ACOUSTICAL SITE ASSESSMENT
SKYLINE TRUCK TRAIL RESIDENTIAL DEVELOPMENT
TPM 21107
SAN DIEGO, CA

Submitted to:

Mr. Alfonso Renteria
559 Merlot Place
Chula Vista, CA 91913

Lead Agency:

County of San Diego
Department of Planning and Land Use
5201 Ruffin Road, Suite B
San Diego, CA 92123

Investigative Science and Engineering, Inc.
Scientific, Environmental, and Forensic Consultants

P.O. Box 488 / 1134 D Street
Ramona, CA 92065
(760) 787-0016
www.ise.us

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EXECUTIVE SUMMARY

The findings contained within this *Acoustical Site Assessment* for the proposed Skyline Truck Trail TPM 21107 project site indicate that no noise sensitive area (i.e. backyards) would be impacted by the adjacent roadway system. Worst-case project-related traffic noise on NSA's was found to be 53.8 dBA CNEL.

Additionally, our findings indicate that there would be no acoustical impacts to the adjacent properties during construction operations. Worst-case noise levels would be 72.2 dBA Leq-8h at residential property lines with the construction plan area.

INTRODUCTION AND DEFINITIONS

Existing Site Characterization

The project site consists of approximately 58.2 acres located within the County of San Diego, California as shown in Figure 1 on the following page. Skyline Truck Trail borders the project site to the south and provides regional access to the project site via State Route 94 (SR-94) from the west as shown in Figure 2 on Page 3 of this report.

The project site currently resides as mostly undisturbed open area with large rocks and vegetation scattered intermittently across the site. Elevations across the entire property range from approximately 2,445 to 2,640 feet above mean sea level (MSL).

Project Description

The proposed development plan calls for a Tentative Parcel Map to subdivide the existing property into four parcels that would be sold for individual residential home development. Each parcel would include a septic system, water well, drainage, and necessary appurtenances required by the development pad. The currently proposed site development plan can be seen in Figure 3 on Page 4 of this report.

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.

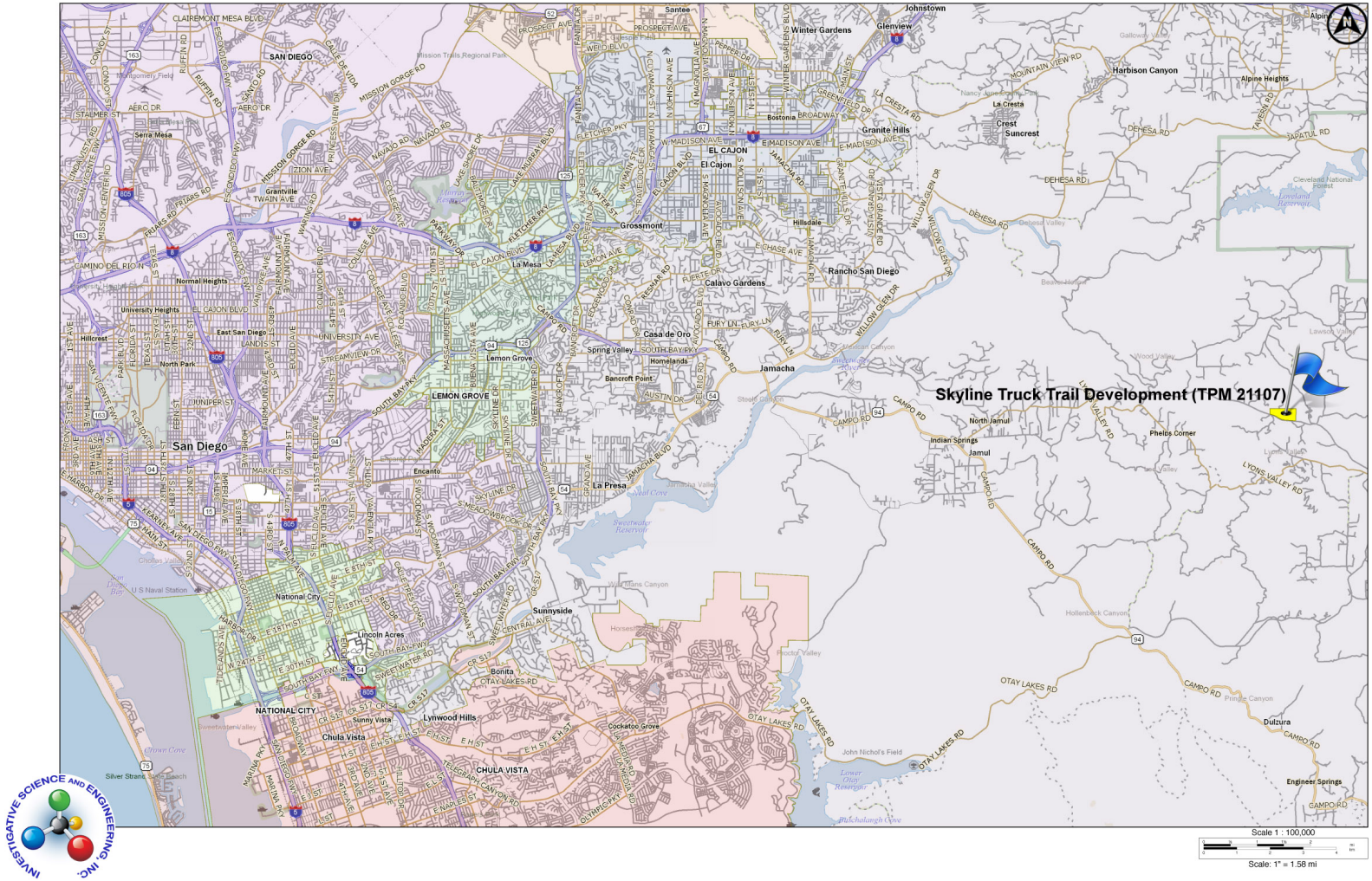

FIGURE 1: Project Study Area Vicinity Map (ISE 3/12)

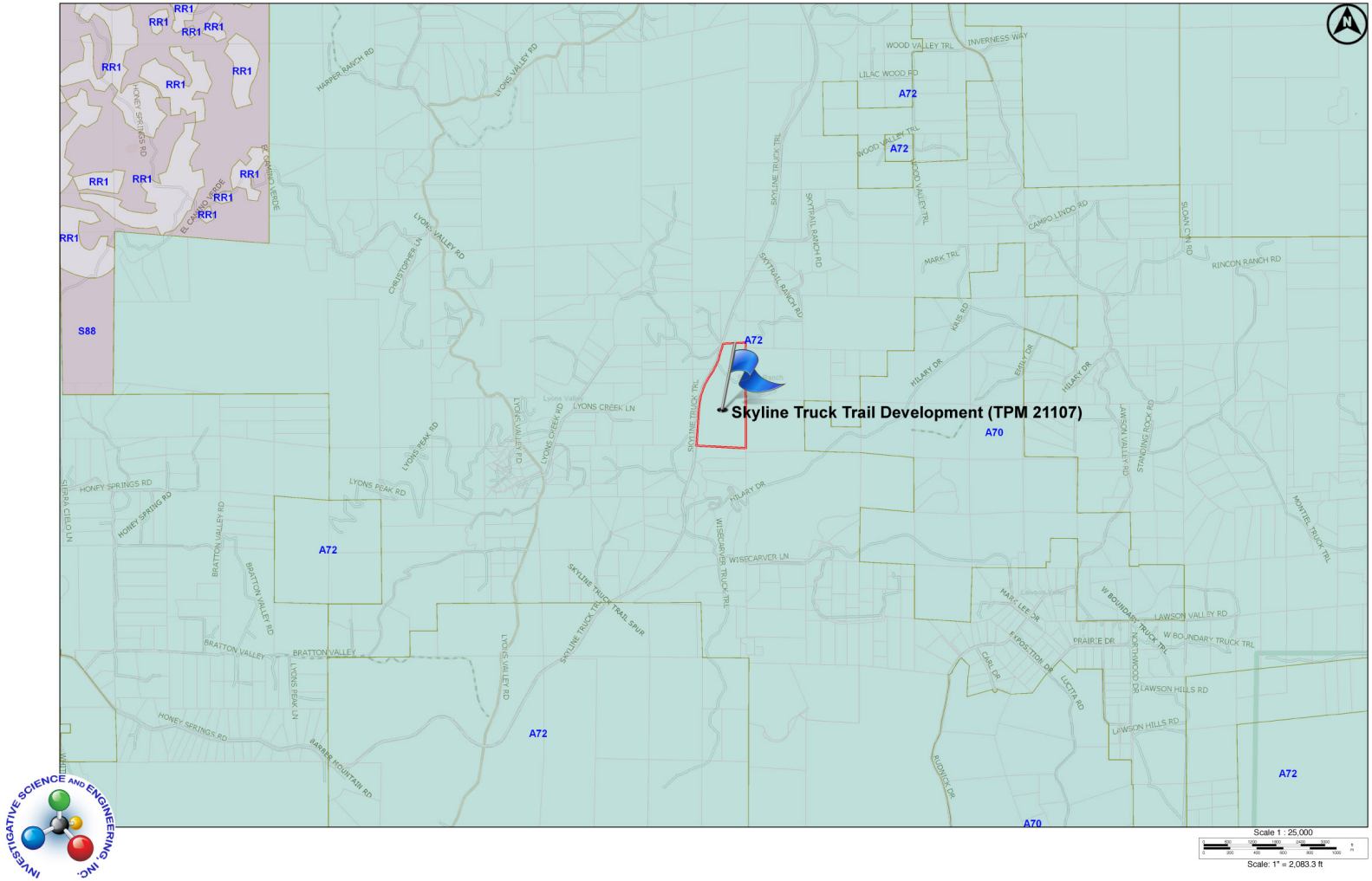

FIGURE 2: Project Site Map w/ Applicable Zoning Overlay (ISE 3/12)

