Heber 1 Parasitic Solar Energy Project

Noise Technical Report

Imperial County, CA

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SECTION 1 Introduction

This report evaluates the potential for impacts related to noise resulting from the proposed Heber 1 Parasitic Solar Energy Project (Project) in Imperial County, California. This report includes an evaluation of potential impacts associated with temporary and permanent increases in noise in the vicinity of the Project site and whether Project-induced noise is in excess of standards established by the applicable local jurisdiction (i.e., Imperial County). Site-specific construction and operations activity information used for noise models is based on information provided by the Applicant (Heber Field Company LLC).

1.1 Project Overview

Heber Field Company, LLC is proposing to develop a new, approximately 20 megawatt (MW) solar energy facility and interconnecting cable line (gen-tie line) that will provide parasitic load to the existing Heber 1 Geothermal Complex in Imperial County, California. The Project site is located approximately 1.4 miles south of the town of Heber on privately-owned land inclusive of approximately 106 acres of Assessor's Parcel No. (APN) 059-020-001 (**Figure 1**). The site zone General Agricultural within the Heber geothermal unit and Imperial County renewable energy overlay zone (A-2-GU). Existing land-use includes a residence, geothermal pipeline corridor, storage/laydown area, and alfalfa cultivation. The solar photovoltaic field will provide behind-the-meter power used to offset the auxiliary load of the Heber 1 facility. The solar arrays will effectively allow for the more efficient generation of geothermal energy. The solar facility will not connect to or generate power that will enter the transmission grid; rather, the solar facility will be entirely behind-the-meter and would serve as an integrated part of the operation of the geothermal power plant. The total project area of disturbance from the proposed development is approximately 121.44 acres as summarized in **Table 1**.

Table 1. Heber 1 Parasitic Solar Energy Project Area of Disturbance Estimates

Facility	Disturbance (Acres)
Cable Route (Largest Area of Disturbance Associated with Cable Route 1, 2, or 3)	~15.25 acres
Solar Field	~106.19 acres
TOTAL	**121.44 acres**

