45dB Acoustics, LLC

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45dB Project 24003

Project & Address:	**Planner:**	**Owner, Client to be Invoiced:**
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Summary

In this report, 45dB Acoustics, LLC ("**45dB**") has described and acoustically modeled typical amplified music sound levels for the proposed indoor events to be held at the proposed Anthem Church sanctuary building at 6595 Covington Way in Goleta, California. We have evaluated the expected amplified music events against the city of Goleta's Municipal Code and Noise Element of the General Plan as well as the potential impact of construction/demolition noise and groundborne vibration on neighboring properties.

Utilizing the 3D noise modeling software SoundPLAN® to model sound level contours, we have concluded that sound levels for a 3 hours of church services during daytime hours (between 7am and 7pm) held inside the proposed Sanctuary building would not exceed the CNEL 65 dBA limit of the Goleta Noise Element at the property lines of nearby noise-sensitive land uses and will comply with the City's Municipal Code. This project will not require mitigation, and the roll-up exterior doors that open to the southeast may be open or closed.

Anthem Church is not proposing any events with outdoor amplification; no outdoor amplification is included in this study.

Construction noise and vibration are expected to be short-term and less than significant. Disregarding the Fire Station as a sensitive receiver, we conclude, based on typical construction equipment use and phasing, that no mitigation is required for construction.

Please contact us with any questions.

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1 Introduction

This sound level assessment is intended to determine the potential noise impacts associated with amplified music for indoor events at Anthem Church in Goleta, California. The following topics are presented in this report in response to the City's requirements for exterior noise levels, as identified by the City's Municipal Code and the Noise Element of the General Plan. The following factors are considered:

- The topographical relationship of amplified noise sources and the nearby potential sensitive receptors
- Identification of noise sources and their characteristics, and evaluation of predicted sound levels at the site's property lines
- Factors affecting sound level prediction at the property line, noise attenuation measures to be applied (if any), and analysis of the noise propagation considering the physical layout of the built environment
- Noise attenuation measures to be applied, if needed
- Information on fundamentals of noise and vibration to aid in interpreting the report (see Appendix, Section 10)

The proposed Project is to be located at 6595 Covington Way in Goleta, CA. The Project's location is shown in Figure 1, highlighted in yellow. Surrounding land uses[1] include Residential, Recreation, Public, and Agriculture (Figure 2). There is an existing, operating church at the northeast corner of the property (Christ Lutheran). Single family housing exists to the north across Covington Way, and County Fire Station #14 lies to the south and adjacent the proposed church. Anthem Church is seeking a Minor Conditional Use Permit to subdivide the property and build a new 2-story church/sanctuary with classrooms/daycare, parking lot and accessory structures. Outdoor patios, play yards and passive recreation areas are included.

The site plan, provided by the Client, is shown in Figure 3. The proposed sanctuary building will be located at the southeast corner of the property. We understand indoor events will occur in the sanctuary, which has four large garage/roll-up doors that open on the southeast side of the building.

2 Regulatory Setting – Local Regulations

2.1 Municipal Code

The Goleta Municipal Code[2] describes the various types of noise, including amplified sounds and music, that are prohibited during nighttime hours, which are between 10pm and 7am. Exemptions to the noise restrictions include: "*Religious Noises. Singing, music, bells, chimes, carillons, and similar noises made for religious purposes, or in conjunction with religious services, or for celebrations of public holidays*."

[1] City of Goleta - Mapping, Land Use. https://goleta.onlinegovt.com/mapping/results
[2] City of Goleta Municipal Code, Chapter 9.09 *Noise Restrictions.* https://ecode360.com/44351744

2.2 Noise Element

The Goleta Noise Element[3] states that noise levels up to CNEL 65 dBA at sensitive receiver locations (i.e., residential, schools, churches, etc.) are conditionally acceptable. The Noise Element also includes field noise measurements (Figure 4) that were conducted in 2003 for selected sites, including this project site for which the measured sound level labeled as L_{eq} was 49.5 dBA. It is unknown if the levels reported in this Noise Element table were a CNEL or simply an equivalent sound level of some undefined time integration period (e.g., hourly). Moreover, the exact location on site and distance from the road is not defined in the Noise Element, which makes a direct comparison to our study impossible.

The Community Noise Equivalent Level, "CNEL", is a 24-hour equivalent level that includes a 5 dB penalty for evening (7 – 10pm) hourly levels and a 10 dB penalty for nighttime (10pm – 7am)hourly levels. CNEL and L_{dn} (or DNL) typically agree within 1 dB and are considered approximately equivalent in this study. (See the Appendix for more background information about sound levels.)

For the purpose of this study, in addition to the residential land uses to the north of the project site (300ft or more away from the new church), we also conservatively consider several nearby properties – the Stow House (approx.. 350 ft away), Goleta Valley Historical Society (approx. 250 ft away), and the South Coast Railroad Museum (approx.. 350 ft away) – to be sensitive receptors, specifically during daytime and evening hours as these buildings are not used for residential or lodging.

2.3 Santa Barbara County Thresholds and Guidelines

The City of Goleta adopted the County's Environmental Thresholds and Guidelines Manual[4]. Part B, Section 2, *Planning Policies,* states that CNEL 65 dBA is the maximum allowed exterior noise exposure for noise-sensitive land uses, which include residential dwellings, unless mitigation is provided; this requirement is consistent with Goleta's Noise Element. The Threshold requirement is shown in Figure 5.

3 Site Measurements

3.1 Existing Ambient Noise Level Measurements

Sound levels (L_{eq}, L_{max}, L_{min}, etc.) have been measured by **45dB** near the project site, at the location shown in Figure 6, for more than a 24-hour period on February 6 – 7, 2024. This location was chosen primarily to characterize the road traffic noise from N Los Carneros Road, which we deem the primary/dominant noise source for the area based on our engineering judgement and direct observation while on site. A Type/Class 2 calibrated sound level meter and calibrator was utilized. Calculation of the CNEL, $L_{eq,d}$ (daytime), $L_{eq,e}$ (evening), and the $L_{eq,n}$ (nighttime) sound levels are calculated from 1-sec Leq measurement data. Church activities were minimal/negligible for the measurement period and, as such, this is considered a representative measurement of the site's ambient levels.

[3] Goleta General Plan/Coastal Land Use Plan, Noise Element. https://www.cityofgoleta.org/home/showpublisheddocument/29813/638369386164200000
[4] Santa Barbara County Thresholds and Guidelines Manual.

The hourly measured 24-hour sound levels and time series are shown in Figure 7. The measured CNEL was 62 dBA and daytime hourly level was 61 dBA. The exterior noise level measurement can be utilized to validate and adjust the road noise levels within the SoundPLAN model. See Table 2, in Section 4 for details and comparison to modeled levels.

Local weather was rainy but with low winds; we estimate the wet roads and tires could have increased particularly the daytime levels by as much as 3 dB; however, on a CNEL basis (wherein daytime levels are higher and not penalized for the CNEL calculation) the increase is anticipated to be no more than 2 dB.

3.2 Measurements of Typical Indoor Worship Service

Sound levels during a typical 1.5-hour indoor worship service were measured on March 10, 2024 inside the sanctuary of Anthem's current operating location at Goleta Valley Junior High School at 6100 Stow Canyon Rd, Goleta, CA 93117. The Client, Anthem Church, confirmed that the service instrumentation, programming, and sound levels will be similar to what they intend for the new/proposed sanctuary. The average level (LA_{eq}) for the amplified voice and music period was approximately 90 dBA; for music alone, this was approximately 95 dBA with a maximum (LA_{max}) of 103 dBA. The 1/3-octave band spectra for the measured levels are shown in Figure 8.

4 Noise Propagation Model

SoundPLAN® is a state-of-the-art sound propagation modeling software package that calculates sound levels while taking into account the air and ground attenuation, terrain variation and the built environment, road pavement types, and other relevant factors. The software incorporates the relevant noise propagation standards—for road traffic, this model utilizes the Federal Highway Administration's Traffic Noise Model (TNM), and for other sources, such as the amplified music for events, ISO 9613-2 is utilized in order to accurately calculate noise propagation. Traffic counts for local roads are input to the model to establish an ambient existing noise environment for comparison with, and potential adjustment by, the calculated noise levels due to the Project's proposed noise-generating sources. See the Appendix for more information on this software and its calculation methods. All sound levels in this report are presented in units of A-weighted decibels, dBA, for direct comparison to the applicable regulations.

4.1 Traffic Noise

The 3D outdoor noise propagation software, SoundPLAN, utilizes traffic counts to accurately model/predict the noise levels from roads. Traffic counts are input into SoundPLAN which, by default, apportions the count into vehicle types including automobiles and medium trucks. Traffic counts for Cathedral Oaks were obtained from a traffic safety study conducted for the City of Goleta[5] and counts for Highway 101 were obtained from CalTrans.[6] The counts (see Table 1) were adjusted to the current year, assuming a 1% per year increase in traffic. SoundPLAN apportions the counts into daytime and nighttime hours, and appropriate vehicle speeds are input in order to predict the outdoor noise levels using the Traffic Noise Model.

[5] A Traffic Safety Study Including Systemic Safety Analysis Report and Local Road Safety Plan For The City of Goleta, 2023. https://www.cityofgoleta.org/home/showpublisheddocument/30501/638502392150770000
[6] California Department of Transportation (CalTrans), Traffic Census Program, 2022. https://dot.ca.gov/programs/traffic-operations/census

Table 1: Traffic Count Data and 2024 Projections

Road	Published AADT	Year	Years to Project	2024 AADT Projection with 1% Annual Growth
Cathedral Oaks (W of Los Carneros)	7,228	2019	5	7,597
Highway 101 (E of Los Carneros)	79,000	2022	2	80,588
Highway 101 (W of Carneros)	67,000	2022	2	68,347

Further discussion and detailed noise contours of the existing conditions for the area surrounding the project site can be found in Section 5.

