**	< 0.10	< 0.10	NM	< 0.10
Nitrogen, Nitrite	mg/L	**0.40**	< 0.10	< 0.10	NM	< 0.10
Sulfate	mg/L	**335**	**75**	**42**	NM	**109**
Sulfide	mg/L	**0.80**	< 0.20	<0.20	NM	<0.20
Major Cations						
Calcium	mg/L	**116**	**27**	**17**	NM	**40**
Magnesium	mg/L	**41**	**9.4**	**6.1**	NM	**13**
Potassium	mg/L	**5.2**	**2.1**	**1.5**	NM	**2.6**
Sodium	mg/L	**48**	**7.1**	**7.2**	NM	**14**
General						
Hardness	mg/L	**479**	**106**	**68**	NM	**154**

* - Insufficient groundwater present for sample collection

2019
Mine Permit Groundwater Monitoring Data
Abbreviations and Data Qualifiers
Humboldt Mill

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 G

Humboldt Mill

Groundwater Trend Analysis Summary

2019
Groundwater Trend Analysis Summary
Humboldt Mill

Location	Classification	Parameter	Unit	Count (n)	Number of Non-Detects	Mean	UCL	Median	Standard Deviation	Coefficient of Variation	Skewness	Minimum	Maximum	Mann Kendall S	Sen Slope	Positive or Negative Trend (Minimum 95% Confidence)
HW-1L	Monitoring	Alkalinity, Bicarbonate	mg/L	22	0	77.34	104.24	82	13.45	0.17	-3.81	20	84	51	0.1	Positive
HW-1L	Monitoring	Alkalinity, Carbonate	mg/L	22	20	7.8	7.8	2	0	0	-	8	8	-40	0	Negative
HW-1L	Monitoring	Arsenic	µg/L	22	21	0.18	-	5	0	0	-	0	0	-11	0	Negative
HW-1L	Monitoring	Calcium	mg/L	22	0	24.06	33.37	24	4.65	0.19	-3.3	5	28	72	0.1929	Positive
HW-1L	Monitoring	Chloride	mg/L	22	0	44.7	55.8	45	5.55	0.12	-0.34	34	53	-87	-0.6	Negative
HW-1L	Monitoring	Copper	µg/L	22	22	-	1.3	4	-	-	-	-	-	-11	0	Negative
HW-1L	Monitoring	Fluoride	mg/L	22	22	-	2.1	1	-	-	-	-	-	-11	0	Negative
HW-1L	Monitoring	Hardness	mg/L	22	0	107.73	151.31	111	21.79	0.2	-2.83	22	139	49	0.4375	Positive
HW-1L	Monitoring	Iron	µg/L	22	1	743.57	1209.25	610	232.84	0.31	0.1	420	1190	43	12.9375	Positive
HW-1L	Monitoring	Lead	mg/L	22	22	-	8	3	-	-	-	-	-	-11	0	Negative
HW-1L	Monitoring	Magnesium	mg/L	22	0	10.28	13.99	11	1.86	0.18	-3.68	2	11	61	0.02	Positive
HW-1L	Monitoring	Manganese	µg/L	22	22	-	191.11	50	-	-	-	-	-	-11	0	Negative
HW-1L	Monitoring	Nickel	mg/L	22	21	0.17	-	20	0	0	-	0	0	-11	0	Negative
HW-1L	Monitoring	Nitrogen, Ammonia	mg/L	16	15	64	-	25	0	0	-	64	64	-63	-2.0813	Negative
HW-1L	Monitoring	Nitrogen, Nitrate	mg/L	22	22	-	5	100	-	-	-	-	-	-29	0	Negative
HW-1L	Monitoring	Nitrogen, Nitrite	mg/L	22	21	7	-	100	0	0	-	7	7	-20	0	Negative
HW-1L	Monitoring	Potassium	mg/L	22	0	2.28	5.22	1.8	1.47	0.64	3.22	2	8	-69	-0.0091	Negative
HW-1L	Monitoring	Sodium	mg/L	22	0	24.1	28.24	25	2.07	0.09	0.28	20	28	-71	-0.125	Negative
HW-1L	Monitoring	Sulfate	mg/L	22	0	22.42	35.1	25	6.34	0.28	-1.87	2	30	197	0.65	Positive
HW-1L	Monitoring	Sulfide	mg/L	22	22	-	0.77	0.2	-	-	-	-	-	-11	0	Negative
HW-1L	Monitoring	Zinc	µg/L	22	21	12	-	10	0	0	-	12	12	-31	0	Negative
HW-1L	Monitoring	pH	SU	17	0	8.62	8.1-9.1	8.46	-	-	0.42	8	10	-59	-0.0554	Negative
HW-1U LLA	Monitoring	Alkalinity, Bicarbonate	mg/L	19	0	105.19	151.86	101.4	23.33	0.22	0.28	48	170	-11	0	Negative
HW-1U LLA	Monitoring	Calcium	mg/L	19	0	25.67	61	31.8	17.67	0.69	1.18	3	64	20	0.2059	Positive
HW-1U LLA	Monitoring	Chloride	mg/L	19	0	31.62	69.93	46	19.15	0.61	1.87	18	90	-34	-0.2933	Negative
HW-1U LLA	Monitoring	Fluoride	mg/L	19	18	1.9	-	1	0	0	-	2	2	-21	0	Negative
HW-1U LLA	Monitoring	Hardness	mg/L	19	0	86.46	162.02	83.9	37.78	0.44	-0.54	10	158	-25	-0.6667	Negative
HW-1U LLA	Monitoring	Iron	µg/L	19	10	13377.11	51415.23	17600	19019.06	1.42	1.95	262	45200	44	5.1667	Positive
HW-1U LLA	Monitoring	Magnesium	mg/L	19	1	10.83	25.28	13.5	7.23	0.67	1.19	2	26	-21	-0.0687	Negative
HW-1U LLA	Monitoring	Nickel	µg/L	19	18	0.78	-	20	0	0	-	1	1	-10	0	Negative
HW-1U LLA	Monitoring	Nitrogen, Nitrate	µg/L	19	16	0.23	0.57	50.213	0.17	0.74	-0.8	0	0	-26	0	Negative
HW-1U LLA	Monitoring	Nitrogen, Nitrite	mg/L	19	15	151.59	749.5	300.05	298.95	1.97	3.13	0	600	-16	0	Negative
HW-1U LLA	Monitoring	Potassium	mg/L	19	0	4.4	13.9	2.3	4.75	1.08	3.34	1	23	-59	-0.1636	Negative
HW-1U LLA	Monitoring	Sodium	mg/L	19	0	62.75	131.92	97.75	34.58	0.55	0.95	31	136	35	0.7643	Positive
HW-1U LLA	Monitoring	Sulfate	mg/L	19	0	114.75	351.69	292	118.47	1.03	1.81	41	434	67	1.2727	Positive
HW-1U LLA	Monitoring	Zinc	mg/L	19	15	25.95	45.91	15	9.98	0.38	1.88	15	35	-18	0	Negative
HW-1U LLA	Monitoring	pH	SU	16	0	8.64	8.1-9.1	8.47	-	-	0.07	8	9	14	0.016	Positive
HW-1U UFB	Monitoring	Alkalinity, Bicarbonate	mg/L	24	0	89.3	126.87	78.5	18.78	0.21	0.82	62	141	-72	-0.9762	Negative
HW-1U UFB	Monitoring	Alkalinity, Carbonate	mg/L	24	8	8.16	16.4	7.05	4.12	0.5	1.39	4	20	-91	-0.2428	Negative
HW-1U UFB	Monitoring	Arsenic	µg/L	24	21	5.82	6	5	4.91	0.84	0.19	0	10	-52	0	Negative
HW-1U UFB	Monitoring	Calcium	mg/L	24	0	18.65	33.17	16.5	7.26	0.39	1.31	9	39	59	0.2813	Positive
HW-1U UFB	Monitoring	Chloride	mg/L	24	15	45.11	96.09	10	25.49	0.57	1.67	22	88	-158	-1.3333	Negative
HW-1U UFB	Monitoring	Copper	µg/L	24	24	-	1.3	4	-	-	-	-	-	-13	0	Negative
HW-1U UFB	Monitoring	Fluoride	mg/L	24	23	0.06	-	1	0	0	-	0	0	-13	0	Negative
HW-1U UFB	Monitoring	Hardness	mg/L	24	0	77.82	136.66	58	29.42	0.38	1.42	45	165	12	0.243	Positive
HW-1U UFB	Monitoring	Iron	µg/L	24	15	442.67	959.39	200	258.36	0.58	2.65	224	1000	104	0	Positive
HW-1U UFB	Monitoring	Lead	µg/L	24	24	-	8	3	-	-	-	-	-	-13	0	Negative
HW-1U UFB	Monitoring	Lithium	µg/L	9	7	12.5	16.74	10	2.12	0.17	-0.83	11	14	-11	0	Negative
HW-1U UFB	Monitoring	Magnesium	mg/L	24	0	7.01	13.84	5	3.41	0.49	1.48	4	16	-46	-0.1	Negative
HW-1U UFB	Monitoring	Manganese	µg/L	24	18	63.97	84.67	50	10.35	0.16	2.21	51	79	19	0	Positive
HW-1U UFB	Monitoring	Nickel	µg/L	24	23	0.31	-	20	0	0	-	0	0	-13	0	Negative
HW-1U UFB	Monitoring	Nitrogen, Ammonia	mg/L	18	13	42.61	103.51	42	30.45	0.71	0.9	0	74	-51	-1.4691	Negative
HW-1U UFB	Monitoring	Nitrogen, Nitrate	mg/L	24	23	620	-	100	0	0	-	620	620	-52	0	Negative
HW-1U UFB	Monitoring	Nitrogen, Nitrite	mg/L	24	23	5	-	50.025	0	0	-	5	5	-34	0	Negative
HW-1U UFB	Monitoring	Potassium	mg/L	24	0	6.78	17.97	3.5	5.6	0.83	1.32	2	19	-160	-0.3056	Negative
HW-1U UFB	Monitoring	Sodium	mg/L	24	0	22.63	60.63	12.95	19	0.84	0.88	5	66	-200	-2	Negative
HW-1U UFB	Monitoring	Sulfate	mg/L	24	3	19.73	62.43	4.45	21.35	1.08	1.38	1	73	-173	-1.9132	Negative
HW-1U UFB	Monitoring	Sulfide	mg/L	24	19	0.78	2.33	0.2	0.77	0.99	3.37	0	2	-87	0	Negative
HW-1U UFB	Monitoring	Zinc	µg/L	24	24	-	38.62	10	-	-	-	-	-	-13	0	Negative
HW-1U UFB	Monitoring	pH	SU	18	0	8.93	8.4-9.4	9.13	-	-	0.44	9	9	-39	-0.0112	Negative
HW-2	Monitoring	Alkalinity, Bicarbonate	mg/L	26	0	107.46	145.36	120	18.95	0.18	-0.44	71	130	-181	-2	Negative
HW-2	Monitoring	Arsenic	µg/L	26	25	0.25	-	5	0	0	-	0	0	-15	0	Negative
HW-2	Monitoring	Calcium	mg/L	26	0	51.33	70.23	60	9.45	0.18	-0.65	34	65	-23	-0.1667	Negative

2019
Groundwater Trend Analysis Summary
Humboldt Mill

Location	Classification	Parameter	Unit	Count (n)	Number of Non-Detects	Mean	UCL	Median	Standard Deviation	Coefficient of Variation	Skewness	Minimum	Maximum	Mann Kendall S	Sen Slope	Positive or Negative Trend (Minimum 95% Confidence)
HW-2	Monitoring	Chloride	mg/L	26	0	25.43	58.01	27	16.29	0.64	3.35	12	97	212	0.8867	Positive
HW-2	Monitoring	Copper	µg/L	26	26	-	1.3	4	-	-	-	-	-	-15	0	Negative
HW-2	Monitoring	Fluoride	mg/L	26	25	0.09	-	1	0	0	-	0	0	-15	0	Negative
HW-2	Monitoring	Hardness	mg/L	26	0	225.85	300	256	37.08	0.16	-0.45	149	284	-33	-0.9091	Negative
HW-2	Monitoring	Lead	µg/L	26	26	-	8	3	-	-	-	-	-	-15	0	Negative
HW-2	Monitoring	Magnesium	mg/L	26	0	22.32	27.28	25	2.48	0.11	-0.94	16	26	-150	-0.1933	Negative
HW-2	Monitoring	Manganese	µg/L	26	3	245.96	552.4	170	153.22	0.62	1.46	77	661	162	10.8235	Positive
HW-2	Monitoring	Mercury	ng/L	26	25	1.28	-	1	0	0	-	1	1	-17	0	Negative
HW-2	Monitoring	Nickel	µg/L	26	25	0.36	-	20	0	0	-	0	0	-15	0	Negative
HW-2	Monitoring	Nitrogen, Ammonia	mg/L	20	9	37.38	94.74	26.5	28.68	0.77	0.62	0	87	-60	-1.6648	Negative
HW-2	Monitoring	Nitrogen, Nitrate	mg/L	26	25	0.11	-	100	0	0	-	0	0	-45	0	Negative
HW-2	Monitoring	Nitrogen, Nitrite	mg/L	26	26	-	323.15	100	-	-	-	-	-	-43	0	Negative
HW-2	Monitoring	Potassium	mg/L	26	0	4.78	6.73	4.7	0.97	0.2	1.17	3	8	57	0.04	Positive
HW-2	Monitoring	Sodium	mg/L	26	0	26.19	54.8	26	14.31	0.55	1.14	13	62	266	1.4143	Positive
HW-2	Monitoring	Sulfate	mg/L	26	0	141.31	192.65	160	25.67	0.18	0.4	97	207	176	2.5238	Positive
HW-2	Monitoring	Sulfide	mg/L	25	21	0.38	0.65	0.2	0.13	0.34	3	0	1	-44	0	Negative
HW-2	Monitoring	Zinc	µg/L	26	26	-	38.72	10	-	-	-	-	-	-15	0	Negative
HW-8U	Monitoring	Alkalinity, Bicarbonate	mg/L	26	0	155.15	204.47	160	24.66	0.16	1.19	127	220	-72	-1.1111	Negative
HW-8U	Monitoring	Arsenic	µg/L	26	10	7.59	6	8.9	1.41	0.19	0.56	5	10	135	0.0952	Positive
HW-8U	Monitoring	Calcium	mg/L	26	0	37.48	49.27	39	5.89	0.16	0.38	29	49	69	0.2857	Positive
HW-8U	Monitoring	Chloride	µg/L	26	12	16.17	22.82	13	3.32	0.21	0.67	10	20	196	0.375	Positive
HW-8U	Monitoring	Copper	mg/L	26	26	-	1.3	4	-	-	-	-	-	-15	0	Negative
HW-8U	Monitoring	Fluoride	mg/L	26	25	0.09	-	1	0	0	-	0	0	-15	0	Negative
HW-8U	Monitoring	Iron	µg/L	26	0	11645	20027.35	10000	4191.18	0.36	1.42	7000	23000	-184	-360	Negative
HW-8U	Monitoring	Lead	µg/L	26	26	-	8	3	-	-	-	-	-	-15	0	Negative
HW-8U	Monitoring	Magnesium	mg/L	26	0	13.39	17.77	13	2.19	0.16	1.54	11	19	-39	-0.04	Negative
HW-8U	Monitoring	Manganese	µg/L	26	1	4902	6742.91	5400	920.46	0.19	-0.47	3000	6220	87	50	Positive
HW-8U	Monitoring	Nickel	µg/L	26	26	-	76.94	20	-	-	-	-	-	-15	0	Negative
HW-8U	Monitoring	Nitrogen, Ammonia	mg/L	20	18	33	41.49	25	4.24	0.13	-0.96	30	36	-92	-0.4006	Negative
HW-8U	Monitoring	Nitrogen, Nitrate	mg/L	26	25	110	-	100	0	0	-	110	110	-70	0	Negative
HW-8U	Monitoring	Nitrogen, Nitrite	mg/L	26	26	-	308.34	100	-	-	-	-	-	-53	0	Negative
HW-8U	Monitoring	Potassium	mg/L	26	0	3.12	3.92	3.5	0.4	0.13	0.37	2	4	108	0.0286	Positive
HW-8U	Monitoring	Sodium	mg/L	26	0	3.75	5.01	4.1	0.63	0.17	0.11	3	5	149	0.06	Positive
HW-8U	Monitoring	Sulfate	mg/L	26	4	9.31	17.7	9	4.19	0.45	-0.02	2	16	283	0.65	Positive
HW-8U	Monitoring	Sulfide	mg/L	26	26	-	0.77	0.2	-	-	-	-	-	-15	0	Negative
HW-8U	Monitoring	Zinc	µg/L	26	21	14.08	28.82	10	7.37	0.52	1.68	3	21	-70	0	Negative
HW-8U	Monitoring	pH	SU	18	0	6.88	6.4-7.4	7.14	-	-	-1.38	6	7	-19	-0.0069	Negative
HYG-1	Monitoring	Alkalinity, Bicarbonate	mg/L	23	0	224.52	350.51	310	62.99	0.28	0.43	140	370	62	3.3333	Positive
HYG-1	Monitoring	Antimony	µg/L	8	0	7.25	5.5	7.4	0.9	0.12	0.24	6	9	13	0.2125	Positive
HYG-1	Monitoring	Arsenic	µg/L	23	22	0.37	-	5	0	0	-	0	0	-12	0	Negative
HYG-1	Monitoring	Calcium	mg/L	23	0	50.35	65.1	55.5	7.38	0.15	-0.09	35	61	69	0.36	Positive
HYG-1	Monitoring	Chloride	mg/L	23	3	14.23	20.81	10.5	3.29	0.23	1.32	11	24	-18	-0.0077	Negative
HYG-1	Monitoring	Copper	µg/L	23	18	6.5	1.3	4.1	3.56	0.55	3.62	4	12	-16	0	Negative
HYG-1	Monitoring	Fluoride	mg/L	23	23	-	2.1	1	-	-	-	-	-	-12	0	Negative
HYG-1	Monitoring	Hardness	mg/L	23	0	239.43	313.09	274	36.83	0.15	0.21	170	310	48	1.1111	Positive
HYG-1	Monitoring	Lead	µg/L	23	23	-	8	3	-	-	-	-	-	-12	0	Negative
HYG-1	Monitoring	Magnesium	mg/L	23	0	25.67	33.12	28.5	3.73	0.15	0.07	19	33	51	0.1375	Positive
HYG-1	Monitoring	Manganese	µg/L	23	3	467.6	1088.42	410	310.41	0.66	0.52	81	1090	202	41.9167	Positive
HYG-1	Monitoring	Mercury	ng/L	23	0	17.61	39.44	27.75	10.92	0.62	0.48	4	39	77	0.64	Positive
HYG-1	Monitoring	Nickel	µg/L	23	22	0.55	-	20	0	0	-	1	1	-12	0	Negative
HYG-1	Monitoring	Nitrogen, Ammonia	mg/L	17	0	231.31	606.06	385	187.38	0.81	0.14	0	570	-27	-12.4755	Negative
HYG-1	Monitoring	Nitrogen, Nitrate	mg/L	23	20	176.33	5	50.05	56.31	0.32	0.12	130	239	-36	0	Negative
HYG-1	Monitoring	Nitrogen, Nitrite	mg/L	23	22	5	-	50.05	0	0	-	5	5	-35	0	Negative
HYG-1	Monitoring	Potassium	mg/L	23	0	9.6	13.12	12	1.76	0.18	-0.09	7	13	117	0.1769	Positive
HYG-1	Monitoring	Sodium	mg/L	23	0	38.71	74.3	68.5	17.79	0.46	0.02	12	78	72	1.0167	Positive
HYG-1	Monitoring	Sulfate	mg/L	23	0	89.94	141.4	110	25.73	0.29	-0.21	48	133	74	1.8182	Positive
HYG-1	Monitoring	Zinc	µg/L	23	21	14	25.31	10	5.66	0.4	-0.17	10	18	-29	0	Negative
HYG-1	Monitoring	pH	mg/L	17	0	6.79	6.3-7.3	6.935	-	-	0.01	7	7	-11	-0.0025	Negative
KMW-5R	COSA	Alkalinity, Bicarbonate	mg/L	25	0	358.68	471.56	380	56.44	0.16	-3.88	104	400	167	2	Positive
KMW-5R	COSA	Alkalinity, Carbonate	mg/L	25	25	-	8.19	2	-	-	-	-	-	-24	0	Negative
KMW-5R	COSA	Aluminum	mg/L	10	5	2484.8	9948.52	50	3731.86	1.5	2.53	250	9110	14	66.6667	Positive
KMW-5R	COSA	Arsenic	µg/L	25	19	11.38	6	5	5.2	0.46	1.85	4	18	67	0	Positive
KMW-5R	COSA	Beryllium	µg/L	10	8	0.97	2.5	1	0.89	0.92	-0.25	0	2	13	0	Positive

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Groundwater Trend Analysis Summary
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Location	Classification	Parameter	Unit	Count (n)	Number of Non-Detects	Mean	UCL	Median	Standard Deviation	Coefficient of Variation	Skewness	Minimum	Maximum	Mann Kendall S	Sen Slope	Positive or Negative Trend (Minimum 95% Confidence)
KMW-5R	COSA	Calcium	mg/L	25	0	1487.96	15118.02	125	6815.03	4.58	4.69	93	34200	-166	-1.9306	Negative
KMW-5R	COSA	Chloride	mg/L	25	11	87.61	191.74	20	52.06	0.59	0.7	4	160	-126	-4.0714	Negative
KMW-5R	COSA	Cobalt	mg/L	10	9	230	-	20	0	0	-	230	230	-15	0	Negative
KMW-5R	COSA	Copper	µg/L	25	15	21.93	1.3	6	17.62	0.8	1.82	2	52	129	0.0976	Positive
KMW-5R	COSA	Fluoride	mg/L	24	23	0.05	-	1	0	0	-	0	0	-13	0	Negative
KMW-5R	COSA	Hardness	mg/L	24	0	506.21	704.21	398.5	99	0.2	-1.32	220	634	-120	-6.3423	Negative
KMW-5R	COSA	Iron	µg/L	25	7	32020.56	121800.2	6600	44889.83	1.4	1.73	240	129000	99	369.5	Positive
KMW-5R	COSA	Lead	µg/L	25	19	3.77	8	3	2.56	0.68	0.9	0	6	59	0	Positive
KMW-5R	COSA	Lithium	µg/L	10	1	16.02	29.19	16	6.58	0.41	1.44	9	31	19	1.25	Positive
KMW-5R	COSA	Magnesium	mg/L	25	0	757.92	7817.13	48.5	3529.61	4.66	4.69	40	17700	-89	-0.5333	Negative
KMW-5R	COSA	Manganese	µg/L	25	2	1842.52	2825.48	2000	491.48	0.27	-0.61	718	2700	-103	-31.5278	Negative
KMW-5R	COSA	Mercury	ng/L	25	15	8.72	23.43	4.21	7.36	0.84	2.17	1	24	87	0	Positive
KMW-5R	COSA	Nickel	µg/L	25	19	36.63	63.01	20	13.19	0.36	1.95	18	49	85	0	Positive
KMW-5R	COSA	Nitrogen, Ammonia	mg/L	19	9	25.51	63.79	33.5	19.14	0.75	-0.07	0	54	-23	-0.0012	Negative
KMW-5R	COSA	Nitrogen, Nitrate	mg/L	25	24	26	-	50.05	0	0	-	26	26	-17	0	Negative
KMW-5R	COSA	Nitrogen, Nitrite	mg/L	25	23	62.5	225.13	50.05	81.32	1.3	-0.95	5	120	-20	0	Negative
KMW-5R	COSA	Potassium	mg/L	25	0	185.26	1962.24	7.35	888.49	4.8	4.69	7	4450	-48	-0.0125	Negative
KMW-5R	COSA	Sodium	mg/L	25	0	758.29	8275.67	5.55	3758.69	4.96	4.69	3	18800	215	0.3782	Positive
KMW-5R	COSA	Sulfate	mg/L	25	0	90.96	130.9	125	19.97	0.22	0.56	66	130	-14	-0.2219	Negative
KMW-5R	COSA	Sulfide	mg/L	25	24	0.03	-	0.2	0	0	-	0	0	27	0	Positive
KMW-5R	COSA	Vanadium	µg/L	10	8	7.25	22.66	4	7.71	1.06	2.35	2	13	13	0	Positive
KMW-5R	COSA	Zinc	µg/L	25	15	17.14	34.19	10	8.53	0.5	1.7	2	34	23	0	Positive
MW-701 QAL	Leachate	Alkalinity, Bicarbonate	mg/L	25	0	53.43	106.86	36.5	26.72	0.5	2.09	29	150	-72	-1.031	Negative
MW-701 QAL	Leachate	Arsenic	µg/L	25	24	0.32	-	5	0	0	-	0	0	-14	0	Negative
MW-701 QAL	Leachate	Calcium	mg/L	25	0	29.35	77.36	9.25	24	0.82	1.12	8	91	-19	-0.1361	Negative
MW-701 QAL	Leachate	Chloride	mg/L	25	12	155.81	544.12	10	194.16	1.25	2.03	10	602	73	0	Positive
MW-701 QAL	Leachate	Copper	µg/L	25	24	0.53	-	4	0	0	-	1	1	-14	0	Negative
MW-701 QAL	Leachate	Fluoride	mg/L	25	24	0.07	-	1	0	0	-	0	0	-14	0	Negative
MW-701 QAL	Leachate	Hardness	mg/L	25	0	126.32	318.37	42	96.02	0.76	1.04	36	373	-15	-0.55	Negative
MW-701 QAL	Leachate	Iron	µg/L	25	23	300	497.99	200	98.99	0.33	-0.52	230	370	-59	0	Negative
MW-701 QAL	Leachate	Magnesium	mg/L	25	0	11.64	29.48	4.3	8.92	0.77	1.16	4	36	-22	-0.05	Negative
MW-701 QAL	Leachate	Manganese	µg/L	25	13	1505.53	4604.19	50	1549.33	1.03	1.62	50	4100	-103	-46.0833	Negative
MW-701 QAL	Leachate	Mercury	ng/L	25	11	2.43	6.98	1.1	2.28	0.94	3.15	1	9	-83	-0.0234	Negative
MW-701 QAL	Leachate	Nickel	µg/L	25	25	-	76.82	20	-	-	-	-	-	-14	0	Negative
MW-701 QAL	Leachate	Nitrogen, Ammonia	mg/L	19	13	152.17	402.21	25	125.02	0.82	1.82	25	300	-114	-4.1625	Negative
MW-701 QAL	Leachate	Nitrogen, Nitrite	mg/L	25	25	-	320.08	50.05	-	-	-	-	-	-38	0	Negative
MW-701 QAL	Leachate	Potassium	mg/L	25	0	5.46	11.22	2.9	2.88	0.53	0.71	2	12	-56	-0.1485	Negative
MW-701 QAL	Leachate	Sulfate	mg/L	25	0	32.98	76.38	18	21.7	0.66	1.3	11	91	-172	-1.775	Negative
MW-701 QAL	Leachate	Zinc	µg/L	25	24	16.4	-	10	0	0	-	16	16	20	0	Positive
MW-701 QAL	Leachate	pH	SU	18	0	5.96	5.5-6.5	5.77	-	-	-0.35	5	7	-36	-0.025	Negative
MW-701 UFB	Leachate	Alkalinity, Bicarbonate	mg/L	26	0	151.27	213.51	150	31.12	0.21	2.55	112	259	65	0.2941	Positive
MW-701 UFB	Leachate	Alkalinity, Carbonate	mg/L	26	25	17	-	2	0	0	-	17	17	-25	0	Negative
MW-701 UFB	Leachate	Arsenic	µg/L	26	25	0.14	-	5	0	0	-	0	0	-15	0	Negative
MW-701 UFB	Leachate	Barium	mg/L	10	4	120.17	162.51	120	21.17	0.18	1.46	100	150	14	5	Positive
MW-701 UFB	Leachate	Calcium	mg/L	26	0	73.37	318.21	34	122.42	1.67	2.95	26	504	156	0.5	Positive
MW-701 UFB	Leachate	Chloride	mg/L	26	16	155.68	639.73	10	242.02	1.55	2.86	11	615	77	0	Positive
MW-701 UFB	Leachate	Copper	µg/L	26	24	18.5	1.3	4	13.44	0.73	4.31	9	28	-30	0	Negative
MW-701 UFB	Leachate	Fluoride	mg/L	26	25	0.09	-	1	0	0	-	0	0	-15	0	Negative
MW-701 UFB	Leachate	Hardness	mg/L	26	0	304.62	1236.95	156	466.17	1.53	2.92	141	1930	109	0.7333	Positive
MW-701 UFB	Leachate	Iron	µg/L	26	0	30942.69	131081.1	17000	50069.2	1.62	3.05	210	201000	93	272.7273	Positive
MW-701 UFB	Leachate	Lead	µg/L	26	26	-	8	3	-	-	-	-	-	-15	0	Negative
MW-701 UFB	Leachate	Lithium	µg/L	10	6	11.45	17.22	10	2.89	0.25	1.21	8	15	12	0	Positive
MW-701 UFB	Leachate	Magnesium	mg/L	26	0	27.47	106.74	15	39.63	1.44	2.85	13	162	44	0	Positive
MW-701 UFB	Leachate	Manganese	µg/L	26	2	3640.42	12623.82	2200	4491.7	1.23	3.01	180	19300	-86	-25.2941	Negative
MW-701 UFB	Leachate	Mercury	ng/L	26	22	2.75	5.55	1	1.4	0.51	3.02	1	4	50	0	Positive
MW-701 UFB	Leachate	Nickel	µg/L	26	26	-	76.94	20	-	-	-	-	-	-15	0	Negative
MW-701 UFB	Leachate	Nitrogen, Ammonia	mg/L	20	16	465.75	1748.26	25	641.25	1.38	3.76	40	1400	-91	-2.0012	Negative
MW-701 UFB	Leachate	Nitrogen, Nitrate	mg/L	26	26	-	5	100	-	-	-	-	-	-53	0	Negative
MW-701 UFB	Leachate	Nitrogen, Nitrite	mg/L	26	25	4	-	100	0	0	-	4	4	-53	0	Negative
MW-701 UFB	Leachate	Potassium	mg/L	26	0	5.3	14.22	3	4.46	0.84	2.29	3	19	-21	-0.0182	Negative
MW-701 UFB	Leachate	Sodium	mg/L	26	0	48.43	306.81	4.8	129.19	2.67	3.13	4	530	-28	-0.025	Negative
MW-701 UFB	Leachate	Sulfate	mg/L	26	0	180.21	1166.32	21	493.06	2.74	2.96	3	1950	-43	-0.4545	Negative
MW-701 UFB	Leachate	Sulfide	mg/L	26	22	0.7	1.86	0.2	0.58	0.83	3.76	0	2	-91	0	Negative

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Groundwater Trend Analysis Summary
Humboldt Mill

