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ASSESSMENT REPORT - **Project: 15182.02**

Yellow Lake Solar Project
Noise Impact Assessment
Alberta, Canada

Prepared for:

Yellow Lake Solar GP Corp
Suite 400, 214 – 11 Ave SW,
Calgary, Alberta T2R 0K1

Prepared by:

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May 17th, 2018

Applicant Information

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Revision History

Revision Number	Description	Date
1	*Initial NIA Report Submission*	January 10th, 2017
2	*NIA Report Amendment (RP2);* Site layout changed – total inverter counts reduced, new 2.5 MVA Inverter unit selected and combined to form 5.0 MVA Inverter Clusters.	May 17th, 2018

1 Introduction

BluEarth Renewables has retained Aercoustics Engineering Limited on behalf of Yellow Lake Solar GP Corp (the Applicant) to prepare an amendment to an existing Noise Impact Assessment, dated January 10, 2017. This Noise Impact Assessment ("NIA") pertains to the Yellow Lake Solar Project. The proposed facility (the "Project") comprises a 19-megawatt alternating current (MWAC) solar facility located roughly 20 km north-west of Foremost, Alberta, on a plot of land measuring roughly 64 hectares.

The purpose of this pre-construction noise impact assessment is to ensure that the predicted sound levels at critical receptors surrounding the Project are in compliance with Alberta Utilities Commission ("AUC") Rule 012 [1], dated July 4, 2017. This report serves as an amendment to the existing noise report, dated January 10th, 2017 and addresses a change to the site layout; the facility comprises two (2) fewer solar inverters, and a new model of inverter has been selected. The new 2.5 MVA solar inverters have been combined in groups of two to form 5.0 MVA inverter clusters.

2 Facility Description

The Project spans 64 hectares (154 Acres) of land situated roughly 20 kilometres north-west of Foremost, Alberta in the county of Forty Mile No.8. The specific UTM coordinates corresponding to the approximate centre of the Project are 463060 mE, 5499981 mN, Zone 12U. The plot of land on which the Project is to be developed is designated NW13-8-12-W4.

The solar facility will include an array of solar panels with eight (8) associated SC2500 2.5 megavolt-ampere (MVA) inverters in groups of two (2) to form a total of four (4) 5.0 MVA inverter clusters. Each of the four inverter clusters has an associated 5.0 MVA pad-mounted transformer.

Although power production will only occur during daylight hours, both daytime and nighttime operation of the facility have been considered in this assessment. This conservative assumption accounts for days of the year where the sun rises before 07:00 AM.

AUC Rule 012 stipulates that any third-party energy-related facilities within 1.5km of the Project receptors must be considered in the noise impact assessment and that the cumulative noise impact for all such facilities, together with the ambient contribution, must meet the applicable noise level limits. Two facilities in the study area meet this description: an AltaLink transformer substation about two (2) kilometres northeast of the Project as well as a pumpjack facility about two (2) kilometres southeast. The locations of these relevant third-party sources are detailed in Figure 1.

3 Noise Sources

The dominant noise sources related to the sustained operation of the Project are the four (4) 5.0MVA solar inverter clusters and the four (4) associated 5.0 MVA pad mounted transformers. Each of the four sets of equipment was modelled as a single point source to represent a Solar Inverter Station with a sound power level equal to the sum of that of the three parts (two inverters, one transformer). The location of the solar inverter stations within the Project is detailed in Figure 2. These noise sources, in addition to the two (2) energy-related facilities – each also modelled as point sources – represent the dominant noise sources considered in this noise impact assessment.

Spectral sound data for the Solar Inverters (SMA SC2500 MV-Block 2.5 MVA) is available in Appendix B and was provided in a manufacturer test report [2]. Specifications for the pad-mounted transformers had not been made at the time of this report and therefor associated noise data was unavailable. The assumed sound power levels for the 5.0 MVA pad-mounted transformers were based on manufacturer data for similarly sized transformer units and adjusted based on NEMA TR 1-2013 [3] and Beranek's *Noise and Vibration Control Engineering* [4]. A summary of this derivation is given in Appendix B.

While the noise from the transformer itself is expected to have tonal components below 250 Hertz, when considered as a component of the noise pair represented in the model, the tonal character of the transformer is not anticipated to be audible in the presence of Low Frequency masking noise generated by the inverter. To assess the potential for a Low Frequency Noise condition, a comparison between the A- and C-weighted predicted sound levels from the Project was performed at critical receptors. This analysis is detailed further in Section 6.2 of this report. The sound power spectra for the two noise source components, as well as for the overall Solar Inverter Station, are stated in Table 1 below. Noise sources used in the model are summarized in Table 2.

Table 1 – Noise Source Spectra

Noise Source	Frequency (Hz)									**Total (dBA)**
	31.5	63	125	250	500	1000	2000	4000	8000	
NEMA Estimate 5.0 MVA Transformer	83	89	91	86	86	80	75	70	63	86
SC2500 Solar Inverter[1] Cluster	94	90	90	91	87	84	84	92	82	95
Combined Source	94	93	93	92	89	85	84	93	82	96

[1] – Test Data Provided in *SMA Inspection Report -91:LE4615* [2]

There are two existing third-party energy-related facilities within 1.5 kilometres of the receptors impacted by the Project. These include an AltaLink transformer substation and a pumpjack facility. Sound power data for the transformer substation was provided by AltaLink. The sound power level for the pumpjack was based on Aercoustics' measurements of a similar unit. Octave data for both third-party sources is also included in Appendix B.

Table 2 – Noise Source Summary

Source ID	Source Name	Sound Power Level (dBA)	Source Location
Inv_A1	5.0 MVA Solar Inverter Station	96[1,2]	YLSP
Inv_A2	5.0 MVA Solar Inverter Station	96[1,2]	YLSP
Inv_B1	5.0 MVA Solar Inverter Station	96[1,2]	YLSP
Inv_B2	5.0 MVA Solar Inverter Station	96[1,2]	YLSP
A02_pump	Pumpjack RD120	98[3]	Third-Party
A02_trans	AltaLink Transformer	100[4]	AltaLink

Note: Further documentation in Appendix B.

1. Sound power data for SC2500 Inverter is from SMA Inspection Report -91:LE4615 [2]
2. Assumed sound power data for the 5.0 MVA transformer based on NEMA Standard and measurement data from a comparable unit
3. Assumed pumpjack sound power based on Aercoustics' measurements of a similar unit.
4. Sound power data provided by AltaLink. Final sound power includes 5dB tonal penalty.

4 Points of Reception

The area immediately surrounding the proposed Project is considered to be a rural environment dominated by agricultural land. Residential dwellings located within 1.5 km of the Project boundary were considered critical receptors in this assessment and are identified as receptors R01-R04 in Figure 1. All receptors were conservatively assumed to be two-storey and were modelled at a height of 4.5m.

