REPORT

Noise Study - EMMA Expansion Project Closure/Closeout Plan

Freeport-McMoRan Tyrone, Inc.

Submitted to:

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List of Acronyms and Abbreviations

ANSI	American National Standards Institute
baseline	existing conditions
CadnaA	environmental noise propagation computer program (model)
CDT	Continental Divide Trail
dB	decibels
dBA	A-weighted decibels
Emma	Emma Expansion Project
EOY	end of year
EPA	U.S. Environmental Protection Agency
ft	foot / feet
Golder	Golder Associates USA Inc.
HUD	U.S. Department of Housing and Urban Development
Hz	Hertz
ISO	International Standard Organization
L_{90}	sound level exceeded 90% of the time
L_{dn}	day / night average sound level
L_{eq}	equivalent continuous sound level
NSA	noise sensitive area(s)
ONAC	Office of Noise Abatement and Control
PPE	personal protective equipment
SPL	sound pressure level
SR 90	New Mexico State Road 90
Tyrone	Freeport-McMoRan Tyrone, Inc.

1.0 INTRODUCTION

Freeport-McMoRan Tyrone, Inc. (Tyrone) is an open pit copper mine located just off State Road 90, approximately 10 miles southwest of Silver City in Grant County, New Mexico (**Figure 1-1**). Tyrone is proposing to develop its mining claims immediately south of the Tyrone Mine. The name of this expansion of the Tyrone Mine is the Emma Expansion Project (Emma). The proposed Emma area is located along the southern boundary of the Tyrone Mine and will include the development of a new open pit and two no-discharging waste rock stockpiles, construction of new haul roads, and installation of various infrastructure to support the project (**Figure 1-2**).

In September 2021, Golder Associates USA Inc. (Golder) performed a comprehensive technical noise study to support the Emma project. The scope of the study included existing conditions (baseline) noise monitoring and an operational project impact analysis. Baseline measurements of the existing noise environment were collected-between September 7 and 8, 2021. Noise measurements were collected at six (6) locations including one (1) 24-hour measurement, and individual measurements during the daytime and at night at five (5) additional locations. Measurements were collected using techniques set forth by the American National Standards Institute (ANSI).

The impact evaluation of the Project was performed using CadnaA, an International Standards Organization (ISO) certified environmental noise propagation computer program that was developed to assist with noise propagation calculations for major noise sources and projects. The model can incorporate specific project noise sources, terrain, meteorological conditions, ground cover, and predict noise impacts at the Emma boundary and off-site receptors. The baseline noise measurements and modeled noise results are combined to calculate a total predicted noise impact from project operations.

1.1 Affected Environment

Emma is located in unincorporated Grant County New Mexico approximately seven miles southwest of Tyrone and five miles north of White Signal. The project is bordered by the Big Burro Mountains to the west and State Road 90 (SR 90) to the east. Closest residences are located directly east of SR 90 across from the existing Tyrone Mine and off Tyrone Road approximately one mile south of the Emma site at the Apache Mound subdivision. The terrain to the south and east is characterized by flat and gently sloping terrain. The site lies near the foot of the Big Burro Mountains to the west close to the continental divide. Vegetation in the area is dominated by a mixture of grasses, cactus, pinyon pine and evergreen oaks with one-seed and alligator juniper subdominant, and desert shrub habitats at the project site and to the east and south, with mixed conifer in the Big Burro Mountains to the west.

Land use patterns in the region are primarily rural residential, mining, and large areas of open space. The area to the west of Emma is public land administered by the U.S. Department of Agriculture, Forest Service. The region is traversed by paved and unpaved roads and experiences off-road vehicle use. Major transportation routes in the region include SR 90, a two-lane highway bordering the east of the Emma. No other major roadways are located within 8 miles of the project area. No eligible or designated scenic highways have been identified within the vicinity of the project.

The Continental Divide Trail (CDT) runs through the Gila National Forrest approximately five miles to the west of Emma. The CDT is a designated national scenic trail.

The landscape surrounding the Tyrone Mine is primarily natural or agricultural land use and therefore has limited sources of anthropogenic noise. The existing noise environment is influenced by traffic on SR 90, local traffic on paved and unpaved roads, the existing mine, wind driven noise, and typical sounds of nature.

1.2 Project Site

The proposed Emma area is located immediately south of the Tyrone. Thus, the proposed change in operations constitutes an expansion of the current approved mine permit area. The proposed Emma area will increase the existing mine permit area by approximately 337 acres. This increase will allow for the construction of the proposed Emma Pit, EMW Waste stockpile, new Southern Haul Roads, and supporting infrastructure. The 6HW Waste stockpile and a new Northern Haul Road will also be constructed as part of this project but will be located entirely within the current approved mine permit area.

Potential areas that can be affected by the added project noise sources include the residences across SR 90 directly east of the existing Tyrone Mine, residences to the south of Emma starting at the intersection of SR 90 and Tyrone Road and the recreational uses of Gila National Forrest. Emma would operate similar to the Tyrone Mine in that operations are expected to be the same during the daytime as at night. The receptors most sensitive to noise typically include residences, hospitals, schools, parks, and churches. These receptors are identified as noise sensitive areas (NSAs). The closest NSAs are residences and the Gila National Forrest. No other NSAs are located within 3 miles of the Emma project.

Surface lands in and adjacent to the mine have historically been used for mining, livestock grazing, timber and fuel wood harvesting, recreation, and wildlife habitat. Ponderosa pine was logged in the Big Burro Mountains south of the Tyrone Mine, and fuel wood has been cut from woodlands in this area for at least a century. Recreation in the area includes camping, picnicking, hunting, off-road vehicle use, hiking, horseback riding, and bicycling. Current surrounding land uses include private residences, grazing, mining, and recreation. Grazing is the predominant land use surrounding the Emma area.

1.3 Typical Noise Levels, Environments, and Perception

Sound propagation involves three principal components: a noise source, a person or a group of people, and the transmission path. While two of these components, the noise source and the transmission path, are easily quantified (i.e., by direct measurements or through predictive calculations), the effect of noise on humans is the most difficult to determine due to the varying responses to the same or similar noise patterns. The perception of sound (noise) by humans is subjective from individual to individual and, like odor and taste, it is difficult to predict a response from one individual to another.

Excessive noise resulting from industrial related construction or mining activities can impact the health and welfare of both workers and the general public. The level of noise is related to its magnitude, which is referred to as sound pressure level (SPL) and is measured in units called decibels (dB). Decibels are calculated as a logarithmic function of the measured SPL in air to a reference effective pressure, which is considered the hearing threshold.

To account for the effect of how the human ear perceives noise, the SPL is adjusted for frequency. This is referred to as A-weighting (dBA), which adjusts measurements for the approximated response of the human ear to low-frequency SPLs (i.e., below 1,000 hertz [Hz]) and high-frequency SPLs (i.e., above 10,000 Hz).

Under controlled listening tests, humans judge that a 10 dB change in sound pressure level, on the average, represents approximately a halving or a doubling of the loudness of a sound. Yet a 10-dB reduction in a sound source means that 90 percent of the radiated sound energy has been eliminated. **Table 1** shows the approximate relationship between sound level changes, the resulting loss in acoustic power, and the judgment of relative loudness of the changes.

Table 1: Sound Level Characteristics and Human Perception of Loudness

Sound Level Change (dBA)	Acousit Energy Loss (%)	Recieved Change in Loudness
0	0	Reference
+/-3	50%	Threshold of perception
+/-10	90%	Twice / Half as loud
+/-20	99%	4 times / 1/4 as loud
+/-30	99.9%	8 times / 1/8 as loud
+-40	99.99%	16 times / 1/16 as loud

Typical sound level levels and environment are outlined in **Table 2** and **Table 3**, respectively. These tables are generally used to provide context to noise levels and perceived loudness.

Table 2: Sound Pressure Levels of Typical Noise Sources

Activity / Noise Source	Sound Pressure Level (dBA)
Air Raid Siren at 50 feet (ft)	120
Jackhammer at 50 ft	95
Loud Shout	90
Heavy Truck at 50 ft	85
Vacuum Cleaner at 3 m	70
Automobile (100 km/hr) at 100 ft	65
Normal Conversation at 3 ft	60
Quiet Living Room	40
Soft Whisper at 6 ft	35
Unoccupied Broadcast Studio	28
Threshold of Hearing	0

Source: Harris, 1998

Table 3: Sound Pressure Levels of Typical Environments

Activity / Noise Source	Sound Pressure Level (dBA)
Rock Concert	110
Subway Platform with Passing Train	100
Sidewalk with Passing Heavy Truck or Bus	90
Sidewalk by Typical Highway	80
Sidewalk of Typical Road with Passing Traffic	70
Typical Urban Area	60 – 70
Typical Suburban Area	50 – 60
Quiet Suburban Area at Night	40 – 50
Typical Rural Area at Night	30 – 40
Quiet Living Room	40
Isolated Broadcast Studio	20 - 30

Source: Harris, 1998

2.0 NOISE STANDARDS, LAWS, AND GUIDELINES

Noise standards, laws, and guidelines discussed in this section were used to evaluate the Emma project's noise impacts during operation. A summary of these standards, laws, and guidelines are presented in **Table 4**.

Table 4: Summary of Applicable Noise Standards, Laws, and Guidelines

Law	Jurisdiction	Requirements	Agency	Section
EPA Noise Control Act, 1972	Federal	Guidelines for state and local Governments: 55 dBA as an L_{dn} 55 dBA outdoor interference 45 dBA indoor interference	EPA and HUD	2.1.1
Grant County	Local	Non-specific nuisance language not directly applicable to the Emma project	Grant County	2.3

2.1 Federal Laws and Guidelines

2.1.1 United State Environmental Protection Agency

Under the Clean Air Act, the U.S. Environmental Protection Agency (EPA) administrator established the Office of Noise Abatement and Control (ONAC) to carry out investigations and studies on noise and its effect on public health and welfare. Through ONAC, the EPA coordinated all Federal noise control activities; but in 1981 the federal government concluded that noise issues were best regulated at the state and local level. While there are no federal, state, or local standards that apply to the Project, EPA has developed noise level guidelines requisite to protect public health and welfare against hearing loss, annoyance, and activity interference. These noise levels are contained in the EPA document “Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.” One of the purposes of this document was to provide a basis for state and local governments’ judgments in setting standards. The document identifies a 24-hour exposure level of 70 dB as the level of environmental noise that will prevent any measurable hearing loss over a lifetime. Likewise, levels of 55 dB outdoors and 45 dB indoors are identified as preventing activity interference and annoyance. These levels of noise are considered those that will permit spoken conversation and other activities such as sleeping, working, and recreation, which are part of the daily human condition (EPA 1974).

The U.S. Department of Housing and Urban Development (HUD) has promulgated noise criteria and standards “to protect citizens against excessive noise in their communities and places of residence.” These criteria relate to short-term and day-night average SPLs.

The equivalent SPL (L_{eq}) is the equivalent constant SPL that would be equal in sound energy to the varying SPL over the same time period. The day-night average sound level (L_{dn}) is the 24-hour average SPL calculated with a 10 dBA “penalty” added to nighttime hours (10 p.m. to 7 a.m.). This is done because residential land uses are more sensitive to nighttime noise impacts. The equation for L_{dn} is:

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

Where: L_d = daytime L_{eq} for the period 0700 to 2200 hours
L_n = nighttime L_{eq} for the period 2200 to 0700 hours

The EPA recommends an outdoor L_{dn} of 55 dBA for residential and farming areas. For industrial areas, an L_{eq} of 70 dBA is suggested. The HUD-recommended goal for exterior noise levels is not to exceed an L_{dn} of 55 dBA. However, the HUD standard for exterior noise is 65 dBA measured as L_{dn}. Without numerical noise limits, an L_{dn} of 55 dBA as recommended by EPA and HUD provides a recommended and conservative outdoor noise level for comparison of noise levels of the Project.

2.2 Local Laws and Guidelines

There are no local standards, laws, or guidelines applicable to the Emma project in regard to noise.

3.0 NOISE MEASUREMENT PROCEDURES

Noise levels were measured at six locations in the vicinity of Emma from September 7 through September 8, 2021. The primary baseline monitoring location collected area wide representative data for a 24-hour period near the center of the proposed Emma Project site. Additional individual measurements allow for baseline data to be collected at or near existing sensitive receptors most likely to be affected by the Project during the daytime and at night. Data at the five additional off-site monitoring locations included daytime and nighttime (between 10 p.m. and 7 a.m.) measurements collected for a minimum of 30 minutes or as long as needed to collect a measurement representative of the existing environment as determined by the on-site noise specialist. The monitoring locations are presented in **Table 5** and are illustrated along with the current plot plan and noise sensitive receptors in **Figure 3-1**.

