ACOUSTICAL SITE ASSESSMENT
ST. GREGORY OF NYSSA GREEK ORTHODOX CHURCH
SAN DIEGO COUNTY, CA

Submitted to:

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TABLE OF CONTENTS / LIST OF TABLES AND FIGURES

LIST OF TABLES

LIST OF FIGURES / MAPS / ADDENDA

INTRODUCTION AND DEFINITIONS

Existing Site Characterization

The project site consists of a total of 1.73 acres within the Rancho San Diego area of San Diego County as shown in Figure 1 on the following page. The site is a generally flat, previously disturbed, grouping of two parcels[1] obtaining primary access off of Jamacha Road/State Route 54 (SR 54), and secondary site access via Mary Ann Way, as shown in Figure 2 on Page 3 of this report.

The project site currently contains an existing 1,649± single-family residential structure zoned RR-2, which would remain upon completion of the project. Elevations across the site average from approximately 537 to 549 feet above mean sea level (MSL).

Project Description

The St. Gregory of Nyssa Greek Orthodox Church project proposes a church complex to be developed in three construction phases. The project will provide for a full service Greek Orthodox church facility including a 3,776 SF church sanctuary, as can be seen in Figure 3 on Page 4 of this report. The proposed development plan is outlined below.

Phase 1: The initial construction phase would consist of:

- Converting the existing one-story residence into a church office, meeting room, Sunday school room and restrooms.
- Adding a 524 +/- SF meeting area to the east side of the existing office building.
- Convert an existing 420+/- SF two-car garage into handicap accessible men's and women's restrooms.
- Add a new one-story, 1,447 SF chapel with fixed seating for eighty-four (84) people, plus three (3) disabled access spaces along with paved surface for designated parking to be installed that will accommodate such seating. New utility services are to be sized and installed to support all three phases of work and to be located under a newly paved private access road known as Mary Ann Way. The utilities for phases 2 and 3 will be stubbed to the South parking area of Phase 3.

Phase 2: Construct a 6,261 SF, one-story multipurpose building to be used for meetings, classrooms, kitchen and offices. The completion of all site improvements, paving, landscaping and installation of utilities will all occur during this phase of work.

Phase 3: Construct a 3,776 SF, one-story church building which will allow for 273 fixed seats with normal ancillary uses.

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[1] APN's 498-320-04 and 498-320-45.

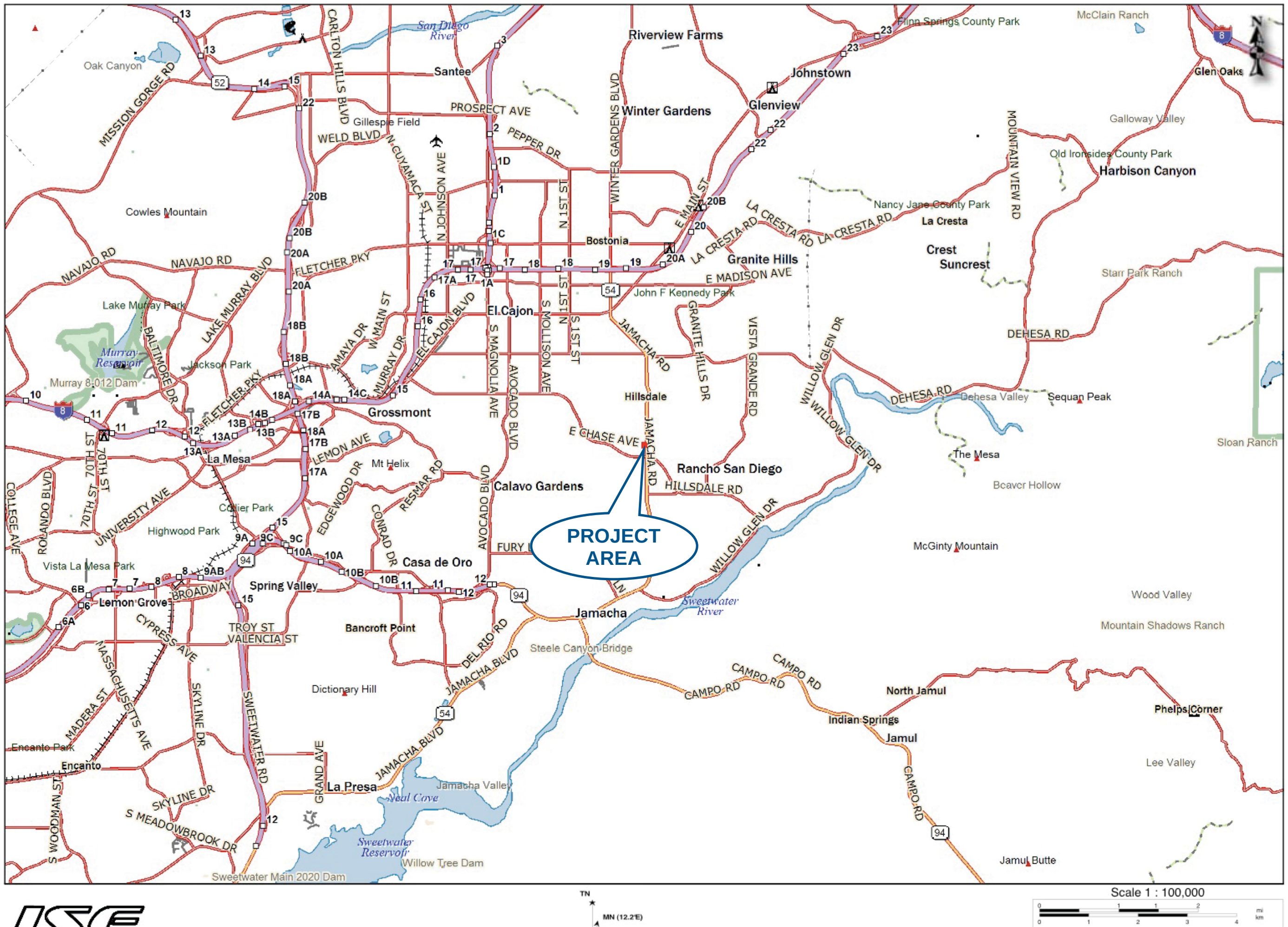

FIGURE 1: Project Vicinity Map (ISE 7/09)

FIGURE 2: Project Site Location Map with Property Boundary Extents (ISE 7/09)

