

Technical Report – Noise and Vibration

Eagle Mine and Humboldt Mill

Prepared for:

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Date: August 8, 2014

TriMedia Project Number: 2014-083

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1.0 INTRODUCTION

1.1 BACKGROUND

There are many metrics for which sound pressure levels (noise) are measured and quantified. The most common metric uses the decibel (dB) scale. The logarithmic decibel scale accommodates the wide range of sound intensities found in the environment, but it is not altogether intuitive, as sound does not follow a linear relationship. For example, the addition of two equivalent sounds does not equate to a doubling in actual sound pressure level. So if a sound of 50 dB is added to another sound of 50 dB, the increase in sound pressure is only 3-decibels (not 100 dB). Therefore, as a rule of thumb, every 3 dB change in sound level represents a doubling or halving of sound energy. This is important to remember as sound changes less than 3-decibels are imperceptible to the human ear.

Sound level is typically measured by a sound level meter or noise dosimeter. Both are standardized instruments that can measure in several different weighting scales. These scales adjust the frequency response of the instrument to approximate that of the human ear under various environmental conditions. The scale commonly used for community noise monitoring is the A-weighted scale. The A-weighted scale approximates how the human ear perceives sound at various frequencies by emphasizing those heard between 1000-2000 hertz (hz), or the middle-ranged frequency. Sounds detected on a sound level meter or dosimeter on the A-weighted scale are reported in decibels and denoted as “dBA”. Further, the average sound level measured over a defined period of time is referred to the L_{eq} . It is important to recall that sound is measured on the logarithmic scale of decibels, so simply adding the levels and dividing by the number of samples measured over time will not yield a true average. The purpose of the L_{eq} is to avoid skewing from instantaneous (or short duration) high and low levels of sound. L_{eq} is defined as the equivalent noise level that accounts for noise level variations over a period of time. The formula used to calculate L_{eq} is provided below:

$$L_{eq} = 10 \log \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} \frac{p_A^2}{p_0^2} dt \right]$$

L_{eq} = equivalent continuous sound pressure level

p_0 = reference pressure level = 20 μ Pa

p_A = acquired sound pressure in Pa

t_1 = start time for measurement

t_2 = end time for measurement

1.2 PURPOSE

TriMedia has prepared this *Technical Report –Noise and Vibration* to document baseline noise monitoring results, baseline vibration monitoring results, and to provide a summary of our conclusions and recommendations. The objective of this assessment was to establish baseline noise and vibrations levels three months prior to the transition from a construction phase to an operational phase at the Humboldt Mill and Eagle Mine sites. The evaluated areas include selected sites in and around both the mine and mill locations.

1.3 PROCEDURES AND EQUIPMENT

Data collection activities included both noise and vibration monitoring using industry standard equipment. Equipment included weatherized 3M SoundPro DL Sound Level Meters with data logging and octave band analyses capabilities and Instante! MicroMate III vibration monitors. Each SoundPro DL was equipped with a cable-attached microphone, environmental case, wind screen, and data logging device. The meters were calibrated on-site prior to deployment using a Quest QC - 10 sound calibrator. The meters used had the capability of performing octave band analysis; the setup parameters can be seen below in [Table 1: Sensor Parameters](#). The equipment was set to log sound pressure levels in one minute intervals using the Z-weighted (flat) scale. This scale was selected in order to evaluate for all potential noise sources, providing a complete picture of the total noise at the site. However the Z-weighting scale does not accurately define on how noise is perceived by the human ear. For this purpose the

noise measurements were converted to the A-weighted scale using the correction factors found in Table 2: A-Scale Correction Factors. Reporting the noise data in the dBA scale will allow for direct comparison to established noise regulations. To accomplish this, readings from nine different frequencies were adjusted using the correction factors in effort to mimic the ear's response to these noise levels. The use of both the dBZ and dBA scale provide useful data on the total noise at a site verse the amount of noise that can be perceived by the human ear.

The noise measuring techniques and produces used in this study are consistent with those outlined in the American National Standards Institute (ANSI) S12.9-1993/Part 3. At each monitoring location, without endangering data quality, the equipment was placed in such a manner that would limit tampering from personnel or wildlife. All meters were left to monitor noise levels for a total of 24-hours and were picked up in good working order.

Table 1: Sensor Parameters	
	Sensor
Weighting	Z Scale
Exchange Rate	3 dB
Response Time	Slow
Bandwidth	1/3
Interval	1 min

Table 2: A-Scale Correction Factors	
Octave Band Center Frequency (Hz)	A-Scale Correction Factor (dB)
31.5	-39
63	-26
125	-16
250	-9
500	-3
1,000	0
2,000	+1
4,000	+1
8,000	-1

Source: OSHA Noise and Hearing Conservation Technical Manual

The Instantel MicroMate III monitors used for the vibration analysis complied with the “Performance Specifications for Blasting Seismographs” document published by the International Society of Explosives Engineers (ISEE). Both the operation and use of this equipment was consistent with the procedures outlined in the ISEE’s “ISEE Field Practice Guidelines for Blasting Seismographs”.

Each MicroMate was equipped with a tri-axial transducer, an air overpressure microphone to record linear-weighted noise levels corresponding to each vibration event, and data logging capabilities. Each transducer measured velocities on three mutually perpendicular axes (V_x , V_y , V_z) corresponding to a radial, transverse, and vertical component. The data acquisition equipment simultaneously recorded each geophone, in digital format, time-domain data for each of the three mutually perpendicular axes at each of the four radial distances. The blasting analysis software provided features for graphical output of the wave forms in each of the three axes and comparison of the measured peak particle velocities (PPVs) and frequency content with various accepted standards developed by the U.S. Bureau of Mines.

2.0 STANDARDS AND GUIDELINES

2.1 NOISE

Currently there are no federal, state or local (Humboldt and Powell Townships of Marquette County) standards that can be used to evaluate the results of this study. However in this case it is common to utilize multiple guidelines and recommendations set forth by other governing bodies. The use of these values can help to evaluate the noise conditions seen at the selected sites.

U.S. Environmental Protection Agency (EPA)

As described in the EPA document titled “Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.” The recommended 24-hour noise exposure level that will prevent any measurable hearing loss over a lifetime is 70 dBA. This document furthers describes that an outdoor noise level of 55 dBA and an indoor level of 45 dBA provide a suitable upper noise limit that will prevent activity interference and annoyance.

The U.S. Department of Housing and Urban Development

The U.S. Department of Housing and Urban Development (HUD) provides both a standard and a recommended exterior noise level for their communities. HUD recommends that exterior noise levels should not exceed a day-night average sound level (L_{dn}) of 55 dBA. While the recommendations should always be taken into account the actual standard set by HUD indicates that the L_{dn} should not exceed 65 dBA. The day-night average sound level is calculated by using the equation below:

$$L_{dn} = 10 \log \frac{15 \times 10^{\frac{L_d}{10}} + 9 \times 10^{\frac{L_n+10}{10}}}{24}$$

L_d = Sound pressure level during day time hours (0700 to 2200 hours).

L_n = Sound pressure level during night time hours (2200 to 0700 hours).

2.2 VIBRATION

The State of Michigan and Humboldt and Powell Township do not currently maintain vibration standards. For the purpose of this baseline assessment, vibration data was compared to the standards set by the U.S. Bureau of Mines (USBM). USBM RI 8507, “Structure Response and Damage Produced by Ground Vibration from Surface Mine Blasting” is considered to be the most widely accepted vibration standard and is currently used for vibration assessments at mines worldwide. USBM has concluded that potential damage to structures is minimal at Particle Point Velocities (PPV) less than 0.5 inches/sec with 2.0 inches/sec being the maximum allowable vibration level associated with mine blasting. For reference purposes it should be noted that PPVs that exceeded 0.05 inches/sec are considered to be in the lower range of human vibration detection.