Table 5: Baseline Noise Study Monitoring Locations

Site	UTM Coordinates (Zone 12N)		Monitoring Dates	Sample Type
	North	East		
Site 1	3613551m N	749087m E	September 8	20-minute minimum
Site 2	3610647m N	749076m E	September 8	20-minute minimum
Site 3	3613798m N	750852m E	September 8	20-minute minimum
Site 4	3608570m N	749768m E	September 8	20-minute minimum
Site 5	3611708m N	742463m E	September 8	20-minute minimum
24-Hr Site	3611853m N	748255m E	September 7 & 8	Continuous

The monitoring duration is dependent on the complexity of the noise environment being monitored. The more complex the environment, the longer the preferred duration of the measurement, and the less complex the environment, the less the monitoring duration. Daytime noise environments are typically more complex than nighttime environments due to human activities that generate noise. Measurements durations at Site 1, 2, 3, 4, and 5 ranged between 22 minutes and one hour. The noise measurements obtained in this study followed the minimum background measurement period outlined in ANSI/ASA S12.9-2013 of 10 minutes (ANSI/ASA 2013).

Measurement techniques set forth by the ANSI S12.9-2013/Part 3, 2013, were used and included using a Type - 1 sound level meter set to the slow response mode to obtain consistent, integrated, A-weighted SPLs. Concurrent one-third octave band frequencies were also measured at all sites. The octave band data from each monitoring site were measured and stored during each monitoring period. These are industry standards for the collection of baseline noise measurements.

Integrated SPL data consisting of the following noise parameters were collected at each location:

- L_{eq} – The SPL averaged over the measurement period; this parameter is the continuous steady SPL that would have the same total acoustic energy as the real fluctuating noise over the same time period.
- L_{max} – The maximum SPL for the sampling period.
- L_{min} – The minimum SPL for the sampling period.
- L_n – The SPLs that were exceeded *n* percent of the time during the sampling period. For example, L_{90} is the level exceeded 90 percent of the time.

The SPL data were analyzed in both dB and dBA. The higher the decibel value, the louder the sound.

The SPL averages were calculated using the following formula:

$$\text{Average SPL} = 10 \text{ Log } \frac{\sum_{i=1}^{N} 10^{(SPL_i/10)}}{N}$$

where: N = number of observations

SPL = individual SPL in data set

The noise monitoring equipment used during the study included:

- Larson Davis Model 824 and 831 Precision Integrating Sound Level Meters with Real Time Frequency Analyzers
- Larson Davis Model PRM902 Microphone Preamplifier
- Larson Davis Model 2560 Pre-polarized ½-inch Condenser Microphone
- Windscreen, tripod, and various cables
- Larson Davis Model CAL200 Sound Level Calibrator (CAL200), 94/114 dB at 1,000 Hz

Monitoring was conducted using the sound level meter mounted on a tripod at a minimum height of 1.5 meters (5 ft) above grade. A windscreen was used since measurements were taken outdoors. The windscreen protects the microphone from interference from wind up to a constant wind speed of 12 miles per hour (mph). The microphone was positioned so that a random incidence response was achieved. The sound level meter and octave band analyzer were calibrated immediately prior to and just after each sampling period using the CAL200 to provide a quality control check of the sound level meter's operation during monitoring.

The operator recorded detailed field notes during monitoring that included major noise sources in the area. The Larson Davis sound level meters comply with Type I – Precision requirements set forth for sound level meters and for one-third octave filters. Calibration reports for the Larson Davis Sound Level Meters can be found in **Appendix A**. Weather data from the closest airport was downloaded for the period when monitoring was completed. The data shows that there were no weather events (rain, excessive wind, or high humidity) that would have interfered with noise monitoring during the field campaign. Weather data from the monitoring period from the nearest reporting airport can be found in **Appendix B**.

4.0 NOISE MODELING METHODOLOGY

The impact evaluation of the Project was performed using CadnaA, an environmental noise propagation computer program that was developed to assist with noise propagation calculations for major noise sources and projects. For the purposes of this analysis the major noise sources modeled are associated with mining activities and truck traffic along the haul roads from Emma to processing areas on the existing Tyrone Mine. Noise sources are entered as octave band SPLs. Coordinates for sources and receptors, either rectangular or polar, can be specified by the user. All noise sources are assumed to be point sources; area sources can be simulated by several point sources located in a defined area. Sound propagation is calculated by accounting for hemispherical spreading and three other user-identified attenuation options: atmospheric attenuation, path-specific attenuation, and barrier attenuation. Atmospheric attenuation is calculated using the data specified in the International Standards Organization Attenuation of Sound During Propagation Outdoors, Part 1: Calculations of the Absorption of Sound by the Atmosphere (International Standard Organization [ISO] 1993). Path-specific attenuation can be specified to account for the effects of vegetation, foliage, and wind shadow. Directional source characteristics and reflection can be simulated using path-specific attenuation. Attenuation due to barriers can be specified by giving the coordinates of the barrier. Barrier attenuation is calculated by assuming a defined barrier perpendicular to the source-receptor path. Total and A-weighted SPLs are calculated.

The model predicted the maximum noise levels produced during Emma operations using expected noise sources from mining operations and haul road traffic in year 4 of operations. It is assumed that by year 4 the project will be at full capacity with the most equipment operating. The noise sources include heavy equipment operations, loading and unloading of material, and on-site large and medium-sized vehicle traffic noise. The model was set up with several conservative assumptions that would increase modeled noise level results. Some of these conservative assumptions are highlighted include:

- Terrain: Existing terrain considered, but on site berms, pit, and stockpile not included. These changes in topography on-site are assumed to attenuate noise.
- Meteorological data: Assumes receptors are downwind of sources at all times.
- Ground Attenuation: Surrounding land is soft ground, but a mixed ground attenuation of both hard and soft ground was used.
- Foliage Attenuation: No attenuation from foliage was assumed.

Table 6 lists the configuration of the calculation parameters used to complete noise modeling for the Project.

Table 6: Noise Model Configuration Parameters

Parameter	Model Setting	Description/Notes
Standards	ISO 9613	All sources and attenuators are treated as required by the cited standards.
Source directivity	Horizontal area sources and line sources	No directivity was applied to modeled sources.
Ground absorption	0.5	Mix of hard and soft ground assumed
Temperature/humidity	20°C / 50% relative humidity	Mild and dry day typical to the area
Wind conditions	Default ISO 9613 – moderate inversion condition	The propagation conditions in the ISO standard are valid for wind speeds between 4 and 18 km/hr; all points are considered downwind.
Terrain	Existing terrain considered	Existing changes in elevation in the impact area will affect sound propagation. On site terrain not considered.
Reflections	1	One reflection is taken into account as mirror image sources from reflecting structures.

Parameter	Model Setting	Description/Notes
Operations	Fully operational day and night	No significant operational difference between daytime hours and at night
Noise Mitigation	None	The model does not include any on-site barriers or mitigation measures outside of best management practices for noise

Equipment type and numbers, sound pressure levels, usage factors, and noise source data input into the model are presented in **Table 7**, which can be found at the end of this report. By law, the heavy equipment outlined in **Table 7** is required to use back-up alarms as a worker health and safety measure. Tyrone can mitigate this noise at Emma by using equipment routs and planning that minimizes need or equipment to back up and could utilize broadband "white noise" backup alarms rather than the typical single tone backup "beepers" that can cause off-site noise nuisances. The white noise backup alarms will have less of an impact to off-site receptors as it has a lower overall noise level and is known to be less of a nuisance to humans than single tone noises.

5.0 EXISTING BASELINE ENVIRONMENT

The Noise levels in the area of the Emma Project are variable; the major noise sources included traffic on SR 90, existing mining operations, local traffic, agricultural noise, residential noise, and typical sounds of nature. **Table 8** shows a summary for the data collected at the monitoring locations. Monitoring locations were selected based on two goals. First, the collection of noise levels that are representative of the entire area. Second, the collection of noise levels at the closest NSAs. In general, the 24-hour measurement represents the entire spectrum of area wide noise levels and the individual location measurements represent noise levels at NSAs.

Anthropogenic noise sources such as traffic and residential noise sources are the major noise sources in the area and as expected was generally greater during the daytime than during the nighttime and generally decreased at greater distances from SR 90, the Tyrone Mine, and residential areas. The daytime L_{eq} ranged from a low of 31.1 dBA at Site 5 to a maximum of 60.4 dBA at Site 1. The nighttime L_{eq} ranged from a low of 32.3 dBA at Site 3 to a high of 43.8 dBA at Site 5. Insect noise did elevate nighttime measurements at some monitoring locations.

The sound level that is exceeded 90 percent of the time (L_{90}) is commonly used when comparing noise monitoring results between locations. This excludes most transient and intermittent noise sources, such as traffic noise, airplane noise, birds chirping, etc. The L_{90} is better used to compare measurements between sites where transient noises may vary greatly. The daytime L_{90} ranged from a low of 25.6 dBA at Site 5 to a maximum of 33.0 dBA at Site 1. The nighttime L_{90} ranged from a low of 30.9 dBA at Site 3 to a high of 42.7 dBA at Site 5.

The day-night average (L_{dn}) sound pressure levels that are used to account for the sensitivity of residential receptors to nighttime noise ranged from 39.2 dBA at Site 3 to 58.5 dBA at Site 1. Noise from SR 90 was found to be a constant source that elevated the L_{eq} for sites located closer to that corridor especially during the daytime hours, and nighttime insect noise caused elevated L_{dn} levels at Site 5.

The 24-hour Site L_{eq} averaged 43.1 dBA, the L_{90} was 25.3 dBA, and the overall L_{dn} average was 45.8 dBA. **Figure 5-1** presents the one-minute average sound pressure level data during the 24-hour monitoring period.

Sections 5.1 through 5.6 summarize the sound level measurements taken at each location.

Table 7: Operations Noise Source Data

Equipment ID	Location	Number Used	Usage Rate (%)	Source Height (m)	Levels at Octave Band Centre Frequencies									dBA	dB	Source
					31.5	63	125	250	500	1000	2000	4000	8000			
793 Cat Haul Trucks	Haul Road	9	60%	2		91	101	113	124	129	130	131	129	136.7	135.6	Vendor Supplied - Catterpillar_785 Haul Truck
Small Water Truck 4,000 gal	Haul Road	2	40%	2	107	103	108	107	105	108	113	110	103	116.9	117.2	Antamina Site Visit Measurement 2/22/07
Large Lube Servcie Truck	Haul Road	1	40%	2		91	94	101	101	102	104	100	91	108.5	108.9	Field Measrmnt 12/20/11 @ landfill_gbm
Prill Trucks	Haul Road	2	40%	2	104	100	105	104	102	105	110	107	100	113.9	114.2	Field Measrmnt 12/20/11 @ landfill_gbm
Caterpiller 785 Water Trucks	Haul Road	2	40%	2	112	115	115	99	93	94	97	90	78	103.2	118.2	Caterpillar 785 Haul Truck
D10/D11 Cat Dozer	Pit	5	60%	2	110	109	103	97	92	85	83	79	74	94.5	111.5	Vendor Supplied - Cat_D10/D11/D7 LGP
Cat 992,988,994 Loader	Pit	4	60%	2		102	110	101	102	99	93	89	82	103.7	111.7	Caterpillar 992 FEL
PV271 Drills	Pit	2	60%	2	124	124	120	119	117	112	106	103	102	118.0	127.6	Blackwater Golder Project - PV271 Diesel Drill
4100 P&H Shovel	Pit	1	100%	1		104	108	98	99	97	92	86	80	101.4	110.1	Blackwater Golder Project - P&H 4100XPC Shovel
Light Plants	Pit	2	100%[a]	2		103	111	106	99	99	94	89	85	103.6	112.5	Noise from Construction, EPA 1971
Cat motor Graders	Auxillary	3	60%	2	124	124	120	119	117	112	106	103	102	118.0	127.6	Caterpillar 14/16 Grader
Cat 349 Excavator	Auxillary	1	60%	2	124	124	120	119	117	112	106	103	102	118.0	127.6	Feild Measrmnt @ Landfill 10/20/11_gbm
Backhoe	Auxillary	1	60%	2	104	107	101	98	97	97	99	93	87	103.4	109.6	Feild Measrmnt @ Landfill 10/20/11_gbm
Cat 824 Wheel Dozer	Auxillary	2	60%	1	112	115	115	112	109	105	102	99	91	111.2	119.7	Cat 988 Wheel Loader

Notes:

[a] Operations during nighttime hours only

Table 8: Noise Summary Table
Baseline Ambient Sound Pressure Levels Observed at the Emma Site September 2021