Location	Classification	Parameter	Unit	Count (n)	Number of Non-Detects	Mean	UCL	Median	Standard Deviation	Coefficient of Variation	Skewness	Minimum	Maximum	Mann Kendall S	Sen Slope	Positive or Negative Trend (Minimum 95% Confidence)
MW-701 UFB	Leachate	Zinc	µg/L	26	24	11	13.83	10	1.41	0.13	-4.33	10	12	-33	0	Negative
MW-702 QAL	Leachate	Alkalinity, Bicarbonate	mg/L	25	1	92.59	157.77	130	32.59	0.35	-0.55	25	160	88	1.55	Positive
MW-702 QAL	Leachate	Alkalinity, Carbonate	mg/L	25	11	15.54	43.7	2	14.08	0.91	1.95	2	49	-92	-0.1742	Negative
MW-702 QAL	Leachate	Arsenic	µg/L	25	22	6	6	5	1.13	0.19	-3.09	5	7	-20	0	Negative
MW-702 QAL	Leachate	Calcium	mg/L	25	0	40.62	73.01	35	16.2	0.4	1.43	23	93	-214	-1.65	Negative
MW-702 QAL	Leachate	Chloride	mg/L	25	16	13	17.58	10	2.29	0.18	2.07	10	18	-81	0	Negative
MW-702 QAL	Leachate	Hardness	mg/L	25	0	145.72	237.31	129	45.79	0.31	0.84	80	270	-211	-5.7	Negative
MW-702 QAL	Leachate	Iron	µg/L	25	24	370	-	200	0	0	-	370	370	-35	0	Negative
MW-702 QAL	Leachate	Lead	µg/L	25	25	-	8	3	-	-	-	-	-	-14	0	Negative
MW-702 QAL	Leachate	Magnesium	mg/L	25	0	9.28	14.74	9.85	2.73	0.29	0.13	4	14	-34	-0.0806	Negative
MW-702 QAL	Leachate	Manganese	µg/L	25	13	201.57	516.26	94	157.35	0.78	1.74	59	550	-133	-8.1	Negative
MW-702 QAL	Leachate	Mercury	ng/L	25	15	2.12	3.22	1.17	0.55	0.26	1.08	1	3	149	0.0389	Positive
MW-702 QAL	Leachate	Nickel	µg/L	25	24	0.88	-	20	0	0	-	1	1	-14	0	Negative
MW-702 QAL	Leachate	Nitrogen, Ammonia	mg/L	19	16	32	42.39	31.5	5.2	0.16	-0.83	29	38	-81	-0.5	Negative
MW-702 QAL	Leachate	Nitrogen, Nitrate	mg/L	25	0	490.33	5	315.26	388.43	0.79	0.42	0	1200	-79	-18.6667	Negative
MW-702 QAL	Leachate	Nitrogen, Nitrite	mg/L	25	18	95.75	231.71	50.05	67.98	0.71	-0.96	0	170	-48	0	Negative
MW-702 QAL	Leachate	Potassium	mg/L	25	0	9.12	20.37	4.75	5.63	0.62	1.78	4	28	-91	-0.2321	Negative
MW-702 QAL	Leachate	Sodium	mg/L	25	0	34.86	59.12	41	12.13	0.35	0.37	17	60	76	0.6511	Positive
MW-702 QAL	Leachate	Sulfate	mg/L	25	0	87.81	130.98	85	21.58	0.25	0.19	54	130	-193	-2.7404	Negative
MW-702 QAL	Leachate	Vanadium	µg/L	9	4	5.84	12.03	4.05	3.1	0.53	1.97	3	11	-10	-0.1571	Negative
MW-702 QAL	Leachate	Zinc	µg/L	25	24	11	-	10	0	0	-	11	11	-27	0	Negative
MW-702 QAL	Leachate	pH	SU	18	0	9.38	8.9-9.9	9.95	-	-	-0.78	7	11	-27	-0.0509	Negative
MW-702 UFB	Leachate	Alkalinity, Carbonate	mg/L	25	24	12	-	2	0	0	-	12	12	-24	0	Negative
MW-702 UFB	Leachate	Arsenic	µg/L	25	24	0.15	-	5	0	0	-	0	0	-14	0	Negative
MW-702 UFB	Leachate	Calcium	mg/L	25	0	28.89	37.77	30	4.44	0.15	-3.35	10	34	30	0.0571	Positive
MW-702 UFB	Leachate	Chloride	mg/L	25	25	-	38.52	10	-	-	-	-	-	-14	0	Negative
MW-702 UFB	Leachate	Copper	mg/L	25	25	-	1.3	4	-	-	-	-	-	-14	0	Negative
MW-702 UFB	Leachate	Fluoride	mg/L	25	25	-	2.1	1	-	-	-	-	-	-14	0	Negative
MW-702 UFB	Leachate	Hardness	mg/L	25	0	114.92	139.29	114	12.19	0.11	-2.77	64	139	12	0	Positive
MW-702 UFB	Leachate	Iron	µg/L	25	1	810.96	1352.39	640	270.71	0.33	1.23	536	1700	44	5	Positive
MW-702 UFB	Leachate	Lead	µg/L	25	25	-	8	3	-	-	-	-	-	-14	0	Negative
MW-702 UFB	Leachate	Magnesium	mg/L	25	0	9.11	11.41	9.75	1.15	0.13	-3.42	4	10	44	0.02	Positive
MW-702 UFB	Leachate	Manganese	mg/L	25	1	89.7	113.53	78.5	11.91	0.13	0.36	75	130	-18	-0.1181	Negative
MW-702 UFB	Leachate	Nickel	µg/L	25	24	0.11	-	20	0	0	-	0	0	-14	0	Negative
MW-702 UFB	Leachate	Nitrogen, Ammonia	mg/L	19	17	52.5	87.86	32.5	17.68	0.34	0.57	40	65	-53	0	Negative
MW-702 UFB	Leachate	Nitrogen, Nitrate	mg/L	25	25	-	5	50.05	-	-	-	-	-	-47	0	Negative
MW-702 UFB	Leachate	Nitrogen, Nitrite	mg/L	25	24	7	-	0.075	0	0	-	7	7	-41	0	Negative
MW-702 UFB	Leachate	Potassium	mg/L	25	0	3.69	9.68	3.3	3	0.81	4.63	3	18	-49	-0.0111	Negative
MW-702 UFB	Leachate	Sodium	mg/L	25	0	3.43	6.25	3.3	1.41	0.41	3.22	3	9	36	0.0071	Positive
MW-702 UFB	Leachate	Sulfate	mg/L	25	0	33.27	37.35	33.5	2.04	0.06	-0.38	29	37	19	0	Positive
MW-702 UFB	Leachate	Sulfide	mg/L	25	25	-	0.77	0.2	-	-	-	-	-	-14	0	Negative
MW-702 UFB	Leachate	Zinc	µg/L	25	22	26.33	76.03	10	24.85	0.94	4.38	11	55	-66	0	Negative
MW-702 UFB	Leachate	pH	SU	17	0	7.66	7.2-8.2	6.88	-	-	-1.12	4	10	-35	-0.0606	Negative
MW-703 DBA	Compliance	Alkalinity, Bicarbonate	mg/L	25	0	63.34	95.54	68.5	16.1	0.25	-0.19	30	91	92	1.0986	Positive
MW-703 DBA	Compliance	Alkalinity, Carbonate	mg/L	25	6	18.11	37.77	17.5	9.83	0.54	0.59	4	38	-115	-0.6667	Negative
MW-703 DBA	Compliance	Arsenic	µg/L	25	24	0.31	-	5	0	0	-	0	0	-14	0	Negative
MW-703 DBA	Compliance	Calcium	mg/L	25	0	16.89	32.32	15	7.72	0.46	-0.12	4	28	87	0.465	Positive
MW-703 DBA	Compliance	Chloride	mg/L	25	0	17.02	20.28	17	1.63	0.1	-0.23	14	19	-241	-0.2091	Negative
MW-703 DBA	Compliance	Copper	mg/L	25	25	-	1.3	4	-	-	-	-	-	-14	0	Negative
MW-703 DBA	Compliance	Fluoride	mg/L	25	25	-	2.1	1	-	-	-	-	-	-14	0	Negative
MW-703 DBA	Compliance	Hardness	mg/L	25	0	87.86	146.46	83	29.3	0.33	-0.29	29	137	29	0.9199	Positive
MW-703 DBA	Compliance	Iron	µg/L	25	18	332.29	753.33	200	210.52	0.63	4.2	210	798	-21	0	Negative
MW-703 DBA	Compliance	Lead	µg/L	25	25	-	8	3	-	-	-	-	-	-14	0	Negative
MW-703 DBA	Compliance	Magnesium	mg/L	25	0	10.16	16.19	11.2	3.02	0.3	-0.04	4	15	-55	-0.145	Negative
MW-703 DBA	Compliance	Manganese	µg/L	25	25	-	192.18	50	-	-	-	-	-	-14	0	Negative
MW-703 DBA	Compliance	Nickel	µg/L	25	24	0.18	-	20	0	0	-	0	0	-14	0	Negative
MW-703 DBA	Compliance	Nitrogen, Ammonia	mg/L	19	13	51.51	122.68	25	35.59	0.69	1.29	0	100	-59	-1.665	Negative
MW-703 DBA	Compliance	Nitrogen, Nitrate	mg/L	25	23	305	5	50.05	275.77	0.9	3.19	110	500	-57	0	Negative
MW-703 DBA	Compliance	Nitrogen, Nitrite	mg/L	25	25	-	304.09	0.075	-	-	-	-	-	-33	0	Negative
MW-703 DBA	Compliance	Potassium	mg/L	25	0	15.72	30.48	16	7.38	0.47	0.06	4	29	-68	-0.4121	Negative
MW-703 DBA	Compliance	Sodium	mg/L	25	0	11	16.51	9.6	2.75	0.25	-0.34	6	15	-157	-0.2733	Negative
MW-703 DBA	Compliance	Sulfate	mg/L	25	1	31.89	80.12	16.5	24.12	0.76	1.13	2	100	53	1.1724	Positive
MW-703 DBA	Compliance	Sulfide	mg/L	25	12	0.54	1.18	0.49	0.32	0.59	2.17	0	1	-24	0	Negative

2019
Groundwater Trend Analysis Summary
Humboldt Mill

Location	Classification	Parameter	Unit	Count (n)	Number of Non-Detects	Mean	UCL	Median	Standard Deviation	Coefficient of Variation	Skewness	Minimum	Maximum	Mann Kendall S	Sen Slope	Positive or Negative Trend (Minimum 95% Confidence)
MW-703 DBA	Compliance	Zinc	µg/L	25	23	18.15	26.21	10	4.03	0.22	1.11	15	21	-27	0	Negative
MW-703 DBA	Compliance	pH	SU	18	0	9.31	8.8-9.8	9.54	-	-	0.81	8	11	-10	-0.0053	Negative
MW-703 LLA	Compliance	Alkalinity, Bicarbonate	mg/L	25	0	79.19	89.86	84.5	5.34	0.07	-0.51	66	87	13	0.0487	Positive
MW-703 LLA	Compliance	Alkalinity, Carbonate	mg/L	25	22	5	10.41	2	2.71	0.54	4.02	3	8	-23	0	Negative
MW-703 LLA	Compliance	Arsenic	µg/L	25	24	0.16	-	5	0	0	-	0	0	-14	0	Negative
MW-703 LLA	Compliance	Chloride	mg/L	25	0	30.12	83.81	11.5	26.85	0.89	1.17	10	100	-202	-2.596	Negative
MW-703 LLA	Compliance	Copper	µg/L	25	25	-	1.3	4	-	-	-	-	-	-14	0	Negative
MW-703 LLA	Compliance	Fluoride	mg/L	25	25	-	2.1	1	-	-	-	-	-	-14	0	Negative
MW-703 LLA	Compliance	Hardness	mg/L	25	0	111.25	136.68	110	12.71	0.11	-0.6	74	135	-54	-0.475	Negative
MW-703 LLA	Compliance	Iron	µg/L	25	1	813.54	1844.17	655	515.32	0.63	2.35	280	2600	-78	-14.5385	Negative
MW-703 LLA	Compliance	Lead	µg/L	25	25	-	8	3	-	-	-	-	-	-14	0	Negative
MW-703 LLA	Compliance	Lithium	µg/L	9	2	16.63	28.8	12.5	6.09	0.37	0.19	7	23	-26	-1.9	Negative
MW-703 LLA	Compliance	Magnesium	mg/L	25	0	10.31	12.11	11	0.9	0.09	-0.4	8	12	15	0	Positive
MW-703 LLA	Compliance	Manganese	µg/L	25	3	74.92	97.25	76	11.17	0.15	-0.35	50	94	41	0.3687	Positive
MW-703 LLA	Compliance	Nickel	µg/L	25	24	0.14	-	20	0	0	-	0	0	-14	0	Negative
MW-703 LLA	Compliance	Nitrogen, Ammonia	mg/L	19	14	48.8	75.54	38	13.37	0.27	0.45	38	71	-47	-1.4691	Negative
MW-703 LLA	Compliance	Nitrogen, Nitrate	mg/L	25	25	-	5	50.05	-	-	-	-	-	-47	0	Negative
MW-703 LLA	Compliance	Nitrogen, Nitrite	mg/L	25	25	-	288.68	0.075	-	-	-	-	-	-41	0	Negative
MW-703 LLA	Compliance	Potassium	mg/L	25	0	4.29	7.33	3.7	1.52	0.35	0.83	3	8	-175	-0.15	Negative
MW-703 LLA	Compliance	Sodium	mg/L	25	0	16.39	44.43	7.4	14.02	0.86	1.24	6	53	-166	-1.2319	Negative
MW-703 LLA	Compliance	Sulfate	mg/L	25	0	29.1	44.6	32	7.75	0.27	-1.12	10	38	47	0.1757	Positive
MW-703 LLA	Compliance	Sulfide	mg/L	25	24	0.02	-	0.2	0	0	-	0	0	-14	0	Negative
MW-703 LLA	Compliance	Zinc	µg/L	25	24	14	-	10	0	0	-	14	14	-29	0	Negative
MW-703 LLA	Compliance	pH	SU	18	0	8.56	8.1-9.1	8.07	-	-	0.18	8	9	-64	-0.05	Negative
MW-703 QAL	Compliance	Alkalinity, Bicarbonate	mg/L	25	0	61	87.03	57	13.01	0.21	1.08	47	91	-239	-1.3768	Negative
MW-703 QAL	Compliance	Calcium	mg/L	25	0	19.66	28.9	15.5	4.62	0.23	1.65	13	32	-110	-0.1854	Negative
MW-703 QAL	Compliance	Chloride	mg/L	25	25	-	38.52	10	-	-	-	-	-	-14	0	Negative
MW-703 QAL	Compliance	Copper	µg/L	25	24	0.37	-	4	0	0	-	0	0	-14	0	Negative
MW-703 QAL	Compliance	Fluoride	mg/L	25	23	60.03	2.1	1	84.81	1.41	4.69	0	120	-33	0	Negative
MW-703 QAL	Compliance	Hardness	mg/L	25	0	83.18	111.72	68	14.27	0.17	1.19	64	119	-83	-0.669	Negative
MW-703 QAL	Compliance	Iron	µg/L	25	23	230	286.57	200	28.28	0.12	4.44	210	250	-43	0	Negative
MW-703 QAL	Compliance	Manganese	mg/L	25	19	77.17	106.54	50	14.69	0.19	1.81	57	91	-105	0	Negative
MW-703 QAL	Compliance	Mercury	ng/L	25	24	1.41	-	1	0	0	-	1	1	14	0	Positive
MW-703 QAL	Compliance	Nickel	µg/L	25	25	-	76.82	20	-	-	-	-	-	-14	0	Negative
MW-703 QAL	Compliance	Nitrogen, Ammonia	mg/L	19	19	-	73.71	25	-	-	-	-	-	-68	0	Negative
MW-703 QAL	Compliance	Nitrogen, Nitrate	mg/L	25	0	738.33	5	550.65	762.16	1.03	0.73	1	2220	126	79.5	Positive
MW-703 QAL	Compliance	Nitrogen, Nitrite	mg/L	25	25	-	304.67	50.05	-	-	-	-	-	-47	0	Negative
MW-703 QAL	Compliance	Potassium	mg/L	25	0	1.71	2.41	1.45	0.35	0.2	1.35	1	3	-178	-0.03	Negative
MW-703 QAL	Compliance	Sodium	mg/L	25	0	3.31	6.95	2.45	1.82	0.55	1.4	2	8	-252	-0.1441	Negative
MW-703 QAL	Compliance	Sulfate	mg/L	25	0	25.06	39.39	13.5	7.17	0.29	0.13	12	40	-12	-0.1345	Negative
MW-703 QAL	Compliance	Sulfide	mg/L	25	25	-	0.77	0.2	-	-	-	-	-	-14	0	Negative
MW-703 QAL	Compliance	Zinc	µg/L	25	24	170	-	10	0	0	-	170	170	-21	0	Negative
MW-703 QAL	Compliance	pH	SU	17	0	6.73	6.2-7.2	6.52	-	-	0.56	6	8	-76	-0.1167	Negative
MW-703 UFB	Compliance	Alkalinity, Bicarbonate	mg/L	25	0	79.01	105.94	82	13.46	0.17	-4.31	16	91	-32	-0.0739	Negative
MW-703 UFB	Compliance	Alkalinity, Carbonate	mg/L	25	24	23	-	2	0	0	-	23	23	-24	0	Negative
MW-703 UFB	Compliance	Arsenic	µg/L	25	24	0.29	-	5	0	0	-	0	0	-14	0	Negative
MW-703 UFB	Compliance	Calcium	mg/L	25	0	30.45	41.1	31	5.32	0.17	-4.11	6	35	37	0.0065	Positive
MW-703 UFB	Compliance	Chloride	mg/L	25	25	-	38.52	10	-	-	-	-	-	-14	0	Negative
MW-703 UFB	Compliance	Copper	µg/L	25	25	-	1.3	4	-	-	-	-	-	-14	0	Negative
MW-703 UFB	Compliance	Fluoride	mg/L	25	24	0.08	-	1	0	0	-	0	0	-14	0	Negative
MW-703 UFB	Compliance	Hardness	mg/L	25	0	120.07	167.8	124	23.87	0.2	-2.84	28	147	25	0.0931	Positive
MW-703 UFB	Compliance	Iron	µg/L	25	1	1217.92	2003.42	1070	392.75	0.32	-0.46	490	1820	76	22.9286	Positive
MW-703 UFB	Compliance	Lead	µg/L	25	25	-	8	3	-	-	-	-	-	-14	0	Negative
MW-703 UFB	Compliance	Magnesium	mg/L	25	0	10.14	13.38	11	1.62	0.16	-4.04	3	11	52	0.0106	Positive
MW-703 UFB	Compliance	Manganese	µg/L	25	3	162.86	214.83	165	25.98	0.16	-0.41	95	207	165	2.7136	Positive
MW-703 UFB	Compliance	Mercury	ng/L	25	24	2.28	-	1	0	0	-	2	2	14	0	Positive
MW-703 UFB	Compliance	Nickel	µg/L	25	24	0.16	-	20	0	0	-	0	0	-14	0	Negative
MW-703 UFB	Compliance	Nitrogen, Ammonia	mg/L	19	16	288.67	750.6	25	230.97	0.8	2.59	26	460	-70	-1.4691	Negative
MW-703 UFB	Compliance	Nitrogen, Nitrate	mg/L	25	25	-	5	50.05	-	-	-	-	-	-47	0	Negative
MW-703 UFB	Compliance	Nitrogen, Nitrite	mg/L	25	24	4	-	0.075	0	0	-	4	4	-41	0	Negative
MW-703 UFB	Compliance	Potassium	mg/L	25	0	2.59	3.89	2.4	0.65	0.25	3.22	2	5	-204	-0.025	Negative
MW-703 UFB	Compliance	Sodium	mg/L	25	0	4.18	14.59	3	5.2	1.24	4.61	3	29	-65	-0.0118	Negative
MW-703 UFB	Compliance	Sulfate	mg/L	25	0	45.35	51.56	45.5	3.11	0.07	0.34	38	52	97	0.1667	Positive

2019
Groundwater Trend Analysis Summary
Humboldt Mill

Location	Classification	Parameter	Unit	Count (n)	Number of Non-Detects	Mean	UCL	Median	Standard Deviation	Coefficient of Variation	Skewness	Minimum	Maximum	Mann Kendall S	Sen Slope	Positive or Negative Trend (Minimum 95% Confidence)
MW-703 UFB	Compliance	Sulfide	mg/L	25	25	-	0.77	0.2	-	-	-	-	-	-14	0	Negative
MW-703 UFB	Compliance	Zinc	µg/L	25	23	7.9	22.32	10	7.21	0.91	-3.39	3	13	-31	0	Negative
MW-703 UFB	Compliance	pH	SU	18	0	7.96	7.5-8.5	5.25	-	-	-0.33	5	10	-26	-0.0218	Negative
MW-704 DBA	Compliance	Alkalinity, Bicarbonate	mg/L	24	0	117.46	160.11	135	21.33	0.18	-2.24	39	142	139	1.5714	Positive
MW-704 DBA	Compliance	Alkalinity, Carbonate	mg/L	24	8	7.71	21.81	3.05	7.05	0.91	2.24	2	29	-140	-0.4136	Negative
MW-704 DBA	Compliance	Arsenic	µg/L	24	23	0.34	-	5	0	0	-	0	0	-13	0	Negative
MW-704 DBA	Compliance	Boron	µg/L	9	9	-	1603.73	300	-	-	-	-	-	-11	0	Negative
MW-704 DBA	Compliance	Calcium	mg/L	24	0	20.7	27.01	22	3.16	0.15	-2.3	9	25	135	0.2	Positive
MW-704 DBA	Compliance	Chloride	mg/L	24	24	-	38.45	10	-	-	-	-	-	-13	0	Negative
MW-704 DBA	Compliance	Copper	µg/L	24	23	4.5	-	4	0	0	-	4	4	-23	0	Negative
MW-704 DBA	Compliance	Fluoride	mg/L	24	24	-	2.1	1	-	-	-	-	-	-13	0	Negative
MW-704 DBA	Compliance	Hardness	mg/L	24	0	101.46	130.46	110.5	14.5	0.14	-2.07	48	125	145	1	Positive
MW-704 DBA	Compliance	Iron	µg/L	24	2	707.5	1037.85	700	165.18	0.23	-0.79	340	950	188	23.1099	Positive
MW-704 DBA	Compliance	Lead	µg/L	24	24	-	8	3	-	-	-	-	-	-13	0	Negative
MW-704 DBA	Compliance	Magnesium	mg/L	24	0	10.68	13.44	12	1.38	0.13	-1.82	6	12	101	0.0861	Positive
MW-704 DBA	Compliance	Manganese	µg/L	24	16	54.84	62.6	52.5	3.88	0.07	-3.92	51	61	91	0	Positive
MW-704 DBA	Compliance	Nickel	µg/L	24	23	0.14	-	20	0	0	-	0	0	-13	0	Negative
MW-704 DBA	Compliance	Nitrogen, Ammonia	mg/L	18	17	37	-	25	0	0	-	37	37	-75	0	Negative
MW-704 DBA	Compliance	Nitrogen, Nitrate	mg/L	24	24	-	5	100	-	-	-	-	-	-41	0	Negative
MW-704 DBA	Compliance	Nitrogen, Nitrite	mg/L	24	23	5	-	100	0	0	-	5	5	-41	0	Negative
MW-704 DBA	Compliance	Potassium	mg/L	24	0	2.65	3.13	2.7	0.24	0.09	1.8	2	4	-73	-0.0067	Negative
MW-704 DBA	Compliance	Sodium	mg/L	24	0	10.72	12.51	11	0.9	0.08	0.46	9	13	-35	0	Negative
MW-704 DBA	Compliance	Sulfate	mg/L	24	15	2.51	5.18	1	1.33	0.53	1.72	1	4	-127	-0.0253	Negative
MW-704 DBA	Compliance	Sulfide	mg/L	24	23	0.02	-	0.2	0	0	-	0	0	-13	0	Negative
MW-704 DBA	Compliance	Zinc	µg/L	24	23	11	-	10	0	0	-	11	11	-27	0	Negative
MW-704 DBA	Compliance	pH	SU	18	0	8.61	8.1-9.1	8.66	-	-	-0.72	8	9	-46	-0.0291	Negative
MW-704 LLA	Compliance	Alkalinity, Bicarbonate	mg/L	26	0	114.88	174.28	120	29.7	0.26	0.16	55	168	112	2.1429	Positive
MW-704 LLA	Compliance	Alkalinity, Carbonate	mg/L	26	13	6.32	13.13	4.1	3.41	0.54	1.68	2	14	-109	-0.1455	Negative
MW-704 LLA	Compliance	Arsenic	µg/L	26	25	0.76	-	5	0	0	-	1	1	-15	0	Negative
MW-704 LLA	Compliance	Calcium	mg/L	26	0	23.95	43.86	19	9.95	0.42	0.7	11	45	85	0.6667	Positive
MW-704 LLA	Compliance	Chloride	mg/L	26	21	13.14	18.19	10	2.52	0.19	2.7	10	16	109	0	Positive
MW-704 LLA	Compliance	Copper	µg/L	26	26	-	1.3	4	-	-	-	-	-	-15	0	Negative
MW-704 LLA	Compliance	Fluoride	mg/L	26	25	0.08	-	1	0	0	-	0	0	-15	0	Negative
MW-704 LLA	Compliance	Hardness	mg/L	26	0	123.77	212.26	98	44.25	0.36	0.97	66	252	107	2.75	Positive
MW-704 LLA	Compliance	Iron	µg/L	26	4	1023.05	3013.63	650	995.29	0.97	3.16	230	5000	101	30.2941	Positive
MW-704 LLA	Compliance	Lead	µg/L	26	26	-	8	3	-	-	-	-	-	-15	0	Negative
MW-704 LLA	Compliance	Lithium	µg/L	10	2	16.79	26.3	22	4.76	0.28	1	13	26	17	0.5286	Positive
MW-704 LLA	Compliance	Magnesium	mg/L	26	0	13.25	18.23	12	2.49	0.19	0.39	9	19	114	0.205	Positive
MW-704 LLA	Compliance	Manganese	µg/L	26	11	88.97	160.81	50	35.92	0.4	1.69	50	161	72	0.1889	Positive
MW-704 LLA	Compliance	Nickel	µg/L	26	25	0.11	-	20	0	0	-	0	0	-15	0	Negative
MW-704 LLA	Compliance	Nitrogen, Ammonia	mg/L	20	19	27	-	25	0	0	-	27	27	-59	0	Negative
MW-704 LLA	Compliance	Nitrogen, Nitrate	mg/L	26	26	-	5	100	-	-	-	-	-	-53	0	Negative
MW-704 LLA	Compliance	Nitrogen, Nitrite	mg/L	26	25	7	-	100	0	0	-	7	7	-53	0	Negative
MW-704 LLA	Compliance	Potassium	mg/L	26	0	6.47	10.93	8.1	2.23	0.34	0.68	4	11	42	0.05	Positive
MW-704 LLA	Compliance	Sodium	mg/L	26	0	5.68	13.91	5.1	4.12	0.73	4.23	4	25	49	0.0211	Positive
MW-704 LLA	Compliance	Sulfate	mg/L	26	0	9.99	19.53	5.7	4.77	0.48	0.62	2	22	-65	-0.2444	Negative
MW-704 LLA	Compliance	Sulfide	mg/L	26	25	0.02	-	0.2	0	0	-	0	0	-15	0	Negative
MW-704 LLA	Compliance	Zinc	µg/L	26	25	11	-	10	0	0	-	11	11	-39	0	Negative
MW-704 LLA	Compliance	pH	SU	18	0	8.63	8.1-9.1	9.15	-	-	-0.26	8	9	-64	-0.0425	Negative
MW-704 QAL	Compliance	Arsenic	µg/L	26	16	14.79	6	5	7.45	0.5	1.22	0	25	-80	0	Negative
MW-704 QAL	Compliance	Calcium	mg/L	26	0	34.31	51.39	40	8.54	0.25	-0.21	18	52	157	0.8688	Positive
MW-704 QAL	Compliance	Chloride	mg/L	26	6	22.79	56.58	16	16.89	0.74	2.85	14	76	130	0.4286	Positive
MW-704 QAL	Compliance	Copper	µg/L	26	25	0.94	-	4	0	0	-	1	1	-15	0	Negative
MW-704 QAL	Compliance	Fluoride	mg/L	26	25	0.04	-	1	0	0	-	0	0	-15	0	Negative
MW-704 QAL	Compliance	Hardness	mg/L	26	0	138.08	208.27	156	35.09	0.25	-0.11	71	205	180	3.7778	Positive
MW-704 QAL	Compliance	Iron	µg/L	26	6	24754.8	85283.32	2200	30264.26	1.22	1.86	506	103000	-39	-100.625	Negative
MW-704 QAL	Compliance	Lead	µg/L	26	26	-	8	3	-	-	-	-	-	-15	0	Negative
MW-704 QAL	Compliance	Magnesium	mg/L	26	0	10.73	18.26	11	3.76	0.35	0.4	6	18	261	0.45	Positive
MW-704 QAL	Compliance	Manganese	µg/L	26	3	3026.52	7810.03	3900	2391.75	0.79	0.72	520	7200	-36	-32.6667	Negative
MW-704 QAL	Compliance	Mercury	ng/L	26	7	8.19	29.18	9.69	10.5	1.28	3.29	1	47	24	0.01	Positive
MW-704 QAL	Compliance	Nickel	µg/L	26	26	-	76.94	20	-	-	-	-	-	-15	0	Negative
MW-704 QAL	Compliance	Nitrogen, Ammonia	mg/L	20	9	59.64	187.44	44	63.9	1.07	2.6	0	230	-29	-0.9928	Negative
MW-704 QAL	Compliance	Nitrogen, Nitrate	mg/L	26	11	502.95	5	740	472.55	0.94	1.29	0	1500	30	0	Positive

2019
Groundwater Trend Analysis Summary
Humboldt Mill

Location	Classification	Parameter	Unit	Count (n)	Number of Non-Detects	Mean	UCL	Median	Standard Deviation	Coefficient of Variation	Skewness	Minimum	Maximum	Mann Kendall S	Sen Slope	Positive or Negative Trend (Minimum 95% Confidence)
MW-704 QAL	Compliance	Nitrogen, Nitrite	mg/L	26	25	110	-	100	0	0	-	110	110	-58	0	Negative
MW-704 QAL	Compliance	Potassium	mg/L	26	0	3.06	6.38	3.2	1.66	0.54	2.48	2	9	145	0.0667	Positive
MW-704 QAL	Compliance	Sodium	mg/L	26	0	15.87	31.59	21	7.86	0.5	-0.2	2	29	113	0.5583	Positive
MW-704 QAL	Compliance	Sulfate	mg/L	26	1	33.32	82.81	38	24.74	0.74	1	8	97	196	2.4091	Positive
MW-704 QAL	Compliance	Sulfide	mg/L	26	26	-	0.77	0.2	-	-	-	-	-	-15	0	Negative
MW-704 QAL	Compliance	Zinc	µg/L	26	24	18	37.8	10	9.9	0.55	2.59	11	25	-50	0	Negative
MW-704 QAL	Compliance	pH	SU	18	0	5.92	5.4-6.4	5.7	-	-	0.87	6	6	-36	-0.0143	Negative
MW-704 UFB	Compliance	Alkalinity, Bicarbonate	mg/L	26	0	148.69	200.61	160	25.96	0.17	-0.34	91	190	101	1.8125	Positive
MW-704 UFB	Compliance	Alkalinity, Carbonate	mg/L	26	25	2.2	-	2	0	0	-	2	2	19	0	Positive
MW-704 UFB	Compliance	Aluminum	µg/L	10	8	1610	5824.36	50	2107.18	1.31	2.64	120	3100	-12	0	Negative
MW-704 UFB	Compliance	Arsenic	µg/L	26	25	0.18	-	5	0	0	-	0	0	-15	0	Negative
MW-704 UFB	Compliance	Calcium	mg/L	26	0	43.3	76.91	56	16.8	0.39	-0.29	10	73	213	1.9947	Positive
MW-704 UFB	Compliance	Chloride	mg/L	26	8	26.99	69.64	19	21.32	0.79	2.63	12	86	214	0.8889	Positive
MW-704 UFB	Compliance	Copper	µg/L	26	25	4.8	-	4	0	0	-	5	5	-35	0	Negative
MW-704 UFB	Compliance	Fluoride	mg/L	26	25	0.04	-	1	0	0	-	0	0	-15	0	Negative
MW-704 UFB	Compliance	Hardness	mg/L	26	0	158.27	272.87	198	57.3	0.36	0.05	68	271	244	7.2	Positive
MW-704 UFB	Compliance	Iron	µg/L	26	0	24402.81	66645.38	28000	21121.28	0.87	0.55	210	69100	204	2294.4444	Positive
MW-704 UFB	Compliance	Lead	µg/L	26	25	4.3	-	3	0	0	-	4	4	-35	0	Negative
MW-704 UFB	Compliance	Lithium	µg/L	10	7	15.67	30.14	11	7.23	0.46	1.81	11	24	-14	0	Negative
MW-704 UFB	Compliance	Magnesium	mg/L	26	0	10.22	20.65	11	5.22	0.51	0.46	2	22	288	0.6312	Positive
MW-704 UFB	Compliance	Manganese	µg/L	26	2	760.12	1554.98	1000	397.43	0.52	-0.24	51	1410	170	40.5556	Positive
MW-704 UFB	Compliance	Mercury	ng/L	26	22	1.25	1.66	1	0.2	0.16	3.19	1	2	34	0	Positive
MW-704 UFB	Compliance	Nickel	µg/L	26	25	0.7	-	20	0	0	-	1	1	-15	0	Negative
MW-704 UFB	Compliance	Nitrogen, Ammonia	mg/L	20	7	61.93	184.15	26.5	61.11	0.99	1.92	0	200	-125	-3.9982	Negative
MW-704 UFB	Compliance	Nitrogen, Nitrate	mg/L	26	25	0.33	-	100	0	0	-	0	0	-55	0	Negative
MW-704 UFB	Compliance	Nitrogen, Nitrite	mg/L	26	23	83	217.27	100	67.13	0.81	-1.15	9	140	-72	0	Negative
MW-704 UFB	Compliance	Potassium	mg/L	26	0	2.97	5.01	4.1	1.02	0.34	-0.77	1	5	76	0.0556	Positive
MW-704 UFB	Compliance	Sulfate	mg/L	26	1	27.18	66.26	47	19.54	0.72	0.84	5	73	103	1.35	Positive
MW-704 UFB	Compliance	Sulfide	mg/L	25	21	0.31	0.49	0.2	0.09	0.29	0.63	0	0	-68	0	Negative
MW-704 UFB	Compliance	Zinc	µg/L	26	25	210	-	10	0	0	-	210	210	-25	0	Negative
MW-705 QAL	Compliance	Alkalinity, Bicarbonate	mg/L	26	0	57.31	92.15	61	17.42	0.3	1.11	31	110	-123	-1.0556	Negative
MW-705 QAL	Compliance	Calcium	mg/L	26	0	16.95	24	15	3.53	0.21	0.42	12	24	-139	-0.2857	Negative
MW-705 QAL	Compliance	Chloride	mg/L	26	0	36.64	65.88	32	14.62	0.4	0.96	19	72	-15	-0.0909	Negative
MW-705 QAL	Compliance	Fluoride	mg/L	26	25	0.06	-	1	0	0	-	0	0	-15	0	Negative
MW-705 QAL	Compliance	Hardness	mg/L	26	0	77.04	108.39	70	15.68	0.2	0.28	48	109	-143	-1.4167	Negative
MW-705 QAL	Compliance	Iron	µg/L	26	0	8490	13329.23	8700	2419.61	0.28	-0.43	1900	13600	-23	-41.4286	Negative
MW-705 QAL	Compliance	Lead	µg/L	26	26	-	8	3	-	-	-	-	-	-15	0	Negative
MW-705 QAL	Compliance	Magnesium	mg/L	26	0	7.5	10.84	6.7	1.67	0.22	0.51	5	11	-138	-0.1421	Negative
MW-705 QAL	Compliance	Manganese	µg/L	26	5	883.48	1529.7	750	323.11	0.37	1.12	280	1500	-126	-25.4444	Negative
MW-705 QAL	Compliance	Mercury	ng/L	26	19	1.67	4	1	1.16	0.69	4.48	1	4	82	0	Positive
MW-705 QAL	Compliance	Nickel	µg/L	26	26	-	76.94	20	-	-	-	-	-	-15	0	Negative
MW-705 QAL	Compliance	Nitrogen, Ammonia	mg/L	20	0	60.97	144.71	92	41.87	0.69	-0.29	0	130	-23	-0.5256	Negative
MW-705 QAL	Compliance	Nitrogen, Nitrate	mg/L	26	26	-	5	100	-	-	-	-	-	-53	0	Negative
MW-705 QAL	Compliance	Nitrogen, Nitrite	mg/L	26	25	6	-	100	0	0	-	6	6	-53	0	Negative
MW-705 QAL	Compliance	Potassium	mg/L	26	0	2.5	3.06	2.7	0.28	0.11	-0.37	2	3	-26	0	Negative
MW-705 QAL	Compliance	Sodium	mg/L	26	0	13.16	21.15	13	4	0.3	0.82	4	25	190	0.3333	Positive
MW-705 QAL	Compliance	Sulfate	mg/L	26	0	7.33	21.25	5	6.96	0.95	2.5	2	33	105	0.2176	Positive
MW-705 QAL	Compliance	Sulfide	mg/L	26	25	0.02	-	0.2	0	0	-	0	0	-15	0	Negative
MW-705 QAL	Compliance	Zinc	µg/L	26	24	92.5	283.42	10	95.46	1.03	4.7	25	160	-50	0	Negative
MW-705 UFB	Compliance	Alkalinity, Bicarbonate	mg/L	26	0	90.03	113.48	86	11.73	0.13	3.1	77	140	-118	-0.4435	Negative
MW-705 UFB	Compliance	Arsenic	µg/L	26	25	0.39	-	5	0	0	-	0	0	-15	0	Negative
MW-705 UFB	Compliance	Calcium	mg/L	26	0	23.4	29.71	23	3.16	0.14	0.22	18	29	197	0.375	Positive
MW-705 UFB	Compliance	Chloride	mg/L	26	8	28.29	45.31	24	8.51	0.3	0.1	12	41	287	1.4	Positive
MW-705 UFB	Compliance	Copper	µg/L	26	25	0.74	-	4	0	0	-	1	1	-15	0	Negative
MW-705 UFB	Compliance	Fluoride	mg/L	26	25	0.08	-	1	0	0	-	0	0	-15	0	Negative
MW-705 UFB	Compliance	Hardness	mg/L	26	0	113.73	147.73	110	17	0.15	1.53	92	172	180	1.4545	Positive
MW-705 UFB	Compliance	Iron	µg/L	26	0	8276.92	13301.52	9700	2512.3	0.3	-1.34	680	12100	107	105.7143	Positive
MW-705 UFB	Compliance	Lead	µg/L	26	26	-	8	3	-	-	-	-	-	-15	0	Negative
MW-705 UFB	Compliance	Magnesium	mg/L	26	0	11.92	15.41	12	1.75	0.15	0.35	9	16	204	0.1846	Positive
MW-705 UFB	Compliance	Manganese	µg/L	26	1	837.92	1224.67	710	193.37	0.23	0.87	530	1440	195	15.5	Positive
MW-705 UFB	Compliance	Nickel	µg/L	26	25	0.76	-	20	0	0	-	1	1	-15	0	Negative
MW-705 UFB	Compliance	Nitrogen, Ammonia	mg/L	20	19	0.03	-	25	0	0	-	0	0	-71	0	Negative
MW-705 UFB	Compliance	Nitrogen, Nitrate	mg/L	26	25	0.11	-	100	0	0	-	0	0	-53	0	Negative