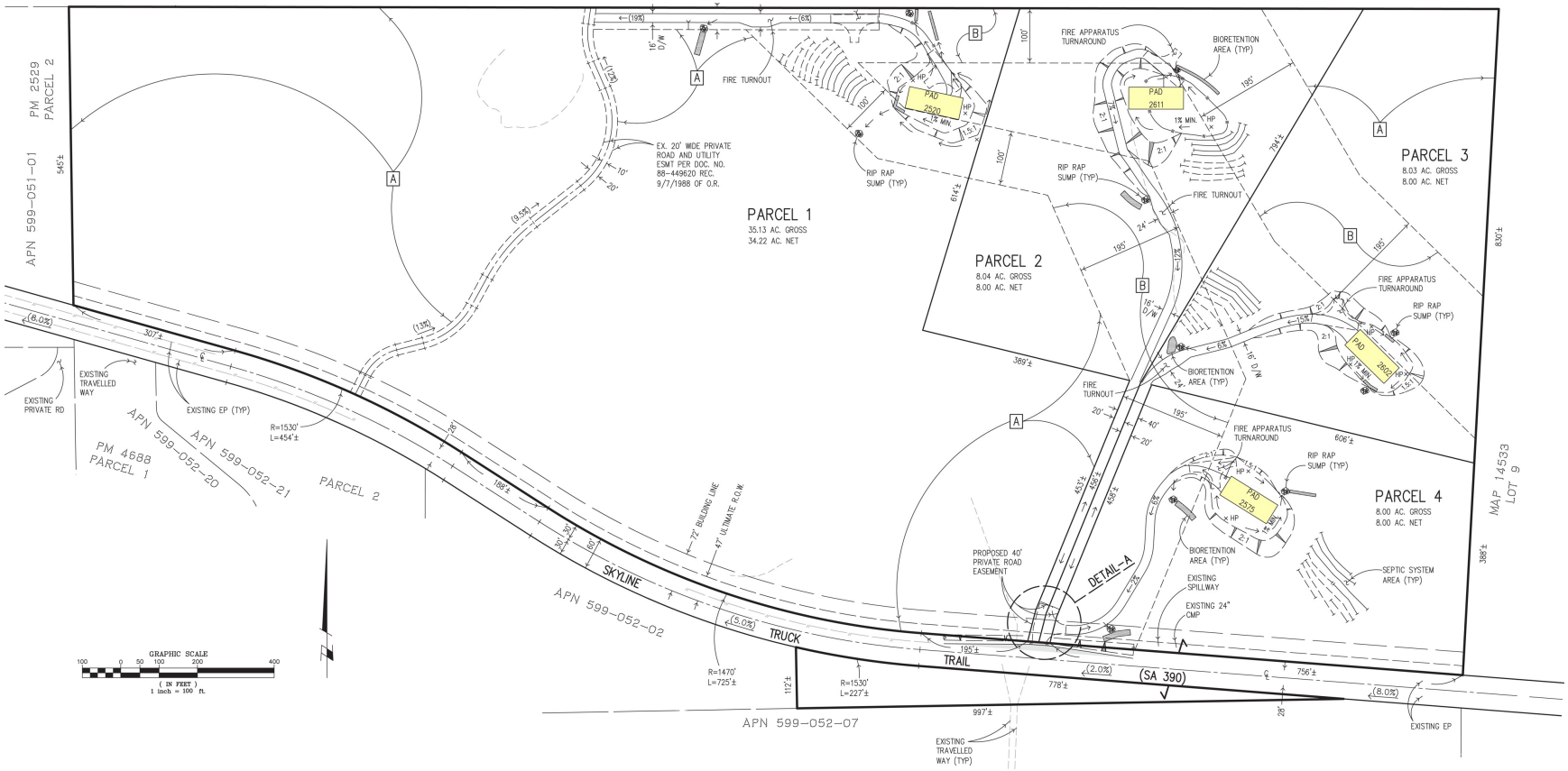

FIGURE 3: Proposed Site Skyline Truck Trail Residential Development Plan (Crew Engineering 4/11)

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.[1]

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

[1] 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.

The minimum change in sound level that the human ear can detect is approximately 3.0 dBA.[2] A change in sound level of 10 dB is usually perceived by the average person as a doubling (or halving) of the sound's loudness.[3] 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.[4]

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,

$$L_{eq} = 10 Log_{10}\left[\frac{1}{T}\int_{0}^{T} SPL(t)^2\, dt\right]$$

where,

L_{eq} is the energy equivalent sound level,

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

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

[4] 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.

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 to,

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

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.

The aggregate of all community noise events are 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-dBA 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 L_{eq} values, via the following expression:

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

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 yields the following alternate expression for CNEL based upon each discrete time period:

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

EXISTING ENVIRONMENTAL SETTING

Existing Conditions Field Survey Protocol

A Quest Model 2900 ANSI Type 2 integrating sound level meter was used as the data collection device. The meter was mounted to a tripod five feet above ground level in order to simulate the noise exposure of an average-height human being. Two short-term sound level measurements, denoted as Monitoring Locations ML 1 and ML 2, are shown in Figures 4a and -b starting on the following page.

The first meter location (ML 1) was located in the southwestern portion of the site roughly 85 ft to the north of Skyline Truck Trail. The second meter location (ML 2) was in the southeastern portion of the site roughly 50 feet north of Skyline Truck Trail. The monitoring was done in this manner in order to obtain an estimate of the worst-case existing onsite noise during typical peak hour traffic conditions.

The measurements were performed on September 3, 2008. All monitoring sites were spatially logged using a geographic positioning system (GPS) in order to maintain horizontal and vertical control. All equipment was calibrated before testing at ISE's acoustics and vibration laboratory.[5]

[5] All equipment calibration is performed at ISE's Acoustics and Vibration Laboratory using LORAN-C and Rubidium atomic time standards traceable to National Institute of Standards & Technology (NIST) to verify conformance with ANSI S1-4 1983 Type 2 and IEC 651 Type 2 standards. The time and frequency calibration signal has a long-term stability of 10^{-10}. Specifications for traceability can be obtained at *www.nist.gov*.

FIGURE 4a: Ambient Monitoring Locations ML 1 and ML 2 Photos (ISE 8/08)

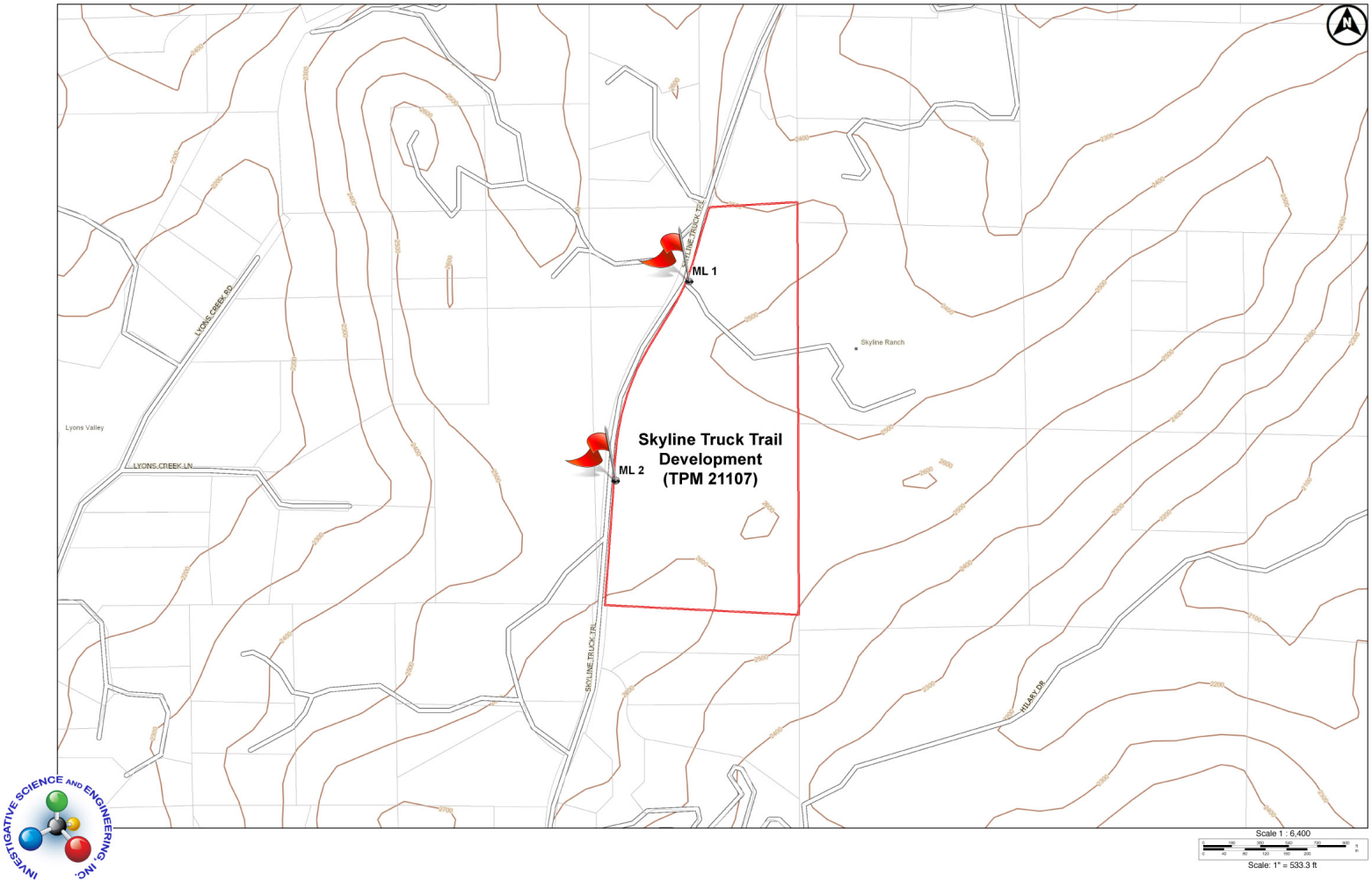

FIGURE 4b: Ambient Noise Monitoring Location Map (ISE 3/12)

Ambient Sound Monitoring Results

Testing conditions during the monitoring period were sunny with an average barometric pressure reading of 29.76 in-Hg, an average westerly wind speed of zero to one miles per hour (MPH) and an approximate mean temperature of 92 degrees Fahrenheit. The results of one-hour sound level monitoring are shown in Table 1 below. The values for the energy equivalent sound level (Leq), the maximum and minimum measured sound levels (Lmax and Lmin), and the statistical indicators L10, L50, and L90, are given for each monitoring location.

TABLE 1: Measured Ambient Sound Levels – Skyline Truck Trail TPM 21107

		1-Hour Noise Level Descriptors in dBA					
Site	**Start Time**	**Leq**	**Lmax**	**Lmin**	**L10**	**L50**	**L90**
ML 1	12:00 p.m.	49.1	64.0	26.5	53.4	38.4	28.9
ML 2	12:15 p.m.	59.6	76.7	33.4	63.8	51.3	38.6

Monitoring Locations:

- ML 1: Southwestern portion of project site facing Skyline Truck Trail.
  GPS: 32°43.677'N x 116°46.648'W, EPE 11 ft.
- ML 2: Southeastern portion of project site facing Skyline Truck Trail.
  GPS: 32°43.594'N x 116°46.422'W, EPE 11 ft.

Measurements performed by ISE on September 3, 2008. EPE = Estimated Position Error.

Measurements collected at the monitoring locations ML 1 and ML 2 reflect the typical sound levels associated with the community setting with existing adjacent roadway activities. The hourly average sound levels (or Leq-h) recorded over the monitoring period ranged between 49.1 dBA at ML 1 and 59.6 dBA at ML 2. The dominant noise source was peak hour traffic along Skyline Truck Trail.