Monitoring Location	Date	Time	Start Time	Sound Pressure Levels (dBA)							Observations
			(HH:MM)	L_{Min}	L_{max}	L_{10}	L_{50}	L_{90}	L_{eq}	L_{dn} [a]	
Site 1: Residence to North	8-Sep-21	Daytime	13:15	31.5	83.3	58.9	40.9	33.0	60.4		Cars/trucks on SR 90. Slightly audible pump of mine operations. Dogs barking at residence.
	8-Sep-21	Nighttime	1:23	30.7	52.7	42.1	31.7	31.0	38.2	58.5	Pump of mine operating continuously - got louder for portion of measurement. Insects.
Site 2: Residences to South	8-Sep-21	Daytime	15:10	30.7	62.5	47.7	38.2	32.1	44.0		Intermittent-moderate traffic on SR 90. Wind. Local car pass by meter.
	8-Sep-21	Nighttime	0:01	30.7	60.6	39.3	31.5	31.0	38.5	46.3	Insects, intermittent animals, coyotes, distant AC unit.
Site 3: East of Project	8-Sep-21	Daytime	14:25	30.8	54.3	37.1	32.7	31.4	35.1		Insects noise. Wind noise. Distant truck. Cow at end of monitoring.
	8-Sep-21	Nighttime	2:00	30.7	54.4	31.9	31.2	30.9	32.3	39.2	Distant owl, insects, car on SR 90.
Site 4: Residences to Southwest	8-Sep-21	Daytime	16:10	30.6	84.6	43.2	34.3	31.3	52.1		Intermittent traffic on SR 90 - distant. Insects, birds, wind noise. Airplane. Dog barking by meter after resident came nearby and technician was in vehicle. Paused for local traffic.
	8-Sep-21	Nighttime	0:40	32.0	58.1	36.0	34.8	33.8	35.3	50.6	Infrequent cars on SR 90, insects, distant coyotes
Site 5: West of Project	8-Sep-21	Daytime	18:17	22.7	50.3	34.0	28.9	25.6	31.1		Insects, slight wind noise. Distant infrequent vehicles.
	7-Sep-21	Nighttime	23:13	41.1	50.9	44.6	43.7	42.7	43.8	49.6	Insects, distant mine operations, distant airplane.
24-Hour Onsite	7-Sep-21 to	Continuous	12:00	18.5	82.0	46.7	31.8	25.3	43.1	45.8	SR 90. Insects. Wind noise.
	8-Sep-21										
EPA and HUD guideline for outdoor residential and farming area receiving land uses										55.0	

Note:

Source: Golder 2021.

[a] Calculated using the daytime and the nighttime Leq for short term measurements. Instrument calculated for 24-hour onsite measurement.

5.1 Monitoring Site 1

This site is located off of SR 90 near the eastern boundary of the Tyrone Mine. It is approximately 310 ft west of the closest sensitive residential receptor to the Emma project. Car and traffic along SR 90, pump operations from the mine, and dogs barking were the noise sources observed during the study.

Overall, the noise levels were greater during the daytime than at night. The daytime L_{eq} was 60.4 dBA compared to a nighttime L_{eq} of 38.2 dBA. The L_{90} used to compare inter-site readings was much closer 33.0 dBA during the day and 31.0 dBA at night. Daytime noise levels were influenced by transient noise source (mostly vehicle traffic) which accounted for the difference between L_{eq} and L_{90} values. The L_{dn} was 58.5 dBA.

The monitoring setup is shown in Photograph 1.

Photograph 1: Noise Monitoring Site 1 – Located in Residential Area East of the Emma Project Site

5.2 Monitoring Site 2

This site is located near residential receptors located off of Tyrone Road to the south of the Emma Project area approximately 500 ft west of SR 90 and 180 ft north of Tyrone Road. Sounds of nature (birds and insects, etc.), local ATV and dirt bikes, intermittent highway noise and distant airplanes were the noise sources observed during the study.

Overall, the noise levels were greater during the daytime than at night. The L_{eq} was 44.0 dBA in the daytime compared to a nighttime L_{eq} of 38.5 dBA. The L_{90} used to compare inter-site readings was 32.1 dBA during the day and 31.0 dBA at night. The L_{dn} was 46.3 dBA. Transient traffic noise sources accounted mostly for the elevated daytime noise levels.

The monitoring setup is shown in Photograph 2.

Photograph 2: Noise Monitoring Site 2 – Located in Residential Area South of the Emma Project Site

5.3 Monitoring Site 3

This site is located east of the Emma Project area, approximated one mile east of SR 90 along Phelps Dodge Mine Road. Distant vehicular traffic from SR 90, cattle, and sounds of nature (insects and animals) were sources observed during the study. Overall, the noise levels measured at the site were constant with the daytime L_{eq} of 35.1 dBA compared to a nighttime L_{eq} of 32.3 dBA. The L_{90} used to compare inter-site readings was 31.3 dBA during the day and 30.9 dBA at night. The L_{dn} was 39.2 dBA. There was slightly more transient noise during the daytime when compared to the nighttime.

The monitoring setup is shown in Photograph 3.

Photograph 3: Noise Monitoring Site 3 – Located in Agricultural Area East of the Emma Project Site

5.4 Monitoring Site 4

This site is located south-southeast of the Emma Project near residences off Christopher Road, approximately 2,200 ft off of SR 90. Sounds of nature (birds and insects, etc.), distant highway noise, and residential noise sources were observed during the measurements.

Overall, the noise levels were greater during the daytime than at night. The daytime L_{eq} was 52.1 dBA in the compared to a nighttime L_{eq} of 35.3 dBA. The L_{90} used to compare inter-site readings was much closer 31.3 dBA during the day and 33.8 dBA at night. Daytime noise levels were influenced by transient noise sources (mostly vehicle traffic) which accounted for the difference between L_{eq} and L_{90} values. Nighttime noise was mostly influenced by continuous insect noise, which accounts for the slightly higher nighttime L_{90}. The L_{dn} was 50.6 dBA

The monitoring setup is shown in Photograph 4.

Photograph 4: Noise Monitoring Site 4 – Located in Residential Area South-Southeast of the Emma Project Site

5.5 Monitoring Site 5

This site is located approximately 3.3 miles west of the Emma Project area off of Loop Trail. Sounds of nature, wind driven noise, and distant traffic noise were sounds observed during the study.

The L_{eq} observed during the daytime measurement was 31.1 dBA compared to a nighttime L_{eq} of 43.8 dBA. The L_{90} used to compare inter-site readings was 25.6 dBA for the daytime measurement and 42.7 dBA at night. The L_{dn} was 49.6 dBA. Nighttime noise was mostly influenced by continuous insect noise, though distant mine operations were observed.

The monitoring setup is shown in Photograph 5.

Photograph 5: Noise Monitoring Site 5 – Located West of the Emma Project Site

5.6 24-hour Site

This site is located near the center of the Emma Project area where the mine pit is planned to be located, approximately three quarters of a mile west of SR 90. Sounds of nature, wind driven noise, and traffic along SR 90 were observed during the study.

The L_{eq} and L_{90} measured at the 24-hour Site were 43.1 and 25.3 dBA, respectively and the L_{dn} was 45.8 dBA. **Figure 5-1** shows that there were intermittent transient noise sources throughout the measurement that were more frequent during the daytime. The large difference between the L_{eq} and L_{90} was caused by the influence of these periodic noise sources and increase in wind driven noise during the daytime.

The monitoring setup is shown in Photograph 6.

Photograph 6: Continuous Site, Located Near the Center of the Emma Project Site

6.0 MODELING RESULTS

The modeling results are summarized in **Table 9** and illustrated in **Figure 6-1**. The modeling results show that noise propagation is affected by changes in terrain causing nonuniform noise levels at increasing distances from noise sources. The existing Tyrone Mine along the north-northwest boundary of the Emma Project provides a significant noise barrier in those directions. Other natural topography structures also provide barriers to noise in a lesser extent in other directions.

The noise impacts at the off-site receptors ranged from a high of 41 dBA at NSA 02 to a low of 26 dBA at NSA 13. The highest contributor to the modeled noise level at NSA 02 is haul truck traffic from the on-site access road between the existing Tyrone Mine and the proposed Emma Project. Since on-site topographic changes are not included in this analysis, it is expected that these noise impacts are conservative and will be lower once the project is up and running with planned berms and stockpiles.

Table 9: Modeled Operational Noise Levels at Residential Receptors

Site	Land Use	Modeled Results (dBA)	
		Day	Night
Site 1	Residential	31	31
Site 2	Residential	37	37
Site 3	Agricultural	32	32
Site 4	Residential	25	25
Site 5	Recreational	18	18
NSA 01	Residential	34	34
NSA 02	Residential	41	41
NSA 03	Residential	33	33
NSA 04	Residential	34	34
NSA 05	Residential	35	35
NSA 06	Residential	35	35
NSA 07	Residential	35	35
NSA 08	Residential	31	31
NSA 09	Residential	33	33
NSA 10	Residential	30	30
NSA 11	Residential	30	31
NSA 12	Residential	30	31
NSA 13	Recreational	26	26

7.0 PROJECT IMPACTS

7.1 Environmental Impacts

The proposed Emma Pit is anticipated to encompass approximately 118 acres of private land at the EOY 2026 (**Figure 7-1**). As shown in **Table 10**, the predicted impacts were calculated by logarithmically adding modeled results to baseline daytime sound levels at ten monitoring locations and at nineteen additional NSAs identified in the Project impact area.

The predicted L_{dn} impact levels at the off-site sensitive receptor locations range from a high of 49 dBA at NSA 13 to a low of 40 dBA at NSA 12. The high noise levels at NSA 13 are inflated due to the elevated nighttime baseline sound levels caused by seasonal insect noise sources measured at Site 5 and the predicted impact at this site is no greater than the measured baseline L_{dn} at Site 5; therefore, no increase to the noise level is expected at this location from project operations. The locations with the highest predicted impacts from Emma project operations is at NSA 02 due to the modeled noise level of 41 dBA from haul truck traffic. This, however, only represents a 1 dBA increase to the L_{dn} over the Site 2 L_{dn} of 46 dBA.

Table 10: Modeled and Predicted Noise Levels at Boundary and Residential Receptors

Site [c]	Land Use	A- Weighted Sound Levels (dBA)								
		Baseline			Modeled [a]		Predicted [b]			
		L_{90}, Day	L_{90}, Night	L_{dn} (L_{eq})	Day	Night	Day	Night	L_{dn}	L_{dn} Difference[c]
Site 1	Residential	33	31	59	31	31	35	34	41	0
Site 2	Residential	32	31	46	37	37	38	38	45	0
Site 3	Agricultural	31	31	39	32	32	34	34	41	2
Site 4	Residential	31	34	51	25	25	32	34	41	0
Site 5	Recreational	26	43	50	18	18	26	43	48	0
NSA 01	Residential	33	31	59	34	34	36	36	42	0
NSA 02	Residential	32	31	46	41	41	41	41	48	1
NSA 03	Residential	32	31	46	33	33	36	35	42	0
NSA 04	Residential	31	34	51	34	34	36	37	43	0
NSA 05	Residential	32	31	46	35	35	37	37	43	0
NSA 06	Residential	32	31	46	35	35	37	37	43	0
NSA 07	Residential	32	31	46	35	35	37	36	43	0
NSA 08	Residential	31	31	39	31	31	34	34	41	1
NSA 09	Residential	32	31	46	33	33	36	35	42	0
NSA 10	Residential	31	34	51	30	30	34	35	42	0
NSA 11	Residential	31	34	51	30	31	34	35	42	0
NSA 12	Residential	32	31	46	30	31	34	34	40	0
NSA 13	Recreational	26	43	50	26	26	29	43	49	0

Note:

Source: Golder Associates Inc, 2021.

[a] Modeled noise generated by proposed operational configuration year 4 calculated by the noise model Cadna A.

[b] Predicted impacts were calculated by logarithmically adding the modeled impacts to the baseline measurements.

[c] Baseline from the most comparable monitoring locations used for NSA baseline.

[d] Predicted Ldn - Baseline Ldn, if result less than zero, corrected to zero.

When comparing the baseline L_{dn} values from **Table 8**, which ranged from 39 dBA to 59 dBA, with the predicted L_{dn} values, which ranged from 40 dBA to 49 dBA at off-site NSAs, the overall impact from the Emma Project will be limited. The reason for this limited impact to L_{dn} levels is due to the distances the NSA are from the Emma Project area and the existing topography acting as a sound barrier. The model did not incorporate future stockpiles or earthen berms that will provide additional barriers to sound propagation. The predicted L_{dn} noise levels are well below the EPA and HUD guidelines of 55 dBA (L_{dn}).

Outdoor conversations may experience mild annoyance when ambient noise levels are above 55 dBA; levels above 62 dBA are considered significant interference to conversations held outdoors (EPA 1974). The predictive noise model suggests that noise generated by Emma project operations will be at or below these levels at the nearest residential receptors during daytime hours when outdoor activity is common. Therefore, no adverse impacts to outdoor activities from project operations are expected.

