3.12 Noise and Vibration

3.12.1 Introduction

This section describes the regulatory setting and environmental setting for noise and vibration in the vicinity of the Proposed Project and the Atwater Station Alternative. It also describes the impacts from noise and vibration on sensitive land use that would result from implementation of the Proposed Project and the Atwater Station Alternative and mitigation measures that would reduce significant impacts, where feasible and appropriate.

Cumulative impacts from noise and vibration, in combination with planned, approved, and reasonably foreseeable projects, are discussed in Chapter 4, *Other CEQA-Required Analysis*.

3.12.1.1 Fundamentals of Environmental Noise and Vibration

Overview of Noise and Sound

Noise from transit systems is expressed in terms of a *source-path-receiver* framework. The *source* generates noise levels that depend on the type of source (e.g., a commuter train) and its operating characteristics (e.g., speed). The *receiver* is the noise-sensitive land use (e.g., residence, hospital, or school) exposed to noise from the source. Between the source and the receiver is the *path*, where the noise is reduced by distance, intervening buildings, and topography. Environmental noise impacts are assessed at the receiver. Noise criteria are established for the various types of receivers because not all receivers have the same noise sensitivity.

Noise is unwanted sound. Sound is measured in terms of sound pressure level and is usually expressed in decibels (dB). The human ear is less sensitive to higher and lower frequencies than it is to mid-range frequencies. All noise ordinances, and this noise analysis, use the *A-weighted decibel* (dBA) system, which measures what humans hear in a more meaningful way because it reduces the sound levels of higher and lower frequency sounds—similar to what humans hear. Figure 3.12-1 shows typical maximum A-weighted sound pressure levels (L_{max}) for transit and non-transit sources.

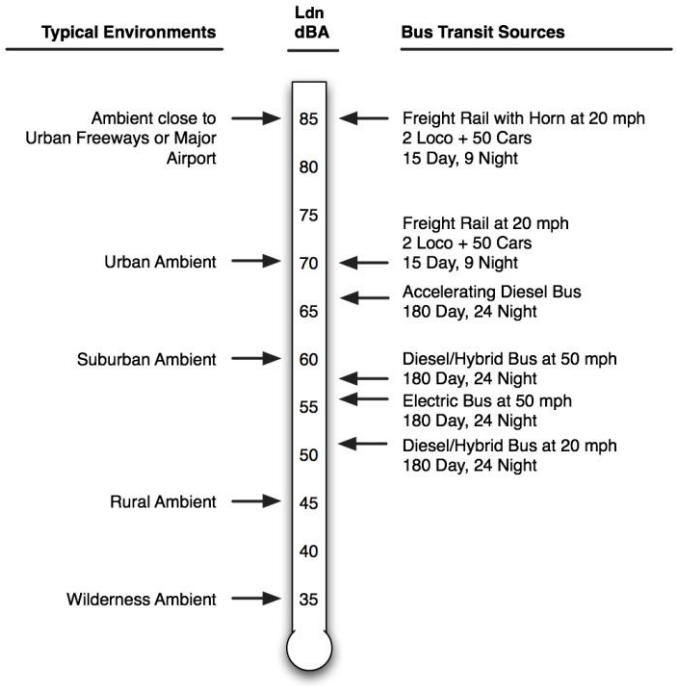

Figure 3.12-1. Cumulative Noise Levels from Transportation Sources

Analysts use four primary noise measurement descriptors to assess noise impacts from traffic and transit projects. They are the equivalent sound level (L_{eq}), the day-night sound level (L_{dn}), and the sound exposure level (SEL) and the maximum sound level (L_{max}).

- **L_{eq}**: The level of a constant sound for a specified period of time that has the same sound energy as an actual fluctuating noise over the same period of time. The peak-hour L_{eq} is used for all traffic and commuter rail noise analyses at locations with daytime use, such as schools and libraries.
- **L_{dn}**: The L_{eq} over a 24-hour period, with 10 dB added to nighttime sound levels (between 10 p.m. and 7 a.m.) to account for the greater sensitivity and lower background sound levels during this time. The L_{dn} is the primary noise-level descriptor for rail noise at residential land uses.
- **SEL**: The SEL is the primary descriptor of a single noise event (e.g., noise from a train passing a specific location along the track). The SEL represents a receiver's cumulative noise exposure from an event and the total A-weighted sound during the event normalized to a 1-second interval.
- **L_{max}**: The loudest 1 second of noise over a measurement period, or L_{max}, is used in many local and state ordinances for noise emitted from private land uses and for construction noise impact evaluations.

Overview of Groundborne Vibration

Vibration from a transit system is also expressed in terms of a *source-path-receiver* framework. The *source* is the train rolling on the tracks, which generates vibration energy transmitted through the supporting structure under the tracks and into the ground. Once the vibration gets into the ground, it propagates through the various soil and rock strata—the *path*—to the foundations of nearby buildings—the *receivers*. Groundborne vibrations are generally reduced with distance depending on

the local geological conditions. A receiver is a vibration-sensitive building (e.g., residence, hospital, or school) where the vibrations may cause perceptible shaking of the floors, walls, and ceilings and a rumbling sound inside rooms. Not all receivers have the same vibration sensitivity. Consequently, vibration criteria are established for the various types of receivers. Groundborne noise occurs as a perceptible rumble and is caused by the noise radiated from the vibration of room surfaces.

Vibration above certain levels can damage buildings, disrupt sensitive operations, and cause annoyance to humans within buildings. The response of humans, buildings, and equipment to vibration is most accurately described using velocity or acceleration. In this analysis, vibration velocity (VdB) is the primary measure to evaluate the effects of vibration. Figure 3.12-2 illustrates typical groundborne vibration velocity levels for common sources and thresholds for human and structural response to groundborne vibration. As shown, the range of interest is from approximately 50 to 100 VdB in terms of vibration velocity level (i.e., from imperceptible background vibration to the threshold of damage). Although the threshold of human perception to vibration is approximately 65 VdB, annoyance does not usually occur unless the vibration exceeds 70 VdB.

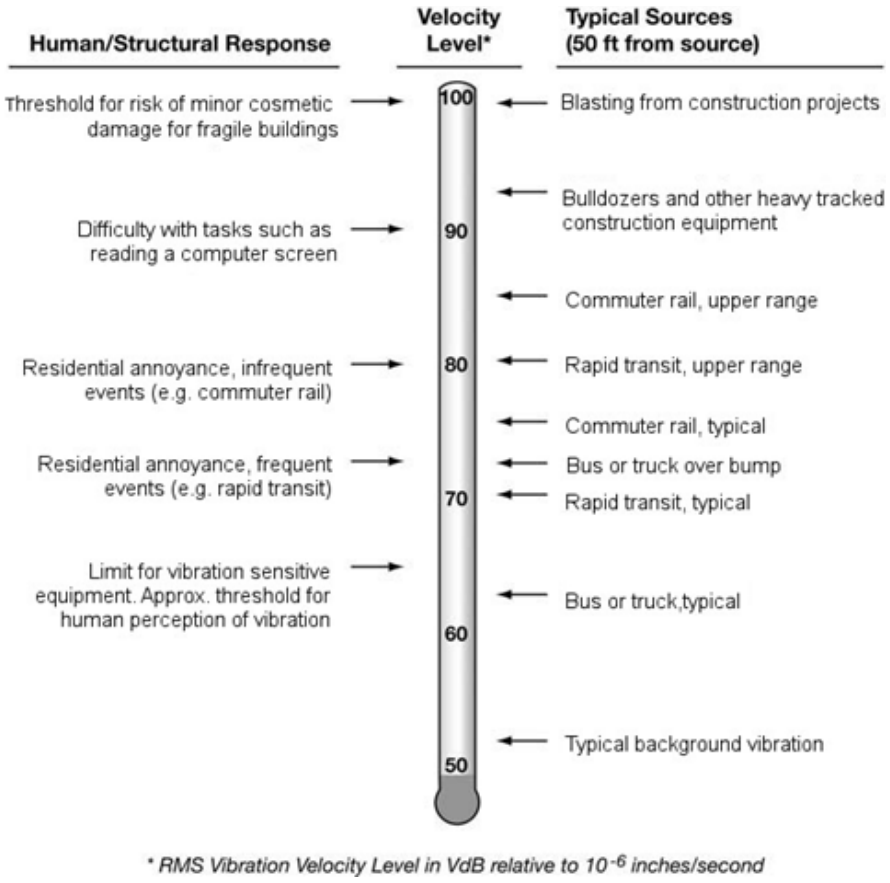

Figure 3.12-2. Typical Groundborne Vibration Levels

3.12.2 Regulatory Setting

This section summarizes federal, state, regional, and local regulations related to noise and vibration and applicable to the Proposed Project and the Atwater Station Alternative.

3.12.2.1 Federal

Noise Control Act of 1972

The Noise Control Act of 1972 (42 United States Code 4910) was the first comprehensive statement of national noise policy. The Noise Control Act declared "it is the policy of the U.S. to promote an environment for all Americans free from noise that jeopardizes their health or welfare." Although the Noise Control Act, as a funded program, was ultimately abandoned at the federal level, it served as the catalyst for comprehensive noise studies and the generation of noise assessment and mitigation policies, regulations, ordinances, standards, and guidance for many states, counties, and municipal governments. For example, the noise elements of community general plan documents and local noise ordinances considered in this analysis were largely created in response to the passage of the Noise Control Act.

U.S. Environmental Protection Agency Railroad Noise Emission Standards

Interstate rail carriers must comply with U.S. Environmental Protection Agency (USEPA) (40 Code of Federal Regulation [C.F.R.] 201) noise emission standards, which are expressed as maximum measured noise levels and applicable to locomotives manufactured after 1979.

- 100 feet from geometric center of stationary locomotive, connected to a load cell and operating at any throttle setting except idle—87 dBA (at idle setting, 70 dBA).
- 100 feet from geometric center of mobile locomotive—90 dBA.
- 100 feet from geometric center of mobile railcars, at speeds of up to 45 miles per hour (mph)—88 dBA—or speeds greater than 45 mph (93 dBA).

Federal Railroad Administration Guidelines and Noise Emission Compliance Regulation

The Federal Railroad Administration (FRA) has developed a guidance manual for assessing noise and vibration impacts from major rail projects. Although not at the level of a rule or a standard, FRA guidance is intended to satisfy environmental review requirements and assist project sponsors in addressing predicted construction and operation noise and vibration during the design process. FRA also has a regulation governing compliance of noise emissions from interstate railroads. FRA's Railroad Noise Emission Compliance Regulation (49 C.F.R. 210) prescribes compliance requirements for enforcing railroad noise emission standards adopted by USEPA (40 C.F.R. 201).

Federal Transit Administration Guidelines

Similar to FRA, the Federal Transit Administration (FTA) has developed a guidance manual for assessing noise and vibration impacts from major rail projects intended to satisfy environmental review requirements and assist project sponsors in addressing predicted construction and operation noise and vibration during the design process. The FTA guidance manual noise and vibration impact criteria for rail projects and their associated fixed facilities, such as storage and

maintenance yards, passenger stations and terminals, parking facilities, and substations are described in Section 3.12.4.2, *Thresholds of Significance*, and are the primary noise criteria used for the Proposed Project. FTA guidance is accepted by FRA.

3.12.2.2 State

California Noise Control Act

At the state level, the California Noise Control Act, enacted in 1973 (Health and Safety Code 46010 et seq.), requires the Office of Noise Control in the Department of Health Services to provide assistance to local communities developing local noise control programs. The Office of Noise Control also works with the Office of Planning and Research to provide guidance for preparing required noise elements in city and county general plans, pursuant to Government Code Section 65302(f). In preparing the noise element, a city or county must identify local noise sources and analyze and quantify, to the extent practicable, current and projected noise levels for various sources, including highways and freeways; passenger and freight railroad operations; ground rapid transit systems; commercial, general, and military aviation and airport operations; and other ground stationary noise sources. These noise sources also would include commuter rail alignments. The California Noise Control Act stipulates the mapping of noise-level contours for these sources, using community noise metrics appropriate for environmental impact assessment as defined in Section 3.12.4.2, *Thresholds of Significance*. Cities and counties use these as guides to making land use decisions to minimize the community residents' exposure to excessive noise.

3.12.2.3 Regional and Local

The San Joaquin Regional Rail Commission (SJRRC), a state joint powers agency, proposes improvements inside and outside of the Union Pacific Railroad (UPRR) right-of-way (ROW). The Interstate Commerce Commission Termination Act (ICCTA) affords railroads engaged in interstate commerce considerable flexibility in making necessary improvements and modifications to rail infrastructure,[1] subject to the requirements of the Surface Transportation Board. ICCTA broadly preempts state and local regulation of railroads and this preemption extends to the construction and operation of rail lines. As such, activities within the UPRR ROW are clearly exempt from local building and zoning codes and other land use ordinances. However, facilities located outside of the UPRR ROW, including proposed stations, the proposed Merced Layover & Maintenance Facility, and the Atwater Station Alternative would be subject to regional and local plans and regulations. Though ICCTA does broadly preempt state and local regulation of railroads, SJRRC intends to obtain local agency permits for construction of facilities that fall outside the UPRR ROW even though SJRRC has not determined that such permits are legally necessary and such permits may not be required.

Appendix G of this environmental impact report (EIR), *Regional Plans and Local General Plans*, provides a list of applicable goals, policies, and objectives from regional and local plans of the jurisdictions in which Proposed Project and the Atwater Station Alternative would be located. Section 15125(d) of the CEQA Guidelines requires an EIR to discuss "any inconsistencies between the proposed project and applicable general plans, specific plans, and regional plans." These plans were considered during the preparation of this analysis and were reviewed to assess whether the Proposed Project and the Atwater Station Alternative would be consistent with the plans of relevant

[1] Altamont Corridor Express (ACE) operates within a ROW and on tracks owned by the UPRR, which operates interstate freight rail service in the same ROW and on the same tracks.

jurisdictions.[2] The Proposed Project and the Atwater Station Alternative would be consistent with most of the applicable goals, policies, and objectives related to noise and vibration identified in Appendix G of this EIR. There are instances, however, in which the Proposed Project and the Atwater Station Alternative could be inconsistent with the local goals, policies, and objectives related to noise and vibration. The noise and vibration impact and mitigation requirements prescribed for the Proposed Project and the Atwater Station Alternative are based on FRA and FTA standards.