As indicated by the monitoring equipment, at least 90 percent of the time (L90) the onsite sound levels at ML 1 and ML 2 were 28.9 dBA and 38.6 dBA, respectively. The acoustic floor for the site, as seen by the Lmin indicator was found to be 26.5 dBA at ML 1 and 33.4 dBA at ML 2. This would be considered the lowest attainable sound levels for the project area near Skyline Truck Trail during peak hour traffic times. Currently, the proposed project site would be deemed *acoustically compatible* with the County's noise abatement policies.

PROJECT CONSISTENCY WITH GENERAL PLAN STANDARDS

General Plan Land Use Noise Guidelines

Transportation noise levels, such as those produced by vehicles traveling to and from the project site, are governed under Policy 4b of the *County of San Diego's Noise Element of the County's General Plan*.[6] 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)*.[7]
> 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 VIII-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.

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[6] *As revised July 2006.*

[7] **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.

"*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:

(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.

Traffic Noise Impact Assessment Approach

The *Traffic Noise Model version 2.5* (TNM 2.5) based on FHWA-PD-96-010 and FHWA/CA/TL-87/03 standards was used to calculate future onsite vehicular traffic noise levels. These components are supported by a scientifically founded and experimentally calibrated acoustic computation methodology. The database is made up of over 6,000 individual pass-by events measured at forty sites across the country. Currently TNM 2.5 is the only noise-modeling program accepted by Caltrans for use within the State of California.

Receptor locations were situated along the property lines closest to major roadways in order to represent the worst-case traffic sound levels across the project site. Receptor elevations were considered five feet above the pad (noise sensitive areas/patios) elevation for first floor rear yard areas and 15 feet above the pad elevation for second floor façade predictions. The receptor locations can be seen in Figure 5 on the following page.

Input to the acoustical model includes the following:

- A digitized representation of all affected roadways (i.e., *Skyline Truck Trail*).
- Future Average Daily Trips (ADTs) for nearby major roadways.[8]
- A 95/3/2 (automobiles/medium/heavy) traffic mix in accordance with CALTRANS.
- A peak hour traffic percentage of 10% of the ADT.[9]
- Receptor and topographic elevations as identified in the project site plans.[10]

The model assumed a 'hard-site' propagation rule (i.e., 3.0 dBA loss per doubling of distance (DD) between source and receiver), thereby yielding a representative worst-case noise contour set.

Future Traffic Noise Impact Findings

The primary sources of future traffic noise near the project site would be from Skyline Truck Trail. The project site is identified within SANDAG Zone 13. Future traffic estimates for this roadway adjacent to our project site predicts volumes for Skyline Truck Trail as high as 4,000 ADT. This volume takes into considerations future developments within traffic analysis Zone 13 as predicted by the enhanced traffic model. The traffic predictions are provided as an attachment to this report.

The results of the acoustical modeling for all lots are shown in Table 2 on Page 16 of this report for receptor calculation points CALC1 through CALC4 previously shown in Figure 5. The table output shows the unmitigated noise sensitive area sound levels modeled with average pavement. The County's Noise Element classifies that any Noise Sensitive Area (NSA) exceeding 60 dBA must be subject to proper mitigation in order to lower the sound levels below 60 dBA.[11] No acoustical impacts are indicated.

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[8] Source: *SANDAG Series 10 – 2030 Enhanced Traffic Prediction Model.*

[9] For values between approximately 8 and 12 percent, the energy-mean A-weighted sound level is equivalent to the CNEL. Outside this range, a maximum variance of up to two dBA occurs between Leq-h and CNEL.

[10] Source: Crew Engineering and Surveying, 4/11.

[11] The County's Noise Element specifies that 10% of the net lot area per parcel must comply with the County's exterior useable area criterion of 60 dBA CNEL. Since the worst-case receptors would not exceed the County's criterion the designed useable area can be any 10% of the proposed pad

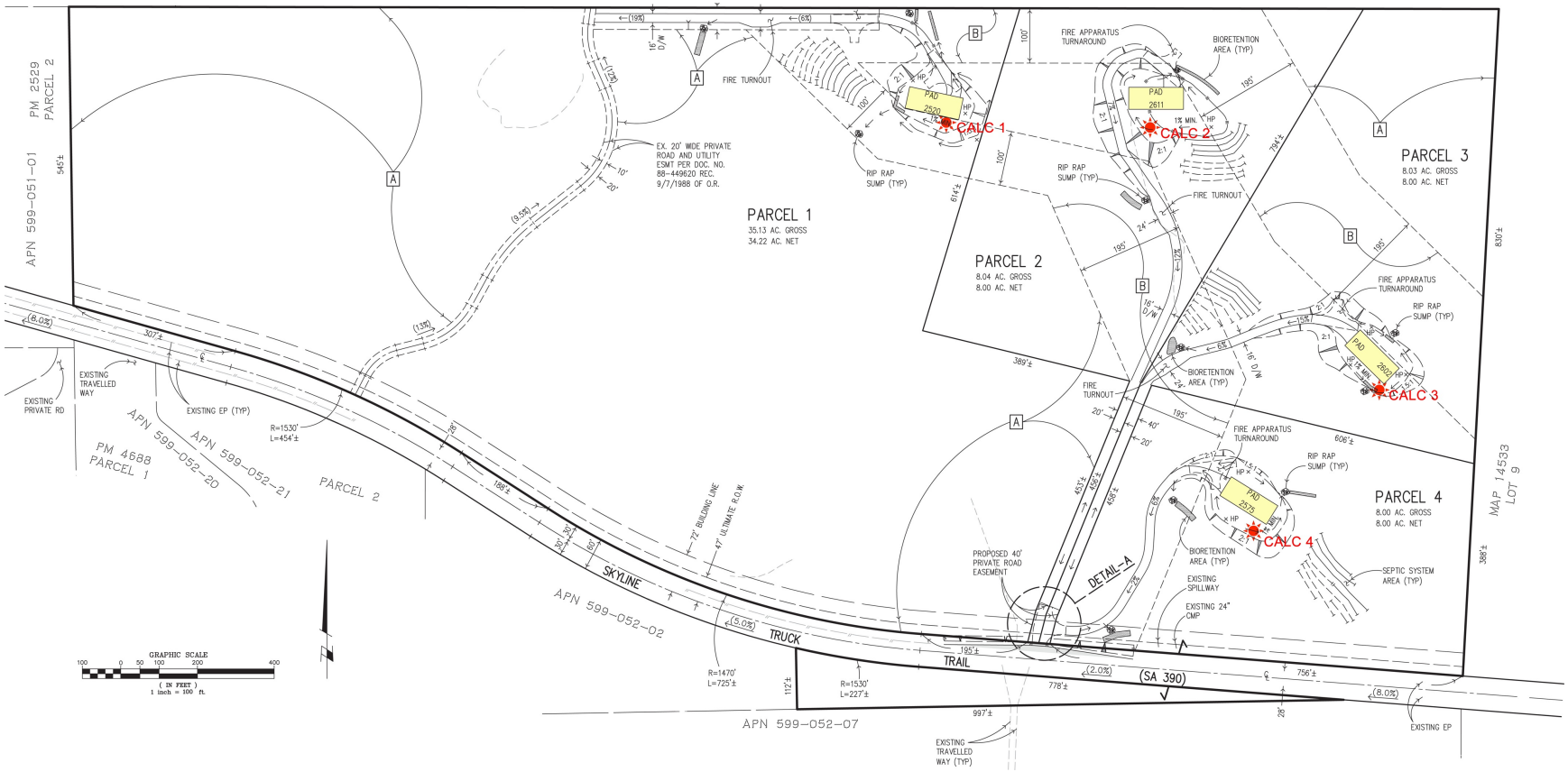
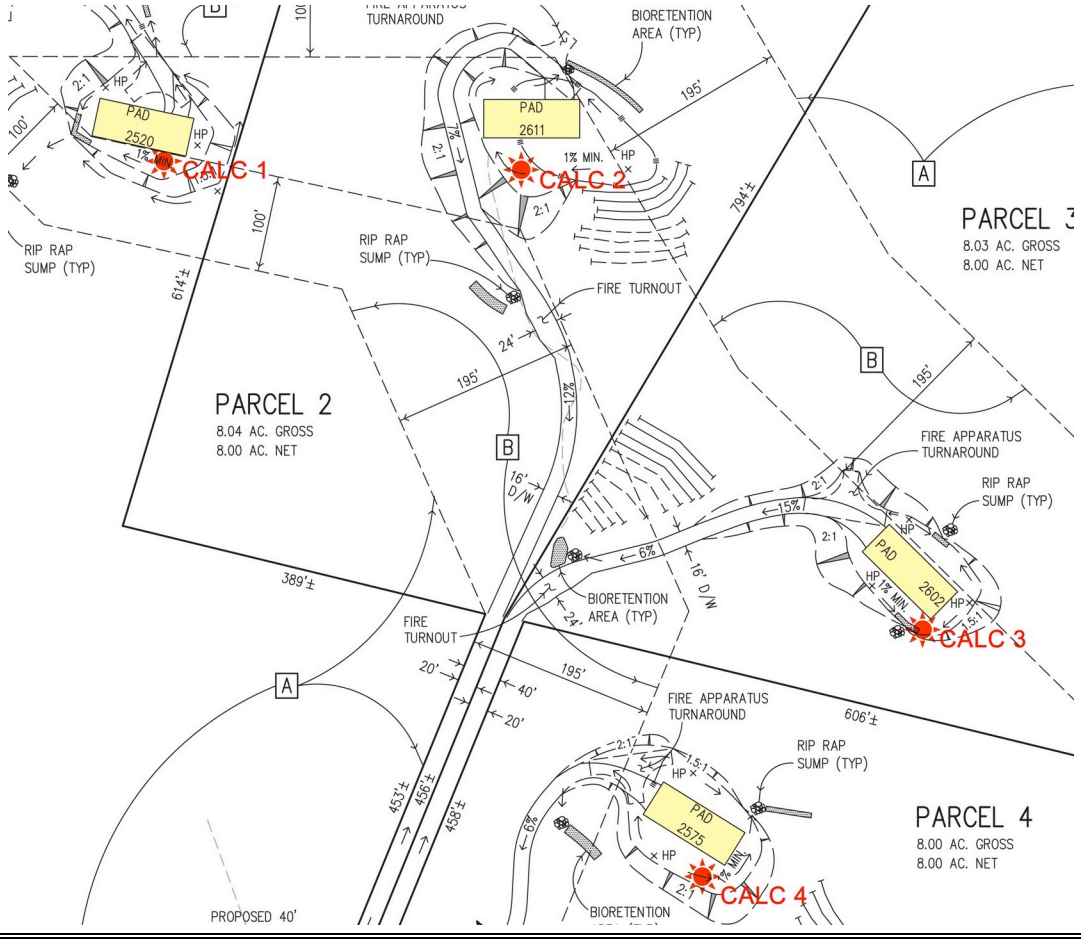


FIGURE 5: Modeled Receptor Locations within Project Site (ISE 3/12)

TABLE 2: Predicted Transportation Noise Levels – Skyline Truck Trail Residential Development

Receptor ID	Unmitigated First Floor Sound Level	Unmitigated Second Floor Sound Level	Exterior Mitigation Required?	Interior Mitigation Required?
CALC 1	39.1	39.1	No	No
CALC 2	44.2	44.2	No	No
CALC 3	45.9	45.9	No	No
CALC 4	53.8	53.8	No	No



Finally, the unobstructed 60 dBA CNEL noise contour for the site is shown in Figure 6 on the following page. The identified 60 dBA noise contour would be nearly the same for both first and second floor areas.