When blasting near fish habitats it is common to compare vibration data to the contents of the Alaska Department of Fish and Game: Blasting Standards for the Protection of Fish (11 AAC 95.248). This standard states that the maximum allowable blast impact in spawning beds, during early stages of egg incubation, shall not generate PPVs greater than 0.5 inches/sec.

3.0 NOISE MEASUREMENTS AND RESULTS

3.1 HUMBOLDT MILL

TriMedia mobilized to the Humboldt Mill site on both 6/24/14 and 6/25/14 to deploy a total four 3M SoundPro DL Sound Level Meters as described previously in this report. Equipment was deployed in three of the four cardinal directions with two meters located on the northern edge of the mill property. The results of the noise monitoring activities indicate that noise levels at all the mine sites were below the EPA and HUD recommended levels. A complete summary of the sound level data recorded at the Mill site can be seen in [Table 3: Sound Pressure Levels –Humboldt Mill](#).

South Location

Situated along the side of County Road 601, the monitoring equipment was placed between the tree line and fence approximately 15 meters away from the road and approximately 470 meters away from the center of the mill complex. The distant sounds of both heavy traffic and equipment, occasional light traffic on County Road 601, wind, nature, and groups of people walking were all observed at this location. At this site the 24-hour L_{eq} was 31.3 dBA, the calculated L_{dn} for this location was found to be 35.3 dBA.

West Location

Equipment was placed between fence line of the mill property and the state recreation trail approximately 250 meters north of County Road 601 and 870 meter northwest of the mill complex. Multiple vehicles with trailers were parked near the trail, possibly for trail access. Along the fence line on the inside of the mill property (1-2 meters away) was an access road for the mill. The sounds of distant heavy traffic, nearby local traffic, and nature were all observed at the site. At this site the 24-hour L_{eq} was 34.3 dBA, the calculated L_{dn} for this location was found to be 37.2 dBA.

North West Location

This site was located approximately 240 meters south of US 41 and 1,300 meters away from the Mill complex. The 24-hour L_{eq} was 30.3 dBA, the calculated L_{dn} for this location was found to be 36.9 dBA.

North East Location

Equipment at this site was placed approximately 80-90 meters south of US 41 and approximately 1,300 meters northeast of the mill complex. Highway traffic, heavy equipment operation, and sounds of nature were observed during the noise monitoring activities. During the monitoring period heavy equipment (bulldozer, dump trucks, and a backhoe) was used to complete a house demolition approximately 230 meters away from the site. The 24-hour L_{eq} was 43.4 dBA, the calculated L_{dn} for this location was found to be 47.2 dBA.

Off Site Control

At the intersection of US 41 and State Road 95, two concurrent 15-minute measurements of sound pressure levels were taken at 2:03 pm and 2:22pm on 6/24/14. Located approximately 2,200 meters from the center of the mill complex this site served as a noise source control. Heavy traffic from both US 41 and State Road 95 were observed, during the monitoring period several large heavy trucks passed by the equipment along State Road 95. The monitored L_{eq} ranged from 47.0 to 48.3 dBA at this site.

3.2 EAGLE MINE

TriMedia mobilized to the Eagle Mine site on 6/26/14 to deploy a total of three 3M SoundPro DL sound level meters as described previously in this report. Equipment was deployed in three locations west of the mine complex. The results of the noise monitoring activities indicated that noise levels at all the mine sites were below the recommended levels established by the EPA and HUD. A complete summary of the sound level data recorded at the Mill site can be seen in Table 4: Sound Pressure Levels –Eagle Mine.

Mine West Location

Equipment at this site was placed approximately 1,300 meters from the center of the mine complex along the Salmon-Trout River over the ore body. The 24-hour L_{eq} was 45.5 dBA, the calculated L_{dn} for this location was found to be 52.0 dBA. No substantial

noise sources were noted or observed at this location. During blasting operations, no noticeable increases in noise levels were observed. The 30-minute L_{eq} surrounding the blast time (15 minutes before and 15 minutes after the scheduled blast time) was found to be 45.6 dBA with a maximum sound pressure level recorded at 46.2 dBA.

Mine East Location

Equipment was placed approximately 530 meters from the center of the mine complex directly west of the mine portal entrance. The 24-hour L_{eq} was 31.8 dBA, the calculated L_{dn} for this location was found to be 39.0 dBA. No substantial noise sources were noted or observed at this location. During blasting operations, no noticeable increases in noise levels were observed. The 30-minute L_{eq} surrounding the blast time was found to be 26.5 dBA with a maximum sound pressure level recorded at 29.2 dBA.

Mine North Location

Equipment was placed approximately 830 meters from the center of the mine complex across Triple A Road from the main vent air raise. The 24-hour L_{eq} was 36.3 dBA, the calculated L_{dn} for this location was found to be 43.0 dBA. No substantial noise sources were noted or observed at this location. During blasting operations, no noticeable increases in noise levels were observed. The 30-minute L_{eq} surrounding the blast time was found to be 28.7 dBA with a maximum sound pressure level recorded at 31.4 dBA.

4.0 OCTAVE BAND ANALYSIS

4.1 HUMBOLDT MILL

The human ear is more sensitive to noise levels in the higher frequency range of 2,000 to 8,000 Hz while sounds occurring in the lower frequency range are not as easily perceived by an observer. This type of response is best described when measuring sound levels on the dBA scale. The dBA scale was developed to represent how an overall noise level would be perceived by the human ear. The opposite is true for noise levels recorded in the dBZ or flat scale. The use of the dBZ scale represents the total amount of noise present and does not take into account how the levels are perceived by a human observer. This concept can be illustrated in the information provided in the figure below (Figure 1).

Using data collected at the Humboldt Mill South monitoring location, the difference in the total noise level (dBZ scale) at the site and the perceived noise level (dBA scale) can be illustrated. Figure 1 shows that sound pressure levels measured in the dBZ scale indicate an overall increase in noise levels ($L_{eq} = 56.2$ dBZ). However when the sound levels are adjusted to represent how noise is perceived by the human ear using the dBA scale, a decrease is seen, predominantly in the lower frequency levels ($L_{eq} = 31.3$ dBA). The majority of the noise levels generated at this site are in the low undetectable frequencies. This shows that while there are increased levels of noise, it cannot be detected by the human ear.

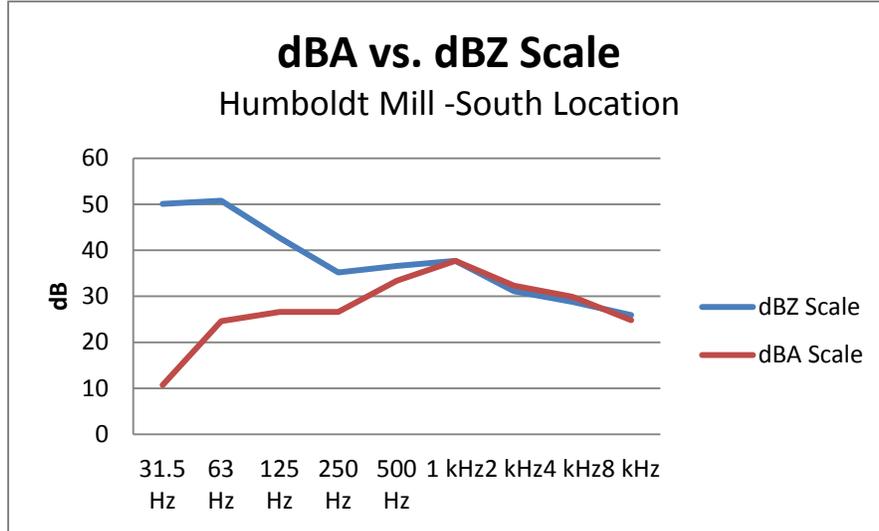


Figure 1: Ear's response to noise (dBA) vs. Total noise (dBZ).

