# Appendix V Noise and Vibration Technical Appendix

This appendix documents the noise and vibration technical analysis to support the impact analysis in the EIS.

## V.1 Background

This section addresses noise effects associated with the proposed program. It describes the affected environment, potential noise and vibration effects that would result from the alternatives, and mitigation measures to minimize or avoid these effects. Key sources of data and information used in the preparation of this chapter are as follows:

- Roadway Construction Noise Model User's Guide (FHWA 2006).
- *Technical Noise Supplement to the Traffic Noise Analysis Protocol* (Caltrans 2013a).
- *Transportation and Construction-Induced Vibration Guidance Manual* (Caltrans 2013b).
- *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).
- *Community Noise* (USEPA 1971).

### V.1.1 Noise Terminology

- A brief background discussion of noise terminology follows.
- **Sound.** A vibratory disturbance created by a vibrating object, which, when transmitted by pressure waves through a medium such as air, is capable of being detected by a receiving mechanism, such as the human ear or a microphone.
- **Noise.** Sound that is loud, unpleasant, unexpected, or otherwise undesirable.
- **Decibel (dB).** A unitless measure of sound on a logarithmic scale, which indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micro-pascals.
- **A-Weighted Decibel (dBA).** An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear. Table V.1-1 shows the range of typical dBA noise levels.
- **Equivalent Sound Level ($L_{eq}$).** The equivalent steady state sound level that in a stated period of time would contain the same acoustical energy.
- **Maximum and minimum sound levels ($L_{max}$ and $L_{min}$).** The maximum and minimum sound levels measured during a measurement period.
- **Peak Sound Level ($L_{peak}$).** The highest instantaneous noise level (typically lasting less than about 1/32 of a second) during the measurement period.

- **Percentile-Exceeded Sound Level ($L_{xx}$).** The sound level exceeded "x" percent of a specific time period. For example, $L_{10}$ is the relatively loud sound level exceeded only 10% of the time, while the $L_{90}$ is a relatively quiet sound exceeded 90% of the time.

Table V.1-1 lists sound levels generated by common outdoor and indoor activities.

**Table V.1-1. Typical A-Weighted Sound Levels**

| Common Outdoor Activities | Noise Level (dBA) | Common Indoor Activities |
|---|---|---|
| | —110— | Rock band |
| Jet flyover at 1,000 feet | | |
| | —100— | |
| Gas lawnmower at 3 feet | | |
| | —90— | |
| Diesel truck at 50 feet at 50 mph | | Food blender at 3 feet |
| | —80— | Garbage disposal at 3 feet |
| Noisy urban area, daytime | | |
| Gas lawnmower, 100 feet | —70— | Vacuum cleaner at 10 feet |
| Commercial area | | Normal speech at 3 feet |
| Heavy traffic at 300 feet | —60— | |
| | | Large business office |
| Quiet urban daytime | —50— | Dishwasher in next room |
| | | |
| Quiet urban nighttime | —40— | Theater, large conference room (background) |
| Quiet suburban nighttime | | |
| | —30— | Library |
| Quiet rural nighttime | | Bedroom at night, concert hall (background) |
| | —20— | |
| | | Broadcast/recording studio |
| | —10— | |
| | | |
| | —0— | |

Source: Caltrans 2013a.
dBA = A-weighted decibel
mph = miles per hour

The perceptibility of a new noise source that intrudes into a background noise environment depends on the nature of the intruding sound compared to the background sound. In general, if the intruding sound has the same character as the background sound (e.g., an increase in continuous traffic noise compared to background continuous traffic noise), human sound perception is such that a change in sound level of 3 dB is just noticeable, a change of 5 dB is clearly noticeable, and a change of 10 dB is perceived as doubling or halving the sound level. However, if the intruding sound is of a character different from the

background sound (e.g., construction noise in an otherwise quiet neighborhood), the intruding sound can be clearly discernible even if it raises the overall dBA noise level by less than 1 dB.

