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August 31, 2021 03243.00001.001

Ross Duenas, Project Manager
CR Associates
3900 5th Avenue, Suite 310
San Diego, CA 92103

Subject: Murrieta Creek Multi-Use Trail Project Noise Analysis

Dear Mr. Ross:

HELIX Environmental Planning, Inc. (HELIX) has performed an analysis of noise and vibration impacts related to the construction and operation associated with the proposed Murrieta Creek Multi Use Trail Project (project). This letter summarizes the methodology and results of the noise and vibration analysis.

PROJECT DESCRIPTION AND ENVIRONMENTAL SETTING

The City of Lake Elsinore (City) is proposing to design and develop the proposed Murrieta Creek Multi Use Trail within the City. The trail is envisioned as a non-motorized, regional multi-use trail along the San Jacinto River, linking the cities of Temecula, Murrieta, Wildomar, and Lake Elsinore. The portion of the trail that is located in the City of Lake Elsinore lies within the East Lake District and extends from the City's southern boundary with the City of Wildomar at Corydon Road to the Lake Levee Trail. The project alignment would extend from the Levee Trail on the southwest, continue southeast and northeast to Stoneman Street, and then southwest and southeast to Skylark Drive; refer to Attachment A, *Regional Location*, and Attachment B, *Project Location*.

The proposed multi-use trail would be a 8- to 12-foot-wide paved trail and would include safety features such as safety fences, retaining walls, pedestrian lights, and removable bollards at entry points. The project also includes the construction of a bridge located across the drainage area near the terminus of Ontario Way. The proposed trail would extend approximately 1.25 mile in length and would include a project area of approximately 3 acres.

Construction of the project is estimated to begin in 2022 and take approximately 10 months to complete. Project construction would require a total of approximately 3,144 cubic yards of cut and equal amounts of fill to be distributed throughout the project limits. Additionally, approximately 240 cubic yards of hot mix asphalt, 480 cubic yards of class II aggregate base, and 280 cubic yards of decomposed granite would be imported to the site.

The proposed project area is located in the southern portion of the East Lake Specific Plan in the City of Lake Elsinore, in western Riverside County. The project area is on the south side of Lake Elsinore, approximately 2.2 miles west of Interstate 15 (I-15). Surrounding land uses include open space and Lake Elsinore to the north and east, and open space and single family residences to the south and west. Additionally, Lakeland Village Elementary School and two recreational vehicle (RV) parks are located southwest of the project.

FUNDAMENTALS OF NOISE/SOUND AND VIBRATION

Noise/Sound

All noise level or sound level values presented herein are expressed in terms of decibels (dB), with A-weighting (dBA) to approximate the hearing sensitivity of humans. Time-averaged noise levels are expressed by the symbol L_{EQ}, with a specified duration.

Sound can be described as the mechanical energy of a vibrating object transmitted by pressure waves through a liquid or gaseous medium (e.g., air) to a hearing organ, such as a human ear. Noise is defined as loud, unexpected, or annoying sound.

In the science of acoustics, the fundamental model consists of a sound (or noise) source, a receiver, and the propagation path between the two. The loudness of the noise source and obstructions or atmospheric factors affecting the propagation path to the receiver contribute to the sound level and characteristics of the noise perceived by the receiver. The field of acoustics deals primarily with the propagation and control of sound.

Continuous sound can be described by frequency (pitch) and amplitude (loudness). A low frequency sound is perceived as low in pitch. Frequency is expressed in terms of cycles per second, or Hertz (Hz) (e.g., a frequency of 250 cycles per second is referred to as 250 Hz). High frequencies are sometimes more conveniently expressed in kilohertz (kHz), or thousands of Hertz. The audible frequency range for humans is generally between 20 Hz and 20,000 Hz.

The amplitude of pressure waves generated by a sound source determines the loudness of that source. A logarithmic scale is used to describe sound pressure level (SPL) in terms of dBA units. The threshold of hearing for the human ear is approximately 0 dBA, which corresponds to 20 micro Pascals (mPa).

