Avellana Solar and Broadband Project
February 2023

U.S. Dept. of Agriculture

Rural Utilities Service

Environmental Assessment

APPENDIX G

ACOUSTICAL ANALYSIS

U.S. Department of Agriculture
Rural Utilities Service (RUS)

CHRISTOPHER JEAN & ASSOCIATES, INC.
ACOUSTICAL CONSULTING SERVICES

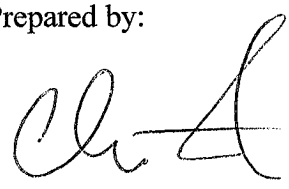
March 8, 2021

ACOUSTICAL ANALYSIS

AVELLANA PROJECT

COUNTY OF SAN BERNARDINO

Prepared by:



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SUMMARY

This analysis has been completed to determine the exterior and interior noise exposure and the necessary mitigation measures for the proposed AVELLANA project located on Bear Valley Road in the County of San Bernardino. A list of requirements and recommendations is given in the following summary. Details are discussed in the body of the report.

A. EXTERIOR NOISE CONTROL

A sound wall at least seven feet (7') high must be constructed along the north property line from a point 30 feet west of the east side of the proposed market building to the east end of the first coach site east of the market (see Exhibit 4). Alternately, the west end of the seven foot sound wall may turn southward and connect with the northeast corner of the market building. A standard privacy wall six feet (6') high will be adequate along the north property line from the east end of the seven foot wall section and continuing eastward.

B. NOISE CONTROL BARRIER CONSTRUCTION MATERIALS

The required noise control barriers may be constructed using any of the following materials:

(1) Masonry block

(2) Stucco on wood frame

(3) 3/4" plywood

(4) 1/4" tempered glass or 1/2" Lexan

(5) Earthen berm

(6) Any combination of the above materials or any material with a surface weight of

at least 3.5 pounds per square foot.

Each completed noise control barrier must present a solid face from top-to-bottom and end-to-end. Cutouts are not permitted except for drain holes.

C. INTERIOR NOISE CONTROL

The residential buildings shall be constructed, as a minimum, in accordance with the outline of Table 5 found in the body of the report. This will be adequate for all coach units with the following exceptions:

(1) Add STC 28 glazing to all coaches within 200 feet of Bear Valley Road.

The non-residential buildings shall be constructed, as a minimum, in accordance with the outline of Table 7 found in the body of the report. This will be adequate for all non-residential buildings with the following exceptions:

(1) Add STC 26 glazing to the Market and all rooms with any view of Bear Valley Road from the Management Office Building.

D. VENTILATION

This analysis assumed that all windows and doors are kept closed. If the allowable interior noise levels are met by requiring that windows and doors be kept closed, then the design of the structure must also specify a ventilation or air conditioning system to provide a habitable interior environment. The ventilation system must not compromise the dwelling or guest room noise reduction.

E. PROJECT DISCLOSURE

The acoustical code requirements represent minimal acceptable standards. Compliance with the Building Department acoustical criteria does not require, guarantee or even imply that local sound sources will be mitigated to inaudibility. Compliance with an exterior noise limit of 60 dBA CNEL means that exterior noise will remain clearly audible within the mitigated exterior space. Compliance with an interior noise limit of 45 dBA CNEL or 50 dBA Leq(1 hour) means that exterior noise sources will remain audible on the interior of a building.

Do not misrepresent the degree of exterior to interior acoustical isolation as anything more than meeting code during any phase of this project. Never, ever, use any form of the term "Soundproof" to describe any portion of this project.

1.0 INTRODUCTION

This report presents the results of a noise impact and design study of the proposed Avellana project located on Bear Valley Road in the County of San Bernardino. This report includes a discussion of the expected exterior community noise environment and the recommendations for control of noise in the exterior and interior living spaces.

A vicinity map showing the general location of the project site is presented in Exhibit 1 – Site Location Map. An aerial photograph of the existing project site and its surroundings is shown on Exhibit 2. The project site plan is shown on Exhibit 3. The project consists of a mobile home park.

2.0 APPLICABLE NOISE CRITERIA

The County of San Bernardino and the California Green Building Standards (CalGreen) require this project to conform to the requirements of Table 1.

TABLE 1

APPLICABLE NOISE CRITERIA (1)

	RESIDENTIAL	NON-RESIDENTIAL
Exterior	60 dBA CNEL	None
Interior	45 dBA CNEL	50 dBA Leq(1 hour)

(1) Please see Noise Rating Methods (Appendix 1) for an explanation of the commonly applicable acoustical terminology.

3.0 DESIGN NOISE LEVELS

3.1 ROADWAYS

The expected future roadway noise impact was projected using the Federal Highway Administration's Highway Noise Prediction Model (FHWA RD-77-108) together with several roadway and site parameters that determine the projected impact of vehicular traffic noise. These include the roadway cross-section (e.g. number of lanes), the roadway active width, the average daily traffic (ADT), the vehicle travel speed, the percentage of auto and truck traffic, the roadway grade, the angle of view, the site conditions ("hard" or "soft" site), and the percentage of average daily traffic that flows each hour throughout a 24 hour period.

The Bear Valley Road forecast traffic volume was obtained by applying a ten-year traffic projection, at a growth rate of two percent per year, to the existing traffic volume published by SBCTA. The percentage of truck traffic was taken from a standard arterial mix. The same source was used to project the distribution by time of day. The input data is listed in Table 2.

TABLE 2

TRAFFIC INPUT DATA -- BEAR VALLEY ROAD

	% DAY	% EVENING	% NIGHT	% VOLUME
Autos	75.51	12.57	9.34	100.0
Medium Trucks	1.56	0.09	0.19	100.0
Heavy Trucks	0.64	0.02	0.08	100.0

Volume = 10,400 ADT

Speed = 55 MPH (posted)

The State Route 18 forecast traffic volume was obtained from CALTRANS data. CALTRANS data was also used for the percentage of truck traffic and to project the distribution by time of day. The input data is listed in Table 3 on the following page.

TABLE 3

TRAFFIC INPUT DATA -- STATE ROUTE 18

	% DAY	% EVENING	% NIGHT	% VOLUME
Autos	73.00	8.60	18.40	80.5
Medium Trucks	73.00	8.60	18.40	7.0
Heavy Trucks	69.10	6.70	24.20	12.5

Volume = 12,700 ADT

Speed = 55 MPH (posted)

The calculations are contained in Appendix 2. The calculations yield 50 foot design noise levels of 71 dBA CNEL for Bear Valley Road and 78 dBA CNEL for State Route 18. Distance and terrain shielding will reduce State Route 18 noise levels to less than 60 dBA CNEL at the project site.