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Location	Classification	Parameter	Unit	Count (n)	Number of Non-Detects	Mean	UCL	Median	Standard Deviation	Coefficient of Variation	Skewness	Minimum	Maximum	Mann Kendall S	Sen Slope	Positive or Negative Trend (Minimum 95% Confidence)
MW-705 UFB	Compliance	Nitrogen, Nitrite	mg/L	26	26	-	308.34	100	-	-	-	-	-	-53	0	Negative
MW-705 UFB	Compliance	Potassium	mg/L	26	0	3.54	4.09	3.9	0.27	0.08	0.5	3	4	73	0.01	Positive
MW-705 UFB	Compliance	Sodium	mg/L	26	0	2.95	3.61	3	0.33	0.11	0.77	2	4	128	0.0231	Positive
MW-705 UFB	Compliance	Sulfate	mg/L	26	0	6.05	12.88	4.7	3.42	0.57	0.92	2	13	-234	-0.3812	Negative
MW-705 UFB	Compliance	Sulfide	mg/L	26	26	-	0.77	0.2	-	-	-	-	-	-15	0	Negative
MW-705 UFB	Compliance	Zinc	µg/L	26	22	17.9	34.43	10	8.26	0.46	2.87	12	30	-49	0	Negative
MW-706 QAL	Building/Second	Alkalinity, Bicarbonate	mg/L	25	0	89.01	132.27	76.5	21.63	0.24	1.35	71	145	-173	-1.8188	Negative
MW-706 QAL	Building/Second	Arsenic	µg/L	25	16	8.3	6	5	2.58	0.31	1.13	6	14	-169	-0.1268	Negative
MW-706 QAL	Building/Second	Calcium	mg/L	25	0	85.7	125.75	88	20.02	0.23	1.27	57	150	-212	-2	Negative
MW-706 QAL	Building/Second	Chloride	mg/L	25	0	116.04	156.79	150	20.37	0.18	0.37	86	150	82	1	Positive
MW-706 QAL	Building/Second	Copper	µg/L	25	25	-	1.3	4	-	-	-	-	-	-14	0	Negative
MW-706 QAL	Building/Second	Fluoride	mg/L	25	24	0.04	-	1	0	0	-	0	0	-14	0	Negative
MW-706 QAL	Building/Second	Hardness	mg/L	25	0	228.28	562.04	43	166.88	0.73	0.03	6	503	-55	-7.0833	Negative
MW-706 QAL	Building/Second	Iron	µg/L	25	0	4462.4	7576.95	4500	1557.28	0.35	0.58	2200	7800	-213	-200	Negative
MW-706 QAL	Building/Second	Lead	µg/L	25	25	-	8	3	-	-	-	-	-	-14	0	Negative
MW-706 QAL	Building/Second	Magnesium	mg/L	25	0	31.11	41.63	34.5	5.26	0.17	0.66	20	47	-138	-0.4215	Negative
MW-706 QAL	Building/Second	Manganese	µg/L	25	4	15319.05	22330.36	18000	3505.66	0.23	0.33	8000	22000	-89	-290.4545	Negative
MW-706 QAL	Building/Second	Molybdenum	µg/L	9	7	43.78	166.02	50	61.12	1.4	-0.7	1	87	-13	0	Negative
MW-706 QAL	Building/Second	Nickel	µg/L	25	11	23.59	26.89	25.5	1.65	0.07	-3.26	21	26	-25	0	Negative
MW-706 QAL	Building/Second	Nitrogen, Ammonia	mg/L	19	0	362.75	938.55	420	287.9	0.79	0.9	0	1200	-79	-32.4598	Negative
MW-706 QAL	Building/Second	Nitrogen, Nitrate	mg/L	25	24	0.44	-	50.22	0	0	-	0	0	-51	0	Negative
MW-706 QAL	Building/Second	Nitrogen, Nitrite	mg/L	25	25	-	304.67	50.05	-	-	-	-	-	-47	0	Negative
MW-706 QAL	Building/Second	Potassium	mg/L	25	0	4.63	5.46	4.6	0.42	0.09	1.82	4	6	-68	-0.0143	Negative
MW-706 QAL	Building/Second	Sodium	mg/L	25	0	49.46	122.12	33	36.33	0.73	2.77	24	190	40	0.3719	Positive
MW-706 QAL	Building/Second	Sulfate	mg/L	25	0	236.84	396.38	205	79.77	0.34	1.41	168	430	-236	-5.8258	Negative
MW-706 QAL	Building/Second	Vanadium	mg/L	9	7	4.35	4.77	4	0.21	0.05	-2.3	4	4	-17	-0.0292	Negative
MW-706 QAL	Building/Second	Zinc	µg/L	25	22	21.2	64.63	10	21.71	1.02	4.55	6	46	-49	0	Negative
MW-706 QAL	Building/Second	pH	SU	18	0	6.21	5.7-6.7	5.94	-	-	0.46	6	7	-89	-0.0567	Negative
MW-707 QAL	Concentrator/CLO	Alkalinity, Bicarbonate	mg/L	25	0	157.96	169.54	160	5.79	0.04	-0.12	150	170	108	0.3723	Positive
MW-707 QAL	Concentrator/CLO	Arsenic	µg/L	25	25	-	6	5	-	-	-	-	-	-14	0	Negative
MW-707 QAL	Concentrator/CLO	Calcium	mg/L	25	0	41.22	46.33	41.5	2.55	0.06	-1.21	33	45	122	0.1821	Positive
MW-707 QAL	Concentrator/CLO	Chloride	mg/L	25	25	-	38.52	10	-	-	-	-	-	-14	0	Negative
MW-707 QAL	Concentrator/CLO	Fluoride	mg/L	25	25	-	2.1	1	-	-	-	-	-	-14	0	Negative
MW-707 QAL	Concentrator/CLO	Hardness	mg/L	25	0	154.32	166.69	155	6.18	0.04	1.53	145	176	142	0.5	Positive
MW-707 QAL	Concentrator/CLO	Iron	µg/L	25	0	5170.8	7105.57	5050	967.38	0.19	0.13	3410	7200	-245	-112.5	Negative
MW-707 QAL	Concentrator/CLO	Lead	µg/L	25	25	-	8	3	-	-	-	-	-	-14	0	Negative
MW-707 QAL	Concentrator/CLO	Magnesium	mg/L	25	0	11.77	13.13	12	0.68	0.06	1.45	11	14	-45	-0.0146	Negative
MW-707 QAL	Concentrator/CLO	Manganese	µg/L	25	3	937.95	1131.9	905	96.97	0.1	0.27	716	1100	-106	-7.2111	Negative
MW-707 QAL	Concentrator/CLO	Nickel	µg/L	25	25	-	76.82	20	-	-	-	-	-	-14	0	Negative
MW-707 QAL	Concentrator/CLO	Nitrogen, Ammonia	mg/L	19	0	204.27	457.94	270	126.84	0.62	-0.99	0	320	-86	-10	Negative
MW-707 QAL	Concentrator/CLO	Nitrogen, Nitrate	mg/L	25	23	73.5	5	50.05	79.9	1.09	-1.16	17	130	-53	0	Negative
MW-707 QAL	Concentrator/CLO	Nitrogen, Nitrite	mg/L	25	25	-	304.67	50.05	-	-	-	-	-	-47	0	Negative
MW-707 QAL	Concentrator/CLO	Potassium	mg/L	25	0	2.42	2.86	2.55	0.22	0.09	1.76	2	3	-84	-0.0091	Negative
MW-707 QAL	Concentrator/CLO	Sodium	mg/L	25	0	3.27	5.71	2.85	1.22	0.37	4.42	3	9	-21	0	Negative
MW-707 QAL	Concentrator/CLO	Sulfate	mg/L	25	5	6.14	10.15	5.25	2	0.33	-0.41	1	10	-192	-0.3118	Negative
MW-707 QAL	Concentrator/CLO	Sulfide	mg/L	25	25	-	0.77	0.2	-	-	-	-	-	-14	0	Negative
MW-707 QAL	Concentrator/CLO	Zinc	µg/L	25	21	16	29.27	10	6.63	0.41	2.05	11	25	-55	0	Negative
MW-707 QAL	Concentrator/CLO	pH	SU	18	0	6.96	6.5-7.5	6.96	-	-	0.23	7	7	58	0.0238	Positive
MW-9R	Concentrator	Alkalinity, Bicarbonate	mg/L	22	1	43.46	83.65	30	20.09	0.46	0.1	6	82	-31	-0.67	Negative
MW-9R	Concentrator	Arsenic	µg/L	22	21	8.7	-	5	0	0	-	9	9	-33	0	Negative
MW-9R	Concentrator	Calcium	mg/L	22	0	51.09	105.37	78	27.14	0.53	0.87	17	120	-100	-2.5133	Negative
MW-9R	Concentrator	Chloride	mg/L	22	2	48.3	158.47	77	55.09	1.14	1.73	10	190	-116	-1.6875	Negative
MW-9R	Concentrator	Copper	µg/L	22	17	11.18	1.3	4	11.83	1.06	3.96	4	32	-39	0	Negative
MW-9R	Concentrator	Fluoride	mg/L	22	21	0.1	-	1	0	0	-	0	0	-13	0	Negative
MW-9R	Concentrator	Hardness	mg/L	22	0	213.79	438.15	300	112.18	0.52	0.78	68	473	-115	-12	Negative
MW-9R	Concentrator	Iron	µg/L	22	12	1852.55	4177.44	200	1162.45	0.63	1.26	16	3800	-59	0	Negative
MW-9R	Concentrator	Lead	µg/L	22	22	-	8	3	-	-	-	-	-	-13	0	Negative
MW-9R	Concentrator	Magnesium	mg/L	22	0	18.63	37.99	30	9.68	0.52	0.72	6	42	-106	-1	Negative
MW-9R	Concentrator	Manganese	µg/L	22	4	385.13	1192.4	63	403.64	1.05	1.39	53	1400	-124	-27.5667	Negative
MW-9R	Concentrator	Mercury	ng/L	22	18	3.15	10.07	1	3.46	1.1	4.25	1	8	-20	0	Negative
MW-9R	Concentrator	Nickel	µg/L	22	4	74.26	190.13	28	57.94	0.78	1.59	22	240	88	3.3333	Positive
MW-9R	Concentrator	Nitrogen, Ammonia	mg/L	17	12	75.22	216.87	25	70.83	0.94	2.47	0	190	-86	-3.1349	Negative
MW-9R	Concentrator	Nitrogen, Nitrate	mg/L	22	6	956.02	5	2.7	1177.13	1.23	1.74	0	4000	-63	-11.1765	Negative

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Groundwater Trend Analysis Summary
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Location	Classification	Parameter	Unit	Count (n)	Number of Non-Detects	Mean	UCL	Median	Standard Deviation	Coefficient of Variation	Skewness	Minimum	Maximum	Mann Kendall S	Sen Slope	Positive or Negative Trend (Minimum 95% Confidence)
MW-9R	Concentrator	Nitrogen, Nitrite	mg/L	22	21	4	-	0.1	0	0	-	4	4	-41	0	Negative
MW-9R	Concentrator	Potassium	mg/L	22	0	3.02	4.94	3.6	0.96	0.32	0.24	2	5	-119	-0.1	Negative
MW-9R	Concentrator	Sodium	mg/L	22	0	17.13	41.92	15	12.4	0.72	1.24	6	47	-143	-1.27	Negative
MW-9R	Concentrator	Sulfate	mg/L	22	0	140.98	302.24	180	80.63	0.57	0.86	42	320	-87	-7.5	Negative
MW-9R	Concentrator	Sulfide	mg/L	22	20	0.06	0.06	0.2	0	0	-2.22	0	0	20	0	Positive
MW-9R	Concentrator	Zinc	µg/L	22	0	22.91	39.61	16	8.35	0.36	1	13	41	46	0.3545	Positive

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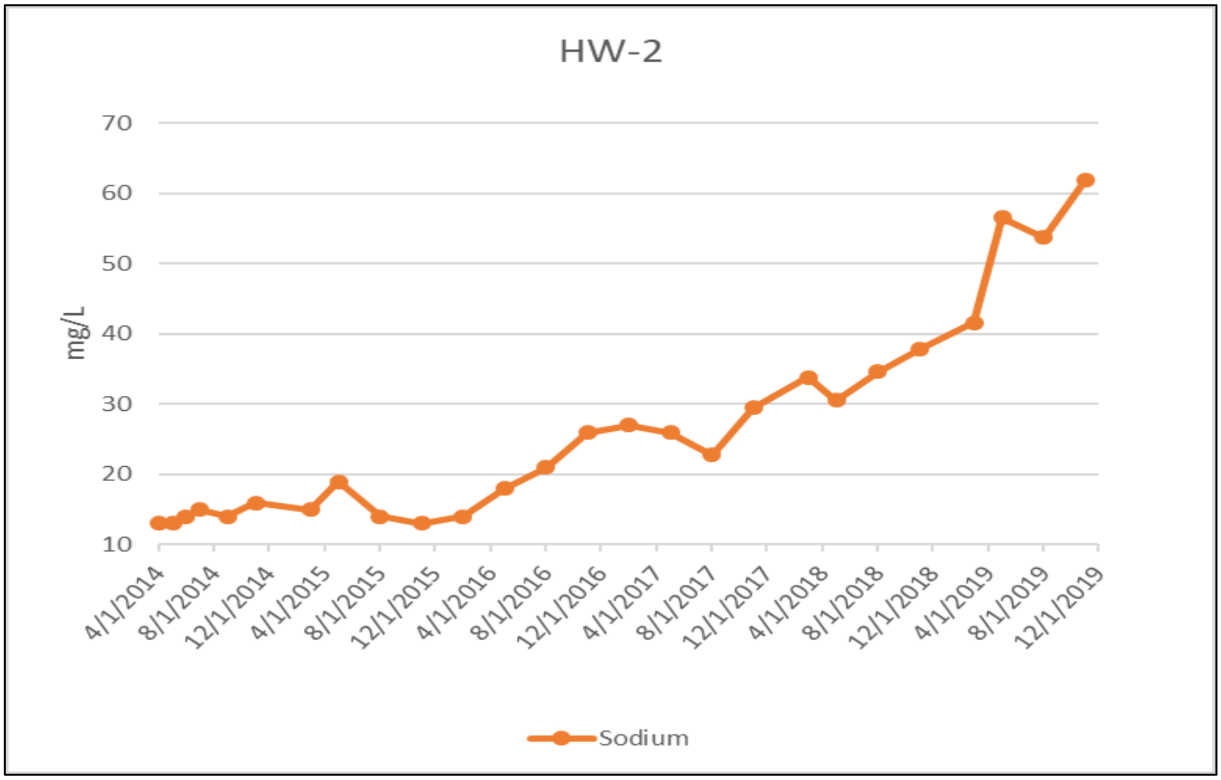

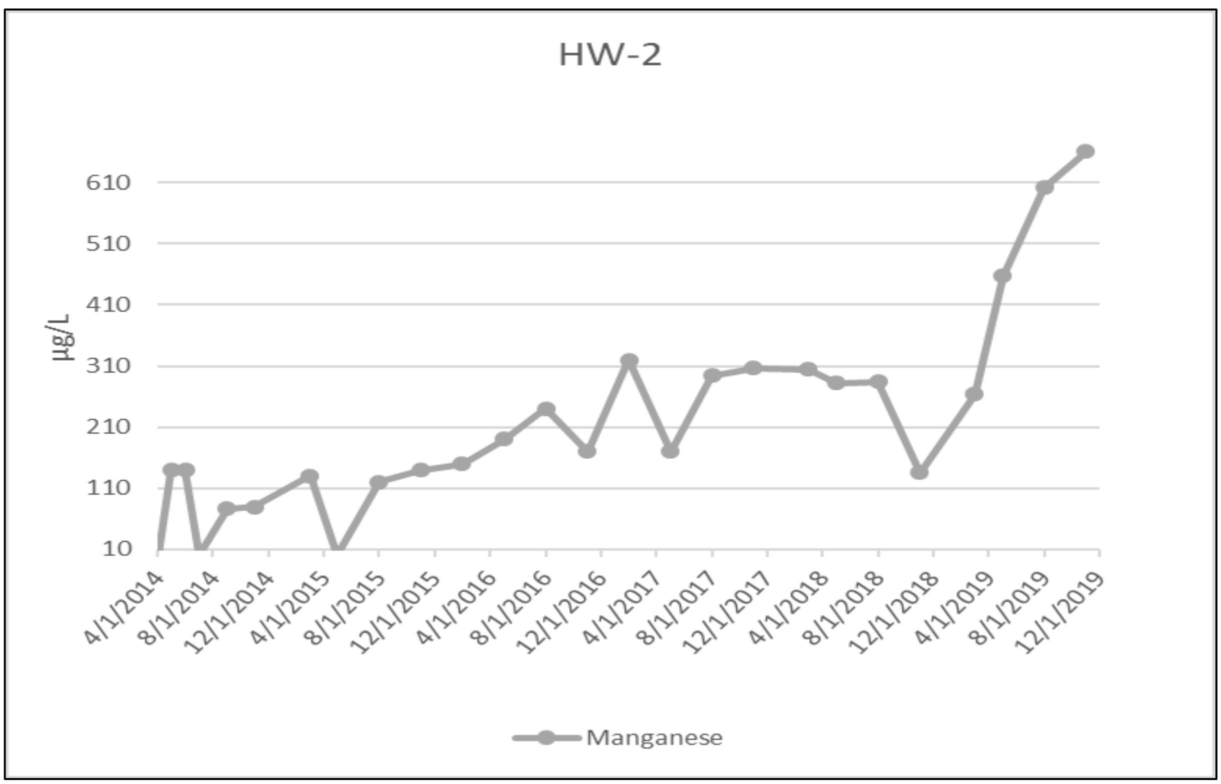

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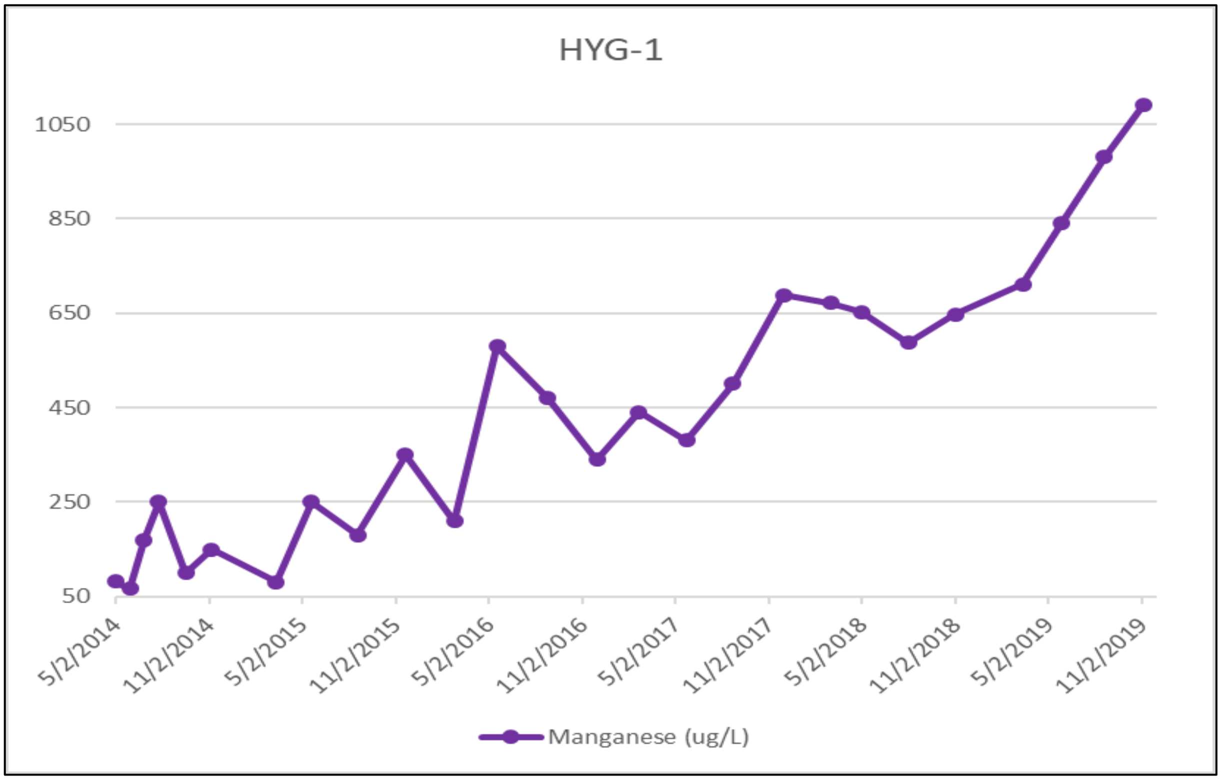

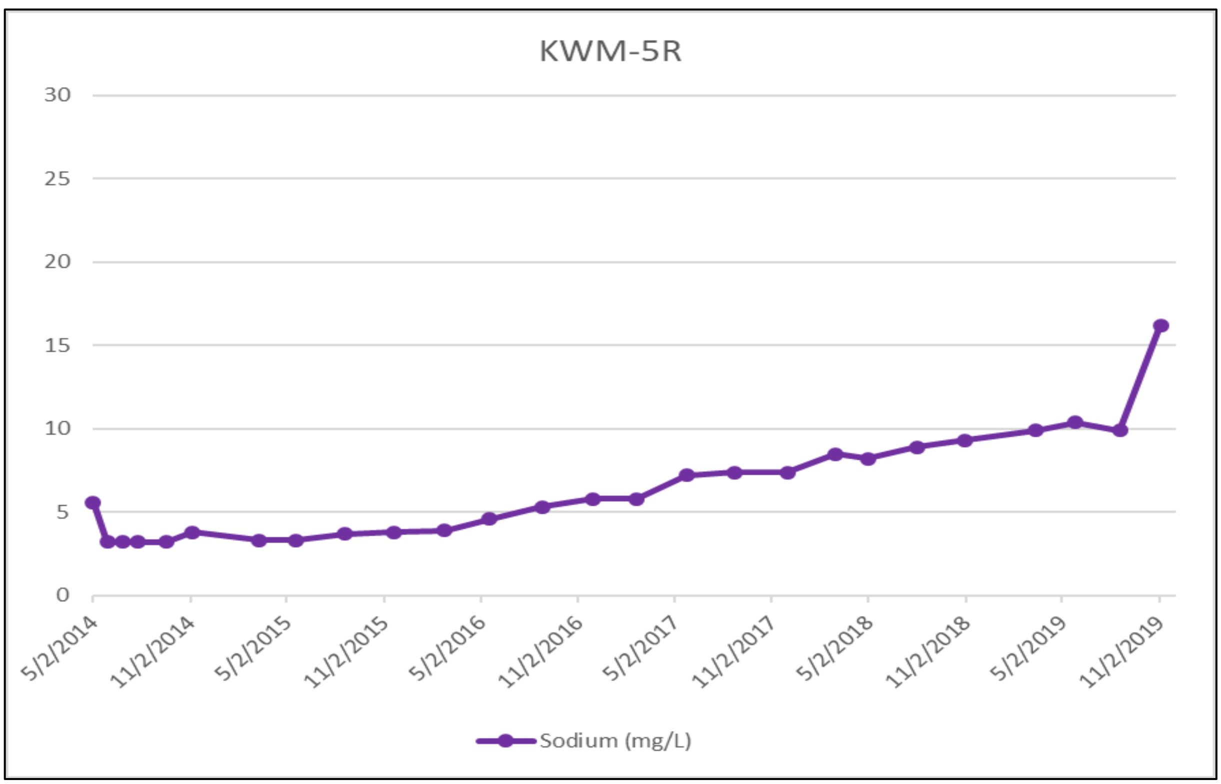

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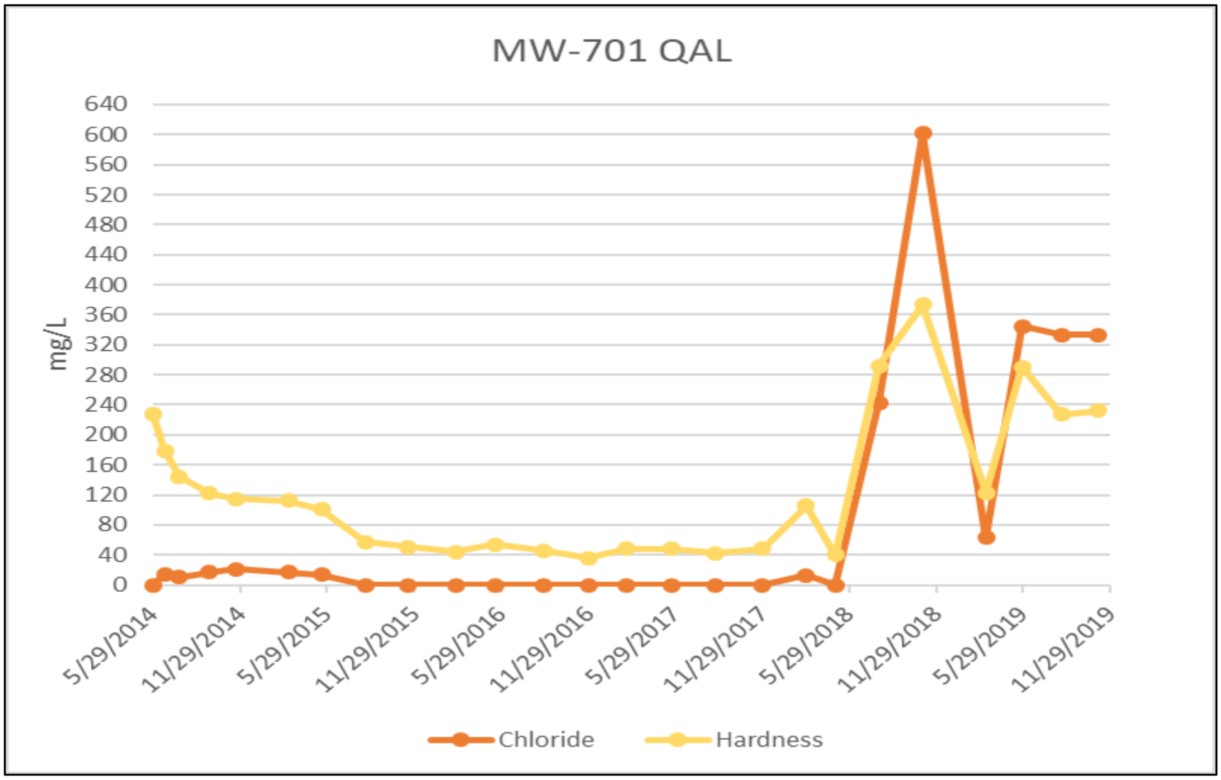

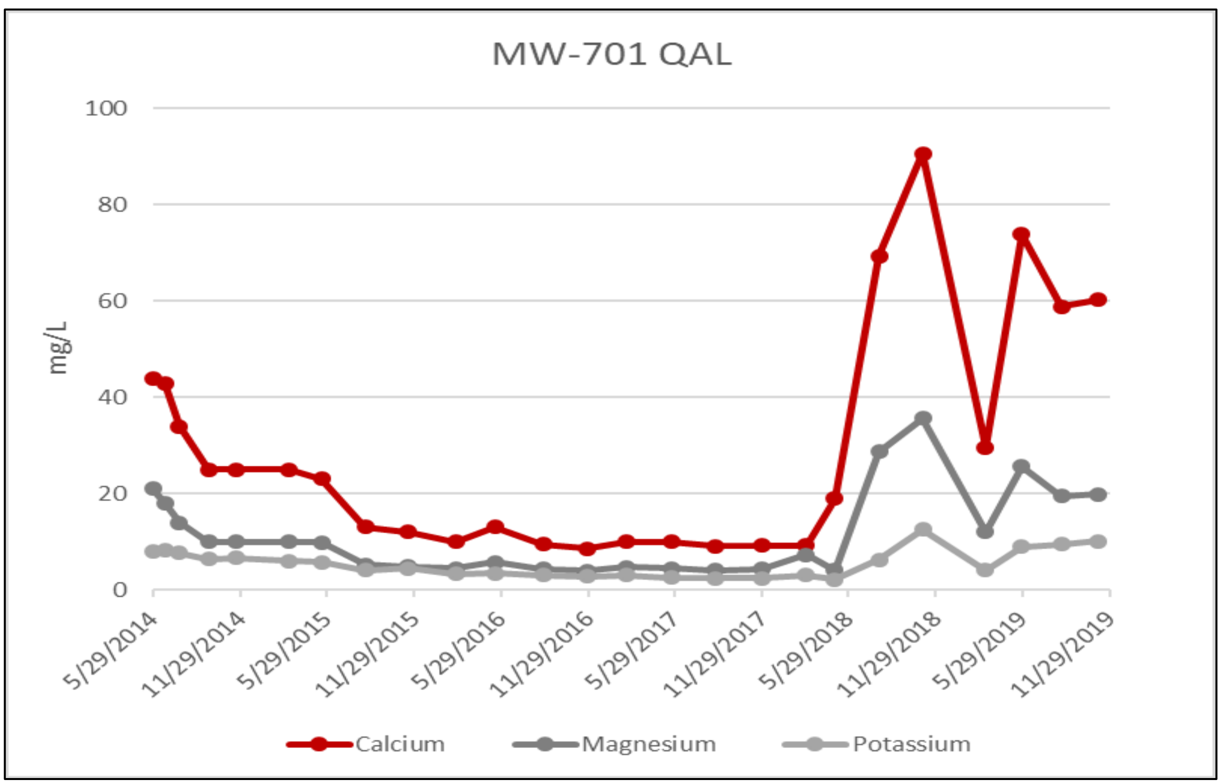

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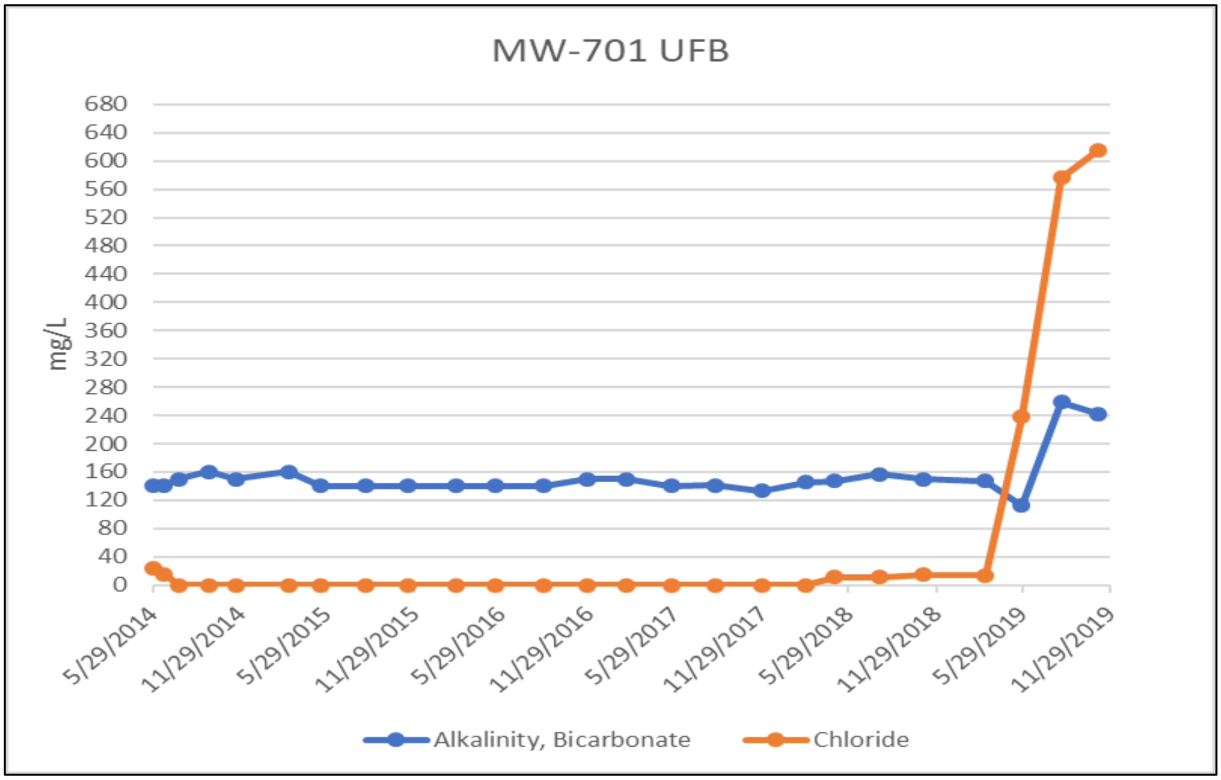