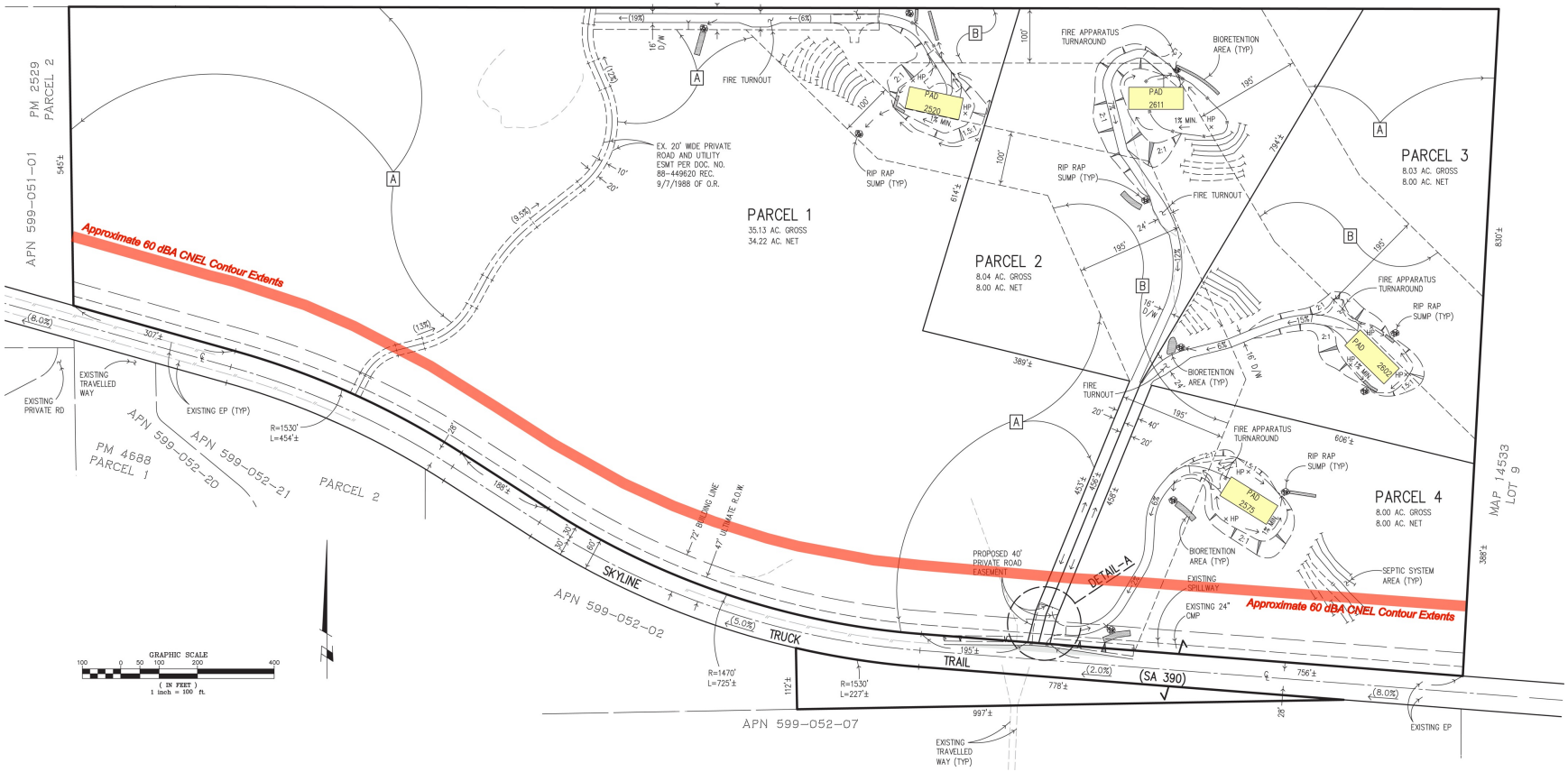


FIGURE 6: Predicted Worst-Case 60 dBA CNEL Contour Line Extents (ISE 3/12)

PROJECT CONSISTENCY WITH NOISE ORDINANCE STANDARDS

County of San Diego Noise Ordinance Standards

The San Diego County Noise Ordinance Section 36.404 governs fixed source and/or operational noise. The applicable sound levels are a function of the time of day and the land use zone. Sound levels are measured at the boundary of the property containing the noise source. The relevant limits are shown in Table 3 below. In the case where two adjacent property lines differ in zoning, the applicable threshold would be the arithmetic average of the two standards. If the ambient sound levels are consistently higher then zonal property line standards, then the ambient conditions would be the property line standard. This standard would be applied during all hours of operation.

TABLE 3: County of San Diego Noise Ordinance Limits

Land Use Zone	Time of Day	1-Hour Average Sound Level (dBA Leq)
R-S, R-D, R-R, R-MH, A-70, A-72, S-80, S-81, S-87, S-88, S-90, S-92, R-V, and R-U	**7 am to 10 pm** **10 pm to 7 am**	**50** **45**
R-R0, R-C, R-M, C-30, and S-86	7 am to 10 pm 10 pm to 7 am	55 50
S-94 and other commercial zones	7 am to 10 pm 10 pm to 7 am	60 55
M-50, M-52, and M-54	any time	70
S-82 and M-58	any time	70

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

The proposed Skyline Truck Trail TPM 21107 development is zoned A-72 (Agriculture). The standard for this zoning would be a one-hour average sound level of 50 dBA between the hours of 7 am and 10 pm and a one-hour average sound level of 45 dBA between the hours of 10 pm and 7 am. Adjacent land uses around the entire project are zoned residential that allows the same standard.

Operational Noise Impact Potential

Due to the large separation distances between individual sensitive receptor areas, operational noise due to the proposed project will have no significant impacts on the adjacent properties.

CONSTRUCTION NOISE IMPACT POTENTIAL

County of San Diego Construction Noise Ordinance Standards

Noise generated by construction activities related to the project will not exceed the standards listed in San Diego County Code Section 36.410, Construction Equipment.

Section 36.410 states the following:

Except for emergency work,

(a) It shall be unlawful for any person to operate construction equipment between the hours of 7 p.m. of any day and 7 a.m. of the following day.

(b) It shall also be unlawful for any person to operate construction equipment on Sundays, and days appointed by the President, Governor, or the Board of Supervisors for a public fast, Thanksgiving, or holiday, but a person may operate construction equipment on the above-specified days between the hours of 10 a.m. and 5 p.m. at his residence or for the purpose of constructing a residence for himself, provided that the average sound level does not exceed 75 decibels during the period of operation and that the operation of construction equipment is not carried out for profit or livelihood.

(c) It shall also be unlawful to operate any construction equipment so as to cause at or beyond the property line of any property upon which a legal dwelling unit is located an average sound level greater than 75 decibels between the hours of 7 a.m. and 7 p.m.

For temporary activities, the County considers the 75 decibel (A) average to be based on a period of one hour.

The project will have a property line threshold of 75 dBA Leq-h between the hours of 7:00 a.m. to 7:00 p.m. Monday through Saturday and 10:00 a.m. to 5:00 p.m. on Sundays or holidays.

Onsite Construction Noise Analysis Procedure

Noise emission generators associated with construction operations for the proposed project would consist of the following equipment: Excavator, backhoe, water trucks, and tractor. A water-drilling rig would be utilized at a time period after completion of the building pad and would consist of a single unit acoustically equivalent to a conventional excavator. Thus, the conventional grading analysis presented herein is a worst-case study of proposed construction noise levels. Typical construction phasing would include grading, underground utility installation, and paving phases. Each phase of the construction process would require the use of any variation of the aforementioned equipment.

Aggregate noise levels associated with this type of activity were analyzed for consistency with the aforementioned construction noise ordinance. It should be noted that not all of the aforementioned equipment would be in operation at the same time and that a construction plan would be in place.

Construction Noise Impact Potential

Construction within the proposed project site for any phase of the project would typically occur between the hours of 7:00 a.m. and 7:00 p.m. Monday through Friday in accordance with County construction requirements and would operate for a period of eight-hours within this timeframe. Additionally, the individual lot grading would normally consist of one medium sized piece of equipment at a time. Construction of the infrastructure would use two medium pieces of equipments at a time over a multi-month period.

Tables 4a through -b starting below identifies typical major classes of construction equipment based upon past measured levels.[12] The table identifies the expected equipment type and the averaged aggregate eight-hour sound level at 50 feet.

TABLE 4a: Predicted Construction Noise Levels – Grading Phase

Equipment Type	Qty. Used	Source Level @ 50 Feet (dBA)
Excavator	1	80
Backhoe	1	75
Tractor	1	80
Water Truck	1	75

TABLE 4b: Predicted Construction Noise Levels – Infrastructure Operations

Equipment Combination	Qty. Used	Cumulative Effect @ 50 Feet (dBA)
Excavator & Backhoe	1	81.2
Excavator & Tractor	1	83.0
Excavator & Water Truck	1	81.2
Backhoe & Tractor	1	81.2
Backhoe & Water Truck	1	78.0
Tractor & Water Truck	1	81.2

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

Tables 5a through -c shown below gives the calculated allowable hours of construction for all phase scenarios to meet the County's 75 dBA eight-hour energy average noise level. Distances from construction sources were taken from the geometric centroid of every lot area to the closest residential property line to determined worst-case noise levels.

TABLE 5a: Maximum Allowable Hours of Construction – Single Equipment Grading Operation Plan

Parcel Number	Distance to P/L (ft)	Single Excavator (Hours/Day)	Single Water Truck (Hours/Day)	Single Tractor (Hours/Day)	Single Backhoe (Hours/Day)
1	229	8.0	8.0	8.0	8.0
2	173	8.0	8.0	8.0	8.0
3	217	8.0	8.0	8.0	8.0
4	177	8.0	8.0	8.0	8.0

TABLE 5b: Maximum Allowable Hours of Construction – Two Equipment Operation Plan

Parcel Number	Distance to P/L (ft)	Excavator & Water Truck (Hours/Day)	Excavator & Tractor (Hours/Day)	Excavator & Backhoe (Hours/Day)
1	229	8.0	8.0	8.0
2	173	8.0	8.0	8.0
3	217	8.0	8.0	8.0
4	177	8.0	8.0	8.0

TABLE 5c: Maximum Allowable Hours of Construction – Two Equipment Operation Plan

Parcel Number	Distance to P/L (ft)	Water Truck & Tractor (Hours/Day)	Water Truck & Backhoe (Hours/Day)	Backhoe & Tractor (Hours/Day)
1	229	8.0	8.0	8.0
2	173	8.0	8.0	8.0
3	217	8.0	8.0	8.0
4	177	8.0	8.0	8.0

All aforementioned scenarios of construction can be conducted throughout the hours of 7 a.m. to 7 p.m. Monday through Saturday. Based on the results, worst-case construction noise levels at any residential property lines would be as high as 72.2 dBA

Leq-8h, which is below the County's allowable threshold of 75.0 Leq-8h. No mitigation due to proposed construction would be necessary.