3.2 RAILROAD

A line of the BNSF railroad passes south of the project site at a distance of 9,400 feet. This distance alone means that railroad noise, though sometimes audible, will not impact the project site.

3.3 AIRCRAFT

There are no concentrated aircraft operations in the vicinity of the project site. Aircraft noise does not impact the site.

4.0 MITIGATION MEASURES

4.1 EXTERIOR

The mitigation of exterior noise would require a sound barrier along the north property line. For purposes of analysis, the barrier height calculations assume that the barrier is located at the top of any slope between the roadway and building pads, and is

only intended to reduce exterior noise to 60 dBA CNEL five feet above ground level. The assumptions for the barrier height calculations are listed in Table 4.

TABLE 4

BARRIER ANALYSIS GENERAL ASSUMPTIONS
FOR RECEIVER AND SOURCE GEOMETRY

RECEIVER ASSUMPTIONS	
HORIZONTAL GEOMETRY	VERTICAL GEOMETRY
Distance behind top-of-roadways barrier: 5' to 10'	Height above pad for ground level receivers: 5'
Distance behind individual patio and balcony barriers: 1' to 3'	Height above pad for second level receivers: 14'

SOURCE ASSUMPTIONS	
HORIZONTAL GEOMETRY *	VERTICAL GEOMETRY
For roadways with grades no greater than 2%, all vehicles were located at the single lane equivalent acoustic center of the full roadway. For roadways with over 2% grade, vehicle count was divided in half and located at the single lane equivalent acoustic center for each side of the roadway.	Automobiles: 0' above center of road grade Medium Trucks: 2.3' above center of road grade Heavy Trucks: 8' above center of road grade

* = Single Lane Equivalent (SLE) location.

The barrier calculations are contained in Appendix 3. These calculations show that a barrier at least seven feet (7') high must be constructed along the north property line from a point 30 feet west of the east side of the proposed market building to the east end of the first coach site east of the market (see Exhibit 4). Alternately, the west end of the seven foot sound wall may turn southward and connect with the northeast corner of the market building. A standard privacy wall six feet (6') high will be adequate along the remainder of the north property line from the east end of the seven foot wall section and continuing eastward. The required noise control barriers may be constructed using any of the following materials:

(1) Masonry block

(2) Stucco on wood frame

(3) 3/4" plywood

(4) 1/4" tempered glass or 1/2" Lexan

(5) Earthen berm

(6) Any combination of the above materials or any material with a surface weight of at least 3.5 pounds per square foot.

Each completed noise control barrier must present a solid face from top-to-bottom. Cutouts and/or openings are not permitted except for drain holes.

4.2 INTERIOR

The City's exposure criteria for new residential construction require that the interior noise environment, attributable to outside noise sources, be limited to 45 dBA CNEL. The CalGreen exposure criteria for new non-residential construction require that the interior noise environment, attributable to outside noise sources, be limited to 50 dBA Leq(1 hour). Analysis and recommendations for control of outdoor-to-indoor noise intrusion are presented in this section.

The exterior-to-interior noise reduction expected for typical mobile homes was based on a detailed analysis of sample rooms and units planned for the development. Calculations of the expected typical noise reduction performance were performed for sample rooms. The analysis was based on the typical spectra expected for the primary sources of community noise impact, the typical octave-band transmission loss for each element in the planned building shell, the relative square footage of each element of the planned building shell, the expected typical interior surface treatment, and the acoustical absorption coefficient for each interior surface treatment. Corrections for the "A" Weighted room absorption factors are also included.

Each component of the mobile home shell (e.g. exterior wall, windows, doors, etc.) provides a different amount of transmission loss for each "A" Weighted octave- band of community noise. With the knowledge of the building shell components and their individual octave band transmission loss values for the noise sources, calculations of the composite building shell transmission loss can be made for each room.

The characteristics of the basic mobile home shell are listed in Table 5 on the following page.

TABLE 5

BASIC MOBILE HOME SHELL CHARACTERISTICS

PANEL	CONSTRUCTION
Exterior Wall	Metal siding, 2" X 4" studs, R-13 fiberglass insulation, paneling
Windows	Double pane
Sliding Glass Door	Double pane
Roof	Corrugated metal over 1/2" plywood, fiberglass insulation, 1/4" drywall, vented
Floor	Carpeted except kitchen and baths

Table 5 construction minimums will provide up to 20 dBA of interior noise reduction with windows and doors closed. This will be adequate for all units exposed to exterior noise levels as high as 60 dBA CNEL. Coach units along the north property line will be exposed to exterior noise levels as high as 68 dBA CNEL which will require interior noise reduction levels as high as 23 dBA. Since Table 5 construction will yield only around 20 dBA, sample room calculations were carried out to determine whether additional mitigation is needed.

The calculations are contained in Appendix 4, and the results are given in Table 6.

TABLE 6

RESIDENTIAL NOISE REDUCTION VALUES

	NOISE REDUCTION VS. GLAZING STC					
ROOM	24	26	28	30	32	34
Bedroom	20	22	24	25	26	27

The results of Table 6 show that Table 5 construction should be adequate for all residential units with the following exceptions:

(1) Add STC 28 glazing to all coaches within 200 feet of Bear Valley Road.

Non-residential structures such as community, management and service buildings must meet an interior noise limit of 50 dBA Leq(1 hour). The potentially impacted non-residential buildings in the project include a Management Office Building and a Market building near the entrance to the park. The characteristics of the basic non-residential building shell are listed in Table 7.

TABLE 7

BASIC NON-RESIDENTIAL BUILDING SHELL CHARACTERISTICS

PANEL	CONSTRUCTION
Exterior Wall	CMU or Stucco over 2" X 4" studs, R-13 fiberglass insulation, 5/8" drywall
Windows/Doors	Double pane or fixed in storefront frame
Roof	Shingles or built-up over 1/2" plywood, fiberglass insulation, 5/8" drywall
Floor	Hard flooring

The non-residential buildings near the park entrance will be exposed to exterior noise levels as high as 68 dBA CNEL which will require interior noise reduction levels as high as 18 dBA. Sample calculations were again carried out to determine whether additional mitigation is needed.

The calculations are contained in Appendix 5, and the results are given in Table 8.

