Dunmore Solar Power Plant

Noise Impact Assessment

Client: Dunmore Solar Inc.
Reference: 23-012
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Dunmore Solar Inc.

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Executive Summary

The Dunmore Solar Power Plant (the Project)[1] was originally submitted to the Alberta Utilities Commission (AUC) in 2021, as a 216-megawatt (MW_{AC}) photovoltaic (PV) electricity generating power plant. Green Cat Renewables Canada Corporation (GCR) was retained by Dunmore Solar Inc. (Dunmore Solar) to prepare the original Noise Impact Assessment (NIA) [2] for the Project. The Project is located in Cypress County, Alberta, approximately 9km northeast of the Hamlet of Dunmore.

Following AUC approval of the Project in September 2021[3], revisions were made to the permitted design, including the inverter type, quantity, and location, and the use of a single-axis tracker system. GCR was therefore retained by Dunmore Solar to complete an additional NIA for the Project, considering the revised Project design. The Project is now proposed to have a lower capacity of 172.8MW_{AC}, consisting of ground mounted, single-axis tracking modules, forty-eight Sungrow SG3600UD-MV inverter/transformer stations, and a Project Substation. For the purposes of the noise assessment, it has been assessed that the only significant noise producing Project elements are the inverter/transformer stations and the Project substation. The sound power level data for the significant noise producing Project elements was used to model sound emissions for both daytime and night-time periods.

GCR reviewed aerial imagery of the site, identifying seven receptors as having the potential to be affected by the noise from the proposed Project. The area was also checked for regulated third-party energy-related facilities that may produce noise within the vicinity of the Project.

A software model was used to predict sound levels from the Project to determine compliance with the Alberta Utilities Commission (AUC) Rule 012: Noise Control requirements. The cumulative sound level was found to be less than 3dB below the Permissible Sound Level (PSL) for night-time periods, so a detailed noise assessment was carried out as per the AUC Rule 012, Appendix 3 – Summary report, recommendations.

Where applicable, cumulative sound levels incorporated sound from: existing regulated third-party energy-related facilities; third-party projects; the proposed Project; and ambient sources. The assessment concluded that cumulative sound levels would be compliant with permitted sound levels at all receptors assessed. A Low Frequency Noise (LFN) assessment determined that sound from the proposed Project is not expected to contain any significant LFN effects.

The proposed Dunmore Solar Power Plant was therefore assessed to meet the requirements of AUC Rule 012.

[1] AUC Proceeding 26485
[2] AUC Exhibit 26485_X0011
[3] AUC Power Plant Approval #26485-D02-2021

Table of Contents

1 Introduction

The Dunmore Solar Power Plant (the Project) was previously approved[4] by the Alberta Utilities Commission (AUC) in 2021[5] as a 216-megawatt (MW_{AC}) photovoltaic (PV) electricity generating power plant located approximately 9km northeast of the Hamlet of Dunmore in Cypress County, Alberta. After AUC approval of the Project, the permitted Project design was refined, including changes to the type, quantity, and location of the inverters. Dunmore Solar Inc. (Dunmore Solar) retained Green Cat Renewables Canada Corporation (GCR) to conduct a noise impact assessment (NIA) for the refined Project design. Following these changes, the Project will now have a grid capacity of 172.8MW_{AC}, consisting of ground mounted, single-axis tracker modules, forty-eight (48) inverter/transformer stations, and a project substation. The Project location is shown in **Figure 1-1** below. The assessment considered the cumulative impact of existing and proposed noise sources on nearby receptors.