Because decibels are logarithmic units, SPL cannot be added or subtracted through ordinary arithmetic. Under the decibel scale, a doubling of sound energy corresponds to a 3 dBA increase. In other words, when two identical sources are each producing sound of the same loudness, the resulting sound level at a given distance would be 3 dBA higher than one source under the same conditions.

Vibration

Vibration is defined as any oscillatory motion induced in a structure or mechanical device as a direct result of some type of input excitation. Sources of ground-borne vibrations include natural phenomena (earthquakes, volcanic eruptions, sea waves, landslides, etc.) or manufactured (explosions, trains, machinery, traffic, construction equipment, etc.). Vibration sources may be transient, steady-state

(continuous), or pseudo steady-state. Examples of transient construction vibrations are those that occur from blasting with explosives, impact pile driving, demolition, and wrecking balls.

Ambient and source vibration information are expressed in terms of the peak particle velocity (PPV) in inches per second (in/sec). The root mean square (RMS) of a signal is the average of the squared amplitude of the signal in decibels (relative to 1 micro-in/sec). Because the net average of a vibration signal is zero, the RMS amplitude is used to describe the "smoothed" vibration amplitude. The RMS amplitude is always less than the PPV and is always positive. The RMS average is typically calculated over a one-second period.

The background vibration velocity level in residential areas is usually 50 vibration decibels (VdB) or lower; this is well below the level perceptible by humans, which is approximately 65 VdB. Most perceptible indoor vibration is caused by sources within buildings, such as the operation of mechanical equipment, movement of people, or slamming of doors. Typical outdoor sources of perceptible ground borne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If the roadway is smooth, the vibration from traffic is rarely perceptible.

NOISE MODELING SOFTWARE

Project construction noise was analyzed using the Roadway Construction Noise Model (RCNM; USDOT 2008), which utilizes estimates of sound levels from standard construction equipment.

EXISTING SENSITIVE LAND USES

Noise sensitive land uses (NSLUs) are land uses that may be subject to stress and/or interference from excessive noise and generally include residences, hospitals, schools, hotels, resorts, libraries, sensitive wildlife habitat, or similar facilities where quiet is an important attribute of the environment. The nearest NSLUs to the project site are the single-family residences located adjacent to the project alignment between Stoneman Street and Skylark Drive. The residences occur as close as 25 feet from the edge of the proposed trail, and approximately 30 feet from the centerline of the proposed trail. Due to the location of the project, construction may also occur in the vicinity of sensitive biological habitat.

EXISTING NOISE SETTING

The proposed project site is in a partially developed area surrounded by undeveloped land and residential land uses. Existing noise sources in the vicinity of the project site include overhead aircraft operations and slow vehicular traffic along nearby roadways. An ambient noise measurement survey was conducted on June 3, 2021 at the project site and included three short-term measurements (refer to Attachment C, *Site Survey Measurement Sheets*). Noise measurement locations and results are shown in Table 1, *Ambient Noise Measurement Survey*.

Table 1
AMBIENT NOISE MEASUREMENT SURVEY

Measurement	Location	Time	Noise Level (dBA L_{EQ})
1	Unpaved extension of Stoneman Street, by the RV park	12:05 p.m. – 12:22 p.m.	40.1
2	Northern terminus of Stoneman Street	12:35 p.m. – 12:51 p.m.	50.1
3	Northern terminus of Ontario Way, in the cul-de-sac	1:10 p.m. – 1:28 p.m.	43.9

NOISE REGULATIONS

City of Lake Elsinore Municipal Code

The City's Municipal Code Chapter 17.176.080, Section F (Construction/Demolition) includes a list of prohibited acts related to construction noise (City 2021), provided below:

1. Operating or causing the operation of any tools or equipment used in construction, drilling, repair, alteration, or demolition work between weekday hours of 7:00 p.m. and 7:00 a.m., or at any time on weekends or holidays, such that the sound therefrom creates a noise disturbance across a residential or commercial real property line, except for emergency work of public service utilities or by variance issued by the City.