TABLE 8

NON-RESIDENTIAL NOISE REDUCTION VALUES

	NOISE REDUCTION VS. GLAZING STC					
ROOM	24	26	28	30	32	34
Market	16	18	20	21	22	23
Corner Office	16	17	19	20	21	22

The results of Table 8 show that Table 7 construction should be adequate for all non-residential buildings with the following exceptions:

(1) Add STC 26 glazing to the Market and all rooms with any view of Bear Valley Road from the Management Office Building.

4.3 VENTILATION

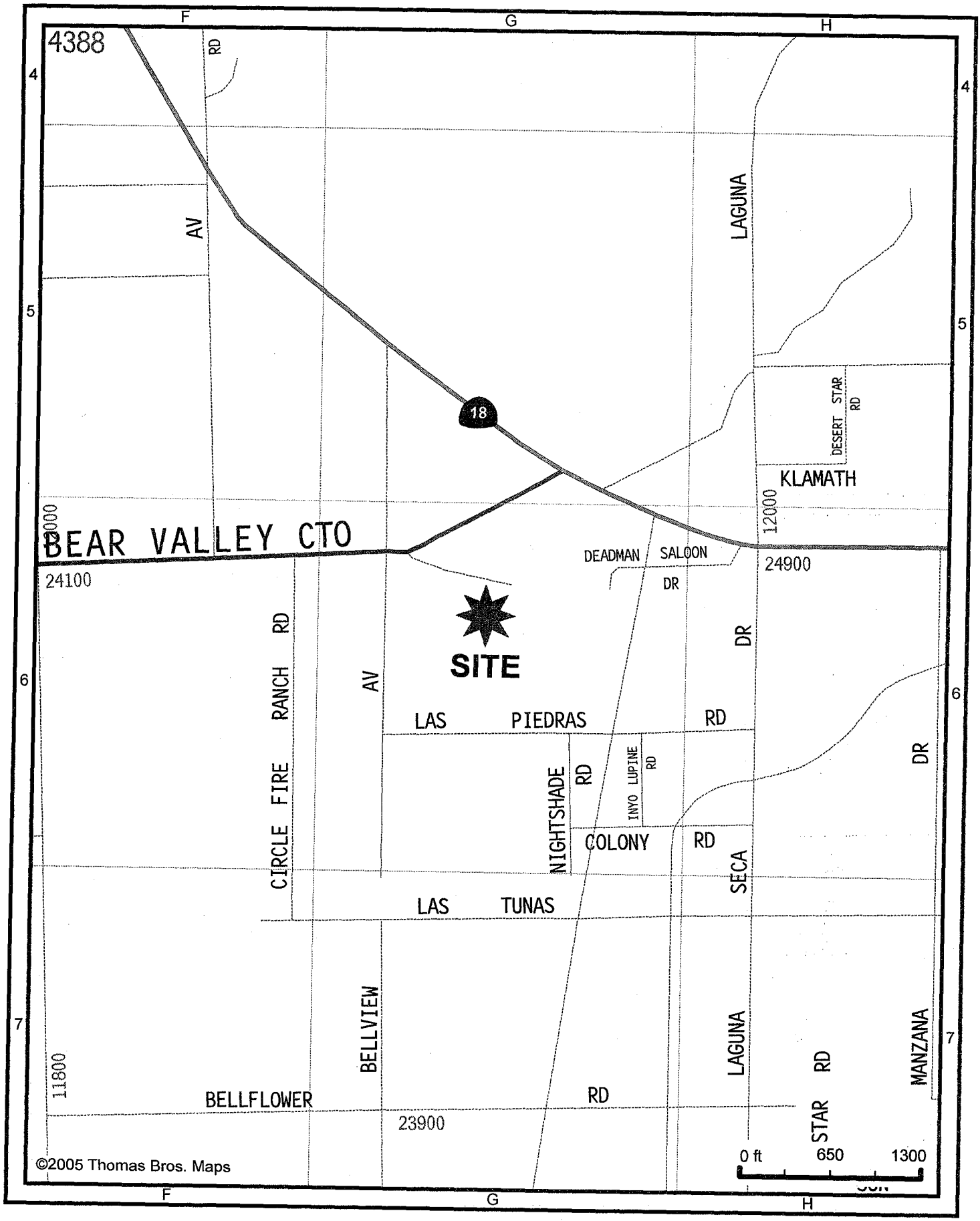
If interior allowable noise levels are met by requiring that windows be unopenable or remain closed, then the design of the structure must also specify a ventilation or air conditioning system to provide a habitable interior environment. The ventilation system must not compromise the dwelling unit or guest room noise reduction.

4.5 PROJECT DISCLOSURE

The acoustical code requirements are minimal acceptable standards. Compliance with Building Department acoustical criteria does not require, guarantee or even imply that local sound sources will be mitigated to inaudibility. Compliance with an exterior noise limit of 60 dBA CNEL means that exterior noise will remain clearly audible within the mitigated exterior space. Compliance with an interior noise limit of 45 dBA CNEL or 50 dBA Leq(1 hour) means that exterior noise sources will remain audible on the interior of a structure.

Do not misrepresent the degree of exterior to interior acoustical isolation as anything more than meeting code during any phase of this project. Never, ever, use any form of the term "Soundproof" to describe any portion of this project.