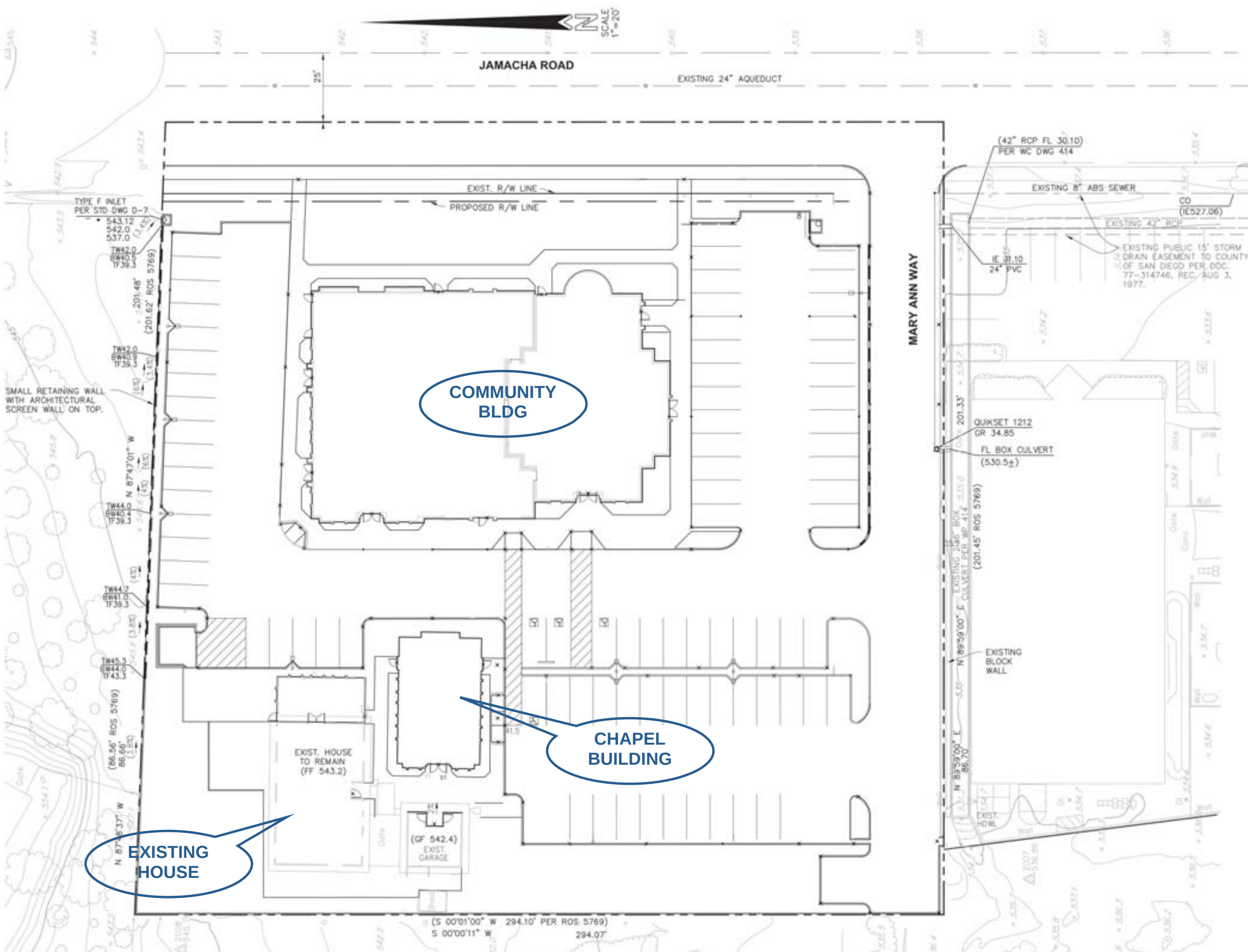

FIGURE 3: St. Gregory of Nyssa Church Site Plan (Morrison Engineering, Inc. 4/18/05)

Acoustical Definitions and Theory

Sound waves are linear mechanical waves. They can be propagated in solids, liquids, and gases. The material transmitting such a wave oscillates in the direction of propagation of the wave itself. Sound waves originate from some sort of vibrating surface. Whether this surface is the vibrating string of a violin or a person's vocal cords, a vibrating column of air from an organ or clarinet, or a vibrating panel from a loudspeaker, drum, or aircraft, the sound waves generated are all similar. All of these vibrating elements alternatively compress the surrounding air on a forward movement and expand it on a backward movement.

There is a large range of frequencies within which linear waves can be generated, sound waves being confined to the frequency range that can stimulate the auditory organs to the sensation of hearing. For humans this range is from about 20 Hertz (Hz or cycles per second) to about 20,000 Hz. The air transmits these frequency disturbances outward from the source of the wave. Sound waves, if unimpeded, will spread out in all directions from a source. Upon entering the auditory organs, these waves produce the sensation of sound. Waveforms that are approximately periodic or consist of a small number of periodic components can give rise to a pleasant sensation (assuming the intensity is not too high), for example, as in a musical composition.

Noise, on the other hand, can be represented as a superposition of periodic waves with a large number of components and is generally defined as unwanted or annoying sound that is typically associated with human activity, and which interferes with or disrupts normal activities. Although exposure to high noise levels has been demonstrated to cause hearing loss, the principal human response to environmental noise is annoyance. The response of individuals to similar noise events is diverse and influenced by the type of noise, the perceived importance of the noise and its appropriateness in the setting, the time of day, and the sensitivity of the individual hearing the sound.

Airborne sound is a rapid fluctuation of air pressure above and below atmospheric levels. The loudest sounds that the human ear can hear comfortably are approximately one trillion (or $1x10^{12}$) times the acoustic energy that the ear can barely detect. Because of this vast range, any attempt to represent the acoustic intensity of a particular sound on a linear scale becomes unwieldy. As a result, a logarithmic ratio, originally conceived for radio work, known as the decibel (dB) is commonly employed.[2]

A sound level of zero “0” dB is scaled such that it is defined as the threshold of human hearing and would be barely audible to a human of normal hearing under extremely quiet listening conditions. Such conditions can only be generated in anechoic or “dead rooms”. Typically, the quietest environmental conditions (extreme rural areas with extensive shielding) yield sound levels of approximately 20 decibels. Normal speech

[2] A unit used to express the relative magnitude of a sound wave. This level is defined as being equal to 20 times the common logarithm of the ratio of the pressure produced by a sound wave of interest to a ‘reference’ pressure wave equal to 20 micro Pascal’s (μPa) measured at a distance of 1 meter. 20 μPa is the smallest amount of pressure capable of producing the sensation of hearing in a human.

has a sound level of approximately 60 dB. Sound levels above 120 dB roughly correspond to the threshold of pain.

The minimum change in sound level that the human ear can detect is approximately 3.0 dBA.[3] A change in sound level of 10 dB is usually perceived by the average person as a doubling (or halving) of the sounds loudness.[4] A change in sound level of 10 dB actually represents an approximate 90 percent change in the sound intensity, but only about a 50 percent change in the perceived loudness. This is due to the nonlinear response of the human ear to sound.

As mentioned above, most of the sounds we hear in the environment do not consist of a single frequency, but rather a broad band of frequencies differing in sound level. The intensities of each frequency add to generate the sound we hear. The method commonly used to quantify environmental sounds consists of determining all of the frequencies of a sound according to a weighting system that reflects the nonlinear response characteristics of the human ear. This is called "A" weighting, and the decibel level measured is called the A-weighted sound level (or dBA). In practice, the level of a noise source is conveniently measured using a sound level meter that includes a filter corresponding to the dBA curve.[5]

Although the A-weighted sound level may adequately indicate the level of environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise includes a conglomeration of sounds from distant sources that create a relatively steady background noise in which no particular source is identifiable. For this type of noise, a single descriptor called the L_{eq} (or equivalent sound level) is used. L_{eq} is the energy-mean A-weighted sound level during a measured time interval, and would be defined mathematically by the following continuous integral below,

$$L_{eq} = 10 Log_{10}\left[\frac{1}{T}\int_0^T SPL(t)^2\, dt\right]$$

[3] Every 3 dB equates to a 50% of drop (or increase) in wave strength; therefore a 6 dB drop/increase = a loss/increase of 75% of total signal strength, and so on.

[4] This is a subjective reference based upon the nonlinear nature of the human ear.

[5] In some cases, it is important to measure the distribution of sound pressure as a function of frequency. Under these circumstances, the incoming sound wave is passed through a series of band pass filters having predefined frequencies where they are resonant. The relative response of each filter (in dB, dBA, etc.) directly corresponds to the amount of sound energy present at that particular frequency. In standard acoustics two unique filter sets are used to accomplish this task, namely the 1/1 octave band and 1/3 octave band set. An octave is defined as the interval between any two frequencies having a ratio of 2 to 1.

By definition, a whole octave filter (1/1) is a band-pass filter having a bandwidth equal to 70.7-percent of its center frequency (i.e., the frequency of interest) distributed across 11 bands between 11 Hz and 22,700 Hz (the effective audio frequency range). A 1/3 Octave Band filter has a bandwidth equal to 23.1% of its center frequency, distributed across 32 bands between 14.1 Hz and 22,390 Hz. Thus, the octave band frequencies would be 16, 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000 and 16000 Hz. The corresponding 1/3 octave band frequencies would be 16, 20, 25, 31.5, 40, 50, 63, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1000, 1250, 1600, 2000, 2500, 3150, 4000, 5000, 6300, 8000, 10000, 12500, 16000 and 20000 Hz.

where,

L_{eq} is the energy equivalent sound level,
t is the independent variable of time,
T is the total time interval of the event,
and, SPL is the sound pressure level *re. 20 μPa*.

