2.3.6 Noise

2.3.6.1 Regulatory Setting

The National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) provide the broad basis for analyzing and abating highway traffic noise effects. The intent of these laws is to promote the general welfare and to foster a healthy environment. The requirements for noise analysis and consideration of noise abatement and/or mitigation, however, differ between NEPA and CEQA.

CEQA

CEQA requires a strictly baseline versus build analysis to assess whether a proposed project will have a noise impact. If a proposed project is determined to have a significant noise impact under CEQA, then CEQA dictates that mitigation measures must be incorporated into the project unless those measures are not feasible. The rest of this section will focus on the NEPA/Title 23 Part 772 of the Code of Federal Regulations (23 CFR 772) noise analysis; please see Chapter 3 of this document for further information on noise analysis under CEQA.

NEPA and 23 CFR 772

For highway transportation projects with Federal Highway Administration (FHWA) involvement (and the California Department of Transportation [Caltrans], as assigned), the Federal-Aid Highway Act of 1970 and its implementing regulations (23 CFR 772) govern the analysis and abatement of traffic noise impacts. The regulations require that potential noise impacts in areas of frequent human use be identified during the planning and design of a highway project. The regulations include noise abatement criteria (NAC) that are used to determine when a noise impact would occur. The NAC differ depending on the type of land use under analysis. For example, the NAC for residences (67 A-weighted decibels [dBA]) is lower than the NAC for commercial areas (72 dBA). Table 2.3.6-1 lists the noise abatement criteria for use in the NEPA/23 CFR 772 analysis.

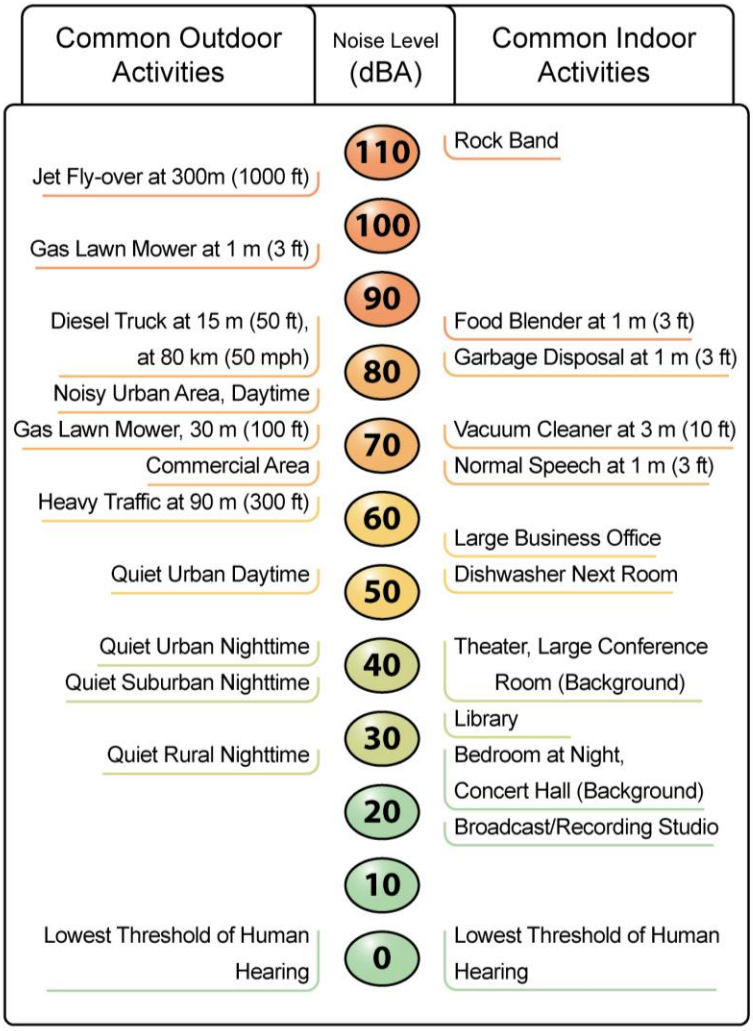
Table 2.3.6-1. Noise Abatement Criteria

Activity Category	NAC, Hourly A-Weighted Noise Level, $L_{eq}(h)$	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B[1]	67 (Exterior)	Residential.
C[1]	67 (Exterior)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52 (Interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	72 (Exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in A–D or F.
F	No NAC—reporting only	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical, etc.), and warehousing.
G	No NAC—reporting only	Undeveloped lands that are not permitted.

[1] Includes undeveloped lands permitted for this activity category.

Figure 2.3.6-1 lists the noise levels of common activities to enable readers to compare the actual and predicted highway noise levels discussed in this section with common activities.

Figure 2.3.6-1. Noise Levels of Common Activities



According to the written policy for implementing 23 CFR 772 in California, *Traffic Noise Analysis Protocol for New Highway Construction and Reconstruction Projects*, April 2020 (Protocol), a noise impact occurs when the predicted future noise level with the project substantially exceeds the existing noise level (defined as a 12 dBA or more) or when the future noise level with the project approaches or exceeds the NAC. A noise level is considered to approach the NAC if it is within 1 dBA of the NAC (Caltrans 2020).

If it is determined that the project will have noise impacts, then potential abatement measures must be considered. Noise abatement measures that are determined to be reasonable and feasible at the time of final design are incorporated into the project plans and specifications. This document discusses noise abatement measures that would likely be incorporated in the project.

Caltrans' *Protocol* sets forth the criteria for determining when an abatement measure is reasonable and feasible. Feasibility of noise abatement is basically an engineering concern. Noise abatement must be predicted to reduce noise by at least 5 decibels (dB) at an impacted receptor to be considered feasible from an acoustical perspective. It must also be possible to design and construct the noise abatement measure for it to be considered feasible. Factors that affect the design and constructability of noise abatement include, but are not limited to, safety, barrier height, topography, drainage, access requirements for driveways, presence of local cross streets, underground utilities, other noise sources in the area, and maintenance of the abatement measure. The overall reasonableness of noise abatement is determined by the following three factors: 1) the noise reduction design goal of 7 dB at one or more affected receptors; 2) the cost of noise abatement; and 3) the viewpoints of benefited receptors (including property owners and residents of the benefited receptors).

2.3.6.2 Affected Environment

This section is based on the analysis and findings presented in the I-5/El Toro Road Interchange Project (Project) Supplemental Noise Study Report (SNSR) (Caltrans 2026a) and Supplemental Noise Abatement Decision Report (SNADR) (Caltrans 2026b).

Land Uses

Acoustical specialists conducted a detailed field investigation to identify land uses that could be subject to traffic noise impacts from the Project. Land uses identified along the Project alignment included single- and multi-family residences (Activity Category B); a place of worship, a park, and a playground and a basketball court (half court) (Activity Category C); a school (Activity Category D); the exterior use areas for restaurants/bars (Activity Category E); and other non-noise-sensitive land uses, including retail (Activity Category F). Interior noise levels were also considered in the impact analysis conducted at the place of worship (Activity Category D).

A planned future development (Village at Laguna Hills), which is not part of the Project, was considered in the analysis. The development is in the planning phase and has not been permitted for construction. However, the proposed development would most likely include residential uses, outdoor recreational areas, hotels, restaurants, offices, and retail. Therefore, for purposes of analysis, the approximate distances to the 66 and 71 dBA noise contour lines, which represent noise levels approaching the NAC for Activity Category B, C, and E land uses, were modeled to assess potential impacts for existing, design-year no-build, and design-year build conditions. During final design, additional analysis may be necessary to determine if abatement is required for the Village at Laguna Hills project.

As required by the Protocol, noise abatement is considered for areas of frequent human use that would benefit from a lowered noise level. Accordingly, this impact analysis focuses primarily on locations with defined outdoor activity areas (i.e., areas of frequent human use), such as residential backyards, common-use areas at multi-family

residences, parks, and places of worship. However, one interior use was considered at the place of worship.

Noise Analysis Areas

For purposes of the noise analysis, the Project study area was divided into four separate Noise Analysis Areas (NAAs), which are based on major local intersections. The location of each NAA is shown on Figure 2.3.6-2 at the end of this section. Land uses within each NAA are described below.

NAA 1 – East side of Interstate (I-) 5, south of El Toro Road: The land uses in this NAA are primarily residential (Activity Category B). Other land uses include outdoor seating areas (Activity Category E) and retail (Activity Category F). The topography in this area is generally flat, with elevations at or below those on I-5. There is an existing 16-foot noise barrier at the right of way/edge of shoulder, and several existing block walls on private property provide varying levels of noise shielding from I-5 at the residences.

NAA 2 – West side of I-5, south of El Toro Road: The land uses in this NAA are a mix of restaurants with outdoor seating (Activity Category E) and retail (Activity Category F). The topography in this area is generally flat, with elevations at or below those on I-5. A large area has been cleared for future development (Village at Laguna Hills). The development is in the planning phase and has not been permitted for construction; however, it is expected to include Activity Category B, C, and/or E land uses.

NAA 3 – East side of I-5, north of El Toro Road: The land uses in this NAA are primarily residential (Activity Category B). Other land uses include a park, a playground and a basketball court (half court) (Activity Category C), outdoor seating areas (Activity Category E), and retail (Activity Category F). The topography in this area is generally flat, with elevations at or above those on I-5. There is an existing 16-foot noise barrier at the right of way/edge of shoulder, and several existing block walls on private property provide varying levels of noise shielding from I-5 at the residences.

NAA 4 – West side of I-5, north of El Toro Road: The land uses in this NAA include multi-family residential (Activity Category B), a school, a place of worship (Activity Category C and D), and outdoor seating areas (Activity Category E). The topography in this area is generally flat, with elevations at or above those on I-5. There is an existing 16-foot noise barrier at the right of way/edge of shoulder, and several existing block walls on private property provide varying levels of noise shielding from I-5 at the residences.

Existing Noise Environment

Short-term noise measurements were conducted at various times between December 3 and 18, 2024, at 20 representative locations within the Project area for use in evaluating the existing noise environment and validating the traffic noise model. Short-term measurements (10 to 15 minutes in duration per measurement) were conducted at areas of frequent human use associated with residential and other noise-sensitive land

uses or locations that were considered acoustically equivalent for traffic noise model validation purposes. At land uses that did not have exterior areas of frequent human use, such as retail or commercial developments, restaurants without exterior dining areas, or undeveloped lands, noise measurements were taken at accessible areas of the property that faced I-5.

Long-term measurements were conducted at various times between December 3 and 10, 2024, at three representative locations within the Project area. Long-term measurements were used to determine changes in noise levels within the Project area throughout a typical day.

The short-term and long-term noise measurement locations are shown on Figure 2.3.6-2. An additional discussion related to the field measurements can be found in the SNSR.

Traffic Noise Model

The FHWA Traffic Noise Model (TNM), version 2.5, was used for noise-level computations. TNM input is based on a three-dimensional grid for the study area to be modeled. Key geometric inputs for the TNM are ground type and the locations of roadways; shielding features (e.g., topography/intervening terrain and buildings); noise barriers, including freeway sound walls and property walls; and receivers.

To ensure the TNM modeling represents actual conditions, the model was validated by comparing short-term measured traffic noise levels to the model's estimate of existing noise levels at field measurement locations. Model validation showed generally good agreement between the measured and modeled levels, with most model validation falling within +/-3 dB. Validated measurement locations that showed any differential between the measured and modeled noise levels received an adjustment factor (K-factor) to bring the model into alignment with validation measurements.[1] Detailed information about how traffic noise levels are calculated and the TNM validation process is provided in the SNSR (Caltrans 2026a).

2.3.6.3 Environmental Consequences

State highway agencies must complete a noise analysis for a project if the requirements of 23 CFR 772 apply and the project would include an activity that would qualify the project as a Type I or Type II project, as defined. The Project is considered a Type 1 project under 23 CFR 772 because the proposed construction would add or relocate interchange ramps and other improvements, thereby triggering the requirement for a noise analysis to be conducted.

[1] In addition to the Protocol, Caltrans provides the *Technical Noise Supplement* (TeNS) (Caltrans 2013), which expands on the concepts and procedures outlined in the Protocol. Section 4.4 in the TeNS provides guidance for validating the TNM model, which states that K-factors should only be 4 dB or greater because a difference of 3 dB or less is considered acceptable and does not require adjustment of the model. However, in accordance with Caltrans District 12 policy, discrepancies within 3 dB are included to ensure that modeled values accurately reflect measured data.