Satisfying AUC Rule 012 Noise Control guidelines ("the Guidelines") at the nearest-situated critical receptors is expected to ensure that compliance at all other receptors will also be met. Table 3 summarizes the location of the critical receptors as well as their position relative to the Project.

Table 3 – Receptor Summary

Receptor ID	Receptor Description	POR Height	Location[1]
R01	Two-storey dwelling	4.5 m	~1240 m southeast
R02	Two-storey dwelling	4.5 m	~1300 m southeast
R03	Two-storey dwelling	4.5 m	~870 m southwest
R04	Two-storey dwelling	4.5 m	~1120 m north

[1] – Location with reference to the nearest Project noise source, direction from source to receptor.

5 Assessment Criteria

This noise impact assessment has been carried out according to the AUC Rule 012 which stipulates that the applicable Basic Sound Level ("BSL") must be derived for all critical receptors based on the density of surrounding residences as well as the proximity from well-travelled roads.

All critical receptors listed above in Table 3 are more than 500 meters from heavily travelled roads or rail lines and not subject to frequent aircraft flyovers. This is consistent with the Category 1 acoustic environment categorization as defined by the Guidelines.

Based on this categorization, a nighttime BSL of 40 dBA was applied for the receptors. An adjustment of 10dB above the nighttime BSL was made to define the daytime Permissible Sound Level ("PSL"). The PSL's for this assessment are summarized in Table 4.

Table 4 – Receptor PSL Summary

Receptor ID	Daytime (07:00 – 22:00) PSL (dBA)	Nighttime (22:00- 07:00) PSL (dBA)
R01	50	40
R02	50	40
R03	50	40
R04	50	40

The above permissible sound levels are limits placed on the cumulative noise level at the critical receptors. The cumulative sound level includes the contribution from the Project, eligible third-party sources, and an assumed ambient noise level. This cumulative sound level will serve as the basis for an assessment of compliance. Based on the Guidelines, the ambient sound level is assumed to be 35dBA at nighttime and 45dBA during the daytime.

6 Noise Impact Assessment

The noise impact calculations were performed using DataKustik's CadnaA environmental noise prediction software (2017 Version). The calculations are based on established environmental sound prediction methods outlined in *ISO 9613-2: A Standard for Outdoor Noise Propagation* [5]. The noise prediction methodology assumes downwind propagation at 70% relative humidity and 10 degrees Celsius. Flat ground topography and a global ground factor of G=0.5 have been conservatively assumed for this assessment as the area surrounding the Project is flat farmland or grassland.

6.1 Predictable Worst Case

A worst-case operating scenario has been assumed for the assessment. This scenario includes all four Solar Inverter Stations as well as the pumpjack and AltaLink substation operating at 100% capacity.

The predicted sound levels corresponding to this worst-case scenario are detailed in Table 5 and are compared with the applicable sound level limits at each receptor. Sample calculations including calculation parameters are included in Appendix C. A noise contour figure for the cumulative nighttime noise impact including ambient and third-party sources is available in Figure 3.

Table 5 – Noise Impact Assessment Summary

Receptor ID	Sound Level at Receptor (daytime / nighttime) [dBA]	PSL (daytime / nighttime) [dBA]	Compliance with PSL? [Yes/No]
R01	45/35	50/40	Yes
R02	45/35	50/40	Yes
R03	45/35	50/40	Yes
R04	45/35	50/40	Yes

6.2 Low Frequency Analysis

Low frequency analysis was performed according to section 4.5 of AUC Rule 012. Both the A- and C-weighted noise impact from the isolated Project were assessed at each receptor and the difference between these levels was calculated. These results are outlined in Table 6 below.

Table 6 – Low Frequency Analysis Summary

Receptor ID	Project-only Impact		
	LAeq [dBA]	LCeq [dBC]	LCeq - LAeq [dB]
R01	21	33	12
R02	20	33	12
R03	24	36	11
R04	22	34	12

Given that the difference between the predicted A- and C-weighted sound pressure levels never exceeds the 20 dB, the presence of a Low Frequency noise condition according to the Guidelines is unlikely.

7 Construction Noise Measures

To minimize the impact of the development of the Project on nearby dwellings, the following mitigation measures should be used as described in AUC Rule 012:

a) Conduct construction activity between the hours of 7 a.m. and 10 p.m. to reduce the duration impact from construction noise,

b) Advise nearby residents of significant noise-causing activities and schedule these events to reduce disruption to them,

c) Ensure that all internal combustion engines are well maintained with muffler systems,

d) Should a noise complaint be filed during construction, the licensee must respond expeditiously and take prompt action to address the complaint.

8 Conclusion

Aercoustics Engineering Limited has completed a Noise Impact Assessment for the Yellow Lake Solar Project in Alberta.

It was determined that the predicted cumulative noise impact from the contributing ambient, relevant third-party sources, and the proposed Yellow Lake Solar Project is in compliance with AUC Rule 012.

9 REFERENCES

[1] Alberta Utilities Commission, “Rule 012 - Noise Control,” 2017.