Homes have an average effective sound attenuation of 15 dBA between the outdoors and indoors (EPA 1974). The highest predicted outdoor sound level at a residence is 41 dBA. Therefore, the predicted indoor sound level from the Emma Project would be 26 dBA. This is well below the EPA's guideline of 45 dBA for interior spaces of sensitive receptors.

As discussed in Section 2.1, the EPA and HUD noise guidelines provide appropriate noise levels where numerical standards have not been established by local governments. The results presented in **Table 10** demonstrate that the modeled Emma Project will be well below all EPA and HUD guidelines for interference with human activities both outside and inside residences and buildings. The Emma Project, therefore, is unlikely to generate nuisance complaints or excessive noise negatively impacting the surrounding area. Additionally, the existing area noise conditions includes transient noise sources from local truck traffic in and out of the currently operating Tyrone Mine and SR 90 traffic. This makes it unlikely the Emma Project will generate nuisance noise complaints as operations will fit in with existing transient noise sources in the area.

8.0 MITIGATION

As no significant adverse impacts to the closest NSAs were identified, no mitigation measures are necessary. This assumes the use of best practices for operation and maintenance of noise generating equipment as implemented for the Tyrone Mine.

9.0 REFERENCES

American National Standards Institute (ANSI), American National Standard (ASA). S12.9-2013 (Part 3). 1993 and Revised 2013. Quantities and Procedures for Description and Measurement of Environmental Sound – Part 3: Short-Term Measurements with an Observer Present.

International Standards Organization (ISO). 1993. Attenuation of Sound during Propagation Outdoors, Part 1: Calculation of the Absorption of Sound by the Atmosphere. Geneva, Switzerland: ISO.

U.S. Environmental Protection Agency (EPA). 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. Office of Noise Abatement and Control. Washington, DC.

Signature Page

Please contact the undersigned with any questions or comments on the information contained in this report.

Respectfully submitted,

Golder Associates USA Inc.

Gage Miller
Senior Project Scientist

Todd Stein
Project Manager

GM/TS/jes

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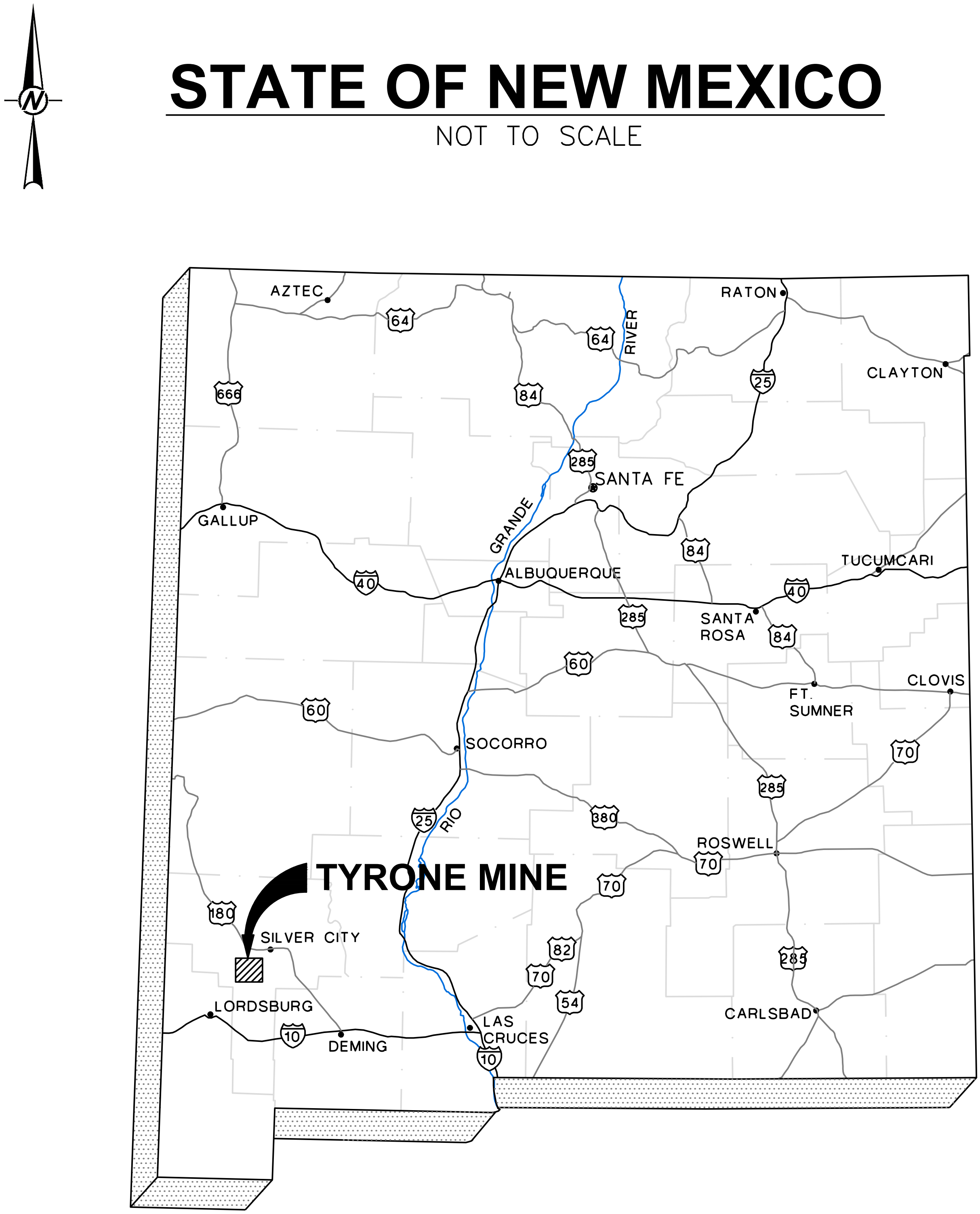
https://golderassociates.sharepoint.com/sites/149301/project files/6 deliverables/007-noise study/rev0_final/21476949-007-r-rev0-emma_noise_study-03nov21.docx

Figures



CLIENT
FREEPORT-MCMORAN TYRONE INC.

PROJECT
EMMA EXPANSION PROJECT CCP

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	09/17/21
PREPARED	SIB
DESIGN	TS
REVIEW	TS
APPROVED	TS

TITLE
MINE LOCATION MAP

PROJECT No.	PHASE	Rev.	FIGURE
21476949		0	1-1

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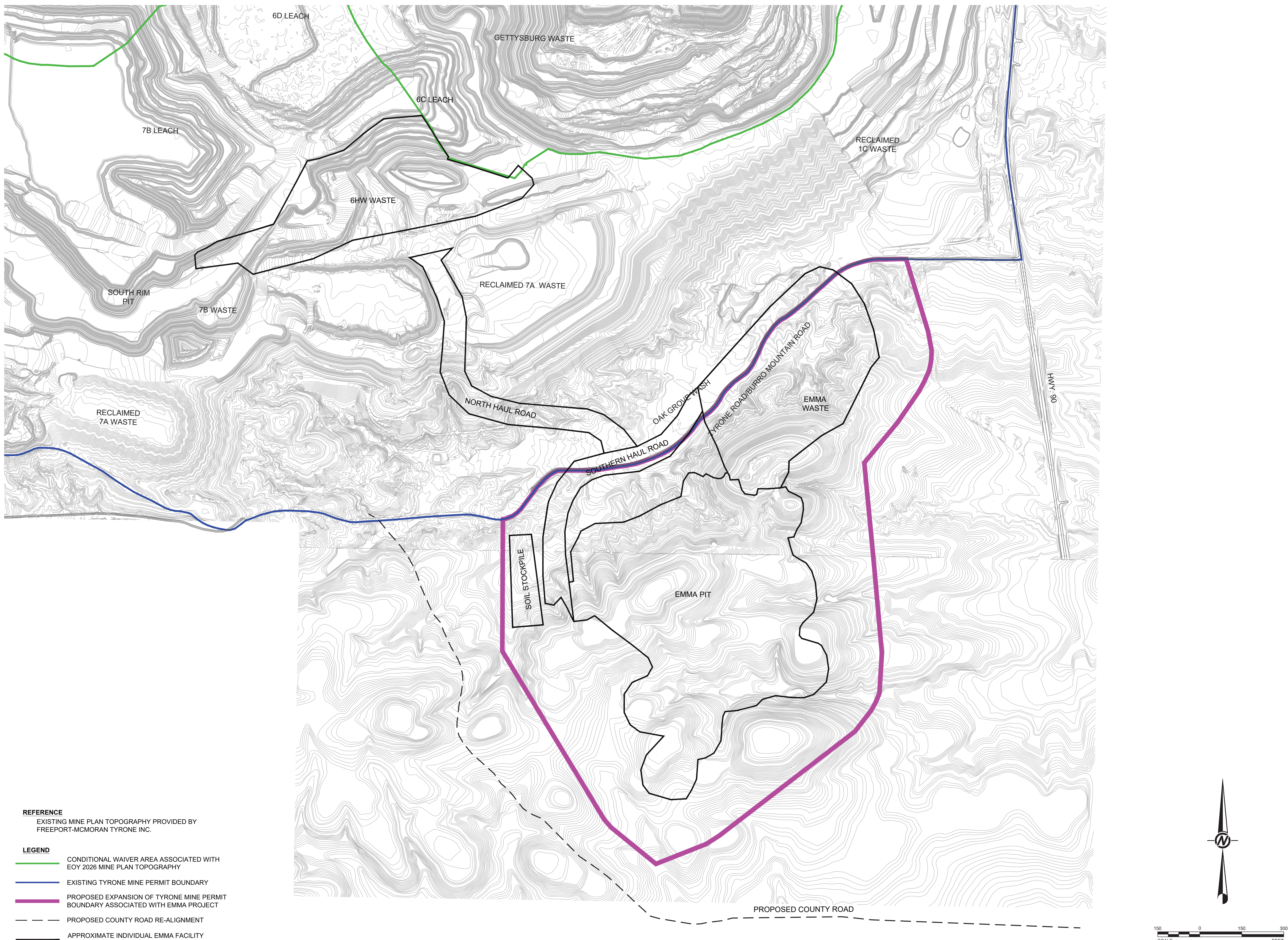

REFERENCE

EXISTING MINE PLAN TOPOGRAPHY PROVIDED BY FREEPORT-MCMORAN TYRONE INC.

LEGEND

- CONDITIONAL WAIVER AREA ASSOCIATED WITH EOY 2026 MINE PLAN TOPOGRAPHY
- EXISTING TYRONE MINE PERMIT BOUNDARY
- PROPOSED EXPANSION OF TYRONE MINE PERMIT BOUNDARY ASSOCIATED WITH EMMA PROJECT
- PROPOSED COUNTY ROAD RE-ALIGNMENT
- APPROXIMATE INDIVIDUAL EMMA FACILITY BOUNDARY

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0	2021-09-10	-		SIB		

SEAL

CLIENT
FREEPORT-MCMORAN TYRONE INC.

CONSULTANT
GOLDER MEMBER OF WSP
GOLDER ASSOCIATES
2108 WEST LABURNUM AVENUE
SUITE 200
RICHMOND, VA 23227
(804) 358-7900
www.golder.com

