APPENDIX C

NOISE IMPACT STUDY

Miragrand Well
Noise Impact Study
City of Claremont, CA

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1.0 Introduction

1.1 Purpose of Analysis and Study Objectives

This noise assessment was prepared to evaluate whether the potential noise impacts associated with the project and project's construction would cause a significant impact from the project site to adjacent land uses. The assessment was conducted and compared to the noise standards set forth by the Federal, State and Local agencies. Consistent with the California Environmental Quality Act (CEQA) and CEQA Guidelines, a significant impact related to noise would occur if a proposed project is determined to result in:

- Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local General Plan or noise ordinance, or applicable agencies.
- Generation of excessive ground-borne vibration or ground-borne noise levels.

The following is provided in this report:

- A description of the study area and the proposed project
- Information regarding the fundamentals of noise
- A description of the local noise guidelines and standards
- An evaluation of the existing ambient noise environment
- An analysis of stationary noise impacts from the project site to adjacent land uses
- Construction noise and vibration evaluation

1.2 Project Purpose and Overview

Three Valleys Municipal Water District (TVMWD) is a wholesale water agency that provides water to the cities of Claremont, Pomona, Walnut, and East San Gabriel valleys. TVMWD's mission is to provide a reliable water source to local suppliers through the imported water it receives from the Metropolitan Water District of Southern California (MWD) as well as from surface water emanating from the San Gabriel mountains, and recycled water from local water treatment plants.

TVMWD operates the Miramar Water Treatment Plant (WTP) located at 1021 East Miramar Avenue in the City of Claremont. There are also two groundwater production wells located at this site. TVMWD is currently constructing an additional well at the terminus of Grand Avenue, approximately ½ mile south of the project site adjacent to the 210 freeway. The proposed MiraGrand Well represents the fourth production well to be developed in the vicinity in support of TVMWD's mission. The addition of the Grand Avenue well and the proposed MiraGrand Well will increase the reliability of TVMWD to provide an uninterrupted source of potable groundwater to its customers. TVMWD's strategy is to diversify its water supply and storage capabilities by increasing extraction capabilities to improve reliability of its water supplies, particularly during emergencies.

1.3 Site Location and Study Area

The project site is located at 675 E. Miramar Avenue in the City of Claremont, California, as shown in Exhibit A. The property is situated within a residential area and is completely surrounded by single-family residences.

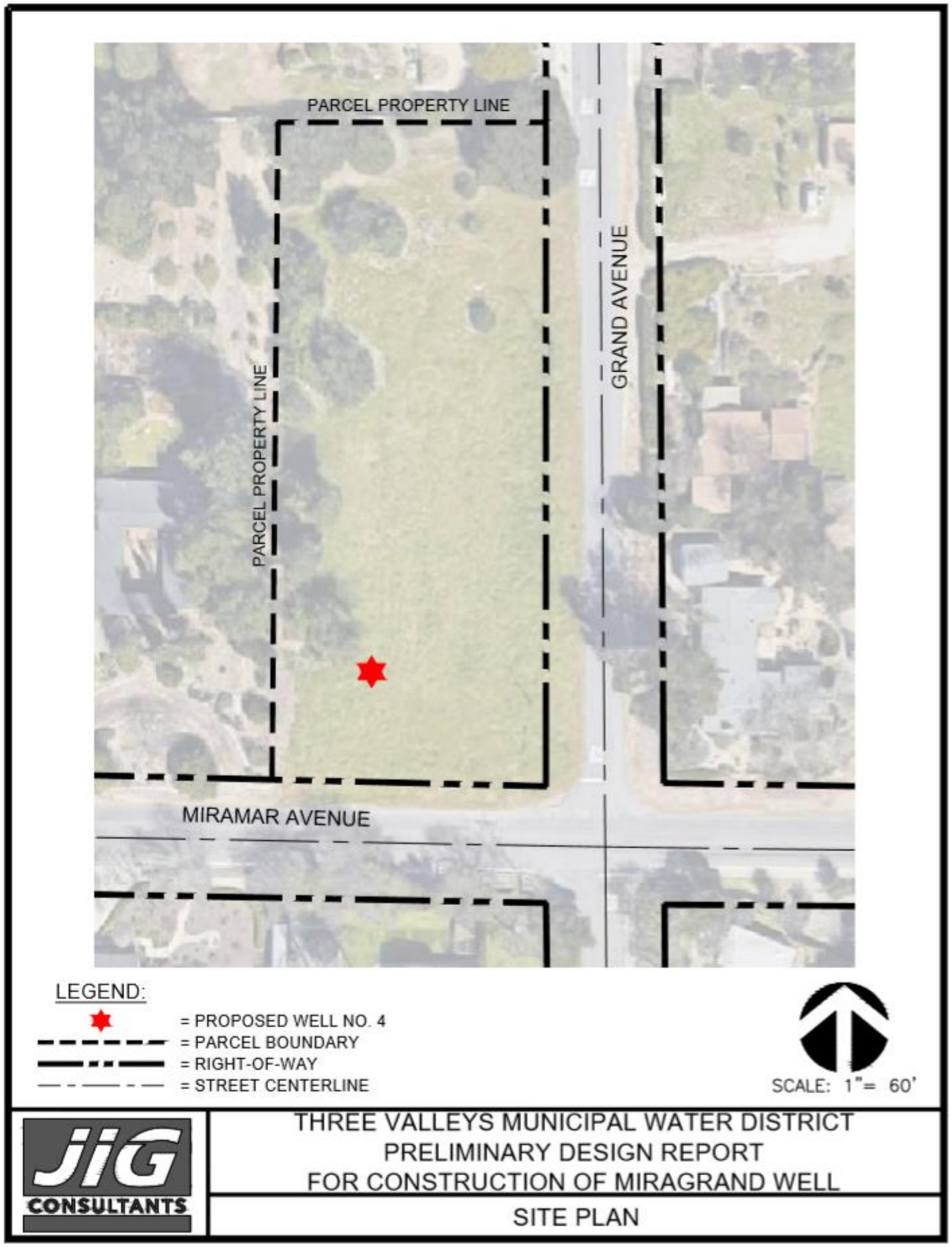
1.4 Proposed Project Description

The Project proposes to construct a groundwater well surrounded by a concrete masonry building and approximately 150’ of pipeline across Grand Avenue.

Exhibit A
Location Map

Exhibit B

Site Plan



2.0 Fundamentals of Noise

This section of the report provides basic information about noise and presents some of the terms used within the report.

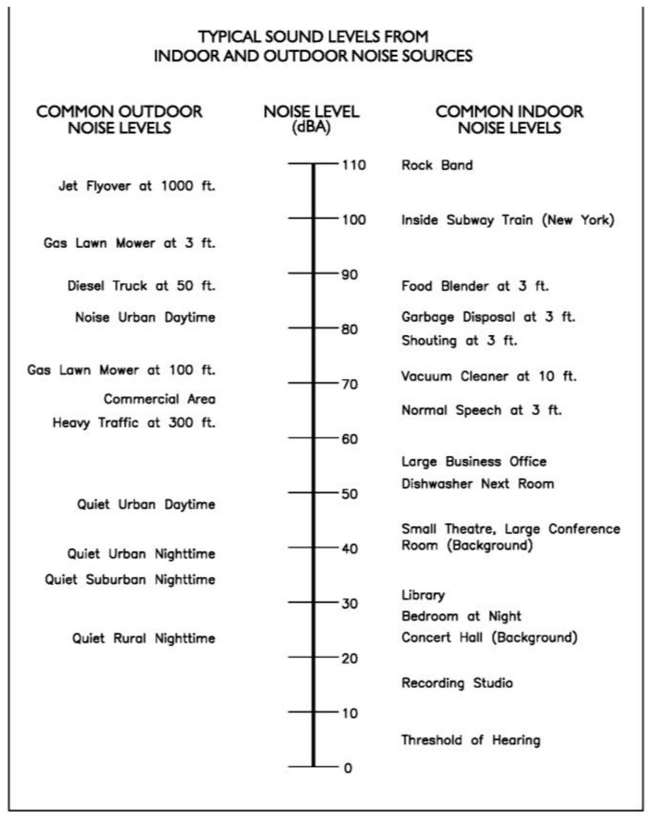
2.1 Sound, Noise and Acoustics

Sound is a disturbance created by a moving or vibrating source and is capable of being detected by the hearing organs. Sound may be thought of as mechanical energy of a moving object transmitted by pressure waves through a medium to a human ear. For traffic or stationary noise, the medium of concern is air. *Noise* is defined as sound that is loud, unpleasant, unexpected, or unwanted.

2.2 Frequency and Hertz

A continuous sound is described by its *frequency* (pitch) and its *amplitude* (loudness). Frequency relates to the number of pressure oscillations per second. Low-frequency sounds are low in pitch (bass sounding) and high-frequency sounds are high in pitch (squeak). These oscillations per second (cycles) are commonly referred to as Hertz (Hz). The human ear can hear from the bass pitch starting out at 20 Hz all the way to the high pitch of 20,000 Hz.

Exhibit C: Typical A-Weighted Noise Levels



2.3 Sound Pressure Levels and Decibels

The *amplitude* of a sound determines its loudness. The loudness of sound increases or decreases as the amplitude increases or decreases. Sound pressure amplitude is measured in units of micro-Newton per square inch meter (N/m2), also called micro-Pascal (µPa). One µPa is approximately one hundred billionths (0.00000000001) of normal atmospheric pressure. Sound pressure level (SPL or L_p) is used to describe in logarithmic units the ratio of actual sound pressures to a reference pressure squared. These units are called decibels abbreviated dB. Exhibit C illustrates references sound levels for different noise sources.

2.4 Addition of Decibels

Because decibels are on a logarithmic scale, sound pressure levels cannot be added or subtracted by simple plus or minus addition. When two sounds or equal SPL are combined, they will produce an SPL 3 dB greater than the original single SPL. In other words, sound energy must be doubled to produce a 3 dB increase. If two sounds differ by approximately 10 dB, the higher sound level is the predominant sound.

