4.2.8 Noise and Vibration

This section addresses baseline noise and vibration conditions at the Mine Site and Plant Site, including a brief introduction to noise concepts and terms.

Noise is generally defined as unwanted sound. Sound travels in a mechanical wave motion and produces a sound pressure level. This sound pressure level, also referred to as loudness or intensity, is measured in decibels (dB). The dB scale is logarithmic such that each 10 dB increase represents a tenfold increase in noise intensity. For example, if sound energy is doubled, there is a 3 dB~~A~~ increase in noise because the two sound levels are added logarithmically, not linearly or arithmetically (e.g., 70 dB~~A~~ plus 70 dB~~A~~ equals 73 dB~~A~~, not 140 dB~~A~~). Sound measurement is further refined by using an A-weighted scale that emphasizes the range between 1,000 and 8,000 cycles per second, which is the range of sound frequencies most audible to the human ear. Unless otherwise noted, all dB measurements presented in this SDEIS are A-weighted (dBA) on a logarithmic scale. This measurement is an expression of the relative loudness of sounds in air as perceived by the human ear. In the A-weighted scale, the dB values of sounds at low frequencies are reduced compared with unweighted dB, in which no correction is made for audio frequency. This correction is made because the human ear is less sensitive at low audio frequencies, especially below 1,000 hertz (Hz), than at high audio frequencies. A sound increase of 3 dBA is barely perceptible to the human ear, while a 5 dBA increase is clearly noticeable and a 10 dBA increase is heard as twice as loud (MPCA 2008, Bies and Hansen 2009, IDOT 2011). ~~For example, if sound energy is doubled, there is a 3 dBA increase in noise because the two sound levels are added logarithmically, not linearly or arithmetically (e.g., 70 dBA plus 70 dBA equals 73 dBA, not 140 dBA). If noise increases to where there is 10 times the sound energy level over a reference level, then there is a 10 dBA increase and it is heard twice as loud. The threshold of perception for the human ear is a 3 dBA increase in dB level from baseline levels (MPCA 2008).~~

Noise emissions diminish or attenuate with distance from the source depending on the nature of the source. When distance from a point source, such as a building, is doubled, the sound level decreases by 6 dB. However, when distance from a line source, such as a busy roadway, is doubled, the sound level decreases by 3 dB (MPCA 2008).

The dB levels of common noise sources are shown in Table 4.2.8-1.

Table 4.2.8-1 Decibel Levels of Common Noise Sources

Common Noise Source	dB Levels
Jet Engine (at 25 meters)	140
Jet Aircraft (at 100 meters)	130
Rock Concert	120
Pneumatic Chipper	110
Jackhammer (at 1 meter)	100
Chainsaw, Lawn Mower (at 1 meter)	90
Heavy Truck Traffic	80
Business Office, Vacuum Cleaner	70
Conversational Speech, typical TV Volume	60
Library	50
Bedroom	40
Secluded Woods	30
Whisper	20

Source: MPCA 2008.

A comparison of typical outdoor noise levels by land use category for daytime and nighttime is shown in Table 4.2.8-2.

Table 4.2.8-2 Typical Outdoor Sound Levels by Land Use Category

Land Use Category	L_{dn} (dBA)	L_d (dBA)	L_n (dBA)
Rural and sparsely populated areas	35 - 50	35 - 50	25 - 40
Quiet suburban (630 people/mi^2, remote from large cities and from industrial activity and trucking)	50	50	40
Normal suburban community (2,000 people/mi^2 not located near industrial activity)	55	55	45
Urban residential community (6,300 people/mi^2 not immediately adjacent to heavily traveled roads and industrial areas	60	59	52
Noisy urban residential community (near relatively busy road or industry or 20,000 people/mi^2)	65	62	58
Very noisy urban residential community (63,000 people/mi^2)	70	67	63

Source: USEPA 1974.