EXHIBIT 1



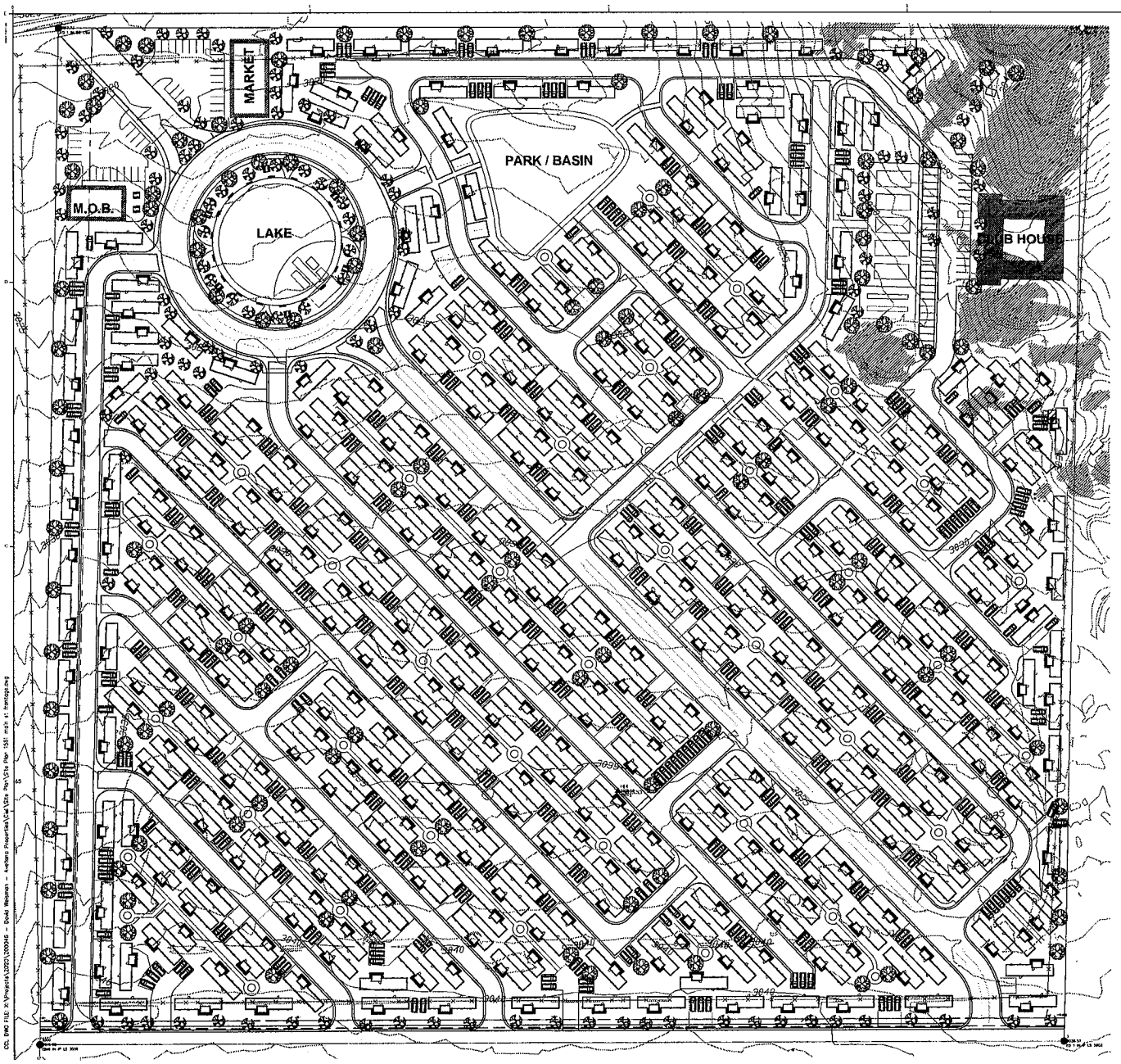
SITE: 22999 Bear Valley Rd, Apple Valley,CA 92308, 4388 -

EXHIBIT 2
AERIAL PHOTO

Google Maps

Imagery ©2021 County of San Bernardino, Maxar Technologies, USDA Farm Service Agency, Map data ©2021 200 ft

EXHIBIT 3
SITE PLAN



PRELIMIN
COUNTY O

GRAPHIC SCALE

DEVELOPER
AVELLANA PROPERTIES
6101 OWENSMOUTH AVE.
WOODLAND HILLS, CA 91

AREA
43.2-ACRES
4.72 -ACRES

ZONING
EX: RL-5
PROPOSED: RM

LAND USE
EX: RESIDENTIAL
PROPOSED: RESIDENTIA

DENSITY
NET DENSITY: 10 DWELLI

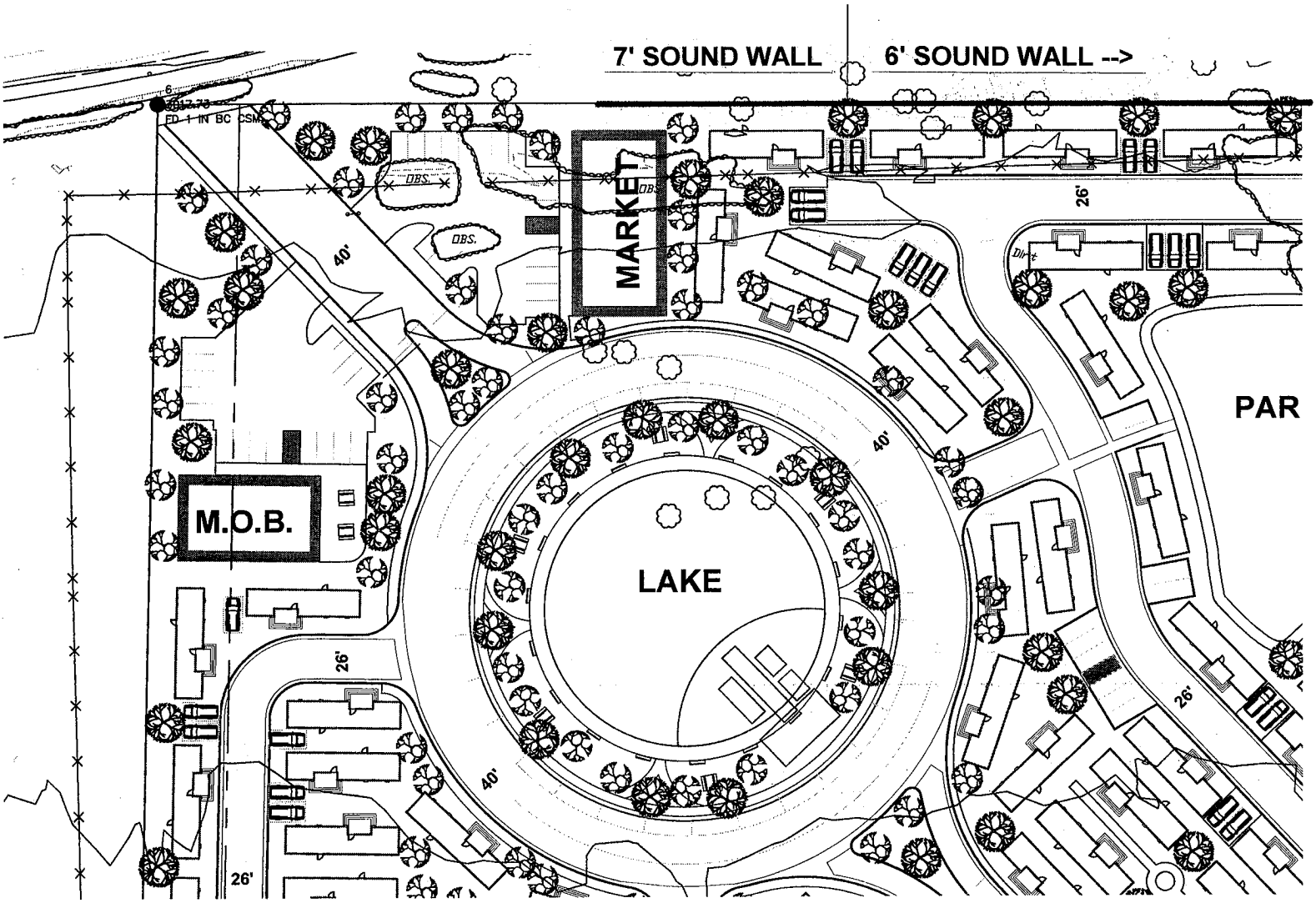
LEGAL DESCRIPTI
PARCEL 1 - APN: 0436-015