2.5 Human Response to Changes in Noise Levels

In general, the healthy human ear is most sensitive to sounds between 1,000 Hz and 5,000 Hz, (A-weighted scale) and it perceives a sound within that range as being more intense than a sound with a higher or lower frequency with the same magnitude. For purposes of this report as well as with most environmental documents, the A-scale weighting is typically reported in terms of A-weighted decibel (dBA). Typically, the human ear can barely perceive a change in noise level of 3 dB. A change in 5 dB is readily perceptible, and a change in 10 dB is perceived as being twice or half as loud. As previously discussed, a doubling of sound energy results in a 3 dB increase in sound, which means that a doubling of sound energy (e.g. doubling the volume of traffic on a highway) would result in a barely perceptible change in sound level.

2.6 Noise Descriptors

Noise in our daily environment fluctuates over time. Some noise levels occur in regular patterns, others are random. Some noise levels are constant while others are sporadic. Noise descriptors were created to describe the different time-varying noise levels.

A-Weighted Sound Level: The sound pressure level in decibels as measured on a sound level meter using the A-weighted filter network. The A-weighting filter de-emphasizes the very low and very high-frequency components of the sound in a manner similar to the response of the human ear. A numerical method of rating human judgment of loudness.

Ambient or Background Noise Level: The composite of noise from all sources, near and far. In this context, the ambient noise level constitutes the normal or existing level of environmental noise at a given location.

Community Noise Equivalent Level (CNEL): The average equivalent A-weighted sound level during a 24-hour day, obtained after addition of five (5) decibels to sound levels in the evening from 7:00 to 10:00 PM and after addition of ten (10) decibels to sound levels in the night before 7:00 AM and after 10:00 PM.

dB(A): A-weighted sound level (see definition below).

Decibel (dB): A unit for measuring the amplitude of a sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micro-pascals.

Equivalent Sound Level (LEQ): The sound level corresponding to a steady noise level over a given sample period with the same amount of acoustic energy as the actual time-varying noise level. The energy average noise level during the sample period.

Field Sound Transmission Class (FSTC): The field sound transmission class (FSTC) rating is used for in situ walls and floor/ceiling sound isolation performance assessment. The standard requires the measurement of sound transmission loss and includes the required procedure to show that the FSTC rating, as it has been determined by the test procedure, was not influenced by flanking of sound around the partition intended to be tested. Sound transmission class and FSTC ratings are intended by standard to be equivalent; however, practical experience indicates that FSTC ratings tend to be up to five ratings points less than laboratory-measured STC ratings.

Habitable Room: Any room meeting the requirements of the Uniform Building Code or other applicable regulations which are intended to be used for sleeping, living, cooking or dining purposes, excluding such enclosed spaces as closets, pantries, bath or toilet rooms, service rooms, connecting corridors, laundries, unfinished attics, foyers, storage spaces, cellars, utility rooms and similar spaces.

L(n): The A-weighted sound level exceeded during a certain percentage of the sample time. For example, L10 in the sound level exceeded 10 percent of the sample time. Similarly L50, L90, and L99, etc.

Noise: *A*ny unwanted sound or sound which is undesirable because it interferes with speech and hearing, or is intense enough to damage hearing, or is otherwise annoying. The State Noise Control Act defines noise as "...excessive undesirable sound...".

Outdoor Living Area: Outdoor spaces that are associated with residential land uses typically used for passive recreational activities or other noise-sensitive uses. Such spaces include patio areas, barbecue areas, jacuzzi areas, etc. associated with residential uses; outdoor patient recovery or resting areas associated with hospitals, convalescent hospitals, or rest homes; outdoor areas associated with places of worship which have a significant role in services or other noise-sensitive activities; and outdoor school facilities routinely used for educational purposes which may be adversely impacted by noise. Outdoor areas usually not included in this definition are: front yard areas, driveways, greenbelts, maintenance areas and storage areas associated with residential land uses; exterior areas at hospitals that are not used for patient activities; outdoor areas associated with places of worship and principally used for short-term social gatherings; and, outdoor areas associated with school facilities that are not typically associated with educational uses prone to adverse noise impacts (for example, school play yard areas).

Percent Noise Levels: See L(n).

Sound Level (Noise Level): The weighted sound pressure level obtained by use of a sound level meter having a standard frequency-filter for attenuating part of the sound spectrum.

Sound Level Meter: An instrument, including a microphone, an amplifier, an output meter, and frequency weighting networks for the measurement and determination of noise and sound levels.

Single Event Noise Exposure Level (SENEL): The dB(A) level which, if it lasted for one second, would the same A-weighted sound energy as the actual event.

Sound Transmission Class (STC)**:** To quantify STC, a Transmission Loss (TL) measurement is performed in a laboratory over a range of 16 third-octave bands between 125 – 4,000 Hertz (Hz). The average human voice creates sound within the 125 – 4,000 Hz 1/3rd octave bands.

STC is a single-number rating given to a particular material or assembly. The STC rating measures the ability of a material or an assembly to resist airborne sound transfer over the specified frequencies (see ASTM International Classification E413 and E90). In general, a higher STC rating corresponds with a greater reduction of noise transmitting through a partition.

STC is highly dependent on the construction of the partition. The STC of a partition can be increased by adding mass, increasing or adding air space, adding absorptive materials within the assembly. The STC rating does not assess low-frequency sound transfer (e.g. sounds less than 125 Hz). Special consideration must be given to spaces where the noise transfer concern has lower frequencies than speech, such as mechanical equipment and or/or music. The STC rating is a lab test that does not take into consideration weak points, penetrations, or flanking paths.

Even with a high STC rating, any penetration, air-gap, or “flanking path can seriously degrade the isolation quality of a wall. Flanking paths are the means for sound to transfer from one space to another other than through the wall. Sound can flank over, under, or around a wall. Sound can also travel through common ductwork, plumbing or corridors. Noise will travel between spaces at the weakest points. Typically, there is no reason to spend money or effort to improve the walls until all weak points are controlled first.

2.7 Traffic Noise Prediction

Noise levels associated with traffic depends on a variety of factors: (1) volume of traffic, (2) speed of traffic, (3) auto, medium truck (2–3 axle) and heavy truck percentage (4 axle and greater), and sound propagation. The greater the volume of traffic, higher speeds, and truck percentages equate to a louder volume in noise. A doubling of the Average Daily Traffic (ADT) along a roadway will increase noise levels by approximately 3 dB; reasons for this are discussed in the sections above.

2.8 Sound Propagation

As sound propagates from a source it spreads geometrically. Sound from a small, localized source (i.e., a point source) radiates uniformly outward as it travels away from the source in a spherical pattern. The sound level attenuates at a rate of 6 dB per doubling of distance. The movement of vehicles down a roadway makes the source of the sound appear to propagate from a line (i.e., line source) rather than a point source. This line source results in the noise propagating from a roadway in a cylindrical spreading versus a spherical spreading that results from a point source. The sound level attenuates for a line source at a rate of 3 dB per doubling of distance.

As noise propagates from the source, it is affected by the ground and atmosphere. Noise models use hard site (reflective surfaces) and soft site (absorptive surfaces) to help calculate predicted noise levels. Hard site conditions assume no excessive ground absorption between the noise source and the receiver. Soft site conditions such as grass, soft dirt or landscaping attenuate noise at a rate of 1.5 dB per doubling of distance. When added to the geometric spreading, the excess ground attenuation results in an overall noise attenuation of 4.5 dB per doubling of distance for a line source and 7.5 dB per doubling of distance for a point source.

Research has demonstrated that atmospheric conditions can have a significant effect on noise levels when noise receivers are located 200 feet from a noise source. Wind, temperature, air humidity, and turbulence can further impact have far sound can travel.

3.0 Ground-Borne Vibration Fundamentals

3.1 Vibration Descriptors

Ground-borne vibrations consist of rapidly fluctuating motions within the ground that have an average motion of zero. The effects of ground-borne vibrations typically only cause a nuisance to people, but at extreme vibration levels, damage to buildings may occur. Although ground-borne vibration can be felt outdoors, it is typically only an annoyance to people indoors where the associated effects of the shaking of a building can be notable. Ground-borne noise is an effect of ground-borne vibration and only exists indoors since it is produced from noise radiated from the motion of the walls and floors of a room and may also consist of the rattling of windows or dishes on shelves.

Several different methods are used to quantify vibration amplitude.

PPV – Known as the peak particle velocity (PPV) which is the maximum instantaneous peak in vibration velocity, typically given in inches per second.

RMS – Known as root mean squared (RMS) can be used to denote vibration amplitude

VdB – A commonly used abbreviation to describe the vibration level (VdB) for a vibration source.

3.2 Vibration Perception

Typically, developed areas are continuously affected by vibration velocities of 50 VdB or lower. These continuous vibrations are not noticeable to humans whose threshold of perception is around 65 VdB. Outdoor sources that may produce perceptible vibrations are usually caused by construction equipment, steel-wheeled trains, and traffic on rough roads, while smooth roads rarely produce perceptible ground-borne noise or vibration. To counter the effects of ground-borne vibration, the Federal Transit Administration (FTA) has published guidance relative to vibration impacts. According to the FTA, fragile buildings can be exposed to ground-borne vibration levels of 0.3 inches per second without experiencing structural damage.

3.3 Vibration Perception

There are three main types of vibration propagation: surface, compression, and shear waves. Surface waves, or Rayleigh waves, travel along the ground's surface. These waves carry most of their energy along an expanding circular wave front, similar to ripples produced by throwing a rock into a pool of water. P-waves, or compression waves, are body waves that carry their energy along an expanding spherical wavefront. The particle motion in these waves is longitudinal (i.e., in a "push-pull" fashion). P-waves are analogous to airborne sound waves. S-waves, or shear waves, are also body waves that carry energy along an expanding spherical wavefront. However, unlike P-waves, the particle motion is transverse, or side-to-side and perpendicular to the direction of propagation.

As vibration waves propagate from a source, the vibration energy decreases in a logarithmic nature and the vibration levels typically decrease by 6 VdB per doubling of the distance from the vibration source.

As stated above, this drop-off rate can vary greatly depending on the soil but has been shown to be effective enough for screening purposes, in order to identify potential vibration impacts that may need to be studied through actual field tests.

4.0 Regulatory Setting

The proposed project is located in the City of Claremont and noise regulations are addressed through the efforts of various federal, state and local government agencies. The agencies responsible for regulating noise are discussed below.