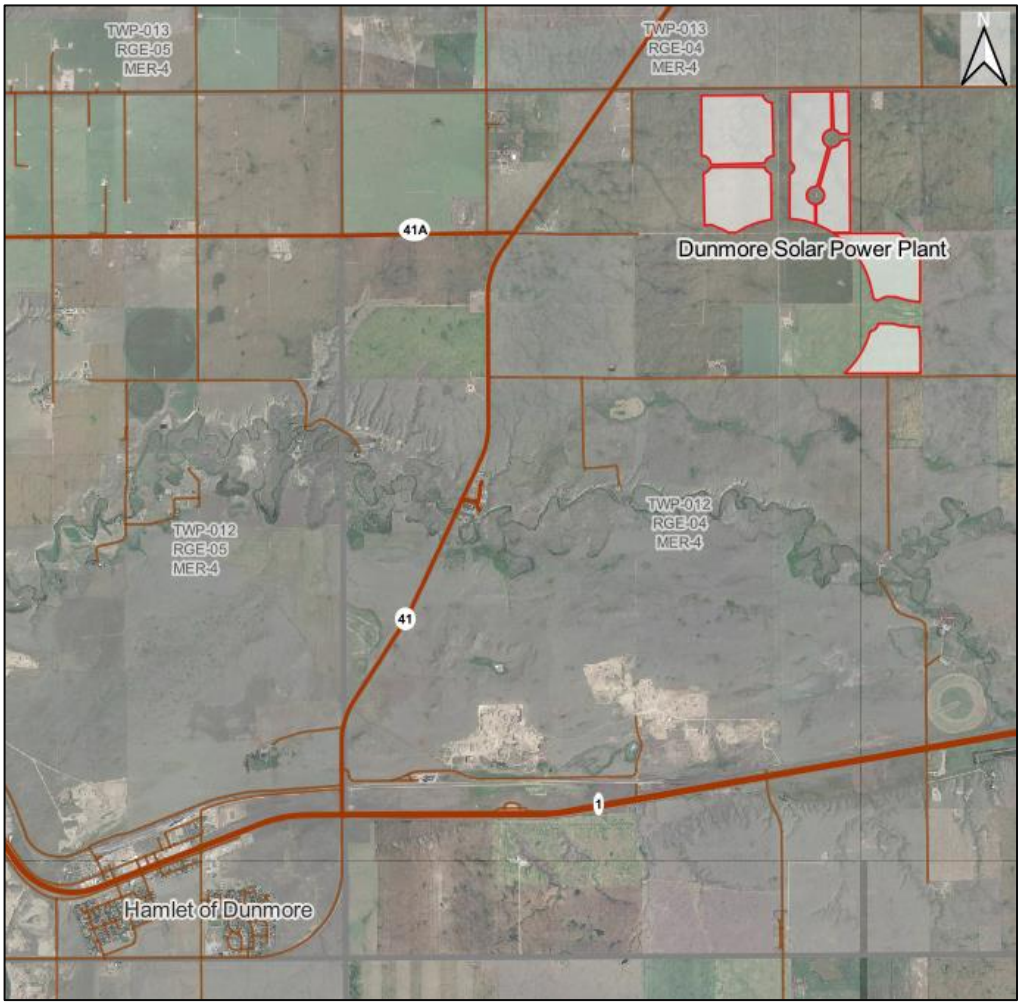


Figure 1-1 – Dunmore Solar Power Plant Location

[4] AUC Power Plant Approval #26485-D02-2021
[5] AUC Proceeding 26485

2 Rule 012 Assessment Process

The assessment process follows Alberta Utilities Commission (AUC) Rule 012 guidelines. The International Standard 'ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors', was followed in the prediction of noise levels at nearby receptors. A glossary of relevant AUC Rule 012 terms is reproduced in Appendix A.

The following steps give an overview of the process followed in identifying potential noise impacts on the most affected receptors.

- Define study area (distance contour at site boundary + 3km)
- Identify active and approved third party regulated energy-related facilities (AUC or Alberta Energy Regulated (AER)) within the study area
- Identify noise receptor(s) within 1.5km of the site boundary, or along the 1.5km boundary criteria (where no noise receptors exist).

For each noise receptor:

- Determine Basic Sound Level (BSL) and Ambient Sound Level (ASL)
- Predict sound level from existing and approved third party regulated energy-related facilities
- Combine facility and Ambient Sound Levels to give baseline sound levels
- Predict sound level from the proposed project
- Assess for Low Frequency Noise (LFN) content due to project
- Calculate Permissible Sound Levels (PSLs)
- Calculate Cumulative Sound Levels
- Assess compliance with AUC Rule 012 requirements

3 Noise Model

All noise propagation calculations were performed using iNoise from DGMR Software (version Enterprise 2023.01). This is quality assured software with full support of ISO/TR 17534-3, which provides recommendations to ensure uniformity in the interpretation of the ISO 9613 method.

DGMR provide the following information on the function of ISO/TR 17534-3[6]: '*The ISO 9613 standard from 1996 is the most used noise prediction method worldwide. Many countries refer to ISO 9613 in their noise legislation. However, the ISO 9613 standard does not contain guidelines for quality assured software implementation, which leads to differences between applications in calculated results. In 2015 this changed with the release of ISO/TR 17534-3. This quality standard gives clear recommendations for interpreting the ISO 9613 method. iNoise fully supports these recommendations. The models and results for the 19 test cases are included in the software...'.*

3.1 Model Parameters

Summer-time climatic conditions were assumed as required by Rule 012. Table 3-1 shows the modelling parameters that were adopted for all calculations.

Table 3-1 – Model Parameters

Modelling Parameter	Setting
Terrain of Site Area	Height Contours Interpolated at 3m[7]
Barrier Effects Included	None
Temperature	10°C
Relative Humidity	70%
Wind	1 – 5ms^{-1} from facility to receptor as per ISO-6913
Ground Attenuation	0.5
Number of Sound Reflections	1
Receptor Height	4.5m (two-storey)
Operation Condition	Full load
Source Height	2.3m for Inverter/Transformer Stations 4.00m for Substation Transformers

[6] https://dgmrsoftware.com/products/inoise/
[7] Data obtained from AltaLIS.

4 Baseline

4.1 Study Area

The development site has a total fenced area of approximately 700 acres. The study area includes rural/agricultural land and waterbodies.

Within the AUC study area of 1.5km outside the project boundary, multiple dwellings were identified surrounding the Project site boundary. Seven (7) dwellings have been assessed for cumulative noise impacts from the Project and other nearby facilities, as required by Rule 012.

4.2 Project Description

The Project will encompass an area of approximately 700 acres of land consisting of approximately 373,360 PV modules, with a total generating capacity of 172.8MW_{AC}. The solar arrays will utilize ground mounted, single-axis tracker modules which will feed 48 inverter/transformer stations. A project substation containing one 240MVA transformer is also included. The inverter/transformer stations and project substation are assumed to be the only significant sources of noise from the Project. As such, no other project elements are considered in this assessment.

Daytime periods are defined as occurring between 07:00-22:00, while night-time periods fall between 22:00-07:00. The Project will largely operate during the defined daytime hours; however, sunrise on the longest days of the year (during summer months) will occur at approximately 05:00, which falls within the night-time period. Therefore, the assessment considers both daytime and night-time operational impacts (i.e., operating 24/7).

4.3 Sensitive Receptors

Seven (7) residential dwellings located within the 1.5km study area were identified by GCR as potentially being the most impacted by the project. To provide a conservative assessment, all receptors were modelled at a two-storey elevation of 4.5m. Table 4-1 shows the location details and the height of each receptor.

Table 4-1 – Receptor Details

Receptor ID	UTM Coordinates (NAD 83, Zone 12N)		Dwelling Type	Receptor Height (m)	Relative location from site boundary
	Easting	Northing			
R1	538152	5543930	Two-Storey	4.5	300m E
R2	535355	5543856	Two-Storey	4.5	840m W
R3	535207	5543602	Two-Storey	4.5	990m W
R4	535283	5543362	Two-Storey	4.5	920m W
R5	536421	5540976	Two-Storey	4.5	1390m W
R6[8]	539343	5540247	Two-Storey	4.5	940m SE

[8] Receptor R6 was not included in the original NIA.

Receptor ID	UTM Coordinates (NAD 83, Zone 12N)		Dwelling Type	Receptor Height (m)	Relative location from site boundary
	Easting	Northing			
R7[9]	539206	5544309	Two-Storey	4.5	1380m NE

4.4 Existing Third-Party Regulated Energy-Related Facilities

A search for active and approved regulated energy-related facilities and pumping wells within 3km of the Project boundary was conducted in February 2023. The AER's Facilities list (ST102) and Wells list (ST037) were consulted for the AER regulated facilities and wells, and AUC eFiling portal was used to identify any existing and approved AUC regulated facilities. GCR did not identify any active or approved AER regulated facilities, AER regulated pumping wells, or AUC regulated facilities within the study area. This is consistent with the original NIA[10] completed by GCR for the Dunmore Solar Power Plant.

