

8.0 NOISE

8.1 ENVIRONMENTAL SETTING

8.1.1 Noise Terminology

Noise is defined as unwanted sound and is widely recognized as a form of environmental degradation. The frequency, duration and intensity of noise contribute to the effect on the listener.

8.1.1.1 The Decibel Scale (dB)

Noise is measured on the logarithmic decibel scale (dB), usually with a frequency sensitivity that matches the human ear, called "A-weighting." Thus, most environmental measurements are reported in dBA, meaning decibels on the A-scale. The logarithmic scale means that a sound level reported as 60 dBA has 10 times the sound energy as a sound with a level of 50 dBA; a sound of 63 dBA is twice as loud as a sound of 60 dBA.

Human hearing matches the logarithmic A-weighted scale, so that an increase of 3 dB is usually perceptible, and in a complex noise environment such as along a street, noise must increase by 5 dB to be considered perceptible. Conversation is in the range from 50 to 65 dBA; with levels rising as the distance between speakers increases or as background noise level rises forcing the speakers to raise their voice in order to be heard. Generally, as environmental noise exceeds 50 dBA, it becomes intrusive and above 65 dBA, noise becomes excessive. Table 8-1 lists typical outdoor noise levels.

Table 8-1 Typical Outdoor Noise Levels	
Common noise levels	Noise level (dBA)
Jet flyover at 1,000 feet	105
Gas lawn mower at 3 feet	95
Roadway in commercial area at 50 feet (area of rough pavement)	75-80
Quiet urban daytime	50
Quiet urban nighttime	40
Quiet suburban nighttime	35

Source: Caltrans Technical Analysis Notes, March 1991.

8.1.1.2 Sound Levels

The equivalent noise level, Leq , represents the level of a steady noise having the same sound energy as the time-varying noise measured. Leq (h) represents the time-weighted average for a 60-minute (hourly) period. Leq is useful for evaluating shorter time intervals over the course of a day. Recording a series of Leq values allows the peak noise periods during a time period to be identified and shows increases in intrusive noise sources. Leq intervals can be used to more accurately describe the effects of increased traffic in the project vicinity.

Variable noise is described as the level exceeded for a portion of the time. Thus, the L25 is the level exceeded 25 percent of the time during the sample period and L90 is the level exceeded 90 percent of the time and usually corresponds to the background sound level. Section 16.54.050 (c) of the County Mining Regulations specifies a 60dBA L25 hourly limit (See Section 8.2, below). Construction type equipment such as that used at the Quarry produces a fairly steady sound level so that the L25 is not appreciably different than the Leq or average sound level.

8.1.1.3 Attenuation

As a sound wave travels away from the source, the energy is dissipated in space and absorbed by the environment. The impact of a noise source depends on both how inherently loud the source is and how far away the receptor is from the source. For community noise analysis, the inherent loudness of a source is indicated by giving its sound level measured at a reference distance such as 50 or 100 feet from the source; this allows the level at other distances to be calculated.

Theoretically, the sound level drops by 6 dB with each doubling of distance from a stationary noise source. For a roadway line source, attenuation is 3 dB for distance doubling. Over long distances, there is also a loss of 1 dB for each 1,000 feet due to air adsorption.

In actual experience, sound is often more attenuated because of non-reflective ground, intervening dense vegetation, or topographic and structural barriers. With line-of-sight transmission in open country, attenuation proves to be somewhat greater than theoretical loss due to absorption of soft ground and approaches 9 dB per doubling of distance for point sources and 4.5 dB for line sources.

Terrain has a significant attenuating effect. An earth berm such as a hill or the edge of a terrace close to the source and projecting more than 20 feet past the line-of-sight will add as much as 20 dB loss to the attenuation from free-field distance effects. Vegetation absorbs sound in proportion to its density. A thinly planted screen has little attenuation effect, but a 100-foot deep strip of woodland will adsorb 10 to 20 dB of acoustic energy as the tree trunks cumulatively obscure direct transmission and increase sound loss.

