Overview

Any large-scale earthmoving operation, such as mining, will inevitably result in increased machinery-generated noise and vibration above previous ambient levels for a given location. The proposed Resolution Copper Mine differs from many mining operations in that most sounds and vibrations from blasting and ore removal would occur far underground and not be perceptible at the surface. There would, however, be increases in noise and vibration throughout the construction and operational phases of the mine from facility-building activity, haul truck traffic, and employee vehicles moving to and from the mine. The text section below provides a detailed analysis of estimated impacts from noise and vibration under the GPO-proposed mine plan and each of the alternatives.

3.4 Noise and Vibration

3.4.1 Introduction

Development, operation, and reclamation of the mine could result in an increase in noise and vibrations in the immediate vicinity of mine facilities. Activities that could increase noise and vibrations include blasting, underground conveyance of ore, processing operations, operations at the filter plant and loadout facility, and operations at the tailings facilities. Increases in traffic associated with worker commuting, material delivery, and mine product shipment could also contribute to an overall increase in noise on area roads and highways.

Noise and vibration (both blasting and non-blasting related) associated with mining activities would vary spatially and temporally throughout the life of the project, depending on the phase.

This section describes noise and vibrations from blasting and non-blasting activities, during both construction and operation, for each alternative. Additional details not included may be found in the project record (Newell 2018d). Note that noise and vibration impacts on wildlife are addressed in section 3.8.

3.4.2 Analysis Methodology, Assumptions, and Uncertain and Unknown Information

3.4.2.1 Analysis Area

The spatial analysis area consists of the area in which predicted noise and vibration caused by the project attenuate to background levels. The analysis generally evaluated land uses within 2 miles of each mine component, which encompasses the area in which predicted noise would be noticeable. The noise and vibration analysis area is shown in figure 3.4.2-1.

3.4.2.2 Noise Analysis Methodology

The following sections describe the analysis methodology, assumptions, and uncertainties involved in modeling noise and vibration, respectively.

Sensitive Receptors

The noise analysis focuses on noise levels at areas where there are existing or future land uses that are particularly sensitive to noise, known as "noise sensitive areas." These are as follows:

- Areas potentially affected by noise from the West Plant Site or traffic: Residences in Superior and residences along U.S. 60 and Main Street
- Areas potentially affected by noise from the East Plant Site: Oak Flat Campground and Apache Leap Special Management Area
- Areas potentially affected by noise from the filter plant and loadout facility: Westernstar Road, Lind Road, Felix Road, and Attaway Road
- Areas potentially affected by noise from the Alternative 2 and 3 tailings storage facility: Hewitt Station, residences in Queen Valley,

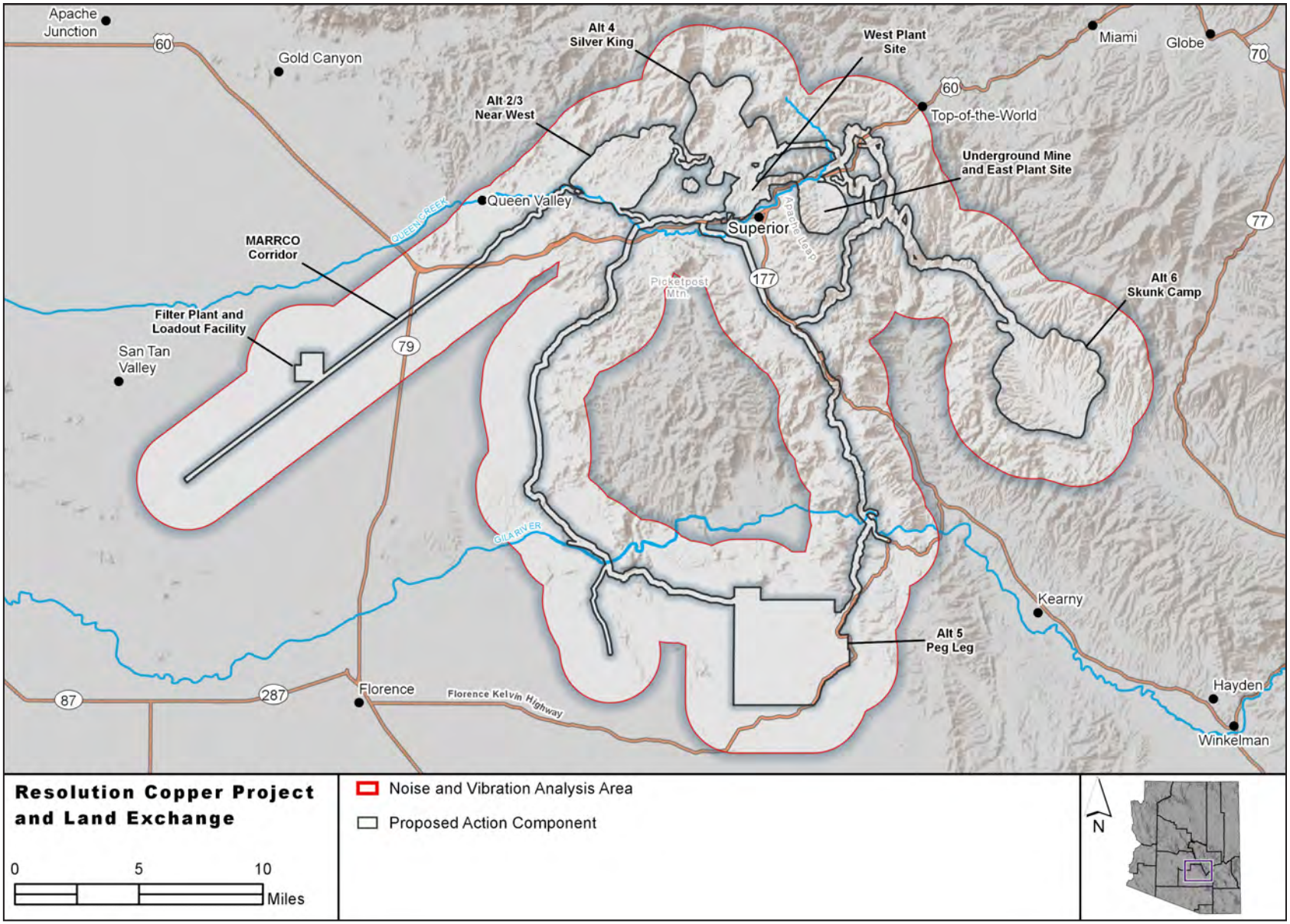

Figure 3.4.2-1. Noise and vibration analysis area

Boyce Thompson Arboretum, and Arizona Trail (northwest of Superior)

- Areas potentially affected by noise from the Alternative 4 tailings storage facility: Arizona Trail (northwest of Superior)
- Areas potentially affected by noise from the Alternative 5 tailings storage facility: Arizona Trail (near Zellweger Wash)
- Areas potentially affected by noise from the Alternative 6 tailings storage facility: Dripping Springs Road and Arizona Trail (near Kelvin)

Within each of these general areas, a specific location was selected for modeling of predicted noise impacts from the project, referred to as a "sensitive receptor." The specific location of each sensitive receptor was placed where predicted noise levels were expected to be highest for that area; these receptors are described further in section 3.4.3.

Background Noise Measurements

In order to conduct noise modeling, an understanding of background noise levels is required. Background noise levels were measured at five locations, corresponding to the noise sensitive areas described under "Sensitive Receptors." Note that background noise levels were not collected specifically for the Alternative 6 tailings storage facility but were assumed to be similar to the Alternative 5 tailings storage facility based on the general area and land use.

Background noise levels are monitored for several days or weeks in order to account for variation between day and night, and weekends and weekdays. The background noise data are then reviewed to identify any anomalies, such as fireworks, thunder, rainfall, high wind, or very close activity (like a nearby off-road vehicle). While these types of noises do occur in the analysis area, they happen infrequently or may affect the monitoring equipment more than they would a human listener. The goal of background noise measurements is to obtain a "typical" background level, while acknowledging that occasional louder noises would also occur.

- East Plant Site. Monitored June 7 through 20, 2016.
- West Plant Site. Monitored June 7 through 10, and June 22 through July 5, 2016.
- Alternative 2 and 3 tailings storage facility. Monitored June 7 through 16, and June 20 through July 5, 2016 (summer conditions), and monitored November 15 through 23, and November 28 through December 6, 2017 (winter conditions).
- Filter plant and loadout facility. Monitored June 7 through 16, and June 20 through July 5, 2016.
- Alternative 4 tailings storage facility. Monitored November 14 through 18, 2017, and January 5 through 15, 2018.
- Alternative 5 tailings storage facility (also used for Alternative 6 tailings storage facility). Monitored November 14 through December 27, 2017.

In order to check whether the background noise levels measured in the field were reasonable, they were checked against the expected noise levels based on similar types of land uses, and also checked against several previous studies conducted for the West Plant Site in 2015. These comparisons, which are described in section 3.4.4, are important because they confirm that the background noise measurements are a reasonably accurate estimate of current baseline conditions and because they also verify that background noise from these six monitoring locations can reasonably be used for all 16 sensitive receptors for which project noise levels are predicted.

Construction Phase – Blasting Noise Modeling

Construction activities include the construction of the underground tunnel to convey ore from the underground production area to the West Plant Site. The tunnel construction would use underground drilling and explosives, generating airblast noise (or more technically, peak air overpressure, which is a measure of the pressure wave generated by the blast).

The predictive model for airblast noise is based on information from the U.S. Bureau of Mines (Siskind et al. 1980) and surface mining regulations (30 CFR 816.67). The model predicts the amount of explosive that can be used, given the distance (as measured at a slant through the ground) between an underground source and a sensitive receptor, and given a desired limit on airblast noise.

Construction Phase – Non-Blasting Noise Modeling

Construction activities occur both underground and aboveground. Construction-phase noise modeling focuses on the aboveground construction of the West Plant Site, the filter plant and loadout facility, and the East Plant Site. Each of these has a focused construction period with increased noise levels that would last from 12 to 18 months.

Underground construction of tunnels and infrastructure would continue throughout the operations phase of the project, as would construction of the tailings storage facility. These construction noise impacts are therefore incorporated into the operational modeling.

To model construction noise, different types of equipment were identified that would be used at each site (i.e., dozers, graders, pickup trucks). Typical noise levels from these types of equipment have been documented by the U.S. Environmental Protection Agency (EPA) (Bolt et al. 1971) and Federal Highway Administration (Knauer et al. 2006). The assumption is made that all equipment is running simultaneously at the middle of each construction site, and the spread of sound waves is modeled, without accounting for any shielding effects from topography or structures. Specific construction assumptions include the following:

- West Plant Site. Construction activities occur over an 18-month period, and include improving the main site entrance at Lone Tree Road, improving Silver King Mine Road, and constructing a number of buildings (administration, warehouse, contractor laydown yard, concentrator site, and new substation).
- East Plant Site. Construction activities occur near Shafts 9 and 10 over a 12-month period, and include expansion of the shaft pad and construction of surface infrastructure that supports the underground operations. Shaft construction is analyzed as part of the blasting noise analysis.
- Filter plant and loadout facility. Construction activities occur over an 18-month period, and include construction of the filter plant, and improvements along the MARRCO corridor (rail line, pipelines, wells, pipeline booster station sites, and access points), and improvements along Skyline Drive.

Operations Phase – Non-Blasting Noise Modeling

Noise modeling for the operational phase identifies the quantity and type of equipment in use, the expected sound level from the equipment, and what percentage of the time it would be used. The noise modeling also takes into account noise from project road and rail traffic. In order to avoid underestimating impacts, all equipment is modeled as if it were operating simultaneously and under weather conditions favorable to sound propagation.

