Section 3.11
Noise

The purpose of this section is to evaluate the proposed project's noise impacts. This section evaluates short-term construction-related impacts and long-term conditions. This section also presents relevant regulatory guidelines and County policies related to noise. The analysis in this section is based on a technical report, *Sound Survey and Analysis Report,* prepared by Tetra Tech (2018; see **Appendix J**) and peer reviewed by Michael Baker International.

ENVIRONMENTAL SETTING

FUNDAMENTALS OF ACOUSTICS

Acoustics is the science of sound. Sound may be thought of as mechanical energy of a vibrating object transmitted by pressure waves through a medium to human (or animal) ears. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard and are called sound. The number of pressure variations per second is called the frequency of sound and is expressed as cycles per second, or hertz (Hz).

A-Weighted Sound Level

Sound is described in terms of the loudness (amplitude) of the sound and frequency (pitch) of the sound. The standard unit of measurement of the loudness of sound is the decibel (dB). Since the human ear is not equally sensitive to sound at all frequencies, a special frequency-dependent rating scale has been devised to relate noise to human sensitivity. The A-weighted decibel scale (dBA) performs this compensation by differentiating among frequencies in a manner approximating the sensitivity of the human ear.

The dBA approximates the frequency response of the average young ear when listening to ordinary sounds. When people make judgments about the relative loudness or annoyance of a sound, their judgments correlate well with the A-scale sound levels of those sounds. Examples of typical noise from outdoor and indoor activities are listed in **Table 3.11-1, Typical Noise Levels**.

Table 3.11-1:
Typical Noise Levels

Common Outdoor Activities	Noise Level (dB)	Common Indoor Activities
	110	Rock band
Jet flyover at 1,000 feet	100	
Gas lawn mower at 3 feet	90	
Diesel truck at 50 feet, at 50 mph	80	Food blender at 3 feet; garbage disposal at 3 feet
Noisy urban area, daytime; gas lawn mower at 100 feet	70	Vacuum cleaner at 10 feet
Commercial area; heavy traffic at 300 feet	60	Normal speech at 3 feet
Quiet urban, daytime	50	Large business office; dishwasher next room
Quiet urban, nighttime	40	Theater; large conference room (background)
Quiet suburban, nighttime	30	Library
Quiet rural, nighttime	20	Bedroom at night; concert hall (background)
	10	Broadcast/recording studio
Lowest threshold of human hearing	0	Lowest threshold of human hearing

Source: Caltrans 2013

Addition of Decibels

The decibel scale is logarithmic, not linear, and therefore sound levels cannot be added or subtracted through ordinary arithmetic. Two sound levels 10 dB apart differ in acoustic energy by a factor of 10. When the standard logarithmic decibel is A-weighted, an increase of 10 dBA is generally perceived as a doubling in loudness. For example, a 70 dBA sound is half as loud as an 80 dBA sound and twice as loud as a 60 dBA sound. When two identical sources are each producing sound of the same loudness, the resulting sound level at a given distance would be 3 dB higher than one source under the same conditions (FTA 2006).

Sound Propagation and Attenuation

Generally, sound spreads (propagates) uniformly outward in a spherical pattern. The sound level decreases (attenuates) at a rate of approximately 6 dB for each doubling of distance from a stationary or point source. Sound from a line source, such as a highway, propagates outward in a cylindrical pattern, often referred to as cylindrical spreading. Sound levels attenuate at a rate

of approximately 3 dB for each doubling of distance from a line source, such as a roadway, depending on ground surface characteristics (Caltrans 2013).

Noise levels may also be reduced by intervening structures or landforms; generally, a single row of buildings between the receptor and the noise source reduces the noise level by about 5 dBA, while a solid wall or berm reduces noise levels by 5 to 10 dBA (FHWA 2006). The manner in which older homes in California were constructed generally provides a reduction of exterior-to-interior noise levels of about 20 to 25 dBA with closed windows. The exterior-to-interior reduction of newer residential units is generally 30 dBA or more.

Noise

Noise is a subjective reaction to different types of sounds. Noise is typically defined as airborne sound that is loud, unpleasant, unexpected, or undesired and may therefore be classified as a more specific group of sounds. A typical noise environment consists of a base of steady "background" noise that is the sum of many distant and indistinguishable noise sources. Superimposed on this background noise is the sound from individual local sources. These sources can vary from an occasional aircraft or train passing by to virtually continuous noise from, for example, traffic on a major highway. Perceptions of sound and noise are highly subjective from person to person.

Noise Descriptors

The decibel scale alone does not adequately characterize how humans perceive noise. The dominant frequencies of a sound have a substantial effect on the human response to that sound. Several rating scales have been developed to analyze the adverse effect of community noise on people. Because environmental noise fluctuates over time, these scales consider that the effect of noise on people is largely dependent on the total acoustical energy content of the noise, as well as the time of day when the noise occurs.

Equivalent Energy Level (L_{eq})

L_{eq} is also referred to as the time-average sound level. It is the equivalent steady-state sound level that in a stated period of time would contain the same acoustical energy as the time-varying sound level during the same time period.

Community Noise Equivalent Level (CNEL)

The CNEL scale represents a time-weighted, 24-hour average noise level based on the A-weighted sound level. The CNEL scale divides the day into three weighted time periods (Day – 7 a.m. to 7 p.m., Evening – 7 p.m. to 10 p.m., and Night – 10 p.m. to 7 a.m.). The CNEL scale accounts for the

increased noise sensitivity during the evening hours (7 p.m. to 10 p.m.) and nighttime hours (10 p.m. to 7 a.m.) by adding 5 dBA and 10 dBA, respectively, to the average sound levels occurring during the evening and nighttime hours.

Day-Night Average (L_{dn})

The L_{dn} scale represents a logical simplification of CNEL. It divides the day into two weighted time periods (Day – 7 a.m. to 7 p.m., and Night – 10 p.m. to 7 a.m.) rather than the three used in the CNEL measurement, with no significant loss in accuracy.

Human Response to Noise

Noise environments and consequences of human activities are usually well represented by median noise levels during the day or night or over a 24-hour period. Environmental noise levels are generally considered low when the CNEL is below 60 dBA, moderate in the 60 to 70 dBA range, and high above 70 dBA. The human response to environmental noise is subjective and varies considerably from individual to individual. Noise in the community has often been cited as a health problem, not in terms of actual physiological damage, such as hearing impairment, but in terms of inhibiting general well-being and contributing to undue stress and annoyance.

The health effects of noise in the community arise from interference with human activities, including sleep, speech, recreation, and tasks that demand concentration or coordination.

Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The L_{dn} as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. For ground vehicles, a noise level of about 55 dBA L_{dn} is the threshold at which a substantial percentage of people begin to report annoyance.

Hearing Loss

While physical damage to the ear from an intense noise impulse is rare, a degradation of auditory acuity can occur even within a community noise environment. Hearing loss occurs mainly due to chronic exposure to excessive noise but may be due to a single event such as an explosion.

Natural hearing loss associated with aging may also be accelerated from chronic exposure to loud noise.