An overview of the Project study area is noted on Figure 4-1.

[9] Receptor R7 was not included in the Original NIA.
[10] AUC Exhibit 26485_X0011

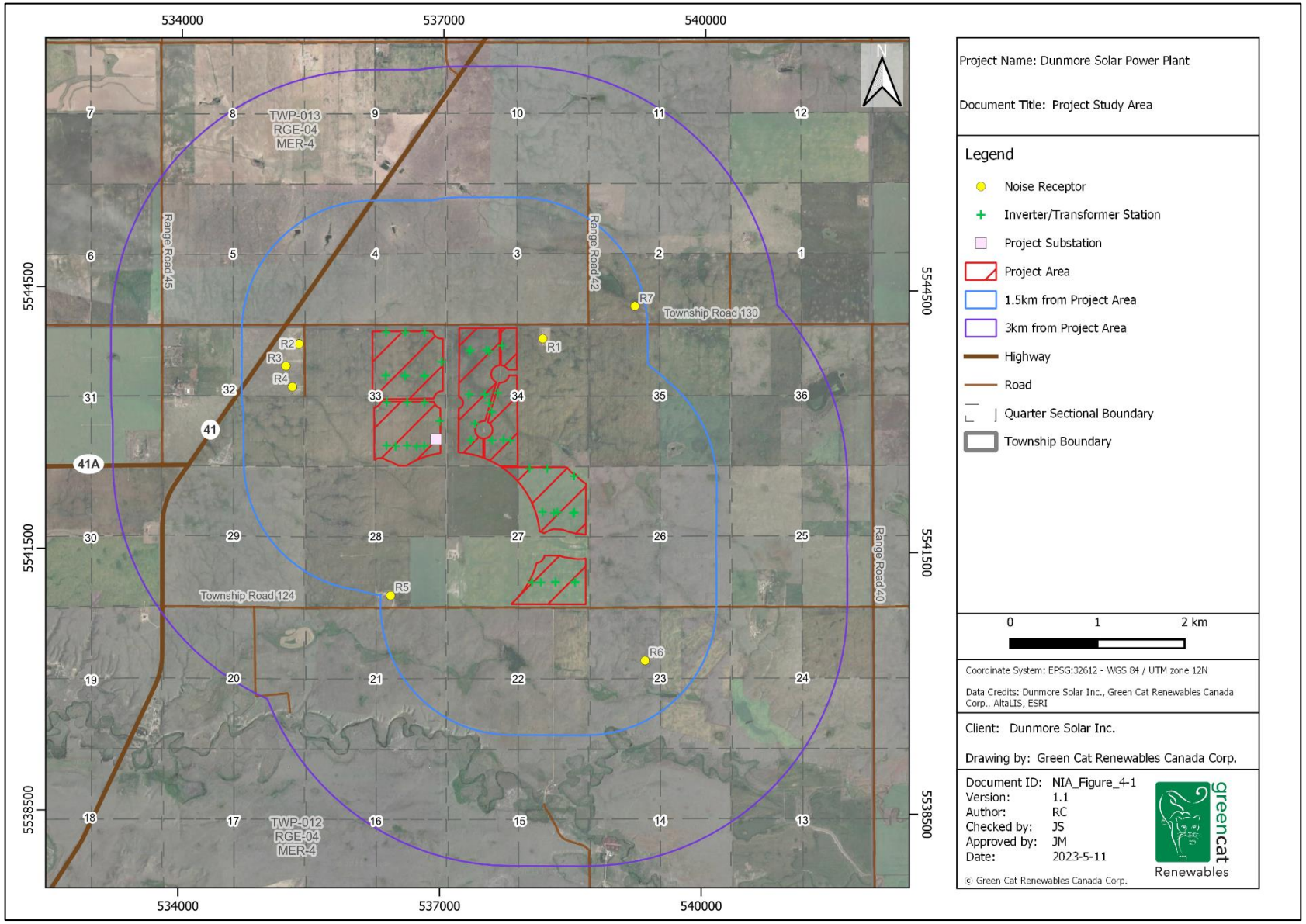


Figure 4-1 – Project Study Area

4.5 Baseline Sound Levels

Baseline sound levels for each receptor should incorporate a contribution from all existing and approved AER and AUC facilities with the addition of the Ambient Sound Level (ASL). ASL is determined from the Basic Sound Level (BSL).

4.5.1 Determination of Basic Sound Level (BSL)

Rule 012 criteria for the determination of BSL include: dwelling density; road and rail traffic noise; and aircraft flyovers. In this case, dwelling density and road & traffic noise are the determining factors. Criteria are given in Table 4-2.

Table 4-2 – Rule 012 Criteria for determination of Basic Sound Levels (BSL)

Proximity to transportation	Dwelling density per quarter section of land		
	(1) 1 to 8 dwellings; 22:00 - 07:00 (night-time) (dBA Leq)	(2) 9 to 160 dwellings; 22:00 - 07:00 (night-time) (dBA Leq)	(3) >160 dwellings; 22:00 - 07:00 (night-time) (dBA Leq)
Category 1[11]	40	43	46
Category 2[12]	45	48	51
Category 3[13]	50	53	56

The assessed receptors in the study area have been evaluated to determine their category for both dwelling density and proximity to transportation. Table 4-3 identifies the categories for the assessed receptors.

Receptors R1 and R5-R7 have been evaluated as category one for both dwelling density and proximity to transportation.

Receptors R2-R4 are assessed as category 2 for proximity to transportation. Traffic data collected for Highway 41, collected at the intersection of Highway 41 and Highway 41A, indicates a level of traffic flow that well exceeds the Rule 012 'Heavily Travelled Road' criteria of '90 or more vehicles travel during the nine-hour night-time period consistently for any one-month period in a year'.

In contrast to the original NIA[14] completed by GCR for the Project, R4 has now been assessed as category 2 for proximity to transportation due to its location being "more than or equal to 30m, but less than 500m from heavily travelled roads". Traffic data is shown in Appendix B.