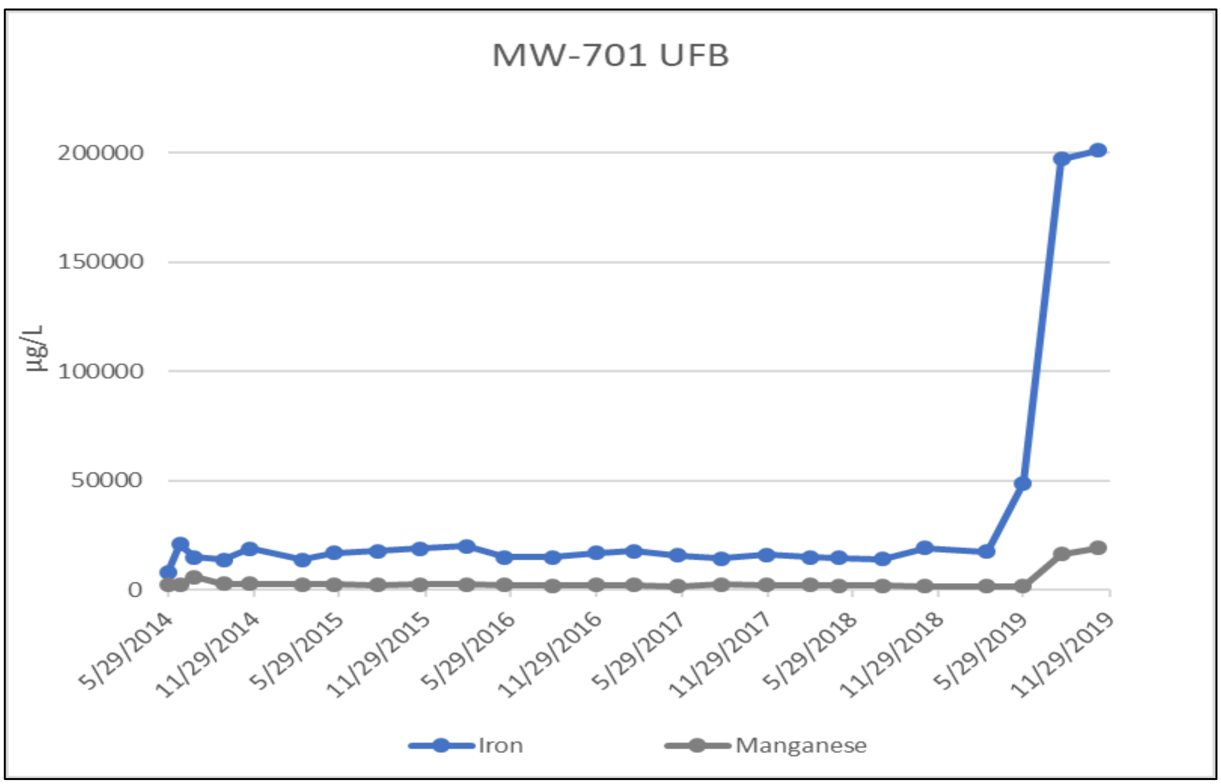

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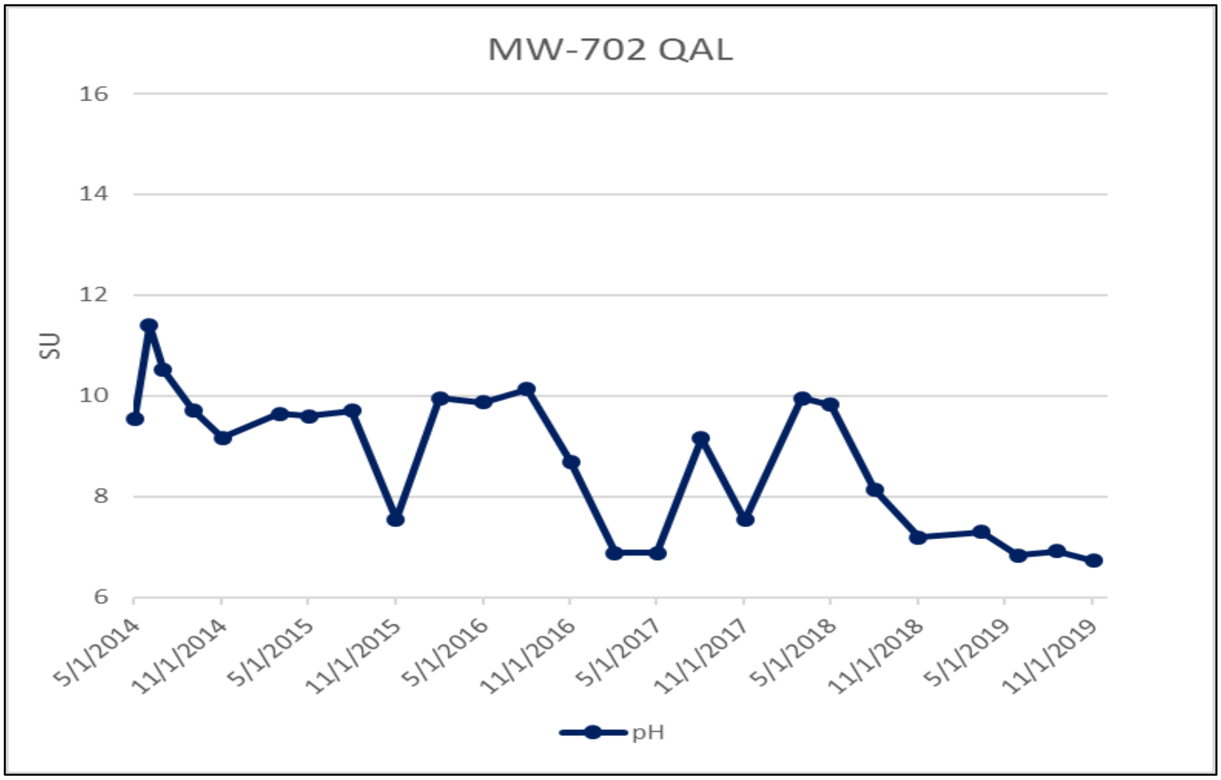

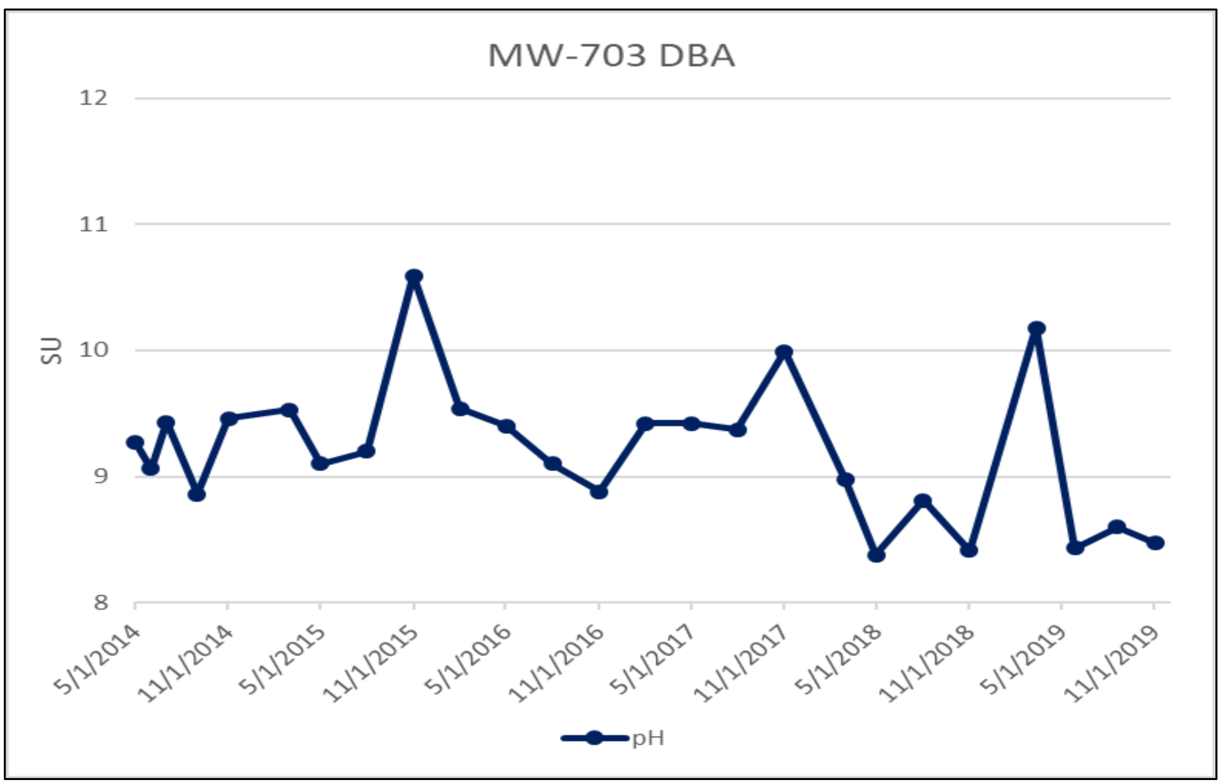

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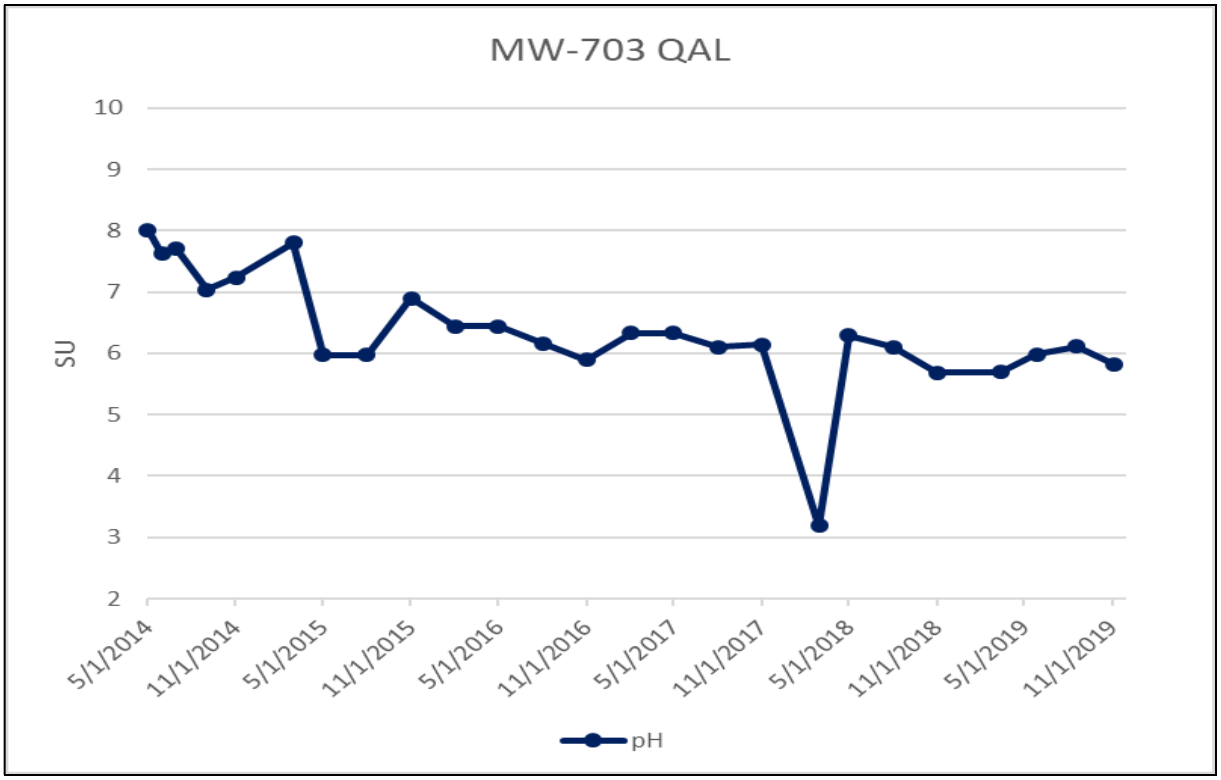

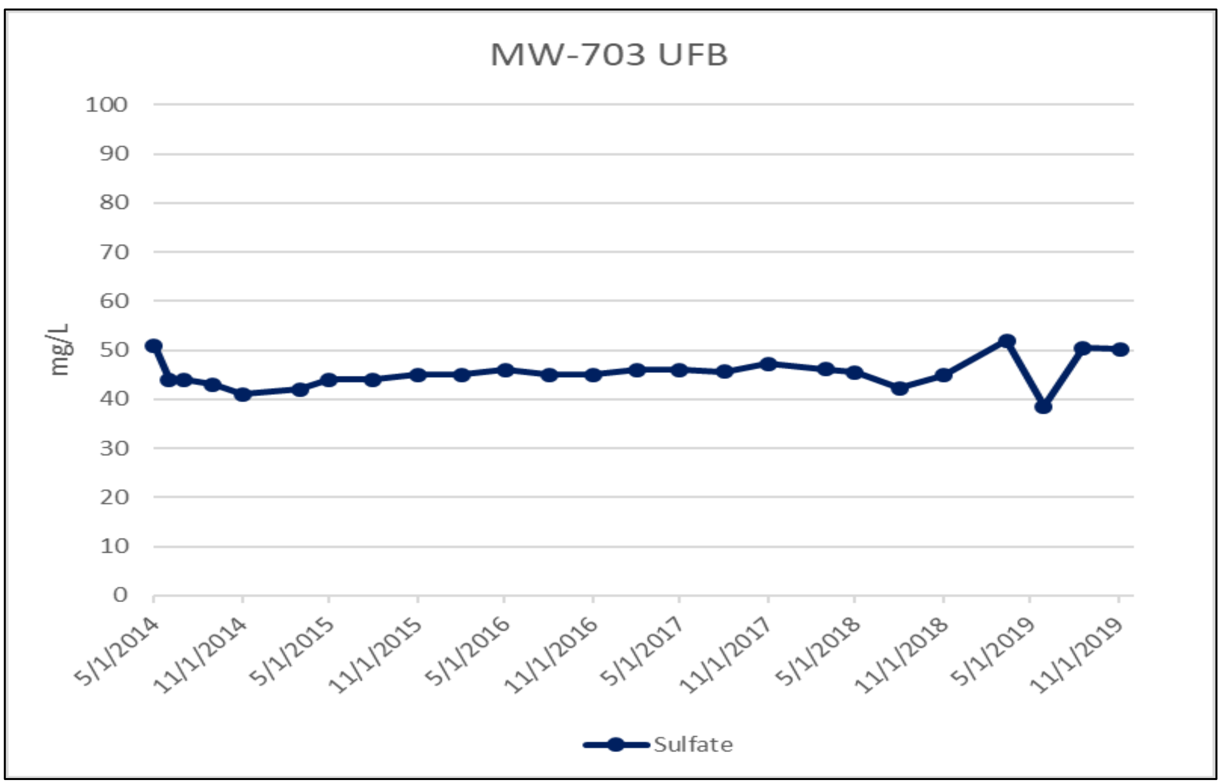

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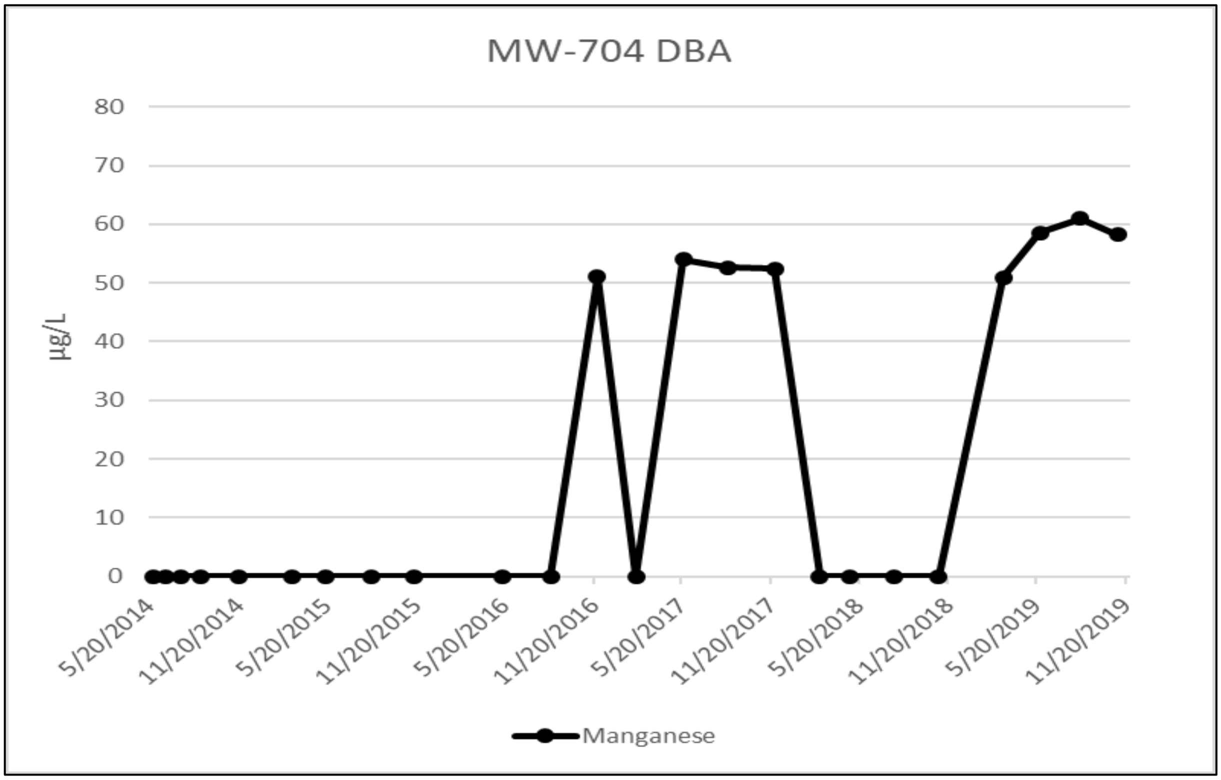
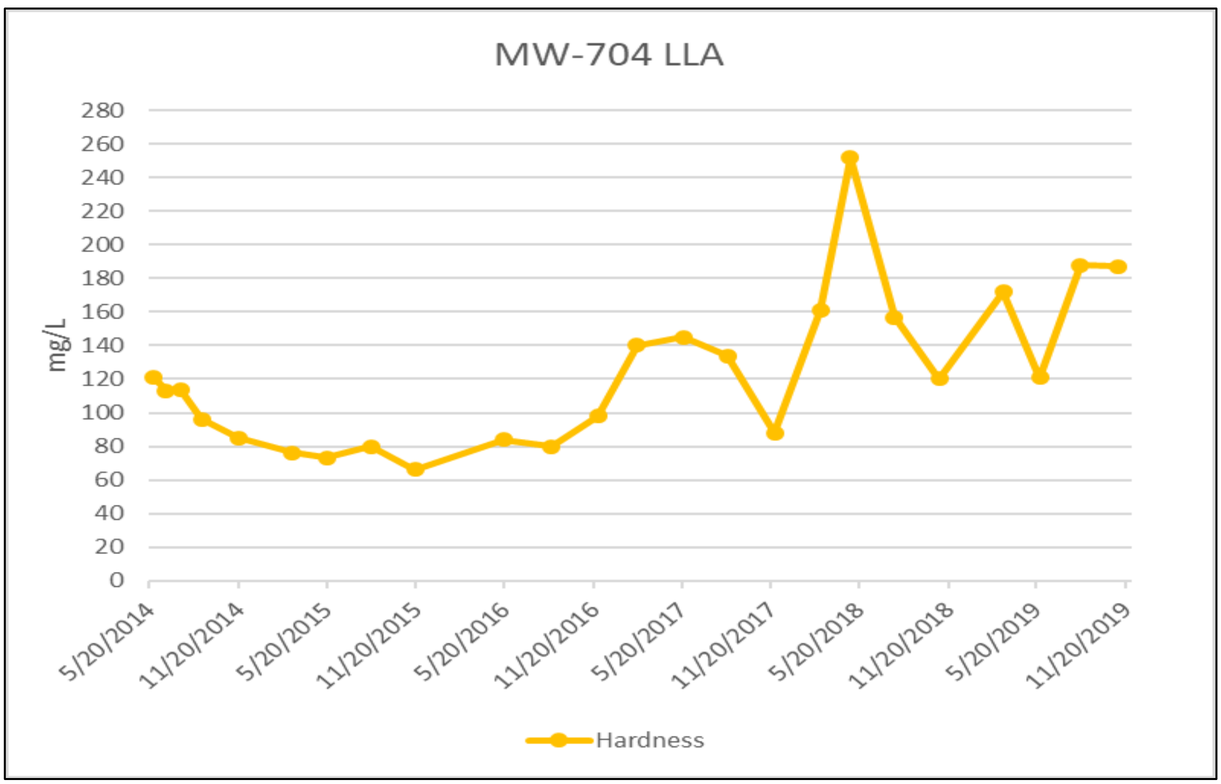
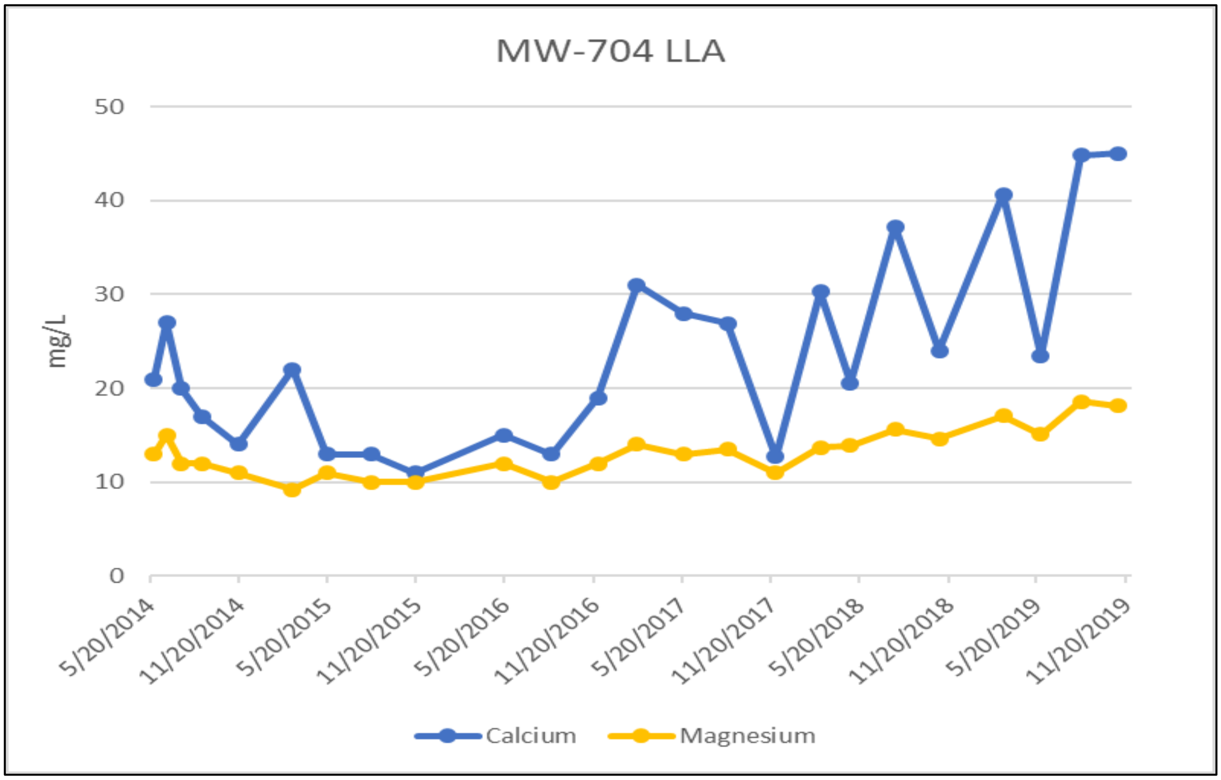
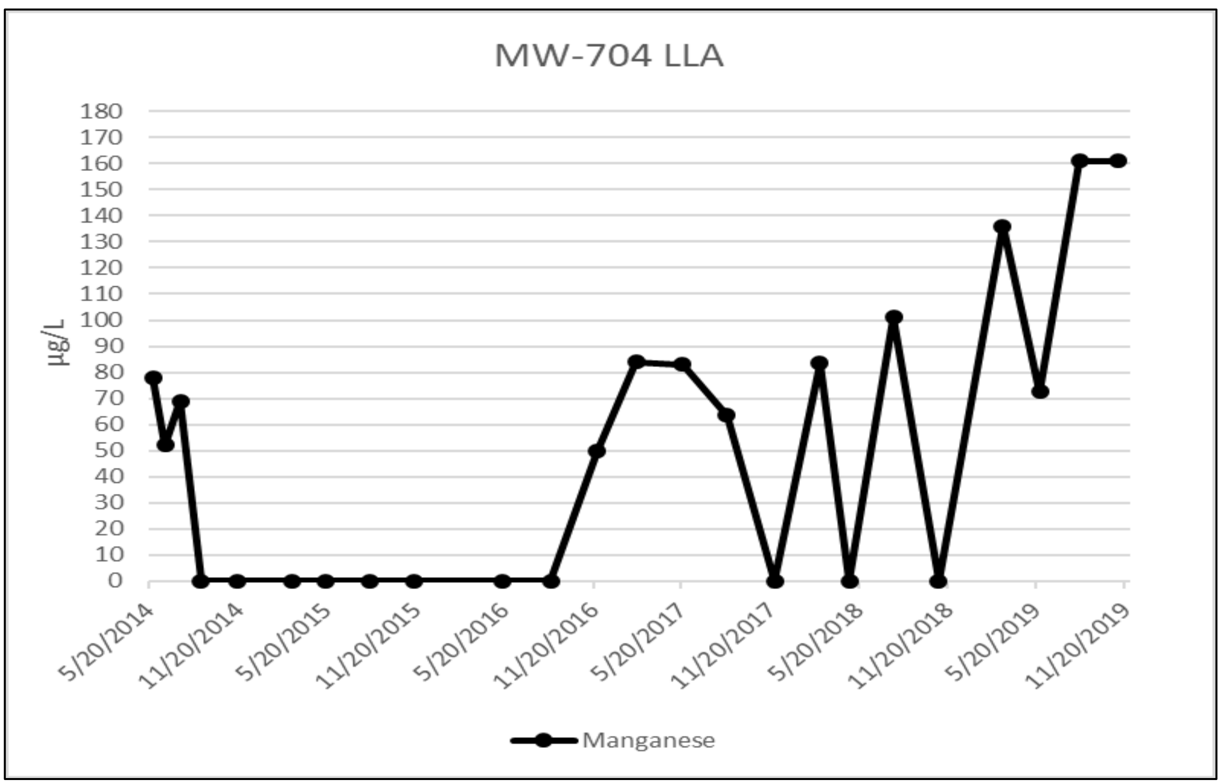
Groundwater Trend Analysis Summary Charts
Humboldt Mill



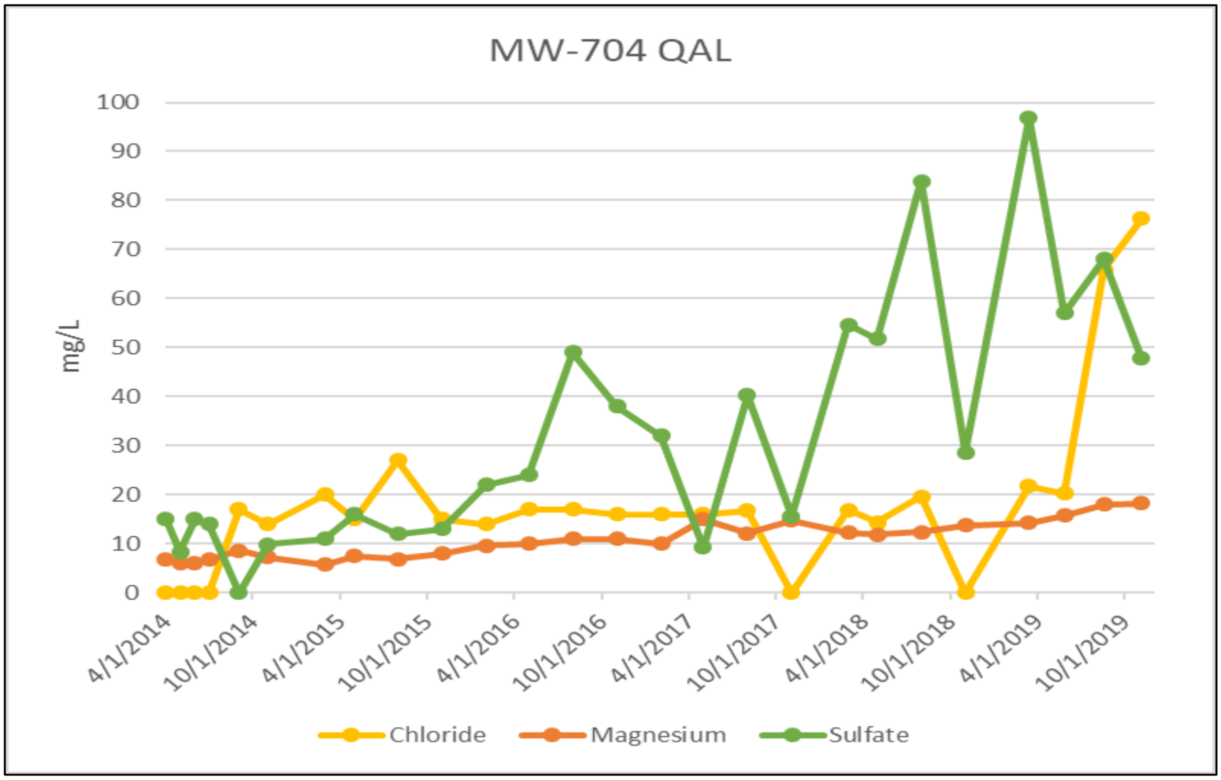


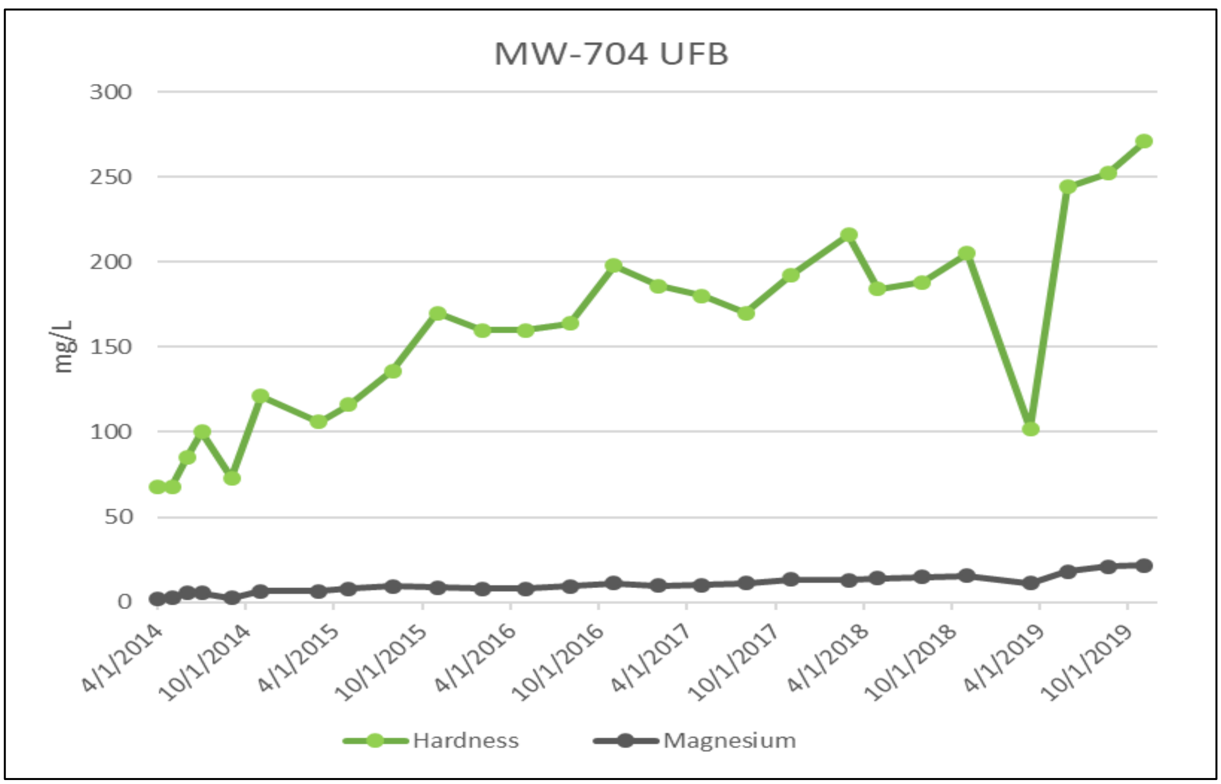
2019
Groundwater Trend Analysis Summary Charts
Humboldt Mill



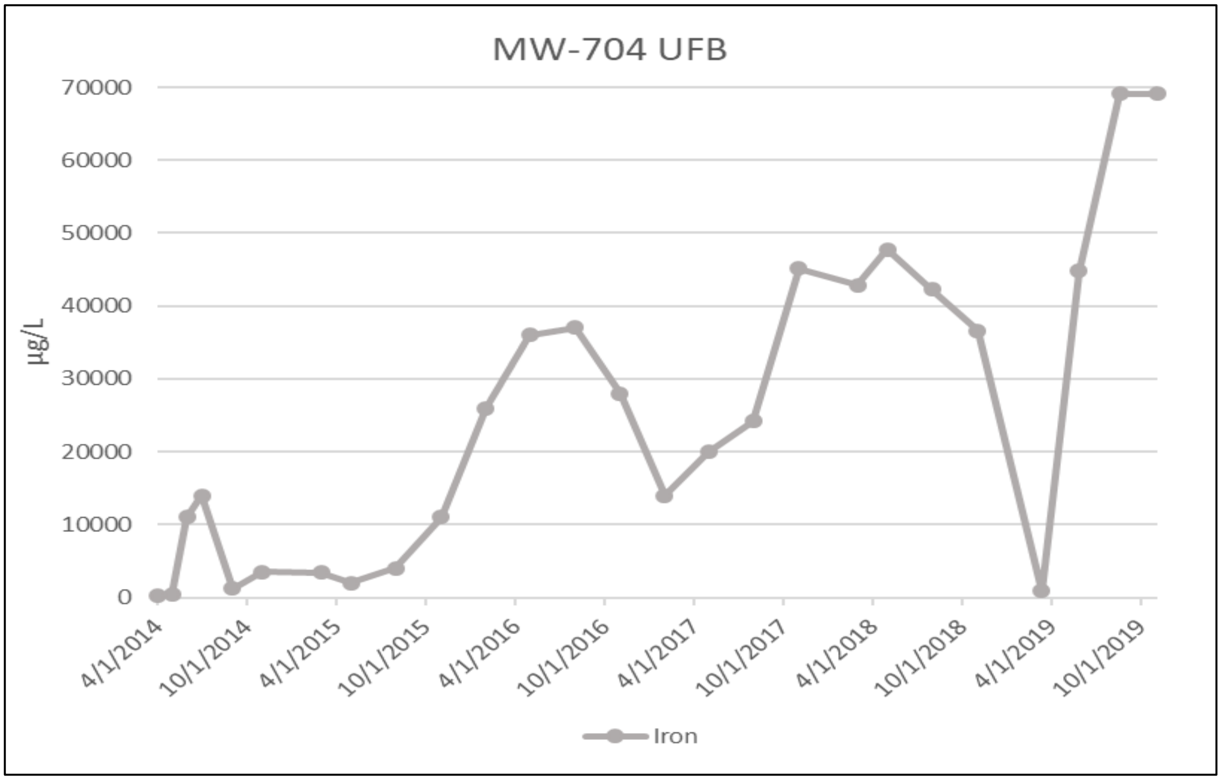


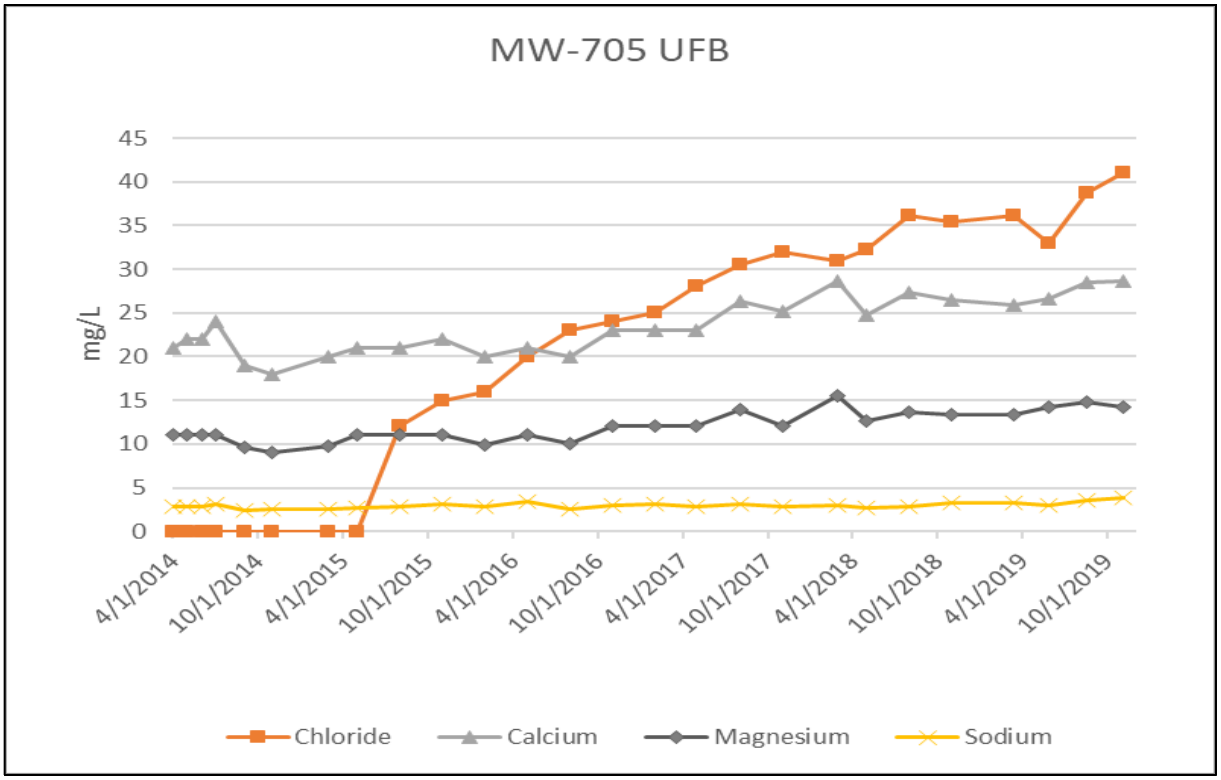
2019
Groundwater Trend Analysis Summary Charts
Humboldt Mill