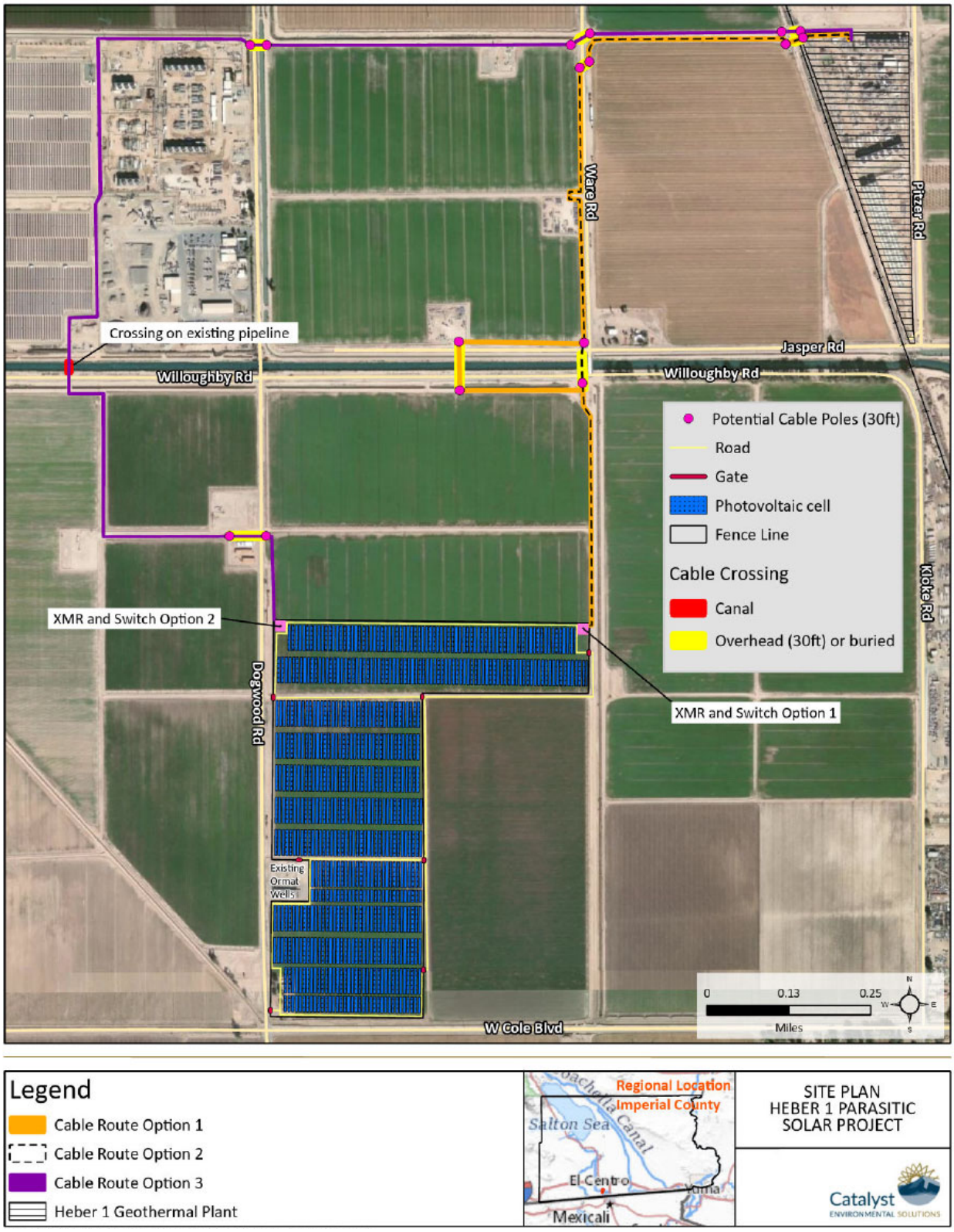

Figure 1. Project Site

1.2 Construction Activities

The Project is anticipated to take 16 to 19 months to install and become fully operational as summarized in **Table 2.**

Table 2. Project Construction Process/Phasing

Construction Phase	Tentative Schedule	Total Duration
Site Preparation (Plant and Solar Field)	2 Months	12 to 19 Months
Project Construction	11 Months	
Switch Development and Interconnection	6 Months	

The estimated construction equipment and vehicle and truck trip counts associated with construction activities are detailed **Table 3** and **Table 4**, respectively.

Table 3. Project Construction Equipment List by Project Activity

Construction Phase	Equipment	Quantity	Daytime Operating Hours	Nighttime Operating Hours	Typical L_{max} (dBA) at 50 feet from Source[1]
Site Preparation (Plant Site and Solar Fields) (2 Months)	Heavy Duty Trucks	3	5	0	76
	Excavator	1	8	0	81
	Roller	2	8	0	80
	Light-Duty Truck	8	4	0	75
Project Construction (11 Months)	Aerial Man Lifts	8	6	0	75
	Excavator	1	8	0	81
	Crane	2	6	0	81
	Forklift	1	8	0	75
	Forklift	6	8	0	75
	Generator Set	1	8	0	81
	Grader	1	8	0	85
	Heavy Duty Trucks	2	8	0	76
	Rubber Tired Loader	1	8	0	84
	Backhoe	1	8	0	78
	Welders	15	6	0	74
	Light Duty Truck	1	4	0	75
	Light Duty Truck	15	4	0	75
Switch Development and Interconnection (6 Months)	Crane	1	8	0	81
	Bore/Drill Rig	1	8	0	84
	Aerial Lift	2	8	0	81
	Heavy Duty Trucks (Delivery)	2	4	0	76
	Backhoe	1	8	0	78
	Forklift	1	8	0	75
	Ditch Digger	1	8	0	78
	Generator Set	2	8	0	73
	Light Duty Truck	5	4	0	75

Notes:
Adapted from FHWA Roadway Construction Noise Model User's Guide (FHWA 2006)

Table 4. Construction Vehicle Trips

Construction Phase	Trip Type	Number of One-Way Trips per Day	One-Way Trip Length (miles)[2]
Site Preparation	Workers[1]	46	10.2
	Vendor	10	11.9
	Haul	8	20
Project Construction	Workers[1]	46	10.2
	Vendor	40	225
	Haul	2	20
Switch Development and Interconnection	Workers[1]	46	10.2
	Vendor	10	11.9
	Haul[3]	0	20

Notes:

[1] Trip generation rate is calculated at roughly 3 trips/worker (assumed 50 percent of 15 workers leave/return once during the day) for a total of 46 trips, and 2 trips/vehicle (in/out) for vendor and haul trips.

[2] Trip lengths consist of default CalEEMod values with exception of vendors for delivery of Project equipment during construction, with deliveries of solar panels, etc. assumed to originate at Port of Long Beach, approximately 225 miles from Project site.

[3] All truck trips are assigned to vendor deliveries.

1.3 Operation Activities

Once the proposed Project is complete, the proposed Project would generally be unstaffed but would require routine maintenance and unscheduled maintenance as needed. The parasitic solar facilities will be monitored remotely with visitation on an as-needed basis, and security personnel will perform periodic site visits. Any required planned maintenance activities would generally consist of equipment inspection and replacement and would be scheduled to avoid peak load periods. Any unplanned maintenance would be responded to as needed, depending on the event.

SECTION 2 Fundamental of Noise and Vibration

2.1 Fundamentals of Sound and Environmental Noise

Sound is mechanical energy transmitted by pressure waves in a compressible medium such as air. When sound becomes excessive or unwanted, it is referred to as noise. Although exposure to high noise levels has been demonstrated to cause hearing loss, the principal human response to environmental noise is annoyance. The response of individuals to similar noise events is diverse and influenced by the type of noise, the perceived importance of the noise and its appropriateness in the setting, the time of day and the type of activity during which the noise occurs, and the sensitivity of the individual.