All of the alternatives (including No Action Alternative) would require use of conventional construction equipment to restore habitat, and to construct setback levees and other intervention measures. Table V.1-2 lists noise levels generated by representative types of construction equipment.

**Table V.1-2. Typical Construction Equipment Noise Emission Levels**

| Equipment | Typical Noise Level ($L_{max}$)[1] |
|---|---|
| Air Compressor | 78 |
| Backhoe | 78 |
| Compactor | 83 |
| Crane | 81 |
| Dozer | 82 |
| Dump Truck | 76 |
| Excavator | 81 |
| Forklift[3] | 75 |
| Front-End Loader | 79 |
| Grader | 85 |
| Haul Truck[2] | 76 |
| Maintainer[5] | 77 |
| Paver | 77 |
| Pickup Truck | 75 |
| Trackhoe[4] | 78 |
| Scraper | 84 |
| Tugboat | 82 |
| Water Truck[2] | 76 |

Sources: FHWA 2006 and FTA 2018.
$L_{max}$ = maximum sound level
1 dBA, A-weighted decibel level, measured at 50 feet.
2 Based on data for dump truck.
3 Based on data for pickup truck.
4 Based on data for backhoe.
5 Based on data for paver.

## V.1.2 Vibration Terminology

Operation of heavy construction equipment creates seismic waves that radiate along the surface of the earth. These surface waves are perceptible as groundborne vibration. Vibration from operation of heavy equipment can potentially result in effects ranging from annoyance of people to damage of structures. As seismic waves travel outward from a vibration source, they excite the particles of rock and soil through which they pass and cause them to oscillate. The actual distance soil particles move is a fraction of an inch. The rate, or velocity at which these particles move is the commonly accepted descriptor of the vibration amplitude, referred to as the "peak particle velocity" (PPV) and expressed in units of inches per second. Variations in geology over an area result in differing vibration amplitudes by frequency, and

propagation of vibration with distance. As with noise, vibration levels decrease (or attenuate) as distance from the source of vibration increases.

Table V.1-3 summarizes typical human response to prolonged steady state vibration such as that produced by typical nonimpact construction activity during earthmoving activity.

**Table V.1-3. Human Response to Steady State Vibration**

| PPV | Human Response |
|---|---|
| 3.6 (at 2 Hz)–0.4 (at 20 Hz) | Very disturbing |
| 0.7 (at 2 Hz)–0.17 (at 20 Hz) | Disturbing |
| 0.20 | Potential damage to interior plaster walls |
| 0.10 | Strongly perceptible |
| 0.035 | Distinctly perceptible |
| 0.012 | Slightly perceptible |

Source: Caltrans 2013b.
PPV = peak particle velocity
Hz = hertz

Table V.1-4 summarizes ground vibration levels generated by typical construction equipment.

**Table V.1-4. Vibration Source Levels for Construction Equipment**

| Equipment | PPV at 25 feet |
|---|---|
| Vibratory roller | 0.210 |
| Large bulldozer | 0.089 |
| Loaded trucks | 0.076 |
| Jackhammer | 0.035 |
| Small bulldozer | 0.003 |

Source: FTA 2018.
PPV = peak particle velocity

Vibration amplitude attenuates over distance and is a complex function of how energy is transferred into the ground and the soil conditions through which the vibration is traveling. Generally, groundborne vibration from heavy non-impact construction equipment such as the equipment types listed in Table V.1-4 is expected to be discernible only for very short distances from the construction site (up to 40 feet away).

## V.1.3 Existing Noise and Vibration Environment

Construction equipment and hauling activities within the action area could potentially affect receptors in restoration and intervention areas extending through several counties, as listed below by region:

- Sacramento River region: counties of Butte, Colusa, El Dorado, Glenn, Nevada, Placer, Plumas, Shasta, Sutter, Tehama, and Yuba
- San Joaquin River region: counties of Fresno, Kern, Kings, Madera, Merced, Stanislaus, and Tulare

