



KENO HILL SILVER DISTRICT MINING OPERATIONS

DUST ABATEMENT AND MONITORING PLAN

September 2023

Prepared by:

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Prepared for:

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VERSION HISTORY

ISSUE DATE	DESCRIPTION AND REVISIONS MADE
June 2011	Monitoring and Surveillance Plan Revision 1, QML-0009. September 2011. Bellekeno Mine. Initial dustfall monitoring program
April 2012	Monitoring and Surveillance Plan Revision 1.1, QML-0009. April 2012. Bellekeno Project. Plan updated to incorporate total solid particulate (TSP) monitoring and additional monitoring stations
January 2013	Monitoring, Surveillance and Reporting Plan Rev 2 Plan updated to reflect the milling of ore from the Bellekeno, Lucky Queen and Onek ore sources
June 2014	Dust Abatement and Monitoring Plan, Keno Hill Silver District Mining Operations, June 2014 Initial stand-alone plan issued Plan updated to incorporate air dispersion modeling results involving various scenarios for the operation of Bellekeno, and/or and Flame & Moth, and/or Lucky Queen and Onek Testing of particulate matter less than 10 µm in diameter (PM ₁₀) added; sample frequency eight samples per month; sample station TSP-1 and TSP-3 moved
June 2015	Plan included with YESAA 2017-0086 Project Proposal Plan updated to reflect production from the Bellekeno, Lucky Queen, Onek and Flame & Moth deposits in accordance with terms and conditions from YESAA Decision Document 2013-0161 Testing of particulate matter less than 2.5 µm in diameter (PM _{2.5}) added; sample frequency is nine samples per month
September 2017	Plan included with YESAA 2017-0176 Project Proposal Plan updated to include additional modeling to account for a new scenario where Flame & Moth and New Birmingham mines would operate concurrently
January 2018	Commitment to continue dustfall monitoring through operations, temporary closure and active closure added Summary of modeling results for the scenario where Flame & Moth and New Birmingham mines operate concurrently removed
April 2018	Sampling frequency description revised
August 2018	Plan approved under QML-0009, subject to update prior to start of production and milling operations and the establishment of a formal complaint mechanism for Keno City residents
February 2021	Plan updated in response to the YESAA processes for Flame & Moth and New Birmingham, and in consideration of the results of the air dispersion model. Inputs from the operation of Lucky Queen and Onek deposits removed and Climate section update Tabulation of dustfall modeling for various scenarios removed Description of dust mitigation measures expanded on Monitoring methodology added Dust Disturbance Notification and Responsibilities added
October 2021	Plan updated in response to comments received from review under the QML Dust Abatement and Monitoring Monitoring will be increased from running for 9 days a month to 18 days per month for one year and a statistical analysis will be completed to evaluate the appropriate monitoring frequency.
January 2023	Keno Hill Silver District Mining Operations, Dust Abatement and Monitoring Plan Current Version
September 2023	Plan updated in response to comments received from Energy Mines and Resources

DOCUMENT REVISIONS

SECTION	SUMMARY OF CHANGES
Entire document	Updated to reflect new ownership of company and revised reporting structure Figures and photographs updated
Version History	Table added that lists the previous revisions of the plan. A brief description of the changes made provided
Document Revisions	Table added to indicate areas where changes have been made to the previous revision of the Plan
Concordance Tables	Tables added that outline the applicable proponent commitments made during the environmental assessment and the decision document terms and conditions that show where they have been addressed in the Plan
List of Acronyms and Abbreviations	List added
Introduction	Overview of the KHSD mining operations added Change of ownership explained
Management Approach	Section added; includes subsections Objectives, Keno City Engagement, and Roles and Responsibilities Objectives revised to focus on mining operations Response to Keno City resident concerns resulted in the relocation of a dustfall monitoring station Roles and responsibilities expands on and replaces October 2021 Plan, Section 6.4
Site Description	Existing climatic conditions from October 2021 Plan, Section 2 updated Subsection on air dispersion modelling added, information from October 2021 Plan, Section 2.1 moved to this section October 2021 Plan, Section 4 (potential dust sources and dust receptors) relocated to this section
Regulatory Context	Section added; includes subsection Permits and Authorizations, and Ambient Air Quality Standards Regulatory Context includes a table of related approvals, permits, licences and operational management plans October 2021 Plan, Section 3 (Yukon ambient air quality standards) and Table 3 from Section 6.1 (Ontario ambient air quality criteria) moved to this section
Dust Abatement and Mitigation Measures	Updates to section include separating abatement measures from mitigation measures and linking objectives
Air Quality Monitoring	Section includes Background, Instrumentation and Methodology, Data and Operator Training subsections
Background	Subsection added to Air Quality Monitoring; includes a description of the evolution of the dustfall monitoring program from 2011 to present October 2021 Plan, Section 6.2 (updated monitoring plan) moved to this section and updated Modifications made to the BGI Omni Ambient Air Quality Samplers setup to enable them to function below -20°C are described
Instrumentation and Methodology	October 2021 Plan references to YESAA decision documents moved to the YESAA Document Concordance Table The schedule necessary to achieve the objective of 18 days of sampling per month is presented in a table for clarity A commitment to investigate the effectiveness of solar battery maintainers is made. The statement about the existing samplers inability to collect samples below -20°C removed
Data	Sample analysis and data quality checks and data review protocol added Mechanism for comparison with triggers in the KHSD Mining Operations Adaptive Management Plan added
Operator Training	Subsection added
Dust Disturbance Register	October 2021 Plan, Section 6.3 relocated to this section and updated; dated appendices removed Noise generating event reference removed
Documentation and Reporting	October 2021 Plan, Section 6.5 relocated to this section and updated
References	Section updated

YESAA DECISION DOCUMENT CONCORDANCE TABLE

TERM	DECISION DOCUMENT	TERM & CONDITION	WHERE ADDRESSED
69	2009-0030	Monitoring dust conditions is an important step in controlling dust impacts. Simple TSP (dustfall) monitoring is a simple and inexpensive way to determine dust deposition at the sampling locations. This test can be done at the site by the proponent with little cost or training necessary.	Section 6.1
70	2009-0030	If warranted by initial dustfall measurements indicating TSP concentrations in excess of 150 micrograms per cubic metre (the BC Air Quality Objectives and Standards Level A criteria) at the fence line, the proponent shall conduct more sophisticated monitoring with high volume samplers and re-evaluate and improve dust suppression techniques to achieve the TSP objective.	Version History Section 6.1
71	2009-0030	Potential dispersal of contaminants from Dry Stack Tailings Facility to Keno must be qualified based on wind dispersion models and local meteorological conditions and provided to appropriate regulator.	Section 3.2
36	2011-0315	The proponent shall amend their dustfall monitoring program to include measurement of total particulate per volume of air for selected size fractions and undertake chemical analyses should the total dust per volume of air exceed health based mass per volume benchmarks.	Section 6.1
37	2011-0315	Any dust measurement conducted by the proponent needs to be comparable to the Yukon Ambient Air Quality Standards. The “simple TSP (dustfall) monitoring” that is mentioned does not allow for this direct comparison of results.	Section 6.1
19	2013-0161	The Proponent shall monitor levels of TSP, PM10, PM2.5 and metals speciation of TSP.	Section 6.1
9	2017-0176	The dust management and abatement plan shall be updated, in consultation with the residents of Keno City, prior to starting operations.	Section 2.2 Section 8
10	2017-0176	A complaint mechanism shall be in place for residents of Keno City and the public to provide an easily accessible means to report dust, noise, and traffic related incidences. The mechanism shall include steps that will be taken to record, investigate, if warranted rectify, and report back to the community and regulators.	Section 7