GROUNDBORNE NOISE IMPACT POTENTIAL

Guidelines for Determination of Significance

The groundborne noise impact screening criteria for development projects, as defined by the County of San Diego, is shown below in Table 6.

TABLE 6: County of San Diego Groundborne Vibration Impact Criteria

Land Use Category	Ground-Borne Vibration Impact Levels (inches/sec RMS)		Ground-Borne Noise Impact Levels (dB re 20 micro Pascal's)	
	Frequent Events1	Infrequent Events[2]	Frequent[1]	Infrequent Events[2]
Category 1: Building where low ambient vibration is essential for interior operations. (research & manufacturing facilities with special vibration constraints)	0.0018 [3]	0.0018 [3]	Not applicable[5]	Not applicable[5]
Category 2: Residences and buildings where people normally sleep. (hotels, hospitals, residences, & other sleeping facilities)	0.0040	0.010	35 dBA	43 dBA
Category 3: Institutional land uses with primarily daytime use. (schools, churches, libraries, other institutions, & quiet offices)	0.0056	0.014	40 dBA	48 dBA

Source: U.S. Department of Transportation, Federal Transit Administration, "Transit Noise and Vibration Impact Assessment," May 2006.

Notes:

1. "Frequent Events" is defined as more than 70 vibration events per day. Most rapid transit projects fall into this category.
2. "Infrequent Events" is defined as fewer than 70 vibration events per day. This category includes most commuter rail systems.
3. This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration sensitive manufacturing or research will require detailed evaluation to define acceptable vibration levels. Ensuring lower vibration levels

in a building often requires special design of the HVAC systems and stiffened floors.

4. Vibration-sensitive equipment is not sensitive to ground-borne noise.
5. There are some buildings, such as concert halls, TV and recording studios, and theaters that can be very sensitive to vibration and noise but do not fit into any of the three categories.
6. For Categories 2 and 3 with occupied facilities, isolated events such as blasting are significant when the peak particle velocity (PPV) exceeds one inch per second. Continuous or frequent intermittent vibration sources such as impact pile drivers are significant when their PPV exceeds 0.1 inch per second. . More specific criteria for structures and potential annoyance were developed by Caltrans (2004) and will be used to evaluate these continuous or transient sources in San Diego County.

Groundborne Noise Findings

Given the type of project being developed, ground vibration due to the proposed project is not anticipated to have significant impacts on adjacent properties.

CONCLUSIONS

Summary of Project Impacts and Mitigation

The proposed Skyline Truck Trail TPM 21107 will not have any noise impacts on the adjacent land uses.

List of Design Considerations

Construction operations should follow the aforementioned hours per day for all scenarios listed in Tables 5a through –c in this report. No exterior mitigation is necessary for the proposed 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

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 a non-photo blue ISE watermark at the bottom of each page.

Approved as to Form and Content:

Rick Tavares, Ph.D.

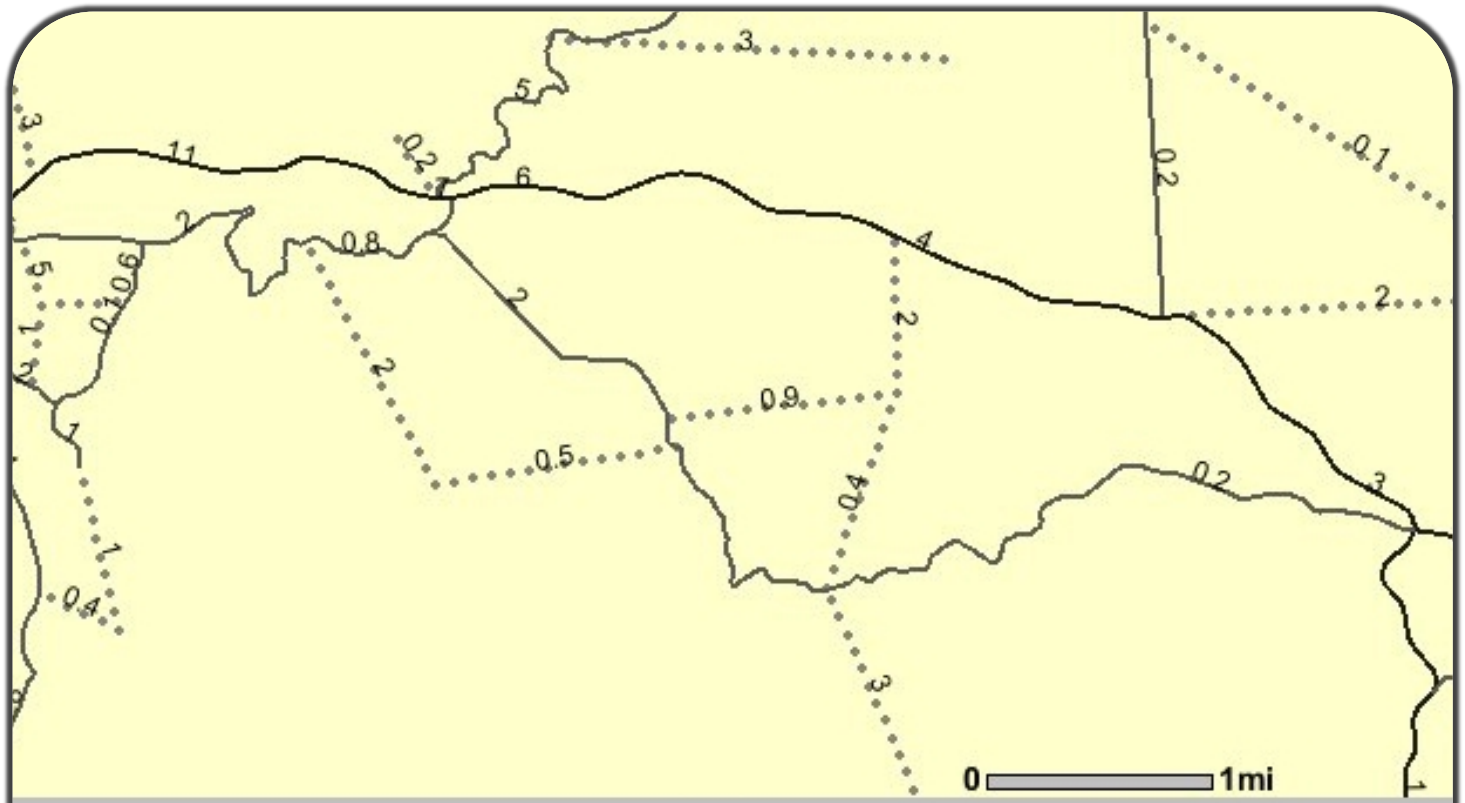
Project Principal
Investigative Science and Engineering, Inc. (ISE)

APPENDICES / SUPPLEMENTAL INFORMATION

APP 1 – Acronyms and Glossary of Terms

ADT	Average Daily Trips
ANSI	American National Standards Institute
a.m.	ante meridian
B.S.	Bachelor of Science (*Baccalaureatus Scientiæ*)
CA	California
Cal/OSHA	California Occupational Safety and Health Administration
CALVENO	California Vehicle Noise Emission Number
CEQA	California Environment Quality Act
CCR	California Code Regulations
CNEL	Community Noise Equivalent Level
dB	Decibels
dBA	A-weighted sound level (decibels)
EIT	Engineer in Training
EPE	Estimated Position Error
GPS	Global Positioning System
Hz	Hertz or Cycles per Second
i.e.	id est (that is)
ISE	Investigative Science & Engineering, Inc.
L10	A-weighted sound level of 10th percentile group
L50	A-weighted sound level of 50th percentile group
L90	A-weighted sound level of 90th percentile group
Ldn	Day-Night Average Sound Level
Leq	Equivalent sound level
Leq-h	Equivalent sound level per hour
Lmax	Maximum noise level
Lmin	Minimum noise level
M.S.	Master of Science (*Magister Scientiæ*)
ML	Monitoring location
MPH	Miles per hour
MSL	Mean Sea Level
Ph.D.	Doctor of Philosophy (*Philosophiæ Doctor*)
PL	Property line
p.m.	post meridian
SPL	Sound pressure level

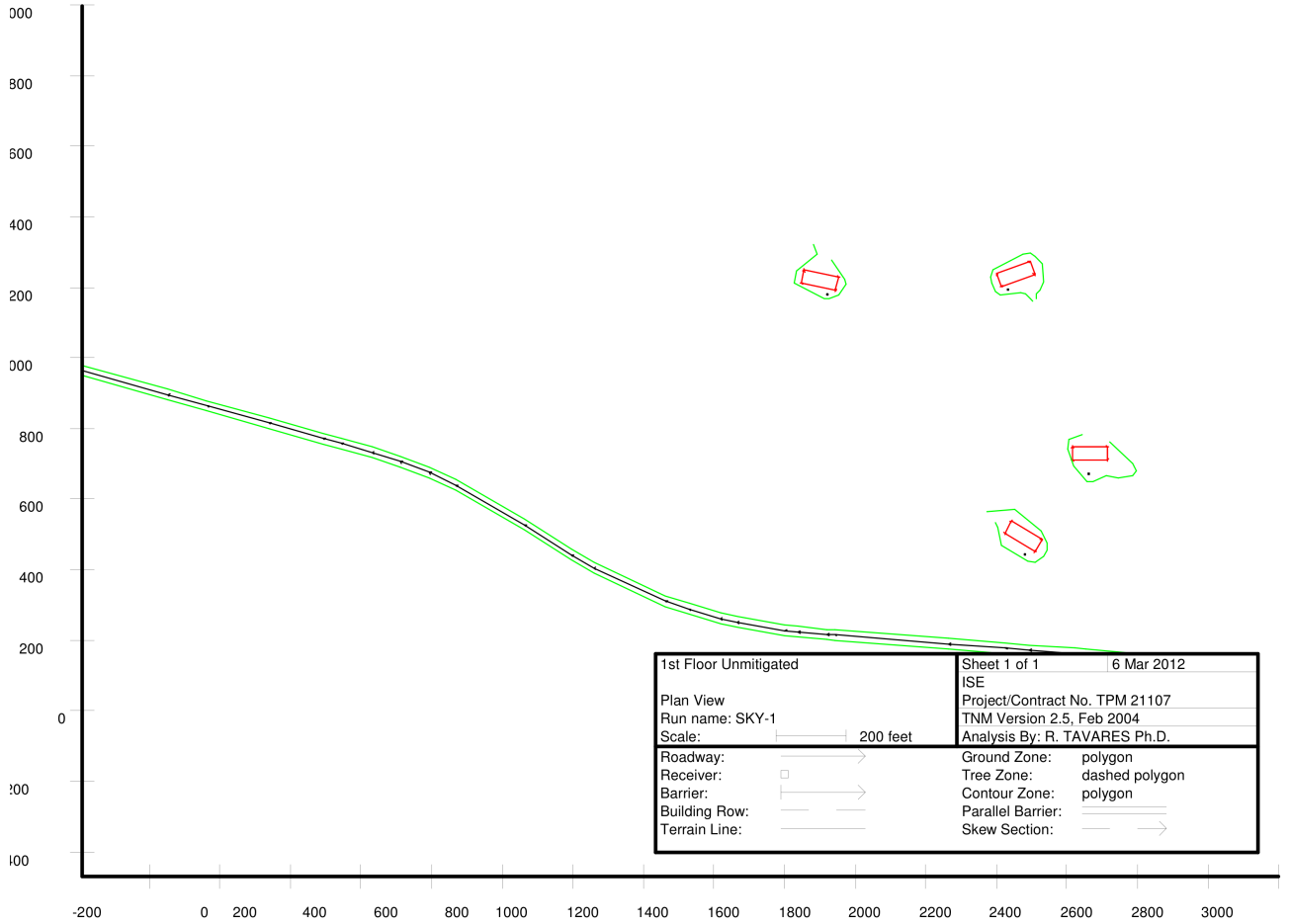
APP 2 – SANDAG 2030 Traffic Projections for Project Area



