4.9 Noise

4.9.1 Introduction

This section presents the existing noise conditions and evaluates potential impacts associated with noise and vibration levels from construction and maintenance of the Russian River Estuary Management Project (Estuary Management Project or proposed project). The analysis is based on review of the guidance developed by regulatory agencies and local noise ordinances and regulations set by Sonoma County. The Impacts and Mitigation Measures section defines significance criteria used for the impact assessment and presents a discussion of potential project-related impacts and associated mitigation.

4.9.2 Affected Environment/Setting

Noise Background

Sound is mechanical energy transmitted by pressure waves through a medium such as air. Noise can be defined as unwanted sound. Sound is characterized by various parameters that include the rate of oscillation of sound waves (frequency), the speed of propagation, and the pressure level or energy content (amplitude). In particular, the sound pressure level has become the most common descriptor used to characterize the loudness of an ambient sound level. Sound pressure level 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. The decibel measurement system is a logarithmic unit of measurement, such that a ten-fold change in sound pressure is represented by an increase of 10 dB.

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 result, 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 ear's 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).

Noise Exposure and Community Noise

An individual's noise exposure is a measure of the noise experienced by the individual over a period of time. A noise level is a measure of noise at a given instant in time. However, noise levels rarely persist consistently over a long period of time. In fact, community noise varies continuously with

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. Background noise levels change throughout a typical day, but do so gradually, corresponding with the addition and subtraction of distant noise sources and atmospheric conditions. The addition of short duration single event noise sources (e.g., aircraft flyovers, motor vehicles, sirens, etc.) makes community noise constantly variable throughout a day.

These successive additions and deletions of sound to the community noise environment change the community noise level from instant to instant 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:

L_{eq}: The equivalent sound level is used to describe noise over a specified period of time, in terms of a single numerical value. The L_{eq} is the constant sound level which 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).

L_{max}: The instantaneous maximum noise level measured during the measurement period of interest.

L_{dn}: Day-Night Average Sound Level, or the energy average of the A-weighted sound levels occurring during a 24-hour period, and 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. It should be noted that the L_{dn} is sometimes referred to as the DNL.

CNEL: The Community Noise Equivalent Level (CNEL) adds a 5-dBA *penalty* for the evening hours between 7:00 p.m. and 10:00 p.m. in addition to a 10-dBA penalty for the nighttime hours between 10:00 p.m. and 7:00 a.m.

Effects of Noise on People

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

1. subjective effects of annoyance, nuisance, and dissatisfaction;
2. interference with activities such as speech, sleep, and learning; and
3. physiological effects such as hearing loss or sudden startling.

Environmental noise typically produces effects in the first two categories. Workers at industrial plants often 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 exists in the individual thresholds of annoyance, 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 new noise compares to the existing noise levels 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 (Caltrans, 1998):

1. Except in carefully controlled laboratory experiments, a change of 1 dBA cannot be perceived;

2. Outside of the laboratory, a 3-dBA change is considered a just-perceivable difference when the change in noise is perceived but does not cause a human response;

3. A change in level of at least 5 dBA is required before any noticeable change in human response would be expected; and

4. 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. A ruler is a *linear* scale, which has marks corresponding to equal quantities of distance, (i.e., the ratio of successive intervals is equal to one). A *logarithmic* scale is different in that the ratio of successive intervals is not equal to one. Each interval on a logarithmic scale is some common factor larger than the previous interval. A typical ratio is 10, so that the marks on the scale read: 1, 10, 100, 1,000, 10,000, etc., doubling the variable plotted on the x-axis. The human ear perceives sound in a non-linear 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, rather they combine 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

Point sources of noise, including stationary mobile sources such as idling vehicles or onsite construction equipment, attenuate (lessen) at a rate of 6.0 dBA to 7.5 dBA per doubling of distance from the source, depending upon the type (i.e., rough or smooth) of the ground surface between the source and receptor (Caltrans, 1998).

Vibration

Vibration is an oscillatory motion through a solid medium in which the motion's amplitude can be described in terms of displacement, velocity, or acceleration. There are several different methods that 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 root mean square amplitude. The decibel notation acts to compress the range of numbers required to describe

vibration (FTA, 2006). Typically, ground-borne vibration generated by man-made activities attenuates rapidly with distance from the source of the vibration.