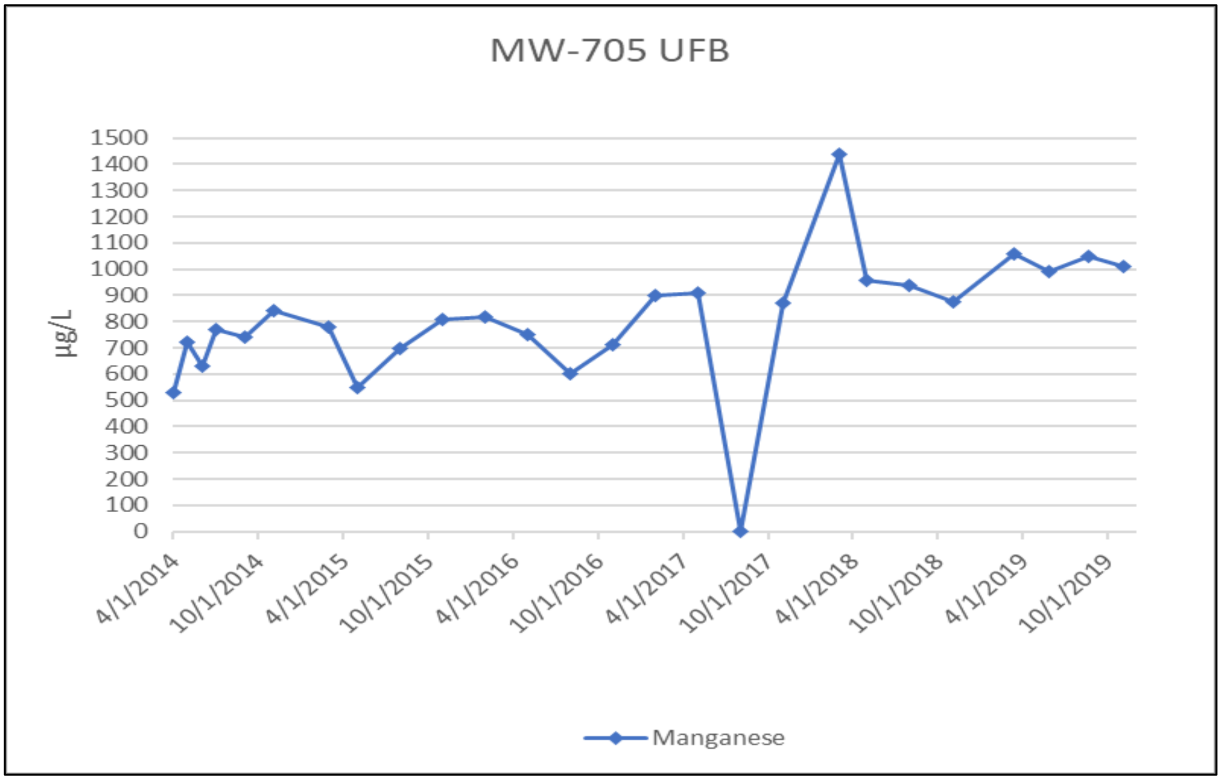


2019
Groundwater Trend Analysis Summary Charts
Humboldt Mill





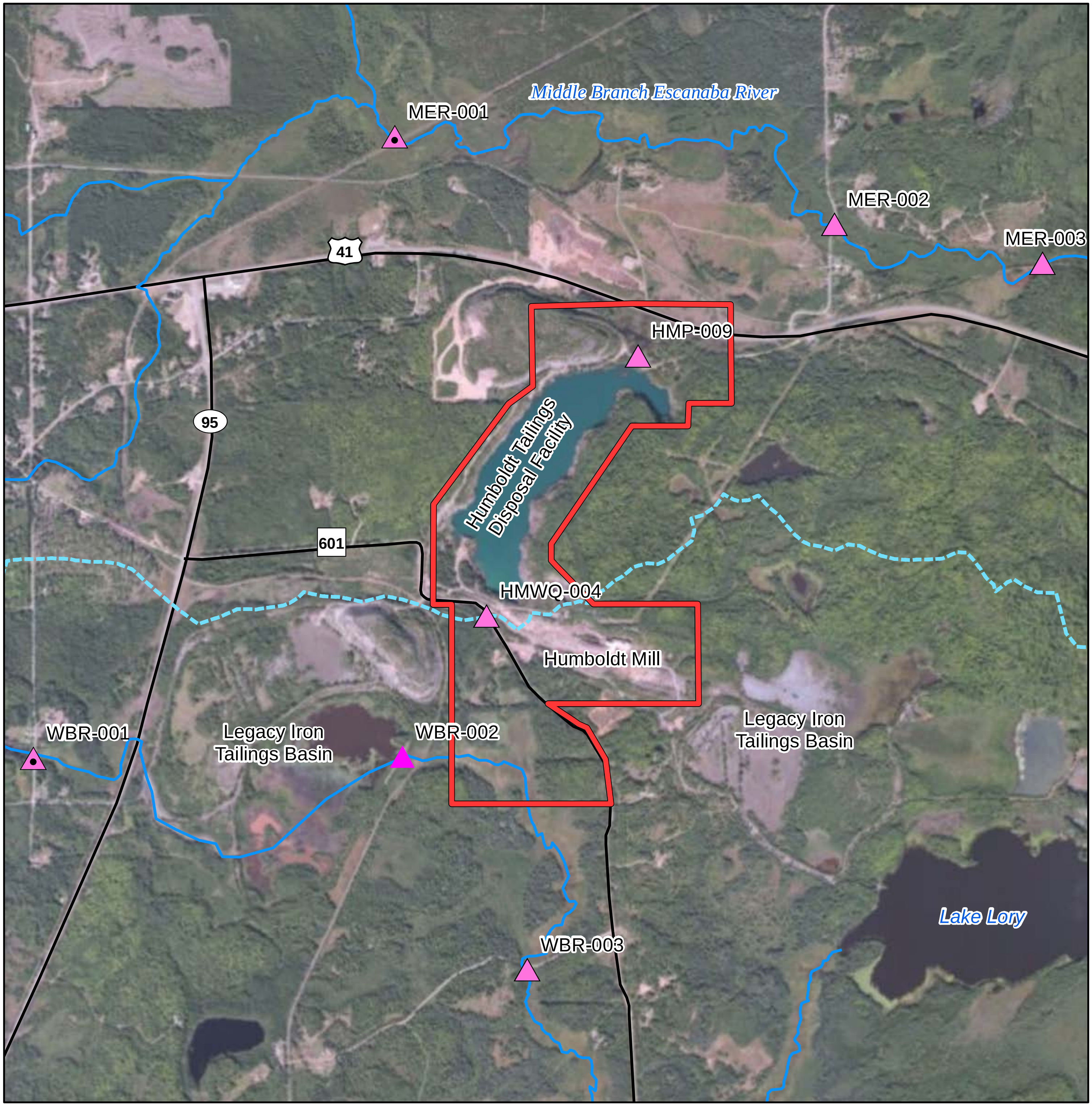
2019
Groundwater Trend Analysis Summary Charts
Humboldt Mill



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

2019
Mine Permit Surface Water Quality Monitoring Data
Benchmark Summary Table

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

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 2018 and Q1 2019) sampling events. 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.
NM = Not measured during the sampling event

2019
Mine Permit Surface Water Quality Monitoring Data
HMWQ-004 (Compliance - Mill Subwatershed)
Humboldt Mill

Parameter	Unit	Permit RL	HMWQ-004 Seasonal Benchmark				HMWQ-004 Data (Q1-Q4 2019)			
			Q1	Q2	Q3	Q4	Q1 2019	Q2 2019	Q3 2019	Q4 2019
			Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain	Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain
							03/18/19	06/04/19	08/22/19	11/07/19
Field										
D.O.	ppm	-	-	-	-	-	NM	NM	NM	NM
ORP	mV	-	-	-	-	-	NM	NM	NM	NM
pH	SU	-	-	-	-	-	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	-	-	-	-	-	NM	NM	NM	NM
Antimony	ug/L	-	-	-	-	-	NM	NM	NM	NM
Arsenic	ug/L	-	-	-	-	-	NM	NM	NM	NM
Barium	ug/L	-	-	-	-	-	NM	NM	NM	NM
Beryllium	ug/L	-	-	-	-	-	NM	NM	NM	NM
Boron	ug/L	-	-	-	-	-	NM	NM	NM	NM
Cadmium	ug/L	-	-	-	-	-	NM	NM	NM	NM
Chromium	ug/L	-	-	-	-	-	NM	NM	NM	NM
Cobalt	ug/L	-	-	-	-	-	NM	NM	NM	NM
Copper	ug/L	-	-	-	-	-	NM	NM	NM	NM
Iron	ug/L	-	-	-	-	-	NM	NM	NM	NM
Lead	ug/L	-	-	-	-	-	NM	NM	NM	NM
Lithium	ug/L	-	-	-	-	-	NM	NM	NM	NM
Manganese	ug/L	-	-	-	-	-	NM	NM	NM	NM
Mercury	ng/L	-	-	-	-	-	NM	NM	NM	NM
Molybdenum	ug/L	-	-	-	-	-	NM	NM	NM	NM
Nickel	ug/L	-	-	-	-	-	NM	NM	NM	NM
Selenium	ug/L	-	-	-	-	-	NM	NM	NM	NM
Silver	ug/L	-	-	-	-	-	NM	NM	NM	NM
Thallium	ug/L	-	-	-	-	-	NM	NM	NM	NM
Vanadium	ug/L	-	-	-	-	-	NM	NM	NM	NM
Zinc	ug/L	-	-	-	-	-	NM	NM	NM	NM
Major Anions										
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	NM	NM	NM	NM
Alkalinity, Carbonate	mg/L	-	-	-	-	-	NM	NM	NM	NM
Chloride	mg/L	-	-	-	-	-	NM	NM	NM	NM
Fluoride	mg/L	-	-	-	-	-	NM	NM	NM	NM
Nitrogen, Ammonia	mg/L	-	-	-	-	-	NM	NM	NM	NM
Nitrogen, Nitrate	mg/L	-	-	-	-	-	NM	NM	NM	NM
Nitrogen, Nitrite	mg/L	-	-	-	-	-	NM	NM	NM	NM
Sulfate	mg/L	-	-	-	-	-	NM	NM	NM	NM
Sulfide	mg/L	-	-	-	-	-	NM	NM	NM	NM
Major Cations										
Calcium	mg/L	-	-	-	-	-	NM	NM	NM	NM
Magnesium	mg/L	-	-	-	-	-	NM	NM	NM	NM
Potassium	mg/L	-	-	-	-	-	NM	NM	NM	NM
Sodium	mg/L	-	-	-	-	-	NM	NM	NM	NM
General										
Hardness	mg/L	-	-	-	-	-	NM	NM	NM	NM
Total Dissolved Solids	mg/L	-	-	-	-	-	NM	NM	NM	NM
Total Suspended Solids	mg/L	-	-	-	-	-	NM	NM	NM	NM

2019
Mine Permit Surface Water Quality Monitoring Data
HMP-009 (Compliance - HTDF Subwatershed)
Humboldt Mill

Parameter	Unit	Permit RL	HMP-009 Seasonal Benchmark	HMP-009 Data (Q1-Q4 2019)			
				Q1 2019	Q2 2019	Q3 2019	Q4 2019
				Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain
				03/18/19	06/04/19	08/22/19	11/07/19
Field							
D.O.	ppm	-	-	NM	**5.8**	**2.8**	**11**
ORP	mV	-	-	NM	**324**	**204**	**247**
pH	SU	-	**7.0-8.0**	NM	**6.78**	**7.28**	**6.97**
Specific Conductance	uS/m	-	-	NM	**655**	**209**	**158**
Temperature	C	-	-	NM	**11**	**14**	**1.6**
Turbidity	NTU	-	-	NM	**3.0**	**3.1**	**3.1**
Flow	cfs	-	-	-	-	-	-
Metals							
Aluminum	ug/L	**50**	**200 (p)**	NM	-	<50.0	-
Antimony	ug/L	**1.0**	**12**	NM	-	<1.0	-
Arsenic	ug/L	**1.0**	**2.2**	NM	<1.0	**1.2**	<1.0
Barium	ug/L	**1.0**	**27**	NM	-	**7.7**	-
Beryllium	ug/L	**1.0**	**0.67**	NM	-	<1.0	-
Boron	ug/L	**1.0**	**113**	NM	-	**21**	-
Cadmium	ug/L	**0.02**	**0.10**	NM	-	<0.007	-
Chromium	ug/L	**1.0**	**1.3**	NM	-	<1.0	-
Cobalt	ug/L	**0.10**	**3.0**	NM	-	**0.21**	-
Copper	ug/L	**0.05**	**7.9**	NM	**1.8**	**1.1**	**1.3**
Iron	ug/L	**10**	**1620**	NM	**859**	**1280**	**1130**
Lead	ug/L	**0.05**	**1.0**	NM	**0.13**	**0.05**	**0.13**
Lithium	ug/L	**8.0**	**5.3**	NM	-	<8.0	-
Manganese	ug/L	**1.0**	**337**	NM	**27**	**86**	**69**
Mercury	ng/L	**0.50**	**1.1**	NM	**1.6**	**2.4**	**3.9**
Molybdenum	ug/L	**1.0**	**13**	NM	-	**1.4**	-
Nickel	ug/L	**0.20**	**17**	NM	**3.1**	**3.2**	**2.1**
Selenium	ug/L	**0.07**	**0.36**	NM	-	**0.01**	-
Silver	ug/L	**0.20**	**0.12**	NM	-	<0.20	-
Thallium	ug/L	**1.0**	**0.68**	NM	-	<1.0	-
Vanadium	ug/L	**1.0**	**1.7**	NM	-	<1.0	-
Zinc	ug/L	**0.50**	**6.1**	NM	**2.9**	**0.48**	**2.0**
Major Anions							
Alkalinity, Bicarbonate	mg/L	**2.0**	**124**	NM	**21**	**60**	**24**
Alkalinity, Carbonate	mg/L	**2.0**	**2.0**	NM	<2.0	<2.0	<2.0
Chloride	mg/L	**1.0**	**15**	NM	**6.0**	**16**	**7.0**
Fluoride	mg/L	**0.10**	**0.41**	NM	<0.10	<0.10	<0.10
Nitrogen, Ammonia	mg/L	**0.50**	**2.0 (p)**	NM	<0.025	<0.025	<0.025
Nitrogen, Nitrate	mg/L	**0.50**	**2.5**	NM	<0.10	<0.10	<0.10
Nitrogen, Nitrite	mg/L	**0.50**	**0.34**	NM	<0.10	<0.10	<0.10
Sulfate	mg/L	**1.0**	**138**	NM	**5.5**	**9.8**	**6.2**
Sulfide	mg/L	**0.50**	**3.0**	NM	<0.20	<0.20	<0.20
Major Cations							
Calcium	mg/L	**0.50**	**68**	NM	**6.7**	**19**	**8.5**
Magnesium	mg/L	**0.50**	**26**	NM	**2.2**	**5.5**	**2.6**
Potassium	mg/L	**0.50**	**9.4**	NM	**0.67**	**1.4**	**0.72**
Sodium	mg/L	**0.50**	**15**	NM	**4.1**	**10**	**4.7**
General							
Hardness	mg/L	**2.0**	**251**	NM	**26**	**71**	**32**
Total Dissolved Solids	mg/L	**50**	**361**	NM	**27**	**108**	**72**
Total Suspended Solids	mg/L	**3.3**	**13**	NM	<5.0	**9.0**	<5.0

* - Recommended Benchmarks are for Q2 - Insufficient Q3 Data to Develop Benchmarks

2019
Mine Permit Surface Water Quality Monitoring Data
MER-001 (Reference - HTDF Subwatershed)
Humboldt Mill

Parameter	Unit	Permit RL	MER-001 Seasonal Benchmark				MER-001 Data (Q1-Q4 2019)			
			Q1	Q2	Q3	Q4	Q1 2019	Q2 2019	Q3 2019	Q4 2019
			Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain	Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain
							03/18/19	06/04/19	08/22/19	11/07/19
Field										
D.O.	ppm	-	-	-	-	-	11	8.9	8.3	13
ORP	mV	-	-	-	-	-	239	173	177	221
pH	SU	-	6.20-7.20	5.70-6.70	6.10-7.10	5.40-6.40	6.87	6.72	7.64	7.52
Specific Conductance	uS/cm	-	-	-	-	-	76	87	156	118
Temperature	C	-	-	-	-	-	-0.04	11	13	0.62
Turbidity	NTU	-	-	-	-	-	1.9	2.4	12	2.6
Flow	cfs	-	-	-	-	-	-	-	5.1	34
Metals										
Aluminum	ug/L	-	-	-	200	-	-	-	<50.0	-
Antimony	ug/L	-	-	-	3.5	-	-	-	<1.0	-
Arsenic	ug/L	1.0	3.6	4.0	2.8	1.8	< 1.0	<1.0	2.0	<1.0
Barium	ug/L	-	-	-	11	-	-	-	8.2	-
Beryllium	ug/L	-	-	-	2.5	-	-	-	<1.0	-
Boron	ug/L	-	-	-	40	-	-	-	<10.0	-
Cadmium	ug/L	-	-	-	0.08	-	-	-	0.01	-
Chromium	ug/L	-	-	-	1.1	-	-	-	<1.0	-
Cobalt	ug/L	-	-	-	0.38	-	-	-	0.11	-
Copper	ug/L	0.05	0.62	0.98	0.68	1.6	0.56	0.59	0.23	0.46
Iron	ug/L	10.0	2413	1206	3532	2136	881	823	1880	1110
Lead	ug/L	0.05	0.21	0.18	0.35	0.66	0.12	0.12	0.06	0.14
Lithium	ug/L	-	-	-	32	-	-	-	<8.0	-
Manganese	ug/L	1.0	149	101	242	124	51	75	86	95
Mercury	ng/L	0.50	5.8	6.9	8.1	4.6	2.7	1.7	1.3	3.4
Molybdenum	ug/L	-	-	-	4.0	-	-	-	<1.0	-
Nickel	ug/L	0.20	1.1	0.68	1.5	0.74	0.45	0.63	0.45	0.80
Selenium	ug/L	-	-	-	0.13	-	-	-	0.08	-
Silver	ug/L	-	-	-	0.80	-	-	-	<0.20	-
Thallium	ug/L	-	-	-	1.5	-	-	-	<1.0	-
Vanadium	ug/L	-	-	-	4.0	-	-	-	<1.0	-
Zinc	ug/L	0.50	39	9.3	5.5	6.3	2.6	2.4	0.58	1.6
Major Anions										
Alkalinity, Bicarbonate	mg/L	2.0	41	26	48	24	13	15	46	16
Alkalinity, Carbonate	mg/L	2.0	8.0	8.0	8.0	8.0	< 2.0	<2.0	<2.0	<2.0
Chloride	mg/L	1.0	13	8.4	16	14	2.3	5.4	13	4.3
Fluoride	mg/L	0.10	0.40	0.40	0.40	0.40	< 0.10	<0.10	<0.10	<0.10
Nitrogen, Ammonia	mg/L	0.50	2.0	2.0	2.0	2.0	<0.025	<0.025	<0.025	<0.025
Nitrogen, Nitrate	mg/L	0.50	0.17	2.0	2.0	2.0	0.273	< 0.10	< 0.10	< 0.10
Nitrogen, Nitrite	mg/L	0.50	2.0	2.0	2.0	2.0	< 0.10	< 0.10	< 0.10	< 0.10
Sulfate	mg/L	1.0	9.0	4.0	4.0	6.4	2.4	3.3	5.4	3.2
Sulfide	mg/L	5.0	20	20	20	20	< 0.20	<0.20	<0.20	<0.20
Major Cations										
Calcium	mg/L	0.50	14	7.6	15	10	5.3	5.9	15	5.9
Magnesium	mg/L	0.50	3.8	2.4	4.1	3.0	1.6	1.8	4.2	1.7
Potassium	mg/L	0.50	0.93	0.69	1.1	1.4	0.78	0.50	0.85	<0.50
Sodium	mg/L	0.50	6.7	5.1	8.5	6.7	1.7	3.3	7.6	2.6
General										
Hardness	mg/L	2.0	51	31	59	44	20	22	55	22
Total Dissolved Solids	mg/L	50	106	113	200	200	37	27	79	39
Total Suspended Solids	mg/L	3.3	3.4	7.6	13	20	< 5.0	<5.0	10	<5.0

2019
Mine Permit Surface Water Quality Monitoring Data
MER-002 (Compliance - HTDF Subwatershed)
Humboldt Mill

Parameter	Unit	Permit RL	MER-002 Seasonal Benchmark				MER-002 Data (Q1-Q4 2019)			
			Q1	Q2	Q3	Q4	Q1 2019	Q2 2019	Q3 2019	Q4 2019
			Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain	Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain
							03/18/19	06/04/19	08/22/19	11/07/19
Field										
D.O.	ppm	-	-	-	-	-	11	8.9	8.2	12
ORP	mV	-	-	-	-	-	266	172	155	113
pH	SU	-	6.20-7.20	5.70-6.70	5.90-6.90	5.30-6.30	6.93	6.58	7.48	7.49
Specific Conductance	uS/cm	-	-	-	-	-	95	85	185	142
Temperature	C	-	-	-	-	-	-0.06	11	16	0.04
Turbidity	NTU	-	-	-	-	-	2.2	1.9	6.5	3.0
Flow	cfs	-	-	-	-	-	-	85	6.9	37
Metals										
Aluminum	ug/L	-	-	-	461	-	-	-	<50.0	-
Antimony	ug/L	-	-	-	3.5	-	-	-	<1.0	-
Arsenic	ug/L	1.0	2.8	0.59	5.3	2.1	< 1.0	<1.0	2.6	1.0
Barium	ug/L	-	-	-	21	-	-	-	9.7	-
Beryllium	ug/L	-	-	-	2.5	-	-	-	<1.0	-
Boron	ug/L	-	-	-	40	-	-	-	15	-
Cadmium	ug/L	-	-	-	0.08	-	-	-	0.007	-
Chromium	ug/L	-	-	-	4.0	-	-	-	<1.0	-
Cobalt	ug/L	-	-	-	0.40	-	-	-	0.25	-
Copper	ug/L	0.05	1.1	0.97	1.4	0.72	0.60	0.61	0.26	0.41
Iron	ug/L	10	3081	1679	6901	2831	1060	1160	2580	1420
Lead	ug/L	0.05	0.34	0.19	0.34	0.15	0.14	0.14	0.06	0.13
Lithium	ug/L	-	-	-	1.4	-	-	-	<8.0	-
Manganese	ug/L	1.0	212	134	628	347	68	115	210	148
Mercury	ng/L	0.50	5.1	6.6	7.5	4.3	3.4	1.3	1.6	3.2
Molybdenum	ug/L	-	-	-	4.0	-	-	-	<1.0	-
Nickel	ug/L	0.20	1.2	0.71	2.1	0.82	0.53	0.81	0.58	0.73
Selenium	ug/L	-	-	-	0.80	-	-	-	0.07	-
Silver	ug/L	-	-	-	0.80	-	-	-	<0.20	-
Thallium	ug/L	-	-	-	4.0	-	-	-	<1.0	-
Vanadium	ug/L	-	-	-	4.7	-	-	-	<1.0	-
Zinc	ug/L	0.50	6.3	7.6	2.0	5.3	2.7	2.7	0.65	1.7
Major Anions										
Alkalinity, Bicarbonate	mg/L	2.0	46	25	54	31	15	16	51	21
Alkalinity, Carbonate	mg/L	2.0	8.0	4.0	8.0	8.0	< 2.0	<2.0	<2.0	<2.0
Chloride	mg/L	1.0	14	7.4	17	18	5.7	5.7	15	6.2
Fluoride	mg/L	0.10	0.40	0.40	0.40	0.40	< 0.10	<0.10	<0.10	<0.10
Nitrogen, Ammonia	mg/L	0.50	2.0	2.0	2.0	2.0	< 0.025	< 0.025	< 0.025	< 0.025
Nitrogen, Nitrate	mg/L	0.50	0.52	0.21	2.0	2.0	0.27	< 0.10	< 0.10	< 0.10
Nitrogen, Nitrite	mg/L	0.50	2.0	2.0	2.0	2.0	< 0.10	< 0.10	< 0.10	< 0.10
Sulfate	mg/L	1.0	14	7.9	16	4.0	3.7	4.7	12	5.4
Sulfide	mg/L	5.0	20	20	20	20	< 0.20	<0.20	<0.20	<0.20
Major Cations										
Calcium	mg/L	0.50	17	9.2	18	15	6.0	6.5	18	7.3
Magnesium	mg/L	0.50	4.6	2.7	5.2	4.1	1.8	2.0	4.9	2.2
Potassium	mg/L	0.50	1.3	0.68	1.4	1.6	0.83	0.60	1.2	0.56
Sodium	mg/L	0.50	8.5	5.1	9.9	9.1	3.4	3.9	9.6	4.2
General										
Hardness	mg/L	2.0	60	34	70	53	23	25	64	27
Total Dissolved Solids	mg/L	50	210	104	200	200	45	32	93	56
Total Suspended Solids	mg/L	3.3	5.6	7.8	21	123	< 5.0	<5.0	<5.0	<5.0

2019
Mine Permit Surface Water Quality Monitoring Data
MER-003 (Compliance - HTDF Subwatershed)
Humboldt Mill

Parameter	Unit	Permit RL	MER-003 Seasonal Benchmark				MER-003 Data (Q1-Q4 2019)			
			Q1	Q2	Q3	Q4	Q1 2019	Q2 2019	Q3 2019	Q4 2019
			Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain	Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain
							03/18/19	06/04/19	08/22/19	11/07/19
Field										
D.O.	ppm	-	-	-	-	-	12	8.9	8.3	13
ORP	mV	-	-	-	-	-	255	176	134	230
pH	SU	-	6.30-7.30	5.60-6.60	5.70-6.70	5.40-6.40	7.24	6.99	6.78	7.09
Specific Conductance	uS/cm	-	-	-	-	-	104	96	198	206
Temperature	C	-	-	-	-	-	0.37	12	16	0.95
Turbidity	NTU	-	-	-	-	-	4.3	45	6.2	3.1
Flow	cfs	-	-	-	-	-	-	-	7.0	30
Metals										
Aluminum	ug/L	-	-	-	200	-	-	-	<50.0	-
Antimony	ug/L	-	-	-	3.5	-	-	-	<1.0	-
Arsenic	ug/L	1.0	2.6	1.8	2.6	2.7	< 1.0	<1.0	2.4	1.1
Barium	ug/L	-	-	-	15	-	-	-	9.3	-
Beryllium	ug/L	-	-	-	2.5	-	-	-	<1.0	-
Boron	ug/L	-	-	-	18	-	-	-	22	-
Cadmium	ug/L	-	-	-	0.08	-	-	-	0.01	-
Chromium	ug/L	-	-	-	4.0	-	-	-	<1.0	-
Cobalt	ug/L	-	-	-	0.40	-	-	-	0.19	-
Copper	ug/L	0.05	2.9	0.97	0.65	0.67	0.58	0.72	0.33	0.92
Iron	ug/L	10	3007	1873	3749	3493	1150	1130	2360	1440
Lead	ug/L	0.05	0.35	0.24	0.18	1.9	0.14	0.14	0.05	0.13
Lithium	ug/L	-	-	-	32	-	-	-	<8.0	-
Manganese	ug/L	1.0	223	157	273	326	71	123	135	163
Mercury	ng/L	0.50	5.2	6.7	7.2	7.0	2.5	1.6	1.9	4.0
Molybdenum	ug/L	-	-	-	4.0	-	-	-	<1.0	-
Nickel	ug/L	0.20	1.5	1.2	1.8	1.5	0.69	0.98	1.4	0.45
Selenium	ug/L	-	-	-	0.28	-	-	-	0.07	-
Silver	ug/L	-	-	-	0.80	-	-	-	<0.20	-
Thallium	ug/L	-	-	-	1.5	-	-	-	<1.0	-
Vanadium	ug/L	-	-	-	4.0	-	-	-	<1.0	-
Zinc	ug/L	0.50	7.5	8.5	2.7	13	2.8	3.3	0.47	3.5
Major Anions										
Alkalinity, Bicarbonate	mg/L	2.0	50	31	58	33	15	18	52	24
Alkalinity, Carbonate	mg/L	2.0	8.0	8.0	8.0	8.0	< 2.0	<2.0	<2.0	<2.0
Chloride	mg/L	1.0	15	11	23	21	6.2	8.2	17	11
Fluoride	mg/L	0.10	0.20	0.50	0.40	0.40	< 0.10	<0.10	<0.10	<0.10
Nitrogen, Ammonia	mg/L	0.50	2.0	2.0	2.0	2.0	< 0.025	< 0.025	< 0.025	< 0.025
Nitrogen, Nitrate	mg/L	0.50	0.18	2.0	2.0	2.0	0.26	< 0.10	< 0.10	< 0.10
Nitrogen, Nitrite	mg/L	0.50	2.0	2.0	2.0	2.0	< 0.10	< 0.10	< 0.10	< 0.10
Sulfate	mg/L	1.0	17	15	21	26	5.8	13	14	24
Sulfide	mg/L	5.0	20	20	20	20	< 0.20	<0.20	<0.20	<0.20
Major Cations										
Calcium	mg/L	0.50	17	11	18	13	6.2	6.6	17	7.4
Magnesium	mg/L	0.50	4.7	3.3	5.8	4.2	1.9	2.2	4.9	2.6
Potassium	mg/L	0.50	1.3	0.94	1.7	1.7	0.87	0.73	1.2	0.89
Sodium	mg/L	0.50	8.8	7.4	12	9.3	4.9	9.2	12	15
General										
Hardness	mg/L	2.0	63	38	78	57	23	26	62	29
Total Dissolved Solids	mg/L	50	134	54	200	200	48	47	106	85
Total Suspended Solids	mg/L	3.3	4.0	9.8	13	20	< 5.0	<5.0	9.0	<5.0

2019
Mine Permit Surface Water Quality Monitoring Data
WBR-001 (Reference - Mill Subwatershed)
Humboldt Mill

Parameter	Unit	Permit RL	WBR-001 Seasonal Benchmark				WBR-001 Data (Q1-Q4 2019)			
			Q1	Q2	Q3	Q4	Q1 2019	Q2 2019	Q3 2019	Q4 2019
			Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain	Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain
							03/18/19	06/04/19	08/22/19	11/07/19
Field										
D.O.	ppm	-	-	-	-	-	NM	7.1	8.0	11
ORP	mV	-	-	-	-	-	NM	255	79	249
pH	SU	-	4.97-5.97	4.70-5.70	5.70-6.70	4.60-5.60	NM	5.29	6.09	7.36
Specific Conductance	uS/cm	-	-	-	-	-	NM	60	115	145
Temperature	C	-	-	-	-	-	NM	12	15	0.59
Turbidity	NTU	-	-	-	-	-	NM	0.77	7.8	0.80
Flow	cfs	-	-	-	-	-	-	-	-	-
Metals										
Aluminum	ug/L	-	-	-	200	-	NM	-	128	-
Antimony	ug/L	-	-	-	3.5	-	NM	-	<1.0	-
Arsenic	ug/L	1.0	6.6	1.8	3.2	1.5	NM	1.2	1.8	1.6
Barium	ug/L	-	-	-	17	-	NM	-	8.4	-
Beryllium	ug/L	-	-	-	2.5	-	NM	-	<1.0	-
Boron	ug/L	-	-	-	40	-	NM	-	<10.0	-
Cadmium	ug/L	-	-	-	0.08	-	NM	-	0.01	-
Chromium	ug/L	-	-	-	1.6	-	NM	-	<1.0	-
Cobalt	ug/L	-	-	-	0.40	-	NM	-	0.43	-
Copper	ug/L	0.05	3.3	1.1	1.4	0.66	NM	0.82	0.58	0.50
Iron	ug/L	10	11518	1759	4873	1900	NM	1220	2220	1260
Lead	ug/L	0.05	4.3	1.1	2.3	1.3	NM	0.67	0.64	0.18
Lithium	ug/L	-	-	-	32	-	NM	-	<8.0	-
Manganese	ug/L	1.0	363	106	770	122	NM	74	179	127
Mercury	ng/L	0.50	15	11	16	11	NM	<1.3	6.4	8.0
Molybdenum	ug/L	-	-	-	4.0	-	NM	-	<1.0	-
Nickel	ug/L	0.20	3.1	0.97	3.0	0.98	NM	0.79	0.65	0.78
Selenium	ug/L	-	-	-	0.28	-	NM	-	0.08	-
Silver	ug/L	-	-	-	0.80	-	NM	-	<0.20	-
Thallium	ug/L	-	-	-	1.5	-	NM	-	<1.0	-
Vanadium	ug/L	-	-	-	1.7	-	NM	-	<1.0	-
Zinc	ug/L	0.50	16	12	13	8.2	NM	8.1	3.0	5.3
Major Anions										
Alkalinity, Bicarbonate	mg/L	2.0	9.1	5.1	16	5.8	NM	<2.0	5.6	26
Alkalinity, Carbonate	mg/L	2.0	8.0	8.0	8.0	8.0	NM	<2.0	<2.0	<2.0
Chloride	mg/L	1.0	24	25	28	23	NM	25	27	17
Fluoride	mg/L	0.10	0.40	0.40	0.40	0.40	NM	<0.10	<0.10	<0.10
Nitrogen, Ammonia	mg/L	0.50	2.0	2.0	2.0	2.0	NM	< 0.025	0.06	0.03
Nitrogen, Nitrate	mg/L	0.50	0.24	2.0	2.0	2.0	NM	< 0.10	< 0.10	< 0.10
Nitrogen, Nitrite	mg/L	0.50	2.0	2.0	2.0	2.0	NM	< 0.10	< 0.10	< 0.10
Sulfate	mg/L	1.0	11	4.0	4.0	4.0	NM	2.6	<1.0	1.9
Sulfide	mg/L	5.0	20	20	20	20	NM	<0.20	<0.20	<0.20
Major Cations										
Calcium	mg/L	0.50	7.6	4.8	7.9	5.6	NM	2.7	5.0	4.0
Magnesium	mg/L	0.50	3.0	1.9	3.1	2.5	NM	1.1	2.0	1.6
Potassium	mg/L	0.50	2.7	0.94	1.6	1.6	NM	0.63	0.58	0.55
Sodium	mg/L	0.50	11	12	13	11	NM	7.8	13	13
General										
Hardness	mg/L	2.0	37	21	39	30	NM	11	41	17
Total Dissolved Solids	mg/L	50	211	211	200	200	NM	49	115	87
Total Suspended Solids	mg/L	3.3	55	13	13	13	NM	<5.0	6.0	<5.0