The modeling takes into account the combined effect of multiple noise sources, and factors that tend to attenuate sound like reflection from surfaces, screening by topography or obstacles, and terrain effects like elevation.

The noise modeling produces the following results. The metrics listed—Leq(h) and Ldn—are common noise metrics, and detailed explanations are included in Newell (2018d):

- The hourly equivalent sound level, Leq(h), at the location of each sensitive receptor
- The 24-hour day-night average sound level, Ldn, at the location of each sensitive receptor
- Noise contours showing how sound from the project propagates over the surrounding area. Noise contours graphically display how the combined project noise would be distributed over the surrounding area; they are similar to topography elevation

maps. Equal noise levels are represented by continuous lines around a source.

The results shown in this section include the noise predicted from the project, the anticipated future noise range (background noise added to predicted project noise), and the incremental increase in noise over background levels.

3.4.2.3 Vibration Analysis Methodology

Construction Phase – Blasting Vibration Modeling

The construction of the underground tunnel would also generate ground-borne vibrations. The predictive model for blasting vibrations is based on information from the U.S. Bureau of Mines (Nicholls et al. 1971; Siskind et al. 1980) and surface mining regulations (30 CFR 816.67). The predictive model for blast vibrations predicts the amount of explosive that can be used, given the distance between an underground source and a sensitive receptor, and given a desired limit on vibrations.

Background vibration measurements were taken at the same locations as the background noise measurements, at approximately the same time. To provide context, the analysis compares the predicted vibrations to measured background vibrations, and also assesses real-world vibration measurements that were collected during blasting at the East Plant Site in 2018.

Construction and Operations Phase – Non-Blasting Vibration Modeling

Non-blasting vibration occurs from train movement, construction activities, stationary equipment, and other mobile equipment. Ground-borne vibrations were predicted using the type of equipment generally causing the greatest vibrations (an earthmoving truck), using estimates from the Federal Transit Administration (Quagliata et al. 2018).

3.4.3 Affected Environment

3.4.3.1 Relevant Laws, Metrics, Regulations, Policies, and Plans

No single regulatory agency or threshold is applicable to non-blasting noise generated by activities at the project sites. A full discussion of noise thresholds of significance appropriate for mining activities can be found elsewhere (Newell 2018d).

Primary Legal Authorities Relevant to the Noise Effects Analysis

- U.S. Department of Housing and Urban Development standards
- Pinal County Excessive Noise Ordinance
- Federal Highway Administration and Arizona Department of Transportation (ADOT) standards
- Office of Surface Mining Reclamation and Enforcement
- Federal Transit Administration
- Occupational Safety and Health Administration
- Mine Safety and Health Administration

3.4.3.2 Selected Thresholds

A variety of thresholds are used to put the predicted noise and vibration modeling results in context. These thresholds are being used for the purposes of the NEPA analysis. Note that these thresholds are likely not applicable to the project in a legal or regulatory sense, and in many cases have very specific applications or specific limitations that are not included explicitly in this analysis.

Blasting Noise Thresholds (Peak Air Overpressure)

The selected threshold for airblast level is at or below 120 unweighted decibels (dBL), which is based on results presented in U.S. Bureau of Mines RI 8485 (Siskind et al. 1980) and represents a reasonable maximum threshold to avoid impacts on structures and humans.

Non-Blasting Noise Thresholds

Thresholds of interest for non-blasting noise include the following:

- For the Ldn metric, the selected threshold is 65 A-weighted decibels (dBA). This is based on the U.S. Department of Housing and Urban Development's Acceptability Standards.
- For the Leq(h) metric, the selected threshold is 55 dBA. This is based on the Pinal County Excessive Noise Ordinance for residential areas during nighttime hours.
- For the Leq(h) metric, an additional selected threshold is 66 dBA. This is based on the ADOT Noise Abatement Criteria for external noise at residential areas (activity class "B").
- An additional threshold applied to all metrics is the incremental increase in noise over background, with a threshold of 15 dBA. This is based on the ADOT substantial noise increase criteria.

Blasting Vibration Thresholds

The selected threshold for ground-borne vibrations is 0.1884 inches per second, peak particle velocity (PPV in/sec.), which is below the human tolerable threshold of 0.5 PPV in/sec., and represents a worst-case threshold. The selected value is also considered reasonable because blasting activities at the mine site are proposed at significant depths, primarily resulting in low-frequency components. However, once blasting commences and vibration monitoring is conducted, if blasting is found to mostly generate frequencies above 3 hertz (i.e., corresponding to high frequency), the selected threshold could increase to 0.5 PPV in/sec.

Non-Blasting-Vibration Thresholds

The selected threshold is at or below 0.04 PPV in/sec. (80 vibration decibels [VdB]), which is based upon results presented in Federal Transit Administration 2018 guidelines (Quagliata et al. 2018).

3.4.3.3 Existing Conditions and Ongoing Trends

The information presented in the following subsections are presented in more detail in the report titled "Sound and Vibration Analysis Report" (Tetra Tech Inc. 2019) and the memorandum titled "Blasting Monitoring Review Memorandum" (Rodrigues 2018).

Land Use and Sensitive Receptor Identification

Land uses within 2 miles of each mine component (i.e., West Plant Site, East Plant Site, filter plant and loadout facility, MARRCO corridor, tailings storage facility alternatives) were grouped and categorized into three main land uses: (1) residential, (2) commercial, and (3) recreation/conservation. Sensitive receptors were then identified and are shown on figure 3.4.3-1.

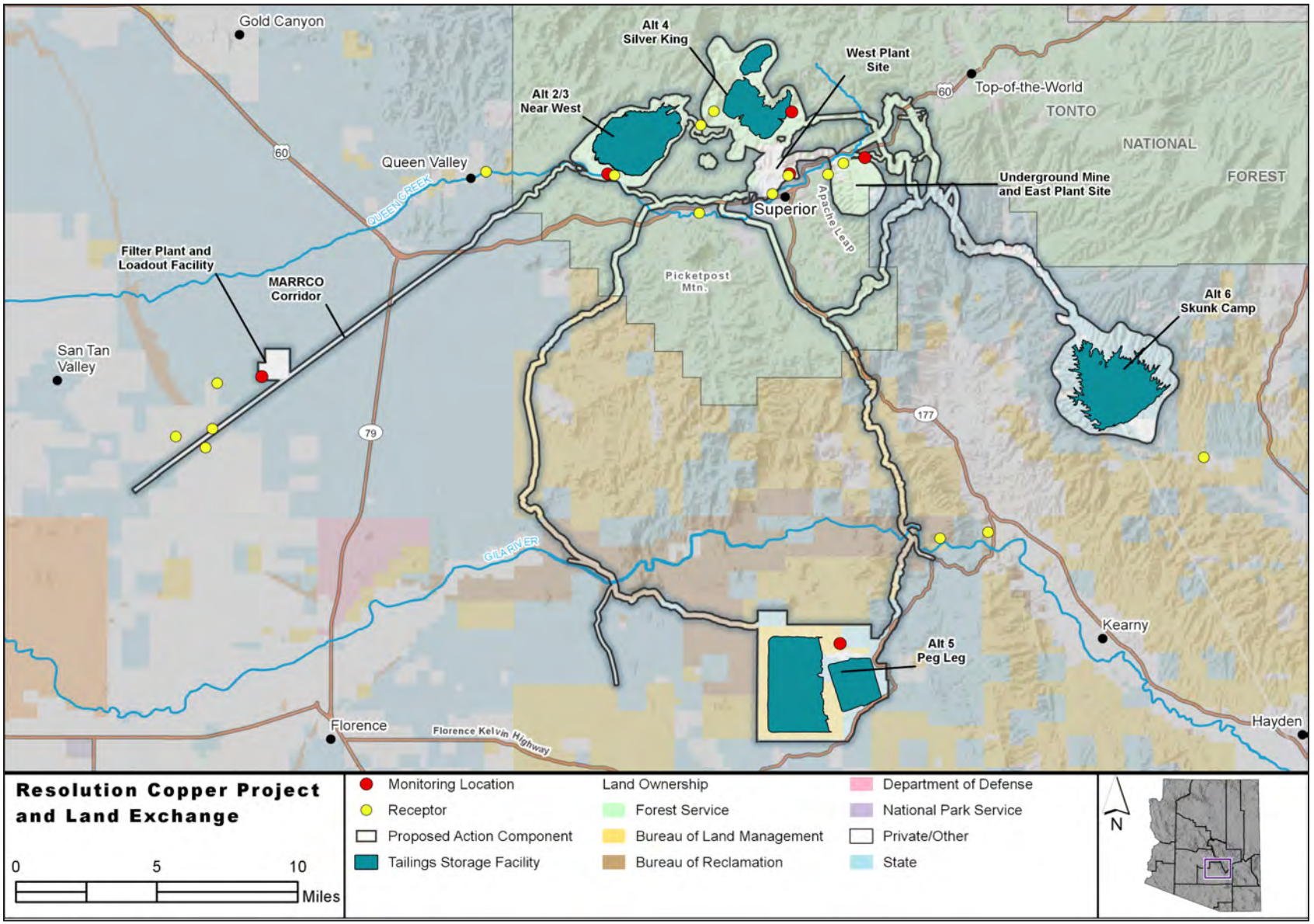

Figure 3.4.3-1. Land use, sensitive areas/receptors identification, and measurement locations

Background Measurement Locations and Descriptions

Background noise and vibration measurements were conducted during two periods, representing the acoustical environment during the spring/summer months (i.e., fewer residents and less outdoor recreation) and fall/winter months (i.e., more residents and more outdoor recreation). The following briefly describes the measurement locations:

- East Plant Site measurement: placed near the edge of the East Plant Site, approximately 650 feet from the existing Shaft 10 and 0.8 mile from the Oak Flat Campground and U.S. 60 route. Nearby land uses include recreation/conservation uses and two sensitive receptors (Oak Flat Campground and the Apache Leap Special Management Area). Noise anomalies removed from the data set included rainfall, thunder, and operation of the existing East Plant Site. These were removed because the East Plant Site noise expected to occur during operations is part of the predicted modeling, not part of the background.
- West Plant Site measurement: placed near the West Plant Site facility property line and adjacent to the town of Superior (incorporated county land), where the nearest residential property line is approximately 260 feet to the south. Land uses within a 2-mile radius include residential, commercial, and recreation/conservation use. Nearby land use represented at this location is residential and includes one sensitive receptor (residences in the town of Superior). Noise anomalies removed from the data set included rainfall, thunder, fireworks, and operation of the existing West Plant Site. These were removed because the West Plant Site noise expected to occur during operations is part of the predicted modeling, not part of the background.
- Near West tailings storage facility measurement: placed on private land, a residential property at 32898 Hewitt Station Road, within the Tonto National Forest, approximately 1,000 feet from the edge of the proposed Near West tailings storage facility. To avoid data contamination from residential activities, the monitoring location was 550 feet from the residence. Nearby land uses include residential and recreation/conservation uses and four sensitive receptors (Hewitt Station, the section of the Arizona Trail near the Near West tailings storage facility, residences in Queen Valley, and Boyce Thompson Arboretum). Noise anomalies removed from the data set included rainfall, thunder, and limited activities of all-terrain vehicles (ATVs) during the summer months and excessive wind, noise from the ranch, rainfall, and ATVs during the winter months.
- Filter plant and loadout facility measurement: placed at the proposed facility location, where the nearest residential property line is approximately 1.6 miles to the west along Skyline Drive. Nearby land uses include residential near Westernstar Road, Lind Road, Felix Road, and Attaway Road. Noise anomalies removed from the data set included rainfall and thunder. Because this location is isolated from any significant noise source, there were no identified primary noise sources.
- Silver King tailings storage facility measurement: placed at the proposed facility location. Nearby land uses include residential and recreation/conservation uses and one sensitive receptor (a section of the Arizona Trail located 2 miles to the west). Noise anomalies removed from the data set included excessive wind and light rainfall. Because this location is isolated from any significant noise source, there were no identified primary noise sources.
- Peg Leg tailings storage facility measurement: placed at the proposed facility location. Nearby land uses include recreation/conservation uses and one sensitive receptor (a section of the Arizona Trail located 2.4 miles to the east). Noise anomalies removed from the data set included excessive wind. Although this location was near a substation, the monitor placement was far enough from the substation to avoid data contamination. Because this location is isolated from any significant noise source, there were no identified primary noise sources. This location also serves as the source of background noise for

Alternative 6, given the similar rural setting. Future background noise measurements may be collected at Alternative 6 if substantial differences are identified in background noise levels.