YESAA PROPONENT COMMITMENT CONCORDANCE TABLE

YESAB ONLINE REGISTRY (YOR)	PROPONENT COMMITMENTS	WHERE ADDRESSED
YOR 2009-0030-124-1	Environmental monitoring plan to monitor effectiveness of mitigation measures.	Version History Section 8
YOR 2011-0315-033-1	Alexco will continue to implement the Monitoring and Surveillance Plan to help mitigate the effects associated with increased dust emissions under QML-0009.	Version History Section 6.1
YOR 2011-0315-130-1	TSP monitoring devices will be in place and operational by August 15, 2012 (anticipated)	Section 6.1
YOR 2011-0315-098-1	Alexco will adhere to Environment Yukon's Ambient Air Quality Standards under the Environment Act. These standards for TSP are set at 120 µg/m ³ for a 24-hour average, and 60 µg/m ³ as an annual geometric mean. Results from TSP monitoring will be compared to the Ambient Air quality Standards under the Environment Act.	Section 4.2
YOR 2013-0161-130-1	Implementing monitoring for PM10 in addition to TSP, at a frequency of 4 times per month, sampling events at least 4 days apart	Version History
YOR 2013-0161-130-1	Continuing air quality monitoring at station TSP-2 which is the historic monitoring station located at the north-west fence line, west of the current DSTF and north of the crusher	Section 6.1
YOR 2013-0161-130-1	Relocating air quality monitoring station TSP-1 from its location south-east of the current DSTF to the western limit of Keno City (near receptor R05)	Section 6.1
YOR 2013-0161-130-1	Implementing an additional air quality monitoring station at the eastern end of Keno City (near receptor R02)	Section 6.1
YOR 2013-0161-174-1	If Keno residents raise concerns about dust from Flame and Moth, Alexco will work with the stakeholders to identify additional mitigation options.	Table 2-1 Section



TABLE OF CONTENTS

1 INTRODUCTION	1
2 MANAGEMENT APPROACH.....	3
2.1 OBJECTIVES	3
2.2 KENO CITY ENGAGEMENT	3
2.3 ROLES AND RESPONSIBILITIES	4
3 SITE DESCRIPTION.....	5
3.1 EXISTING CLIMATIC CONDITIONS	5
3.2 AIR DISPERSION MODELING	6
3.3 POTENTIAL DUST SOURCES	6
3.4 DUST RECEPTORS.....	7
4 REGULATORY CONTEXT	8
4.1 PERMITS AND AUTHORIZATIONS	8
4.2 AMBIENT AIR QUALITY STANDARDS	8
5 DUST ABATEMENT AND MITIGATION MEASURES	10
6 AIR QUALITY MONITORING	12
6.1 BACKGROUND	12
6.2 INSTRUMENTATION AND METHODOLOGY	16
6.3 DATA	17
6.4 OPERATOR TRAINING.....	17
7 DUST DISTURBANCE REGISTER.....	18
8 DOCUMENTATION AND REPORTING	19
9 REFERENCES	20

LIST OF TABLES

Table 1-1: Keno Hill Silver District Mining Operations Overview 1
 Table 2-1: Post YESAA 2017-0183 Community Engagement and Consultation on Dust..... 3
 Table 3-1: Mayo A Climate Normal (1981-2010) Average Precipitation..... 6
 Table 3-2: Discrete Receptors in Keno City..... 7
 Table 4-1: Related Approvals, Permits, Licences and Operational Management Plans 8
 Table 4-2: Yukon Ambient Air Quality Standards ($\mu\text{g}/\text{m}^3$) 9
 Table 4-3: Ontario Ambient Air Quality Criteria as Suspended Particulate Matter ($\mu\text{g}/\text{m}^3$) 9
 Table 6-1: Summary of Dust Monitoring Locations for the Keno Hill Silver District..... 13
 Table 6-2: Example Monthly Dust Monitoring Schedule 17

LIST OF FIGURES

Figure 1-1: Keno Hill Silver District Mining Operations Overview 2
 Figure 3-1: District Mill Wind Rose June 2011 – October 2021 5
 Figure 3-2: Potential Dust Sources, Receptors and Weather Station (pre 2023)..... 7
 Figure 5-1: Dust Collection and Ventilation System 10
 Figure 6-1: Meteorological and Air Quality Monitoring Stations Locations 15
 Figure 6-2: Inlet Jet Sizes for TSP (grey), PM_{10} (blue), and $\text{PM}_{2.5}$ (red) 16

LIST OF APPENDICES

APPENDIX A: DISTURBANCE NOTIFICATION FORM

LIST OF ACRONYMS AND ABBREVIATIONS

AKHM	Alexco Keno Hill Mining Corp.
CCME	Canadian Council of Ministers of the Environment
DSTF	Dry Stack Tailings Facility
EMR	Energy, Mines and Resources
ERDC	Elsa Reclamation & Development Company Ltd.
FNNND	First Nation of Na-Cho Nyak Dun
ICP-MS	Inductively coupled plasma – mass spectrometry
KHSD	Keno Hill Silver District
LOM	Life Of Mine
masl	metres above sea level
PM	Particulate Matter
PM₁₀	Particulate Matter less than 10 µm in diameter
PM_{2.5}	Particulate Matter less than 2.5 µm in diameter
QML	Quartz Mining Licence
QP	Qualified Professional
TSP	Total Suspended Particulate
WL	Water Licence
WTP	Water Treatment Plant
YAAQS	Yukon Ambient Air Quality Standards
YESAA	Yukon Environmental and Socio-economic Assessment Act
YESAB	Yukon Environmental and Socio-economic Assessment Board
YOR	YESAB Online Registry
YWB	Yukon Water Board