PROJECT
EMMA EXPANSION PROJECT CCP

TITLE
TYRONE MINE AREAS AND FACILITIES

PROJECT NO.
21-476949

REV. 0 of

FIGURE
1-2

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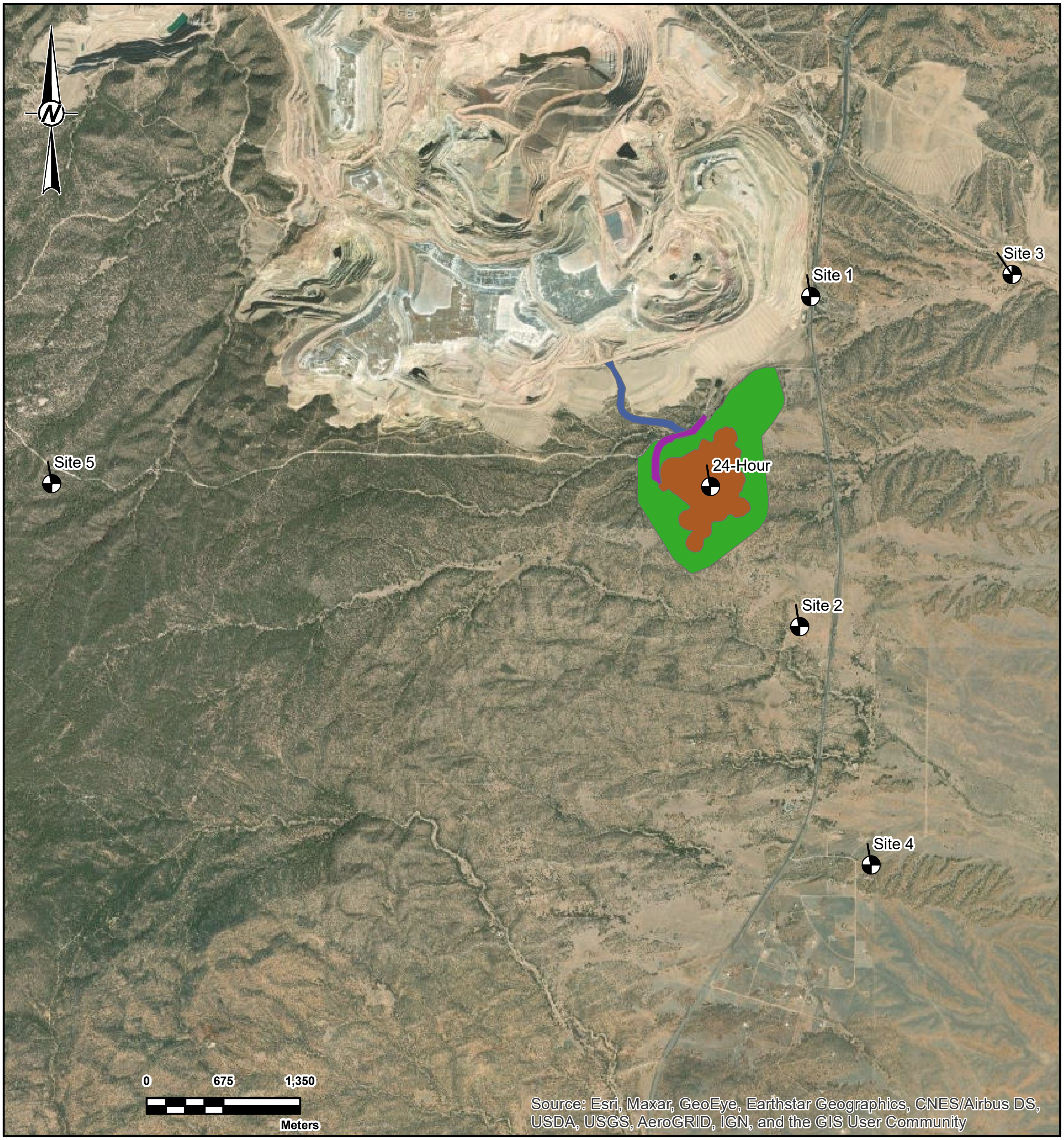

LEGEND

- Noise Monitoring Locations
- EMMA Expansion Area
- EMMA Pit Area Yr 4
- Haul Road Area 1 Final
- Haul Road Area 2 Final

REFERENCE(S)
1. NOISE MONITORING LOCATIONS, GOLDER ASSOCIATES INC., 2021.
2. SITE LAYOUT, FREEPORT-MCMORAN TYRONE INC. 2021

COORDINATE SYSTEM: NAD 1983 STATEPLANE NEW MEXICO WEST FIPS 3003 FEET
PROJECTION: TRANSVERSE MERCATOR
DATUM: NORTH AMERICAN 1983
UNITS: FOOT US

CLIENT
FREEPORT-MCMORAN TYRONE INC.

PROJECT
EMMA EXPANSION PROJECT

TITLE
BASELINE NOISE MONITORING LOCATIONS

CONSULTANT
GOLDER

YYYY-MM-DD	2021-07-29
DESIGNED	GFD
PREPARED	JGW
REVIEWED	
APPROVED	

PROJECT NO.	CONTROL	REV.	FIGURE
21476949	A002	3	3-1

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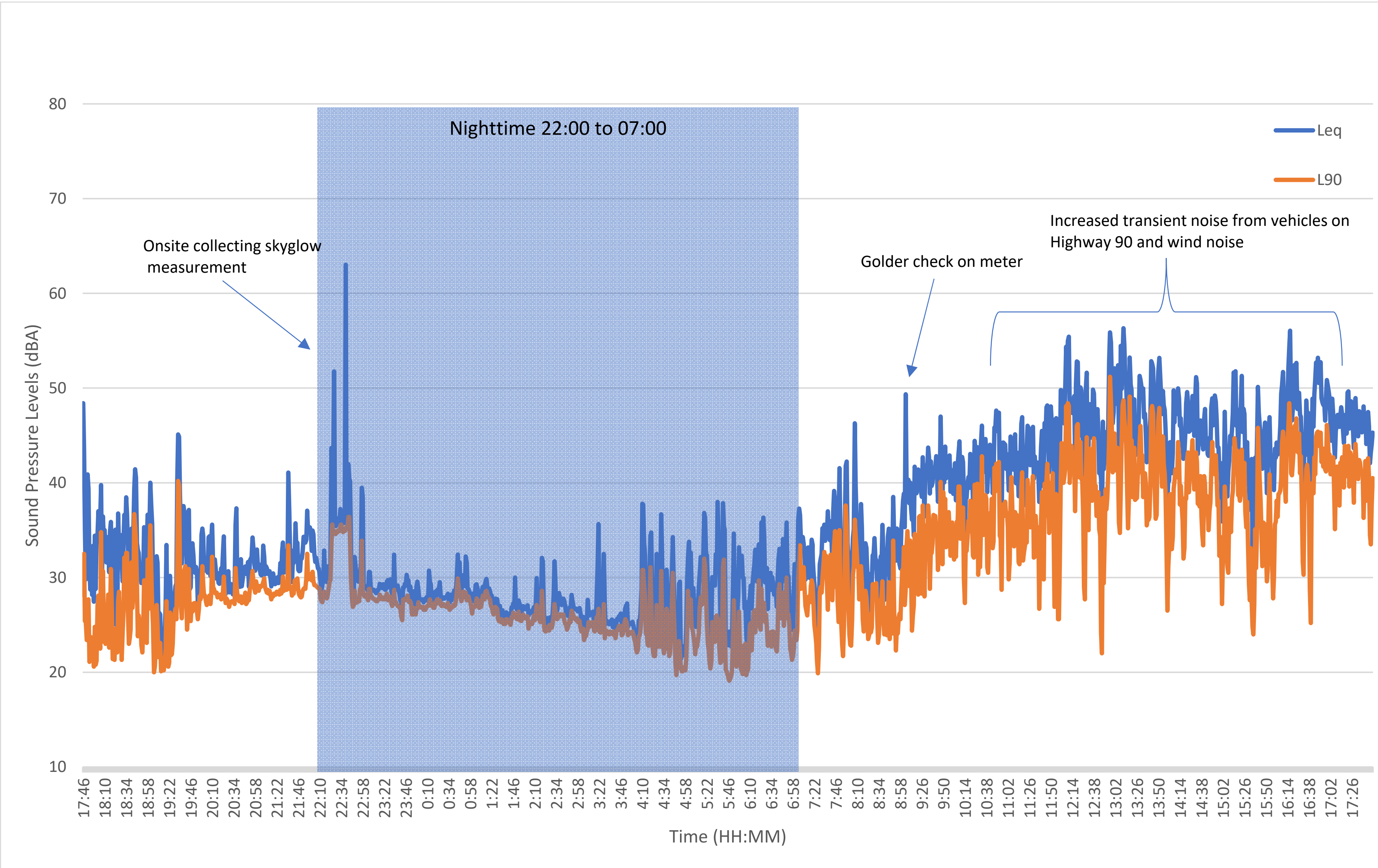
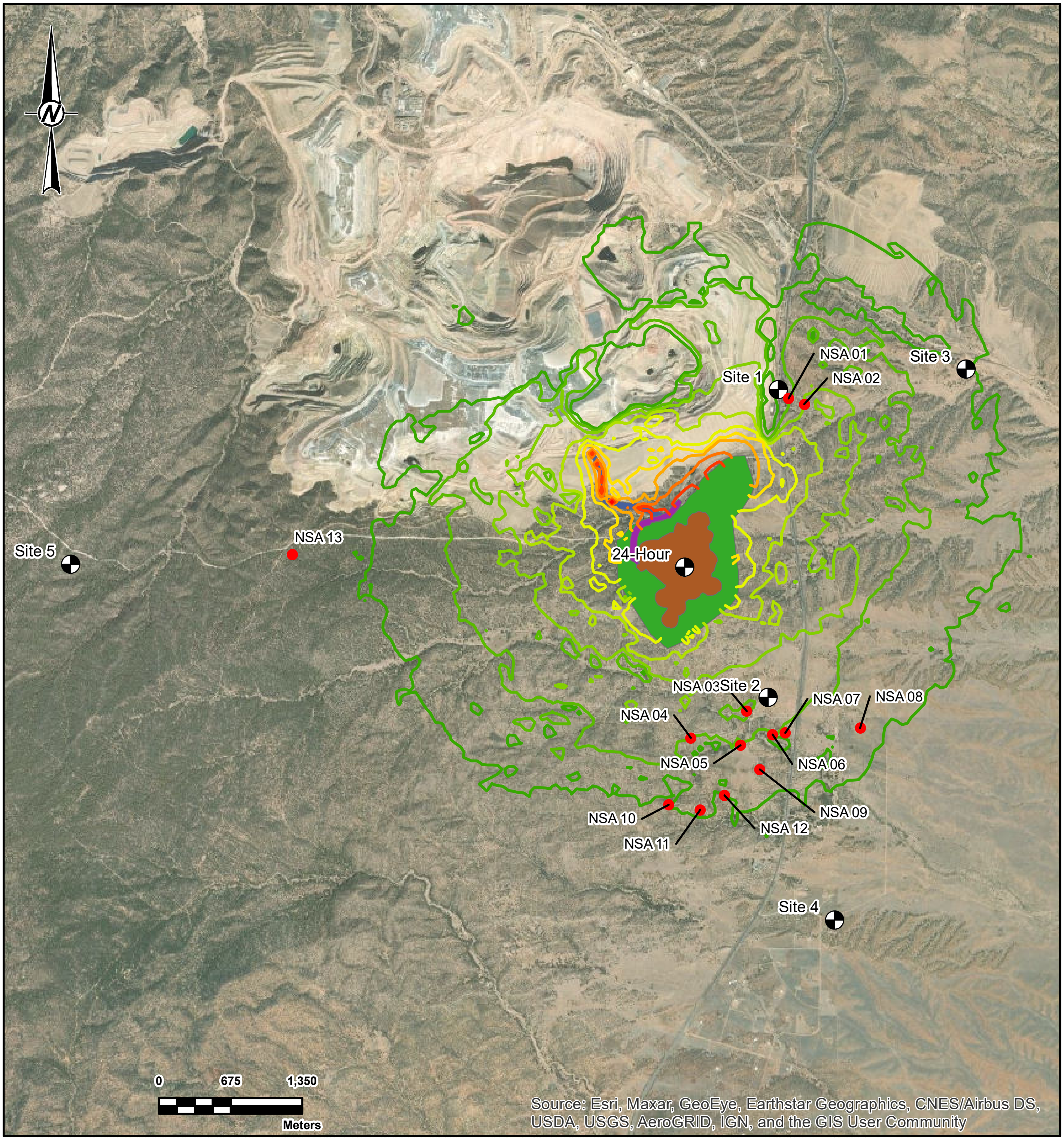
25mm

Figure 5-1:
24-Hour Baseline Sound Pressure Levels, One Minute Intervals





LEGEND

- Noise Sensitive Area
- Noise Monitoring Locations

Noise Contours

- 30 dBA
- 35 dBA
- 40 dBA
- 45 dBA
- 50 dBA
- 55 dBA
- 60 dBA
- 65 dBA
- 70 dBA
- 75 dBA
- EMMA Expansion Area
- EMMA Pit Area Yr 4
- Haul Road Area 1 Final
- Haul Road Area 2 Final

REFERENCE(S)

1. NOISE MONITORING LOCATIONS, GOLDER ASSOCIATES INC., 2021.
2. SITE LAYOUT, FREEPORT-MCMORAN TYRONE INC. 2021

COORDINATE SYSTEM: NAD 1983 STATEPLANE NEW MEXICO WEST FIPS 3003 FEET
PROJECTION: TRANSVERSE MERCATOR
DATUM: NORTH AMERICAN 1983
UNITS: FOOT US

CLIENT
FREEPORT-MCMORAN TYRONE INC.

PROJECT
EMMA EXPANSION PROJECT

TITLE
OPERATIONAL NOISE MODELLING IMPACTS

CONSULTANT

GOLDER

YYYY-MM-DD	2021-07-29
DESIGNED	GFD
PREPARED	JGW
REVIEWED	
APPROVED	

PROJECT NO.	CONTROL	REV.	FIGURE
21476949	A003	3	**6-1**

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

0 25mm

REV.	MM/DD/YY	DESCRIPTION	DESIGN	CADD	CHECK	REVIEW
0	2021-09-10	-	SIB			

SEAL

CLIENT
FREEPORT-MCMORAN TYRONE INC.