4.1 Federal Regulations

The adverse impact of noise was officially recognized by the federal government in the Noise Control Act of 1972, which serves three purposes:

- Publicize noise emission standards for interstate commerce
- Assist state and local abatement efforts
- Promote noise education and research

The Federal Office of Noise Abatement and Control (ONAC) originally was tasked with implementing the Noise Control Act. However, it was eventually eliminated leaving other federal agencies and committees to develop noise policies and programs. Some examples of these agencies are as follows: The Department of Transportation (DOT) assumed a significant role in noise control through its various agencies. The Federal Aviation Agency (FAA) is responsible for regulating noise from aircraft and airports. The Federal Highway Administration (FHWA) is responsible for regulating noise from the interstate highway system. The Occupational Safety and Health Administration (OSHA) is responsible for the prohibition of excessive noise exposure to workers.

The federal government advocates that local jurisdictions use their land use regulatory authority to arrange new development in such a way that "noise sensitive" uses are either prohibited from being constructed adjacent to a highway or, alternatively that the developments are planned and constructed in such a manner that potential noise impacts are minimized.

Since the federal government has preempted the setting of standards for noise levels that can be emitted by the transportation source, the City is restricted to regulating the noise generated by the transportation system through nuisance abatement ordinances and land use planning.

4.2 State Regulations

Established in 1973, the California Department of Health Services Office of Noise Control (ONC) was instrumental in developing regularity tools to control and abate noise for use by local agencies. One significant model is the "Land Use Compatibility for Community Noise Environments Matrix." The matrix allows the local jurisdiction to clearly delineate compatibility of sensitive uses with various incremental levels of noise.

The State of California has established noise insulation standards as outlined in Title 24 and the Uniform Building Code (UBC) which in some cases requires acoustical analyses to outline exterior noise levels and to ensure interior noise levels do not exceed the interior threshold. The State mandates that the legislative body of each county and city adopt a noise element as part of its comprehensive general plan.

The local noise element must recognize the land use compatibility guidelines published by the State Department of Health Services. The City of Claremont has published their version of these guidelines as illustrated in Exhibit D.

Exhibit D: Land Use Compatibility Guidelines

Property Receiving Noise		Maximum Noise Level (Ldn or CNEL, dBA)	
Type of Use	Zoning Designations	Interior	Exterior[3]
Residential	Hillside Rural Very Low Low Low Medium	45	65
	Medium	45	65 / 70[1]
	High	45	70[1]
Commercial and Office	Professional Commercial Neighborhood Limited Major Highway Freeway	--	70
	Professional Office	50	70
Business Park	Business Park	55	75
Public/Institutional	Schools	50	65
	All others	50	70
Open Space	Active Open Space	--	70
	Passive Open Space	--	70 /65[2]

1 Maximum exterior noise levels up to 70 dB CNEL are allowed for Multiple-Family Housing.
2 Where quiet is a basis required for the land use.
3 Regarding aircraft-related noise, the maximum acceptable exposure for new residential development is 60 dB CNEL.

4.3 City of Claremont Noise Regulations

The City of Claremont outlines their noise regulations and standards within the Public Safety and Noise Element from the General Plan and the Noise Ordinance from the Municipal Code.

City of Claremont General Plan

Applicable policies and standards governing environmental noise in the City are set forth in the General Noise Element. Section 16.154.020 of the Claremont Municipal Code outlines the base noise standards as 60 dBA from 7AM to 10PM and 55 dBA from 10PM to 7AM for residential use. Therefore, the project must demonstrate compliance to the City’s noise standards.

In addition to the noise standards, the City has outlined goals, policies and implementation measures to reduce potential noise impacts and are presented below:

Goals, Policies, and Implementation Measures

Policies and goals from the Safety and Noise Chapter that would mitigate potential impacts on noise include the following. All General Plan policies are followed by a set of numbers in parentheses. These numbers reference measures that will be undertaken by the City to implement the policy.

Non-Transportation Noise Sources

Goal 6-12 Minimize the impact of excessive noise levels throughout the community and adopt appropriate noise level requirements for all land uses.

6-12.1 Use noise contour maps and noise/land use compatibility criteria in planning and development decisions.

6-12.2 Develop standards and encourage private property owners to locate, screen, and/or buffer equipment in order to reduce noise impacts on surrounding areas.

6-12.3 Minimize noise from property maintenance equipment, construction activities and other non transportation noise sources by enforcing designated construction and maintenance hours.

6-12.4 Require mitigation of any potential noise impacts before allowing mining of aggregate resources.

City of Claremont – Noise Ordinance

D. Exterior Noise Standards

1. The Base Noise Level is the ambient noise level or the Ambient Base Noise Level, whichever is higher. The Ambient Base Noise Levels are as follows:

Table 1: Allowable Exterior Noise Level[1]

Noise Zone	Type of Land Use	Allowed Equivalent Noise Level, Leq	
		7:00 am to 10:00 pm	10:00 pm to 7:00 am
I	Residential - Exterior Noise	60 dBA	55 dBA
II	Commercial - Exterior Noise	65 dBA	60 dBA
III	Industrial - Exterior	70 dBA	70 dBA

Notes:
1. If the ambient noise exceeds the resulting standard, the ambient noise level shall be the standard.

Each of the noise limits above shall be reduced 5 dBA for noise consisting of impulse or simple tone noise.

2. It shall be unlawful for any person at any location within the incorporated area of the City to create any noise or allow the creation of any noise on the property owned, leased, occupied, or otherwise

controlled by such person, which causes the noise level when measured on the property line of any other property to exceed the basic noise level as adjusted below:

Basic Noise Level for a cumulative period of more than 15 minutes in any one hour; or

Basic Noise Level plus 5 dBA for a cumulative period of more than 10 minutes in any one hour; or

Basic Noise Level plus 14 dBA for a cumulative period of more than 5 minutes in any one hour; or

Basic Noise Level plus 15 dBA at any time.

3. If the measurement location is a boundary between two different noise zones, the lower noise level standard shall apply.

4. If the intruding noise source is continuous and cannot reasonably be discontinued or stopped for a time period whereby the ambient noise level can be determined, the measured noise level obtained while the noise is in operation shall be compared directly to the allowable noise level standards as specified respective to the measurement location's designated land use and for the time of day the noise level is measured. The reasonableness of temporarily discontinuing the noise generation by an intruding noise source shall be determined by the Director or his/her duly authorized deputy for the purpose of establishing the existing ambient noise level at the measurement location.

Construction Noise Regulations

F. Exemptions

The following activities shall be exempted from the provisions of this chapter:

4. Noise sources associated with or vibration created by construction, repair, remodeling or grading of any real property, or during authorized seismic surveys, provided:

> a. Activities take place between the hours of 7:00 AM and 8:00 PM weekdays and Saturdays, excluding national holidays; and
>
> b. Noise levels, as measured on residential properties, do not exceed 65 dBA for a cumulative period of more than 15 minutes in any one hour, 70 dBA for a cumulative period of more than 10 minutes in any one hour, 79 dBA for a cumulative period of more than 5 minutes in any one hour or 80 dBA at any time; and
>
> c. Any vibration created does not endanger the public health, welfare, and safety. Only that construction, repair, remodeling and grading activity that does not exceed the noise levels set by Section 16.154.020.D may occur on Sundays and national holidays.

Vibration

J. Vibration

Notwithstanding other sections of this chapter, it shall be unlawful for any person to create, maintain or cause any ground vibration which is perceptible without instruments at any point on any affected property adjoining the property on which the vibration source is located. For the purpose of this chapter, the perception threshold shall be presumed to be more than 0.05 inches per second RMS vertical velocity.

Threshold Applied to the Project

Operational

The project's operation is continuous day and night and therefore must not exceed the basic noise level as outlined in Table 1 (Section 16.154.020)(D)). The residential exterior standard is 60 dBA, Leq (15-min) from 7AM to 10PM, and 55 dBA, Leq (15-min) from 10PM to 7AM as measured on any residential property.

In addition, the noise level must not exceed the following standards at the property line:

- Basic Noise Level plus 5 dBA for a cumulative period of more than 10 minutes in any one hour; (>65 dBA for 10 minutes, 7AM – 10PM and >60 dBA for 10 min, 10PM to 7AM)
- Basic Noise Level plus 14 dBA for a cumulative period of more than 5 minutes in any one hour; (>74 dBA for 5 minutes, 7AM – 10PM and >69 dBA for 5 min, 10PM to 7AM)
- Basic Noise Level plus 15 dBA at any time (>75 dBA for anytime, 7AM – 10PM and >70 dBA, 10PM to 7AM).

Project operations were compared to the strictest daytime and nighttime standard of 60 dBA and 55 dBA, respectively. In addition to the City

Any construction activity which occurs between the hours of 8PM and 7AM or on Sundays or holidays, such as the continuous 24-hour well drilling, must follow these residential standards outlined above.

Construction

Construction activity between 7AM and 8PM weekdays and Saturdays must not exceed 65 dBA for more than 15 minutes in an hour, 70 dBA for more than 10 minutes in an hour, 79 dBA for more than 5 minutes in an hour, and 80 dBA at any time.

5.0 Study Method and Procedure

The following section describes the noise modeling procedures and assumptions used for this assessment.

5.1 Noise Measurement Procedure and Criteria

Noise measurements are taken to determine the existing noise levels. A noise receiver or receptor is any location in the noise analysis in which noise might produce an impact. The following criteria are used to select measurement locations and receptors:

- Locations expected to receive the highest noise impacts, such as the first row of houses
- Locations that are acoustically representative and equivalent of the area of concern
- Human land usage
- Sites clear of major obstruction and contamination

MD conducted the sound level measurements in accordance with the City noise ordinance and similar parameters to the CalTrans technical noise specifications. All measurement equipment meets American National Standards Institute (ANSI) specifications for sound level meters (S1.4-1983 identified in Chapter 19.68.020.AA). The following gives a brief description of the Caltrans Technical Noise Supplement procedures for sound level measurements:

- Microphones for sound level meters were placed 5-feet above the ground for all measurements
- Sound level meters were calibrated (Larson Davis CAL 200) before and after each measurement
- Following the calibration of equipment, a windscreen was placed over the microphone
- Frequency weighting was set on “A” and slow response
- Results of the long-term noise measurements were recorded on field data sheets
- During any short-term noise measurements, any noise contaminations such as barking dogs, local traffic, lawn mowers, or aircraft fly-overs were noted
- Temperature and sky conditions were observed and documented

5.2 Noise Measurement Locations

Noise measurement locations were selected based on the nearest adjacent land use to project site. A total of (1) 24-hour noise measurement was conducted at the project site. The field data is utilized to characterize the existing ambient conditions within the project vicinity is illustrated in Exhibit E. Appendix A includes photos, field sheet, and measured noise data.