Sensitive Receptors

Human response to noise varies considerably from one individual to another. Effects of noise at various levels can include interference with sleep, concentration, and communication, and can cause physiological and psychological stress and hearing loss. Given these effects, some land uses are considered more sensitive to ambient noise levels than others. California Government Code Section 65302 considers residences, schools, churches, libraries, office buildings, hospitals, and nursing homes to be the most sensitive to noise. Recreational areas can also be considered sensitive to noise. Commercial and industrial uses are considered the least noise-sensitive.

The nearest sensitive receptors to the proposed Estuary management area at Goat Rock State Beach are residences associated with the town of Jenner along the north bank of the Russian River. The closest residence is approximately 1,000 feet to the east of the proposed lagoon outlet channel, across the State Route 1 and the closest recreation area is Goat Rock State Beach, approximately 4,000 feet to the south.

Existing Ambient Noise Environment

The main contributors to the noise environment in the area are State Route 1 and wave action of the Pacific Ocean. Additional noise sources may include other man-made localized sources. Much of the study area is typified by relatively low noise levels due to the lack of loud noise sources. Average noise levels in the vicinity of the Estuary Management Project area range from approximately 40 dBA in areas set back from the highway to approximately 55 dBA adjacent to the highway.

4.9.3 Regulatory Framework

Federal, State, and local agencies regulate different aspects of environmental noise. Federal and State agencies generally set noise standards for mobile sources such as aircraft and motor vehicles, while local agencies regulate stationary sources. Local regulation of noise involves implementation of general plan policies and noise ordinance standards. Local general plans tend to identify general principles intended to guide and influence development plans, while local noise ordinances establish standards and procedures for addressing specific noise sources and activities.

Sonoma County General Plan

The Noise Element of the *County of Sonoma General Plan 2020* establishes the following goal, objectives, and policies to reduce existing and future noise impacts and conflicts (Sonoma County, 2008).

> **Goal NE-1:** Protect people from the adverse effects of exposure to excessive noise and to achieve an environment in which people and land uses may function without impairment from noise.

***Objective NE-1.1*:** Provide noise exposure information so that noise impacts may be effectively evaluated in land use planning and project review.

***Objective NE-1.3*:** Protect the present noise environment and prevent intrusion of new noise sources which would substantially alter the noise environment.

Policy NE-1a: Designate areas within Sonoma County as noise impacted if they are exposed to existing or projected exterior noise levels exceeding 60 dB L_{dn}, 60 dB CNEL, or the performance standards of Table NE-2 (presented below as **Table 4.9-1**).

Policy NE-1c: Control non-transportation related noise from new projects. The total noise level resulting from new sources shall not exceed the standards in Table NE-2 (presented below as Table 4.9-1) as measured at the exterior property line of any adjacent noise sensitive land use. Limit exceptions to the following: (4) For short term noise sources which are permitted to operate no more than six days per year, such as concerts or race events, the allowable noise exposures shown in Table NE-2 (presented below as Table 4.9-1) may be increased by 5 dB. These events shall be subject to a noise management plan including provisions for maximum noise level limits, noise monitoring, complaint response and allowable hours of operation. The plan shall address potential cumulative noise impacts from all events in the area.

TABLE 4.9-1
MAXIMUM ALLOWABLE EXTERIOR NOISE EXPOSURES FOR NON-TRANSPORTATION NOISE SOURCES

Hourly Noise Metric[a], dBA	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
L50 (30 minutes in any hour)	50	45
L25 (15 minutes in any hour)	55	50
L08 (5 minutes in any hour)	60	55
L02 (1 minute in any hour)	65	60

[a] The sound level exceeded n% of the time in any hour. For example, the L50 is the value exceeded 50% of the time or 30 minutes in any hour; this is the median noise level. The L02 is the sound level exceeded 1 minute in any hour.

SOURCE: County of Sonoma, 2008.

The *Sonoma County General Plan 2020* Noise Element does not specifically address intermittent or short-term construction noises, such as those that would occur under the Estuary Management Project, and there is currently no adopted noise ordinance in the County of Sonoma Municipal Code. The General Plan calls for the County to adopt a noise ordinance that will include noise performance standards as outlined in Table 4.9-1 as well as exemptions, measurement methods, and procedures for variances. However, a noise ordinance has not been adopted to date.