Thus, L_{eq} is the 'equivalent' constant sound level that would have to be produced by a given source to equal the average of the fluctuating level measured. For most acoustical studies, the study interval is generally taken as one-hour and is abbreviated $L_{eq\text{-}h}$ or $L_{eq(h)}$; however, other time intervals are utilized depending on the jurisdictional preference. For a series of discrete sound sources, the above expression would reduce to its Riemann equivalent as,

$$L_{eq} = 10 Log_{10}\left[\frac{1}{T}\sum_{i=1}^{n} SPL(t_i)^2 \Delta t_i\right]$$

To describe the time-varying character of environmental noise, the statistical noise descriptors L_{10}, L_{50}, and L_{90} are commonly used. They are the noise levels equaled or exceeded during 10 percent, 50 percent, and 90 percent of a stated time. Sound levels associated with the L_{10} typically describe transient or short-term events, while levels associated with the L_{90} describe the steady state (or most prevalent) noise conditions. The L_{50} level is the arithmetic average of the measured sound interval. In addition, it is often desirable to know the acoustic range of the noise source being measured. This is accomplished through the maximum and minimum measured sound level (L_{max} and L_{min}) indicators. The L_{min} value obtained for a particular monitoring location is often called the *acoustic floor* for that location.

Finally, the aggregate of all community noise events is typically averaged into a single value known as the Community Noise Equivalent Level (CNEL). This descriptor is calculated by averaging all events over a specified time interval, and applying a 5-dBA penalty to any sounds occurring between 7:00 p.m. and 10:00 p.m., and a 10-decibel penalty to sounds that occur during nighttime hours (i.e., 10 p.m. to 7 a.m.). This penalty is applied to compensate for the increased sensitivity to noise during the quieter nighttime hours.

Mathematically, CNEL can be derived based upon the hourly Leq values via the following expression:

$$CNEL = 10 Log_{10} \frac{1}{n}\sum_{i=1}^{n}\left(10^{\frac{Leq(day)_i}{10}} + 10^{\frac{Leq(evening+5)_i}{10}} + 10^{\frac{Leq(night+10)_i}{10}}\right)$$

where,

$L_{eq}(x)_i$ is the equivalent sound level during period '*x*' at time interval 'i'
and 'n' is the number of time intervals.

Treating each time interval separately would give the following alternate expression for CNEL, based upon each discrete time period:

$$CNEL = 10Log_{10}\frac{1}{p+q+r}\left[\sum_{i=1}^{p}\left(10^{\frac{Leq(day)_p}{10}}\right)+\sum_{i=1}^{q}\left(10^{\frac{Leq(evening+5)_q}{10}}\right)+\sum_{i=1}^{r}\left(10^{\frac{Leq(night+10)_r}{10}}\right)\right]$$

A similar sound measure known as the Day-Night Sound Level (DNL or L_{dn}) is defined identically to CNEL, with the exception that no penalty is applied between 7:00 p.m. and 10:00 p.m. Thus, DNL would be represented as,

$$DNL = 10Log_{10}\frac{1}{p+r}\left[\sum_{i=1}^{p}\left(10^{\frac{Leq(day)_p}{10}}\right)+\sum_{i=1}^{r}\left(10^{\frac{Leq(night+10)_r}{10}}\right)\right]$$

Given this, both CNEL and Ldn have a maximum statistical variance of about one dBA under most environmental conditions.

ENVIRONMENTAL SIGNIFICANCE THRESHOLDS

California Environmental Quality Act (CEQA) Thresholds

Section 15382 of the California Environmental Quality Act (CEQA) guidelines defines a significant impact as,

> *"… a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance."*

The minimum change in sound level that the human ear can detect is approximately three decibels. This increment, 3-dBA, is commonly accepted under CEQA as representing the point at which a noise level increase would represent a significant impact.

This impact threshold is accepted by the County of San Diego and will be used as the significance threshold to determine the project's impact on the affected (existing) environment. Additionally, the County considers a cumulative increase in sound due to a project to be an impact if it is over one decibel (i.e., 1-dBA).

Construction Noise Impact Thresholds

The County of San Diego Noise Ordinance Sections 36.409 through 36.410 govern construction noise emissions. The relevant parts are cited below.

Section 36.409: Sound Level Limitations on Construction Equipment [6]

"Except for emergency work, it shall be unlawful for any person to operate construction equipment or cause construction equipment to be operated, that exceeds an average sound level of 75 decibels for an eight-hour period, between 7 a.m. and 7 p.m., when measured at the boundary line of the property where the noise source is located or on any occupied property where the noise is being received."

Section 36.410: Sound Level Limitations on Impulsive Noise [7]

1. Except for emergency work or work on a public road project, no person shall produce or cause to be produced an impulsive noise that exceeds the maximum sound level… {of 82 dBA within a residential, village zoning or civic use area, or 85 dBA within an agricultural, commercial or industrial use zone}, …when measured at the boundary line of the property where the noise source is located or on any occupied property where the noise is received, for 25 percent of the minutes in the measurement period, as described in subsection (c) below. The maximum sound level depends on the use being made of the occupied property.
2. Except for emergency work, no person working on a public road project shall produce or cause to be produced an impulsive noise that exceeds the maximum sound level… {of 85 dBA within a residential, village zoning or civic use area, or 90 dBA within an agricultural, commercial or industrial use zone}, …when measured at the boundary line of the property where the noise source is located or on any occupied property where the noise is received, for 25 percent of the minutes in the measurement period, as described in subsection (c) below. The maximum sound level depends on the use being made of the occupied property.
3. The minimum measurement period for any measurements conducted under this section shall be one hour. During the measurement period a measurement shall be conducted every minute from a fixed location on an occupied property. The measurements shall measure the maximum sound level during each minute of the measurement period. If the sound level caused by construction equipment or the producer of the impulsive noise exceeds the maximum sound level for any portion of any minute, it will be deemed that the maximum sound level was exceeded during that minute.

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[6] Amended by Ord. No. 9700 (N.S.), effective 2-4-05; amended by Ord. No. 9962 (N.S.), effective 1-9-09.

[7] Added by Ord. No. 9962 (N.S.), effective 1-9-09.

Vehicular/Transportation Noise Impact Thresholds

Transportation noise levels affecting sensitive land uses are governed under Policy 4b of the *County of San Diego's Noise Element of the County's General Plan*.[8] The relevant sections of the Noise Element are cited below:

> "Since exterior community noise equivalent levels (CNEL) above 60 decibels and/or interior CNEL above 45 decibels may have an adverse effect on public health and welfare, it is the policy of the County of San Diego that:
>
> 1. Whenever it appears that new *development* may result in any (existing or future) *noise sensitive land use* being subject to noise levels of CNEL equal to 60 *decibels (A)* or greater, an acoustical analysis shall be required.
> 2. If the acoustical analysis shows that noise levels at any *noise sensitive land use* will exceed CNEL equal to 60 decibels, modifications shall be made to the *development* which reduce the *exterior noise* level to less than CNEL of 60 *decibels (A)* and the *interior noise* level to less than CNEL of 45 *decibels (A).*[9]
> 3. If modifications are not made to the *development* in accordance with paragraph 2 above, the *development* shall not be approved unless a finding is made that there are specifically identified overriding social or economic considerations which warrant approval of the development without such modification; provided, however, if the acoustical study shows that sound levels for any noise sensitive land use will exceed a CNEL equal to 75 *decibels (A) even* with such modifications, the *development* shall not be approved irrespective of such social or economic considerations."