The Proposed Project and the Atwater Station Alternative traverses and is located in the jurisdiction of two counties and six incorporated cities. Table 3.12-1 lists county and city general plans and summarizes applicable noise and vibration policies that have been reviewed and considered for the preparation of this analysis. Appendix G of this EIR contains a list of applicable noise and vibration goals, policies, and objectives from these plans.

Table 3.12-1. List of Local Plans Regarding Noise and Vibration[3]

Document Title	Summary
Stanislaus County	
Stanislaus County General Plan (Stanislaus County 2015)	Noise Policy 2 requires mitigation in unincorporated areas when noise exceeds standards. For transportation noise sources, limits are set at 60 dB L_{dn} for outdoor activity areas of single-family homes and 65 dB L_{dn} for outdoor activity areas of multifamily dwellings. Noise Policy 3 protects noise-sensitive land uses and requires mitigation when L_{dn} is increased by 3 dB and exceeds "normally acceptable" levels or increased by 5 dB and remains with in "normally acceptable" levels.
Ceres General Plan 2035 (City of Ceres 2018)	Policy 5.L.2 sets the maximum allowable noise exposure for transportation noise sources which identifies 60 dB L_{dn} as the maximum for residential and other noise-sensitive land uses and 65 dB L_{dn} for office buildings and playgrounds/neighborhood parks. Policy Noise 5.L.11 requires noise mitigation to achieve these noise standards.
Turlock General Plan (City of Turlock 2012)	Policy 9.4-b requires preventative measures for the degradation of the noise environment. Policy 9.4-c protects residential and noise-sensitive land use areas by minimizing excessive noise exposure. Policy 9.4-e requires noise-attenuating features for projects with noise exposures exceeding "normally acceptable" standards identified as 60 dB L_{dn} residential and other noise-sensitive land uses, 65 dB L_{dn} for playgrounds, recreational, and commercial and office uses, and 70 dB L_{dn} for industrial uses.
Merced County	
2030 Merced County General Plan (Merced County 2013)	Policy HS-7.2 requires noise mitigation measures to reduce traffic and/or rail noise levels to comply with standards if pre-project noise levels already exceed the standards for new uses affected by transportation (65 dB L_{dn} for residential, office buildings, and other noise-sensitive land uses; and 70 dB L_{dn} for playgrounds and parks) and the increase is significant. Policy HS-7.11 support improvements to at-grade crossings in urban areas to eliminate the need for train horn sounding near communities. Policy HS-7.12 requires new projects to include appropriate noise mitigation measures to comply with standards.

[2] An inconsistency with regional or local plans is not necessarily considered a significant impact under CEQA, unless it is related to a physical impact on the environment that is significant in its own right.

[3] All general plans follow the noise standards set by the State of California.

Document Title	Summary
City of Livingston 2025 General Plan (City of Livingston 1999)	Policy Noise 3 requires noise created by new transportation sources be mitigated as not to exceed 65 dB L_{dn} for residential and other noise-sensitive land uses.
City of Atwater General Plan (City of Atwater 2000)	Policy NO-2.4 requires mitigation for noise created by new transportation sources for standards in excess of 60 dB L_{dn} for residential and other noise-sensitive land uses, and 70 dB L_{dn} for playgrounds and parks.
Merced Vision 2030 General Plan (City of Merced 2012)	Policy N-1.6 requires mitigation for all significant noise impacts as a condition of project approval for sensitive land uses. The maximum allowable noise exposure from transportation (railroad) noise sources is set at 65 dB L_{dn} for residential and other noise-sensitive land uses and 70 dB L_{dn} for playgrounds and parks.

CNEL = community noise equivalent level.
dB = decibels.
dBA = A-weighted decibel.
FTA = Federal Transit Administration.
L_{dn} = day-night sound level.

3.12.3 Environmental Setting

3.12.3.1 Study Area

This section describes the environmental setting related to noise and vibration for the Proposed Project and the Atwater Station Alternative. For the purposes of this analysis, the study area for noise and vibration is defined as follows.

- The study area for noise is the area within approximately 500 feet of the track centerline.
- The study area for vibration is the area within approximately 200 feet of the track centerline.

Figures 3.12-3 through 3.12-13 depict the noise and vibration study areas for the Proposed Project and the Atwater Station Alternative.

3.12.3.2 Noise and Vibration Levels

Information presented in this section regarding noise and vibration was obtained from the following sources.

- Available reports and data (federal and state statutes, regional agency policies, and ordinances).
- Altamont Corridor Express (ACE) data on existing locomotive fleet and operations.
- Available data on UPRR freight train volumes.
- General plan noise elements for jurisdictions where the Proposed Project would be located.

Based on the information that was reviewed, existing noise sources in the study area include commuter rail operations (in some areas), freight rail operations, roadway traffic, and general community activity. Because the thresholds for noise impacts in FTA noise criteria are based on the existing noise levels, setting these existing levels is an important step for the assessment. These levels can either be set by measurement or modeling. Due to the current circumstances associated with the Novel Coronavirus (COVID-19), existing noise levels are lower than conditions prior to the COVID-19 pandemic. For example, freight volumes and traffic volumes are much lower than those prior to the pandemic. As such, if existing noise measurements were to be taken, the noise that

would be measured would be lower than the conditions that would be representative of typical operations and traffic volumes. Because of this, the impacts associated with the Proposed Project would not be representative of normal conditions if noise measurements were taken. Therefore, modeling was used to set the existing noise levels between Ceres and Merced. The noise levels along the rail corridor between Ceres and Merced are similar to those previously measured from Lathrop to Ceres in the *ACE Extension Lathrop to Ceres/Merced EIR* (Prior EIR). Using information from those measurements, as well as freight information from the Federal Railroad Administration, local traffic data, and population data, the existing noise was modeled at all sensitive receptors along the corridor. The existing noise levels along the corridor was modeled to be between 53 dBA and 80 dBA Ldn, depending on proximity to the rail tracks, grade crossings, and crossover locations.

Significant sources of vibration in the study area are freight rail operations. Because a general vibration assessment (rather than a detailed vibration analysis) was performed, existing vibration levels were not measured for this analysis.

3.12.3.3 Sensitive Land Uses

The Proposed Project is located in the central portion of Stanislaus County and the eastern portion of Merced County. The segment extends from central Ceres to central Merced, and traverses Keyes, Turlock, Delhi, Livingston, and Atwater, along the existing UPRR Fresno Subdivision. Noise sensitive land uses within the study area by location are as follows.:

- **Ceres**—Iglesia Santuario De Jesucristo, Mar Gewargis Assyrian Church, and single-family and multi-family housing.
- **Keyes**—single-family housing.
- **Turlock**—Holy Ground Ministry, Calvary Chapel Turlock, Good News Tabernacle Pentecostal, Apostolic Assembly Church, St John Assyrian Presbyterian Church, Harvest Church, First Baptist Church of Turlock, Valley Hope Community Church, Sikh Temple Turlock, and single-family and multi-family housing.
- **Delhi**—Delhi Community Presbyterian, Delhi Adult School, Iglesia Jesus Es El Senor, Delhi Church of God of Prophecy, and single-family and multi-family housing.
- **Livingston**—Iglesia Cristo Es La Respoesta, Livingston Apostolic Assembly, St Jude Thaddeus Roman Catholic Church, Livingston Hispanic SDA Church, Our Redeemer Lutheran Church, Livingston Historical Museum, Church of Christ, and single-family and multi-family housing.
- **Atwater**—Church of Christ, Atwater Christian Life Center, Atwater Church of the Nazarene, Mt Olive Baptist Church, Bloss Mansion, Valley Christian Center, Victory Baptist Church, and single-family and multi-family housing.
- **Merced**—Merced Baptist Church, Sound of Life International Ministries, Harvest 2 Outreach, Sequoia High School, Sacred Heart Church, Faith Mission Ministries, UC Merced Downtown Campus Center, UC Merced Venture Lab, and single-family and multi-family housing.

The Atwater Station Alternative is located in the city of Atwater. Noise sensitive land uses are as follows.

- **Atwater**—Single-family and multi-family housing.

The sensitive land uses for vibration are essentially the same as for noise, except that parkland is not considered a vibration-sensitive receptor.

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Stations
Proposed Ceres to Merced Extension Alignment
Vibration Study Area
Noise Study Area

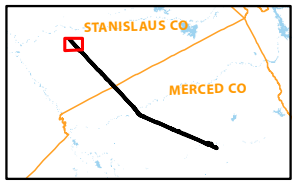
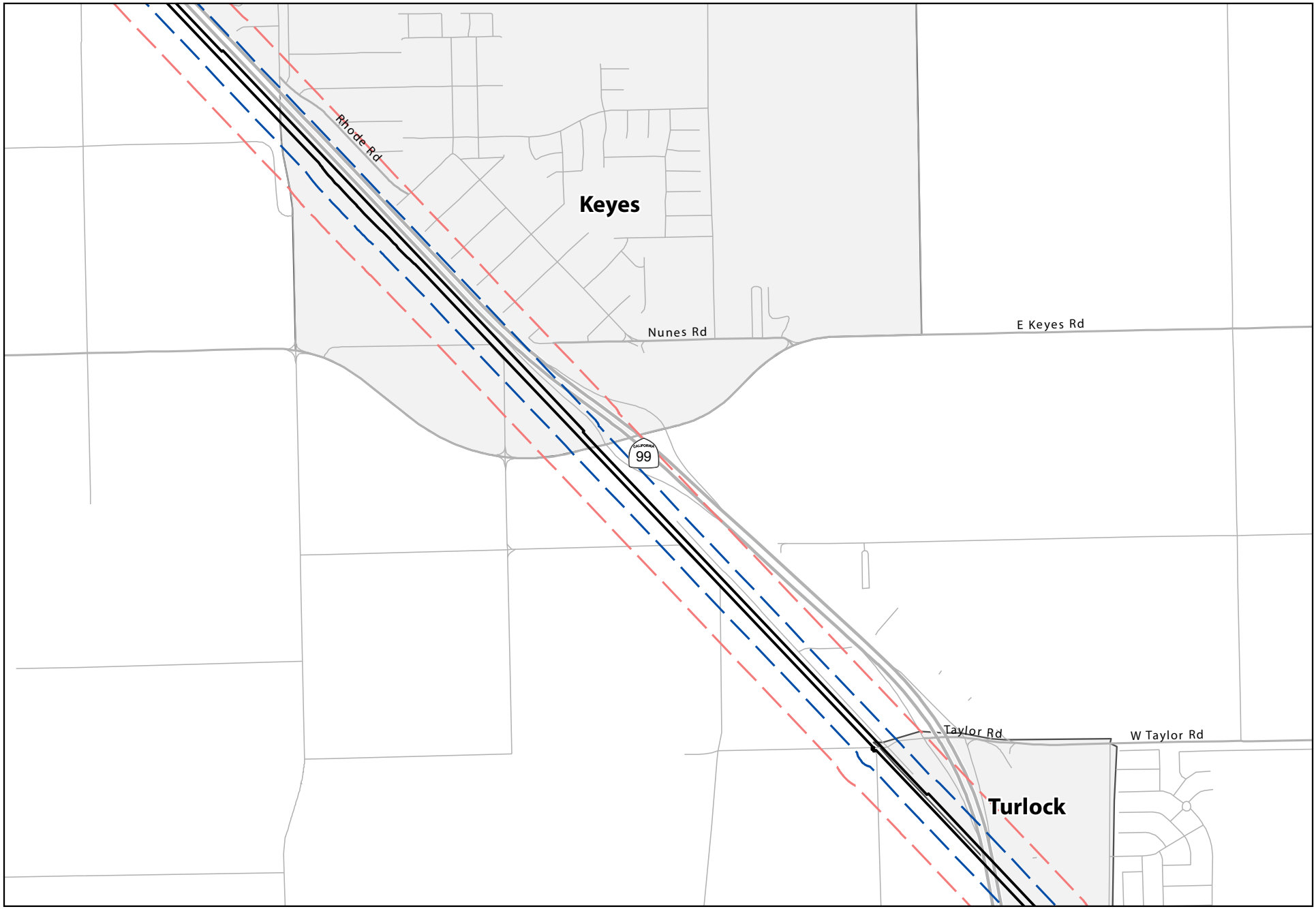


Figure 3.12-3
Noise and Vibration Study Area
ACE Ceres-Merced Extension Project



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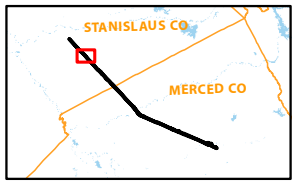