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GOLDER MEMBER OF WSP

PROJECT
EMMA EXPANSION PROJECT CCP

TITLE
LAYOUT OF EMMA FACILITIES AT THE END OF YEAR 2026

PROJECT NO. 21-476949
REV. 0
FIGURE 7-1

APPENDIX A

Sound Level Meter Calibration Reports

Calibration Certificate

Certificate Number 2020010459

Customer:

Golder Associates Inc
Suite 100
6925 Century Avenue
Mississauga, ON L5N 7K2, Canada

Model Number	831	***Procedure Number***	D0001.8378		
Serial Number	0001314	***Technician***	Eric Olson		
Test Results	**Pass**	***Calibration Date***	17 Sep 2020		
Initial Condition	AS RECEIVED same as shipped	***Calibration Due***	17 Sep 2021		
		Temperature	23.71	°C	± 0.25 °C
Description	Larson Davis Model 831 Class 1 Sound Level Meter Firmware Revision: 2.403	***Humidity***	52.1	%RH	± 2.0 %RH
		Static Pressure	86.6	kPa	± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRM831 S/N 0480 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 μPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. **Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

Correction data from Larson Davis Model 831 Sound Level Meter Manual, I831.01 Rev S, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 μPa; Reference Range: 0 dB gain

Periodic tests were performed in accordance with precedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

LARSON DAVIS - A PCB PIEZOTRONICS DIV.
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

ACCREDITED Cert. #3622.01

Calibration Certificate

Certificate Number 2020010495

Customer:

Golder Associates Inc
Suite 100
6925 Century Avenue
Mississauga, ON L5N 7K2, Canada

Model Number	831
Serial Number	0001314
Test Results	**Pass**
Initial Condition	AS RECEIVED same as shipped
Description	Larson Davis Model 831 Class 1 Sound Level Meter Firmware Revision: 2.403

Procedure Number	D0001.8384		
Technician	Eric Olson		
Calibration Date	17 Sep 2020		
Calibration Due	17 Sep 2021		
Temperature	23.62	°C	± 0.25 °C
Humidity	50.1	%RH	± 2.0 %RH
Static Pressure	86.57	kPa	± 0.13 kPa

Evaluation Method ***Tested with:*** ***Data reported in dB re 20 μPa.***

Larson Davis PRM831. S/N 0480
PCB 377B20. S/N 137680
Larson Davis CAL200. S/N 9079
Larson Davis CAL291. S/N 0108

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.11 (R2009) Class 1
IEC 61260:2001 Class 1	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

Correction data from Larson Davis Model 831 Sound Level Meter Manual, I831.01 Rev O, 2016-09-19

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

Initial Assessment

Certificate Number 2020010505

Customer:

Golder Associates Inc
Suite 100
6925 Century Avenue
Mississauga, ON L5N 7K2, Canada

Model Number	CAL200	***Procedure Number***	D0001.8386			
Serial Number	4318	***Technician***	Scott Montgomery			
Test Results	**Pass**	***Calibration Date***	18 Sep 2020			
Initial Condition	As Received	***Calibration Due***	18 Sep 2021			
Description	Larson Davis CAL200 Acoustic Calibrator	***Temperature***	25	°C	± 0.3 °C	
		Humidity	29	%RH	± 3 %RH	
		Static Pressure	101.3	kPa	± 1 kPa	

Evaluation Method The data is aquired by the insert voltage calibration method using the reference microphone's open circuit sensitivity. Data reported in dB re 20 μPa.

Compliance Standards Compliant to Manufacturer Specifications per D0001.8190 and the following standards:
IEC 60942:2017 ANSI S1.40-2006

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.
Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Agilent 34401A DMM	08/04/2020	08/04/2021	001021
Larson Davis Model 2900 Real Time Analyzer	04/02/2020	04/02/2021	001051
Microphone Calibration System	03/03/2020	03/03/2021	005446
1/2" Preamplifier	08/27/2020	08/27/2021	006506
Larson Davis 1/2" Preamplifier 7-pin LEMO	08/06/2020	08/06/2021	006507
1/2 inch Microphone - RI - 200V	06/04/2020	06/04/2021	006510
Pressure Transducer	10/18/2019	10/18/2020	007204

Calibration Certificate

Certificate Number 2020010507

Customer:

Golder Associates Inc
Suite 100
6925 Century Avenue
Mississauga, ON L5N 7K2, Canada

Model Number	CAL200	***Procedure Number***	D0001.8386			
Serial Number	4318	***Technician***	Scott Montgomery			
Test Results	**Pass**	***Calibration Date***	18 Sep 2020			
Initial Condition	Adjusted	***Calibration Due***	18 Sep 2021			
		Temperature	25	°C	± 0.3 °C	
Description	Larson Davis CAL200 Acoustic Calibrator	***Humidity***	29	%RH	± 3 %RH	
		Static Pressure	100.9	kPa	± 1 kPa	

Evaluation Method The data is aquired by the insert voltage calibration method using the reference microphone's open circuit sensitivity. Data reported in dB re 20 μPa.

Compliance Standards Compliant to Manufacturer Specifications per D0001.8190 and the following standards:
IEC 60942:2017 ANSI S1.40-2006

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.
Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Agilent 34401A DMM	08/04/2020	08/04/2021	001021
Larson Davis Model 2900 Real Time Analyzer	04/02/2020	04/02/2021	001051
Microphone Calibration System	03/03/2020	03/03/2021	005446
1/2" Preamplifier	08/27/2020	08/27/2021	006506
Larson Davis 1/2" Preamplifier 7-pin LEMO	08/06/2020	08/06/2021	006507
1/2 inch Microphone - RI - 200V	06/04/2020	06/04/2021	006510
Pressure Transducer	10/18/2019	10/18/2020	007204

CERTIFICATE OF ENVIRONMENTAL TEST

Certificate # 2020-0924-01

Test Date:	22 Sep 2020		
Sound Level Meter:	831	**Serial #:**	0001314
Preamplifier Model:	PRM831	**Serial #:**	0480
Microphone Model:	N/A	**Serial #:**	N/A
Temperature Range:	-40° C to 70°C	**Humidity Range:**	50% to 95%

Calibrated Equipment used durring Test:

Type	Mfg.	Model	Serial	Trace #	Cal Due
Humidity Chamber	Thermotron	SE-1000L	36541	2019-1121-1	21 NOV 2020

ENVIROMENTAL CONDITIONS:

Temperature:	25 °C
Relative Humidity:	30 %
Barometric Pressure:	86 kPa

This "Certificate of Environmental Test" verifies that this system has been tested to the Larson Davis environmental specifications appropriate for the instrument. Copies of the test data are attached for customer review.

This calibration complies with the requirements of ISO 9001.

The results documented in this certificate relate only to the system that was verified and tested. Calibration interval assignment and adjustment is the responsibility of the end user. This certificate may not be reproduced, except in full, without the written approval of Larson Davis.

Eric Olson, Technician

Test preformed at: Larson Davis, a division of PCB Piezotronics, Inc
1681 West 820 North, Provo Utah 84601

Larson Davis, a division of PCB Piezotronics, Inc
Tel: 716 684-0001 www.LarsonDavis.com

Calibration Certificate

Certificate Number 2020001094

Customer:
Golder Associates Inc
6026 Northwest 1st Place
Gainesville, FL 32607, United States

Model Number	824	***Procedure Number***	D0001.8442		
Serial Number	A3106	***Technician***	Sean Childs		
Test Results	**Pass**	***Calibration Date***	23 Jan 2020		
Initial Condition	AS RECEIVED same as shipped	***Calibration Due***	23 Jan 2021		
		Temperature	23.27	°C	± 0.01 °C
Description	Larson Davis Model 824	***Humidity***	53	%RH	± 0.5 %RH
	Firmware Revision: 4.290	***Static Pressure***	86.98	kPa	± 0.03 kPa

Evaluation Method Tested electrically using Larson Davis PRM902 S/N 3275 and an ADP005 input adaptor substituted for the microphone.
Data reported in dB re 20 µPa assuming a microphone sensitivity of 44.5 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards:

IEC 61672:2002 Class 1	ANSI S1.4-1983 Type 1
IEC 61260:2001 Class 1	ANSI S1.11-1986 Type 1D
IEC 60651:2001 Type 1	IEC 60804:2000 Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005.
Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with JCGM 100:2008 (ISO/IEC Guide 98-3:2008) Evaluation of measurement data - Guide to the expression of uncertainty in measurement. A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-S Humidity/Temperature Sensor	07/18/2019	07/18/2020	006946
SRS DS360 Ultra Low Distortion Generator	03/04/2019	03/04/2020	007635

LARSON DAVIS - A PCB PIEZOTRONICS DIV.
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

ilac-MRA ACCREDITED Cert. #3622.01

LARSON DAVIS
A PCB PIEZOTRONICS DIV.

Calibration Certificate

Certificate Number 2020000951

Customer:
Golder Associates
6026 Northwest 1st Place
Gainesville, FL 32607, United States

Model Number	2560	***Procedure Number***	D0001.8387			
Serial Number	3424	***Technician***	Abraham Ortega			
Test Results	**Pass**	***Calibration Date***	21 Jan 2020			
Initial Condition	AS RECEIVED same as shipped	***Calibration Due***	21 Jan 2021			
Description	1/2 inch Microphone - RI - 200V	***Temperature***	23.1	°C	± 0.01 °C	
		Humidity	30.5	%RH	± 0.5 %RH	
		Static Pressure	101.50	kPa	± 0.03 kPa	

Evaluation Method Tested electrically using an electrostatic actuator.

Compliance Standards Compliant to Manufacturer Specifications.

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005.
Test points marked with a ‡ do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Standards Used

Description	Cal Date	Cal Due	Cal Standard
Larson Davis Model 2900 Real Time Analyzer	07/01/2019	07/01/2020	001230
Microphone Calibration System	08/27/2019	08/27/2020	001233
1/2" Preamplifier	12/17/2019	12/17/2020	001274
Agilent 34401A DMM	12/06/2019	12/06/2020	001329
Larson Davis CAL250 Acoustic Calibrator	12/23/2019	12/23/2020	003030
1/2" Preamplifier	04/12/2019	04/12/2020	006506
Larson Davis 1/2" Preamplifier 7-pin LEMO	07/08/2019	07/08/2020	006507
1/2 inch Microphone - RI - 200V	05/21/2019	05/21/2020	006510
1/2 inch Microphone - RI - 200V	08/06/2019	08/06/2020	006519
Larson Davis 1/2" Preamplifier 7-pin LEMO	07/08/2019	07/08/2020	006530
Larson Davis 1/2" Preamplifier 7-pin LEMO	08/14/2019	08/14/2020	006531

Calibration Certificate

Certificate Number 2020001093
Customer:
Golder Associates Inc
6026 Northwest 1st Place
Gainesville, FL 32607, United States

Model Number	PRM902	***Procedure Number***	D0001.8383		
Serial Number	3275	***Technician***	Sean Childs		
Test Results	**Pass**	***Calibration Date***	23 Jan 2020		
Initial Condition	AS RECEIVED same as shipped	***Calibration Due***	23 Jan 2021		
		Temperature	23.31	°C	± 0.01 °C
Description	Larson Davis 1/2" Preamplifier 7-pin LEMO	***Humidity***	52.5	%RH	± 0.5 %RH
		Static Pressure	86.98	kPa	± 0.03 kPa

Evaluation Method Tested electrically using an 18.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 μPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005.
Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Larson Davis Model 2900 Real Time Analyzer	01/10/2020	01/10/2021	003062
Hart Scientific 2626-S Humidity/Temperature Sensor	07/18/2019	07/18/2020	006946
Agilent 34401A DMM	07/11/2019	07/11/2020	007172
SRS DS360 Ultra Low Distortion Generator	03/04/2019	03/04/2020	007635

Calibration Certificate

Certificate Number 2020001115

Customer:
Golder Associates Inc
6026 Northwest 1st Place
Gainesville, FL 32607, United States

Model Number	CAL200	***Procedure Number***	D0001.8386
Serial Number	5636	***Technician***	Scott Montgomery
Test Results	**Pass**	***Calibration Date***	23 Jan 2020
Initial Condition	Adjusted	***Calibration Due***	23 Jan 2021
		Temperature	24 °C ± 0.3 °C
Description	Larson Davis CAL200 Acoustic Calibrator	***Humidity***	29 %RH ± 3 %RH
		Static Pressure	101.2 kPa ± 1 kPa

Evaluation Method The data is aquired by the insert voltage calibration method using the reference microphone's open circuit sensitivity. Data reported in dB re 20 μPa.