8.1.2 Sensitive Receptors

As a whole the quarry is fairly isolated. Figure 38, Sensitive Receptors, shows adjoining parcels within 2,000 feet of the Boundary Expansion Area; parcels are coded "C" to indicate properties owned by CEMEX and "R" to indicate other properties with residences. The distance between these residences and the project are shown in Table 7-1 (above).

The nearest homes (C3, C4) are located off Smith Grade Road north of the quarry, 950 and 830 feet north of the northern property line and current mining plan boundary and 3,500 feet from the crusher. These properties are owned by CEMEX and rented to quarry employees.

Four other residences within 2,000 feet of the Boundary Expansion Area are identified on the proposed mining plan and shown in Figure 38. These residences are northeast and east of the current mining plan boundary.

8.1.3 Ambient Noise Levels and Existing Operations

In 2003 and 2006, TRA measured noise levels in project vicinity to confirm the noise analysis in the prior EIR and to corroborate the annual noise monitoring conducted for CEMEX permit compliance. Noise from the current operation at the Limestone Quarry for drilling and blasting, loading and hauling, crushing and conveying activities is part of the baseline condition.

8.1.3.1 Monitoring Results

Annual noise monitoring is conducted by Consultants in Engineering Acoustics (CIEA) since 1997 for CEMEX and submitted to the County of Santa Cruz in the Quarry's annual report. CIEA reported ambient noise levels at the quarry rim when quarry is inoperative as typically 37 or 38 dBA, increasing to the range of 50 to 54 dBA when quarry operations commence. CIEA measured individual pieces of equipment and show a consistent noise source (See Table 8-2).

In 1993, 2003, and 2006, TRA measured background noise levels in the project vicinity as very low, typical of a low-density rural setting. In calm weather, ambient noise is below 35 dBA, with wind in the trees, ambient rises to 45 dBA. Noise from human sources includes light vehicular traffic on Bonny Doon and Smith Grade Roads, the Bonny Doon Quarries, and occasional aircraft overflights.

Equipment Type	Dec 2000	Dec 2001	March 2003	March 2004	March 2005
Bulldozer	81.0 dBA	82.0 dBA	Not Measured	Not in Use	Not Measured
Front-end loader	76.7 dBA	80.0 dBA	79.9 dBA	83.3 dBA	83.1 dBA
Hole driller	88.0* dBA	81.9 dBA	69.2-78.9**	87.6 dBA	Not in Use
Rock breaker	Not in use	In repair	89.5 dBA	92.5 dBA	92.1 dBA
CAT Haul truck#1	83.0 dBA	78.3 dBA	78.9 dBA	85-55 dBA	85.5 dBA
Hitachi shovel	85.2 dBA	83.9 dBA	85.0 dBA	Not in Use	86.1 dBA
CAT Haul truck#2	Not present	Not present	Not present	Not present	84.5 dBA
Volvo Haul truck#3	Not present	Not present	Not present	Not present	78.4 dBA

* Noise level 50 feet from two drillers operating concurrently. Estimated level from single driller at 50 feet = 85.0 dBA.

** This drill (DM43E) was not in operation last year; the older drill was. The higher noise level was measured on the radiator fan side of the drill system; the lower noise level was on its exhaust side.

Source: Consultants in Engineering Acoustics, 2000 through 2005

8.1.3.2 Excavation

Use permit conditions limit quarry operations to the hours between 7:30 am and 5:00 pm, Monday through Friday. Heavy equipment usually ceases operation at about 3:30 pm each day. The Limestone Quarry is in operation 5 days per week, year round. The Shale Quarry is in operation typically two or three days per week on an as-needed basis. Haul trucks do not travel on public roads.

The major noise sources are the diesel powered heavy equipment used to move overburden and harvest rock. Operating equipment includes two bulldozers (Caterpillar, Model D10), wheeled loaders (Caterpillar Model 988F), several 50-ton trucks (Caterpillar Model 773), two hydraulic drills and a pneumatic rock breaker that operate on the quarry benches in the

northern portion of the quarry, and several other pieces of equipment. The crusher and conveyor system are in the southern portion of the quarry.