4.2 Proposed Event Sound Levels

An interior sound level of 90 dBA (LAeq) for the 3-hour event was used for the event source (i.e., two loudspeakers) to represent typical amplified music for events in the proposed event areas, which matches the indoor worship service levels measured in Section 3.2. See the Appendix, Section 10.1 for additional context on sound levels. Table 12 also has a general description of sound levels associated with different scenarios to help with understanding levels described in this report.

A particular change—either increase or decrease—of a noise source will result in the same decibel change at a receiver location for a given geometrical setup, including terrain, buildings, etc., assuming other noises can be neglected. Once the resulting levels at the property line are determined, conclusions may be drawn about the compliance of the levels occurring *at the event* and adjusted upward or downward in order to determine levels that should not be exceeded *at the event* in order to remain compliant with the City’s limits *at the specified property lines.*

4.2.1 Indoor Events

For an event inside the sanctuary, the source was modeled as a building radiating sound from the four 10’x12’ open doors on the east side of the building. Levels measured during an (indoor) church service on March 10, 2024, were used to represent typical levels during the service which had an average reverberant sound pressure level (LA_{eq}) of 90 dBA inside the space. Levels radiated to the exterior were modeled conservatively with open doors and three (3) hours of daytime (i.e., held between 7:00am and 7:00pm) event/services. Based on these results, we can also determine whether doors must be closed during events and if, necessary, how much sound attenuation the doors must provide to maintain compliance with the local regulations.

4.2.2 Parking Lots

All events included parking activity for vehicles fully using the two parking lots during each event. Default parking lot noise levels from the SoundPLAN library were utilized. Although we include it to be thorough, the parking lot noise does not significantly contribute further to the sound levels produced by the amplified events.

5 Modeled Ambient Noise Environment

5.1 Existing Ambient Noise Levels

The ambient noise environment, based on the existing road traffic, was modeled and compared to the field measurements conducted by **45dB (**discussed in Section 3). The measured noise levels are expected to be generally representative of the expected sound levels at this location. As shown below in Table 2, the modeled and measured CNEL was within 0.2 dB. Minor differences can be attributed to slight variations in daily traffic.

Table 2: Comparison of Feb 6-7, 2024, Measured Levels with Predicted/Modeled Levels Near Project Site

	CNEL / DNL (dBA)	Daytime Hourly Leq,d (dBA)	Evening Hourly Leq,e (dBA)	Nighttime Hourly Leq,n (dBA)
Measured	62.1	60.9	59.8	52.3
Modeled	61.9	59.7	59.6	52.9

Modeled levels closer to the existing church buildings, presumably near where the field measurements were made in 2003 for the Goleta Noise Element, are approximately CNEL 56-58 dBA, which is about 6-8 dB higher than the 2003 measured level in the Noise Element. This difference could be due to an increase in local traffic/population density over the past 21 years as well as any variations due to the unknown location of the actual/precise measurement location on the property.

5.2 Ambient Noise Levels with Project

Ambient noise levels were modeled with the new church building in place (using existing ambient noise conditions, i.e., no added traffic/parking due to project). Figure 10 shows a 3D view of the acoustic model's geometry with the proposed church building in place. Terrain/elevation data is imported from Google Maps.

Figure 11 shows the existing CNEL noise contours for the area (at a 5-ft height) due to road traffic with the proposed sanctuary building in place. "S1" represents the location where site measurements were taken in February 2024. Levels at selected receiver locations, as indicated in the contour maps, were modeled to determine the ambient levels for comparison with expected levels during the proposed events for locations along the property lines and at the nearest sensitive receptors.

In general, the existing ambient sound levels along the nearest property lines are anticipated to range between CNEL 56-57 dBA. Nearby existing residential properties also have ambient levels of approximately CNEL 56-57 dBA. Table 12 summarizes these levels as well as the levels at the other nearby locations that were considered "sensitive receptors" as part of this study.

6 Modeled Noise Environment with Indoor Events

Using our SoundPLAN 3D model constructed for the existing noise environment, the proposed Project building and parking lot were added to the model along with the proposed 3-hour daytime indoor event to ensure compliance with the local Ordinance.

6.1 Noise Model

As discussed in Section 4.2.1, a typical church service held inside the new Sanctuary building was modeled with an average interior reverberant level of 90 dBA (as measured within the Sanctuary) and the four doors open on the southeast elevation. Levels were modeled during daytime hours for a total of 3 hours. The resulting sound level contours are shown in Figure 12.

6.2 Evaluation of Compliance

With indoor events having an average interior noise level similar to a typical indoor church service and all four doors open, levels are expected to comply at all nearby noise-sensitive locations and at the property lines, as shown below in Table 3. Based on these results, we can conclude that an indoor event can be held for 3 hours within the Sanctuary with the doors open during daytime hours. Three (3) hours is anticipated to be the maximum length of amplified music/voice events for the Church's proposed events.

In addition, because these levels were calculated with the roll-up doors open, we can also conclude that indoor events with closed doors will comply with local regulations, and the doors may be constructed with any type of material.

Table 3: Ambient and Event Noise Levels at Selected Receiver Locations for Indoor Event with Doors Open

Receiver*	Ambient CNEL (dBA)	3-Hour Daytime Indoor Event with Doors Open (Interior LA_{eq} 90 dBA) CNEL (dBA)
FH	57	57
GVHS	57	58
PL-E	57	64
PL-S	56	63
PL-SE	56	60
Res-1	57	57
Res-2	57	57
Res-3	56	56
RR	57	59
SH	58	59

** Receivers in **bold** are considered "sensitive receptors" for this analysis*

For all nearby noise-sensitive locations and at the property lines, CNEL levels are expected to remain below CNEL 65 dBA for all daytime events held for 3 total hours, with the exterior roll-up doors open or closed.

7 Construction and Demolition Noise and Vibration Analysis

7.1 Regulatory Setting

The U.S. government, State of California, and the City of Santa Barbara have established plans and policies that are designed to limit noise exposure at noise sensitive land uses. Plans and policies applicable to construction noise and vibration from the proposed Project include:

1. Federal Transit Administration (FTA)
2. California Department of Transportation (Caltrans)
3. California Environmental Quality Act (CEQA)
4. City of Goleta General Plan/Coastal Land Use Plan, Noise Element

7.1.1 Federal Regulation – Federal Transit Administration (FTA)

When a detailed construction noise assessment is completed for a project's surrounding residential land uses, the FTA[7] recommends that each phase of construction maintains an L_{eq} of 80 dBA (or less) over an 8-hour period during daytime hours. While this is not a requirement, it can be used as a guideline when the local jurisdiction does not specify a limit for construction noise.

7.1.2 State Regulation

7.1.2.1 California Department of Transportation (Caltrans)

Caltrans[8] has provided recommendations on vibration limits for both human annoyance as well as structural integrity of buildings neighboring a construction site. Caltrans characterizes the human response to vibration as "distinctly perceptible" at PPV levels greater than 0.25 in/sec for transient sources and 0.04 in/sec for continuous sources (Table 4). To prevent structural damage in older residential buildings, Caltrans recommends transient vibration levels of no more than a PPV (peak particle velocity) of 0.5 in/sec or 0.3 in/sec for continuous or frequent sources, as shown in Table 5.

Table 4: CalTrans Guidelines for Vibration Annoyance Potential Criteria

Human Response	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Barely perceptible	0.04	0.01
Distinctly perceptible	0.25	0.04
Strongly perceptible	0.9	0.10
Severe	2.0	0.4

Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

Table 5: CalTrans Guidelines for Vibration Damage Potential Threshold Criteria

Structure and Condition	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

[7] Federal Transit Administration, Transit Noise and Vibration Impact Assessment Manual, September 2018. https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf

[8] California Department of Transportation, Transportation and Construction Vibration Guidance Manual, April 2020. https://dot.ca.gov/programs/environmental-analysis/noise-vibration/guidance-manuals

7.1.3 Local Regulation – City of Goleta Noise Element

The City of Goleta Noise Element is intended to provide goals and policies that ensure undesirable noise, e.g., construction noise, does not create an unacceptable noise environment. The Noise Element addresses the impact of construction noise on the sensitive receivers surrounding the Project site as part of "Policy NE 6: Single-Event and Nuisance Noise".

Policies to address "Nuisance Noise" from construction activity include the following requirements:

1. Restricting construction hours to Monday through Friday, 8:00 am to 5:00 pm, with no construction activity on weekends or state holidays,
2. Employing sound-control devices and muffling exhaust systems on all construction equipment,
3. Implementing mitigation measures such as relocating stationary equipment away from sensitive receivers, shutting off idling equipment, and installing acoustic barriers around noise sources, as needed, and
4. Maintaining buffers between equipment and sensitive receivers so that the noise level at the receiver sites does not exceed 65 dB CNEL.

7.2 Modeled Existing Ambient Noise Environment

As described previously in Sections 3.1 and 5.1, existing ambient levels around and across the Project site were measured and predicted using SoundPLAN. The resulting modeled sound level contours for the traffic noise around the existing site are shown in Figure 9. Levels at selected locations surrounding the site are shown below in Table 6. Daytime hourly levels are generally quiet, ranging from 53 to 56 dBA.

Table 6: Modeled Existing Ambient Levels at Selected Neighboring and Sensitive Receiver Locations

Receiver	Distance to Site Boundary (ft)	Distance to Project Center (ft)	CNEL (dBA)	Daytime Hourly $L_{eq,d}$ (dBA)	Evening Hourly $L_{eq,e}$ (dBA)	Nighttime Hourly $L_{eq,n}$ (dBA)
FH	0	220	56	53	53	47
GVHS	165	430	57	55	55	49
PL-E	0	170	56	54	54	48
PL-S	0	220	57	54	54	48
PL-SE	0	250	57	54	54	48
Res-0	60	290	59	56	56	50
Res-1	210	335	57	54	54	49
RR	190	405	57	55	54	49

Receiver "FH" is located nearest to the project site and is on the southern site boundary. The fire station building is located approximately 10 feet from the project boundary. Receiver "Res-0" is the nearest residential (sensitive) receiver, located 60 feet from the north Project site boundary.