Temporary Impacts

Build Alternatives

Build Alternative 1

During construction, noise from construction activities under Build Alternative 1 may intermittently dominate the noise environment in the immediate Project area. Two types of short-term noise impacts are expected to occur during Project construction. The first type would be from construction crew commutes and the transport of construction equipment and materials to the Project site, which is expected to incrementally raise noise levels on access roads leading to the Project construction site. It is assumed that heavy equipment for grading and construction activities would be moved on-site, would remain for the duration of each construction phase, and would not add to the daily traffic volume in the Project vicinity. Therefore, a high level of potential single-event noise exposure (i.e., 87 dBA maximum noise level [L_{max}] from trucks passing at 50 feet) would exist. However, the projected construction traffic is expected to be minimal compared with existing traffic volumes on I-5 and other affected streets; the associated noise-level change would therefore not be perceptible. As such, construction-related worker commutes and equipment transport noise impacts would be short term and would not be adverse.

The second type of short-term noise impact would be from construction activities. Construction is performed in distinct steps, each of which has its own mix of equipment and consequently its own noise characteristics. These various sequential phases would change the character of the noise generated as well as the noise levels along the Project alignment as construction progresses. Despite the variety in the types and sizes of construction equipment, similarities in dominant noise sources and patterns of operation allow construction-related noise ranges to be categorized by work phase. Table 2.3.6-2 lists typical construction equipment noise levels (L_{max}) recommended for noise impact assessments, based on a distance of 50 feet between the equipment and a noise receptor.

The conventional construction equipment is expected to generate noise levels ranging from 80 to 96 dBA L_{max} at a distance of 50 feet. Noise produced by construction equipment would be reduced at a rate of about 6 dB per doubling of distance.

The site preparation phase, which includes grading and paving, tends to generate the highest noise levels because the noisiest construction equipment is earthmoving equipment. Earthmoving equipment includes excavation machinery such as backhoes, bulldozers, and front-end loaders. Compacting equipment includes compactors, scrapers, and graders. Typical operating cycles for these types of construction equipment may require 1 or 2 minutes of full-power operation, followed by 3 or 4 minutes at lower power settings.

In addition to the standard construction equipment, the Project would require the use of pile drivers. As shown in Table 2.3.6-2, pile driving generates noise levels of up to 96 dBA L_{max} at 50 feet.

Table 2.3.6-2. Typical Construction Equipment Noise Levels

Type of Equipment	Range of Maximum Sound Levels (dBA L_{max} at 50 feet)	Suggested Maximum Sound Levels for Analysis (dBA L_{max} at 50 feet)
Pile drivers	81 to 96	93
Rock drills	83 to 99	96
Jackhammers	75 to 85	82
Pneumatic tools	78 to 88	85
Pumps	74 to 84	80
Scrapers	83 to 91	87
Haul trucks	83 to 94	88
Cranes	79 to 86	82
Portable generators	71 to 87	80
Rollers	75 to 82	80
Dozers	77 to 90	85
Tractors	77 to 82	80
Front-end loaders	77 to 90	86
Hydraulic backhoes	81 to 90	86
Hydraulic excavators	81 to 90	86
Graders	79 to 89	86
Air compressors	76 to 89	86
Trucks	81 to 87	86

Source: Bolt Beranek and Newman, Inc. 1987
dBA = A-weighted decibel; L_{max} = maximum instantaneous noise level

Temporary impacts related to noise during construction would be minimized with implementation of **PF-N-1**, which is a standard measure for all Caltrans projects. No substantial adverse noise impacts from construction are anticipated.

PF-N-1 Caltrans Standard Specifications Section 14.8-02: Control and monitor noise resulting from work activities. Do not exceed 86 A-weighted decibels maximum instantaneous noise level (dBA L_{max}) at 50 feet from the job site from 9:00 p.m. to 6:00 a.m.

Design Variation: Build Alternative 1a

A design variation, Build Alternative 1a, includes all features of Build Alternative 1 and a new public street that would enter the Village of Laguna Hills development at the new southbound I-5/Avenida de la Carlota ramp terminal intersection south of El Toro Road. The design variation is not expected to result in considerable differences in estimated construction noise levels relative to Build Alternative 1. Therefore, the results discussed for Build Alternative 1 are also applicable to its design variation.

Build Alternative 3

Build Alternative 3 consists of technology improvements and does not include any physical or geometric modifications. As such, no temporary construction-related noise impacts are anticipated.

No-Build Alternative

The No-Build Alternative proposes no action. No construction would occur at the I-5/El Toro Road interchange, and no temporary construction-related noise impacts would result.

Permanent Impacts

Build Alternatives

Build Alternative 1

Predicted design-year traffic noise levels under Build Alternative 1 were compared to existing conditions and design-year no-build conditions. The comparison to existing conditions is included in the analysis to identify "substantial" traffic noise impacts under 23 CFR 772. The comparison to no-build conditions indicates the projected direct impact of noise resulting from the Project.

The modeling results summarized in Table 2.3.6-3 and included in the tables in Appendix B of the SNSR indicate that calculated worst-hour traffic noise levels (i.e., equivalent hourly noise level [$L_{eq}(h)$]) for design-year build conditions would approach or exceed the NAC (67 dBA) at residential and recreational land uses (Activity Categories B and C) in NAAs 3 and 4. In addition, the calculated worst-hour traffic noise levels are predicted to approach or exceed the NAC of 52 dBA for Activity Category D (interior receiver) land uses and 72 dBA for Activity Category E (exterior commercial receiver) land uses. Traffic noise impacts are predicted to occur at Activity Category B, C, D, and E land uses within the study area. Therefore, noise abatement must be considered at those locations.

The sections that follow provide additional details regarding the traffic noise impacts predicted in each NAA. Table 2.3.6-3 summarizes existing noise levels as well as predicted future noise levels at all analyzed receiver locations. The table also includes information about the noise barriers that were evaluated as potential noise abatement for affected receivers. Further discussion of considered abatement (i.e., noise barriers) is provided in Section 2.3.6.4, *Avoidance, Minimization, and/or Abatement Measures*, below.

NAA 1 – East side of I-5, south of El Toro Road: The land uses in this NAA are primarily residential (Activity Category B). Other land uses include outdoor seating areas (Activity Category E) and retail (Activity Category F). There are 43 modeled receivers (M01.01 through M01.43), representing 90 receptors, within NAA 1. The predicted worst-hour exterior traffic noise levels range from 52 to 70 dBA $L_{eq}(h)$ for existing conditions, 53 to 72 dBA $L_{eq}(h)$ for design-year no-build conditions, and 53 to 72 dBA $L_{eq}(h)$ for Build Alternative 1 design-year conditions. Design-year noise levels for Build Alternative 1 are predicted to change by approximately 1 to 2 dBA relative to existing noise levels and by -1 (i.e., a 1 dBA decrease) to 0 dBA relative to design-year no-build noise levels. One modeled receiver, M01.41, representing one receptor, is predicted to approach or exceed the NAC for Activity Category E; therefore, consideration of noise abatement is required. The locations of all modeled receivers in NAA 1 are shown in Figure 2.3.6-2.

NAA 2 – West side of I-5, south of El Toro Road: The land uses in this NAA are a mix of restaurants with outdoor seating areas (Activity Category E) and retail (Activity Category F). There are 19 modeled receivers (M02.01 through M02.19), representing two receptors, within NAA 2. The predicted worst-hour exterior traffic noise levels range from 63 to 73 dBA L_{eq}(h) for existing conditions, 64 to 74 dBA L_{eq}(h) for design-year no-build conditions, and 62 to 74 dBA L_{eq}(h) for Build Alternative 1 design-year conditions. Design-year noise levels for Build Alternative 1 are predicted to change by approximately -4 (i.e., a 4 dBA decrease) to 4 dBA relative to existing noise levels and by -5 (i.e., a 5 dBA decrease) to 2 dBA relative to design-year no-build noise levels. Modeled receivers M02.04 through M02.19 are used to identify the 66 and 71 dBA contour lines within the large area under development for the Village at Laguna Hills project. This information was used to evaluate the likelihood of traffic noise impacts if future development occurs in this area. Because noise levels are not predicted to approach or exceed the NAC, or result in a substantial increase in noise, as a result of the Project, noise abatement does not need to be considered for NAA 2. The locations of all modeled receivers in NAA 2 are shown on Figure 2.3.6-2.

Table 2.3.6-3. Project Worst-Hour Noise Levels – Alternative 1

Receiver ID	Measurement Location	NAA	Barrier ID	Activity Category (Noise Abatement Criteria)	Existing Noise Level (dBA)	Design-Year (2050) Noise Level without Project (No-Build Alternative) (dBA)	Design-Year (2050) Noise Level with Project (Build Alternative) (dBA)	Noise Impact Requiring Abatement Consideration	Predicted Noise Level with Abatement (dBA)								
									6-foot wall	8-foot wall	10-foot wall	12-foot wall	14-foot wall	16-foot wall	18-foot wall	20-foot wall	22-foot wall
M01.01	--	1		B (67)	57	58	58	No	--	--	--	--	--	--	--	--	--
M01.02	--	1		B (67)	58	59	59	No	--	--	--	--	--	--	--	--	--
M01.03	--	1		B (67)	59	60	60	No	--	--	--	--	--	--	--	--	--
M01.04	--	1		B (67)	57	58	58	No	--	--	--	--	--	--	--	--	--
M01.05	--	1		B (67)	57	58	58	No	--	--	--	--	--	--	--	--	--
M01.06	--	1		B (67)	55	56	56	No	--	--	--	--	--	--	--	--	--
M01.07*	ST01.01	1		F (-)	63	64	64	No	--	--	--	--	--	--	--	--	--
M01.08	--	1		B (67)	59	60	60	No	--	--	--	--	--	--	--	--	--
M01.09	--	1		B (67)	59	60	60	No	--	--	--	--	--	--	--	--	--
M01.10	--	1		B (67)	58	59	59	No	--	--	--	--	--	--	--	--	--
M01.11	--	1		B (67)	57	58	58	No	--	--	--	--	--	--	--	--	--
M01.12	ST01.02	1		B (67)	64	65	65	No	--	--	--	--	--	--	--	--	--
M01.13	--	1		B (67)	57	59	58	No	--	--	--	--	--	--	--	--	--
M01.14	--	1		B (67)	57	59	58	No	--	--	--	--	--	--	--	--	--
M01.15	--	1		B (67)	60	61	61	No	--	--	--	--	--	--	--	--	--
M01.16	--	1		B (67)	59	60	60	No	--	--	--	--	--	--	--	--	--
M01.17	--	1		B (67)	59	60	60	No	--	--	--	--	--	--	--	--	--
M01.18	ST01.03	1		B (67)	58	59	59	No	--	--	--	--	--	--	--	--	--
M01.19	--	1		B (67)	60	61	61	No	--	--	--	--	--	--	--	--	--
M01.20	ST01.04	1		B (67)	58	59	59	No	--	--	--	--	--	--	--	--	--
M01.21	--	1		B (67)	59	60	60	No	--	--	--	--	--	--	--	--	--
M01.22	--	1		B (67)	54	55	55	No	--	--	--	--	--	--	--	--	--
M01.23	--	1		B (67)	55	56	56	No	--	--	--	--	--	--	--	--	--
M01.24	--	1		B (67)	54	55	55	No	--	--	--	--	--	--	--	--	--
M01.25	ST01.05	1		B (67)	53	54	54	No	--	--	--	--	--	--	--	--	--
M01.26	--	1		B (67)	53	54	54	No	--	--	--	--	--	--	--	--	--
M01.27	--	1		B (67)	55	56	56	No	--	--	--	--	--	--	--	--	--
M01.28*	ST01.06	1		F (-)	55	56	56	No	--	--	--	--	--	--	--	--	--
M01.29	--	1		B (67)	58	59	59	No	--	--	--	--	--	--	--	--	--
M01.30	--	1		B (67)	58	59	59	No	--	--	--	--	--	--	--	--	--
M01.31	--	1		B (67)	57	58	58	No	--	--	--	--	--	--	--	--	--
M01.32	--	1		B (67)	57	59	59	No	--	--	--	--	--	--	--	--	--
M01.33	--	1		B (67)	59	60	60	No	--	--	--	--	--	--	--	--	--
M01.34	--	1		B (67)	55	56	56	No	--	--	--	--	--	--	--	--	--
M01.35	--	1		B (67)	54	55	55	No	--	--	--	--	--	--	--	--	--
M01.36	--	1		B (67)	55	56	56	No	--	--	--	--	--	--	--	--	--
M01.37	--	1		B (67)	53	54	54	No	--	--	--	--	--	--	--	--	--
M01.38	--	1		B (67)	54	55	55	No	--	--	--	--	--	--	--	--	--