L_{dn}, or day-night sound level, is the average equivalent A-weighted sound level during a 24-hour time period with a 10-dB weighting applied to equivalent sound level during the nighttime hours of 10 p.m. to 7 a.m.
L_d, or daytime L_{eq}, is the average equivalent sound level for daytime (7 a.m. to 10 p.m.).
L_n, or nighttime L_{eq}, is the average equivalent sound level for nighttime (10 p.m. to 7 a.m.).
L_d and L_n values were determined from the L_{dn} values using methods described in the 1974 USEPA document referenced above (based on data from 63 sets of background measurements conducted at various land-use areas across the United States).

Vibration is defined as regularly repeated movement of a physical object about a fixed point. Blasting is an activity associated with mining that could result in vibration. There are two types of vibration associated with mine blasting: ground vibration and air vibration or airblast overpressure. The magnitude of ground vibration is expressed in terms of peak particle velocity (PPV) and is measured in inches per second (in/s) or millimeters per second (mm/s). Airblast overpressure is measured in linear-weighted decibels (dBL).

4.2.8.1 Regional Setting

Noise exposure goals for various types of land use reflect the varying noise sensitivities associated with each of these uses. Residences, hospitals, and guest lodging are most sensitive to noise intrusion and therefore have more stringent noise exposure targets than industrial or commercial uses that are not subject to effects such as sleep disturbance. The land use in the Superior National Forest is mostly for forest. The region surrounding the Mine Site has traditionally supported various mining activities, as well as logging, on federal, state, county, and private forest lands. Noise sources associated with logging activities include skidders, feller bunchers, and log loaders. Noise sources associated with mining activities include drills, explosives, dump trucks, excavators, crushers, and power generators. Considering the attenuation effect of the surrounding forest and the fact that most of the mining and logging activities typically occur several thousand feet away from each other, the noise levels are localized (rather than regional) and diminish very quickly with distance due to geometric divergence or spreading losses. In addition to the spreading losses, dense vegetation (foliage) in the Superior National Forest also helps to attenuate noise from the mining and logging activities.

4.2.8.2 Mine Site

The Mine Site is situated mostly on federal land in the Superior National Forest, except for the privately owned land bordering Dunka Road to the south of the Mine Site. As indicated above, the region surrounding the Mine Site has traditionally supported various mining activities, as well as logging, on federal, state, county, and private forest lands. The Northshore Mine and Mesabi Nugget Phase I Plant ~~is~~ are located approximately 2 miles north and 8 miles west of the Mine Site, respectively. Dunka Road, which provides access to the Mine Site, is an existing private road located south of the Mine Site, with no public access and little usage. The existing LTVSMC railroad grade is also located south of the Mine Site.

Review of the most up-to-date aerial maps indicates that there are no noise-sensitive areas or receptors (e.g., residences, campgrounds, schools, churches, or wilderness areas) within the Mine Site and surrounding federal lands. However, there are a few receptors outside the Mine Site. The closest noise-sensitive receptor to the Mine Site is the City of Babbitt, located approximately 6 miles to the north. Survey data identified a Boy Scout camp located 5 miles from the Mine Site, but the clerk's office of the City of Hoyt Lakes indicated that the only Boy Scout camp near the Mine Site is located on Colby Lake, approximately 10 miles southwest of the Mine Site. Other noise-sensitive receptors in the general area of the Mine Site include: Skibo (a small residential area), approximately 8 miles to the south; the City of Hoyt Lakes, approximately 9 miles to the southwest; and the City of Aurora, approximately 13 miles to the south. The BWCAW is part of the national wilderness preservation system where sensitivity to human-caused sound and noise effects are important considerations. It is approximately 20 miles (in a northeasterly direction) from the Mine Site to the closest portion of the BWCAW. The cities of Ely and Tower are also located close to the BWCAW and are approximately 21 miles north-northeast and 19 miles northwest of the Mine Site, respectively. The Bois Forte Reservation is located near Tower. In addition to the receptors identified above, other receptors such as recreational sites (family campgrounds, campsites, boating, fishing, swimming, and family picnic areas), wildlife corridors, trails, and State wild rice waters/beds (used by tribal members for harvesting) are also within the Mine Site vicinity. The closest recreational site is a family picnic area located approximately 9 miles south of the Mine Site (near Skibo). The closest

wildlife corridor and trail (Stony Spur Snowmobile Trail) are located approximately 1 mile northwest and 6 miles northeast and of the Mine Site, respectively. The closest State wild rice waters/beds are located approximately 5.5 miles north (Mud Lake) and 7 miles northeast (Birch Lake) of the Mine Site. Figure 4.2.8-1 shows the locations of the closest receptors to the Mine Site[1].