* - Lowest achievable Reporting Limit by laboratory due to matrix interference

2019
Mine Permit Surface Water Quality Monitoring Data
WBR-002 (Compliance - Mill Subwatershed)
Humboldt Mill

Parameter	Unit	Permit RL	WBR-002 Seasonal Benchmark				WBR-002 Data (Q1-Q4 2019)			
			Q1	Q2	Q3	Q4	Q1 2019	Q2 2019	Q3 2019	Q4 2019
			Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain	Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain
							03/18/19	06/04/19	08/22/19	11/07/19
Field										
D.O.	ppm	-	-	-	-	-	6.8	6.7	4.4	12
ORP	mV	-	-	-	-	-	51	168	-40	232
pH	SU	-	5.90-6.90	6.04-6.94	6.20-7.20	5.40-6.40	6.45	6.03	6.53	6.92
Specific Conductance	uS/cm	-	-	-	-	-	248	106	216	226
Temperature	C	-	-	-	-	-	0.79	13	16	1.4
Turbidity	NTU	-	-	-	-	-	20	8.2	152	21
Flow	cfs	-	-	-	-	-	-	0.28	-	25
Metals										
Aluminum	ug/L	-	-	-	200	-	-	-	57	-
Antimony	ug/L	-	-	-	3.5	-	-	-	<1.0	-
Arsenic	ug/L	1.0	7.1	3.0	7.2	4.6	7.5	1.9	13	2.8
Barium	ug/L	-	-	-	16	-	-	-	16	-
Beryllium	ug/L	-	-	-	2.5	-	-	-	<1.0	-
Boron	ug/L	-	-	-	18	-	-	-	16	-
Cadmium	ug/L	-	-	-	0.08	-	-	-	<0.007	-
Chromium	ug/L	-	-	-	4.0	-	-	-	<1.0	-
Cobalt	ug/L	-	-	-	0.69	-	-	-	0.23	-
Copper	ug/L	0.05	1.4	2.5	1.9	2.0	0.60	1.2	0.33	0.92
Iron	ug/L	10	16421	4819	12928	9112	21800	2570	12500	4710
Lead	ug/L	0.05	0.44	0.55	0.49	0.61	0.21	0.09	0.08	0.28
Lithium	ug/L	-	-	-	32	-	-	-	<8.0	-
Manganese	ug/L	1.0	1550	262	709	458	989	97	940	90
Mercury	ng/L	0.50	4.5	3.6	3.0	4.7	1.4	<1.3	1.1	8.0
Molybdenum	ug/L	-	-	-	4.0	-	-	-	<1.0	-
Nickel	ug/L	0.20	3.3	2.5	2.6	3.2	2.0	1.4	0.56	1.3
Selenium	ug/L	-	-	-	0.28	-	-	-	0.08	-
Silver	ug/L	-	-	-	0.80	-	-	-	<0.20	-
Thallium	ug/L	-	-	-	1.5	-	-	-	<1.0	-
Vanadium	ug/L	-	-	-	4.0	-	-	-	1.1	-
Zinc	ug/L	0.50	20	25	2.5	4.8	2.7	3.4	0.61	1.6
Major Anions										
Alkalinity, Bicarbonate	mg/L	2.0	105	18	38	20	31	12	39	23
Alkalinity, Carbonate	mg/L	2.0	8.0	8.0	8.0	8.0	< 2.0	<2.0	<2.0	<2.0
Chloride	mg/L	1.0	60	42	48	59	38	25	33	29
Fluoride	mg/L	0.10	0.29	0.40	0.40	0.40	< 0.10	<0.10	0.12	<0.10
Nitrogen, Ammonia	mg/L	0.50	2.0	2.0	2.0	2.0	0.19	<0.025	0.46	<0.025
Nitrogen, Nitrate	mg/L	0.50	2.0	2.0	2.0	2.0	<0.050	<0.10	<0.10	<0.10
Nitrogen, Nitrite	mg/L	0.50	2.0	2.0	2.0	2.0	0.01	<0.10	<0.10	<0.10
Sulfate	mg/L	1.0	10	9.1	4.0	4.0	2.2	2.6	1.0	2.5
Sulfide	mg/L	5.0	20	20	20	20	< 0.20	<0.20	<0.20	<0.20
Major Cations										
Calcium	mg/L	0.50	13	7.0	9.7	9.8	9.1	4.9	9.8	6.7
Magnesium	mg/L	0.50	5.9	3.5	4.5	5.1	4.4	2.3	4.0	3.3
Potassium	mg/L	0.50	2.6	2.0	1.4	2.1	1.8	1.4	1.8	1.4
Sodium	mg/L	0.50	28	22	25	27	20	16	17	18
General										
Hardness	mg/L	2.0	57	33	46	44	41	22	41	30
Total Dissolved Solids	mg/L	50	170	278	200	200	140	67	115	117
Total Suspended Solids	mg/L	3.3	13	13	32	16	43	<5.0	6.0	<5.0

* - Lowest achievable Reporting Limit by laboratory due to matrix interference

2019
Mine Permit Surface Water Quality Monitoring Data
WBR-003 (Compliance - Mill Subwatershed)
Humboldt Mill

Parameter	Unit	Permit RL	WBR-003 Seasonal Benchmark				WBR-003 Data (Q1-Q4 2019)			
			Q1	Q2	Q3	Q4	Q1 2019	Q2 2019	Q3 2019	Q4 2019
			Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain	Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain
							03/18/19	06/04/19	08/22/19	11/07/19
Field										
D.O.	ppm	-	-	-	-	-	6.8	6.7	1.8	6.6
ORP	mV	-	-	-	-	-	51	168	-100	219
pH	SU	-	5.80-6.80	5.80-6.80	6.20-7.20	4.90-5.90	6.45	6.03	6.76	6.98
Specific Conductance	uS/m	-	-	-	-	-	248	106	311	219
Temperature	C	-	-	-	-	-	0.79	13	15	0.28
Turbidity	NTU	-	-	-	-	-	20	8.2	75	9.7
Flow	cfs	-	-	-	-	-	-	0.28	-	-
Metals										
Aluminum	ug/L	-	-	-	200	-	-	-	119	-
Antimony	ug/L	-	-	-	3.5	-	-	-	<1.0	-
Arsenic	ug/L	1.0	4.0	1.7	6.3	2.1	7.5	1.9	18	1.6
Barium	ug/L	-	-	-	27	-	-	-	30	-
Beryllium	ug/L	-	-	-	2.5	-	-	-	<1.0	-
Boron	ug/L	-	-	-	13	-	-	-	12	-
Cadmium	ug/L	-	-	-	0.08	-	-	-	<0.007	-
Chromium	ug/L	-	-	-	4.0	-	-	-	<1.0	-
Cobalt	ug/L	-	-	-	2.6	-	-	-	1.7	-
Copper	ug/L	0.05	0.67	0.74	0.20	1.1	0.60	1.2	0.57	0.50
Iron	ug/L	10	12988	5033	19898	4248	21800	2570	35400	3260
Lead	ug/L	0.05	0.40	0.26	0.29	0.28	0.21	0.09	0.23	0.18
Lithium	ug/L	-	-	-	32	-	-	-	<8.0	-
Manganese	ug/L	1.0	2261	374	2794	235	989	97	1550	109
Mercury	ng/L	0.50	6.1	3.4	5.7	6.9	1.4	<1.3	2.6	2.6
Molybdenum	ug/L	-	-	-	4.0	-	-	-	1.5	-
Nickel	ug/L	0.20	3.5	1.8	2.4	1.7	2.0	1.4	1.5	0.78
Selenium	ug/L	-	-	-	0.28	-	-	-	0.16	-
Silver	ug/L	-	-	-	0.80	-	-	-	<0.20	-
Thallium	ug/L	-	-	-	1.5	-	-	-	<1.0	-
Vanadium	ug/L	-	-	-	4.0	-	-	-	2.0	-
Zinc	ug/L	0.50	17	15	4.5	18	2.7	3.4	56	0.93
Major Anions										
Alkalinity, Bicarbonate	mg/L	2.0	51	34	88	22	31	12	91	26
Alkalinity, Carbonate	mg/L	2.0	8.0	8.0	8.0	8.0	< 2.0	<2.0	<2.0	<2.0
Chloride	mg/L	1.0	43	32	42	37	38	25	22	24
Fluoride	mg/L	0.10	0.30	0.34	0.19	0.40	< 0.10	<0.10	0.22	<0.10
Nitrogen, Ammonia	mg/L	0.50	2.0	2.0	2.0	2.0	0.19	<0.025	0.41	0.03
Nitrogen, Nitrate	mg/L	0.50	0.26	2.0	2.0	2.0	<0.050	<0.10	<0.10	<0.10
Nitrogen, Nitrite	mg/L	0.50	2.0	2.0	2.0	2.0	0.01	<0.10	<0.10	<0.10
Sulfate	mg/L	1.0	17	20	4.0	4.0	2.2	2.6	<1.0	3.7
Sulfide	mg/L	5.0	20	20	20	20	< 0.20	<0.20	<0.20	<0.20
Major Cations										
Calcium	mg/L	0.50	15	11	24	8.4	9.1	4.9	25	7.2
Magnesium	mg/L	0.50	6.1	4.5	9.6	3.9	4.4	2.3	8.4	3.5
Potassium	mg/L	0.50	2.2	1.7	2.3	2.7	1.8	1.4	1.4	1.1
Sodium	mg/L	0.50	20	15	22	20	20	16	14	14
General										
Hardness	mg/L	2.0	64	43	109	36	41	22	98	32
Total Dissolved Solids	mg/L	50	177	120	200	200	140	67	198	87
Total Suspended Solids	mg/L	3.3	19	9.8	27	13	43	<5.0	39	<5.0

* - Lowest achievable Reporting Limit by laboratory due to matrix interference

2019
Mine Permit Surface Water Quality Monitoring Data
Data Abbreviations & Data Qualifiers
Humboldt Mill

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.

Appendix J

Humboldt Mill

Surface Water Trend Analysis Summary

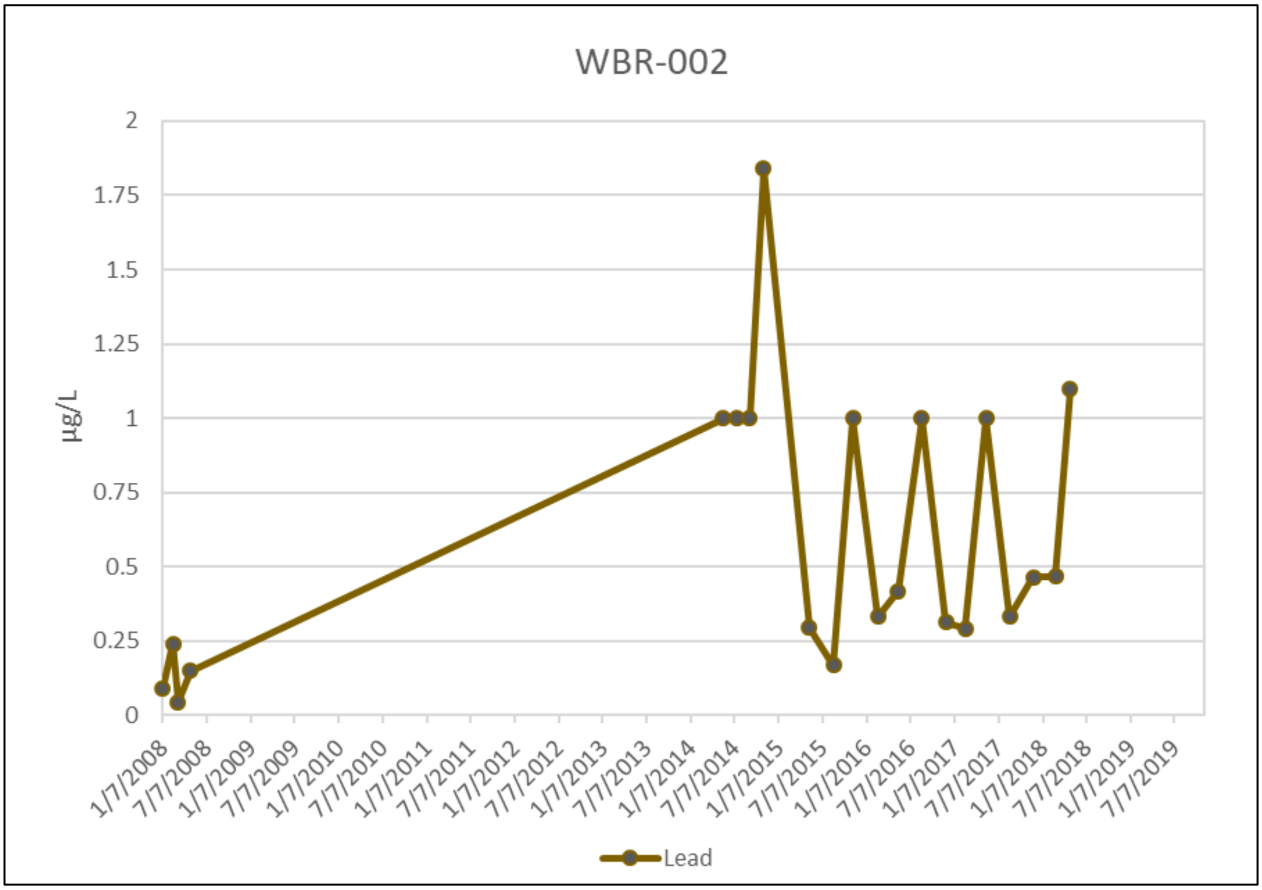
2019
Surface Water Trend Analysis Summary
Humboldt Mill

Location	Classification	Parameter	Unit	Count (n)	Number of Non-Detects	Mean	UCL	Median	Standard Deviation	Coefficient of Variation	Skewness	Minimum	Maximum	Mann Kendall S	Sen Slope	Positive or Negative Trend (Minimum 95% Confidence)
MER-001 Q1	Monitoring	Alkalinity, Carbonate	mg/L	8	8	-	9.8	2	-	-	-	-	-	-15	-0.185714286	Negative
MER-001 Q1	Monitoring	Calcium	mg/L	8	0	8.76	13.96	7.35	2.6	0.3	0.95022342	5	14	-14	-0.578571429	Negative
MER-001 Q1	Monitoring	Chloride	mg/L	8	0	6.43	12.29	6.6	2.93	0.46	0.53405822	2	12	-14	-0.704761905	Negative
MER-001 Q1	Monitoring	Hardness	mg/L	8	0	2483.95	16315.81	35.5	6915.93	2.78	2.26778234	34	19600	17	2.208333333	Positive
MER-001 Q1	Monitoring	Iron	µg/L	8	0	1485.12	2352.83	1500	433.85	0.29	0.50496991	881	2290	-10	-102.375	Negative
MER-001 Q1	Monitoring	Magnesium	mg/L	8	0	2.48	3.73	2.2	0.62	0.25	0.88231197	2	4	-15	-0.124571429	Negative
MER-001 Q1	Monitoring	Nickel	µg/L	8	0	0.63	1.01	0.585	0.19	0.3	1.00016388	0	1	-18	-0.0575	Negative
MER-001 Q1	Monitoring	Nitrogen, Nitrate	mg/L	8	4	68.36	5	0.5	136.42	2	2.26777047	0	273	12	0.094375	Positive
MER-001 Q1	Monitoring	Nitrogen, Nitrite	mg/L	8	8	-	5.85	0.5	-	-	-	-	-	16	0.116	Positive
MER-001 Q1	Monitoring	Potassium	mg/L	8	0	0.65	0.94	0.65	0.14	0.22	0.47013674	0	1	15	0.03875	Positive
MER-001 Q1	Monitoring	Sodium	mg/L	8	0	3.51	6.34	3.6	1.42	0.4	0.59225823	2	6	-10	-0.344047619	Negative
MER-001 Q1	Monitoring	Sulfate	mg/L	8	1	3.9	8.32	1.35	2.21	0.57	0.45339158	2	7	-14	-0.75	Negative
MER-001 Q1	Monitoring	Total Suspended Solids	mg/L	7	4	1.73	3.35	3.3	0.81	0.47	0.10048821	1	3	12	0.425	Positive
MER-001 Q2	Monitoring	Hardness	mg/L	7	0	3205.37	20045.25	24	8419.94	2.63	2.04124061	16	22300	13	3.466666667	Positive
MER-001 Q2	Monitoring	Iron	µg/L	7	0	813.29	1244.87	900	215.79	0.27	-1.12882813	380	1070	12	70	Positive
MER-001 Q2	Monitoring	Magnesium	mg/L	7	0	1.69	2.33	1.85	0.32	0.19	0.10596437	1	2	10	0.1	Positive
MER-001 Q2	Monitoring	Manganese	µg/L	7	0	317.34	1713.89	71	698.27	2.2	2.03649355	12	1900	15	18	Positive
MER-001 Q2	Monitoring	Mercury	ng/L	7	0	4.34	7.32	4.42	1.49	0.34	-0.50799781	2	6	-15	-0.621666667	Negative
MER-001 Q2	Monitoring	Total Suspended Solids	mg/L	7	5	2.51	7.57	3.8	2.53	1.01	-0.91202304	1	4	13	0.425	Positive
MER-001 Q3	Monitoring	Barium	µg/L	7	0	9.27	10.98	9	0.86	0.09	1.09856857	8	11	-12	-0.166666667	Negative
MER-001 Q3	Monitoring	Hardness	mg/L	7	0	12158.41	56008.38	44.45	21924.98	1.8	1.2865401	32	55000	17	5973.6	Positive
MER-001 Q3	Monitoring	Manganese	µg/L	7	0	139.99	237.21	137	48.61	0.35	-0.19454753	86	190	-11	-12.38333333	Negative
MER-001 Q3	Monitoring	Sulfate	mg/L	7	6	5.4	-	1	0	0	-	5	5	11	0.14	Positive
MER-001 Q3	Monitoring	Sulfide	mg/L	7	6	0.02	-	2.6	0	0	-	0	0	-12	-0.96	Negative
MER-001 Q3	Monitoring	Total Suspended Solids	mg/L	7	5	6.8	15.85	3.3	4.53	0.67	2.03295152	4	10	11	0.06	Positive
MER-001 Q4	Monitoring	Copper	µg/L	5	1	0.69	1.3	0.535	0.36	0.52	0.53861351	0	1	-10	-0.205	Negative
MER-001 Q4	Monitoring	Hardness	mg/L	6	0	7051.83	28828.39	28	10888.28	1.54	0.71096794	22	21700	10	4335.6	Positive
MER-001 Q4	Monitoring	Lead	µg/L	5	0	0.24	0.61	0.1505	0.18	0.75	1.45801168	0	1	-10	-0.027	Negative
MER-001 Q4	Monitoring	Potassium	mg/L	6	1	0.78	1.38	0.52	0.3	0.38	0.67328076	0	1	-10	-0.073333333	Negative
MER-001 Q4	Monitoring	Zinc	µg/L	6	2	2.84	5.31	2.63	1.23	0.43	0.52503423	2	5	-10	-0.636666667	Negative
MER-002 Q1	Monitoring	Alkalinity, Carbonate	mg/L	8	8	-	9.8	2	-	-	-	-	-	-15	-0.185714286	Negative
MER-002 Q1	Monitoring	Chloride	mg/L	8	0	8.3	13.31	7.55	2.51	0.3	1.8044022	6	14	-17	-0.325	Negative
MER-002 Q1	Monitoring	Hardness	mg/L	8	0	2860.99	18812.53	37	7975.77	2.79	2.26778207	35	22600	12	1.366666667	Positive
MER-002 Q1	Monitoring	Nickel	µg/L	8	0	0.75	1.13	0.78	0.19	0.25	0.29293884	1	1	-16	-0.029	Negative
MER-002 Q1	Monitoring	Nitrogen, Nitrate	mg/L	8	3	54.18	5	0.5	120.65	2.23	2.26777349	0	270	10	0.0545	Positive
MER-002 Q1	Monitoring	Nitrogen, Nitrite	mg/L	8	8	-	5.85	0.5	-	-	-	-	-	16	0.116	Positive
MER-002 Q1	Monitoring	Potassium	mg/L	8	0	0.81	1.19	0.825	0.19	0.23	0.24048875	1	1	10	0.034666667	Positive
MER-002 Q1	Monitoring	Sodium	mg/L	8	0	4.96	8.01	4.75	1.53	0.31	1.56963171	3	8	-10	-0.141666667	Negative
MER-002 Q1	Monitoring	Sulfate	mg/L	8	0	8.15	14.15	7.95	3	0.37	0.0869225	4	13	-10	-0.916666667	Negative
MER-002 Q1	Monitoring	Total Suspended Solids	mg/L	7	3	2.65	5.57	4	1.46	0.55	0.13459566	2	5	11	0.425	Positive
MER-002 Q2	Monitoring	Alkalinity, Bicarbonate	mg/L	7	0	16.4	26.06	19	4.83	0.29	-0.21542037	9	23	10	1.966666667	Positive
MER-002 Q2	Monitoring	Calcium	mg/L	7	0	6.16	9.11	6.9	1.48	0.24	-0.16521886	4	8	10	0.451666667	Positive
MER-002 Q2	Monitoring	Hardness	mg/L	7	0	3533.99	22112.47	26	9289.24	2.63	2.04124026	14	24600	14	4	Positive
MER-002 Q2	Monitoring	Iron	µg/L	7	0	1016.71	1697.7	1200	340.49	0.33	-1.24079049	337	1300	15	120	Positive
MER-002 Q2	Monitoring	Magnesium	mg/L	7	0	1.84	2.76	2.05	0.46	0.25	-0.36262349	1	2	11	0.151666667	Positive
MER-002 Q2	Monitoring	Manganese	µg/L	7	0	77.84	161.05	93.5	41.61	0.53	-0.52275898	11	125	17	18.33333333	Positive
MER-002 Q2	Monitoring	Mercury	ng/L	7	0	4.17	7.27	4.205	1.55	0.37	-0.75271422	1	6	-17	-0.713333333	Negative
MER-002 Q2	Monitoring	Sodium	mg/L	7	0	3.49	5.19	3.9	0.85	0.24	-1.34717006	2	4	13	0.25	Positive
MER-002 Q2	Monitoring	Total Suspended Solids	mg/L	7	5	2.4	7.77	3.8	2.69	1.12	-1.02336294	0	4	13	0.425	Positive
MER-002 Q3	Monitoring	Barium	mg/L	7	0	11.8	19.21	10.5	3.71	0.31	1.84955913	10	20	-12	-0.5	Negative
MER-002 Q3	Monitoring	Boron	µg/L	7	4	17.27	27.92	11.9	5.33	0.31	1.4374392	14	23	13	0.95	Positive
MER-002 Q3	Monitoring	Hardness	mg/L	7	0	13662.4	64006.17	45.4	25171.89	1.84	1.39061967	34	64400	13	6192.4	Positive
MER-002 Q3	Monitoring	Potassium	mg/L	7	0	0.91	1.43	0.865	0.26	0.29	-0.4648935	1	1	10	0.05	Positive
MER-002 Q3	Monitoring	Sulfide	mg/L	7	6	0.02	-	2.6	0	0	-	0	0	-12	-0.96	Negative
MER-002 Q4	Monitoring	Hardness	mg/L	6	0	8235.33	33868.58	24	12816.62	1.56	0.75702145	18	27200	10	5436.4	Positive
MER-003 Q1	Monitoring	Alkalinity, Carbonate	mg/L	8	8	-	9.8	2	-	-	-	-	-	-15	-0.185714286	Negative
MER-003 Q1	Monitoring	Calcium	mg/L	8	0	10.98	16.86	10	2.94	0.27	0.43277727	6	17	-15	-0.55	Negative

2019
Surface Water Trend Analysis Summary
Humboldt Mill

Location	Classification	Parameter	Unit	Count (n)	Number of Non-Detects	Mean	UCL	Median	Standard Deviation	Coefficient of Variation	Skewness	Minimum	Maximum	Mann Kendall S	Sen Slope	Positive or Negative Trend (Minimum 95% Confidence)
MER-003 Q1	Monitoring	Chloride	mg/L	8	0	9.56	14.7	8.95	2.57	0.27	1.15871046	6	15	-20	-0.558333333	Negative
MER-003 Q1	Monitoring	Magnesium	mg/L	8	0	3.27	4.78	3.15	0.75	0.23	-0.18703017	2	5	-12	-0.167380952	Negative
MER-003 Q1	Monitoring	Nickel	µg/L	8	0	1.01	1.52	1.145	0.25	0.25	0.17219606	1	1	-10	-0.0415	Negative
MER-003 Q1	Monitoring	Nitrogen, Nitrate	mg/L	8	4	64.87	5	0.5	129.42	2	2.26776888	0	259	12	0.099375	Positive
MER-003 Q1	Monitoring	Nitrogen, Nitrite	mg/L	8	8	-	5.85	0.5	-	-	-	-	-	16	0.116	Positive
MER-003 Q1	Monitoring	Sodium	mg/L	8	0	5.85	8.29	5.35	1.22	0.21	1.41679079	5	9	-13	-0.120416667	Negative
MER-003 Q1	Monitoring	Total Dissolved Solids	mg/L	6	0	79.33	130.1	68	25.38	0.32	0.25782647	48	114	-11	-10.5	Negative
MER-003 Q1	Monitoring	Total Suspended Solids	mg/L	7	4	1.77	4.01	3.3	1.12	0.63	-0.14464547	1	3	12	0.45	Positive
MER-003 Q2	Monitoring	Arsenic	µg/L	7	4	1.01	1.86	1.1	0.42	0.42	-0.96237426	1	1	11	0.08	Positive
MER-003 Q2	Monitoring	Chloride	mg/L	7	0	7.33	10.72	8.35	1.7	0.23	-0.51859687	4	9	11	0.616666667	Positive
MER-003 Q2	Monitoring	Iron	µg/L	7	0	1057	1885.4	1350	414.2	0.39	-0.6633033	349	1500	13	195	Positive
MER-003 Q2	Monitoring	Magnesium	mg/L	7	0	2.09	3.25	2.45	0.58	0.28	0.0847812	1	3	10	0.158333333	Positive
MER-003 Q2	Monitoring	Manganese	µg/L	7	0	85.57	180.91	110	47.67	0.56	-0.55765892	12	137	18	20.66666667	Positive
MER-003 Q2	Monitoring	Mercury	ng/L	7	0	4.35	7.3	4.225	1.48	0.34	-0.91442389	2	6	-15	-0.59	Negative
MER-003 Q2	Monitoring	Potassium	mg/L	7	0	0.69	1	0.72	0.15	0.22	0.02557179	0	1	11	0.06	Positive
MER-003 Q2	Monitoring	Sodium	mg/L	7	0	5.32	10.11	5.6	2.4	0.45	0.23510857	2	9	19	1.14	Positive
MER-003 Q3	Monitoring	Alkalinity, Bicarbonate	mg/L	7	0	49.83	101.97	36.15	26.07	0.52	1.49547461	27	105	11	3.825	Positive
MER-003 Q3	Monitoring	Barium	mg/L	7	0	11.1	14.33	10.8	1.61	0.15	0.68066382	9	14	-11	-0.333333333	Negative
MER-003 Q3	Monitoring	Boron	µg/L	7	1	16.43	29.11	12.8	6.34	0.39	0.73973378	10	26	14	2	Positive
MER-003 Q3	Monitoring	Hardness	mg/L	7	0	13337.1	62011.5	50.35	24337.2	1.82	1.34744208	38	61800	13	6252.2	Positive
MER-003 Q3	Monitoring	Manganese	µg/L	7	0	167.86	254.89	141	43.51	0.26	-0.41253619	100	210	-10	-12.4	Negative
MER-003 Q3	Monitoring	Nickel	µg/L	6	1	1.2	1.74	1.12	0.27	0.23	0.40160206	1	2	11	0.12	Positive
MER-003 Q3	Monitoring	Sulfide	mg/L	7	6	0.02	-	2.6	0	0	-	0	0	-12	-0.96	Negative
MER-003 Q3	Monitoring	Total Suspended Solids	mg/L	7	5	6.35	13.85	3.3	3.75	0.59	2.02102298	4	9	11	0.08	Positive
WBR-001 Q1	Monitoring	Alkalinity, Bicarbonate	mg/L	8	0	9.46	27.26	4.75	8.9	0.94	2.0442398	4	31	13	1.016666667	Positive
WBR-001 Q1	Monitoring	Alkalinity, Carbonate	mg/L	8	8	-	9.8	2	-	-	-	-	-	-15	-0.185714286	Negative
WBR-001 Q1	Monitoring	Hardness	mg/L	8	0	5138.54	34038.18	19	14449.82	2.81	2.2677829	16	40900	12	4.925	Positive
WBR-001 Q1	Monitoring	Nitrogen, Nitrite	mg/L	8	7	10	-	0.5	0	0	-	10	10	16	0.116	Positive
WBR-001 Q1	Monitoring	Potassium	mg/L	8	0	1.11	2.6	0.745	0.75	0.68	1.3261024	1	3	10	0.069125	Positive
WBR-001 Q1	Monitoring	Zinc	µg/L	8	0	8.08	15.56	7.185	3.74	0.46	0.6231837	3	15	-16	-0.963571429	Negative
WBR-001 Q2	Monitoring	Chloride	mg/L	7	0	19.19	27.82	18	4.32	0.23	0.01425271	13	25	10	1.25	Positive
WBR-001 Q2	Monitoring	Total Suspended Solids	mg/L	7	5	10.4	38.68	3.3	14.14	1.36	1.85871298	0	20	13	0.725	Positive
WBR-001 Q3	Monitoring	Sodium	mg/L	5	0	7.72	12.71	7.25	2.5	0.32	-0.41589225	4	10	-10	-1.391666667	Negative
WBR-002 Q1	Monitoring	Copper	µg/L	6	0	0.83	1.29	1.01	0.23	0.28	0.42748544	1	1	11	0.12	Positive
WBR-002 Q2	Monitoring	Alkalinity, Bicarbonate	mg/L	6	0	11.4	19.63	12	4.11	0.36	-0.92003605	4	16	12	1.06	Positive
WBR-002 Q2	Monitoring	Copper	µg/L	6	0	1.68	1.3	1.93	0.85	0.51	0.30566741	0	3	11	0.4425	Positive
WBR-002 Q2	Monitoring	Lead	µg/L	6	2	0.49	1.33	0.418	0.42	0.86	-0.09839553	0	1	10	0.123	Positive
WBR-002 Q2	Monitoring	Nickel	µg/L	6	0	1.97	3.36	2.21	0.69	0.35	0.89471091	1	3	11	0.336666667	Positive
WBR-002 Q2	Monitoring	Total Suspended Solids	mg/L	6	0	7.35	14.7	9.3	3.68	0.5	-0.33005448	2	12	11	1.75	Positive
WBR-003 Q1	Monitoring	Alkalinity, Carbonate	mg/L	7	7	-	10.06	2	-	-	-	-	-	-12	-0.24	Negative
WBR-003 Q1	Monitoring	Fluoride	mg/L	7	4	0.24	0.3	0.1	0.03	0.12	0.43854403	0	0	-11	-0.0275	Negative
WBR-003 Q1	Monitoring	Potassium	mg/L	7	0	1.5	2.17	1.6	0.34	0.23	-1.05948043	1	2	12	0.13	Positive
WBR-003 Q2	Monitoring	Arsenic	µg/L	6	0	1.32	2.14	1.3	0.41	0.31	0.47197893	1	2	12	0.2	Positive
WBR-003 Q2	Monitoring	Iron	µg/L	6	0	3176.67	5426.38	4600	1124.86	0.35	0.25898133	1830	4600	11	500	Positive
WBR-003 Q2	Monitoring	Manganese	µg/L	6	0	164.4	431.4	320	133.5	0.81	0.23027508	22	324	11	60.32	Positive
WBR-003 Q2	Monitoring	Total Suspended Solids	mg/L	6	2	5.4	11.26	6.8	2.93	0.54	0.24367533	2	8	12	1.25	Positive

2019
Surface Water Trend Analysis Summary Charts
Humboldt Mill



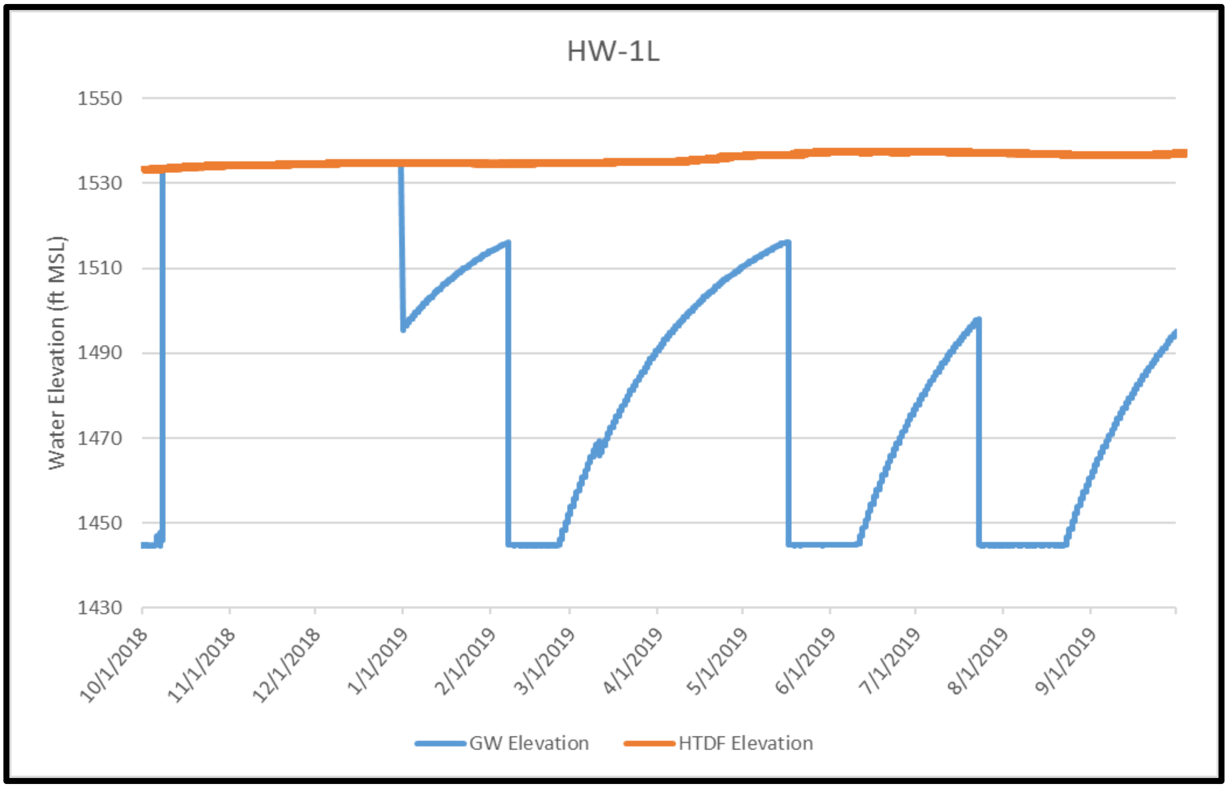
Note: Qualifier for charting a parameter is 2 consecutive benchmark exceedances and a trend. No exceedances/tends observed for 2019.