2. Noise Restrictions at Affected Properties. Where technically and economically feasible, construction activities shall be conducted in such a manner that the maximum noise levels at affected properties will not exceed those listed below in Table 2, *City of Lake Elsinore Property Line Noise Limits*:

Table 2
CITY OF LAKE ELSINORE PROPERTY LINE NOISE LIMITS

Receiving Land Use	Type I Areas Single-Family Residential	Type II Areas Multifamily Residential	Type III Areas Semi-Residential/ Commercial
Mobile Equipment[1]			
Daily (Except Sundays and Legal Holidays) 7:00 a.m. to 7:00 p.m.	75 dBA	80 dBA	85 dBA
Daily, 7:00 p.m. to 7:00 a.m. and All Sundays and Legal Holidays	60 dBA	65 dBA	70 dBA
Stationary Equipment[2]			
Daily (Except Sundays and Legal Holidays) 7:00 a.m. to 7:00 p.m.	60 dBA	65 dBA	70 dBA
Daily, 7:00 p.m. to 7:00 a.m. and All Sundays and Legal Holidays	50 dBA	55 dBA	60 dBA

[1] Maximum noise levels for nonscheduled, intermittent, short-term operation (less than 10 days) of mobile equipment.
[2] Maximum noise levels for repetitively scheduled and relatively long-term operation (period of 10 days or more) of stationary equipment.

dBA = A-weighted sound level, the sound pressure level in decibels as measured using the A weighting filter network, which de-emphasizes the very low- and very high-frequency components of the sound in a manner similar to the frequency response of the human ear.

3. All mobile or stationary internal combustion engine powered equipment or machinery shall be equipped with suitable exhaust and air intake silencers in proper working order.

Biologically Sensitive Habitat

Some studies, such as that completed by the Bioacoustics Research Team (1997), have concluded that 60 dBA is a criterion to use as a starting point for passerine impacts until more specific research is done. Associated guidelines produced by the U.S. Fish and Wildlife Service (USFWS) require that project noise be limited to a level not to exceed 60 dBA L_{EQ} or, if the existing ambient noise level is above 60 dBA L_{EQ}, increase the ambient noise level by 3 dBA L_{EQ} at the edge of occupied habitat during the avian species breeding season.

ANALYSIS AND IMPACTS

Construction Noise Levels

Construction of the proposed project would involve a non-motorized, regional multi-use trail. The magnitude of the impact would depend on the type of construction activity, equipment, duration of each construction phase, distance between the noise source and receiver, and intervening structures. Construction would generate elevated noise levels that may by audible at nearby residential uses in the vicinity of the project site.

Construction equipment would not all operate at the same time or location. Furthermore, construction equipment would not be in constant use during a typical 8-hour operating day. Table 3, *Construction Equipment Noise Levels*, provides the 30-foot distance noise levels for expected construction equipment.

Table 3
CONSTRUCTION EQUIPMENT NOISE LEVELS

Unit	Percent Operating Time	dBA L_{EQ} at 30 feet
Backhoe	40	78.0
Compactor	20	80.7
Compressor	40	78.1
Crane	16	77.0
Excavator	40	81.2
Front-End Loader	40	79.6
Generator	50	82.1
Grader	40	85.5
Paver	50	78.6
Pumps	50	82.4
Roller	20	77.4
Scraper	40	84.0
Tractor	40	84.5

Source: USDOT 2008

As shown in Table 3, operation of each piece of construction equipment that would be used during project construction would exceed the City's 75 dBA L_{EQ} mobile equipment construction noise threshold at the nearest single-family residences, with the grader resulting in the highest noise levels (85.5 dBA L_{EQ} at 30 feet). However, these noise levels do not account for existing barriers, such as walls, that may attenuate noise at adjacent properties.