5.3 Operational Stationary Noise Modeling

The operational noise was evaluated based on the inverse square law, proposed well pump enclosure design and reference equipment noise level data) to calculate noise level projections. The project proposes to use a 125-horsepower well motor. MD has previously performed field measurements on 400 horsepower well motors (see Appendix B) and therefore utilizes the data for a 400 horsepower well motor as a worst-case scenario. Noise from a 125-horsepower well motor is anticipated to be quieter and therefore the noise data and projections for a 400-horsepower motor would be considered conservative.

The overall noise level is 90 dBA, Leq at 3 feet from the 400-hp motor. The noise is projected to the nearest sensitive receptor with noise attenuation through a masonry building, lined with acoustical panels. MD calculated the noise attenuation based on the well enclosure building envelop design (See Section 7.1.1).

5.4 FHWA Roadway Construction Noise Model

The construction noise analysis utilizes the Federal Highway Administration (FHWA) Roadway Construction Noise Model (RNCM), together with several key construction parameters. Key inputs include distance to the sensitive receiver, equipment usage, % usage factor, and baseline parameters for the project site.

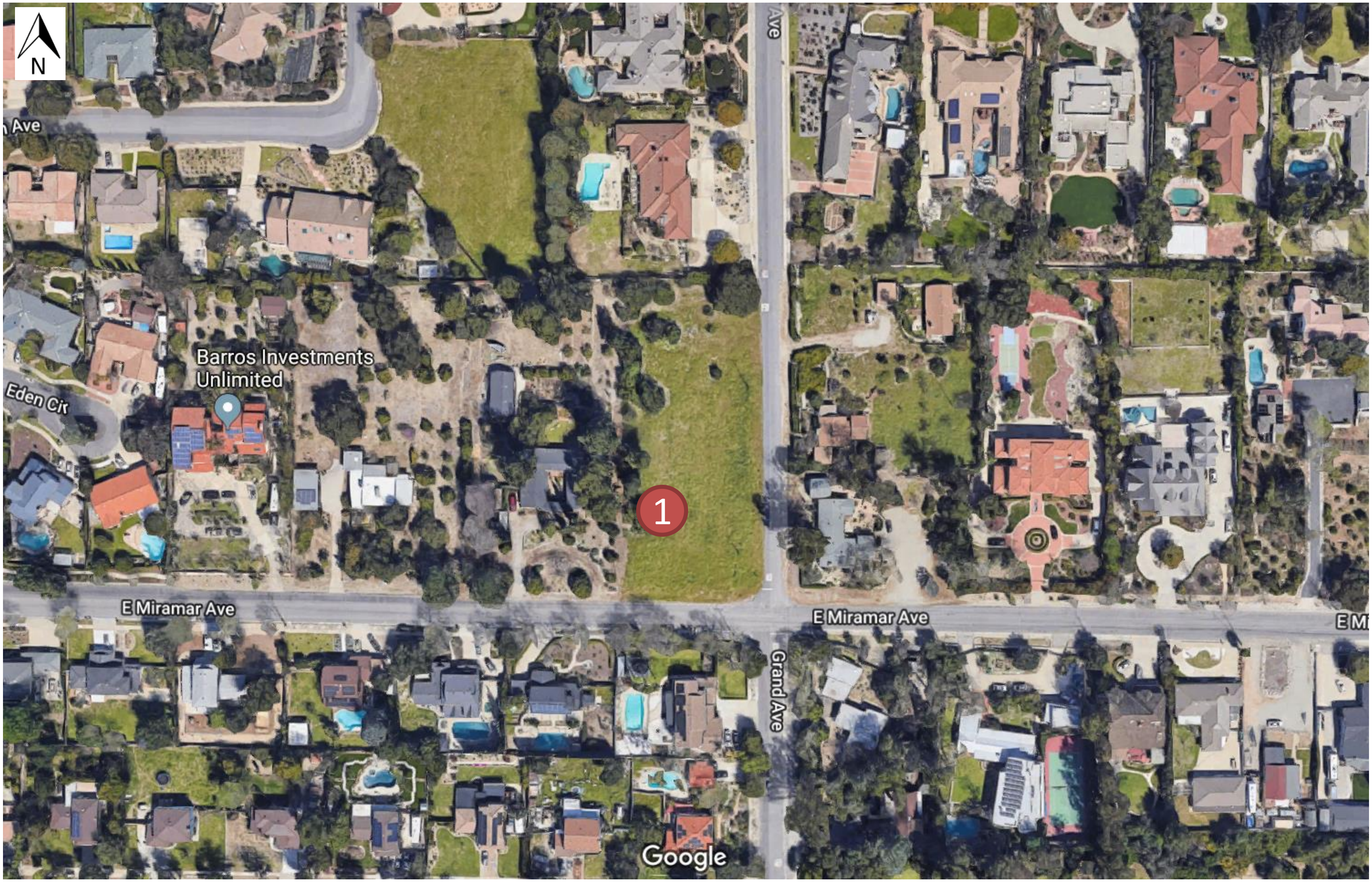
The project was analyzed based on the different construction phases. Construction noise is expected to be loudest during the cutting and drilling phases of construction. The construction noise calculation output worksheet is located in Appendix C. The following assumptions relevant to short-term construction noise impacts were used:

- The duration of well drilling construction activities is estimated to be three to four months with preparation of each phase in-between the actual construction. Several of the phases will overlap.
- Cutting of pavement/concrete will last approximately 3 to 5 days.
- 24-hour drilling will last approximately 10 to 14 days.
- Laying of pipe (100 to 150 feet) along Miramar Avenue will last approximately 2 to 3 days.
- Repaving will last approximately 3 days.
- Enclosure construction will last approximately 4 weeks.

Exhibit E

Measurement Locations

1 = Long-term Monitoring Location



6.0 Existing Noise Environment

A twenty-four (24) hour ambient noise measurement was conducted at the project site approximately 99 feet from the center of Miramar Ave and 133 feet from the centerline of Grand Ave. The measurement measured the 1-hour Leq, Lmin, Lmax and other statistical data (e.g. L2, L8). The noise measurement was taken to determine the existing baseline noise conditions.

6.1 Noise Measurement Results

The results of the field measurements are provided in Table 2.

Table 2: Long-Term Noise Measurement Data[1]

Date	Time	dB(A)							
		L_{EQ}	L_{MAX}	L_{MIN}	L_2	L_8	L_{25}	L_{50}	L_{90}
7/11/2019	6AM-7AM	55.8	83.2	44.0	63.1	50.9	49.3	48.6	47.7
7/11/2019	7AM-8AM	57.4	72.1	40.3	68.1	59.8	57.1	56.7	53.1
7/11/2019	8AM-9AM	56.6	64.3	55.9	57.3	56.9	56.7	56.7	56.5
7/11/2019	9AM-10AM	52.2	71.4	37.0	60.1	56.5	56.1	48.8	44.2
7/11/2019	10AM-11AM	46.9	65.7	35.4	57.6	50.0	46.8	44.7	40.6
7/11/2019	11AM-12PM	49.3	68.4	35.5	60.7	52.1	48.5	45.8	40.8
7/11/2019	12PM-1PM	53.1	76.0	36.7	64.5	53.6	49.0	46.3	41.7
7/11/2019	1PM-2PM	50.2	70.8	36.6	59.1	52.3	49.6	47.8	44.3
7/11/2019	2PM-3PM	48.2	71.0	36.8	57.2	48.1	45.6	44.2	41.8
7/11/2019	3PM-4PM	62.6	77.5	38.8	70.9	68.4	66.9	63.0	44.5
7/11/2019	4PM-5PM	47.2	65.4	38.5	58.7	49.7	46.3	44.7	42.5
7/11/2019	5PM-6PM	46.8	70.2	39.1	54.8	48.7	46.6	45.4	43.2
7/11/2019	6PM-7PM	45.1	59.7	39.0	52.8	48.2	46.1	44.8	42.8
7/11/2019	7PM-8PM	43.7	56.5	38.3	51.0	46.4	44.4	43.5	41.9
7/11/2019	8PM-9PM	44.6	57.1	39.4	51.4	47.1	45.3	44.5	43.1
7/11/2019	9PM-10PM	45.5	62.4	37.0	53.2	46.6	45.5	44.9	43.5
7/11/2019	10PM-11PM	57.2	85.0	37.6	60.2	44.8	43.4	42.9	41.9
7/11/2019	11PM-12AM	43.0	55.4	39.2	47.0	45.1	44.0	43.3	42.3
7/12/2019	12AM-1AM	48.2	58.9	41.1	53.4	51.1	49.7	48.8	47.3
7/12/2019	1AM-2AM	46.6	54.1	41.3	51.2	49.0	48.1	47.5	45.9
7/12/2019	2AM-3AM	46.9	54.0	42.1	51.9	49.4	47.7	46.9	45.6
7/12/2019	3AM-4AM	49.1	55.9	44.1	50.0	48.6	48.0	47.6	46.6
7/12/2019	4AM-5AM	50.7	69.9	45.6	52.2	51.1	50.4	49.8	48.7
7/12/2019	5AM-6AM	61.8	81.8	47.1	54.6	52.7	51.7	51.1	50.0
DNL		58.5							

Notes:
1. Long-term noise monitoring location 1 (LT1) is illustrated in Exhibit E.

Noise data indicates that ambient noise data at the southwest portion of the project site ranges between 43.0 to 61.8 dBA Leq(h). The existing daytime 60 dBA Leq(h) and nighttime 55 dBA Leq(h) conditions are exceeded at various times as indicated in the highlighted yellow areas of Table 2. The exceedances are as a result of existing traffic conditions along the subject roadways.

The measured DNL is 58.5 and is within the normally acceptable range when comparing the level to the City's noise compatibility matrix and municipal code.

7.0 Future Noise Environment Impacts and Mitigation

This assessment analyzes future noise impacts as a result of the project and compares the results to the City's Noise Standards. Potential stationary noise impacts associated with the well pump were projected to the adjacent sensitive land uses.