Since the Mine Site is located in a rural and sparsely populated environment, the existing ambient steady L_{eq} for all nearby sensitive receptors (except the BWCAW)~~, such as residential houses~~, are expected to range from 35 to 50 dBA or approximately 45 dBA (daytime) and 25 to 40 dBA or approximately 35 dBA (nighttime) (Table 4.2.8-2 and 4.2.8-3). The ambient L_{eq} assumed for receptors outside the Mine Site area account for existing noise from the Northshore Mine located approximately 2 miles north of the Mine Site. Since the BWCAW is located in a pristine and quiet rural environment, the existing ambient L_{eq} at the BWCAW area is expected to be ~~has been assumed to be 5 dB~~ lower than the levels for other receptors surrounding the Mine Site area. In February 2011, the US Forest Service Superior National Forest unit conducted an ambient sound level survey at Little Gabbro Lake in the western part of the BWCAW (ambient data provided by US Forest Service staff via email in June 2013). In March 2011, the Superior National Forest unit also conducted an ambient sound level survey at Royal Lake in the eastern part of the BWCAW (USDA 2011). The ambient data at both sites are comparable but the data at Royal Lake is slightly lower. For the purpose of this Project, the Royal Lake ambient data has been used to provide a conservative natural ambient level at BWCAW[2]. ~~This means that daytime and nighttime ambient L_{eq} for the BWCAW are not expected to exceed 40 and 30 dB, respectively~~ (Table 4.2.8-3).

Minnesota's noise standards are based on statistical calculations that quantify noise levels according to duration over a 1-hour monitoring period. The L_{10} is the noise level that is exceeded for 10 percent, or 6 minutes, of the hour, and the L_{50} is the noise level exceeded for 50 percent, or 30 minutes, of the hour. There is not a limit on maximum noise (MPCA 2008). For the purposes of this assessment, the estimated baseline L_{eq} levels for the nearest receptors (except for the BWCAW where measured percentile data were available) were converted to other noise percentile metrics, such as L_{50} and L_{10} using a USEPA calculation methodology (USEPA 1974). The calculation was based on an assumed standard deviation of 3 dB for the sound level statistical distribution. A summary of the estimated existing daytime and nighttime ambient levels (i.e., L_{eq}, L_{50}, and L_{10}) expected at receptors closest to the NorthMet Project area is presented in Table 4.2.8-3. As indicated above, natural ambient levels for the BWCAW were based on measured L_{50} and L_{10} data taken from Royal Lake in the eastern part of the BWCAW (USDA 2011).

[1] Though not depicted on Figure 4.2.8-1 due to sensitivity regarding cultural resources and locations, the federal Co-lead agencies have identified a few archaeological sites in consultation with the State Historic Preservation Office and the Bands. Although barely discernible in some cases, a few well-defined trail segments of the Vermilion to Beaver Bay Trail and two other unnamed trail segments (BBLV Trail Segment #1) represent the trail corridors that cross the Mine Site and Plant Site, as well as the NorthMet Project area (See Section 4.2.9, Cultural Resources).

[2] In addition to the fact that the Royal Lake ambient data are more conservative (i.e., lower than Gabbro Lake data), the US Forest Service staff indicated that the measured ambient data at Gabbro Lake has not been reviewed by the National Park Service but the measured data at Royal Lake has been reviewed and used by the National Park Service soundscape program for some recent work they did to model noise impacts to the BWCAW.