Roads

Rec	NM	AWT1000S	SPEED	LANES	WAY	CLASS	#SHAPE#	#ID#
1	SKYLINE TRUCK	4	40	2	2	COLLECTOR	[line]	14915

APP 3 – TNM Model Input/Output Data – Skyline Truck Trail Residential Development (First Floor)



INPUT: ROADWAYS **TPM 21107**

ISE					**6 March 2012**							
R. TAVARES Ph.D.					**TNM 2.5**							
INPUT: ROADWAYS								**Average pavement type shall be used unless**				
PROJECT/CONTRACT:	**TPM 21107**							**a State highway agency substantiates the use**				
RUN:	**1st Floor Unmitigated**							**of a different type with the approval of FHWA**				
Roadway		**Points**										
Name	**Width**	**Name**	**No.**	**Coordinates (pavement)**				**Flow Control**			**Segment**	
				X	**Y**	**Z**		**Control Device**	**Speed Constraint**	**Percent Vehicles Affected**	**Pvmt Type**	**On Struct?**
	ft			ft	ft	ft			mph	%		
Skyline Truck Trail	30.0	STT-1	1	2,843.0	135.0	2,615.00					Average	
		STT-2	2	2,768.0	141.0	2,605.00					Average	
		STT-3	3	2,591.0	154.0	2,595.00					Average	
		STT-4	4	2,562.0	157.0	2,585.00					Average	
		STT-5	5	2,447.0	166.0	2,555.00					Average	
		STT-6	6	2,419.0	168.0	2,550.00					Average	
		STT-7	7	2,289.0	178.0	2,545.00					Average	
		STT-8	8	2,221.0	183.0	2,540.00					Average	
		STT-9	9	2,061.0	196.0	2,540.00					Average	
		STT-10	10	1,739.0	221.0	2,550.00					Average	
		STT-11	11	1,717.0	222.0	2,555.00					Average	
		STT-12	12	1,635.0	230.0	2,555.00					Average	
		STT-13	13	1,598.0	234.0	2,550.00					Average	
		STT-14	14	1,463.0	257.0	2,550.00					Average	
		STT-15	15	1,416.0	268.0	2,545.00					Average	
		STT-16	16	1,327.0	294.0	2,535.00					Average	
		STT-17	17	1,260.0	317.0	2,530.00					Average	
		STT-18	18	1,058.0	411.0	2,525.00					Average	
		STT-19	19	995.0	448.0	2,520.00					Average	
		STT-20	20	862.0	533.0	2,520.00					Average	
		STT-21	21	668.0	645.0	2,525.00					Average	
		STT-22	22	593.0	680.0	2,540.00					Average	
		STT-23	23	511.0	711.0	2,545.00					Average	
		STT-24	24	432.0	737.0	2,540.00					Average	
		STT-25	25	345.0	762.0	2,525.00					Average	

INPUT: ROADWAYS **TPM 21107**

		STT-26	26	294.0	776.0	2,520.00			Average	
		STT-27	27	141.0	820.0	2,500.00			Average	
		STT-28	28	-35.0	869.0	2,475.00			Average	
		STT-29	29	-146.0	900.0	2,450.00			Average	
		STT-30	30	-432.0	981.0	2,425.00				

INPUT: TRAFFIC FOR LAeq1h Volumes **TPM 21107**

ISE			**6 March 2012**									
R. TAVARES Ph.D.			**TNM 2.5**									
INPUT: TRAFFIC FOR LAeq1h Volumes												
PROJECT/CONTRACT:	**TPM 21107**											
RUN:	**1st Floor Unmitigated**											
Roadway	**Points**											
Name	**Name**	**No.**	**Segment**									
			Autos		**MTrucks**		**HTrucks**		**Buses**		**Motorcycles**	
			V	**S**	**V**	**S**	**V**	**S**	**V**	**S**	**V**	**S**
			veh/hr	mph	veh/hr	mph	veh/hr	mph	veh/hr	mph	veh/hr	mph
Skyline Truck Trail	STT-1	1	380	40	12	40	8	40	0	0	0	0
	STT-2	2	380	40	12	40	8	40	0	0	0	0
	STT-3	3	380	40	12	40	8	40	0	0	0	0
	STT-4	4	380	40	12	40	8	40	0	0	0	0
	STT-5	5	380	40	12	40	8	40	0	0	0	0
	STT-6	6	380	40	12	40	8	40	0	0	0	0
	STT-7	7	380	40	12	40	8	40	0	0	0	0
	STT-8	8	380	40	12	40	8	40	0	0	0	0
	STT-9	9	380	40	12	40	8	40	0	0	0	0
	STT-10	10	380	40	12	40	8	40	0	0	0	0
	STT-11	11	380	40	12	40	8	40	0	0	0	0
	STT-12	12	380	40	12	40	8	40	0	0	0	0
	STT-13	13	380	40	12	40	8	40	0	0	0	0
	STT-14	14	380	40	12	40	8	40	0	0	0	0
	STT-15	15	380	40	12	40	8	40	0	0	0	0
	STT-16	16	380	40	12	40	8	40	0	0	0	0
	STT-17	17	380	40	12	40	8	40	0	0	0	0
	STT-18	18	380	40	12	40	8	40	0	0	0	0
	STT-19	19	380	40	12	40	8	40	0	0	0	0
	STT-20	20	380	40	12	40	8	40	0	0	0	0
	STT-21	21	380	40	12	40	8	40	0	0	0	0
	STT-22	22	380	40	12	40	8	40	0	0	0	0
	STT-23	23	380	40	12	40	8	40	0	0	0	0

C:\Documents and Settings\winmac\Desktop\TPM 21107\SKY-1 **1**

INPUT: TRAFFIC FOR LAeq1h Volumes									TPM 21107			
	STT-24	24	380	40	12	40	8	40	0	0	0	0
	STT-25	25	380	40	12	40	8	40	0	0	0	0
	STT-26	26	380	40	12	40	8	40	0	0	0	0
	STT-27	27	380	40	12	40	8	40	0	0	0	0
	STT-28	28	380	40	12	40	8	40	0	0	0	0
	STT-29	29	380	40	12	40	8	40	0	0	0	0
	STT-30	30										

INPUT: TRAFFIC FOR LAeq1h Volumes **TPM 21107**

ISE			**6 March 2012**									
R. TAVARES Ph.D.			**TNM 2.5**									
INPUT: TRAFFIC FOR LAeq1h Volumes												
PROJECT/CONTRACT:	**TPM 21107**											
RUN:	**1st Floor Unmitigated**											
Roadway	**Points**											
Name	**Name**	**No.**	**Segment**									
			User 1		**User 2**		**User 3**		**User 4**		**<unknown>**	
			V	**S**	**V**	**S**	**V**	**S**	**V**	**S**	**V**	**S**
			veh/hr	mph	veh/hr	mph	veh/hr	mph	veh/hr	mph	veh/hr	mph
Skyline Truck Trail	STT-1	1										
	STT-2	2										
	STT-3	3										
	STT-4	4										
	STT-5	5										
	STT-6	6										
	STT-7	7										
	STT-8	8										
	STT-9	9										
	STT-10	10										
	STT-11	11										
	STT-12	12										
	STT-13	13										
	STT-14	14										
	STT-15	15										
	STT-16	16										
	STT-17	17										
	STT-18	18										
	STT-19	19										
	STT-20	20										
	STT-21	21										
	STT-22	22										
	STT-23	23										

INPUT: TRAFFIC FOR LAeq1h Volumes **TPM 21107**

	STT-24	24
	STT-25	25
	STT-26	26
	STT-27	27
	STT-28	28
	STT-29	29
	STT-30	30

INPUT: RECEIVERS **TPM 21107**

ISE						**6 March 2012**					
R. TAVARES Ph.D.						**TNM 2.5**					
INPUT: RECEIVERS											
PROJECT/CONTRACT:	**TPM 21107**										
RUN:	**1st Floor Unmitigated**										
Receiver											
Name	**No.**	**#DUs**	**Coordinates (ground)**			**Height**	**Input Sound Levels and Criteria**				**Active**
			X	**Y**	**Z**	**above**	**Existing**	**Impact Criteria**		**NR**	**in**
						Ground	**LAeq1h**	**LAeq1h**	**Sub'l**	**Goal**	**Calc.**
			ft	ft	ft	ft	dBA	dBA	dB	dB	
CALC2	2	1	2,229.1	1,196.7	2,560.00	4.92	0.00	60	10.0	8.0	Y
CALC4	3	1	2,274.9	449.3	2,575.00	4.92	0.00	60	10.0	8.0	Y
CALC3	4	1	2,455.9	676.6	2,520.00	4.92	0.00	60	10.0	8.0	Y
CALC1	5	1	1,718.5	1,182.6	2,512.00	4.92	0.00	60	10.0	8.0	Y