According to the RCNM, operation of a grader would generate a noise level of 75.0 dBA L_{EQ} at 100 feet. Therefore, construction of the portions of the trail farther than 100 feet from the closest residences would have a less than significant impact related to construction noise. During construction of the portions of the trail located within 100 feet of the nearby residences, construction noise may exceed the 75 dBA L_{EQ} mobile equipment construction noise threshold in the City's Municipal Code. However, such impacts would be temporary in nature and would not occur during the entire construction period due to the linear nature of the project. Still, potential impacts during construction may occur and mitigation would be required. Implementation of Mitigation measure NOI-1 would minimize impacts related to noise generated during construction.

If biologically sensitive habitat is determined to be located within the vicinity of the project, construction noise levels may exceed the applicable 60 dBA L_{EQ} threshold for sensitive avian species during the breeding season. Because construction equipment would potentially move to different locations along the trail alignment as construction proceeds, and because exact locations of sensitive species may vary along the alignment, calculations of noise levels at specific receptor locations are not possible at this time. Instead, the setback distances needed to meet the applicable 60 dBA L_{EQ} threshold for biological resources is provided in Table 4, *Construction Equipment Setback Distances for Sensitive Biological Resources*.

Table 4
CONSTRUCTION EQUIPMENT SETBACK DISTANCES FOR SENSITIVE BIOLOGICAL RESOURCES

Unit	Distance to 60 dBA L_{EQ} (feet)
Backhoe	240
Compactor	325
Compressor	243
Crane	214
Excavator	345
Front-End Loader	285
Generator	380
Grader	560
Paver	258
Pumps	395
Roller	224
Scraper	475
Tractor	500

Source: USDOT 2008

If occurring during the breeding seasons of sensitive avian species (March 1 through August 30)., operation of construction equipment within the distances provided in Table 4 could result in a significant noise impact to sensitive biological resources. Implementation of Mitigation measure NOI-1 would minimize impacts related to noise generated at sensitive biological resources during construction.

NOI-1 **Construction Management Plan.** Noise levels from project-related construction activities shall not exceed the noise limit specified in the City of Lake Elsinore Municipal Code of 75 dBA, when measured at the boundary line of any occupied property where noise is being received. Additionally, noise generated by construction activities during the breeding season of sensitive avian species (March 1 through August 30) shall not exceed the 60 dBA L_{EQ} (1 hour) standard or 3 dBA L_{EQ} (1 hour) above the average ambient noise level, whichever is greater, as measured at the edge of the habitat. A Construction Management Plan that describes the measures included on the construction plans to ensure compliance with the noise limit shall be prepared and approved by the City prior the commencement of construction. The following measures may be included to reduce construction noise:

- Construction equipment to be properly outfitted and maintained with manufacturer-recommended noise-reduction devices.
- Diesel equipment to be operated with closed engine doors and equipped with factory-recommended mufflers.
- Mobile or fixed "package" equipment (e.g., arc welders and air compressors) to be equipped with shrouds and noise control features that are readily available for that type of equipment.
- Electrically powered equipment to be used instead of pneumatic or internal combustion-powered equipment, where feasible.
- Unnecessary idling of internal combustion engines (e.g., in excess of 5 minutes) to be prohibited.
- Material stockpiles and mobile equipment staging, parking, and maintenance areas to be located as far as practicable from noise sensitive receptors.
- The use of noise-producing signals, including horns, whistles, alarms, and bells, shall be for safety warning purposes only.
- No project-related public address or music system shall be audible at any adjacent sensitive receptor.
- Temporary sound barriers or sound blankets may be installed between construction operations and adjacent noise-sensitive land uses to adequately reduce noise levels. If a barrier is used, the project Contractor shall construct a temporary noise barrier at least six feet in height meeting the specifications listed below (or of a Sound Transmission Class [STC] 19 rating or better) to attenuate noise.