1 INTRODUCTION

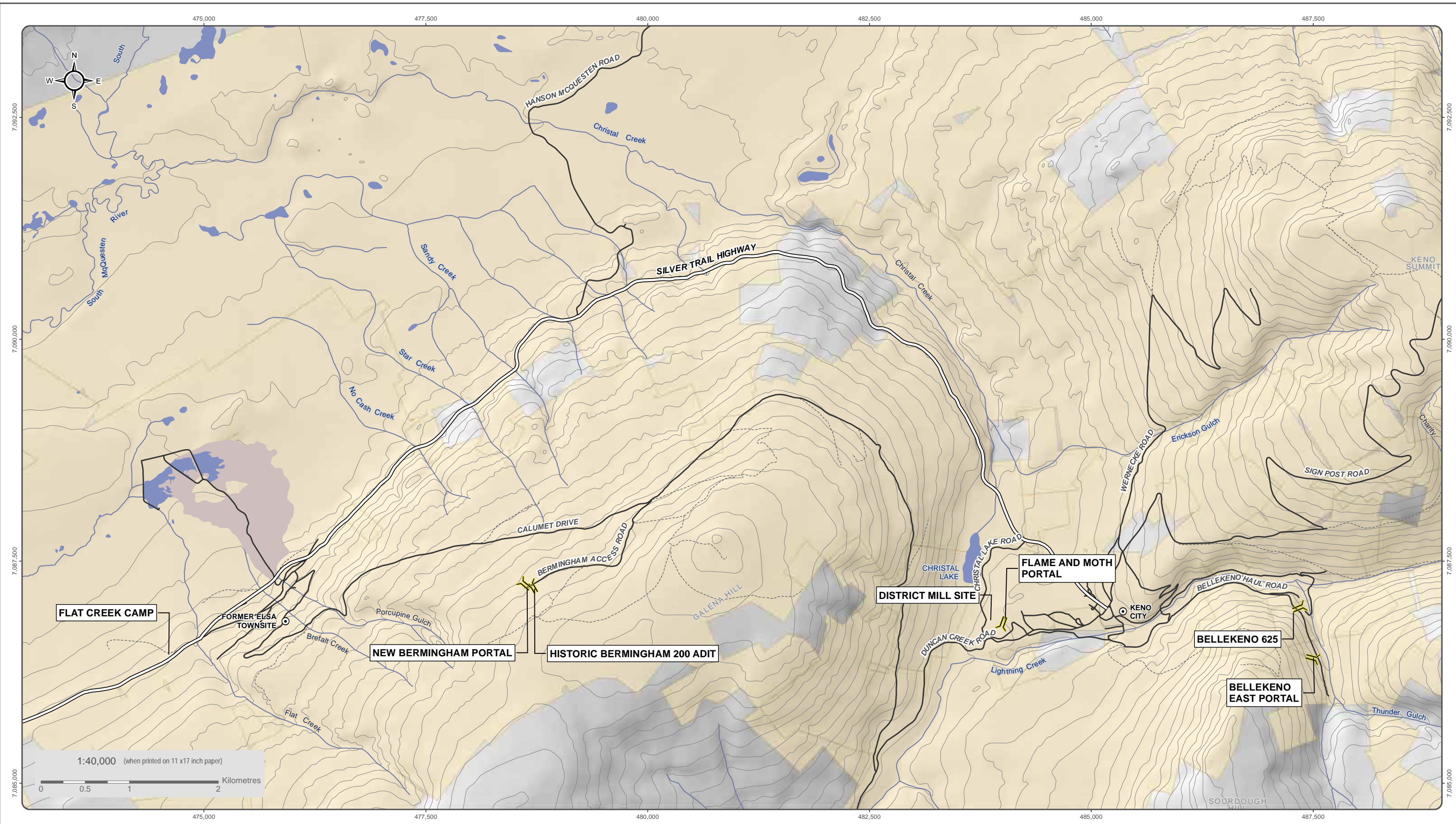
This Dust Abatement and Monitoring Plan has been developed to describes measures taken to identify and address potential air quality effects that may occur because of Alexco Keno Hill Mining Corp. (AKHM) Keno Hill Silver District (KHSD) operations, in accordance with QML-0009.

The site is 354 km north of Whitehorse, in the vicinity of Keno City in the central Yukon. AKHM owns and operates of a series of small underground silver/lead/zinc mines with a centralized mill, the Keno Hill Silver District Mining Operations as described in Table 1-1 and shown on Figure 1-1. On September 7, 2022, Alexco Resource Corp. (doing business as Hecla Yukon), the parent company of AKHM, was acquired by Hecla Mining Company.

Table 1-1: Keno Hill Silver District Mining Operations Overview

MINES / ORE DEPOSITS	Bellekeno (Production 2010 – 2013, suspended 2013 – 2020, production 2020, temporary closure 2020) Flame & Moth (Development 2018, suspended 2018 – 2020, development and production 2020 - present) New Bermingham (Advanced exploration 2017 – 2018, development and production 2020 - present) Lucky Queen, Onek 990 (Advanced exploration 2013, not active)
MILL	District Mill location at Flame & Moth Mine area (Constructed 2010) Tailings placed in Dry Stack Tailings Facility (Established 2010) or underground as backfill
WORK FORCE	~ 250 employees and contractors during active mine and reclamation operations (as per Yukon Environmental and Socio-economic Assessment Act [YESAA] 2018-0169 Decision Document)
AIRSTRIP	Village of Mayo, YT
CAMP FACILITIES	Flat Creek camp facilities include a trailer camp, kitchen facility, welcoming center and dry Four refurbished houses and a bunkhouse located nearby in the townsite of Elsa
POWER	Hydro grid power Yukon Energy, diesel power backup
WATER SUPPLY AND USE	Fresh water supply from Flat Creek and adjacent well Water treatment plants at Bellekeno 625, Flame & Moth, and New Bermingham for mine effluent Process water is recycled from the Mill Pond to the plant
FIRST NATIONS	First Nation of Na-Cho Nyak Dun (FNND)

The Keno Hill mining camp has a long mining history and is a brownfields site. AKHM develops the mineral resources, operates the KHSD mines and undertakes receiving environmental monitoring and treatment of mine discharge waters. Hecla Yukon’s wholly owned subsidiary Elsa Reclamation & Development Company Ltd. (ERDC) undertakes care and maintenance, environmental monitoring and water treatment of historic adit drainages, district-wide closure planning and studies for the historic environmental liabilities. ERDC work and associated monitoring and reporting is outside the scope of this Dust Abatement and Monitoring Plan.



National Topographic Data Base (NTDB) compiled by Natural Resources Canada at a scale of 1:50,000. Cadastral data compiled by Natural Resources Canada. Reproduced under license from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

Datum: NAD 83; Map Projection: UTM Zone 8N

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






-  Adit
-  AKHM / ERDC Quartz Claims
-  Silver Trail Highway
-  Other Road
-  Limited-Use Road
-  Tailings Area
-  Waterbody
-  Watercourse
-  Contours (100 ft intervals)



FIGURE 1-1
KENO HILL SILVER DISTRICT MINING OPERATIONS OVERVIEW

DECEMBER 2022

D:\Project\AllProjects\Keno_Area_Mines\ALL-SITES\02-Map\01-Overview\01-District_Wide\Overview_20221115.mxd
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2 MANAGEMENT APPROACH

2.1 OBJECTIVES

The objectives of this Plan are to:

- 1) ensure employees and contractors are trained in dust abatement practices to minimize dust emissions from operations at the District Mill, dry stack tailings facility (DSTF), and Bellekeno, Flame & Moth, and New Birmingham mine sites;
- 2) describe proper mitigation measures to maintain minimal impact on the community of Keno City; and
- 3) outline the monitoring program required for ongoing operations in a safe and compliant manner.

The Dust Abatement and Monitoring Plan has been developed to validate the air dispersion modelling and to address concerns raised during the Yukon Environmental and Socio-economic Assessment Act (YESAA) processes and from further consultation with Keno City residents.

2.2 KENO CITY ENGAGEMENT

Addressing the potential effects of fugitive dust on community health and well-being is of key importance given the location of the KHSD Mining Operations to Keno City. Consultation with Keno City residents has included both formal community meetings and posters, as well as informal phone calls, emails, and discussions in town with individual residents. Recent community interactions in which dust was discussed are listed in Table 2-1. In addition, AKHM notifies Keno City residents regarding traffic increases in the area, operation schedule changes and potential dust generating events. Commencing in 2022, AKHM provided residents with quarterly reports summarizing the results of the on-going dust monitoring program.