7.3 Expected Project Construction and Demolition Noise and Vibration

7.3.1 Construction Phasing

Construction of the proposed Project would generate noise that may temporarily increase noise levels at nearby residential receivers and other sensitive receptors. Noise impacts resulting from construction depend on the noise generated by various pieces of construction equipment operating on site, the timing and duration of noise generating activities, and the distance between construction noise sources and noise sensitive receptors. Construction of a project such as this would typically involve site improvements, excavation, construction of foundations, building framing, paving, and landscaping. The hauling of excavated material and construction materials would generate truck trips on local roadways. Blasting or pile-driving is generally not expected for this project.

Construction activities for a large project such as this are typically carried out in phases. During each phase of construction, there would be a different mix of operating equipment. Construction noise levels would vary by phase and vary within the phases based on the amount of equipment in operation and location where the equipment is operating. Typical phases of construction and the associated larger equipment used for each phase are shown in Table 7 below.

Table 7: Typical Construction Equipment Used for Each Project Phase

Phase / Scope of Work	Anticipated Large Equipment
Grading	Dump Truck, Dozer, Backhoe
Utilities	Backhoe, Mini Excavator
Foundations and Pads	Concrete Mixer Truck, Concrete Pump
Framing	Forklift, Compressor
Driveways	Concrete Mixer Truck, Concrete Pump

7.3.2 Equipment Noise

Construction activity will typically generate varying levels of noise throughout the construction phase, depending on location, equipment types, duration, and quantity of units in use. Typical maximum/instantaneous (L_{max}) noise levels produced by various types of construction equipment, measured at 50 feet from the source, are shown in Table 8. Levels range from about 80 to 90 dBA L_{max} at a distance of 50 feet. The overall hourly noise levels (L_{eq}) as well as the cumulative CNEL at a neighboring sensitive receptor are determined by the usage factor (percent of time each piece of equipment is expected to be in use during an 8-hour workday), distance between the equipment and receptor, and the quantity and types of equipment in use during the construction phase.

Table 8: Construction Equipment 50-ft Noise Emission Levels

Equipment	Typical Noise Level 50 ft from Source, dBA
Air Compressor	80
Backhoe	80
Ballast Equalizer	82
Ballast Tamper	83
Compactor	82
Concrete Mixer	85
Concrete Pump	82
Concrete Vibrator	76
Crane, Derrick	88
Crane, Mobile	83
Dozer	85
Generator	82
Grader	85
Impact Wrench	85
Jack Hammer	88
Loader	80
Paver	85
Pile-driver (Impact)	101
Pile-driver (Sonic)	95
Pneumatic Tool	85
Pump	77
Rail Saw	90
Rock Drill	95
Roller	85
Saw	76
Scarifier	83
Scraper	85
Shovel	82
Spike Driver	77
Tie Cutter	84
Tie Handler	80
Tie Inserter	85
Truck	84

**Source: Federal Transit Administration, Transit Noise and Vibration Impact Assessment Manual*

Construction-generated noise levels generally drop off at a rate of about 6 dBA per doubling of distance between the source and receptor. Shielding by buildings or terrain will result in lower construction noise levels at distant receptors.

Impacts from construction noise primarily occur when construction activities are in progress during noise-sensitive times of the day (early morning, evening, or nighttime hours), when construction occurs in areas immediately adjoining noise sensitive land uses, or when construction phases last over extended periods of time.

7.3.3 Expected Noise Levels

Noise levels for typical construction equipment are shown below in Table 9, along with the expected maximum noise level at the closest sensitive receiver (i.e., receiver "Res-0" from Table 6, which is located approximately 50 feet from the south Project site boundary), as well as at the center of the construction site. We understand that the Fire Station is not to be considered a sensitive receiver for the purposes of construction noise evaluation.

Table 9: Maximum Construction Equipment Noise Levels

Equipment	Reference L_{max} (dBA) *At a distance of 50 ft*	L_{max} (dBA) *At Fire Station "FH" (50-ft)*	L_{max} (dBA) *At closest residential receiver (290-ft)*
Excavator	85	83	70
Tractor / Loader / Backhoe	84	82	69
Bulldozer	85	83	70
Dump Truck	84	82	69
Scraper	85	83	70
Water Truck	84	82	69
Crane	85	83	70
Forklift	80	78	65
Pickup Truck / ATV	55	53	40
Welder	73	71	58
Concrete Mixer Truck	85	83	70
Roller	85	83	70

As shown, the maximum construction noise levels at the closest residential receiver "R0" are expected to reach up to 70 dBA, depending on equipment used and its location within the project site. Construction equipment rarely operate continuously throughout the day or along the project boundary and the overall noise levels at these locations will generally be lower.

Disregarding the Fire Station and instead using the residential receiver R0 as the nearest sensitive receiver, we can make an assumption on construction usage factor, i.e., percentage of operating time, and arrive at a conclusion about predicted construction noise levels. For Lmax levels at this receiver of 70 dBA, the equipment could operate 100% of 4 daytime hours and 50% of the other 9 daytime hours and still be slightly under CNEL 65 dBA. We feel this is a conservatively high estimate of equipment usage, and actual CNEL levels on a given day are most likely going to be well under these levels most of the time. Since construction noise levels are expected to remain below CNEL 65 dBA at the nearest residential receiver, **no mitigation measures are required for construction noise.**

7.4 Construction Equipment Vibration

7.4.1 Typical Equipment Vibration Levels

Although construction activities at this project site are not expected to produce high levels of vibration, such as blasting or pile driving, some project equipment may produce vibration levels that should be evaluated for potential impact on sensitive receptors. Construction equipment at this site is expected to include bulldozers, vibratory rollers, and loaded trucks. Vibration source amplitudes for typical construction equipment, as measured at a distance of 25 feet, are shown below in Table 10.

Table 10: Construction Equipment Vibration Source Amplitudes

Equipment	Reference PPV at 25 ft. (in/sec)
Vibratory roller	0.210
Large bulldozer	0.089
Caisson drilling	0.089
Loaded trucks	0.076
Jackhammer	0.035
Small bulldozer	0.003
Crack-and-seat operations	2.4

Sources: Federal Transit Administration 2018 (except Hanson 2001 for vibratory rollers) and Caltrans 2000 for crack-and seat-operations.

7.4.2 Expected Vibration Levels

The nearest sensitive receptor to the construction site, "R0", is located 290 feet from the perimeter of the project site. Based on the reference values in Table 10 and the distance from the vibration sources, we calculate that loaded trucks would have a PPV level of 0.005 in/sec, which is well below the 0.24 in/sec criteria for human annoyance due to transient vibration sources and **will not require mitigation**. *There will be no crack-and-seat operations at this site.*

Table 11: Construction Vibration Levels at Nearest Off-Site Structure (Fire Station)

Equipment	PPV at 10-ft (in/sec)	Distance required to avoid exceeding PPV 0.24 in/sec (for human annoyance)	Distance required to avoid exceeding PPV 0.50 in/sec (for structural damage)
Vibratory roller	0.005	23 ft	14 ft
Large bulldozer	0.002	13 ft	8 ft
Caisson drilling	0.002	13 ft	8 ft
Loaded trucks	0.002	12 ft	7 ft
Jackhammer	0.001	7 ft	4 ft
Small bulldozer	0.000	1 ft	1 ft

8 Conclusion

Utilizing the 3D noise modeling software SoundPLAN® to model sound level contours, we have concluded that sound levels for a typical 3-hour church service during daytime hours (between 7am and 7pm) held inside the proposed Sanctuary building would not exceed the CNEL 65 dBA limit of the Goleta Noise Element at the property lines of nearby noise-sensitive land uses and will comply with the City's Municipal Code. This project will not require mitigation, and the roll-up exterior doors that open to the southeast may be open or closed.

Because it is difficult for anyone to identify source levels as described in this report, event sound levels may be monitored to ensure compliance with the Ordinance. In Section 10.6 of the Appendix, we describe some commercially available tools that laypeople and owners, DJ's, and others may use to self-manage and accurately measure and control sound levels created at these events.

Construction noise and vibration are expected to be short-term and less than significant; mitigation is therefore not required. Recommendations for noise management have been provided; if our assumptions on equipment types or usage are inaccurate, re-evaluation may be needed..

The conclusions and recommendations of this acoustical analysis are based upon the information known to 45dB Acoustics, LLC ("**45dB**") at the time the analysis was prepared concerning the proposed site plans, traffic volumes, proposed project-related sound source and hours of operation, and reference noise level data. Any significant changes to these factors will require a reevaluation of the findings of this report. Additionally, any significant future changes in equipment, noise regulations or other factors beyond **45dB**'s control may result in long-term noise results different from those described by this analysis.