- Delta region: counties of Contra Costa, Sacramento, San Joaquin, Solano, and Yolo
- San Francisco Bay Area region: counties of Alameda, Napa, San Benito, and Santa Clara
- Central Coast region: counties of San Luis Obispo and Santa Barbara
- Southern California region: counties of Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura

Background noise levels in the action area vary between rural and urban settings. Based on historical measured noise levels taken at representative rural and urban settings (USEPA 1971), it is assumed that existing 1-hour $L_{eq}$ noise levels at the remote rural sites are in the range of 35–50 dBA during the day and 30–40 dBA at night. Daytime noise levels at sites located within small towns are assumed to be 50–55 dBA. Daytime noise levels at sites within 100 feet of high-volume freeways or highways are assumed to be 55–65 dBA (Caltrans 2013a). Sources of ambient noise in the action area include traffic, agricultural equipment, boats, and aircraft. Some locations in the action area are within airport land use planning or influence areas, and may experience ambient noise from aircraft arrivals and departures. Rail transportation corridors in the action area are a source of rail noise and vibration from freight and commuter trains. The influence of these sources of noise on ambient levels depends on the proximity of receivers to highways, rail corridors, airports, and developed areas.

Existing groundborne vibration levels would generally not be discernible at locations beyond the road shoulders of highways or freeways. Proposed construction activity is not expected to result in perceptible levels of vibration in sensitive buildings.

The action alternatives have a negligible potential to generate groundborne noise. In a few unusual cases (e.g., a railroad tunnel constructed underneath a concert hall) ground vibration transmitted through bedrock can cause nearby structures to vibrate and generate a low frequency rumble inside the structure. However, that unusual case is not relevant to the alternatives. Therefore, this effect is not discussed further.

### V.1.4 General Types of Noise-Sensitive Land Uses

Noise-sensitive land uses generally are defined as locations where people reside or where the presence of elevated noise emissions could significantly affect the use of the land. Noise-sensitive land use may be near individual construction sites and staging areas, or near access roads used for substantial haul truck traffic. Typical sensitive receptors include residences, schools, hospitals, and places of worship. Noise-sensitive receptors can also include parks, where quiet conditions are important for normal conversation between park users, and outdoor use areas at businesses, such as outdoor dining areas at restaurants.

### V.1.5 Regulatory Guidance for Noise and Vibration Assessment

Construction noise and vibration effects have been assessed using analysis methods recommended by the U.S. Department of Transportation for construction of large public works infrastructure projects. The Federal Transit Administration has developed methods for evaluating construction noise levels, described in the *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018). While these methods are not standardized criteria, they are often applied as guidelines for noise limits at sensitive land uses to describe levels that may potentially result in negative community reaction.

For residences, the recommended standard noise limits are 80 dBA Leq (8-hour) during daytime hours (7:00 a.m. to 10:00 p.m.), and 70 dBA Leq (8-hour) during nighttime hours (10:00 p.m. to 7:00 a.m.) These standards are appropriate for use in an impact assessment, or where no noise level criteria have been set by the applicable local jurisdiction.

Groundborne vibration was assessed using the methodology discussed in Federal Highway Administration and Federal Transit Administration guidance. Groundborne vibration during project construction is generally localized around the site of construction activity. Vibration produced at a level high enough to be perceptible inside building structures can result in annoyance and sleep disturbance to occupants of buildings. Vibration can also potentially result in building damage, depending on the level of vibration and the type of construction of the affected structures. A vibration level of 0.10 inches/second PPV is considered to be "strongly perceptible" during prolonged construction activity using non-impact equipment (Caltrans 2013b). A vibration level exceeding 0.20 inches/second PPV may potentially result in damage to non-engineered timber and masonry buildings. (FTA 2018).