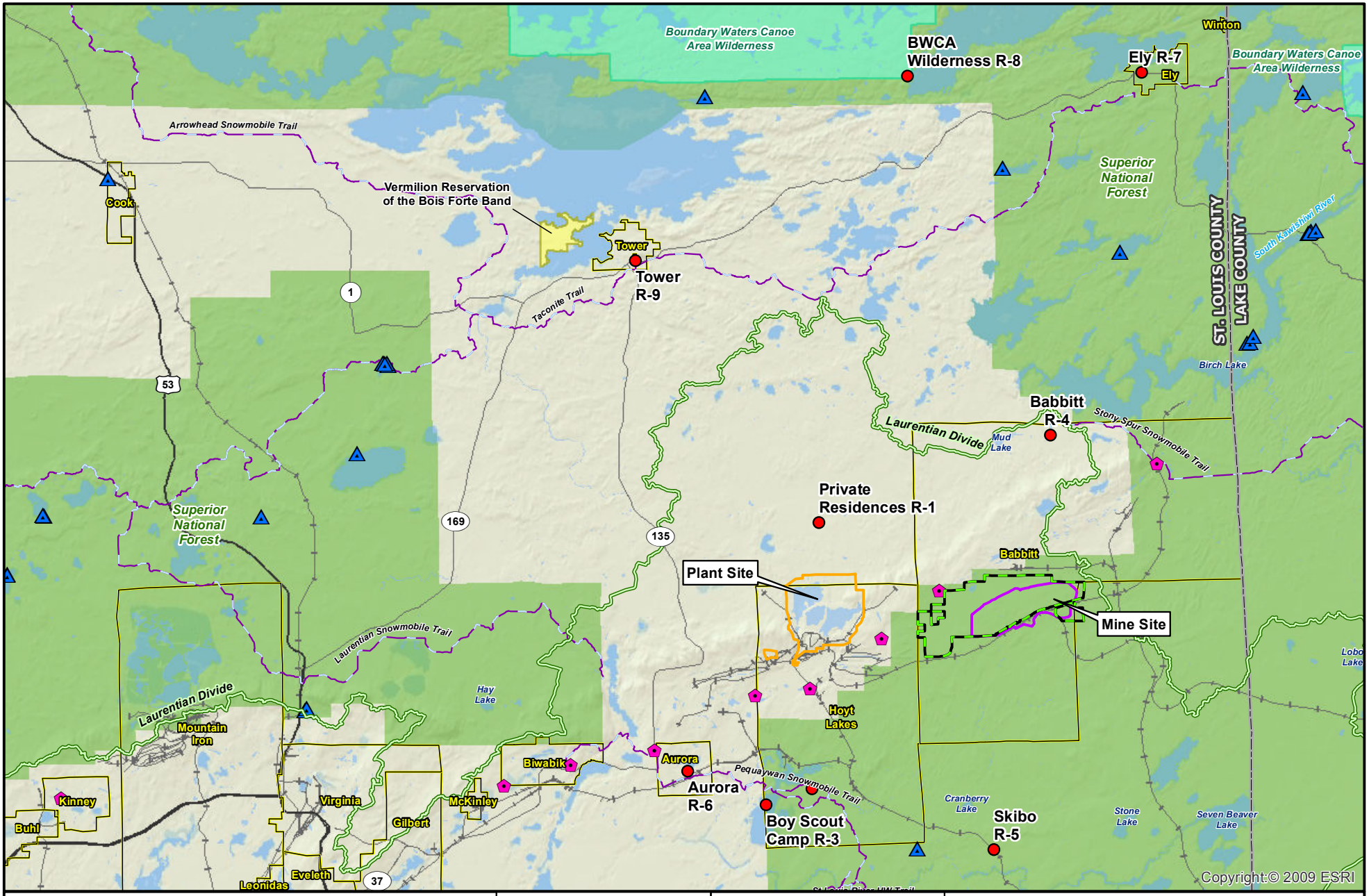

Figure 4.2.8-1
Nearest Noise Sensitive Receptors to the NorthMet Project Area
NorthMet Mining Project and Land Exchange PSDEIS
Minnesota
DRAFT SUBJECT TO REVISION
August 2013

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Table 4.2.8-3 Summary of Estimated Existing Ambient Noise Levels at the Closest Receptors to the NorthMet Project Area, including the BWCAW

Ambient Noise Levels	Daytime (dBA)	Nighttime (dBA)
All Receptors except the BWCAW[1]:		
L_{eq}	45.0	35.0
L_{50}	44.0	34.0
L_{10}	48.8	37.8
BWCAW[2]:		
L_{eq}	~~40.0~~34.0	~~30.0~~34.0
L_{50}	~~39.0~~23.4	~~29.0~~23.4
L_{10}	~~42.8~~33.2	~~32.8~~33.2

[1] Source: USEPA 1974.