Sound (noise) levels are measured and quantified with several metrics. All of them use the logarithmic decibel (dB) scale with 0 dB roughly equal to the threshold of human hearing. A property of the decibel scale is that the sound pressure levels of two separate sounds are not directly additive. For example, if a 50 dB sound is added to another 50 dB sound, the total is only a 3 dB increase (to 53 dB). Thus, every 3 dB change in sound levels represents a doubling or halving of sound energy. Related to this is the fact that a less-than-3 dB change in sound levels is imperceptible to the human ear. Sound power level is the acoustic energy emitted by a source which produces a sound pressure level at some distance. While the sound power level of a source is fixed, the sound pressure level depends upon the distance from the source and the acoustic characteristics of the area in which it is located.

The frequency of sound is a measure of the pressure fluctuations per second, measured in hertz (Hz). Most sounds do not consist of a single frequency but consist of a broad band of frequencies differing in level. The characterization of sound level magnitude with respect to frequency is the sound spectrum. Many rating methods exist to analyze sound of different spectra. The method used for this analysis is A-weighting (there are also B- and C-weighting filters). The A-weighted scale (dBA) most closely approximates how the human ear responds to sound at various frequencies by progressively deemphasizing frequency components below 1,000 Hz and above 6,300 Hz and reflects the relative decreased sensitivity of humans to both low and extremely high frequencies (Federal Highway Administration [FHWA] 2018). **Table 5** lists typical sound levels from representative sources.

Table 5. Typical Noise Levels (Measured at a Distance a Person Would Typically be From the Source)

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	— 110 —	Rock band
Jet fly-over at 1,000 feet	— 100 —	
Gas lawn mower at 3 feet	— 90 —	
Diesel truck at 50 feet at 50 miles per hour	— 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, Normal speech at 3 feet
Commercial area, Heavy traffic at 300 feet	— 60 —	
Quiet urban daytime	— 50 —	Large business office, Dishwasher next room

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
Quiet urban nighttime	— 40 —	Theater, large conference room (background)
Quiet suburban nighttime	— 30 —	Library, Bedroom at night
Quiet rural nighttime	— 20 —	
	— 10 —	Broadcast/recording studio
Lowest threshold of human hearing	— 0 —	Lowest threshold of human hearing

Source: California Department of Transportation (CalTrans) 2013

The duration of noise and the time period at which it occurs are important factors in determining the impact of noise. Several methods are used for describing variable sounds including the equivalent level (L_{eq}), the maximum level (L_{max}), and the percent-exceeded levels. These metrics are derived from a large number of moment-to-moment A-weighted sound level measurements. Some common metrics reported in community noise monitoring studies are described below:

- L_{eq}, the equivalent level, can describe any series of noise events of arbitrary duration, although the most common averaging period is hourly. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events, and L_{eq} is the common energy-equivalent sound/noise descriptor.
- L_{max} is the maximum sound level during a given time. L_{max} is typically due to discrete, identifiable events such as an airplane overflight, car or truck passing by, or a dog barking.
- L_{90} is the sound level in dBA exceeded 90 percent of the time during the measurement period. L_{90} is close to the lowest sound level observed. It is essentially the same as the residual sound level, which is the sound level observed when no obvious nearby intermittent noise sources occur.
- L_{50} is the median sound level in dBA exceeded 50 percent of the time during the measurement period.
- L_{10} is the sound level in dBA exceeded only 10 percent of the time. It is close to the maximum level observed during the measurement period. L_{10} is sometimes called the intrusive sound level because it is caused by occasional louder noises like those from passing motor vehicles.

In determining the daily measure of community noise, it is important to account for the difference in human response to daytime and nighttime noise. Noise is more disturbing at night than during the day, and noise indices have been developed to account for the varying duration of noise events over time as well as community response to them. The Day-Night Average Level (L_{dn}) is such an index. L_{dn} represents the 24-hour A-weighted equivalent sound level with a 10 dBA penalty added to the “nighttime” hourly noise levels between 10:00 p.m. and 7:00 a.m. Because of the time-of-day penalties associated with the L_{dn} index, the L_{eq} for a continuously operating sound source during a 24-hour period will be numerically less. The Community Noise Equivalent Level (CNEL), similar to L_{dn}, applies a 10 dBA penalty for noise levels occurring during the nighttime hours between 10:00 p.m. and 7:00 a.m., and a 5 dBA penalty for noise levels the sound levels occurring during evening hours between 7:00 p.m. and 10:00 p.m. CNEL has

been adopted by the State of California to define the community noise environment for development of the community noise element of a General Plan. Noise is also more disturbing the closer a receptor is to the source; noise levels decrease by 6 dB as the distance from its source doubles (FHWA 2011).

2.2 Fundamentals of Vibration

Ground-borne vibration consists of waves transmitted through solid material. Several types of wave motions exist in solids, unlike air, including compressional, shear, torsional, and bending. The solid medium can be excited by forces, moments, or pressure fields. Ground-borne vibration propagates from the source through the ground to adjacent buildings by surface waves. Vibration may be composed of a single pulse, a series of pulses, or a continuous oscillatory motion. The frequency of a vibrating object describes how rapidly it is oscillating, measured in Hz. Most environmental vibrations consist of a composite or "spectrum" of many frequencies and are generally classified as broadband or random vibrations. The normal frequency range of most ground-borne vibration that can be felt generally starts from a low frequency of less than 1 Hz to a high of about 200 Hz.