7.1 Future Exterior Noise

The following outlines the exterior noise levels associated with the proposed project.

7.1.1 Stationary Source Noise

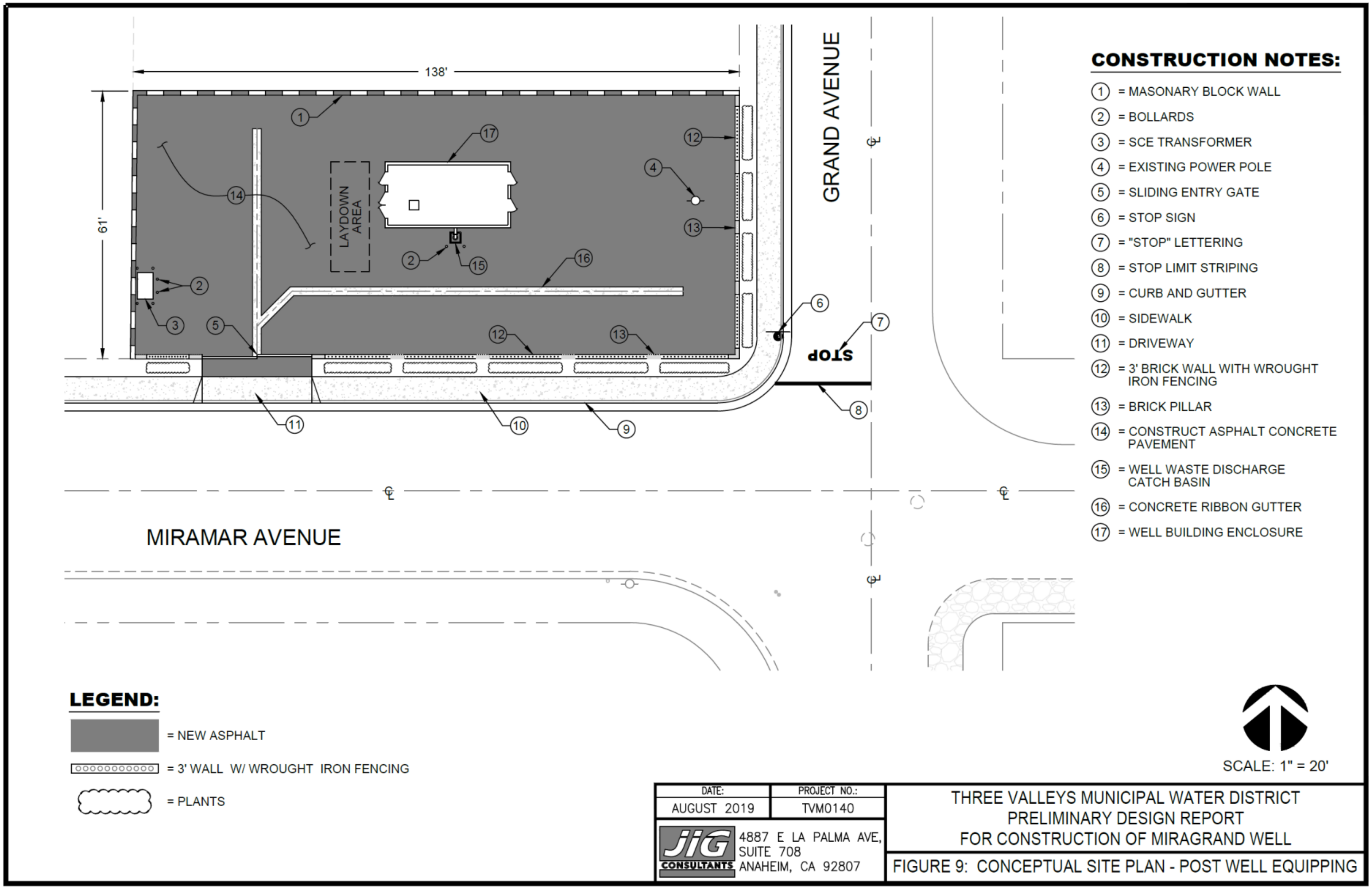
The project is surrounded by single family residential uses that may be affected by project operational noise. The main source of operational noise from the well will be the 100-horsepower pump motor which will be enclosed by a masonry building as shown in Exhibit F. The room which holds the well and motor will be lined with acoustic panels to further reduce impact to the surrounding residences.

Based on the referenced data, the motor noise is approximately 90 dBA, Leq at 3 feet from the motor. When projecting the noise level to the nearest sensitive receptor (100 feet from the motor), the noise would measure 59.5 dBA, Leq.

As previously mentioned, the project proposes to enclose the motor in a masonry building with a room lined with acoustic panels which will provide at least 30 dB reduction. The noise at the closest sensitive receptor would be approximately 30 dBA, Leq, which is below the City's noise ordinance and will not increase the ambient noise level. When comparing the projected operational noise level (30 dBA, Leq) to the quietest measured baseline hourly noise level of 43.0 dBA (11PM – 12PM), the projected level is approximately 13 dB lower than the quietest measured noise level. The project's operations will meet the City's stationary noise limit and will not have a significant impact.

Furthermore, the operational noise will not exceed the City's 65 DNL/CNEL land use compatibility noise matrix for residential uses.

Exhibit F
Proposed Well Pump Enclosure



8.0 Construction Noise Impact

The degree of construction noise may vary for different areas of the project site and also vary depending on the construction activities. Noise levels associated with the construction will vary with the different phases of construction.

8.1 Construction Noise

The Federal Highway Administration has compiled data regarding the noise generated characteristics of typical construction activities. The data is presented in Table 3.

Table 3: CA/T Equipment Noise Emissions and Acoustical Usage Factor Database

Equipment Description	Impact Device?	Acoustical use Factor (%)	Spec. 721.560 Lmax @ 50ft (dBA, slow)	Actual Measured Lmax @ 50ft (dBA, slow)	No. of Actual Data Samples (Count)
All Other Equipment > 5 HP	No	50	85	-N/A-	0
Auger Drill Rig	No	20	85	84	36
Backhoe	No	40	80	78	372
Bar Bender	No	20	80	-N/A-	0
Blasting	Yes	-N/A-	94	-N/A-	0
Boring Jack Power Unit	No	50	80	83	1
Chain Saw	No	20	85	84	46
Clam Shovel (dropping)	Yes	20	93	87	4
Compactor (ground)	No	20	80	83	57
Compressor (air)	No	40	80	78	18
Concrete Batch Plant	No	15	83	-N/A-	0
Concrete Mixer Truck	No	40	85	79	40
Concrete Pump Truck	No	20	82	81	30
Concrete Saw	No	20	90	90	55
Crane	No	16	85	81	405
Dozer	No	40	85	82	55
Drill Rig Truck	No	20	84	79	22
Drum Mixer	No	50	80	80	1
Dump Truck	No	40	84	76	31
Excavator	No	40	85	81	170
Flat Bed Truck	No	40	84	74	4
Front End Loader	No	40	80	79	96
Generator	No	50	82	81	19
Generator (<25KVA, VMS signs)	No	50	70	73	74
Gradall	No	40	85	83	70
Grader	No	40	85	-N/A-	0
Grapple (on backhoe)	No	40	85	87	1
Horizontal Boring Hydr. Jack	No	25	80	82	6
Hydra Break Ram	Yes	10	90	-N/A-	0
Impact Pile Driver	Yes	20	95	101	11
Jackhammer	Yes	20	85	89	133
Man Lift	No	20	85	75	23
Mounted Impact hammer (hoe ram)	Yes	20	90	90	212
Pavement Scarafier	No	20	85	90	2

Paver	No	50	85	77	9
Pickup Truck	No	40	55	75	1
Pneumatic Tools	No	50	85	85	90
Pumps	No	50	77	81	17
Refrigerator Unit	No	100	82	73	3
Rivit Buster/chipping gun	Yes	20	85	79	19
Rock Drill	No	20	85	81	3
Roller	No	20	85	80	16
Sand Blasting (Single Nozzle)	No	20	85	96	9
Scraper	No	40	85	84	12
Shears (on backhoe)	No	40	85	96	5
Slurry Plant	No	100	78	78	1
Slurry Trenching Machine	No	50	82	80	75
Soil Mix Drill Rig	No	50	80	-N/A-	0
Tractor	No	40	84	-N/A-	0
Vacuum Excavator (Vac-truck)	No	40	85	85	149
Vacuum Street Sweeper	No	10	80	82	19
Ventilation Fan	No	100	85	79	13
Vibrating Hopper	No	50	85	87	1
Vibratory Concrete Mixer	No	20	80	80	1
Vibratory Pile Driver	No	20	95	101	44
Warning Horn	No	5	85	83	12
Welder/Torch	No	40	73	74	5

Table 4 provides the construction noise level projections during the various phases of construction.

Table 4: Construction Noise Levels (dBA, Leq(h))

Location	Phase	Construction Noise Level[1]	Reduction with Mufflers	Reduction with Wall	Abated Noise Level	Ambient Level[2]	Final Projected Noise Level
Residences	Cutting	88.8	-15.0	N/A	73.8	46.8	73.8
	Laying	87.4	-15.0	N/A	72.4	46.8	72.4
	Paving	88.2	-15.0	N/A	73.2	46.8	73.2
	Drilling	59.0	N/A	-14.0	45.0	43.0	47.1
	Building	78.6	-15.0	-14.0	49.6	46.8	51.4

Notes:
1. Distance projected from center of proposed road/well to nearest home.
2. Lowest ambient level during operational hours.

As shown in Table 4, the noise level during the various phases of construction will vary between 47.1 to 73.8 dBA. The noise level projections include the reduced noise as a result of mufflers and the 24-foot tall noise barrier surrounding the project construction site (see Exhibit G).

Noise from pavement/concrete cutting will be intermittent and short-term in nature such that while the cutting occurs the noise will reach 73.8 dBA at the nearest sensitive receptor, but when cutting does not occur the noise will fall back down to the ambient condition. Cutting of pavement will occur over a 3 to

5-day period with intermittent saw cutting. In addition, saw cutting will only occur between 7AM to 6PM. Therefore, the noise from cutting is temporary and considered a short-term impact.

Laying of pipe along Miramar Avenue will last approximately 2 to 3 days. Noise will reach up to 72.4 dBA. The noise from laying of pipe is short-term and temporary in nature. Laying of pipe will only occur between 7AM to 6PM.