Interpretation of Background "Ambient" Noise Measurements

Noise levels within the analysis area showed relatively low levels and exhibited typical diurnal patterns. The predominant source in the measured adjusted noise levels (i.e., after removal of identified anomalies) at each of the measurement locations were (1) for the East Plant Site: wildlife and vehicle traffic from Magma Mine Road and U.S. 60, (2) for the West Plant Site: wildlife and community sources from the town of Superior, (3) for the Near West tailings storage facility: operations from nearby ranches, light vehicle traffic on local roadways, and wildlife, (4) for the filter plant and loadout facility: wildlife and aircraft overflights, (5) for the Silver King tailings storage facility: wildlife and light traffic from campers, and (6) for the Peg Leg tailings storage facility: wildlife and aircraft overflights.

In general, the measured adjusted noise levels were within the expected ranges for the given land use, except for the East Plant Site measurement location, where measured levels were approximately 5 to 10 decibels (dB) higher than expected ranges. However, the higher measured data (i.e., 5–10 dB) is reasonable because the expected range assumes an isolated location and does not consider any influence from the nearby U.S. 60 route. Table 3.4.3-1 summarizes the project sites and associated sensitive receptors, land uses, and expected and measured noise level ranges.

Interpretation of West Plant Site Previous Study Noise Measurements

ARCADIS Inc. conducted two noise studies along the West Plant Site property line adjacent to the town of Superior. The first study, "West Plant Noise Monitoring Study" (ARCADIS U.S. Inc. 2015b), included three measurement locations and collected noise data from May 7 through 15, 2015. Of the three locations, one was placed similar to the West Plant Site measurement location discussed earlier in this section and shown on figure 3.4.3-1. The study found that noise levels at this location ranged from 39 to 65 dBA, Leq(h); however, 65 dBA was noted as an anomaly where noise levels typically ranged between 40 to 50 dBA Leq(h).

The second study, titled "Lower Smelter Pond Noise Monitoring Report Superior, Arizona" (ARCADIS U.S. Inc. 2015a), included four measurement locations and collected noise data from August 18 to September 17, 2015. Three measurement locations were along the West Plant Site southern property line and one was within the residential area near the lower smelter pond. The study found that noise levels at these locations were as high as 75 to 80 dBA, Leq(h) during sludge removal activities, but noise levels typically ranged from 31 to 50 dBA Leq(h).

Noise levels from ARCADIS Inc. studies further confirm that the background noise levels at the West Plant site (39–47 dBA daytime, 33–47 dBA nighttime) are reasonably accurate and representative of adjacent residences in the town of Superior.

Interpretation of Project Area Background "Ambient" Vibration Measurements

The vibration levels at the measurement location were at levels that could be perceived by humans (table 3.4.3-2), but considerably below the U.S. Bureau of Mines RI 8507 threshold of 0.5 PPV in/sec., which is tolerable by 95 percent of humans for an event occurring in a 1-second duration. Based on the maximum values, vibration levels recorded were highest at the West Plant Site—0.07 PPV in/sec. (85 VdB)—which exceeds the Federal Transit Administration's threshold for residential annoyance of 0.04 PPV in/sec. (80 VdB). Average values for vibration levels did not exceed any thresholds of interest.

Table 3.4.3-1. Background measured noise levels and expected ranges for sensitive receptors based on land use

				Sound Level (dBA)		
Project Site	**Sensitive Receptors**	**Land Use Type**	**Data Source**	**Ldn**	**Daytime Leq(h)**	**Nighttime Leq(h)**
West Plant Site	***Noise Measurement Location***		***Measured***	***43–53***	***39–47***	***33–47***
	Residences in Superior	Residential and Commercial	Expected	48–54	48–54	38–44
	Residences between U.S. 60 and Main Street	Residential and Commercial	Expected	48–54	48–54	38–44
East Plant Site	***Noise Measurement Location***		***Measured***	***52–54***	***45–50***	***45–48***
	Oak Flat Campground	Recreation/Conservation	Expected	41–44	41–45	31–33
	Apache Leap Special Management Area	Residential/Recreation/Conservation	Expected	41– 54	41–54	31–44
Near West tailings storage facility	***Noise Measurement Location***		***Measured***	***40–46***	***36–43***	***32–39***
	Hewitt Station	Residential	Expected	35–45	35–45	31–33
	Queen Valley	Residential	Expected	36–42	36–42	26–32
	Boyce Thompson Arboretum	Recreation/Conservation	Expected	41–44	41–45	31–33
	Arizona Trail (northwest of Superior)	Recreation/Conservation	Expected	33–35	32–37	25–30
Filter plant and loadout facility	***Noise Measurement Location***		***Measured***	***38–48***	***38–45***	***27–41***
	Westernstar Road	Residential	Expected	36–45	35–45	28–35
	Lind Road	Residential	Expected	36–45	35–45	28–35
	Felix Road	Residential	Expected	36–45	35–45	28–35
	Attaway Road	Residential	Expected	36–45	35–45	28–35
Silver King tailings storage facility	***Noise Measurement Location***		***Measured***	***35–46***	***31–41***	***27–39***
	Arizona Trail (northwest of Superior)	Recreation/Conservation	Expected	33–35	32–37	25–30
Peg Leg tailings storage facility (measured) and Skunk Camp tailings storage facility (assumed)	***Noise Measurement Location***		***Measured***	***34–52***	***30–51***	***26–46***
	Arizona Trail (near Zellweger Wash)	Recreation/Conservation	Expected	33–35	32–37	25–30

Note: Noise measurements were collected as described below:

West Plant Site: June 7–10, 2016, and June 22–July 5, 2016

East Plant Site: June 7–20, 2016

Near West tailings storage facility: June 7–16, 2016, June 20–July 5, 2016, November 15–23, 2017, and November 28–December 6, 2017

Filter plant and loadout facility: June 7–16, 2016, and June 20–July 5, 2016

Silver King tailings storage facility: November 14–18, 2017, and January 5–15, 2018

Peg Leg tailings storage facility: November 14–December 27, 2017

Table 3.4.3-2. Background vibration measurement summary

Project Site	Measurement Period	Average PPV, in/sec.	Maximum PPV, in/sec.	Maximum VdB
West Plant Site	June 7–July 5, 2016	0.0034	**0.0723**	**85**
East Plant Site	June 7–July 5, 2016	0.0031	0.013	70
Near West tailings storage facility	June 7–July 5, 2016	0.0035	0.0164	72
Filter plant and loadout facility	June 7–July 5, 2016	0.0077	0.0186	73
Silver King tailings storage facility	November 15–December 12, 2017	0.0033	0.0048	62
Peg Leg tailings storage facility	November 15–December 12, 2017	0.0057	0.0175	73

Notes:
VdB = calculated vibration decibel using a vibration reference of 10−6 in/sec. and a crest factor of 4 (i.e., representing a difference of 12 VdB).
Shaded cells indicate an exceedance of a selected threshold by background measurements.

Table 3.4.3-3. East Plant Site noise data comparison (with blasting and no-blasting activities)

Noise Level Ranges for Each Measurement Period								
Ldn, dBA	Daytime Leq(h), dBA				Nighttime Leq(h), dBA			
	Leq	L10	L90	Lmax	Leq	L10	L90	Lmax
Measurement Period (June 7–20, 2016)								
51.9–54.2	45.2–49.7	47.5–52.2	43.7–46.8	52.1–60.3	45.3–47.7	47.6–50.1	44.3–46.4	49.9–57.9
Measurement Period (January 30–March 19, 2018)								
48.5–58.5	44.1–55.4	48.7–62.3	41.6–53.3	52.5–65.9	41.5–51.2	46.3–56.6	40.3–49.8	48.6–62.8

Notes:
Ldn = Day-night average noise level, a 24-hour average with annoyance penalty of 10 dBA for nighttime noise levels.
Daytime Leq(h) = Equivalent sound level for period between 7:00 a.m. and 10:00 p.m.
Nighttime Leq(h) = Equivalent sound level for period between 10:00 p.m. and 7:00 a.m.
L10 = sound level was exceeded 10 percent of the time (overall monitoring period).
L90 = sound level was exceeded 90 percent of the time (overall monitoring period).
Lmax = Maximum sound level recorded during the measurement period.

Interpretation of East Plant Site Additional Noise and Vibration Measurements

In January 2018, blasting activities commenced at the East Plant Site 4,000 level (i.e., 4,000 feet below surface) and occurred periodically between January 30 and March 19, 2018. Blasting time histories indicate that 29 blasting activities took place during this period, during both daytime and nighttime hours. Noise and vibration data from blasting events were continuously monitored and recorded. Each event incorporated an average loading of 225 pounds of explosives distributed in a patterned hole system consisting of approximately 50 to 60 holes. The blasting monitoring data show that vibration levels from blasting activities were not distinguishable from background ground-vibration levels.

To determine whether the blasting events influenced background noise levels, the noise data set from January/March 2018 (which included blasting events) was compared with the noise data set from June 2016 (which did not include any blasting events and was used to establish the background acoustic environment). Table 3.4.3-3 presents a summary of noise monitoring data collected during the 2016 and 2018 periods.

The two data sets are comparable overall for most metrics. The 2018 noise data exhibited a wider range, with the minimum values generally lower than the 2016 background measurements, and the maximum values generally higher than the 2016 background measurements. The L10 (noise level exceeded 10 percent of the time) and Lmax (maximum sound level) metrics are both widely used to describe noise from intermittent or individual events, though very short individual events (like blasting) are unlikely to show up in the L10 values. The 2018 daytime L10 and Lmax metrics had a wide range but were overall higher

than the 2016 background noise measurements, suggesting blasting noise may have been detected. However, a direct comparison of noise levels (collected every second) immediately before, during, and after each blasting event does not show any clear effects (Tetra Tech Inc. 2019).

3.4.4 Environmental Consequences of Implementation of the Proposed Mine Plan and Alternatives

Direct impacts from noise and vibration during construction and operational phases have been modeled for the project (AMEC Foster Wheeler Environment and Infrastructure 2017; Rodrigues 2018; Tetra Tech Inc. 2019).