Receiver ID	Measurement Location	NAA	Barrier ID	Activity Category (Noise Abatement Criteria)	Existing Noise Level (dBA)	Design-Year (2050) Noise Level without Project (No-Build Alternative) (dBA)	Design-Year (2050) Noise Level with Project (Build Alternative) (dBA)	Noise Impact Requiring Abatement Consideration	Predicted Noise Level with Abatement (dBA)								
									6-foot wall	8-foot wall	10-foot wall	12-foot wall	14-foot wall	16-foot wall	18-foot wall	20-foot wall	22-foot wall
M01.39	--	1		B (67)	52	53	53	No	--	--	--	--	--	--	--	--	--
M01.40	--	1		B (67)	54	55	55	No	--	--	--	--	--	--	--	--	--
M01.41	--	1	NB32A1 – El Toro Rd/ Rockfield Blvd ROW	E (72)	70	72	72	Yes	65	63	62	61	60	59	59	58	58
M01.42	--	1		E (72)	65	66	66	No	63	61	60	59	59	58	58	57	57
M01.43	--	1		E (72)	61	63	63	No	59	58	58	57	57	56	56	56	56
M02.01	ST02.02	2		F (-)	71	72	--	--	--	--	--	--	--	--	--	--	--
M02.02*	ST02.01	2		E (72)	64	65	65	No	--	--	--	--	--	--	--	--	--
M02.03	--	2		E (72)	66	68	70	No	--	--	--	--	--	--	--	--	--
M02.04	--	2		B/C (67)/E (72)	68	69	64	N/A**	--	--	--	--	--	--	--	--	--
M02.05	--	2		B/C (67)/E (72)	67	68	65	N/A**	--	--	--	--	--	--	--	--	--
M02.06	--	2		B/C (67)/E (72)	64	65	63	N/A**	--	--	--	--	--	--	--	--	--
M02.07	--	2		B/C (67)/E (72)	63	64	62	N/A**	--	--	--	--	--	--	--	--	--
M02.08	--	2		B/C (67)/E (72)	72	73	74	N/A**	--	--	--	--	--	--	--	--	--
M02.09	--	2		B/C (67)/E (72)	70	71	72	N/A**	--	--	--	--	--	--	--	--	--
M02.10	--	2		B/C (67)/E (72)	67	68	69	N/A**	--	--	--	--	--	--	--	--	--
M02.11	--	2		B/C (67)/E (72)	63	64	66	N/A**	--	--	--	--	--	--	--	--	--
M02.12	--	2		B/C (67)/E (72)	73	74	74	N/A**	--	--	--	--	--	--	--	--	--
M02.13	--	2		B/C (67)/E (72)	71	72	72	N/A**	--	--	--	--	--	--	--	--	--
M02.14	--	2		B/C (67)/E (72)	68	69	70	N/A**	--	--	--	--	--	--	--	--	--
M02.15	--	2		B/C (67)/E (72)	64	65	66	N/A**	--	--	--	--	--	--	--	--	--
M02.16	--	2		B/C (67)/E (72)	72	74	73	N/A**	--	--	--	--	--	--	--	--	--
M02.17	--	2		B/C (67)/E (72)	70	71	71	N/A**	--	--	--	--	--	--	--	--	--
M02.18	--	2		B/C (67)/E (72)	67	68	68	N/A**	--	--	--	--	--	--	--	--	--
M02.19	--	2		B/C (67)/E (72)	64	65	65	N/A**	--	--	--	--	--	--	--	--	--
M03.01	--	3	NB234A1 – NB Mainline EOS	E (72)	66	66	68	No	65	65	64	63	62	62	61	61	61
M03.02	ST03.01	3		F (-)	79	79	78	No	--	--	--	--	--	--	--	--	--
M03.03	--	3		B (67)	62	63	67	Yes	67	66	65	64	64	64	63	63	62
M03.04	ST03.02	3		C (67)	67	68	80	Yes	80	77	72	70	68	67	66	65	64
M03.05	--	3		B (67)	60	61	67	Yes	65	64	63	61	62	61	61	61	60
M03.06	ST03.03	3		B (67)	55	56	59	No	59	59	59	58	57	56	55	55	54
M03.07	--	3		B (67)	54	55	58	No	58	58	58	57	57	56	55	54	54
M03.08	--	3		B (67)	56	57	59	No	59	59	59	58	58	57	56	56	56
M03.09*	ST03.04	3		F (-)	66	67	77	No	--	--	--	--	--	--	--	--	--
M03.10	--	3		B (67)	67	68	76	Yes	74	72	71	70	69	67	67	67	66
M03.11	--	3		B (67)	62	63	71	Yes	67	66	65	65	63	62	61	61	60
M03.12	--	3		B (67)	63	64	68	Yes	67	67	66	66	65	64	64	63	63
M03.13	--	3		B (67)	66	67	69	Yes	69	68	68	68	67	66	66	66	65
M03.14	--	3		B (67)	69	70	70	Yes	70	69	69	69	69	69	69	68	68
M03.15	ST03.05	3		B (67)	69	70	70	Yes	70	69	69	69	69	69	69	69	69

Receiver ID	Measurement Location	NAA	Barrier ID	Activity Category (Noise Abatement Criteria)	Existing Noise Level (dBA)	Design-Year (2050) Noise Level without Project (No-Build Alternative) (dBA)	Design-Year (2050) Noise Level with Project (Build Alternative) (dBA)	Noise Impact Requiring Abatement Consideration	Predicted Noise Level with Abatement (dBA)								
									6-foot wall	8-foot wall	10-foot wall	12-foot wall	14-foot wall	16-foot wall	18-foot wall	20-foot wall	22-foot wall
M03.16	ST03.06	3		C (67)	69	70	70	Yes	70	70	70	69	69	69	69	69	69
M03.17	--	3		B (67)	66	67	66	Yes	66	66	66	66	66	66	66	66	66
M03.18	--	3		B (67)	67	68	68	Yes	68	68	68	68	68	68	68	68	68
M03.19	--	3		B (67)	59	60	64	No	64	63	62	62	61	60	59	59	58
M03.20	--	3		B (67)	56	57	60	No	59	59	58	58	57	57	56	56	55
M03.21	--	3		B (67)	56	57	61	No	60	59	60	59	58	57	56	56	55
M03.22	--	3		B (67)	57	58	60	No	60	60	60	59	59	58	58	58	58
M03.23	--	3		B (67)	57	58	59	No	59	59	59	58	58	58	58	58	58
M03.24	--	3		B (67)	63	64	65	No	64	64	64	64	64	64	64	64	64
M03.25	--	3		B (67)	62	63	63	No	63	63	63	63	63	63	63	63	63
M03.01	--	3	NB234A1 + NB244A1 – NB Mainline EOS	E (72)	66	66	68	No	65	65	64	63	62	62	61	61	61
M03.02	--	3		F (-)	79	79	78	No	--	--	--	--	--	--	--	--	--
M03.03	--	3		B (67)	62	63	67	Yes	67	66	65	64	64	64	63	63	62
M03.04	--	3		C (67)	67	68	80	Yes	80	77	72	70	68	67	66	65	64
M03.05	--	3		B (67)	60	61	67	Yes	65	64	63	61	62	61	61	61	60
M03.06	--	3		B (67)	55	56	59	No	59	59	59	58	57	56	55	55	54
M03.07	--	3		B (67)	54	55	58	No	58	58	58	57	57	56	55	54	54
M03.08	--	3		B (67)	56	57	59	No	59	59	59	58	58	57	56	56	55
M03.09*	--	3		F (-)	66	67	77	No	--	--	--	--	--	--	--	--	--
M03.10	--	3		B (67)	67	68	76	Yes	74	73	71	70	69	67	67	66	65
M03.11	--	3		B (67)	62	63	71	Yes	67	66	65	65	63	62	61	60	60
M03.12	--	3		B (67)	63	64	68	Yes	67	67	67	66	65	64	63	63	63
M03.13	--	3		B (67)	66	67	69	Yes	70	70	69	69	68	66	66	65	64
M03.14	--	3		B (67)	69	70	70	Yes	72	71	71	71	70	69	68	68	67
M03.15	--	3		B (67)	69	70	70	Yes	73	72	72	71	70	69	68	68	68
M03.16	--	3		C (67)	69	70	70	Yes	73	72	72	71	70	69	69	68	67
M03.17	--	3		B (67)	66	67	66	Yes	70	70	69	69	68	66	65	64	65
M03.18	--	3		B (67)	67	68	68	Yes	71	71	70	69	69	67	66	65	65
M03.19	--	3		B (67)	59	60	64	No	64	63	62	62	61	60	59	59	58
M03.20	--	3		B (67)	56	57	60	No	59	59	59	58	57	57	56	55	55
M03.21	--	3		B (67)	56	57	61	No	60	59	60	59	58	57	56	56	55
M03.22	--	3		B (67)	57	58	60	No	61	61	61	60	59	58	58	58	59
M03.23	--	3		B (67)	57	58	59	No	61	61	60	60	59	58	57	58	58
M03.24	--	3		B (67)	63	64	65	No	65	65	65	64	64	64	63	62	61
M03.25	--	3		B (67)	62	63	63	No	63	63	63	63	63	63	63	63	62
M03.26	--	3	NB33A1 – El Toro Rd/Rockfield Blvd ROW	E (72)	69	71	71	Yes	66	64	63	62	62	62	61	61	61

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									6-foot wall	8-foot wall	10-foot wall	12-foot wall	14-foot wall	16-foot wall	18-foot wall	20-foot wall	22-foot wall
M04.01	--	4	NB229A1 – Private Property	C (67)	64	66	66	Yes	62	60	59	59	58	58	58	58	58
M04.01	--	4	NB235A1 – SB Mainline EOS	C (67)	64	66	66	Yes	66	66	66	66	66	66	66	66	66
M04.02	--	4		C (67)	62	63	72	Yes	72	66	64	63	61	60	60	59	59
M04.03	--	4		C (67)	61	63	67	Yes	64	64	64	63	63	62	62	62	61
M04.04	--	4		D (52)	45 #	46 #	55 #	Yes	51 #	50 #	48 #	47 #	46 #	45 #	45 #	44 #	44 #
M04.05	--	4		C (67)	64	66	72	Yes	69	68	67	66	66	65	65	64	64
M04.06a	--	4		B (67)	59	61	61	No	61	61	61	61	61	61	61	60	60
M04.06b	--	4		E (72)	68	69	67	No	--	--	--	--	--	--	--	--	--
M04.06c	--	4		E (72)	66	67	67	No	--	--	--	--	--	--	--	--	--
M04.07	--	4		B (67)	59	61	61	No	60	60	60	60	60	60	60	60	60
M04.08	--	4		B (67)	59	61	61	No	61	61	61	61	61	61	60	60	60
M04.09	--	4		B (67)	51	53	54	No	54	53	53	52	52	52	52	52	51
M04.10	--	4		B (67)	58	60	60	No	60	60	60	60	60	59	59	59	59
M04.11	--	4		B (67)	55	56	57	No	57	57	56	56	56	56	56	56	55
M04.12	--	4		B (67)	52	54	53	No	53	53	53	53	53	53	53	53	53
M04.13	--	4		B (67)	58	60	61	No	60	60	60	59	59	59	59	59	58
M04.14*	ST04.03	4		F (-)	58	60	61	No	--	--	--	--	--	--	--	--	--
M04.15	--	4		B (67)	52	53	54	No	54	53	53	53	53	53	52	52	52
M04.16	--	4		B (67)	58	60	62	No	61	61	60	60	60	60	59	59	59
M04.17	--	4		B (67)	53	54	55	No	55	55	54	54	54	53	53	52	52
M04.18	--	4		B (67)	58	60	63	No	62	61	60	60	60	60	59	59	59
M04.19	--	4		B (67)	60	62	65	No	63	63	62	62	62	61	61	61	61
M04.20	--	4		B (67)	59	61	64	No	62	62	61	61	61	61	60	60	60
M04.21	--	4		B (67)	57	58	60	No	59	58	58	57	57	57	57	57	56
M04.22	--	4		B (67)	61	63	65	No	63	63	62	62	61	61	61	61	61
M04.23-2	--	4		B (67)	66	67	69	Yes	68	67	66	66	65	65	65	64	64
M04.24	--	4		B (67)	55	56	56	No	56	56	56	55	55	54	54	53	53
M04.25-3	--	4		B (67)	76	77	80	Yes	78	77	75	74	73	71	70	70	69
M04.26	--	4		B (67)	54	55	56	No	55	55	55	55	55	54	54	53	53
M04.27-2	--	4		B (67)	72	73	76	Yes	73	72	70	70	69	68	67	67	66
M04.28-2	--	4		B (67)	61	62	62	No	62	62	61	61	60	60	60	59	59
M04.29-2	--	4		B (67)	74	75	78	Yes	74	72	71	70	69	69	68	68	67
M04.30-3	--	4		B (67)	78	79	81	Yes	80	79	78	76	74	73	72	71	71
M04.31-2	--	4		B (67)	67	68	69	Yes	67	66	65	64	63	63	63	63	63
M04.32	ST04.01	4		B (67)	65	66	68	Yes	66	65	65	65	65	64	64	64	64
M04.33-2	--	4		B (67)	76	77	78	Yes	77	75	73	71	71	70	69	69	68