4.5.2 Determination of Ambient Sound Level (ASL)

The Project is located in an area typical of rural Alberta (including agricultural and oil & gas industries). Rule 012 states that 'In the absence of measurement, the night-time ambient sound level is assumed to be five dB less than the basic sound level and the daytime ambient sound level is assumed to be five dB less than the basic sound level plus the

[11] Category 1—dwelling(s) distance is more than or equal to 500 metres (m) from heavily travelled roads or rail lines and not subject to frequent aircraft flyovers.
[12] Category 2—dwelling(s) distance is more than or equal to 30 m, but less than 500 m from heavily travelled roads or rail lines and not subject to frequent aircraft flyovers.
[13] Category 3—dwelling(s) distance is less than 30 m from heavily travelled roads, or rail lines or subject to frequent aircraft flyovers.
[14] AUC Exhibit 26485_X0011

daytime adjustment'.[15] This results in a night-time ASL between 35-40dB(A) and a daytime ASL between 45-50dB(A) for the assessed receptors. BSL and ASL for night-times and daytimes for each receptor are given in Table 4-3.

4.5.3 Determination of Permissible Sound Level (PSL)

For each receptor, the PSL is determined using Basic Sound Level (BSL) plus any allowed adjustments. In this case, as no special conditions exist, the PSL is determined as:

Night-Time (NT) Permissible Sound Level = Basic Sound Level

Daytime (DT) Permissible Sound Level = Basic Sound Level + Daytime Adjustment (10dB)

BSLs, ASL, and PSLs for night-times and daytimes and for each location are given in Table 4-3.

Table 4-3 – Daytime and Night-time BSL, ASL, and PSL

Dwelling ID	Transportation Category	Dwelling Category	BSL	ASL		PSL	
			NT/DT	NT	DT	NT	DT
R1	1	1	40	35	45	40	50
R2	2	1	45	40	50	45	55
R3	2	1	45	40	50	45	55
R4	2	1	45	40	50	45	55
R5	1	1	40	35	45	40	50
R6	1	1	40	35	45	40	50
R7	1	1	40	35	45	40	50

4.6 Total Baseline Sound Levels

Baseline sound levels include the noise contributions from existing adjacent sound sources and the ambient sound level assessed for the local environment. Considering the absence of active or approved third-party facilities within the study area according to publicly available data, and the conservative assumption that all receptors are two-storey, it was concluded that a site visit to field verify the baseline sound level considerations was not necessary. Due to no active or approved third-party facilities being located in the study area, the baseline sound levels are equal to the ambient sound levels for both night-time and daytime periods at each receptor. Table 4-4 shows the cumulative baseline sound levels for night-time (NT) and daytime (DT) periods.

[15] The daytime ASL accounts for the addition of the standard 10db(A) daytime adjustment to the night-time ASL for the hours between 7 a.m. and 10 p.m., without any further adjustments, i.e., Class A, B, and C adjustments were not applied.

Table 4-4 – Cumulative Baseline Sound Levels for Night-time and Daytime Periods

Dwelling ID	ASL		Baseline	
	NT	DT	NT	DT
R1	35	45	35	45
R2	40	50	40	50
R3	40	50	40	50
R4	40	50	40	50
R5	35	45	35	45
R6	35	45	35	45
R7	35	45	35	45

In contrast to the original NIA[16] completed by GCR for the Project, the baseline sound levels at R4 are assessed to be 40dB(A) during the night-time period and 50dB(A) during the daytime period, representing a 5dB(A) increase to the baseline sound level for each period. This is a result of assessing R4 as category 2 for proximity to transportation within this assessment, as per AUC Rule 012. Supplemental noise source information for each receptor is provided in Appendix C.

[16] AUC Exhibit 26485_X0011

5 Project Sound Levels

The Project will consist of solar PV arrays using ground-mounted single-axis trackers from NEXTracker Inc[17]. The solar arrays will be connected to forty-eight inverter/transformer stations, with a total capacity of up to 172.8MW_{AC}. A Project substation has been proposed to be included in the project area, consisting of one 240MVA high voltage (HV) transformer.

For the purposes of the noise assessment, it has been assessed that the only significant noise producing Project elements are the inverter/transformer stations and the Project substation.

The NEXTracker trackers use a mass balanced system requiring only low wattage motors, expected to be more than four orders of magnitude quieter than the inverter/transformer stations, and to operate asynchronously across the site for a few seconds every few minutes to adjust the tilt angle of the modules (adjustment frequency is dependant on time of year). Due to the trackers' infrequent and asynchronous operation, and their even distribution across solar sites, it was assessed that they would have limited potential to contribute to overall project sound levels and would not be considered significant noise producing Project elements.

The sound power level data for the significant noise producing Project elements was used to model sound emissions for both daytime and night-time periods. The inverter/transformers and Project substation were assumed to operate at full load, which is an inherently conservative modelling approach for night-time periods at a solar farm.

5.1 Inverter/Transformer Stations

The inverter/transformer stations proposed for the Project are the Sungrow SG3600UD-MV units. The sound data measurements for these inverters provided by the equipment manufacturer are shown in Appendix D.

Table 5-1 shows the linear, 'A', and 'C' frequency weighted octave band sound power spectra for SG3600UD-MV.

Table 5-1 – Octave Band Sound Power Levels for SG3600UD-MV Inverter/Transformer Stations

Octave Band Frequency (Hz)	Sound Power (dB)	Sound Power (dBA)	Sound Power (dBC)
31.5	91.0	51.6	88.0
63.0	92.0	65.8	91.2
125.0	93.0	76.9	92.8
250.0	92.0	83.4	92.0
500.0	97.0	93.8	97.0
1000.0	88.0	88.0	88.0
2000.0	87.0	88.2	86.8
4000.0	83.0	84.0	82.2
8000.0	80.0	78.9	77.0
Sum	**100.9**	**95.9**	**100.7**

[17] https://www.nextracker.com/nx-horizon-solar-tracker

5.2 Substation

The project substation will be comprised of one 240MVA HV transformer that will be used to transform electricity generated from the PV system to grid voltage. Each transformer has been modelled with Oil Natural Air Forced (ONAF) conditions for a conservative prediction. ONAF is an operation that uses second stage cooling for the transformers when there are higher ambient temperatures. Typically, in ONAF mode, the cooling fan is the source of the loudest noise emissions from the transformer. Octave band levels were derived using published ONAF spectral data, shown in Table 5-2.