The Occupational Safety and Health Administration (OSHA) has a noise exposure standard that is set at the noise threshold where hearing loss may occur from long-term exposures. The maximum allowable level is 90 dBA averaged over 8 hours. If the noise is above 90 dBA, the allowable exposure time is correspondingly shorter.

FUNDAMENTALS OF ENVIRONMENTAL GROUNDBORNE VIBRATION

Sources of groundborne vibrations include natural phenomena (earthquakes, volcanic eruptions, sea waves, landslides, etc.) or man-made causes (explosions, machinery, traffic, trains, construction equipment, etc.). Vibration sources may be continuous (e.g., factory machinery) or transient (e.g., explosions).

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One is the peak particle velocity (PPV); another is the root mean square (RMS) velocity. The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. The RMS velocity is defined as the average of the squared amplitude of the signal. The PPV is generally used to characterize potential for building damage, while RMS is best for characterizing human response to ground vibration. However, to evaluate annoyance to humans, the vibration dB (VdB) notation is commonly used. The decibel notation acts to compress the range of numbers required to describe vibration. The abbreviation VdB is used for vibration decibels to reduce the potential for confusion with sound decibels.

Table 3.11-2, Typical Levels of Groundborne Vibration, displays common vibration sources and the effects on people and buildings. The annoyance levels shown in the table should be interpreted with care since vibration may be found to be annoying at much lower levels than those listed, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying.

Table 3.11-2:
Typical Levels of Groundborne Vibration

Human/Structural Response	PPV (in/sec)	Velocity Level (VdB)	Typical Sources (50 feet from source)
Threshold, minor cosmetic damage, fragile buildings	0.4	100	Blasting from construction projects
	0.17–0.2	92–94	Heavy tracked construction equipment
Difficulty with tasks, such as reading a computer screen	0.125	90	
	0.074	85	Commuter rail, upper range
Residential annoyance, infrequent events	0.04	80	Rapid transit, upper range
	0.013	75	Commuter rail, typical
	0.023	72	Bus or truck bump over
Residential annoyance, frequent events	0.013	70	Rapid transit, typical
Approximate threshold of human perception	0.007	65	
	0.005	62	Bus or truck, typical
	0.0013	50	Typical background vibration levels

Source: Tetra Tech 2018

EXISTING CONDITIONS

NOISE-SENSITIVE RECEPTORS

Noise-sensitive land uses are those that may be subject to stress and/or interference from excessive noise. Typically, residential uses are considered noise-sensitive receptors. Other noise-sensitive land uses include schools, hospitals, and institutional uses such as churches and museums. Industrial and commercial land uses are generally not considered sensitive to noise.

There are residences located adjacent to the project to the north and south, as well as residences scattered to north and east of the project site. The town of Daggett is approximately 0.5 miles to the west, and the town of Newberry Springs is approximately 1 mile southeast of the project boundary. Short-term noise measurements were conducted at eight residential locations in the project vicinity, as shown in **Exhibit 3.11-1, Noise Measurement Locations**. The noise measurement locations (MLs) were selected to be representative of the potential receptors nearest the project.

EXISTING AMBIENT NOISE LEVELS

Table 3.11-3, Measured Noise Levels, summarizes the measured ambient sound levels observed at each of the monitoring locations for both the daytime and nighttime L_{eq}.

Table 3.11-3:
Measured Noise Levels

Monitoring Location	Time Period	Leq (dBA)
ML-1 (1.1 mile north)	Day	50
	Night	46
ML-2 (190 feet north)	Day	43
	Night	40
ML-3 (0.75 mile east)	Day	39
	Night	38
ML-4 (adjacent)	Day	37
	Night	39
ML-5 (adjacent)	Day	46
	Night	41
ML-6 (adjacent)	Day	56
	Night	48
ML-7 (0.25 mile south)	Day	49
	Night	47
ML-8 (adjacent)	Day	46
	Night	45

Source: Tetra Tech 2018

Ambient sound levels exhibited typical day/night patterns. Daytime L_{eq} sound levels at the measurement locations ranged from a low of 37 dBA at ML-4 to a high of 56 dBA at ML-6. Nighttime sound levels ranged from a low of 38 dBA at ML-3 to 48 dBA at ML-6. The daytime and nighttime measurements at ML-1 were heavily influenced by rustling trees due to moderate wind. The noise levels at ML-2, ML-3, and ML-8 were heavily influenced by vehicle traffic along adjacent roads. The noise levels at ML-4, ML-5, ML-6, and ML-7 were influenced by vehicle traffic as well as train traffic associated with the nearby railway.

REGULATORY FRAMEWORK

FEDERAL

Occupational Safety and Health Administration

With the Occupational Safety and Health Act of 1970, Congress created OSHA to ensure safe and healthful working conditions for working men and women by setting and enforcing standards

and by providing training, outreach, education, and assistance. The Act requires protection against the effects of noise exposure for employees when sound levels exceed 90 dBA over an eight-hour period. If such controls fail to reduce sound levels to within acceptable levels, personal protective equipment is required. Additionally, a Hearing Conservation Program must be instituted by the employers whenever employee noise exposure equals or exceeds an eight-hour time-weighted average sound level of 85 dBA. The Hearing Conservation Program requirements consist of periodic area and personal noise monitoring, performance and evaluation of audiograms, provision of hearing protection, annual employee training, and record keeping.

Federal Transit Administration Construction Noise Guidelines

There are no standardized state or federal regulatory standards developed for assessing construction noise impacts. However, the Federal Transit Administration (FTA) has developed and published a guideline criterion that is considered to be reasonable to assess noise impacts from construction operations. The FTA noise criteria are summarized in **Table 3.11-4** below.

Table 3.11-4:
FTA Construction Noise Criteria

Land Use	8-hour (dBA Leq)		30- Day Average Ldn (dB) or Leq (dBA)
	Day	Night	
Residential	80	70	75a
Commercial	85	85	80b
Industrial	90	90	85b

[a] In urban areas with very high ambient noise (L_{dn}>65 dB), L_{dn} from construction operations should not exceed existing ambient + 10 dB.
[b] Twenty-four hour L_{eq}, not L_{dn}.

STATE

California Environmental Quality Act

Primary environmental legislation in California is found in the California Environmental Quality Act (CEQA) and its implementing guidelines (CEQA Guidelines), which require that projects with potential adverse effects (or impacts) on the environment undergo environmental review, including noise analysis.

California Noise Control Act of 1973

California Health and Safety Code Sections 46000 through 46080, known as the California Noise Control Act, find that excessive noise is a serious hazard to public health and welfare and that exposure to certain levels of noise can result in physiological, psychological, and economic

damage. The act also finds that there is a continuous and increasing bombardment of noise in urban, suburban, and rural areas. The act declares that the State of California has a responsibility to protect the health and welfare of its citizens through the control, prevention, and abatement of noise. It is the policy of the state to provide an environment for all Californians that is free from noise that jeopardizes their health or welfare.