Program-specific noise and vibration thresholds were developed for this effects analysis. Program- or Project-level activities would be considered to result in a significant noise or vibration effect if one or more of the following were predicted to occur:

- A significant noise effect may be considered to occur if construction noise is predicted to exceed a daytime (7 a.m. to 7 p.m.) exterior noise level (1-hour $L_{eq}$) of 70 dBA, or an evening/nighttime (7 p.m. to 7 a.m.) exterior noise level of 60 dBA (1-hour $L_{eq}$). These criteria were derived by subtracting 10 dBA from the construction noise limits specified in the federal guidance described above (FTA 2018). The minus-10 dBA adjustment was made to the Federal Transit Administration's noise level criteria to account for the rural nature of much of the action area, where construction equipment would be more noticeable above surrounding existing ambient levels, and background noise levels are likely much lower than urban areas where transit projects are usually constructed.
- Project-related haul truck traffic is predicted to cause traffic noise to increase of 12 dBA (peak-hour $L_{eq}$) or more compared to the existing peak-hour $L_{eq}$ at any noise sensitive receptor within 500 feet of the access road. The California Department of Transportation defines a 12 dB noise increase as a "substantial" noise increase. (Caltrans 2013a).
- Construction equipment is predicted to produce vibration levels that would be "strongly perceptible" inside of buildings (i.e., exceeding 0.10 inch/second PPV) for more than one hour per day.

# V.2 Evaluation of Alternatives

This section describes the technical background for the evaluation of environmental consequences associated with the action alternatives and the No Action Alternative.

## V.2.1 Methods and Tools

Construction activities (including construction equipment used for long-term maintenance) are the predominant source of noise and vibration associated with the program. Based on anticipated construction equipment types and methods of operation, construction noise levels for various elements of the construction process have been calculated. The magnitude of construction noise effects at noise-sensitive land uses depends on the type of construction activity, the noise level generated by various pieces of

construction equipment, the distance between the activity and noise-sensitive land uses, and whether the ground between the source and the receiver is "acoustically hard" (e.g., pavement, reflective water) or "acoustically soft" (e.g., unpaved soil). Methods for calculation of construction equipment noise are based on U.S. Department of Transportation guidance.

### V.2.2 No Action Alternative

The No Action Alternative would include restoration of 8,000 acres of Delta habitat. Restoration activities would require use of trucks and heavy earth moving equipment, which would potentially result in a temporary increase in noise levels at nearby sensitive receivers. Haul trucks would result in an increase in traffic noise on local roads.

### V.2.3 Alternative 1

#### V.2.3.1 *Project-Level Effects*

Temporary and permanent equipment noise and vibration levels would be the same as the No Action Alternative. There would be no project-level effects.

#### V.2.3.2 *Program-Level Effects*

*Potential exposure of sensitive receptors to temporary construction-related noise.*

Habitat restoration and interventions would involve temporary use of construction equipment, which may result in increased ambient noise levels at sensitive receptor locations relative to the No Action Alternative. Tidal habitat restoration in the Bay-Delta region would be the same as that under the No Action Alternative and would have no increased noise level effects under Alternative 1. Construction activities are not expected to result in discernible vibration levels inside of structures.

*Potential exposure of sensitive receptors along truck haul routes to a temporary increase in traffic noise*

Habitat restoration, interventions, and construction activities could temporarily increase truck traffic along truck haul routes. Activities with the greatest potential for truck haul routes that would increase traffic noise are spawning and rearing habitat restoration, Delta Cross Chanel gate improvements, Delta Fish Species Conservation Hatchery construction, and the Tracy Fish Collection Facility and Skinner Fish Protective Facility improvements. Truck haul routes will be determined prior to construction; the exposure of sensitive receptors will be taken into consideration to the extent possible.

*Potential exposure of sensitive receptors to intermittent noise due to long-term maintenance activity including emergency repair activities*

Increased levels of long-term maintenance are anticipated for spawning and rearing habitat restoration and Delta Fish Species Conservation Hatchery production. The frequency and magnitude of maintenance will be determined for each project at a later date and captured in an operations and maintenance plan. Maintenance of the Delta Cross Channel gate and Tracy Fish Collection and Skinner Fish Protective Facilities is not expected to be greater than that under the No Action Alternative because operations and maintenance would continue in much the same manner even with the facility upgrades.

### V.1.1 Alternative 2

#### V.2.3.3 *Project-Level Effects*

Temporary and permanent equipment noise and vibration levels would be the same as the No Action Alternative. There would be no project-level effects.