Vibration may be defined in terms of the displacement, velocity, or acceleration of the particles in the medium material. In environmental assessments, where human response is the primary concern, velocity is commonly used as the descriptor of vibration level, typically expressed in inches per second (in/sec) or millimeters per second (mm/s). The amplitude of vibration can be expressed in terms of the wave peaks or as an average, called the root mean square. The root mean square level is generally used to assess the effect of vibration on humans. Like noise, vibration can be expressed in terms of decibels with a reference velocity of $1x10^{-6}$ in/sec. The abbreviation "VdB" is often used for vibration decibels to reduce the potential for confusion with sound decibels.

Vibration can produce several types of wave motion in solids including compression, shear, and torsion, so the direction in which vibration is measured is significant and should generally be stated as vertical or horizontal. Human perception also depends to some extent on the direction of the vibration energy relative to the axes of the body. In whole-body vibration analysis, the direction parallel to the spine is usually denoted as the z-axis, while the axes perpendicular and parallel to the shoulders are denoted as the x- and y-axes, respectively.

The two primary concerns with project-induced vibration, the potential to damage a structure and the potential to annoy people, are evaluated against different vibration limits. Studies have shown that the threshold of perception for the average person is a peak particle velocity (PPV) in the range of 0.2 to 0.3 mm/s (0.008 to 0.012 in/sec). Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level. Vibration levels for typical construction-related sources of ground-borne vibration are shown in **Table 6** below.

Table 6. Vibration Source Amplitudes for Construction Equipment

Equipment	PPV at 25 feet (in/sec)		Approximate Vibration Velocity Level (Velocity Level in Decibels [VdB])	
	25 feet	50 feet	25 feet	50 feet
Large Bulldozer	0.089	0.031	87	78
Caisson Drilling	0.089	0.031	87	78
Loaded Trucks	0.076	0.027	86	77
Jackhammer	0.035	0.012	79	70
Small Bulldozer	0.003	0.001	58	49

Source: Adapted from CalTrans 2020 and Federal Transit Administration (FTA) 2018

SECTION 3 Regulatory Framework

Federal, state, and local noise regulations and policies that may apply to the proposed Project are described below.

3.1 Federal

3.1.1 Noise Control Act of 1972

USEPA, pursuant to the Noise Control Act of 1972, established guidelines for acceptable noise levels for sensitive receptors such as residential areas, schools, and hospitals. The levels set forth are 55 dBA L_{dn} for outdoor use areas and 45 dBA L_{dn} for indoor use areas, and a maximum level of 70 dBA L_{dn} is identified for all areas to prevent hearing loss (USEPA 1974). These levels provide guidance for local jurisdictions but do not have regulatory enforceability. In the absence of applicable noise limits, the USEPA levels can be used to assess the acceptability of project-related noise.

3.1.2 U.S. Department of Housing and Urban Development

The U.S. Department of Housing and Urban Development (HUD) has also established guidelines for acceptable noise levels for sensitive receivers such as residential areas, schools, and hospitals (24 CFR 51). HUD's noise levels include a two-pronged guidance, one for the desirable noise level and the other for the maximum acceptable noise level. The desirable noise level established by HUD conforms to the USEPA guidance of 55 dBA L_{dn} for outdoor use areas of residential land uses and 45 dBA L_{dn} for indoor areas of residential land uses. The secondary HUD standard establishes a maximum acceptable noise level of 65 dBA L_{dn} for outdoor use areas of residential areas.

3.1.3 Federal Transit Authority

The FTA has published guidance relevant to assessing ground-borne vibration associated with construction activities, which have been applied by other jurisdictions to other types of projects (FTA 2018). For example, engineered concrete and masonry (no plaster) buildings can be exposed to ground-borne vibration levels of 0.3 inches per second without experiencing structural damage. Buildings extremely susceptible to vibration damage (e.g., historic buildings) can be exposed to ground-borne vibration levels of 0.12 in/sec without experiencing structural damage.

3.2 State

The California Code of Regulations (CCR) has guidelines for evaluating the compatibility of various land uses as a function of community noise exposure, as shown in **Table 7** below.

The extensive state regulations pertaining to worker noise exposure are applicable to the proposed project (for example California Occupational Safety and Health Administration Occupational Noise Exposure Regulations [8 CCR General Industrial Safety Orders, Article 105, Control of Noise Exposure, Section 5095, et seq.]), for workers in a "central plant" and/or maintenance facility, or for those involved in the use of maintenance equipment or heavy machinery.