Appendix K

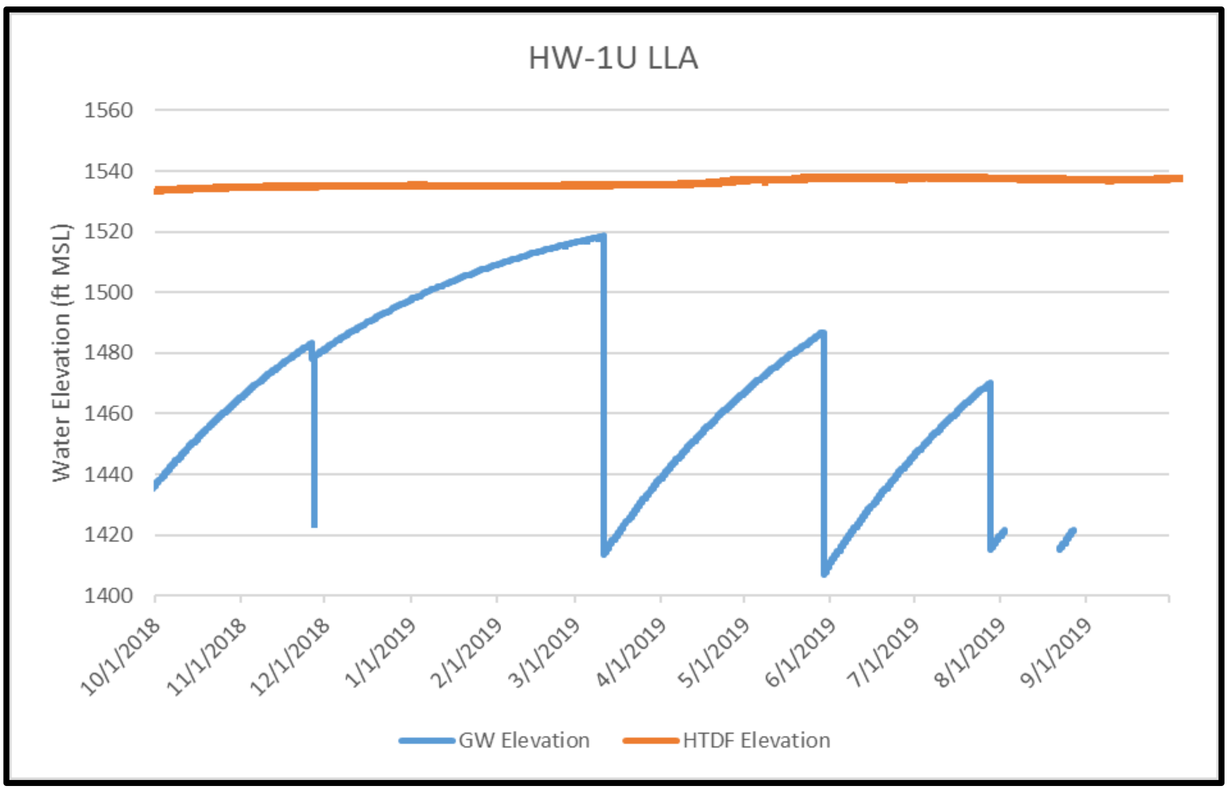
Humboldt Mill

Groundwater Hydrographs

2019 Groundwater Hydrographs
Humboldt Mill

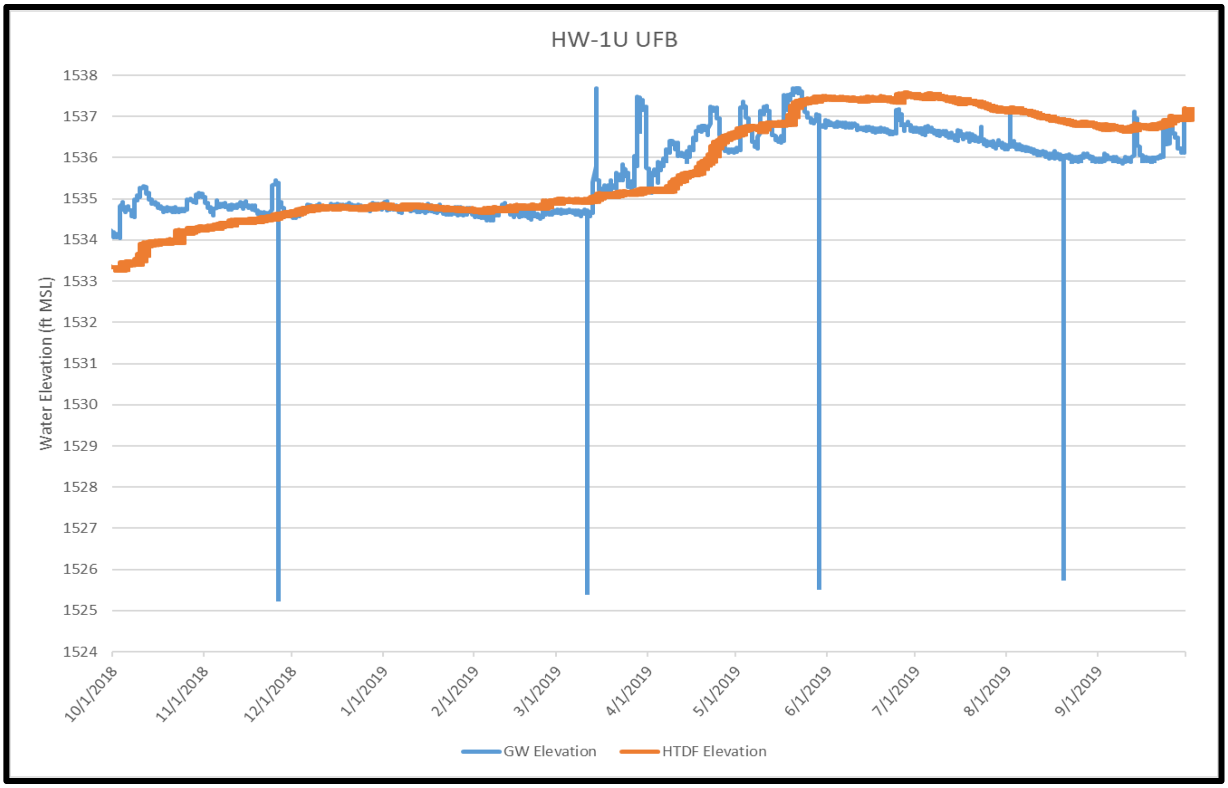


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.

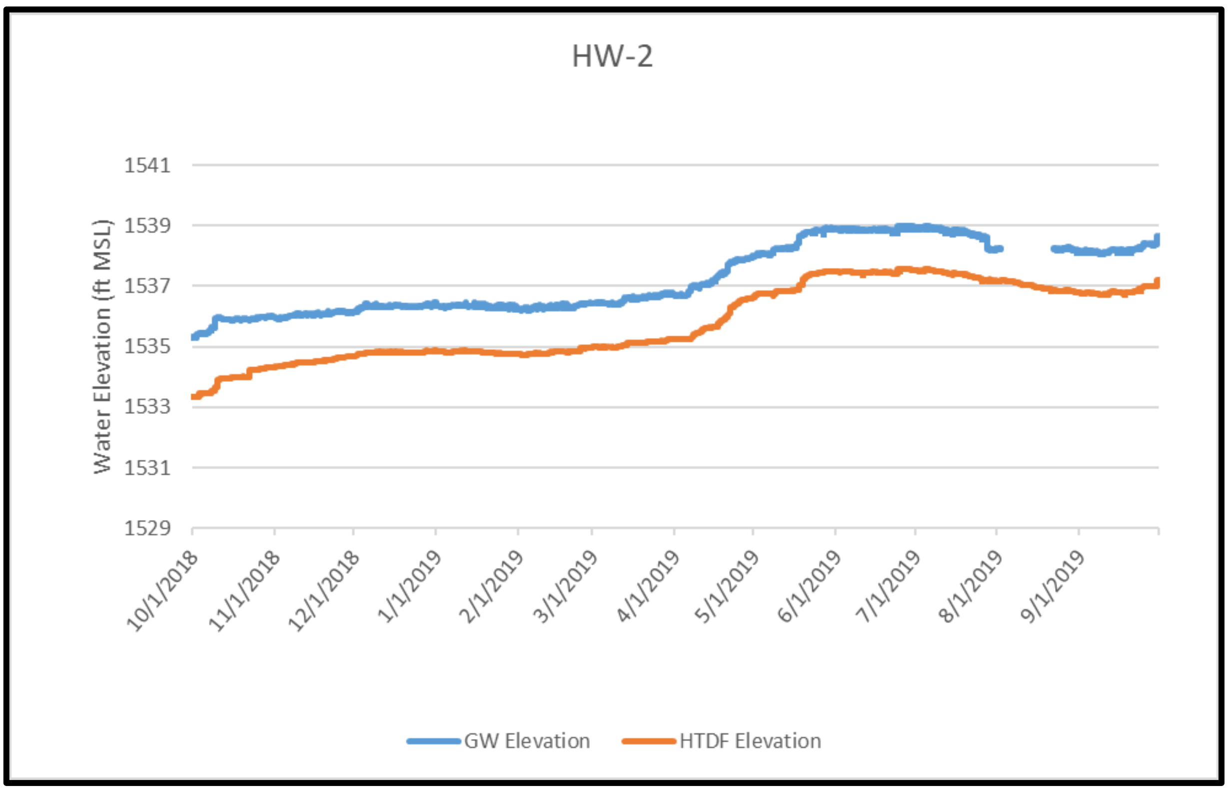


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.
Note: GW elevation data from 8-17-19 through 11-21-19 was unavailable due to equipment malfunction.

2019 Groundwater Hydrographs
Humboldt Mill

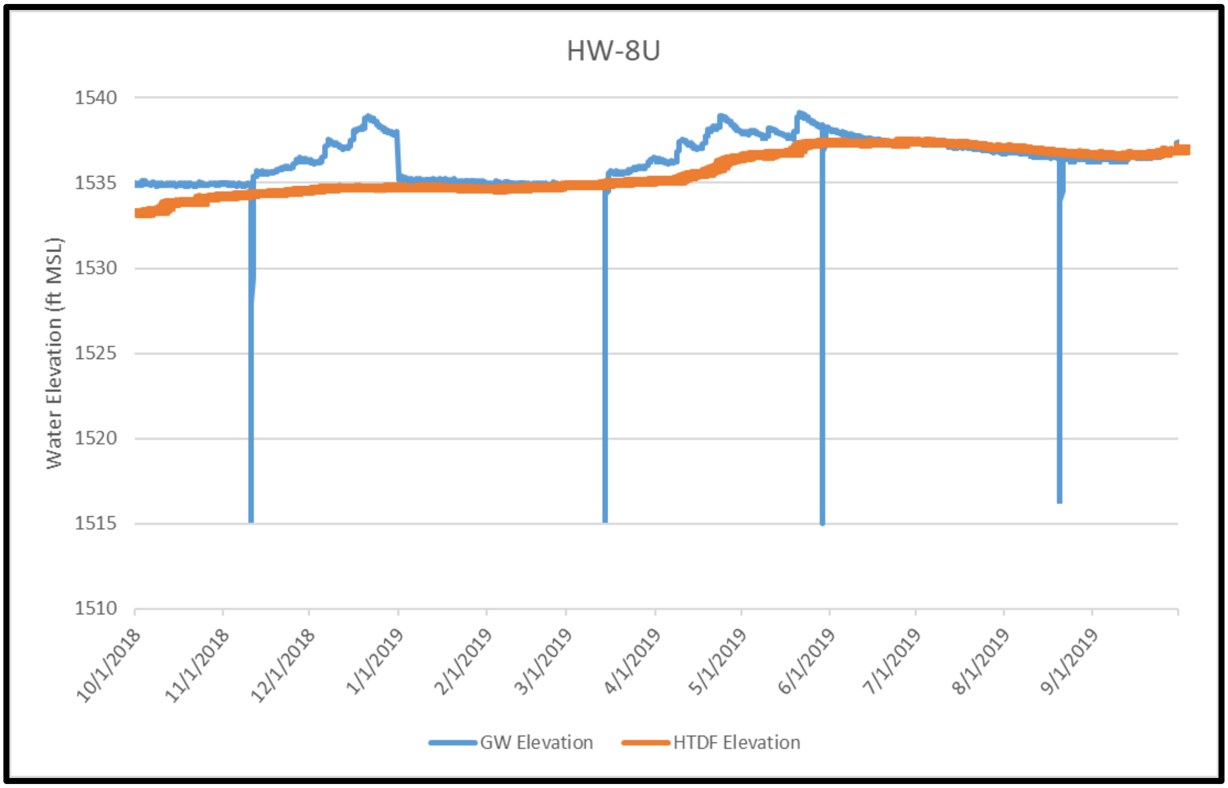


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.

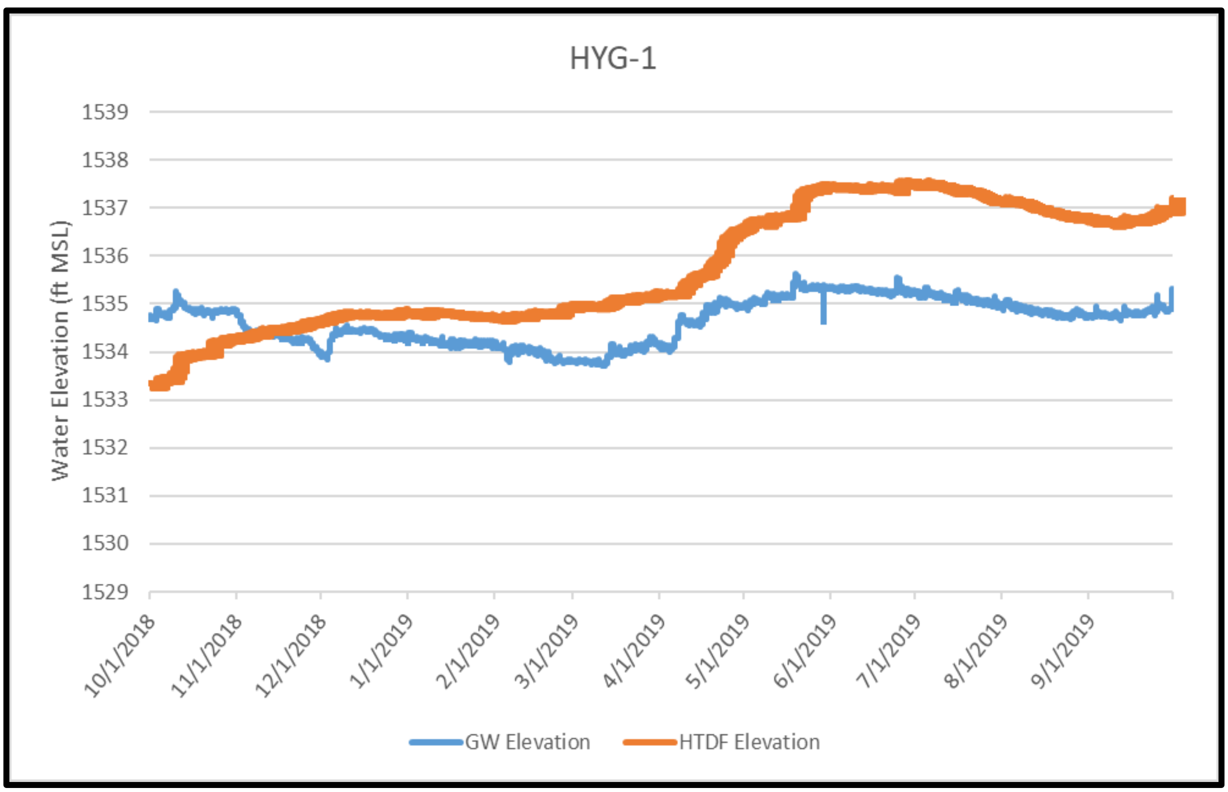


Note: Driver memory reached capacity and stopped collecting data on 7-28-19 and was replaced on 8-22-19.

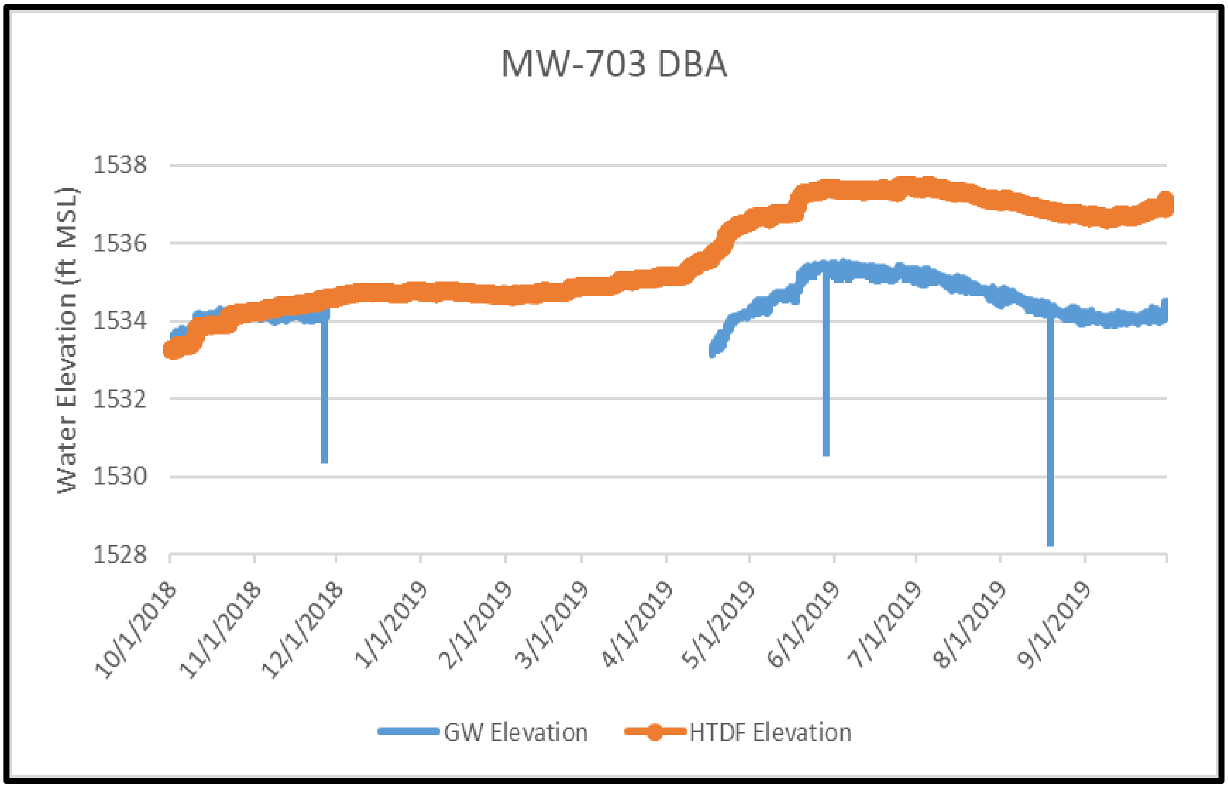
2019 Groundwater Hydrographs
Humboldt Mill



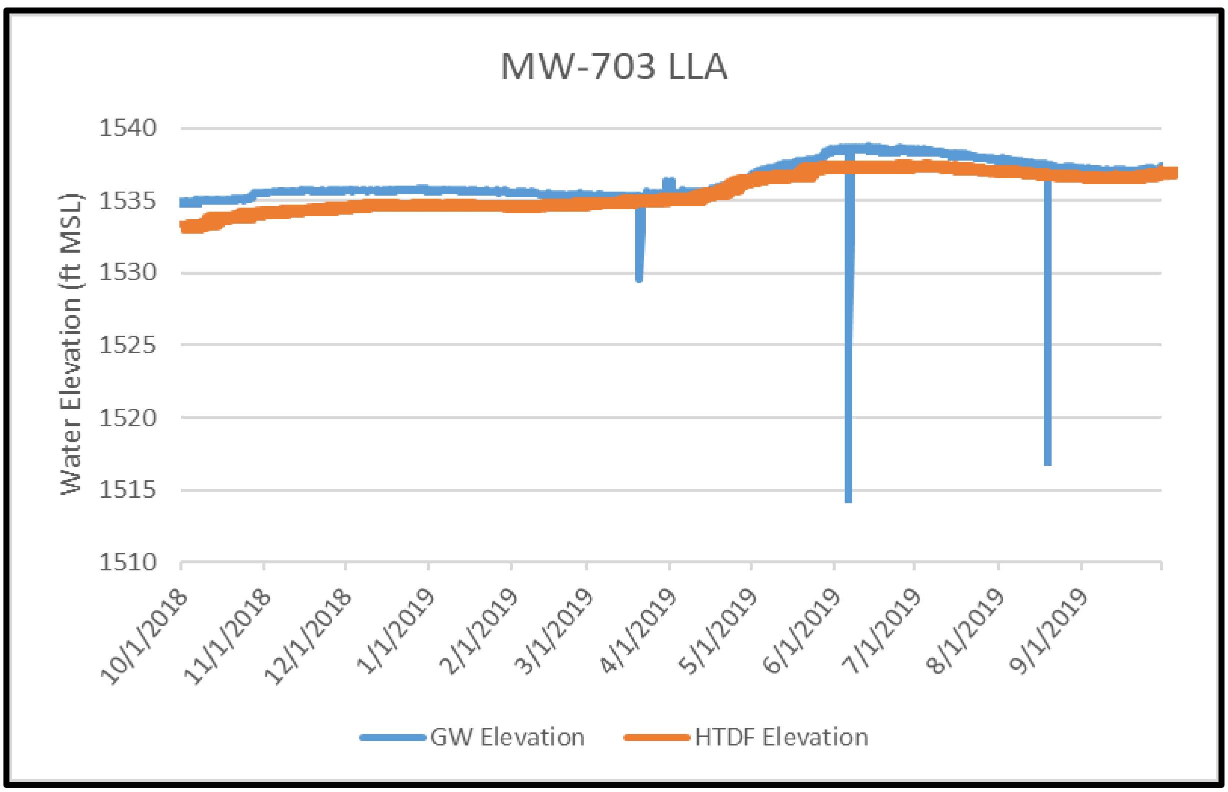
Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.



2019 Groundwater Hydrographs
Humboldt Mill

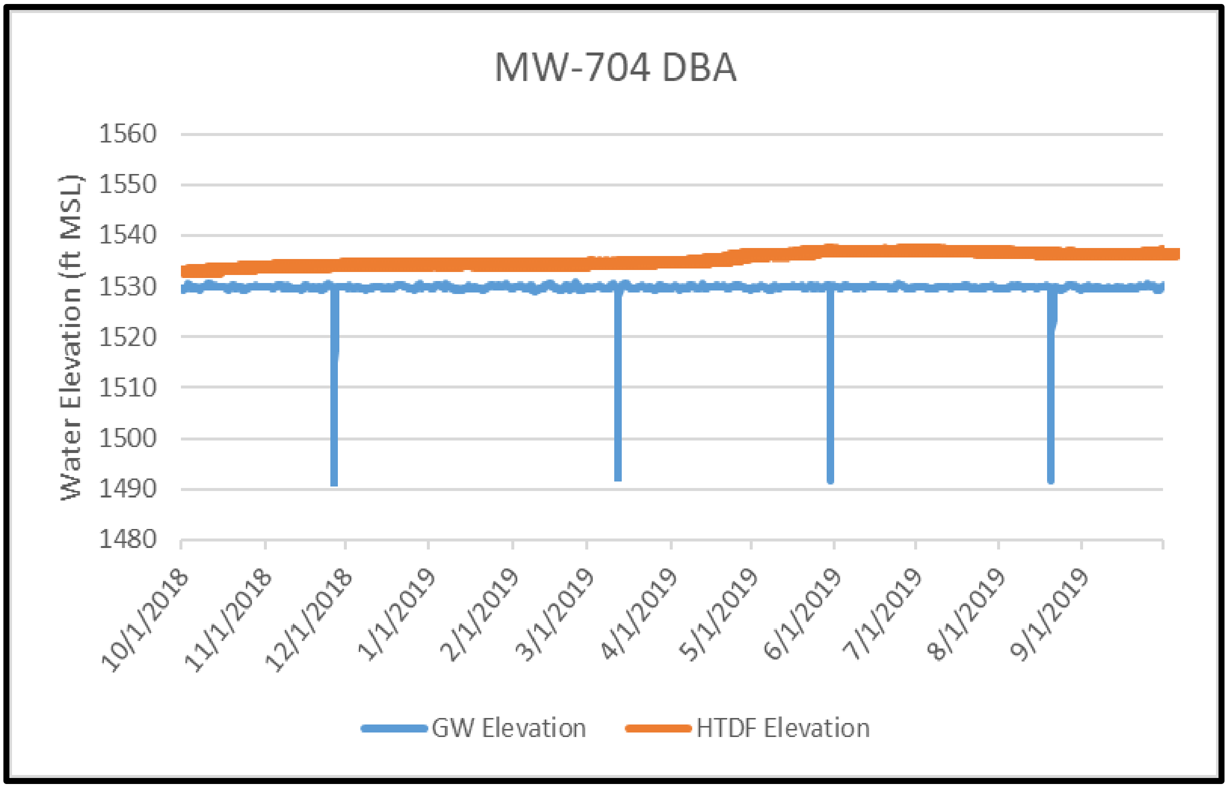


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.
Note: GW elevation data from 11-28-18 through 4-17-19 was unavailable due to equipment malfunction.

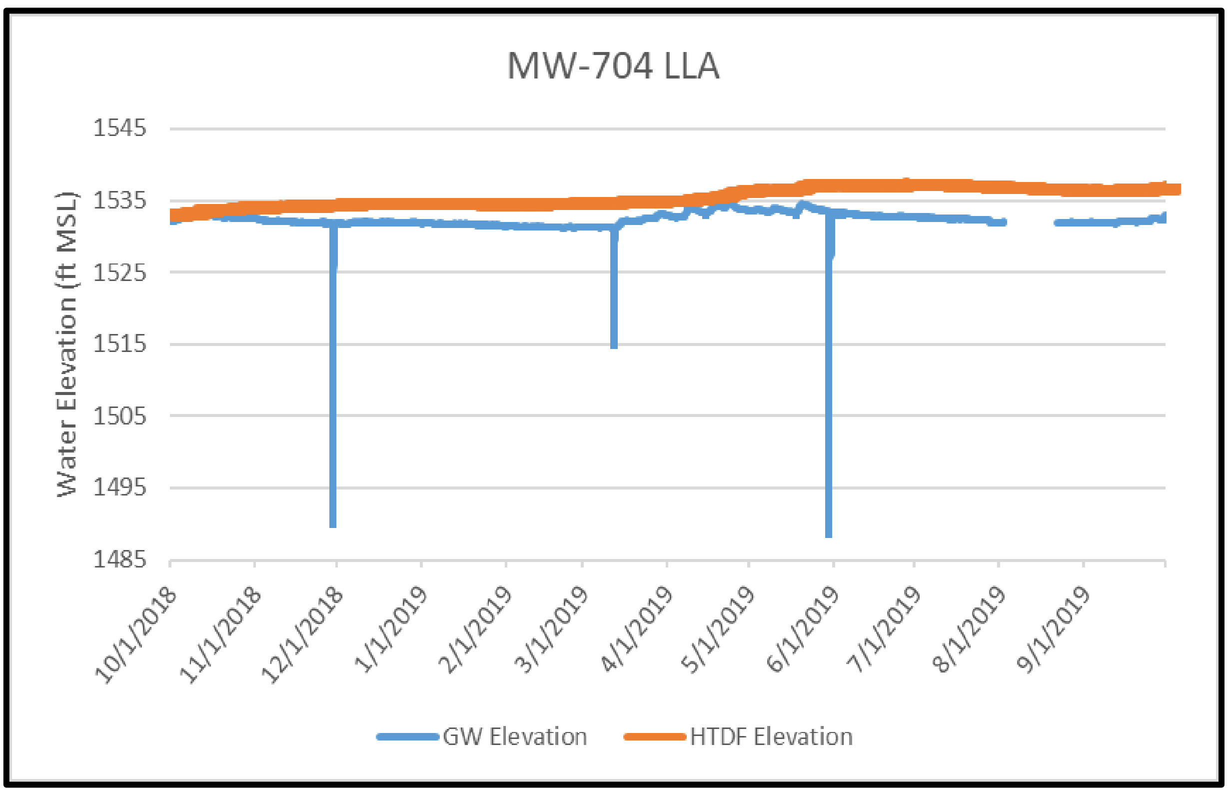


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.

2019 Groundwater Hydrographs
Humboldt Mill

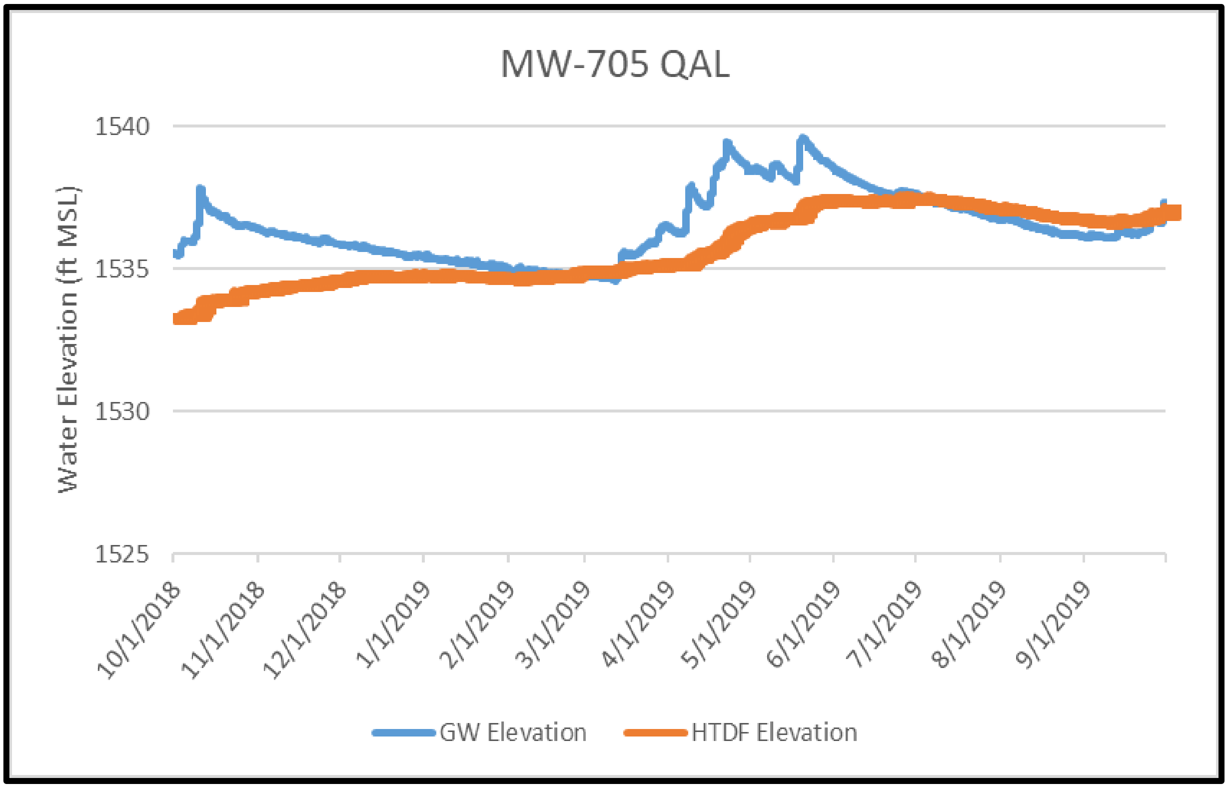


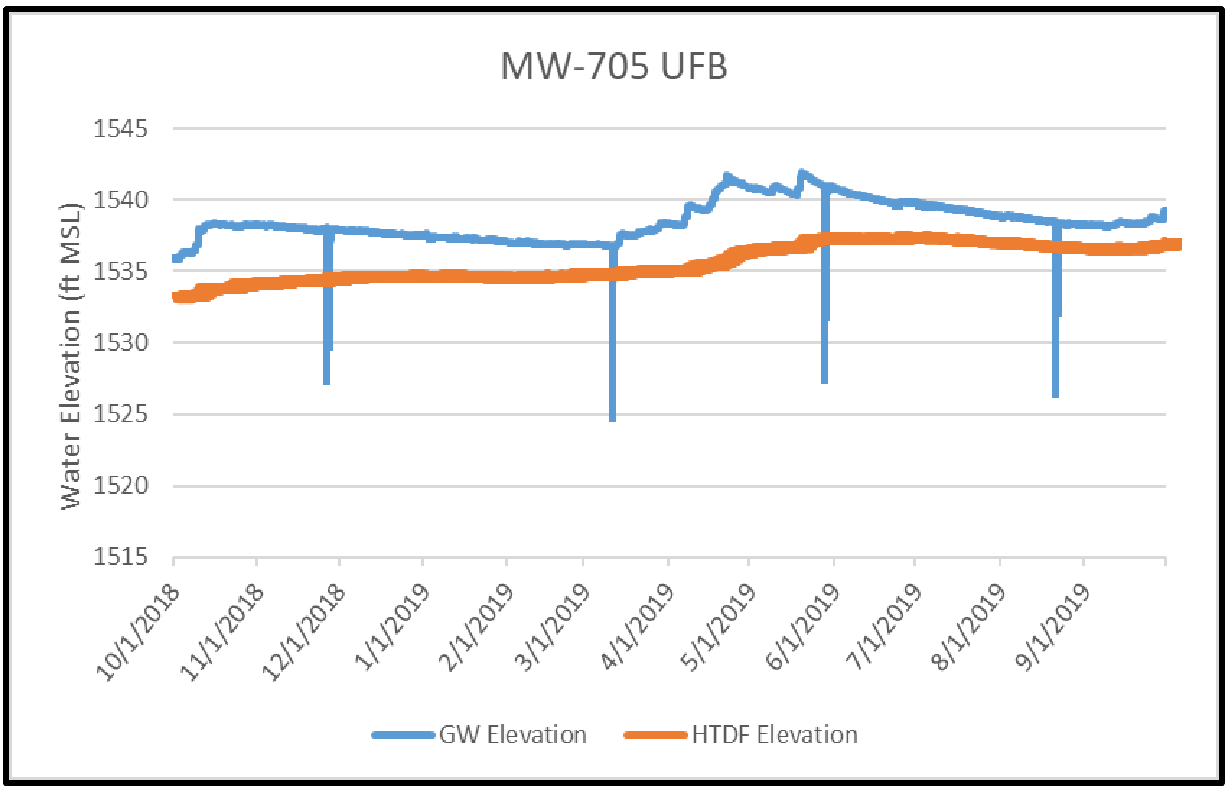
Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.



Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.
Note: Driver memory reached capacity and stopped collecting data on 7-28-19 and was replaced on 8-22-19.

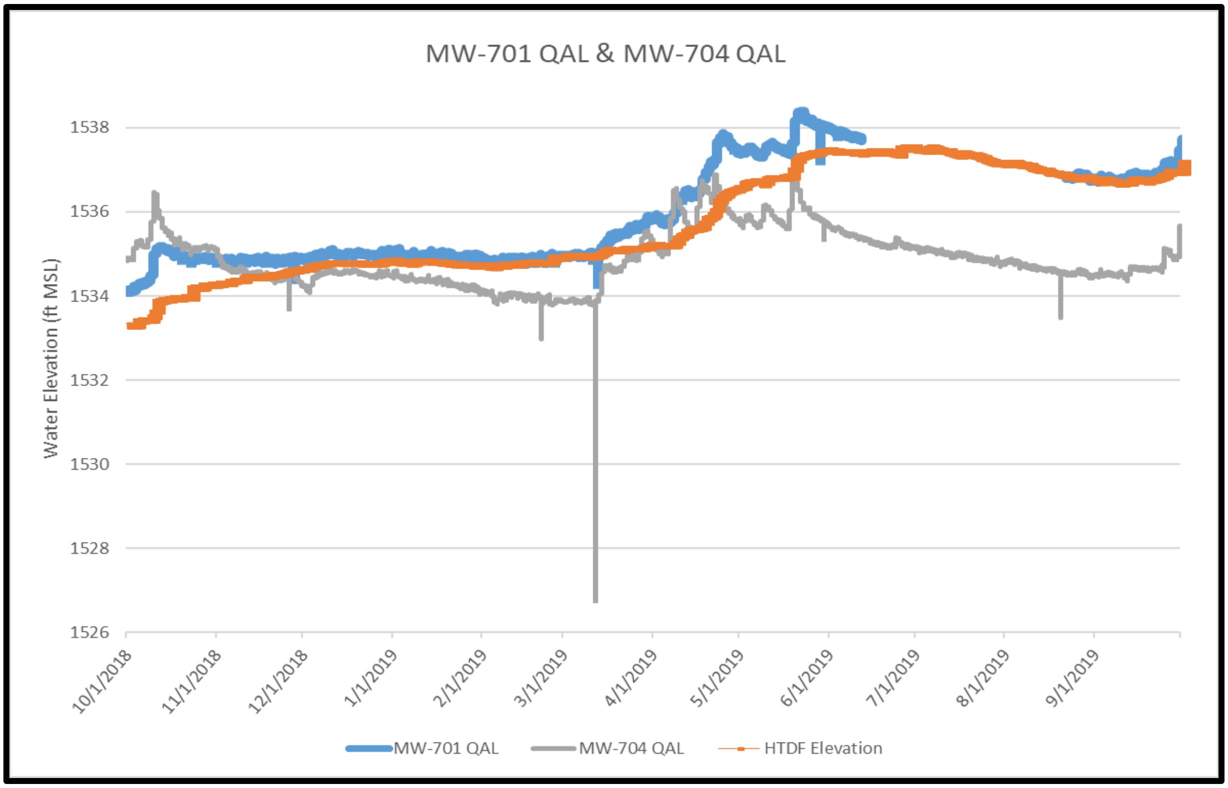
2019 Groundwater Hydrographs
Humboldt Mill



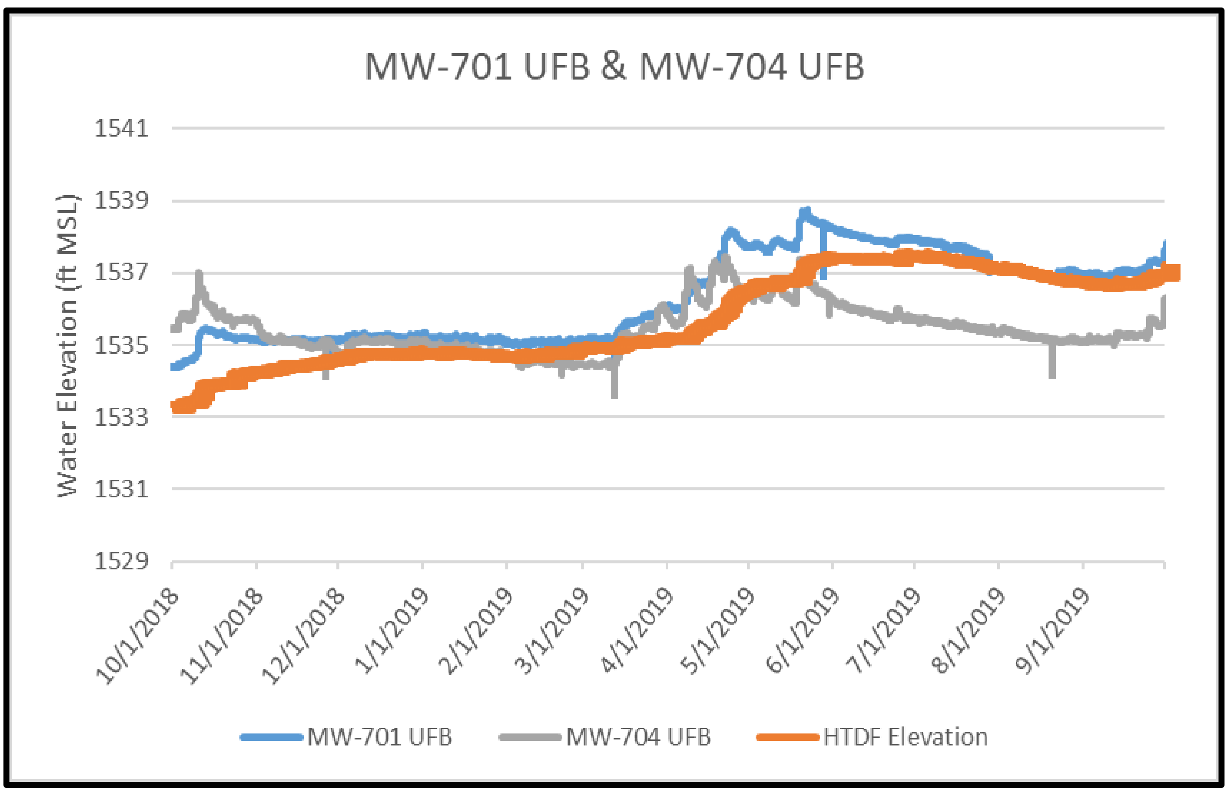


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.

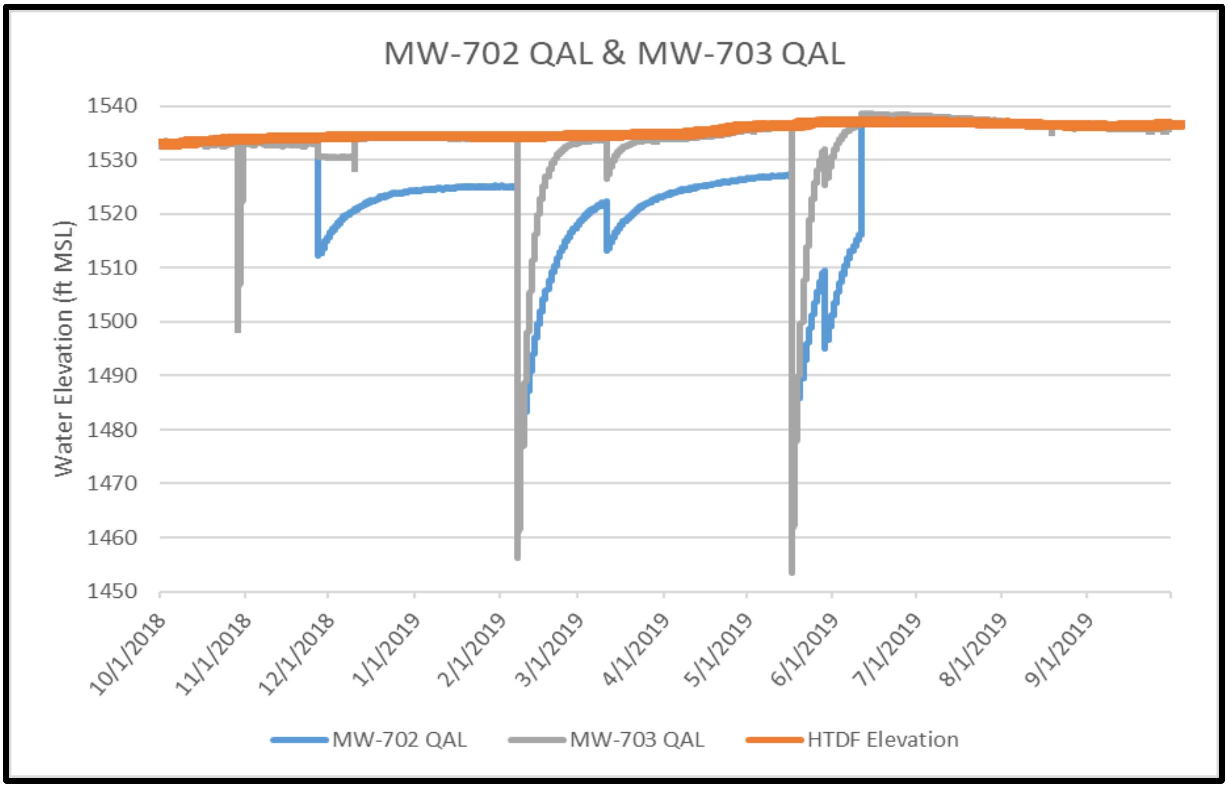
2019 Groundwater Hydrographs
Humboldt Mill



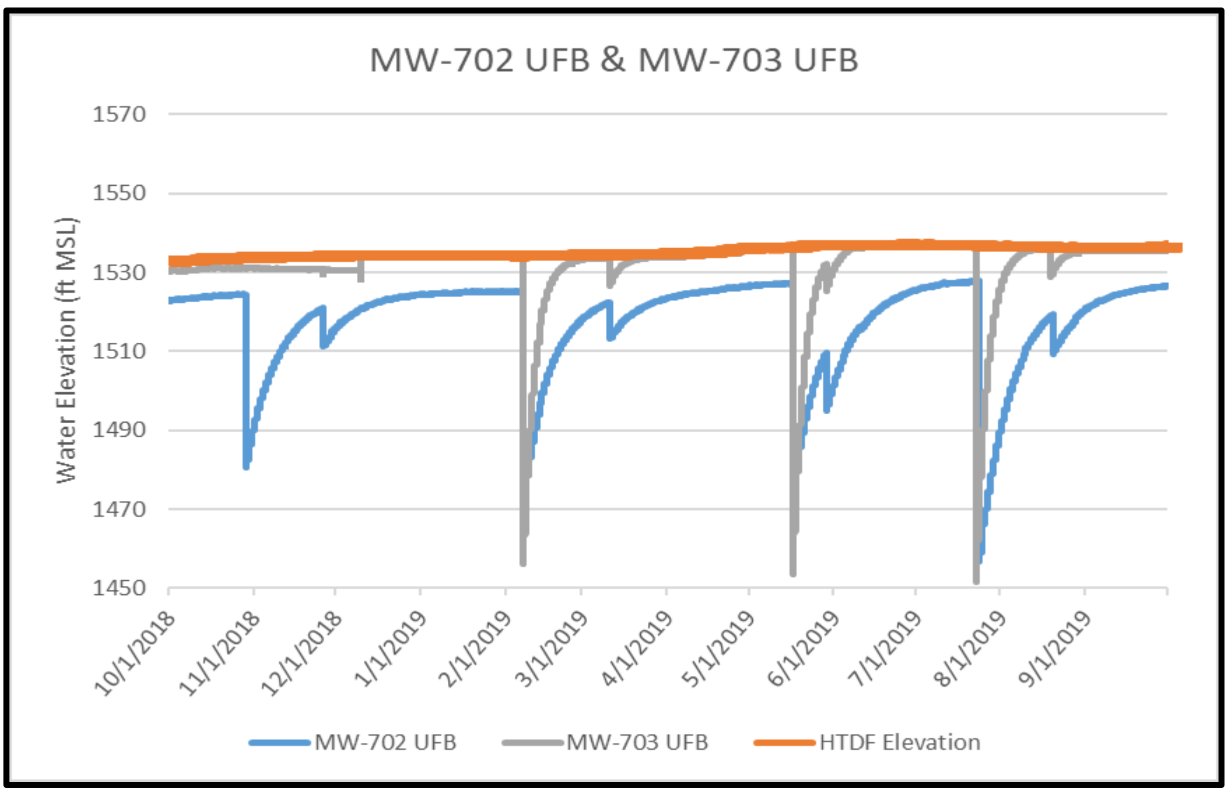
Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.
Note: GW elevation data from 6-11-19 through 8-22-19 was unavailable due to equipment malfunction.



2019 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.

Appendix L

Humboldt Mill

Flora & Fauna Survey Location Maps

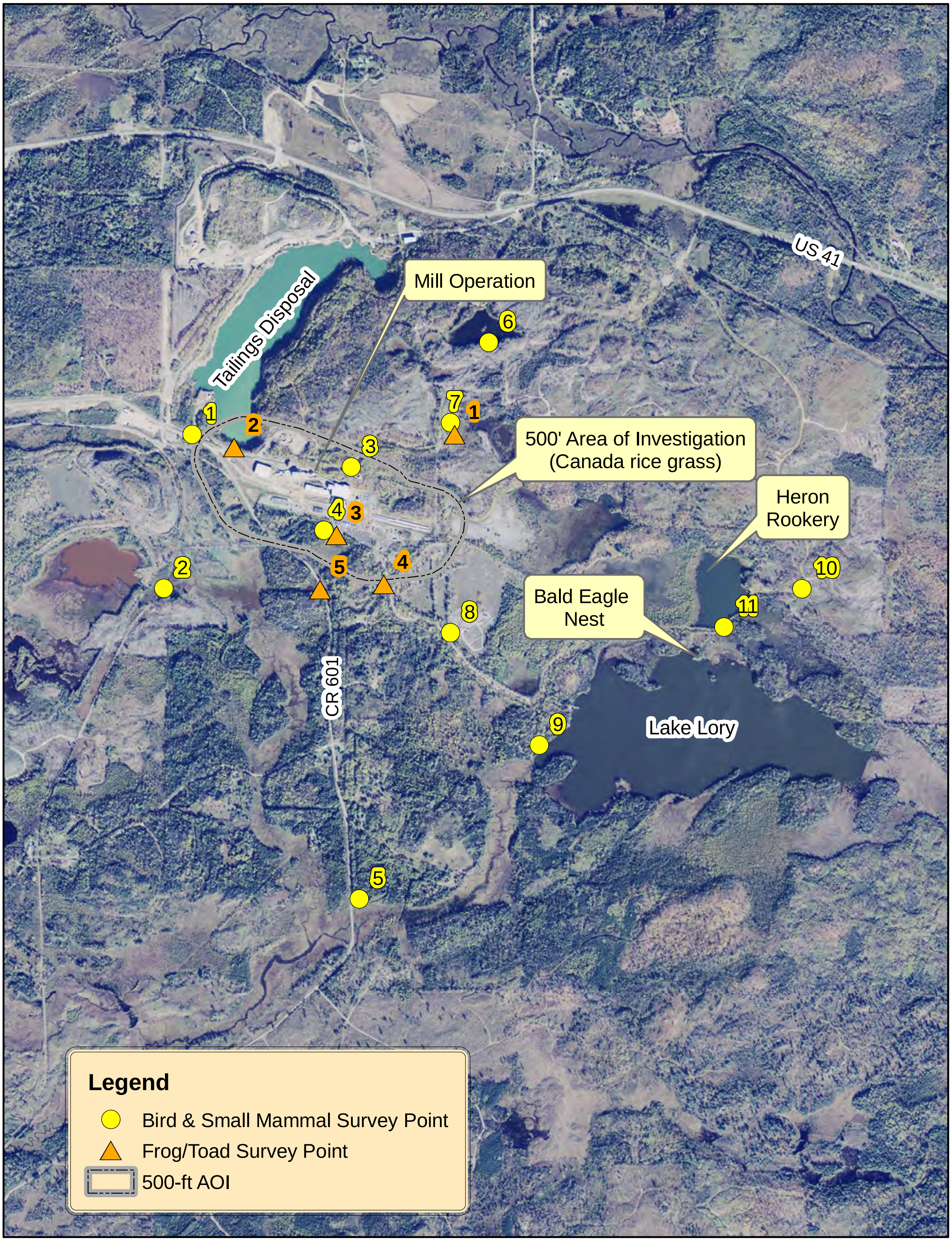
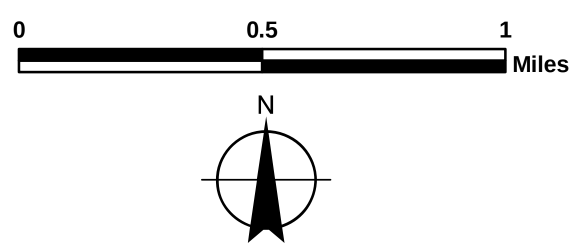


Figure 1-3. Biological Survey Areas



King & MacGregor Environmental, Inc.

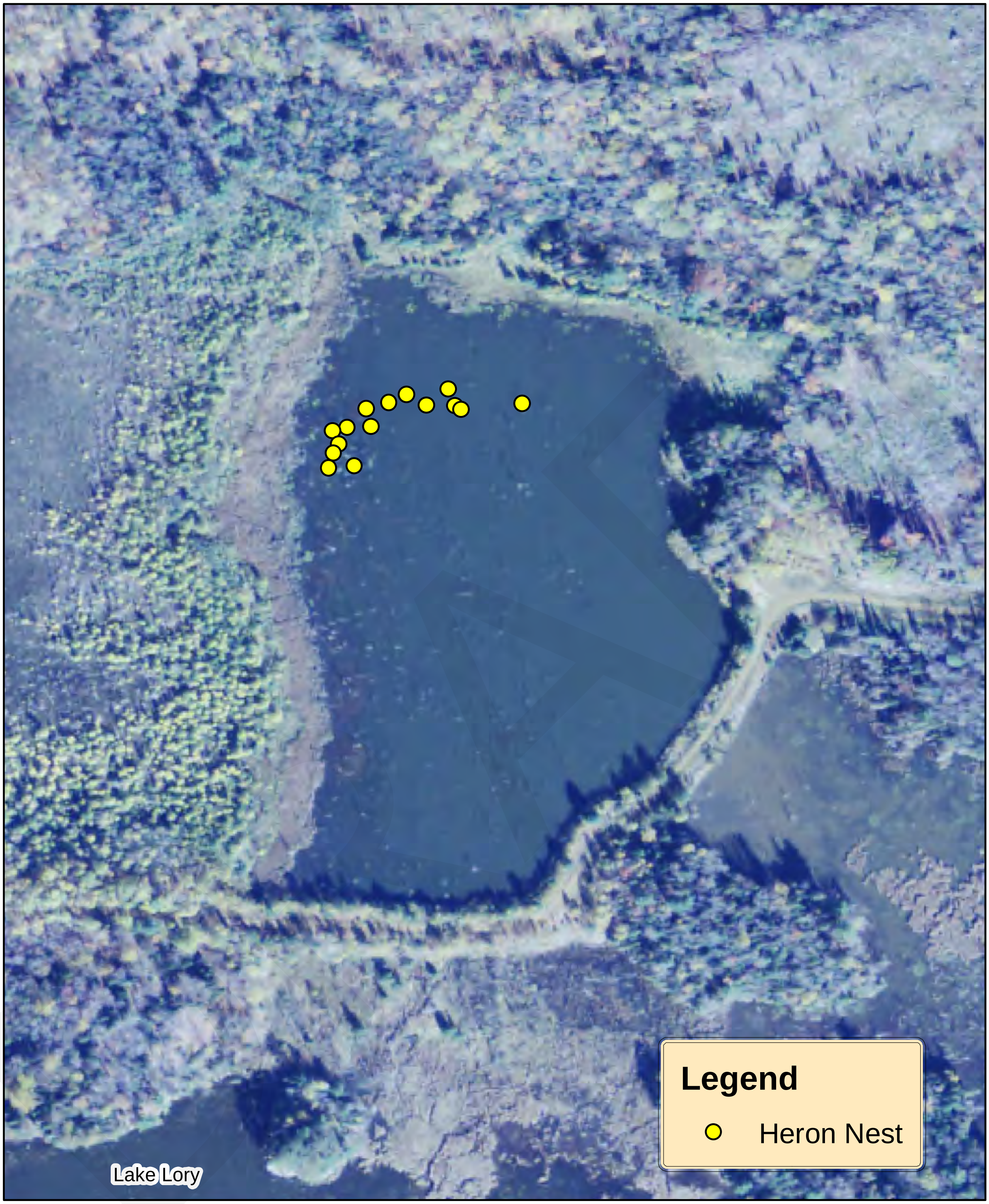
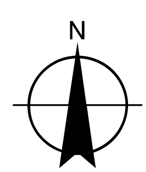


Figure 5-1. Great Blue Heron Rookery

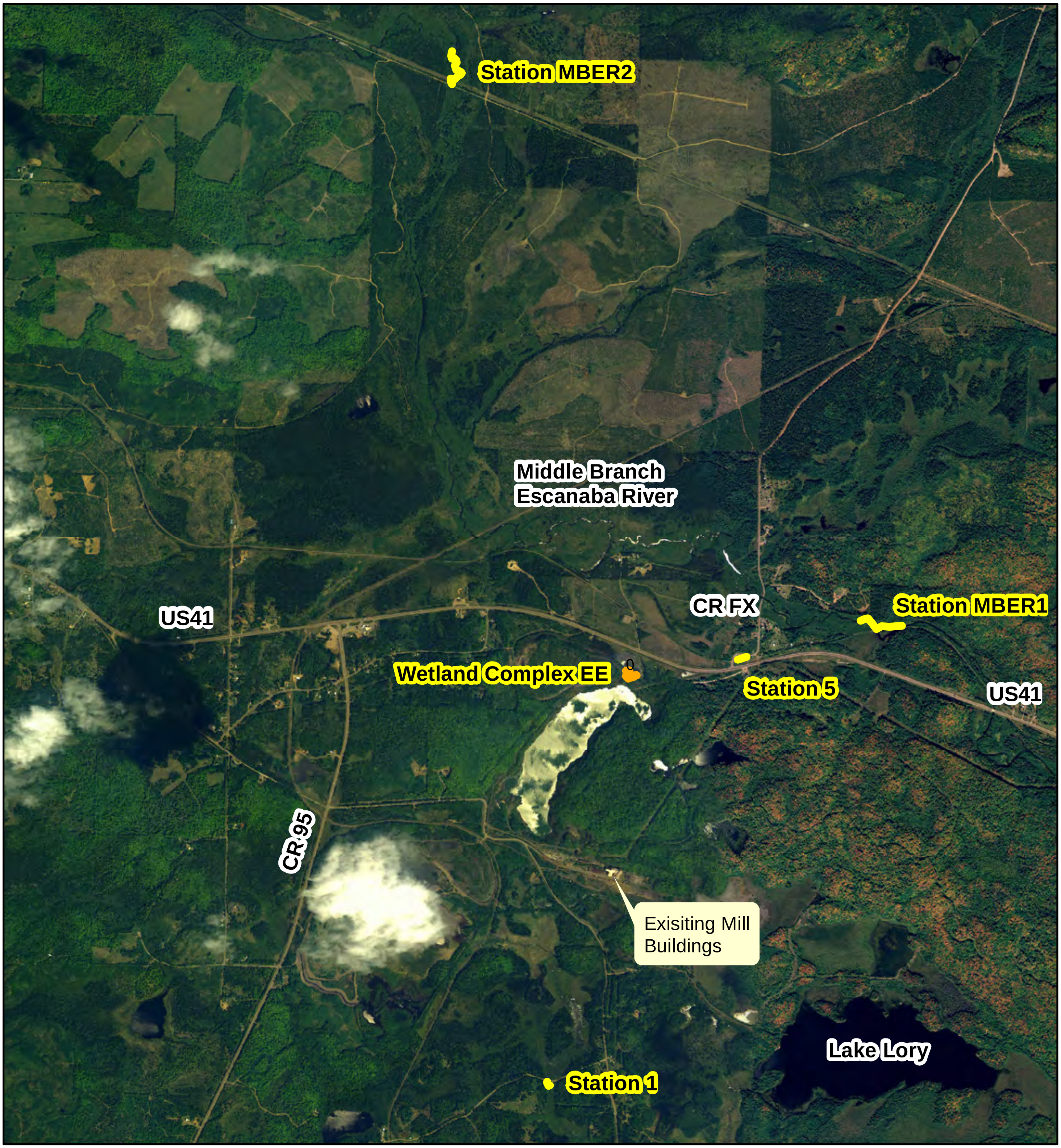


King & MacGregor Environmental, Inc.

Appendix M

Humboldt Mill

Aquatic Survey Location Maps



Legend

Wetland Complex EE Station

Stream Sample Station Locations

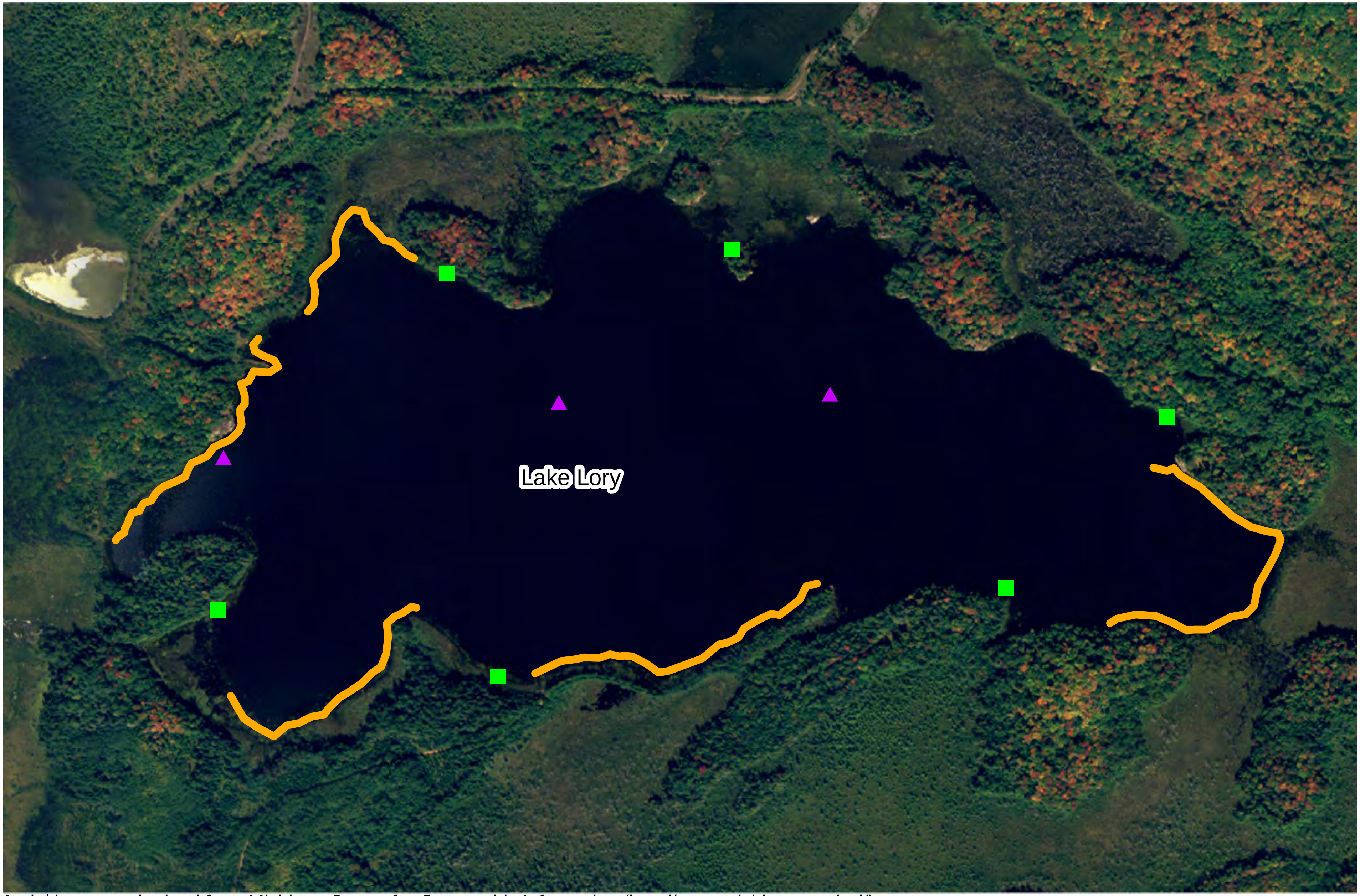
0 875 1,750 3,500 5,250 7,000 Feet

N

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

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 N

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 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.

<u>Bulk Tank Failure</u> – 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.

<u>Mishandling/Leaking Hoses</u> - 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.

<u>Construction/Reclamation Phase Release</u> - 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 1.1.8 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	4,398 lbs	WTP chemical storage
2	Sodium Bisulfite 38%	Sodium Bisulfite	7631-90-5	617 lbs	WTP chemical storage
3	Sodium Hydroxide 25%	Sodium Hydroxide/Caustic Soda	1310-73-2	1,798 lbs	WTP chemical storage
4	Sodium Hypochlorite 12.5%	Chlorine/Bleach	7681-52-9	1,117 lbs	WTP chemical storage
5	1) Ferric Chloride 35%	Ferric Chloride	1) 7705-08-0, 2) 7647-01-0	30,650 lbs	WTP Reactor Area (West of WTP)
6	1) Sodium Hydroxide 50%	Sodium Hydroxide/Causic Soda	1) 1310-73-2, 2) 7647-14-5	53,523 lbs	WTP chemical storage
7	Sulfuric Acid 93.19%	Sulfuric Acid, 66 Deg	7664-93-9	39,194 lbs	WTP chemical storage
8	Aluminum chloride hydroxide sulfate	Nalco 8136/PAC	39290-78-3	13,213 lbs	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	805 lbs	WTP chemical storage
10	Hydrotreated Light Distillate	Nalclear 7766 Plus/Flocculant	64742-47-8	294 lbs	WTP chemical storage

Item No.	Chemical Name	Trade Name	CAS No.	Storage Volumes	Storage Areas
11	Hydrogen Peroxide 50%	Hydrogen Peroxide	7722-84-1	34,736 lbs	WTP reactor Area
12	Permatreat PC-191T	Permatreat PC-191T/Reverse osmosis antiscalant	unknown	3,750 lbs	WTP chemical storage
13	1) Magnesium nitrate 2) 5-Chloro-2Methyl-4-Isothiazolin-3-one 3) 2-Methyl-4-Isothiazolin-3-one	Biocide PC-56	1) 10377-60-3 2) 26172-55-4 3) 2682-20-4	1,400 lbs	WTP chemical storage
14	1) Sodium Carbonate 2) Ethylenediamine Acid 3) Sodium lauryl sulfate 4) Sodium gluconate	Hydrex 4501 (dry)	1) 497-19-8 2) 64-02-8 3) 151-21-3 4) 527-07-1	2,100 lbs	WTP chemical storage
15	Citric Acid (Dry)	Citric Acid (dry)	77-92-9	4,000 lbs	WTP chemical storage
16	Sodium carboxymethyl cellulose	CMC/Depramin C	9004-32-4	20 tons	Reagent storage area
17	Calcium Oxide	High Calcium Quick Lime	1305-78-8	39 tons	Lime silo
18	Optimer 83949	Flocculant	Unknown	2 tons	Reagent storage area
19	Methyl isobutyl carbinol (MIBC)	MIBC/Frother	108-11-2	2.2 tons	MIBC tank
20	Sodium isopropyl xanthane (SIPX)	SIPX	140-93-2	15 tons	Reagent storage area
21	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 team is comprised of 11 individuals and trainings occur on a monthly basis and may include first aid, evacuation, and building or confined space extrications.

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 O

Financial Assurance

EAGLE MINE AND HUMBOLDT MILL CLOSURE

2019 CLOSURE PLAN ESTIMATE

SUMMARY OF THE ESTIMATE (US$)

Description	SLR Estimate November 2018	Difference from Previous Estimate	Comments
Functional Currency	USD		
Current Day Cost	2019		
Expected Operations Completion Date	2025	Plus 2 Year	Previous was 2023
Expected Closure Completion Date	2028/29	Plus 2 Year	SLR provides 2 years for Mine Closure and 3 years for Mill Closure (winter work is avoided)
Expected Post-Closure Completion Date	2029	Plus 2 Year	SLR provides for an initial post-closure period of 5 years to allow Sites to come to equlibriam.
Post-Closure Monitoring Completion Date	2049	Plus 2 Year	SLR provides 15 years to demonstrate no further action is required including monitoring.

Code	Description	Estimated Cost ($1000's)	Contingency ($1000's)	Closure Estimate ($1000's)	
	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
1120	Building Demolition	$0	$0	$0	Not applicable to the underground workings
1130	Demolition of Underground Infrastructure	$1,097,368	$131,684	$1,229,052	Underground Infrastructure Demolition, Load, Haul to Surface Processing Area
1140	Concrete and Asphalt Demolition	$0	$0	$0	Concrete/Asphalt in the UG workings will be decontaminated if necessary but will remain in place
1150	Drainage Facilities and Road Removal	$0	$0	$0	Not applicable to the underground workings
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	
1180	General Site Planting and Revegetation	$0	$0	$0	Not applicable to the underground workings
1190	Other Miscellaneous Closure Requirements	$0	$0	$0	Not applicable to the underground workings
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
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 infrastruc
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)	$5,613,114	$561,311	$6,174,425	2019 Using same as 2018 of 5 year operating level
7200	Humboldt Mill (4 years)	$7,825,099	$782,510	$8,607,609	2019 changed per Golder review of 4 year operating plan
	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	$29,052,627	$3,390,916	$32,443,544	
	Humboldt Mill Subtotal	$25,939,189	$2,969,939	$28,909,127	
	Total	$54,991,816	$6,360,855	$61,352,671	
	Grand Total of All Cash Flows - Engineer's Estimate	**$54,991,816**	**$6,360,855**	**$61,352,671**	

ADD	**ADD** - Fill Open Stopes with CRF & Clear TDRSA of waste material	$2,096,334	$0	$2,096,334
	Total for Project before inflation	$57,088,150	$6,360,855	$63,449,005
	Escalation Factor - Detroit CPI No Adjustment for this estimate as prepared with 2018 year-end dollars	$1,427,204	$159,021	$1,586,225
	Total for Project including inflation (excludes Contingency)	$58,515,353	$6,519,876	$65,035,230
	EGLE Adminstrative Oversight	$5,983,860	$0	$5,983,860
	Estimate to EGLE - Total for Project	**$64,499,213**	**$6,519,876**	**$71,019,090**
	Previous Estimate			**$ 68,774,901**
	Difference			**$ 2,244,188**

Appendix P

Humboldt Mill

Organizational Information

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 16, 2020

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

Kristen Mariuzza	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
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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
Kristen Mariuzza	President/Managing Director	4547 County Road 601 Champion, MI 49814
Scott Manninen	CFO	4547 County Road 601 Champion, MI 49814