Table 2-1: Post YESAA 2017-0183 Community Engagement and Consultation on Dust

DATE	TOPIC
July 2020	AKHM posted and distributed a poster to update residents on the site activities and introduce new members of the team. This poster mentions the dust control activities and provides reference for the building design.
October 2020	AKHM hosted a consultation event in Keno City, to which all residents were invited. Approximately 11 people attended in person, with attendance varying over the course of the morning's discussion. Two people attended by telephone. Other residents who were not able to participate requested one on one conversations in the preceding or following week. Following the meeting, AKHM followed up on specific questions with emails or photos. A presentation was provided to all participants as a record of the main subjects of discussion. In addition to presentation of the AKHM production plans, the group discussed the construction of the crusher building for dust and noise control, traffic management on the haul road, groundwater monitoring, and the progress of the ERDC reclamation plan.
October 2021	Keno City public meeting provided an update on the KHSD Mining Operations included a presentation on the Dust Abatement and Monitoring Plan. Feedback from the community on the locations of the dust monitors requested. Dust mitigation measures described and input on other mitigation measures to consider requested from community. Effectiveness of the notification process for potential dust and noise generating events discussed. Disturbance notification form reviewed.
Throughout 2022	AKHM General Manager has had numerous calls, emails and in-person discussions with residents of Keno City. All have been informal. The dust monitor installed at the eastern end of Keno City (near receptor R01) was relocated to the Onek 400 portal area, near receptor R04, in response to concerns raised.

2.3 ROLES AND RESPONSIBILITIES

The Mine Manager or appointed designate is responsible for the effective implementation of the Dust Abatement and Monitoring Plan, providing the resources needed for the implementation and continual improvement of the Plan and for participating in regulator and community engagement and consultation.

Area managers and supervisors conduct inspections in their assigned work areas as required for fugitive dust emission concerns and address them with the appropriate measures.

Water treatment operators are responsible for conducting the field dust monitoring, submitting samples to the analytical laboratory, along with maintaining and calibrating the air quality samplers.

Environmental Coordinators are responsible for obtaining permits, permit amendments and regulatory and community reporting with respect to dust abatement and monitoring. They are also responsible for coordinating external review of data and updates to the models as necessary.

All staff and contractors at AKHM are required to implement the mitigation measures described in this plan as it pertains to their activities. Specifically, these responsibilities include:

- taking all necessary steps to minimize fugitive dust generation; and
- providing recommendations for improving fugitive dust management.

3 SITE DESCRIPTION

3.1 EXISTING CLIMATIC CONDITIONS

The site is characterized by sub-arctic climatic conditions with moderate precipitation. Summers are short (June to September), while winters are long and cold with moderate snowfall. Climatic parameters at the site are measured by three weather stations. An automated Onset HOBO meteorological station (Calumet Weather Station) was installed on Galena Hill above the Hector adit at 1,388 metres above sea level (masl). The second station, District Mill Campbell Scientific automated meteorological station, was located above the dry stack tailings facility, adjacent the former Keno City dump at elevation 937 masl (Figure 3-2). Per the plan, the District Mill weather station was relocated to the south side of Duncan Creek Road across from the crusher building at an elevation of 915.5 masl in Q3 2022. The original location for the weather station was within the footprint of DSTF phase 1 and was required to be moved as the DSTF was expanded. Therefore, the nearest suitable location was selected for the station, which is approximately 420 m from the original location. Due to the similar elevations at both locations, conditions are expected to be similar. The third station is the Valley Tailings Onset HOBO automated meteorological station, and it is located near the Valley Tailings at an elevation of 718 masl.

The mean monthly temperatures range from approximately -23°C in February to 15°C in June, July, and August at the District Mill station. The average wind speed in 2020 was approximately 1.32 m/s, with the wind direction mostly from the southeast at the District Mill. The extreme maximum wind speed recorded in 2020 was 9.78 m/s. Wind data from June 2011 to December 2020 is shown in the wind rose, Figure 3-1.

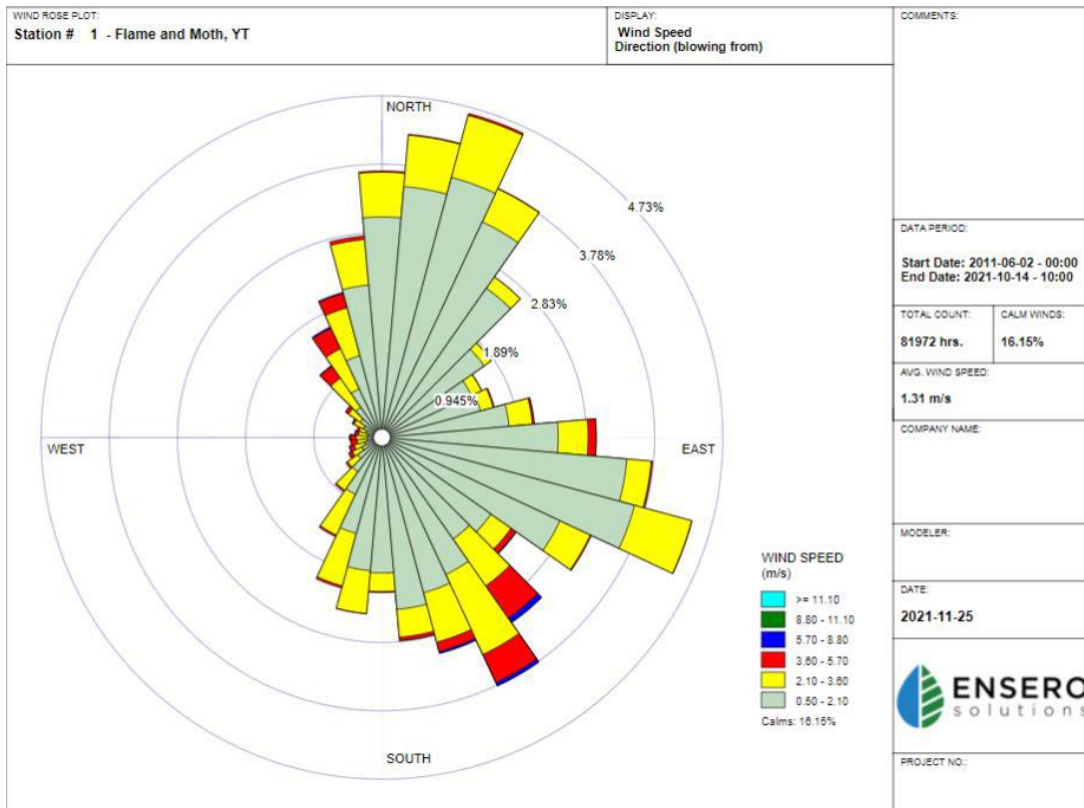


Figure 3-1: District Mill Wind Rose June 2011 – October 2021

Of the three local meteorological stations, only the District Mill station measures total precipitation, whereas the other two stations measure rainfall only. Analysis indicates that these data are not adequate for estimating precipitation trends at site; the Mayo A station is therefore used as a proxy. Table 3-1 presents mean monthly and annual rainfall, snowfall, total precipitation, at the Mayo 1981-2010 climate normal period (ECCC, 2023).

