4.11 Noise

This section provides an overview of the existing noise environment in the Los Vaqueros Reservoir Expansion Project area, as well as the regulatory framework, an analysis of potential noise impacts that would result from implementation of the project and alternatives, and mitigation measures where appropriate.

4.11.1 Affected Environment

Noise and Vibration Principles

Noise Descriptors

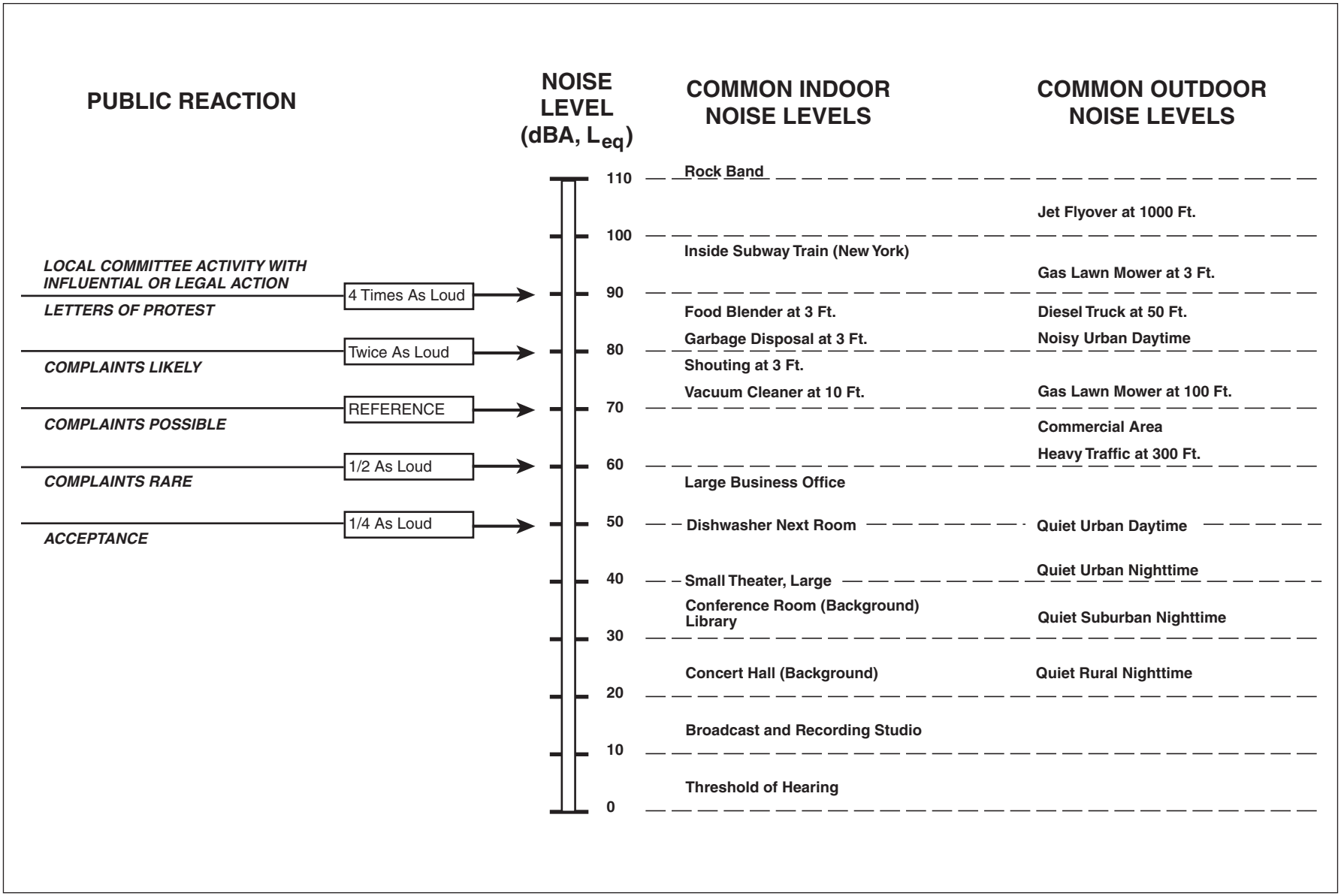
Noise is defined as unwanted sound. Sound, traveling in the form of waves from a source, exerts a sound pressure level (referred to as sound level) which is measured in decibels (dB), with zero dB corresponding roughly to the threshold of human hearing, and 120 to 140 dB corresponding to the threshold of pain. Pressure waves traveling through air exert a force registered by the human ear as sound.

Sound pressure fluctuations can be measured in units of hertz (Hz), which correspond to the frequency of a particular sound. Typically, sound does not consist of a single frequency, but rather a broad band of frequencies varying in levels of magnitude (sound power). When all the audible frequencies of a sound are measured, a sound spectrum is plotted consisting of a range of frequency spanning 20 to 20,000 Hz. The sound pressure level, therefore, constitutes the additive force exerted by a sound corresponding to the sound frequency/sound power level spectrum.

The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum. As a consequence, when assessing potential noise impacts, sound is measured using an electronic filter that de-emphasizes the frequencies below 1,000 Hz and above 5,000 Hz in a manner corresponding to the human ears decreased sensitivity to low and extremely high frequencies instead of the frequency mid-range. This method of frequency weighting is referred to as A-weighting and is expressed in units of A-weighted decibels (dBA). Frequency A-weighting follows an international standard methodology of frequency de-emphasis and is typically applied to community noise measurements. Some representative noise sources and their corresponding A-weighted noise levels are shown in **Figure 4.11-1**.

Noise Exposure and Community Noise

An individual's noise exposure is a measure of noise over a period of time. A noise level is a measure of noise at a given instant in time. The noise levels presented in Figure 4.11-1 are representative of measured noise at a given instant in time; however, they rarely persist consistently over a long period of time. Rather, community noise varies continuously over a period of time with respect to the contributing sound sources of the community noise environment. Community noise is primarily the product of many distant noise sources, which constitute a relatively stable background noise exposure, with the individual contributors unidentifiable. The background noise level changes throughout a typical day but does so gradually, corresponding with the addition and subtraction



SOURCE: ESA, 2008

Figure 4.11-1
Effects of Noise on People

of distant noise sources such as traffic and atmospheric conditions. What makes community noise constantly variable throughout a day, besides the slowly changing background noise, is the addition of short duration single event noise sources (e.g., aircraft flyovers, motor vehicles, sirens), which are readily identifiable to the individual.

These successive additions of sound to the community noise environment varies the community noise level from instant to instant, thus requiring the measurement of noise exposure over a period of time to legitimately characterize a community noise environment and evaluate cumulative noise impacts. This time-varying characteristic of environmental noise is described using statistical noise descriptors. The most frequently used noise descriptors are summarized below:

Leq: The equivalent sound level is used to describe noise over a specified period of time, typically one hour, in terms of a single numerical value. The Leq is the constant sound level that would contain the same acoustic energy as the varying sound level, during the same time period (i.e., the average noise exposure level for the given time period).

Lmax: The instantaneous maximum noise level for a specified period of time.

L50: The noise level that is equaled or exceeded 50 percent of the specified time period. The L50 represents the median sound level.

L90: The noise level that is equaled or exceeded 90 percent of the specified time period. The L90 is sometimes used to represent the background sound level.

DNL: The 24-hour day and night A-weighted noise exposure level, which accounts for the greater sensitivity of most people to nighttime noise by weighting noise levels at night ("penalizing" nighttime noises). Noise between 10:00 p.m. and 7:00 a.m. is weighted (penalized) by adding 10 dBA to take into account the greater annoyance of nighttime noises.

CNEL: Similar to the DNL, the Community Noise Equivalent Level (CNEL) adds a 5-dBA "penalty" for the evening between 7:00 p.m. and 10:00 p.m. in addition to a 10-dBA penalty between 10:00 p.m. and 7:00 a.m.

As a general rule, in areas where the noise environment is dominated by traffic, the Leq during the peak hour is generally equivalent to the DNL at that location (Caltrans, 1998).

Effects of Noise on People

The effects of noise on people can be placed into three categories:

- Subjective effects of annoyance, nuisance, and dissatisfaction
- Interference with activities such as speech, sleep, or learning
- Physiological effects such as hearing loss or sudden startling

Environmental noise typically produces effects in the first two categories. Workers in industrial plants can experience noise in the last category. There is no completely satisfactory way to measure the subjective effects of noise or the corresponding reactions of annoyance and dissatisfaction. A wide variation in individual thresholds of annoyance exists, and different tolerances to noise tend to develop based on an individual's past experiences with noise. Thus, an important way of predicting

a human reaction to a new noise environment is the way the noise compares to the existing environment to which one has adapted: the so called "ambient noise" level. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged by those hearing it. With regard to increases in A-weighted noise level, the following relationships occur:

- Outside of the laboratory, a 3-dBA change is considered a just-perceivable difference.
- A change in level of at least 5 dBA is required before any noticeable change in human response would be expected.
- A 10-dBA change is subjectively heard as approximately a doubling in loudness, and can cause an adverse response.

These relationships occur in part because of the logarithmic nature of sound and the decibel system. The human ear perceives sound in a nonlinear fashion; hence the decibel scale was developed. Because the decibel scale is based on logarithms, two noise sources do not combine in a simple additive fashion but increase logarithmically. For example, if two identical noise sources produce noise levels of 50 dBA, the combined sound level would be 53 dBA, not 100 dBA.

Noise Attenuation

Stationary point sources of noise, including stationary mobile sources such as idling vehicles, attenuate (lessen) at a rate between 6 dBA for hard sites and 7.5 dBA for soft sites for each doubling of distance from the reference measurement. Hard sites are those with a reflective surface between the source and the receiver, such as parking lots or smooth bodies of water. No excess ground attenuation is assumed for hard sites, and the changes in noise levels with distance (the drop-off rate) is simply the geometric spreading of the noise from the source. Soft sites have an absorptive ground surface such as soft dirt, grass, or scattered bushes and trees. In addition to geometric spreading, an excess ground attenuation value of 1.5 dBA (per doubling distance) is normally assumed for soft sites. Line sources (such at traffic noise from vehicles) attenuate at a rate between 3 dBA for hard sites and 4.5 dBA for soft sites for each doubling of distance from the reference measurement (Caltrans, 1998).