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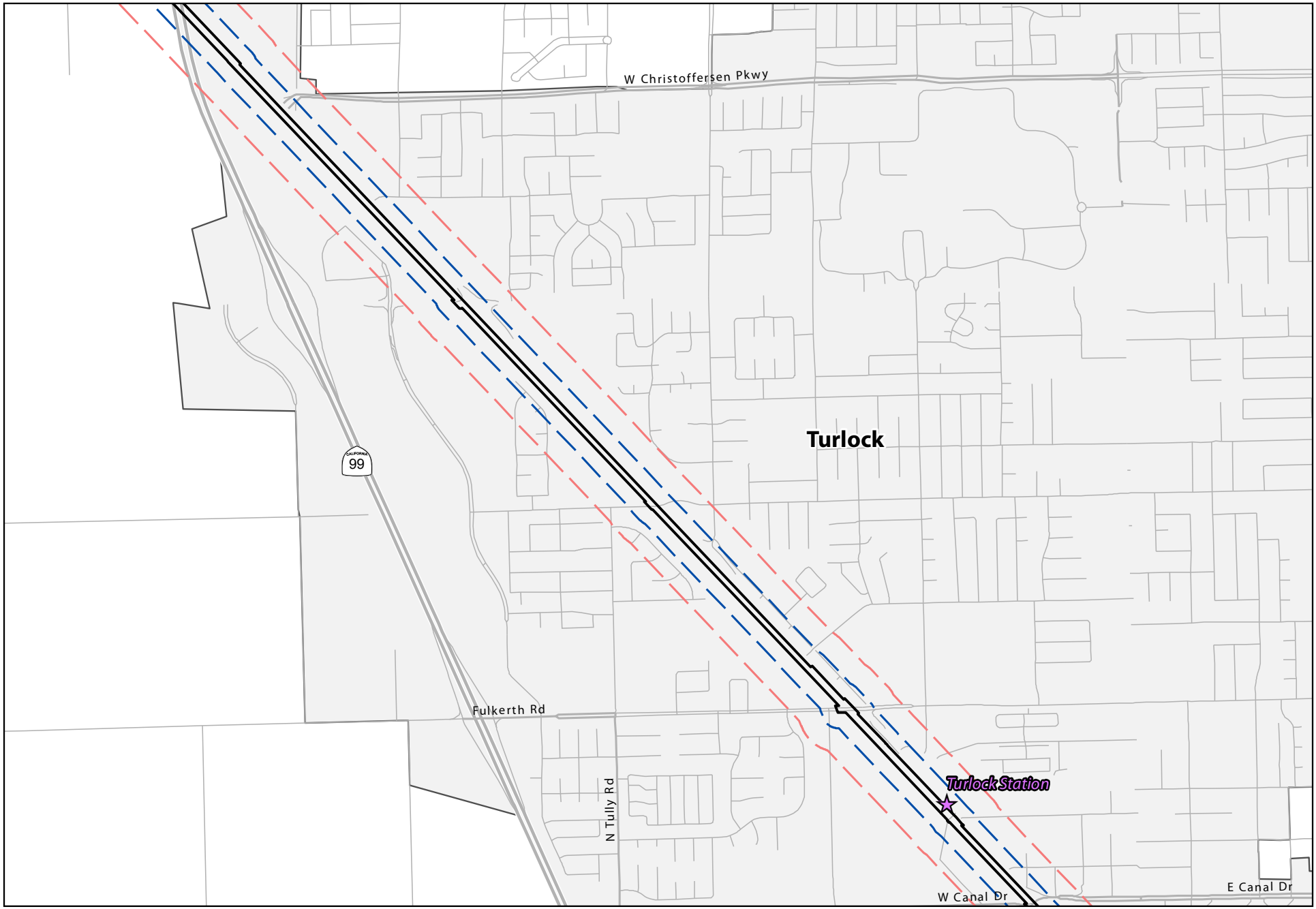

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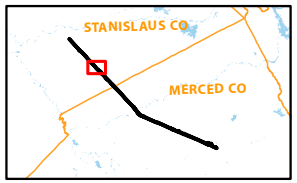

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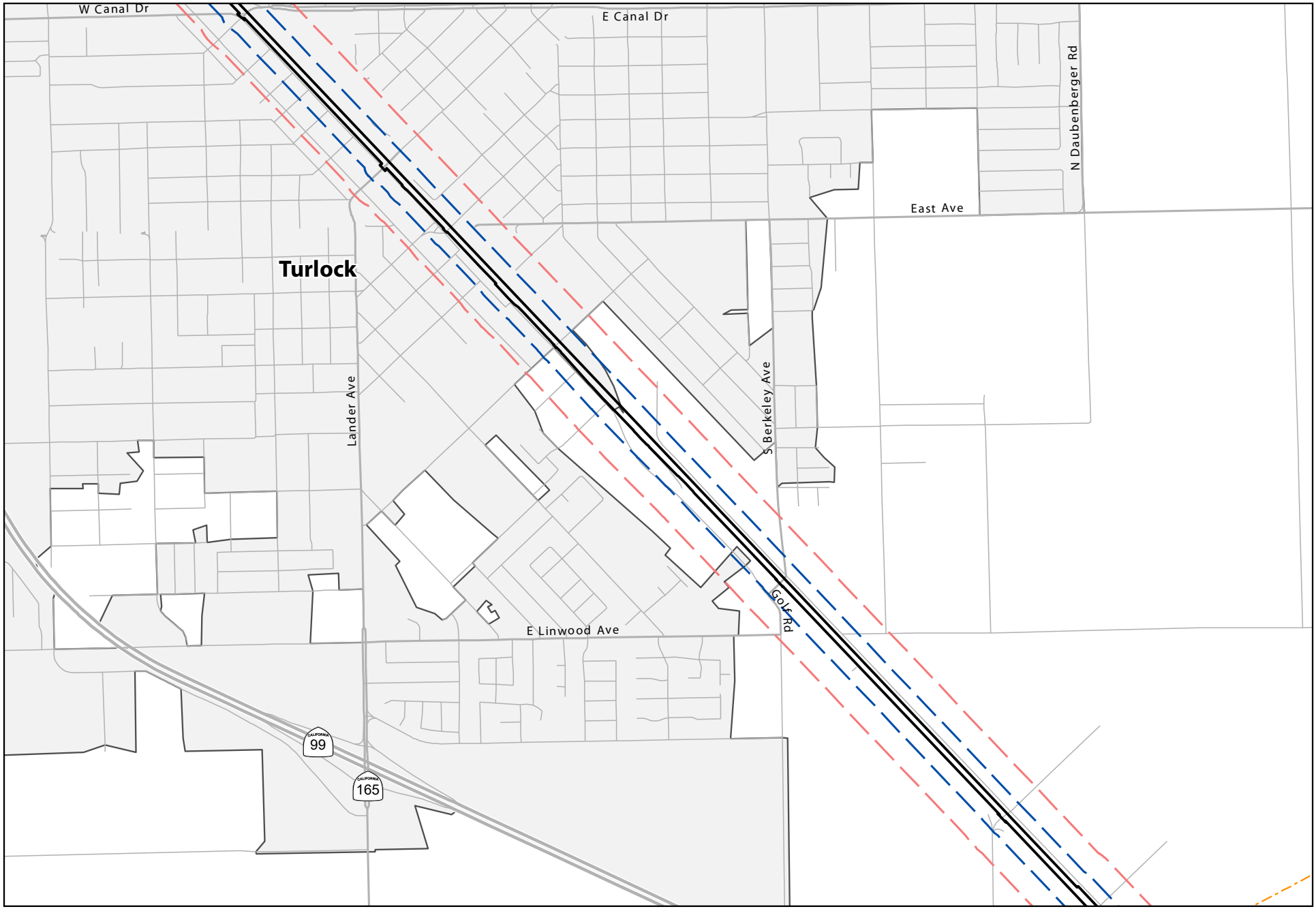

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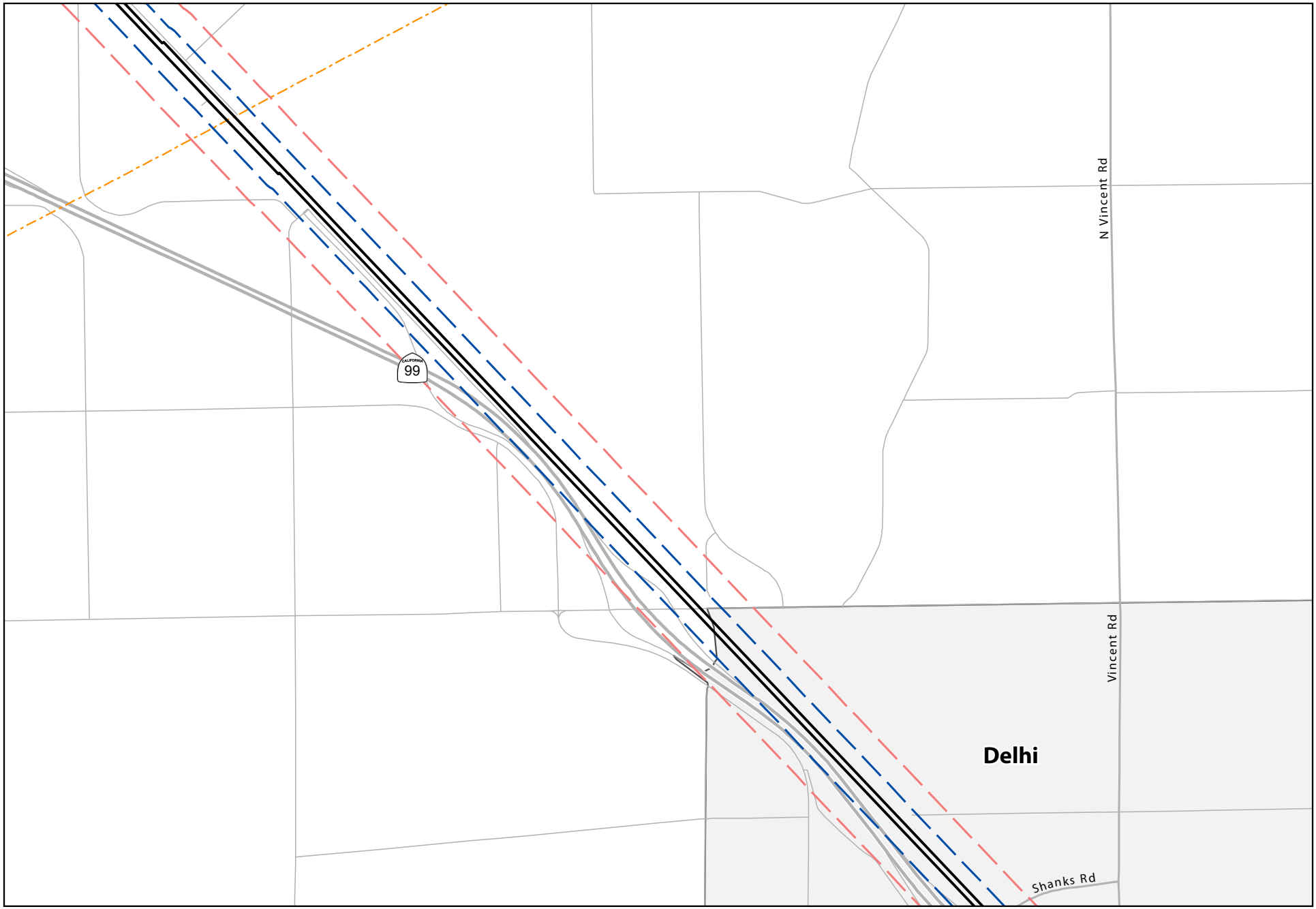
ACE Ceres-Merced Extension Project



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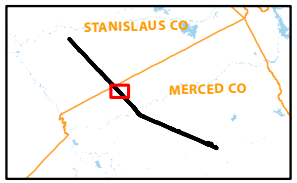

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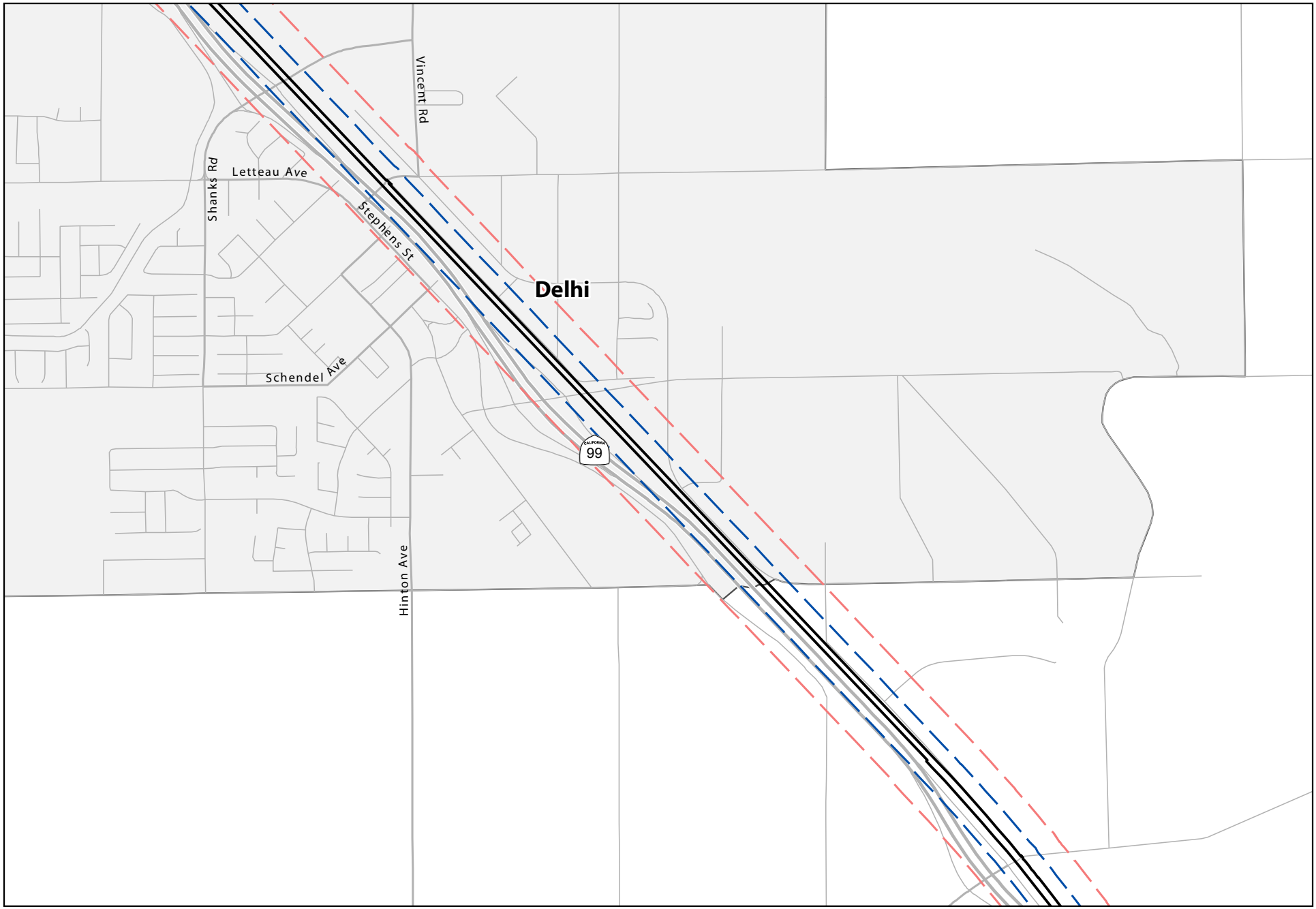
ACE Ceres-Merced Extension Project