Table 3-1: Mayo A Climate Normal (1981-2010) Average Precipitation

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall (mm)	0.3	0.0	0.1	2.9	22.2	38.9	50.2	44.5	34.8	9.4	0.3	0.3	203.8
Snowfall (cm)	28.3	20.2	14.5	7.8	1.0	0.1	0.0	0.3	3.9	23.0	31.8	29.8	160.6
Precipitation (mm)	18.3	13.0	9.9	8.8	23.2	39.0	50.2	44.6	38.7	27.0	21.1	19.8	313.5
Average Snow Depth (cm)	31	38	34	15	0	0	0	0	0	3	14	23	13

3.2 AIR DISPERSION MODELING

Air dispersion modelling was conducted to identify the potential dust sources from mining-related activities, as well as the sensitive receptors, and predict the anticipated ambient concentrations under different operation scenarios. A model was conducted to identify the potential dust sources from the Bellekeno, Lucky Queen, Onek 990, and Flame & Moth mining-related (ACG 2014). Further modelling was carried out in to evaluate the potential air quality effects of the Bermingham Mine development and production program (AEG, 2017).

3.3 POTENTIAL DUST SOURCES

The main dust sources during the operations phase of mining include the DSTF, mineral processing (crushing), and traffic on unpaved roads (see Figure 3-2).

3.3.1 Dry Stack Tailings Facility

Tailings from the mill is transported to the DSTF. The DSTF is designed to be constructed in two phases. Deposition of tailings within the Phase 1 footprint commenced in 2010. Following completion of Phase 1, DSTF Phase 2 will allow the remaining volume of tailings estimated in the Life of Mine (LOM) Plan to be stored.

The DSTF contains fine grained material that could be subject to wind-blown transport. Degraded air quality may result from dust generation. The presence of metals in the tailings represents a potential source of airborne dust and therefore presents a potential risk to human health and the environment. The DSTF is being progressively reclaimed and this is the principal method of dust control.

3.3.2 Mineral Processing

The main processes taking place at the mill and crusher include primary and secondary crushing, wet grinding and various material transfers and handling. Ore from the Flame & Moth, and New Bermingham deposits is stored at the coarse ore stockpile on a concrete base pad surrounded by portable concrete containment blocks. Ore is mixed within this coarse ore stockpile area to provide a consistent feed blend. Processing of ore from the Bellekeno deposit ceased in 2021.

Ore crushing is completed through a two-stage crushing plant. The crushing system operates in closed circuit. Crushed ore is reclaimed via a draw down pocket located beneath the fine ore stockpile. The crusher was covered with a building that has ventilation and dust control to minimize the emission of dust from this source.

3.3.3 Traffic

Fugitive dust from the unpaved roads is another source. The roads and estimated traffic are described in the KHSD Mining Operations Traffic Management Plan. Fugitive dust emissions from unpaved roads are naturally mitigated by precipitation and the haulage roads are also controlled with the use of road watering or chemical suppressants, as required.

3.4 DUST RECEPTORS

Addressing the potential effects on community health and wellbeing is of key importance given the location of the mine site to Keno City. To assess potential effects of particulate matter, discrete receptors in Keno City were used in the modelling. Ambient concentrations were predicted at six discrete receptors in Keno City (Figure 3-2). Table 3-2 presents the coordinates and description of the six receptors. Those same receptors were used in the Noise Impact Assessment and are part of the KHSD Mining Operations Noise Monitoring and Management Plan.

Table 3-2: Discrete Receptors in Keno City

RECEPTOR	GPS LOCATION	DESCRIPTION
R01	N63.90827 W135.29599	East end Residence, north side of Lightning Creek Road
R02	N63.91019 W135.29968	Residence, east side of Sign Post Road
R03	N63.91023 W135.30205	Town Center, north from the Snack Bar
R04	N63.91239 W135.30376	Residence, west side of Wernecke Road
R05	N63.90851 W135.30993	Residence, about 850m east from the Mill
Cmpgrnd	N63.90772 W135.29998	Keno City campground

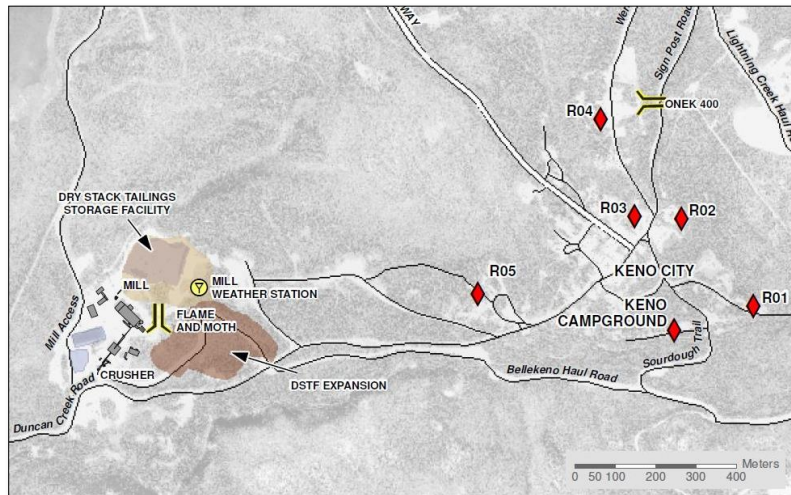


Figure 3-2: Potential Dust Sources, Receptors and Weather Station (pre 2023)

4 REGULATORY CONTEXT

4.1 PERMITS AND AUTHORIZATIONS

AKHM has all permits and authorizations in place for development and production of KHSD mines Bellekeno, Flame & Moth, and New Bermingham and operation of the District Mill. Approvals, permits, and licences and operational management plans associated with dust abatement are listed in Table 4-1. This plan should be read in conjunction with these documents.

Table 4-1: Related Approvals, Permits, Licences and Operational Management Plans

YESA APPROVALS	<ul style="list-style-type: none"> Decision Documents and Evaluation Reports for projects #2009-0030, #2011-0315, #2013-0161, #2017-0086, #2017-0176 and #2017-0183
QUARTZ MINING ACT APPROVALS	<ul style="list-style-type: none"> Class 4 Mining Land Use Approval (LQ00476 expires 2028) Quartz Mining Licence (QML-0009, updated December 2021, expires 2037)
WATER LICENCE	<ul style="list-style-type: none"> Type A Water Licence (QZ18-044 expires 2037)
MANAGEMENT PLANS¹	<ul style="list-style-type: none"> Management Health and Safety Program / Emergency Response Plan Mill Development and Operations Plan Mine Development and Operations Plans Adaptive Management Plan Environmental Monitoring, Surveillance and Reporting Plan Noise Monitoring and Management Plan Overburden Management (included in the Construction Site Plan Revision 1) Reclamation and Closure Plan Sediment and Erosion Control Plan (included in the Construction Site Plan Revision 1) Spill Contingency Plan Road Management Plans Tailings Management Plans Traffic Management Plan Waste Management Plan Waste Rock Management

¹ Management plans included here are not required by all of the authorizations listed.

Terms and conditions listed in the YESAA Decision Document Concordance Table and proponent commitments listed in the YESAA Proponent Commitment Concordance Table have been addressed in this plan in the corresponding sections. All references to documents on the Yukon Environmental and Socio-economic Assessment Board (YESAB) Online Registry can be found by searching for the Project and document number on the YOR.