Understanding what frequencies contribute to overall noise levels is an important concept in noise control. The use of octave band analysis investigates the specific frequency range involved in the observed total noise levels. The use of special filters on monitoring equipment record sound pressure levels within a selected frequency band. This provides the ability to analyze sound pressure within specific frequency ranges to help identify noise sources. Understanding the frequency range of the noise source at a site allows for the identification of what equipment or source is responsible for the noise levels.

An offsite location at the intersection of US 41 and State Road 95 served as a control site to characterize noise levels outside of the mill site. Octave band analysis on sound pressure levels at this location was performed. This generated a frequency distribution of the noise sources seen at this site; these sources included heavy traffic from cars and trucks along both US 41 and State Road 95. This was then compared to the frequency distributions of the other monitoring sites in effort to identify the potential noise sources at these locations. When comparing the data of mill sites to that of the offsite control, the octave band analysis showed similarities between the two finger prints. The information presented in Figure 2 show a representative example of this conclusion.

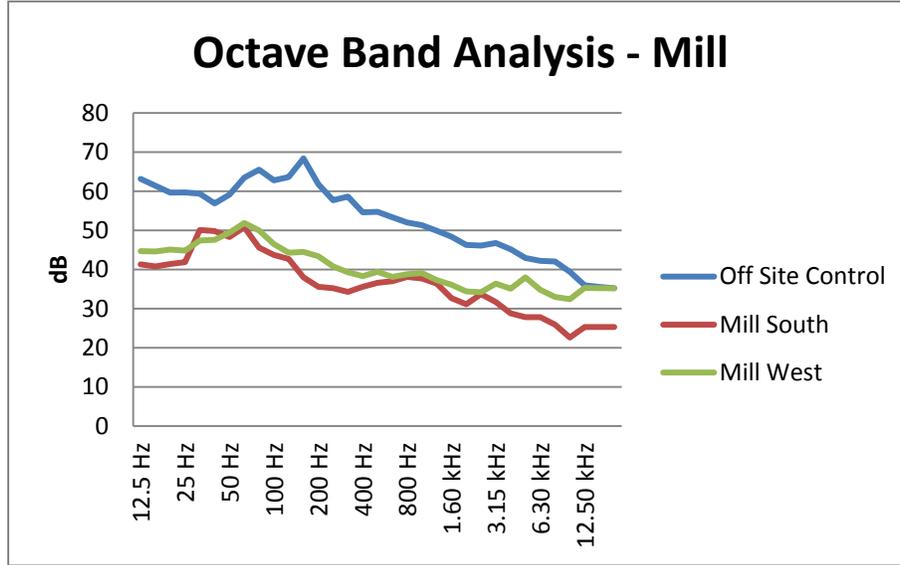


Figure 2: Octave band analysis for the Off Site Control, Mill South, and Mill West locations.

The information presented in Figure 2 illustrates the total noise versus frequency distribution recorded during octave band analysis at the Off Site Control, Mill South, and Mill West monitoring site. The results above indicate what was generally seen at the other noise monitoring locations. The octave band analysis at the mill sites match that of the offsite control in shape and distribution, indicating that the sources of the sound pressure levels are related in composition. The magnitudes of the sound pressure levels at the Off Site control location are also greater than those at the other sites. This also provides the necessary evidence to suggest that common road noise is the major contributing source of noise at these sites.

In general as the distance increases from a noise source, the magnitude of the sound pressure level decreases. This is a phenomenon represented by the Inverse Square Law which states, assuming optimal conditions, that the intensity of the noise is inversely proportional to the square of the distance from the source. It is TriMedia's opinion that the majority of the noise sources seen at the monitored sites are that of typical common noise associated with the area traffic on the local roads and highways around the site.

4.2 EAGLE MINE

It was noted during the noise monitoring activities that the Mine West (L_{dn} 52.0 dBA) site experienced higher noise levels than the Mine East and North location (L_{dn} 39.0 dBA and L_{dn} 43.0 dBA, respectively). An octave band analysis of the noise data collected at these locations was performed. The information presented in Figure 3 illustrate that the majority of the noise levels observed at the Mine West site occurred in the high frequency range. While the other two locations (Mine East and Mine North) had lower high frequency noise levels.

It is TriMedia's opinion that during the monitoring period, the increase in high frequency noise levels at the Mine West site are directly related to the surrounding natural environment. The sounds of nature (insects, animals, wind, etc.) generally occur in the higher frequency ranges, it is believed that the remoteness of this particular location contributed to the increased activity of the surrounding natural environment.

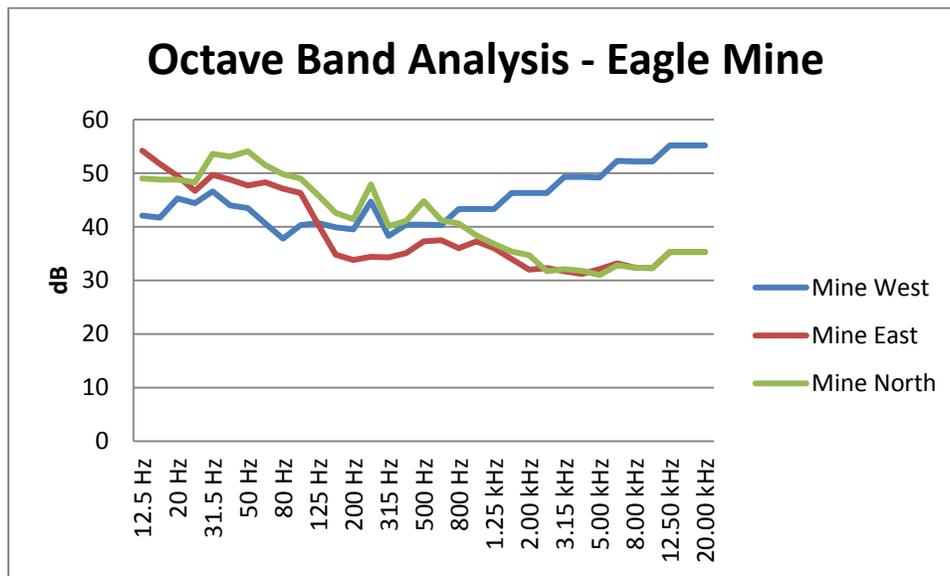


Figure 3: Octave band analysis of the Mine West, East, and North locations.

5.0 VIBRATION MEASUREMENTS AND RESULTS

TriMedia mobilized to the Eagle Mine site on both 6/26/14 and 6/30/14 to deploy a total four InstanTel MicroMate III vibration monitors as described previously in this report. Equipment was deployed in preselected area to correspond with planned blasting activities at the mine site. The ground at each monitoring site was leveled prior to placement of the monitors. Ground spikes were attached to provide the necessary ground contact. Before each blasting event the vibration monitors had a sensor check performed to ensure data accuracy.