THE NORTHWEST QUART
T4N, R2W. SBBM

PARCEL 2 - APN: 0436-015
PARCEL 2 OF PM 12811 AS
MAPS.

402

EXHIBIT 4
SOUND WALL LOCATIONS



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APPENDIX 1

NOISE RATING METHODOLOGY

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NOISE RATING METHODOLOGY

The A-weighted decibel (dBA) or "A" scale on a sound level meter is typically used for environmental noise measurements because the weighting characteristics of the "A" scale approximate the subjective response of the human ear to a broad frequency band noise source by discriminating against the very low and very high frequencies of the audible sound spectrum.

Since community noise is seldom constant, varying from moment to moment and throughout the day, the "A" weighted noise level needs to be further described to provide meaningful data. The Environmental Protection Agency, the Federal Department of Transportation, several foreign countries and many private consultants are now using three time-exceeded percentile figures to describe noise, which are:

(1) L_{90} is the noise level that is exceeded 90 percent of any sample measurement period (such as 24 hours) and is often used to describe the background or ambient noise level.

(2) L_{50} is the noise level that is exceeded 50 percent of any sample measurement period. It is generally considered to represent the median noise level.

(3) L_{10} is the noise level that is exceeded 10 percent of any sample measurement period. It is a good descriptor of fluctuating noise sources such as vehicular traffic. It indicates the near-maximum noise levels that occur for groups of single noise events. Being related to the subjective annoyance to community noise, the L_{10} is a good design tool in the planning of acoustical barriers.

More recent noise assessment methods are based on the equivalent energy concept where Leq(x) represents the average energy content of a fluctuating noise source over a sample measurement period. The subscript (x) represents the period over which the energy is computed and/or measured. Current practice references the time quantity to either one (1) hour, eight (8) hours, or twenty-four (24) hours. When referenced to one (1) hour, Leq is also called the HNL (Hourly Noise Level).

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Since Leq is the summation of the functional products of noise level and duration, many different combinations of noise levels, duration times and time histories can produce similar Leq values. Thus a value of Leq(24) equals 50 means only that the average noise level is 50 dB. During that 24-hour period, there can be times when the noise level is higher than 50 dB and times when it is lower than 50 dB.

If the period of the measurement is only a single event, the energy content is not averaged. The energy expression for a single event is simply the sum of the functional product of the noise level and duration time of the event. This term is called the Le or SENEL (Single Event Noise Exposure Level). The summation of Le values averaged over one hour is Leq(1), over eight hours is Leq(8), over 24 hours is Leq(24), etc.

Leq is further refined into Ldn (Level Day-Night) and CNEL (Community Noise Equivalent Level), where noise that occurs during certain hours of the day are weighted (or penalized) in an attempt to compensate for the general perception that such noise is more annoying during these time periods (typically evening and nighttime hours).

(1) Ldn is the sound level in dBA that corresponds to the average energy content of the noise being measured over a 24-hour period but includes a ten (10) dBA weighting penalty for noise that occurs during the nighttime hours between 10:00 PM and 7:00 AM. The Ldn is a noise rating method recommended by the Environmental Protection Agency because it takes into account those subjectively more annoying noise events that occur during normal sleeping hours.

(2) CNEL is the sound level in dBA that corresponds to the average energy content of the noise being measured over a 24-hour period but includes a five (5) dBA penalty for noise that occurs during the evening hours between 7:00 PM and 10:00 PM, and a ten (10) dBA penalty for noise that occurs during the nighttime hours between 10:00 PM and 7:00 AM. For typical highway vehicular traffic situations, computer analysis has shown that the Ldn and CNEL values correlate within 0.5 dBA.

The percentile figures L_{10}, L_{50} and L_{90} can be directly scaled from a graphical recording of the measured noise sample over a particular time period. These figures can also be measured directly using modern automatic noise measuring equipment. Measurement of the parameters Le, Leq, Ldn and CNEL requires even more sophisticated and correspondingly expensive noise measuring equipment. As a result, engineers have devised ways of estimating Leq (and hence, Ldn) using standard instrumentation and methods.

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APPENDIX 2

FUTURE TRAFFIC NOISE CALCULATIONS

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FHWA RD-77-108 HIGHWAY NOISE PREDICTION MODEL

PROJECT NAME :AVELLANA
SITE LOCATION :SBD COUNTY
DESCRIPTION :BEAR VALLEY ROAD
SITE TYPE :SOFT

INPUT DATA	AUTO	MEDIUM TRUCK	HEAVY TRUCK
SPEED	55	55	55
% DAY	75.51	1.56	.64
% EVENING	12.57	0.09	0.02
% NIGHT	9.34	.19	.08
% VOLUME	100	100	100

VOLUME 10400

----AVERAGE HOURLY NOISE LEVELS AT 50 FEET----

	DAY	EVENING	NIGHT	24 HOUR	CNEL
AUTO	68.30	66.53	60.47	66.39	69.66
MEDIUM TRK.	61.31	54.94	53.41	59.01	62.08
HEAVY TRK.	61.29	52.26	53.51	58.91	61.98
TOTAL	69.76	66.97	61.93	67.73	70.95

NOISE LEVEL AT SPECIFIED DISTANCES

DISTANCE	CNEL
50	70.95
75	68.30
100	66.43
125	64.98
150	63.79
175	62.79
200	61.92
225	61.15
250	60.46
275	59.84
300	59.27
325	58.75
350	58.27
375	57.82
400	57.40
450	56.63
500	55.95
550	55.33
600	54.76
650	54.24
700	53.75