Table 5-2 – Octave Band Sound Power Levels for the Project Substation

Octave Band Frequency (Hz)	Sound Power (dB)	Sound Power (dBA)	Sound Power (dBC)
31.5	98.3	58.9	95.3
63	102.3	76.1	101.5
125	105.3	89.2	105.1
250	103.3	94.7	103.3
500	103.3	100.1	103.3
1000	97.3	97.3	97.3
2000	92.3	93.5	92.1
4000	87.3	88.3	86.5
8000	79.3	78.2	76.3
Sum	**110.4**	**103.5**	**110.0**

5.3 Modelling Results

Predicted sound levels for the Project are shown in Table 5-3. The results assume full operation 24 hours a day, and they are applicable to night-time and daytime periods.

Table 5-3 – Predicted Project Case Sound Levels

Dwelling ID	Project Sound Level (dBA)
R1	37.9
R2	33.0
R3	32.3
R4	33.1
R5	31.3
R6	30.8

Dwelling ID	Project Sound Level (dBA)
R7	26.4

Receptor R1 is expected to be the receptor most impacted by noise from the Project, having a maximum sound pressure level of 37.9dB(A). In contrast to the original NIA[18] completed by GCR for the Project, the refined Project design considered in this assessment results in an increase of the Project case sound levels at R1-R5. R6 and R7 were not included in the original NIA[19].

The increase in the Project case sound levels observed for the refined Project design can be attributed to the location changes of the inverter/transformer stations, as well as the transition to the Sungrow SG3600UD-MV inverter/transformer stations, which have higher sound power levels than the Sungrow SG2500 units considered in the Original NIA[20].

Project sound level contours are shown in Appendix E.

5.4 Low Frequency Assessment

Table 5-4 shows the difference between A and C weighted predicted sound levels at each of the receptors modelled. The results show that the C-weighted and A-weighted receptor levels have differences well below the Rule 012 criterion of 20dB. This indicates that low frequency noise is not expected to be an issue.

Table 5-4 – Low Frequency Noise Assessment

Dwelling ID	Predicted Sound Level (dBA)	Predicted Sound Level (dBC)	Difference dBC – dBA
R1	37.9	44.6	6.7
R2	33.0	40.1	7.1
R3	32.3	39.7	7.4
R4	33.1	40.4	7.3
R5	31.3	39.6	8.3
R6	30.8	38.6	7.8
R7	26.4	35.0	8.6

[18] AUC Exhibit 26485_X0011
[19] AUC Exhibit 26485_X0011
[20] AUC Exhibit 26485_X0011

6 Cumulative Impact Assessment

The cumulative impact assessment incorporates sound level contributions from the baseline and Project case assessments. Compliance with AUC Rule 012 is determined through comparison of cumulative sound levels with PSLs. Table 6-1 shows the results of the cumulative impact and compliance assessment.

Table 6-1 – Cumulative Sound Level Assessment for Night-Time (NT) and Daytime (DT) Periods

Receptor	Baseline Sound Level (dBA)		Project Sound Level (dBA)		Cumulative Sound Level (dBA)		PSL (dBA)		PSL Compliance Margin (dB)	
Dwelling ID	NT	DT	NT	DT	NT	DT	NT	DT	NT	DT
R1	35.0	45.0	37.9	37.9	39.7	45.8	40	50	0	4
R2	40.0	50.0	33.0	33.0	40.8	50.1	45	55	4	5
R3	40.0	50.0	32.3	32.3	40.7	50.1	45	55	4	5
R4	40.0	50.0	33.1	33.1	40.8	50.1	45	55	4	5
R5	35.0	45.0	31.3	31.3	36.5	45.2	40	50	3	5
R6	35.0	45.0	30.8	30.8	36.4	45.2	40	50	4	5
R7	35.0	45.0	26.4	26.4	35.6	45.1	40	50	4	5

In comparison to the Original NIA[21] completed by GCR for the Project, which considered R1-R5, the night-time and daytime cumulative sound levels have increased at all assessed receptors, which is a result of the refined Project design and subsequent increases to the Project case sound levels.

Receptor R1 is the most affected by the Project sound levels. The refined Project design considered in this assessment resulted in R1 having a cumulative sound level of 39.7dB(A), representing a 4.1dB(A) increase from the Original NIA[22]. This increase is primarily due to the transition to the Sungrow SG3600UD-MV inverter/transformer stations considered in the refined Project design, which have higher sound power levels than the previously considered Sungrow SG2500 units.

Receptors R2, R3, and R5 also saw increases of up to 1.2dB(A)in the cumulative sound levels. Again, this increase is primarily due to the difference in inverter selection between the two Project designs.

Receptor R4 was assessed as category 2 for proximity to transportation, as per AUC Rule 012, resulting in a 5dB(A) increase in the night-time and daytime baseline sound levels in comparison to the Original NIA[23]. The resulting cumulative sound level at R4 for the refined Project design is 40.8dB(A), representing a 5.5dB(A) increase. Neglecting

[21] AUC Exhibit 26485_X0011
[22] AUC Exhibit 26485_X0011
[23] AUC Exhibit 26485_X0011

the effects of the changes in baseline sound level, the cumulative sound levels at R4 only showed minor increases, again due to the difference in inverter selection between the two designs.

Despite these increases, the cumulative sound levels at all assessed receptors are shown to meet PSLs by a minimum margin of 0dB during the nighttime periods and by at least 4dB for the daytime periods. Worst-case Project impacts are assessed to be compliant with the requirements of AUC Rule 012.

7 Conclusions

Seven receptors, within 1.5km of the project site boundary, were selected to assess potential noise impacts arising from the Project. Worst-case sound power levels were used to model sound emissions from the Project during day and night periods.

The Project will generally operate when the sun is out during daytime hours; however, AUC Rule 012 defines night-time hours to be from 22:00 to 07:00 all year long. Due to the sun rising prior to 07:00 during summer months, the Project may operate during the defined night-time period. Therefore, the assessment also considered worst-case (full load operation) noise emission levels 24 hours a day. In practice there will be periods when the Project operates in standby mode where sound emissions are much lower than the peak sound output levels assumed throughout this assessment.