Data was recorded both before and after the blast event to measure for ground movement. For the purpose of this baseline assessment, vibration data was compared to the U.S. Bureau of Mines standards. USBM has concluded that potential damage to structures is minimal at PPVs less than 0.5 inches/sec and that 2.0 inches/sec is the maximum allowable vibration level associated with mine blasting. Analysis of the data showed that all ground vibration levels were well below the U.S. Bureau of Mines standards. The data also suggests that vibration levels in the nearby fish habitat from the monitored blast events are also below the limits set by the Alaskan Department of Fish and Game. The results of the vibration analysis are summarized in Figures 4 through Figure 7 below.

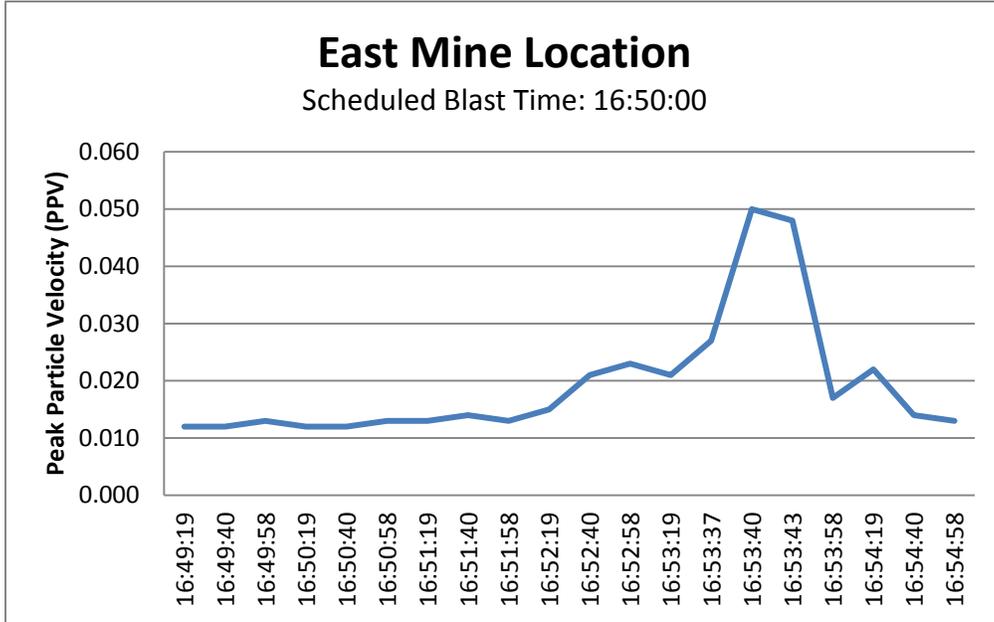


Figure 4: Recorded event PPVs (inches/sec) at the East Mine Location around the blast time.

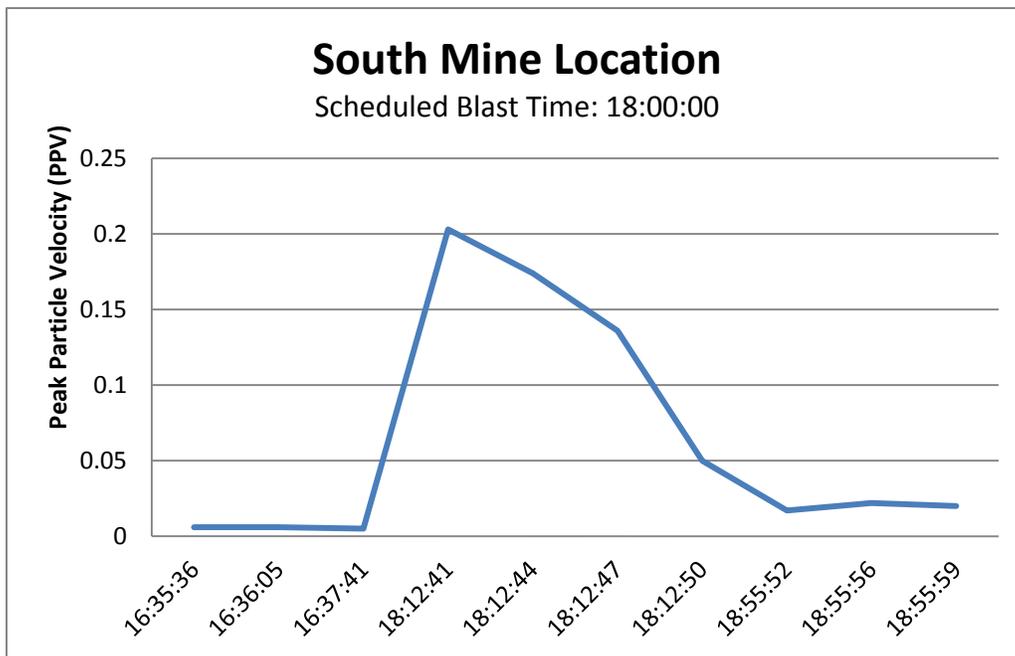


Figure 5: Recorded event PPVs (inches/sec) at the South Mine Location around the blast time.

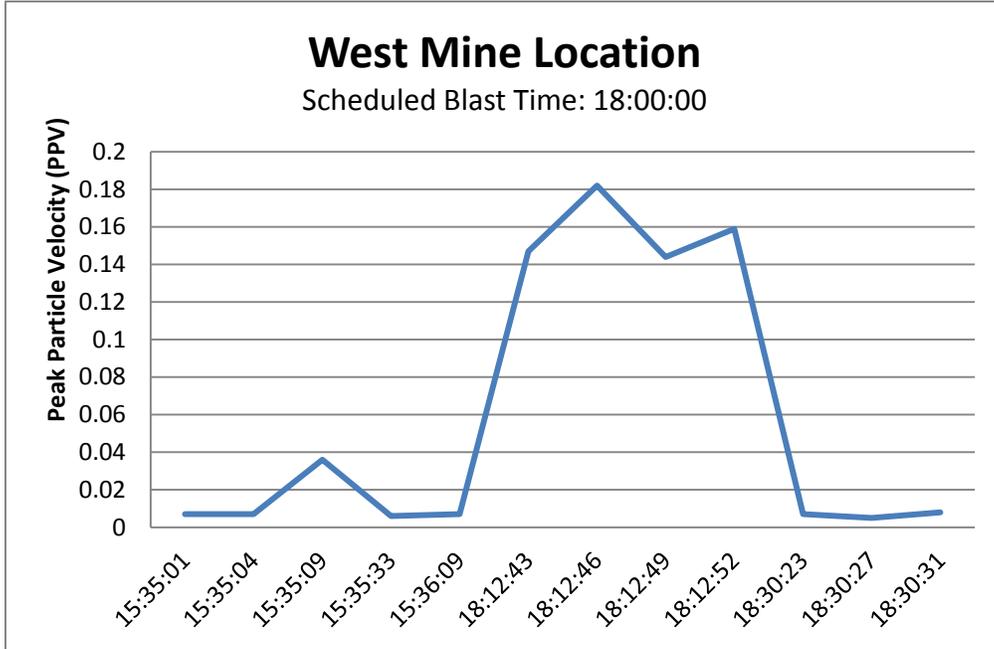


Figure 6: Recorded event PPVs (inches/sec) at the West Mine Location around the blast time.