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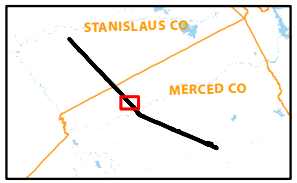
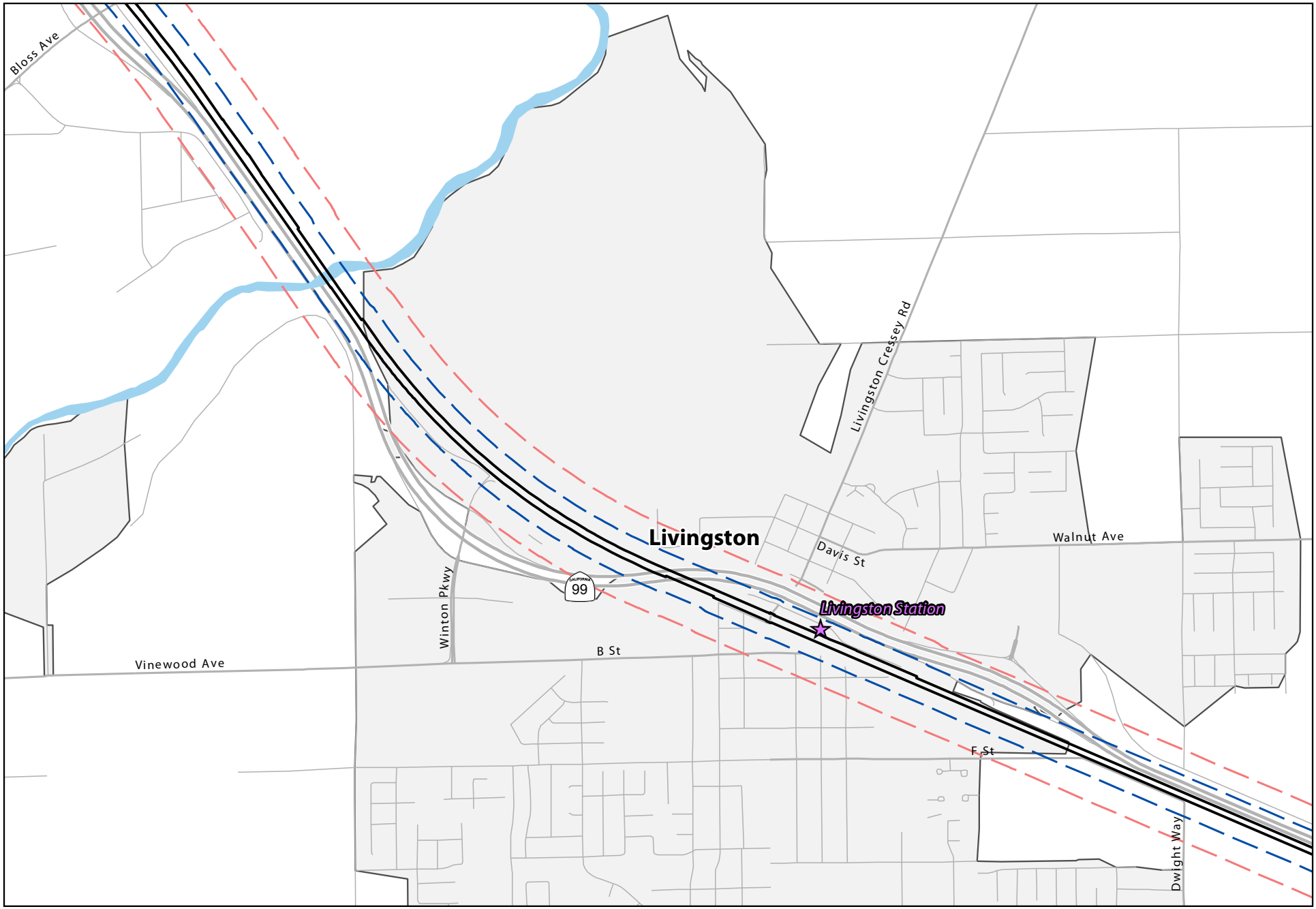


Figure 3.12-8
Noise and Vibration Study Area
ACE Ceres-Merced Extension Project



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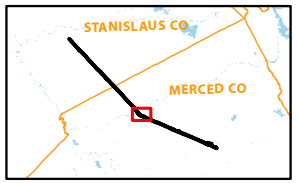
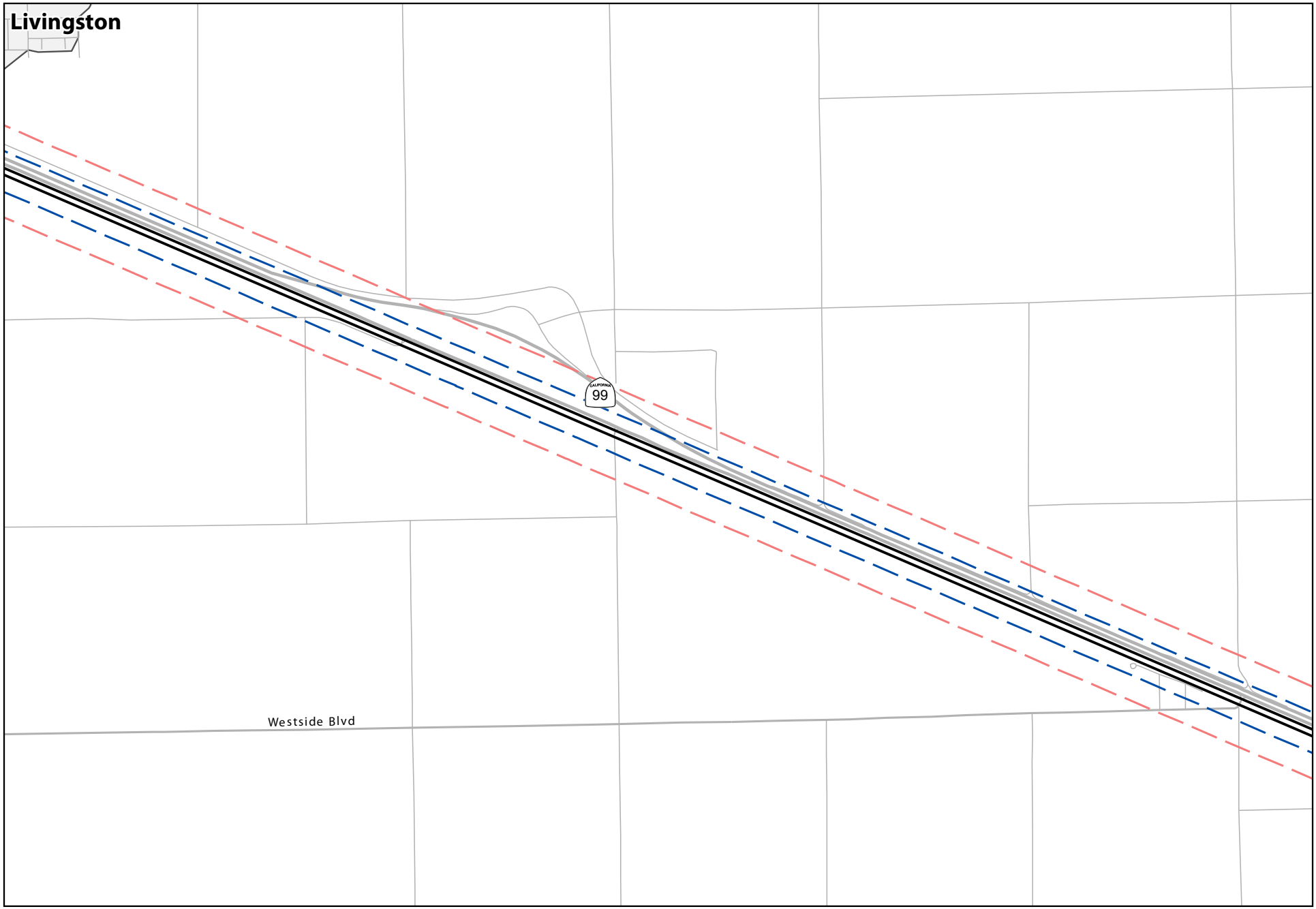


Figure 3.12-9
Noise and Vibration Study Area
ACE Ceres-Merced Extension Project



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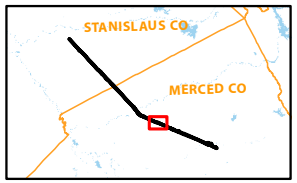

Figure 3.12-10
Noise and Vibration Study Area
ACE Ceres-Merced Extension Project

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Proposed Ceres to Merced Extension Alignment
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Noise Study Area