Compliance Standards Compliant to Manufacturer Specifications per D0001.8190 and the following standards:
IEC 60942:2017 ANSI S1.40-2006

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005.
Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

Standards Used

Description	**Cal Date**	**Cal Due**	**Cal Standard**
Agilent 34401A DMM	08/15/2019	08/15/2020	001021
Larson Davis Model 2900 Real Time Analyzer	04/02/2019	04/02/2020	001051
Microphone Calibration System	03/04/2019	03/04/2020	005446
1/2" Preamplifier	09/17/2019	09/17/2020	006506
Larson Davis 1/2" Preamplifier 7-pin LEMO	08/06/2019	08/06/2020	006507
1/2 inch Microphone - RI - 200V	05/21/2019	05/21/2020	006510
Pressure Transducer	06/24/2019	06/24/2020	007310

APPENDIX B

Weather Data, Grant County Airport Weather Station

weather.gov

Weather observations for the past three days

Grant County Airport

Enter Your "City, ST" or zip code Go

metric

Date	Time (mdt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (ºF)				Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure		Precipitation (in.)		
						Air	Dwpt	6 hour Max.	6 hour Min.				altimeter (in)	sea level (mb)	1 hr	3 hr	6 hr
10	11:15	NE 7	10.00	Partly Cloudy	SCT110	83	39			21%	NA	81	30.33	NA			
10	10:55	SE 6	10.00	Partly Cloudy	SCT110	83	40			22%	NA	81	30.33	NA			
10	10:35	SW 3	10.00	Mostly Cloudy	BKN110	82	43			25%	NA	80	30.33	NA			
10	10:15	SE 3	10.00	Fair	CLR	81	44			27%	NA	80	30.33	NA			
10	09:55	Calm	10.00	Fair	CLR	80	46			30%	NA	79	30.33	NA			
10	09:35	Calm	10.00	Fair	CLR	79	45			30%	NA	79	30.33	NA			
10	09:15	Calm	10.00	Fair	CLR	76	47			36%	NA	78	30.33	NA			
10	08:55	Calm	10.00	Fair	CLR	73	49			43%	NA	NA	30.33	NA			
10	08:35	NW 5	10.00	Fair	CLR	70	49			47%	NA	NA	30.33	NA			
10	08:15	N 6	10.00	Fair	CLR	67	47			50%	NA	NA	30.31	NA			
10	07:55	N 8	10.00	Fair	CLR	64	46			53%	NA	NA	30.31	NA			
10	07:35	N 9	10.00	Fair	CLR	60	45			57%	NA	NA	30.30	NA			
10	07:15	N 10	10.00	Fair	CLR	59	45			59%	NA	NA	30.29	NA			
10	06:55	N 10	10.00	Fair	CLR	58	44			60%	NA	NA	30.29	NA			
10	06:35	N 9	10.00	Fair	CLR	58	44			61%	NA	NA	30.28	NA			
10	06:15	N 8	10.00	Fair	CLR	58	44			60%	NA	NA	30.28	NA			
10	05:55	N 9	10.00	Fair	CLR	58	44	63	58	59%	NA	NA	30.28	NA			
10	05:35	N 10	10.00	Fair	CLR	58	43			57%	NA	NA	30.27	NA			
10	05:15	N 10	10.00	Fair	CLR	58	43			56%	NA	NA	30.27	NA			
10	04:55	N 10	10.00	Fair	CLR	59	42			54%	NA	NA	30.27	NA			
10	04:35	N 10	10.00	Fair	CLR	59	42			54%	NA	NA	30.27	NA			
10	04:15	N 10	10.00	Fair	CLR	59	42			53%	NA	NA	30.27	NA			
10	03:55	N 9	10.00	Fair	CLR	59	42			53%	NA	NA	30.27	NA			
10	03:35	N 10	10.00	Fair	CLR	59	42			53%	NA	NA	30.27	NA			
10	03:15	N 9	10.00	Fair	CLR	60	42			53%	NA	NA	30.27	NA			
10	02:55	N 8	10.00	Fair	CLR	59	42			53%	NA	NA	30.27	NA			
10	02:35	N 9	10.00	Fair	CLR	60	42			53%	NA	NA	30.27	NA			
10	02:15	N 10	10.00	Fair	CLR	60	42			52%	NA	NA	30.27	NA			
10	01:55	N 9	10.00	Fair	CLR	60	43			53%	NA	NA	30.27	NA			
10	01:35	N 8	10.00	Fair	CLR	62	42			49%	NA	NA	30.27	NA			
10	01:15	N 7	10.00	Fair	CLR	60	43			53%	NA	NA	30.27	NA			
10	00:55	N 7	10.00	Fair	CLR	62	42			48%	NA	NA	30.28	NA			
10	00:35	NE 7	10.00	Fair	CLR	61	42			51%	NA	NA	30.28	NA			
10	00:15	NE 6	10.00	Fair	CLR	60	43			53%	NA	NA	30.28	NA			
09	23:55	NE 6	10.00	Fair	CLR	60	42	85	60	52%	NA	NA	30.28	NA			
09	23:35	N 5	10.00	Fair	CLR	61	42			49%	NA	NA	30.28	NA			

09	23:15	N 6	10.00	Fair	CLR	64	42			45%	NA	NA	30.28	NA
09	22:55	N 5	10.00	Partly Cloudy	SCT095 SCT120	62	42			48%	NA	NA	30.28	NA
09	22:35	N 5	10.00	Mostly Cloudy	BKN095 BKN120	65	42			42%	NA	NA	30.28	NA
09	22:15	Calm	10.00	Partly Cloudy	SCT110	64	42			45%	NA	NA	30.28	NA
09	21:55	Calm	10.00	Fair	CLR	62	43			50%	NA	NA	30.27	NA
09	21:35	Calm	10.00	Fair	CLR	64	42			46%	NA	NA	30.27	NA
09	21:15	E 5	10.00	Fair	CLR	69	42			38%	NA	NA	30.26	NA
09	20:55	SE 7	10.00	Fair	CLR	70	43			38%	NA	NA	30.25	NA
09	20:35	SE 8	10.00	Fair	CLR	72	42			35%	NA	NA	30.24	NA
09	20:15	SE 8	10.00	Fair	CLR	72	43			36%	NA	NA	30.23	NA
09	19:55	SE 7	10.00	Fair	CLR	73	43			34%	NA	NA	30.23	NA
09	19:35	SE 8	10.00	Fair	CLR	76	43			32%	NA	77	30.22	NA
09	19:15	SE 7	10.00	Fair	CLR	79	43			28%	NA	78	30.22	NA
09	18:55	SE 8	10.00	Fair	CLR	82	42			24%	NA	80	30.21	NA
09	18:35	SE 9	10.00	Fair	CLR	83	41			23%	NA	81	30.21	NA
09	18:15	SE 12	10.00	Fair	CLR	84	41			22%	NA	81	30.22	NA
09	17:55	SE 10 G 17	10.00	Fair	CLR	85	42	87	82	22%	NA	82	30.22	NA
09	17:35	SE 8	10.00	Fair	CLR	86	43			22%	NA	83	30.22	NA
09	17:15	S 9	10.00	Fair	CLR	86	44			23%	NA	83	30.22	NA
09	16:55	SE 14 G 18	10.00	Fair	CLR	86	43			22%	NA	83	30.23	NA
09	16:35	SE 10 G 18	10.00	Fair	CLR	87	42			21%	NA	84	30.23	NA
09	16:15	SE 10 G 17	10.00	Fair	CLR	87	43			22%	NA	84	30.23	NA
09	15:55	SE 13 G 18	10.00	Fair	CLR	86	44			23%	NA	83	30.24	NA
09	15:35	S 7	10.00	Fair	CLR	86	46			25%	NA	83	30.24	NA
09	15:15	SE 8 G 13	10.00	Fair	CLR	86	47			26%	NA	83	30.25	NA
09	14:55	SE 7 G 16	10.00	Fair	CLR	86	47			26%	NA	83	30.25	NA
09	14:35	SE 10 G 17	10.00	Fair	CLR	86	48			27%	NA	83	30.26	NA
09	14:15	S 10	10.00	Fair	CLR	84	49			30%	NA	82	30.27	NA
09	13:55	SE 13	10.00	Fair	CLR	85	49			29%	NA	83	30.28	NA
09	13:35	E 6	10.00	Fair	CLR	84	49			30%	NA	82	30.28	NA
09	13:15	SE 8	10.00	Fair	CLR	83	50			31%	NA	81	30.29	NA
09	12:55	SE 7	10.00	Fair	CLR	84	51			32%	NA	82	30.29	NA
09	12:35	SE 6	10.00	Fair	CLR	82	51			34%	NA	81	30.30	NA
09	12:15	SE 9	10.00	Fair	CLR	82	51			34%	NA	81	30.31	NA
09	11:55	SE 8	10.00	Fair	CLR	82	50	82	60	34%	NA	81	30.32	NA

09	11:35	SE 5	10.00	Fair	CLR	81	50			34%	NA	80	30.32	NA
09	11:15	SE 6	10.00	Fair	CLR	81	51			35%	NA	80	30.33	NA
09	10:55	SE 9	10.00	Fair	CLR	80	51			36%	NA	80	30.33	NA
09	10:35	SE 5	10.00	Fair	CLR	80	50			36%	NA	80	30.33	NA
09	10:15	SE 7	10.00	Fair	CLR	80	51			36%	NA	80	30.32	NA
09	09:55	E 3	10.00	Fair	CLR	78	51			38%	NA	79	30.32	NA
09	09:35	E 7	10.00	Fair	CLR	78	50			38%	NA	79	30.32	NA
09	09:15	E 7	10.00	Partly Cloudy	SCT090 SCT120	76	52			42%	NA	78	30.32	NA
09	08:55	NE 8	10.00	Overcast	BKN100 OVC110	75	52			46%	NA	NA	30.31	NA
09	08:35	NE 5	10.00	Mostly Cloudy	BKN100 BKN120	73	52			47%	NA	NA	30.31	NA
09	08:15	NE 7	10.00	Overcast	BKN100 OVC120	70	52			53%	NA	NA	30.31	NA
09	07:55	N 5	10.00	Overcast	OVC100	66	52			60%	NA	NA	30.31	NA
09	07:35	N 5	10.00	Overcast	OVC100	65	51			61%	NA	NA	30.31	NA
09	07:15	NE 9	10.00	Overcast	OVC100	64	50			62%	NA	NA	30.30	NA
09	06:55	NE 7	10.00	Overcast	OVC100	61	50			68%	NA	NA	30.30	NA
09	06:35	NE 8	10.00	Overcast	OVC110	61	50			68%	NA	NA	30.30	NA
09	06:15	N 10	10.00	Overcast	OVC110	61	50			68%	NA	NA	30.30	NA
09	05:55	N 10	10.00	Mostly Cloudy	BKN110	60	50	69	59	70%	NA	NA	30.30	NA
09	05:35	NE 7	10.00	Mostly Cloudy	BKN110	61	50			66%	NA	NA	30.29	NA
09	05:15	NE 9	10.00	Overcast	OVC110	61	50			67%	NA	NA	30.28	NA
09	04:55	NE 7	10.00	Overcast	OVC110	61	50			68%	NA	NA	30.28	NA
09	04:35	NE 8	10.00	Overcast	OVC110	62	50			66%	NA	NA	30.28	NA
09	04:15	NE 7	10.00	Overcast	OVC100	62	50			65%	NA	NA	30.28	NA
09	03:55	NE 7	10.00	Overcast	BKN100 OVC120	62	50			66%	NA	NA	30.28	NA
09	03:35	N 8	10.00	Overcast	BKN100 OVC120	62	50			64%	NA	NA	30.29	NA
09	03:15	N 6	10.00	Overcast	OVC110	62	49			64%	NA	NA	30.29	NA
09	02:55	N 7	10.00	Overcast	OVC110	61	49			66%	NA	NA	30.29	NA
09	02:35	N 6	10.00	Overcast	OVC110	60	48			65%	NA	NA	30.29	NA
09	02:15	Calm	10.00	Mostly Cloudy	BKN110	64	49			57%	NA	NA	30.29	NA
09	01:55	Calm	10.00	Overcast	OVC110	61	48			63%	NA	NA	30.28	NA
09	01:35	Calm	10.00	Overcast	OVC100	63	48			59%	NA	NA	30.28	NA
09	01:15	Calm	10.00	Overcast	OVC100	61	48			62%	NA	NA	30.28	NA
09	00:55	Calm	10.00	Overcast	OVC100	64	48			55%	NA	NA	30.28	NA
09	00:35	NE 7	10.00	Overcast	BKN100 OVC120	67	47			49%	NA	NA	30.28	NA
09	00:15	NE 5	10.00	Partly Cloudy	SCT110	63	48			59%	NA	NA	30.28	NA
08	23:55	E 7	10.00	Partly Cloudy	SCT120	69	48	86	69	48%	NA	NA	30.28	NA
08	23:35	E 9	10.00	Partly Cloudy	SCT110	69	47			46%	NA	NA	30.27	NA
08	23:15	E 8	10.00	Mostly Cloudy	BKN110	71	47			42%	NA	NA	30.27	NA
08	22:55	E 9	10.00	Mostly	BKN110	71	47			42%	NA	NA	30.27	NA