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									6-foot wall	8-foot wall	10-foot wall	12-foot wall	14-foot wall	16-foot wall	18-foot wall	20-foot wall	22-foot wall
M04.34	--	4		B (67)	57	58	58	No	58	58	58	58	57	57	57	56	56
M04.35-2	--	4		B (67)	79	80	81	Yes	79	77	75	74	73	72	71	71	70
M04.36	--	4		B (67)	67	68	69	Yes	68	67	66	65	65	64	64	64	63
M04.37	--	4		B (67)	68	69	70	Yes	68	67	65	65	64	64	64	64	65
M04.38	--	4		B (67)	59	60	60	No	60	60	60	60	59	58	58	58	57
M04.39	--	4		B (67)	68	69	69	Yes	68	67	66	66	65	65	64	64	64
M04.40	--	4		B (67)	55	56	56	No	56	56	56	55	55	55	54	54	53
M04.41-2	--	4		B (67)	79	80	81	Yes	79	78	76	75	74	73	72	72	72
M04.42	ST04.04	4		B (67)	61	62	62	No	62	61	62	61	61	60	60	59	59
M04.43	--	4		B (67)	58	59	59	No	58	58	58	58	57	57	56	56	55
M04.44-2	--	4		B (67)	78	79	79	Yes	78	76	74	73	72	71	71	70	69
M04.45-2	--	4		B (67)	78	79	79	Yes	78	76	74	73	72	71	70	70	69
M04.46	--	4		B (67)	68	69	69	Yes	69	67	66	66	65	65	65	64	64
M04.47-2	--	4		B (67)	64	65	65	No	65	64	64	63	63	63	62	62	62
M04.48	--	4		B (67)	67	68	68	Yes	67	66	65	64	66	67	66	66	65
M04.49-2	--	4		B (67)	76	77	77	Yes	76	75	73	72	71	71	70	69	68
M04.50-3	--	4		B (67)	78	79	79	Yes	78	77	77	76	75	73	72	71	70
M04.51	--	4		B (67)	62	63	64	No	62	61	61	60	62	62	62	61	61
M04.52	--	4		B (67)	67	68	68	Yes	67	66	65	64	64	63	62	62	62
M04.53-2	--	4		B (67)	78	79	78	Yes	78	77	75	74	73	72	71	70	69
M04.54	--	4		B (67)	60	61	61	No	60	59	58	60	60	59	59	58	58
M04.55	ST04.02	4		B (67)	68	69	69	Yes	68	67	66	65	64	64	63	63	63
M04.56	--	4		B (67)	68	69	69	Yes	67	66	66	65	64	64	64	63	63
M04.57-2a	--	4		B (67)	72	73	72	Yes	71	70	69	69	68	67	66	65	65
M04.57b	--	4		B (67)	63	64	64	No	63	62	61	61	61	61	61	60	60
M04.57c	--	4		B (67)	54	55	55	No	55	55	54	54	54	54	53	53	52
M04.57d	--	4		B (67)	59	60	60	No	60	59	59	59	58	58	57	57	56
M04.58-2	--	4		B (67)	67	68	67	Yes	66	65	64	64	63	62	61	61	61
M04.59-3	--	4		B (67)	69	70	69	Yes	68	67	66	65	65	64	63	63	62
M04.60	--	4		B (67)	66	67	67	Yes	66	65	64	64	64	64	64	64	64
M04.61	--	4		B (67)	60	61	61	No	61	61	61	60	60	60	60	59	58
M04.62-2	--	4		B (67)	59	60	60	No	60	60	60	59	59	59	58	57	56
M04.63-3	--	4		B (67)	67	68	68	Yes	68	68	67	67	67	66	65	64	64
M04.64	--	4		B (67)	72	73	73	Yes	72	71	71	70	69	69	68	67	66
M04.65-2	--	4		B (67)	71	72	72	Yes	72	71	71	70	69	68	67	66	66
M04.66-2	--	4		B (67)	62	63	63	No	63	63	62	62	61	61	60	59	58
M04.67	--	4		B (67)	61	62	62	No	61	61	61	60	59	59	58	57	57
M04.68-2a	--	4		B (67)	59	60	60	No	60	59	59	59	59	58	58	57	57

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									6-foot wall	8-foot wall	10-foot wall	12-foot wall	14-foot wall	16-foot wall	18-foot wall	20-foot wall	22-foot wall
M04.68b	--	4		B (67)	54	55	55	No	55	54	54	54	53	52	52	51	51
M04.69-2	--	4		B (67)	80	81	81	Yes	80	79	78	76	75	73	71	70	69
M04.70-3	--	4		B (67)	78	79	79	Yes	78	78	78	77	76	76	74	72	71
M04.71-2	--	4		B (67)	75	76	76	Yes	75	74	73	72	72	70	69	68	67
M04.72-2	--	4		B (67)	76	77	77	Yes	76	75	74	74	73	71	70	69	68
M04.73-3	--	4		B (67)	76	77	77	Yes	77	76	76	75	74	74	73	71	69
M04.74-2	--	4		B (67)	72	72	72	Yes	72	71	71	70	69	67	66	66	65
M04.75-3	--	4		B (67)	71	72	72	Yes	71	70	69	69	68	67	65	64	64
M04.76	--	4		B (67)	70	71	71	Yes	70	69	68	67	66	66	66	66	66
M04.77	ST04.06	4		B (67)	72	73	73	Yes	72	71	70	69	70	69	68	67	66
M04.78	--	4		B (67)	60	60	60	No	60	60	60	60	59	59	58	57	56
M04.79	--	4		B (67)	57	58	57	No	57	57	57	57	57	56	55	54	54
M04.80-2	--	4		B (67)	75	76	76	Yes	75	74	73	72	69	69	67	67	66
M04.81	--	4		B (67)	66	67	67	Yes	66	65	64	63	63	62	62	62	61
M04.82	ST04.05	4		B (67)	64	65	65	No	65	64	63	63	62	62	61	60	60
M04.83-2	--	4		B (67)	70	71	71	Yes	70	69	69	67	66	66	65	65	64

An additional value is added to the receiver I.D. number to signify receivers modeled above the first floor (e.g., “-2” for second floor, “-3” for third floor).
Interior noise levels are estimated from exterior noise levels using building noise reduction factors from Table 6 of Highway Traffic Noise: Analysis and Abatement Guidance (FHWA 2011). A 20 dB exterior-to-interior noise reduction is assumed at M04.04. This corresponds to light-frame construction with ordinary sash windows.
*This receiver was used for model validation purposes only and does not accurately represent the primary area of outdoor human use. Nearby modeled receivers are used to assess impacts at this land use.
**This receiver, included for informational purposes only, was used to assess potential impacts for future development by identifying the distance to the 66 and 71 dBA contour line.
EOS = edge of shoulder; NB = northbound; ROW = right of way; SB = southbound

NAA 3 – East side of I-5, north of El Toro Road: The land uses in this NAA are primarily residential (Activity Category B). Other land uses include a park, a playground, and a basketball court (half court) (Activity Category C); outdoor seating areas (Activity Category E); and retail (Activity Category F). There are 26 modeled receivers (M03.01 through M03.26), representing 47 receptors, within NAA 3. The predicted worst-hour exterior traffic noise levels range from 54 to 79 dBA L_{eq}(h) for existing conditions, 55 to 79 dBA L_{eq}(h) for design-year no-build conditions, and 58 to 80 dBA L_{eq}(h) for Build Alternative 1 design-year conditions. Design-year noise levels for Build Alternative 1 are predicted to change by approximately -1 (i.e., a 1 dBA decrease) to 13 dBA relative to existing noise levels and by -1 (i.e., a 1 dBA decrease) to 12 dBA relative to design-year no-build noise levels. The higher end of the increases in predicted noise levels under the design-year condition relative to existing and design-year no-build conditions is due to widening the northbound mainline, which reduces the distance between the roadway and noise-sensitive residences, and demolishing the existing 16-foot noise barrier to accommodate improvements to the northbound on-ramp from El Toro Road. Noise levels at 13 modeled receivers—M03.03, M03.04, M03.05, M03.10, M03.11, M03.12,M03.13, M03.14, M03.15, M03.16, M03.17, M03.18, and M03.26—representing 24 receptors, would approach or exceed the NAC for Activity Categories B, C, and E; therefore, consideration of noise abatement is required. The locations of all modeled receivers in NAA 3 are shown on Figure 2.3.6-2.

NAA 4 – West side of I-5, north of El Toro Road: The land uses in this NAA include multi-family residential (Activity Category B), a place of worship, a school (Activity Category C and D), and outdoor seating areas (Activity Category E). There are 89 modeled receivers, representing 182 receptors, within NAA 4: M04.01 through M04.06a, M04.06b, M04.06c; M04.07 through M04.57a, M04.57b, M04.57c. M04.57d; M04.58-2 through M04.68-2a and M04.68b; and M04.69-2 through M04.83-2. The predicted worst-hour exterior traffic noise levels range from 51 to 80 dBA L_{eq}(h) for existing conditions, 53 to 81 dBA L_{eq}(h) for design-year no-build conditions, and 53 to 81 dBA L_{eq}(h) for Build Alternative 1 design-year conditions. Design-year noise levels for Build Alternative 1 are predicted to change by approximately -1 (i.e., a 1 dBA decrease) to 10 dBA relative to existing noise levels and by -2 (i.e., a 2 dBA decrease) to 9 dBA relative to design-year no-build noise levels. The higher end of the increases in predicted noise levels under the design-year condition relative to existing and design-year no-build conditions is due to the existing 16-foot noise barrier being demolished to accommodate improvements to the southbound off-ramps to Avenida de la Carlota. Noise levels at 47 modeled receivers—M04.01 through M04.05, M04.23-2, M04.25-3, M04.27-2, M04.29-2 through M04.33-2, M04.35-2 through M04.37, M04.39, M04.41-2, M04.44-2 through M04.46, M04.48 through M04.50-3, M04.52, M04.53-2, M04.55 through M04.60, M04.63-3 through M04.65-2, M04.69-2 through M04.77, M04.80-2, M04.81, and M04.83-2—representing 85 receptors, are predicted to approach or exceed the NAC for Activity Categories B, C, and D; therefore, consideration of noise abatement is required. The locations of all modeled receivers in NAA 4 are shown in Figure 2.3.6-2.

Design Variation: Build Alternative 1a

A design variation, Build Alternative 1a, includes all features of Build Alternative 1 and a new public street that would enter the Village of Laguna Hills development at the new

southbound I-5/Avenida de la Carlota ramp terminal intersection south of El Toro Road. The design variation is not expected to result in a substantive difference in predicted traffic noise levels. Therefore, the results included for Build Alternative 1 are applicable to the design variation.

Build Alternative 3

Build Alternative 3 consists of technology improvements and does not include any physical or geometric modifications. As such, no permanent noise impacts are anticipated.