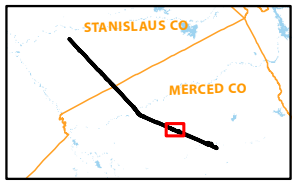

Figure 3.12-11
Noise and Vibration Study Area
ACE Ceres-Merced Extension Project

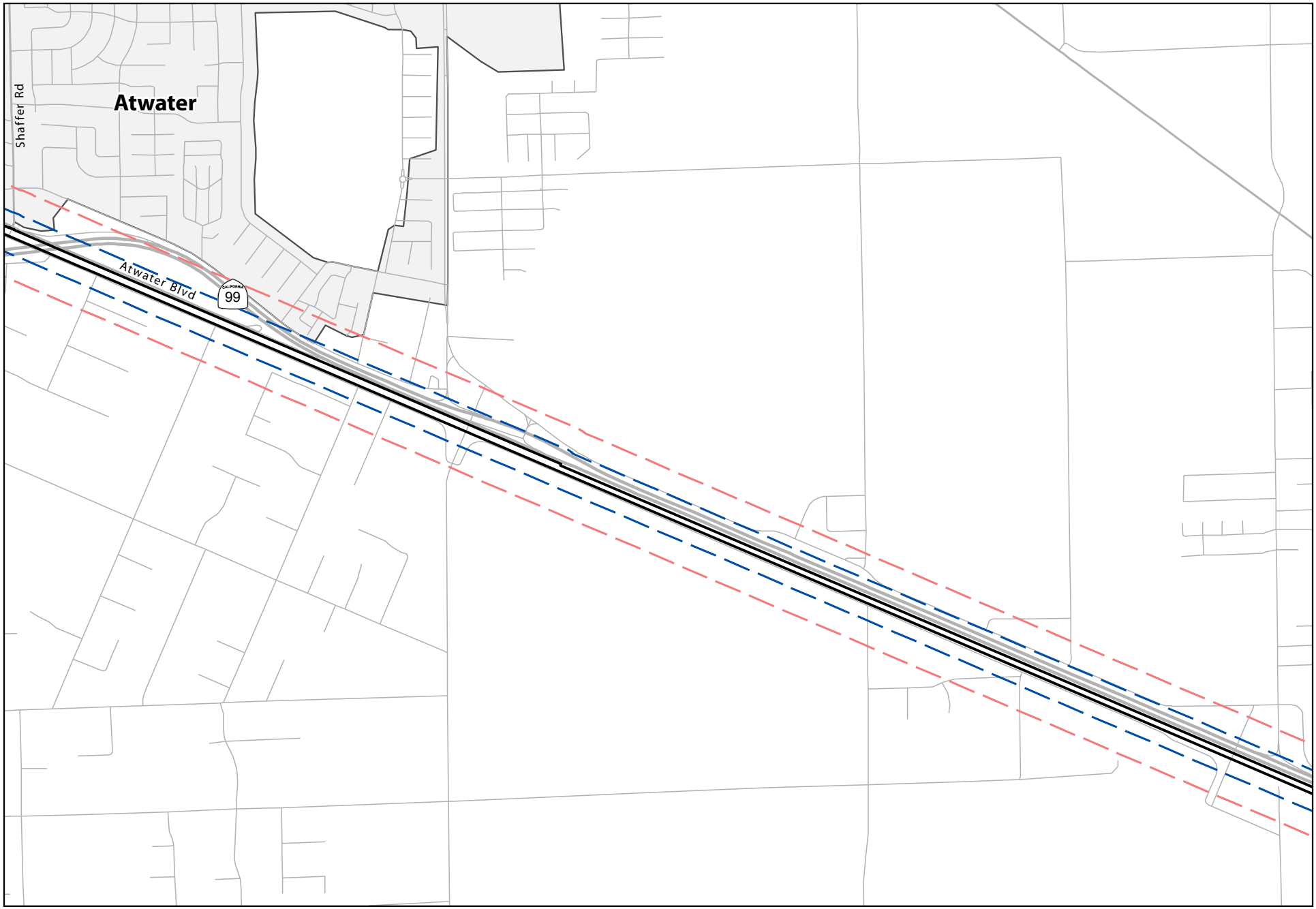

Figure 3.12-12
Noise and Vibration Study Area
ACE Ceres-Merced Extension Project

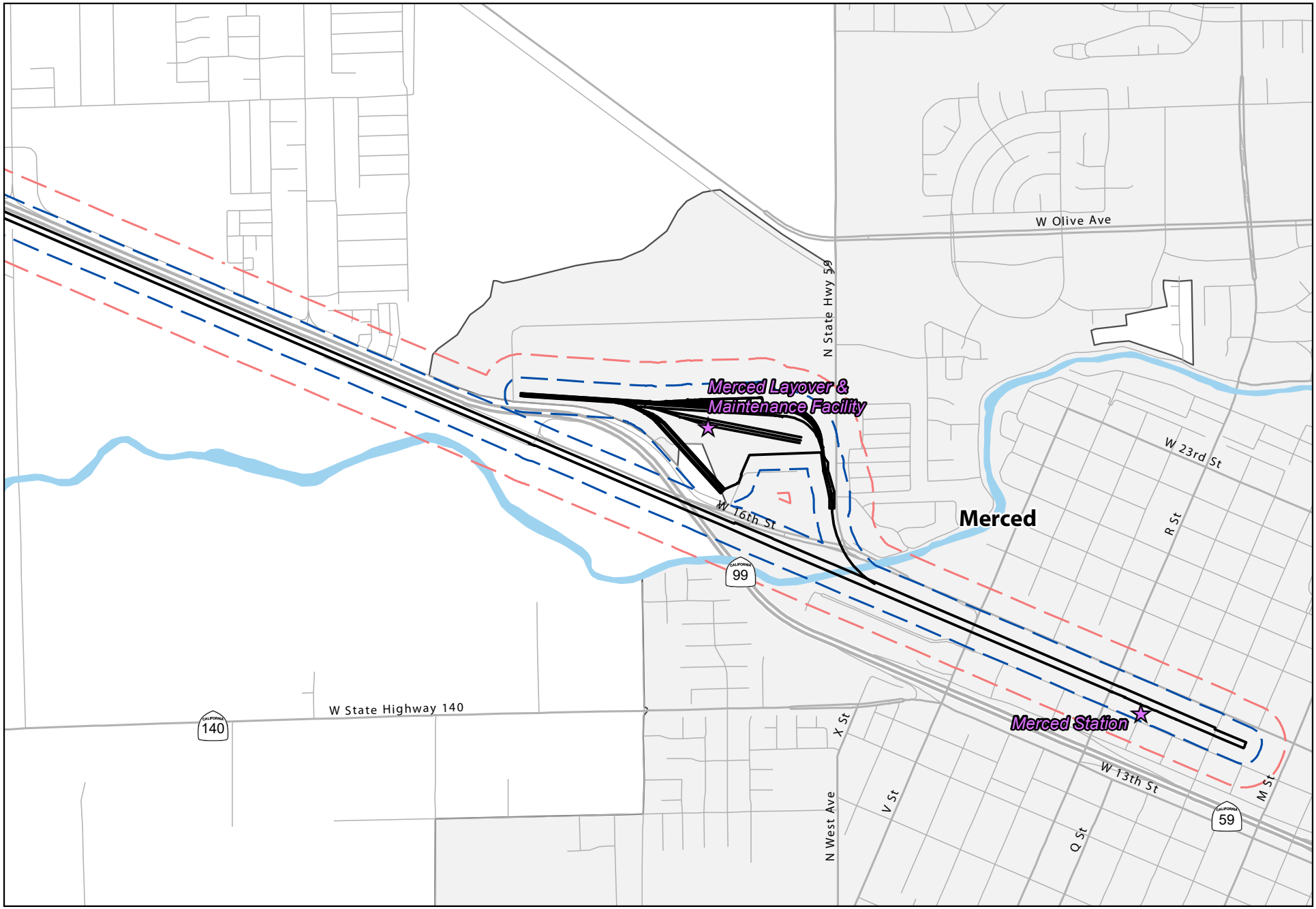

Figure 3.12-13
Noise and Vibration Study Area
ACE Ceres-Merced Extension Project

3.12.4 Impact Analysis

This section describes the environmental impacts on noise and vibration due to the Proposed Project and the Atwater Station Alternative. It describes the methods used to evaluate the impacts and the thresholds used to determine whether an impact would be significant. Measures to mitigate significant impacts are provided, where appropriate.

3.12.4.1 Methods for Analysis

The assessment of potential noise and vibration impacts associated with construction and operation of the Proposed Project and the Atwater Station Alternative is quantitative. The approach can be summarized as follows.

- Analyze direct noise and vibration impacts through quantitative analysis.
- To assess station noise and vibration, consider train type, train schedules (number of stopping trains and number of through trains during daytime and nighttime hours), number of cars in each train, speed profiles for stopping and through trains, plans and profiles of station structures, landform topography, and noise level changes associated with alterations to train service volumes.
- To assess railroad noise and vibration, consider train type, train schedules (number of through trains during daytime and nighttime hours), number of cars in each train, speed profiles, landform topography, and noise level changes associated with alterations to train service volumes.
- To assess construction noise emissions, consider equipment expected to be used by contractors during construction, usage scenarios for how equipment would be operated, estimated site layouts of equipment along the ROW, and the location of construction operations with respect to nearby noise-sensitive receptors.
- To assess construction vibration, account for vibration from construction equipment, estimated site layout of equipment along the ROW, and the location of construction operations with respect to nearby vibration-sensitive receptors.
- Include existing conditions plus construction and operations scenarios.
- Refer to FTA's guidance manual, *Transit Noise and Vibration Impact Assessment* (Federal Transit Administration 2018).

Construction Noise and Vibration Impact Assessment Methodology

The construction noise impact assessment used the methodology described in the FTA guidance manual (Federal Transit Administration 2018). SJRRC, UPRR, and their contractors will make decisions regarding procedures and equipment. For this analysis, construction scenarios for typical railroad construction projects are used to predict noise impacts. The construction noise methodology includes the following information.

- Noise emissions from typical equipment used by contractors.
- Construction methods.
- Scenarios for equipment usage.

- Estimated site layouts of equipment along the ROW.
- Proximity of construction activities to nearby noise-sensitive receptors.
- FTA construction noise assessment criteria.

The FTA guidance manual (Federal Transit Administration 2018) also provides the methodology for the assessment of construction vibration impacts. Estimated construction scenarios have been developed for typical railroad construction projects allowing a quantitative construction vibration assessment to be conducted. Construction vibration is assessed quantitatively where the potential for blasting, pile driving, vibratory compaction, demolition, or excavation close to vibration-sensitive structures exists. The methodology included the following information.

- Vibration source levels from equipment used by contractors.
- Estimated site layouts of equipment along the ROW.
- Relationship of construction activities to nearby vibration-sensitive receptors.
- FTA vibration impact criteria for annoyance and building damage.

Train Operation Noise and Vibration Impact Assessment Methodology

Train operational noise and vibration levels were projected using the operational plans for the Proposed Project and the prediction models provided in the FTA guidance manual (Federal Transit Administration 2018). Potential impacts were evaluated in accordance with the Detailed Noise Analysis and General Vibration Assessment procedures outlined in the FTA guidance manual. The Proposed Project's only change would be for additional service between Ceres and Merced. No changes are proposed to the existing service between Stockton and San Jose, and no changes are proposed to the planned service to Sacramento or the planned services of Ceres to Lathrop. The methodology and assumptions for train operation are as follows.

- In the morning, three northbound trains would run from Merced Station to the Natomas/ Sacramento Airport Station (included in the Valley Rail Sacramento Extension Project). Passengers boarding in Merced and Stanislaus Counties and Southern San Joaquin County would either stay on the train in the direction of Sacramento or transfer onto the three westbound trains in the direction of San Jose at the North Lathrop Station (timed transfers). One westbound train would run from Merced Station to San Jose Diridon Station.
- The trains would layover at Natomas and San Jose during the day. The trains would layover at the Merced layover & Maintenance Facility at night.
- In the evening, three southbound trains would run from Natomas/Sacramento Airport Station to Merced Station. ACE passengers returning from the Bay Area would transfer at the North Lathrop Station (timed transfers) onto the three Sacramento to Merced trains. One eastbound/southbound train would run from San Jose Diridon Station to Merced Station.

Projected and existing ambient noise exposures were tabulated at the identified noise-sensitive receptors or clusters of receptors, and the levels of noise impact (no impact, moderate impact, or severe impact) were identified by comparing the existing and train noise exposure based on the applicable FTA noise impact criteria. Similarly, projected and existing maximum train vibration levels were tabulated at vibration-sensitive receptor locations and potential impacts were identified based on the applicable FTA vibration impact criteria along with FTA guidance on how to account for existing vibration.

3.12.4.2 Thresholds of Significance

The CEQA Guidelines Appendix G (14 California Code of Regulations 15000 et seq.) has identified significance criteria for determining whether a project could have significant impacts on noise- and vibration-sensitive land use from noise and vibration.

An impact would be considered significant if construction or operation of the Proposed Project or the Atwater Station Alternative would have any of the following consequences.

- Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of severe impact standards for a severe impact established by FTA for transit projects and other changes related to the project. These standards cover both substantial permanent and substantial temporary/periodic increases in ambient noise levels in the vicinity of the project above levels existing without the project.
- Generation of excessive groundborne vibration or groundborne noise levels.

The noise and vibration impact criteria for the Proposed Project and Atwater Station Alternative are based on FTA and FRA guidelines, which are described in the following subsections.

FTA Noise Criteria

Construction Noise and Vibration Impact Assessment Criteria

Construction activities for a large transportation project often generate noise and vibration complaints even though they take place only for a limited time. Construction noise and vibration impacts are assessed where the exposure of noise- and vibration-sensitive receptors in relation to construction-related noise or vibration is expected to occur at levels exceeding standards established by FTA and established thresholds for architectural and structural building damage (Federal Transit Administration 2018).

Construction Noise Impact Criteria

Table 3.12-2 presents the FTA noise assessment criteria for construction activity. The last column applies to construction activities that extend over 30 days near any given receptor. L_{dn} is used to assess impacts in residential areas and 24-hour L_{eq} is used in commercial and industrial areas. The 8-hour L_{eq} and the 30-day average L_{dn} noise exposure from construction noise calculations use the noise emission levels of the construction equipment, its location, and operating hours. The construction noise limits are normally assessed at the noise-sensitive receptor property line.

Table 3.12-2. Federal Transit Administration Construction Noise Assessment Criteria

	8-hour L_{eq}, dBa		Noise Exposure, L_{dn}, dBA
Land Use	**Day**	**Night**	**30-day Average**
Residential	80	70	75[a]
Commercial	85	85	80[b]
Industrial	90	90	85[b]

Source: Federal Transit Administration 2018.

[a] In urban areas with very high ambient noise levels (L_{dn} greater than 65 dB), L_{dn} from construction operations should not exceed existing ambient noise levels + 10 dB.

[b] 24-hour L_{eq}, not L_{dn}.

L_{eq} = equivalent sound level.
dBA = A-weighted decibel.
L_{dn} = day-night sound level.
dB = decibels.

Construction Vibration Impact Criteria

Guidelines in the FTA guidance manual (Federal Transit Administration 2018) provide the basis for the construction vibration assessment. FTA provides construction vibration criteria designed primarily to prevent building damage, and to assess whether vibration might interfere with vibration-sensitive building activities or temporarily annoy building occupants during the construction period. The FTA criteria include two ways to express vibration levels.

- Root-mean-square (RMS) vibration velocity level ($L_{v,}$ in VdB) for annoyance and activity interference.
- Peak particle velocity (PPV), which is the maximum instantaneous peak of a vibration signal used for assessments of damage potential.

To avoid temporary annoyance to building occupants during construction or construction interference with vibration-sensitive equipment inside special-use buildings, such as a magnetic resonance imaging (MRI) machine, FTA recommends using the long-term operational vibration criteria (discussed in the *Operational Noise and Vibration Impact Assessment Criteria* subsection).

Table 3.12-3 presents the FTA building damage criteria for construction activity and lists PPV and approximate L_v limits for four building categories. These limits are used to estimate potential problems that should be addressed during final design.

Table 3.12-3. Federal Transit Administration Construction Vibration Damage Criteria

Building Category	PPV (inch/sec)	Approximate L_v[a]
I. Reinforced concrete, steel, or timber (no plaster)	0.5	102
II. Engineered concrete and masonry (no plaster)	0.3	98
III. Non-engineered timber and masonry buildings	0.2	94
IV. Buildings extremely susceptible to vibration damage	0.12	90

Source: Federal Transit Administration 2018.

[a] RMS vibration velocity level in VdB relative to 1 micro-inch/second.

PPV = peak particle velocity.
RMS = root-mean-square.
VdB = vibration decibel.

Operational Noise and Vibration Impact Assessment Criteria

Train Noise Impact Criteria

The descriptors and criteria for assessing noise impacts vary according to land use categories adjacent to the track. For land uses where people live and sleep (e.g., residential neighborhoods, hospitals, and hotels), L_{dn} is the assessment parameter. For other land use types where there are noise-sensitive uses (e.g., outdoor concert areas, schools, and libraries), $L_{eq}(h)$ for an hour of noise sensitivity that coincides with train activity is the assessment parameter. Table 3.12-4 summarizes the three land use categories and noise metrics applied to each category.

Table 3.12-4. Federal Transit Administration Noise-Sensitive Land Use Categories

Land Use Category	Noise Metric (dBA)	Land Use Category
1	Outdoor $L_{eq}(h)$*	Tracts of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet, such as outdoor amphitheaters, concert pavilions, and National Historic Landmarks with significant outdoor use.
2	Outdoor L_{dn}	Residences and buildings where people normally sleep. This category includes homes and hospitals, where nighttime sensitivity to noise is of utmost importance.
3	Outdoor $L_{eq}(h)$*	Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, and churches, where it is important to avoid interference with such activities as speech, meditation, and concentration. Buildings with interior spaces where quiet is important, such as medical offices, conference rooms, recording studios, and concert halls fall into this category, as well as places for meditation or study associated with cemeteries, monuments, and museums. Certain historical sites, parks, and recreational facilities are also included.

Source: Federal Transit Administration 2018.

* L_{eq} for the noisiest hour of transit-related activity during hours of noise sensitivity.

dBA = A-weighted decibel.

L_{eq} = equivalent sound level.

L_{dn} = day-night sound level.

The noise impact criteria used by FTA and FRA are ambient based; the increase in future noise (future noise levels with the Proposed Project compared to existing noise levels) is assessed rather than the noise caused by each passing train. It is important to note that the criteria do not specify a comparison of future Proposed Project noise with projections of future No Project noise. This is because comparison of a noise projection with an existing noise condition is more accurate than comparison of a projection with another noise projection. Because background noise is expected to increase by the time the Proposed Project generates noise, this approach of using existing noise conditions is conservative.