- If a temporary barrier is used, all barriers shall be solid and constructed of wood, plastic, fiberglass, steel, masonry, or a combination of those materials, with no cracks or gaps through or below the wall. Any seams or cracks must be filled or caulked. If wood is used, it can be tongue and groove or close butted seams and must be at least ¾-inch thick or have a surface density of at least 3.5 pounds per square-foot. Sheet metal of 18 gauge (minimum) may be used if it meets the other criteria and is properly supported and stiffened so that it does not rattle or create noise itself from vibration or wind. Noise blankets, hoods, or covers also may be used, provided they are appropriately implemented to provide the required sound attenuation.

- The project applicant shall notify residences within 100 feet of the project's property line in writing within one week of any construction activity. The notification shall describe the activities anticipated, provide dates and hours, and provide contact information with a description of a complaint and response procedure.

- The on-site construction supervisor shall have the responsibility and authority to receive and resolve noise complaints. A clear appeal process for the affected resident shall be established prior to construction commencement to allow for resolution of noise problems that cannot be immediately solved by the site supervisor.

Through the implementation of mitigation measure NOI-1, the proposed project would not result in a violation of the City's construction noise standards, and impacts would be less than significant.

Construction Vibration

Construction of the project alignment between Stoneman Street and Skylark Drive would occur adjacent to single-family residences, with the nearest houses occurring as close as 25 feet from the edge of the proposed trail, and approximately 30 feet from the centerline of the proposed trail. The greatest source of vibration would be from compaction of the soil. Due to the width of the trail alignment, hand tools or a small vibratory plate compactor or tamping rammer would likely be used. The anticipated methods would have no measurable vibration beyond 10 to 15 feet. Impacts from excessive vibration would therefore be less than significant.

Operation Noise Levels

Upon completion of the project, operational noise would be from individual users of the trail, including pedestrians, bicyclists, and equestrians. No new permanent operational noise-generating components would be introduced. Operation of the project would therefore not generate or expose persons to excessive noise levels, and impacts would be less than significant.

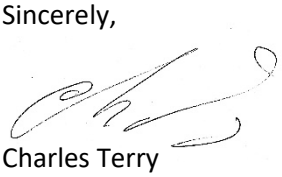
Operation Vibration Levels

Operation of the project would consist of pedestrians, bicyclists, and equestrians utilizing the non-motorized trail. No new permanent operational vibration-generating components would be introduced. Operation of the project would therefore not generate or expose persons to excessive vibration levels, and impacts would be less than significant.

CONCLUSIONS

Construction of the proposed project has the potential to result in significant impacts related to noise. Specifically, the project may result in substantial short-term noise to off-site NSLUs during construction. Implementation of mitigation measure NOI-1 would reduce impacts related to construction noise to a less than significant level. Vibration impacts resulting from project construction would be less than significant, and no mitigation is required. Noise and vibration impacts related to project operation would be below a level of significance, and no mitigation is required.

Sincerely,



Charles Terry
Principal Specialist Noise, Acoustics & Vibration

Jason Runyan
Specialist Noise, Acoustics & Vibration

Attachments:

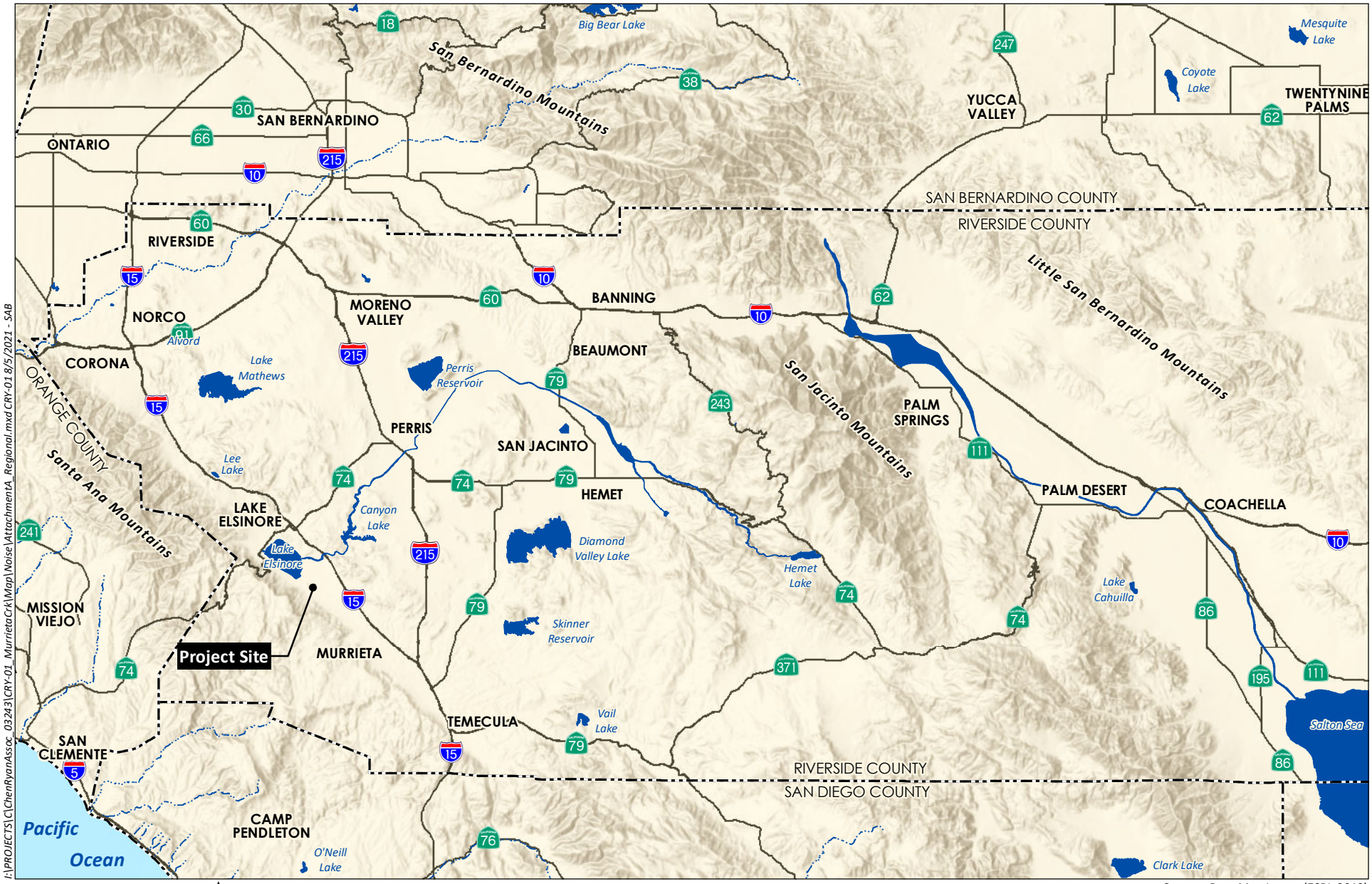
Attachment A – Regional Location
Attachment B – Project Location
Attachment C – Site Survey Measurement Sheets

REFERENCES

Bioacoustics Research Team. 1997. Environmental Effects of Transportation Noise, A Case Study: Noise Criteria for Protection of Endangered Passerine Birds. University of California, Davis, Transportation Noise Control Center Technical Report 97-001.

City of Lake Elsinore (City). 2021. Lake Elsinore Municipal Code. Chapter 17.176, Noise Control. June 8.

U.S. Department of Transportation (USDOT). 2008. Roadway Construction Noise Model (RCNM).