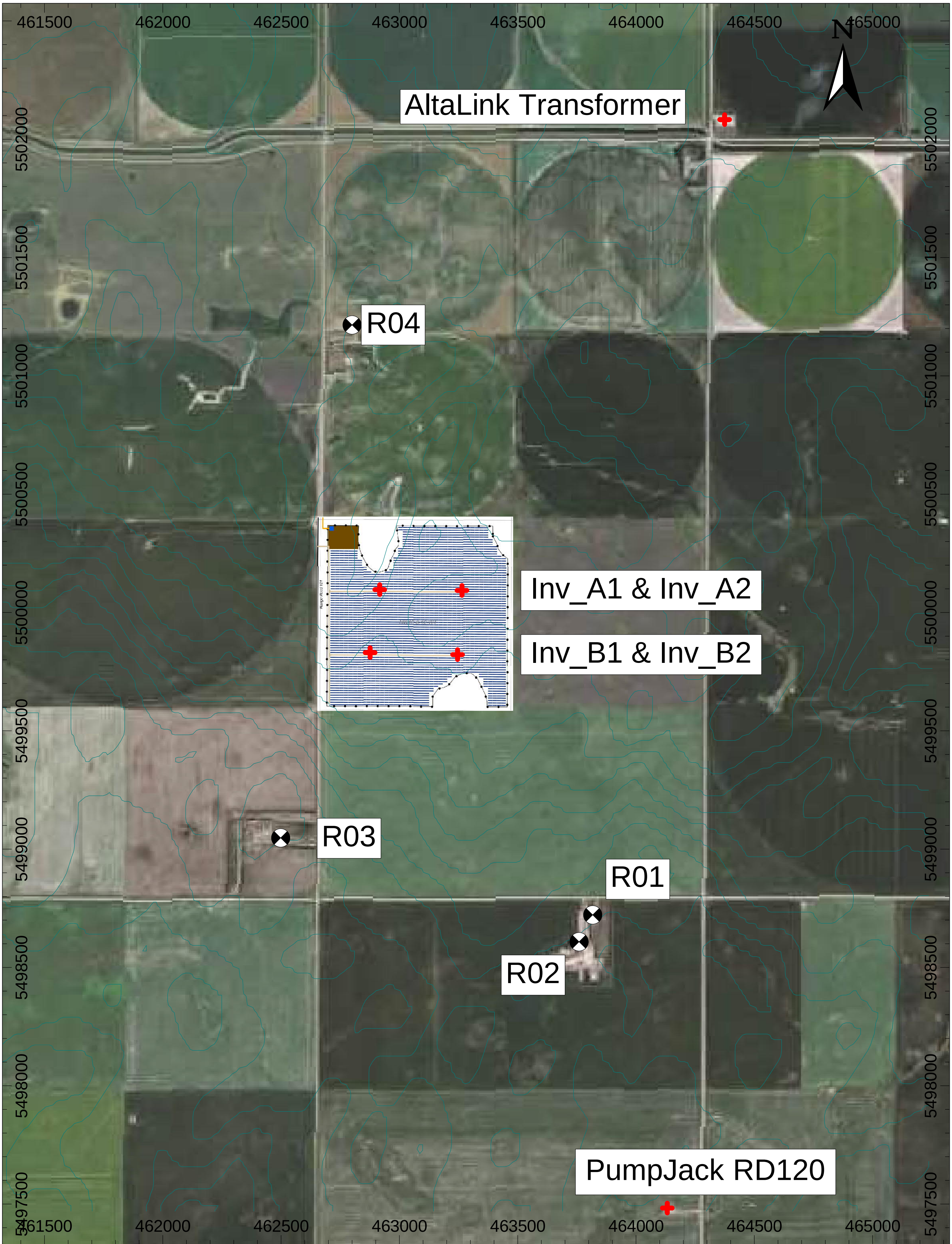
[2] SMA, “SC2500 MV-Block -91:LE4615 Acoustic Environnmental Test Inspection Report,” 2016.

[3] National Electrical Manufacturers Association, “NEMA TR 1-2013 - Transformers, Step Voltage Regulators and Reactors,” National Electrical Manufacturers Association, Rosslyn, VA, 2014.

[4] L. Beranek, “Noise and Vibration Control Engineering,” Institute of Noise Control Engineering, 1992.

[5] ISO, “International Standard ISO 9613-2 “Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation”,” 1996.