The 24-hour drilling will last approximately 10 to 14 days. The projected noise level to the nearest sensitive receptor is 47.1 dBA which is below the City's 55 dBA nighttime noise requirement. Noise from drilling will be mitigated using 24-foot tall barriers and mufflers on drilling equipment engines. Therefore, the impact is less than significant with mitigation.

The repaving of the roadway will last approximately 3-days. The projected noise level to the nearest sensitive receptor is 73.2 dBA. Paving will only occur between 7AM to 6PM, and the noise will be intermittent during paving.

Noise during the construction of the enclosure is projected to be 51.4 dBA and is below the City's noise limit. Construction is anticipated to occur only during the hours of 7AM to 6PM, and therefore the impact is considered less than significant.

Construction is anticipated to occur during the permissible hours according the City's Municipal Code except for the 24-hour drilling which should not exceed the nighttime residential noise limit. Construction noise will have a temporary or periodic increase in the ambient noise level above the existing within the project vicinity. Furthermore, construction design noise reduction measures are provided to further reduce construction noise (Section 8.3).

8.2 Construction Vibration

Construction activities can produce vibration that may be felt by adjacent land uses. The construction of the proposed project would not require the use of equipment such as pile drivers, which are known to generate substantial construction vibration levels. According to the FTA Noise and Vibration Impact Assessment manual, a loaded truck has a PPV of 0.076 in/sec (86 VdB) at 25 feet. At 40 feet from the truck the maximum PPV is 0.045 in/sec and is below any threshold of damage. Appendix D provides the vibration calculations. This is within the municipal code guidelines for perception of vibration. No additional mitigation measures are needed.

8.3 Construction Design Noise Reduction Measures

Construction operations must follow the City's General Plan and the Noise Ordinance, which states that construction, repair or excavation work performed must occur within the permissible hours. To further ensure that construction activities do not disrupt the adjacent land uses, the following measures will be taken:

1. Construction will occur between the hours of 7AM and 6PM. Monday through Saturday except during holidays.

2. During construction, the contactor will ensure all construction equipment is equipped with appropriate noise attenuating devices.

3. The contractor will locate equipment staging areas that will create the greatest distance between construction-related noise/vibration sources and sensitive receptors nearest the project site during all project construction.

4. Idling equipment will be turned off when not in use.

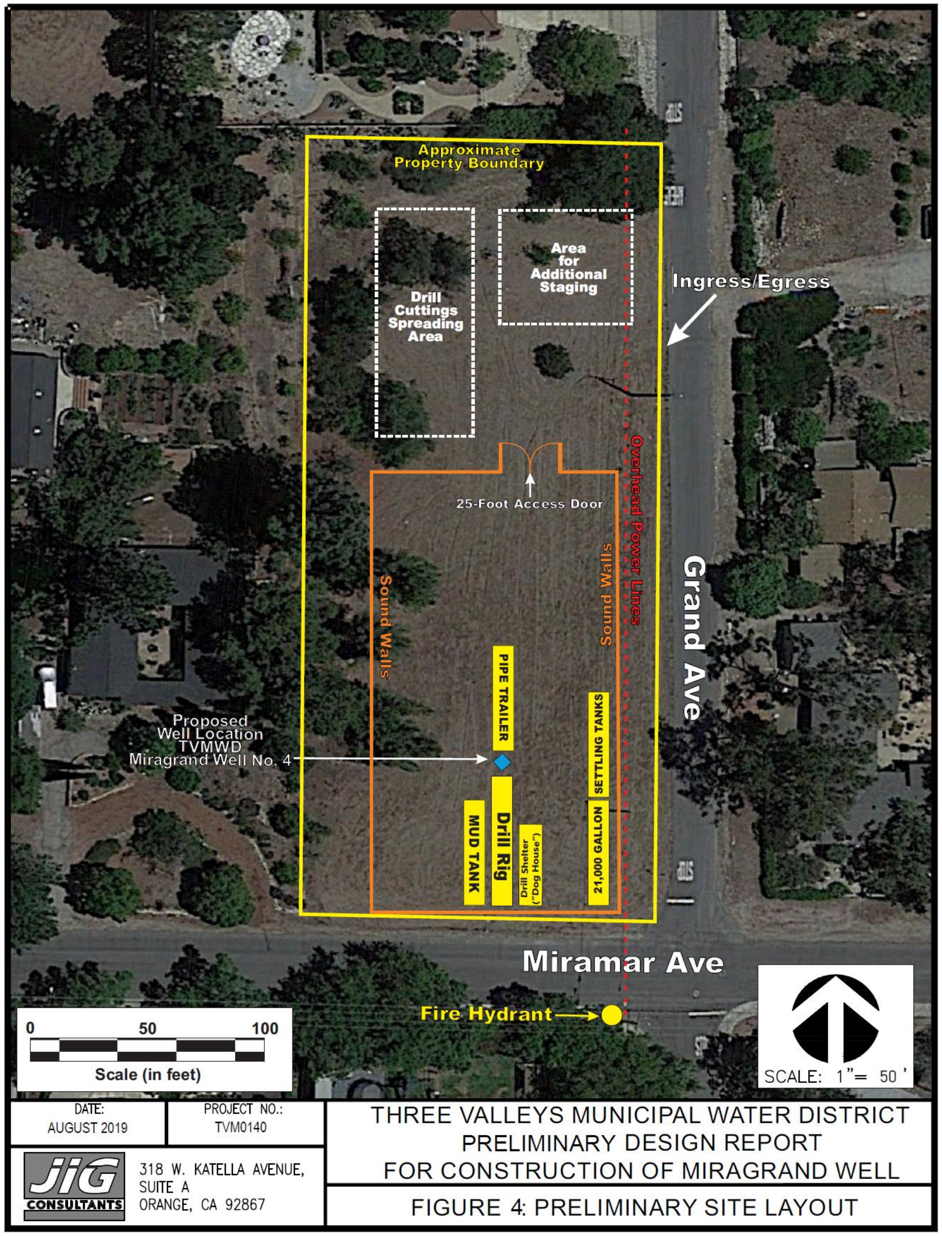
5. Equipment will be maintained so that vehicles and their loads are secured from rattling and banging.

6. A 24-ft high noise barrier will be placed around the well where noted during well construction (see Exhibit G).

7. Nearby residences will be notified before 24-hour drilling and pavement cutting occurs.

Exhibit G

Proposed Sound Wall Layout



9.0 References

State of California General Plan Guidelines: 1998. Governor's Office of Planning and Research.

City of Claremont: General Plan Chapter 6 Safety and Noise Element. 2009.

City of Claremont: Noise Ordinance.

FHWA Noise Construction Handbook.

Appendix A:

Photographs and Field Measurement Data

AZ Office
4960 S. Gilbert Rd, Ste 1-461
Chandler, AZ 85249

CA Office
1197 E Los Angeles Ave, C-256
Simi Valley, CA 93065

24-Hour Continuous Noise Measurement Datasheet

Project: Miramar & Grand
Site Address/Location: Intersection of Miramar and Grand Claremount, CA
Date: 7/11/2019 to 7/12/2019
Field Tech/Engineer: Jason Schuyler & Mike Dickerson, INCE

Site Observations: Meter was placed 90' from Miramar north of road Under a pine tree. From the meter location it was 133' west of Grand on the property line with a house on the west side.

General Location:
Sound Meter: LD 831 **SN:** 3713
Settings: A-weighted, slow, 1-min, 1-hour interval, 24-hour duration
Meteorological Con.: No wind, Sunny on 7/11 and 7/12
Site ID: NM1

Site Topo: Flat
Ground Type: street surface hard & Compactec

Noise Source(s) w/ Distance:
99' from Miramar Ave C/L
133' West of Grand Ave C/L

Figure 1: LT-1 Monitoring Location

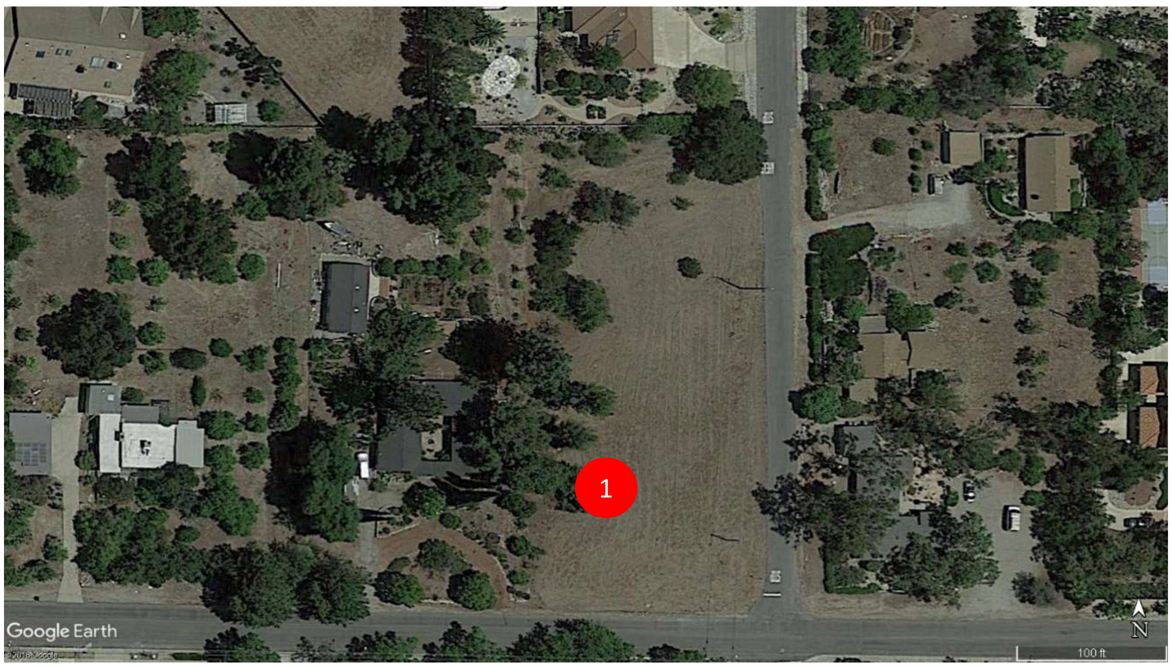
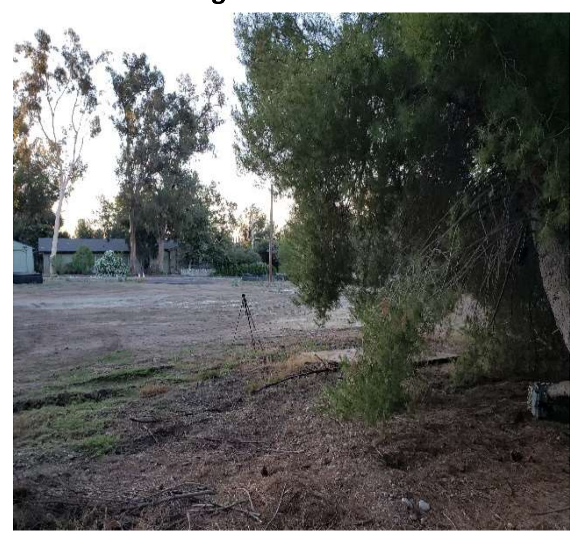