FHWA RD-77-108 HIGHWAY NOISE PREDICTION MODEL

PROJECT NAME :AVELLANA
SITE LOCATION :SBD COUNTY
DESCRIPTION :SR 18
SITE TYPE :SOFT

INPUT DATA	AUTO	MEDIUM TRUCK	HEAVY TRUCK
SPEED	55	55	55
% DAY	73	73	69.1
% EVENING	8.60	8.60	24.20
% NIGHT	18.4	18.4	12.5
% VOLUME	80.5	7	12.5
VOLUME	12700		

	----AVERAGE HOURLY NOISE LEVELS AT 50 FEET----				
	DAY	EVENING	NIGHT	24 HOUR	CNEL
AUTO	68.08	64.81	63.34	66.43	70.95
MEDIUM TRK.	67.33	64.06	62.59	65.68	70.20
HEAVY TRK.	73.46	74.92	67.28	72.30	76.31
TOTAL	75.31	75.64	69.70	73.99	78.18

NOISE LEVEL AT SPECIFIED DISTANCES

DISTANCE	CNEL
50	78.18
75	75.53
100	73.66
125	72.21
150	71.02
175	70.01
200	69.14
225	68.38
250	67.69
275	67.07
300	66.50
325	65.98
350	65.50
375	65.05
400	64.63
450	63.86
500	63.18
550	62.55
600	61.99
650	61.47
700	60.98

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APPENDIX 3

SOUND BARRIER SHIELDING CALCULATIONS

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BARRIER NOISE REDUCTION ANALYSIS,WALL HEIGHT VARIABLE

REFERENCE VEHICLE LEVELS AT 50 FEET

AUTO.....= 69.66001
M.TRUCK.....= 62.08
H.TRUCK.....= 61.98

PROJECT.....AVELLANA
DESCRIPTION..NORTH PROPERTY LINE SOUND WALL
SOURCE ELEVATION..... 0
RECEIVER ELEVATION..... 0
BARRIER ELEVATION..... 0
RECEIVER HEIGHT..... 5
DISTANCE TO SOURCE..... 100
DISTANCE TO RECEIVER... 10
AUTO NOISE LEVEL..... 66.23578
M.TRK NOISE LEVEL..... 58.65578
H.TRK NOISE LEVEL..... 58.55577
SOURCE NOISE LEVEL..... 67.52

ANGULAR CORRECTION(DB) - 0

WALL HEIGHT	ANL	MTNL	HTNL	TNL	TIL
0.00	66.24	58.66	58.56	67.52	0.00
FN	0.0000	0.0000	0.0000		
1.00	66.24	58.66	58.56	67.52	0.00
FN	0.0000	0.0000	0.0000		
2.00	66.24	58.66	58.56	67.52	0.00
FN	0.0000	0.0000	0.0000		
3.00	66.24	58.66	58.56	67.52	0.00
FN	0.0000	0.0000	0.0000		
4.00	66.24	58.66	58.56	67.52	0.00
FN	0.0000	0.0000	0.0000		
5.00	61.11	53.61	58.56	63.50	4.03
FN	0.0108	0.0040	0.0000		
6.00	60.10	52.69	53.22	61.52	6.00
FN	0.1144	0.0887	0.0288		
7.00	59.02	51.68	52.20	60.46	7.06
FN	0.3262	0.2815	0.1617		

8.00	57.58	50.26	50.98	59.05	8.47
FN	0.6420	0.5785	0.3988		
9.00	56.15	48.82	49.54	57.62	9.90
FN	1.0555	0.9732	0.7336		
10.00	54.87	47.52	48.17	56.33	11.20
FN	1.5589	1.4578	1.1584		

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APPENDIX 4

RESIDENTIAL INTERIOR NOISE REDUCTION CALCULATIONS

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WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME MOBILE HOME BEDROOM + STC = 24

FLOOR AREA 100

SURFACES	TL	@	AREA	T*S
EXT.WALL 1	40		75	0.00750
EXT.WALL 2	43		100	0.00501
EXT.WALL 3	50		0	0.00000
INT.WALL			160	
WINDOW 1	22	.05	25	0.15774
WINDOW 2	25	.05	0	0.00000
WINDOW 3	32	.05	0	0.00000
SGD	22	.05	0	0.00000
DOORS	0	.04	0	0.00000
ROOF	40	.04	100	0.01000
FLOOR		.6	100	
ET*S				0.18025
-10LOG(ET*S)				7.4
10LOGA				18.8
NOISE REDUCTION				20.2

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME MOBILE HOME BEDROOM + STC = 26

FLOOR AREA 100

SURFACES	TL	@	AREA	T*S
EXT.WALL 1	40		75	0.00750
EXT.WALL 2	43		100	0.00501
EXT.WALL 3	50		0	0.00000
INT.WALL			160	
WINDOW 1	24	.05	25	0.09953
WINDOW 2	27	.05	0	0.00000
WINDOW 3	34	.05	0	0.00000
SGD	24	.05	0	0.00000
DOORS	0	.04	0	0.00000
ROOF	40	.04	100	0.01000
FLOOR		.6	100	

ET*S	0.12204
-10LOG(ET*S)	9.1
10LOGA	18.8
NOISE REDUCTION	21.9

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME MOBILE HOME BEDROOM + STC = 28

FLOOR AREA 100

SURFACES	TL	@	AREA	T*S
EXT.WALL 1	40		75	0.00750
EXT.WALL 2	43		100	0.00501
EXT.WALL 3	50		0	0.00000
INT.WALL			160	
WINDOW 1	26	.05	25	0.06280
WINDOW 2	29	.05	0	0.00000
WINDOW 3	36	.05	0	0.00000
SGD	26	.05	0	0.00000
DOORS	0	.04	0	0.00000
ROOF	40	.04	100	0.01000
FLOOR		.6	100	
ET*S				0.08531
-10LOG(ET*S)				10.7
10LOGA				18.8
NOISE REDUCTION				23.5

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME MOBILE HOME BEDROOM + STC = 30

FLOOR AREA 100

SURFACES	TL	@	AREA	T*S
EXT.WALL 1	40		75	0.00750
EXT.WALL 2	43		100	0.00501
EXT.WALL 3	50		0	0.00000
INT.WALL			160	
WINDOW 1	28	.05	25	0.03962
WINDOW 2	31	.05	0	0.00000
WINDOW 3	38	.05	0	0.00000
SGD	28	.05	0	0.00000
DOORS	0	.04	0	0.00000
ROOF	40	.04	100	0.01000
FLOOR		.6	100	