Typical diesel engines used on D10 bulldozers and in equipment of similar power ratings (400 to 700 bhp) have a sound level of 81 to 85 dBA at 50 feet. Much of the sound comes from the engine fan and exhaust. Mechanical noise from metal-on-metal contact from cat-tracked equipment puts a source at the high end of the scale. A warning back-up beeper is intermittent but adds 3 dB to momentary sound levels and significantly contributes to the audibility of the equipment at a distance. Sound level varies only slightly with load, dropping 5 dB for idling and peaking 4 dB for impact noise and the beeper. The L25 of typical quarry equipment is 82 dBA at 50 feet.

Special equipment is needed to drill holes for blasting and to break rocks too large for the crusher. The drill is similar in noise potential to the conventional heavy equipment. The rock breaker is a pneumatic tool, basically a large jackhammer, mounted on an extensible back hoe type arm. The impact frequency is around one blow per second. The engine and compressor noise are constant at around 82 dBA at 50 feet. The impacts of the breaker are frequent enough to contribute significant acoustical energy so that the L25 is around 95 dBA at 50 feet.

The crusher is a diffuse source producing an ambient sound level of 80 to 85 dBA in the immediate vicinity, with an effective noise strength of 85 dBA at 50 feet, roughly equivalent to a bulldozer. The conveyor line is usually an insignificant noise source, less than 60 dBA at 50 feet with an occasional louder noise from a bad roller bearing.

8.1.3.3 Blasting

Blasting is a special case, not readily analyzed in the context of the Mining Regulations noise limitation. None of the sound sources associated with blasting last as long as 15 minutes in the hour. Blasting operations consist of a single blast two days per week scheduled at 11:30 a.m. or 3:30 p.m. Prior to detonation of the explosives; the two nearest neighbors are called. At 15 minutes and then 5 minutes before detonation, the warning siren above the crusher sounds two or three times. The warning siren sounds for 9 seconds and has a source strength of 105 dBA at 100 feet. This produces a level of 84 dBA at the northern property line and is audible well off-site. This high sound level is needed for safety to alert the work area and must be audible to workers with heavy equipment who may be in high noise environments.

The explosion itself is only of about 0.25 second duration. The three or four tons of explosive produce an intense, low frequency ground shock with only minor airborne sound energy. The A-weighted measurements referenced in the Mining Regulations do not apply to explosions because they are a short impulse source and contain predominantly low-frequency noise too low to hear. The audible noise varies from blast-to-blast with some louder and less muffled by the depth of the charges and the pit faces. At a distance of 1,000 feet the sound of a blast is similar to the sound of a single handclap across a room.

8.1.3.4 Sound Levels Off-site

Under current operations, sensitive receptors are not significantly affected by quarry operations. According to annual monitoring, noise levels at the Limestone Quarry north property

line near the east end of the mining limit show an Leq of less than 50 dBA (CIEA, 2003). The ambient noise level at the eastern property line toward residence R4 is 34 to 38 dBA when the Quarry is operating (CIEA, 1999).

The nearest residents' exposure to noise from the Limestone Quarry varies as drilling blasting and loading operations move within the quarry. Measured noise levels at the nearest receptors (CEMEX residences) are less than 50 dBA. Measured noise levels at the property line near residence R3 are 36 dBA. Equipment is audible and residents on Smith Grade Road may be disturbed by the sound of mechanical equipment that detracts from the rural atmosphere. The actual sound level is not excessive and is within normally acceptable levels for this land use.

Sound levels around the quarry depend on the degree of line-of-sight exposure and the distance from the noise sources. Any location where the heavy equipment can be seen would have close to free-field attenuation of 6 dB per distance doubling, thus, theoretically, any heavy equipment source closer than 500 feet with line-of-sight noise transmission would likely exceed the 16.54.050 Mining Regulation standard of 60 dBA L25 level. Because the upper benches are within 25 feet of the property line, the potential to exceed the Mining Regulation requirement is unavoidable for equipment operating at grade or near the property line.

The residential receptors are set back from the quarry and have no line-of-sight noise transmission. There is additional attenuation from the greater distance, the terrain and the dense intervening redwood and foothill oak woodland. When the wind is calm, the noise from the Quarry is audible as a low rumble with the sound of the rock breaker and the back-up beeper the only distinct, recognizable sounds. Field measurements at residence C1 in 1993 showed a background noise (L90) of 36 dBA and a L25 of 40 dBA. Clearly, Quarry operations did not result in significant noise levels there. A second neighboring site was monitored, at a clearing in a redwood grove, representing the closest location where it would be topographically practical to build a residence. The Quarry was visible through the trees, but the majority of the Quarry activities were below the rim of the quarry bowl. The L25 value at this location ranged from 48.0 to 50.5, with the overburden equipment contributing to the higher values. The receptors further east, closer to the Boundary Expansion Area have lower noise levels.

8.2 REGULATORY SETTING

The Quarry is regulated through GP/LCP policies, Mining Regulation, Use Permit conditions, and COC Conditions of Approval. See County Plans and Policies, Section 3.0 for a complete listing of regulations applicable to the project.

Mining Regulation 16.54.050 (c) specifies the following noise standard:

(1) Noise and Vibration. All facilities and equipment shall be constructed, maintained and operated in compliance with the Industrial Performance Standards of Section 13.10.445 and County General Plan Section 3.6.1. Maximum noise level measured at property boundaries shall be no greater than 60 dBA for a cumulative period of 15 minutes during any hour of operation. A lower noise level may be required by the Planning Commission if a health or safety effect or nuisance related to noise level is demonstrated. A higher noise level may be authorized by the Planning Commission if the increase in noise level is from construction related activity, the noise is generated only on a specified temporary basis and all neighbors, within 1,000 feet of the property, have been notified in writing of the increase in noise level by the operator.

GP/LCP Policy 6.9.1 on Land Use Compatibility Guidelines is a guide to potential significance of off-site impact.

Require new development to conform with the Land Use Compatibility Guidelines (Figure 6-1). All new residential and noise sensitive land developments should conform to a noise exposure standard of 60dB Ldn (day/night average noise level) for outdoor use and 45dB Ldn for indoor use. New development of land, which cannot be made to conform to this standard, shall not be permitted. Assure a compatible noise environment for various land uses through site planning, building orientation and design, interior layout, and physical barriers, landscaping, and buffer areas where appropriate.

8.3 PROJECT IMPACTS

8.3.1 Thresholds of Significance

According to Appendix G of the CEQA Guidelines, a project will normally have a significant effect on the environment if it will result in:

- Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies. Section 16.54.050 (c) of the County Mining Regulations (60 dBA for a cumulative period of 15 minutes during any hour of operation i.e. L25) and General Plan Policy 6.9.1 Land Use Compatibility Guidelines (60 dB Ldn) serve as the principal standards of significance.
- Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels;
- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;
- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;

8.3.2 Site Preparation

Vegetation clearing and overburden removal in the Boundary Expansion Area prior to the start of mining would commence at grade, level with adjoining properties and thus would not have acoustic shielding by the quarry rim for at least several months during the two-year site preparation period. Noise from this preparation stage would be comparable to routine earthmoving for construction and would be audible at distances of 1,000 feet.

Receptor parcels C3 and C5 are located along the northern quarry property boundary. Noise levels on the portion of these parcels immediately adjoining the Boundary Expansion Area would routinely exceed 75 dBA during site preparation activities. This is above the 60 dBA L25 standard set forth in Mining Regulation 16.54.050(d).

As overburden is removed, the heavy equipment activity would gradually drop below the newly forming rim of the quarry and noise levels at the property line would fall. Once overburden removal is complete and the upper bench of the expanded quarry pit is established, the noise level of the mining operation would again comply with 60 dBA standard at the property line.

The residences closest to the Boundary Expansion Area are owned by CEMEX (C3 and C4) and are located 900 and 980 feet from the Boundary Expansion Area. As explained in Section 8.1.1.3, Attenuation, sound from a point source traveling across heavily vegetated terrain is reduced by 9 dB with each doubling of the distance to the source. Due to their distance from the quarry, quarry noise at these residences would be reduced by at least 30 dB and sound levels would be below 60 dBA during daytime working hours.

The closest residences not owned by CEMEX (R3 and R4) are located roughly 1,300 feet east of the Boundary Expansion Area (see Table 7-1). Noise levels from site preparation would be in the range of 40 to 55 dBA at these parcels. Site preparation noise at all residences is consistent with the 60 dBA Mining Regulation standard and also consistent with GP/LCP Policy 6.9.1 which requires noise sensitive land developments (occupied by sensitive receptors) to conform to a noise exposure standard of 60 dB Ldn (day/night average noise level) for outdoor noise.

8.3.3 Expanded Quarry Operations

The Boundary Expansion Area would move actual mining operations 400 feet east to its Legal Mining Limit. This allows the existing pit to expand in a northeastward direction. Drilling, blasting and loading operations could significantly increase noise levels at the Quarry's northern and eastern boundaries. As the limestone pit is developed, the working face would become steeper, operations would move downward, and the rim would provide greater shielding.

Quarry operations and site preparation noise sources comprise individual pieces of heavy equipment producing from 81 to 94 dBA at a reference distance of 50 feet. Taken as a whole, the operations act as a diffuse area source generating an effective source strength of 61 dBA average (Leq) at locations around the edge of the quarry property with line-of-sight noise transmission.

Because the quarry forms benches below steep slopes, the operation is blocked from line-of-sight noise transmission with the quarry rim acting as an effective noise barrier. Field measurements show the typical attenuation reduces quarry operations noise to the 40 to 45 dBA Leq range at points 200 feet back from the rim.

Following site preparation and the establishment of the upper bench, the quarry would continue to operate the same type of excavation equipment in the Boundary Expansion Area. Annual noise monitoring of quarry operations have been conducted with most equipment operating on the western and northern benches so that levels measured at the northern property line consistently fall below 60 dBA L25, in compliance with the Mining Regulation regulations.

The final elevation at the expanded mining perimeter is 1,150 feet. The property itself continues east increasing in elevation and forming several ridgeline knolls near the property line at elevation 1,250 feet. The nearest residences to the east of the quarry property are situated behind these knolls, roughly 1,300 feet away.

Moving mining operations 400 feet to the east would not bring noise sources closer to the northern residences (C3, C4) than currently permitted and there would be no appreciable increase in noise level.

The four easterly residences (R1-R4) are now 1,650 to 1,900 feet from active mining; the project would reduce that distance by 300 to 400 feet or roughly 20 percent of the present distance. Theoretically, the decrease in sound attenuation due to reducing distance by 20 percent is 2 to 3 dB; this level of increase is not usually considered significant. Because of the distance and shielding effect of the quarry configuration, these four easterly residences would not be significantly affected by noise from expanded quarry operations.

With the expansion project, the Quarry would continue mining both the Shale and Limestone Quarries at their current rates; there would be no change in equipment or intensification of operations. Mining the 17.1-acre Boundary Expansion Area would add approximately three years of additional life to the quarry operation, effectively in the time frame from 2012 to 2015. Although this extends the ongoing impact of the Quarry, monitoring has shown that the current operation meets Mining Regulation noise standards and the noise impact of extending the Quarry operating life is less than significant.

CEMEX implements several noise control measures in accordance with the COC Conditions of Approval (see Appendix B, COC Conditions III.H.1 through III.H.3). These measures include locating the rock breaker more than two levels below the quarry rim, maintaining vehicles and equipment in proper order, and notifying nearby neighbors prior to blasting. These conditions would be applied to the mining operations in the Boundary Expansion Area through project amendment of the COC.

8.3.4 1996 Reclamation Plan Amendment

The proposed amendment to the 1996 Reclamation Plan would modify the target vegetation communities, but not the techniques used to provide final revegetation. The difference in noise impacts would be less than significant.

8.3.5 Cumulative Impact

There is no significant cumulative noise impact. The noise produced by site preparation would be superimposed on the noise from the ongoing Quarry operation. The excavation equipment acts as point sources operating in a broad area. The sound level perceived at a source is determined mainly by the sound of the loudest, and in this case, the closest equipment. The impacts of site preparation would dominate the immediate surroundings and the additional noise from ongoing quarry operation would not be appreciable.

Noise from operation of the Expanded Mining Area would not add to noise from increased traffic, construction, or habitation that would result from foreseeable development in the Bonny Doon planning area.

8.4 MITIGATION MEASURES

None required.