Fundamentals of Vibration

As described in the Federal Transit Administration's *Transit Noise and Vibration Impact Assessment* (FTA, 2006), ground-borne vibration can be a serious concern for nearby neighbors of a transit system route or maintenance facility; ground-borne vibration can cause buildings to shake and rumbling sounds to be heard. In contrast to airborne noise, ground-borne vibration is not a common environmental problem. It is unusual for vibration from sources such as buses and trucks to be perceptible, even close to major roads. Some common sources of ground-borne vibration are trains, buses on rough roads, and construction activities such as blasting, pile-driving, and operating heavy earthmoving equipment.

Several different methods are used to quantify vibration. The peak particle velocity (PPV) is defined as the maximum instantaneous peak of the vibration signal. The PPV is most

frequently used to describe vibration impacts to buildings. The root mean square (RMS) amplitude is most frequently used to describe the affect of vibration on the human body. The RMS amplitude is defined as the average of the squared amplitude of the signal. Decibel notation (Vdb) is commonly used to measure RMS. The decibel notation acts to compress the range of numbers required to describe vibration. Typically, ground-borne vibration generated by man-made activities attenuates rapidly with distance from the source of the vibration. Sensitive receptors for vibration include structures (especially older masonry structures), people (especially residents, the elderly, and sick), and vibration-sensitive equipment.

Ground-borne vibration can cause movement of building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. In extreme cases, the vibration can cause damage to buildings. Buildings are rarely damaged during construction projects, although blasting and pile-driving have on occasion caused building damage. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by only a small margin. A vibration level that causes annoyance will be well below the damage threshold for normal buildings. The Federal Transit Administration (FTA) measure of the threshold of architectural damage for conventional sensitive structures is 0.2 inch per second PPV, and the FTA threshold of human annoyance to ground-borne vibration is 80 RMS (FTA, 2006).

In regards to blasting activities, the term “blast noise” is misleading because the largest component of blast-induced noise occurs at frequencies below the threshold-of-hearing for humans (16 to 20 Hz). Hence, the common industry term for blast-induced noise is “air-overpressure”. As its name implies, air-overpressure is a measure of the transient pressure changes. These low-intensity pulsating pressure changes, above and below ambient atmospheric pressure, are manifested in the form of acoustical waves traveling through the air. When measurements include the low frequency component they are called linear scale measurements and are expressed as dBL. Air-overpressure has a 133 dBL regulatory limit used by the US Bureau of Mines for air-overpressure measured with a 2-Hz response seismograph. Research into window damage caused by overpressure has shown first failures occur at 150dBL with substantial window damage occurring at 160dBL.

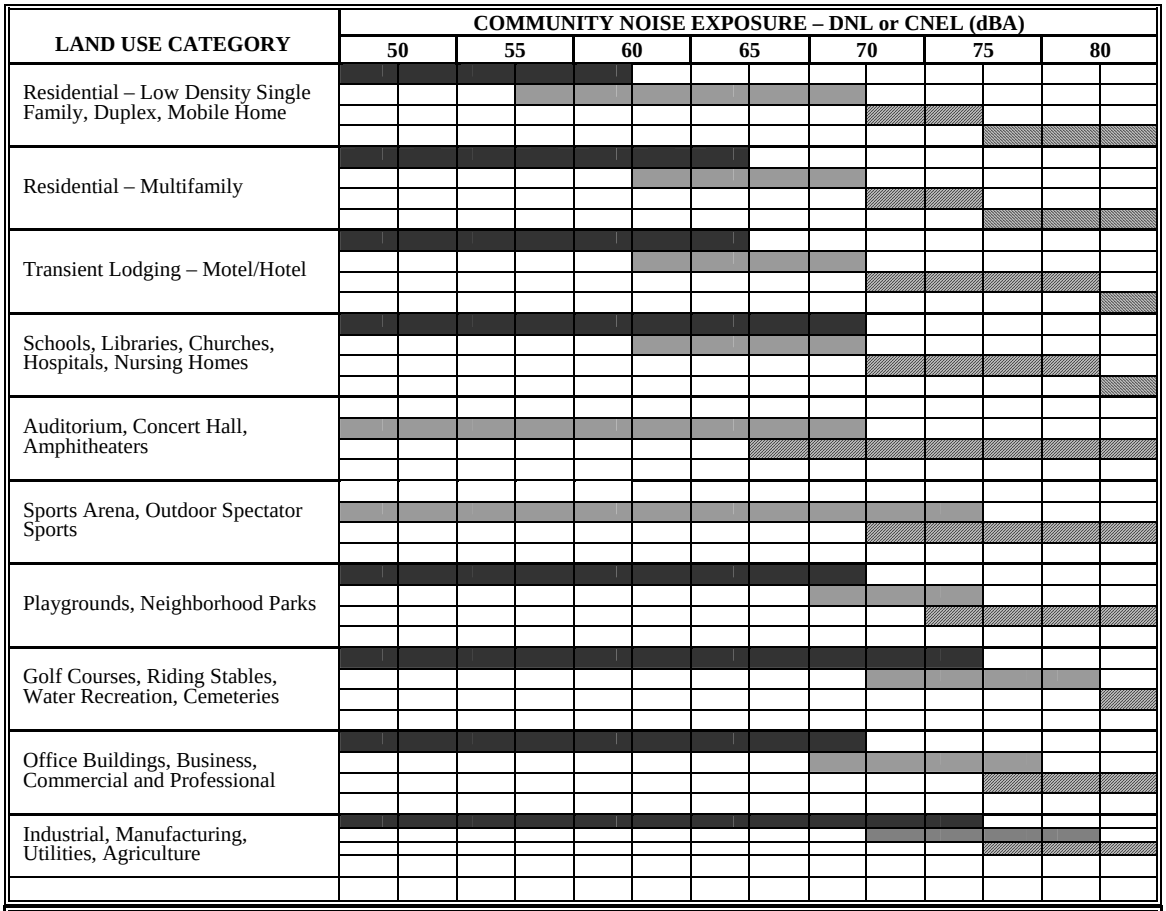
Regulatory Setting

Federal

Federal regulations establish noise limits for medium and heavy trucks (more than 4.5 tons, gross vehicle weight rating) under the Code of Federal Regulations, Title 40, Part 205, Subpart B. The federal truck pass-by noise standard is 80 dBA at 15 meters from the vehicle pathway centerline. These controls are implemented through regulatory controls on truck manufacturers.

State

The State of California has guidelines for evaluating the compatibility of various land uses as a function of community noise exposure, as shown in **Figure 4.11-2**. The State of California also establishes noise limits for vehicles licensed to operate on public roads. For heavy trucks, the



	Normally Acceptable	Specified land use is satisfactory, based on 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.
	Normally Unacceptable	New construction or development should be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirement must be made and needed noise insulation features included in the design.
	Clearly Unacceptable	New construction or development generally should not be undertaken.

SOURCE: State of California, Governor's Office of Planning and Research, 1998.

Los Vaqueros Reservoir Expansion Project . 201110

Figure 4.11-2
Land Use Compatibility for Community Noise Environment

state pass-by standard is consistent with the federal limit of 80 dB. The state pass-by standard for light trucks and passenger cars (less than 4.5 tons, gross vehicle rating) is also 80 dBA at 15 meters from the centerline. These standards are implemented through controls on vehicle manufacturers and by legal sanction of vehicle operators by state and local law enforcement officials.

The State of California has also established noise insulation standards for new multifamily residential units, hotels, and motels that would be subject to relatively high levels of transportation-related noise. These requirements are collectively known as the California Noise Insulation Standards (Title 24, California Code of Regulations). The noise insulation standards set forth an interior standard of DNL 45 dBA in any habitable room. Where dwelling units are proposed in areas subject to noise levels greater than DNL 60 dBA, these standards require an acoustical analysis that demonstrates how such units have been designed to meet this interior standard. Title 24 standards are typically enforced by local jurisdictions through the building permit application process.

Local

In California, local regulation of noise involves implementation of general plan policies and noise ordinance standards. Local general plans identify general principles intended to guide and influence development plans, and noise ordinances set forth the specific standards and procedures for addressing particular noise sources and activities. General plans recognize that different types of land uses have different sensitivities toward their noise environment; residential areas are considered to be the most sensitive type of land use to noise, and industrial/commercial areas are considered to be the least sensitive.

Contra Costa County Noise Element

Contra Costa County does not have an adopted noise ordinance; however, the Noise Element of the Contra Costa County General Plan (Contra Costa County, 2005) sets various goals and policies that act as noise and land use compatibility guidance for projects in Contra Costa County. Most of these policies address land use compatibility for evaluating the acceptability of existing and future exterior noise levels (i.e., transportation) at new projects proposing noise-sensitive receptors (e.g., residential development) and are not directly applicable to the proposed project and alternatives. However, the following policies, which address noise levels at existing sensitive receptors and construction noise, are applicable.

- *Policy 11-7*. Public Projects shall be designed and constructed to minimize long-term noise impacts on existing residents.

- *Policy 11-8*. Construction activities shall be concentrated during the hours of the day that are not noise-sensitive for adjacent land uses and should be commissioned to occur during normal work hours of the day to provide relative quiet during the more sensitive evening and early morning periods.

Policy 11-2 also notes that the County's standard for outdoor noise levels in residential areas is 60 dB DNL, but that this level "may not be achievable in all residential areas due to economic or aesthetic constraints." These and other noise related goals and policies are found in Appendix E-2,

"General Plan Goals, Policies and Programs for Contra Costa County." Noise from construction activities in Contra Costa County is considered exempt from applicable standards during daytime hours, although the County has not defined "daytime" or "normal work hours" for construction noise. Instead, the County uses project-specific conditions of approval to regulate construction noise levels for projects that require County approvals (Frazier, pers. comm., 2008).