ET*S	0.06213
-10LOG(ET*S)	12.1
10LOGA	18.8
NOISE REDUCTION	24.9

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME MOBILE HOME BEDROOM + STC = 32

FLOOR AREA 100

SURFACES	TL	@	AREA	T*S
EXT.WALL 1	40		75	0.00750
EXT.WALL 2	43		100	0.00501
EXT.WALL 3	50		0	0.00000
INT.WALL			160	
WINDOW 1	30	.05	25	0.02500
WINDOW 2	33	.05	0	0.00000
WINDOW 3	40	.05	0	0.00000
SGD	30	.05	0	0.00000
DOORS	0	.04	0	0.00000
ROOF	40	.04	100	0.01000
FLOOR		.6	100	
ET*S				0.04751
-10LOG(ET*S)				13.2
10LOGA				18.8
NOISE REDUCTION				26.0

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME MOBILE HOME BEDROOM + STC = 34

FLOOR AREA 100

SURFACES	TL	@	AREA	T*S
EXT.WALL 1	40		75	0.00750
EXT.WALL 2	43		100	0.00501
EXT.WALL 3	50		0	0.00000
INT.WALL			160	
WINDOW 1	32	.05	25	0.01577
WINDOW 2	35	.05	0	0.00000
WINDOW 3	42	.05	0	0.00000
SGD	32	.05	0	0.00000
DOORS	0	.04	0	0.00000
ROOF	40	.04	100	0.01000
FLOOR		.6	100	

ET*S	0.03829
-10LOG(ET*S)	14.2
10LOGA	18.8
NOISE REDUCTION	27.0

CHRISTOPHER JEAN & ASSOCIATES, INC.
ACOUSTICAL CONSULTING SERVICES

APPENDIX 5

NON-RESIDENTIAL INTERIOR NOISE REDUCTION CALCULATIONS

P. O. BOX 2325 • FULLERTON, CALIFORNIA • 92837
PHONE: 714-805-0115

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME MARKET + STC = 24

FLOOR AREA 3150

SURFACES	TL	@	AREA	T*S
EXT.WALL 1	40		504	0.05040
EXT.WALL 2	43		1050	0.05262
EXT.WALL 3	50		0	0.00000
INT.WALL			504	
WINDOW 1	22	.05	0	0.00000
WINDOW 2	25	.05	750	2.37171
WINDOW 3	32	.05	0	0.00000
SGD	22	.05	0	0.00000
DOORS	0	.04	0	0.00000
ROOF	40	.04	3150	0.31500
FLOOR		9.999999E-02	3150	
ET*S				2.78973
-10LOG(ET*S)				-4.5
10LOGA				26.8
NOISE REDUCTION				16.4

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME MARKET + STC = 26

FLOOR AREA 3150

SURFACES	TL	@	AREA	T*S
EXT.WALL 1	40		504	0.05040
EXT.WALL 2	43		1050	0.05262
EXT.WALL 3	50		0	0.00000
INT.WALL			504	
WINDOW 1	24	.05	0	0.00000
WINDOW 2	27	.05	750	1.49645
WINDOW 3	34	.05	0	0.00000
SGD	24	.05	0	0.00000
DOORS	0	.04	0	0.00000
ROOF	40	.04	3150	0.31500
FLOOR		9.999999E-02	3150	
ET*S				1.91447
-10LOG(ET*S)				-2.8
10LOGA				26.8
NOISE REDUCTION				18.0

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME MARKET + STC = 28

FLOOR AREA 3150

SURFACES	TL	@	AREA	T*S
EXT.WALL 1	40		504	0.05040
EXT.WALL 2	43		1050	0.05262
EXT.WALL 3	50		0	0.00000
INT.WALL			504	
WINDOW 1	26	.05	0	0.00000
WINDOW 2	29	.05	750	0.94419
WINDOW 3	36	.05	0	0.00000
SGD	26	.05	0	0.00000
DOORS	0	.04	0	0.00000
ROOF	40	.04	3150	0.31500
FLOOR		9.999999E-02	3150	

ET*S	1.36222
-10LOG(ET*S)	-1.3
10LOGA	26.8
NOISE REDUCTION	19.5

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME MARKET + STC = 30

FLOOR AREA 3150

SURFACES	TL	@	AREA	T*S
EXT.WALL 1	40		504	0.05040
EXT.WALL 2	43		1050	0.05262
EXT.WALL 3	50		0	0.00000
INT.WALL			504	
WINDOW 1	28	.05	0	0.00000
WINDOW 2	31	.05	750	0.59575
WINDOW 3	38	.05	0	0.00000
SGD	28	.05	0	0.00000
DOORS	0	.04	0	0.00000
ROOF	40	.04	3150	0.31500
FLOOR		9.999999E-02	3150	
ET*S				1.01377
-10LOG(ET*S)				-0.1
10LOGA				26.8
NOISE REDUCTION				20.8

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME MARKET + STC = 32

FLOOR AREA 3150

SURFACES	TL	@	AREA	T*S
EXT.WALL 1	40		504	0.05040
EXT.WALL 2	43		1050	0.05262
EXT.WALL 3	50		0	0.00000
INT.WALL			504	
WINDOW 1	30	.05	0	0.00000
WINDOW 2	33	.05	750	0.37589
WINDOW 3	40	.05	0	0.00000
SGD	30	.05	0	0.00000
DOORS	0	.04	0	0.00000
ROOF	40	.04	3150	0.31500
FLOOR		9.999999E-02	3150	

ET*S	0.79392
-10LOG(ET*S)	1.0
10LOGA	26.8
NOISE REDUCTION	21.8

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME MARKET + STC = 34

FLOOR AREA 3150

SURFACES	TL	@	AREA	T*S
EXT.WALL 1	40		504	0.05040
EXT.WALL 2	43		1050	0.05262
EXT.WALL 3	50		0	0.00000
INT.WALL			504	
WINDOW 1	32	.05	0	0.00000
WINDOW 2	35	.05	750	0.23717
WINDOW 3	42	.05	0	0.00000
SGD	32	.05	0	0.00000
DOORS	0	.04	0	0.00000
ROOF	40	.04	3150	0.31500
FLOOR		9.999999E-02	3150	
ET*S				0.65520
-10LOG(ET*S)				1.8
10LOGA				26.8
NOISE REDUCTION				22.7