#### V.2.3.4 *Program-Level Effects*

Temporary and permanent equipment noise and vibration levels would be the same as the No Action Alternative. Alternative 2 does not include any program-level habitat restoration and would therefore result in less noise impacts than other action alternatives that include restoration and construction activities. There would be no program-level noise effects.

### V.2.4 Alternative 3

#### V.2.4.1 *Project-Level Effects*

Temporary and permanent equipment noise and vibration levels would be the same as the No Action Alternative. There would be no project-level effects.

#### V.2.4.2 *Program-Level Effects*

*Sensitive receptors could be exposed to temporary construction-related noise.*

Restoration and interventions under Alternative 3 would be greater than those under Alternative 1 because the construction of 25,000 acres of habitat would be expected to involve an increased use of construction equipment over a larger area for a longer period of time. Program-level habitat restoration under Alternative 3 would involve temporary use of construction equipment such as trucks, excavators, bulldozers, and other earthmoving equipment, which may potentially result in increased ambient noise levels at more sensitive receptor locations compared to the No Action Alternative. Noise effects could occur within approximately 0.25 mile (1,320 feet) of the activity. Construction equipment such as graders, concrete mixers, and earthmoving equipment would be used for upgrades to the Tracy Fish Collection and Skinner Fish Protective Facilities, which may result in perceptible increases to ambient noise levels at noise-sensitive receivers located within 0.25 mile of these facilities. Because there is a greater potential for increased noise levels at noise-sensitive receivers relative to Alternative 1, effects under Alternative 3 would be greater than under Alternative 1.

*Sensitive receptors along truck haul routes could be exposed to a temporary substantial increase in traffic noise.*

Hauling activities under Alternative 3 would be greater than those under Alternative 1 because the construction of 25,000 acres of habitat would involve increased material transport over a larger area for a longer period of time. Transport of materials would serve habitat restoration projects at an increased level compared to Alternative 1, in addition to upgrades to the Tracy and Skinner fish facilities. Activities under Alternative 3 would involve temporary use of haul trucks that may result in increased ambient noise levels at more sensitive receptor locations relative to the No Action Alternative. Truck haul routes will be determined prior to construction; the exposure of sensitive receptors will be taken into consideration to the extent possible.

*Sensitive receptors could be exposed to intermittent noise due to long-term maintenance activity including emergency repair activities.*

Maintenance activities under Alternative 3 would be greater than those under Alternative 1 because of the additional 25,000 acres of habitat that would be constructed. Maintenance activities for 25,000 acres of habitat would be greater than those carried out under the No Action Alternative. The frequency and magnitude of maintenance will be determined for each project at a later date and captured in an operations and maintenance plan. Maintenance of the Delta Cross Channel gate and the Tracy and Skinner fish facilities is not expected to be greater than that under the No Action Alternative because operations and maintenance would continue in much the same manner even with the facility upgrades.

## V.2.5 Alternative 4

### V.2.5.1 *Project-Level Effects*

Temporary and permanent equipment noise and vibration levels would be the same as the No Action Alternative. There would be no project-level effects.

### V.2.5.2 *Program-Level Effects*

*Sensitive receptors could be exposed to temporary construction-related noise.*

Construction of program-level water use efficiency measures under Alternative 4 would involve temporary use of construction equipment such as graders, concrete mixers, and earthmoving equipment, which may potentially result in increased ambient noise levels at more sensitive receptor locations compared to the No Action Alternative. Noise effects could occur within approximately 0.25 mile (1,320 feet) of the activity. Construction of measures for agricultural water use efficiency is unlikely to take place in the vicinity of sensitive receptors; however, distribution system improvements or landscape changes implemented in an urban setting would likely be within 0.24 miles of a sensitive receptor and may result in temporary construction-related noise greater than that under the No Action Alternative.