9 Figures

Figure 1: Site View (Google Maps)

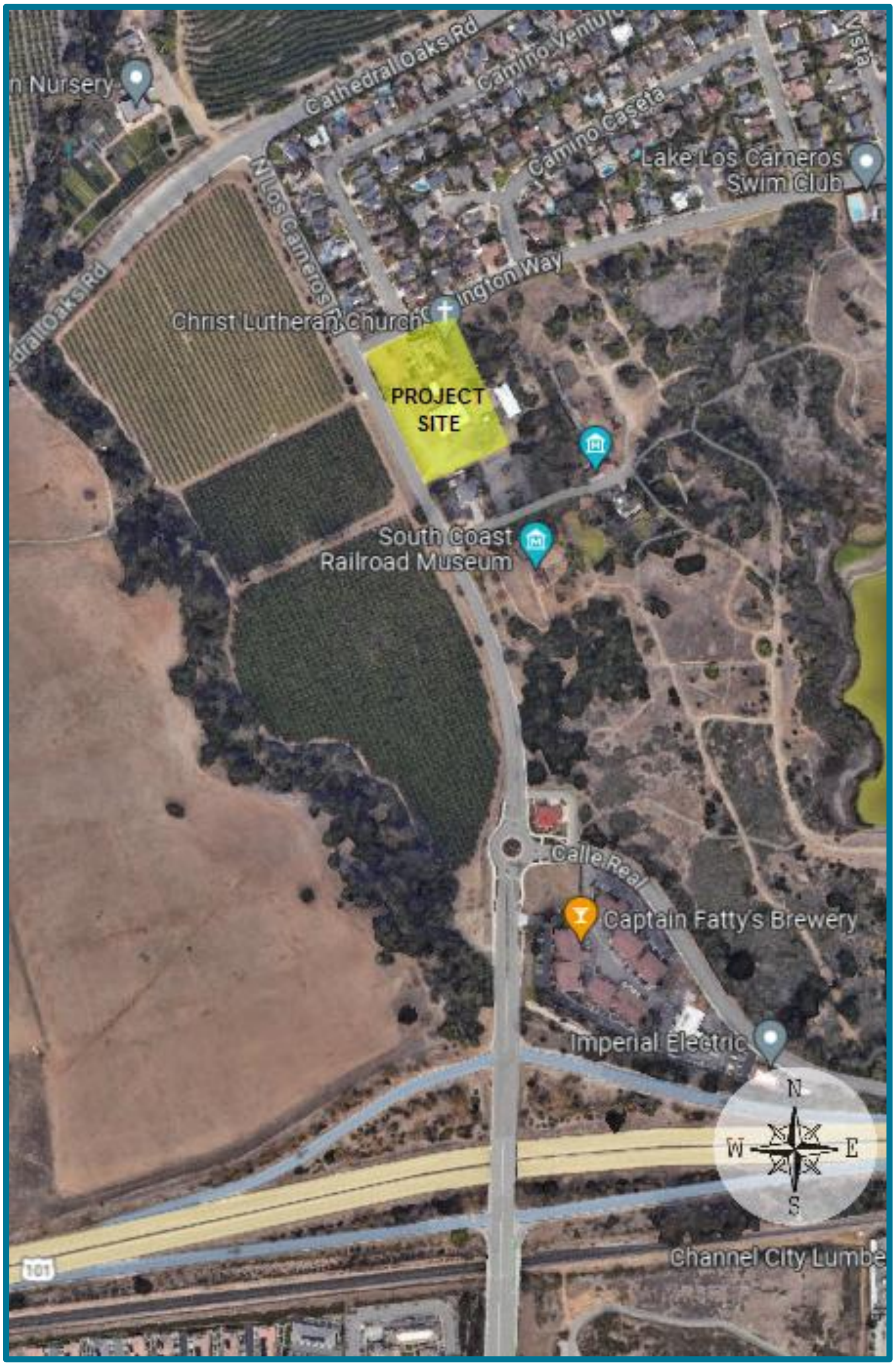


Figure 2: Project Site (outlined in blue) and Surrounding Land Uses

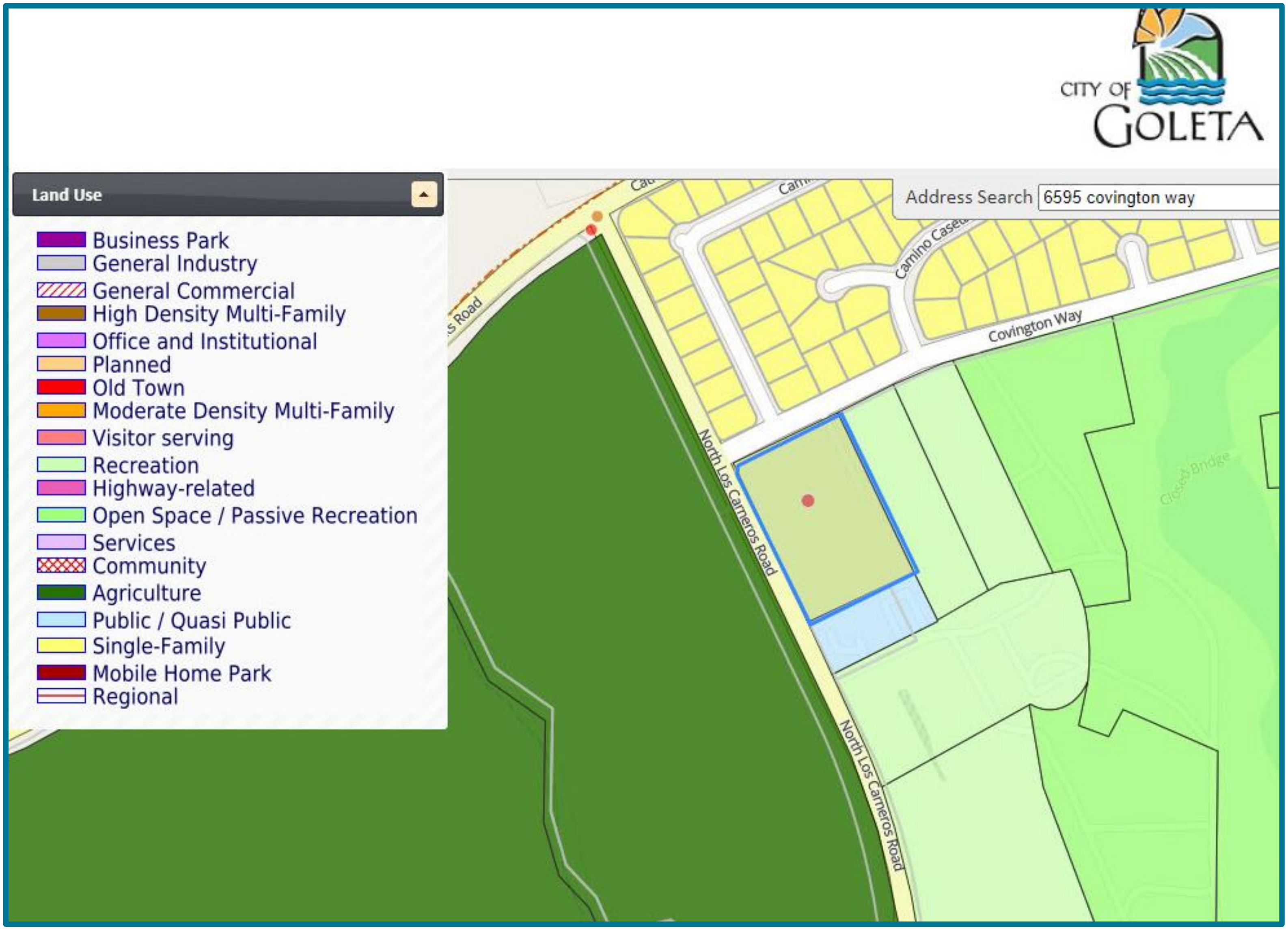


Figure 3: Project Site Plan (from client drawings)

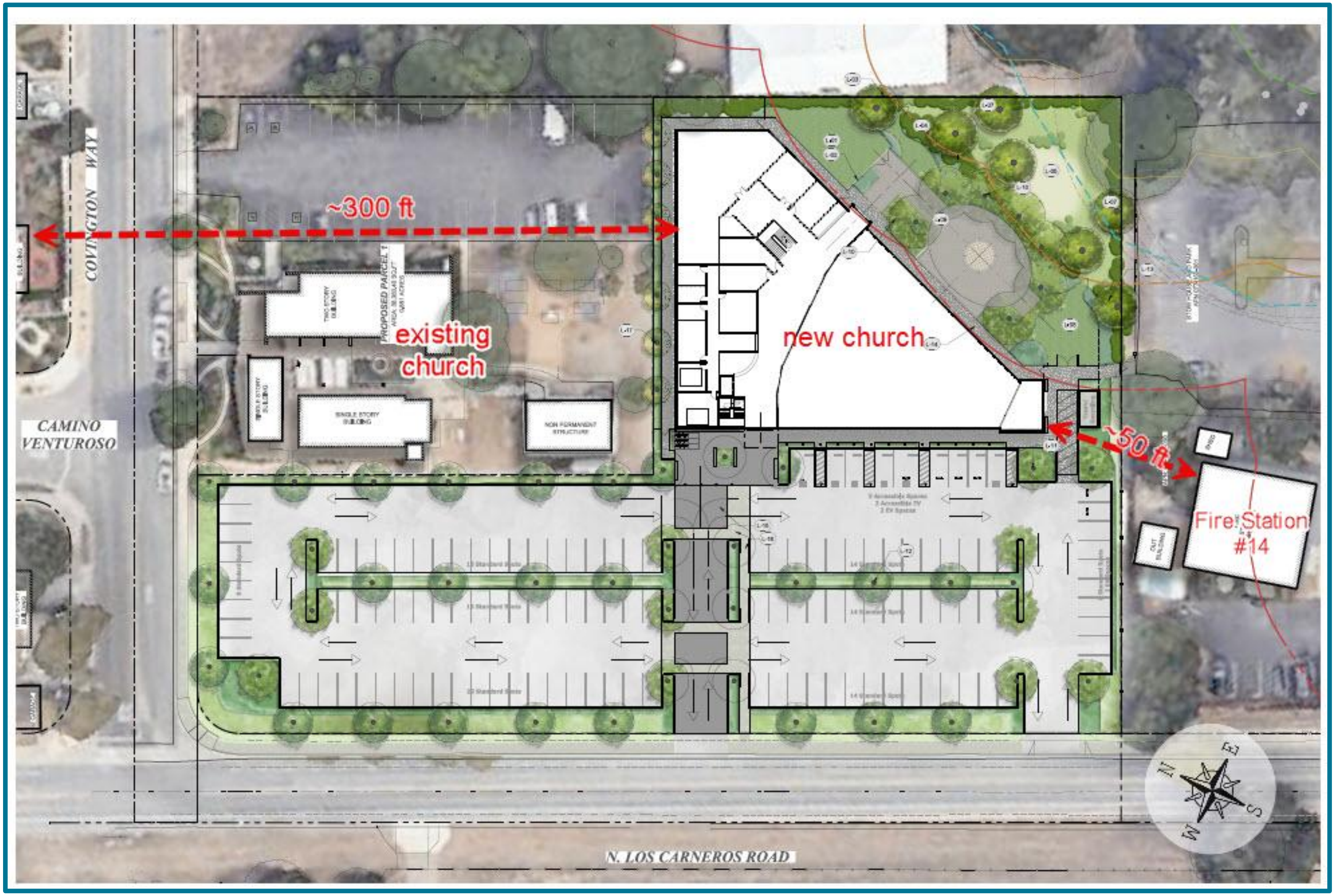


Figure 4: Goleta Noise Element, Field Noise Measurements (reprinted)

TABLE 9-1
FIELD NOISE MEASUREMENTS AT NOISE SENSITIVE LOCATIONS

Site No.	Category	Sensitive Receptor	Leq dBA
1	Residential	Winchester Commons	54.5
2	Residential	Santa Barbara West Mobile Home Park	55.4
3	School	Evergreen Discovery/Learning Center: Brandon Elementary School	50
4	Church	El Camino Presbyterian Church	58.8
5	School	El Rancho Elementary School	44.1
6	School	Dos Pueblos High School	55.5
7	Church	Christ Lutheran Church of Goleta ELCA	49.5
8	School	La Patera	47.8
9	School	Goleta Valley Junior High/Santa Barbara Charter School	53.7
10	Church	Goleta Presbyterian Church/Presbytery of Santa Barbara (also Care Unit in back)	56.3
11	Church	Goleta Valley Church	52.9
12	School	Montessori Center School	51.9
13	Church	Jehovah's Witnesses	46.6
14	Church	Live Oak Unitarian Universalist Congregation	49.1
15	Library	Goleta Library	50.1
16	Church/Child care	Good Shepherd Lutheran Church and Preschool	57
17	School	Coastline Christian Academy	54.2
18	Church	South Coast Church	51.2
19	School	Kellogg School	48.8
20	Church/Child care	Cambridge Drive Baptist Church/Goleta Valley Nursery School	48.8
21	Church	Church of Jesus Christ of Latter-Day Saints/LDS Institute of Religion	51.3
22	Retirement	Maravilla Senior Complex	57.5
23	Hospital	Goleta Valley Cottage Hospital	54.2
24	Church	Saint Raphael's Church and K–8 School	59.8
25	Residential	Rancho Goleta Mobile Home Park	55.2
26	Community center	Goleta Valley Community Center	62.3
27	Child care	United Boys and Girls Clubs of Santa Barbara County	48.3
28	Residential	Old Town Residential Area	60.7
29	Residential	University Mobile Home Park	59.5
30	Child care	Kinder Care	51.4
31	Child care	Village Park Child Care Center	64.8
32	Residential	Sesame Tree Apartments	65.5
33	Church	Jubilee Christian Church	61.3
34	Residential	Wayside Village (Mobile Home Park)	62.4
35	Residential	Rancho Mobile Homes	60.1
36	Residential	Santa Barbara Shores	57.8
37	School	Ellwood School	55.1

K–8 = kindergarten through 8th grade
Source: Noise monitoring survey conducted by RBF Consulting on October 13, 14, and 15, 2003.

Figure 5: Santa Barbara County Environmental Thresholds and Guidelines Manual, Section 13.B.3 (excerpt)

3. **Noise thresholds.** The following are thresholds of significance for assisting in the determination of significant noise impacts.

   a. If existing exterior noise levels, including at outdoor living areas, experienced by sensitive receptors is below 65 dB(A) CNEL, and if the proposed project will generate noise that will cause the existing noise levels experienced by the sensitive receptors to exceed 65 dB(A) CNEL – either individually or cumulatively when combined with other noise-generating sources – then the proposed project is presumed to have a significant impact.

   b. If existing exterior noise levels, including at outdoor living areas, experienced by sensitive receptors exceeds 65 dB(A) CNEL, and if the proposed project will generate noise that will cause the existing noise levels experienced by the sensitive receptors to increase by 3 dB(A) CNEL – either individually or cumulatively when combined with other noise-generating sources – then the proposed project is presumed to have a significant impact.

   c. If existing noise levels experienced by sensitive receptors in interior livings areas is below 45 dB(A) CNEL, and if the proposed project will generate noise that will cause the existing noise levels experienced by the sensitive receptors in interior living areas to exceed 45 dB(A) CNEL – either individually or cumulatively when combined with other noise-generating sources – then the proposed project is presumed to have a significant impact.

   d. If existing noise levels experienced by sensitive receptors in interior livings areas exceeds 45 dB(A) CNEL, and if the proposed project will generate noise that will cause the existing noise levels experienced by the sensitive receptors in interior living areas to increase by 3 dB(A) CNEL – either individually or cumulatively when combined with other noise-generating sources – then the proposed project is presumed to have a significant impact.

   e. Noise from grading and construction activity proposed within 1,600 feet of sensitive receptors, including schools, residential development, commercial lodging facilities, hospitals or care facilities, would generally result in a potentially significant impact. According to EPA guidelines (see Figure 2) average construction noise is 95 dB(A) at a 50' distance from the source. A 6 dB drop occurs with a doubling of the distance from the source. Therefore, locations within 1,600 feet of the construction site would be affected by noise levels over 65 dB(A). To mitigate this impact, construction within 1,600 feet of sensitive receptors shall be limited to weekdays between the hours of 8 AM to 5 PM only. Noise attenuation barriers and muffling of grading equipment may also be required. Construction equipment generating noise levels above 95 dB(A) may require additional mitigation.

All noise studies evaluating ambient noise levels and changes resulting from project development should be prepared by licensed acoustical engineers.

Figure 6: Existing Sound Level Measurement Location, Feb 6-7, 2024

Figure 7: 24-Hour Measured Sound Levels

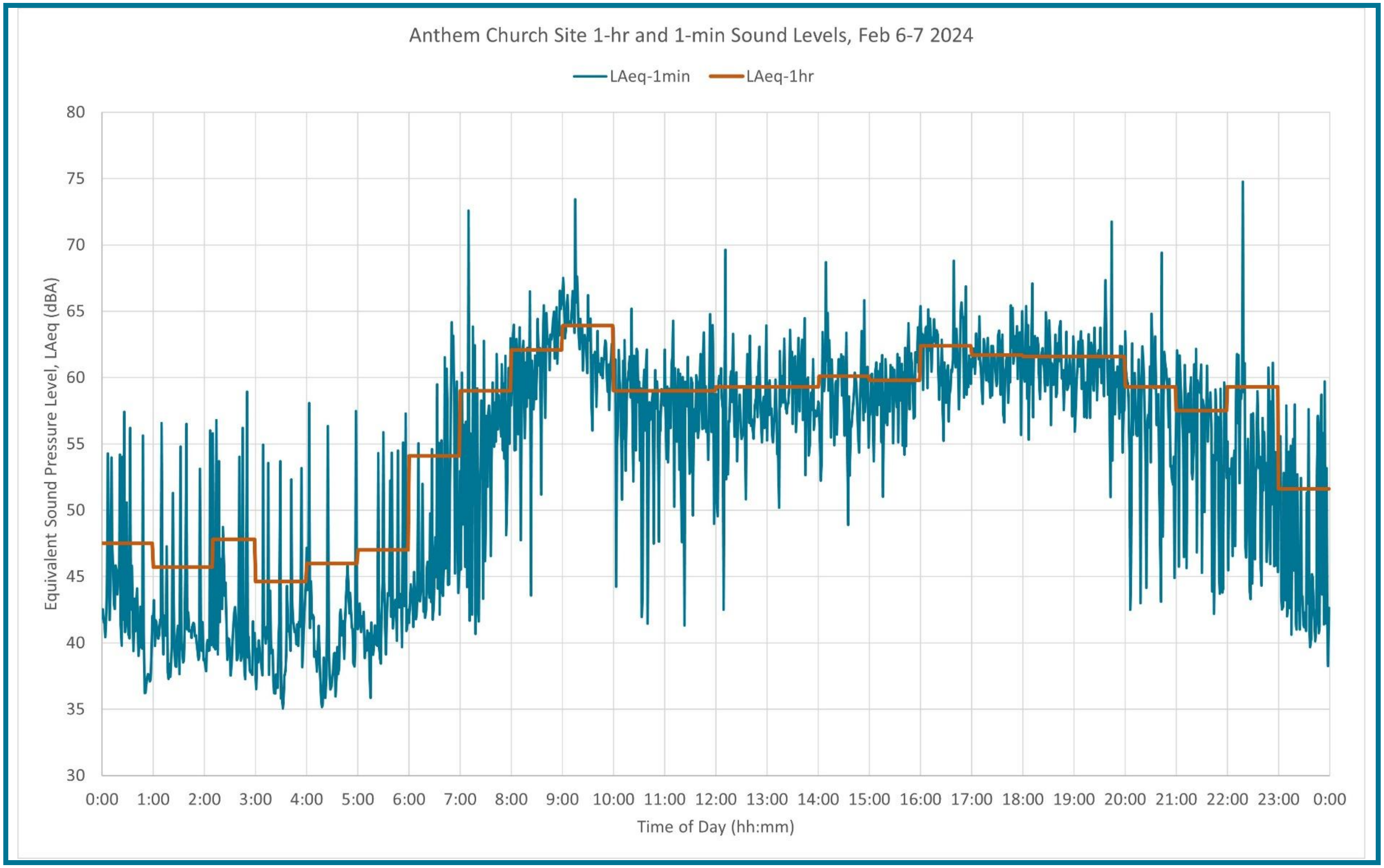


Figure 8: 1/3-Octave Spectra Sound Levels During Typical Indoor Church Service, Measured March 10, 2024