FIGURES



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Project ID: 15182.02

Scale: NTS
Drawn by: KC
Reviewed by: PA
Date: May 17, 2018
Revision: 1

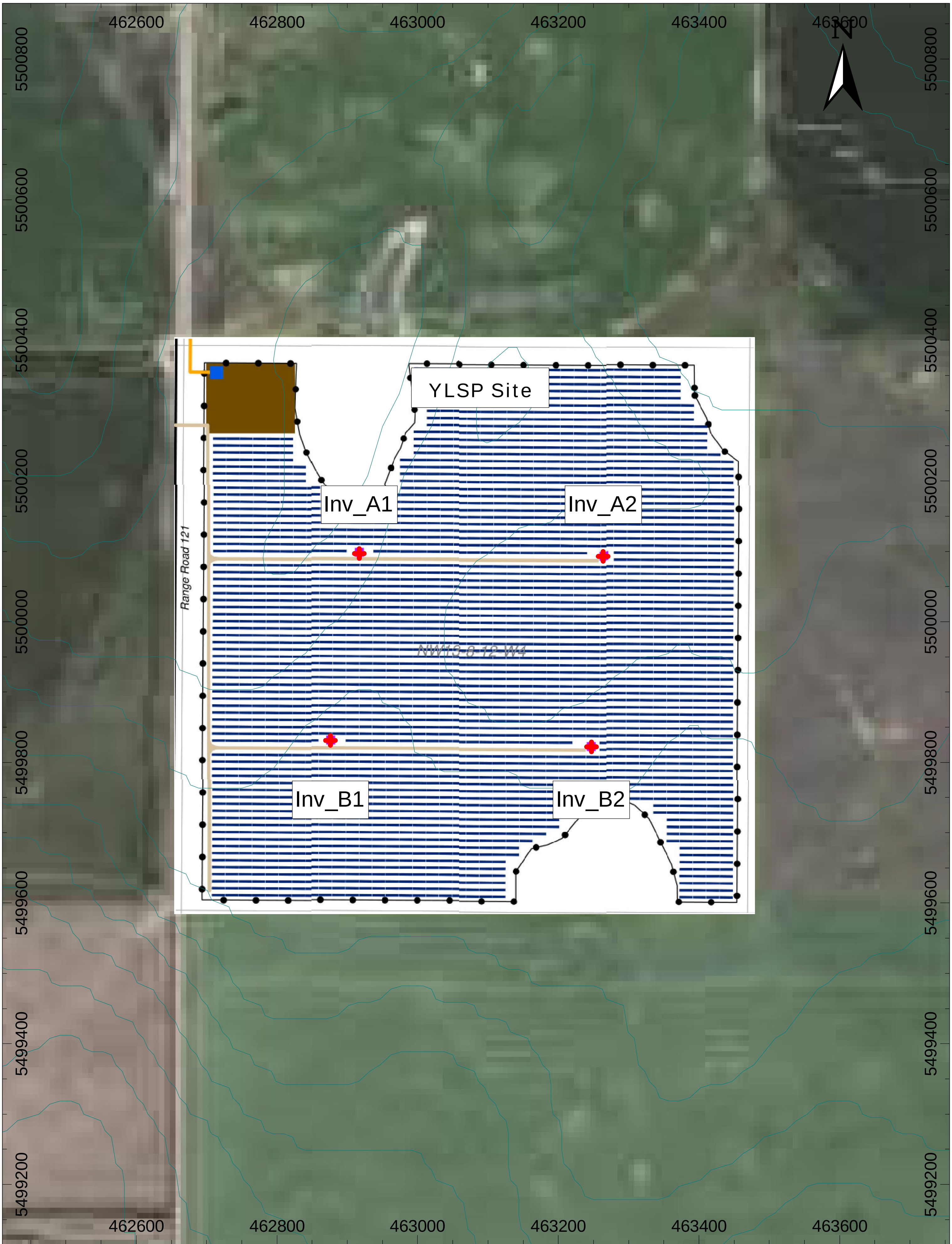
Project Name

Yellow Lake Solar Project - Noise Impact Assessment

Figure Title

Site Plan

Figure 1



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Date: May 17, 2018
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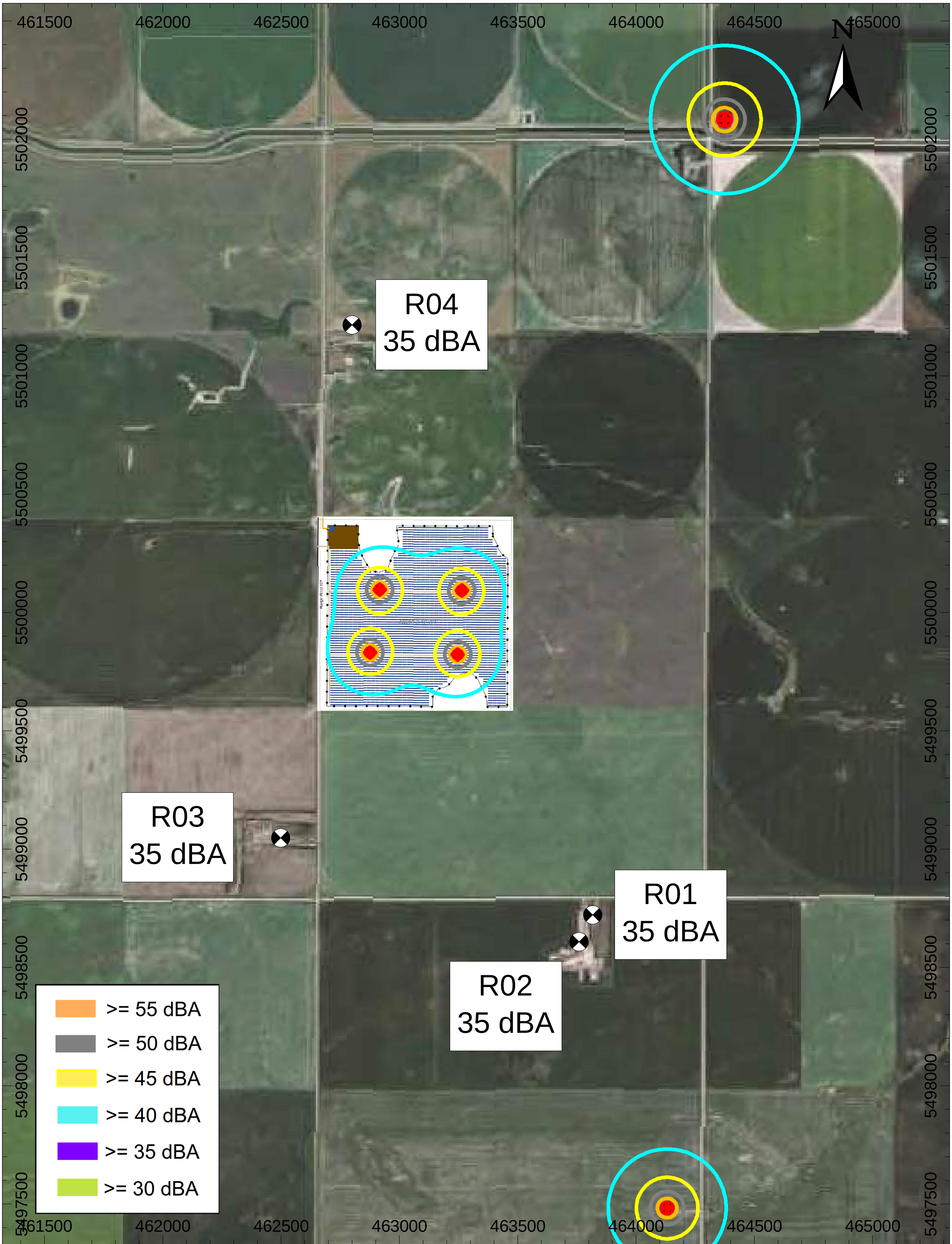
Project Name

Yellow Lake Solar Project - Noise Impact Assessment

Figure Title

Noise Source Locations

Figure 2



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Project ID: 15182.02

Scale: NTS
Drawn by: KC
Reviewed by: PA
Date: May 17, 2018
Revision: 1

Project Name

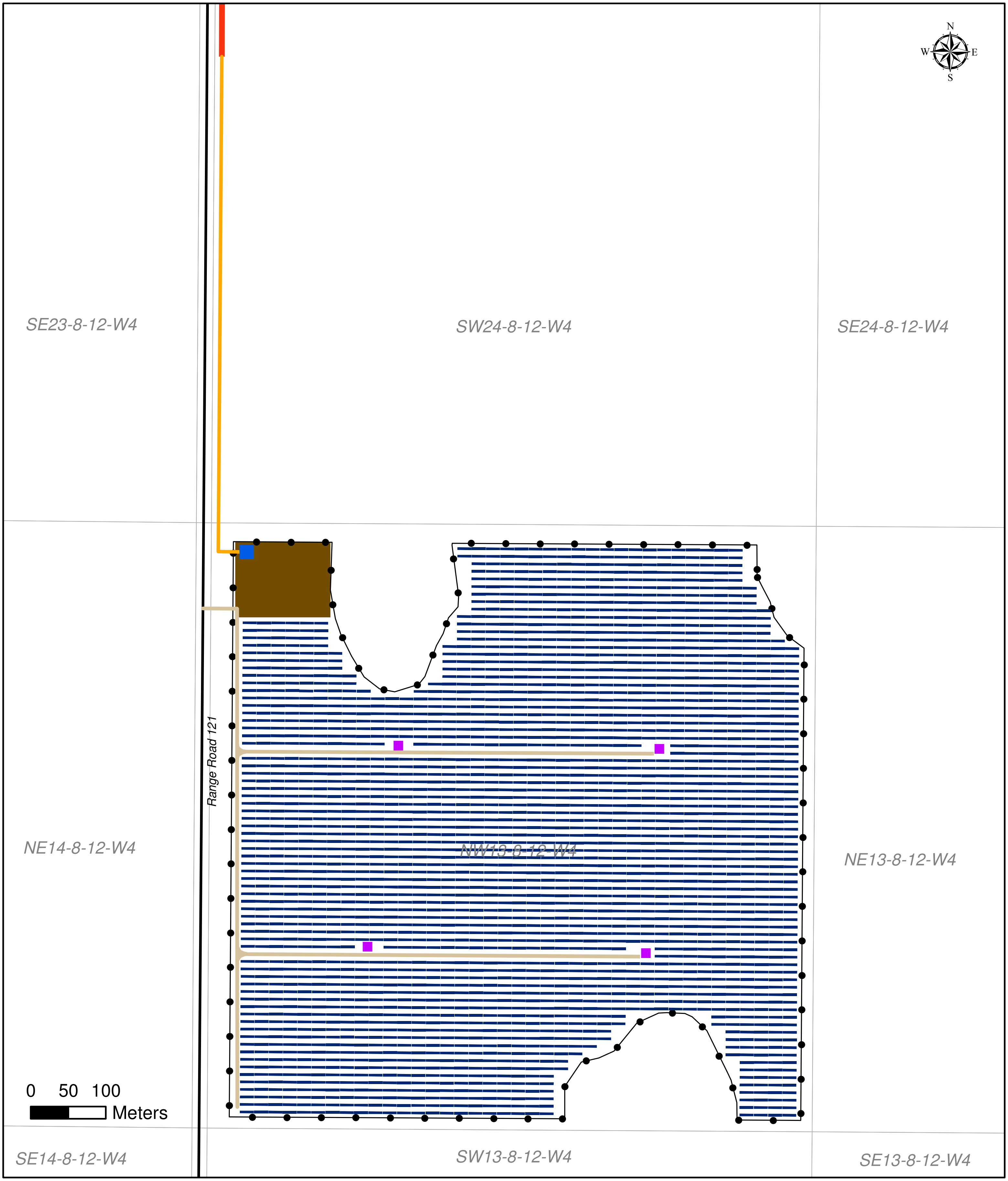
Yellow Lake Solar Project - Noise Impact Assessment