4.2 AMBIENT AIR QUALITY STANDARDS

Dust or particulate matter can be divided into fractions of different sizes. Particulate matter less than 10 µm in diameter (PM₁₀) is the fraction of TSP that is inhalable, and therefore have the potential to cause adverse health effects. Fine particulate matter less than 2.5 µm in diameter (PM_{2.5}) can penetrate deeper into the lungs and are generally considered a stronger risk factor than the coarse fraction of PM₁₀ (WHO, 2013).

Yukon Government, Department of Environment, implemented Ambient Air Quality Standards (YG, 2019) for TSP and PM_{2.5} in 2010, and more recently for PM₁₀. Those standards and averaging periods are presented in Table 4-2.

Table 4-2: Yukon Ambient Air Quality Standards (µg/m³)

PARAMETER	24-HOUR	ANNUAL
TSP	120	60
PM ₁₀	50	n/a
PM _{2.5}	27	8.8

TSP, PM₁₀ and PM_{2.5} monitoring results are compared to the Yukon Ambient Air Quality Standards (YAAQS) under the *Environment Act* (see Table 4-2). Since there are no standards for metal concentrations in TSP in Yukon, results of metal speciation are compared to the Ontario Ambient Air Quality Criteria for reference. These criteria are summarized in Table 4-3.

Table 4-3: Ontario Ambient Air Quality Criteria as Suspended Particulate Matter (µg/m³)

PARAMETER	CRITERIA	
	24-HOUR AVERAGE	ANNUAL AVERAGE
Antimony	25	-
Arsenic	0.3	-
Barium	10	-
Beryllium	0.01	-
Boron	120	-
Cadmium	0.025	0.005
Chromium	0.5 (metallic, divalent, trivalent)	0.0007 (CrVI)
Cobalt	0.1	-
Copper	50	-
Iron	4	-
Lead	0.5	-
Manganese	0.4	-
Molybdenum	120	-
Nickel	0.2	0.04
Selenium	10	-
Silver	1	-
Strontium	120	-
Tin	10	-
Titanium	120	-
Vanadium	2	-
Zinc	120	-

5 DUST ABATEMENT AND MITIGATION MEASURES

Dust abatement refers to the process of inhibiting the creation of excess soil dust, whereas dust mitigation refers to the action of reducing the severity of the dust generated.

AKHM is committed to implementing dust abatement and mitigation measures which were incorporated into the air dispersion model.

Dust abatement measures include:

- enclosure of crusher in a building with a dust collection and ventilation system (completed in 2021; Figure 5-1);
- all traffic related to the New Birmingham development to remain a minimum of 500 m from the Keno City Campground;
- notify Keno City residents regarding traffic increases, operation schedules and potential dust generating events;
- cessation of ore haulage on the Keno City bypass road from the Bellekeno Mine; and
- minimizing traffic through Keno City. No traffic related to the KHSD Mining Operations will enter Keno City unless Keno City is the destination.



Figure 5-1: Dust Collection and Ventilation System

Dust mitigation measures implemented include, but are not limited to:

- work area inspections for dust emission concerns;
- progressive reclamation, such as placement of cover and revegetation, measures will be implemented on the existing and DSTF Phase II; and
- chemical dust suppressant (calcium chloride or similar) will be applied to the roads when required in addition to the road watering that will be carried between chemical dust suppressant applications.

Routine dust monitoring and meteorological monitoring is used to confirm the modelling results and determine if additional mitigations measures are required in the vicinity of Keno City. The results of the dust monitoring are reviewed on a quarterly basis by a Qualified Professional and any thresholds crossed or triggers activated as specified in the KHSD Mining Operations Adaptive Management Plan would be identified and mitigation measures implemented.

Additional mitigation measures that could further reduce fugitive dust emissions include:

- dust suppressant could be applied to the DSTF. Including the application of a tackifier product to the exposed tailings surfaces (as final slopes or benches are completed), to reduce potential wind erosion prior to progressive reclamation; and
- additional engineering controls/systems.

While colder temperatures may reduce dust emissions (e.g., wet and/or frozen surfaces), emissions are more heavily influenced by mining activities and wind speed, with higher winds promoting diffusion of dust emissions from the area (Wang et al., 2022). Wind speeds in the KHSD are on average lower in the winter months, thereby limiting dispersion of dust from the area. Although concentrations of metals and particulates have generally been low in the KHSD to date, dust data will be reviewed to determine if additional mitigation measures are required.

6 AIR QUALITY MONITORING

6.1 BACKGROUND

The monitor program that has been developed is used to confirm the modelling results and determine if additional mitigations measures are required. This routine monitoring program has been developed to monitor the level of risk to the community.

Dustfall monitoring stations were installed at four locations near the District Mill site in 2011. Bergerhoff dust monitoring gauges were utilized to carry out this initial program. The Bergerhoff deposit dust gauge is designed to measure dust deposition, which can be reported as a weight per unit area over unit time.

Total suspended particulates (TSP) and total metal monitoring was undertaken using BGI Omni Ambient Air Quality Samplers at two locations near the Keno District Mill site in August 2012. Additional sampling for coarse and fine fractions of particulate matter (PM₁₀ and PM_{2.5} respectively) was instigated in August 2015 at the three operational stations (TSP-1, TSP-2, TSP-3) in accordance with the revised Dust Abatement and Monitoring Plan.

A summary of past and current air quality monitoring stations used to monitor dust for the KHSD are summarized in Table 6-1.

Table 6-1: Summary of Dust Monitoring Locations for the Keno Hill Silver District