3.4.4.1 Alternative 1 – No Action

As detected in the 2016 background noise measurements, certain noise-producing activities are currently taking place on Resolution Copper private property at the West Plant Site and East Plant Site. Under the no action alternative, these activities would continue. Noise and vibration levels do not rise above any selected thresholds under background conditions

3.4.4.2 Impacts Common to All Action Alternatives

Effects of Land Exchange

The selected Oak Flat Federal Parcel would leave Forest Service jurisdiction. The role of the Tonto National Forest under its primary authorities in the Organic Administration Act, Locatable Regulations (36 CFR 228 Subpart A), and Multiple-Use Mining Act is to ensure that mining activities minimize adverse environmental effects on National Forest System surface resources; this includes effects on the natural setting from noise that could occur on the Oak Flat Federal Parcel. The Oak Flat Federal Parcel would become private at the completion of the NEPA process, and the Forest Service would not have the ability to require mitigation for effects from noise on the lands; however, no adverse noise effects were identified to occur from the East Plant Site operations.

The offered parcels would come under Federal jurisdiction. Specific management of the natural setting of those parcels would be determined by the agencies to meet desired conditions or support appropriate land uses and would include noise considerations.

Effects of Forest Plan Amendment

The Tonto National Forest Land and Resource Management Plan (1985b) provides guidance for management of lands and activities within the Tonto National Forest. It accomplishes this by establishing a mission, goals, objectives, and standards and guidelines. Missions, goals, and objectives are applicable on a forest-wide basis. Standards and guidelines are either applicable on a forest-wide basis or by specific management area.

A review of all components of the 1985 forest plan was conducted to identify the need for amendment due to the effects of the project, including both the land exchange and the proposed mine plan (Shin 2019). No standards and guidelines were identified applicable to noise or vibration. For additional details on specific rationale, see Shin (2019).

Summary of Applicant-Committed Environmental Protection Measures

A number of environmental protection measures are incorporated into the design of the project that would act to reduce potential impacts on noise and vibration. These are non-discretionary measures and their effects are accounted for in the analysis of environmental consequences.

The GPO (2016d) outlined applicant-committed environmental protection measures by Resolution Copper in the “Environmental Protection Elements” section.

- Mining activities, primary crushing and conveying, will take place underground, and exhaust fans will be equipped with silencers for noise reduction. Milling will take place within a fully enclosed building.

3.4.4.3 Alternatives 2 and 3 – Near West – Modified Proposed Action

Construction Phase – Blasting Noise and Vibration Impacts

In order to analyze ground-borne vibrations associated with construction of the underground tunnel, 10 structures in the town of Superior were selected as representative samples based on the shortest slant distance to the tunnel. Sections of the tunnel would also run along the Apache Leap SMA sensitive receptor, where the shortest slant distance is approximately 1,536 feet (near the westerly side) and 3,506 feet (near the easterly side) (figure 3.4.4-1).

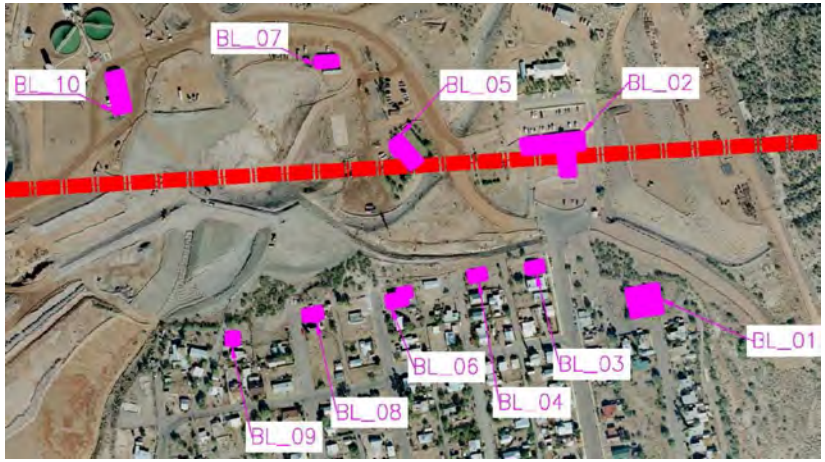

Figure 3.4.4-1. Locations of buildings analyzed for selected vibration threshold near West Plant Site and underground tunnel

Table 3.4.4-1. Calculated explosive loading at sensitive receptor samples based on selected vibration threshold

Sensitive Receptor	Slant Distance (feet)	Allowable Explosive Load per Delay (kg TNTe)
BL_1	1,235	24
BL_2 (*located on West Plant Site facility property*)	864	12
BL_3	1,114	19
BL_4	1,061	18
BL_5 (*located on West Plant Site facility property*)	758	9
BL_6	1,101	19
BL_7 (*located on West Plant Site facility property*)	1,023	16
BL_8	1,135	20
BL_9	1,210	23
BL_10 (*located on West Plant Site facility property*)	775	9
Apache Leap SMA	1,535	37

Note: Calculated allowable explosive load per delay is based on 0.1884 PPV in/sec. vibration threshold.

The explosive load per delay presented in table 3.4.4-1 are calculated based on the selected vibration threshold, sensitive receptor locations, tunnel alignment, and profile data. At the nearest sensitive receptor (BL_5), located on the West Plant Site facility property, the blast loading should be kept below 9 kilograms TNT equivalent (kg TNTe) per delay. Impacts on the Apache Leap SMA could also be limited by keeping the blast loading below 37 kg TNTe/delay.

Airblast impacts could be more notable near the vent raise and portal openings; analysis for these areas is shown in table 3.4.4-2. The vent raise location is approximately 1,600 feet and the portal opening is approximately 2,792 feet from the closest sensitive receptor (identified

Table 3.4.4-2. Calculated explosive loading at sensitive receptor samples based on airblast selected threshold

Source Location	Sensitive Receptor	Slant Distance (feet)	Allowable Explosive Load per Delay (kg TNTe)	Estimated Results	
				Airblast Level, dBL	PPV in/ sec.
Vent raise	BL_10	1,600	35	118	0.170
	Apache Leap SMA	5,981	380	114	0.157
Portal opening	BL_10	2,792	120	118	0.186

as BL_10). The vent raise location is also approximately 5,981 feet from the westerly side of the Apache Leap SMA boundary. Blasting loading should be kept below 35 kg TNTe at the vent raise and 120 kg TNTe at the portal opening.

The exact blasting plan for the tunnel would depend on conditions encountered during construction and has not yet been developed; explosive loads kept under these limits are not anticipated to result in adverse impacts from vibration.

Construction Phase – Non-Blasting Noise Impacts

Table 3.4.4-4, later in this section, shows noise level estimates from the construction of the operational facilities would range from 89 dBA at 50 feet to 63 dBA at 1,000 feet. Construction activities would occur for 10 hours during daytime weekday shifts. The most appropriate noise threshold for daytime activities is the Leq(h) of 66 dBA, based on ADOT residential criteria. Past 1,000 feet, noise levels do not exceed this threshold. The overall levels should be lower, because (as discussed in section 3.4.2) these estimates exclude attenuation factors and trend toward quieter construction equipment since the source data were developed. Beyond 1,000 feet, construction noise is not anticipated to result in adverse impacts.

Operations Phase – Non-Blasting Noise Impacts

Table 3.4.4-5, later in this section, shows that noise impacts in Leq(h) metric are not expected to occur based on the predicted minimum and average noise level ranges, whether looking at overall combined noise levels (project noise plus background noise), or the incremental noise increase over background levels.

If the maximum of each range is used, incremental increases are at or above the selected threshold of 15 dBA at following sensitive receptors:

- Residential receptors near U.S. 60 and Main Street.
- Recreational users within Apache Leap SMA.
- Recreational users of nearby section of the Arizona Trail.

Residential receptors near U.S. 60 and Main Street would also experience future levels (project noise plus background noise) above 55 dBA (Pinal County nighttime noise threshold limit), but below 66 dBA (ADOT's modified Noise Abatement Criteria "B" for residential uses). Because residential receptors near U.S. 60 and Main Street are within incorporated lands in the town of Superior, ADOT's modified Noise Abatement Criteria would be more applicable.

Table 3.4.4-6, later in this section, shows that predicted future noise levels in Ldn metric would comply with the selected threshold of 65 Ldn. Nearby sections of the Arizona Trail would experience increases in noise above the incremental threshold of 15 dBA, but only under maximum conditions. The maximum condition assumes all equipment operating simultaneously during the quietest period; this would be an infrequent and unlikely occurrence. Figures 3.4.4-2 and 3.4.4-3 show the predicted noise contours propagation over the surrounding area of the mine site associated with the Alternatives 2 and 3.

Table 3.4.4-3. Predicted non-blasting vibration impacts during operations, Alternatives 2 and 3

	Calculated Non-Blasting Vibration Levels	
Feet from Source	PPV in/sec.	VdB
25	**0.0890**	**87**
50	0.0315	78
75	0.0171	73
100	0.0111	69
125	0.0080	66
150	0.0061	64
175	0.0048	62
200	0.0039	60
225	0.0033	58
250	0.0028	57
275	0.0024	56
300	0.0021	55

Shaded cells indicate an exceedance of selected threshold of 0.04 PPV in/sec (80 VdB).

OPERATIONS PHASE – NON-BLASTING VIBRATION IMPACTS

Table 3.4.4-3 shows that ground-borne vibration PPV in/sec. are not expected to exceed the selected threshold of 0.04 PPV in/sec. (80 VdB) at 50 feet or more from the source. The calculated vibration levels in 25-foot increments from the source show 0.0315 PPV in/sec. (78 VdB) at 50 feet, which is less than the selected threshold.

Beyond 50 feet, vibration during operations is not anticipated to result in adverse impacts.

3.4.4.4 Alternative 4 – Silver King

Alternative 4 would have identical impacts on Alternatives 2 and 3 for construction blasting noise, construction blasting vibration, construction non-blasting noise, and operations non-blasting vibration. Only operational noise impacts would differ and are described here.

Similar to Alternatives 2 and 3, table 3.4.4-7 shows that noise impacts in Leq(h) metric are not expected to occur based on the predicted minimum and average noise level (whether looking at overall combined noise levels [project noise plus background noise], or the incremental noise increase over background levels). If the maximum of each range is used, incremental increases are at or above the selected threshold of 15 dBA at the following receptors:

- Residential receptors near U.S. 60 and Main Street.
- Recreational users within Apache Leap SMA.

The maximum condition assumes all equipment operating simultaneously during the quietest period; this would be an infrequent and unlikely occurrence.

Residential receptors near U.S. 60 and Main Street would also experience future levels above 55 dBA, but below 66 dBA, based on maximum values. Table 3.4.4-8 shows that predicted future noise levels in Ldn metric would comply with all the selected thresholds. Figure 3.4.4-4 shows the predicted noise contours for Alternative 4.