INPUT: BARRIERS **TPM 21107**

ISE **6 March 2012**
R. TAVARES Ph.D. **TNM 2.5**

INPUT: BARRIERS
PROJECT/CONTRACT: **TPM 21107**
RUN: **1st Floor Unmitigated**

Barrier Name	Type	Height Min	Height Max	If Wall $ per Unit Area	If Berm $ per Unit Vol.	Top Width	Run:Rise	Add'tnl $ per Unit Length	Points Name	No.	Coordinates (bottom) X	Y	Z	Height at Point	Segment Seg Ht Increment	Perturbs #Up	Perturbs #Dn	On Struct?	Important Reflections?
		ft	ft	$/sq ft	$/cu yd	ft	ft:ft	$/ft			ft	ft	ft	ft	ft				
House 1	W	0.00	99.99	0.00				0.00	H1-1	1	2,196.0	1,242.4	2,560.00	10.00	0.00	0	0		
									H1-2	2	2,290.0	1,276.6	2,560.00	10.00	0.00	0	0		
									H1-3	3	2,303.0	1,239.6	2,560.00	10.00	0.00	0	0		
									H1-4	4	2,209.0	1,205.6	2,560.00	10.00	0.00	0	0		
									H1-5	5	2,195.0	1,242.6	2,560.00	10.00					
House 2	W	0.00	99.99	0.00				0.00	H2-1	6	2,239.0	543.0	2,575.00	10.00	0.00	0	0		
									H2-2	7	2,324.0	490.0	2,575.00	10.00	0.00	0	0		
									H2-3	8	2,303.0	456.0	2,575.00	10.00	0.00	0	0		
									H2-4	9	2,218.0	509.0	2,575.00	10.00	0.00	0	0		
									H2-5	10	2,238.0	543.0	2,575.00	10.00					
House 3	W	0.00	99.99	0.00				0.00	H3-1	11	1,652.0	1,254.0	2,520.00	10.00	0.00	0	0		
									H3-2	12	1,750.0	1,233.0	2,520.00	10.00	0.00	0	0		
									H3-3	13	1,741.0	1,194.0	2,520.00	10.00	0.00	0	0		
									H3-4	14	1,644.0	1,215.0	2,520.00	10.00	0.00	0	0		
									H3-5	15	1,652.0	1,253.0	2,520.00	10.00					
House 4	W	0.00	99.99	0.00				0.00	H4-1	16	2,409.7	754.1	2,512.00	10.00	0.00	0	0		
									H4-2	17	2,509.7	754.1	2,512.00	10.00	0.00	0	0		
									H4-3	18	2,509.7	714.1	2,512.00	10.00	0.00	0	0		
									H4-4	19	2,409.7	714.1	2,512.00	10.00	0.00	0	0		
									H4-5	20	2,409.7	753.1	2,512.00	10.00					

INPUT: BUILDING ROWS **TPM 21107**

ISE					**6 March 2012**	
R. TAVARES Ph.D.					**TNM 2.5**	
INPUT: BUILDING ROWS						
PROJECT/CONTRACT:	**TPM 21107**					
RUN:	**1st Floor Unmitigated**					
Building Row			**Points**			
Name	**Average**	**Building**	**No.**	**Coordinates (ground)**		
	Height	**Percent**		**X**	**Y**	**Z**
	ft	%		ft	ft	ft
<< This table is empty >>						

INPUT: "STRUCTURE" BARRIERS **TPM 21107**

ISE			**6 March 2012**		
R. TAVARES Ph.D.			**TNM 2.5**		
INPUT: "STRUCTURE" BARRIERS					
PROJECT/CONTRACT:	**TPM 21107**				
RUN:	**1st Floor Unmitigated**				
Barrier	**Segments**		**Shielded Roadways**	**Segments**	
Name	**Name**	**No.**	**Name**	**Name**	**No.**
<< This table is empty >>					

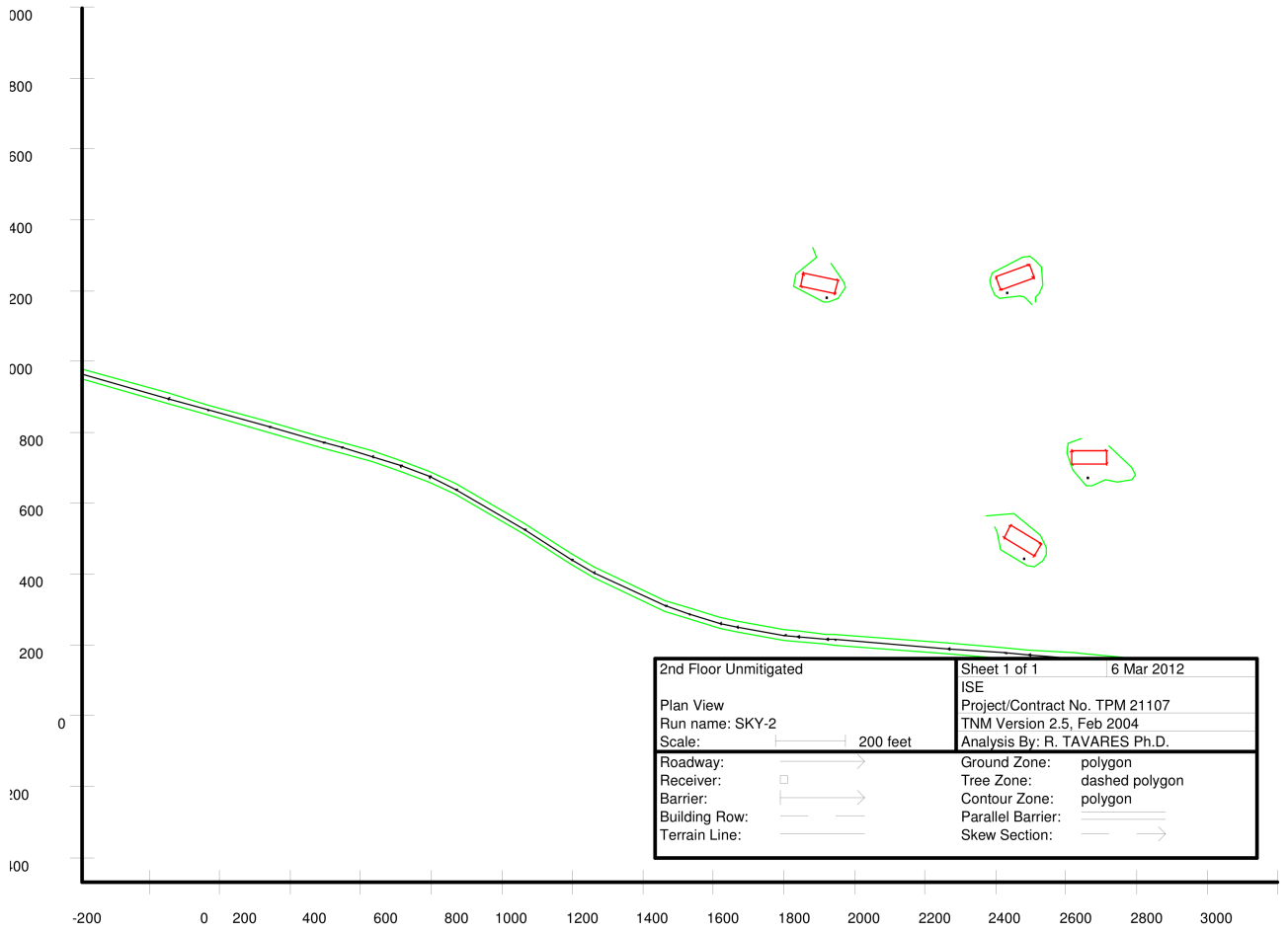
RESULTS: SOUND LEVELS **TPM 21107**

ISE **6 March 2012**
R. TAVARES Ph.D. **TNM 2.5**
Calculated with TNM 2.5
RESULTS: SOUND LEVELS
PROJECT/CONTRACT: **TPM 21107**
RUN: **1st Floor Unmitigated**
BARRIER DESIGN: **INPUT HEIGHTS** **Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.**
ATMOSPHERICS: **68 deg F, 50% RH**

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
CALC2	2	1	0.0	44.2	60	44.2	10	----	44.2	0.0	8	-8.0
CALC4	3	1	0.0	53.8	60	53.8	10	----	53.8	0.0	8	-8.0
CALC3	4	1	0.0	45.9	60	45.9	10	----	45.9	0.0	8	-8.0
CALC1	5	1	0.0	39.1	60	39.1	10	----	39.1	0.0	8	-8.0

Dwelling Units	# DUs	Noise Reduction Min	Avg	Max
		dB	dB	dB
All Selected	4	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

APP 4 – TNM Model Input/Output Data – Skyline Truck Trail Residential Development (Second Floor)



INPUT: ROADWAYS **TPM 21107**

ISE					**6 March 2012**							
R. TAVARES Ph.D.					**TNM 2.5**							
INPUT: ROADWAYS								**Average pavement type shall be used unless**				
PROJECT/CONTRACT:	**TPM 21107**							**a State highway agency substantiates the use**				
RUN:	**2nd Floor Unmitigated**							**of a different type with the approval of FHWA**				
Roadway		**Points**										
Name	**Width**	**Name**	**No.**	**Coordinates (pavement)**				**Flow Control**			**Segment**	
				X	**Y**	**Z**		**Control Device**	**Speed Constraint**	**Percent Vehicles Affected**	**Pvmt Type**	**On Struct?**
	ft			ft	ft	ft			mph	%		
Skyline Truck Trail	30.0	STT-1	1	2,843.0	135.0	2,615.00					Average	
		STT-2	2	2,768.0	141.0	2,605.00					Average	
		STT-3	3	2,591.0	154.0	2,595.00					Average	
		STT-4	4	2,562.0	157.0	2,585.00					Average	
		STT-5	5	2,447.0	166.0	2,555.00					Average	
		STT-6	6	2,419.0	168.0	2,550.00					Average	
		STT-7	7	2,289.0	178.0	2,545.00					Average	
		STT-8	8	2,221.0	183.0	2,540.00					Average	
		STT-9	9	2,061.0	196.0	2,540.00					Average	
		STT-10	10	1,739.0	221.0	2,550.00					Average	
		STT-11	11	1,717.0	222.0	2,555.00					Average	
		STT-12	12	1,635.0	230.0	2,555.00					Average	
		STT-13	13	1,598.0	234.0	2,550.00					Average	
		STT-14	14	1,463.0	257.0	2,550.00					Average	
		STT-15	15	1,416.0	268.0	2,545.00					Average	
		STT-16	16	1,327.0	294.0	2,535.00					Average	
		STT-17	17	1,260.0	317.0	2,530.00					Average	
		STT-18	18	1,058.0	411.0	2,525.00					Average	
		STT-19	19	995.0	448.0	2,520.00					Average	
		STT-20	20	862.0	533.0	2,520.00					Average	
		STT-21	21	668.0	645.0	2,525.00					Average	
		STT-22	22	593.0	680.0	2,540.00					Average	
		STT-23	23	511.0	711.0	2,545.00					Average	
		STT-24	24	432.0	737.0	2,540.00					Average	
		STT-25	25	345.0	762.0	2,525.00					Average	