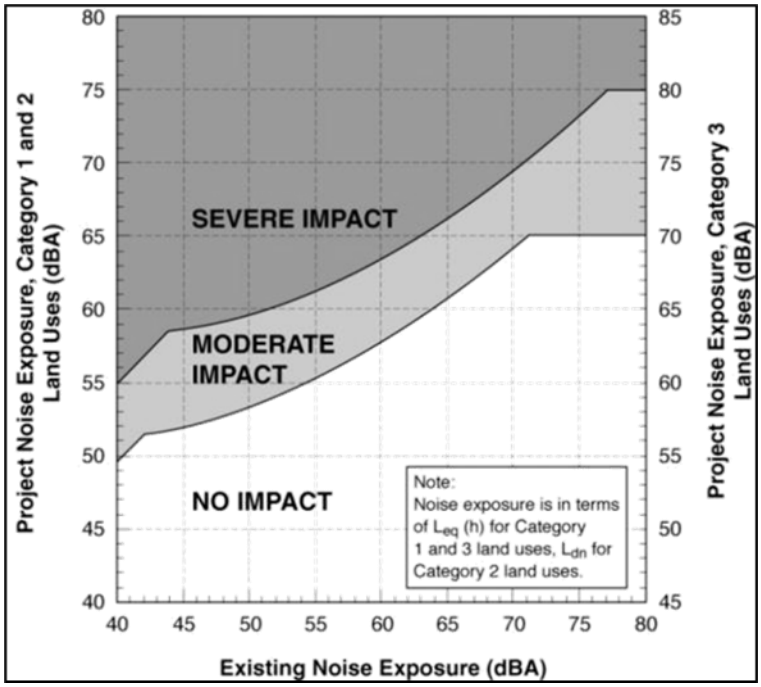

Figure 3.12-14. Federal Transit Administration Noise Impact Criteria

Figure 3.12-14 depicts the FTA noise impact criteria for human annoyance. Depending on the magnitude of the cumulative noise increases, FTA and FRA categorize impacts as follows.

- No impact.
- Moderate impact—The change in cumulative noise level would be noticeable to most people, but may not be sufficient to generate strong, negative reactions.
- Severe impact—A significant percentage of people would be highly annoyed by the project's noise.

As the existing level of ambient noise increases, the allowable level of transit noise increases, but the total amount that community noise exposure is allowed to increase is reduced. This approach accounts for the potential for a project noise exposure that is lower than the existing noise exposure to still cause an effect.

Train Vibration Impact Criteria

Table 3.12-5 summarizes FTA criteria for acceptable groundborne vibrations and presents vibration sensitivity in terms of the land use categories. These levels represent the maximum vibration level of an individual train passing. A vibration event occurs each time a train passes the building or property and causes discernible vibration. *Frequent events* are more than 70 vibration events per day, *occasional events* are 30 to 70 vibration events per day, and *infrequent events* are fewer than 30 vibration events per day. Groundborne vibration impacts from train operations inside vibration-sensitive buildings are defined by the vibration velocity level, expressed in terms of VdB, and the number of vibration events per day from the same kind of source. As shown in Table 3.12-6, these guidelines also provide impact criteria for special buildings that are very sensitive to groundborne vibrations, such as concert halls, recording studios, and theaters.

Tables 3.12-5 and 3.12-6 include separate FTA criteria for groundborne noise. Although the criteria are expressed in dBA, which emphasizes the more audible middle and high frequencies, the criteria are significantly lower than airborne noise criteria to account for the annoying low-frequency character of groundborne noise. Groundborne noise is a low-frequency rumbling sound inside buildings, caused by vibrations of floors, walls, and ceilings. Groundborne noise is generally not a problem for buildings near railroad tracks at or above grade, because the airborne noise from trains typically overshadows effects of groundborne noise. Groundborne noise becomes an issue in cases where airborne noise cannot be heard, such as for buildings near tunnels.

Table 3.12-5. Federal Transit Administration Groundborne Vibration and Groundborne Noise Impact Criteria

	Groundborne Vibration Impact Levels (VdB re 1 micro-inch/second)			Groundborne Noise Impact Levels (dBA re 20 micro Pascals)		
Land Use Category	**Frequent Events**	**Occasional Events**	**Infrequent Events**	**Frequent Events**	**Occasional Events**	**Infrequent Events**
Category 1: Buildings where vibration would interfere with interior operations.	65 VdB[a]	65 VdB[a]	65 VdB[a]	N/A[b]	N/A[b]	N/A[b]
Category 2: Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB	35 dBA	38 dBA	43 dBA
Category 3: Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB	40 dBA	43 dBA	48 dBA

Source: Federal Transit Administration 2018.

[a] This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. For equipment that is more sensitive, a detailed vibration analysis must be performed.

[b] Vibration-sensitive equipment is generally not sensitive to groundborne noise.

VdB = vibration decibel.
dBA = A-weighted decibel.
N/A = not applicable.

Table 3.12-6. Federal Transit Administration Groundborne Vibration and Groundborne Noise Impact Criteria for Special Buildings

Type of Building or Room	Groundborne Vibration Impact Levels (VdB re 1 micro-inch/second)		Groundborne Noise Impact Levels (dBA re 20 micro-Pascals)	
	Frequent Events	Occasional or Infrequent Events	Frequent Events	Occasional or Infrequent Events
Concert Halls	65 VdB	65 VdB	25 dBA	25 dBA
TV Studios	65 VdB	65 VdB	25 dBA	25 dBA
Recording Studios	65 VdB	65 VdB	25 dBA	25 dBA
Auditoriums	72 VdB	80 VdB	30 dBA	38 dBA
Theaters	72 VdB	80 VdB	35 dBA	43 dBA

Source: Federal Transit Administration 2018.
VdB = vibration decibel.
dBA = A-weighted decibel.

One factor not incorporated in the criteria is existing vibration. In most cases, except near railroad tracks, the existing environment does not include a substantial number of perceptible groundborne vibration or noise events. However, rail projects sometimes use existing railroad tracks. The criteria presented in Tables 3.12-5 and 3.12-6 do not indicate how to account for existing vibration, a common situation for rail projects using existing rail ROWs. Representative scenarios for existing vibrations can be assessed using the following methods.

- **Infrequently used rail route:** Use the vibration criteria from Tables 3.12-5 and 3.12-6 when the existing rail traffic consists of four trains or fewer per day.
- **Moderately used rail route:** If the existing rail traffic consists of 5 to 12 trains per day with vibration that substantially exceeds the impact criteria, there would be no effect as long as the project vibration levels are at least 5 VdB less than the existing vibration. Vibration from existing trains can be estimated using the General Assessment procedures in Chapter 10 of the FTA guidelines.
- **Heavily used rail route:** If the existing traffic exceeds 12 trains per day and if the project would not substantially increase the number of vibration events (less than doubling the number of trains is usually considered not substantial), there would be no additional effect unless the project vibration, estimated using the procedures of Chapter 10 of the FTA guidelines, would be higher than the existing vibration. In locations where the new trains would be operating at higher speeds than the existing rail traffic, the trains would likely generate substantially higher levels of groundborne vibration. When the project would cause vibration more than 5 VdB greater than the existing source, the existing source can be ignored and the vibration criteria in Tables 3.12-5 and 3.12-6 can be applied to the project.
- **Moving existing tracks:** Another scenario where existing vibration can be substantial is a new rail line within an existing rail ROW that requires shifting the location of existing tracks. Where the track relocation would cause higher vibration levels at sensitive receptors, the projected vibration levels from both rail systems must be compared to the appropriate impact criterion to determine if there would be a new effect. If an effect is judged to have existed prior to moving the tracks, new effects would be assessed only if the relocation would result in an increase of more than 3 VdB in vibration level. Although the impact thresholds given in Tables 3.12-5 and 3.12-6 are based on experience with vibration from rail transit systems, the thresholds can be

applied to freight train vibrations as well. However, locomotive and rail car vibration should be considered separately. Because locomotive vibration only lasts for a few seconds, the infrequent-event limit is appropriate, but for a typical line haul freight train where the rail car vibration lasts for several minutes, the frequent-event limits should be applied to the rail car vibration. Some judgment must be exercised to make sure that the approach is reasonable. For example, some spur rail lines carry very little rail traffic (sometimes only one train per week) or have short trains, in which case the infrequent-event limits are appropriate.

3.12.4.3 Impacts and Mitigation Measures

Impact NOI-1	Construction of the Proposed Project could generate a substantial temporary increase in ambient noise levels in the vicinity of the Proposed Project in excess of FTA thresholds.
Level of Impact	**Potentially significant impact**
Mitigation Measures	NOI-1.1: Implement a construction noise control plan
Level of Impact after Mitigation	**Significant and unavoidable impact**

Impact Characterization and Significance Conclusion

Proposed Project

Construction of the Proposed Project would include three basic activities: (1) site work, (2) rail work, and (3) structures work. Depending on the improvement, site work is expected to occur over periods of 8 to 14 months at any given site, rail work is expected to occur over periods of 12 months, and structures work is expected to occur over periods of 8 to 24 months at any given site. Generally, construction of the Proposed Project could last anywhere from 10 to 36 months, depending on the improvement (refer to Table 2-10 in Chapter 2, *Project Description*). Because the track improvements are located on an active rail line, construction work could occur during the nighttime. The local noise ordinances for the cities and counties along the extension alignment generally limit construction noise to particular time periods during weekday, weekend, and holiday daytime hours. Nighttime construction work is generally prohibited, but some jurisdictions allow for a variance.

Table 3.12-7 summarizes the estimated construction noise levels and residential noise impact screening distances for each of the planned construction activities. The noise estimates are based on scenarios for the construction activities, using FTA methodology described in Section 3.12.4.1, *Methods for Analysis*, and FTA criteria described in Section 3.12.4.2. However, to be conservative, the screening distance estimates did not assume any topography or ground effects. The results of the analysis indicate that noise impacts would be limited to residences within 135 to 270 feet from a construction site, depending on the activity. The potential for noise impacts would be greatest during structures work at locations where pile driving is required for bridge construction. Construction activities would be considered to have a potentially significant impact if they would generate noise exposure in excess of the FTA thresholds.

Table 3.12-7. Residential Noise Impact Assessment for Construction Activities

Construction Activity and Equipment	Noise Level at 50 feet (dBA)	Equipment Usage Factor (%)	8-Hour L_{eq} at 50 feet (dBA)		Approx. Noise Impact Distance (feet)
			Predicted Exposure	Daytime Criterion	
Site Work			**89**	**80**	**135**
Grader	85	53	82	--	--
Water Truck	84	44	80	--	--
D6 Dozer	85	61	83	--	--
D8 Dozer	85	45	82	--	--
Compactor	82	45	79	--	--
Dump Truck	84	23	78	--	--
Rail Work			**90**	**80**	**150**
Locomotive	88	25	82	--	--
D6 Dozer	85	38	81	--	--
Grader	85	38	81	--	--
Water Truck	84	38	80	--	--
Tamper	83	20	76	--	--
Aligner	85	20	78	--	--
Swinger	85	19	78	--	--
Welder	74	38	70	--	--
Flat Bed Truck	84	31	79	--	--
Pickup Truck	75	25	69	--	--
Sports Utility Vehicle	75	31	70	--	--
35 Ton Rough Terrain Crane	83	38	79	--	--
Flat Bed Tractor	84	13	75	--	--
Wheel Loader	80	28	74	--	--
Structures Work			**95**	**80**	**270**
Impact Pile Driver	101	20	94	--	--
Generator	82	90	82	--	--
75 Ton Mobile Crane	83	38	79	--	--
Water Truck	84	20	77	--	--
Flat Bed Truck	84	25	78	--	--
Pickup Truck	75	53	72	--	--
Concrete Mixer	85	13	76	--	--
Concrete Pump	82	18	75	--	--
Wheel Loader	80	20	73	--	--
Welder	74	31	69	--	--

dBA = A-weighted decibel.
L_{eq} = equivalent sound level.

As shown in Table 3.12-7, the operation of certain construction equipment and construction activities could generate noise exposure in excess of FTA thresholds for residences within 135 to 270 feet from a construction site, depending on the activity. The potential for noise impacts would be greatest during structures work at locations where pile driving is required for bridge construction. Nighttime construction near residential uses would have larger impacts than daytime construction. Because residences would be located within 135 to 270 feet from a construction site for the Proposed Project, construction of the Proposed Project could generate a substantial temporary increase in ambient noise levels in excess of FTA thresholds, and this would be a potentially significant impact.

Atwater Station Alternative

Residences are located within 270 feet from the construction footprint of the Atwater Station Alternative. Therefore, as with the Proposed Project, construction of the Atwater Station Alternative could generate a substantial temporary increase in ambient noise levels in excess of FTA thresholds, and this would be a potentially significant impact.

Mitigation Measures

Mitigation Measure NOI-1.1 would apply to the construction of the Proposed Project. Likewise, Mitigation Measure NOI-1.1 would apply to the construction of the Atwater Station Alternative.

Mitigation Measure NOI-1.1: Implement a construction noise control plan

A noise control plan that incorporates, at a minimum, the following best practices into the construction scope of work and specifications to reduce the impact of temporary construction-related noise on nearby noise-sensitive receptors (if present in the construction area) will be prepared and implemented.

- Install temporary construction site sound barriers near noise sources.
- Use moveable sound barriers at the source of the construction activity.
- Avoid the use of impact pile drivers where possible near noise-sensitive areas or use quieter alternatives (e.g., drilled piles) where geological conditions permit.
- Locate stationary construction equipment as far as possible from noise-sensitive sites.
- Re-route construction-related truck traffic along roadways that will cause the least disturbance to residents.
- Use low-noise emission equipment.
- Implement noise-deadening measures for truck loading and operations.
- Line or cover storage bins, conveyors, and chutes with sound-deadening material.
- Use acoustic enclosures, shields, or shrouds for equipment and facilities.
- Use high-grade engine exhaust silencers and engine-casing sound insulation.
- Minimize the use of generators to power equipment.
- Limit use of public address systems.
- Grade surface irregularities on construction sites.

- Monitor and maintain equipment to meet noise limits.
- Establish an active community liaison program to keep residents informed about construction and to provide a procedure for addressing complaints.