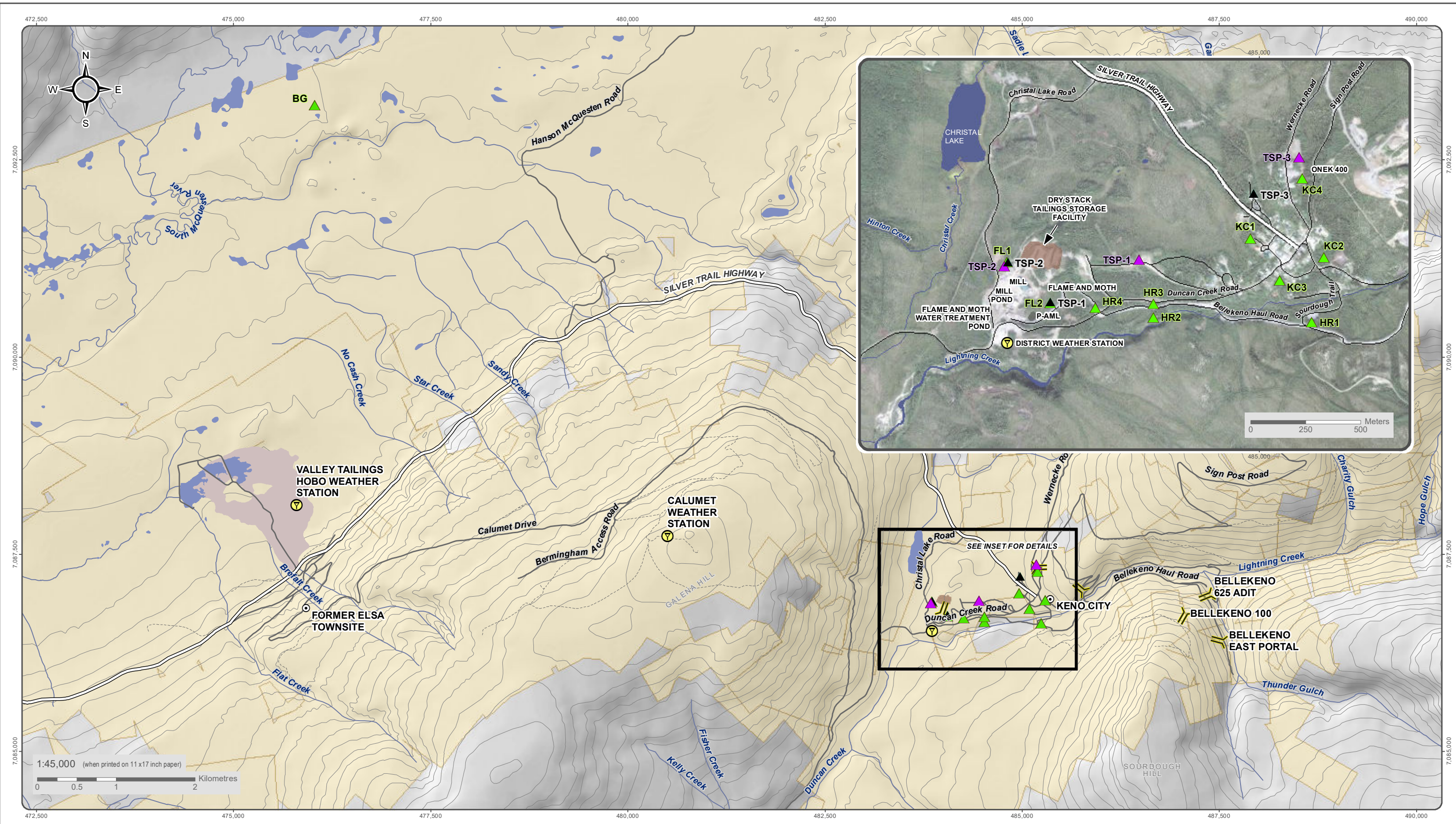
STATION	LOCATION	COORDINATES		COMMISSIONING DATE	OPERATIONAL STATUS
		INITIAL	CURRENT		
DM-1	East of the DSTF.	484099.4 7086871	N/A	2011	Decommissioned
DM-2	South of the Mill Pond.	483754 7086687	N/A	2011	Decommissioned
DM-3	East of the mill and crusher.	484047.8 7086714	N/A	2011	Decommissioned
DM-4	Toe of the DSTF.	483855.1 7086898	N/A	2011	Decommissioned
TSP-1	Initially located east of the mill and crusher. In January 2021, the station rendered unsalvageable and replaced to the north side of Keno City, adjacent the Onek 400 water treatment plant.	484051 7086715	484454.3 7086913	August 2012	In use
TSP-2	Initially located at the toe of the DSTF. Relocated in 2018 to the DSTF phase 2 expansion area (approximately 22 m from initial location) to characterize ambient concentrations closer to Keno City.	483857 7086898	483841.7 7086882	August 2012	In use
TSP-3	Initially located at the north side of Keno City. Relocated to the west side of Keno City in 2022.	484972.4 7087208	485179.5 7087377	December 2014	In use

N/A – not applicable (station has been decommissioned).

To provide better understanding of how ambient concentrations vary throughout town, and based on feedback received through the engagement and regulatory processes for AKHM, the following changes were made to the air quality monitoring program in Q2 2022:

- monitoring frequency objective was increased from running for 9 days a month to 18 days per month;
- the dust monitor previously located at the north side of Keno City (TSP-3) was relocated to the west side (near receptor R05);
- a third sampler (TSP-1) was installed and commissioned at the eastern end of Keno City in December 2014 in accordance with the revised Dust Abatement and Monitoring Plan; however, in response to concerns raised by local residents about the noise the sampler generated it was relocated to the north side of Keno City, adjacent the Onek 400 water treatment plant (near receptor R04); and
- samplers that operate from battery power had their batteries upgraded to deep cycle marine batteries installed within an insulated box to enable the proper functioning of the equipment at temperatures below -20°C.

The sampler at the toe of the DSTF (TSP-2) remains in operation to provide information on ambient concentrations within the Project area and to provide data continuity as this station has been monitored for TSP since August 2012.



National Topographic Data Base (NTDB) compiled by Natural Resources Canada at a scale of 1:50,000. Cadastral data compiled by Natural Resources Canada. Reproduced under license from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

Satellite imagery obtained from Yukon Geomatics map service <http://mapservices.gov.yk.ca/ArcGIS/services> on March 2023.

Datum: NAD 83; Map Projection: UTM Zone 8N

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	Alexco TSP Monitoring Stations		Mine Feature Footprint		Watercourse
	Former Alexco TSP Monitoring Stations		Current DSTF		Silver Trail Highway
	YG PM10 Monitoring Sites 2013		Tailings Area		Other Road
	Weather Station		Waterbody		Limited-Use Road
	Adit		Alexco/ERDC Quartz Claims		



HECLA KENO HILL

FIGURE 6-1

METEOROLOGICAL AND AIR QUALITY MONITORING STATIONS LOCATION

MARCH 2023

D:\Project\AllProject\Keno_Area_Mines\AL-SITES\02-Map\04-Subset\Air_Noise_Dust\Air_Quality_Site_YTD_20230203.mxd
(Last edited by: ameh@hecla.com 2023-03-22 09:58 AM)

6.2 INSTRUMENTATION AND METHODOLOGY

The BGI Omni samplers are set up with TSP, PM₁₀, or PM_{2.5} inlets (or jets), and use the filter reference method. The jet allows the desired size of particulate matter (i.e., PM_{2.5}, PM₁₀, or TSP) to enter the lower portion of the flow path. The size of the particles passing through the jet is determined by the physical configuration of the inlet and the air flow velocity. The individual jets are hand detachable and removed/installed by screwing in and out. Furthermore, jets for sampling TSP, PM₁₀, or PM_{2.5} are different colours to better distinguish between the jet sizes and ensure the correct jet is installed prior to initiating sampling (Figure 6-2). Furthermore, samples are collected following a standard operating procedure to ensure proper sample collection, including compliance with the 24-hr, gravimetric National Air Pollution Surveillance (NAPS) reference method.



Figure 6-2: Inlet Jet Sizes for TSP (grey), PM₁₀ (blue), and PM_{2.5} (red)

Samples are collected over 24-hour periods and sent to Bureau Veritas laboratory for gravimetric analysis and metals by inductively coupled plasma – mass spectrometry (ICP-MS) (from TSP samples only). The sampling locations are shown on Figure 6-1.

The air quality samplers are equipped to such that the jet sizes installed can be changed to sample three sizes: TSP, PM₁₀ or PM_{2.5} inlets. Samples are collected in compliance with the 24-hr, gravimetric National Air Pollution Surveillance reference method. If the 24-hr run is interrupted (e.g., power loss), a minimum of 75% data completeness is required for comparison to the Standard (CCME, 2011). As such filter runs are retained and sent to the laboratory if they ran for 18 or more hours.