Definitions, Notes and Exceptions

"Decibels (A)" refers to A-weighted sound levels as noted on page Vlll-2 within the Element.

"Development" means any physical development including but not limited to residences, commercial, or industrial facilities, roads, civic buildings, hospitals, schools, airports, or similar facilities.
"*Exterior noise*":

(a) For single family detached dwelling projects, "exterior noise" means noise measured at an outdoor living area which adjoins and is on the same lot as the dwelling, and which contains at least the following minimum area:

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[8] *As revised July 2006.*

[9] **Action Program 4b1:** Recommend programs to soundproof buildings or redevelop areas where it is impossible to reduce existing source noise to acceptable levels.

Action Program 4b2: Study the feasibility of extending the application of Section 1092, California Administrative Code dealing with noise insulation standards to single-family dwellings, and incorporating higher standards for reduction of exterior noise intrusion into structures.

Action Program 4b3: Require present and projected noise level data to be included in Environmental Impact Reports. Designs to mitigate adverse noise impacts shall also be used.

(i) Net lot area up to 4,000 sq. ft.: 400 square feet.
(ii) Net lot area 4,000 sq. ft. to 10 ac.: 10% of net lot area.
(iii) Net lot area over 10 ac.: 1 ac.

(b) For all other projects, "exterior noise" means noise measured at all exterior areas, which are provided for group or private usable, *open space* purposes.

(c) For County road construction projects, the exterior noise level due to vehicular traffic impacting a noise sensitive area should not exceed the following values:

(i) Federally funded projects: The Noise standard contained in applicable Federal Highway Administration Standards.

(ii) Other projects: 60 *decibels (A),* except if the existing or projected noise level without the project is 58 decibels (*A*) or greater, a 3 *decibel* (*A*) increase is allowed, up to the maximum permitted by Federal Highway Administration Standards.

"Group or Private Usable Open Space" shall mean: Usable open space intended for common use by occupants of a development, either privately owned and maintained or dedicated to a public agency, normally including swimming pools, recreation courts, patios, open landscaped areas, and greenbelts with pedestrian walkways and equestrian and bicycle trails, but not including off-street parking and loading areas or driveways (Group Usable Open Space); and usable open space intended for use of occupants of one dwelling unit, normally including yards, decks and balconies (Private Usable Open Space).

“Interior noise": The following exception shall apply: For rooms which are usually occupied only a part of the day (schools, libraries, or similar), the interior one-hour average sound level, due to noise outside, should not exceed 50 *decibels (A)*.

"Noise sensitive land use" means any residence, hospital, school, hotel, resort, library or any other facility where quiet is an important attribute of the environment.

The proposed St. Gregory of Nyssa Greek Orthodox Church development plan does not include any sensitive outdoor usable space as defined under Policy 4b; however, all structures onsite, by virtue of their use, would be subject to the interior noise requirement cited above, namely, interior use spaces would be required to meet a 50 dBA CNEL level under a closed window condition.

Operational On-Site Noise Thresholds

The proposed St. Gregory of Nyssa Greek Orthodox Church site is located within an RR-2 zone with surrounding uses having a consistent zoning as shown in Figure 4 on the following page. The only exception is a C-36 zone located immediately south of the project site.

The San Diego County Noise Ordinance Section 36.404 governs fixed source and/or operational noise as a function of the time of day and the aforementioned land use zoning. The relevant limits are given in Table 1 at the top of Page 13 of this report.

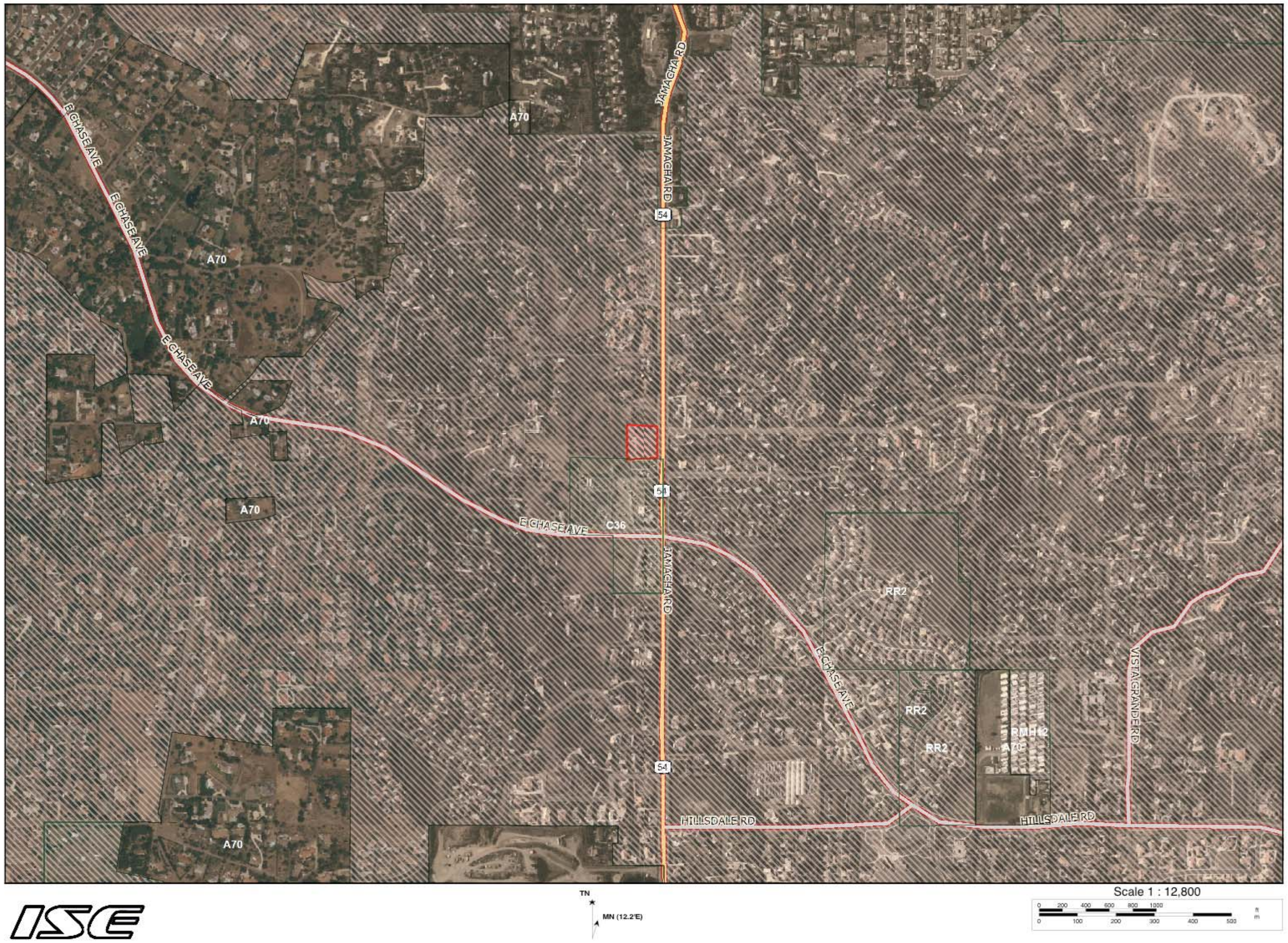

FIGURE 4: Property Zoning Map within Project Vicinity

TABLE 1: County of San Diego Noise Ordinance Limits

Land Use Zone	Time of Day	1-Hour Average Sound Level (dBA Leq)
RS, RD, RR, RMH, A70, A72, S80, S81, S87, S90, S92, RV, and RU with a density of less than 11 dwelling units per acre	7 a.m. to 10 p.m.	**50**
	10 p.m. to 7 a.m.	**45**
RRO, RC, RM, S86, V5, RV and RU with a density of 11 or more dwelling units per acre	7 a.m. to 10 p.m.	55
	10 p.m. to 7 a.m.	50
S94, V4, and all commercial zones	7 a.m. to 10 p.m.	60
	10 p.m. to 7 a.m.	55
V1, V2	7 p.m. to 10 p.m.	55
V1	10 p.m. to 7 a.m.	55
V2	10 p.m. to 7 a.m.	50
V3	7 a.m. to 10 p.m.	70
	10 p.m. to 7 a.m.	65
M-50, M-52, and M-54	Anytime	70
S82, M56, and M58	Anytime	75
S88	(See note 1 below)	

Notes:

(1) S88 zones are Specific Planning Areas that allow different uses. The sound level limits in Table 36.404 above that apply in an S88 zone depend on the use being made of the property. The limits in Table 36.404, subsection (1) applies to property with a residential, agricultural or civic use. The limits in subsection (3) apply to property with a commercial use. The limits in subsection (5) apply to property with an industrial use that would only be allowed in an M50, M52 or M54 zone. The limits in subsection (6) apply to all property with an extractive use or a use that would only be allowed in an M56 or M58 zone.