Figure Title

Cumulative Noise Impact Contours - Nighttime

Figure 3

APPENDIX A – Site Plan of Yellow Lake Solar Project



Legend

- Inverter Stations
- Panel
- Road
- Project Interconnection
- New Transmission
- Fortis 25kV feeder 368S-15LW
- Fence
- Construction Staging
- Existing Roads
- Quarter Sections
- Waterbody

Site Plan

Yellow Lake Solar Project

BluEarth RENEWABLES

Coordinate System NAD 1983 UTM Zone 12N
Projection Transverse Mercator
Datum North American 1983
Units Meter

Created: 2018-05-08

APPENDIX B – Sound Data Sheets

Revision History

Document number SC2500 MV-Block	Version and revision type [1]		Comments	Author
-91:LE4615	1.0	A	First version	S. Vorderbruegge

[1] A: First version or revision due to inaccurate documentation or improvement of the documentation

B: Revision assuring complete or forward compatibility

C: Revision limiting or excluding compatibility

Tested by	19.11.2015 X Manager EMC and Environmental Laboratory Authorized signatory Signiert von: Stephan Vorderbruegge	Released by	28.04.2016 X Senior Manager EMC and Environmental Laboratory Authorized signatory Signiert von: Peter Thomae

2 Overview of Results

The EN 3744:04/2011, EN 9614-2:08/2011 and German Noise Control Guidelines form the testing specification for the thresholds and requirements	Requirement		2500 kW max. fan load [dB$_A$]
	Standard (Germany)	SMA	
EN 9614-2 **sound power L_{WA}** [3]	–	–	**92,32**
EN9614-1 Derived sound pressure level at a distance of 1m via sound power			**76,87**
EN 3744:2011-02 typical value at a distance of 1m; L_{Aeq} averaged [1]	– [5]	– [5]	77,02
Sound pressure level in 10 m L_{xpA10} [4]	–	70	**64,33**
Sound pressure level in 50 m L_{xpA50} [4]	–	–	50,35
§48 of the German Federal Emission Control Act (BImSchG):09-2002 German Noise Control Guidelines; LPA 2)	(A) 70	70	passed
Overall result (if applicable)			*Standard requirements: - **passed**

*** Dependent on the local conditions at the mounting location (distance of 10m standard)**

Please note the detailed description of the measurement environment. See Section 4.3Test Environment

[1] This measurement involves purely informative measured values for development. The result shown is based on an averaged value of all sides of the device to be tested (see Section 5.1.3).

[2] Calculated average sound pressure level over the entire measurement area (see Section 6.1.2).

[3] Acoustic power resulting from sound intensity measurement (see Section 6.1.2).

[4] Calculated sound pressure level at the desired distance (see Section 6.1.3).

Overview of the Acoustic Power

Third octave band center frequency [Hz]	Sound power- level L_{wA} [$dB_{A/pW}$] 2500 kW	Sound power- level L_{wz} [$dB_{A/pW}$] 2500 kW no fan
25 Hz	42,97	-
31.5 Hz	45,72	-
40 Hz	48,71	-
50 Hz	52,45	-
63 Hz	55,56	-
80 Hz	59,50	-
100 Hz	63,83	-
125 Hz	64,83	-
160 Hz	64,57	-
200 Hz	68,49	-
250 Hz	71,54	-
315 Hz	79,94	-
400 Hz	76,96	-
500 Hz	71,97	-
630 Hz	73,50	-
800 Hz	77,20	-
1 kHz	75,50	-
1.25 kHz	71,59	-
1.6 kHz	69,75	-
2 kHz	70,31	-
2.5 kHz	81,21	-
3.15 kHz	90,61	-
4 kHz	70,23	-
5 kHz	68,72	-
6.3 kHz	78,07	-
8 kHz	68,56	-
10 kHz	66,46	-
Acoustic power above the surface	A-rated	Z-rated
	92,32	94.64

Sound Power Used for Analysis - Combined Source

5.0 MVA - Medium Voltage Transformer Sound Power Estimate

Rated Capacity	5.0 MVA
NEMA Sound Pressure Estimate [1]	67 dBA
Assumed Surface Area	75 m^2

	31.5	63	125	250	500	1000	2000	4000	8000	Total (dBA)
Frequency Spectrum Adjustment [2]	-3	3	5	0	0	-6	-11	-16	-23	**-**
Sound Power Level (dB)	83	89	91	86	86	80	75	70	63	**86**

[1] Based on NEMA TRI-1993 (R2000), Table 0-2, Immersed Power Transformers
[2] from Beranek, Noise and Vibration Control Engineering, 1992. Table 18.1, Line 28

5.0 MVA Transformer and SC2500 5.0 MVA Inverter Cluster **[5MVA Inverter Station]**

Noise Source	31.5	63	125	250	500	1000	2000	4000	8000	**Total (dBA)**
NEMA Estimate 5 MVA Transformer	83	89	91	86	86	80	75	70	63	**86**
SC2500 5MVA Solar Inverter Cluster	94	90	90	91	87	84	84	92	82	**95**
Combined Source	94	93	93	92	89	85	84	93	82	**96**

AltaLink Apparatus S und P wer Levels and Site/Building Dimensi ns

Table 1 – Westfield 107S S und P wer Level Data

			Octave Band S und P wer Level (dB)									Overall S und P wer Level		
Apparatus	Height	N minal Rating	31.5	63	125	250	500	1000	2000	4000	8000	dBA	dBC	S urce
Transformer #1	2.9 m	138/25 kV, 25 MVA	89.7	93.7	96.7	94.7	94.7	88.7	83.7	78.7	70.7	94.9	101.4	CAN/CSA-C88-M90