The refined Project design considered within this assessment resulted in increases in the cumulative sound levels at all assessed receptors when compared to the Original NIA[24]. These increases can be attributed to the location changes of the inverter/transformer stations, as well as the transition to the Sungrow SG3600UD-MV inverter/transformer stations, which have higher sound power levels than the Sungrow SG2500 units considered in the Original NIA[25].

Cumulative sound levels at the receptors considered in this NIA were assessed to be below PSLs at all receptors by a minimum margin of 0dB. R1 was assessed to be the most impacted receptor.

A LFN assessment determined that sound from the proposed Project is not expected to produce any significant LFN effects.

It is therefore concluded that the refined design of the proposed Dunmore Solar Power Plant would operate in compliance with AUC Rule 012 requirements at all assessed receptors.

[24] AUC Exhibit 26485_X0011
[25] AUC Exhibit 26485_X0011

8 Acoustic Practitioners' Information

Table 8-1 summarizes the information of the authors and technical reviewer.

Table 8-1 – Summary of Practitioners' Information

Name	Riley Corrigan	Justin Lee	Merlin Garnett	Cameron Sutherland
Title	Renewable Energy E.I.T	Renewable Energy E.I.T	Principal Noise Consultant	Technical Director
Role	• Acoustic noise modelling • Noise Impact Assessment (NIA) co-author	• Acoustic noise modelling • Noise Impact Assessment (NIA) co-author	• Discipline lead • Acoustic noise modelling • Fieldwork lead • Noise Impact Assessment (NIA) Technical Reviewer	• Technical Assessment Lead • Noise Impact Assessment (NIA) Technical Reviewer and Approver
Experience	• Experience with acoustic modelling (iNoise) of renewable energy projects in Alberta.	• Experience with acoustic modelling in iNoise to model renewable energy projects in Alberta. • Analyst on multiple noise assessments for renewable energy projects in Alberta. • Current INCE associate.	• Over 10 years of acoustic and environmental consultancy for projects in the U.K. and Alberta. • Completed the UK Institute of Acoustics (IOA) diploma in 2015. • Full member of the IOA. • Author and reviewer of NIAs for multiple renewable energy projects in Alberta (2020-Present).	• 18 years of acoustic and environmental consultancy. • Acoustics (IOA) diploma (2012). • Expert witness experience in wind turbine noise in the UK (2017/18). • Expert witness experience in technical solar development in Canada (2019-23).

Appendix A: Rule 012 Glossary

Ambient sound level (ASL)

The sound level that is a composite of different airborne sounds from many sources far away from and near the point of measurement. The ambient sound level does not include noise from any energy-related facilities or from wind and must be determined without it. The average night-time ambient sound level in rural Alberta is 35 dBA. The ambient sound level can be measured when the sound level in an area is not believed to be represented by the basic sound levels in Table 1[26]. The ambient sound level must be determined under representative conditions and does not constitute absolute worst-case conditions (e.g., an unusually quiet day) but conditions that portray typical conditions for the area.

In the absence of measurement, the night-time ambient sound level is assumed to be 5 dBA less than the basic sound level and the daytime ambient sound level is assumed to be 5 dBA less than the basic sound level plus the daytime adjustment.

A-weighted sound level

The sound level as measured on a sound level meter using a setting that emphasizes the middle frequency components similar to the frequency response of the human ear at levels typical of rural backgrounds in mid frequencies. Sound levels are denoted: dB(A).

Basic sound level (BSL)

The night-time A-weighted Leq sound level commonly observed to occur in the designated land-use categories with industrial presence and is assumed to be five dB(A) above the ambient sound level, as set out in Table 1 of Rule 012.

Comprehensive sound level

The comprehensive sound level includes ambient sound level, noise from existing facilities and energy-related facilities.

Cumulative sound level

The cumulative sound level includes the comprehensive sound level, noise from proposed facilities, energy-related facilities approved but not yet constructed, and the predicted noise from the applicant's proposed facility.

C-weighted sound level

The C-weighting approximates the sensitivity of human hearing at industrial noise levels (above about 85 dBA). The C-weighted sound level (e.g., measured with the C-weighting) is more sensitive to sounds at low frequencies than the A-weighted sound level and is sometimes used to assess the low-frequency content of complex sound environments.

Daytime

Defined as the hours from 7 a.m. to 10 p.m.

Daytime adjustment

An adjustment that allows a 10 dBA increase because daytime ambient sound levels are generally about 10 dBA higher than night-time values.

[26] Table 1. Basic sound levels (BSL) for night-time (AUC Rule 12, Page 5, http://www.auc.ab.ca/Shared%20Documents/Rules/Rule012.pdf)

Density per quarter section

Refers to a quarter section with the affected dwelling at the centre (a 451-metre radius). For quarter sections with various land uses or with mixed densities, the density chosen must be factored for the area under consideration.

Down wind

The wind direction from the noise source towards the receiver (± 45 degrees), measured at either dwelling height or source height. The 45 degrees requirement is consistent with the definition for downwind conditions, as included in ISO 9613-1996, Attenuation of Sound During Propagation Outdoors – Part 2: general method of calculation.

Dwelling

Any permanently or seasonally occupied structure used for habitation for the purpose of human rest; including a nursing home or hospital with the exception of an employee or worker residence, dormitory, or construction camp located within an energy-related industrial plant boundary. Trailer parks and campgrounds may qualify as a dwelling if it can be demonstrated that they are in regular and consistent use.

A permanent dwelling is a fixed residence occupied on a full-time basis.

The most impacted dwelling(s) are those subject to the highest average weighted sound level relative to the permissible sound level.

Energy equivalent sound level (Leq)

The Leq is the average weighted sound level over a specified period of time. It is a single-number representation of the cumulative acoustical energy measured over a time interval. The time interval used should be specified in brackets following the Leq—e.g., Leq (9 hours) is a nine-hour Leq.

Energy-related facility

A facility under the jurisdiction of the Commission or other regulatory agency, used for energy generation, transport (except by road or rail line) and resource extraction. These include mining, extraction, processing, and transportation (except by road or rail line) as well as federally regulated electrical transmission lines and pipelines.

Far field

The far field is that area far enough away from the noise source that the noise emissions can be treated as if they come from a single point or line source and the individual components of the noise source are not apparent as separate sources. This is typically at a distance of at least three to five times the major dimensions of the noise source, such as length, width, height, or diameter.