No-Build Alternative

The No-Build Alternative proposes no action. No improvements would be made to the I-5/El Toro Road interchange. Design-year no-build noise levels are predicted to change by approximately 0 to 2 dBA relative to existing noise levels. One modeled receiver in NAA 1, representing one receptor, would approach or exceed the NAC for Activity Category E. Modeled receivers were used in NAA 2 to identify the 66 and 71 dBA contour lines within the large area under development for the Village at Laguna Hills project. This information is intended to be used to evaluate the likelihood of traffic noise impacts if future development occurs in this area. Nine modeled receivers in NAA 3, representing 17 receptors, would approach or exceed the NAC for Activity Category B, C, and E land uses. Forty-four modeled receivers in NAA 4, representing 82 receptors, would approach or exceed the NAC for Activity Category B and C land uses.

2.3.6.4 Avoidance, Minimization, and/or Abatement Measures

Noise abatement in the form of noise barriers (i.e., sound walls) was considered for each affected receiver. Each noise barrier has been evaluated for acoustical feasibility, based on the achievable noise reduction (i.e., 5 dB or more) at the outdoor frequent-use areas (i.e., areas of frequent human use) of the representative receivers. For each noise barrier determined to be acoustically feasible, a determination was made as to whether the noise reduction design goal of 7 dB could be achieved. For noise barriers that were projected to achieve a noise reduction of 5 dB or more and where it is projected that the design goal of 7 dB could be achieved, reasonable cost allowances were calculated.

The Protocol defines the procedure for assessing the reasonableness of noise barriers from a cost perspective. An allowance is provided for each benefited receptor (i.e., each receptor that receives at least 5 dB of noise reduction from a noise barrier that also provides at least 7 dB of noise reduction for one or more benefited receptors). The current allowance is $170,000 per benefited receptor. The total allowance for each noise barrier is calculated by multiplying the cost allowance per receptor by the number of benefited receptors. If the estimated construction cost of a barrier is less than the total calculated allowance for the barrier, the barrier is considered reasonable from a cost perspective.

The Protocol also provides information on potential noise reflecting off reflective noise barriers (i.e., noise barriers constructed of noise-reflective materials). Proposed barriers

that are parallel and within a 15:1 or less ratio of height to distance between or that have receptors on the far side of the facility and have direct line of sight from an area of frequent human use should be considered for reflections. Under these conditions, noise reflected between parallel barriers could reduce barrier effectiveness or result in unintended noise increases in areas not protected by the noise barriers. To minimize reflected-noise effects, an acoustically absorptive surface with a noise reduction coefficient of 0.80 or greater would be provided, consistent with Caltrans guidance. Because the absorptive treatment is required to address potential reflected-noise effects associated with the barrier configuration, the cost of the absorptive treatment is not included in the estimated construction costs. Therefore, the inclusion of absorptive treatment does not affect the reasonableness determination for the proposed noise barriers.

Table 2.3.6-3 includes the predicted future noise levels at receiver locations that would receive a traffic noise reduction from the evaluated noise barriers. A range of possible noise barrier heights was evaluated (i.e., between 6 and 22 feet). The preliminary noise abatement decision for each acoustically feasible noise barrier that meets the design goal is discussed in the SNSR (Caltrans 2026a) and SNADR (Caltrans 2026b), and a summary is provided in Table 2.3.6-4. . An additional discussion of the noise abatement measures is provided after the table. The locations of each evaluated noise barrier are shown on Figure 2.3.6-2.

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Table 2.3.6-4. Summary of Noise Barrier Abatement Key Information

Receiver ID	Area	Barrier ID	Noise Abatement							
			Feasible	Design Goal Met	Reasonable	Barrier Height (feet)	Number of Benefited Receptors	Total Reasonableness Allowance	Estimated Construction Cost[b]	Construction Cost Exceeds Allowance[c]
M01.41	1	NB32A1[a] – ROW	Yes	Yes	No	6	1	$170,000	N/A	N/A
M01.42			Yes	Yes	No	8	3	$510,000	N/A	N/A
M01.43			Yes	Yes	No	10	3	$510,000	N/A	N/A
			Yes	Yes	No	12	3	$510,000	N/A	N/A
			Yes	Yes	No	14	3	$510,000	N/A	N/A
			Yes	Yes	No	16	3	$510,000	N/A	N/A
			Yes	Yes	No	18	3	$510,000	N/A	N/A
			Yes	Yes	No	20	3	$510,000	N/A	N/A
			Yes	Yes	No	22	3	$510,000	N/A	N/A
M03.26	3	NB33A1[a] – ROW	Yes	No	No	6	1	--	N/A	N/A
			Yes	Yes	No	8	1	$170,000	N/A	N/A
			Yes	Yes	No	10	1	$170,000	N/A	N/A
			Yes	Yes	No	12	1	$170,000	N/A	N/A
			Yes	Yes	No	14	1	$170,000	N/A	N/A
			Yes	Yes	No	16	1	$170,000	N/A	N/A
			Yes	Yes	No	18	1	$170,000	N/A	N/A
			Yes	Yes	No	20	1	$170,000	N/A	N/A
			Yes	Yes	No	22	1	$170,000	N/A	N/A
M03.01–M03.25	3	NB234A1 – Mainline EOS	No	No	No	6	--	--	--	--
			Yes	No	No	8	2	--	--	--
			Yes	Yes	No	10	5	$850,000	$1,560,381	No
			Yes	Yes	No	12	8	$1,360,000	$1,733,757	No
			Yes	Yes	No	14	8	$1,360,000	$1,926,397	No
			Yes	Yes	No	16	10	$1,700,000	$2,140,441	No
			Yes	Yes	Yes	18	14	$2,380,000	$2,378,268	Yes
			Yes	Yes	No	20	14	$2,380,000	$2,617,291	No
			Yes	Yes	Yes	22	20	$3,400,000	$2,850,070	Yes
M03.01–M03.25	3	NB234A1 and NB244A1 – Mainline EOS	No	No	No	6	--	--	--	--
			Yes	No	No	8	2	--	--	--
			Yes	Yes	No	10	5	$850,000	$4,880,294	No
			Yes	Yes	No	12	8	$1,360,000	$5,371,995	No
			Yes	Yes	No	14	8	$1,360,000	$5,906,596	No
			Yes	Yes	No	16	11	$1,870,000	$6,488,864	No
			Yes	Yes	No	18	20	$3,400,000	$7,124,095	No
			Yes	Yes	No	20	27	$4,590,000	$8,036,292	No
			Yes	Yes	No	22	33	$5,610,000	$9,054,882	No

Receiver ID	Area	Barrier ID	Noise Abatement							
			Feasible	Design Goal Met	Reasonable	Barrier Height (feet)	Number of Benefited Receptors	Total Reasonableness Allowance	Estimated Construction Cost[b]	Construction Cost Exceeds Allowance[c]
M04.01–M04.05	4	NB235A1 – Mainline EOS	No	No	No	6	--	--	--	--
M04.06a			Yes	Yes	No	8	3	$510,000	$6,209,303	No
M04.06b			Yes	Yes	No	10	17	$2,890,000	$6,870,181	No
M04.06c			Yes	Yes	No	12	26	$4,420,000	$7,592,176	No
M04.07–M04.56			Yes	Yes	No	14	38	$6,460,000	$8,369,410	No
M04.57-2a			Yes	Yes	Yes	16	59	$10,030,000	$9,206,157	Yes
M04.57b			Yes	Yes	Yes	18	70	$11,900,000	$10,119,293	Yes
M04.57c			Yes	Yes	Yes	20	83	$14,110,000	$11,300,069	Yes
M04.57d			Yes	Yes	Yes	22	87	$14,790,000	$12,596,750	Yes
M04.58-2–M04.67										
M04.68-2a										
M04.68b										
M04.69-2–M04.83-2										
M04.01	4	NB229A1 – Private Property	No	No	No	6	--	--	--	--
			Yes	No	No	8	1	--	--	--
			Yes	Yes	No	10	1	$170,000	$435,000	No
			Yes	Yes	No	12	1	$170,000	$481,000	No
			Yes	Yes	No	14	1	$170,000	$530,000	No
			Yes	Yes	No	16	1	$170,000	$583,000	No
			Yes	Yes	No	18	1	$170,000	$866,494	No
			Yes	Yes	No	20	1	$170,000	$894,830	No
			Yes	Yes	No	22	1	$170,000	$913,717	No

[a] The City of Lake Forest does not support the construction of this noise barrier; it is included for informational purposes only.
[b] "N/A" is used in place of total reasonable allowance for noise barriers not supported by the City of Lake Forest.
[c] "N/A" is used in place of estimated construction costs for noise barriers not supported by the City of Lake Forest.
EOS = edge of shoulder; ROW = right of way

Considered Noise Abatement Measures

Based on the studies completed to date, Caltrans considered the noise abatement measures that follow. Caltrans intends to incorporate noise abatement in the form of the noise barriers that were found to be both feasible and reasonable.

NAA 1 – East side of I-5, south of El Toro Road: As shown in Table 2.3.6-3, noise levels at one modeled receiver, M01.41, are predicted to approach or exceed the NAC for Activity Category E land uses. A detailed modeling analysis was conducted for one barrier option at the right of way. The barrier, detailed below, was found to be feasible and met the noise reduction design goal of 7 dBA.

Noise Barrier 32A1 was evaluated along the right of way at the southeast quadrant of the El Toro Road and Rockfield Boulevard intersection, approximately from station 04+00 on Rockfield Boulevard to station 34+25 on El Toro Road. With a total length of approximately 269 feet, the barrier was modeled in 2-foot height increments from 6 to 22 feet. The location of Noise Barrier 32A1 is presented on Figure 2.3.6-2, sheet 3.

Noise Barrier 32A1 is projected to provide acoustically feasible traffic noise abatement and meet the design goal for up to three modeled receivers (representing a total of up to three benefited receptors) at barrier heights of 6 to 22 feet. Through coordination with the City of Lake Forest, the Project team received confirmation that the City of Lake Forest does not support construction of a noise barrier at this location. As a result, Noise Barrier 32A1 is discussed only for informational purposes and is not considered further. It will not be included as noise abatement as part of the Project.

NAA 3 – East side of I-5, north of El Toro Road: As shown in Table 2.3.6-3, noise levels at 13 modeled receivers, M03.03, M03.04, M03.05, M03.10, M03.11, M03.12, M03.13, M03.14, M03.15, M03.16, M03.17, M03.18, and M03.26, are predicted to approach or exceed the NAC for Activity Category B, C, and E land uses. In addition, modeling results indicated a substantial noise increase at one receiver (M03.04) when comparing the design-year build condition to the existing condition. A detailed modeling analysis was conducted for two barriers at the northbound mainline edge of shoulder and one barrier at the El Toro Road and Rockfield Boulevard intersection right of way. All analyzed barriers, as detailed below, were found to be feasible and met the noise reduction design goal of 7 dBA.

Noise Barrier 234A1 was evaluated along the northbound on-ramp, north of El Toro Road, and mainline edge of shoulder, from on-ramp station 05+00 to mainline station 245+00. With a total length of approximately 1,993 feet, the barrier was modeled in 2-foot height increments from 6 to 22 feet. The location of Noise Barrier 234A1 is presented on Figure 2.3.6-2, sheets 2 and 3.

Noise Barrier 234A1 is projected to provide acoustically feasible traffic noise abatement for up to 11 modeled receivers (representing a total of up to 20 benefited receptors) at barrier heights of 8 to 22 feet. Barrier heights of 10 to 22 feet are projected to meet the noise reduction design goal of 7 dBA. As summarized in Table 2.3.6-4, the current estimated construction costs for Noise Barrier 234A1 at heights of 10 to 16 feet as well

as at 20 feet were found to not be reasonable from a cost perspective. The estimated construction costs for Noise Barrier 234A1 at heights of 18 and 22 feet were less than the total reasonable cost allowance. Therefore, these noise barrier options are preliminarily considered reasonable to construct.

The noise barrier evaluated at a height of 18 feet would benefit 14 receptors. It was estimated to cost $2,378,268. The noise barrier evaluated at a height of 22 feet would benefit 20 receptors. It was estimated to cost $2,850,070. Considering both cost effectiveness and the number of benefited receptors, a noise barrier height of 18 feet is recommended for Noise Barrier 234A1.