Table 7. Estimated Existing Noise Exposure for General Assessment

Land Use Category	Noise Exposure Ranges (dB CNEL) Normally Acceptable[1]	Noise Exposure Ranges (dB CNEL) Conditionally Acceptable[2]	Noise Exposure Ranges (dB CNEL) Normally Unacceptable[3]	Noise Exposure Ranges (dB CNEL) Clearly Unacceptable[4]
Residential: Low-density Single Family, Duplex, Mobile Homes	<60	55-70	70-75	>75
Residential: Multiple Family	<65	60-70	70-75	>75
Transient Lodging: Motels, Hotels	<65	60-70	70-80	>80
Schools, Libraries, Churches, Hospitals, Nursing Homes	<70	60-70	70-80	>80
Auditoriums, Concert Halls, Amphitheaters	Undefined	<70	>65	Undefined
Sports Arena, Outdoor Spectator Sports	Undefined	<75	>70	Undefined
Playgrounds, Neighborhood Parks	<70	67-75	>73	Undefined
Golf Courses, Riding Stables, Water Recreation, Cemeteries	<75	Undefined	70-80	>80
Office Buildings, Business Commercial and Professional	<70	67-77	>75	Undefined
Industrial, Manufacturing, Utilities, Agriculture	<75	70-80	>75	Undefined

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

Notes:

1. Normally Acceptable: specified land use is satisfactory, based upon the assumption that any buildings involved are of normal construction without any special noise insulation requirements.
2. Conditionally Acceptable: New construction or development should only be undertaken after a detailed analysis of the noise reduction requirements is made and the needed insulation features included in the design.
3. Normally Unacceptable: New construction or development should generally be discouraged. If new development is to proceed, a detailed analysis of the noise reduction requirements is made, and the needed insulation features are included in the design.
4. Clearly Unacceptable: New development or construction should not be undertaken.

3.3 Local

Imperial County is the agency responsible for regulating and controlling noise through the Noise Element of the County General Plan and the Noise Ordinance of the County's Codified Ordinances. The Noise Element of the Imperial County General Plan provides a program for incorporating noise issues into the land use planning process with a goal of minimizing adverse noise impacts to noise-sensitive receptors. The Noise Element specifies construction hours and noise limits and the acceptable property line operational noise levels at various land uses for day, evening, and night periods for the County Noise Ordinance.

3.3.1 Imperial County General Plan Noise Element

The Noise Element of the Imperial County General Plan examines noise sources and provides information to be used in setting land use policies to protect noise-sensitive land uses and for developing and enforcing a local noise ordinance. The Noise Element (2015) provides a program for incorporating noise issues into the land use planning process with a goal of minimizing adverse noise impacts to receptors such as residences, schools, and hospitals, which are sensitive to noise. The County identifies Noise Impact Zones for sensitive receptors likely to be exposed to significant noise (greater than 60 dB CNEL or 75 dBA L_{eq}) from roadways, railroads, airports, and agricultural activities. The purpose of the Noise Impact Zone is to define areas and properties where an acoustical analysis of a proposed project is required to demonstrate project compliance with land use compatibility requirements and other applicable environmental noise standards. Any property within 1,500 feet of an interstate highway or 1,100 feet of a State highway is within a Noise Impact Zone, as is any property within 0.25 mile (1,320 feet) of existing farmland that is in an agricultural zone.

An acoustical analysis is required for any action that would be located, all or in part, in a Noise Impact Zone. According to the Noise Element, if the future noise levels from the action are within the normally acceptable noise level guidelines but result in an increase of 5 dBA CNEL or greater, the action would have a potentially significant noise impact; and mitigation measures must be considered. If the future noise level after the action is completed is greater than the normally acceptable noise level, a noise increase of 3 dBA CNEL or greater should be considered a potentially significant noise impact; and mitigation measures must be considered.

Land use compatibility defines the acceptability of a land use in a specified noise environment. Noise/Land Use Compatibility Guidelines are provided in the Noise Element to evaluate potential noise impacts and provide criteria for environmental impact findings and conditions for project approval. An acoustical analysis is required to demonstrate conformance of a proposed project with Noise/Land Use Compatibility Guidelines. These guidelines categorize noise levels at residential land uses as "normally acceptable" up to 60 dBA day-night average sound level (L_{dn}) or CNEL and as "conditionally acceptable" up to 70 dBA L_{dn} or CNEL.

Construction noise standards included in the Noise Element restrict construction equipment noise levels to 75 dBA L_{eq} when averaged over an eight-hour period and measured at the nearest sensitive receptor. This standard assumes a construction period, relative to an individual sensitive receptor of days or weeks. In cases of extended length construction times, the standard may be tightened so as not to exceed 75 dB L_{eq} when averaged over a one-hour period. In addition, construction equipment operation

is limited to the hours of 7:00 a.m. to 7:00 p.m., Monday through Friday, and 9:00 a.m. to 5:00 p.m. on Saturday. Further, no commercial construction operations are permitted on Sunday or holidays.

3.3.2 Imperial County Noise Ordinance

The County enforces construction and operation noise standards specified in the Noise Element through the Noise Ordinance. Noise-generating sources in Imperial County are regulated under the County of Imperial Codified Ordinances, Title 9, Division 7 (Noise Abatement and Control). The noise standards of the Ordinance limit the hours of construction and the level of noise emitted by the construction, as well as the operational noise levels at various land uses for day, evening, and night. Noise limits are established in Chapter 2 of this ordinance and shown in **Table 8**.

Table 8. Imperial County Property Line Noise Limits.