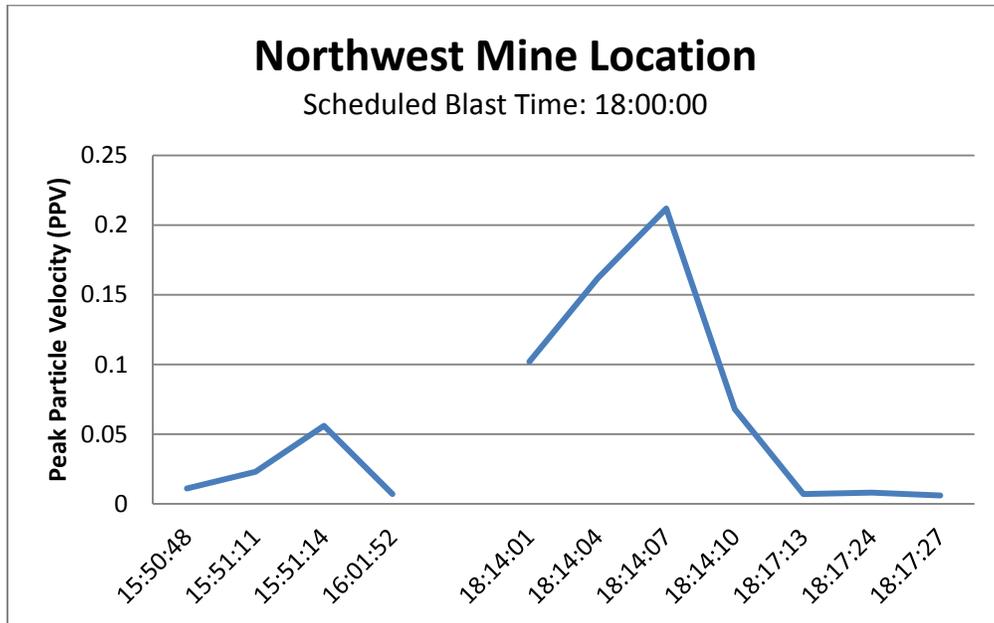


Figure 7: Recorded event PPVs (inches/sec) at the Northwest Mine Location around the blast time.

No recordable seismic events were detected between 16:01:52 and 18:14:01.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Overall, the results from this baseline assessment indicate that noise levels at both the Humboldt Mill and Eagle Mine are within applicable regulatory standards. There were no exceedances of the EPA or HUD noise standards or recommendations. Also onsite blasting activities at the Eagle Mine were not a source of vibration impacts to the adjacent area and surrounding community. The current results suggest that the monitored blasting activities did not generate a harmful environment to the local fish habitat.

Background noise levels measured at the Off Site Control location at the intersection of US 41 and State Road 95 were higher than the other monitored locations. The results of the octave band analysis also indicated that a vast majority of the noise levels heard at the mill and mine sites were that of distant road noise. Construction work related to a house demolition during the monitoring period near the Northeast Mill site produced atypical results for that location. However measured noise levels at this site were still below both the EPA and HUD recommendations during this time period. It should also be mentioned that the two noise sites that were closest to the Humboldt Mill (South Location) and Eagle Mine (East Location), both had the lowest calculated L_{dn} for each site. This represents that current activities at both the mine and the mill do not place an excess noise burden on the surround community. TriMedia does not believe any actions are necessary to mitigate noise or vibration sources at either the Humboldt Mill or Eagle Mine in relation to community noise levels and blasting activities.

APPENDICES

- Appendix A Tables
- Appendix B Photographic Documentation
- Appendix C GIS Maps
- Appendix D Equipment Calibration Records

Appendix A

Tables

Table 3: Sound Pressure Levels - Humboldt Mill

Monitoring Location	South	West	North West	North East	Offsite Control
Latitude	46.479529	46.488449	46.495351	46.494288	46.495693
Longitude	-87.898188	-87.907526	-87.902367	-87.890448	-87.920012
Date	6/24/2014	6/24/2014	6/25/2014	6/24/2014	6/24/2014
Start Time	12:47 PM	1:05 PM	1:41 PM	1:20 PM	2:00 PM
Duration	24 Hours	24 Hours	24 Hours	24 Hours	15 Minute

	24-Hour Noise Levels (dBA)				15-Minute Noise Level (dBA)
L_{eq}	31.3	34.3	30.3	43.4	47.7
L_d	32.6	35.9	30.2	44.7	NA
L_n	27.8	28.9	30.6	39.7	NA
L_{dn}	35.3	37.2	36.9	47.2	NA
EPA*	55.0	55.0	55.0	55.0	55.0
HUD**	55.0	55.0	55.0	55.0	55.0

Notes:

*U.S. Environmental Protection Agency recommended 24-hour outdoor noise level. (L_{eq})

**U.S. Department of Housing and Urban Development recommended day-night average sound level. (L_{dn})

L_{eq} = Equivalent Continuous Sound Level

L_d = Sound pressure level during day time hours (0700 to 2200 hours).

L_n = Sound pressure level during night time hours (2200 to 0700 hours).

NA - indicates no applicable criteria exist for the constituent.

Bold indicates levels that exceeds the recommendations.

All results are presented in dBA.



Table 4: Sound Pressure Levels - Eagle Mine

Monitoring Location	East	North	West
Latitude	46.746483	46.748552	46.747665
Longitude	-87.889034	-87.893029	-87.897882
Date	6/26/2014	6/26/2014	6/26/2014
Start Time	4:58 PM	4:45 PM	2:35 PM
Duration	24 Hours	24 Hours	24 Hours

24-Hour Noise Levels (dBA)			
L_{eq}	31.8	36.3	45.5
L_d	31.1	35.9	45.6
L_n	32.9	36.8	45.6
L_{dn}	39.0	43.0	52.0
EPA*	55.0	55.0	55.0
HUD**	55.0	55.0	55.0

Notes:

*U.S. Environmental Protection Agency recommended 24-hour outdoor noise level. (L_{eq})

**U.S. Department of Housing and Urban Development recommended day-night average sound level. (L_{dn})

L_{eq} = Equivalent Continuous Sound Level

L_d = Sound pressure level during day time hours (0700 to 2200 hours).

L_n = Sound pressure level during night time hours (2200 to 0700 hours).

Bold indicates levels that exceeds the recommendations.

All results are presented in dBA.



Appendix B

Photographic Documentation

NOISE AND VIBRATION
EAGLE MINE AND HUMBOLDT MILL



Description: East Noise Site – Eagle Mine
Date: 06/26/14

Photo #: 1



Description: North Noise Site – Eagle Mine
Date: 06/26/14

Photo #: 2



Description: West Noise Site and West Vibration Site (Salmon-Trout River) – Eagle Mine
Date: 06/26/14