Based on the studies completed to date, Caltrans intends to incorporate noise abatement in the form of Noise Barrier 234A1 at the southbound mainline edge of shoulder and off-ramp, with a total length of approximately 3,484 feet and a height of 18 feet. Calculations based on preliminary design data show that Noise Barrier 234A1 is projected to reduce noise levels by 5 to 7 dBA L_{eq}(h) for 14 benefited receptors at a cost of $2,378,268. This abatement measure may change, based on input received from the public. If conditions change substantially during final design, the noise abatement measure may not be constructed. The final decision on noise abatement will be made upon completion of the Project design.

Noise Barrier System 234A1 and 244A1 was evaluated with the two noise barriers in combination. Noise Barrier 234A1 was analyzed separately above. Noise Barrier 244A1 is an existing 16-foot-tall segment that would remain in place but with taller barrier heights considered.[2] The combined barrier was evaluated along the northbound on-ramp, north of El Toro Road, and mainline edge of shoulder, from on-ramp station 05+00 to mainline station 256+23. With a total length of approximately 3,125 feet, the combined barrier was modeled in 2-foot height increments from 6 to 22 feet. The location of Noise Barrier System 234A1 and 244A1 is presented on Figure 2.3.6-2, sheets 1 through 3.

Noise Barrier System 234A1 and 244A1 is predicted to provide acoustically feasible traffic noise abatement for up to 17 modeled receivers (representing a total of up to 33 benefited receptors) at barrier heights of 8 to 22 feet. Barrier heights of 10 to 22 feet are projected to meet the noise reduction design goal of 7 dBA. However, as summarized in Table 2.3.6-4, at heights of 10 to 22 feet, Noise Barrier System 234A1 and 244A1 was found to not be reasonable from a cost perspective. Based on studies completed to date, Noise Barrier System 234A1 and 244A1 is not recommended as abatement as part of the Project.

Noise Barrier 33A1 was evaluated along the right of way at the northeast quadrant of the El Toro Road and Rockfield Boulevard intersection. With a total length of

[2] Noise Barrier 234A1 is intended to replace an existing 16-foot segment of a noise barrier that would be removed to accommodate roadway widening improvements; therefore, it would be included as part of the Project regardless of cost. Because Noise Barrier 234A1 would be constructed under all Project scenarios, Noise Barrier 244A1 was evaluated only in combination with Noise Barrier 234A1 and was not analyzed independently.

approximately 174 feet, the barrier was modeled in 2-foot height increments from 6 to 22 feet. The location of Noise Barrier 33A1 is presented on Figure 2.3.6-2, sheet 3.

Noise Barrier 33A1 is predicted to provide acoustically feasible traffic noise abatement for one modeled receiver (representing one benefited receptor) at barrier heights of 6 to 22 feet. Barrier heights of 8 to 22 feet are projected to meet the noise reduction design goal of 7 dBA. However, through coordination with the City of Lake Forest, the Project team received confirmation that the City of Lake Forest does not support the construction of a noise barrier at this location. As a result, Noise Barrier 33A1 is discussed only for informational purposes. It is not considered further and will not be included as noise abatement as part of the Project.

NAA 4 – West side of I-5, north of El Toro Road: As shown in Table 2.3.6-3, noise levels at 47 modeled receivers, M04.01 through M04.05, M04.23-2, M04.25-3, M04.27-2, M04.29-2 through M04.33-2, M04.35-2 through M04.37, M04.39, M04.41-2, M04.44-2 through M04.46, M04.48 through M04.50-3, M04.52, M04.53-2, M04.55 through M04.60, M04.63-3 through M04.65-2, M04.69-2 through M04.77, M04.80-2, M04.81, and M04.83-2, are predicted to approach or exceed the relevant NAC for Activity Category B, C, and D land uses. A detailed modeling analysis was conducted for two barriers, one at the southbound mainline edge of shoulder to the southbound off-ramp and one at a private property along Avenida de la Carlota. Both barriers were found to be feasible and met the noise reduction design goal of 7 dBA.

Noise Barrier 235A1 was evaluated along the southbound mainline edge of shoulder and off-ramp, from mainline station 262+00 to southbound off-ramp station 02+00. With a total length of approximately 3,484 feet, the barrier was modeled in 2-foot height increments from 6 to 22 feet. The location of Noise Barrier 235A1 is presented on Figure 2.3.6-2, sheets 1 and 2.

Noise Barrier 235A1 is predicted to provide acoustically feasible traffic noise abatement for up to 45 modeled receptors (representing a total of up to 87 benefited receptors) at barrier heights of 8 to 22 feet. Barrier heights of 10 to 22 feet are projected to meet the noise reduction design goal of 7 dBA. As summarized in Table 2.3.6-4, the current estimated construction costs for Noise Barrier 235A1 at heights of 8 to 14 feet were found to not be reasonable from a cost perspective. The estimated construction costs for Noise Barrier 235A1 at heights of 16 to 22 feet were less than the total reasonable cost allowance. Therefore, these noise barrier options are preliminarily considered reasonable to construct.

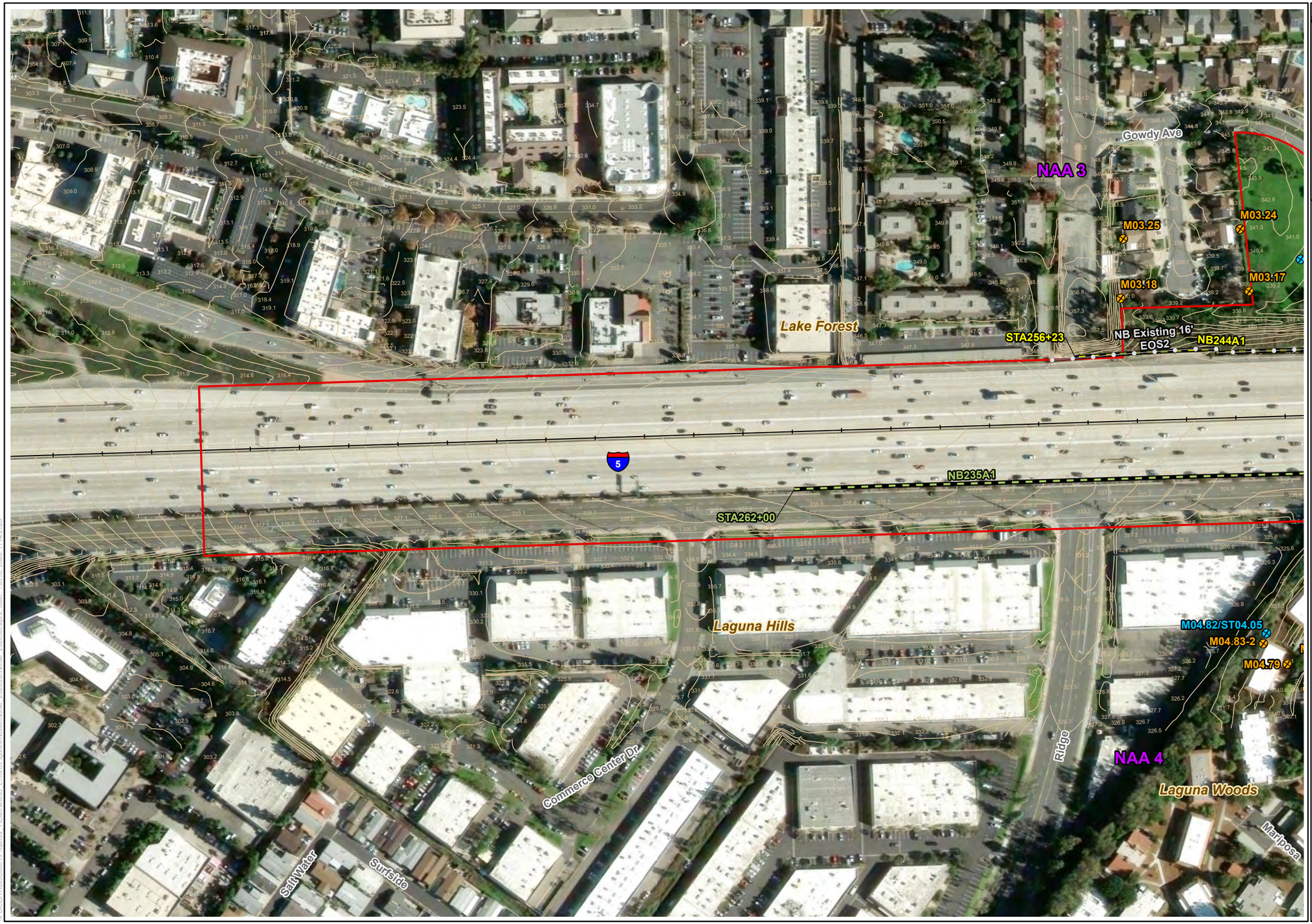
The noise barrier evaluated at a height of 16 feet is predicted to benefit 59 receptors and estimated to cost $9,206,157. The noise barrier evaluated at a height of 18 feet is projected to benefit 70 receptors and estimated to cost $10,119,293. The noise barrier evaluated at a height of 20 feet is projected to benefit 83 receptors and estimated to cost $11,300,069. The noise barrier evaluated at a height of 22 feet is projected to benefit 87 receptors and estimated to cost $12,596,750. Considering both cost-effectiveness and the number of benefited receptors, noise barrier heights of 16, 18,

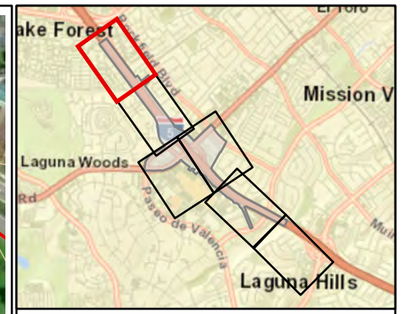
and 20 feet are recommended for Noise Barrier 235A1. Determination of the preferred barrier height will be based on the viewpoints of the benefited receptors.

Based on the studies completed to date, Caltrans intends to incorporate noise abatement in the form of Noise Barrier 235A1 at the southbound mainline edge of shoulder and off-ramp, with a total length of approximately 3,484 feet and a height of 16, 18, or 20 feet. Calculations based on preliminary design data show that Noise Barrier 235A1 is projected to reduce noise levels by 5 to 7 dBA L_{eq}(h) for 59 to 83 benefited receptors at a cost of $9,206,157 to $12,596,750. This abatement measure may change, based on input received from the public. If conditions have change substantially during final design, noise abatement may not be constructed. The final decision on noise abatement will be made upon completion of the Project design.

Noise Barrier 229A1 was evaluated on a private property in place of an existing fence at northbound Avenida de la Carlota, north of Paseo de Valencia. With a total length of approximately 290 feet, the barrier was modeled in 2-foot height increments from 6 to 22 feet. The location of Noise Barrier 229A1 is presented on Figure 2.3.6-2, sheet 2.

Noise Barrier 229A1 is predicted to provide acoustically feasible traffic noise abatement for one modeled receptor (representing one benefited receptor) at barrier heights of 8 to 22 feet. Barrier heights of 10 to 22 feet are projected to meet the noise reduction design goal of 7 dBA. However, as summarized in Table 2.3.6-4, at heights of 10 to 22 feet, Noise Barrier 229A1 was found to not be reasonable from a cost perspective. Based on studies completed to date, Noise Barrier 229A1 is not recommended as abatement as part of the Project.