Appr ximate Site Dimensi ns

Fence line: L x W = 75 x 40 m

Appr ximate Building Dimensi ns

Building #1: L x W x H = 9.8 x 4.3 x 3.0 m

Table 2 – Burdett 368S S und P wer Level Data

			Octave Band S und P wer Level (dB)									Overall S und P wer Level		
Apparatus	Height	N minal Rating	31.5	63	125	250	500	1000	2000	4000	8000	dBA	dBC	S urce
Transformer #1	3.1 m	138/25 kV, 42 MVA	85.7	89.7	92.7	90.7	90.7	84.7	79.7	74.7	66.7	90.9	97.4	Manufacturer
Transformer #2	3.8 m	138/25 kV, 42 MVA	91.7	95.7	98.7	96.7	96.7	90.7	85.7	80.7	72.7	96.9	103.4	CAN/CSA-C88-M90
Capacitor Bank #1	9.6 m	138 kV, 27 Mvar	N/A	N/A	94.1	74.5	80.5	74.3	64.5	62.0	63.5	81.9	94.2	Field measurement*
Capacitor Bank #2	9.6 m	138 kV, 27 Mvar	N/A	N/A	94.1	74.5	80.5	74.3	64.5	62.0	63.5	81.9	94.2	Field measurement*

** Measurement f capacit r bank at an ther substati n with the same rating*

Appr ximate Site Dimensi ns

Fence line: L x W = 80 x 58 m

Appr ximate Building Dimensi ns

Building #1: L x W x H = 9.5 x 6.5 x 5.3 m

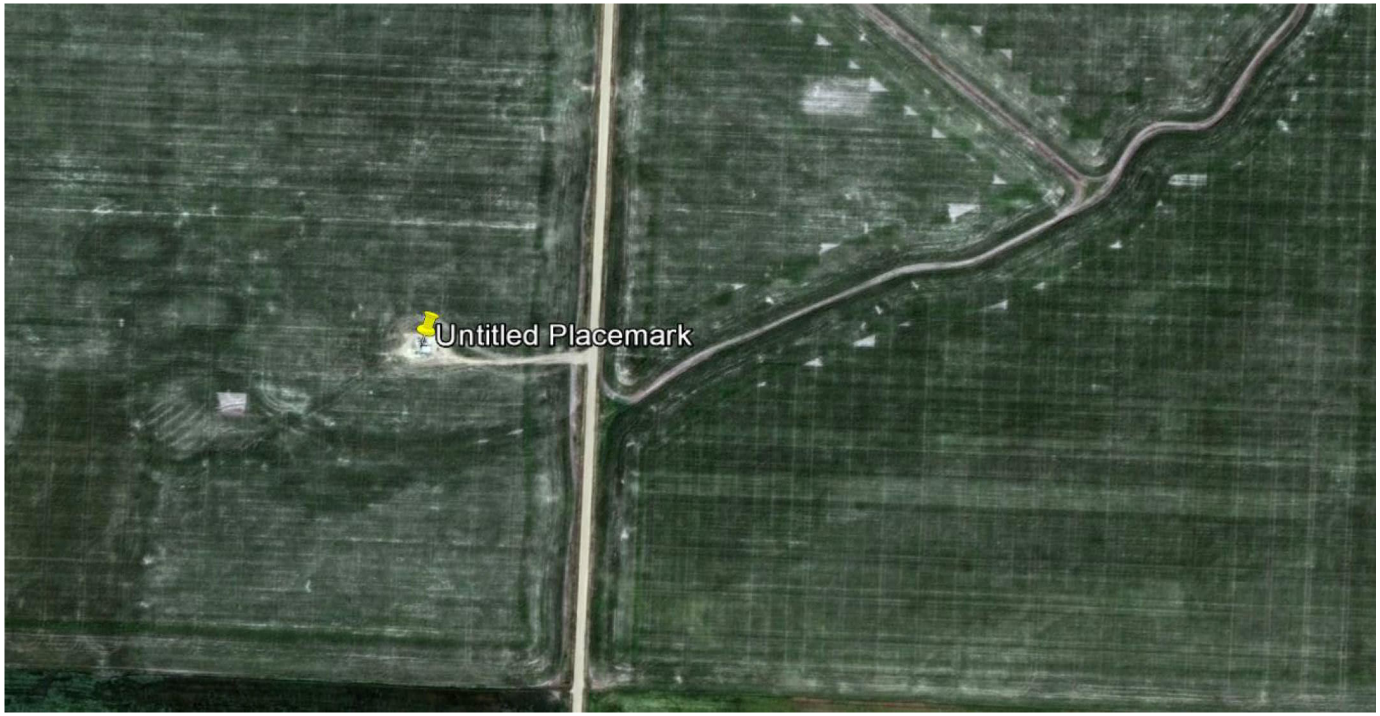
Building #2: L x W x H = 14.0 x 6.4 x 5.3 m

Building #3: L x W x H = 12.6 x 5.0 x 3.0 m

		Octave S und P wer (dB)								
	S und P wer Level	31.5	63	125	250	500	1000	2000	4000	8000
Pump Jack	**98 dBA**	104	101	101	91	93	93	92	87	80

Pump Jack L cati n:

UTM C   rdinates
464134 m E
5497429 m N
Z ne 12



APPENDIX C – ISO Calculation

Configuration	
Parameter	Value
General	
Country	(user defined)
Max. Error (dB)	0.00
Max. Search Radius (m)	2000.00
Min. Dist Src to Rcvr	0.00
Partition	
Raster Factor	0.50
Max. Length of Section (m)	1000.00
Min. Length of Section (m)	1.00
Min. Length of Section (%)	0.00
Proj. Line Sources	On
Proj. Area Sources	On
Ref. Time	
Reference Time Day (min)	60.00
Reference Time Night (min)	60.00
Daytime Penalty (dB)	0.00
Recr. Time Penalty (dB)	6.00
Night-time Penalty (dB)	10.00
DTM	
Standard Height (m)	830.00
Model of Terrain	Triangulation
Reflection	
max. Order of Reflection	0
Search Radius Src	100.00
Search Radius Rcvr	100.00
Max. Distance Source - Rcvr	1000.00 1000.00
Min. Distance Rvcr - Reflector	1.00 1.00
Min. Distance Source - Reflector	0.10
Industrial (ISO 9613)	
Lateral Diffraction	some Obj
Obst. within Area Src do not shield	On
Screening	Excl. Ground Att. over Barrier
	Dz with limit (20/25)
Barrier Coefficients C1,2,3	3.0 20.0 0.0
Temperature (°C)	10
rel. Humidity (%)	70
Ground Absorption G	0.50
Wind Speed for Dir. (m/s)	3.0
Roads (RLS-90)	
Strictly acc. to RLS-90	
Railways (Schall 03 (1990))	
Strictly acc. to Schall 03 / Schall-Transrapid	
Aircraft (???)	
Strictly acc. to AzB	