Heavily travelled road

Includes highways and any other road where 90 or more vehicles travel during the nine-hour night-time period consistently for any one-month period in a year. The following methods to validate the travel volume are acceptable:

Alberta Transportation's Average Annual Summer Daily Traffic (ASDT) value. If the ASDT is not available, the Alberta Transportation's Average Annual Daily Traffic (AADT) value can be used. In the case of using the ASDT or AADT, 10 per cent of the daily traffic volume can be assumed to be the night-time period traffic.

Linear weighting (or Z-weighting)

The sound level measured without any adjustment for the sensitivity of human hearing. It is a direct measure in decibels of the variation in air pressure and is often referred to as the "sound pressure level". This level is sometimes

called the "linear weighted level" or "the unweighted level," as it includes no frequency weighting beyond the tolerances and limits of the sound level meter being used for the measurements.

Low frequency noise

Where a clear tone is present below and including 250 Hz and the difference between the overall C-weighted sound level and the overall A-weighted sound level exceeds 20 dB.

Night-time

Defined as the hours from 10 p.m. to 7 a.m.

No net increase

The concept of no net increase in relation to noise impact assessments may arise when the sound added by an incremental project to the baseline sound level results in a negligible sound level increase.

In cases where an applicant is proposing development of a facility where it is not practical or efficient to characterize baseline sound levels, the applicant may assume baseline compliance with the permissible sound level and use no net increase to justify that the proposed facility will have a negligible impact on cumulative sound levels. However, the predicted cumulative sound level must not exceed the permissible sound level by more than 0.4 dB.

When baseline sound levels are predicted to exceed the permissible sound level by 0.4 dB or less, the applicant is required to assess compliance for its proposed facility by adding noise contribution from its proposed facility to baseline sound levels.

Noise

The unwanted portion of sound.

Permissible sound level (PSL)

The maximum daytime or nighttime sound level as determined in Table 1 at a point 15 m from the dwelling(s) in the direction of the facility. The permissible sound level is the sum of the basic sound level, daytime adjustment, Class A adjustments and Class B adjustment, or Class C adjustments.

Proposed facility

A proposed facility is a facility for which an application has been deemed complete by the Commission but is not yet approved or for which an approval has been issued, but is not yet constructed.

Sound power level

The decibel equivalent of the rate of energy (or power) emitted in the form of noise. The sound power level is an inherent property of a noise source.

Sound pressure level

The decibel equivalent of the pressure of sound waves at a specific location, which is measured with a microphone. Since human reaction and material behaviours vary with frequency, the sound pressure level may be measured using frequency bands or with an overall weighting scale such as the A-weighting system. The sound pressure level depends on the noise sources, as well as the location and environment of the measurement path.

Summertime conditions

Ground cover and temperatures that do not meet the definition for wintertime conditions. These can occur at any time of the year.

Tonal components

The test for the presence of tonal components consists of two parts. The first must demonstrate that the sound pressure level of any one of the slow-response, linear, one-third octave bands between 20 and 250 Hz is 10 dBA or more than the sound pressure level of at least one of the adjacent bands within two one-third octave bandwidths. In addition, there must be a minimum of a 5 dBA drop from the band containing the tone within two bandwidths on the opposite side.

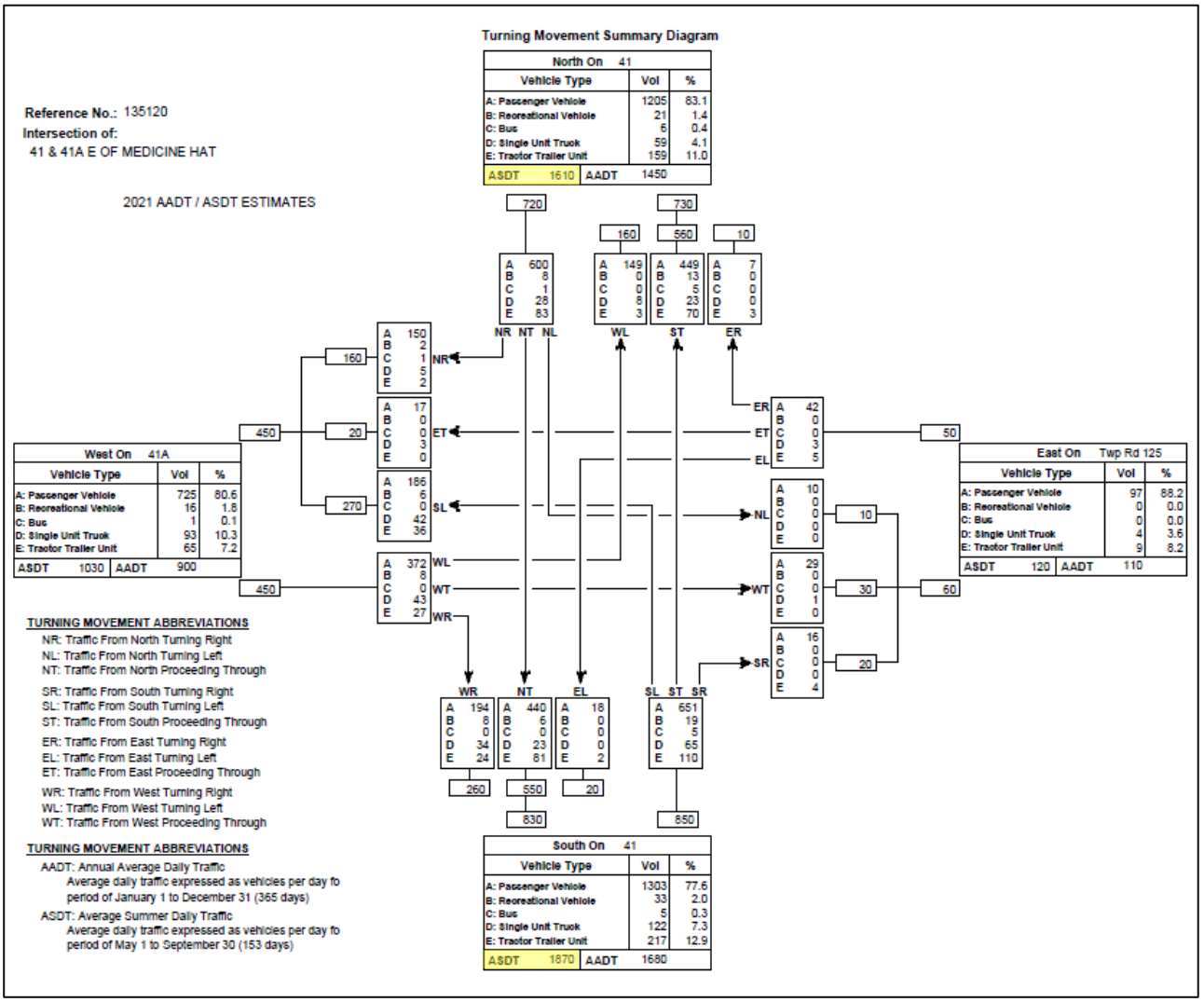
The second part is that the tonal component must be a pronounced peak clearly obvious within the spectrum.