Zone	Time	Average Hourly Sound (L_{eq})
Residential Zones	7 a.m. to 10 p.m.	50
	10 p.m. to 7 a.m.	45
Multi-Residential Zones	7 a.m. to 10 p.m.	55
	10 p.m. to 7 a.m.	50
Commercial Zones	7 a.m. to 10 p.m.	60
	10 p.m. to 7 a.m.	55
Light Industrial/Industrial Park Zones	Anytime	70
General Industrial Zones	Anytime	75

Source: Imperial County Ordinance - Title 9, Division 7 (Noise Abatement and Control)

When the noise-generating property and the receiving property have different uses, the more restrictive standard shall apply. When the ambient noise level is equal to or exceeds the Property Line noise standard, the increase of the existing or proposed noise shall not exceed 3 dB L_{eq}.

Property line noise limits apply to noise generation from one property to an adjacent property. The standards imply the existence of a sensitive receptor on the adjacent, or receiving, property. In the absence of a sensitive receptor, an exception or variance to the standards may be appropriate. These standards do not apply to construction noise. These standards are enforced through the County's code enforcement program on the basis of complaints received from persons impacted by excessive noise. The County may act to restrict disturbing, excessive, or offensive noise which causes discomfort or annoyance to reasonable persons of normal sensitivity residing in an area. Noise received at the property line of a residence is limited to 50 dBA L_{eq} in the daytime and 45 dBA L_{eq} at night.

Under Section 90702.00 of the County’s Codified Ordinances, sound level limits for industrial noise are set at 75 dBA L_{eq} on or beyond the boundary of the property line at any time. Average hourly noise in residential areas is limited to 50 to 55 dBA from 7:00 a.m. to 10:00 p.m. and to 45 to 50 dBA from 10:00 p.m. to 7:00 a.m.

SECTION 4 Existing Conditions

4.1 Noise Sensitive Receptors

Noise-sensitive land uses are generally considered to include those uses where noise exposure could result in health-related risks to individuals, as well as places where quiet is an essential element of their intended purpose. Residential dwellings are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels, and because of the potential for nighttime noise to result in sleep disruption. Additional land uses such as schools, transient lodging, historic sites, cemeteries, and places of worship are also generally considered sensitive to increases in noise levels. These land use types are also considered vibration-sensitive land uses, as are commercial and industrial buildings where vibration would interfere with operations within the building, including levels that may be well below those associated with human annoyance.

There are numerous noise sensitive receptors in proximity to Project components including residences, Mt. View Cemetery, and Heber Elementary School. **Table 9** summarizes the sensitive receptors in the Project area and distance to the nearest Project components.

Table 9. Sensitive Receptors in Proximity to Project Components

Sensitive Receptor	Nearest Project Component	Distance to Nearest Project Component (feet)
Residence (600 Dogwood Rd.)[1]	Parasitic Solar Field	0
Residence (104 Jasper Rd.)	Cable Route Option 1	390
Residence (97 W. Cole Blvd.)	Heber 1 Parasitic Solar Field	2,695
Residential Area (E. Fawcett Rd.)	Cable Route Option 2	2,700
Residences (153, 185, 195 E. Cole Blvd.)	Heber 1 Parasitic Solar Field	2,735
Heber Elementary School	Cable Route Option 2	3,050
Mt. View Cemetery	Cable Route to Heber 1	4,375

Notes:

[1] It is Catalyst's understanding that this residential building will be removed prior to the Project.

4.2 Existing Noise Sources and Ambient Noise Levels

Existing ambient noise in the vicinity of the Project sites is consistent with a rural agricultural landscape with the dominant noise sources consisting of vehicular traffic on local roads, the existing Heber Geothermal Complex, and the operation of agricultural equipment. The major source of vehicular noise is traffic along Interstate 8 (I-8) to the north, State Route (SR) 86 to the west, SR 111 to the east, and the Regional Arterials Dogwood Road, Cole Boulevard, and Jasper Road. SR 86 is a principal farm-to-market route for Imperial County agricultural products and carries a high percentage of heavy trucks. SR 86 also carries heavy recreational traffic on weekends (Imperial County 2015). The Noise Element of the Imperial County General Plan provides calculated noise contours for the area's highways based on

vehicle volumes, speed, and vehicle mix. Calculated noise levels for SR 86 south of I-8 indicate that the 60 dBA (CNEL) noise contour would be met at 1,600 feet from the travel corridor under 2015/future conditions (i.e., with consideration to increases in traffic volumes in the years following the preparation of the Noise Element in 2015).

The existing geothermal facilities adjacent to the Project site also contribute to the existing noise environment. Typical sound power levels for the existing power plants and geothermal well pads are in the range of 113 dBA at the loudest noise source of the power plant and 92 dBA directly adjacent to each well. Noise from these stationary sources lessens at a rate of approximately 6 dB per doubling of distance, depending on such environmental conditions as topography, vegetation, and weather. Specifically, operational noise levels of an existing geothermal facility in Imperial County were recorded at 70 dBA L_{eq} at approximately 100 feet (Chambers Group, Inc. 2015).

4.3 Existing Vibration Environment

Similar to the environmental setting for noise, the vibration environment is dominated by traffic from nearby roadways. Heavy trucks can generate ground-borne vibrations that vary depending on vehicle type, weight, and pavement conditions. According to the FTA (2018), *Transit noise and Vibration Impacts Assessments*, “if the roadway is fairly smooth, the vibration from rubber-tired traffic is rarely perceptible.” Roads in the Project area are smooth asphalt and it is unlikely that traffic on the local roadway is perceptible.