				Cloudy										
08	22:35	E 7	10.00	Mostly Cloudy	BKN110	71	47			42%	NA	NA	30.27	NA
08	22:15	E 8	10.00	Partly Cloudy	SCT110	73	47			40%	NA	NA	30.27	NA
08	21:55	E 7	10.00	Fair	CLR	72	47			41%	NA	NA	30.26	NA
08	21:35	E 8	10.00	Fair	CLR	72	48			42%	NA	NA	30.26	NA
08	21:15	E 7	10.00	Fair	CLR	73	49			44%	NA	NA	30.25	NA
08	20:55	E 7	10.00	Fair	CLR	73	48			41%	NA	NA	30.24	NA
08	20:35	E 8	10.00	Fair	CLR	74	48			40%	NA	NA	30.23	NA
08	20:15	E 7	10.00	Fair	CLR	75	49			40%	NA	NA	30.23	NA
08	19:55	E 6	10.00	Partly Cloudy	SCT090	75	49			40%	NA	NA	30.22	NA
08	19:35	E 7	10.00	Partly Cloudy	SCT090	77	49			37%	NA	78	30.22	NA
08	19:15	SE 6	10.00	Thunderstorm in Vicinity	SCT090	80	49			34%	NA	79	30.21	NA
08	18:55	SE 10	10.00	Partly Cloudy	SCT090	82	47			30%	NA	80	30.21	NA
08	18:35	SE 13	10.00	Partly Cloudy	SCT055 SCT080 SCT090	84	48			29%	NA	82	30.21	NA
08	18:15	SE 12	10.00	Partly Cloudy	SCT055 SCT090 SCT110	85	48			28%	NA	83	30.20	NA
08	17:55	SE 9	10.00	Partly Cloudy	SCT100	85	49	88	84	28%	NA	83	30.21	NA
08	17:35	E 10 G 16	10.00	Partly Cloudy	SCT090 SCT120	86	48			27%	NA	83	30.21	NA
08	17:15	S 7	10.00	Partly Cloudy	SCT090 SCT120	85	48			28%	NA	83	30.21	NA
08	16:55	SE 10 G 16	10.00	Partly Cloudy	SCT090	87	48			27%	NA	84	30.21	NA
08	16:35	S 16	10.00	Partly Cloudy	SCT090	85	49			28%	NA	83	30.21	NA
08	16:15	SE 13 G 17	10.00	Fair	CLR	87	48			26%	NA	84	30.21	NA
08	15:55	E 9 G 20	10.00	Fair	CLR	87	48			26%	NA	84	30.22	NA
08	15:35	SE 14 G 17	10.00	Fair	CLR	88	48			25%	NA	85	30.22	NA
08	15:15	E 13 G 18	10.00	Fair	CLR	88	49			26%	NA	85	30.22	NA
08	14:55	SE 10 G 22	10.00	Partly Cloudy	SCT090 SCT120	88	48			25%	NA	85	30.23	NA
08	14:35	SE 10 G 18	10.00	Mostly Cloudy	SCT100 BKN120	86	47			26%	NA	83	30.23	NA
08	14:15	E 9 G 17	10.00	Overcast	SCT090 OVC110	86	48			27%	NA	83	30.24	NA
08	13:55	E 13 G 18	10.00	Overcast	SCT080 OVC100	87	48			26%	NA	84	30.25	NA
08	13:35	SE 13 G 17	10.00	Overcast	SCT075 OVC100	87	48			26%	NA	84	30.25	NA
08	13:15	SE	10.00	Mostly	BKN100	87	49			27%	NA	84	30.26	NA

		10		Cloudy	BKN120									
08	12:55	E 12 G 22	10.00	Mostly Cloudy	BKN090 BKN110	85	48			27%	NA	83	30.26	NA
08	12:35	E 14 G 20	10.00	Overcast	BKN100 OVC120	86	48			26%	NA	83	30.26	NA
08	12:15	E 14 G 21	10.00	Overcast	BKN100 OVC120	86	47			27%	NA	83	30.27	NA
08	11:55	SE 8 G 16	10.00	Mostly Cloudy	BKN100 BKN120	85	48	85	58	28%	NA	83	30.27	NA
08	11:35	SE 9	10.00	Mostly Cloudy	BKN100 BKN120	85	48			28%	NA	83	30.28	NA
08	11:15	SE 7	10.00	Overcast	OVC100	83	48			29%	NA	81	30.28	NA
08	10:55	SE 9	10.00	Overcast	OVC100	83	47			29%	NA	81	30.28	NA
08	10:35	SE 8	10.00	Overcast	OVC100	83	47			29%	NA	81	30.28	NA
08	10:15	SE 9	10.00	Overcast	OVC100	82	46			29%	NA	80	30.28	NA
08	09:55	SE 7	10.00	Overcast	OVC100	81	47			30%	NA	80	30.28	NA
08	09:35	E 12	10.00	Overcast	OVC100	81	49			33%	NA	80	30.27	NA
08	09:15	E 7	10.00	Mostly Cloudy	BKN110	79	51			37%	NA	79	30.27	NA
08	08:55	E 7	10.00	Mostly Cloudy	BKN110	77	51			41%	NA	78	30.27	NA
08	08:35	NE 7	10.00	Mostly Cloudy	BKN110	76	52			43%	NA	78	30.26	NA
08	08:15	NE 6	10.00	Mostly Cloudy	BKN110	73	52			48%	NA	NA	30.26	NA
08	07:55	NE 6	10.00	Overcast	OVC110	68	52			57%	NA	NA	30.26	NA
08	07:35	NE 8	10.00	Overcast	OVC110	66	51			59%	NA	NA	30.25	NA
08	07:15	N 9	10.00	Mostly Cloudy	BKN110	62	51			66%	NA	NA	30.25	NA
08	06:55	N 8	10.00	Mostly Cloudy	BKN110	59	51			74%	NA	NA	30.24	NA
08	06:35	NW 5	10.00	Mostly Cloudy	BKN110	59	50			72%	NA	NA	30.23	NA
08	06:15	NW 6	10.00	Mostly Cloudy	BKN110	60	50			70%	NA	NA	30.22	NA
08	05:55	NW 3	10.00	Partly Cloudy	SCT110	60	50	65	59	69%	NA	NA	30.22	NA
08	05:35	NE 6	10.00	Partly Cloudy	SCT110	63	49			62%	NA	NA	30.22	NA
08	05:15	N 7	10.00	Mostly Cloudy	BKN110	62	50			66%	NA	NA	30.21	NA
08	04:55	N 7	10.00	Mostly Cloudy	BKN110	62	49			62%	NA	NA	30.21	NA
08	04:35	N 9	10.00	Mostly Cloudy	BKN110	65	49			56%	NA	NA	30.21	NA
08	04:15	N 9	10.00	Overcast	OVC110	64	49			58%	NA	NA	30.21	NA
08	03:55	NE 9	10.00	Overcast	OVC110	64	49			59%	NA	NA	30.21	NA
08	03:35	N 6	10.00	Overcast	OVC110	62	50			64%	NA	NA	30.21	NA
08	03:15	N 6	10.00	Overcast	OVC110	63	50			63%	NA	NA	30.21	NA
08	02:55	N 7	10.00	Overcast	OVC100	61	50			66%	NA	NA	30.21	NA
08	02:35	NW 7	10.00	Overcast	OVC100	60	51			71%	NA	NA	30.21	NA
08	02:15	N 6	10.00	Overcast	OVC110	63	50			63%	NA	NA	30.21	NA
08	01:55	N 9	10.00	Overcast	OVC110	60	50			70%	NA	NA	30.21	NA
08	01:35	NW 8	10.00	Overcast	OVC110	61	51			70%	NA	NA	30.20	NA

08	01:15	NW 6	10.00	Overcast	OVC110	61	50			68%	NA	NA	30.20	NA
08	00:55	N 7	10.00	Overcast	OVC110	62	51			68%	NA	NA	30.19	NA
08	00:35	N 8	10.00	Overcast	OVC110	63	51			65%	NA	NA	30.18	NA
08	00:15	N 6	10.00	Overcast	OVC110	62	51			67%	NA	NA	30.18	NA
07	23:55	N 7	10.00	Overcast	OVC110	65	51	89	63	61%	NA	NA	30.18	NA
07	23:35	N 7	10.00	Overcast	OVC110	64	51			65%	NA	NA	30.18	NA
07	23:15	N 6	10.00	Overcast	OVC110	64	51			62%	NA	NA	30.18	NA
07	22:55	N 7	10.00	Overcast	OVC110	65	51			62%	NA	NA	30.19	NA
07	22:35	N 8	10.00	Overcast	OVC110	65	50			58%	NA	NA	30.18	NA
07	22:15	N 8	10.00	Overcast	OVC110	68	51			54%	NA	NA	30.18	NA
07	21:55	N 6	10.00	Overcast	SCT075 BKN100 OVC120	68	50			53%	NA	NA	30.18	NA
07	21:35	N 7	10.00	Overcast	OVC100	70	50			50%	NA	NA	30.17	NA
07	21:15	N 8	10.00	Overcast	BKN100 OVC120	69	50			50%	NA	NA	30.17	NA
07	20:55	N 7	10.00	Overcast	BKN100 OVC120	69	50			51%	NA	NA	30.16	NA
07	20:35	NE 3	10.00	Overcast	OVC100	71	50			48%	NA	NA	30.16	NA
07	20:15	Calm	10.00	Mostly Cloudy	BKN110	74	49			42%	NA	NA	30.15	NA
07	19:55	SE 7	10.00	Partly Cloudy	SCT110	75	48			39%	NA	NA	30.14	NA
07	19:35	SE 12	10.00	Partly Cloudy	SCT120	78	48			34%	NA	78	30.13	NA
07	19:15	SE 10	10.00	Partly Cloudy	SCT110	84	40			21%	NA	81	30.12	NA
07	18:55	E 10	10.00	Partly Cloudy	SCT110	85	40			20%	NA	82	30.10	NA
07	18:35	SE 5	10.00	Partly Cloudy	SCT110	87	45			23%	NA	84	30.11	NA
07	18:15	SE 9	10.00	Partly Cloudy	SCT110	88	45			23%	NA	85	30.11	NA
07	17:55	SE 6	10.00	Overcast	OVC100	89	43	91	84	20%	NA	85	30.11	NA
07	17:35	SE 8	10.00	Mostly Cloudy	BKN100	89	44			20%	NA	85	30.11	NA
07	17:15	SE 7	10.00	Overcast	OVC100	90	44			21%	NA	86	30.11	NA
07	16:55	SE 5	10.00	Overcast	OVC100	90	45			21%	NA	86	30.11	NA
07	16:35	SE 7	10.00	Overcast	OVC100	91	44			20%	NA	87	30.12	NA
07	16:15	SE 12	10.00	Overcast	BKN100 OVC120	90	46			22%	NA	87	30.12	NA
07	15:55	SE 7	10.00	Mostly Cloudy	BKN110	87	46			23%	NA	84	30.12	NA
07	15:35	E 8	10.00	Overcast	BKN100 OVC120	90	51			26%	NA	87	30.13	NA
07	15:15	SE 12	10.00	Overcast	BKN100 OVC120	89	51			26%	NA	86	30.14	NA
07	14:55	S 5	10.00	Mostly Cloudy	SCT100 BKN120	89	50			26%	NA	86	30.14	NA
07	14:35	S 7	10.00	Mostly Cloudy	BKN100	90	52			27%	NA	87	30.15	NA
07	14:15	Calm	10.00	Mostly Cloudy	BKN100 BKN120	89	50			26%	NA	86	30.15	NA
07	13:55	Calm	10.00	Mostly Cloudy	SCT100 BKN120	88	49			27%	NA	85	30.16	NA
07	13:35	Calm	10.00	Overcast	OVC100	88	49			27%	NA	85	30.16	NA

Date	Time (mdt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (ºF) Air	Dwpt	6 hour Max.	Min.	Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure altimeter (in.)	sea level (mb)	Precipitation (in.) 1 hr	3 hr	6 hr
07	13:15	SE 7	10.00	Overcast	OVC100	87	49			27%	NA	84	30.17	NA			
07	12:55	SE 8	10.00	Overcast	OVC110	87	49			27%	NA	84	30.18	NA			
07	12:35	Calm	10.00	Overcast	OVC110	85	47			26%	NA	82	30.18	NA			
07	12:15	E 6	10.00	Mostly Cloudy	BKN100 BKN110	85	48			28%	NA	83	30.19	NA			
07	11:55	SE 3	10.00	Mostly Cloudy	SCT090 BKN110	85	47	85	57	27%	NA	83	30.19	NA			
07	11:35	NW 5	10.00	Partly Cloudy	SCT110	83	53			36%	NA	82	30.20	NA			

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