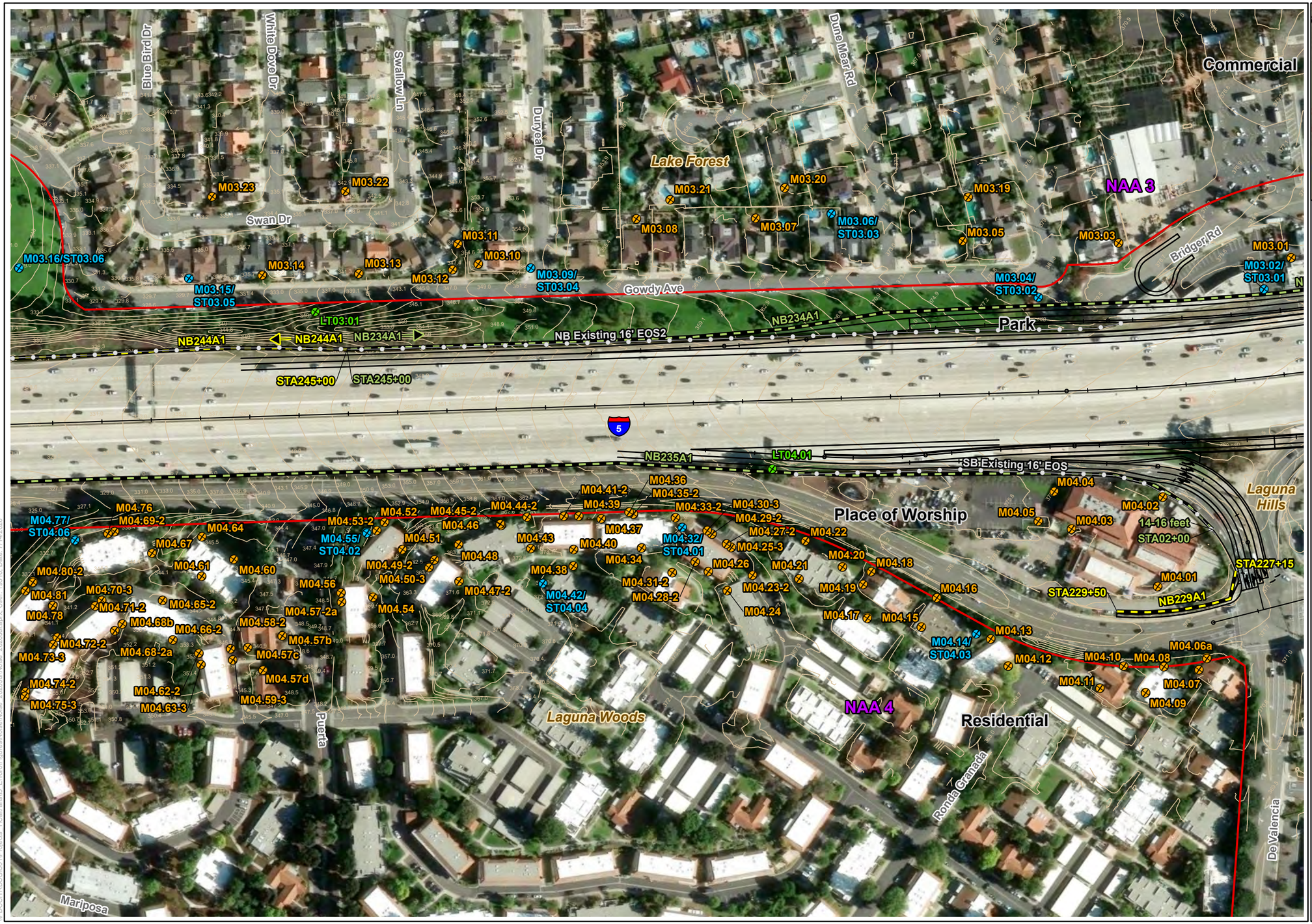


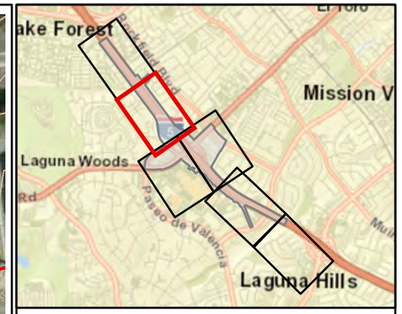
Legend

- Limits of Disturbance
- Long-term Noise Measurement Location
- Modeled Receiver Location/ Short-term Noise Measurement Location
- Modeled Receiver Location
- Feasible and Reasonable
- Feasible and Not Reasonable
- Existing Barriers
- Project Layout

0 100 200 Feet
1:2,400

Figure 2.3.6-2, Sheet 1 of 6
Noise Measurement and Modeling Locations, and Evaluated Noise Barriers - Alternative 1
Interstate 5 El Toro Road Interchange Project



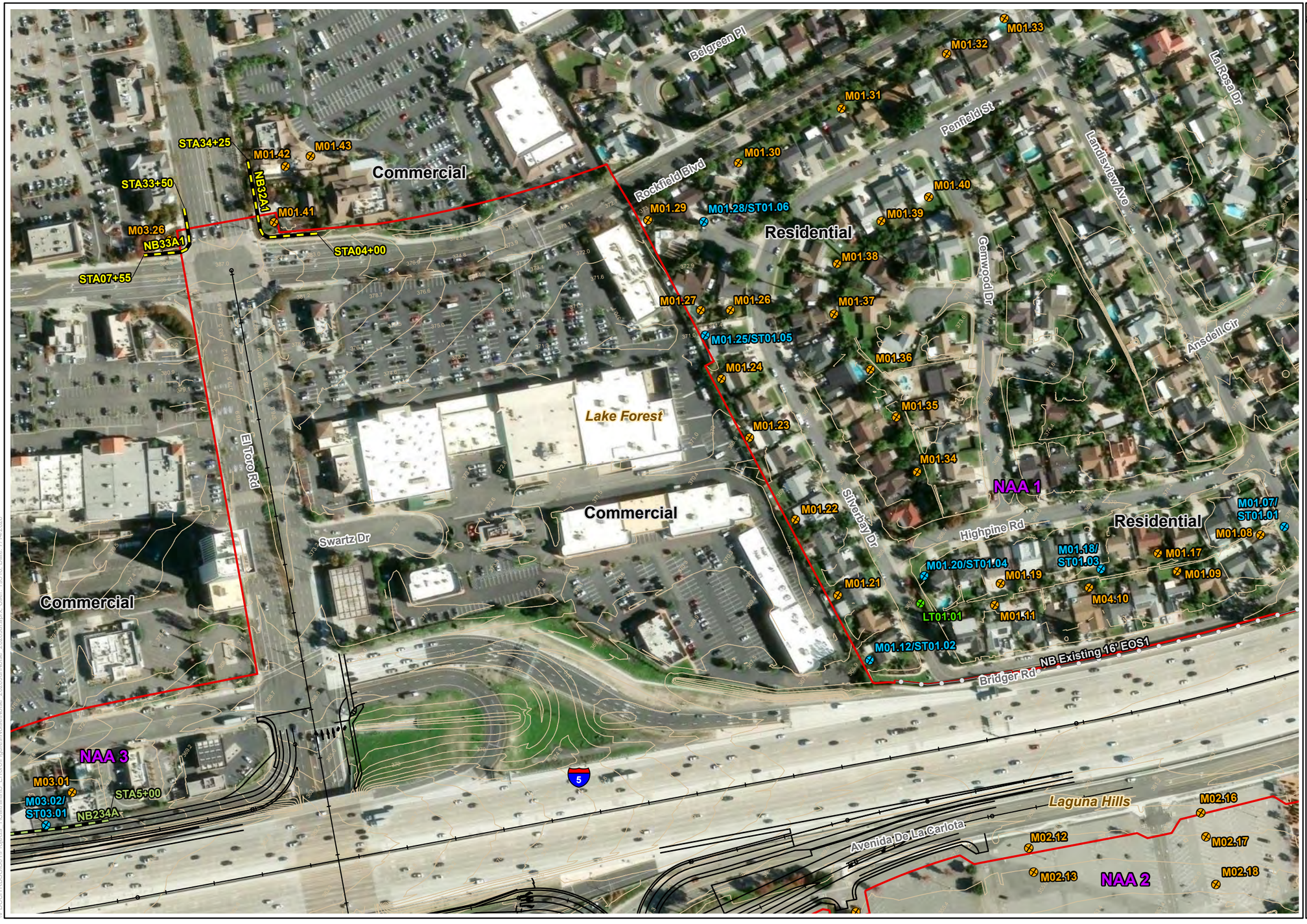


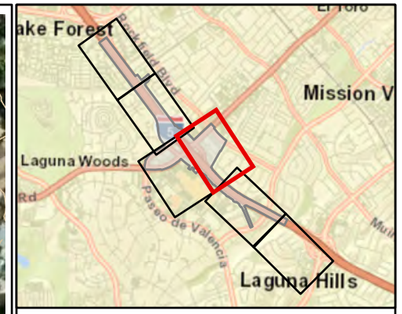
Legend

- Limits of Disturbance
- Long-term Noise Measurement Location
- Modeled Receiver Location/ Short-term Noise Measurement Location
- Modeled Receiver Location
- Feasible and Reasonable
- Feasible and Not Reasonable
- Existing Barriers
- Project Layout

0 100 200 Feet
1:2,400

Figure 2.3.6-2, Sheet 2 of 6
Noise Measurement and Modeling Locations, and Evaluated Noise Barriers - Alternative 1
Interstate 5 El Toro Road Interchange Project



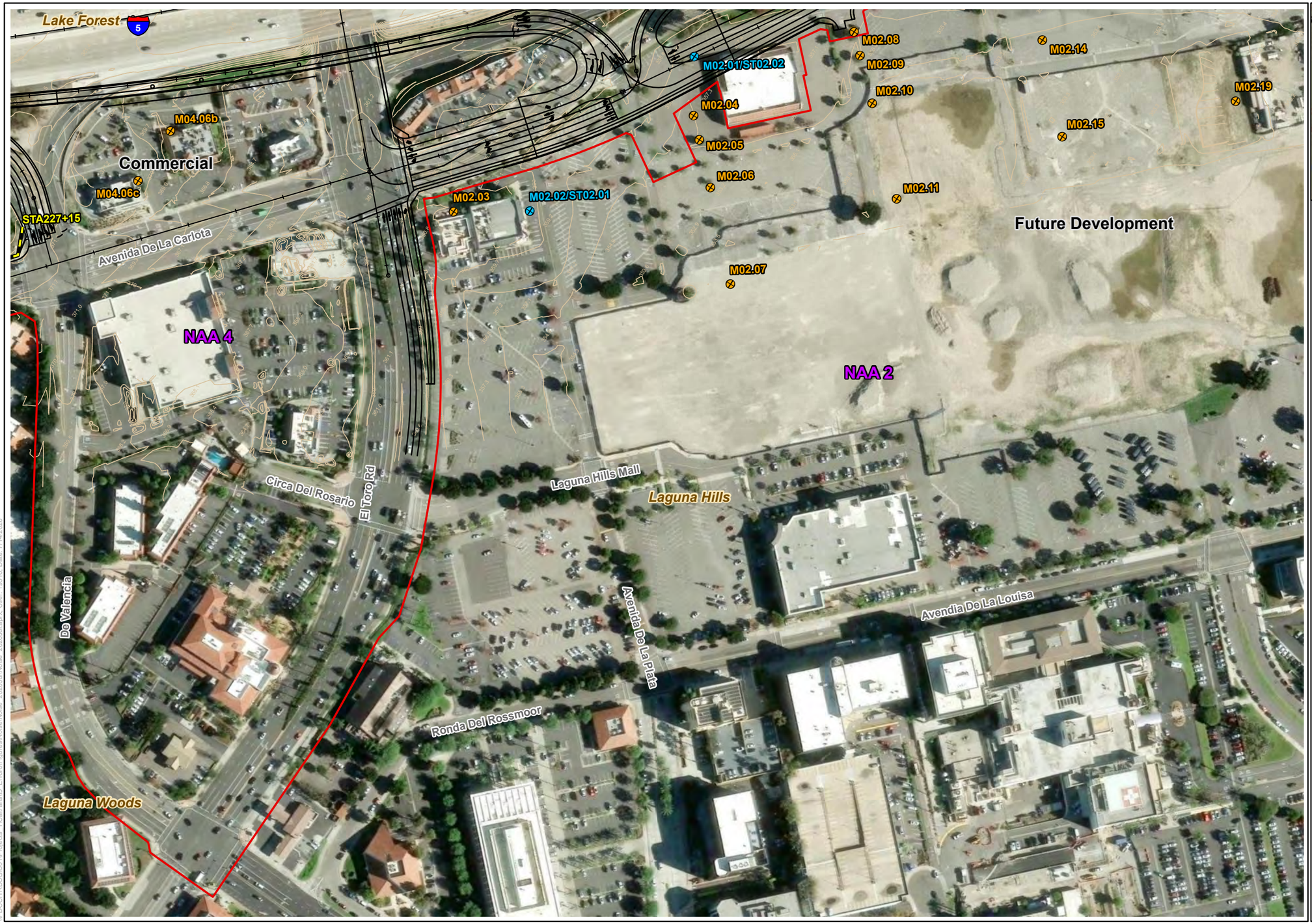


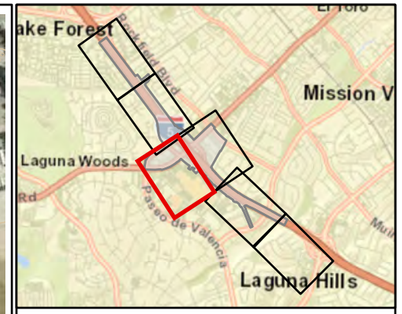
Legend

- Limits of Disturbance
- Long-term Noise Measurement Location
- Modeled Receiver Location/ Short-term Noise Measurement Location
- Modeled Receiver Location
- Feasible and Reasonable
- Feasible and Not Reasonable
- Existing Barriers
- Project Layout