Source: Base Map Layers (ESRI, 2013)

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Regional Location

Attachment A

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0 2,000 Feet

Source: Aerial (Riverside County 2019)

HELIX Environmental Planning

Project Location

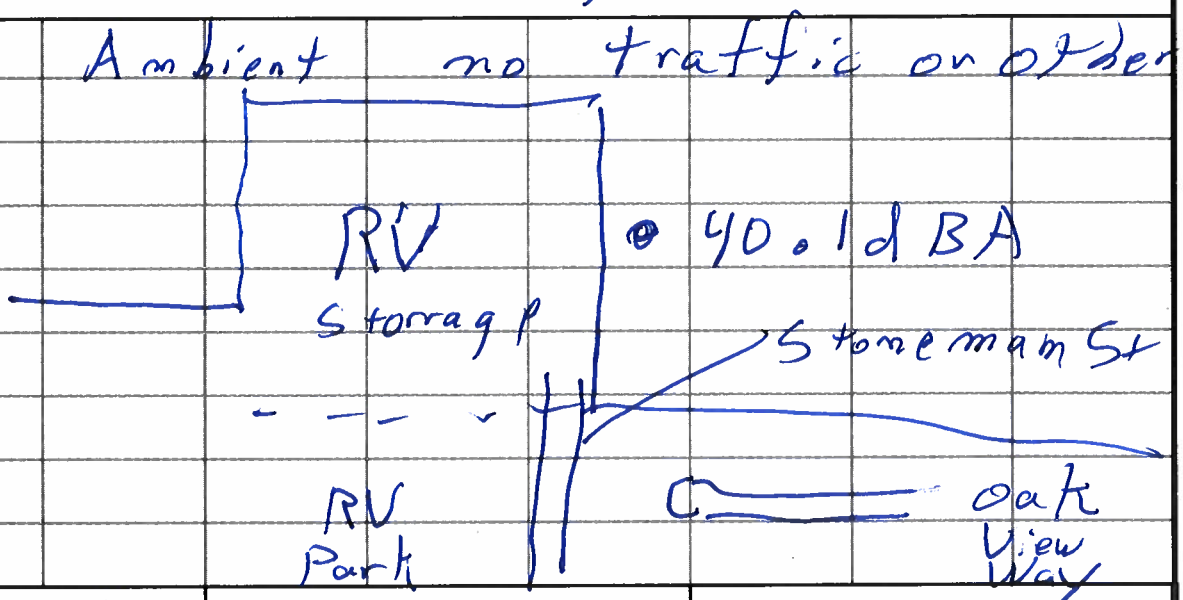
Attachment B

Site Survey

Job # CRY-01	Project Name: Lake Murrieta Tra. 1,		
Date: 6/3/21	Site #: 1	Engineer: CT	
Address: Extension of Stoneman St			
Meter: LD831	Serial #: 1741	Calibrator: CA250	Serial #: 2621

Notes: Only major source were 2 parachute drop planes taking off

Sketch:



Temp: 92°	Wind Spd: 2-3 mph	Humidity: Low %
Start of Measurement: 12:05	End of Measurement: 12:22	~~42~~ 40 dBA L_{EQ}

Cars (tally per 5 cars)	Medium Trucks (MT)	Heavy Trucks (HT)

