ATTACHMENT O: ACOUSTIC ASSESSMENT REPORT

Wautoma Solar Energy Project
Acoustic Assessment Report

Prepared for:

Innergex Renewable Development USA, LLC

Prepared by:

TETRA TECH

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Acronyms and Abbreviations

AC	alternating current
Applicant	Innergex Renewable Development USA, LLC
BESS	battery energy storage system
BPA	Bonneville Power Administration
CadnaA	Computer-Aided Noise Abatement
dB	decibel
dBA	A-weighted decibel
dBL	linear decibel
DC	direct current
EDNA	Environmental Designation for Noise Abatement
EFSEC	Energy Project Site Evaluation Council
EPA	U.S. Environmental Protection Agency
FHWA	Federal Highway Administration
Hz	hertz
ISO	International Organization for Standardization
kV	kilovolt
L_{dn}	day-night average sound level
L_{eq}	equivalent sound level
L_{max}	maximum sound level
L_P	sound pressure level
L_w	sound power level
µPa	microPascal
NSR	noise sensitive receptor
Project	Wautoma Solar Energy Project
PV	photovoltaic
Tetra Tech	Tetra Tech, Inc.
WAC	Washington Administrative Code

1.0 Introduction

Innergex Renewable Development USA, LLC (the Applicant) is seeking to develop the Wautoma Solar Energy Project (Project) in unincorporated Benton County, Washington. The Project is a 470-megawatt[1] solar photovoltaic (PV) generation facility coupled with a 4-hour battery energy storage system (BESS) sized to the maximum capacity of the Project, as well as related interconnection and ancillary support infrastructure. The Project is generally located 12.5 miles northeast of the city of Sunnyside and 1 mile south of the State Route 241 and State Route 24 interchange in in Benton County, Washington.

Tetra Tech, Inc. (Tetra Tech) has prepared this acoustic assessment for the Project, evaluating potential sound impacts relative to the applicable noise regulations prescribed in the Washington Administrative Code (WAC). The existing ambient acoustic environment was characterized based on land use, population density, and proximity to major roadways. An acoustic modeling analysis was conducted simulating sound produced during both construction and operation. Operational sound sources consisted primarily of the inverters, step-up transformers, battery storage, and transformer at the on-site substation. The overall objectives of this assessment were to 1) identify Project sound sources and estimate sound propagation characteristics, 2) computer-simulate sound levels using internationally accepted calculation standards, and 3) confirm that the Project will operate in compliance with the applicable noise regulations.