(2) Where a noise study has been conducted and the noise mitigation measures recommended by that study have been made conditions of approval of a Major Use Permit, which authorizes the noise-generating use or activity and the decision making body approving the Major Use Permit determined that those mitigation measures reduce potential noise impacts to a level below significance, implementation and compliance with those noise mitigation measures shall constitute compliance with this subsection.

(3) The sound level limit at a location on a boundary between two zones is the arithmetic mean of the respective limits for the two zones. The one-hour average sound level limit applicable to extractive industries, however, including but not limited to borrow pits and mines, shall be 75 decibels at the property line regardless of the zone in which the extractive industry is located.

(4) A fixed-location public utility distribution or transmission facility located on or adjacent to a property line shall be subject to the sound level limits of this section measured at or beyond six feet from the boundary of the easement upon which the facility is located.

Source: County of San Diego Noise Ordinance Section 36.404, 1981.[10]

Given this, the proposed St. Gregory of Nyssa Greek Orthodox Church project is surrounded by consistent land use zoning having a property line standard of 50.0 dBA $L_{eq\text{-}h}$ during the hours of 7 a.m. to 10 p.m., and 45.0 dBA $L_{eq\text{-}h}$ during the hours of 10 p.m. to 7 a.m. Since the proposed operational hours of the church would be from approximately 8:00 a.m. to 8:00 p.m., the 50 dBA $L_{eq\text{-}h}$ standard would be the applicable compliance point.

[10] Amended by Ord. No. 7094 (N.S.), effective 3-25-86; amended by Ord. No. 9478 (N.S.), effective 7-19-02; amended by Ord. No. 9621 (N.S.), effective 1-9-04; amended by Ord. No. 9962 (N.S.), effective 1-9-09

It should further be noted that the neighboring C-36 zone has a 10-decibel higher allowable standard than the surrounding RR-2 zones. Thus, compliance of the project with the RR-2 zone standard of 50 dBA Leq-h would ensure de facto compliance with the neighboring C-36 zone with a requisite margin of compliance.

ANALYTICAL APPROACH AND METHODOLOGY

Existing Conditions / Baseline Calibration Survey

A single noise-monitoring location was selected on the project site for the purpose of determining the ambient baseline site conditions due to the projects frontage to SR 54 (Jamacha Road). The instrumentation location, denoted as Monitoring Location ML 1 (as indicated by the designator 1), is shown in Figures 5a and -b starting on the following page. Measurements were taken on July 13, 2009, beginning at 2:30 p.m. during normal traffic flow conditions, and would be indicative of the baseline acoustical environment within the project site during its proposed hours of operations.

For the field monitoring effort, a Quest SoundPro SP-DL-2 ANSI Type 2 integrating sound level meter was used for data collection. The meter was affixed to a tripod five-feet above ground level in order to simulate the noise exposure of an average-height human being. Prior to testing, all equipment was calibrated at ISE's acoustics and vibration laboratory to verify conformance with ANSI S1-4 1983 Type 2 and IEC 651 Type 2 standards.[11]

Construction Noise Impact Assessment Approach

Construction noise emission generators at the proposed St. Gregory of Nyssa Greek Orthodox Church site would consist primarily of earthwork equipment required for a minimal movement of approximately 1,700 cubic-yards of material (1,100 cubic yards cut, 600 cubic-yards fill) over the course of approximately 30 days. All grading would be performed as a single task.

Source equipment noise levels were based upon past levels measured by ISE and published sources[12] for each expected equipment type. The duty cycle and average engine power requirements for each of the equipment were obtained in consultation with the project applicant.

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[11] All testing and calibration performed by ISE's Acoustics and Vibration Laboratory is performed using a LORAN-C frequency and time standard traceable to National Institute of Standards & Technology (NIST). The LORAN-C network provides redundant time and frequency calibration signals from 50 cesium atomic clock transmitters within the northern hemisphere with a long-term stability of 10^{-12}. Specifications for traceability can be obtained at www.nist.gov.

[12] Source: EPA PB 206717 *"Noise from Construction Equipment and Operations"*, Environmental Protection Agency, 12/31/71.

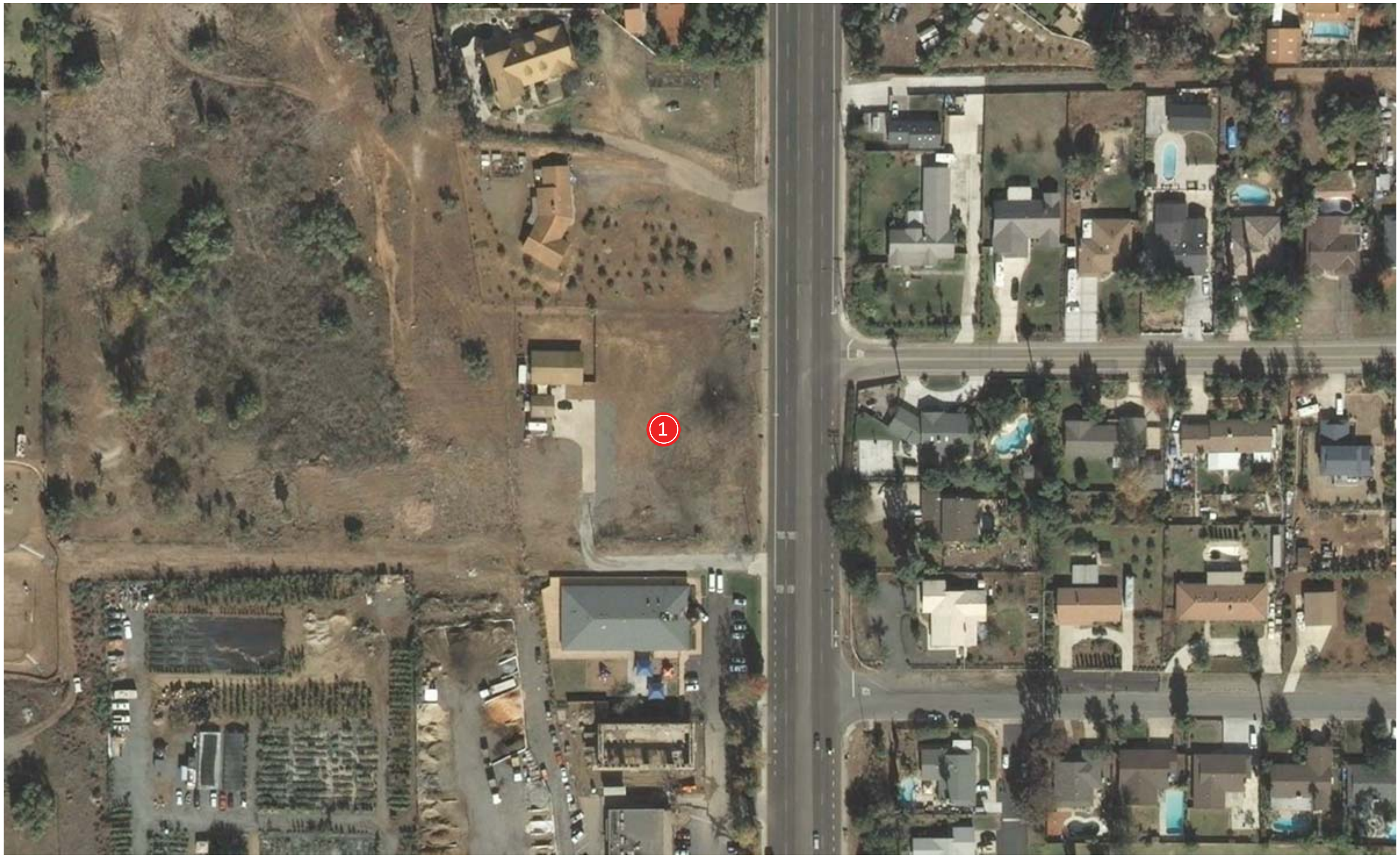

FIGURE 5a: Ambient Noise Monitoring Location ML 1 (Basemap Image Google Earth 2009)