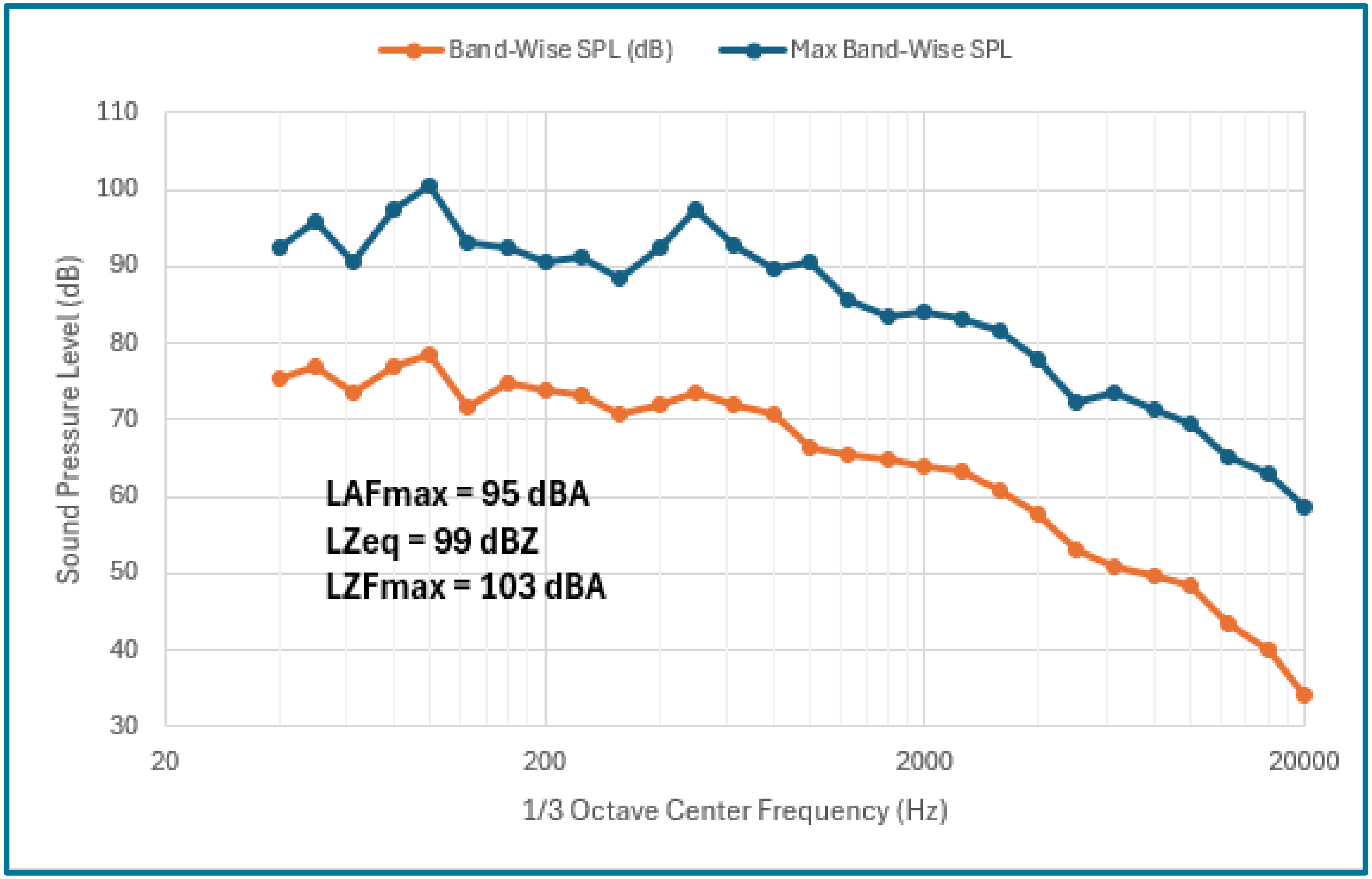


Figure 9: Existing Ambient Sound Level Contours, Plan View

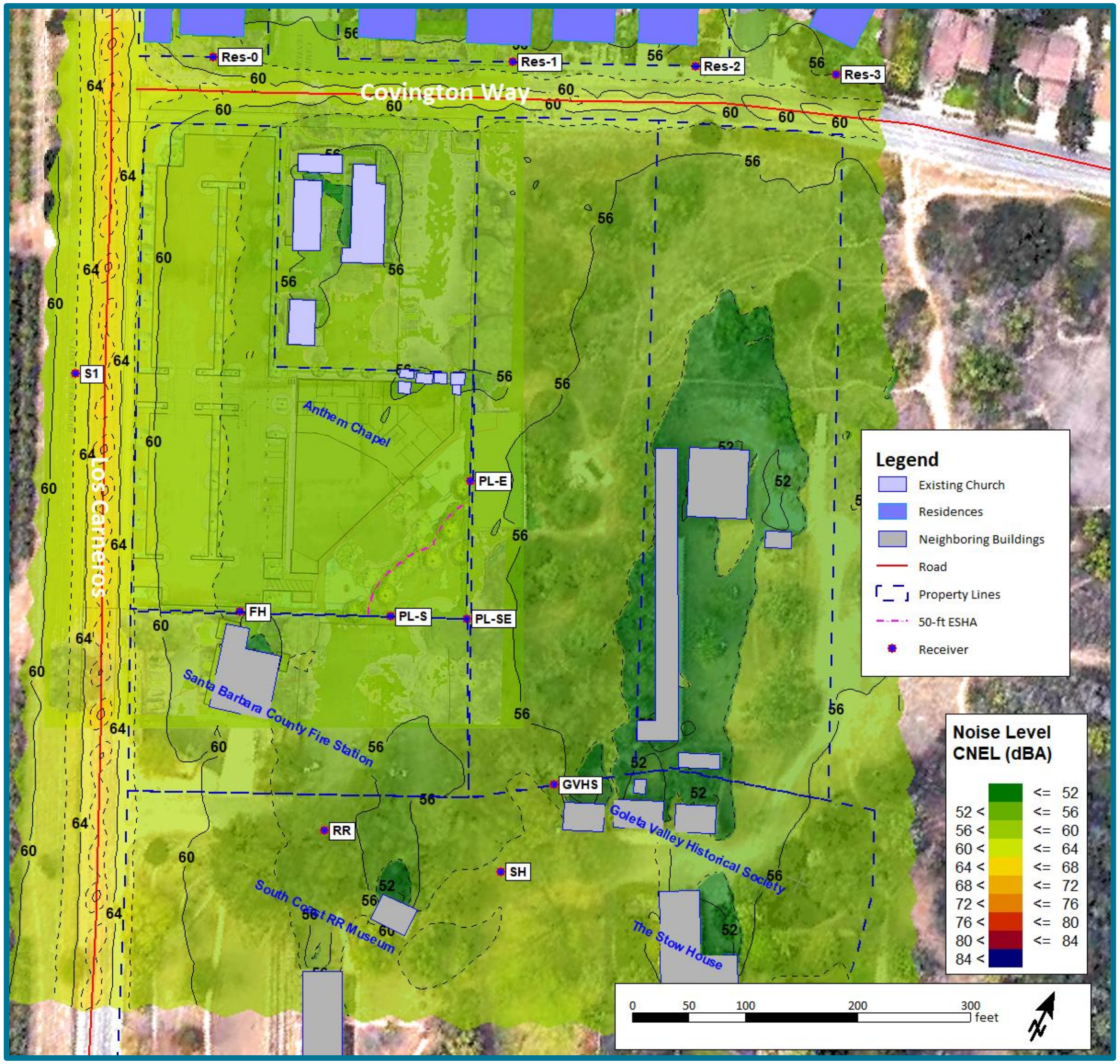


Figure 10: 3D Perspective of Acoustic Model Geometry with Proposed Indoor Event

Figure 11: Ambient Sound Level Contours with Buildings in Place, Plan View

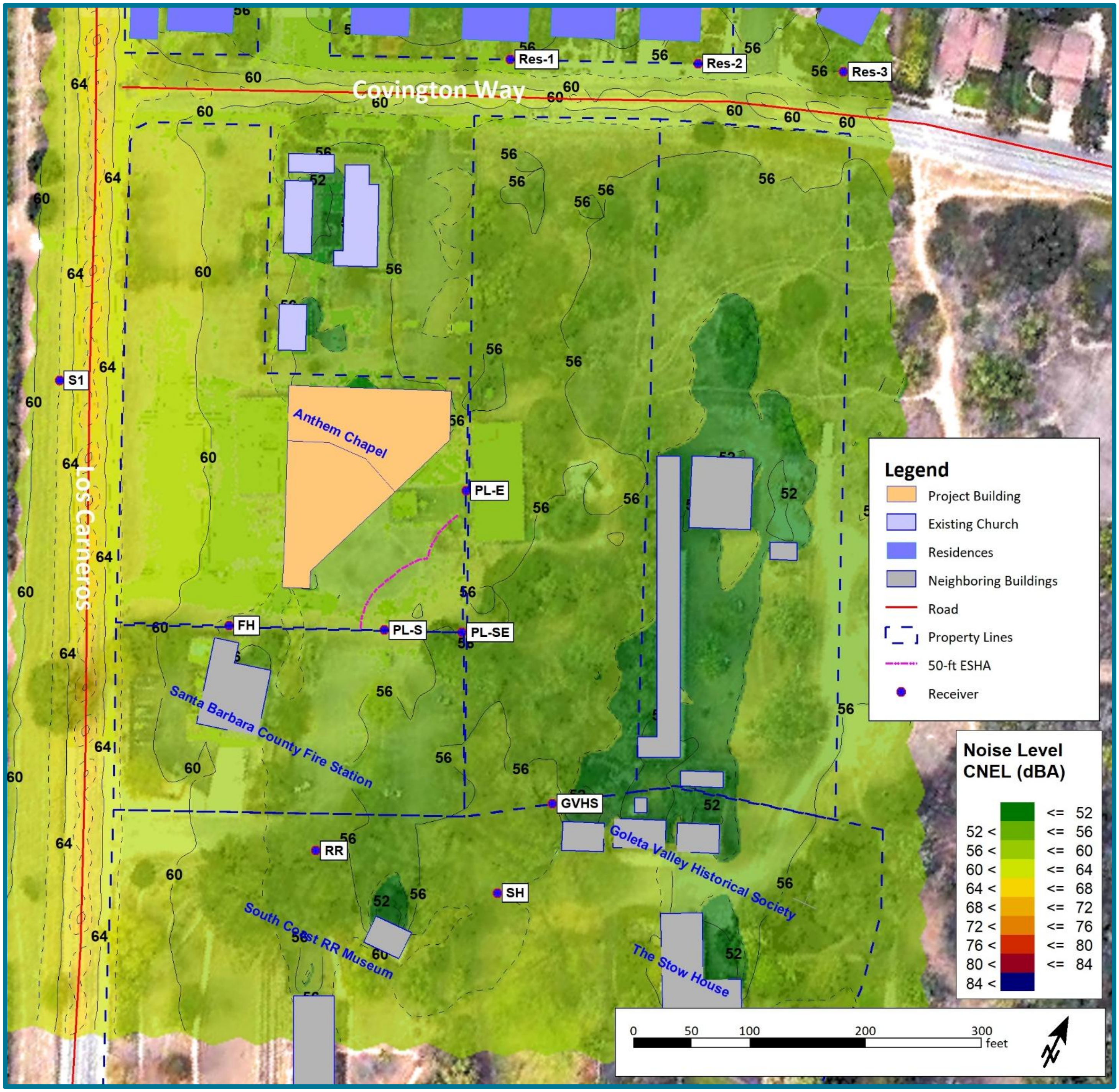
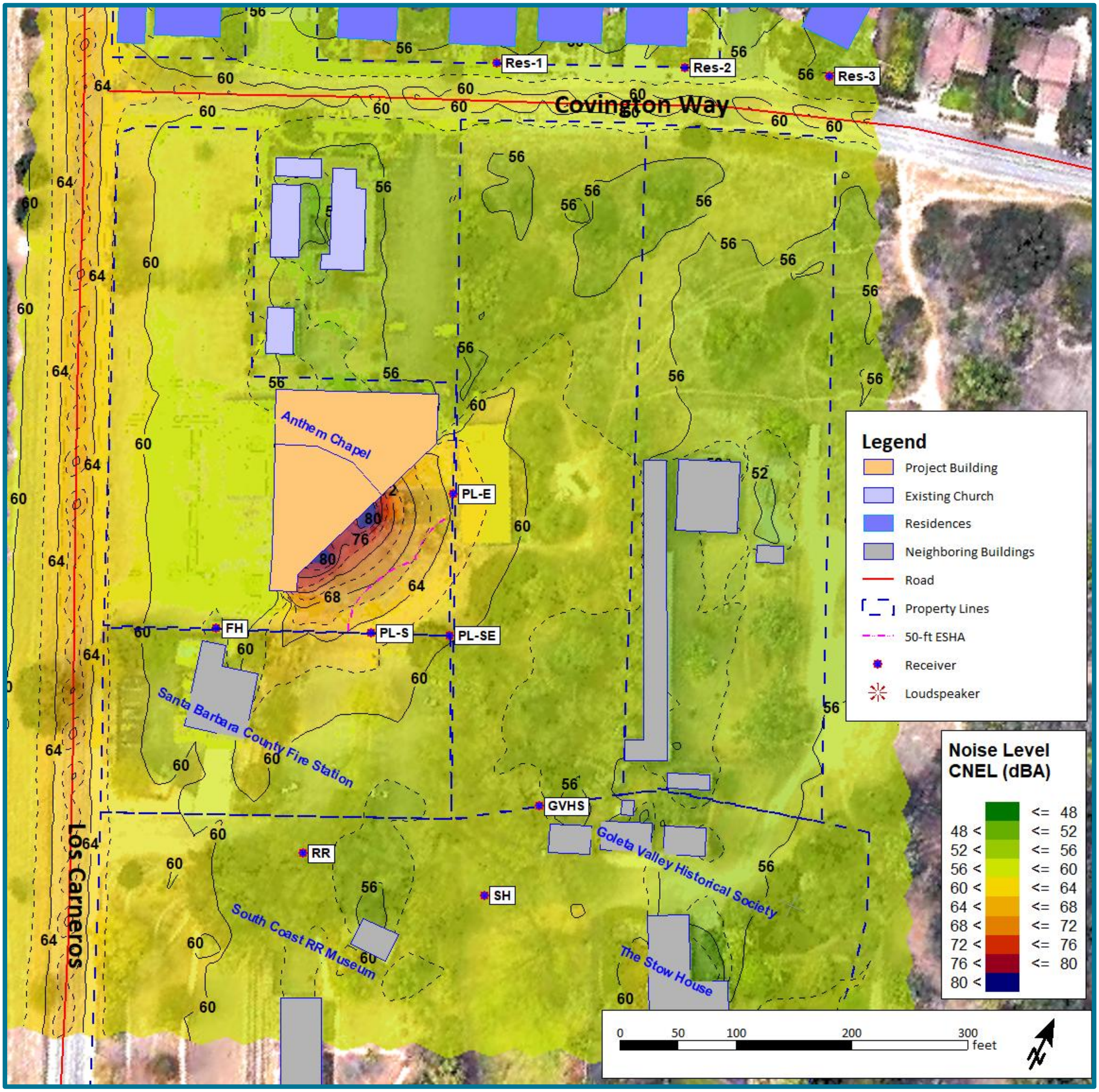


Figure 12: Sound Level Contours for 3-Hour Daytime Indoor Event



10 Appendix

10.1 Characteristics of Sound

When an object vibrates, it radiates part of its energy as acoustical pressure in the form of a sound wave. Sound can be described in terms of amplitude (loudness), frequency (pitch), or duration (time). The human hearing system is not equally sensitive to sound at all frequencies. Therefore, to approximate this human, frequency-dependent response, the A-weighted filter system is used to adjust measured sound levels. The normal range of human hearing extends from approximately 0 to 140 dBA.

Table 12: Examples of Sound Pressure Levels

SPL (dBA)	Description
0	*The threshold of hearing.* This is the quietest sound that a child or young adult with good hearing can detect at 1kHz. (It is not silence.)
10 - 20	Very faint. A gentle breeze through the trees.
20 - 30	A soft whisper (at 1 meter).
30 - 40	A quiet auditorium.
40 - 60	Background music in a cafe, bar, or restaurant.
60 - 70	Typical conversation levels (from the listener's position).
70 - 80	The cabin of an aircraft during normal cruise conditions.
80 - 90	Typical wedding or dinner-dance band (typical audience position).
90 - 100	Loud orchestra (playing *fff*, as it would sound in the front row of the audience).
100 - 110	Typical disco.
110 - 115	A loud rock band (front rows of audience).
115 - 130	*Threshold of pain.* Often given as 120 dB SPL, this varies with frequency and from person to person.
140	Jet engine from 3 meters.

Examples of sound levels are listed on websites such as:

- "Time to Listen: Most Regular Patrons of Music Venues Prefer Lower Volumes" https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6438925/
- The Center for Hearing and Communication https://chchearing.org/noise/common-environmental-noise-levels/
- University of Michigan https://www.uofmhealth.org/health-library/tf4173
- https://www.researchgate.net/publication/328133495_Expected_Sound_Levels_at_Concert_Venues_for_Amplified_Music

Unlike linear units such as inches or pounds, decibels are measured on a logarithmic scale, representing points on a sharply rising curve. Because of the physical characteristics of noise transmission and of noise perception, the relative loudness of sound does not closely match the actual amounts of sound energy. Table 13 below presents the subjective effect of changes in sound pressure levels.

Table 13: Sound Level Change Relative Loudness/Acoustic Energy Loss[11]

Change in Level	Relative Loudness	Acoustic Energy Loss
0 dB	Reference	0%
- 3 dB	Just Perceptible Change	50%
- 5 dB	Readily Perceptible Change	67%
- 10 dB	Half as Loud	90%
- 20 dB	1/4 as Loud	99%
- 30 dB	1/8 as Loud	99.9%

Sound levels are generated from a source and their decibel level decreases as the distance from that source increases. Sound dissipates exponentially with distance from the noise source. This phenomenon is known as spreading loss. Generally, sound levels from a point source will decrease by 6 dBA for each doubling of distance. Sound levels for a highway line source vary differently with distance because sound pressure waves propagate along the line and overlap at the point of measurement. A closely spaced, continuous line of vehicles along a roadway becomes a line source and produces a 3 dBA decrease in sound level for each doubling of distance. However, experimental evidence has shown that where sound from a highway propagates close to "soft" ground (e.g., plowed farmland, grass, crops, etc.), a more suitable drop-off rate to use is not 3.0 dBA but rather 4.5 dBA per distance doubling (FHWA 2010).