Table 3.4.4-4. Estimated noise levels from construction activities

Sound Source	Quantity			Utilization Factor	dBA Leq(h)*				
	West Plant Site	East Plant Site	Filter Plant and Loadout Facility	%	50	100	250	500	1,000
Dozer	6	5	1	40	**81**	**75**	**67**	61	55
Grader	3	3	1	40	**81**	**75**	**67**	61	55
Compactor	2	2	1	20	**73**	**67**	59	53	47
Scraper	3	3	1	40	**81**	**75**	**67**	61	55
Water truck	2	1	1	40	**80**	**74**	66	60	54
Fuel/lube truck	1	1	1	40	**80**	**74**	66	60	54
Excavator	2	2	1	40	**81**	**75**	**67**	61	55
Loader	1	1	0	40	**86**	**70**	62	56	50
Haul truck	1	1	0	40	**80**	**74**	66	60	54
Pickup truck	3	3	0	40	51	45	37	31	25
Combined Noise Levels					**89**	**83**	**75**	**69**	**63**

Source: Tetra Tech (2018)
Note: Shaded cells indicate an exceedance of selected threshold of 66 dBA
* Calculations assume only one sound source is in operation

Table 3.4.4-5. Predicted noise impacts during operations, Alternatives 2 and 3, Leq(h) metric

Project Site	Sensitive Receptors	Future Levels, dBA						
		Project Predicted Levels	Project plus Background Levels			Increase Over Background Levels		
			Min	Avg	Max	Min	Avg	Max
West Plant Site	***Noise Measurement Location****	***47***	***47***	***49***	***50***	***3***	***5***	***14***
	Residences in Superior	47	47	49	50	3	5	14
	Residences U.S. 60 and Main Street†	53	53	55	**57**	3	4	15
East Plant Site	***Noise Measurement Location****	***61***	***61***	***61***	***61***	***11***	***12***	***16***
	Oak Flat Campground‡	43	43	49	51	1	1	12
	Apache Leap SMA‡	46	46	50	51	1	2	15
Near West tailings storage facility	***Noise Measurement Location****	***43***	***43***	***45***	***46***	***3***	***4***	***11***
	Hewitt Station	44	44	46	47	4	5	12
	Residences in Queen Valley‡	<10	26	40	43	<1	<1	<1
	Boyce Thompson Arboretum	24	33	41	43	<1	<1	1
	Arizona Trail (northwest of Superior)‡	51	51	51	52	9	11	**26**
Filter plant and loadout facility/ MARRCO corridor	***Noise Measurement Location****	***47***	***47***	***48***	***49***	***4***	***6***	***20***
	Westernstar Road	<10	27	42	45	<1	<1	<1
	Lind Road	32	33	43	45	<1	<1	6
	Felix Road	26	30	42	45	<1	<1	3
	Attaway Road	13	27	42	45	<1	<1	<1

Note: Shaded cells indicate an exceedance at a sensitive receptor of selected threshold of 55 dBA for project plus background levels, and 15 dBA for increase over background levels.
Min = Minimum, Avg = Average, Max = Maximum
* Prediction location is not a sensitive receptor and included for comparison to the existing measured noise levels (see table 3.4.3-1).
† Lower and upper levels are based on the expected sound levels due to the vicinity of the highway (see table 3.4.3-1).
‡ The expected lower level was applied to be conservative (see table 3.4.3-1).

Table 3.4.4-6. Predicted noise impacts during operations, Alternatives 2 and 3, Ldn metric

		Future Levels, dBA						
		Project Predicted Levels	Project plus Background Levels			Increase Over Background Levels		
Project Site	Sensitive Receptors		Min	Avg	Max	Min	Avg	Max
West Plant Site	***Noise Measurement Location****	***54***	***54***	***56***	***57***	***4***	***5***	***11***
	Residences in Superior	54	54	56	57	4	5	11
	Residences U.S. 60 and Main Street†	59	59	60	60	6	7	11
East Plant Site	*Noise Measurement Location**	***67***	***67***	***67***	***67***	***13***	***16***	***26***
	Oak Flat Campground‡	50	51	54	55	1	2	10
	Apache Leap SMA‡	52	55	56	56	2	2	4
Near West tailings storage facility	***Noise Measurement Location****	***48***	***49***	***50***	***50***	***4***	***5***	***9***
	Hewitt Station	50	50	51	51	5	6	10
	Residences in Queen Valley‡	<10	36	44	46	<1	<1	<1
	Boyce Thompson Arboretum	31	41	45	46	<1	<1	1
	Arizona Trail (northwest of Superior)‡	58	58	58	58	12	15	25
Filter plant and loadout facility/ MARRCO corridor	***Noise Measurement Location****	***53***	***53***	***54***	***54***	***6***	***8***	***15***
	Westernstar Road	<10	38	46	48	<1	<1	<1
	Lind Road	30	39	46	48	<1	<1	1
	Felix Road	24	38	46	48	<1	<1	<1
	Attaway Road	11	38	46	48	<1	<1	<1

Note: Shaded cells indicate an exceedance at a sensitive receptor of selected threshold of 65 dBA for project plus background levels, and 15 dBA for increase over background levels.
Min = Minimum, Avg = Average, Max = Maximum
* Prediction location is not a sensitive receptor and included for comparison to the existing measured noise levels (see table 3.4.3-1).
† Lower and upper levels are based on the expected sound levels due to the vicinity of the highway (see table 3.4.3-1).
‡ The expected lower level was applied to be conservative (see table 3.4.3-1).

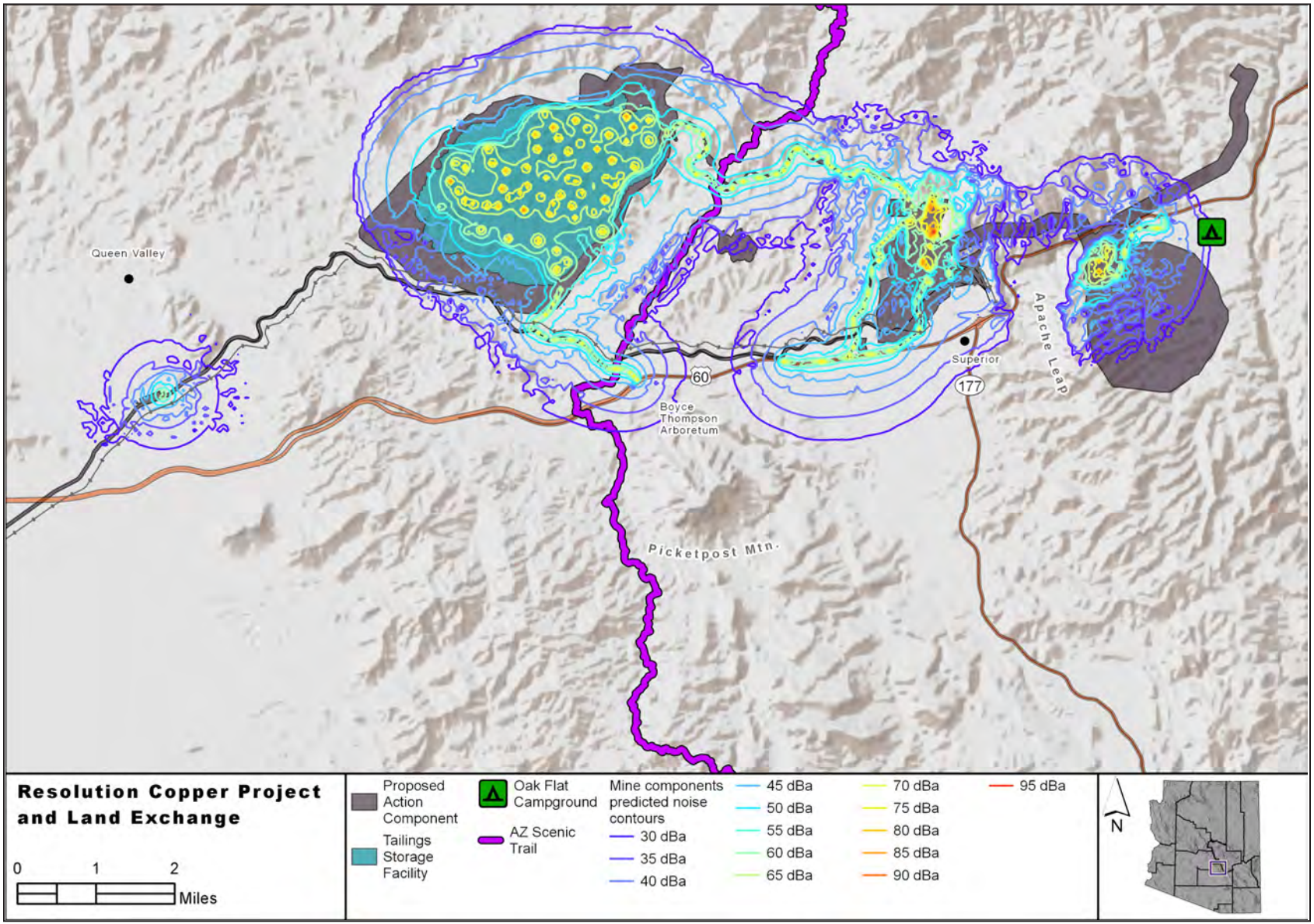

Figure 3.4.4-2. Predicted noise contours associated with Alternatives 2 and 3 (1 of 2)

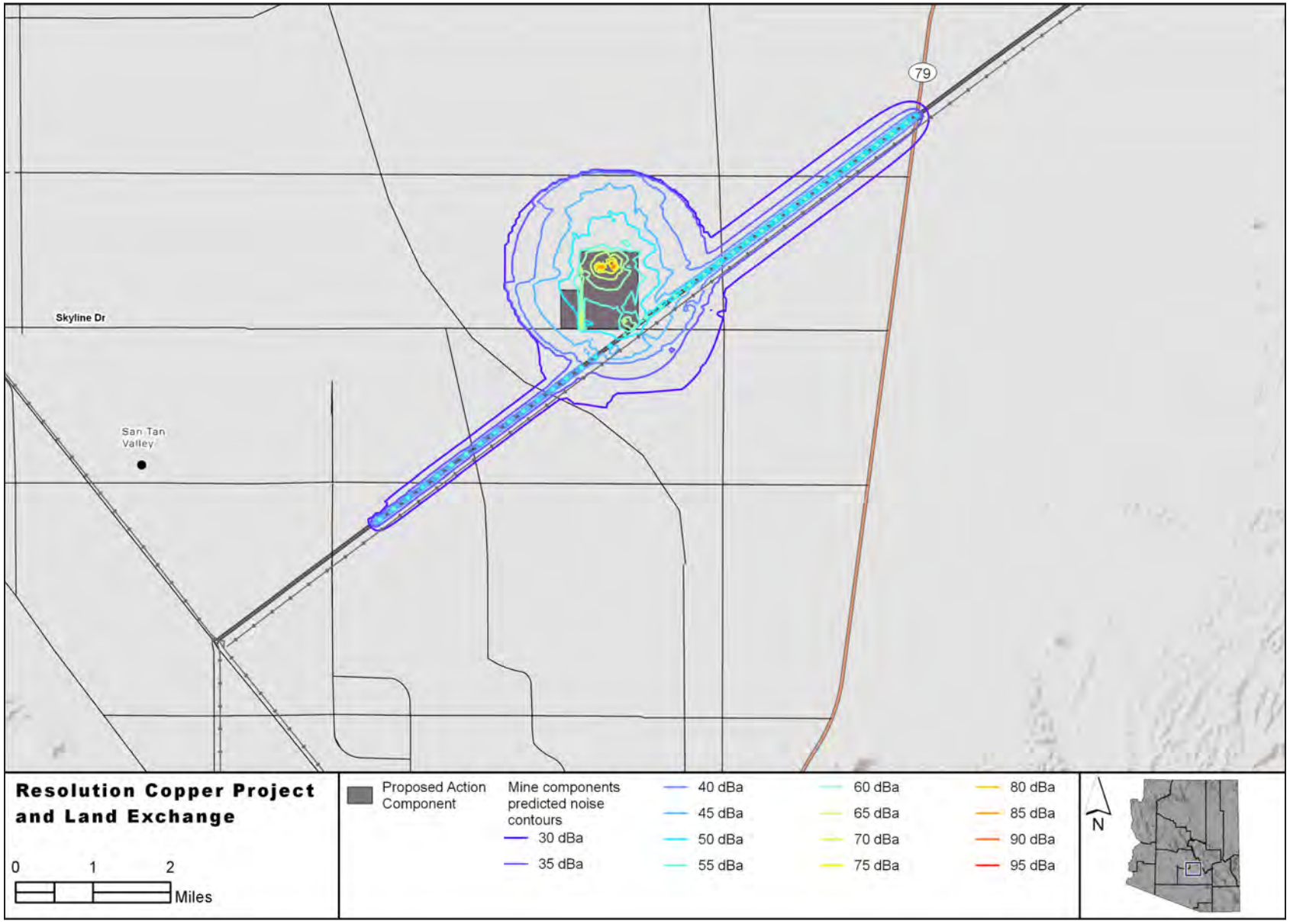

Figure 3.4.4-3. Predicted noise contours associated with Alternatives 2 and 3 (2 of 2)