Project: Yellow Lake Solar Project
Project Number: 15182.02

Source ID	Source Name	Point of Reception R01		Point of Reception R02		Point of Reception R03		Point of Reception R04	
		Distance to POR (m)	Sound Level at POR (dBA) Night	Distance to POR (m)	Sound Level at POR (dBA) Night	Distance to POR (m)	Sound Level at POR (dBA) Night	Distance to POR (m)	Sound Level at POR (dBA) Night
Inv_A1	5 MVA Inverter Station	1643	13	1711	13	1130	18	1123	18
Inv_A2	5 MVA Inverter Station	1478	15	1565	14	1296	16	1213	17
Inv_B1	5 MVA Inverter Station	1454	15	1509	14	870	21	1385	15
Inv_B2	5 MVA Inverter Station	1238	17	1318	16	1077	18	1462	15

Project-Only Contribution (dBA)		**21**		**21**		**24**		**22**
3rd Party Contribution (dBA)		**20**		**21**		**<10**		**22**
Ambient Contribution (dBA)		**35**		**35**		**35**		**35**
Cumulative Impact (dBA)		**35**		**35**		**35**		**35**

Receiver: R01
Project: Yellow Lake Solar Project
Project Number: 15182.02

Time Period	Total (dBA)
Night	35

Receiver Name	Receiver ID	X	Y	Z
R01	R01	463817.0	5498722.6	841.3

Source ID	Source Name	X	Y	Z	Refl.	Lw	L/A	Freq	Adiv	K0	Agr	Abar	Aatm	Afol	Ahous	Cmet	Dc	RL	Lr
Inv_B2	5 MVA Inverter Station	463247.0	5499822.0	833.1	0	96	0.0	A	72.9	0.0	-1.7	0.0	8.0	0.0	0.0	0.0	0.0	0.0	17
Inv_B1	5 MVA Inverter Station	462876.0	5499831.0	833.6	0	96	0.0	A	74.3	0.0	-1.7	0.0	8.4	0.0	0.0	0.0	0.0	0.0	15
Inv_A2	5 MVA Inverter Station	463264.0	5500093.0	832.6	0	96	0.0	A	74.4	0.0	-1.7	0.0	8.5	0.0	0.0	0.0	0.0	0.0	15
Inv_A1	5 MVA Inverter Station	462917.0	5500097.0	832.3	0	96	0.0	A	75.3	0.0	-1.6	0.0	8.8	0.0	0.0	0.0	0.0	0.0	13
A02_pump	PumpJack RD120	464131.9	5497483.3	838.0	0	98	0.0	A	73.1	0.0	-0.5	0.0	5.5	0.0	0.0	0.0	0.0	0.0	20

Project Contribution (dBA)		21
3rd Party Contribution (dBA)		20
Ambient Contribution (dBA)		35

Receiver: R02
Project: Yellow Lake Solar Project
Project Number: 15182.02

Time Period	Total (dBA)
Night	35

Receiver Name	Receiver ID	X	Y	Z
R02	R02	463759.8	5498608.3	841.7

Source ID	Source Name	X	Y	Z	Refl.	Lw	L/A	Freq	Adiv	K0	Agr	Abar	Aatm	Afol	Ahous	Cmet	Dc	RL	Lr
Inv_B2	5 MVA Inverter Station	463247.0	5499822.0	833.1	0	96	0.0	A	73.4	0.0	-1.7	0.0	8.1	0.0	0.0	0.0	0.0	0.0	16
Inv_B1	5 MVA Inverter Station	462876.0	5499831.0	833.6	0	96	0.0	A	74.6	0.0	-1.7	0.0	8.5	0.0	0.0	0.0	0.0	0.0	14
Inv_A2	5 MVA Inverter Station	463264.0	5500093.0	832.6	0	96	0.0	A	74.9	0.0	-1.6	0.0	8.6	0.0	0.0	0.0	0.0	0.0	14
Inv_A1	5 MVA Inverter Station	462917.0	5500097.0	832.3	0	96	0.0	A	75.7	0.0	-1.6	0.0	8.9	0.0	0.0	0.0	0.0	0.0	13
A02_pump	PumpJack RD120	464131.9	5497483.3	838.0	0	98	0.0	A	72.5	0.0	-0.6	0.0	5.2	0.0	0.0	0.0	0.0	0.0	21

Project Contribution (dBA)		20
3rd Party Contribution (dBA)		21
Ambient Contribution (dBA)		35

Receiver: R03
Project: Yellow Lake Solar Project
Project Number: 15182.02

Time Period	Total (dBA)
Night	35

Receiver Name	Receiver ID	X	Y	Z
R03	R03	462498.4	5499047.8	842.5

Source ID	Source Name	X	Y	Z	Refl.	Lw	L/A	Freq	Adiv	K0	Agr	Abar	Aatm	Afol	Ahous	Cmet	Dc	RL	Lr
Inv_B1	5 MVA Inverter Station	462876.0	5499831.0	833.6	0	96	0.0	A	69.8	0.0	-1.7	0.0	7.1	0.0	0.0	0.0	0.0	0.0	21
Inv_B2	5 MVA Inverter Station	463247.0	5499822.0	833.1	0	96	0.0	A	71.6	0.0	-1.7	0.0	7.6	0.0	0.0	0.0	0.0	0.0	18
Inv_A1	5 MVA Inverter Station	462917.0	5500097.0	832.3	0	96	0.0	A	72.1	0.0	-1.7	0.0	7.7	0.0	0.0	0.0	0.0	0.0	18
Inv_A2	5 MVA Inverter Station	463264.0	5500093.0	832.6	0	96	0.0	A	73.2	0.0	-1.7	0.0	8.1	0.0	0.0	0.0	0.0	0.0	16

Project Contribution (dBA)		24
3rd Party Contribution (dBA)		<10
Ambient Contribution (dBA)		35

Receiver: R04
Project: Yellow Lake Solar Project
Project Number: 15182.02

Time Period	Total (dBA)
Night	35

Receiver Name	Receiver ID	X	Y	Z
R04	R04	462800.2	5501214.3	832.7

Source ID	Source Name	X	Y	Z	Refl.	Lw	L/A	Freq	Adiv	K0	Agr	Abar	Aatm	Afol	Ahous	Cmet	Dc	RL	Lr
A02_trans	AltaLink Transformer	464374.8	5502082.6	830.3	0	100	0.0	A	76.1	0.0	-2.0	0.0	4.2	0.0	0.0	0.0	0.0	0.0	22
Inv_A1	5 MVA Inverter Station	462917.0	5500097.0	832.3	0	96	0.0	A	72.0	0.0	-1.7	0.0	7.7	0.0	0.0	0.0	0.0	0.0	18
Inv_A2	5 MVA Inverter Station	463264.0	5500093.0	832.6	0	96	0.0	A	72.7	0.0	-1.7	0.0	7.9	0.0	0.0	0.0	0.0	0.0	17
Inv_B1	5 MVA Inverter Station	462876.0	5499831.0	833.6	0	96	0.0	A	73.8	0.0	-1.7	0.0	8.3	0.0	0.0	0.0	0.0	0.0	15
Inv_B2	5 MVA Inverter Station	463247.0	5499822.0	833.1	0	96	0.0	A	74.3	0.0	-1.7	0.0	8.4	0.0	0.0	0.0	0.0	0.0	15