Photo #: 3

NOISE AND VIBRATION
EAGLE MINE AND HUMBOLDT MILL



Description: West Noise Site – Humboldt Mill
Date: 06/24/14
Photo #: 4



Description: South Noise Site – Humboldt Mill
Date: 06/24/14
Photo #: 5



Description: North West Vibration Site – Eagle Mine
Date: 06/26/14
Photo #: 6



Description: East Vibration Site – Eagle Mine
Date: 06/26/14
Photo #: 7

NOISE AND VIBRATION
EAGLE MINE AND HUMBOLDT MILL



Description: North East Noise Site – Humboldt Mill
Date: 06/24/14
Photo #: 7



Description: North West Noise Site – Humboldt Mill
Date: 06/25/14
Photo #: 8

Appendix C

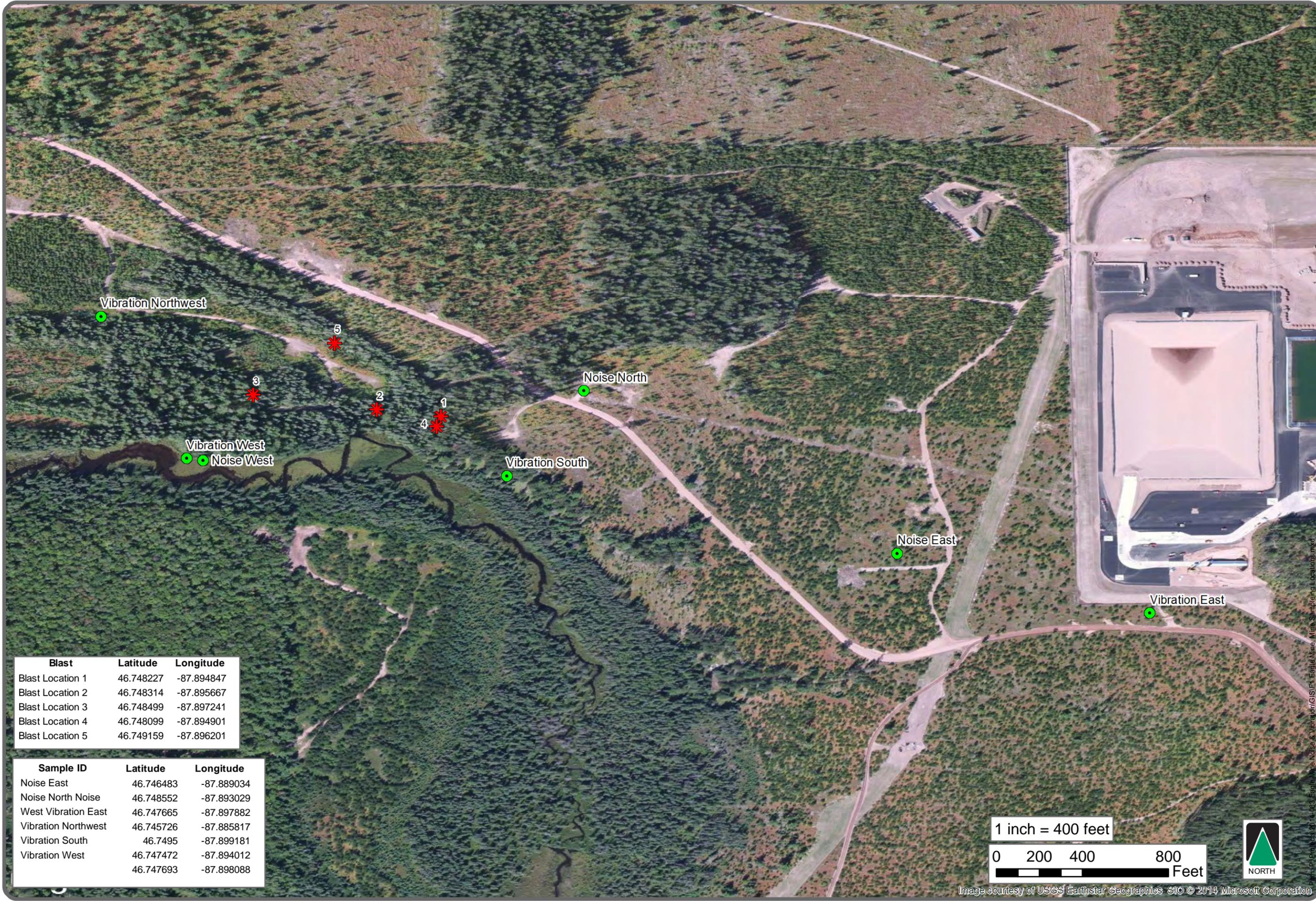
GIS Maps

Eagle Mine
Mine Site
Noise and Vibration Monitoring Locations
Eagle Mine, Big Bay, MI

DATE	DESCRIPTION
10/13/14	Report

DESIGNED: RRL
DRAWN: KDL
CHECKED: JPG
APPROVED: JPG

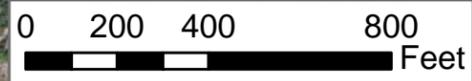
TRIMEDIA
JOB NUMBER
2014-083
FIGURE TITLE:
**Eagle Mine
Mine Site
Noise &
Vibration
Monitoring
Locations**
FIGURE NUMBER:
8



Blast	Latitude	Longitude
Blast Location 1	46.748227	-87.894847
Blast Location 2	46.748314	-87.895667
Blast Location 3	46.748499	-87.897241
Blast Location 4	46.748099	-87.894901
Blast Location 5	46.749159	-87.896201

Sample ID	Latitude	Longitude
Noise East	46.746483	-87.889034
Noise North Noise	46.748552	-87.893029
West Vibration East	46.747665	-87.897882
Vibration Northwest	46.745726	-87.885817
Vibration South	46.7495	-87.899181
Vibration West	46.747472	-87.894012
	46.747693	-87.898088

1 inch = 400 feet



P:\mine\PA\083\083_14_083_Eagle_Mine_Noise_Vibration\GIS\F1_Eagle_Mine_Mine_Sampling_Locations.mxd



Sample ID	Latitude	Longitude
South Site	46.479529	-87.898188
West Site	46.488449	-87.907526
Off Site Control	46.495693	-87.920012
North West Site	46.495351	-87.902367
North East Site	46.494288	-87.890448



Image courtesy of USGS Earthstar Geographics S10 © 2014 Microsoft Corporation



Eagle Mine
Humboldt Mill Site
Noise Monitoring Locations
Humboldt Mill, Champion, MI

DATE	DESCRIPTION
8/8/14	Report

DESIGNED: RRL
DRAWN: KDL
CHECKED: JPG
APPROVED: RRL

TRIMEDIA
JOB NUMBER
2014-083

FIGURE TITLE:
**Eagle Mine
Humboldt Mill**
Noise
Monitoring
Locations

FIGURE NUMBER:
9

Path: P:\Projects\2014-083 Eagle Mine Noise & Vibration\GIS\F1 Eagle Mine, Mine Sampling Locations.mxd

Appendix D

Equipment Calibration Records

Calibration Certificate

Part Number: 721A0401
Description: MICROMATE SYSTEM (ISEE)
Serial Number: UM6230
Calibration Date: JUN 12 2014
Calibration Equipment: 714J7403

InstanTel certifies that the above product was calibrated in accordance with the applicable InstanTel procedures. These procedures are part of a quality system that is designed to assure that the product listed above meets or exceeds InstanTel specifications.

InstanTel further certifies that the measurement instruments used during the calibration of this product are traceable to the National Institute of Standards and Technology; or National Research Council of Canada. Evidence of traceability is on file at InstanTel and is available upon request.

The environment in which this product was calibrated is maintained within the operating specifications of the instrument.

Please note that the sensor check function is intended to check that the sensors are connected to the unit, installed in the proper orientation and sufficiently level to operate properly. This function should not be confused with a formal calibration, which requires the sensors be checked against a reference that is traceable to a known standard. InstanTel recommends that products be returned to InstanTel or an authorized service and calibration facility for annual calibration.

Calibrated By:


PAUL BASTOW


300-332-0435



 **InstanTel**

Calibration Certificate

Part Number: 721A0201
Description: Linear Microphone 2-250Hz
Serial Number: UL1365
Calibration Date: JUN 12 2014
Calibration Equipment: 714J7402

InstanTEL certifies that the above product was calibrated in accordance with the applicable InstanTEL procedures. These procedures are part of a quality system that is designed to assure that the product listed above meets or exceeds InstanTEL specifications.

InstanTEL further certifies that the measurement instruments used during the calibration of this product are traceable to the National Institute of Standards and Technology; or National Research Council of Canada. Evidence of traceability is on file at InstanTEL and is available upon request.

The environment in which this product was calibrated is maintained within the operating specifications of the instrument.