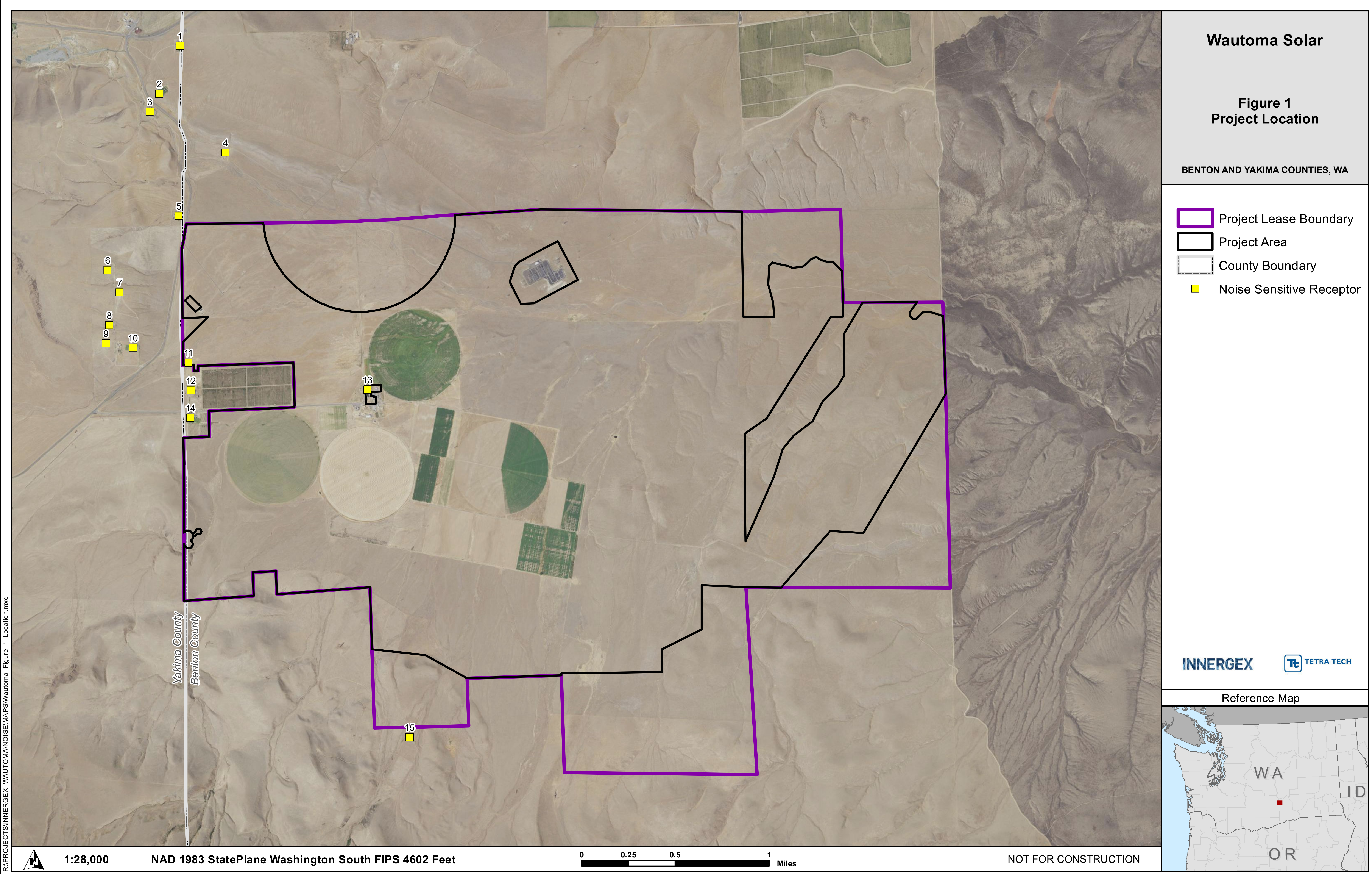
1.1 Project Area

The Project Lease Boundary is approximately 5,852 acres that encompasses 35 privately owned assessor parcels for which the Applicant has executed or is pursuing a lease agreement with the underlying property owner. The approximately 4,573-acre Project Area will accommodate all of the Project facilities, including solar PV system and BESS, Project substation, transmission line, and operations and maintenance building. The solar PV system will consist of a series of solar PV panels mounted on a solar tracker racking system and related electrical equipment. The system includes the solar panels, tracker racking system, posts, collector lines, and power conversion systems, which consists of the direct current (DC)-coupled BESS, inverters, and transformers. The DC--coupled BESS can either store electricity for future use or, as required based on grid demand, convert DC electricity to alternating current (AC) electricity and send the AC electricity to the step-up transformer. As an alternative, a centralized AC-coupled BESS may be constructed. An acoustic analysis for this alternative also is provided in this memorandum.

Current land uses in the Project Area include irrigated agriculture, rangeland, undeveloped land, local roads, and existing electrical utility infrastructure. Lands to the north, west, and south are zoned for agricultural purposes in Benton and Yakima counties with similar land uses as the Project Lease Boundary, as well as several rural residences. The Hanford Reach National Monument Rattlesnake Unit is located to the east.

[1] Megawatt rating provided in alternating current (MWac)

The preliminary design accounts for Project size, topography, and other constraints; however, the solar modules, supporting components, and precise layout of the solar array have not yet been finalized. Figure 1 provides an overview of the Project area and provides the locations of nearby participating and non-participating residences, which are considered noise sensitive receptors (NRSs, i.e., residences).


Wautoma Solar
Figure 1
Project Location
BENTON AND YAKIMA COUNTIES, WA
Project Lease Boundary
Project Area
County Boundary
Noise Sensitive Receptor
INNERGEX
TETRA TECH
Reference Map
WA
ID
OR
1
2
3
4
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Yakima County
Benton County
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1.2 Acoustic Metrics and Terminology

All sounds originate with a source, whether it is a human voice, motor vehicles on a roadway, or a combustion turbine. Energy is required to produce sound, and this sound energy is transmitted through the air in the form of sound waves – tiny, quick oscillations of pressure just above and just below atmospheric pressure. These oscillations, or sound pressures, impinge on the ear, creating the sound we hear. A sound source is defined by a sound power level (L_W), which is independent of any external factors. By definition, sound power is the rate at which acoustical energy is radiated outward and is expressed in units of watts.

A source sound power level cannot be measured directly. It is calculated from measurements of sound intensity or sound pressure at a given distance from the source outside the acoustic and geometric near-field. A sound pressure level (L_P) is a measure of the sound wave fluctuation at a given receiver location and can be obtained through the use of a microphone or calculated from information about the source sound power level and the surrounding environment. The sound pressure level in decibels (dB) is the logarithm of the ratio of the sound pressure of the source to the reference sound pressure of 20 microPascals (μPa), multiplied by 20.1. The range of sound pressures that can be detected by a person with normal hearing is very wide, ranging from about 20 μPa for very faint sounds at the threshold of hearing, to nearly 10 million μPa for extremely loud sounds such as a jet during take-off at a distance of 300 feet.

Broadband sound includes sound energy summed across the entire audible frequency spectrum. In addition to broadband sound pressure levels, analysis of the various frequency components of the sound spectrum can be completed to determine tonal characteristics. The unit of frequency is hertz (Hz), measuring the cycles per second of the sound pressure waves. Typically, the frequency analysis examines 11 octave bands ranging from 16 Hz (low) to 16,000 Hz (high). Since the human ear does not perceive every frequency with equal loudness, spectrally-varying sounds are often adjusted with a weighting filter. The A-weighted filter is applied to compensate for the frequency response of the human auditory system and is represented in A-weighted decibels (dBA).

Sound can be measured, modeled, and presented in various formats, with the most common metric being the equivalent sound level (L_{eq}). The L_{eq} has been shown to provide both an effective and uniform method for comparing time-varying sound levels and is widely used in acoustic assessments in the state of Washington. Estimates of noise sources and outdoor acoustic environments, and the comparison of relative loudness, are presented in Table 1. Table 2 presents additional reference information on terminology used in the report.