FIGURE 5b: Ambient Monitoring Location ML 1 Photos (ISE 7/09)

Onsite Noise Impact Assessment Approach

Aggregate noise emission levels due to rooftop HVAC systems were modeled using the ISE *Industrial Source Model* (*IS*^{3}) *v4.0*.[13] The IS^3 model calculates the predicted acoustic field pattern using a vector-based summation of all source-receptor pairs. The resulting output consists of an isogram containing the predicted acoustic field, accounting for both refractive and attenuative effects. The modeled building definitions and location of the proposed HVAC equipment are shown in Figure 6 on the following page.

For the purposes of analysis it was assumed that all HVAC units would be operating simultaneously and have an adjusted source level of 75 dBA at 3.0-feet from the source (i.e., each source was treated as a hemispherical radiator having a baseline free-field ARI emission level of 80 dBA at 3.0-feet). The lowest dominant emissive frequency was set at 300 Hz.

Traffic Segment Impact Assessment Approach

The ISE *RoadNoise v2.2* traffic noise prediction model, which is based upon the Federal Highway Administration's RD-77-108 Noise Prediction Model with California (CALVENO, FHWA/CA/TL-87/03) noise emission factors was used to calculate the increase in vehicular traffic noise levels due to the proposed St. Gregory of Nyssa Greek Orthodox Church project along all identified major servicing roadways.[14] The model assumed a 'hard-site' propagation rule and a 95/3/2 mix of automobiles/midsize/large vehicles/trucks, thereby yielding a representative worst-case noise contour set.[15]

FINDINGS AND RECOMMENDATIONS

Ambient Sound Measurement Results

Testing during the monitoring period was performed under a daytime condition, with light, variable wind from the west-northwest up to approximately 5 miles per hour, a temperature of 99.9 degrees Fahrenheit, and relative humidity of about 30%. The results of the sound level monitoring are shown in Table 2 on Page 19 of this report. The values for the equivalent sound level ($L_{eq\text{-}h}$), the maximum and minimum measured sound levels (Lmax and Lmin), and the statistical indicators L_{10}, L_{50}, and L_{90}, are given for both monitoring locations.

[13] The ISE *Industrial Source Model* (*IS*^{3}) *v4.0* provides a visual representation of an acoustic field pattern across any three-dimensional surface, factoring in the effects of topographic and structural interference, apparent receptor elevation, static reflection from objects, multiple material attenuative sources, variable propagation rates and source types, and atmospheric scattering.

[14] Source: *Traffic Study for St. Gregory of Nyssa Greek Orthodox Church (P05-010) – Darnell & Associates, 2/2/09.*

[15] Hard Site propagation is defined as a 3.0-dBA loss per doubling of distance (DD) between source and receiver.

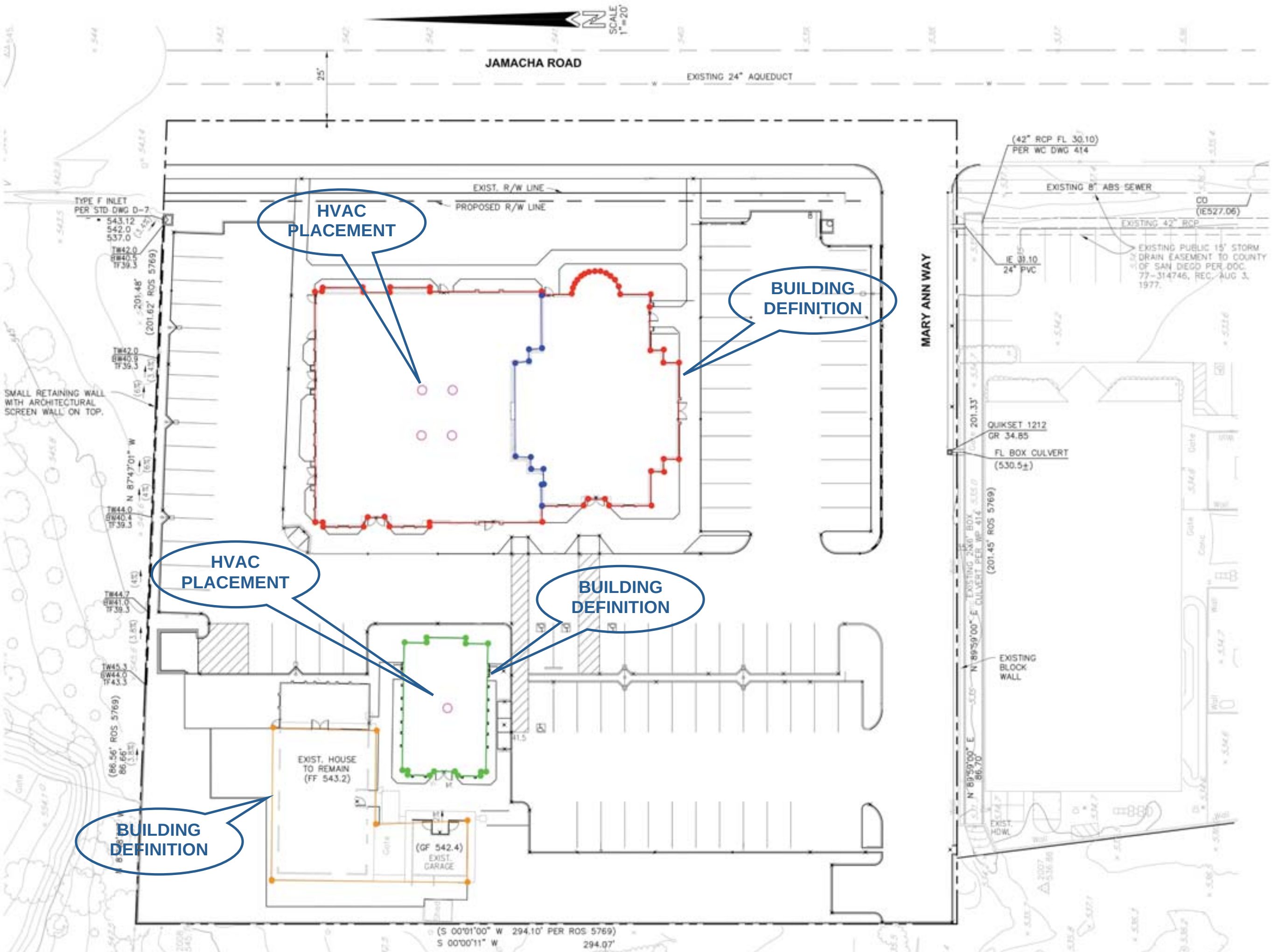

FIGURE 6: IS³ Model of Onsite Geometry and HVAC Placement

TABLE 2: Measured Ambient Sound Levels – St. Gregory of Nyssa Greek Orthodox Church Site

		1-Hour Noise Level Descriptors in dBA					
Monitoring Location	**Start Time**	**Leq**	**Lmax**	**Lmin**	**L10**	**L50**	**L90**
1	2:30 p.m.	59.1	73.3	42.6	61.8	56.9	50.0

Monitoring Locations:

Location 1: Centrally located in the St. Gregory of Nyssa Greek Orthodox Church proposed project site.
GPS: N32 46.266 x W116 55.698, EPE 18 ft, Temp range 99.9 °F, RH 30%

Measurements performed by ISE on 7/13/09. EPE = Estimated Position Error.