[2] Source: USDA 2011.

Currently, no ground- or air-vibrating sources or activities (e.g., mine blasting, piling, etc.) occur at the Mine Site. The closest vibration-generating activity is blasting at the Northshore Mine. Like noise emissions, ground and air vibration effects diminish with distance from the source. Because of the distance from the operating mine, existing baseline levels of vibration at the Mine Site and nearby receptors are expected to be negligible.

4.2.8.3 Plant Site

The Plant Site is situated on private land located 8 miles west of the Mine Site. The closest noise-sensitive receptors to the Plant Site include a few private residences located approximately 3.5 miles north; the City of Hoyt Lakes, located approximately 5 miles south; and the City of Aurora, located approximately 8 miles southwest. A Boy Scout camp, which is only used occasionally, is located approximately 10 miles south-southwest. In addition to the receptors identified above, other receptors such as recreational sites, wildlife corridors, trails, archaeological sites (used by tribal members for cultural and spiritual purposes) and State wild rice waters/beds (used by tribal members for harvesting) are also within the Plant Site vicinity. The closest recreational site is a family picnic area located approximately 9 miles south of the Plant Site (near Skibo). The closest wildlife corridor and trail (Pequaywan Snowmobile Trail) are located approximately 2 miles south and 6 miles southeast of the Plant Site, respectively. The closest State wild rice waters/beds are located approximately 6 miles west (Hay Lake) of the Plant Site. Figure 4.2.8-1 shows the locations of the closest receptors to the Plant Site[3].

Like the Mine Site, the Plant Site is also located in a rural and sparsely populated environment; therefore, the daytime and nighttime ambient levels (i.e., L_{eq}, L_{50}, and L_{10}) for all nearby sensitive

[3] Though not depicted on Figure 4.2.8-1 due to sensitivity regarding cultural resources and locations, the federal Co-lead agencies have identified a few archaeological sites in consultation with the State Historic Preservation Office and the Bands. These archaeological sites include the Spring Mine Lake Sugarbush (a natural maple-basswood stand of cultural significance, less than 1 mile east of the Plant Site) and the Mesabe Widjiu (a long linear landform running the length of the Mesabi Iron Range, and intersecting portions of the Laurentian Divide and northeast of the Plant Site near the Tailings Basin) possess important spiritual and cultural significance to the Ojibwe people. Although barely discernible in some cases, a few well-defined trail segments of the Vermilion to Beaver Bay Trail and two other unnamed trail segments (BBLV Trail Segment #1) represent the trail corridors that cross the Mine Site and Plant Site, as well as the NorthMet Project area (See Section 4.2.9, Cultural Resources).

receptors, such as residential houses, are expected to be similar to the levels shown in Table 4.2.8-3. The closest noise generating sources are the coal and flux pulverizer, rotary hearth furnace, and cooling towers at Mesabi Phase I Plant in Hoyt Lakes, which is approximately 1 mile west-southwest of the Plant Site. The baseline noise levels of the identified receptors near the Plant Site (Table 4.2.8-3) already capture or account for noise from the Mesabi Phase I Plant.

Currently, no ground- or air-vibrating sources or activities (e.g., mine blasting or pile driving) occur at the Plant Site. The closest vibration-generating ~~activity~~sources ~~is~~ are the coal and flux pulverizer and rotary hearth furnace at the Mesabi Phase I Plant in Hoyt Lakes, which is approximately 1 mile west-southwest of the Plant Site. ~~blasting at the Northshore Mine, which is 9 miles northeast of the Plant Site.~~ Since ground and air vibration effects diminish with distance from the source, existing baseline levels of vibration at the Plant Site and the nearest sensitive receptors are expected to be negligible.