Significance with Application of Mitigation

Mitigation Measure NOI-1.1 would require the preparation and implementation of a construction noise control plan to reduce the impacts of construction noise on nearby noise-sensitive receptors that could be exposed to noise in excess of FTA thresholds. Although the measures specified in Mitigation Measure NOI-1.1 would generally reduce the construction noise levels, the measures would not necessarily guarantee that noise-sensitive residential receptors would not be exposed to noise levels exceeding the 80-dBA limit during the day or the 70-dBA limit at night. Specifically, because track improvements are located within or near an active railroad, it is probable that construction near some residential areas would have to be conducted at night to avoid disruption of freight and passenger rail operations and to complete construction on schedule. Furthermore, a temporary soundwall may be effective in certain locations, but in many cases the nature of the construction work makes use of such soundwalls infeasible. Construction-related noise would be short term and would cease after the construction is completed. However, even with mitigation, the impact of temporary construction-related noise on nearby noise-sensitive receptors would remain a significant and unavoidable impact, in particular where heavy construction would occur immediately adjacent to residences and where construction would occur at night near residences. Thus, construction the Proposed Project could generate a substantial temporary increase in ambient noise levels in excess of FTA thresholds, even with implementation of mitigation, and the impact would be significant and unavoidable.

For the same reasons as the Proposed Project, construction of the Atwater Station Alternative could generate a substantial temporary increase in ambient noise levels in excess of FTA thresholds, even with implementation of Mitigation Measure NOI-1.1, and the impact would be significant and unavoidable.

Comparison of the Proposed Livingston Station and Atwater Station Alternative

The Atwater Station Alternative is expected to result in more construction noise impacts than the proposed Livingston Station. Although there are residences located near the track that would be implemented near the proposed Livingston Station, there are no residences or other sensitive receptors located near the parking that would be constructed for the proposed Livingston Station. There are, however, residences located near the parking proposed for the Atwater Station Alternative. As such, the Atwater Station Alternative is expected to result in a greater impact from construction noise than the proposed Livingston Station.

Impact NOI-2	Operation of the Proposed Project would not generate a substantial permanent increase in ambient noise levels in the vicinity of the Proposed Project in excess of FTA thresholds.
Level of Impact	**Less than significant impact**

Impact Characterization and Significance Conclusion

Proposed Project

The noise impact assessment for operation of the Proposed Project evaluates two components.

1. Proposed Project facilities: Individual Proposed Project facilities (such as tracks, stations, station parking and traffic on local roads, and the Merced Layover & Maintenance Facility) were assessed for their potential to create noise impacts. Individual facilities by themselves do not result in noise impacts.
2. Proposed Project facilities plus new passenger service: With operation of the Proposed Project, new rail passenger service would be introduced between Ceres and Merced. Operations would introduce four roundtrips between Ceres and Merced. Additionally, the trains would be stored overnight at the Merced Layover & Maintenance Facility.

Table 3.12-10, in Section 3.12.5, *Noise and Vibration Impact Assessment Tables*, provides detailed information regarding impacts, including locations, existing noise levels, noise levels with operations of the Proposed Project, impact thresholds, and numbers of severe and moderate impacts. There would be no impacts at the Turlock Station, Livingston Station, Merced Station, and the Merced Layover & Maintenance Facility, as there are no sensitive receptors within the screening distances for these locations. There would also be no impacts due to the new passenger service between Ceres and Merced (i.e., operation of the Ceres to Merced Extension Alignment). The Proposed Project would result in no moderate or severe noise impacts. As such, operation of the Proposed Project would not generate a substantial permanent increase in ambient noise levels in excess of FTA thresholds, and the impact would be less than significant.

Atwater Station Alternative

There would be no noise impacts at the Atwater Station Alternative, as there are no sensitive receptors within the screening distance for this location. Like the Proposed Project, operation of the Atwater Station Alternative would not generate a substantial permanent increase in ambient noise levels in excess of FTA thresholds and the impact would be less than significant. There would be no difference in noise impacts between operation of the proposed Livingston Station and the Atwater Station Alternative (both would result in a less-than-significant impact).

Impact NOI-3	Construction of the Proposed Project could generate excessive groundborne vibration or groundborne noise levels
Level of Impact	**Potentially significant impact**
Mitigation Measures	NOI-3.1: Implement a construction vibration control plan
Level of Impact after Mitigation	**Less than significant impact**

Impact Characterization and Significance Conclusion

Proposed Project

Construction of the Proposed Project can be expected to generate vibration levels from 25 feet away as high as 94 VdB due to compactors during site work, 87 VdB due to bulldozers during rail work, and 104 VdB due to impact pile drivers during structures work. Except for pile drivers, it is unlikely that such equipment would be used close enough to sensitive structures to have any damaging

effects. For pile driving, it is anticipated that the potential for damaging effects will be limited to structures located at distances in the range of 30 to 75 feet from the pile driving operations, depending on the building category.

In terms of vibration annoyance effects or interference with the use of sensitive equipment, the potential extent of vibration effects from pile driving is expected to be even greater than for damage effects. Table 3.12-8 provides the approximate distances within which receptors could experience construction-related vibration annoyance effects based on FTA methodology. The results of the analysis indicate that vibration impacts would extend to distances of 230 to 630 feet from pile driving operations, 100 to 240 feet for compacting, and less than 130 feet for bulldozers, depending on the vibration sensitivity of the land use category.

Table 3.12-8. Approximate Screening Distances for Vibration Annoyance Effects from Pile Driving

Land Use Category[a]	Vibration Criterion Level (VdB)	Approximate Vibration Impact Distance (feet)
Category 1 (Sensitive Buildings)	65	630
Category 2 (Residential Buildings)	72	290
Category 3 (Institutional Buildings)	75	230

[a] See Table 3.12-5 for a description of land use categories.
VdB = vibration velocity.

As shown in Table 3.12-8, construction activities would be considered to have a significant impact if they would generate vibration in excess of FTA thresholds. It is expected that groundborne vibration from construction activities would cause only intermittent localized disturbance along the rail corridor. Although processes such as earthmoving with bulldozers or the use of vibratory compaction rollers can create annoying vibration, there should be only isolated cases where it is necessary to use this type of equipment in close proximity to residential buildings. It is possible that construction activities involving pile drivers occurring at the edge of or slightly outside of the current ROW could result in vibration damage, and damage from construction vibration would be a potentially significant impact. As such, construction of the Proposed Project could generate excessive groundborne vibration or groundborne noise levels, resulting in a potentially significant impact.

Atwater Station Alternative

For the same reasons as the Proposed Project, construction of the Atwater Station Alternative could generate excessive groundborne vibration or groundborne noise levels, resulting in a potentially significant impact. There would be no difference in construction vibration impacts between the proposed Livingston Station and the Atwater Station Alternative (both would result in a less-than-significant impact after mitigation).

Mitigation Measures

Mitigation Measure NOI-3.1 would apply to the construction of the Proposed Project. Likewise, Mitigation Measure NOI-3.1 would apply to the construction of the Atwater Station Alternative.

Mitigation Measure NOI-3.1: Implement construction vibration control plan

A vibration control plan that incorporates, at a minimum, the following best practices into the construction scope of work and specifications to reduce the impact of temporary construction-related vibration on nearby vibration-sensitive land uses will be prepared and implemented.

- Avoid the use of impact pile drivers where possible near vibration-sensitive areas or use alternative construction methods (e.g., drilled piles) where geological conditions permit.
- Avoid vibratory compacting/rolling in close proximity to structures.
- Require vibration monitoring during vibration-intensive activities.

In the event building damage occurs due to construction, repairs would be made, or compensation would be provided.

Significance with Application of Mitigation

Mitigation Measure NOI-3.1 would require the preparation and implementation of a construction vibration control plan to reduce the impacts of construction vibration on nearby vibration-sensitive land uses that could be exposed to vibration levels in excess of FTA thresholds. In the event building damage occurs due to construction, repairs would be made, or compensation would be provided. With implementation of Mitigation Measure NOI-3.1, impacts resulting from construction vibration structural damage would be minimized to a less than significant level and the Proposed Project would note generate excessive groundborne vibration or groundborne noise levels.

For the same reasons as the Proposed Project, with implementation of Mitigation Measure NOI-3.1, impacts resulting from construction vibration structural damage would be minimized to a less-than-significant level for the Atwater Station Alternative and would not generate excessive groundborne vibration or groundborne noise levels.

Impact NOI-4	Operation of the Proposed Project could generate excessive groundborne vibration or groundborne noise levels.
Level of Impact	**Potentially significant impact**
Mitigation Measures	NOI-4.1: Implement special trackwork
Level of Impact after Mitigation	**Less than significant impact**

Impact Characterization

Proposed Project

The vibration impact assessment for operations evaluates three components.

1. Proposed Project improvements: Individual track improvements (such as tracks, stations, and the layover and maintenance facility) were assessed for their potential to create vibration impacts. There are no vibration impacts associated with individual improvements.
2. New passenger service: For locations with existing train traffic, FTA vibration criteria for locations with existing vibration was used. Because of the high volume of train traffic throughout the corridor and the very small increase in the number of trains, and because the increased passenger service would not result in vibration levels greater than existing levels, no vibration impacts are projected at locations with existing train operations.

3. Track improvements plus new passenger service: With Proposed Project operations, new rail passenger service would be introduced between Ceres and Merced. For these new trains to operate on the Fresno Subdivision, additional tracks and track work is being added. This was assessed for vibration impacts.

Table 3.12-9 summarizes the results of the vibration impact assessment. Vibration impacts are present at up to three locations along the Ceres to Merced Extension Alignment where there is a new turnout (south of West F Street in Turlock) adjacent to sensitive receptors. Table 3.12-11 in Section 3.12.5, *Noise and Vibration Impact Assessment Tables,* provides detailed information regarding impacts in locations where there are vibration sensitive receptors near new crossovers, including locations, vibration levels with project operations, impact thresholds, and numbers of impacts. Figure 3.12-15 depict the locations of vibration impacts.

Gaps in the rails at turnouts generate around 10 dB of increased vibration for locations close to the track. There are three vibration impacts adjacent to the relocated turnout south of West F Street in Turlock. Table 3.12-11 provides detailed information regarding impacts in locations where there are vibration sensitive receptors near new crossovers, including locations, vibration levels with project operations, impact thresholds, and numbers of impacts. Figure 3.12-15 depicts the locations of vibration impacts. Operation of the Ceres to Merced Extension Alignment could generate excessive groundborne vibration or groundborne noise levels, and the impact would be potentially significant. No vibration impacts were identified for the universal crossovers that are proposed for the Proposed Project, including the two universal crossover options in Turlock and the two crossover options in Livingston.

Operation of the Turlock Station, Livingston Station, Merced Station, and Merced Layover & Maintenance Facility would not generate excessive groundborne vibration or groundborne noise levels, and the impact would be less than significant.

Atwater Station Alternative

As shown in Table 3.12-9, operation of the Atwater Station Alternative would not generate excessive groundborne vibration or groundborne noise levels, and the impact would be less than significant. There would be no difference in vibration impacts between operation of the proposed Livingston Station and the Atwater Station Alternative (both would result in a less-than-significant impact).

Table 3.12-9. Operational Vibration Impacts

	Vibration Impacts
Proposed Project	**3**
Ceres to Merced Extension Alignment	3
Turlock Station	0
Livingston Station	0
Merced Layover & Maintenance Facility	0
Merced Station	0
Alternative Analyzed at an Equal Level of Detail	**0**
Atwater Station Alternative	0

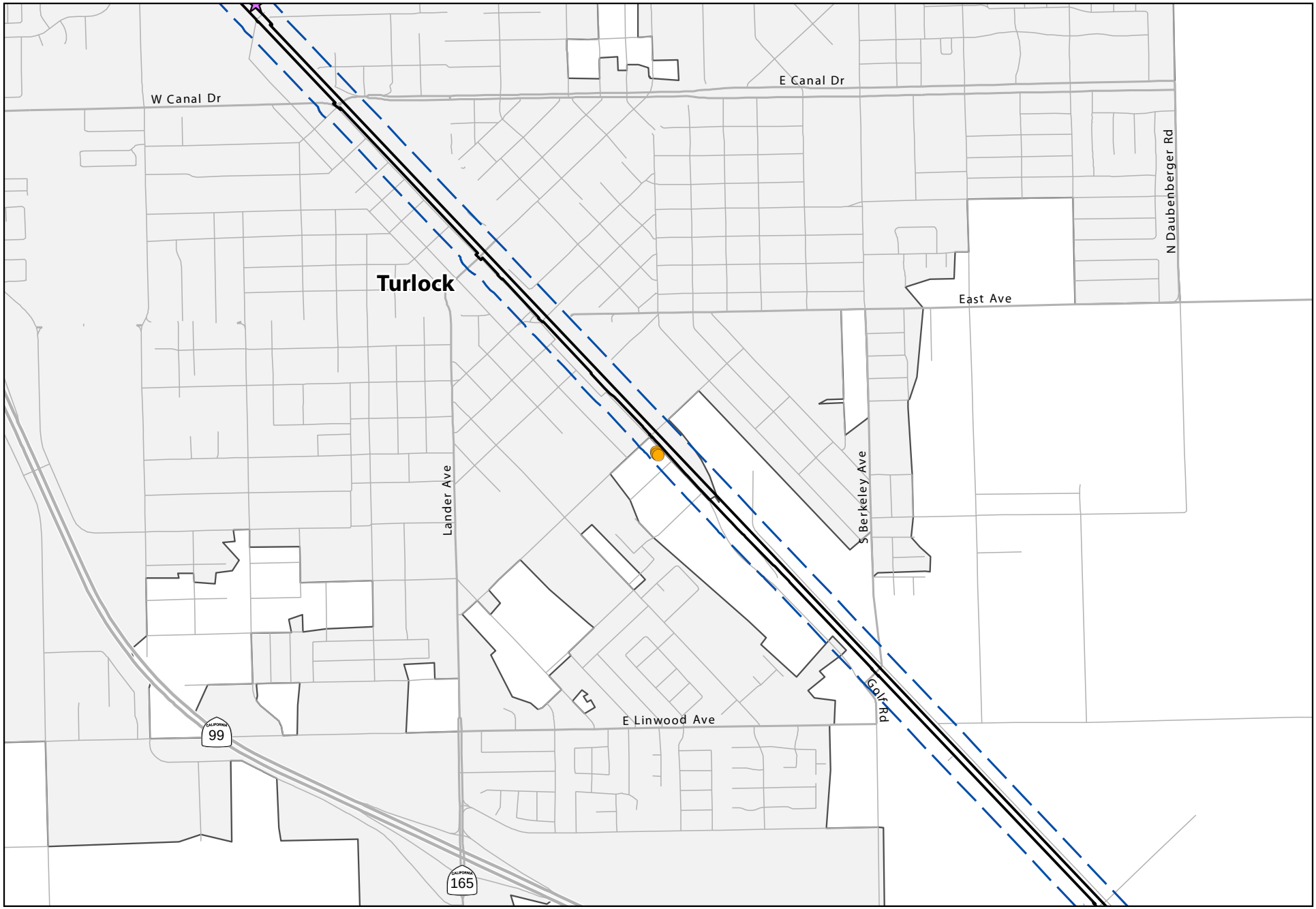

Figure 3.12-15
Operational Vibration Impacts
ACE Ceres-Merced Extension Project

Mitigation Measures

The following mitigation measure would apply to operation of the Proposed Project, due to the Ceres to Merced Extension Alignment.