*Potential exposure of sensitive receptors along truck haul routes to a temporary increase in traffic noise*

Construction of water use efficiency measures under Alternative 4 could temporarily increase truck traffic along truck haul routes as compared to the No Action Alternative. Activities with the greatest potential for truck haul routes that would increase traffic noise are installation of new irrigation systems, distribution system improvements, new supplier spill and tailwater systems, and landscape transformation. Truck haul routes will be determined prior to construction; the exposure of sensitive receptors will be taken into consideration to the extent possible.

*Potential exposure of sensitive receptors to intermittent noise due to long-term maintenance activity including emergency repair activities*

Increased levels of long-term maintenance could occur under Alternative 4 for actions which alter land use or construct new structures such as tail water systems. Maintenance of existing systems which are improved under Alternative 4 is not expected to be greater than that under the No Action Alternative because operations and maintenance would continue in much the same manner even with the upgrades. Upgraded systems even have the potential to reduce long-term maintenance due to improved operation

and technology. The frequency and magnitude of maintenance will be determined for each project at a later date and captured in an operations and maintenance plan.

### V.2.6 Mitigation Measures

To avoid and minimize for adverse noise effects as compared to the No Action Alternative, Mitigation Measure NOI-1, Employ Standard Measures to Reduce Noise Levels from Heavy Equipment, has been identified. Where applicable, Reclamation and DWR will implement best practices to reduce construction noise levels at noise-sensitive land uses to reduce the potential for negative community reaction.

#### Mitigation Measure NOI-1: Employ Standard Measures to Reduce Noise Levels from Heavy Equipment

Where applicable, Reclamation will implement best practices to reduce construction noise levels at noise-sensitive land uses to reduce the potential for negative community reaction. These methods would be implemented to limit construction noise levels to 70 dBA Leq(1h) during daytime hours (7:00 a.m. to 7:00 p.m.) and 60 dBA Leq(1h) during evening and nighttime hours (7:00 p.m. to 7:00 a.m.) wherever possible.

Potential measures identified to limit construction noise include the following:

- Limiting noise-generating construction operations to daytime hours.
- Locating stationary equipment (e.g., generators, compressors, rock crushers, cement mixers, idling trucks) as far as possible from noise-sensitive land uses.
- Prohibiting gasoline or diesel engines from having unmuffled exhaust.
- Requiring that all construction equipment powered by gasoline or diesel engines have sound-control devices that are at least as effective as those originally provided by the manufacturer and that all equipment be operated and maintained to minimize noise generation.
- Preventing excessive noise by shutting down idle vehicles or equipment.
- Using noise-reducing enclosures around noise-generating equipment.
- Selecting haul routes that affect the fewest number of people.
- Constructing barriers between noise sources and noise-sensitive land uses or taking advantage of existing barrier features (e.g., terrain, structures) to block sound transmission to noise-sensitive land uses. Barriers would be designed to obstruct the line of sight between the noise-sensitive land use and on-site construction equipment.
- Notifying adjacent residents in advance of construction work.

### V.1.2 Summary of Impacts

Table V.2-1 includes a summary of impacts, the magnitude and direction of those impacts, and potential mitigation measures for consideration.

**Table V.2-1. Impact Summary**

| Impact | Alternative | Magnitude and Direction of Impacts | Potential Mitigation Measures |
|---|---|---|---|
| Potential exposure of sensitive receptors to temporary construction-related noise (Program-Level) | No Action | A temporary increase in ambient noise levels from heavy equipment during restoration projects and facility construction. | – |
| | 1 | A temporary increase in ambient noise levels from heavy equipment during restoration projects and facility construction. | MMNOI-1 |
| | 2 | No effects | – |
| | 3 | A temporary increase in ambient noise levels from heavy equipment during restoration projects and facility construction. | MMNOI-1 |
| | 4 | A temporary increase in ambient noise levels from heavy equipment during installation and upgrade of water use efficiency measures. | MMNOI-1 |
| Potential exposure of sensitive receptors along truck haul routes to a temporary increase in traffic noise (Program-Level) | No Action | A temporary increase in truck traffic during restoration activities. | – |
| | 1 | A temporary increase in truck traffic during restoration and facility construction and upgrades. | MMNOI-1 |
| | 2 | No effects | – |
| | 3 | A temporary increase in truck traffic primarily due to tidal habitat restoration activities. | MMNOI-1 |
| | 4 | A temporary increase in truck traffic primarily due to facility upgrades. | MMNOI-1 |
| Sensitive receptors could be exposed to intermittent noise due to long-term maintenance activity including emergency repair activities (Program-Level) | No Action | Increase in noise levels due to maintenance activities at new restoration sites | |
| | 1 | Increase in noise level due to maintenance activities at new restoration sites. | MMNOI-1 |