0 100 200 Feet
1:2,400

Figure 2.3.6-2, Sheet 3 of 6
Noise Measurement and Modeling Locations, and Evaluated Noise Barriers - Alternative 1
Interstate 5 El Toro Road Interchange Project



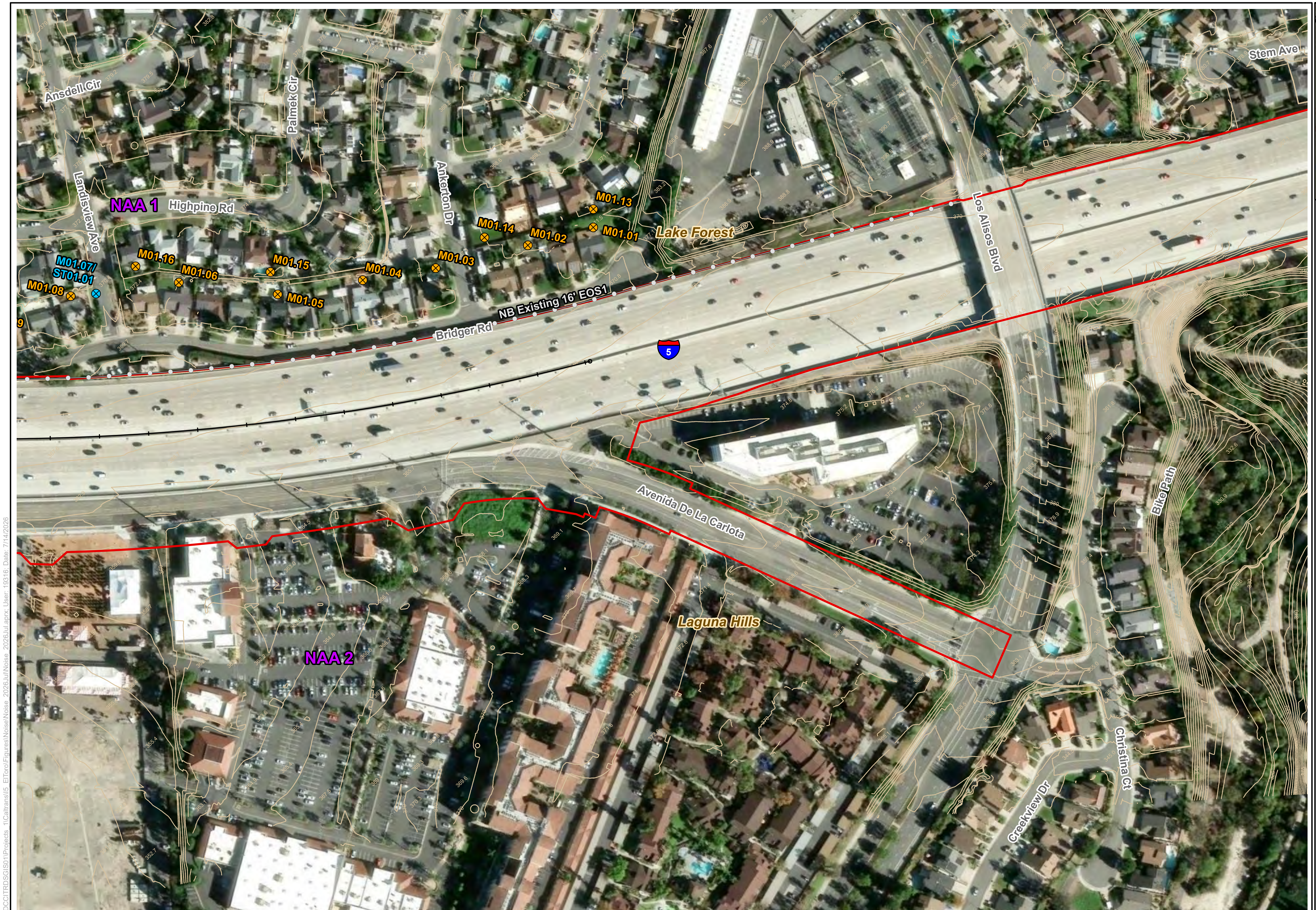


Legend

- Limits of Disturbance
- Long-term Noise Measurement Location
- Modeled Receiver Location/ Short-term Noise Measurement Location
- Modeled Receiver Location
- Feasible and Reasonable
- Feasible and Not Reasonable
- Existing Barriers
- Project Layout

0 100 200 Feet
1:2,400

Figure 2.3.6-2, Sheet 4 of 6
Noise Measurement and Modeling Locations, and Evaluated Noise Barriers - Alternative 1
Interstate 5 El Toro Road Interchange Project



Legend

- Limits of Disturbance
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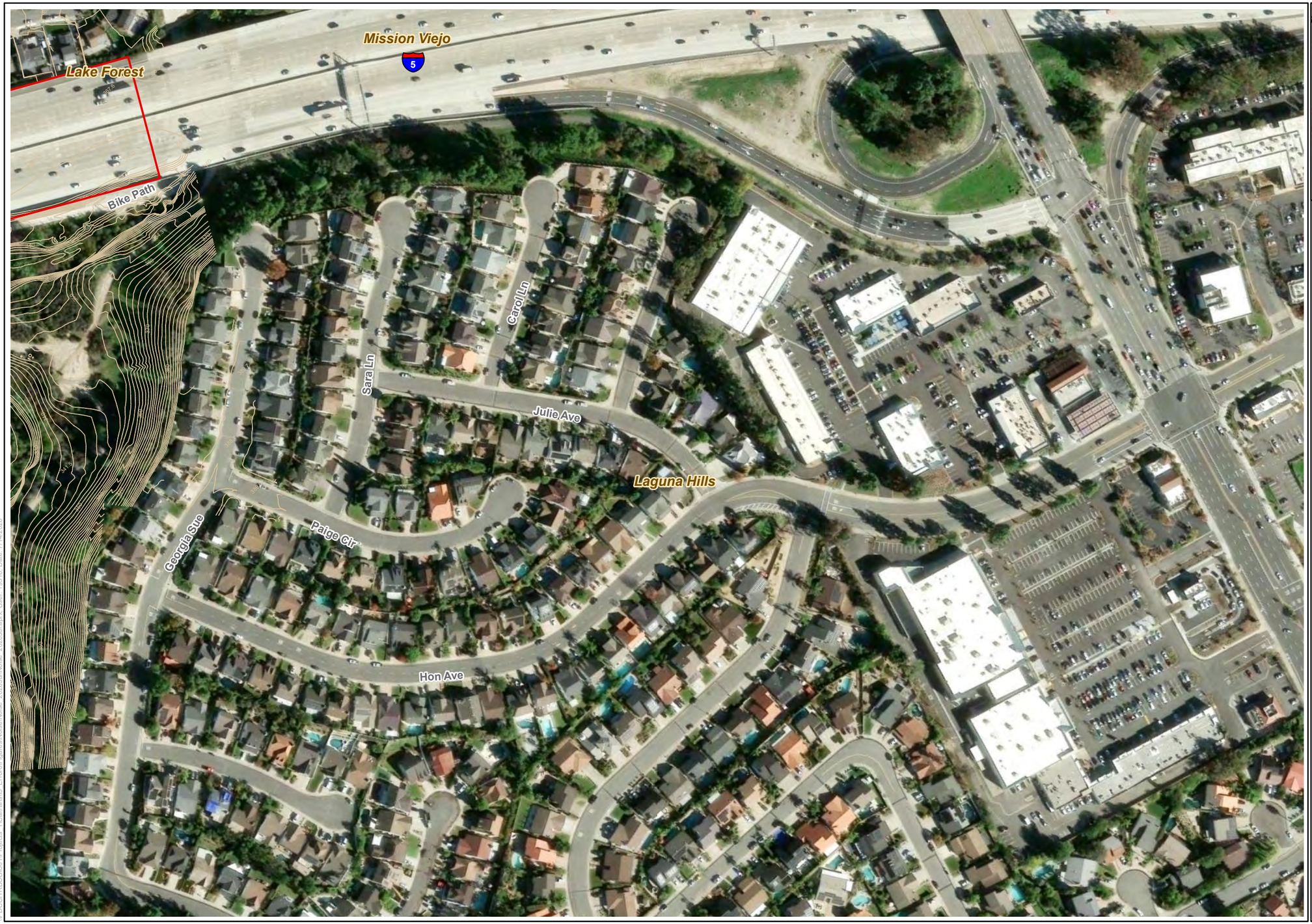
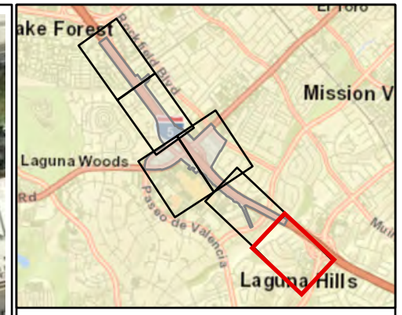
- Feasible and Reasonable
- Feasible and Not Reasonable
- Existing Barriers
- Project Layout

0 100 200 Feet
1:2,400

Figure 2.3.6-2, Sheet 5 of 6
Noise Measurement and Modeling Locations, and Evaluated Noise Barriers - Alternative 1
Interstate 5 El Toro Road Interchange Project





Legend

- Limits of Disturbance
- Long-term Noise Measurement Location
- Modeled Receiver Location/ Short-term Noise Measurement Location
- Modeled Receiver Location
- Feasible and Reasonable
- Feasible and Not Reasonable
- Existing Barriers
- Project Layout

0 100 200 Feet
1:2,400

Figure 2.3.6-2, Sheet 6 of 6
Noise Measurement and Modeling Locations, and Evaluated Noise Barriers - Alternative 1
Interstate 5 El Toro Road Interchange Project

Summary of Abatement

The Project would incorporate Project Feature PF-N-1, outlined in Section 2.3.6.3, which is a standard measure for all Caltrans projects, to help address potential temporary noise impacts. Based on the studies completed to date, Caltrans intends to incorporate noise abatement in the form of the following noise barriers, which may change after input from the public:

- Noise Barrier 234A1, at the northbound on-ramp and mainline edge of shoulder in NAA 3, from on-ramp station 09+24 (equivalent to mainline station 229+24) to mainline station 245+00, with a total length of approximately 1,576 feet and a height of 16 feet. Calculations based on preliminary design data show that the barrier will reduce noise levels by 5 to 7 dBA L_{eq}(h) for 14 benefited receptors at a cost of $2,378,268.
- Noise Barrier 235A1, at the southbound mainline edge of shoulder and off-ramp in NAA 4, from mainline station 262+00 to southbound off-ramp station 02+00, with a total length of approximately 3,484 feet and heights of 16 to 20 feet. Calculations based on preliminary design data show that the barrier will reduce noise levels by 5 to 7 dBA L_{eq}(h) for 59 to 83 benefited receptors at a cost of $9,206,157 to $12,596,750.

Noise Barrier 234A1 and 235A1 were evaluated for potential noise reflection effects in accordance with the Protocol. The evaluation determined that the reflected noise criteria would be met between Noise Barrier 234A1 and Noise Barrier 235A1, and between the existing property line barrier along Avenida de la Carlota and Noise Barrier 235A1. To minimize reflected-noise effects, Noise Barrier 234A1 and 234A1 will incorporate an acoustically absorptive surface with a noise reduction coefficient of 0.80 or greater, consistent with Caltrans guidance.

In accordance with Section 5 of the Protocol, the noise impact analysis presented in this document is based on a preliminary design. If the Project design changes in such a way that the acoustical performance of the barriers is affected, the barrier design will be modified to achieve the barrier performance outlined in this document. If, during final design, conditions change substantially, noise abatement may not be necessary. The final decision on noise abatement will be made upon completion of the Project design.

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