When sound is measured for distinct time intervals, the statistical distribution of the overall sound level during that period can be obtained. The L_{eq} is the most common parameter associated with such measurements. The L_{eq} metric is a single-number noise descriptor that represents the average sound level over a given period of time. For example, the L50 noise level is the level that is exceeded 50 percent of the time. This level is also the level that is exceeded 30 minutes in an hour. Similarly, the L02, L08 and L25 values are the noise levels that are exceeded 2, 8, and 25 percent of the time or 1, 5, and 15 minutes per hour. Other values typically noted during a noise survey are the L_{min} and L_{max}. These values represent the minimum and maximum root-mean-square noise levels obtained over the measurement period.

Because community receptors are more sensitive to unwanted noise intrusion during the evening and at night, State law requires that, for planning purposes, an artificial dB increment be added to quiet-time noise levels in a 24-hour noise descriptor called the CNEL or L_{dn}. This increment is incorporated in the calculation of CNEL or L_{dn}, described earlier.

[11] Highway Traffic Noise Analysis and Abatement Policy and Guidance, U.S. Department of Transportation, Federal Highway Administration, Office of Environment and Planning, Noise and Air Quality Branch, June 1995.

10.2 Terminology/Glossary

A-Weighted Sound Level (dBA)
The sound pressure level in decibels, as measured on a sound level meter using the internationally standardized A-weighting filter or as computed from sound spectral data to which A-weighting adjustments have been made. A-weighting de-emphasizes the low and very high frequency components of the sound in a manner similar to the response of the average human ear. A-weighted sound levels correlate well with subjective reactions of people to noise and are universally used for community noise evaluations.

Air-borne Sound
Sound that travels through the air, differentiated from structure-borne sound.

Ambient Sound Level
The prevailing general sound level existing at a location or in a space, which usually consists of a composite of sounds from many sources near and far. The ambient level is typically defined by the L_{eq} level.

Background Sound Level
The underlying, ever-present lower-level noise that remains in the absence of intrusive or intermittent sounds. Distant sources, such as Traffic, typically make up the background. The background level is generally defined by the L90 percentile noise level.

Community Noise Equivalent Level (CNEL)
The L_{eq} of the A-weighted noise level over a 24-hour period with a 5-dB penalty applied to noise levels between 7 p.m. and 10 p.m. and a 10-dB penalty applied to noise levels between 10 p.m. and 7 a.m. CNEL is similar to L_{dn}.

Day-Night Sound Level (DNL or L_{dn})
The L_{eq} of the A-weighted noise level over a 24-hour period with a 10-dB penalty applied to noise levels between 10 p.m. and 7 a.m. L_{dn} is similar to CNEL.

Decibel (dB)
The decibel is a measure on a logarithmic scale of the magnitude of a particular quantity (such as sound pressure, sound power, sound intensity) with respect to a reference quantity.

DBA or dB(A)
A-weighted sound level. The ear does not respond equally to all frequencies and is less sensitive at low and high frequencies than it is at medium or speech range frequencies. Thus, to obtain a single number representing the sound level of a noise containing a wide range of frequencies in a manner representative of the ear's response, it is necessary to reduce the effects of the low and high frequencies with respect to the medium frequencies. The resultant sound level is said to be A-weighted, and the units are dBA. The A-weighted sound level is also called the noise level.

Energy Equivalent Level (L_{eq})
Because sound levels can vary markedly in intensity over a short period of time, some method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, one describes ambient sounds in terms of an average level that has the same acoustical energy as the summation of all the time-varying

events. This energy-equivalent sound/noise descriptor is called L_{eq} . In this report, an hourly period is used.

Field Sound Transmission Class (FSTC)
A single number rating similar to STC, except that the transmission loss values used to derive the FSTC are measured in the field. All sound transmitted from the source room to the receiving room is assumed to be through the separating wall or floor-ceiling assembly.

Noise Reduction (NR)
Noise reduction is the difference between outdoor sound level and indoor sound level. It is not identical to Sound Transmission Class.

Outdoor-Indoor Transmission Class (OITC)
A single number classification, specified by the American Society for Testing and Materials (ASTM E 1332 issued 1994), that establishes the A-weighted sound level reduction provided by building facade components (walls, doors, windows, and combinations thereof), based upon a reference sound spectrum that is an average of typical air, road, and rail transportation sources. The OITC is the preferred rating when exterior façade components are exposed to a noise environment dominated by transportation sources. Once built, as much as a 5-point reduction in Apparent Outside-Inside Transmission Class (OITC) from the original, as-designed OITC may be expected.

Percentile Sound Level, Ln
The noise level exceeded during *n* percent of the measurement period, where *n* is a number between 0 and 100 (e.g., L10 or L90)

Sound Transmission Class (STC)
STC is a single number rating, specified by the American Society for Testing and Materials, which can be used to measure the sound insulation properties for comparing the sound transmission capability, in decibels, of interior building partitions for noise sources such as speech, radio, and television. It is used extensively for rating sound insulation characteristics of building materials and products.

Structure-Borne Sound
Sound propagating through building structure. Rapidly fluctuating elastic waves in gypsum board, joists, studs, etc.

Sound Exposure Level (SEL)
SEL is the sound exposure level, defined as a single number rating indicating the total energy of a discrete noise-generating event (e.g., an aircraft flyover) compressed into a 1-second time duration. This level is handy as a consistent rating method that may be combined with other SEL and L_{eq} readings to provide a complete noise scenario for measurements and predictions. However, care must be taken in the use of these values since they may be misleading because their numeric value is higher than any sound level which existed during the measurement period.

Subjective Loudness Level
In addition to precision measurement of sound level changes, there is a subjective characteristic which describes how most people respond to sound:

- A change in sound level of 3 dBA is *barely perceptible* by most listeners.
- A change in level of 6 dBA is *clearly perceptible*.

- A change of 10 dBA is perceived by most people as being *twice* (or *half*) as loud.

10.3 SoundPLAN® Acoustics Software

SoundPLAN®, the software used for this acoustic analysis, is an acoustic ray-tracing program dedicated to the prediction of noise in the environment. Noise emitted by various sources propagates and disperses over a given terrain in accordance with the laws of physics. The software calculates sound attenuation of environmental noise, even over complex terrain, uneven ground conditions, and with complex obstacles. Up to three reflections for each noise source are taken into account to closely and accurately predict real-world acoustics. Worldwide, governments and engineering associations have created algorithms to calculate acoustical phenomena to standardize the assessment of physical scenarios. Accuracy has been validated in published studies to be + / - 2.7 dBA with an 85% confidence level, for a wide variety of large-scale models and situations.

10.4 ISO 9613-2

For industrial and other noise sources besides road traffic, SoundPLAN calculates the sound field in accordance with ISO 9613-2 "Acoustics - Attenuation of sound during propagation outdoors, Part 2: General Method of Calculation." The standard states that "this part of ISO 9613 specifies an engineering method for calculating the attenuation of sound during propagation outdoors, in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level under meteorological conditions favorable to propagation from sources of known sound emissions. These conditions are for downwind propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs at night." The uncertainty of calculations with this method are +/-1 dB for sources less than 10m in height and within 1000m of the receiver.

10.5 Traffic Noise Model (TNM)

The Federal Highway Administration Traffic Noise Model (TNM), implemented into the SoundPLAN® software, was used for the road traffic sound level modeling in this study. TNM contains the following components:

1. Modeling of five standard vehicle types, including automobiles, medium trucks, heavy trucks, buses, and motorcycles, as well as user-defined vehicles.
2. Modeling both constant- and interrupted-flow traffic using a field-measured database.
3. Modeling effects of different pavement types, as well as the effects of graded roadways.
4. Sound level computations based on a one-third octave-band data base and algorithms.
5. Graphically-interactive noise barrier design and optimization.
6. Attenuation over/through rows of buildings and dense vegetation.
7. Multiple diffraction analysis.
8. Parallel barrier analysis.
9. Contour analysis, including sound level contours, barrier insertion loss contours, and sound-level difference contours.

These components are supported by a scientifically founded and experimentally calibrated acoustic computation methodology, as well as a flexible database, made up of over 6000 individual pass-by events measured at forty sites across the country.

10.6 Self-Management of Sound Levels

Because it is difficult for anyone to discern differences in source levels, there are some commercially available tools that laypeople, DJ's, and others may use to self-manage and accurately measure and control sound levels created at these events.

Cell phone apps are inaccurate, and they rely on an uncalibrated internal microphone; studies have shown that they can be off by 10dB or more from the accurate/actual sound level.

There are many commercial solutions for monitoring sound levels at a given location that may be of assistance in maintaining good neighbor relationships. Below are two such solutions we would suggest if the Client wishes to monitor their own sound levels:

- www.StudioSixDigital.com offers a suite of affordable apps called "Audio Tools" for Apple-brand devices (e.g., iPhone or iPod). When a Class 2 (survey grade) or Class 1 (precision grade) external microphone is plugged into such a device, and calibrated using a microphone calibrator, accurate sound levels may be acquired. Their website lists several compliant microphone options.

- Class 1 high-precision meters and calibrators are "engineering grade", while Class 2 are mid-grade accuracy, lower cost, and suitable for use by laypeople in the field while still allowing for accurate measurements. For an extremely affordable standalone Class 2 sound level meter, SoftdB's Piccolo and Piccolo II are sold in the USA through Scantek, Inc. here: https://www.scantekinc.com/products/sound-level-meters/softdb/piccolo-compact-sound-level-meter-and-datalogger/ This would allow for a permanent sound level monitoring "station" at any desired location without the need for an Apple product.

- Any sound measurement devise should be calibrated using a calibrator in order to continually ensure that the device/meter is calibrated to report accurate sound levels. A Class 2 calibrator can be purchased from many suppliers for a few hundred dollars.

- **45dB** is available to consult with business owners wishing to monitor their own sound emission. Be wary of cheap products sold on Amazon or other marketplaces—if it is not IEC/ANSI certified as a Class/Type 1 or 2 device, and not able to be calibrated with an ANSI Type 1 or 2 calibrator, it is not credible, official, or to be relied upon..