East County Area Plan – A Portion of the Alameda County General Plan

The East County Area Plan (Alameda County, 1994, revised 2002), which is a component of the Alameda County General Plan, sets various environmental health and safety goals and objectives that apply to projects in eastern Alameda County. The following noise-related policies aim to minimize East County residents' and workers' exposure to excessive noise:

- *288*. The County shall endeavor to maintain acceptable noise levels throughout East County.
- *289*. The County shall limit or appropriately mitigate new noise-sensitive development in areas exposed to projected noise levels exceeding 60 dB based on the *California Office of Noise Control Land Use Compatibility Guidelines*.

These and other noise related policies are listed in Appendix E-1. The "Alameda County General Plan Goals, Policies and Programs" do not list standards for acceptable noise levels, as provided in the Alameda County Noise Ordinance (see below); however, they indicate that noise studies should be required as part of development review.

Alameda County Noise Ordinance

Alameda County policy prohibits unnecessary, excessive, and annoying noise and vibration in the county, as described in the Alameda County Ordinance Code, Title 6.0 (Health and Safety), Chapter 6.60 (Noise). The policy is to maintain quiet in areas that have low noise levels and to implement programs aimed at reducing noise in those areas within the county where noise levels are above acceptable limits. **Table 4.11-1** presents the County's acceptable exterior noise levels within residential and commercial areas that are affected by stationary noise sources. Construction activities, including construction-related traffic noise, are exempt from the Noise Ordinance provisions if the construction activities are limited to between 7:00 a.m. and 7:00 p.m., Monday through Friday, and between 8:00 a.m. and 5:00 p.m. on Saturday and Sunday. Ord. Code § 6.60.070E.

Existing Noise Environment

The noise environment in the project area is influenced primarily by agricultural operations and traffic on local roadways. Wind turbines located in the foothills south and southeast of the Los Vaqueros Reservoir can be heard by persons in close proximity (e.g. – within approximately 1,500 feet) to wind energy generation machinery, however the turbines are not a recognizable noise source beyond their immediate geographic area. Sound levels away from these noise sources can be quite low, depending on the amount of nearby human activity.

TABLE 4.11-1
ALAMEDA COUNTY EXTERIOR NOISE LEVEL STANDARDS

Category	Cumulative Minutes in any One-Hour Time Period	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Receiving Land Use – Single or Multifamily Residential, School, Hospital, Church, or Public Library Properties – Noise Level Standards (dBA)			
1	30	50	45
2	15	55	50
3	5	60	55
4	1	65	60
5	0	70	65
Receiving Land Use – Commercial Properties – Noise Level Standards (dBA)			
1	30	65	60
2	15	70	65
3	5	75	70
4	1	80	75
5	0	85	80

SOURCE: Alameda County, 2006. Alameda County Noise Ordinance, Chapter 6.60 of the Alameda County Code. Alameda County Code last updated December 2006.

Metrosonics Model db308 sound level meters were used to obtain the ambient noise level measurements. The meters were calibrated to ensure the accuracy of the measurements. Two long-term (72-hour) noise level measurements and 12 short-term (five-minute) noise level measurements were taken in the vicinity of the project sites. The noise measurement locations are shown on **Figure 4.11-3**, and the results are presented in **Table 4.11-2**. Long-term measurement results (from locations shown on Figure 4.11-3) are also graphically depicted in **Figures 4.11-4** through **4.11-9**.

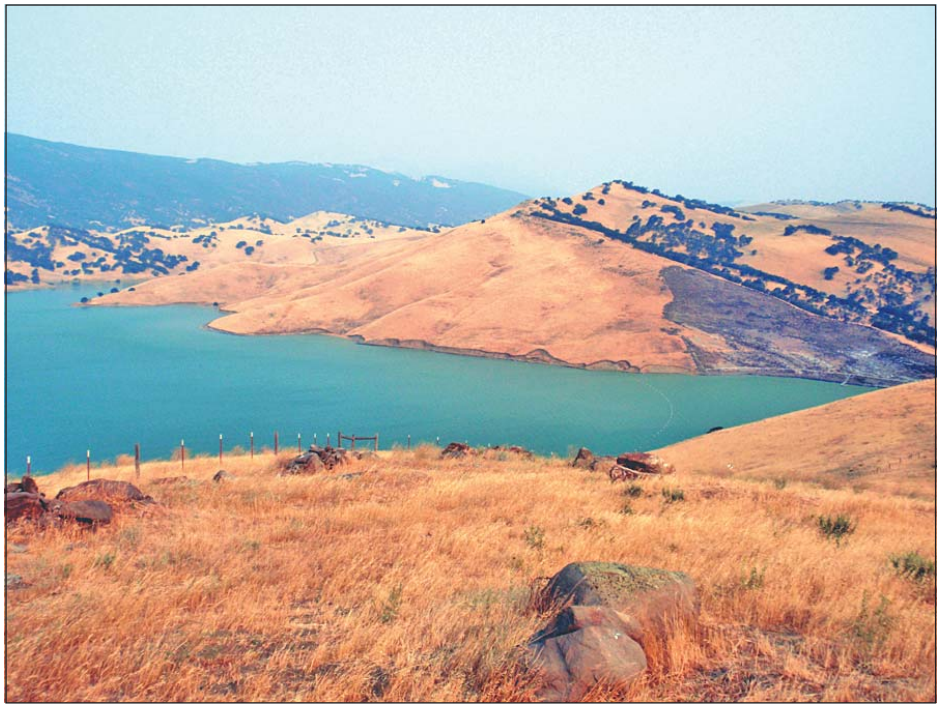
Sensitive Receptors

Some land uses are considered more sensitive to ambient noise levels than others because of the amount of noise exposure (in terms of both exposure duration and insulation from noise) and the types of activities typically involved. Residences, hotels, schools, rest homes, and hospitals are generally more sensitive to noise than commercial and industrial land uses. The closest sensitive receptors to each project component are described below and shown on Figure 4.11-3.

Alternative 1

The closest sensitive receptor to the Los Vaqueros Reservoir Expansion/Dam Modification site is a single residence located along Los Vaqueros Road about 2 miles south of the reservoir. There are also 12 residences on the ridge west of the watershed near Morgan Territory Road, about 1.6 miles from the reservoir and 3 miles from the reservoir dam site. In addition, there are several residences approximately 2.5 miles northeast of the expanded dam site, located off Silver Hills Drive near the north entrance to the watershed that may also be sensitive receptors affected by some construction noise.

PHOTOGRAPH 3. View from Vista Grande Trail looking southeast toward San Joaquin County (October 2008)



PHOTOGRAPH 4. View from Eastside Trail looking northwest toward the dam and borrow area (July 2008)

SOURCE: ESA, 2006

Figure 4.14-3
Site Photographs

TABLE 4.11-2
EXISTING NOISE ENVIRONMENT AT PROJECT SITES

Location	Time Period	Leq (dB)	Noise Sources
Long-Term Location 1: 50 feet from corner of Newport and SR 4 - About 50 feet from Delta-Transfer Pipeline and 5,000 feet from the New Western Substation.	24-hour CNEL measurements were: Wednesday 3/28/07: 72 Thursday 3/29/07: 73 Friday 3/30/07: 73	Hourly Leq ranged from: 65 – 70	Unattended noise measurements do not specifically identify noise sources.
Long-Term Location 2: 50 feet from SR 4 and near Old River Intake and Pump Station. About 4,500 feet from the new Delta Intake and Pump Station.	24-hour CNEL measurements were: Wednesday 3/28/07: 71 Thursday 3/29/07: 70 Friday 3/30/07: 70	Hourly Leq ranged from: 62 – 69	Unattended noise measurements do not specifically identify noise sources.
Short-Term Location 1: 50 feet from the corner of Discovery Bay and SR 4 - About 50 feet from Delta-Transfer Pipeline	5 Minutes 3/27/07 11:38	67.2	• Traffic at light • Wind
Short-Term Location 2: 50 feet from corner of Newport and SR 4 - About 50 feet from Delta-Transfer Pipeline and 5,000 feet from the New Western Substation.	5 Minutes 3/27/07 11:51	69.3	• Traffic 55 mph • Wind
Short-Term Location 3: 50 feet from corner of Bixler and SR 4 - About 50 feet from Delta-Transfer Pipeline	5 Minutes 3/27/07 12:12	70.1	• Traffic at light • Wind
Short-Term Location 4: Corner of SR 4 and Byron Highway - About 3,500 feet from Delta-Transfer Pipeline	5 Minutes 3/27/07 12:27	74.2	• Traffic at light • Street Cleaner 78 dB • Westside Concrete • Wind
Short-Term Location 5: 50 feet from the corner of Camino Diablo and Vasco Road - About 50 feet from Transfer-Bethany Pipeline and 9,000 feet from the stockpile area	5 Minutes 3/27/07 14:19	66.2	• Traffic at light • Wind
Short-Term Location 6: 50 feet from Vasco Road – About 1,500 feet from Transfer-Bethany Pipeline and 23,000 feet from the Expanded Dam area	5 Minutes 3/27/07 14:36	75.1	• Traffic 65 mph • Wind
Short-Term Location 7: Nearest parking lot to Los Vaqueros Dam – About 50 feet from Transfer-LV Pipeline and 900 feet from the Expanded Dam area	5 Minutes 3/27/07 14:56	46	• Cows – 50.4 dB • Dropped pen – 58 dB • Wind
Short-Term Location 7: Nearest parking lot to Los Vaqueros Dam – About 50 feet from Transfer-LV Pipeline and 900 feet from the Expanded Dam area	5 Minutes 3/27/07 15:01	45.5	• Cows – 50.4 dB • Wind
Short-Term Location 8: 50 feet from corner of Camino Diablo and Walnut Boulevard – About 50 feet from Transfer-LV Pipeline	5 Minutes 3/27/07 15:15	53	• Traffic 55 mph • Wind