State of California 2017 General Plan Guidelines

The California Governor's Office of Planning and Research's noise element guidelines include recommended exterior and interior noise level standards for local jurisdictions to identify and prevent the creation of incompatible land uses due to noise. The guidelines contain a table that describes the compatibility of various land uses with a range of environmental noise levels in terms of CNEL. **Table 3.11-5, Land Use Compatibility for Community Noise Environments**, presents guidelines for determining acceptable and unacceptable community noise exposure limits for various land use categories. The guidelines also present adjustment factors that may be used to arrive at noise acceptability standards that reflect the noise control goals of the community, the particular community's sensitivity to noise, and the community's assessment of the relative importance of noise pollution.

Table 3.11-5:
Land Use Compatibility for Community Noise Environments

Land Use Category	Community Noise Exposure (L_{dn} or CNEL, dBA)			
	Normally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Residential – Low Density, Single-Family, Duplex, Mobile Homes	50–60	55–70	70–75	75–85
Residential – Multiple Family	50–65	60–70	70–75	70–85
Transient Lodging – Motel, Hotels	50–65	60–70	70–80	80–85
Schools, Libraries, Churches, Hospitals, Nursing Homes	50–70	60–70	70–80	80–85
Auditoriums, Concert Halls, Amphitheaters	NA	50–70	NA	65–85
Sports Arenas, Outdoor Spectator Sports	NA	50–75	NA	70–85
Playgrounds, Neighborhood Parks	50–70	NA	65–75	75–85
Golf Courses, Riding Stables, Water Recreation, Cemeteries	50–70	NA	70–80	80–85
Office Buildings, Business Commercial and Professional	50–70	65–75	75–85	NA
Industrial, Manufacturing, Utilities, Agriculture	50–75	70–80	75–85	NA

Source: California Governor's Office of Planning and Research (OPR) 2017

Table 3.11-5, continued

Notes: NA: not applicable; L_{dn}: average day/night sound level; CNEL: community noise equivalent level
Normally Acceptable – Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
Conditionally Acceptable – New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.
Normally Unacceptable – New construction or development should be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.
Clearly Unacceptable – New construction or development should generally not be undertaken.

LOCAL

County of San Bernardino 2007 General Plan

The purpose of the County's General Plan Noise Element is to limit the community's exposure to excessive noise levels. The element contains goals, policies, and programs that must be used to guide decisions concerning land uses that are common sources of excessive noise levels. The General Plan noise policies most applicable to the proposed project are included below.

GOAL N 1 The County will abate and avoid excessive noise exposures through noise mitigation measures incorporated into the design of new noise-generating and new noise-sensitive land uses, while protecting areas within the County where the present noise environment is within acceptable limits.

Policy N 1.1 Designate areas within San Bernardino County as "noise impacted" if exposed to existing or projected future exterior noise levels from mobile or stationary sources exceeding the standards listed in Chapter 83.01 of the Development Code [**Table 3.11-5** in this EIR].

Policy N 1.3 When industrial, commercial, or other land uses, including locally regulated noise sources, are proposed for areas containing noise sensitive land uses, noise levels generated by the proposed use will not exceed the performance standards of Table N-2 [**Table 3.11-4** in this EIR] within outdoor activity areas. If outdoor activity areas have not yet been determined, noise levels shall not exceed the performance standards listed in Chapter 83.01 of the Development Code at the boundary of areas planned or zoned for residential or other noise-sensitive land uses.

Policy N 1.5 Limit truck traffic in residential and commercial areas to designated truck routes; limit construction, delivery, and through-truck traffic to designated routes; and distribute maps of approved truck routes to County traffic officers.

Policy N 1.6 Enforce the hourly noise-level performance standards for stationary and other locally regulated sources, such as industrial, recreational, and construction activities as well as mechanical and electrical equipment.

GOAL N 2 The County will strive to preserve and maintain the quiet environment of mountain, desert and other rural areas.

Policy N 2.1 The County will require appropriate and feasible on-site noise attenuating measures that may include noise walls, enclosure of noise-generating equipment, site planning to locate noise sources away from sensitive receptors, and other comparable features.

County of San Bernardino Development Code

Noise Standard

The County's Development Code (Division 3, Countywide Development Standards; Chapter 83.01, General Performance Standards, Section 83.01.080, Noise) sets interior and exterior noise standards for specific land uses by type of noise source. Noise standards for stationary noise sources are summarized in **Table 3.11-6, Noise Standards for Stationary Noise Sources**. As shown, the noise standard for residential properties is 55 dBA L_{eq} from 7 a.m. to 10 p.m. and 45 dBA L_{eq} from 10 p.m. to 7 a.m. For industrial properties, the noise standard from stationary noise sources is 70 dBA at any time of the day or night. Areas exposed to noise levels exceeding these standards are considered noise-impacted areas. The County's Development Code exempts noise from construction noise, provided that construction is limited to the hours between 7 a.m. and 7 p.m., except on Sundays or federal holidays, when construction is not allowed.

Table 3.11-6:
Noise Standards for Stationary Noise Sources

Affected Land Uses (Receiving Noise)	7 a.m. – 10 p.m. L_{eq}	10 p.m. – 7 a.m. L_{eq}
Residential	55 dBA	45 dBA
Professional Services	55 dBA	55 dBA
Other Commercial	60 dBA	60 dBA
Industrial	70 dBA	70 dBA

Source: San Bernardino County 2014, Development Code, Section 83.01.080, Table 83-2
Notes:
L_{eq} = (Equivalent Energy Level). The sound level corresponding to a steady-state sound level containing the same total energy as a time-varying signal over a given sample period, typically 1, 8, or 24 hours.
dBA = (A-weighted Sound Pressure Level). The sound pressure level, in decibels, as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound, placing greater emphasis on those frequencies within the sensitivity range of the human ear.

Vibration Standard

Development Code Section 83.01.090, Vibration, establishes standards for acceptable vibration levels. The section states that no ground vibration shall be allowed that can be felt without the aid of instruments at or beyond the lot line, nor shall any vibration be allowed which produces a particle velocity greater than or equal to two-tenths (0.20) inches per second measured at or beyond the lot line. Temporary construction, maintenance, repair, or demolition activities between 7 a.m. and 7 p.m. are exempt from this vibration limit, except on Sundays and federal holidays, when construction is prohibited.

IMPACT ANALYSIS AND MITIGATION MEASURES

THRESHOLDS FOR DETERMINATION OF SIGNIFICANCE

A project would result in a significant impact if it would:

- Expose persons to, or generate, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
- Expose persons to, or generate, excessive groundborne vibration or groundborne noise levels.
- Cause a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.
- Cause a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.
- For a project located within an airport land-use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, expose people residing or working in the project area to excessive noise levels.
- For a project within the vicinity of a private airstrip, expose people residing or working in the project area to excessive noise levels.

PROJECT IMPACTS AND MITIGATION

ANALYSIS OF PROJECT EFFECTS AND DETERMINATION OF SIGNIFICANCE

EXCEED NOISE STANDARDS

Impact 3.11-1 **The project could cause exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies. Impacts would be less than significant with mitigation.**

SHORT-TERM CONSTRUCTION

The proposed project is expected to be constructed in three phases. Within each development phase (Phases 1-3), the construction activities are separated into five different stages: (1) site preparation and grading; (2) solar array foundation installation, conductor installation, and construction of control building; (3) solar panel assembly and constructing electrical components; (4) inverter pad construction, substation installation, cabling and gen-tie construction; and (5) array and interconnection commissioning.