Project Contribution (dBA)		22
3rd Party Contribution (dBA)		22
Ambient Contribution (dBA)		35

APPENDIX D – Acoustical Practitioner Information

Aercoustics Engineering Ltd.
1004 Middlegate Road, Suite 1100
Mississauga, ON L4Y 0G1

Tel: 416-249-3361
Fax 416-249-3613
aercoustics.com

kohl clark
BEng

profile

Kohl Clark is an Engineer in Training (EIT) in the Province of Ontario and holds a Bachelor's degree in Mechanical Engineering from McMaster University. He has 1.5 years of experience in the field of Acoustics and has been involved in different aspects of environmental noise and vibration.

education + career milestones

B.Eng., Mechanical Engineering, McMaster University, June 2016
joined Aercoustics full time in 2016 as a noise and vibration consultant.
Member of Professional Engineers of Ontario.

selected projects

Noise modelling and assessment

Oshawa Asphalt Plant	Oshawa, ON
Coleraine Drive Asphalt Plant	Bolton, ON
Derry Heights Commercial Development	Milton, ON
Rogers 333 Bloor Generator Upgrade	Toronto, ON
Loblaws Supermarkets	Various locations within Canada

Wind Farm noise measurements and compliance verification

Headwaters Wind Farm	Randolph County, IN
Snowy Ridge Wind Farm	Kawartha Lakes, ON
Port Ryerse Wind Farm	Port Dover, ON
K2 Wind Project Wind Project	Kincardine, ON
Grey Highlands Wind Projects	Grey County, ON

payam ashtiani

BASc PEng ASA

profile

Payam Ashtiani is a Professional engineer in good standing, with a Bachelor's degree in Mechanical Engineering from the University of Toronto. He has 8 years of experience in the field of Acoustics with a specific focus on noise from wind turbines. Apart from completing numerous noise assessments for wind projects, and extensive wind turbine noise measurement campaigns, he has authored multiple research papers on the topic and presented at international technical conferences. His experience has included providing expert advice to regulatory bodies such as the Ontario Ministry of Environment, and the Vermont Public Service Department on the topic of wind turbine noise, and has appeared as expert witness in cases such as the Kent Breeze Environmental Review Tribunal, and the Alberta Utilities Commission Hearing for the Bull Creek Wind Farm. Payam also oversees the technical group responsible for carrying out IEC 61400-11 measurements – the only such group accredited to ISO 17025 in Canada.

education + career milestones

B.A.Sc., Mechanical Engineering, University of Toronto, 2005
joined aercoustics in 2006 as a noise and vibration consultant.
Member of

Canadian Acoustical Association,
Professional Engineers of Ontario,
Acoustical Society of America

publications

Detection of Amplitude Modulation in Southern Ontario Wind Farms, Halstead, D., Suban-Loewen, S, **Ashtiani P**, 6th International Conference of Wind Turbine Noise, Glasgow, Scotland, 20-23 April 2015

Spectral discrete probability density function of measured wind turbine noise in the far field. **Ashtiani P** and Denison A (2015). Front. Public Health 3:52. doi: 10.3389/fpubh.2015.00052

Health-based audible noise guidelines account for infrasound and low-frequency noise produced by wind turbines. Berger RG, **Ashtiani P**, Ollson CA, Whitfield Aslund M, McCallum LC, Leventhall G and Knopper LD (2015) Front. Public Health 3:31. doi: 10.3389/fpubh.2015.00031

Generating a better picture of noise immissions in post construction monitoring using statistical analysis, **Ashtiani, P.**, 5th International Conference of Wind Turbine Noise, Denver, Colorado, 28 - 30 August 2013

A new software tool to facilitate NURB based geometries in acoustic design, O'Keefe J., **Ashtiani, P.**, Grant D., International Symposium on Room Acoustics, Toronto, Canada, 9 June 2013

Analysis of noise immission levels measured from wind turbines, **Ashtiani, P.**, Titus, S, Wind Turbine Noise 2011, Rome, Italy, 11-14 April 2011

Improved noise audit technique for wind farms, Titus S., **Ashtiani P.**, INTER-NOISE 2010, Lisbon, Portugal, 13-16 June 2010

Concerns with using simplified wind profiles in determining noise impacts of wind turbines, Gambino, V., **Ashtiani, P.**, Preager, T., Ramakrishnan, R., INTER-NOISE 2009, Ottawa, Canada, August 23-26, 2009

Acoustic Performance Considerations For A "Once Through Steam Generator", Gambino, V., **Ashtiani, P.**, 2006.

selected projects

Noise modelling and assessment

Wolfe Island EcoPower Centre	Wolfe Island, ON
McLeans Mountain Wind Farm	Manitoulin Island, ON
Grand Bend Wind Farm	Grand Bend, ON
Bull Creek Wind Farm	Provost, AB
Ingredion (formerly CASCO) facility NIA	Cardinal, ON
Kraft Foods NIA and noise abatement plans	Various locations within Ontario
Q9 Networks data centres	Various locations within ON, AB, BC
Oldcastle building products (Permacon Group)	Various locations within Ontario

Wind Turbine noise measurements and compliance verification

Kingsbridge wind plant (K1)	Goderich, ON
Melancthon EcoPower Centre	Melancthon, ON
Wolfe Island EcoPower Centre	Wolfe Island, ON
Gosfield Wind Project	Essex County, ON
Comber Wind Project	Essex County, ON
South Kent Wind Project	Chatham-Kent, ON
Port Dover Nanticoke Wind Project	Nanticoke, ON
South Dundas Wind Project	South Dundas, ON
HAF Wind Energy Project	West Lincoln, ON
Wainfleet Wind Energy Project	Wainfleet, ON
Vestas R&D Acoustics Testing	Undisclosed locations
GE R&D Acoustic Testing	Undisclosed locations
Hybridyne wind Systems	Various locations with Ontario

Peer Review, expert witness, and expert advice

Various Wind Turbine Noise submissions to Public Service Board	Montpellier, VT
Ontario Ministry of Environment wind turbine noise measurement protocol	Ontario
Dufferin Wind Power project noise study peer review	Dufferin County, ON
Kent Breeze ERT (Erickson vs. Director)	Chatham-Kent, ON