Table 3.4.4-7. Predicted noise impacts during operations, Alternative 4, Leq(h) metric

Project Site	Sensitive Receptors	Future Levels, dBA						
		Project Predicted Levels	Project plus Background Levels			Increase Over Background Levels		
			Min	Avg	Max	Min	Avg	Max
West Plant Site	***Noise Measurement Location****	***47***	***47***	***49***	***50***	***3***	***5***	***14***
	Residences in Superior	47	47	49	50	3	5	14
	Residences U.S. 60 and Main Street†	53	53	55	**57**	3	4	15
East Plant Site	***Noise Measurement Location****	***61***	***61***	***61***	***61***	***11***	***12***	***16***
	Oak Flat Campground	43	43	49	51	1	1	12
	Apache Leap SMA	46	46	50	51	1	2	15
Filter Plant and Loadout Facility/ MARRCO corridor	***Noise Measurement Location****	***20***	***28***	***42***	***45***	***<1***	***<1***	***1***
	Westernstar Road	<10	27	42	45	<1	<1	<1
	Lind Road	32	33	43	45	<1	<1	6
	Felix Road	26	30	42	45	<1	<1	3
	Attaway Road	21	28	42	45	<1	<1	1
Silver King tailings storage facility	***Noise Measurement Location****	***52***	***52***	***52***	***52***	***11***	***14***	***25***
	Arizona Trail (northwest of Superior)	43	43	44	45	4	6	**16**

Notes: Shaded cells indicate an exceedance at a sensitive receptor of selected threshold of 55 dBA for project plus background levels, and 15 dBA for increase over background levels.
Min = Minimum, Avg = Average, Max = Maximum
* Prediction location is not a sensitive receptor and is included for comparison with the existing measured noise levels (see table 3.4.3-1).
† Lower and upper levels are based on the expected sound levels due to the vicinity of the highway (see table 3.4.3-1).

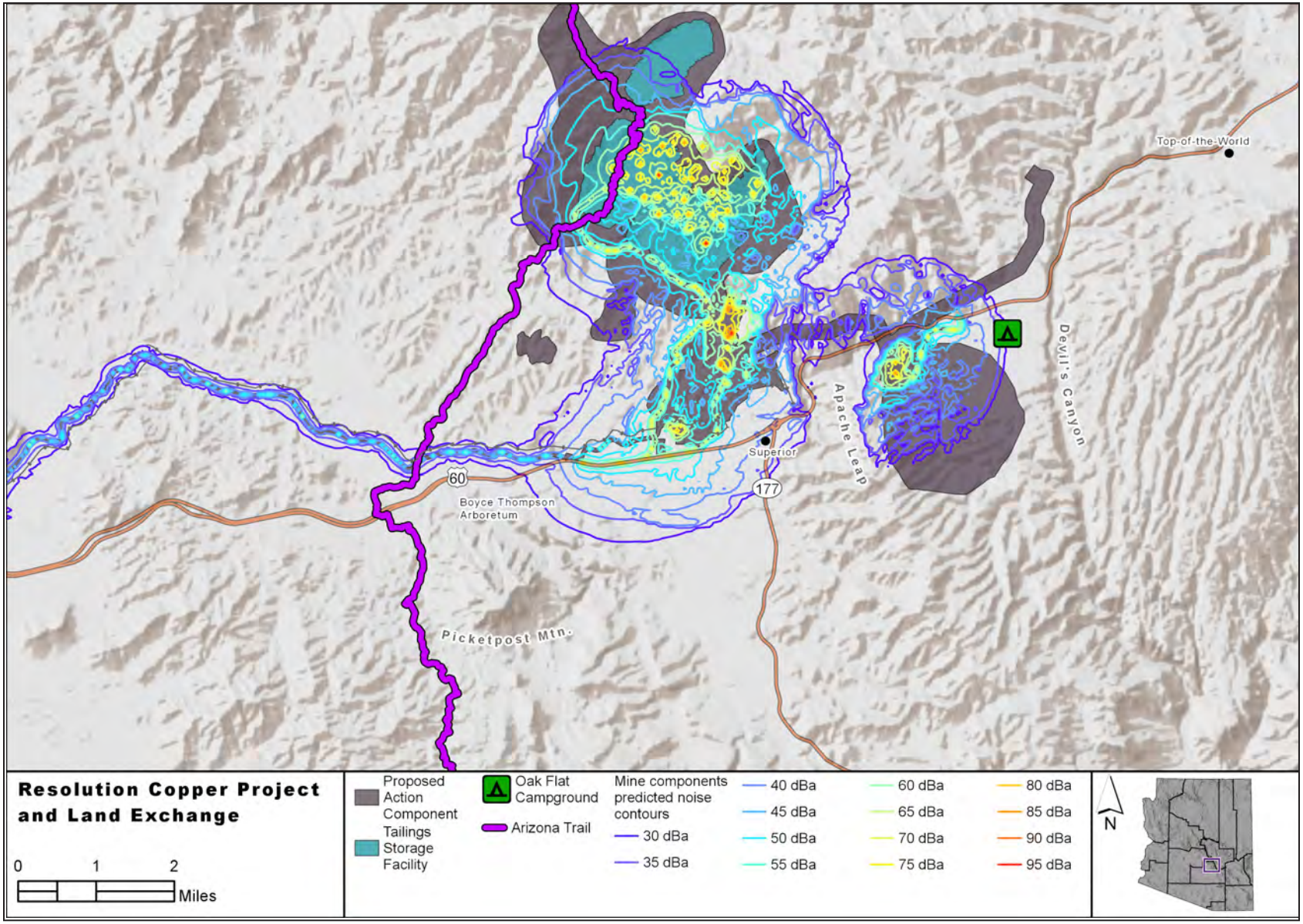

Figure 3.4.4-4. Predicted noise contours associated with operations, Alternative 4

3.4.4.5 Alternative 5 – Peg Leg

Alternative 5 would have identical impacts on Alternatives 2 and 3 for: construction blasting noise, construction blasting vibration, construction non-blasting noise, and operations non-blasting vibration. Only operational noise impacts would differ and are described here.

Similar to Alternatives 2 and 3, table 3.4.4-9 shows that noise impacts in Leq(h) metric are not expected to occur based on the predicted minimum and average noise level (whether looking at overall combined noise levels [project noise plus background noise], or the incremental noise increase over background levels). If the maximum of each range is used, incremental increases are at or above the selected threshold of 15 dBA at the following receptors:

- Residential receptors near U.S. 60 and Main Street.
- Recreational users within Apache Leap SMA.

The maximum condition assumes all equipment operating simultaneously during the quietest period; this would be an infrequent and unlikely occurrence.

Residential receptors near U.S. 60 and Main Street would also experience future levels above 55 dBA, but below 66 dBA, based on maximum values. Table 3.4.4-10 shows that predicted future noise levels in Ldn metric would comply with all the selected thresholds. Figure 3.4.4-5 shows the predicted noise contours for Alternative 5.

3.4.4.6 Alternative 6 – Skunk Camp

Alternative 6 would have identical impacts on Alternatives 2 and 3 for construction blasting noise, construction blasting vibration, construction non-blasting noise, and operations non-blasting vibration. Only operational noise impacts would differ and are described here.

Table 3.4.4-11 shows that noise impacts in Leq(h) metric are not expected to occur based on the predicted minimum and average noise level, except along Dripping Springs Road. There, the expected sound levels exceed the Leq(h) selected threshold of 55 dBA but are below the selected threshold of 66 dBA. If the maximum of each range is used, incremental increases are at or above the selected threshold of 15 dBA at the following receptors:

- Residential receptors near U.S. 60 and Main Street.
- Recreational users within Apache Leap SMA.
- Residential/recreational users along Dripping Springs Road.

The maximum condition assumes all equipment operating simultaneously during the quietest period; this would be an infrequent and unlikely occurrence.

Residential receptors near U.S. 60 and Main Street would also experience future levels above 55 dBA, but below 66 dBA, based on maximum values. For the Ldn metric, noise levels along Dripping Springs Road are also above the selected threshold of 65 dBA, as shown in table 3.4.4-12. Figure 3.4.4-6 shows the predicted noise contours for Alternative 6.

3.4.4.7 Cumulative Effects

The Tonto National Forest has identified the following list of reasonably foreseeable future actions as likely to occur in conjunction with development of the Resolution Copper Mine. The projects described here are expected, or have potential, to contribute to incremental changes in the existing noise and vibration conditions near the Resolution Copper Mine. As noted in section 3.1, past and present actions are assessed as part of the affected environment; this section analyzes the effects of any RFFAs, to be considered cumulatively along with the affected environment and Resolution Copper Project effects.

- *Pinto Valley Mine Expansion.* The Pinto Valley Mine is an existing open-pit copper and molybdenum mine located approximately 8 miles west of Miami, Arizona, in Gila County. Pinto Valley Mining Corporation is proposing to expand mining

Table 3.4.4-8. Predicted noise impacts during operations, Alternative 4, Ldn metric

		Future Levels, dBA						
		Project Predicted Levels	Project plus Background Levels			Increase Over Background Levels		
Project Site	Sensitive Receptors		Min	Avg	Max	Min	Avg	Max
West Plant Site	Noise Measurement Location*	***54***	***54***	***56***	***57***	***4***	***5***	***11***
	Residences in Superior	54	54	56	57	4	5	11
	Residences U.S. 60 and Main Street†	59	59	60	60	6	7	11
East Plant Site	Noise Measurement Location*	***67***	***67***	***67***	***67***	***13***	***16***	***26***
	Oak Flat Campground	50	51	54	55	1	2	10
	Apache Leap SMA	52	55	56	56	2	2	4
Filter plant and loadout facility/ MARRCO corridor	Noise Measurement Location*	***18***	***38***	***46***	***48***	***<1***	***<1***	***<1***
	Westernstar Road	<10	38	46	48	<1	<1	<1
	Lind Road	30	39	46	48	<1	<1	1
	Felix Road	24	38	46	48	<1	<1	<1
	Attaway Road	19	38	46	48	<1	<1	<1
Silver King tailings storage facility	Noise Measurement Location*	***57***	***57***	***57***	***57***	***11***	***14***	***22***
	Arizona Trail (northwest of Superior)	49	49	50	51	5	6	14

Notes: Shaded cells indicate an exceedance at a sensitive receptor of selected threshold of 65 dBA for project plus background levels, and 15 dBA for increase over background levels.
Min = Minimum, Avg = Average, Max = Maximum
* Prediction location is not a sensitive receptor and is included for comparison with the existing measured noise levels (see table 3.4.3-1).
† Lower and upper levels are based on the expected sound levels due to the vicinity of the highway (see table 3.4.3-1).