Based on sound model calculations, construction sound levels are predicted to range from 40 to 85 dBA at residential properties located at ML-1 through ML-8. **Table 3.11-7, Projected Construction Noise Levels by Stage (dBA)**, summarizes the projected construction noise resulting from project construction. As shown in the table, the highest projected sound levels from construction-related activity are expected to occur at ML-2, ML-5, and ML-8 during activities associated with Stage 3 and Stage 4; refer to **Exhibit 3.11-1, Noise Measurement Locations**.

Table 3.11-7:
Projected Construction Noise Levels by Stage (dBA)

Construction Stage	USEPA Construction Noise Level at 50 Feet	ML-1	ML-2	ML-3	ML-4	ML-5	ML-6	ML-7	ML-8
Stage 1	87	46	76	50	74	81	74	59	76
Stage 2	86	44	74	48	73	80	73	58	75
Stage 3	91	49	79	53	78	85	78	63	80
Stage 4	89	48	78	52	76	83	76	61	78
Stage 5	82	40	70	44	69	76	69	54	71

Source: Tetra Tech 2018

The construction of the project may cause short-term, but unavoidable noise impacts that could be loud enough at times to temporarily interfere with speech communication outdoors and indoors with windows open for the limited number of nearby receptors. The noise levels resulting from the construction activities will vary significantly depending on several factors such as the type and age of equipment, specific equipment manufacture and model, the operations being performed, and the overall condition of the equipment and exhaust system mufflers.

Project construction would occur between 7 a.m. and 7 p.m., Monday through Friday in compliance with the County Code. However, at receptors located adjacent to the project property line there is a potential that the construction noise levels will exceed the FTA threshold of 80 dBA. Therefore, to reduce construction noise levels to below the FTA threshold noise modeling calculations show that temporary sound barriers, or other engineering solution, should be utilized when construction activities are located within 200 feet of a residence so that the noise level at the residents' property line is less than the FTA threshold of 80 dBA.

Implementation of mitigation measure **NOI-1** would reduce short-term related noise level impacts because it identifies specific noise reduction and abatement construction procedures to be implemented during construction (i.e., limiting construction noise to daytime hours and deploying a sound barrier when construction activities are located within 200 feet of a residence to ensure that noise levels at a resident's property line remain below the FTA threshold of 80 dBA). Due to the anticipated infrequent nature of loud construction activities at the site, the limited hours of construction, and the implementation of mitigation measure **NOI-1**, temporary noise impacts due to project construction would be less than significant.

In addition, the County's Development Code expressly exempts construction noise. Nonetheless, mitigation measure **NOI-1** would be implemented to reduce short-term construction noise to less than significant levels.

LONG-TERM OPERATION

The primary noise sources during operation will be the inverters, transformers, and battery storage heating, ventilation and air conditioning units (HVAC) units. **Table 3.11-8, Projected Operational Noise**, shows the projected exterior noise levels resulting from full, normal operation of the project at the noise measurement locations. The table also includes the predicted net increase in sound energy at each of the eight MLs.

Table 3.11-8:
Projected Operational Noise

Monitoring Location	Daytime Ambient L_{eq}, dBA	Operational Sound Level, dBA	Total Sound Level (Ambient + Project), dBA	Net Increase in Sound Level, dBA
ML-1 (1.1 mile north)	50	28	50	0
ML-2 (190 feet north)	43	46	48	5
ML-3 (0.75 mile east)	39	33	40	1
ML-4 (adjacent)	37	55	55	18
ML-5 (adjacent)	46	41	47	1
ML-6 (adjacent)	56	46	56	0
ML-7 (0.25 mile south)	49	40	50	1
ML-8 (adjacent)	46	44	48	2

Source: Tetra Tech 2018

Noise contours displaying sound levels are shown in **Exhibit 3.11-2, Operational Noise Contour**. The noise contours are graphical representations of the cumulative noise associated with full operation of the equipment and show how operational noise would be distributed over the surrounding area within a 1-mile radius of the project. **Exhibit 3.11-2** also shows the sound levels at the noise measurement locations.

Typically, the noise-producing equipment would not operate during the nighttime (10 p.m. to 7 a.m.) The calculated noise level at ML-4 is shown to be at the County's daytime noise threshold of 55 dBA for stationary noise sources. To reduce noise levels at the sensitive receptors near ML-4, mitigation measure **NOI-2** would be required. Implementation of mitigation measure **NOI-2** would reduce operational noise to less than significant levels because it would require that battery storage containers located in the eastern portion of the project be rotated so that HVAC units are pointed away from sensitive receptors (or a comparable engineering solution to minimize noise from such equipment) to ensure compliance with noise level thresholds. With implementation of mitigation measure **NOI-2**, operational noise impacts to sensitive receptors would be less than significant.

Ambient noise at ML-6 was measured at 56 dBA, which exceeds the County's daytime threshold of 55 dBA, but the additional noise from project operations would not be enough to increase noise levels at ML-6. Therefore, no mitigation is required to reduce noise impacts at ML-6.

DECOMMISSIONING NOISE

Decommissioning would first involve removing the solar photovoltaic (PV) panels for sale into a secondary solar PV panel market or for recycling. Most of the components of the solar installation are composed of materials that can be easily recycled. If the panels can no longer be used in a solar array, the aluminum can be resold and the glass can be recycled. Other components of the solar installation, such as the solar array structure and mechanical assemblies, can be recycled since they are made from galvanized steel. Equipment such as inverters and switchgears can be reused, or their components recycled. The equipment pads are made from concrete that can be crushed and recycled. Conduit and wire would be removed by uncovering trenches and backfilling when done. The electrical wiring is made from copper and/or aluminum and could also be reused or recycled.

Noise levels from decommissioning would be similar to the construction process. The same types of heavy equipment and vehicles would be used to decommission the site as were used to construct it. Decommissioning activities would comply with County construction noise ordinance standards as detailed previously. Implementation of mitigation measure **NOI-1** would reduce decommissioning-related noise level impacts by outlining noise reduction and abatement construction procedures, such as limiting construction noise to daytime hours and deploying a sound barrier when construction activities are located within 200 feet of a residence to ensure that noise level at the residents' property lines remains below the FTA threshold of 80 dBA. Therefore, noise impacts from project decommissioning would be less than significant with mitigation.

Mitigation Measures:

NOI-1 The following noise mitigation measures are required to minimize noise impacts:

- Maintain all construction tools and equipment in good operating order according to manufacturers' specifications.
- Limit use of major excavating and earthmoving machinery to daytime hours.
- To the extent feasible, schedule construction activity during normal working hours on weekdays when higher sound levels are typically present and are found acceptable. Some limited activities, such as concrete pours, may occur continuously until completion.
- Equip any internal combustion engine related to the job with a properly operating muffler that is free from rust, holes, and leaks.