Table 1. Sound Pressure Levels and Relative Loudness of Typical Noise Sources and Acoustic Environments

Noise Source or Activity	Sound Level (dBA)	Subjective Impression
Vacuum cleaner (10 feet)	70	Moderate
Passenger car at 65 miles per hour (25 feet)	65	
Large store air-conditioning unit (20 feet)	60	
Light auto traffic (100 feet)	50	Quiet
Quiet rural residential area with no activity	45	
Bedroom or quiet living room; bird calls	40	Faint
Typical wilderness area	35	
Quiet library, soft whisper (15 feet)	30	Very quiet
Wilderness with no wind or animal activity	25	Extremely quiet
High-quality recording studio	20	
Acoustic test chamber	10	Just audible
	0	Threshold of hearing

Adapted from: Beranek (1988) and EPA (1971a)

Table 2. Acoustic Terms and Definitions

Term	Definition
Noise	Typically defined as unwanted sound. This word adds the subjective response of humans to the physical phenomenon of sound. It is commonly used when negative effects on people are known to occur.
Sound Pressure Level (LP)	Pressure fluctuations in a medium. Sound pressure is measured in dB referenced to 20 μPa, the approximate threshold of human perception to sound at 1,000 Hz.
Sound Power Level (LW)	The total acoustic power of a sound source measured in dB referenced to picowatts (one trillionth of a watt). Noise specifications are provided by equipment manufacturers as sound power as it is independent of the environment in which it is located. A sound level meter does not directly measure sound power.
Equivalent Sound Level (L_{eq})	The L_{eq} is the continuous equivalent sound level, defined as the single sound pressure level that, if constant over the stated measurement period, would contain the same sound energy as the actual monitored sound that is fluctuating in level over the measurement period.
A-Weighted Decibel (dBA)	Environmental sound is typically composed of acoustic energy across all frequencies. To compensate for the auditory frequency response of the human ear, an A-weighting filter is commonly used for describing environmental sound levels. Sound levels that are A-weighted are presented as dBA in this report.
Unweighted Decibels (dBL)	Unweighted sound levels are referred to as linear. Linear decibels are used to determine a sound's tonality and to engineer solutions to reduce or control noise as techniques are different for low and high frequency noise. Sound levels that are linear are presented as dBL in this report.
Propagation and Attenuation	Propagation is the decrease in amplitude of an acoustic signal due to geometric spreading losses with increased distance from the source. Additional sound attenuation factors include air absorption, terrain effects, sound interaction with the ground, diffraction of sound around objects and topographical features, foliage, and meteorological conditions including wind velocity, temperature, humidity, and atmospheric conditions.

1.3 Noise Regulations and Guidelines

1.3.1 Federal Regulations

There are no federal noise regulations applicable to the Project.

1.3.2 Washington Administrative Code State Regulations

Environmental noise limits have been established by the Washington Administrative Code (WAC 173-60). WAC 173-60 establishes noise limits based on the Environmental Designation for Noise Abatement (EDNA) of the sound source and the receiving properties.

- Class A EDNA – Lands where people reside and sleep. They typically include residential property; multiple family living accommodations; recreational facilities with overnight accommodations such as camps, parks, camping facilities, and resorts; and community service facilities including orphanages, homes for the aged, hospitals, and health and correctional facilities.
- Class B EDNA – Lands involving uses requiring protection against noise interference with speech. These typically will include commercial living accommodations; commercial dining establishments; motor vehicle services; retail services; banks and office buildings; recreation and entertainment property not used for human habitation such as theaters, stadiums, fairgrounds, and amusement parks; and community service facilities not used for human habitation (e.g., educational, religious, governmental, cultural and recreational facilities).
- Class C EDNA –Lands involving economic activities of a nature that noise levels higher than those experienced in other areas are normally to be anticipated. Typical Class A EDNA uses generally are not permitted in such areas. Typically, Class C EDNA include storage, warehouse, and distribution facilities; industrial property used for the production and fabrication of durable and nondurable man-made goods; and agricultural and silvicultural property used for the production of crops, wood products, or livestock.

Land use that is considered agricultural is defined as Class C receiving properties. Conversely, agricultural properties principally used for residential purposes with no clearly visible farming or ranching activities are identified as Class A receiving properties. The WAC does maintain flexibility for interpretation in the classification of the appropriate EDNA on both the state and local level. In this assessment, receiving properties consist of Class C Lands and Class C Lands containing Class A residential structures. Between the hours of 10:00 p.m. and 7:00 a.m., the noise limitations are reduced by 10 dBA for receiving property within Class A EDNAs. WAC 173.60.050 exempts temporary construction noise from the state noise limits.

The noise level limits by EDNA classifications are presented in Table 3. The WAC allows these limits to be exceeded for certain periods of time: 5 dBA for no more than 15 minutes in any hour, 10 dBA for no more than 5 minutes of any hour, and 15 dBA for no more than 1.5 minutes of any hour;

these are commonly presented as L_n statistical sound levels as well as maximum sound levels (L_{max}), as shown in Table 4.

Table 3. Washington State Environmental Noise Limits

EDNA of Source Property	EDNA of Receiving Property		
	Class A Land Day/Night	Class B Land	Class C Land
Class A Land	55/45	57	60
Class B Land	57/47	60	65
Class C Land	60/50	65	70

Source: WAC 173-60-040

Table 4. L_n Environmental Noise Limits for Class C Sources

EDNA of Source Property	Statistical Sound Level Limits			
	LN_{25}	$LN_{8.3}$	$LN_{2.5}$	L_{MAX}
Class A Land	60/50	65/55	70/60	75/65
Class B Land	65	70	75	80
Class C Land	70	75	80	85

Source: WAC 173-60-040 (b) and (c)

The Project site is located on land zoned GMAAD (Benton County), which is considered Class C land. Adjacent land also is zoned GMAAD in Benton County, and zoned Agriculture in Yakima County immediately to the west of the Project Lease Boundary. See Figure 1 in Attachment D to this Application for zoning designations in the Project vicinity. Agricultural land is considered Class C under the definitions provided above; however, some of these agricultural lands contain residential structures. This analysis conservatively considers agricultural lands with non-participating residences to be Class A receptors. Table 3 shows that the applicable daytime and nighttime noise limits will vary based on each abutting land use class. In this memorandum, compliance with applicable limits will be assessed at the Project lease boundary. For agricultural land containing non-participating residential structures, limits of 60 dBA and 50 dBA apply to daytime and nighttime hours, respectively. For Class C land containing participating residential structures, a daytime and nighttime limit of 70 dBA is applicable. The Applicant is voluntarily setting a design target for participating residential structures of no greater than 60 dBA.