4.9.4 Environmental Impacts and Mitigation Measures

Significance Criteria

Consistent with the CEQA Guidelines Appendix G, the proposed Estuary Management Project would result in a significant impact on the environment if it would result in:

1. Exposure of persons to or generation of noise levels in excess of standards established in any applicable plan or noise ordinance, or applicable standards of other agencies.

2. Exposure of persons to or generation of excessive ground-borne vibration or ground-borne noise levels

3. A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

4. A substantial temporary or periodic increase in ambient noise levels in the project vicinity above existing levels existing without the project.

5. Exposure of people residing or working in the project area to excessive noise levels, for a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport.

6. Expose people residing or working in the project area to excessive noise levels if the project is located in the vicinity of a private airstrip.

Periodic short-term construction noise, such as that that would occur under the Estuary Management Project, is not addressed in the County of Sonoma General Plan 2020 Noise Element and County of Sonoma does not have an adopted noise ordinance. In addition, there are no noise standards of other agencies that would be applicable to the Estuary Management Project. Therefore, there is no potential that the Estuary Management Project would expose persons to or generate noise levels in excess of standards established in an applicable plan or noise ordinance, or applicable standards of other agencies, and no impact would occur. This issue is not addressed further in this EIR.

The Estuary Management Project would result in noise levels associated with the creation and periodic maintenance of the lagoon outlet channel and would not result in a permanent increase in ambient levels above levels existing without the Estuary Management Project. Therefore, there would be no impact associated with a permanent increase in noise levels and this issue is not addressed further in this EIR.

Implementation of the Estuary Management Project would not expose people residing or working in the area to excessive aircraft noise impacts. Therefore, no airport or airstrip related impacts would occur under the Estuary Management Project and this issue is not addressed further in this EIR.

Approach to Analysis

As noted in **Chapter 2.0, Project Description**, the Water Agency would continue its current practice of artificial breaching outside of the lagoon management period of May 15 through October 15. Timing, implementation, access, sensitivity to pinniped haulout, personnel, equipment and general procedures would be equivalent to current practices, as described in **Section 2.2.2**. No change to artificial breaching outside of the lagoon management period would occur under the Estuary Management Project.

For the purposes of this EIR, temporary impacts during lagoon outlet channel creation and maintenance activities under the Estuary Management Project would be considered significant if they would substantially interfere with sensitive land uses, such as residences. Substantial interference could result from a combination of factors, including: exposing sensitive receptors to the generation of substantial (i.e., equal to or greater than 80 dBA) noise levels at sensitive receptor locations lasting long periods of time at any one location (i.e., more than one week); and/or construction activities that would affect noise-sensitive uses during the nighttime.

A numerical threshold to identify the point at which a vibration impact occurs has not been identified by Sonoma County standards or municipal codes. In the absence of local regulatory significance thresholds for vibration from construction equipment, it is appropriate to use a California Department of Transportation (Caltrans) identified PPV thresholds for adverse human reaction and risk of architectural damage to buildings, which are 0.010 inches per second and 0.20 inches per second, respectively (Caltrans, 2002).

Impact Analysis

Impacts associated with noise are summarized and categorized as either “less than significant,” “less than significant with mitigation,” or “significant and unavoidable.”

Impact 4.9.1: Ambient Noise Levels. The Estuary Management Project would result in periodic noise levels above existing ambient conditions. (Less than Significant with Mitigation)

Implementation of the Estuary Management Project would require the use of up to two pieces of heavy equipment, such as an excavator and/or bulldozer. At the start of the management period, when configuring the proposed lagoon outlet channel for the first time that year, it is anticipated that the machinery would operate for up to two consecutive working days in the vicinity of the lagoon outlet channel. As noted in **Chapter 2.0, Project Description**, the frequency of equipment operation on the barrier during the lagoon management period may be incrementally increased compared to existing conditions, and could include up to 18 additional maintenance activities over the course of the lagoon management period, depending upon the performance of the outlet channel. This represents a potential incremental increase in temporary noise impacts.

Table 4.9-2 presents the noise levels associated with a bulldozer and an excavator, and the combined noise level that would occur if the equipment would operate simultaneously. As indicated in the

TABLE 4.9-2
NOISE LEVELS ASSOCIATED WITH CONSTRUCTION EQUIPMENT

Equipment Description	Noise Level at 50 feet (dBA)
Bulldozer	85
Excavator	85
Combine Sound Level	88

SOURCE: FTA, 2006.

table, the combined equipment noise level would be up to 88 dBA at a distance of 50 feet from the proposed lagoon outlet channel.