- For construction devices that utilize internal combustion engines, ensure the engine's housing doors are kept closed, and install noise-insulating material mounted on the engine housing consistent with manufacturers' guidelines, if possible.
- Limit possible evening shift work to low noise activities such as welding, wire pulling, and other similar activities, together with appropriate material handling equipment.
- Utilize a complaint resolution procedure to address any noise complaints received from residents.
- Post signage showing the overall construction schedule.
- Deploy temporary sound barrier or other engineering solution when construction activities are located within 200 feet of a residence so that the noise level at the residents' property line is less than the federal transit administration threshold of 80 dBA. The sound barriers should be placed so that the construction equipment is blocked with a buffer of approximately 20 feet from the equipment to edges of the barrier. This reduction in noise can also be accomplished using a comparable engineering solution to minimize noise.

NOI-2 Battery storage containers located in the eastern portion of the project shall be rotated so that the heating, ventilation and air conditioning units are pointed away from receptors; or a comparable engineering solution to minimize noise from this equipment shall be implemented, such that noise levels do not exceed the County daytime threshold of 55 dBA.

Level of Significance After Mitigation: Less than significant with mitigation.

PERMANENT NOISE INCREASE

Impact 3.11-2 **The project could result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project. Impacts would be less than significant with mitigation.**

As discussed in Impact 3.11-1 above, on-site noise sources associated with operation of the proposed project would include trackers, inverters, transformers, and battery storage HVAC units. The nearest noise-sensitive land uses are the residential properties adjacent to the project (ML-4, ML-5, ML-6, and ML-8). As shown in **Table 3.11-8** and **Exhibit 3.11-2**, during full, normal operation, noise levels at these locations would range from 47 to 56 dBA L_{eq}.

Typically, the noise-producing equipment will not operate during the nighttime (10 p.m. to 7 a.m.) Existing ambient noise at ML-6 was measured at 56 dBA, which exceeds the County's daytime threshold of 55 dBA. However, the additional noise from project operations would not increase the operational noise at ML-6, as shown in **Table 3.11-8**. In addition, operational noise levels at ML-6 were calculated to be in the 40-45 dBA range as shown in **Exhibit 3.11-2**. Therefore, no mitigation is required to reduce noise levels at ML-6.

Ambient noise levels at ML-4 were measured at 37 dBA with the dominant noise source coming from vehicle traffic along Silver Valley Road and Wildhorse Road. With the addition of the project, noise levels at ML-4 are expected to increase by 18 dBA to a total of 55 dBA, which would be at the County's daytime threshold for stationary sources. However, with implementation of mitigation measure **NOI-2**, noise levels at ML-4 with the addition of the project are expected to only increase by 11 dBA to a total of 48 dBA which would be less than the County's daytime threshold for stationary sources. Mitigation measure **NOI-2** would require that the battery storage containers located in the eastern portion of the property be sited so that the HVAC units are pointed away from sensitive receptors (or a comparable engineering solution) to reduce potential noise effects. With implementation of mitigation measure **NOI-2**, permanent noise impacts would be less than significant.

Mitigation Measures: Implement mitigation measure **NOI-2**.

Level of Significance After Mitigation: Less than significant with mitigation.

TEMPORARY NOISE INCREASE

Impact 3.11-3	**The project could cause a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project. Impacts would be less than significant with mitigation.**

As discussed in Impact 3.11-1 above, proposed project construction would consist of several phases and would include standard equipment such as graders, scrapers, backhoes, loaders, cranes, dozers, water trucks, portable generators and air compressors, and miscellaneous trucks. Noise levels generated by construction equipment would vary greatly, depending on factors such as the type and specific model of the equipment, the operation being performed, and the condition of the equipment.

The maximum noise level ranges for various pieces of construction equipment at a distance of 50 feet are listed in **Table 3.11-9, Construction Equipment Noise Emission Levels**. The maximum noise levels at 50 feet for typical equipment would be up to 90 dBA for the type of equipment normally used for this type of project. However, because equipment will be used throughout the site and at different intervals during the construction workday, and due to the typical operating

cycles for construction equipment involving 1 or 2 minutes of full power operation followed by 3 to 4 minutes at lower power settings, the hourly average noise levels would vary. Construction noise in a well-defined area typically attenuates at approximately 6 dB per doubling of distance.

Based on sound model calculations, construction sound levels are predicted to range from 40 to 85 dBA at residential properties at ML-1 through ML-8. **Table 3.11-7** summarizes the projected construction noise resulting from project construction. As shown in **Table 3.11-7**, the highest projected sound levels from construction-related activity are expected to occur at ML-2, ML-5, and ML-8 during activities associated with Stage 3 and Stage 4.

Table 3.11-9:
Construction Equipment Noise Emission Levels

Equipment Type	Typical Equipment dBA at 50 Feet
Generator	78
Loader	84
Paver	88
Pneumatic tools	85
Water pump	76
Vibratory pile driver (RTG Model RG21T)	85-90
Power hand saw	78
Shovel	82
Truck	88

Source: FHWA 2006

Noise from construction could result in annoyance at times to nearby noise-sensitive residences. However, the duration at any one location would be relatively brief, and project construction would comply with County construction noise ordinance standards (i.e., construction activities would take place only between the hours of 7 a.m. and 7 p.m. on weekdays, and not on Sundays or federal holidays). Although the County's Development Code exempts noise from construction, mitigation measure **NOI-1** would be implemented to reduce noise to less-than-significant levels. Mitigation measure **NOI-1** would reduce noise impacts because it would require noise reduction and abatement construction procedures (i.e., limiting construction activities to daytime hours and deploying a sound barrier when construction activities are located within 200 feet of a residence to ensure that noise levels at the residents' property line remains below the FTA threshold of 80 dBA). Due to the infrequent nature of loud construction activities at the site, the limited hours of construction and the implementation of mitigation measure **NOI-1**, the temporary increase in noise due to construction is considered to be a less than significant impact.

Mitigation Measures: Implement mitigation measure **NOI-1**.

Level of Significance After Mitigation: Less than significant with mitigation.

EXCESSIVE VIBRATIONS

Impact 3.11-4 **The project would not cause exposure of persons to, or generation of, excessive groundborne vibration or groundborne noise levels. Impacts would be less than significant.**

Groundborne vibration is a small, rapidly fluctuating motion transmitted through the ground that diminishes rapidly over distance. Anticipated groundborne vibration from heavy equipment operations during project construction was evaluated and compared to relevant vibration impact criteria using the Federal Transit Administration's Transit Noise and Vibration Impact Assessment (FTA 2006), which provides vibration impact criteria and recommended methodologies and guidance for the assessment of vibration effects.

Vibration levels were evaluated for the worst-case vibration source, which would be pile driving. Based on vibration propagation calculations, construction vibration levels are predicted to range from 0.0002 peak particle velocity (PPV) inches per second (33 VdB) to 0.0805 PPV inches per second (86 VdB) at the nearest sensitive receptors. **Table 3.11-10, Projected Construction Vibration Levels**, summarizes the predicted vibration levels at each of the noise measurement locations using the highest vibration generating equipment, a vibratory pile driver.