The WAC regulatory limits are absolute and independent of the existing acoustic environment; therefore, a baseline noise survey is not requisite to determine conformance.

1.3.3 Benton County Code

Chapter 6A.15 in the Benton County Code regulates noise as a public nuisance and does not provide numerical decibel limits.

2.0 Existing Sound Environment

The degree of audibility of a new or modified sound source is dependent, in a large part, on the relative level of the ambient noise. A range of noise settings occurs within the Project Area. Variations in acoustic environment are due, in part, to existing land uses, population density, and proximity to transportation corridors. Elevated existing ambient sound levels in the region occur near major transportation corridors such as interstate highways and in areas with higher population densities. Nearby rural airstrips and airports, including the Desert Aire Regional Airport and Sunnyside Municipal Airport, also contribute to ambient noise levels in both surrounding urban and rural areas. Principal contributors to the existing acoustic environment likely include motor vehicle traffic, mobile farming equipment, all-terrain vehicles, local roadways, periodic aircraft flyovers, and natural sounds such as birds, insects, and leaf or vegetation rustle during elevated wind conditions. Diurnal effects result in sound levels that are typically quieter during the night than during the daytime, except during periods when evening and nighttime insect noise dominates in warmer seasons.

The analysis area is inclusive of all areas that could be potentially affected by construction or operational noise resulting from the Project. The analysis area for noise around the Project was defined as the area bounded by a perimeter extending approximately 1.2 miles (2 kilometers) from the Project Area. In the absence of ambient measurement data, the existing sound level environment in the vicinity of Project was estimated with a method published by the Federal Highway Administration (FHWA) in its Transit Noise and Vibration Impact Assessment (FHWA 2006). This document presents the general assessment of existing noise exposure based on the population density per square mile and proximity to area sound sources such as roadways and rail lines.

The proposed Project is approximately 10 miles (16.2 kilometers) southeast of the city of Desert Aire, which has a population density of 2,288 per square mile according to the U.S. Census Bureau (2020). Table 5 indicates the estimated baseline sound levels based on population density for daytime, evening, and nighttime L_{eq}, as well as the day-night average sound level (L_{dn}). The L_{dn} is the average equivalent sound level over a 24-hour period, with a 10 dB penalty added for noise during the nighttime hours of 10:00 p.m. – 7:00 a.m.

Table 5. Estimated Baseline Sound Levels in Proximity to the Project

Average Sound Level (dBA)	L_{eq} (Day)	L_{eq} (Evening)	L_{eq} (Night)	L_{dn}
	50	45	40	50

3.0 Project Construction

Construction of the Project is expected to be typical of other solar power generating facilities in terms of schedule, equipment, and activities. Construction is anticipated to occur over approximately 22 months and would require a variety of equipment and vehicles.

3.1 Noise Calculation Methodology

Acoustic emission levels for activities associated with Project construction were based on typical ranges of energy equivalent noise levels at construction sites, as documented by the U.S. Environmental Protection Agency (EPA; 1971b) and the EPA's "Construction Noise Control Technology Initiatives" (EPA 1980). The EPA methodology distinguishes between type of construction and construction stage. Using those energy equivalent noise levels as input to a basic propagation model, construction noise levels were calculated at a series of set reference distances.

The basic model assumed spherical wave divergence from a point source located at the closest point of the Project site. Furthermore, the model conservatively assumed that all pieces of construction equipment associated with an activity would operate simultaneously for the duration of that activity. An additional level of conservatism was built into the construction noise model by excluding potential shielding effects due to intervening structures and buildings along the propagation path from the site to receiver locations.

3.2 Projected Noise Levels During Construction

Table 6 summarizes the expected equipment to be used during Project construction, organized into the following work stages: site preparation and grading, trenching and road construction, equipment installation, and commissioning. Table 6 also shows the maximum noise level at 50 feet and the usage factor percentage for the expected equipment phases.

Table 6. Project Construction Noise Levels by Phase

Phase No.	Construction Phase	Construction Equipment	Usage Factor %	Maximum (L_{max}) Equipment Noise Level at 50 feet
1	Site Preparation and Grading	(2) Graders (174 hp) (1) Rubber Tired Loaders (164 hp) (1) Scrapers (313 hp) (2) Water Trucks (189 hp) (2) Generator Sets	57 59 72 50 74	95
2	Trenching and Road Construction	(5) Excavators (168 hp) (2) Graders (174 hp) (2) Water Trucks (189 hp) (1) Trencher (63 hp) (2) Rubber Tired Loaders (164 hp) (2) Generator Sets	57 57 50 75 54 74	97

Table 6. Project Construction Noise Levels by Phase

Phase No.	Construction Phase	Construction Equipment	Usage Factor %	Maximum (L_{max}) Equipment Noise Level at 50 feet
3	Equipment Installation	(1) Crane (399 hp) (1) Concrete Batch Plant (5) Forklifts (145 hp) (8) Pile drivers (15) Pickup Trucks/ATVs (2) Water Trucks (189 hp) (2) Generator Sets	43 15 30 20 40 50 74	110
4	Commissioning	(5) Pickup Trucks/ATVs	40	62

hp = horsepower; ATV = all-terrain vehicle

Table 7 shows the projected noise levels from Project construction per phase at nearby NSRs. Periodically, sound levels may be higher or lower than those presented in Table 7; however, the overall sound levels should generally be lower due to excess attenuation and the trend toward quieter construction equipment in the intervening decades since the EPA data were developed.