For the purposes of this analysis, it is assumed that noise from a point source attenuates at a rate of 6.0 dBA per doubling of distance to account for the smooth sand and water surfaces at the Estuary Management Project site. At the closest sensitive receptor location approximately 1,000 feet from the proposed lagoon outlet channel site, the combined equipment noise level would be up to 62 dBA. This noise level may be perceived as a nuisance to the closest residences to the site. However, implementation of **Mitigation Measure 4.9-1** would require that activities at the lagoon outlet channel site that would involve the use of heavy equipment, be conducted during daytime hours. Implementation of this mitigation measure would insure that the periodic noise level increases in the vicinity of the proposed lagoon outlet channel site would be less than significant.

In addition to activities at the proposed lagoon outlet channel site, it is assumed that the Estuary Management Project would require approximately five small pickup truck trips to transport Water Agency staff to the project site (only a single vehicle drives on the beach) and up to two semi-tractor vehicle trips to transport the heavy equipment to the staging area at the Goat Rock State Beach north parking lot. Noise levels that would occur along the vehicle routes associated with a passing vehicle would range from a high 60-dBA to high 80-dBA range, depending on the type of vehicle and distance to the vehicle. Given the limited amount of vehicles that would be associated with operations of the Estuary Management Project and the limited amount of days per year that trips would occur, noise levels associated with off-site vehicle trips would be negligible and would result in a less than significant impact.

Mitigation Measures

Mitigation Measure 4.9.1: Time of Day Limits and Notice to Residents. The Water Agency shall limit activities at the lagoon outlet channel that involve the use of heavy equipment to between local sunrise to local sunset.

Impact Significance after Mitigation: Less than Significant.

Impact 4.9.2: Ground-borne Vibration. Estuary Management Project activities would generate ground-borne vibration levels. (Less than Significant)

Some types of construction equipment can produce vibration levels that can cause architectural damage to structures and be annoying to nearby sensitive receptors. Vibration levels generated by the Estuary Management Project would vary. Typical vibration levels for the equipment type that would generally result in the highest vibration levels associated with the Estuary Management Project (i.e., a large bulldozer) are presented in **Table 4.9-3**.

TABLE 4.9-3
VIBRATION SOURCE LEVELS FROM CONSTRUCTION EQUIPMENT

	Peak Particle Velocity (in/sec)
Distance (feet)	Large Bulldozer
75	0.017
100	0.011
150	0.006

SOURCE: FTA, 2006.

A numerical threshold to identify the point at which a vibration impact occurs has not been identified by County standards or municipal codes. Therefore, a PPV threshold identified by Caltrans is used in this analysis to determine the significance of vibration impacts related to adverse human reaction and risk of architectural damage to normal buildings. The PPV thresholds for adverse human reaction and risk of architectural damage to buildings are 0.010 inches per second and 0.20 inches per second, respectively (Caltrans, 2002). These respective PPV levels have been found to be annoying to people in buildings and can pose a risk of architectural damage to buildings.

The nearest residences would be approximately 1,000 feet to active Estuary Management Project construction equipment. At this distance, construction equipment PPV levels would be negligible and would be substantially less than the identified significance thresholds. Therefore, short-term vibration impacts would be less than significant and no mitigation would be required.

Impact Significance: Less than Significant; no mitigation measures are required.

4.9.5 References

California Department of Transportation (Caltrans), *Technical Noise Supplement*, October 1998. http://www.dot.ca.gov/hq/env/noise/pub/Technical%20Noise%20Supplement.pdf, Accessed September 26, 2008.

Caltrans, *Transportation Related Earthborne Vibrations (Caltrans Experiences):* Technical Advisory, Vibration TAV-02-01-R9601, February 20, 2002.

County of Sonoma, Permits and Resources Management Department, *County of Sonoma General Plan 2020*, Noise Element, adopted September 23, 2008.

Federal Transit Administration (FTA), *Transit Noise and Vibration Impact Assessment*, May 2006, available online: http://www.fta.dot.gov/documents/FTA_Noise_and_ Vibration_Manual.pdf, Accessed April 20, 2010.