Table 3.4.4-9. Predicted noise impacts during operations, Alternative 5, Leq(h) metric

		Future Levels, dBA						
		Project Predicted Levels	Project plus Background Levels			Increase Over Background Levels		
Project Site	**Sensitive Receptors**		**Min**	**Avg**	**Max**	**Min**	**Avg**	**Max**
West Plant Site	***Noise Measurement Location****	***47***	***47***	***49***	***50***	***3***	***5***	***14***
	Residences in Superior	47	47	49	50	3	5	14
	Residences U.S. 60 and Main Street†	53	53	55	**57**	3	4	15
East Plant Site	***Noise Measurement Location****	***61***	***61***	***61***	***61***	***11***	***12***	***16***
	Oak Flat Campground‡	43	43	49	51	1	1	12
	Apache Leap SMA‡	46	46	50	51	1	2	15
Filter plant and loadout facility/ MARRCO corridor	***Noise Measurement Location****	***47***	***47***	***48***	***49***	***4***	***6***	***20***
	Westernstar Road	<10	27	42	45	<1	<1	<1
	Lind Road	32	33	43	45	<1	<1	6
	Felix Road	26	30	42	45	<1	<1	3
	Attaway Road	13	27	42	45	<1	<1	<1
Peg Leg tailings storage facility	***Noise Measurement Location****	***56***	***56***	***57***	***57***	***6***	***9***	***30***
	Arizona Trail (near Zellweger Wash)	34	35	48	51	<1	<1	9

Notes: Shaded cells indicate an exceedance at a sensitive receptor of selected threshold of 55 dBA for project plus background levels, and 15 dBA for increase over background levels.
Min = Minimum, Avg = Average, Max = Maximum
* Prediction location is not a sensitive receptor and is included for comparison with the existing measured noise levels (see table 3.4.3-1).
† Lower and upper levels are based on the expected sound levels due to the vicinity of the highway (see table 3.4.3-1).
‡ The expected lower level was applied to be conservative (see table 3.4.3-1).

Table 3.4.4-10. Predicted noise impacts during operations, Alternative 5, Ldn metric

		Future Levels, dBA						
			Project plus Background Levels			Increase Over Background Levels		
Project Site	Sensitive Receptors	Project Predicted Levels	Min	Avg	Max	Min	Avg	Max
West Plant Site	***Noise Measurement Location****	***54***	***54***	***56***	***57***	***4***	***5***	***11***
	Residences in Superior	54	54	56	57	4	5	11
	Residences U.S. 60 and Main Street†	59	59	60	60	6	7	11
East Plant Site	***Noise Measurement Location****	***67***	***67***	***67***	***67***	***13***	***16***	***26***
	Oak Flat Campground‡	50	51	54	55	1	2	10
	Apache Leap SMA‡	52	55	56	56	2	2	4
Filter plant and loadout facility/ MARRCO corridor	***Noise Measurement Location****	***53***	***53***	***54***	***54***	***6***	***8***	***15***
	Westernstar Road	<10	38	46	48	<1	<1	<1
	Lind Road	30	39	46	48	<1	<1	1
	Felix Road	24	38	46	48	<1	<1	<1
	Attaway Road	11	38	46	48	<1	<1	<1
Peg Leg tailings storage facility	***Noise Measurement Location****	***62***	***62***	***62***	***62***	***10***	***13***	***28***
	Arizona Trail (near Zellweger Wash)	40	41	50	52	<1	1	7

Notes: Shaded cells indicate an exceedance at a sensitive receptor of selected threshold of 65 dBA for project plus background levels, and 15 dBA for increase over background levels.
Min = Minimum, Avg = Average, Max = Maximum
* Prediction location is not a sensitive receptor and is included for comparison with the existing measured noise levels (see table 3.4.3-1).
† Lower and upper levels are based on the expected sound levels due to the vicinity of the highway (see table 3.4.3-1).
‡ The expected lower level was applied to be conservative (see table 3.4.3-1).

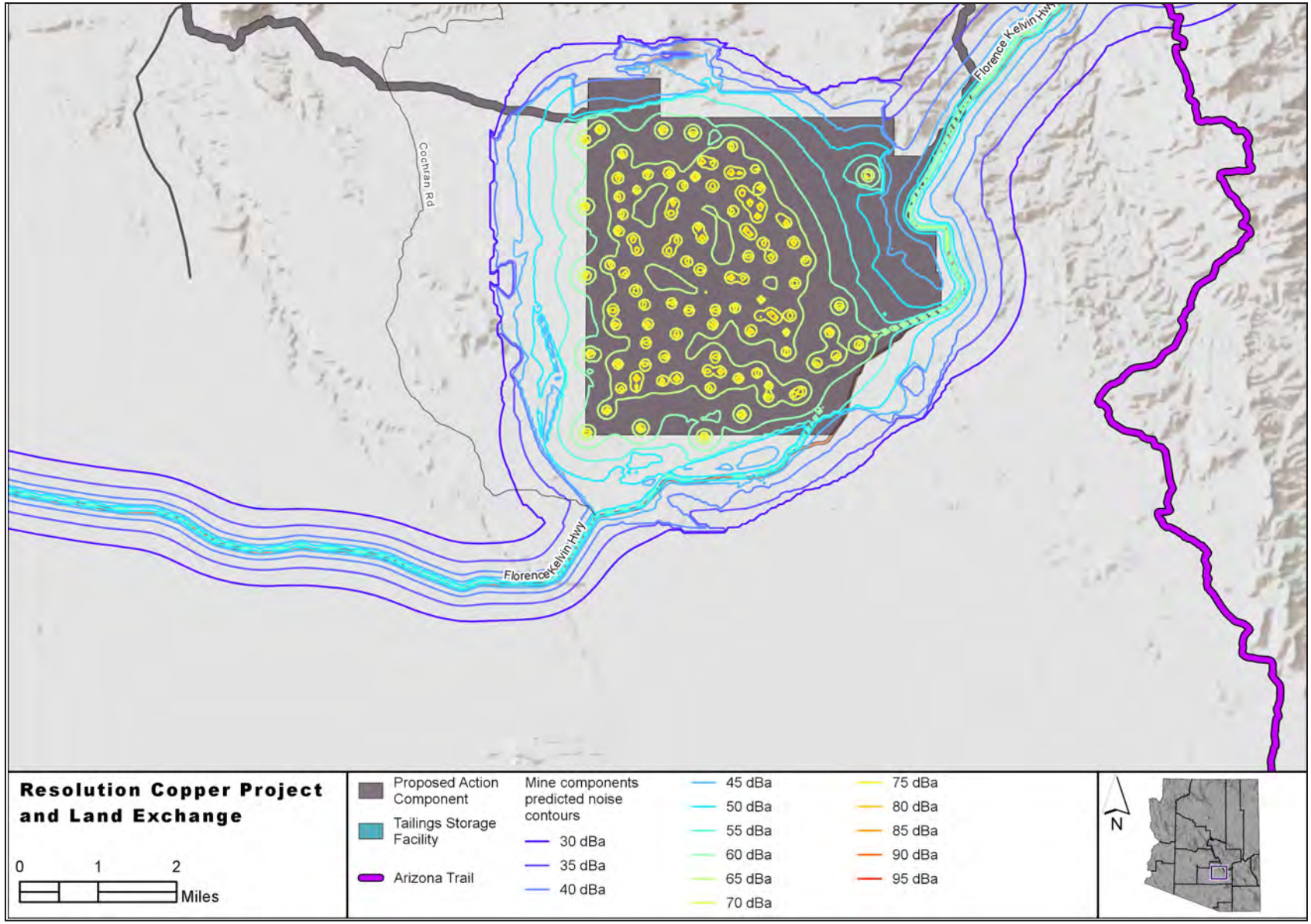

Figure 3.4.4-5. Predicted noise contours associated with operations, Alternative 5

Table 3.4.4-11. Predicted noise impacts during operations, Alternative 6, Leq(h) metric

		Future Levels, dBA						
		Project Predicted Levels	Project plus Background Levels			Increase Over Background Levels		
Project Site	Sensitive Receptors		Min	Avg	Max	Min	Avg	Max
West Plant Site	***Noise Measurement Location****	***47***	***47***	***49***	***50***	***3***	***5***	***14***
	Residences in Superior	47	47	49	50	3	5	14
	Residences U.S. 60 and Main Street†	53	53	55	**57**	3	4	15
East Plant Site	***Noise Measurement Location****	***61***	***61***	***61***	***61***	***11***	***12***	***16***
	Oak Flat Campground‡	43	43	49	51	1	1	12
	Apache Leap SMA‡	46	46	50	51	1	2	15
Filter Plant and Loadout Facility/ MARRCO corridor	***Noise Measurement Location****	***47***	***47***	***48***	***49***	***4***	***6***	***20***
	Westernstar Road	<10	27	42	45	<1	<1	<1
	Lind Road	32	33	43	45	<1	<1	6
	Felix Road	26	30	42	45	<1	<1	3
	Attaway Road	13	27	42	45	<1	<1	<1
Skunk Camp tailings storage facility	Arizona Trail (near Kelvin)§	<10	26	48	51	<1	<1	<1
	Dripping Springs Road	60	**60**	**60**	**60**	10	12	**34**

Notes: Shaded cells indicate an exceedance at a sensitive receptor of selected threshold of 55 dBA for project plus background levels, and 15 dBA for increase over background levels.
Min = Minimum, Avg = Average, Max = Maximum
* Prediction location is not a sensitive receptor and is included for comparison with the existing measured noise levels (see table 3.4.3-1).
† Lower and upper levels are based on the expected sound levels due to the vicinity of the highway (see table 3.4.3-1).
‡ The expected lower level was applied to be conservative (see table 3.4.3-1).
§ The lower and upper levels are based on the Peg Leg noise measurement location (see table 3.4.3-1).

Table 3.4.4-12. Predicted noise impacts during operations, Alternative 6, Ldn metric

		Future Levels, dBA						
		Project Predicted Levels	Project plus Background Levels			Increase Over Background Levels		
Project Site	**Sensitive Receptors**		**Min**	**Avg**	**Max**	**Min**	**Avg**	**Max**
West Plant Site	***Noise Measurement Location****	***54***	***54***	***56***	***57***	***4***	***5***	***11***
	Residences in Superior	54	54	56	57	4	5	11
	Residences U.S. 60 and Main Street†	59	59	60	60	6	7	11
East Plant Site	***Noise Measurement Location****	***67***	***67***	***67***	***67***	***13***	***16***	***26***
	Oak Flat Campground‡	50	51	54	55	1	2	10
	Apache Leap SMA‡	52	55	56	56	2	2	4
Filter Plant and Loadout Facility/ MARRCO corridor	***Noise Measurement Location****	***53***	***53***	***54***	***54***	***6***	***8***	***15***
	Westernstar Road	<10	38	46	48	<1	<1	<1
	Lind Road	30	39	46	48	<1	<1	1
	Felix Road	24	38	46	48	<1	<1	<1
	Attaway Road	11	38	46	48	<1	<1	<1
Skunk Camp tailings storage facility	Arizona Trail (near Kelvin)§	<10	34	49	52	<1	<1	<1
	Dripping Springs Road	67	**67**	**67**	**67**	**15**	**18**	**33**

Notes: Shaded cells indicate an exceedance at a sensitive receptor of selected threshold of 65 dBA for project plus background levels, and 15 dBA for increase over background levels.