SECTION 5 Project Noise Prediction

5.1 Methodology

The Project construction and operation noise levels were estimated using the computer noise propagation model SoundPLAN Essential (version 5.1), which calculates noise impacts taking into account terrain features including relative elevations of noise sources, receivers, and intervening objects, ground effects due to areas of pavement and unpaved ground, and atmospheric effects on sound propagation. The following assumptions and parameters are included in the SoundPLAN supported noise source assessment:

- Ground effect acoustical absorption coefficient equal to 0.0, which represents the acoustically reflective "hard" surface for the majority of the geothermal plant site. Vegetated fields surrounding the Project site were assigned a coefficient of 1.0, which represents the acoustically "soft" surface associated with the vegetated ground cover;
- Reflection order of 1, which allows for a single reflection of sound paths on encountered structural surfaces such as buildings and structures; and
- Calm meteorological conditions (i.e., no wind) with 70 degrees Fahrenheit and 83% relative humidity.

5.1.1 Construction

5.1.1.1 Onsite Construction Noise

The potential construction noise levels onsite associated with proposed Project construction activities were estimated for each distinct construction phase. For the purposes of a conservative analysis, the noisiest phase of construction, Project Construction and Switch Development and Interconnection, was modeled for the solar field and three cable route options. The noise model conservatively assumes that construction equipment presented in **Table 3** above for the Project Construction and Switch Development and Interconnection phases will be operated simultaneously (note that the three cable route options were also modeled simultaneously, although only one route would ultimately be chosen). To reflect the nature of earthwork and construction activities, equipment was modeled as an area source distributed over the project footprint. The total sound energy of the area source was modeled with all pieces of equipment operating simultaneously. In actual practice, however, the types and numbers of construction equipment near any specific receptor location will vary over time.

5.1.1.2 Offsite Noise (Construction Traffic)

Estimated vehicle trips associated with each phase of construction is presented above in **Table 4**. For the purpose of this analysis, the principals of logarithmic summation are applied to estimate the maximum noise increase associated with construction traffic along local surface streets. Specifically, noise levels increase by 3 dBA when the number of similar noise sources double. The increase in delivery/haul trucks and construction worker vehicle trips are not anticipated to double the amount of traffic that currently

exist in the surrounding area. As such, the increase in delivery/haul trucks and worker vehicles in the surrounding roadways is not anticipated to incrementally increase noise levels in the surrounding area by 3 dBA or more and are not analyzed further herein.

5.1.2 Operations

Once completed, the solar field would not have any stationary sources of noise. Due to the low number of additional trips associated with operation of the proposed Project, vehicles traveling to/from the Project site are not expected to result in changes to noise levels in the surrounding area. Accordingly, operational noise is not analyzed further herein.

5.1.3 Vibration

Construction would result in temporary ground vibration. Ground vibration generated by construction equipment spreads through the ground and diminishes in magnitude with increases in distance. Construction activities most likely to cause vibration include operation of heavy construction equipment. Vibration levels from surface construction including demolition, excavation, pile driving, etc. are typically less than 0.10 to 0.20 in/sec at 10 feet from the source. Ground-borne vibration dissipates very rapidly with distance, reducing the typical construction-related vibrations to less than the threshold of 0.2 in/sec for typical non-engineered timber and masonry buildings at a distance greater than 10 feet from the source and to an imperceptible level at about 200 feet from the source (FTA 2018). No residence or other offsite sensitive receptor structures are located within 200 feet of Project construction activities.

Construction would also result in additional heavy vehicle trips on local roadways accessing the Project site. Rubber-tire heavy vehicles traveling on roadways typically will not produce perceptible vibration at adjacent buildings. Roadways providing access to the Project are located at a distance of more than 100 feet from any offsite residence or any other sensitive receptor structure.

Once completed, the solar field would not have any stationary sources of vibration. Further, the speed limit on the adjacent roadways is 55 miles per hour and the road surface is in good condition. As trucks enter and exit the site, they would traverse the asphalt drive at very low speeds. As noted in FTA (2018), rubber tires and suspension systems provide vibration isolation, and therefore, it is unusual for ground-borne vibration associated with on-road vehicle movement to be perceptible.

As detailed above, vibration impacts associated with Project construction and operation are not expected to be significant and are not evaluated further herein.

5.2 Predicted Results

Based on the types and number of equipment to be used, construction activities associated with Project site construction (solar fields and plant site) are identified to have the greatest potential to increase noise levels in the Project area. The cumulative noise for all construction equipment is propagated to the nearest sensitive receptors to estimate the maximum change in noise levels resulting from the proposed Project as summarized in **Table 11** and illustrated in **Figure 2**. As shown in **Table 10** and **Figure 2**, construction activities would not exceed the Imperial County daytime noise standard for construction activities of 75 dBA L_{eq} at the nearest sensitive receptor.

Table 10. Modeled Maximum Project Construction Sound Levels (L_{eq}, dBA).