TABLE 4.11-2 (Continued)
EXISTING NOISE ENVIRONMENT AT PROJECT SITES

Location	Time Period	Leq (dB)	Noise Sources
Short-Term Location 9: Near LT2. 50 feet from SR 4 and near Old River Intake and Pump Station. About 4,500 feet from the new Delta Intake and Pump Station.	5 Minutes 3/27/07 16:05	69.6	• Traffic 45 mph • Wind
Short-Term Location 10: 50 feet from Kellogg Creek Road - About 50 feet from Delta-Transfer Pipeline	5 Minutes 4/02/07 10:08	49	• Traffic on SR 4 in distance • Wind
Short-Term Location 11: 50 feet from Byron Highway and Hoffman Lane - About 50 feet from Delta-Transfer Pipeline	5 Minutes 4/02/07 10:22	63.4	• Traffic on Byron Highway • Two cars on Hoffman • Wind
Short-Term Location 12: 50 feet from Hoffman Lane - About 50 feet from Delta-Transfer Pipeline	5 Minutes 4/02/07 10:30	56.9	• Traffic on SR 4 in distance • Tractor in adjacent field • Truck 72 dB • Wind

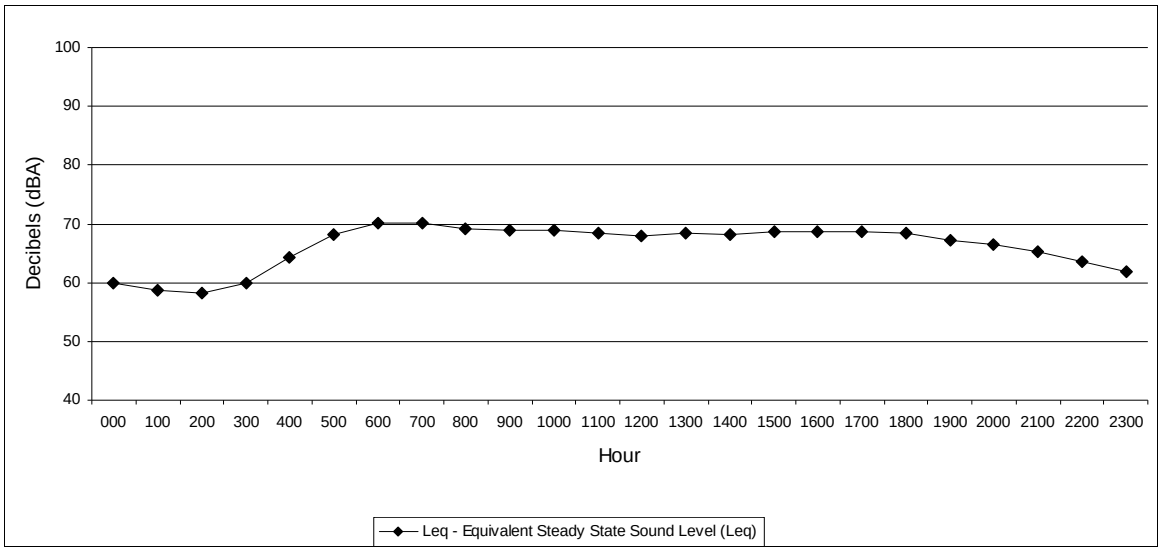
SOURCE: ESA, 2007.

The new Delta Intake and Pump Station would be constructed along Old River within the siting zone shown on Figure 3-14, and could be as close as 500 feet or as far as 1,000 feet from an existing residence located on the east side of Old River, outside the levee. For purposes of impact assessment, this residence is considered to be located 500 feet east of the anticipated construction.

Conveyance facilities for Alternative 1 include the following facilities and associated sensitive receptors:

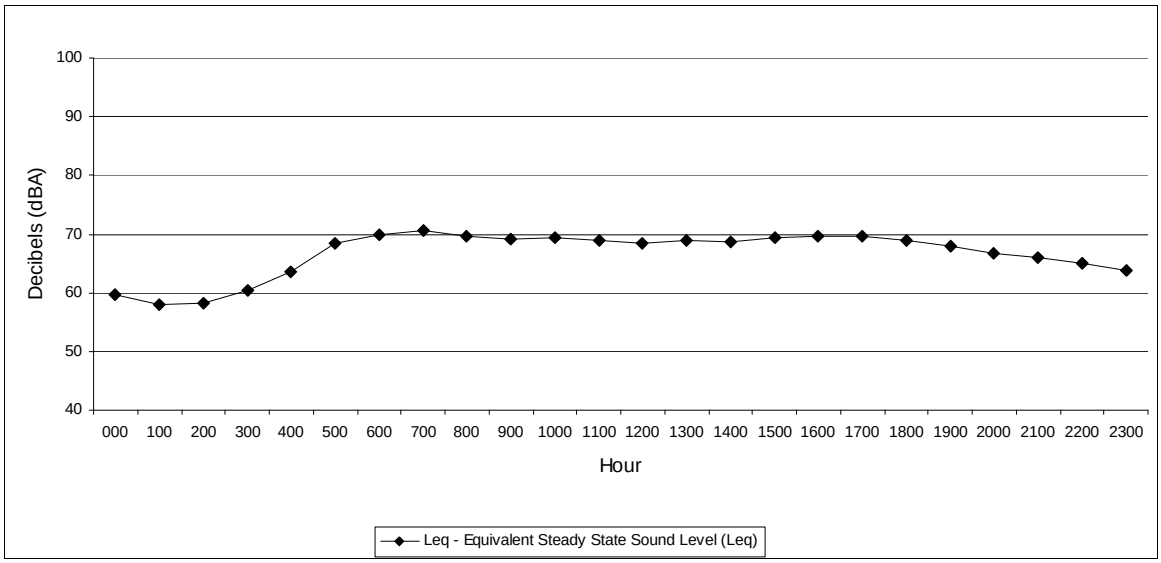
- The Delta-Transfer Pipeline would pass as close as 50 feet from the closest homes on SR 4, Bixler Road, Kellogg Creek Road, and Hoffman Lane, including construction along SR 4 south of the Discovery Bay residential community.
- The Transfer Facility Expansion would be about 1,450 feet east of the nearest residence on Walnut Boulevard.
- The Transfer-LV Pipeline would pass as close as 50 feet from homes on along Camino Diablo and Walnut Avenue.
- The Transfer-Bethany Pipeline would pass as close as 50 feet from homes on Armstrong Road.

Proposed additional electrical power supply lines would be extended to the existing Old River Intake and Pump Station, new Delta Intake and Pump Station, and Expanded Transfer Facility and would largely be located in close proximity to proposed project pipelines, affecting the same sensitive receptors as described above.



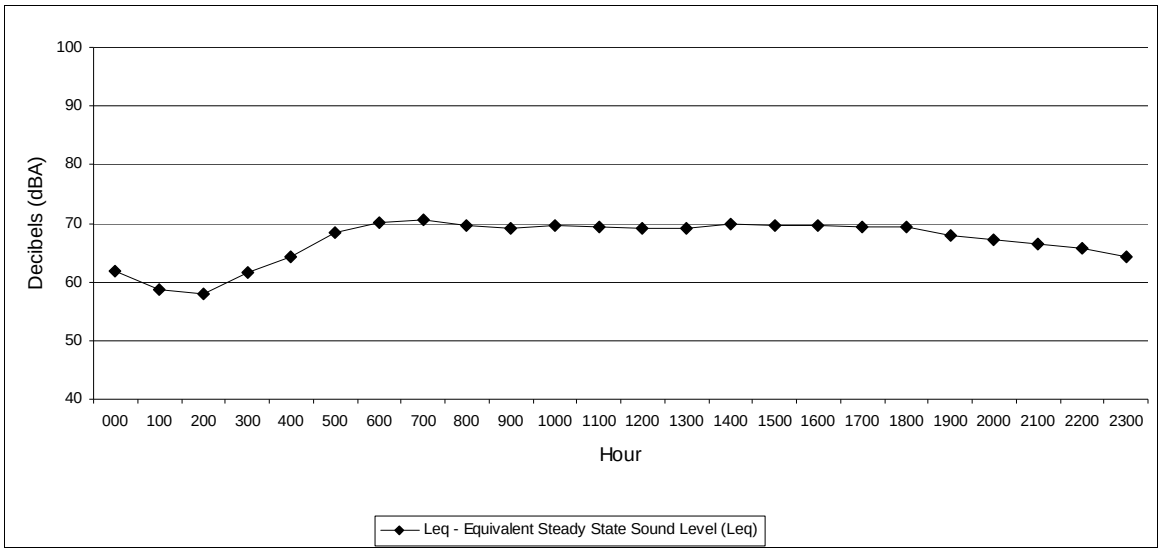
Los Vaqueros Reservoir Expansion Project. 201110

Figure 4.11-4
24-Hour Noise Measurement – Site LT1
Wednesday March 28, 2007



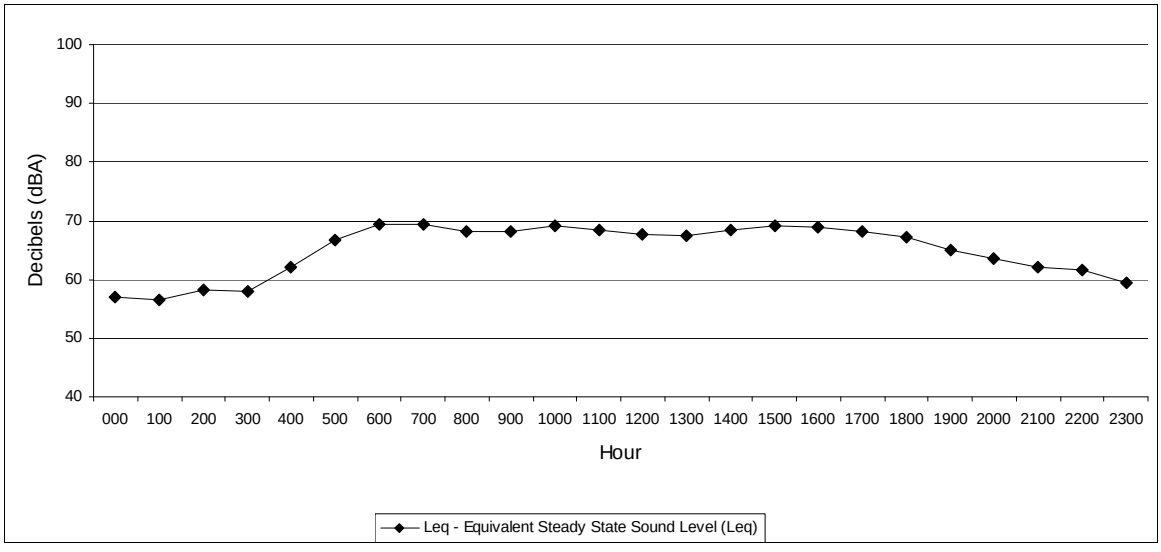
Los Vaqueros Reservoir Expansion Project. 201110