Noise Measurement for Information Only

No Through Roadways

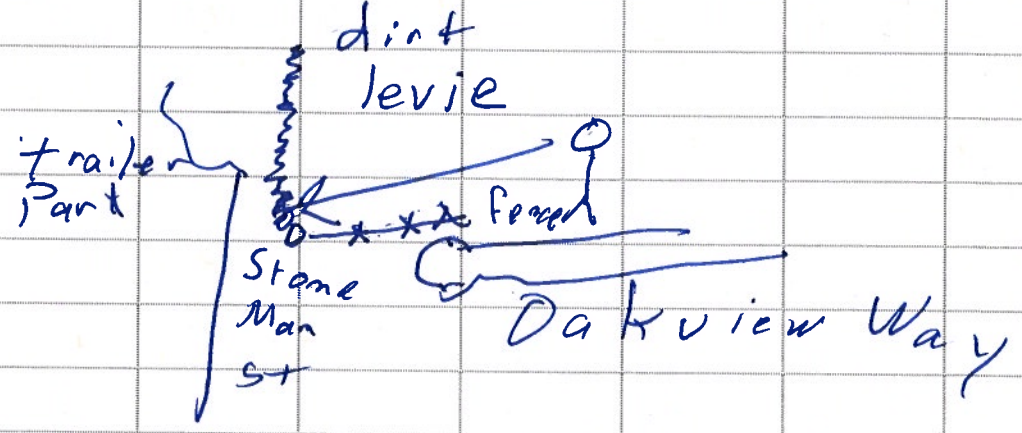
No Calibration Analysis Will Be Provided

Site Survey Lake Murrieta Trail

Project # CRY-01	Project Name:		
Date: 6/3/21	Site #: 2	Engineer: *Charles Terry*	
Address: ~~Site~~ end of Stoneman St			
Meter: LD 831	Serial #: 1741	Calibrator: CA250	Serial #: 2621

Notes: (2) Aircraft Take off & two slow cars

Sketch:



Temp: 92	Wind Spd: 1-3	mph	Humidity: 10	%
Start of Measurement: 12:35	End of Measurement: 12:57		50.1	dBA L_{EQ}

Cars (tally per 5 cars)	Medium Trucks (MT)	Heavy Trucks (HT)

Noise Measurement for Information Only

No Through Roadways

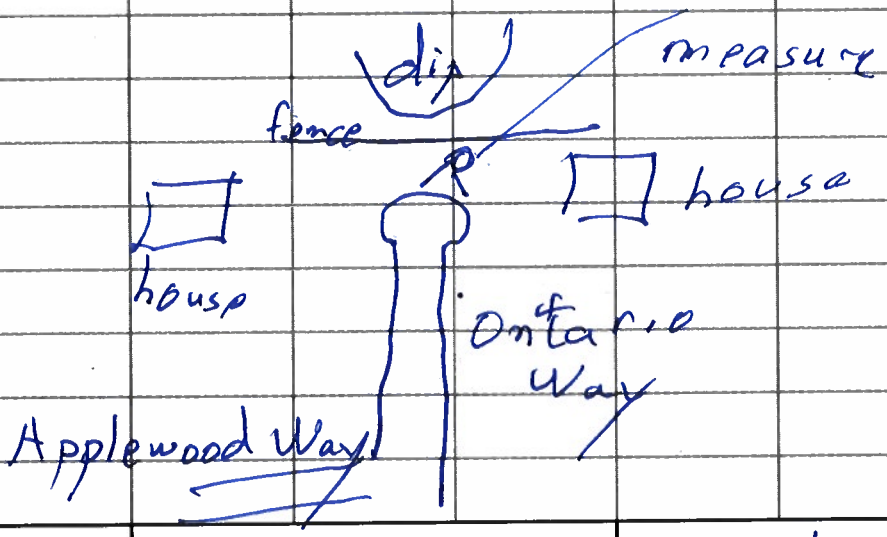
No Calibration Analysis Will Be Provided

Site Survey Lake Murrieta

Job # CRY-01	Project Name:		
Date: 6/3/21	Site #: 3	Engineer:	
Address: North end Culde-Sac Ontario Way			
Meter:	Serial #:	Calibrator:	Serial #:

Notes: Nort

Sketch:



Temp: 93	Wind Spd: 3-5 mph	Humidity: 10%
Start of Measurement: 10	End of Measurement: 28	43.9 dBA L_{EQ}

Cars (tally per 5 cars)	Medium Trucks (MT)	Heavy Trucks (HT)
X	X	X

Noise Measurement for Information Only

No Through Roadways

No Calibration Analysis Will Be Provided