Table 3.11-10:
Projected Construction Vibration Levels

Construction Operation	Vibration Level Metric	FTA Construction Vibration Level at 25 feet	ML-1	ML-2	ML-3	ML-4	ML-5	ML-6	ML-7	ML-8
Pile Driving	PPV in/sec	0.644	0.0002	0.0307	0.0003	0.0247	0.0805	0.0239	0.0017	0.0325
	VdB	104	33	78	39	76	86	75	53	78

Source: Tetra Tech 2018

As shown in **Table 3.11-10**, project construction would not exceed the County Development Code vibration threshold limit of 0.20 PPV inches per second. Therefore, project construction would not create substantial levels of groundborne vibration during operation.

Mitigation Measures: None required.

Level of Significance: Less than significant.

PUBLIC AIRPORT

Impact 3.11-5 **The project would not expose people residing or working in the project area to excessive noise levels within 2 miles of a public airport. Impacts would be less than significant.**

The project site is located directly north of the Barstow-Daggett Airport as shown on **Exhibit 3.11-3, Barstow-Daggett Airport Noise Contour**. According to the Barstow-Daggett Airport Comprehensive Land Use Plan (ACLUP), 65 CNEL is the acceptable level of aircraft noise for persons living in the vicinity of airports (County of San Bernardino 1992). This noise exposure level has been determined to be reasonable for persons residing in residential areas where homes are of typical California construction and may have windows partially open. **Exhibit 3.11-3** shows the estimated 65 CNEL noise contour identified in the ACLUP, along with project boundary.

Table 3.11-11, Land Use Compatibility Noise Environments – Barstow-Daggett Airport, identifies land uses compatible with airport operations.

Table 3.11-11:
Land Use Compatibility Noise Environments – Barstow-Daggett Airport

Land Use Category	Community Noise Exposure (Ldn or CNEL, dBA)			
	Normally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Residential – Low Density, Single-Family, Duplex, Mobile Homes	50–60	60-65	65-75	75–85
Residential – Multiple Family	50–60	60-65	65-75	75–85
Transient Lodging – Motel, Hotels	50–60	60-65	65-75	75–85
Schools, Libraries, Churches, Hospitals, Nursing Homes	50-65	NA	65-75	75–85
Auditoriums, Concert Halls, Amphitheaters	NA	50–70	70-85	NA
Sports Arenas, Outdoor Spectator Sports	NA	50–75	75-85	NA
Playgrounds, Neighborhood Parks	50–65	NA	65–75	75–85
Golf Courses, Riding Stables, Water Recreation, Cemeteries	50–70	NA	70–80	80–85
Office Buildings, Business Commercial and Professional	50–65	65–75	75–85	NA
Industrial, Manufacturing, Utilities, Agriculture	50–75	70–80	75–85	NA

Source: County of San Bernardino 1992
Notes: NA: not applicable; L_{dn}: average day/night sound level; CNEL: community noise equivalent level

As seen in **Exhibit 3.11-3**, a portion of the project site is located within the 65 CNEL contour. Per **Table 3.11-11**, the ACLUP indicates that noise levels ranging from 50 to 75 dBA would be normally acceptable for industrial, manufacturing, utilities, and agriculture land uses. Therefore, the

project would not require any special noise insulation and would not expose employees to excessive noise levels. Impacts would be less than significant.

Mitigation Measures: None required.

Level of Significance: Less than significant.

PRIVATE AIRSTRIP

Impact 3.11-6	**The project would not expose people residing or working in the project area to excessive noise levels in the vicinity of a private airstrip. Impacts would be less than significant.**

The project site is not located in the vicinity of a private airstrip. The nearest private airport to the project site is the Depue Airport, approximately 20 miles to the west in Barstow. Therefore, the project would not expose people working in the project area to excessive noise levels associated with aircraft from a private airstrip. Project impacts would be less than significant.

Mitigation Measures: None required.

Level of Significance: Less than significant.

CUMULATIVE IMPACTS

Impact 3.11-7	**The project would not result in cumulative noise impacts. Impacts would be less than significant with mitigation.**

The geographic extent of the cumulative setting for noise consists of the project site and immediate vicinity. As stated previously, ambient noise levels in the project area are primarily affected by vehicle traffic on nearby and/or adjacent roadways. As a result, the primary factor for cumulative noise impact analysis is the consideration of future traffic noise levels along area roadways. However, ambient noise levels are also influenced by train traffic associated with the nearby railway and airplane and helicopter noise associated with the Barstow-Daggett Airport, as well as intermittent periods of moderate to strong winds.

When determining whether overall noise (and vibration) impacts from cumulative projects would be cumulatively significant and whether the project's incremental contribution to any significant cumulative impacts would be cumulatively considerable, it is important to note that noise and vibration are localized occurrences. As such, they decrease rapidly in magnitude as the distance from the source to the receptor increases. Therefore, only two projects identified in **Table 3.0-1** and shown on **Exhibit 3.0-1** in Section 3.0, Introduction to the Environmental Analysis, are in the direct vicinity of the project study area and are considered influential with regard to noise and

vibration. Only the Minneola Solar (project #4) located adjacent to the proposed project and Solar 33 (project #9) located approximately 3,200 feet to the southwest of the project site are physically close enough to have the potential to be considered in a cumulative context with the project's incremental contribution.

SHORT-TERM CONSTRUCTION

Construction equipment noise from the cumulative projects identified in **Table 3.0-1** and shown on **Exhibit 3.0-1** is anticipated to be similar in nature and magnitude to that identified for the proposed project. Specifically, noise levels from construction activities for all future development in the area would fluctuate depending on the particular type, number, and duration of usage for the varying equipment.

Although hourly average noise levels would vary, project construction noise levels would exceed applicable standards at nearby sensitive receptors and/or result in substantial increases in ambient noise levels, especially during the more noise-sensitive hours of the day. Implementation of mitigation measure **NOI-1** would reduce project construction noise impacts to a less than significant level.

Each cumulative project identified would require separate discretionary approval and CEQA assessment, which would address potential construction-related noise impacts and identify necessary mitigation measures, where appropriate. The existing noise environment is similar for the relevant cumulative projects and feasible mitigation for construction is available to reduce noise impacts from the relevant cumulative projects to less-than-significant levels. Therefore, it is anticipated that the individual cumulative projects would result in less than significant construction-related noise impacts (with implementation of mitigation such as **NOI-1**). Thus, when considered together with the proposed project, cumulative impacts would similarly be less than significant.

Vibration

Groundborne noise and vibration levels from construction of Minneola Solar (project #4) and Solar 33 (project #9) as shown on **Exhibit 3.0-1** would be similar in nature and magnitude to those identified for the proposed project. Specifically, construction activities would result in varying degrees of temporary groundborne noise and vibration, depending on the specific construction equipment used and activities involved. As discussed above, at a distance of approximately 50 feet, the vibration level from heavy construction machinery (such as a loaded truck or a drilling rig) would be between approximately 0.027 and 0.031 PPV inches per second. Vibration levels of this magnitude would be well below the County's and the FTA's threshold of 0.20 PPV inches per second.

Each of the cumulative projects would require separate CEQA analysis and approval relative to groundborne vibration. The existing vibration environment is similar for the relevant cumulative projects and feasible mitigation for construction is available to reduce vibration impacts from the relevant cumulative projects to less-than-significant levels. As such, it is anticipated that the cumulative projects would result in less than significant vibration impacts.