Measurements collected reflect the ambient sound levels at the project site. As shown above, the hourly average sound level (or $L_{eq\text{-}h}$) recorded at ML 1 over the monitoring period was found to be 59.1 dBA. The acoustic floor, as seen by the L_{min} indicator, was found to be 42.6 dBA. The dominant observed noise source was found to be due to surface street traffic along Jamacha Road. These levels would be consistent with the siting of the proposed church facility.

Construction Noise Emission Levels

The proposed St. Gregory of Nyssa Greek Orthodox Church project proposes a minimal amount of earthwork and would excavate approximately 1,700 cubic-yards of material (1,100 cubic yards cut, 600 cubic-yards fill) to fully develop the 75,714 square foot site area. All grading would be performed as a single phase lasting approximately 30 days.

The estimated construction noise emission levels are shown below in Table 3 under the worst-case assumption that all equipment is aggregated at a single point. Based upon the findings, no significant construction noise property line impacts are indicated.

TABLE 3: Predicted Construction Noise Levels (All Earthwork Phases)

Equipment Type	Qty. Used	Duty Cycle (Hrs. / day)	Source Level @ 50 Feet (dBA)	Cumulative Effect @ 50 Feet (dBA Leq-8h)
Dozer – D6 Cat	1	4	70	67.0
Mini Excavator	1	4	70	67.0
Water Truck	1	2	65	59.0
Dump/Haul Trucks	1	6	65	63.8
Mini Scraper	1	4	70	67.0
			Worst-Case Aggregate Sum @ 50 Ft. (Σ):	**72.6**

Operational Noise Emission Levels

The results of the IS^3 computer modeling of all rooftop HVAC systems are shown in Figure 7 on the following page. The colored contours represent areas of equal noise exposure within the project site and surrounding properties, and are a composite of the approximate 125,000 data points generated by the computer model. This model included the effects of the proposed onsite structural features, including the rooftop parapets and building placement. The IS^3 model input and output results are provided as an attachment to this report.

Based upon these findings, full operation of the HVAC systems would create property line noise levels no greater than 40 dBA L_{eq-h}, which is 10-dBA below the applicable worst-case property line standard and less than the daytime background sound level (L_{90}), which is also, coincidentally, 50 dBA.

All mechanical HVAC noise would be fully contained within the proposed project site. Thus, no significant operational acoustical impacts are expected from the project. No remedial mitigation would be required.

Future Traffic Noise Impacts

The results showing the effect of traffic noise increases on the various servicing roadway segments associated with the proposed St. Gregory of Nyssa Greek Orthodox Church project are presented in Tables 4a through –e starting on Page 22, for the following scenarios:

Table 4a)	Existing Traffic Conditions
Table 4b)	Existing + Project Traffic Conditions
Table 4c)	Existing + Cumulative Traffic Conditions
Table 4d)	Existing + Cumulative + Project Traffic Conditions
Table 4e)	Project Traffic Noise Increases

For each roadway segment examined, the worst case average daily traffic volume (ADT) and observed/predicted speeds are shown along with the corresponding reference noise level at 50-feet (in dBA). Additionally, the line-of-sight distance from the roadway centerline to the 60- through 75-dBA CNEL contours are provided as an indication of the worst-case unobstructed theoretical traffic noise contour placement.

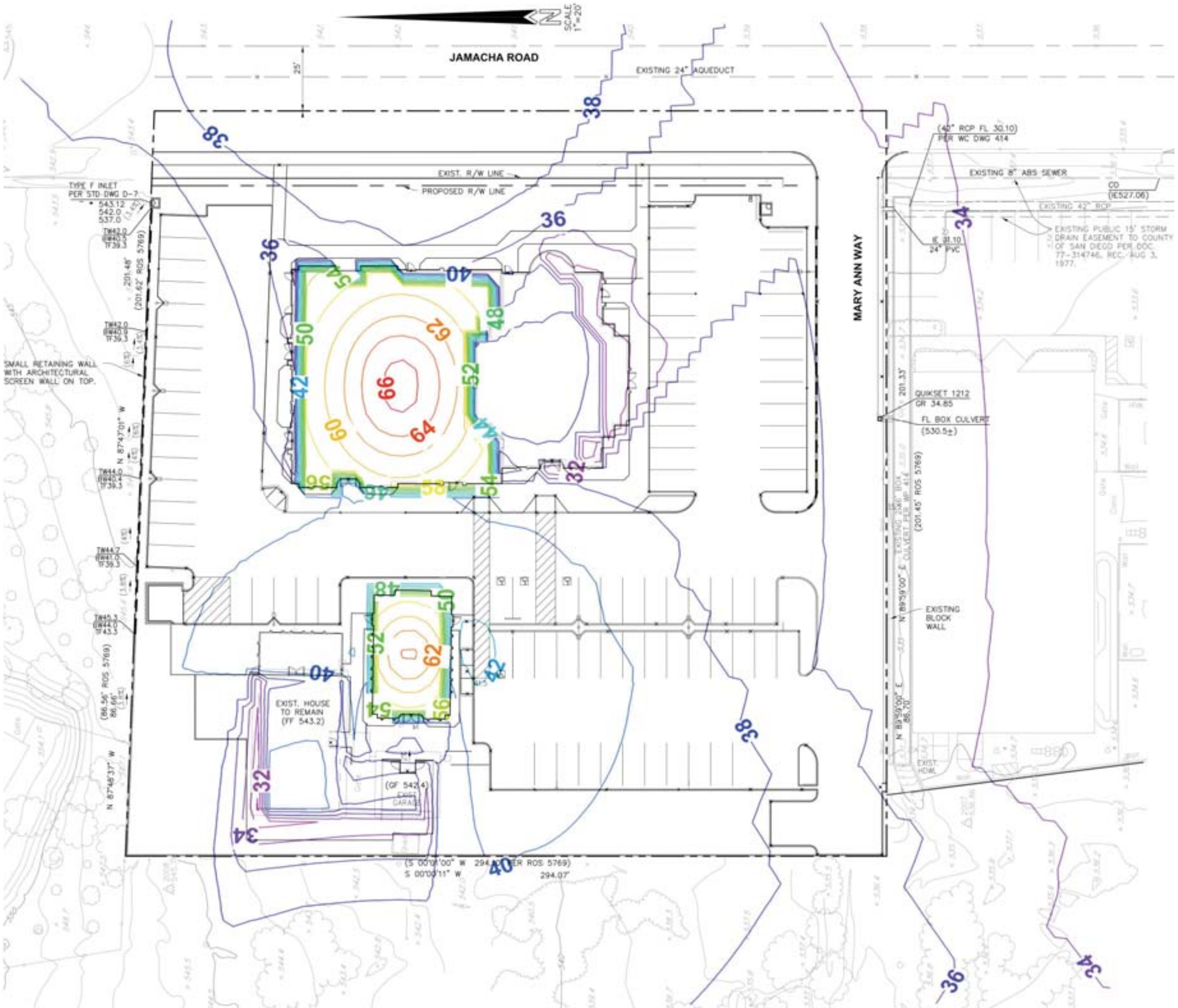

FIGURE 7: IS³ Model Results of Expected HVAC Noise Emission Levels

TABLE 4a: Existing Traffic Conditions

Roadway	Segment	ADT	Speed (MPH)	SPL	CNEL Contour Distances (feet) 75 CNEL	70 CNEL	65 CNEL	60 CNEL
Jamacha Road	South of Washington Avenue	26,595	45	73.7	37	116	366	1,159
	North of Chase Avenue	25,039	45	73.4	35	109	345	1,091
	South of Chase Avenue	24,606	45	73.3	34	107	339	1,072

Notes:

- ADT = Average Daily Trips – Source: Darnell & Associates, 2/2/09.
- SPL = Sound Pressure Level in dBA at 50-feet from the road edge. CNEL = Community Noise Equivalent Level.
- All values given in dBA CNEL. Contours assumed to be line-of-sight perpendicular (⊥) distance.