Modeled Receptors	Modeled Daytime Construction Noise Level[1]	Presumed Ambient Noise Level (Day)	Noise Standard[2] (Day)	Exceed Standard?
Residence (104 Jasper Rd.)	47.5	50	75	No
Residence (97 W. Cole Blvd.)	40.8	50	75	No
Residences (153, 185, 195 E. Cole Blvd.)	42.6	50	75	No

Notes:

1. Modeled noise level is associated with construction equipment. Modeled construction noise levels less than ambient would not be expected to increase noise levels at the modeled receptors.
2. The noise standard for construction activities as provided in the Imperial County General Plan Noise Element specifies that construction noise shall not exceed 75 dBA at the nearest sensitive receptor. This standard is applicable for daytime noise given the restrictions on construction hours per the Noise Element.

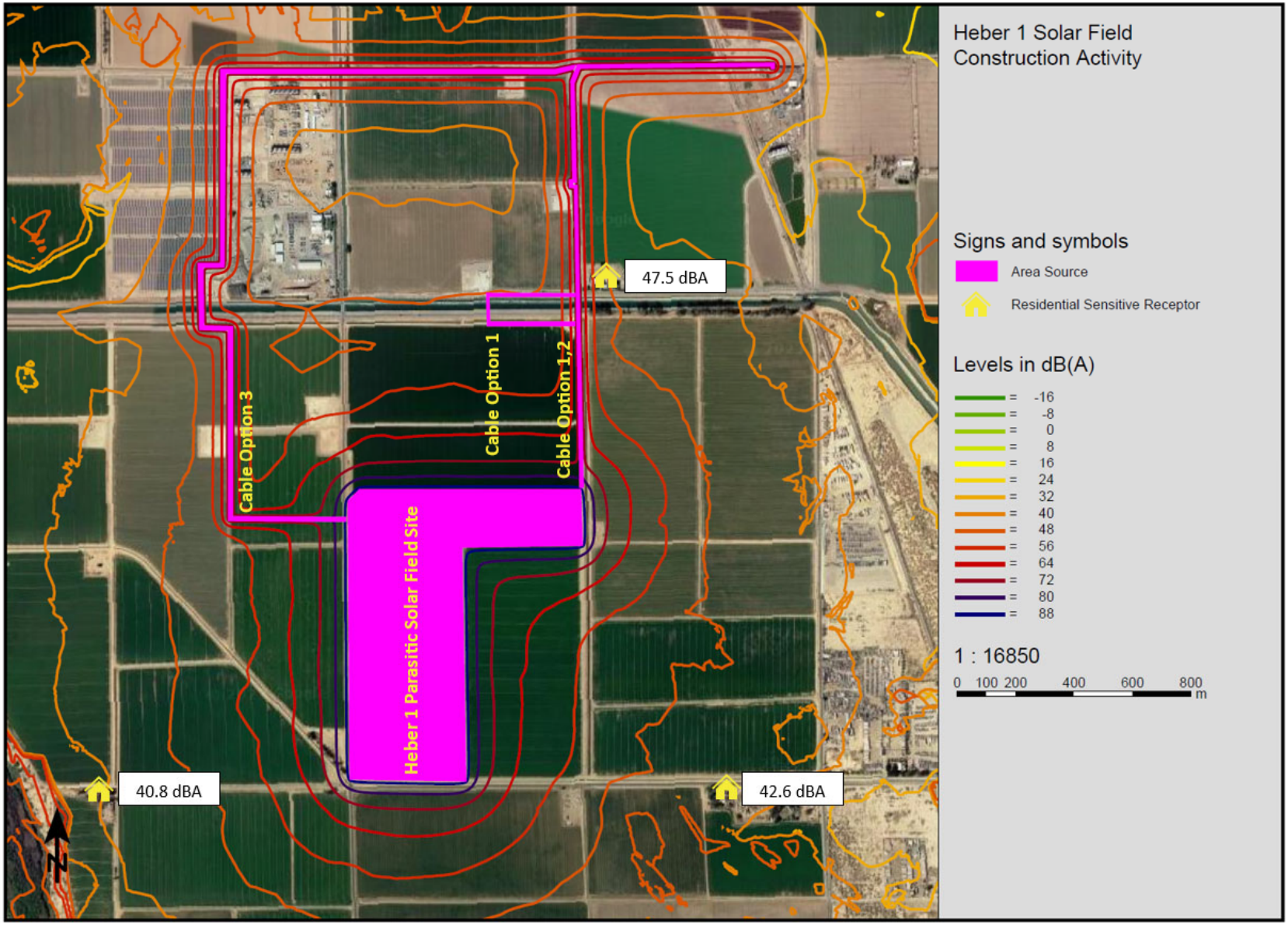

Figure 2. Modeled Construction Noise

SECTION 6 Conclusions

Based on the SoundPLAN modeling of the Project, anticipated operational and construction noise levels would not exceed local thresholds and would comply with local guidelines set forth in the County's Noise Element and Noise Ordinance. Therefore, the Project would not generate significant noise levels that would disturb noise-sensitive land uses (i.e., residential) in the vicinity.

SECTION 7 References

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