INPUT: ROADWAYS **TPM 21107**

		STT-26	26	294.0	776.0	2,520.00			Average	
		STT-27	27	141.0	820.0	2,500.00			Average	
		STT-28	28	-35.0	869.0	2,475.00			Average	
		STT-29	29	-146.0	900.0	2,450.00			Average	
		STT-30	30	-432.0	981.0	2,425.00				

INPUT: TRAFFIC FOR LAeq1h Volumes **TPM 21107**

ISE			**6 March 2012**									
R. TAVARES Ph.D.			**TNM 2.5**									
INPUT: TRAFFIC FOR LAeq1h Volumes												
PROJECT/CONTRACT:	**TPM 21107**											
RUN:	**2nd Floor Unmitigated**											
Roadway	**Points**											
Name	**Name**	**No.**	**Segment**									
			Autos		**MTrucks**		**HTrucks**		**Buses**		**Motorcycles**	
			V	**S**	**V**	**S**	**V**	**S**	**V**	**S**	**V**	**S**
			veh/hr	mph	veh/hr	mph	veh/hr	mph	veh/hr	mph	veh/hr	mph
Skyline Truck Trail	STT-1	1	380	40	12	40	8	40	0	0	0	0
	STT-2	2	380	40	12	40	8	40	0	0	0	0
	STT-3	3	380	40	12	40	8	40	0	0	0	0
	STT-4	4	380	40	12	40	8	40	0	0	0	0
	STT-5	5	380	40	12	40	8	40	0	0	0	0
	STT-6	6	380	40	12	40	8	40	0	0	0	0
	STT-7	7	380	40	12	40	8	40	0	0	0	0
	STT-8	8	380	40	12	40	8	40	0	0	0	0
	STT-9	9	380	40	12	40	8	40	0	0	0	0
	STT-10	10	380	40	12	40	8	40	0	0	0	0
	STT-11	11	380	40	12	40	8	40	0	0	0	0
	STT-12	12	380	40	12	40	8	40	0	0	0	0
	STT-13	13	380	40	12	40	8	40	0	0	0	0
	STT-14	14	380	40	12	40	8	40	0	0	0	0
	STT-15	15	380	40	12	40	8	40	0	0	0	0
	STT-16	16	380	40	12	40	8	40	0	0	0	0
	STT-17	17	380	40	12	40	8	40	0	0	0	0
	STT-18	18	380	40	12	40	8	40	0	0	0	0
	STT-19	19	380	40	12	40	8	40	0	0	0	0
	STT-20	20	380	40	12	40	8	40	0	0	0	0
	STT-21	21	380	40	12	40	8	40	0	0	0	0
	STT-22	22	380	40	12	40	8	40	0	0	0	0
	STT-23	23	380	40	12	40	8	40	0	0	0	0

C:\Documents and Settings\winmac\Desktop\TPM 21107\SKY-2 **1**

INPUT: TRAFFIC FOR LAeq1h Volumes									TPM 21107			
	STT-24	24	380	40	12	40	8	40	0	0	0	0
	STT-25	25	380	40	12	40	8	40	0	0	0	0
	STT-26	26	380	40	12	40	8	40	0	0	0	0
	STT-27	27	380	40	12	40	8	40	0	0	0	0
	STT-28	28	380	40	12	40	8	40	0	0	0	0
	STT-29	29	380	40	12	40	8	40	0	0	0	0
	STT-30	30										

INPUT: TRAFFIC FOR LAeq1h Volumes **TPM 21107**

ISE			**6 March 2012**									
R. TAVARES Ph.D.			**TNM 2.5**									
INPUT: TRAFFIC FOR LAeq1h Volumes												
PROJECT/CONTRACT:	**TPM 21107**											
RUN:	**2nd Floor Unmitigated**											
Roadway	**Points**											
Name	**Name**	**No.**	**Segment**									
			User 1		**User 2**		**User 3**		**User 4**		**<unknown>**	
			V	**S**	**V**	**S**	**V**	**S**	**V**	**S**	**V**	**S**
			veh/hr	mph	veh/hr	mph	veh/hr	mph	veh/hr	mph	veh/hr	mph
Skyline Truck Trail	STT-1	1										
	STT-2	2										
	STT-3	3										
	STT-4	4										
	STT-5	5										
	STT-6	6										
	STT-7	7										
	STT-8	8										
	STT-9	9										
	STT-10	10										
	STT-11	11										
	STT-12	12										
	STT-13	13										
	STT-14	14										
	STT-15	15										
	STT-16	16										
	STT-17	17										
	STT-18	18										
	STT-19	19										
	STT-20	20										
	STT-21	21										
	STT-22	22										
	STT-23	23										

INPUT: TRAFFIC FOR LAeq1h Volumes **TPM 21107**

	STT-24	24
	STT-25	25
	STT-26	26
	STT-27	27
	STT-28	28
	STT-29	29
	STT-30	30

INPUT: RECEIVERS **TPM 21107**

ISE						**6 March 2012**					
R. TAVARES Ph.D.						**TNM 2.5**					
INPUT: RECEIVERS											
PROJECT/CONTRACT:	**TPM 21107**										
RUN:	**2nd Floor Unmitigated**										
Receiver											
Name	**No.**	**#DUs**	**Coordinates (ground)**			**Height**	**Input Sound Levels and Criteria**				**Active**
			X	**Y**	**Z**	**above**	**Existing**	**Impact Criteria**		**NR**	**in**
						Ground	**LAeq1h**	**LAeq1h**	**Sub'l**	**Goal**	**Calc.**
			ft	ft	ft	ft	dBA	dBA	dB	dB	
CALC2	2	1	2,229.1	1,196.7	2,560.00	4.92	0.00	60	10.0	8.0	Y
CALC4	3	1	2,274.9	449.3	2,575.00	4.92	0.00	60	10.0	8.0	Y
CALC3	4	1	2,455.9	676.6	2,520.00	4.92	0.00	60	10.0	8.0	Y
CALC1	5	1	1,718.5	1,182.6	2,512.00	4.92	0.00	60	10.0	8.0	Y

INPUT: BARRIERS **TPM 21107**

ISE **6 March 2012**
R. TAVARES Ph.D. **TNM 2.5**

INPUT: BARRIERS
PROJECT/CONTRACT: **TPM 21107**
RUN: **2nd Floor Unmitigated**

Barrier Name	Type	Height Min	Height Max	If Wall $ per Unit Area	If Berm $ per Unit Vol.	Top Width	Run:Rise	Add'tnl $ per Unit Length	Points Name	No.	Coordinates (bottom) X	Y	Z	Height at Point	Segment Seg Ht Increment	Perturbs #Up	Perturbs #Dn	On Struct?	Important Reflections?
		ft	ft	$/sq ft	$/cu yd	ft	ft:ft	$/ft			ft	ft	ft	ft	ft				
House 1	W	0.00	99.99	0.00				0.00	H1-1	1	2,196.0	1,242.4	2,560.00	10.00	0.00	0	0		
									H1-2	2	2,290.0	1,276.6	2,560.00	10.00	0.00	0	0		
									H1-3	3	2,303.0	1,239.6	2,560.00	10.00	0.00	0	0		
									H1-4	4	2,209.0	1,205.6	2,560.00	10.00	0.00	0	0		
									H1-5	5	2,195.0	1,242.6	2,560.00	10.00					
House 2	W	0.00	99.99	0.00				0.00	H2-1	6	2,239.0	543.0	2,575.00	10.00	0.00	0	0		
									H2-2	7	2,324.0	490.0	2,575.00	10.00	0.00	0	0		
									H2-3	8	2,303.0	456.0	2,575.00	10.00	0.00	0	0		
									H2-4	9	2,218.0	509.0	2,575.00	10.00	0.00	0	0		
									H2-5	10	2,238.0	543.0	2,575.00	10.00					
House 3	W	0.00	99.99	0.00				0.00	H3-1	11	1,652.0	1,254.0	2,520.00	10.00	0.00	0	0		
									H3-2	12	1,750.0	1,233.0	2,520.00	10.00	0.00	0	0		
									H3-3	13	1,741.0	1,194.0	2,520.00	10.00	0.00	0	0		
									H3-4	14	1,644.0	1,215.0	2,520.00	10.00	0.00	0	0		
									H3-5	15	1,652.0	1,253.0	2,520.00	10.00					
House 4	W	0.00	99.99	0.00				0.00	H4-1	16	2,409.7	754.1	2,512.00	10.00	0.00	0	0		
									H4-2	17	2,509.7	754.1	2,512.00	10.00	0.00	0	0		
									H4-3	18	2,509.7	714.1	2,512.00	10.00	0.00	0	0		
									H4-4	19	2,409.7	714.1	2,512.00	10.00	0.00	0	0		
									H4-5	20	2,409.7	753.1	2,512.00	10.00					

INPUT: BUILDING ROWS **TPM 21107**

ISE					**6 March 2012**	
R. TAVARES Ph.D.					**TNM 2.5**	
INPUT: BUILDING ROWS						
PROJECT/CONTRACT:	**TPM 21107**					
RUN:	**2nd Floor Unmitigated**					
Building Row			**Points**			
Name	**Average**	**Building**	**No.**	**Coordinates (ground)**		
	Height	**Percent**		**X**	**Y**	**Z**
	ft	%		ft	ft	ft
<< This table is empty >>						

INPUT: "STRUCTURE" BARRIERS **TPM 21107**

ISE			6 March 2012		
R. TAVARES Ph.D.			TNM 2.5		
INPUT: "STRUCTURE" BARRIERS					
PROJECT/CONTRACT:	TPM 21107				
RUN:	2nd Floor Unmitigated				
Barrier	Segments		Shielded Roadways	Segments	
Name	Name	No.	Name	Name	No.
<< This table is empty >>					

RESULTS: SOUND LEVELS **TPM 21107**

ISE **6 March 2012**
R. TAVARES Ph.D. **TNM 2.5**
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: **TPM 21107**
RUN: **2nd Floor Unmitigated**
BARRIER DESIGN: **INPUT HEIGHTS** **Average pavement type shall be used unless a State highway agency substantiates the use**
ATMOSPHERICS: **68 deg F, 50% RH** **of a different type with approval of FHWA.**

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
CALC2	2	1	0.0	44.2	60	44.2	10	----	44.2	0.0	8	-8.0
CALC4	3	1	0.0	53.8	60	53.8	10	----	53.8	0.0	8	-8.0
CALC3	4	1	0.0	45.9	60	45.9	10	----	45.9	0.0	8	-8.0
CALC1	5	1	0.0	39.1	60	39.1	10	----	39.1	0.0	8	-8.0

Dwelling Units	# DUs	Noise Reduction Min dB	Avg dB	Max dB
All Selected	4	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

INDEX OF IMPORTANT TERMS