Min = Minimum, Avg = Average, Max = Maximum

* Prediction location is not a sensitive receptor and is included for comparison with the existing measured noise levels (see table 3.4.3-1).

† Lower and upper levels are based on the expected sound levels due to the vicinity of the highway (see table 3.4.3-1).

‡ The expected lower level was applied to be conservative (see table 3.4.3-1).

§ The lower and upper levels are based on the Peg Leg noise measurement location (see table 3.4.3-1).

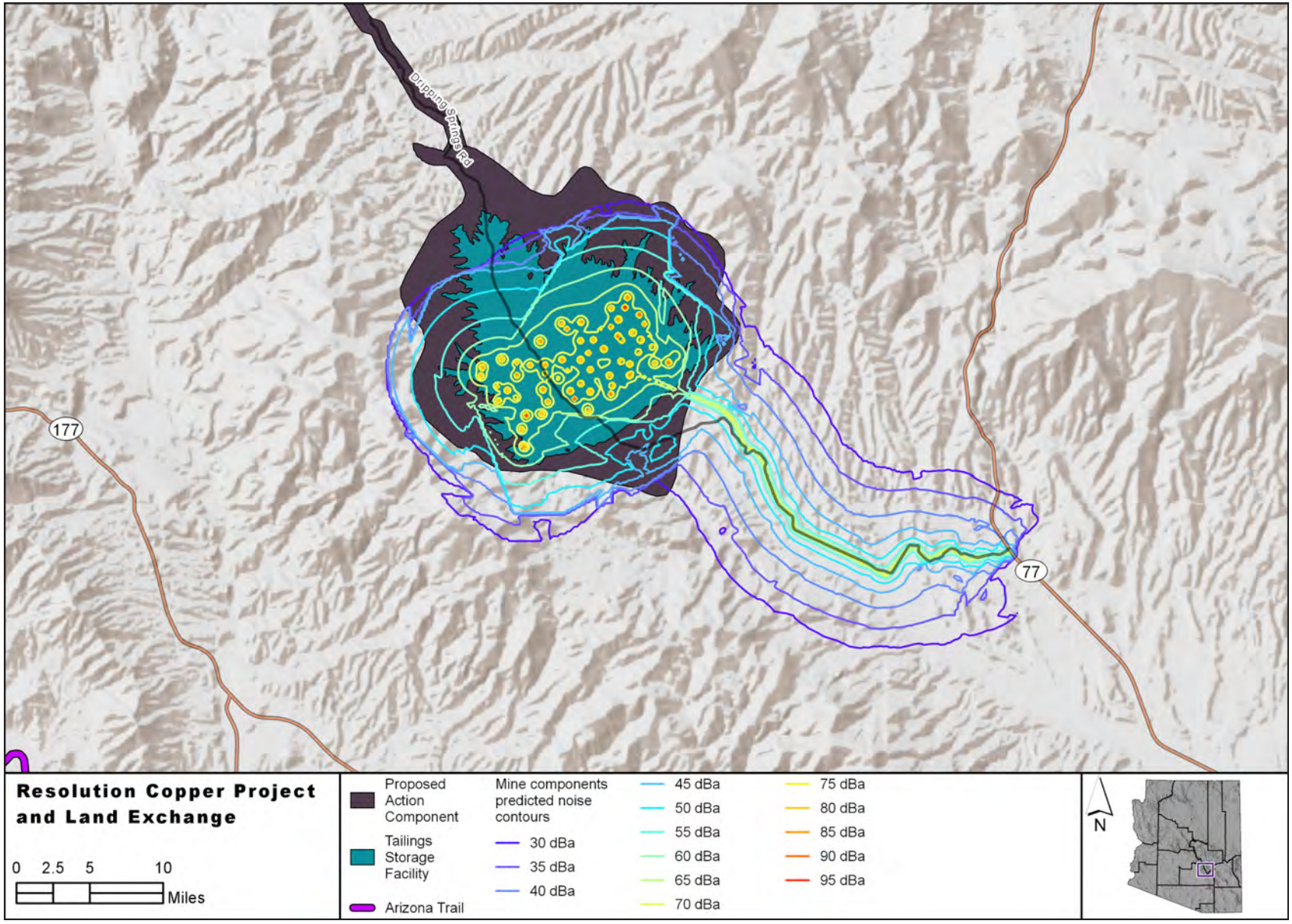

Figure 3.4.4-6. Predicted noise contours associated with operations, Alternative 6

activities onto the Tonto National Forest and extend the life of the mine to 2039. EIS impact analysis is pending; however, continued mine operations associated with the expansion over the next 20 years would contribute to equivalent or possibly increased noise and vibration levels perceptible to nearby residences and/or recreational users of adjacent lands. Because the effects of noise and vibration at the mine property would be relatively limited geographically and quickly attenuate with distance, analysis of those effects as a cumulative effect is not considered necessary. However, noise and vibrations from increased haul truck traffic could contribute to cumulative effects for residences and along major roadways.

- *Silver Bar Mining Regional Landfill and Cottonwood Canyon Road*. AK Mineral Mountain, LLC, NL Mineral Mountain, LLC, POG Mineral Mountain, LLC, SMT Mineral Mountain, LLC, and Welch Mineral Mountain, LLC are proposing to build a municipal solid waste landfill on private property surrounded by BLM land (Middle Gila Canyons area). Site access would require crossing BLM land. The owners/developers and Pinal County have applied for a BLM right-of-way grant and Temporary Use Permit for two temporary construction sites to obtain legal access to the private property and authorization of the needed roadway improvements. The proposed action includes improving a portion of the existing Cottonwood Canyon Road and a portion of the existing Sandman Road in order to accommodate two-way heavy truck traffic to and from the proposed landfill. Traffic generated by the planned landfill would significantly increase the overall annual daily traffic on Cottonwood Canyon Road. Average annual daily traffic would increase by approximately 367 percent (303 percent during winter months and 549 percent in summer). Traffic generated by the landfill would primarily consist of tractor/trailer vehicles with a gross weight of over 80,000 pounds. Mineral Mountain Road and Price Road are likely to be impacted by displaced traffic due to temporary closures and disruption of access on Cottonwood Canyon Road. Noise impacts would be expected to increase notably on local roads due to increased traffic, with minor impacts from vibration.
- *Ray Land Exchange and Proposed Plan Amendment*. ASARCO is also seeking to complete a land exchange with the BLM by which the mining company would gain title to approximately 10,976 acres of public lands and federally owned mineral estate located near ASARCO's Ray Mine in exchange for transferring to the BLM approximately 7,304 acres of private lands, primarily in northwestern Arizona. It is known that at some point ASARCO wishes to develop a copper mining operation in the "Copper Butte" area west of the Ray Mine. Under the proposed action, noise and vibration impacts on the selected lands would be expected to increase with the development of new mining activity. No specific noise or vibration impacts are anticipated in association with the offered lands, as they would have come under the administration of the BLM, and thus be subject to respective resource management plan strategies.
- *ADOT Vegetation Treatment*. ADOT plans to conduct annual treatments using EPA-approved herbicides to contain, control, or eradicate noxious, invasive, and native plant species that pose safety hazards or threaten native plant communities on road easements and NFS lands up to 200 feet beyond road easement on the Tonto National Forest. It can be reasonably assumed that ADOT would continue to conduct vegetation treatments along U.S. 60 on the Tonto National Forest during the expected life of the Resolution Copper Mine (50–55 years) for safety reasons. The vegetation treatment may result in short-term noise impacts along roadways but generally would be minimal and not cumulative with Resolution Copper Project impacts.

Other unplanned large-scale mine developments in the area are likely to occur during the foreseeable life of the Resolution Copper Mine (50–55 years). Large-scale mining would affect the ambient noise and vibration conditions perceived by sensitive receptors during both the short-term exploration phases and the longer term operational phases. The Tonto Nation Forest's Travel Management Plan would alter localized traffic

noise slightly, as the plan would include rerouting various NFS roads, which could contribute to cumulative noise impacts. Additionally, construction of other planned and unplanned projects such as pipelines and/or transmission lines could also contribute to noise and vibration, but impacts would be short term and occur only during construction or maintenance.

3.4.4.8 Mitigation Effectiveness

The Forest Service is in the process of developing a robust mitigation plan to avoid, minimize, rectify, reduce, or compensate for resource impacts that have been identified during the process of preparing this EIS. Appendix J contains descriptions of mitigation concepts being considered and known to be effective, as of publication of the DEIS. Appendix J also contains descriptions of monitoring that would be needed to identify potential impacts and mitigation effectiveness. As noted in chapter 2 (section 2.3), the full suite of mitigation would be contained in the FEIS, required by the ROD, and ultimately included in the final GPO approved by the Forest Service. Public comment on the EIS, and in particular appendix J, will inform the final suite of mitigations.

This section contains an assessment of the effectiveness of design features from the GPO and mitigation and monitoring measures found in appendix J that are applicable to noise and vibration.

Mitigation Measures Applicable to Noise and Vibration

Alternate road access to Skunk Camp tailings storage facility (RC-218): Resolution Copper proposes to construct an alternate access route to the Skunk Camp tailings storage facility to reduce noise at residences along Dripping Springs Road. This action seeks to mitigate impacts related to noise, dust, and traffic and is relevant only to Alternative 6. If implemented, the measure would be required by the Forest Service in the final ROD and final mining plan of operations. Several possible routes are considered. A southern route would bypass residences along Dripping Springs Road. This could be used for the life of operations but may be most beneficial during the initial construction period of the embankment. A northern route would provide access from SR 77 to the northern portion of the tailings storage facility area and completely bypass Dripping Springs Road.

Mitigation Effectiveness and Impacts

Of all expected operational noise impacts, the most substantial impact identified in the analysis was on residences or recreational users along Dripping Springs Road; these impacts would be caused by mine traffic. Rerouting of traffic off this road would be effective at eliminating this noise impact. The construction of the southern alternate access route would potentially require 364 acres of additional ground disturbance based on 1,000 feet of right-of-way for construction and would be 3.1 miles long. The construction of the northern alternate access route would potentially require 1,391 acres of additional ground disturbance based on 1,000 feet of right-of-way for construction and would be 11.9 miles long.

Unavoidable Adverse Impacts

No impacts above selected thresholds were identified from construction blasting noise and vibration (provided explosive loading is appropriately limited), from construction non-blasting noise (beyond 1,000 feet from active equipment), or from operational vibrations (beyond 50 feet from active equipment).

For operational noise, with the exception of Dripping Springs Road, the only impacts identified above selected thresholds were associated with the maximum range of impacts, which is an infrequent and unlikely scenario that suggests that all equipment is running simultaneously and during the quietest period (i.e., lowest background levels observed). Under most conditions, the analysis indicates that no impacts would be expected from project noise.

Application of the mitigation of rerouting traffic from Dripping Springs Road would eliminate those operational noise impacts as well.

After mitigation, no unavoidable adverse impacts are anticipated from noise or vibration.

3.4.4.9 Other Required Disclosures

Short-Term Uses and Long-Term Productivity

Noise and vibration levels did not rise beyond threshold of concern under most conditions, but the noise and vibration associated with the surrounding environment from mining and associated activities would be short term (during the estimated 51- to 56-year life of the mine, including construction, operations, and reclamation) and are expected to end with mine reclamation.

Irreversible and Irretrievable Commitment of Resources

Irretrievable commitment of resources would consist of mine-related noise during the construction, mining, closure, and reclamation phases of the mine. Because the mine-related noise would cease after closure of the mine, noise impacts would not be considered an irreversible commitment of resources.