Samples are collected at each site (3 samples for each jet inlet size, for a total of 9 samples) and sent to Bureau Veritas Laboratories for gravimetric analysis and metals by ICP-MS for the TSP jet sample only. Review of the standard operating procedure, including confirming jet inlet size, is done as a quality assurance/quality control measure prior to collecting samples to ensure proper jet inlet size is installed. Quality control measures also include the collection and analysis of blank samples. The monitoring frequency is determined based on a review of data by a qualified professional and in consultation with residents of Keno City. Table 6-2 illustrates the sampling schedule necessary to achieve a monitoring frequency objective of eighteen (18) days per month.

Table 6-2: Example Monthly Dust Monitoring Schedule

STATION TSP-1							STATION TSP-2							STATION TSP-3						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
				1	2	3					1	2	3					1	2	3
4	5	6	7	8	9	10	4	5	6	7	8	9	10	4	5	6	7	8	9	10
11	12	13	14	15	16	17	11	12	13	14	15	16	17	11	12	13	14	15	16	17
18	19	20	21	22	23	24	18	19	20	21	22	23	24	18	19	20	21	22	23	24
25	26	27	28	29	30	31	25	26	27	28	29	30	31	25	26	27	28	29	30	31



The air quality samplers do not function properly below -30°C and, therefore, during winter months sampling is preferentially conducted on days where the temperatures are milder. The viability of solar battery maintainers to extend the life of the batteries will be assessed in 2022. Samples are to be collected through the operations, temporary closure, and active closure period.

6.3 DATA

Dust or particulate matter (PM) is divided into different sized fractions for air quality monitoring. AKHM collect three filter inlet sizes (TSP, PM₁₀ and PM_{2.5}) at each air quality monitor and sends the samples to an analytical laboratory for gravimetric analysis. Metals analyses by ICP-MS are conducted on the TSP sample. Samples stored on site and submitted for analysis every at least quarterly.

The gravimetric results are compared to the YAAQS (Table 4-2). Since there are no standards for metal concentrations in TSP in Yukon, metal results are compared to the Ontario Ambient Air Quality Criteria (Table 4-3). Data quality checks are completed following the receipt of laboratory results. The results of the dust monitoring are reviewed on a quarterly basis by a Qualified Professional and any thresholds crossed or triggers activated as specified in the KHSD Mining Operations Adaptive Management Plan would be identified.

The District Mill weather station records hourly temperature, relative humidity, total precipitation, wind speed and direction to access wind-blown transport potential.

6.4 OPERATOR TRAINING

Adequate operator training is required to ensure the proper operation and maintenance of the equipment, sample integrity and compliance with permits and licences. Operators are trained in equipment programming, maintenance, and calibration; along with sample collection, handling, shipping, record keeping, and chain of custody requirements.

7 DUST DISTURBANCE REGISTER

A Dust Disturbance Register enables Keno City residents to raise their dust disturbance concerns formally. AKHM has created a Dust Disturbance Register to track dust disturbance claims through Disturbance Notification Forms (Appendix A). The forms were provided to Keno City residents in 2020. Copies of the Disturbance Notification Forms are available at the Keno City Library or sent to Keno City residents upon request by direct delivery, email, or fax. To request or submit a Disturbance Notification Form is provided below, Keno City residents can contact Hecla via telephone or email below:

Telephone: 647-519-3537

Email: yk-contactus@hecla.com

The Dust Disturbance Register is currently implemented. Any entries received will be summarized in the quarterly air quality monitoring summaries and the annual report in accordance with QML-0009.

Dust disturbance incidents will be investigated on a case-by-case basis. Responses to a dust disturbance claim will be based on the nature of the claim and may include (but are not limited to):

- AKHM will record the dust disturbance claim in the Dust Disturbance Register and will notify the complainant that the claim has been recorded;
- If warranted, AKHM personnel will conduct an on-site visit to further investigate the dust disturbance;
- AKHM personnel will attempt to link the identified dust disturbance with a source (a specific event or activity conducted as part of mining or construction), and will determine what measures may be taken to lessen the dust generation; and
- AKHM will then report back to the community and regulators.

8 DOCUMENTATION AND REPORTING

Quarterly summaries of monitoring results are submitted to the Director, Mineral Resources, Yukon Department of Energy, Mines and Resources and to Keno City residents. An annual air quality monitoring evaluation report is submitted under QML-0009. The annual report is also provided to FNNND.

The results of the dust monitoring are reviewed in conjunction with the KHSD Mining Operations Adaptive Management Plan to determine if additional mitigations are required for dust management. Reporting protocols are based on the level of the trigger activated.

Entries from the Dust Disturbance register are summarized in the annual air quality monitoring reports. Dust related incidences as reported by the public and residents of Keno City will be submitted as part of the annual reporting requirements.

This Dust Abatement and Monitoring Plan is an operational document that will require periodic updates as modifications and improvements are made to milling process and material management. The plan is reviewed annually in conjunction with the results of the dust monitoring and community input; and updated as needed to incorporate additional mitigations for dust management or amendments to licence and permit terms and conditions.

9 REFERENCES

- Alexco Consulting Group (ACG). 2014. *Flame and Moth Development and Production Program Air Dispersion Modeling*. June 2014.
- Alexco Environmental Group Inc. (AEG). 2017. *Birmingham Development and Production Program Air Dispersion Model*. September 27, 2017.
- Canadian Council of Ministers of the Environment (CCME). 2011. *Guidance Document on Achievement Determination: Canadian Ambient Air Quality Standards for Fine Particulate Matter and Ozone (2011)*
- Environment and Climate Change Canada (ECCC), *1981-2010 Climate Normals & Averages*. https://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnName&txtStationName=mayo&searchMethod=contains&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=1572&dispBack=0. Accessed January 6, 2023.
- Wang, Z., Zhou, W., Jiskani, I.M., Ding, X., Luo, H. 2022. Dust pollution in cold region surface mines and its prevention and control. *Environmental Pollution*, Vol. 292(A).
- World Health Organization (WHO). 2013. Health Effects of Particulate Matter
http://www.euro.who.int/__data/assets/pdf_file/0006/189051/Health-effects-of-particulate-matter-finalEng.pdf
- Yukon Government (YG). 2014. *YESAA Decision Document. Flame & Moth Development and Production Program. Project number 2013-0161*. Yukon Government. 2014. Yukon Ambient Air Quality Standards, Updated September 2014.
- Yukon Government (YG). 2018. *YESAA Decision Document. Birmingham Development and Production Program. Project number 2017-0176*.
- Yukon Government (YG). 2019. *Yukon Ambient Air Quality Standards*. Updated October 23, 2019



APPENDIX A:

DISTURBANCE NOTIFICATION FORM

DISTURBANCE NOTIFICATION FORM

ALEXCO KENO HILL MINING CORP. – KENO HILL SILVER DISTRICT MINING OPERATIONS

Name of Complainant:

Phone Number & Address of Complainant:

Date	Start Time/ End Time	Location	Description of Noise, Traffic or Dust (e.g., likely source, magnitude, duration, ongoing or isolated dust incident)	How did the disturbance disrupt your life and/or your business/livelihood?

This form has been created for Keno Residents to formally complain of disturbance associated with Alexco Keno Hill Mining Corp.'s Keno Hill Silver District Operations by calling 647-519-3537 or completing the notification form. Please complete all fields. Return completed forms to yk-contactus@hecla.com.

Signature:

Date: