Chapter 14

Noise

Chapter 14
Noise

Affected Environment

Introduction

Background information on environmental acoustics and state and federal noise regulations is provided in Appendix C. The following are brief definitions of acoustical terminology used in this chapter:

- **Sound.** A vibratory disturbance created by a vibrating object, which, when transmitted by pressure waves through a medium such as air, is capable of being detected by a receiving mechanism, such as the human ear or a microphone.
- **Noise.** Sound that is loud, unpleasant, unexpected, or otherwise undesirable.
- **Decibel (dB).** A unitless measure of sound on a logarithmic scale, which indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micro-Pascals.
- **A-Weighted Decibel (dBA).** An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.
- **Maximum Sound Level (L_{max}).** The maximum sound level measured during the measurement period.
- **Minimum Sound Level (L_{min}).** The minimum sound level measured during the measurement period.
- **Equivalent Sound Level (L_{eq}).** The equivalent steady state sound level, which in a stated period of time would contain the same acoustical energy.
- **Percentile-Exceeded Sound Level (L_{xx}).** The sound level exceeded "x" percent of a specific time period. L_{10} is the sound level exceeded 10 percent of the time.
- **Day-Night Level (L_{dn}).** The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.
- **Community Noise Equivalent Level (CNEL).** The energy average of the A-weighted sound levels occurring during a 24-hour period with 5 dB added

to the A-weighted sound levels occurring during the period from 7:00 p.m. to 10:00 p.m. and 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.

L_{dn} and CNEL values rarely differ by more than 1 dB. As a matter of practice, L_{dn} and CNEL values are considered to be equivalent and are treated as such in this assessment. In general, human sound perception is such that a change in sound level of 3 dB is just noticeable, a change of 5 dB is clearly noticeable, and a change of 10 dB is perceived as doubling or halving the sound level.

Pile Driving

Pile driving would likely be required as part of the intake facility construction. Pile driving creates seismic waves that radiate along the surface of the earth and downward into the earth. These surface waves can be felt as ground vibration. Pile driving can result in effects ranging from annoyance of people to damage of structures. Varying geology and distance will result in different vibration levels containing different frequencies and displacements. In all cases, vibration amplitudes will decrease with increasing distance.

As seismic waves travel outward from pile driving, they excite the particles of rock and soil through which they pass and cause them to oscillate. The actual distance that these particles move is usually only a few ten-thousandths to a few thousandths of an inch. The rate or velocity (in inches per second) at which these particles move is the commonly accepted descriptor of the vibration amplitude, referred to as the peak particle velocity (ppv).

Blasting

Blasting would be required as part of the construction process to breach the existing Pardee Dam and fill the enlarged reservoir (Alternative 6). As explained in the project description, a low-level tunnel would be partially excavated from the downstream face, leaving a plug at the upstream face. Water would then be transferred to the reservoir between the two dams. After the water level has equalized, the crest notch would be completed to finished elevation by blasting the remaining concrete. The submerged plug in the tunnel would also be removed by blasting, using divers to load explosives in predrilled holes. The two primary environmental effects of blasting are airblast and groundborne vibration. The following is a brief discussion of each of these effects.

Airblast

Energy released in an explosion creates an air overpressure (commonly called an airblast) in the form of a propagating wave. If the receiver is close enough to the blast, the overpressure can be felt as the pressure front of the airblast passes. The

accompanying booming sound lasts for only a few seconds. The explosive charges used in mining and mass grading are typically wholly contained in the ground, resulting in an airblast with frequency content below about 250 cycles per second, or Hertz (Hz).

Because an airblast lasts for only a few seconds, use of L_{eq} (a measure of sound level averaged over a specified period of time) to describe blast noise is inappropriate. Airblast is properly measured and described as a linear peak air overpressure (i.e., an increase above atmospheric pressure) in pounds per square inch (psi). Modern blast monitoring equipment is also capable of measuring peak overpressure data in terms of unweighted dB. Decibels, as used to describe airblast, should not be confused with or compared to dBA, which are commonly used to describe relatively steady-state noise levels. An airblast with a peak overpressure of 130 dB can be described as being mildly unpleasant, whereas exposure to jet aircraft noise at a level of 130 dBA would be painful and deafening.

Ground Vibration Associated with Blasting

Blasting creates seismic waves that radiate along the surface of the earth and downward into the earth. These surface waves can be felt as ground vibration. Airblast and ground vibration can result in effects ranging from annoyance of people to damage of structures. Varying geology and distance will result in different vibration levels containing different frequencies and displacements. In all cases, vibration amplitudes will decrease with increasing distance.

Human Response to Vibration and Airblast

Human response to ground vibration and airblast is difficult to quantify. Vibration and airblast can be felt or heard well below the levels that produce any damage to structures. The duration of the event has an effect on human response, as does blast frequency. Blast events are relatively short, on the order of several seconds for sequentially delayed blasts. Generally, as blast duration and vibration frequency increase, the potential for adverse human response increases. Studies have shown that a few blasts of longer duration will produce a less adverse human response than short blasts that occur more often.

Table 14-1 summarizes the average human response to vibration and airblast that may be anticipated when a person is at rest in quiet surroundings. If the person is engaged in any type of physical activity, the level required for the responses indicated are increased considerably.

Table 14-1. Average Human Response to Airblast and Ground Vibration from Blasting

Response	Ground Vibration Range ppv (inches per second)	Airblast Range (dB)
Barely to distinctly perceptible	0.02–0.10	50–70
Distinctly perceptible to strongly perceptible	0.10–0.50	70–90
Strongly perceptible to mildly unpleasant	0.50–1.00	90–120
Mildly unpleasant to distinctly unpleasant	1.00–2.00	120–140
Distinctly unpleasant to intolerable	2.00–10.00	140–170

Source: Bender pers. comm.

Freeport Intake Facility to Mokelumne Aqueducts

Noise-Sensitive Land Uses

Noise-sensitive land uses are generally defined as locations where people reside or where the presence of unwanted sound could adversely affect the use of the land. Noise-sensitive land uses typically include residences, hospitals, schools, guest lodging, libraries, and certain types of recreational uses. Land uses within the vicinity that are considered noise-sensitive land uses include assorted residences, residential subdivisions, churches, and schools. Because the pipeline alignments are generally located within streets and roads, a large number of such noise-sensitive land uses are located adjacent to the pipelines and other project components.

Existing Noise Environment

City of Sacramento

Major sources of noise near the alternative pipeline alignments include: traffic noise from major freeways, primary arterials, and major city streets; train noise; and aircraft noise from local airports. Results of a citywide community noise survey are typically in the range of 50–75 dBA L_{dn}. In general, areas containing noise-sensitive land uses are quiet, except those near major roadways, airports, railroad tracks, and industrial areas. For purposes of this analysis, sound levels near project facilities are assumed to be within a range of approximately 45–60 dBA L_{dn}.

Sacramento County

Results of a countywide community noise survey results indicate that typical noise levels in noise-sensitive areas of the county are in the range of 50–60 dBA L_{dn}. In general, the areas of Sacramento County that contain noise-sensitive land uses are relatively quiet except near major roadways, airports, railroad tracks, and industrial areas. For purposes of this analysis, sound levels near project facilities are assumed to be within a range of approximately 40–60 dBA L_{dn}.

San Joaquin County

No generalized noise information is available for areas in San Joaquin County, but the areas near the pipeline alignments are generally rural and typically quiet. For purposes of this analysis, sound levels near project facilities are assumed to be within a range of approximately 40–60 dBA L_{dn}.

Existing Noise Levels at Freeport Intake Facility Site

Continuous monitoring was conducted at the Freeport intake facility site between September 6 and September 9, 2002, using a Larson-Davis Model 700 Type 2 sound level meter. The sound meter was placed near the western boundary of the proposed intake facility site (LD 1132).

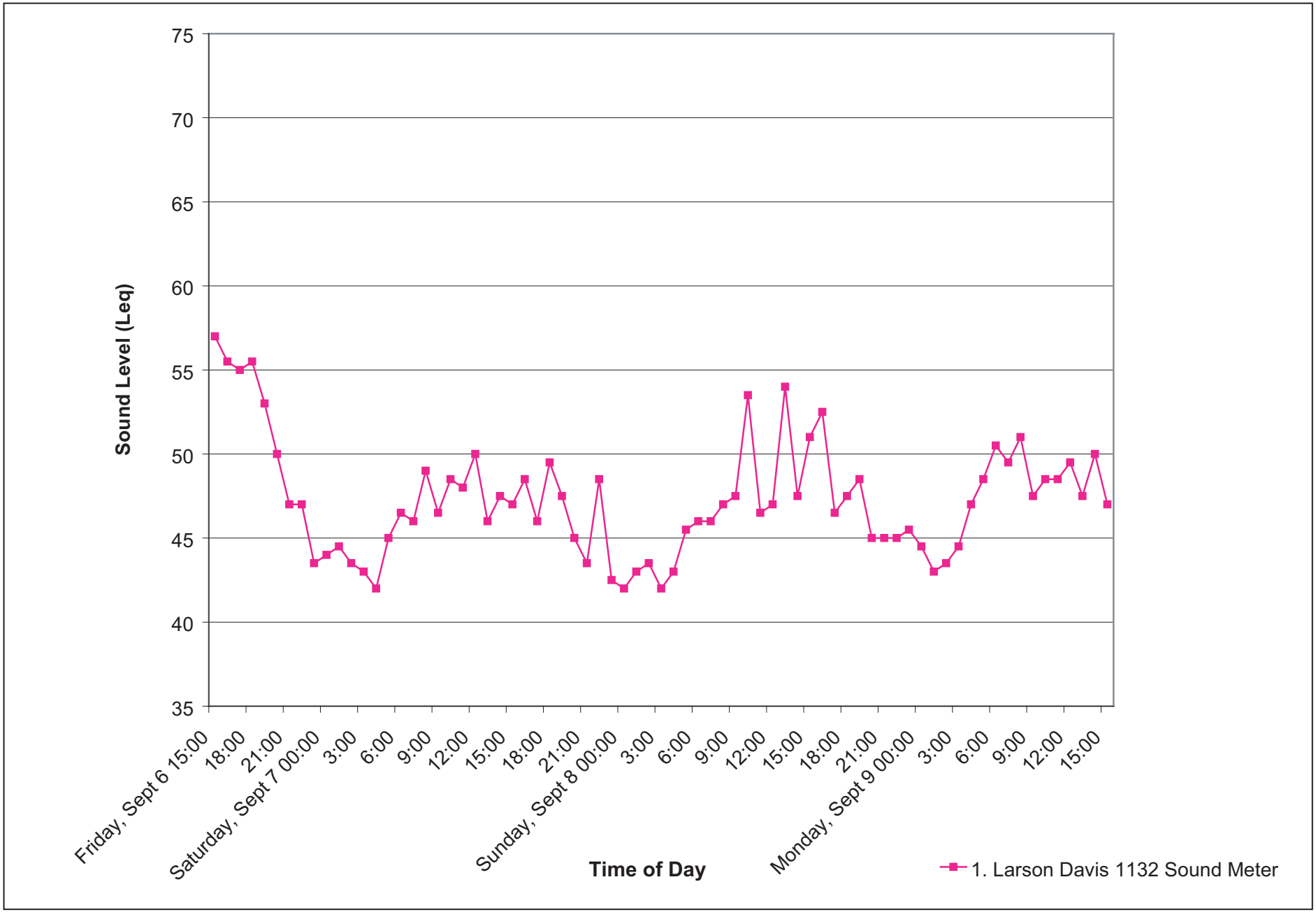
The long-term sound level data were collected over a 4-day period beginning on Friday, September 6, 2002. The purpose of these measurements was to quantify variations in sound level throughout the day, rather than absolute sound levels at a specific receptor of concern. Weather conditions were generally warm and calm. Table 14-2 and Figure 14-1 summarize the results of the long-term monitoring.

Table 14-2. Summary of Long-Term Noise Monitoring (Monitor LD-1132)

Time	1-Hour dB-L_{eq}					Maximum Noise Hour dB-L_{eq} *Minus* Hourly dB-L_{eq}
	Friday (9/6/2002)	Saturday (9/7/2002)	Sunday (9/8/2002)	Monday (9/9/2002)	Average	
12 a.m.	NA[1]	44	42	44.5	44	9
1 a.m.	NA[1]	44.5	43	43	44	9
2 a.m.	NA[1]	43.5	43.5	43.5	44	9
3 a.m.	NA[1]	43	42	44.5	43	9
4 a.m.	NA[1]	42	43	47	44	8
5 a.m.	NA[1]	45	45.5	48.5	46	6
6 a.m.	NA[1]	46.5	46	50.5	48	5
7 a.m.	NA[1]	46	46	49.5	47	5
8 a.m.	NA[1]	49	47	51	49	3
9 a.m.	NA[1]	46.5	47.5	47.5	47	5
10 a.m.	NA[1]	48.5	53.5	48.5	50	2
11 a.m.	NA[1]	48	46.5	48.5	48	5
12 p.m.	NA[1]	50	47	49.5	49	3
1 p.m.	NA[1]	46	54	47.5	49	3
2 p.m.	53.5	47.5	47.5	50	50	3
3 p.m.	57	47	51	47	51	2
4 p.m.	55.5	48.5	52.5	NA[1]	52	0
5 p.m.	55	46	46.5	NA[1]	49	3
6 p.m.	55.5	49.5	47.5	NA[1]	51	1
7 p.m.	53	47.5	48.5	NA[1]	50	3
8 p.m.	50	45	45	NA[1]	47	6
9 p.m.	47	43.5	45	NA[1]	45	7
10 p.m.	47	48.5	45	NA[1]	47	5
11 p.m.	43.5	42.5	45.5	NA[1]	44	8
Average L_{eq}	52	46	47	48	NA[1]	NA[1]

[1] Data not available.

Figure 14-1 indicates that, in the vicinity of the intake facility, there is a typical urban pattern of noise levels, with the lowest noise levels between 2:00 a.m. and 5:00 a.m., and the loudest noise levels in the mid-afternoon. Daytime peaks correspond to morning, lunch, and evening activities, particularly commute traffic on Freeport Boulevard and I-5. Noise levels drop off during the evening



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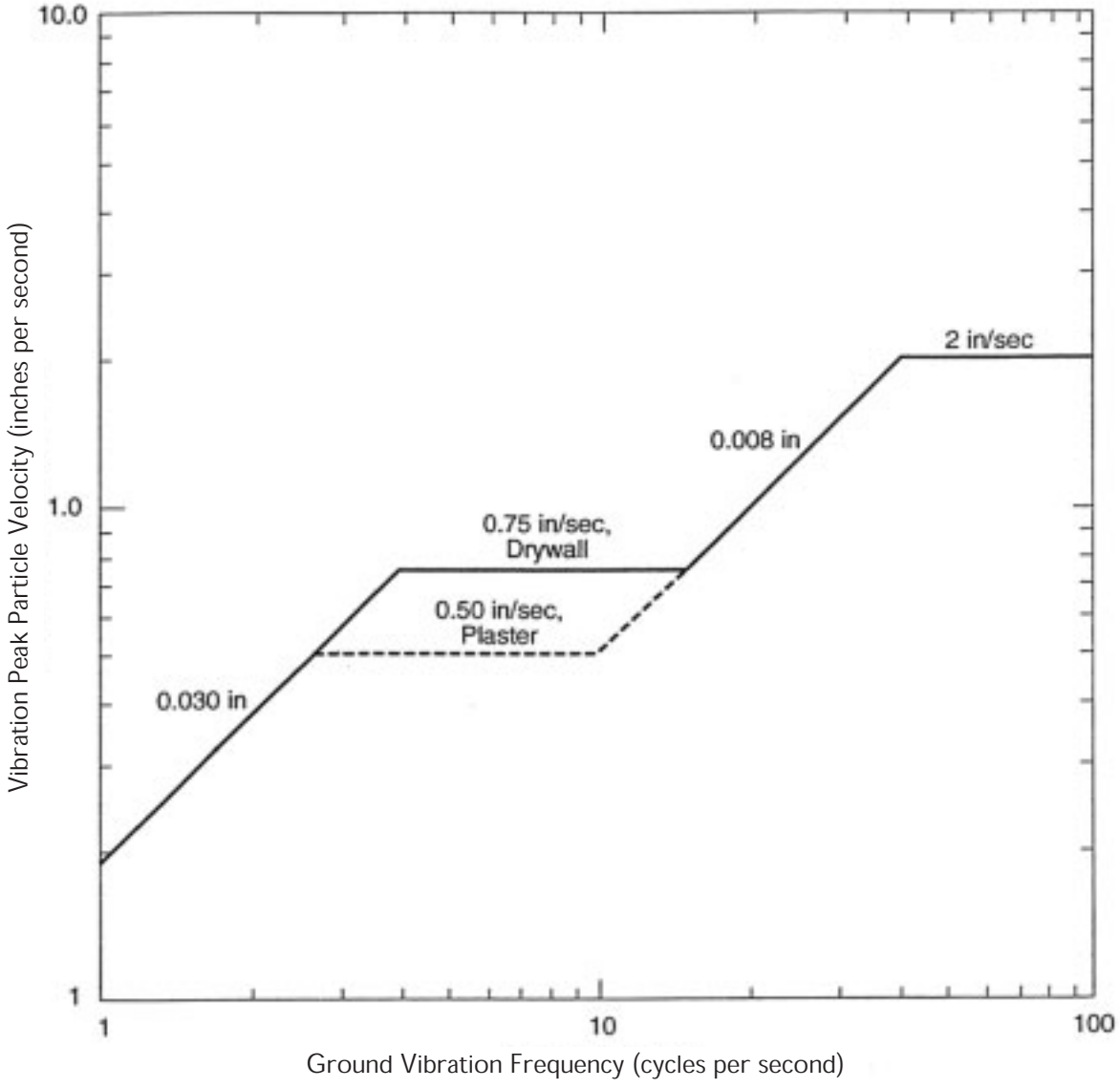
Jones & Stokes

Figure 14-1
Summary of 24 Hour Monitoring
at the Freeport Intake Facility Site



Source: U.S. Bureau of Mines 1980b.

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Jones & Stokes

Figure 14-2
USBM Vibration Criteria

and nighttime hours. Table 14-2 summarizes the average hourly L_{eq} sound levels measured in each hour of the day over the long-term monitoring period. The differences between the sound levels measured during each hour and the maximum noise hour sound levels are also shown. These values are provided for general reference and can be used to estimate worst-noise hour noise levels from measurements not taken during the worst-noise hour and to estimate L_{dn} values from calculated worst-hour noise levels.

Enlarge Pardee Reservoir

Noise-Sensitive Land Uses

Noise-sensitive land uses are generally defined as locations where people reside or where the presence of unwanted sound could adversely affect the use of the land. Noise-sensitive land uses typically include residences, hospitals, schools, guest lodging, libraries, and certain types of recreational uses.

Near Pardee Reservoir, noise-sensitive land uses include:

- the Mokelumne River Lodge, located at Mokelumne River Bridge on SR 49;
- whitewater rafters and kayakers using the Mokelumne River between the SR 49 bridge and the Middle Bar Bridge;
- hikers on the Coast-to-Crest Trail (Narrow Gauge and Fire Road Trials); and
- recreation activities associated with the Pardee Recreation Area.

Recreation activities associated with the Pardee Recreation Area include swimming, fishing, boating, picnicking, camping, and long- and short-term RV use. In addition, the Pardee Recreation Area employee housing facilities located at the recreation area are occupied year round.

Pardee Center, located south of Pardee Dam and the South Spillway, also include offices, operation and maintenance facilities, and residences for EBMUD staff.

Existing Noise Environment

The existing noise environment in the Pardee Reservoir project area is governed primarily by recreation activities on Pardee Reservoir (boating), traffic on SR 49, Middle Bar Road/Gwin Mine Road, Paloma Road, Pardee Dam Road, Stony Creek Road, and other local roadways in the area, and occasional aircraft overflights. The powerhouse located at the existing dam facilities does not contribute to the existing noise environment because of shielding provided by the canyon walls and because the powerhouse facilities are enclosed in a building.

Existing Noise Levels near Pardee Reservoir

Noise monitoring was conducted in the Pardee Reservoir area on November 13, 2002, using a Larson Davis SLM Model 812 sound level meter. Noise monitoring was conducted at two locations:

- Stony Creek Road near the existing Pardee Recreation Area employee housing, and
- Pardee Center housing facilities between McLean Hall Lodge and Pardee House.

Table 14-3 summarizes noise monitoring results.

Table 14-3. Summary of Noise Monitoring at Pardee Reservoir

Position	Date	Start Time	Duration (minutes)	Sound Level (dBA-L_{eq})	L_{max} (dBA)	L_{10} (dBA)	L_{90} (dBA)	Sources
1	11/13/2002	10:56 a.m.	5:00	36.5	54.4	38.0	31.9	Birds overhead, gunshot blast
2	11/13/2002	12:18 p.m.	10:00	40.5	54.8	44.0	33.9	Birds overhead, heavy machinery

Regulatory Setting

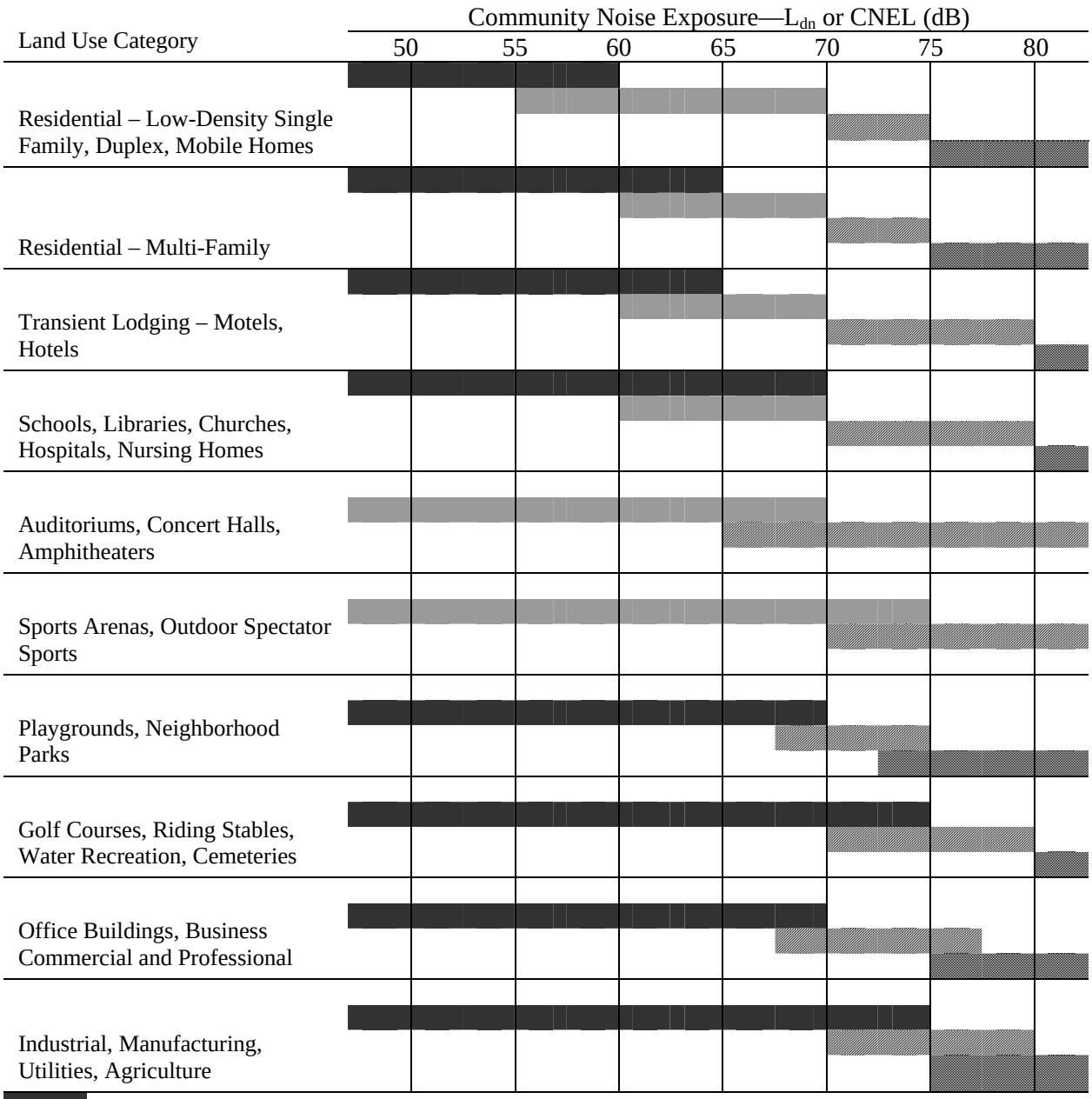
Federal

Reclamation does not have any noise standards. No other federal noise standards would apply to this project.

State

California requires each local government entity to implement a noise element as part of its general plan. *Guidelines for the Preparation and Content of the Noise Element of the General Plan*, published by California Governors Office of Planning and Research, has guidelines for the compatibility of various land uses as a function of community noise exposure. These land use compatibility guidelines are listed in Table 14-4.

Table 14-4. State Land Use Compatibility Standards for Community Noise Environment



Normally Acceptable	Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
Conditionally Acceptable	New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features are included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

Land Use Category	Community Noise Exposure—L_{dn} or CNEL (dB)						
	50	55	60	65	70	75	80
Normally Unacceptable	New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.						
Clearly Unacceptable	New construction or development generally should not be undertaken.						

The Office of Noise Control (ONC) of the California Department of Health published a model noise ordinance in 1977. This model ordinance provides recommended limits on noise generated by various types of noise sources. Because many local ordinances do not specify limits on construction noise, the construction noise limits specified in the model ordinance are provided in Table 14-5 as a point of reference.

Table 14-5. Office of Noise Control Construction Noise Limits

	Single Family Residential		Multi-Family Residential		Semi-Residential/ Commercial	
Time of Day	Duration <10 days	Duration ≥10 days	Duration <10 days	Duration ≥ 10 days	Duration <10 days	Duration ≥10 days
Daily, except Sundays and legal holidays, 7 a.m. to 7 p.m.	75 dBA	60 dBA	80 dBA	65 dBA	85 dBA	70 dBA
Daily, 7 p.m. to 7 a.m. and all day Sunday and legal holidays	60 dBA	50 dBA	65 dBA	5 dBA	70 dBA	60 dBA

Local

The project components are located within the City of Sacramento, and the counties of Sacramento, San Joaquin, Amador, and Calaveras. The jurisdictions have established policies and regulations concerning the generation and control of noise that could adversely affect their citizens and noise-sensitive land uses. General plans are required by state law and serve as the jurisdiction's blueprint for land use and development. The general plans are comprehensive, long-term documents that provide details for the physical development of the jurisdiction, set out policies, and identify ways to put the policies into action. General plans also provide an overall framework for development in the jurisdiction and protection of its natural and cultural resources. The noise elements of general plans contain planning guidelines relating to noise. The noise element identifies

goals and policies to support achievement of those goals. The goals and policies contained in general plans are applicable throughout the jurisdiction. The following is a brief discussion of general plan policies and noise ordinance regulations implemented by each jurisdiction to protect its citizens from adverse noises.

City of Sacramento General Plan Noise Element

The City of Sacramento General Plan Noise Element establishes 60 dBA Ldn as the maximum acceptable exterior noise level for schools and single- and multi-family residential areas.

City of Sacramento Noise Ordinance

The City of Sacramento's noise ordinance states that exterior noise limits shall not exceed 50 dBA between 10:00 p.m. and 7:00 a.m. and 55 dBA between 7:00 a.m. and 10:00 p.m. for residential and agricultural areas. The City of Sacramento's noise ordinance exempts construction activities from the ordinance, provided they occur between the hours of 7:00 a.m. and 6:00 p.m., Monday through Saturday, and between 9:00 a.m. and 6:00 p.m. on Sundays. The ordinance further states that internal combustion engines in use on construction sites must be equipped with "suitable exhaust and intake silencers which are in good working order." Agricultural operations that occur between the hours of 6:00 a.m. and 8:00 p.m. are also exempted from the ordinance, provided internal combustion engines are equipped with suitable exhaust and intake silencers which are in good working order.

County of Sacramento General Plan Noise Element

The Sacramento County General Plan Noise Element states that noise created by new non-transportation noise sources may not exceed the noise level standards shown in Table 14-6, as measured immediately within the property line of any affected residentially designated land.

Table 14-6. Noise Level Performance Standards[a] for Residential Areas Affected by Non-Transportation Noise[b]

Statistical Noise Level Descriptor	Exterior Noise Level Standards (dBA)	
	Daytime (7:00 a.m. to 10:00 p.m.)	Nighttime (10:00 p.m. to 7:00 a.m.)
L_{50}	50	45
L_{max}	70	65

[a] These standards are for planning purposes and may vary from standards of the County Noise Ordinance, which are for enforcement purposes.

[b] These standards apply to new or existing residential areas affected by new or existing non-transportation sources.

County of Sacramento Noise Ordinance

The Sacramento County Noise Ordinance states that exterior noise limits shall not exceed 50 dBA between 10:00 p.m. and 7:00 a.m. and 55 dBA between 7:00 a.m. and 10:00 p.m. for residential and agricultural areas. However, construction activities between 6:00 a.m. and 8:00 p.m., Monday through Friday, and 7:00 a.m. and 8:00 p.m. on weekends are exempt from this ordinance. Agricultural operations that occur between 6:00 a.m. and 8:00 p.m. are also exempted from the ordinance.

County of San Joaquin General Plan Noise Element

The noise element of the San Joaquin County General Plan states that 65 dB L_{dn} or less is considered acceptable for residential development and that development shall be planned and designed to minimize noise interference from outside noise sources. For schools, group care facilities, and hospitals, 60 dB L_{dn} or less is considered acceptable.

San Joaquin County Code

Chapter 9-1025.9 of the San Joaquin County Development Title is the county's regulation relating to noise. The section on stationary sources states that proposed projects that will create new stationary noise sources or expand existing stationary noise sources shall be required to mitigate the noise level from these stationary sources so as not to exceed the noise level standards specified in Table 14-7.

Table 14-7. County of San Joaquin Development Title Maximum Allowable Noise Exposure from Stationary Sources

	Outdoor Activity Areas[1]	
Noise Level Descriptor	Daytime[2] (7 a.m.–10 p.m.)	Nighttime[2] (10 p.m.–7 a.m.)
Hourly L_{eq}	50 dBA	45 dBA
Maximum level (L_{max})	70 dBA	65 dBA

[1] Where the location of outdoor activity areas is unknown or is not applicable, the noise standard shall be applied at the property line of the receiving land use. When determining the effectiveness of noise mitigation measures, the standards shall be applied on the receiving side of noise barriers or other property line noise mitigation measures.

[2] Each of the noise level standards specified shall be reduced by 5 dB for impulsive noise, single-tone noise, or noise consisting primarily of speech or music.

Construction activities that occur between 6:00 a.m. and 9:00 p.m., Sunday through Saturday, are exempted from the provisions of the county's Development Title, as are noises resulting from the maintenance or modification of private or pubic utility facilities.

County of Amador General Plan Noise Element

The noise element specifies that the maximum allowable noise exposure levels noise-sensitive land uses may be exposed to from non-transportation noise sources are 65 dBA L_{dn} for exterior noise levels (as measured at their property line), and 45 dBA L_{dn} for interior noise levels. Noise levels that exceed these thresholds shall be mitigated to levels below these thresholds. Where noise-sensitive land uses are proposed near existing noise sources, exterior noise levels may not exceed 55 dBA L_{dn} for exterior noise levels (as measured at their property line) or 45 dBA L_{dn} for interior noise levels.

The county's noise element also establishes additional noise standards for noise-generating projects. Table 14-8 summarizes the county's maximum allowable changes in ambient noise levels, while Table 14-9 summarizes temporal limits to noise generation levels, as applied to the county's exterior noise standard of 65 L_{dn} (as measured at their property line) and interior noise standard of 45 L_{dn}. Table 14-10 summarizes the county's maximum allowable intermittent impulse noise levels. The county noise standards indicated in Tables 14-8 through 14-10 apply to the property line of any noise-generating project.

Table 14-8. County of Amador Maximum Allowable Changes in Ambient Noise Levels

Existing Ambient Noise Level	Allowed Increase in Ambient Noise
55 dBA L_{dn}	3 dBA
60 dBA L_{dn}	2 dBA
65 dBA L_{dn}	1 dBA

Table 14-9. County of Amador Maximum Allowable Noise Levels

Duration of Noise Generation	Allowable addition to County Standards[1]
Cumulative period of more than 30 minutes in any hour	+ 0
Cumulative period of more than 15 minutes in any hour	+ 5
Cumulative period of more than 5 minutes in any hour	+ 10
Cumulative period of more than 1 minute in any hour	+ 15
Level that may not be exceed any time per hour[2]	+ 20

Notes:

[1] Exterior standard is 65 dBA L_{dn} and interior standard is 45 dBA L_{dn}.

[2] Noise level may be exceeded for impulse and intermittent noise levels. See Table 14-8.

Table 14-10. County of Amador Maximum Allowable Intermittent Impulse Noise Levels

Impulse Duration	25 μ seconds or Less	1 Second	1 Second	1 Second
Number of Impulses per Day	1	1	10	100
Maximum Noise Level	167 dBA	145 dBA	135 dBA	125 dBA-85

The county's noise element also establishes blasting-noise and vibration limits. Noise from blasting shall not exceed the standards recommended in the U.S. Bureau of Mines' (USBM's) publication RI8485, *Structure Response and Damage Produced by Airblast from Surface Mining*, while vibration from blasting shall not exceed the standards recommended in the USBM's publication RI8508, *Airblast Instrumentation and Measurement Techniques for Surface Mine Blasting*. However, the noise element states that if the USBM revises these publications or updates them with new publications, any new standards or criteria shall automatically become effective in the county's noise element without further action by the county.

Amador County Code

Amador County has no noise ordinance (Grijalva pers. comm.).

County of Calaveras General Plan Policies

Table 14-11 summarizes the county's maximum allowable noise exposure levels for noise-sensitive land uses, as measured at their property line.

Table 14-11. County of Calaveras General Plan Maximum Allowable Noise Levels

Noise-Sensitive Land Use	Maximum Allowable Noise Level
Single Family Residential	60 dBA Ldn
Multifamily Residential	65 dBA Ldn
Schools, Hospitals	70 dBA Ldn

Calaveras County Code

The Calaveras County Code states that various land use types must meet the average and maximum noise standards established in the county's general plan noise element (see Table 14-11).

Environmental Consequences

Methods and Assumptions

The assessment of potential noise impacts was conducted using methodology developed by the Federal Transit Administration (FTA) (Federal Transit Administration 1995) and standard acoustical modeling methods. Specific assumptions used are discussed under each impact.

Significance Criteria

The criteria used for determining the significance of a noise impact are based on Appendix G of the State CEQA Guidelines (Environmental Checklist) and professional standards and practices. Impacts on noise may be considered significant if implementation of an alternative would:

- expose persons to or generate noise levels in excess of standards established in a local general plan or noise ordinance or applicable standards of other agencies,

- expose persons to or generate excessive groundborne vibration or groundborne noise levels,
- result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project, or
- result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

These guidelines, along with local noise standards, were used to develop the following specific significance thresholds for noise impacts.

Freeport Intake Facility to Mokelumne Aqueducts

Construction Noise Significance Criteria

The City of Sacramento and the counties of San Joaquin and Sacramento exempt construction activities from compliance with noise standards during specified daytime hours. Although each jurisdiction has adopted slightly different standards, they are generally consistent with normal working hours. Accordingly, construction noise impact thresholds have been based on those specified on the ONC model noise ordinance.

Construction activity is considered to have a significant noise impact if it is expected to result in noise levels that exceed the limits specified in Table 14-5 or exceed the existing noise level by more than 5 dB at sensitive receptor locations.

Ground Vibration Significance Criteria

There are no commonly accepted thresholds for acceptable levels of ground vibration from pile driving. However, the U.S. Department of Transportation suggests a vibration damage threshold of 0.20 inches/second (in/sec) for fragile buildings and 0.12 in/sec for extremely fragile historic buildings (Federal Transit Administration 1995). The Transportation Research Board suggests maximum allowable peak particle velocities from pile driving for various structure types and conditions (Transportation Research Board 1997). Table 14-12 summarizes these values.

For the purposes of this assessment, pile driving will be considered to result in an adverse ground vibration impact if fragile or historic building structures would be exposed to ground vibration in excess of 0.20 inches per second, or if other building structures would be exposed to ground vibration in excess of 0.5 inches per second.

Table 14-12. Transportation Research Board Building Structure Vibration Criteria

Structure and Condition	Limiting ppv (in/sec)
Historic and some old buildings	0.5
Residential structures	0.5
New residential structures	1.0
Industrial buildings	2.0
Bridges	2.0

Operational-Noise Significance Criteria

Operation of facilities is considered to result in a significant noise impact if operations are expected to result in noise that exceeds the existing or presumed ambient sound level by more than 5 dB at sensitive receptor locations.

Enlarge Pardee Reservoir

Construction Noise Significance Criteria

Amador and Calaveras Counties do not have specific noise standards related to construction activity. Therefore, construction noise impact thresholds have been based on those specified on the ONC model noise ordinance.

Construction activity is considered to have a significant noise impact if it is expected to result in noise levels that exceed the limits specified in Table 14-5 or exceed the existing noise level by more than 5 dB at sensitive receptor locations.

Blasting Significance Criteria

Blasting would be required as part of the construction process to breach the existing Pardee Dam. The two primary environmental effects of blasting are airblast and groundborne vibration. The following is a brief discussion of standards used to assess the impacts of blasting.

Airblast Criteria

Conventional noise criteria (for steady-state noise sources) and limits established for repetitive impulsive noise (such as for gun-firing ranges) do not apply to air overpressures from blasting. USBM Report of Investigations 8485 and the regulations issued more recently by the U.S. Office of Surface Mining and Reclamation Enforcement specify a maximum safe overpressure of 0.013 psi (133 dB) for impulsive airblast when recording is accomplished with equipment having a frequency range of response of at least 2–200 Hz.

Ground Vibration Criteria

As discussed above, the Amador County Code uses standards recommended in USBM Report of Investigations 8508 to assess the significance of vibration from blasting. A review of USBM RI8508 was conducted and did not indicate any recommended thresholds of significance from blasting. However, USBM Report of Investigations 8507 contains blasting-level criteria that can be appropriately applied to keep ground vibration well below levels that might cause damage to neighboring structures. At low-vibration frequencies, velocities of ground vibration are restricted to low levels. As vibration frequency increases, higher velocities are allowed up to a maximum of 2.00 inches per second. Figure 14-2 depicts blasting-level criteria as a function of frequency.

Blasting activity is considered to result in a significant noise impact if it is expected to result in:

- airblast that exceeds 133 dB at noise sensitive land uses, or
- ground vibration that exceeds limits specified in Figure 14-2.

Operational-Noise Significance Criteria

Operation of dam facilities is considered to have a significant noise impact if operations are expected to result in noise that exceeds the acceptable noise standards of the relevant jurisdictions or existing or presumed ambient sound level by more than 5 dB at sensitive receptor locations.

Less-than-Significant Impacts

Alternative 1

Alternative 1 would not result in any construction-related or operation-related noise impacts associated with construction of FRWP facilities.

Alternatives 2–5

Alternatives 2 through 5 differ only in the pipeline alignments from the Freeport intake facility to the FSC. Project construction and operation for Alternatives 2 through 5 are very similar. Impacts related to noise for each alternative differ only slightly from each other; therefore, the results for Alternatives 2 through 5 are presented together but are representative of each individual alternative, unless otherwise noted.

Construction-Related Impacts

Impact 14-1: Exposure of Existing Structures to Vibration from Pile Driving Activities

Pile driving would be required at the intake facility site. Table 14-13 presents vibration source levels generated from typical impact pile driver activity. The table was based on FTA methodology (Federal Transit Administration 1995) and was used in this analysis to estimate vibration from construction activities.

Table 14-13. Vibration Source Levels from Typical Impact Pile Driving Activities

Distance to Receptor (feet)	Vibration Level at Receptor ppv (in/sec)
50	0.228
100	0.081
150	0.044
200	0.028
250	0.020
300	0.015
500	0.007
750	0.004
1,000	0.003

Table 14-13 presents estimated vibration source levels associated with typical impact pile driving activities at 50-foot intervals. Further calculations indicate that ground vibration in excess of the 0.20 inch per second threshold could occur within a distance of 55 feet from active pile driving activities, while ground vibration in excess of the 0.5 inch per second threshold could occur within a distance of about 20 feet from active pile driving activities. There are no fragile or historic building structures located within 55 feet, or other buildings located within 20 feet of active pile driving activities that could be exposed to excessive vibration levels. This impact is therefore less than significant. No mitigation is required.

Operation-Related Impacts

There are no less-than-significant operation-related noise impacts associated with Alternatives 2 through 5.

Alternative 6

As described in Chapter 2, "Project Description," Alternative 6 consists of enlarging Pardee Reservoir and conveying water from the Sacramento River. Alternative 6 includes the following project components: enlarge Pardee Reservoir (which includes additional components), Freeport intake facility, pipeline from intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP. Though slightly different in size, the Freeport intake facility, pipeline from intake facility to the Zone 40 Surface WTP and the Zone 40 Surface WTP project components are the same as those that make up Alternative 5. Therefore, several of the impacts associated with Alternative 5 (described above) are also associated with Alternative 6 and are restated below. Additionally, impacts associated with the enlarge Pardee Reservoir component of this alternative are described below.

Construction-Related Impacts

Impact 14-2: Exposure of Existing Structures to Vibration from Pile Driving Activities

As described above, pile driving will be required at the intake facility site. Table 14-13 presents vibration source levels generated from typical impact pile driver activity. There are no fragile or historic building structures located within 55 feet, or other buildings located within 20 feet of active pile driving activities that could be exposed to excessive vibration levels. This impact is therefore less than significant. No mitigation is required.

Impact 14-3: Exposure of Existing Structures and Noise-Sensitive Uses to Noise and Vibration from Blasting Activities at Enlarged Pardee Reservoir

As discussed in Chapter 2, once construction of the new Pardee Dam is complete, a low-level tunnel would be partially excavated from the downstream face of the existing dam, leaving a plug at the upstream face. Water would then be transferred to the reservoir between the two dams. After the water level has equalized, the crest notch would be completed to finished elevation by blasting the remaining concrete. The submerged plug in the tunnel would also be removed by blasting, using divers to load explosives in predrilled holes.

The need for blasting would depend on site-specific conditions and engineering considerations that are not known at this time. Accordingly, specific information on the location, type, or extent of blasting is not available. Noise and vibration generated by blasting is a complex function of the charge size, charge depth, hole size, degree of confinement, initiation methods, spatial distribution of charges, and other factors. To provide a general indication of the potential for airblast and vibration impacts from blasting, data developed from the blasting assessment for a mining project in northern California is presented in Table 14-14 (Jones & Stokes 1999). Specifically, Table 14-14 presents estimated airblast and ground-vibration values as a function of distance, based on a 293-pound charge under average normal confinement. It is anticipated that blasting charges associated

with the enlarge Pardee Reservoir component would be substantially less than 293 pounds.

Table 14-14. Estimated Airblast and Ground-Vibration Levels for a 293-Pound Charge

Distance (feet)	ppv under Average Normal Confinement (in/sec)	Probable Peak Air Overpressure (dB)
250	1.4	130
500	0.46	123
750	0.24	119
1,000	0.15	116
1,250	0.11	114
1,500	0.08	112
1,850	0.057	110
2,000	**0.05**	**109**
2,250	0.042	108
3,450	0.021	103
4,400	0.014	101
5,150	0.011	99
6,200	0.008	97
7,200	0.006	96

The results in Table 14-14 indicate that a 293-pound charge could exceed the ground vibration thresholds indicated in Figure 14-2 (between 0.5 in/sec and 2.0 in/sec) within a distance of between 200 and 500 feet of a blast. In addition, the same charge size could exceed the airblast threshold (130 dB) within about 250 feet of a blast. Pardee Center is the nearest noise-sensitive land use in the vicinity of where blasting would occur, which is in excess of 2,000 feet from the existing Pardee Dam. Table 14-14 indicates that for a 293-pound charge, airblast and ground vibration levels would be below threshold levels at a distance of 2,000 feet. Because the proposed project is anticipated to use blasting charges substantially smaller than a 293-pounds, airblast and ground vibration levels are anticipated to be substantially smaller than those indicated in Table 14-14. Consequently, noise and vibration impacts associated with blasting would be less than significant. No mitigation is required.

Operation-Related Impacts

Impact 14-4: Exposure of Noise-Sensitive Land Uses to Operation of Power-Generating Facilities

Operation of the power-generating facilities and other dam operations associated with the enlarge Pardee Reservoir component of this alternative are not anticipated to result in operational-noise impacts. Noise-generating equipment associated with operation of the dam includes power-generating equipment located at the powerhouse facilities. These facilities would be located within the Mokelumne River canyon, and would be more than 4,200 feet downstream from the nearest noise-sensitive land use (Pardee Center). In addition, the building structure that would enclose the hydroelectric generators and turbines is anticipated to provide sufficient noise attenuation and shielding to minimize noise exposure of nearby noise-sensitive land uses to operational noise.

Sufficient shielding provided by the canyon walls and powerhouse building structure, as well as the distance between the powerhouse facilities and the nearest noise-sensitive land uses (in excess of 4,200 feet), would attenuate noise generated by the powerhouse equipment to less-than-significant levels. Consequently, this impact is considered to be less than significant. No mitigation is required.

Significant Impacts and Mitigation Measures

Alternatives 2–5

Construction-Related Impacts

Impact 14-5: Short-Term Increases in Construction Noise Levels during Daytime Hours

Construction of project features under these alternatives would result in short-term increases in noise levels along the adopted pipeline alignment and at project facility locations. Construction activities at most locations would persist for no more than several days to a few weeks; however, substantially longer construction periods are expected at major facility locations.

Potential noise impacts resulting from construction of facilities were evaluated by estimating the amount of noise generated on a theoretical worst-case period of construction activity. This estimate is based on equipment that would be used during construction activities. A detailed inventory of heavy construction equipment that would be used for the project alternative was provided by the project engineers and used in the estimation of general construction noise. Table 14-15 summarizes anticipated equipment required for construction of each component of the project alternative.

Further, Table 14-15 presents a list of noise generation levels for various types of equipment typically used on various construction projects. The list, compiled by

Table 14-15. Construction Equipment Inventory and Noise Emission Levels: Freeport Intake Facility to Mokelumne Aqueducts

Construction and Equipment [1]	Typical Noise Level (dBA) 50 ft from Source [2]	Project Component						
		Intake Facility	Freeport Intake Facility to Zone 40 Surface WTP/FSC Pipeline	Zone 40 Surface WTP	Terminal Facility	FSC to Mokelumne Aqueducts Pipeline	Canal Pumping Plant	Aqueduct Pumping Plant and Pretreatment Facility
Backhoe	80	X	X	X	X	X	X	X
Compactor	82	X	X	X	X			X
Concrete Mixer	85					X	X	
Concrete Pump	82			X	X	X	X	X
Crane, Derrick	88					X	X	
Crane, Mobile	83	X	X	X	X	X	X	X
Dozer	85	X	X	X	X	X	X	X
Generator	81	X	X	X	X	X	X	X
Grader	85		X	X	X	X	X	X
Loader	85	X	X	X		X	X	X
Paver	89	X	X					
Pile Driver (Impact)	101	X						
Pile Driver (Sonic)	96	X	X		X			
Rail Saw	90		X					
Roller/Sheep's Foot	74	X	X					
Scraper	89			X				X
Truck	88	X	X	X	X	X	X	X
Tunneling/Boring Machine	88 [3]		X					

Sources:

[1] CH2M HILL pers. comm.
[2] Federal Transit Administration 1995.
[3] Jones and Stokes reference material of 300 hp bore machine and 450 hp drilling fluid system.

the FTA (1995), was used in this analysis to estimate construction noise. The magnitude of construction noise impacts was assumed to depend on the type of construction activity, the noise level generated by various pieces of construction equipment, the duration of the activity, and the distance between the activity and noise-sensitive receivers. Shielding effects that might result from local barriers, including topography, are not specifically addressed.

A reasonable worst-case assumption is that the three loudest pieces of equipment would operate simultaneously and continuously over at least a 1-hour period for a combined source noise level. Based on the noise levels summarized in Table 14-15, Tables 14-16 through 14-19 have been developed to calculate estimated sound levels from construction activities as a function of distance based on anticipated activity at each primary construction site.

Freeport Intake Facility

Table 14-16 calculates anticipated noise levels for construction of the intake facility as a function of distance. In the vicinity of simultaneous operation of an impact pile driver[1], truck, and paver, a combined source level of 101 dBA at 50 feet is assumed. Point-source attenuation of 6 dB per doubling of distance, as well as molecular absorption of 0.7 dB per 1,000 feet and anomalous excess attenuation of 1 dB per 1,000 feet, is also assumed (Hoover 1996).

[1] It was anticipated that impact and vibratory pile driving would not occur concurrently. Therefore, only the loudest pile driving (impact) is used in the assessment.

Table 14-16. Estimated Construction Noise in the Vicinity of the Freeport Intake Facility Construction Site

Distance Attenuation	
Distance to Receptor (feet)	Sound Level at Receptor (dBA)
50	101
100	95
225	88
400	82
600	78
800	76
1,000	73
1,500	69
2,000	67
2,500	63
3,000	60
4,000	56
5,280	52
7,500	45

The following assumptions were used:

Basic sound level drop-off rate:	6.0 dB per doubling of distance
Molecular absorption coefficient:	0.7 dB per 1,000 feet
Anomalous excess attenuation:	1.0 dB per 1,000 feet
Reference sound level:	101 dBA
Distance for reference sound level:	50 Feet

Notes: This calculation does not include the effects, if any, of local shielding, which may reduce sound levels further.

Estimates are based on calculations for an impact pile driver, truck, and paver.

Although these anticipated noise levels would be temporary if they were to occur, the noise levels would exceed local noise regulation standards and would be substantially higher than existing noise levels. Nearby residences and other noise-sensitive land uses within approximately 3,000 feet could be temporarily exposed to noise levels that exceed local noise regulations. Noise impacts associated construction at the intake facility site would be significant. There are no mitigation measures available to reduce this impact to less-than-significant levels. Therefore, this impact is significant and unavoidable. However, implementation of Mitigation Measure 14-1 could minimize these potential impacts.

Mitigation Measure 14-1: Provide Public Notice of Proposed Activities and Provide Noise Shielding to the Extent Feasible

Prior to construction, adequate notice should be provided to all potentially affected residences. The construction contractor will designate a noise disturbance coordinator who will be responsible for responding to complaints regarding construction noise. The coordinator will determine the cause of the complaint and will ensure that reasonable measures are implemented to correct the problem. A contact telephone number for the noise disturbance coordinator will be conspicuously posted on construction site fences and will be included in the written notification of the construction schedule sent to nearby residents. Such notices should be provided to all residences within 4,000 feet of construction areas at least 2 weeks before construction activities begin. In addition, noise shielding should be provided to the extent feasible and practicable. Such shielding may include, but is not limited to, features such as movable noise barriers, noise-reducing "blankets," hay bale shield walls, and similar features. Full consideration should be given to noise-reducing construction methods. A noise specialist shall be consulted to assist in identifying feasible methods of noise reduction.

Freeport Intake Facility to Zone 40 Surface Water Treatment Plant/Folsom South Canal Pipeline

Table 14-17 calculates anticipated noise levels for construction of the pipeline from the intake facility to the Zone 40 Surface WTP/FSC as a function of distance. A reasonable worst-case assumption is that the three loudest pieces of equipment would operate simultaneously and continuously over at least a 1-hour period for a combined source noise level. In the vicinity of simultaneous operation of a rail saw, sonic pile driver, and a paver, a combined source level of 98 dBA at 50 feet is assumed. Point-source attenuation of 6 dB per doubling of distance, as well as molecular absorption of 0.7 dB per 1,000 feet and anomalous excess attenuation of 1 dB per 1,000 feet, is also assumed (Hoover 1996).

Table 14-17. Estimated Construction Noise in the Vicinity of the Freeport Intake Facility to Zone 40 Surface WTP/FSC Pipeline Construction Site

Distance Attenuation	
Distance to Receptor (feet)	Sound Level at Receptor (dBA)
50	98
100	92
225	85
400	79
600	75
800	73
1,000	70
1,500	66
1,600	65
2,500	60
3,000	57
4,000	53
5,280	49
7,500	42

The following assumptions were used:

Basic sound level drop-off rate:	6.0 dB per doubling of distance
Molecular absorption coefficient:	0.7 dB per 1,000 feet
Anomalous excess attenuation:	1.0 dB per 1,000 feet
Reference sound level:	98 dBA
Distance for reference sound level:	50 Feet

Notes: This calculation does not include the effects, if any, of local shielding, which may reduce sound levels further.

Estimates are based on calculations for a rail saw, sonic pile driver, and a paver.

Although these anticipated noise levels would be temporary if they were to occur, the noise levels would exceed local noise regulation standards and would be substantially higher than existing noise levels. Nearby residences and other noise-sensitive land uses within approximately 3,000–5,000 feet could be temporarily exposed to noise levels that exceed local noise regulations. Noise impacts associated with construction would be significant. There are no mitigation measures available to reduce this impact to less-than-significant levels. Therefore, this impact is significant and unavoidable. However, implementation of Mitigation Measure 14-1, described above, could minimize these potential impacts.

Zone 40 Surface Water Treatment Plant and Aqueduct Pumping Plant and Pretreatment Facility

Table 14-18 calculates anticipated noise levels for construction of the Zone 40 Surface WTP and aqueduct pumping plant and pretreatment facility as a function of distance. A reasonable worst-case assumption is that the three loudest pieces of equipment would operate simultaneously and continuously over at least a 1-hour period for a combined source noise level. In the vicinity of simultaneous operation of one scraper and two trucks, a combined source level of 93 dBA at 50 feet is assumed. Point-source attenuation of 6 dB per doubling of distance, as well as molecular absorption of 0.7 dB per 1,000 feet and anomalous excess attenuation of 1 dB per 1,000 feet, is also assumed (Hoover 1996).

Table 14-18. Estimated Construction Noise in the Vicinity of the Zone 40 Surface WTP and Aqueduct Pumping Plant and Pretreatment Facility Construction Sites

Distance Attenuation	
Distance to Receptor (feet)	Sound Level at Receptor (dBA)
50	93
100	87
225	80
400	74
600	70
800	68
1,000	65
1,500	61
2,000	58
2,500	55
3,000	52
4,000	48
5,280	44
7,500	37

The following assumptions were used:

Basic sound level drop-off rate:	6.0 dB per doubling of distance
Molecular absorption coefficient:	0.7 dB per 1,000 feet
Anomalous excess attenuation:	1.0 dB per 1,000 feet
Reference sound level:	93 dBA
Distance for reference sound level:	50 Feet

Notes: This calculation does not include the effects, if any, of local shielding, which may reduce sound levels further.

Estimates are based on calculations for a one scraper and two trucks.

Although these anticipated noise levels would be temporary if they were to occur, the noise levels would exceed local noise regulation standards and would be substantially higher than existing noise levels. Nearby residences and other noise-sensitive land uses within approximately 3,000 feet could be temporarily exposed to noise levels that exceed local noise regulations. Noise impacts associated with construction at the Zone 40 Surface WTP and aqueduct pumping plant and pretreatment facility sites would be significant. There are no mitigation measures available to reduce this impact to less-than-significant levels. Therefore, this impact is significant and unavoidable. However, implementation of Mitigation Measure 14-1, described above, could minimize these potential impacts.

Canal Pumping Plant and Folsom South Canal to Mokelumne Aqueducts Pipeline

Table 14-19 calculates anticipated noise levels for construction of the canal pumping plant and the pipeline from the FSC to Mokelumne Aqueducts (FSCC pipeline) as a function of distance. A reasonable worst-case assumption is that the three loudest pieces of equipment would operate simultaneously and continuously over at least a 1-hour period for a combined source noise level. In the vicinity of simultaneous operation of one derrick crane and two trucks, a combined source level of 93 dBA at 50 feet is assumed. Point-source attenuation of 6 dB per doubling of distance, as well as molecular absorption of 0.7 dB per 1,000 feet and anomalous excess attenuation of 1 dB per 1,000 feet, is also assumed (Hoover 1996).

Table 14-19. Estimated Construction Noise in the Vicinity of the FSC to Mokelumne Aqueducts Pipeline and Canal Pumping Plant Active Construction Sites

Distance Attenuation	
Distance to Receptor (feet)	Sound Level at Receptor (dBA)
50	93
100	87
225	80
400	74
600	70
800	68
1,000	65
1,500	61
2,000	58
2,500	55
3,000	52
4,000	48
5,280	44
7,500	37

The following assumptions were used:

Basic sound level drop-off rate: 6.0 dB per doubling of distance
Molecular absorption coefficient: 0.7 dB per 1,000 feet
Anomalous excess attenuation: 1.0 dB per 1,000 feet
Reference sound level: 93 dBA
Distance for reference sound level: 50 Feet

Notes: This calculation does not include the effects, if any, of local shielding, which may reduce sound levels further.

Estimates are based on calculations for one derrick crane and two trucks.

Although these anticipated noise levels would be temporary if they were to occur, the noise levels would exceed local noise regulation standards and would be substantially higher than existing noise levels. Nearby residences and other noise-sensitive land uses within approximately 4,000 feet could be temporarily exposed to noise levels that exceed local noise regulations. Noise impacts associated with construction at the canal pumping plant site would be significant. There are no mitigation measures available to reduce this impact to less-than-significant levels. Therefore, this impact is significant and unavoidable. However, implementation of Mitigation Measure 14-1, described above, could minimize these potential impacts.