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME CORNER OFFICE + STC = 24

FLOOR AREA 100

SURFACES	TL	@	AREA	T*S
EXT.WALL 1	40		75	0.00750
EXT.WALL 2	43		100	0.00501
EXT.WALL 3	50		0	0.00000
INT.WALL			160	
WINDOW 1	22	.05	25	0.15774
WINDOW 2	25	.05	0	0.00000
WINDOW 3	32	.05	0	0.00000
SGD	22	.05	0	0.00000
DOORS	0	.04	0	0.00000
ROOF	40	.04	100	0.01000
FLOOR		9.999999E-02	100	
ET*S				0.18025
-10LOG(ET*S)				7.4
10LOGA				14.1
NOISE REDUCTION				15.5

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME CORNER OFFICE + STC = 26

FLOOR AREA 100

SURFACES	TL	@	AREA	T*S
EXT.WALL 1	40		75	0.00750
EXT.WALL 2	43		100	0.00501
EXT.WALL 3	50		0	0.00000
INT.WALL			160	
WINDOW 1	24	.05	25	0.09953
WINDOW 2	27	.05	0	0.00000
WINDOW 3	34	.05	0	0.00000
SGD	24	.05	0	0.00000
DOORS	0	.04	0	0.00000
ROOF	40	.04	100	0.01000
FLOOR		9.999999E-02	100	

ET*S	0.12204
-10LOG(ET*S)	9.1
10LOGA	14.1
NOISE REDUCTION	17.2

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME CORNER OFFICE + STC = 28

FLOOR AREA 100

SURFACES	TL	@	AREA	T*S
EXT.WALL 1	40		75	0.00750
EXT.WALL 2	43		100	0.00501
EXT.WALL 3	50		0	0.00000
INT.WALL			160	
WINDOW 1	26	.05	25	0.06280
WINDOW 2	29	.05	0	0.00000
WINDOW 3	36	.05	0	0.00000
SGD	26	.05	0	0.00000
DOORS	0	.04	0	0.00000
ROOF	40	.04	100	0.01000
FLOOR		9.999999E-02	100	
ET*S				0.08531
-10LOG(ET*S)				10.7
10LOGA				14.1
NOISE REDUCTION				18.8

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME CORNER OFFICE + STC = 30

FLOOR AREA 100

SURFACES	TL	@	AREA	T*S
EXT.WALL 1	40		75	0.00750
EXT.WALL 2	43		100	0.00501
EXT.WALL 3	50		0	0.00000
INT.WALL			160	
WINDOW 1	28	.05	25	0.03962
WINDOW 2	31	.05	0	0.00000
WINDOW 3	38	.05	0	0.00000
SGD	28	.05	0	0.00000
DOORS	0	.04	0	0.00000
ROOF	40	.04	100	0.01000
FLOOR		9.999999E-02	100	

ET*S	0.06213
-10LOG(ET*S)	12.1
10LOGA	14.1
NOISE REDUCTION	20.2

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME CORNER OFFICE + STC = 32

FLOOR AREA 100

SURFACES	TL	@	AREA	T*S
EXT.WALL 1	40		75	0.00750
EXT.WALL 2	43		100	0.00501
EXT.WALL 3	50		0	0.00000
INT.WALL			160	
WINDOW 1	30	.05	25	0.02500
WINDOW 2	33	.05	0	0.00000
WINDOW 3	40	.05	0	0.00000
SGD	30	.05	0	0.00000
DOORS	0	.04	0	0.00000
ROOF	40	.04	100	0.01000
FLOOR		9.999999E-02	100	
ET*S				0.04751
-10LOG(ET*S)				13.2
10LOGA				14.1
NOISE REDUCTION				21.3

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME CORNER OFFICE + STC = 34

FLOOR AREA 100

SURFACES	TL	@	AREA	T*S
EXT.WALL 1	40		75	0.00750
EXT.WALL 2	43		100	0.00501
EXT.WALL 3	50		0	0.00000
INT.WALL			160	
WINDOW 1	32	.05	25	0.01577
WINDOW 2	35	.05	0	0.00000
WINDOW 3	42	.05	0	0.00000
SGD	32	.05	0	0.00000
DOORS	0	.04	0	0.00000
ROOF	40	.04	100	0.01000
FLOOR		9.999999E-02	100	

ET*S	0.03829
-10LOG(ET*S)	14.2
10LOGA	14.1
NOISE REDUCTION	22.3

Appendix 5

Creation and Propagation of Noise Produced by Solar Farm

Noise associated with operation of a solar farm comes from the use of inverters. Photovoltaic (PV) panels produce direct current (DC) electrical power which is good when storing energy within a DC battery. However, in order to transfer this electrical power to the local grid, the DC power must be converted to alternating-current (AC) power. This conversion process is done by an "Inverter".

The process of converting DC into AC power requires very fast switches which change the polarity (or direction of electrical flow). Since AC power cycles 60 times per second (or 60 hertz), the switches must activate twice per electrical cycle.

This process produces tonal sound at twice electrical line frequency (120 hertz) and its harmonics (240, 360, 480 hertz and higher).

What noise the PV installation will produce is generated by the inverters. APREC will be deploying (16) Sungrow SG 125HV 125kW inverters. The inverters will be located on a concrete pad in the center of the PV array 175' away from either perimeter wall abutting a Sensitive Receptor.

Under normal operating conditions the inverters will generate 53.7 dba at 1 meter (3.28 feet from the pad). In order to determine the sound pressure level at the perimeter wall the following calculation shall be used:

Equation 1. $DL = Lp2 - Lp1$

Calculation

$DL = (10 \log (R2 / R1)2$

$DL = 20 \log (R2 / R1)2$

$DL = 20 \log (175/3.28$

$DL = 34.5$ dBA

53.7 dBA – 34.5dBA = 19.2 dBA

Variables:
DL = difference in sound pressure (dBA)
Lp1 = Sound pressure level at location 1
Lp2 = Sound pressure level at location 2
R1 = distance from source to location 1
R2 = distance from source to location 2

During daylight areas (when the inverters are operating) the Solar farm will generate 53.7dBA at the center of the farm and 19.2 dBA at the perimeter walls abutting Sensitive Receptors. Therefore, impacts from solar farm operation would be negligible beyond the fenced project area, and no permanent noise impacts would be associated with operation. APREC would use no specialized equipment that would generate loud noises. No long-term noise pollution is expected as a result of the proposed project.