Please note that the sensor check function is intended to check that the sensors are connected to the unit, installed in the proper orientation and sufficiently level to operate properly. This function should not be confused with a formal calibration, which requires the sensors be checked against a reference that is traceable to a known standard. InstanTEL recommends that products be returned to InstanTEL or an authorized service and calibration facility for annual calibration.

Calibrated By: _____


Ninh Nguyen

 **InstanTEL**

Calibration Certificate

Part Number: 721A0401
Description: MICROMATE SYSTEM (ISEE)
Serial Number: UM6242
Calibration Date: JUN 12 2014
Calibration Equipment: 714J7403

InstanTel certifies that the above product was calibrated in accordance with the applicable InstanTel procedures. These procedures are part of a quality system that is designed to assure that the product listed above meets or exceeds InstanTel specifications.

InstanTel further certifies that the measurement instruments used during the calibration of this product are traceable to the National Institute of Standards and Technology; or National Research Council of Canada. Evidence of traceability is on file at InstanTel and is available upon request.

The environment in which this product was calibrated is maintained within the operating specifications of the instrument.

Please note that the sensor check function is intended to check that the sensors are connected to the unit, installed in the proper orientation and sufficiently level to operate properly. This function should not be confused with a formal calibration, which requires the sensors be checked against a reference that is traceable to a known standard. InstanTel recommends that products be returned to InstanTel or an authorized service and calibration facility for annual calibration.

Calibrated By:


PAUL BASTOW


800-332-0435



 **InstanTel**

Calibration Certificate

Part Number: 721A0201
Description: Linear Microphone 2-250Hz
Serial Number: UL1366
Calibration Date: JUN 12 2014
Calibration Equipment: 714J7402

Instantel certifies that the above product was calibrated in accordance with the applicable Instantel procedures. These procedures are part of a quality system that is designed to assure that the product listed above meets or exceeds Instantel specifications.

Instantel further certifies that the measurement instruments used during the calibration of this product are traceable to the National Institute of Standards and Technology; or National Research Council of Canada. Evidence of traceability is on file at Instantel and is available upon request.

The environment in which this product was calibrated is maintained within the operating specifications of the instrument.

Please note that the sensor check function is intended to check that the sensors are connected to the unit, installed in the proper orientation and sufficiently level to operate properly. This function should not be confused with a formal calibration, which requires the sensors be checked against a reference that is traceable to a known standard. Instantel recommends that products be returned to Instantel or an authorized service and calibration facility for annual calibration.

Calibrated By: _____


Ninh Nguyen

 **Instantel**

Calibration Certificate

Part Number: 721A0401
Description: MICROMATE SYSTEM (ISEE)
Serial Number: UM6243
Calibration Date: JUN 12 2014
Calibration Equipment: 714J7403

Instantel certifies that the above product was calibrated in accordance with the applicable Instantel procedures. These procedures are part of a quality system that is designed to assure that the product listed above meets or exceeds Instantel specifications.

Instantel further certifies that the measurement instruments used during the calibration of this product are traceable to the National Institute of Standards and Technology; or National Research Council of Canada. Evidence of traceability is on file at Instantel and is available upon request.

The environment in which this product was calibrated is maintained within the operating specifications of the instrument.

Please note that the sensor check function is intended to check that the sensors are connected to the unit, installed in the proper orientation and sufficiently level to operate properly. This function should not be confused with a formal calibration, which requires the sensors be checked against a reference that is traceable to a known standard. Instantel recommends that products be returned to Instantel or an authorized service and calibration facility for annual calibration.

Calibrated By:


PAUL BASTOW


800-332-0436



 **Instantel**

Calibration Certificate

Part Number: 721A0201
Description: Linear Microphone 2-250Hz
Serial Number: UL1367
Calibration Date: JUN 12 2014
Calibration Equipment: 714J7402

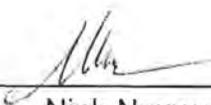
Instantel certifies that the above product was calibrated in accordance with the applicable Instantel procedures. These procedures are part of a quality system that is designed to assure that the product listed above meets or exceeds Instantel specifications.

Instantel further certifies that the measurement instruments used during the calibration of this product are traceable to the National Institute of Standards and Technology; or National Research Council of Canada. Evidence of traceability is on file at Instantel and is available upon request.

The environment in which this product was calibrated is maintained within the operating specifications of the instrument.

Please note that the sensor check function is intended to check that the sensors are connected to the unit, installed in the proper orientation and sufficiently level to operate properly. This function should not be confused with a formal calibration, which requires the sensors be checked against a reference that is traceable to a known standard. Instantel recommends that products be returned to Instantel or an authorized service and calibration facility for annual calibration.

Calibrated By: _____


Ninh Nguyen

 **Instantel**



Certificate of Compliance and Calibration

Certificate Number		6/20/2014 - 1141	
Make/Model	QC-10	Cal Date:	6/20/2014
Asset#	0005987	Next Cal Due:	6/20/2015
Serial Number	QIK020086		

Argus-Hazco does hereby certify that the above listed equipment is to be in physical, mechanical working order and within the manufacturer's acceptable limits. Each unit is tested and inspected in accordance with prescribed procedures before each rental.

This report may be reproduced in its entirety only with written approval of Argus-Hazco

Notes

Location	Detroit, MI	Asset Released In Tolerance	<input checked="" type="checkbox"/>
Technician	DS	All Tests Passed	<input checked="" type="checkbox"/>
Date	6/20/2014		
Time	2:43:36 PM		
SOP#			

Quality Control:

Date:

Please Note: All tests performed with NIST Traceable test and measurement equipment at ambient room temperature, humidity, and pressure at the location listed above. Time in transit or any change in temperature, pressure, humidity, or elevation may result in changes to the calibration values listed. Performance of a field calibration is recommended prior to each use; refer to owner's manual for calibration procedures. Use of this test sheet constitutes proof that the testing environment was within manufacturers' limitation and the instrument conforms to manufacturers' specification.



Certificate of Compliance and Calibration

Certificate Number		12/9/2013 - 883	
Make/Model	SOUNDPRO	Cal Date:	12/9/2013
Asset#	1086974	Next Cal Due:	12/9/2014
Serial Number	BIH030022		

Argus-Hazco does hereby certify that the above listed equipment is to be in physical, mechanical working order and within the manufacturer's acceptable limits. Each unit is tested and inspected in accordance with prescribed procedures before each rental.

This report may be reproduced in its entirety only with written approval of Argus-Hazco

Notes

Location	Detroit, MI	Asset Released In Tolerance	<input checked="" type="checkbox"/>
Technician	DS	All Tests Passed	<input checked="" type="checkbox"/>
Date	12/9/2013		
Time	8:26:54 AM		
SOP#			

Quality Control: _____ **Date:** _____

Please Note: All tests performed with NIST Traceable test and measurement equipment at ambient room temperature, humidity, and pressure at the location listed above. Time in transit or any change in temperature, pressure, humidity, or elevation may result in changes to the calibration values listed. Performance of a field calibration is recommended prior to each use; refer to owner's manual for calibration procedures. Use of this test sheet constitutes proof that the testing environment was within manufacturers' limitation and the instrument conforms to manufacturers' specification.



Certificate of Compliance and Calibration

Certificate Number		4/22/2014 - 1064	
Make/Model	SOUNDPRO	Cal Date:	4/22/2014
Asset#	1095800	Next Cal Due:	4/22/2015
Serial Number	BII010003		

Argus-Hazco does hereby certify that the above listed equipment is to be in physical, mechanical working order and within the manufacturer's acceptable limits. Each unit is tested and inspected in accordance with prescribed procedures before each rental.