Figure 4.11-5
24-Hour Noise Measurement – Site LT1
Thursday March 29, 2007



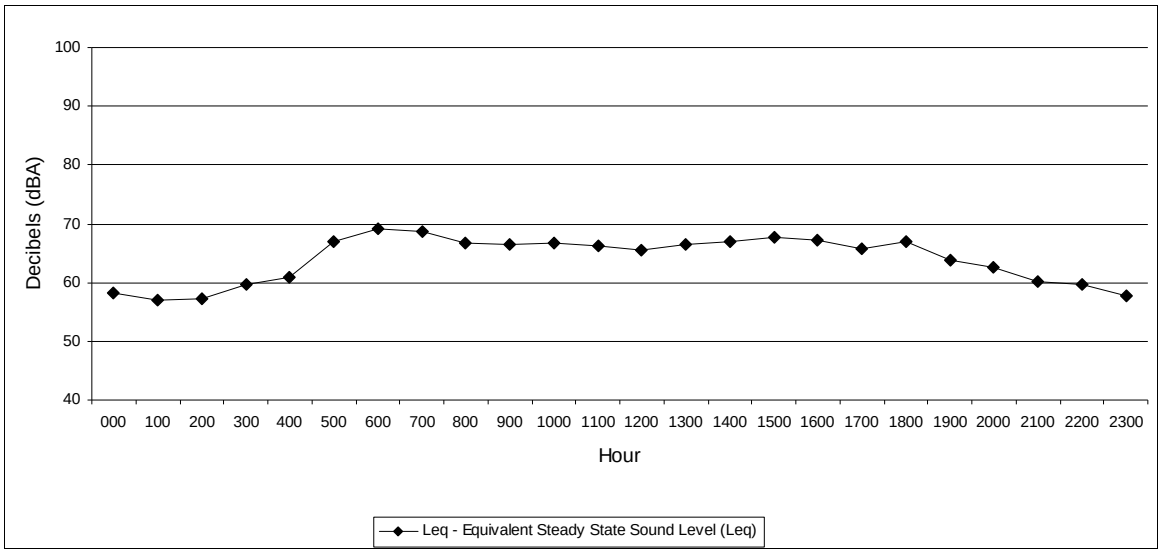
Los Vaqueros Reservoir Expansion Project. 201110

Figure 4.11-6
24-Hour Noise Measurement – Site LT1
Friday March 30, 2007



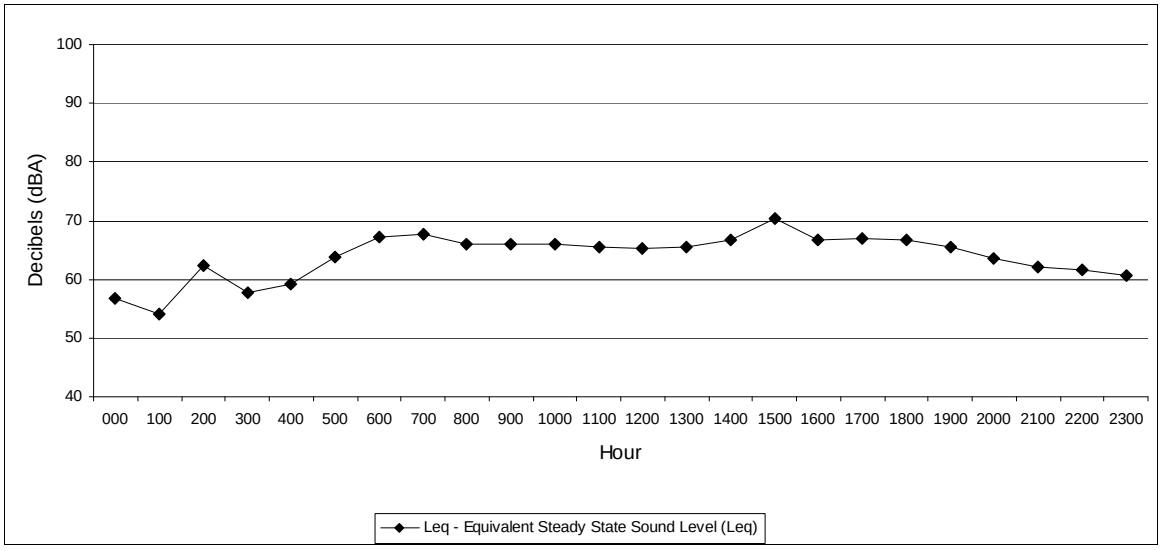
Los Vaqueros Reservoir Expansion Project. 201110

Figure 4.11-7
24-Hour Noise Measurement – Site LT2
Wednesday March 28, 2007



Los Vaqueros Reservoir Expansion Project. 201110

Figure 4.11-8
24-Hour Noise Measurement – Site LT2
Thursday March 29, 2007



Los Vaqueros Reservoir Expansion Project. 201110

Figure 4.11-9
24-Hour Noise Measurement – Site LT2
Friday March 30, 2007

The nearest rural residences to the Power Option 1 (Western only) are about 1,275 feet away from the proposed Western substation and upgraded transmission line to be extended to the new Delta Intake Pump Station. The substation under Power Option 2 (Western & PG&E) would be located within the CCWD watershed property line, approximately 500 feet west of the nearest residences located on Silver Hills Drive.

Recreation Facilities associated with expansion of the reservoir to 275 TAF include a Marina Complex and an Interpretive Center located west of the enlarged dam; relocated and new hiking trails and access; and other facilities (fishing piers, picnic areas, restrooms and parking). All of these facilities would be located within the CCWD watershed property line. The nearest sensitive receptor would be a residence located southeast of the corner of Camino Diablo and Walnut Boulevard, over one mile from anticipated new recreational facilities.

Alternative 2

The potential noise impacts on sensitive receptors associated with Alternative 2 would be exactly the same as those described above for Alternative 1 because Alternative 2 includes all the same proposed facilities and construction activities in the same locations.

Alternative 3

Sensitive receptors and noise impacts for Alternative 3 would be largely the same as those outlined for Alternative 1 with three substantive differences:

- The existing Old River Intake and Pump Station would be expanded under this alternative but not under Alternative 1. Construction activity to expand this facility would occur approximately 3,000 feet from the nearest residence located to the northwest along SR 4 (see Figure 14.11-3).

- Alternative 3 would not include construction of a new Delta Intake and Pump Station, so there would be no exposure of sensitive receptors to noise associated with this facility as there would be under Alternative 1.

- Alternative 3 would not include the Transfer-Bethany pipeline, so there would be no exposure of sensitive receptors to noise associated with this facility.

The closest sensitive receptors to the remaining project components would be the same as described above for Alternative 1.

Alternative 4

Alternative 4 would include a dam raise for a 160 TAF reservoir that would be smaller and involve less construction material and construction activity than the dam raise required under Alternative 1 for the 275 TAF reservoir. Alternative 4 would involve construction of the same dam appurtenance facilities as Alternative 1. Under Alternative 4, the closest sensitive receptor to the Expanded Los Vaqueros Reservoir Expansion/Dam Modification site is the single residence located along Los Vaqueros Road 1.5 miles to the south. In addition, there are also several residences approximately 2.5 miles northeast of the expanded dam site, located off Silver Hills Drive.

There are twelve additional residences located near Morgan Territory Road about 2.5 miles southwest of the reservoir and 3 miles from the dam raise that may also be sensitive receptors affected by some construction noise. Like Alternative 1, blasting would be used at the shell borrow area adjacent to the dam, although less material would be excavated under this alternative. Blasting would not result in a significant impact on any of the nearby residences. The closest sensitive receptors to the 160 TAF Reservoir Expansion core borrow area are residences located east of the Watershed boundary, about 2,000 feet north of the 160 TAF borrow site.

Alternative 4 would not include expansion of the existing Old River Pump Station or construction of the new Delta Intake and Pump Station, any of the proposed conveyance facilities, or any new power supply facilities. Also, fewer recreation facilities would be relocated or expanded within CCWD watershed lands under Alternative 4 than under Alternative 1. Construction of the new and relocated recreation facilities would not increase noise levels at any sensitive receptor sites.

4.11.2 Environmental Consequences

Methodology

Noise impacts are assessed based on a comparative analysis of the noise levels resulting from the alternative and the noise levels under existing conditions. Analysis of temporary construction noise effects is based on typical construction phases and equipment noise levels and attenuation of those noise levels due to distances between the construction activity and the sensitive receptors near the sources of construction noise.

Vibration from construction is evaluated for potential impacts at sensitive receptors. Typical activities evaluated for potential building damage due to construction vibration include demolition, pile driving, and drilling or excavation in close proximity to structures. The ground-borne vibration is also evaluated for perception to eliminate annoyance. Vibration propagates according to the following expression, based on point sources with normal propagation conditions:

$$PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$$

Where PPV (equip) is the peak particle velocity in inches per second of the equipment adjusted for distance, PPV (ref) is the reference vibration level in inches per second at 25 feet, and D is the distance from the equipment to the receiver. The PPV is defined as the maximum instantaneous positive or negative peak of the vibration and is often used in monitoring vibration because it is related to the stresses experienced by structures.