TABLE 4b: Existing + Project Traffic Conditions

Roadway	Segment	ADT	Speed (MPH)	SPL	CNEL Contour Distances (feet) 75 CNEL	70 CNEL	65 CNEL	60 CNEL
Jamacha Road	South of Washington Avenue	26,683	45	73.7	37	116	368	1,163
	North of Chase Avenue	25,087	45	73.4	35	109	346	1,093
	South of Chase Avenue	24,626	45	73.3	34	107	339	1,073

Notes:

- ADT = Average Daily Trips – Source: Darnell & Associates, 2/2/09.
- SPL = Sound Pressure Level in dBA at 50-feet from the road edge. CNEL = Community Noise Equivalent Level.
- All values given in dBA CNEL. Contours assumed to be line-of-sight perpendicular (⊥) distance.

TABLE 4c: Existing + Cumulative Traffic Conditions

Roadway	Segment	ADT	Speed (MPH)	SPL	CNEL Contour Distances (feet) 75 CNEL	70 CNEL	65 CNEL	60 CNEL
Jamacha Road	South of Washington Avenue	27,818	45	73.8	38	121	383	1,212
	North of Chase Avenue	26,191	45	73.6	36	114	361	1,141
	South of Chase Avenue	25,738	45	73.5	35	112	355	1,122

Notes:

- ADT = Average Daily Trips – Source: Darnell & Associates, 2/2/09.
- SPL = Sound Pressure Level in dBA at 50-feet from the road edge. CNEL = Community Noise Equivalent Level.
- All values given in dBA CNEL. Contours assumed to be line-of-sight perpendicular (⊥) distance.

TABLE 4d: Existing + Cumulative + Project Traffic Conditions

					CNEL Contour Distances (feet)			
Roadway	**Segment**	**ADT**	**Speed (MPH)**	**SPL**	**75 CNEL**	**70 CNEL**	**65 CNEL**	**60 CNEL**
Jamacha Road	South of Washington Avenue	27,906	45	73.9	38	122	385	1,216
	North of Chase Avenue	26,239	45	73.6	36	114	362	1,143
	South of Chase Avenue	25,758	45	73.5	35	112	355	1,122

Notes:
- ADT = Average Daily Trips – Source: Darnell & Associates, 2/2/09.
- SPL = Sound Pressure Level in dBA at 50-feet from the road edge. CNEL = Community Noise Equivalent Level.
- All values given in dBA CNEL. Contours assumed to be line-of-sight perpendicular (⊥) distance.

TABLE 4e: Project Traffic Noise Increases

Roadway	**Segment**	**Project Contribution to Existing Traffic**	**Project Contribution to Cumulative Traffic**	**Maximum Project Related Difference (SPL)**
Jamacha Road	South of Washington Avenue	0.0	0.1	**0.1**
	North of Chase Avenue	0.0	0.0	0.0
	South of Chase Avenue	0.0	0.0	0.0

Notes:
- SPL = Sound Pressure Level in dBA at 50-feet from the road edge. CNEL = Community Noise Exposure Level.
- All values given in dBA CNEL. Contours assumed to be line-of-sight perpendicular (⊥) distance.

As can be seen from the traffic data, the largest increase in traffic noise would be 0.1-dBA CNEL occurring under both the direct and cumulative scenarios. Therefore, no project related traffic noise impacts are expected.

CONCLUSIONS

No adverse acoustical impacts are expected due to either construction grading or operation of the proposed St. Gregory of Nyssa Greek Orthodox Church development plan. The project, by virtue of its use, would be subject to the interior noise requirement under the County's General Plan Policy 4b, namely, interior use spaces would be required to meet a 50 dBA CNEL level under a closed window condition.

No remedial mitigation other than that identified would be required for this project.

CERTIFICATION OF ACCURACY AND QUALIFICATIONS

This report was prepared by Investigative Science and Engineering, Inc. (ISE), located at 1134 D Street, Ramona, CA 92065. The members of its professional staff contributing to the report are listed below:

Rick Tavares *(rtavares@ise.us)*	Ph.D. Civil Engineering M.S. Structural Engineering M.S. Mechanical Engineering B.S. Aerospace Engineering / Engineering Mechanics
Karen Tavares *(ktavares@ise.us)*	B.S. Electrical Engineering

ISE affirms to the best of its knowledge and belief that the statements and information contained herein are in all respects true and correct as of the date of this report. Should the reader have any questions regarding the findings and conclusions presented in this report, please do not hesitate to contact ISE at (760) 787-0016.

Content and information contained within this report is intended only for the subject project and is protected under 17 U.S.C. §§ 101 through 810. Original reports contain non-photo blue ISE watermark at the bottom of each page.

Approved as to Form and Content:

Rick Tavares, Ph.D.
Project Principal
Investigative Science and Engineering, Inc.

APPENDICES / SUPPLEMENTAL INFORMATION

ISE IS^3 4.0 Input/Output Results

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IS3 PROGRAM INPUT DECK - (C) 2009 INVESTIGATIVE SCIENCE & ENGINEERING INC.
GLOBAL VARIABLE DECLARATION
   PROBLEM STATEMENT: ST. GREGORY OF NYSSA CHURCH
   STARTING POINT (XY IN FEET): 2925,746
   ENDING POINT (XY IN FEET): 3279,1205
   ANALYSIS FREQUENCY (HZ): 300
   REFERENCE DISTANCE FOR SOUND (D IN FEET): 3
   SOUND PROPAGATION COEFF XLOG10: 20
   EXCESS ATTENUATION (DB): 0
   COMPUTATIONAL STEP DISTANCE (IN FEET): 5
   RECEPTOR ELEVATION (IN FEET): 5
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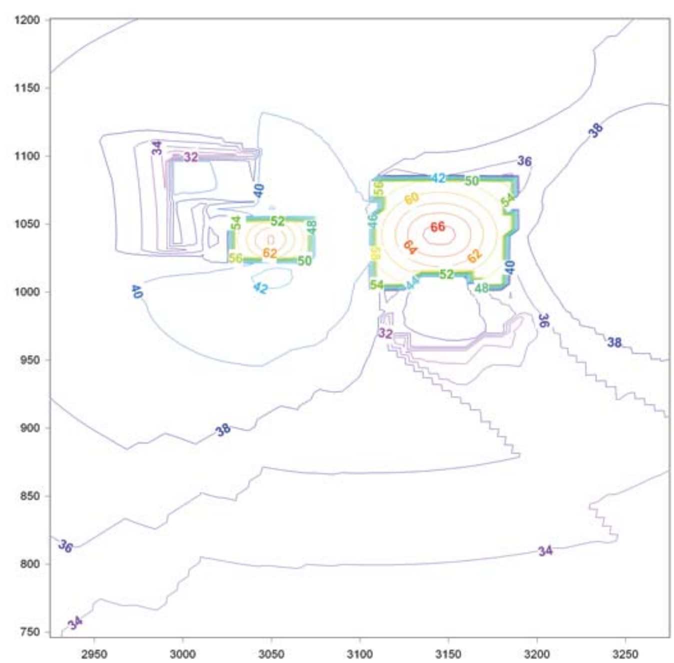

INDEX OF IMPORTANT TERMS