Impact 14-6: Exposure of Noise-Sensitive Land Uses to General Construction Noise at Night

Most construction activity would be limited to daytime hours consistent with local noise regulations. However, certain construction activities may require construction to occur over 24-hour periods for limited times, and nighttime construction may be desirable in some locations to minimize potential traffic or other issues. Potential noise impacts resulting from nighttime construction of facilities were evaluated by estimating the amount of noise generated on a theoretical worst-case period of construction activity, as previously described under "Impact 14-5: Short-Term Increases in Construction Noise Levels during Daytime Hours." This estimate is based on equipment that would be used during construction activities for the Freeport intake facility, pipelines, Zone 40 Surface WTP and aqueduct pumping plant and pretreatment facility, canal pumping plant, and all other related facilities. Estimated construction noise is shown in Tables 14-16 through 14-19.

Although the anticipated noise levels would be temporary if they were to occur, the noise levels would exceed local noise regulation standards and would be substantially higher than existing noise levels. Nearby residences and other noise-sensitive land uses could be temporarily exposed to noise levels that exceed local noise regulations. Noise impacts associated with nighttime construction would be significant. There are no mitigation measures available to reduce this impact to less-than-significant levels. Therefore, this impact is unavoidable. However, implementation of Mitigation Measures 14-1 and 14-2 could minimize these potential impacts.

Mitigation Measure 14-2: Minimize Nighttime Construction Activity

Construction activities should be limited to daytime hours consistent with local noise regulations to the maximum extent feasible. If nighttime construction is determined to be required, adequate notice should be provided to all potentially affected residences. The construction contractor will designate a noise disturbance coordinator who will be responsible for responding to complaints regarding construction noise. The coordinator will determine the cause of the complaint and will ensure that reasonable measures are implemented to correct the problem. A contact telephone number for the noise disturbance coordinator will be conspicuously posted on construction site fences and will be included in the written notification of the construction schedule sent to nearby residents. Such notices should be provided at least two weeks prior to commencement of nighttime construction activities to all residences within 4,000 feet of nighttime construction areas.

Operation-Related Impacts

Impact 14-7: Increase in Noise Levels from Facility Operation

These alternatives would require long-term operation of major facilities including the intake facility, the Zone 40 Surface WTP, the canal pumping plant, and aqueduct pumping plant and pretreatment facility. As described in the Environmental Commitments section of Chapter 2, project facilities would be

designed to meet the local jurisdictions noise standards. However, because ambient noise levels in some areas could be as low as 35-40 dBA L_{dn}, each of these facilities would be capable of generating noise levels that could be 5 dB greater than existing noise levels. Accordingly, this impact is significant. While implementation of the noise attenuation environmental commitment would minimize this impact, it may not reach a less-than-significant level. Therefore, this impact is considered significant and unavoidable.

Alternative 6

Construction-Related Impacts

Impact 14-8: Short-Term Increases in Construction Noise Levels during Daytime Hours

As described above, construction of project components under this alternative would result in short-term increases in noise levels along the pipeline alignment, at project facility locations, and at Pardee Dam. Construction activities at most locations would persist for several days to no more than a few weeks; however, substantially longer construction periods are expected at major facility locations and Pardee Dam.

Potential noise impacts resulting from construction of facilities were evaluated by estimating the amount of noise generated on a theoretical worst-case period of construction activity, as previously described under "Impact 14-5: Short-Term Increases in Construction Noise Levels during Daytime Hours." This estimate is based on equipment that would be used during construction activities for the Freeport intake facility, pipelines, Zone 40 Surface WTP, enlarging Pardee Dam, and all other related facilities. Table 14-15 summarizes anticipated equipment required for construction of each component of the project alternative, and estimated construction noise is shown in Tables 14-16 through 14-19.

Although the anticipated noise levels would be temporary if they were to occur, the noise levels would exceed local noise regulation standards and would be substantially higher than existing noise levels. Nearby residences and other noise-sensitive land uses could be temporarily exposed to noise levels that exceed local noise regulations. Noise impacts associated with construction would be significant. There are no mitigation measures available to reduce this impact to less-than-significant levels. Therefore, this impact is unavoidable. However, implementation of Mitigation Measures 14-1 could minimize these potential impacts.

Impact 14-9: Exposure of Noise-Sensitive Land Uses to General Construction Noise at Night

Most construction activity would be limited to daytime hours consistent with local noise regulations. However, certain construction activities may require construction to occur over 24-hour periods for limited times, and nighttime construction may be desirable in some locations to minimize potential traffic or other issues. Potential nighttime noise impacts resulting from construction of this

alternative were evaluated by estimating the amount of noise generated on the theoretical worst-case day of construction activity, as described above. This estimate is based on equipment that would be used during construction activities. A detailed inventory of heavy construction equipment that would be used for the project alternative was not available; therefore, this noise analysis is based on anticipated construction equipment that would be used during construction activities. Table 14-15 summarizes anticipated equipment required for construction of each component of the project alternative.

Based on the noise levels summarized in Table 14-15, Table 14-20 calculates estimated sound levels from construction activities as a function of distance. Simultaneous operation of an impact pile driver[2], rock drill, and a paver for a combined source level of 103 dBA at 50 feet is assumed. Point-source attenuation of 6 dB per doubling of distance, as well as molecular absorption of 0.7 dB per 1,000 feet and anomalous excess attenuation of 1 dB per 1,000 feet, are assumed (Hoover 1996). The canyon topography surrounding the new dam facilities and the distance to the nearest noise-sensitive land uses (i.e., Pardee Center, more than 4,200 feet away) would provide sufficient attenuation to minimize construction noise at the new Pardee Dam construction site to less-than-significant levels. However, in other construction areas associated with this alternative (i.e., construction of the Pardee Saddle Dams, Jackson Creek Saddles Dams, removal of Middle Bar Bridge, and construction of the SR 49 replacement bridge), the surrounding topography would not provide sufficient attenuation of noise at the remaining construction sites. In addition, the other construction sites are closer to nearby noise-sensitive land uses (e.g., the Mokelumne River Lodge is approximately 250 feet from the SR 49 bridge).

[2] It was anticipated that impact and vibratory pile driving would not occur concurrently. Therefore, only the loudest pile driving (impact) is used in the assessment.

Table 14-20. Estimated Construction Noise in the Vicinity of an Active Enlarge Pardee Reservoir Construction Site

Distance Attenuation	
Distance to Receptor (feet)	Sound Level at Receptor (dBA)
50	103
100	97
225	90
400	84
600	80
800	78
1,000	75
1,500	71
2,000	68
2,500	65
3,000	62
4,000	58
5,280	54
7,500	47

The following assumptions were used:

Basic sound level drop-off rate:	6.0 dB per doubling of distance
Molecular absorption coefficient:	0.7 dB per 1,000 feet
Anomalous excess attenuation:	1.0 dB per 1,000 feet
Reference sound level:	103 dBA
Distance for reference sound level:	50 Feet

Notes: This calculation does not include the effects, if any, of local shielding, which may reduce sound levels further.

Estimates are based on calculations for an impact pile driver, rock drill, and paver.

The results in Table 14-20 indicate that construction activities within approximately 3,000 feet of noise-sensitive land uses could expose these land uses to noise levels in excess of the nighttime threshold of 60 dBA and/or exceed existing conditions by more than 5 dB. Noise-sensitive land uses located within this distance (primarily Mokelumne River Lodge) would be exposed to noise levels in excess of the applicable significance thresholds listed above; this would result in a significant noise impact. There are no mitigation measures available to reduce this impact to less-than-significant levels. Therefore, this impact is significant and unavoidable. However, implementation of Mitigation Measures 14-1 and 14-2, described above, could minimize these potential impacts.

Operation-Related Impacts

Impact 14-10: Increase in Noise Levels from Facility Operation

This alternative would require long-term operation of major facilities including the intake facility and the Zone 40 Surface WTP. As described in the Environmental Commitments section of Chapter 2, project facilities would be designed to meet the local jurisdictions noise standards. However, because ambient noise levels in some areas could be as low as 35-40 dBA L_{dn}, each of these facilities would be capable of generating noise levels that could be 5 dB greater than existing noise levels. Accordingly, this impact is significant. While implementation of the noise attenuation environmental commitment would minimize this impact, it may not reach a less-than-significant level. Therefore, this impact is considered significant and unavoidable.