To determine the potential for annoyance, the RMS vibration level (L_v) at any distance (D) is estimated based on the following equation:

$$L_v(D) = L_v(25\ ft) - 30\log(D/25)$$

Significance Criteria

The thresholds for determining the significance of impacts for this analysis are based on the environmental checklist in Appendix G of the State CEQA Guidelines, on thresholds used in previously certified CCWD EIRs, on the guidance provided by the Contra Costa County and Alameda County General Plans and the Alameda County Noise Ordinance, and on California Department of Transportation recommendations regarding vibration impacts. These thresholds also encompass the factors taken into account under NEPA to assess environmental impact of an action in terms of the context and the intensity of its effects. CEQA thresholds with respect to airports or private airstrips are not relevant to the project and are therefore not included here. The proposed project or an alternative was determined to result in a significant effect on the noise environment as follows:

Short-Term Construction Noise Impacts. Short-term construction noise impacts from construction in Contra Costa County would be considered significant if construction activities would be conducted outside of normal working hours and if noise levels would result in noticeable noise increase (i.e., 5 dBA or greater) in ambient noise levels at nearby noise-sensitive land uses (sensitive receptors). Contra Costa County does not have noise-related performance standards or definitions of "daylight" or "normal" working hours, but for purposes of this impact analysis normal working hours are considered to be 7 a.m. to 7 p.m. Monday through Friday, and 8 a.m. to 5 p.m. on Saturday and Sunday -- the same as the exempt construction hours in Alameda County.

Similarly, for construction activities within Alameda County, in accordance with the Alameda County Noise Ordinance, short-term noise impacts from construction would also be considered significant if construction activities would be conducted outside the daytime hours of 7 a.m. to 7 p.m. Monday through Friday, or 8 a.m. to 5 p.m. on Saturday and Sunday, and if noise levels would result in noticeable noise increase (i.e., 5 dBA or greater) in ambient noise levels at nearby noise-sensitive land uses.

Traffic Noise Impacts. Long-term traffic noise impacts would be significant if project-generated traffic would increase the average daily noise levels at a noise-sensitive land use by more than 5 dBA, or cause the overall level to exceed the "normally acceptable" standard for land use compatibility established by the Contra Costa County and Alameda County General Plans (60 dBA L_{dn} for the most noise-sensitive land uses considered by each jurisdiction in its general plan).

Stationary and Area-Source Impacts. Long-term stationary and area source impacts would be significant if the proposed project or alternative results in an substantial permanent increase in ambient noise levels (i.e., 5 dBA) at noise-sensitive receptors (i.e., residences) as this would result in a noticeable noise increase above ambient levels, or causes the overall total noise level to exceed the "normally acceptable" standards for land use compatibility described above. In addition, for project stationary source noise in Alameda County, the associated noise levels would be considered significant if the hourly exterior Leq would exceed the standards in Table 4.11-1.

Vibration Impacts. For most structures, a peak particle velocity (PPV) threshold of 0.5 inch per second is sufficient to avoid structural damage; however, the California Department of Transportation recommends a more conservative threshold of 0.2 inch per second PPV for residential buildings. Impacts would be considered significant if 0.2 inch per second PPV were reached at nearby vibration-sensitive receptors. In addition, an air-overpressure greater than 133 dBL is considered by the U.S. Bureau of Mines to be significant.

Impact Summary

Table 4.11-3 provides a summary of the impact analysis for issues related to noise based on the project construction and operation scenarios described in Chapter 3.

TABLE 4.11-3
SUMMARY OF IMPACTS – NOISE

Impact	Project Alternatives			
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**
4.11.1: Construction of facilities under the proposed project and alternatives could generate noise levels that exceed the Contra Costa County or Alameda County noise standards at nearby sensitive receptors if construction activities are carried out during noise-sensitive hours, causing sleep disturbance and/or annoyance.	LSM	LSM	LSM	LSM
4.11.2: Operation of the project and alternatives would generate traffic, stationary source, and area source noise similar to existing noise associated with operation of Los Vaqueros Reservoir system and would not exceed County noise requirements.	LS	LS	LS	LS
4.11.3: Project construction would not expose persons to or generate excessive ground-borne vibration or ground-borne noise levels.	LS	LS	LS	LS
4.11.4: The proposed project or alternatives would not make a cumulatively considerable contribution to noise levels during either construction or operation.	LS	LS	LS	LS

SU = Significant and Unavoidable
LSM = Less-than-Significant Impact with Mitigation
LS = Less-than-Significant Impact
NI = No Impact

Impact Analysis

No Project/No Action Alternative

Under the No Project/No Action Alternative, no project construction work would take place and no construction-generated noise would result. No new stationary sources of noise would be created, and there would be no new source of ground-borne vibration or noise.

Impact 4.11.1: Construction of facilities under the proposed project and alternatives could generate noise levels that exceed the Contra Costa County or Alameda County noise standards at nearby sensitive receptors if construction activities are carried out during noise-sensitive hours, causing sleep disturbance and/or annoyance. (Less than Significant with Mitigation)

Neither Contra Costa County nor Alameda County applies noise standards to daytime construction noise. If project construction proceeded at night in the vicinity of sensitive receptors, however, the project could cause significant impacts by causing 5-dBA or greater increases in noise at sensitive receptors.

Construction noise levels at and near the construction areas would fluctuate depending on the particular type, number, and duration of use of various pieces of construction equipment. Construction-related material haul trips would raise ambient noise levels along haul routes, depending on the number of haul trips and types of vehicles used. In addition, certain types of construction equipment and construction activities generate impulsive noises (such as pile driving), which can be particularly annoying. **Table 4.11-4** shows typical noise levels during different construction stages. **Table 4.11-5** shows typical noise levels produced by various types of construction equipment.

TABLE 4.11-4
TYPICAL CONSTRUCTION NOISE LEVELS

Construction Phase	Noise Level (dBA, Leq)[a]
Ground Clearing	843
Excavation	89
Foundations	78
Erection	85
Finishing	89

[a] Average noise levels correspond to a distance of 50 feet from the noisiest piece of equipment associated with a given phase of construction and 200 feet from the rest of the equipment associated with that phase.

SOURCE: U.S. EPA, 1971.

TABLE 4.11-5
TYPICAL NOISE LEVELS FROM CONSTRUCTION EQUIPMENT

Construction Equipment	Noise Level (dBA, Leq at 50 feet)
Dump Truck	88
Portable Air Compressor	81
Concrete Mixer (Truck)	85
Scraper	88
Jackhammer	88
Dozer	87
Paver	89
Generator	76
Pile Driver	101
Backhoe	85
Rock Drill	98

SOURCE: Cunniff, 1977.

Blast noise occurs at a broad range of frequencies and the highest-energy blast noise usually occurs at frequencies below that of human hearing (<20 Hz). Since blasting activities generate noise at frequencies inaudible by the human ear, it will not be discussed further under this impact. The air-overpressure from blasting, however, will be analyzed under Impact 4.11.3.

Noise from construction activities generally attenuates at a rate of 4.5 to 7.5 dBA per doubling of distance; therefore, other sensitive receptors in the study area would be exposed to construction noise at incrementally lower levels than the noise levels expected at the closest residences. Noise levels are analyzed below with an assumed attenuation rate of 7.5 dBA because construction activities would attenuate at a rate similar to a point source over an absorptive ground surface.

Alternative 1

Los Vaqueros Reservoir Expansion

Expansion of Los Vaqueros Reservoir and the associated Dam Raise would require extensive excavation as well as rock drilling in preparation for blasting at the borrow area located west (upstream) of the Dam during construction. Excavation and rock drilling can generate noise levels of up to 89 dBA Leq and 98 dBA Leq at 50 feet, respectively. With the nearest residence approximately 1.5 miles (7,920 feet) west of the reservoir along Los Vaqueros Road, noise levels generated during excavation and rock drilling activities would attenuate by distance to 34 dBA Leq and 43 dBA Leq, respectively, at this residence. Construction noise at these levels would not be greater than existing noise levels in the vicinity of the reservoir (45.5 Leq measured at Short-Term Location 7, as described in Table 4.11-2).

For the residences located along Silver Hills Drive, 2.5 miles northeast of the dam, excavation and rock drilling noise attenuate by distance to less than noticeable levels (29 dBA Leq and 38 dBA Leq, respectively). For the 12 residences located along Morgan Territory Road, 3 miles west of the dam, excavation and rock drilling noise would be reduced by the distance to less than noticeable levels (27 dBA Leq and 36 dBA Leq, respectively).

Table 4.11-6 summarizes the anticipated effects of excavation and rock drilling upon sensitive receptors located 1.5 miles to 3.0 miles west of the dam raise construction.

New Delta Intake and Pump Station

During construction of the new Delta Intake and Pump Station, a residence located as close as 500 feet to the east would be exposed to approximately 66 dBA Leq sound levels during pile driving (required for installation of the cofferdam to allow construction in the river at the new intake site) based on attenuation by distance and tall earthen levees. Pile driving is among the loudest of the proposed construction activities. Existing noise levels measured at Long-Term Location 2 (62 to 69 dBA Leq, described in Table 4.11-2) would attenuate by distance to approximately 40 dBA Leq at the residence east of the New Delta Intake and Pump Station, and would be representative of ambient noise levels at this residence. Although the single residence would be buffered from some construction noise by tall earthen levees, pile driving noise at 66 dBA Leq would be substantially greater (approximately 26 dBA increase) than existing noise

TABLE 4.11-6
LOS VAQUEROS RESERVOIR EXPANSION NOISE AT THE NEAREST SENSITIVE RECEPTORS IN THE PROJECT VICINITY

Nearest Sensitive Receptor	Excavation Hourly Leq (dBA) at Receptor based on Excavation	Greater than 5 dBA increase and outside normal work hours (potentially significant)? (Yes or No)	Rock Drilling Hourly Leq (dBA) at Receptor based on Distance Alone	Greater than 5 dBA increase and outside normal work hours (potentially significant)? (Yes or No)
1.5 miles west of reservoir	34	No	43	No
2.5 miles northeast of the reservoir	29	No	38	No
3 miles west of reservoir	27	No	36	No

SOURCE: ESA, 2008.

levels at this nearby sensitive receptor location. In this same location, excavation and ground clearing noise would result in approximately 54 dBA Leq, which would also be substantially greater the ambient noise environment at this sensitive receptor.

Conveyance Facilities

Because portions of the Delta-Transfer, Transfer-LV, and Transfer-Bethany pipeline alignments are located within 50 feet of single residences as well as residential areas, some noise-sensitive receptors would be located within 50 feet of pipeline trench excavation and construction activities. Sensitive receptors, such as residences, located within 50 feet of pipeline construction areas would be exposed to 89 dBA Leq during excavation, which is anticipated to be the loudest of anticipated construction activities associated with pipeline trench construction. Construction noise at these levels would be substantially greater (approximately 40 dBA increase) than existing noise levels (49 Leq measured at Short-Term Location 10, as described in Table 4.11-2) at these nearby sensitive receptor locations.