Figure 2: LT-1 Photo



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AZ Office
4960 S. Gilbert Rd, Ste 1-461
Chandler, AZ 85249

CA Office
1197 E Los Angeles Ave, C-256
Simi Valley, CA 93065

24-Hour Noise Measurement

Project: Miramar & Grand **Day:** 1 of 1
Site Address/Location: Intersection of Miramar and Grand Claremount, CA
Site ID: LT-1

Date	Start	Stop	Leq	Lmax	Lmin	L2	L8	L25	L50	L90
6/11/2019	6:00 AM	7:00 AM	55.8	83.2	44.0	63.1	50.9	49.3	48.6	47.7
6/11/2019	7:00 AM	8:00 AM	57.4	72.1	40.3	68.1	59.8	57.1	56.7	53.1
6/11/2019	8:00 AM	9:00 AM	56.6	64.3	55.9	57.3	56.9	56.7	56.7	56.5
6/11/2019	9:00 AM	10:00 AM	52.2	71.4	37.0	60.1	56.5	56.1	48.8	44.2
6/11/2019	10:00 AM	11:00 AM	46.9	65.7	35.4	57.6	50.0	46.8	44.7	40.6
6/11/2019	11:00AM	12:00 PM	49.3	68.4	35.5	60.7	52.1	48.5	45.8	40.8
6/11/2019	12:00 PM	1:00 PM	53.1	76.0	36.7	64.5	53.6	49.0	46.3	41.7
6/11/2019	1:00 PM	2:00 PM	50.2	70.8	36.6	59.1	52.3	49.6	47.8	44.3
6/11/2019	2:00 PM	3:00 PM	48.2	71.0	36.8	57.2	48.1	45.6	44.2	41.8
6/11/2019	3:00 PM	4:00 PM	62.6	77.5	38.8	70.9	68.4	66.9	63.0	44.5
6/11/2019	4:00 PM	5:00 PM	47.2	65.4	38.5	58.7	49.7	46.3	44.7	42.5
6/11/2019	5:00 PM	6:00 PM	46.8	70.2	39.1	54.8	48.7	46.6	45.4	43.2
6/11/2019	6:00 PM	7:00 PM	45.1	59.7	39.0	52.8	48.2	46.1	44.8	42.8
6/11/2019	7:00 PM	8:00 PM	43.7	56.5	38.3	51.0	46.4	44.4	43.5	41.9
6/11/2019	8:00 PM	9:00 PM	44.6	57.1	39.4	51.4	47.1	45.3	44.5	43.1
6/11/2019	9:00 PM	10:00 PM	45.5	62.4	37.0	53.2	46.6	45.5	44.9	43.5
6/11/2019	10:00 PM	11:00 PM	57.2	85.0	37.6	60.2	44.8	43.4	42.9	41.9
6/11/2019	11:00 PM	12:00 AM	43.0	55.4	39.2	47.0	45.1	44.0	43.3	42.3
6/12/2019	12:00 AM	1:00 AM	48.2	58.9	41.1	53.4	51.1	49.7	48.8	47.3
6/12/2019	1:00 AM	2:00 AM	46.6	54.1	41.3	51.2	49.0	48.1	47.5	45.9
6/12/2019	2:00 AM	3:00 AM	46.9	54.0	42.1	51.9	49.4	47.7	46.9	45.6
6/12/2019	3:00 AM	4:00 AM	49.1	55.9	44.1	50.0	48.6	48.0	47.6	46.6
6/12/2019	4:00 AM	5:00 AM	50.7	69.9	45.6	52.2	51.1	50.4	49.8	48.7
6/12/2019	5:00 AM	6:00 AM	61.8	81.8	47.1	54.6	52.7	51.7	51.1	50.0

CNEL: 58.5

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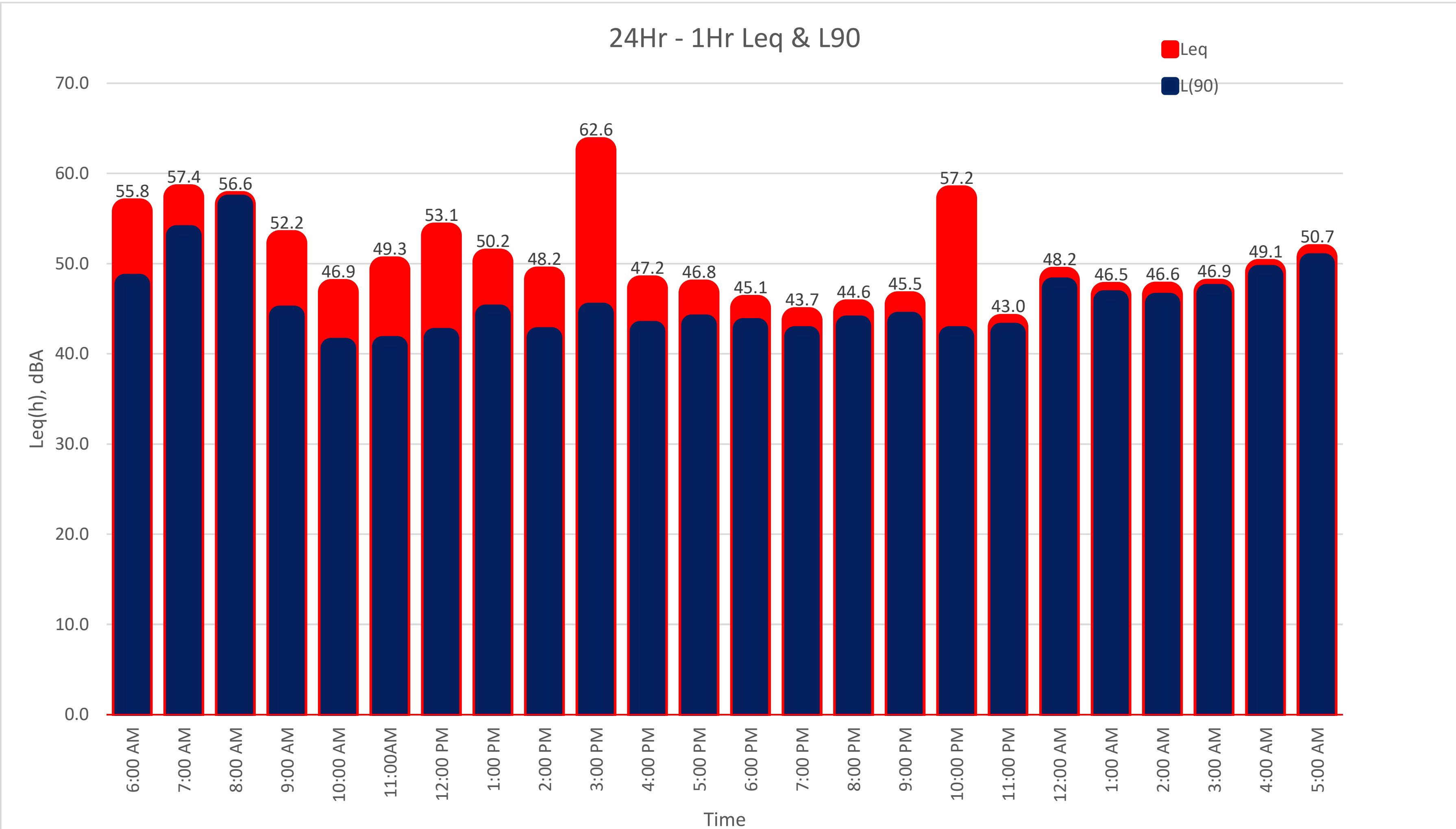
AZ Office
4960 S. Gilbert Rd, Ste 1-461
Chandler, AZ 85249

CA Office
1197 E Los Angeles Ave, C-256
Simi Valley, CA 93065

24-Hour Continuous Noise Measurement Datasheet - Cont.

Project: Miramar & Grand **Day:** 1 of 1
Site Address/Location: Intersection of Miramar and Grand Claremount, CA
Site ID: LT-1



Appendix B:

Well Motor Noise Measurements

AZ Office
4960 S. Gilbert Rd, Ste 1-461
Chandler, AZ 85249
p. (602) 774-1950

CA Office
1197 Los Angeles Ave, Ste C-256
Simi Valley, CA 93065
p. (805) 426-4477

Project: Town of Queen Creek, AZ
Site Location: Hastings
Date: 2/8/2019
Field Tech/Engineer: Mike Dickerson, INCE
Source/System: NIDEC Motor Corp

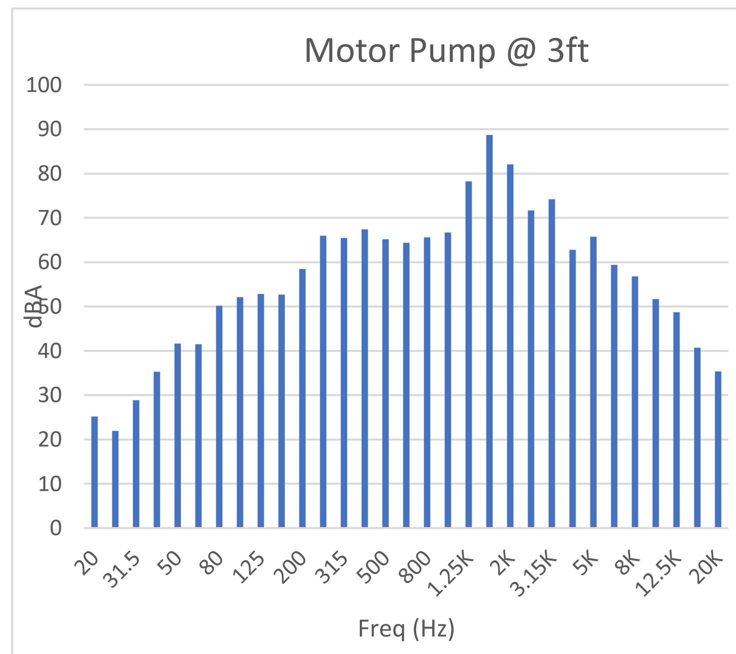
Site Observations:
Clear sky, measurements were performed within 3ft of source @ 54Hz.