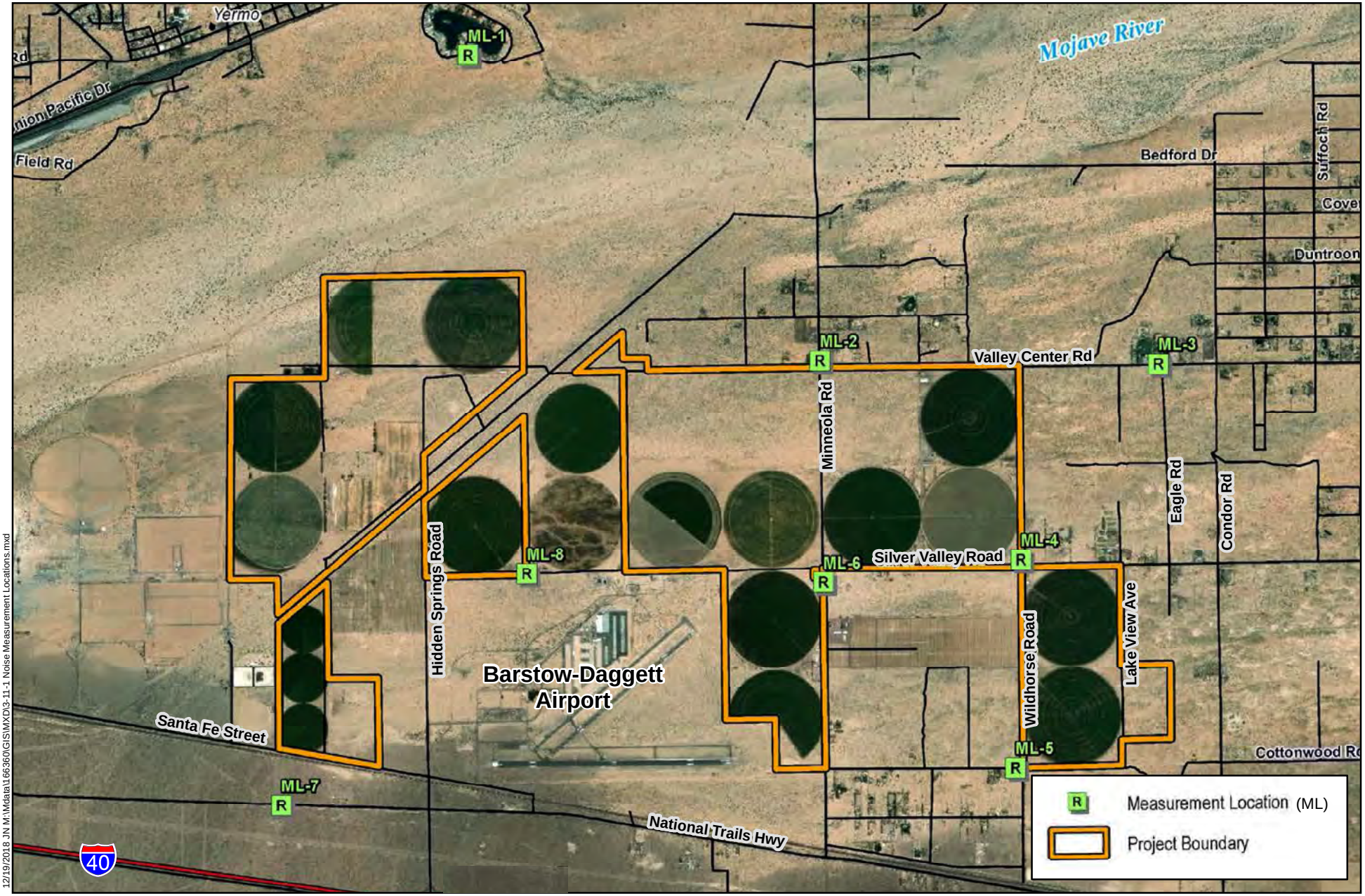
LONG-TERM OPERATION

Stationary-source and vehicular noise from the Minneola Solar (project #4) located adjacent to the proposed project and Solar 33 (project #9) located approximately 3,200 feet to the southwest of the proposed project would be similar in nature to those discussed for the proposed project. Operation of the cumulative projects could result in long-term stationary source noise levels that exceed applicable standards at nearby sensitive receptors and/or result in substantial increases in ambient noise levels. As discussed above, operation of the proposed project could result in a significant impact from long-term stationary source noise levels. However, implementation of mitigation measure **NOI-2** would reduce this impact to less than significant by requiring that battery storage containers located in the eastern portion of the project site be rotated so that the HVAC units are directed away from sensitive receptors (or a comparable engineering solution) to minimize noise from this equipment. None of the cumulative projects are located near enough to sensitive receptor ML-4 so as to result increase the noise levels at this location above the County's daytime noise threshold.

Each cumulative project would require separate discretionary approval and CEQA assessment, which would address potential operational noise impacts and identify necessary mitigation measures, where appropriate. All projects would be required to adhere to federal, state, and local requirements for noise impacts. Therefore, the cumulative projects are not anticipated to result in significant long-term cumulative noise impacts.

Mitigation Measure: Implement mitigation measures **NOI-1** and **NOI-2**.

Level of Significance: Less than significant with mitigation.