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. Noise levels resulting from the construction activities would vary significantly depending on several factors such as the type and age of equipment, specific equipment manufacturer and model, the operations being performed, and the overall condition of the equipment and exhaust system mufflers.

Project construction would generally occur during the day, Monday through Friday. Furthermore, all reasonable efforts would be made to minimize the impact of noise resulting from construction activities including implementation of standard noise reduction measures. Due to the infrequent nature of loud construction activities at the site, the limited hours of construction, and the implementation of noise mitigation measures, the temporary increase in noise due to construction is considered to be a less than significant impact.

Table 7. Project Construction Noise Levels by Phase, dBA L_{eq}

NSR ID	Distance (feet)	Phase 1	Phase 2	Phase 3	Phase 4
NSR-1	5,000	52	54	63	18
NSR-2	3,700	55	56	66	21
NSR-3	3,300	56	57	67	22
NSR-4	2,000	60	62	71	26
NSR-5	300	77	78	88	42

Table 7. Project Construction Noise Levels by Phase, dBA L_{eq}

NSR ID	Distance (feet)	Phase 1	Phase 2	Phase 3	Phase 4
NSR-6	2,000	60	62	71	26
NSR-7	1,700	62	63	73	27
NSR-8	2,000	60	62	71	26
NSR-9	2,200	60	61	70	25
NSR-10	1,400	63	65	74	29
NSR-11	50	92	94	103	58
NSR-12	550	72	73	82	37
NSR-13	50	92	94	103	58
NSR-14	500	72	74	83	38
NSR-15	2,250	59	61	70	25

3.3 Construction Noise Mitigation

Since construction equipment operates intermittently, and the types of machines in use at the Project site change with the stage of construction, noise emitted during construction would be mobile and highly variable, making it challenging to control. The construction management protocols would include the following noise mitigation measures to minimize noise impacts:

- Maintain all construction tools and equipment in good operating order according to manufacturers' specifications.
- Limit use of major excavating and earth-moving machinery to daytime hours.
- To the extent practicable, 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, would be required to occur continuously until completion.
- Equip any internal combustion engine used for any purpose on the job or 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.

4.0 Operational Noise

This section describes the model used for the assessment, input assumptions used to calculate noise levels due to the Project's normal operation, a conceptual noise mitigation strategy, and the results of the noise impact analysis.

4.1 Noise Prediction Model

The CadnaA (Computer-Aided Noise Abatement) computer noise model was used to calculate sound pressure levels from the operation of the Project equipment in the vicinity of the Project site. An industry standard CadnaA was developed by DataKustik GmbH (2020) to provide an estimate of sound levels at distances from sources of known emission. It is used by acousticians and acoustic engineers due to the capability to accurately describe noise emission and propagation from complex facilities consisting of various equipment types like the Project, and in most cases, yields conservative results of operational noise levels in the surrounding community.

The outdoor noise propagation model is based on the International Organization for Standardization (ISO) 9613, Part 2: "Attenuation of Sound during Propagation Outdoors" (1996). The method described in this standard calculates sound attenuation under weather conditions that are favorable for sound propagation, such as for downwind propagation or atmospheric inversion, conditions which are typically considered worst-case. The calculation of sound propagation from source to receiver locations consists of full octave band sound frequency algorithms, which incorporate the following physical effects:

- Geometric spreading wave divergence;
- Reflection from surfaces;
- Atmospheric absorption at 10 degrees Celsius and 70 percent relative humidity;
- Screening by topography and obstacles;
- The effects of terrain features including relative elevations of noise sources;
- Sound power levels from stationary and mobile sources;
- The locations of noise-sensitive land use types such as residential land uses;
- Intervening objects including buildings and barrier walls, to the extent included in the design;
- Ground effects due to areas of pavement and unpaved ground;
- Sound power at multiple frequencies;
- Source directivity factors;

- Multiple noise sources and source type (point, area, and/or line); and
- Averaging predicted sound levels over a given time.

CadnaA allows for three basic types of sound sources to be introduced into the model: point, line, and area sources. Each noise-radiating element was modeled based on its noise emission pattern. Larger dimensional sources such as the transformers and inverters were modeled as area sources.

Off-site topography was obtained using the publicly available U.S. Geological Survey digital elevation data. A default ground attenuation factor of 0.5 was assumed for off-site sound propagation over acoustically "mixed" ground. A conservative ground attenuation factor of 0.25 for a reflective surface was assumed onsite.

The output from CadnaA includes tabular sound level results at selected receiver locations and colored noise contour maps (isopleths) that show areas of equal and similar sound levels.