Mitigation Measure NOI-4.1: Implement special trackwork

For the relocated turnout south of West F Street in Turlock, SJRRC or its contractor(s) would implement special trackwork, such as spring-rail, moveable point, or flange bearing frogs to eliminate the gap in the rail at the crossover.

Significance with Application of Mitigation

Vibration mitigation is primarily applied at the source, generally the track structure, and is dependent on the frequency content of the vibration and any resonances of the materials. With the proposed special trackwork, the impacts on vibration from operation of the Proposed Project would be less than significant.

3.12.4.4 Overall Comparison of the Proposed Livingston Station and Atwater Station Alternative

The only meaningful difference between the Atwater Station Alternative and the proposed Livingston Station would be the number of sensitive receptors that would be exposed to noise during construction. Implementation of the Atwater Station Alternative is expected to expose more residential receptors to construction noise than if the Livingston Station were implemented. Nonetheless, overall, both the Atwater Station Alternative and the proposed Livingston Station would result in similar impacts on noise and vibration.

3.12.5 Noise and Vibration Impact Assessment Tables

Table 3.12-10. Summary of Federal Transit Administration Category 2 (Residential) and Category 3 (Institutional) Noise Impacts

Location	Side of Track	Distance to Near Track (feet)	Max. Train Speed (mph)	Existing Noise Level (dBA)	Noise Levels (dBA)				
					Project Levels	FTA Criteria		Type and # of Impacts	
						Mod.	Sev.	Mod.	Sev.
Residential – Ceres									
E Whitmore Ave to Pine St	NB	403	79	69	51	64	69	0	0
E Whitmore Ave to Pine St	SB	250	79	69	46	63	69	0	0
Pine St to Michell Rd	NB	253	79	72	53	65	73	0	0
Pine St to Michell Rd	SB	55	79	80	60	65	75	0	0
Residential – Keyes									
Michell Rd to Faith Home Rd	NB	393	79	72	48	65	71	0	0
Michell Rd to Faith Home Rd	SB	149	79	78	60	65	75	0	0
Faith Home Rd to Nunes Rd	NB	300	79	74	49	65	72	0	0
Faith Home Rd to Nunes Rd	SB	No noise sensitive receivers.							
Nunes Rd to Barnhart Rd	NB	No noise sensitive receivers.							
Nunes Rd to Barnhart Rd	SB	457	79	67	46	62	67	0	0
Barnhart Rd to Taylor Rd	NB	1031	79	69	48	64	69	0	0
Barnhart Rd to Taylor Rd	SB	No noise sensitive receivers.							
Residential – Turlock									
Christoffersen Pkwy to Monte Vista Ave	NB	357	79	72	55	65	71	0	0
Christoffersen Pkwy to Monte Vista Ave	SB	491	79	69	47	63	69	0	0
Monte Vista Ave to Tuolumne Rd	NB	423	79	70	49	65	70	0	0
Monte Vista Ave to Tuolumne Rd	SB	193	79	74	58	65	73	0	0
Tuolumne Rd to Fulkerth Rd	NB	432	79	70	50	65	70	0	0
Tuolumne Rd to Fulkerth Rd	SB	186	79	74	58	65	72	0	0

Location	Side of Track	Distance to Near Track (feet)	Max. Train Speed (mph)	Existing Noise Level (dBA)	Noise Levels (dBA)				
					Project Levels	FTA Criteria		Type and # of Impacts	
						Mod.	Sev.	Mod.	Sev.
Fulkerth Rd to Canal Dr	NB	107	79	80	64	65	75	0	0
Fulkerth Rd to Canal Dr	SB	722	79	65	49	61	66	0	0
Canal Dr to East Ave	NB	534	79	64	48	60	66	0	0
Canal Dr to East Ave	SB	117	79	78	62	65	75	0	0
East Ave to Linwood Ave	NB	168	79	69	54	63	69	0	0
East Ave to Linwood Ave	SB	98	79	78	64	65	75	0	0
Residential – Unincorporated County near Delhi									
Linwood Ave to Harding Rd	NB	112	79	75	57	65	73	0	0
Linwood Ave to Harding Rd	SB	221	79	73	58	65	72	0	0
Harding Rd to Bradbury Rd	NB	458	79	65	46	61	66	0	0
Harding Rd to Bradbury Rd	SB	300	79	69	49	63	69	0	0
Bradbury Rd to Shanks Rd	NB	No noise sensitive receivers.							
Bradbury Rd to Shanks Rd	SB	432	79	73	47	65	71	0	0
Shanks Rd to South Ave	NB	85	79	76	59	65	74	0	0
Shanks Rd to South Ave	SB	377	79	74	55	65	72	0	0
South Ave to Sycamore St	NB	92	79	76	58	65	74	0	0
South Ave to Sycamore St	SB	416	79	69	50	64	69	0	0
Sycamore St to Merced River	NB	No noise sensitive receivers.							
Sycamore St to Merced River	SB	420	79	71	47	65	70	0	0
Residential – Livingston									
Merced River to N Main St	NB	141	79	74	55	65	73	0	0
Merced River to N Main St	SB	127	79	78	62	65	75	0	0
N Main St to Dwight Way	NB	564	79	71	52	65	70	0	0

Location	Side of Track	Distance to Near Track (feet)	Max. Train Speed (mph)	Existing Noise Level (dBA)	Noise Levels (dBA)				
					Project Levels	FTA Criteria		Type and # of Impacts	
						Mod.	Sev.	Mod.	Sev.
N Main St to Dwight Way	SB	207	79	71	57	65	70	0	0
Dwight Way to Liberty Ave	NB	481	79	69	46	64	69	0	0
Dwight Way to Liberty Ave	SB	420	79	68	47	63	68	0	0
Residential – Unincorporated County near Arena									
Liberty Ave to Westside Blvd	NB	371	79	72	48	65	71	0	0
Liberty Ave to Westside Blvd	SB	82	79	76	60	65	74	0	0
Westside Blvd to Bert Crane Rd	NB	369	79	72	48	65	71	0	0
Westside Blvd to Bert Crane Rd	SB	210	79	74	53	65	72	0	0
Residential – Atwater									
Bert Crane Rd to Winton Way	NB	129	79	77	63	65	75	0	0
Bert Crane Rd to Winton Way	SB	66	79	81	61	65	75	0	0
Winton Way to Shaffer Rd	NB	192	79	76	61	65	74	0	0
Winton Way to Shaffer Rd	SB	No noise sensitive receivers.							
Shaffer Rd to Buhach Rd	NB	112	79	74	57	65	73	0	0
Shaffer Rd to Buhach Rd	SB	194	79	74	60	65	73	0	0
Residential – Unincorporated County near Fergus									
Buhach Rd to Gurr Rd	NB	392	79	71	48	65	70	0	0
Buhach Rd to Gurr Rd	SB	No noise sensitive receivers.							
Gurr Rd to Trindade Rd	NB	294	79	73	50	65	72	0	0
Gurr Rd to Trindade Rd	SB	157	79	73	55	65	72	0	0
Trindade Rd to Franklin Rd	NB	400	79	71	47	65	70	0	0
Trindade Rd to Franklin Rd	SB	96	79	76	57	65	74	0	0
Franklin Rd to Beachwood Dr	NB	341	79	72	49	65	71	0	0
Franklin Rd to Beachwood Dr	SB	No noise sensitive receivers.							

Location	Side of Track	Distance to Near Track (feet)	Max. Train Speed (mph)	Existing Noise Level (dBA)	Noise Levels (dBA)				
					Project Levels	FTA Criteria		Type and # of Impacts	
						Mod.	Sev.	Mod.	Sev.
Residential – Merced									
Beachwood Dr to Golden State Highway	NB	276	79	74	50	65	73	0	0
Beachwood Dr to Golden State Highway	SB	No noise sensitive receivers.							
Golden State Highway to V St	NB	1280	79	58	31	56	62	0	0
Golden State Highway to V St	SB	257	79	71	50	65	70	0	0
V St to O St	NB	284	79	73	57	65	72	0	0
V St to O St	SB	465	79	69	60	63	69	0	0
O St to G St	NB	305	79	69	52	64	69	0	0
O St to G St	SB	313	79	70	52	64	69	0	0
G St to Yosemite Pkwy	NB	205	79	71	63	65	70	0	0
G St to Yosemite Pkwy	SB	664	79	67	47	62	67	0	0
Merced Maintenance Facility Lead Track	NB	134	10	69	63	64	69	0	0
Merced Maintenance Facility Lead Track	SB	No noise sensitive receivers.							
Institutional – Ceres									
Iglesia Santuario De Jesucristo	NB	403	79	69	51	69	74	0	0
Mar Gewargis Assyrian Church of the East	NB	295	79	72	53	70	76	0	0
Institutional – Turlock									
Holy Ground Ministry	NB	233	79	72	62	70	76	0	0
Calvary Chapel Turlock	SB	351	79	64	55	65	71	0	0
Good News Tabernacle Pntcstl	SB	282	79	70	62	69	74	0	0
Apostolic Assembly Church	SB	1262	79	53	40	60	66	0	0
St John Assyrian Presbyterian Church	NB	1205	79	54	41	60	66	0	0
Harvest Church	SB	888	79	55	44	60	66	0	0
First Baptist Church of Turlock	SB	1086	79	54	34	60	66	0	0

Location	Side of Track	Distance to Near Track (feet)	Max. Train Speed (mph)	Existing Noise Level (dBA)	Noise Levels (dBA)				
					Project Levels	FTA Criteria		Type and # of Impacts	
						Mod.	Sev.	Mod.	Sev.
Valley Hope Community Church	NB	890	79	56	44	61	67	0	0
Sikh Temple Turlock	SB	1151	79	55	37	60	66	0	0
Institutional – Delhi									
Delhi Community Presbyterian	NB	425	79	64	53	65	71	0	0
Delhi Church of God of Prophecy	SB	430	79	69	50	69	74	0	0
Delhi Adult School	NB	865	79	60	41	63	68	0	0
Iglesia Jesus Es El Senor	SB	974	79	61	37	63	69	0	0
Institutional – Livingston									
Iglesia Cristo Es La Respoesta	SB	196	79	71	57	70	75	0	0
Livingston Apostolic Assembly	SB	290	79	68	54	68	73	0	0
St Jude Thaddeus Roman Catholic Church	NB	947	79	62	48	64	69	0	0
Livingston Hispanic SDA Church	SB	907	79	58	44	62	68	0	0
Our Redeemer Lutheran Church, Livingston	SB	1042	79	58	42	62	67	0	0
Livingston Historical Museum	SB	783	79	59	46	62	68	0	0
Church of Christ	SB	986	79	58	43	62	67	0	0
Institutional – Atwater									
Church of Christ	NB	708	79	58	50	62	67	0	0
Atwater Christian Life Center	NB	802	79	57	41	61	67	0	0
Atwater Church of the Nazarene	NB	1164	79	54	37	60	66	0	0
Mt Olive Baptist Church	NB	506	79	59	51	62	68	0	0
Bloss Mansion	NB	634	79	57	41	61	67	0	0
Valley Christian Center	NB	813	79	54	44	60	66	0	0
Victory Baptist Church	NB	791	79	54	36	60	66	0	0

Location	Side of Track	Distance to Near Track (feet)	Max. Train Speed (mph)	Existing Noise Level (dBA)	Noise Levels (dBA)				
					Project Levels	FTA Criteria		Type and # of Impacts	
						Mod.	Sev.	Mod.	Sev.
Institutional – Merced									
Merced Baptist Church	SB	358	79	69	60	68	74	0	0
Sound Life International Ministries	NB	465	79	62	53	64	70	0	0
Harvest 2 Outreach	NB	203	79	71	63	70	75	0	0
Sequoia High School	NB	1137	79	58	41	62	67	0	0
Sacred Heart Church	SB	1129	79	67	41	67	72	0	0
Faith Mission Ministries	NB	1090	79	56	41	61	67	0	0
UC Merced Downtown Campus Center	NB	1117	79	56	41	61	67	0	0
UC Merced Venture Lab	NB	961	79	57	43	61	67	0	0

NB = northbound.
SB = southbound.
mph = miles per hour.
dBA = A-weighted decibels.
Mod. = moderate.
Sev. = severe.
FTA = Federal Transit Administration.
SR = State Route.

Table 3.12-11. Summary of Federal Transit Administration Category 2 (Residential) Vibration Impacts

Location	Side of Track	Distance to Near Track (feet)	Maximum Train Speed (mph)	Vibration Levels (VdB)		# of Impacts
				Project Level	FTA Criteria	
East Avenue to Linwood Avenue – Turnout (Turlock)	SB	123	79	86	80	3

SB = southbound.
mph = miles per hour.
VdB = Vibration decibels.