12/19/2018 JN M:\Mdata\16360\GIS\MXD\3-11-1 Noise Measurement Locations.mxd

Michael Baker INTERNATIONAL

0 1,500 3,000 6,000 Feet

Source: Tetra Tech 2018

DAGGETT SOLAR POWER FACILITY
ENVIRONMENTAL IMPACT REPORT

Noise Measurement Locations

Exhibit 3.11-1

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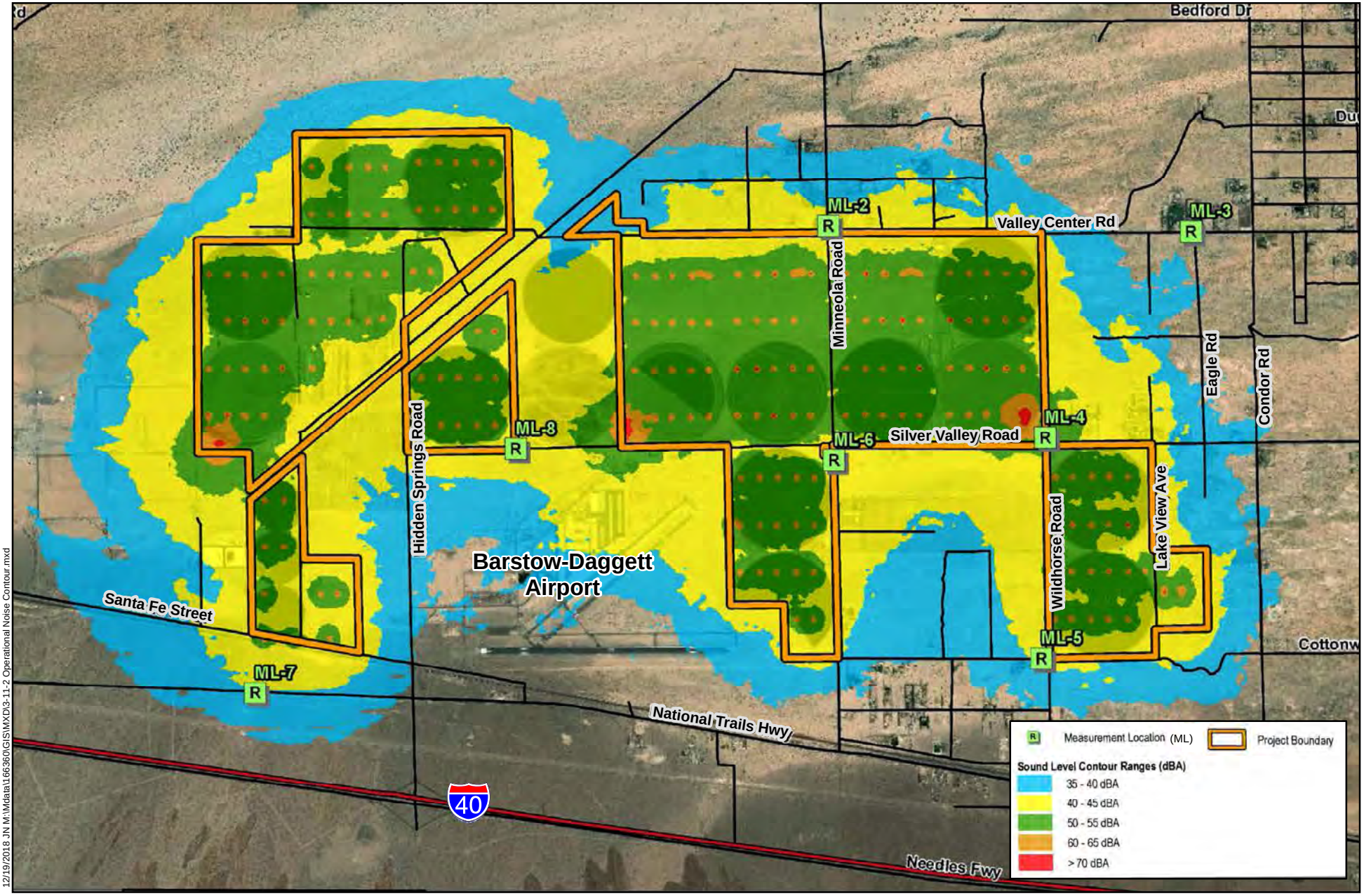

12/19/2018 JN M:\Mdata\16636\GIS\MXD\3-11-2 Operational Noise Contour.mxd

Michael Baker INTERNATIONAL

0 1,500 3,000 6,000 Feet

Source: Tetra Tech 2018

DAGGETT SOLAR POWER FACILITY
ENVIRONMENTAL IMPACT REPORT

Operational Noise Contour

Exhibit 3.11-2

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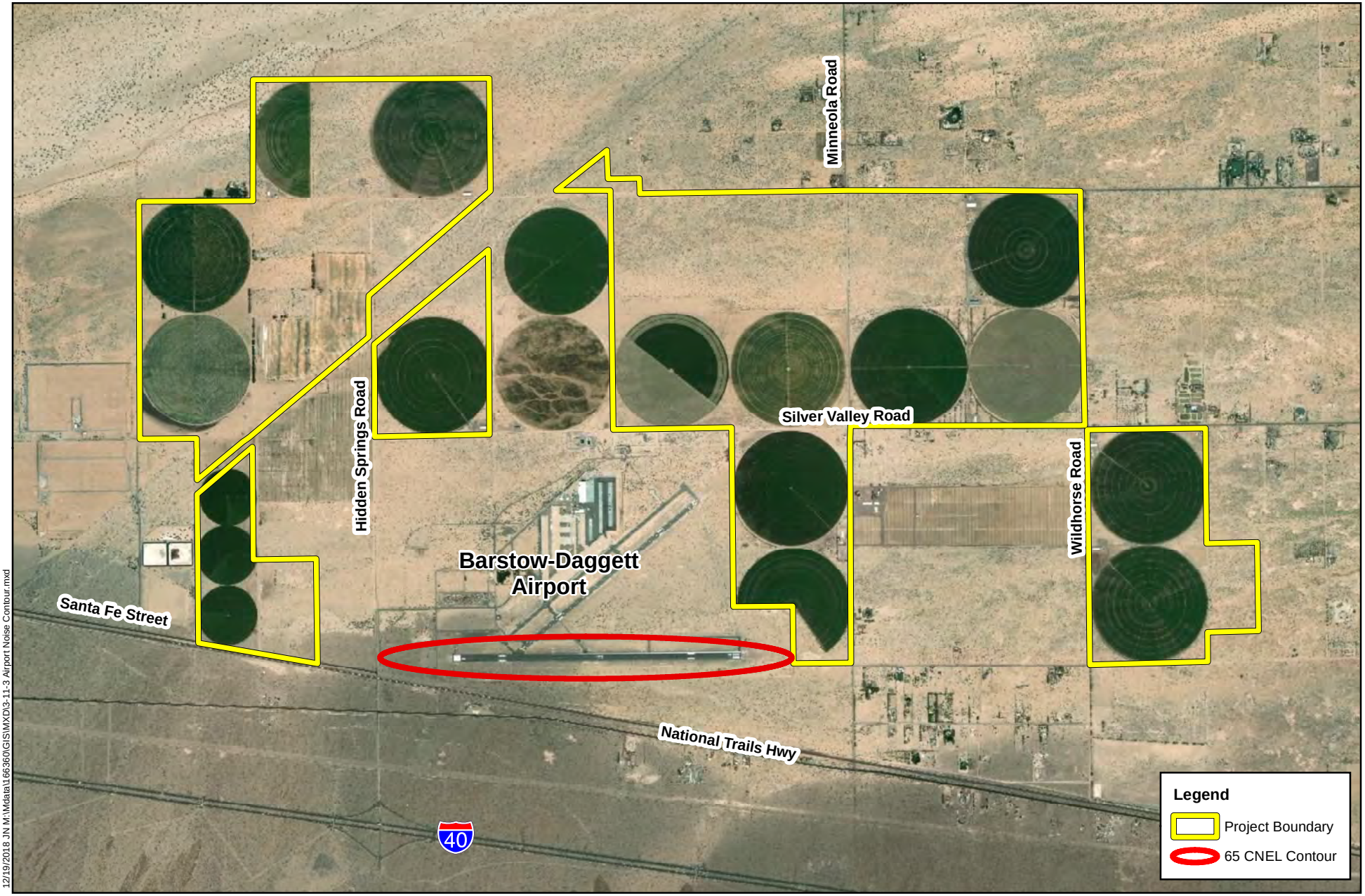

12/19/2018 JN M:\Mdata\166360\GIS\MXD\3-11-3 Airport Noise Contour.mxd

Michael Baker INTERNATIONAL

0 1,500 3,000 6,000 Feet

Source: Barstow-Daggett Airport Comprehensive Land Use Plan, ESRI World Imagery

DAGGETT SOLAR POWER FACILITY
ENVIRONMENTAL IMPACT REPORT

Barstow-Daggett Airport Noise Contour

Exhibit 3.11-3

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