4.2 Input to the Noise Prediction Model

The Project's general arrangement was reviewed and directly imported into the acoustic model so that on-site equipment could be easily identified, buildings and structures could be added, and sound emission data could be assigned to sources as appropriate. The primary noise sources during operations are the inverters, their integrated step-up transformers, BESS units, and substation transformers. Electronic noise from inverters can be audible but is often reduced by a combination of shielding, noise cancellation, filtering, and noise suppression. The Project layout includes 159 step-up transformers distributed throughout the solar array areas. BESS units will either be positioned in groups of four at each step-up transformer location, or will be located in an approximately 16-acre area southwest of the substation. Both options for battery storage and their associated sound emissions were considered in the acoustic analysis.

Substations have switching, protection, and control equipment, as well as a main power transformer, which generate the sound generally described as a low humming. There are three chief noise sources associated with a transformer: core noise, load noise, and noise generated by the operation of the cooling equipment. The core is the principal noise source and does not vary significantly with electrical load. The load noise is primarily caused by the load current in the transformer's conducting coils (or windings), and consequently, the main frequency of this sound is twice the supply frequency: 120 Hz for 60 Hz transformers. The cooling equipment (fans and pumps) may also be an important noise component, depending on fan design. During air-forced cooling method, cooling fan noise is produced in addition to the core noise. The resulting audible sound is a combination of hum and the broadband fan noise. Breaker noise is a sound event of very short duration, expected to occur only a few times throughout the year. Just as horsepower ratings designate the power capacity of an electric motor, a transformer's megavolt amperes rating indicates its maximum power output capacity.

Reference sound power levels input to CadnaA were provided by equipment manufacturers, based on information contained in reference documents or developed using empirical methods. The source levels used in the predictive modeling are based on estimated sound power levels that are generally deemed to be conservative. The projected operational noise levels are based on

Applicant-supplied sound power level data for the major sources of equipment. Table 8 summarizes the equipment sound power level data used as inputs to the acoustic modeling analysis. For the purpose of the analysis, it was assumed that all equipment would operate consistently during both daytime and nighttime periods.

Table 8. Modeled Octave Band Sound Power Level for Major Pieces of Project Equipment

Sound Source	Sound Power Level (L_W) by Octave Band Frequency dBL									Broadband Level
	31.5	63	125	250	500	1k	2k	4k	8k	dBA
Step-up Transformer	77	77	73	73	73	67	62	56	49	73
Inverter	71	79	86	87	86	83	78	71	64	92
BESS	85	93	100	101	100	97	92	85	78	106
Substation Transformer	100	104	99	100	99	93	89	83	75	100

In addition to the above, the modeling analysis accounts for the short (0.25 mile) 500-kilovolt (kV) transmission line, which extends from the Project substation to the point of interconnection at the existing the Bonneville Power Administration (BPA) transmission system at the BPA Wautoma Substation. Transmission lines generate sound referred to as corona. The level of corona noise generated by a transmission line is highly dependent on weather conditions (i.e., foul weather), electrical gradient, altitude, and condition of the conductor wires. The corona effect is initiated where the conductor's electric field is concentrated by imperfections in the conductor surface such as nicks or scratches, or by substances on the lines such as water droplets, dirt or dust, and bird droppings. Corona activity increases with increasing altitude, and with increasing voltage in the line, but is generally not affected by system loading. Details pertaining the transmission line have not been finalized, but the audible sound level associated with transmission line operation under foul weather conditions was conservatively estimated at 69 dBA at a distance of 50 feet from the transmission line.