Construction of the Transfer-Bethany Pipeline would include tunneling and trenching in the area south of the Byron Airport and toward Bethany Reservoir. Two Bethany connection options (Westside and Eastside) would both likely involve rock drilling in order to construct pipeline tunnels. The boring pit for the Westside Option tunnel is located approximately 3,000 feet south of an existing residence. Tunnel construction activities, including rock drilling, could expose this sensitive receptor to noise levels of 54 dBA Leq. Construction noise at these levels would be less than existing noise levels (75.1 dBA Leq measured at Short-Term Location 6, as described in Table 4.11-2) at these nearby sensitive receptor locations. Additional boring pits for both the Westside Option (1 additional boring pit) and Eastside Option (4 smaller boring pits) are not located in proximity to residences or other sensitive receptors.

Expansion of the Transfer Facility would include pump capacity upgrades at the existing pump station along with the construction of additional pumping facilities and a new reservoir adjacent to the existing facilities. Construction of these facilities would occur approximately 1,500 feet from the nearest residence on Walnut Boulevard, and would result in this residence being exposed to 52 dBA Leq during periods of excavation and other construction activity. Construction noise at these levels would not be greater than existing noise levels at these nearby sensitive receptor locations (53 Leq measured at Short-Term Location 8, as described in Table 4.11-2).

Power Supply

Construction of the proposed powerlines under either Power Option 1 (Western only) or Power Option 2 (Western & PG&E) would consist of vegetation removal at the pole site, auguring the pole holes, setting the framed poles, backfilling, and stringing the overhead distribution lines. In addition, pull and tension sites during conductor installation would be required. Construction of a substation under either option would include vegetation removal, grading, excavation, and construction of subsurface footings and concrete slabs for aboveground structures and equipment. Typical noise levels at 50 feet from the source for some of the heavy pieces of construction equipment that would be required to construct these electrical power facilities are listed in Table 4.11-4. Excavation would be the loudest construction activity at 89 dBA Leq at 50 feet (whereas auguring would generate 85 dBA Lmax at 50 feet (FHWA, 2006)). The nearest sensitive receptor for Power Option 1 (Western Only) is 1,275 feet away from the construction area and would be exposed to 54 dBA Leq during excavation, which would be substantially greater (5 dBA increase) than ambient noise levels (49 dBA Leq measured at Short-Term Location 10, as described in Table 4.11-2). The nearest sensitive receptor for Power Option 2 (Western & PG&E) is 500 feet away from the construction area and would result in 64 dBA Leq during excavation, which would be substantially greater (11 dBA) than ambient noise levels (53 Leq measured at Short-Term Location 8, as described in Table 4.11-2).

Under either power option, impacts from construction of the power line between the existing Western substation south of the Harvey O. Banks Pumping Plant and the Delta facilities would be somewhat less than as those analyzed for the Delta-Transfer Pipeline, above, although the facilities would be co-aligned, because the power line installation does not involve the trench excavation and trenching activities required for pipeline construction. Instead, individual power pole locations would be augured at distances of 200 to 300 feet, and lines strung between the poles.

Recreation Facilities

Recreation facilities associated with expansion of the reservoir to 275 TAF include a Marina Complex and an Interpretive Center located west of the enlarged dam; relocation of existing hiking trails and access roads; installation of additional access roads and hiking trails; and the relocation and/or addition of other facilities (i.e., fishing piers, picnic areas, restrooms and parking). All of these facilities would be located within the CCWD watershed property line. The nearest sensitive receptor would be a residence located southeast of the corner of Camino Diablo and Walnut Boulevard, over one mile from the relocated and new recreational facilities. Since pile-driving (the loudest of construction activities for the recreational facilities) construction noise for marina

development would attenuate to 50 dBA Leq, construction noise would be less than the existing noise levels (53 Leq measured at Short-Term Location 8, as described in Table 4.11-2) at this receptor and would not be noticeable.

Summary

Noise from construction of pipeline segments, the New Delta Intake and Pump Station, and power supply facilities of Alternative 1 would be significant if the construction occurred outside of the specified "normal" working hour time periods of 7 a.m. to 7 p.m. Monday through Friday, and 8 a.m. to 5 p.m. on Saturday and Sunday because these activities could result in noise increases of 5 dBA or more over ambient noise levels at sensitive noise receptors (residences) located in proximity to the construction areas.

Alternative 2

The noise generated by construction of Alternative 2 would be the same as discussed above for Alternative 1 because Alternative 2 includes construction of the same facilities as does Alternative 1. The noise impacts would be significant if the construction occurred outside of daytime hours.

Alternative 3

The noise generated by construction of Alternative 3 would be the same as discussed above for Alternative 1 with three substantive differences:

- Expansion work at the Old River Intake and Pump Station would occur approximately 3,000 feet from the nearest residence to the northwest along SR 4. This expansion work would not require pile driving, and given the distance to the nearest residence this activity would not result in construction noise levels above ambient levels, as discussed further below.

- Alternative 3 would not include a new Delta Intake and Pump Station, which would avoid pile driving and other construction approximately 500 feet from the existing residence across Old River on Victoria Island.

- Alternative 3 would not include a Transfer-Bethany pipeline, so there would be no exposure to sensitive receptor locations associated with this pipeline and its tunnel components.

During construction for the Old River Intake and Pump Station Expansion, which would occur 3,000 feet from noise-sensitive land uses to the northwest, the sensitive receptors would be exposed to 45 dBA Leq during the excavation and finish work. Construction at these sound levels would not be a significant impact on the nearest residences because the existing noise environment is dominated by traffic on SR 4, with monitored hourly Leqs that ranged from 65 to 70 dBA (Table 4.11-2, Long-Term Location 1) in the vicinity of the receptors.

Alternative 4

The noise generated by construction of Alternative 4 would be substantially less than that generated by construction of Alternative 1 because Alternative 4 would not include facilities

outside CCWD watershed property lines. Alternative 4 would include a dam raise for a 160 TAF reservoir expansion that would be smaller and involve less construction activity than the dam raise required under Alternative 1 for the 275 TAF reservoir. Alternative 4 would involve construction of the same dam appurtenance facilities as Alternative 1. Under Alternative 4, the closest sensitive receptor to the Los Vaqueros Reservoir Expansion/Dam Modification site is the single residence located along Los Vaqueros Road 1.5 miles to the south. As with Alternative 1, there are several residences about 2.5 miles northeast of the dam raise site on Silver Hills Drive, and the twelve residences located 3 miles west of the dam raise site near Morgan Territory Road. They would notice but not be adversely affected by the 160 TAF Reservoir Expansion because borrow materials would not be excavated by blasting activities at the shell borrow area adjacent to the dam, as would occur under Alternative 1. The closest sensitive receptors to the 160 TAF Reservoir Expansion core borrow area are residences located east of the Watershed boundary, about 2,000 feet to the north of the 160 TAF borrow site; excavation at the core borrow area would result in 49 dBA Leq during excavation, which would be less than ambient noise levels (53 Leq measured at Short-Term Location 8, as described in Table 4.11-2).

Alternative 4 would not include modifications to the existing Old River Pump Station or construction of the new Delta Intake and Pump Station, any of the proposed conveyance facilities, or any new power supply facilities. Also, fewer recreation facilities would be relocated or expanded within CCWD watershed lands under Alternative 4 than under Alternative 1. Construction of the new and relocated recreation facilities would not increase noise levels at any sensitive receptor sites.

Mitigation Measures

Measure 4.11.1a: To avoid noise-sensitive hours of the day and night, construction will be limited to the hours between 7 a.m. to 7 p.m. Monday through Friday, and 8 a.m. to 5 p.m. on Saturday and Sunday for the following facilities, construction activities and project areas:

- Alternatives 1, 2, 3, or 4: Construction of any facilities in those areas that are 3,000 feet or less from sensitive residences. At 3,000 feet, excavation activities would attenuate to 45 dBA and would be less than the quietest existing noise environment measured and depicted in Table 4.11-2 and would not be noticeable.

Measure 4.11.1b: To further address the impact of construction for all alternatives, construction contractors will implement the following:

- Signs will be posted at all construction site entrances to the property when project construction begins to inform all contractors/subcontractors, their employees, agents, material haulers, and all other persons at the applicable construction sites of the basic requirements of Mitigation Measures 4.11.1a, 4.11.1c, and 4.11.1d.

- Signs will be posted at the construction sites that include permitted construction days and hours, a day and evening contact number for the job site, and a contact number in the event of problems.

- An onsite complaint and enforcement manager will respond to and track complaints and questions related to noise.

Measure 4.11.1c: To reduce noise impacts due to construction for all alternatives, construction contractors will be required to implement the following measures:

- During construction, the contractor will outfit all equipment, fixed or mobile, with properly operating and maintained exhaust and intake mufflers, consistent with manufacturers' standards.

- Impact tools (e.g., jackhammers, pavement breakers, and rock drills) used for construction will be hydraulically or electrically powered wherever possible to avoid noise associated with compressed air exhaust from pneumatically powered tools. Where use of pneumatic tools is unavoidable, an exhaust muffler on the compressed air exhaust will be used. External jackets on the tools themselves will be used where feasible. Quieter procedures, such as use of drills rather than impact tools, will be used whenever construction occurs within 3,000 feet of sensitive residences.

- Stationary noise sources will be located as far from adjacent sensitive receptors as possible.

Measure 4.11.1d: For all alternatives, no amplified sources (e.g., stereo "boom boxes") will be used in the vicinity of residences during project construction.

Measure 4.11.1e: To further reduce less than significant pile driving noise impacts at the Delta Pump Station facilities under all alternatives, CCWD shall require construction contractors to implement "quiet" pile-driving technology (such as sonic or vibratory pile-driver use; pre-drilling of piles; jetted pile-driving) where feasible, with consideration of geotechnical and structural requirements and conditions.