Location: 3feet from motor
Sound Meter: LD831c **SN:** 10685
Settings: A-weighted, fast, 1-sec, 30-sec duration
Meteorological Cond.: 77 degrees F, 2 mph wind

Table 1: Summary Measurement Data

Source	System	Overall dB(A)	3rd Octave Band Data (dBA)																													
			20	25	32	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1K	1.25K	1.6K	2K	2.5K	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K	20K
Well Pump Motor	Water Pump	90.2	25	22	29	35	42	41	50	52	53	53	58	66	65	67	65	64	66	67	78.2	89	82	72	74	63	66	59	57	52	49	41	35

Figure 1: Example Measurement Position



Appendix C:

Construction Calculations

MD ACOUSTICS
Sound Solutions for Planning and Design
www.mdacoustics.com

AZ Office
4960 S. Gilbert Rd, Ste 1-461
Chandler, AZ 85249
p. (602) 774-1950

CA Office
1197 Los Angeles Ave, Ste C-256
Simi Valley, CA 93065
p. (805) 426-4477

Project: Well Drilling Monitoring
Site Location: Rittenhouse and Cherrywood Lane, QC, AZ
Date: 5/16/2019
Field Tech/Engineer: Robert Pearson
Source/System: Drill / Casing Rig

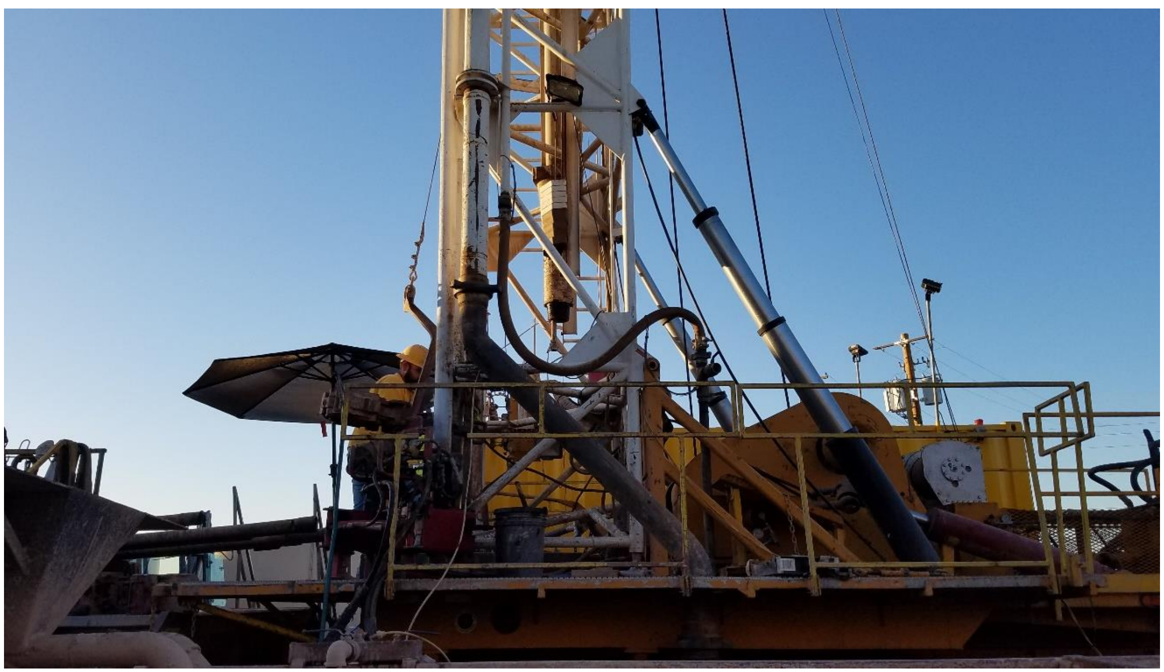
Site Observations:
Clear sky, measurement was performed 10 feet from platform/rig.

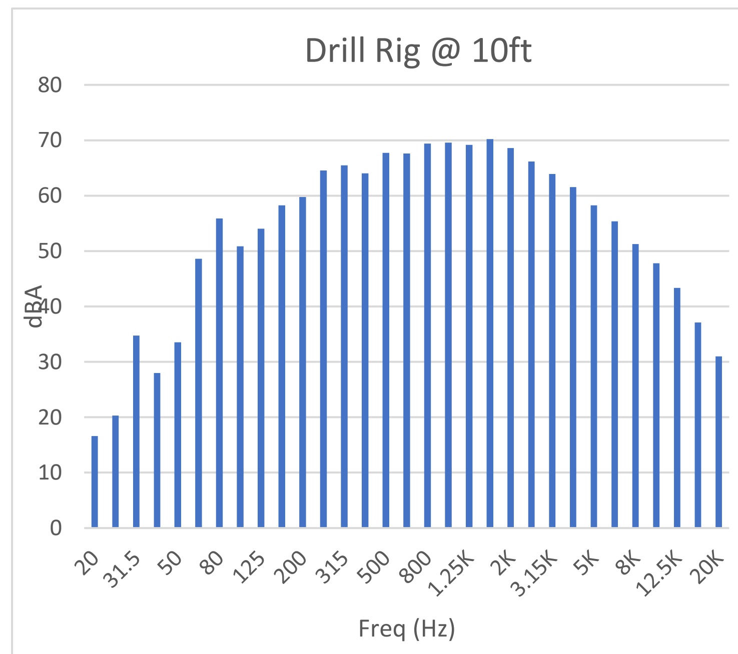
Location: 10 feet from platform
Sound Meter: NTi XL2 **SN:** A2A-05967-E0
Settings: A-weighted, fast, 1-sec, 1-min duration
Meteorological Cond.: 85 degrees F, 2 mph wind

Table 1: Summary Measurement Data

Source	System	Overall dB(A)	3rd Octave Band Data (dBA)																													
			20	25	32	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1K	1.25K	1.6K	2K	2.5K	3.15K	4K	5K	6.3K	8K	10K	12.5K	16K	20K
Well Drilling	Platform/Rig	78.8	17	20	35	28	34	49	56	51	54	58	60	65	65	64	68	68	69	70	69.2	70	69	66	64	62	58	55	51	48	43	37	31

Figure 1: Example Measurement Position





Receptor - House

A	B	C	D	E	F	G	H	I	J
Construction Phase Equipment Item	# of Items	Item Lmax at 50 feet, dBA	Dist. To Recptr.	Item Usage Percent	Usage Factor	Dist. Correction dB	Usage Adj. dB	Recptr. Item Lmax, dBA	Recptr. Item Leq, dBA
CUTTING									
1. Backhoe	1	80	40	40	0.40	1.9	-4.0	81.9	78.0
2. Crane	1	85	40	16	0.16	1.9	-8.0	86.9	79.0
3. Pavement Cutter	1	85	40	20	0.20	1.9	-7.0	86.9	79.9
4. Water Truck	1	85	40	40	0.40	1.9	-4.0	86.9	83.0
5. Delivery/Dump Truck	2	84	40	40	0.80	1.9	-1.0	85.9	85.0
							Log Sum	93.1	88.8
LAYING									
1. Crane	1	85	40	16	0.16	1.9	-8.0	86.9	79.0
2. Delivery/Dump Truck	3	84	40	40	1.20	1.9	0.8	85.9	86.7
							Log Sum	89.5	87.4
DRILLING									
1. Drill Rig/Drilling Operations	1	69	100	40	0.40	-6.0	-4.0	63.0	59.0
									59.0
PAVING									
1. Paver	1	85	40	50	0.50	1.9	-3.0	86.9	83.9
2. Roller	1	85	40	20	0.20	1.9	-7.0	86.9	79.9
3. Delivery/Dump Truck	2	84	40	40	0.80	1.9	-1.0	85.9	85.0
							Log Sum	91.4	88.2
BUILDING									
1. Crane	1	85	100	16	0.16	-6.0	-8.0	79.0	71.0
2. Loader/Backhoe	1	80	100	40	0.40	-6.0	-4.0	74.0	70.0
3. Delivery/Dump Truck	2	84	100	40	0.80	-6.0	-1.0	78.0	77.0
							Log Sum	82.2	78.6

Appendix D:

Vibration Calculations

VIBRATION LEVEL IMPACT

Project:	Miragrand Well	Date: 8/26/19
Source:	Drilling	
Scenario:	Unmitigated	
Location:	Project Site	
Address:		
PPV = PPVref(25/D)^n (in/sec)		

DATA INPUT

Equipment = Type	3	Caisson Drilling	INPUT SECTION IN BLUE
PPVref =	0.089	Reference PPV (in/sec) at 25 ft.	
D =	100.00	Distance from Equipment to Receiver (ft)	
n =	1.10	Vibration attenuation rate through the ground	

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

DATA OUT RESULTS

PPV =	**0.019**	IN/SEC	OUTPUT IN RED

VIBRATION LEVEL IMPACT

Project:	Miragrand Well	Date: 8/26/19
Source:	Pipe Construction	
Scenario:	Unmitigated	
Location:	Project Site	
Address:		

PPV = PPVref(25/D)^n (in/sec)

DATA INPUT

Equipment = Type	4	Loaded Trucks	INPUT SECTION IN BLUE
PPVref =	0.076	Reference PPV (in/sec) at 25 ft.	
D =	40.00	Distance from Equipment to Receiver (ft)	
n =	1.10	Vibration attenuation rate through the ground	

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

DATA OUT RESULTS

PPV =	**0.045**	IN/SEC	OUTPUT IN RED