This report may be reproduced in its entirety only with written approval of Argus-Hazco

Notes

Location	Detroit, MI	Asset Released In Tolerance	<input checked="" type="checkbox"/>
Technician	DS	All Tests Passed	<input checked="" type="checkbox"/>
Date	4/22/2014		
Time	2:02:00 PM		
SOP#			

Quality Control: _____ **Date:** _____

Please Note: All tests performed with NIST Traceable test and measurement equipment at ambient room temperature, humidity, and pressure at the location listed above. Time in transit or any change in temperature, pressure, humidity, or elevation may result in changes to the calibration values listed. Performance of a field calibration is recommended prior to each use; refer to owner's manual for calibration procedures. Use of this test sheet constitutes proof that the testing environment was within manufacturers' limitation and the instrument conforms to manufacturers' specification.



Certificate of Compliance and Calibration

Certificate Number		5/19/2014 - 1080	
Make/Model	QC-10	Cal Date:	5/19/2014
Asset#	0040314	Next Cal Due:	5/19/2015
Serial Number	QI9100185		

Argus-Hazco does hereby certify that the above listed equipment is to be in physical, mechanical working order and within the manufacturer's acceptable limits. Each unit is tested and inspected in accordance with prescribed procedures before each rental.

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Notes

Location	Detroit, MI	Asset Released In Tolerance	<input checked="" type="checkbox"/>
Technician	DS	All Tests Passed	<input checked="" type="checkbox"/>
Date	5/19/2014		
Time	9:44:13 AM		
SOP#			

Quality Control:

Date:

Please Note: All tests performed with NIST Traceable test and measurement equipment at ambient room temperature, humidity, and pressure at the location listed above. Time in transit or any change in temperature, pressure, humidity, or elevation may result in changes to the calibration values listed. Performance of a field calibration is recommended prior to each use; refer to owner's manual for calibration procedures. Use of this test sheet constitutes proof that the testing environment was within manufacturers' limitation and the instrument conforms to manufacturers' specification.



Certificate of Compliance and Calibration

Certificate Number		4/14/2014 - 1053	
Make/Model	QC-10	Cal Date:	4/14/2014
Asset#	0004963	Next Cal Due:	4/14/2015
Serial Number	QIJ030264		

Argus-Hazco does hereby certify that the above listed equipment is to be in physical, mechanical working order and within the manufacturer's acceptable limits. Each unit is tested and inspected in accordance with prescribed procedures before each rental.

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Notes

Location	Detroit, MI	Asset Released In Tolerance	<input checked="" type="checkbox"/>
Technician	DS	All Tests Passed	<input checked="" type="checkbox"/>
Date	4/14/2014		
Time	2:09:17 PM		
SOP#			

Quality Control:

Date:

Please Note: All tests performed with NIST Traceable test and measurement equipment at ambient room temperature, humidity, and pressure at the location listed above. Time in transit or any change in temperature, pressure, humidity, or elevation may result in changes to the calibration values listed. Performance of a field calibration is recommended prior to each use; refer to owner's manual for calibration procedures. Use of this test sheet constitutes proof that the testing environment was within manufacturers' limitation and the instrument conforms to manufacturers' specification.



Certificate of Compliance and Calibration

Certificate Number		6/10/2014 - 1140	
Make/Model	Quest Soundpro DL	Cal Date:	6/10/2014
Asset#	1115453	Next Cal Due:	6/10/2015
Serial Number	BIJ080007		

Argus-Hazco does hereby certify that the above listed equipment is to be in physical, mechanical working order and within the manufacturer's acceptable limits. Each unit is tested and inspected in accordance with prescribed procedures before each rental.

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Notes

Location **Asset Released In Tolerance**
Technician MFG **All Tests Passed**
Date 6/10/2014
Time
SOP#

Quality Control: **Date:**

Please Note: All tests performed with NIST Traceable test and measurement equipment at ambient room temperature, humidity, and pressure at the location listed above. Time in transit or any change in temperature, pressure, humidity, or elevation may result in changes to the calibration values listed. Performance of a field calibration is recommended prior to each use; refer to owner's manual for calibration procedures. Use of this test sheet constitutes proof that the testing environment was within manufacturers' limitation and the instrument conforms to manufacturers' specification.



Certificate of Compliance and Calibration

Certificate Number		6/10/2014 - 1117	
Make/Model	QC-10	Cal Date:	6/10/2014
Asset#	0002389	Next Cal Due:	6/10/2015
Serial Number	QIB110165		

Argus-Hazco does hereby certify that the above listed equipment is to be in physical, mechanical working order and within the manufacturer's acceptable limits. Each unit is tested and inspected in accordance with prescribed procedures before each rental.

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Notes

Location	Detroit, MI	Asset Released In Tolerance	<input checked="" type="checkbox"/>
Technician	DS	All Tests Passed	<input checked="" type="checkbox"/>
Date	6/10/2014		
Time	3:06:52 PM		
SOP#			

Quality Control:

Date:

Please Note: All tests performed with NIST Traceable test and measurement equipment at ambient room temperature, humidity, and pressure at the location listed above. Time in transit or any change in temperature, pressure, humidity, or elevation may result in changes to the calibration values listed. Performance of a field calibration is recommended prior to each use; refer to owner's manual for calibration procedures. Use of this test sheet constitutes proof that the testing environment was within manufacturers' limitation and the instrument conforms to manufacturers' specification.



Certificate of Compliance and Calibration

Certificate Number		9/10/2013 - 600	
Make/Model	Soundpro DL	Cal Date:	9/10/2013
Asset#	1115452	Next Cal Due:	9/10/2014
Serial Number	BIJ080009		

Argus-Hazco does hereby certify that the above listed equipment is to be in physical, mechanical working order and within the manufacturer's acceptable limits. Each unit is tested and inspected in accordance with prescribed procedures before each rental.

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Notes

Location Detroit, MI
Technician DS
Date 9/10/2013
Time 1:31:11 PM
SOP#

Asset Released In Tolerance
All Tests Passed

Quality Control:

Date:

Please Note: All tests performed with NIST Traceable test and measurement equipment at ambient room temperature, humidity, and pressure at the location listed above. Time in transit or any change in temperature, pressure, humidity, or elevation may result in changes to the calibration values listed. Performance of a field calibration is recommended prior to each use; refer to owner's manual for calibration procedures. Use of this test sheet constitutes proof that the testing environment was within manufacturers' limitation and the instrument conforms to manufacturers' specification.



Certificate of Compliance and Calibration

Certificate Number		6/25/2014 - 1142	
Make/Model	SoundPro DL Type 2	Cal Date:	6/25/2014
Asset#	1114752	Next Cal Due:	6/25/2015
Serial Number	BIJ080014		

Argus-Hazco does hereby certify that the above listed equipment is to be in physical, mechanical working order and within the manufacturer's acceptable limits. Each unit is tested and inspected in accordance with prescribed procedures before each rental.

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Notes

Location	Detroit, MI	Asset Released In Tolerance	<input checked="" type="checkbox"/>
Technician	D Taylor	All Tests Passed	<input checked="" type="checkbox"/>
Date	6/25/2014		
Time	1:04:56 PM		
SOP#			

Quality Control:  **Date:** 6/25/14

Please Note: All tests performed with NIST Traceable test and measurement equipment at ambient room temperature, humidity, and pressure at the location listed above. Time in transit or any change in temperature, pressure, humidity, or elevation may result in changes to the calibration values listed. Performance of a field calibration is recommended prior to each use; refer to owner's manual for calibration procedures. Use of this test sheet constitutes proof that the testing environment was within manufacturers' limitation and the instrument conforms to manufacturers' specification.