4.3 Noise Prediction Model Results

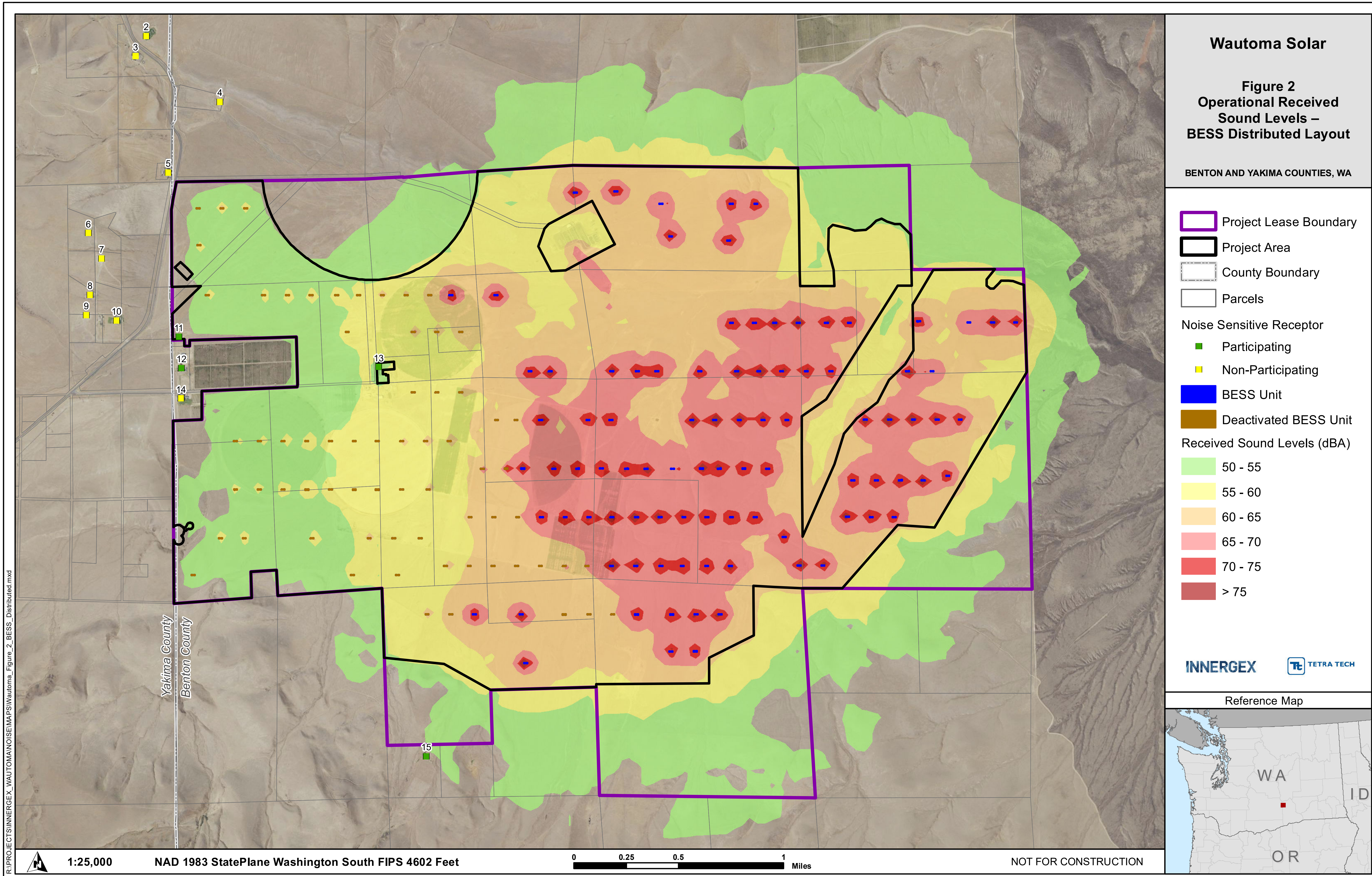
Broadband (dBA) sound pressure levels were calculated for expected normal Project operation assuming that all components identified previously are operating continuously and concurrently at the representative manufacturer-rated sound power level. It is expected that all sound-producing equipment would operate during both daytime and nighttime periods. After calculation, the sound energy was then summed to determine the equivalent continuous A-weighted downwind sound pressure level at a point of reception. Sound contour plots displaying broadband (dBA) sound levels presented as color-coded isopleths are provided in Figure 2 for operations with the BESS units distributed with the step-up transformers during foul weather conditions, and Figure 3 for operations with the BESS units located in an approximately 16-acre area, southwest of the substation, during foul weather conditions. The sound 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 of the Project site. The contour lines shown are analogous to elevation contours on a topographic map (i.e., the sound contours are continuous lines of equal noise level around some source, or sources, of sound).

Table 9 shows the projected exterior sound levels resulting from full, normal operation of the Project during both daytime and nighttime hours, at all nearby NSRs. The Project is located on Class C land while the adjacent properties consist of a mix of both Class C land with Class A residential structures, which has a daytime limit of 60 dBA and nighttime limit of 50 dBA, and Class C land, which has a daytime and nighttime limit of 70 dBA.

The Project will comply with the 50 dBA nighttime limit at all non-participating NSRs implementing either BESS design configuration. In addition, the Project is predicted to comply with all the applicable WAC regulatory limits at the Project Lease Boundary implementing either BESS design configuration.