Impact Significance after Mitigation: Less than Significant.

Impact 4.11.2: Operation of the project and alternatives would generate traffic, stationary source, and area source noise similar to existing noise associated with operation of the Los Vaqueros Reservoir system and would not exceed County noise requirements. (Less than Significant)

Alternative 1

Long-term operation of the proposed facilities under Alternative 1 would generate traffic volumes similar to the existing traffic within the project area. With respect to facilities operation and maintenance, there would be only a few (less than 10) additional employees added to operate the expanded system; as with the existing system most facility operations would be automated and monitored remotely. In addition, the expanded system would require only limited additional maintenance worker trips. For the most part, the new or expanded facilities would be integrated into or adjacent to existing facilities, requiring monitoring and maintenance at the same locations and at similar levels to the existing system. Facility operation would not generate much additional traffic that would contribute appreciably to noise levels in the project area. While portions of the proposed pipelines and powerlines would be located near residences, periodic inspection and maintenance of these facilities would not generate significant noise.

With respect to traffic associated with visitor use of the expanded recreation facilities at Los Vaqueros Reservoir under Alternative 1, Impact 4.9.6 in Section 4.9 – Traffic and Circulation discusses the anticipated changes in recreation traffic due to relocation of the Marina Complex from the south end of the reservoir to the north end along with the addition of an additional interpretive center and expanded hiking trails. While some increase in visitor use of the recreation facilities is anticipated under these three alternatives, the associated increase in daily traffic on local roadways would not be sufficient to appreciably affect ambient noise levels.

Noise generated the new Delta Intake and Pump Station would be similar to the noise levels at the existing Old River Intake and Pump Station. The new Delta Intake and Pump Station could be located as close as 500 feet to the nearest sensitive receptor compared to the existing Old River Intake and Pump Station, which is 3,000 feet from the nearest residence. Without proper noise control or enclosure, pump station equipment could result in noise levels in the range of 78 to 88 dBA at 3 to 5 feet from the source depending on the type and size (U.S. EPA, 1971). Existing noise levels measured at Long-Term Location 2 (62 to 69 dBA Leq, described in Table 4.11-2) would attenuate by distance to about 40 dBA Leq at the residence east of the new Delta Intake and Pump Station, and would be representative of ambient noise levels at this residence. Noise from the pump station would attenuate between the new Delta Intake and Pump Station and the nearby residence as a result of distance and the presence of earthen levees to less than 38 dBA Leq, which would be less than the ambient noise levels at this residence and would not be noticeable.

Summary

Operation of the project and alternatives would generate traffic, stationary source, and area source noise similar to existing noise associated with the current operation of Los Vaqueros Reservoir. The new Delta Intake and Pump Station would generate noise levels less than the existing ambient noise levels and would be less than significant.

Alternative 2

Operational noise effects under Alternative 2 would be exactly the same as those described for Alternative 1, since Alternative 2 includes all the same facilities and operations. As for Alternative 1, operational noise effects would be less than significant.

Alternative 3

Operational noise effects under Alternative 3 would be similar to those described for Alternative 1 although Alternative 3 would generate even less operational noise because it involves expansion of the existing Old River Intake and Pump Station instead of construction or operation of the new Delta Intake and Pump Station. Noise generated by the expanded Old River Intake and Pump Station would be similar to that of the existing facility. The noise environment for these residences would continue to be dominated by traffic noise from SR 4. Operational noise effects for Alternative 3 would be less than significant.

Alternative 4

Operational noise effects under Alternative 4 would be less than those described for Alternative 1 because this alternative involves substantially fewer new or expanded facilities. The reservoir would be expanded to 160 TAF but there would be no change in the existing intake and pumping facilities or pipeline conveyance facilities and thus no additional noise sources associated with system operations. The Marina Complex would not be relocated from the south end of the reservoir to the north end as it would under Alternative 1 and there would be no appreciable change expected in visitor use of the recreation facilities over current levels as a result of the project. Operational noise effects for Alternative 4 would be less than significant.

Mitigation: None required.

Impact 4.11.3: Project construction would not expose persons to or generate excessive ground-borne vibration or ground-borne noise levels. (Less than Significant)

Alternative 1

As shown in **Table 4.11-7**, use of heavy equipment during construction generates vibration levels of up to 0.644 PPV or 104 RMS (pile driver) at a distance of 25 feet. Bulldozers would generate approximately 0.089 PPV and 87 RMS at 25 feet. Pile driving required for construction of the new Delta Intake and Pump Station would occur within 500 to 3,000 feet of the nearest residence (depending on the final site location selected within the siting zone) and could generate vibration of approximately 0.007 PPV and 65 RMS. The nearest sensitive receptors to any of the proposed pipelines would be approximately 50 feet (for construction of the Delta-Transfer pipeline, Transfer-LV pipeline, and Transfer-Bethany pipeline, as previously described in the "Sensitive Receptor" discussion) from heavy equipment activity and could experience vibration levels of 0.031 PPV and 78 RMS from bulldozer operation. Tunneling activity associated with the Transfer-Bethany Pipeline is located 3,000 feet from the nearest sensitive receptor.

TABLE 4.11-7
VIBRATION VELOCITIES FOR CONSTRUCTION EQUIPMENT

Equipment Activity	PPV at 25 Feet (inches/second)[a]	RMS at 25 Feet (VDB)[b]
Pile Driver	0.644	104
Large Bulldozer	0.089	87
Loaded Trucks	0.076	86
Jackhammer	0.035	79

[a] Buildings can be exposed to ground-borne vibration levels of 0.2 PPV without experiencing structural damage.
[b] The human annoyance response level is 80 RMS.

SOURCE: FTA, 2006.

Vibration levels at these receptors would not exceed the potential building damage threshold of 0.2 PPV or the annoyance threshold of 80 RMS. Other sensitive receptors in the project vicinity would be exposed to vibration levels at incrementally lower levels than those calculated for pile driving at the new Delta Intake and Pump Station construction site.

For potential blasting activities associated with reservoir construction (to excavate needed borrow materials), the nearest noise-sensitive residence is approximately 1.5 miles (7,920 feet) west of the reservoir. Vibration levels at this substantial distance would not be noticeable. However, in regards to air-overpressure at 1.5 miles from the blast, the nearest residence would be exposed to between 87 to 107 dBL from the blast (URS, 2008). This air-overpressure is well below the 133 dBL regulatory limit used by the U.S. Bureau of Mines. The impact associated with vibration generated by construction activities would be less-than-significant, and no mitigation is required.

Alternative 2

The vibration effects that could occur under Alternative 2 would be exactly the same as those described from Alternative 1 since this alternative would involve construction of all of the same facilities as Alternative 1. As with Alternative 1, the vibration effects of facilities construction under Alternative 2 would be less than significant.

Alternative 3

The vibration effects that could occur under Alternative 3 would be exactly the same at the expanded reservoir/dam modification site as those described from Alternative 1. Under Alternative 3 there would be no construction of a new Delta Intake and Pump Station so those vibration effects would not occur. This alternative does not include the new Transfer-Bethany pipeline and thus would not result in vibration effects caused by pipeline trenching and tunneling for this facility. As with Alternative 1, the vibration effects of facilities construction under Alternative 3 would be less than significant.

Alternative 4

The vibration effects that could occur under Alternative 4 would be much less than those described under Alternative 1 because this alternative involves construction of fewer facilities. Construction under this alternative involves only dam modification for a 160 TAF reservoir expansion and relocation of impacted recreation facilities. Earthwork and possible blasting for construction of the dam raise would result in vibration effects similar to those described for Alternative 1. As with Alternative 1, the vibration effects of facilities construction under Alternative 4 would be less than significant.

Mitigation: None required.

Impact 4.11.4: The proposed project or alternatives would not make a cumulatively considerable contribution to noise levels during either construction or operation. (Less than Significant)

All Alternatives

Noise is a localized occurrence and attenuates with distance. Therefore, only other projects or activities in relatively close proximity (about ½ mile) to the project sites would have the potential to add to anticipated project-generated noise and create cumulative noise effects. As discussed in Section 4.1 – Approach to Analysis (see subsection 4.1.3 Approach to Cumulative Analysis), there are no other identified development or public works projects proposed for construction during the same timeframe as, and in close proximity to, the proposed facility sites for the Los Vaqueros Reservoir Expansion Project. Based on this review of probable future projects, Los Vaqueros Reservoir Expansion Project construction activities would not contribute considerably to any significant cumulative noise effects. In addition, as described in Impact 4.11.1, the project construction activities that would result in the greatest noise effects would occur at pipeline construction sites in the proximity of noise-sensitive receptors (for Alternatives 1, 2 and 3). Under Mitigation Measure 4.11.1a, all pipeline construction activities within 3,000 feet of residences, would be prohibited at night. Therefore, there would be no noisy nighttime construction activities that could contribute to any significant cumulative construction noise impact, even if other projects near the Proposed Project or alternative sites are proposed and approved in the future and are constructed at night. Project construction is anticipated to be completed in approximately 3 years for Alternatives 1, 2, and 3 and less for Alternative 4, after which there would be no further potential for the project to contribute to cumulative noise effects associated with construction activities.

With respect to long-term operational noise from project traffic and stationary noise sources, again there does not appear to be the potential to make a considerable contribution to cumulative noise effects. As noted in subsection 4.1.3, Approach to Cumulative Analysis, inquiries with local land use and utility agencies in the project area did not identify any reasonably foreseeable new projects in the area in the longer term. Also, a review of the applicable local land use plans for the vicinity does not suggest the potential for appreciable development or land use changes in the vicinity of proposed project facilities. Further, as discussed in Impact 4.11.2, the project operation under all alternatives would make extremely minor contributions to the existing ambient noise levels. These contributions would be so small that they would not be cumulatively considerable. With the addition of project operations noise levels would remain similar to existing conditions, and in most project areas outside of the CCWD watershed, ambient noise levels would continue to be dominated by agricultural operations and local traffic noise. The project would not make a cumulatively considerable contribution to the noise environment.

Because, as described above, no other nearby construction projects are anticipated to coincide with project construction activities, no significant cumulative vibration impact would occur.

Mitigation: None required.