| Impact | Alternative | Magnitude and Direction of Impacts | Potential Mitigation Measures |
|---|---|---|---|
| | 2 | No effects | – |
| | 3 | Increase in noise level due to maintenance activities at new restoration sites and a tidal habitat restoration sites. | MMNOI-1 |
| | 4 | Increase in noise level due to maintenance activities at new facilities and potential decreases in maintenance activities at existing, upgraded facilities/systems. | MMNOI-1 |

## V.2.7 Cumulative Effects

### V.2.7.1 *Project-Level*

Temporary and permanent equipment noise and vibration levels under the action alternatives would be the same as the No Action Alternative. There would be no project-level cumulative effects.

### V.2.7.2 *Program-Level*

The No Action Alternative would not change CVP and SWP operations, and temporary increases in noise from construction equipment would be due to planned program-level actions. As such, there would be no program-level cumulative effects from implementation of the No Action Alternative.

Implementation of Alternatives 1, 3, or 4 may result in an increase in ambient noise at sensitive receptor locations, such as residences, on a temporary basis. The temporary increase in noise levels would be due to use of heavy equipment and trucks during construction and maintenance of restoration projects and associated facilities. Alternative 2 has no program-level construction actions.

Several past, present, and reasonably foreseeable projects, described in Appendix Y, *Cumulative Methodology*, include the use of construction equipment or the operation of facilities that would introduce one or more new noise sources. The cumulative projects include actions in many regions to develop new water storage and conveyance infrastructure, transportation infrastructure, and construction of new facilities. Regional growth across California would induce other development and infrastructure improvement projects not listed in Appendix Y that have the potential to influence noise levels, such building of new residential or commercial development areas.

The use of construction equipment for Alternatives 1, 3, or 4 simultaneously with other planned projects may result in a temporary cumulative increase in noise levels where projects are located within 0.5 mile of one another. The timing and location of many program-level projects is unknown; however, the cumulative effect of simultaneous construction projects could result in a cumulative increase in noise and vibration levels if the timing of construction of two or more projects overlap.

While cumulative projects overlapping with construction under the action alternatives have the potential to cause a cumulative increase in noise levels, the effect would be temporary and intermittent. If a cumulative effect is likely, coordination of construction phasing of simultaneous projects would minimize construction-related noise effects. Therefore, Alternatives 1, 3, or 4 are not expected to contribute to a cumulative noise effect. Alternative 2 has no program-level construction actions, and therefore, no cumulative noise effects.

## V.3 References

California Department of Transportation (Caltrans). 2013a. *Technical Noise Supplement to the Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects.* May. Sacramento, CA.

California Department of Transportation (Caltrans). 2013b. *Transportation- and Construction-Induced Vibration Guidance Manual.* California Department of Transportation Noise, Vibration and Hazardous Waste Management Office. Prepared by Jones & Stokes, Sacramento, CA. June. (J&S 02-039).

Federal Highway Administration (FHWA). 2006. *Construction Noise Handbook*. August. U.S. Department of Transportation. Available: http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/. Accessed: December 7, 2012.

Federal Transit Administration (FTA). 2018. *Transit Noise and Vibration Impact Assessment Manual.* September. U.S. Department of Transportation. Available: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf. Accessed: March 12, 2019.

U.S. Environmental Protection Agency (USEPA). 1971. *Community Noise.* EPA Report No. NTID300.3. December.