Table 9. Acoustic Modeling Results Summary

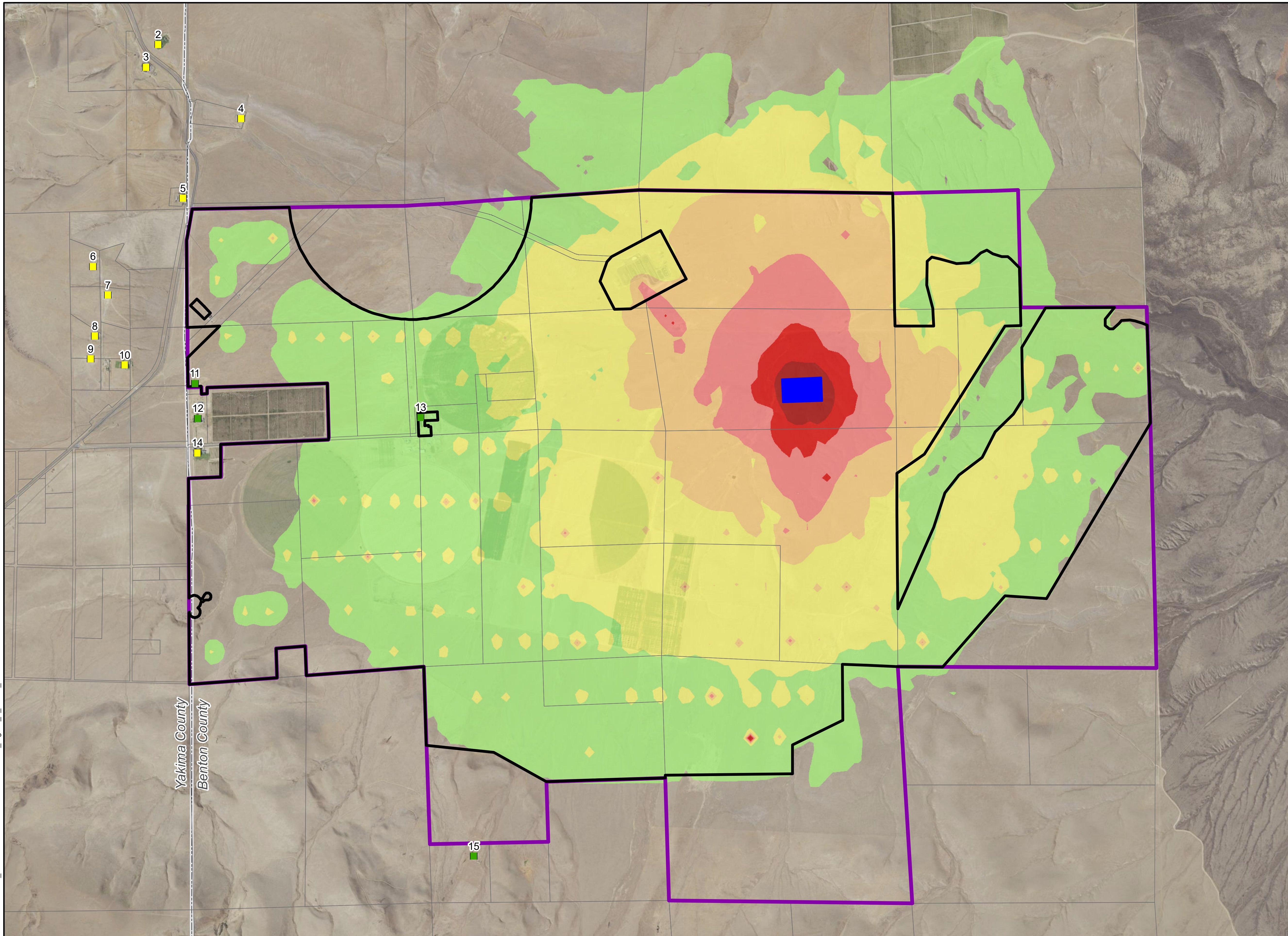
NSR ID	Participation Status	UTM Coordinates (meters) NAD83 UTM Zone 10		Operational Sound Levels (dBA)	
		Easting	Northing	BESS Distributed Layout	BESS Consolidated Layout
NSR-1	Non-participant	279573	5157308	39	38
NSR-2	Non-participant	279379	5156902	41	40
NSR-3	Non-participant	279290	5156752	43	42
NSR-4	Non-participant	279923	5156372	45	44
NSR-5	Non-participant	279500	5155848	45	44
NSR-6	Non-participant	278867	5155410	44	43
NSR-7	Non-participant	278962	5155211	45	44
NSR-8	Non-participant	278861	5154935	45	43
NSR-9	Non-participant	278825	5154780	45	43
NSR-10	Non-participant	279055	5154729	45	44
NSR-11	Participant	279528	5154582	49	48
NSR-12	Participant	279536	5154343	47	45
NSR-13	Participant	281051	5154282	53	50
NSR-14	Non-participant	279522	5154109	47	45
NSR-15	Participant	281283	5151280	50	46


Wautoma Solar
Figure 2
Operational Received
Sound Levels –
BESS Distributed Layout
BENTON AND YAKIMA COUNTIES, WA
Project Lease Boundary
Project Area
County Boundary
Parcels
Noise Sensitive Receptor
Participating
Non-Participating
BESS Unit
Deactivated BESS Unit
Received Sound Levels (dBA)
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
INNERGEX
TETRA TECH
Reference Map
WA
ID
OR
Yakima County
Benton County
2
3
4
5
6
7
8
9
10
11
12
13
14
15
1:25,000
NAD 1983 StatePlane Washington South FIPS 4602 Feet
0
0.25
0.5
1
Miles
NOT FOR CONSTRUCTION
R:\PROJECTS\INNERGEX_WAUTOMA\NOISE\MAPS\Wautoma_Figure_2_BESS_Distributed.mxd

Wautoma Solar

Figure 3
Operational Received Sound Levels – BESS Consolidated Layout

BENTON AND YAKIMA COUNTIES, WA



- Project Lease Boundary
- Project Area
- County Boundary
- Parcels

Noise Sensitive Receptor

- Participating
- Non-Participating
- BESS Unit

Received Sound Levels (dBA)

- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70
- 70 - 75
- > 75

INNERGEX TETRA TECH

Reference Map

1:25,000 NAD 1983 StatePlane Washington South FIPS 4602 Feet

0 0.25 0.5 1 Miles

NOT FOR CONSTRUCTION

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5.0 Conclusion

Tetra Tech completed a detailed acoustic assessment of the Wautoma Solar Energy Project, proposed in Benton County, Washington. The assessment included an evaluation of potential Project sound level impacts during construction and operation phases.

The construction noise assessment indicated that construction noise would be periodically audible at off-site locations; however, that noise would be temporary and minimized to the extent practicable through implementation of best management practices and noise mitigation measures as identified in Section 3.3. Traffic noise generated during construction onsite and offsite would also add to overall sound levels, but would be intermittent and short-term.

Operational sound levels were modeled and evaluated at nearby NSRs. Anticipated Project sound sources consist of the collector substation main power transformers, integrated inverter/ transformers, BESS units, and the 500-kV transmission line. Incorporating a number of conservative assumptions, acoustic modeling results indicate that the Project will comply with the 50-dBA nighttime limit at all non-participating NSRs implementing either BESS design configuration. In addition, the Project is predicted to comply with all the applicable WAC regulatory limits at the Project Lease Boundary implementing either BESS design configuration. Sound generated from existing sound sources in the Project Area, such as the operation of agricultural equipment, would be expected to be relatively higher than Project operations. Overall, sound emissions associated with the Project are expected to remain at a low level, consistent with other solar energy facilities of similar size and design.

6.0 References

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