Wind speed

The speed of the wind, expressed in metres per second (m/s), measured in and averaged over 10-minute intervals at the same height as the microphone, but not more than 10 metres above ground level.

Appendix B: Alberta Traffic Volume History

The following chart[27] shows the relevant section of the traffic volume history for the portion of Highway 41 in the proximity of the site. Using the '10% of ASDT' calculation to determine whether the highway is a 'Heavily Travelled Road', the available data show that the Rule 012 criteria of '90 or more vehicles travel during the nine-hour night-time period consistently for any one-month period in a year' is exceeded for vehicles travelling both north and south on Highway 41.



[27] http://www.transportation.alberta.ca/mapping/2021/TM/00135120.pdf

Appendix C: Supplemental Noise Source Information

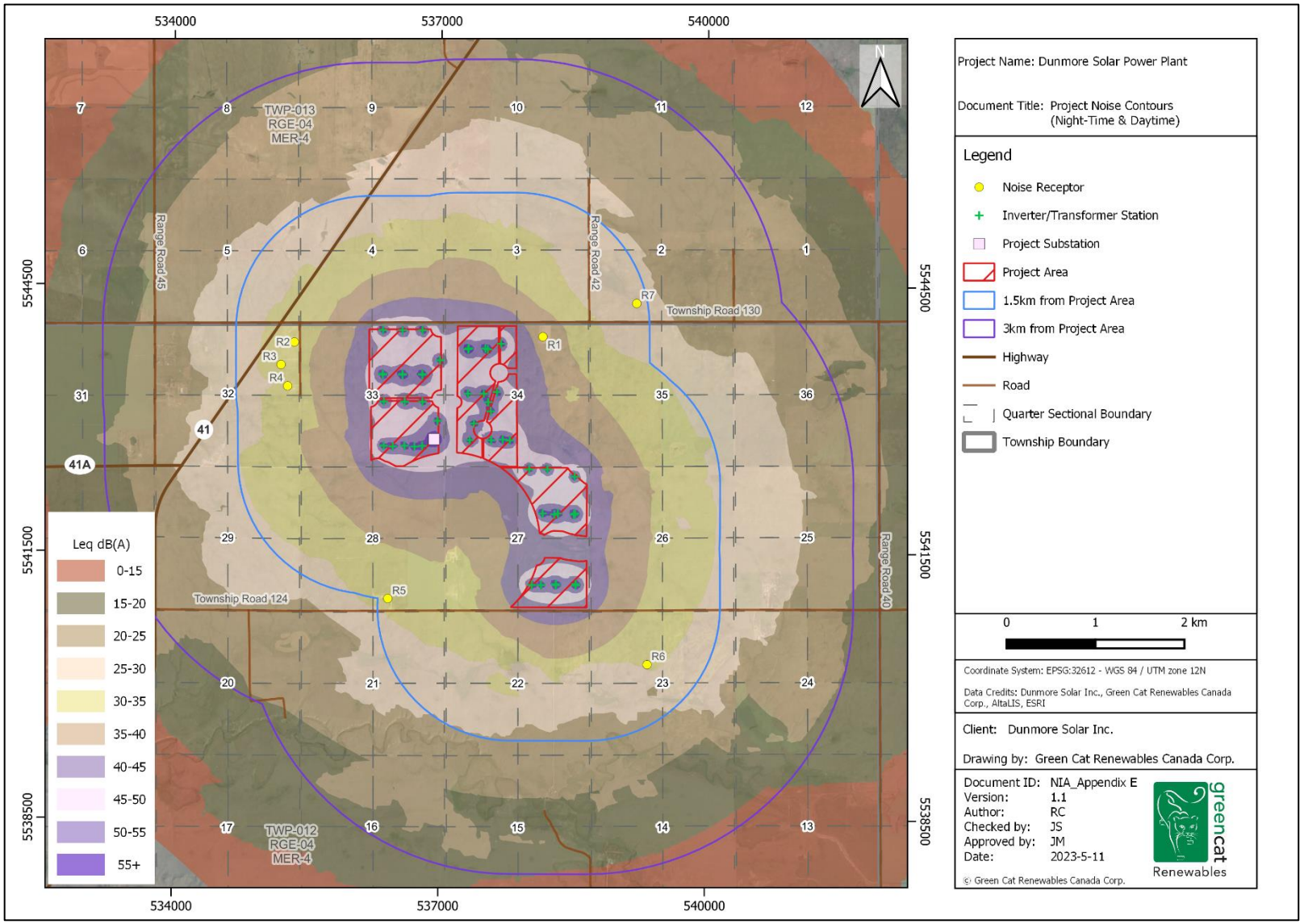
Dwelling ID	Project	
	Nearest Significant Project Noise Source	Distance to Nearest Significant Project Noise Source
R1	Inverter/Transformer Station	480m W
R2	Inverter/Transformer Station	1010m E
R3	Inverter/Transformer Station	1150m E
R4	Inverter/Transformer Station	1070m E
R5	Inverter/Transformer Station	1630m E
R6	Inverter/Transformer Station	1200m NW
R7	Inverter/Transformer Station	1590m SW

Appendix D: Vendor's Sound Power Data (Sungrow SG3600UD-MV)

Table 1. Sound Measurement Data, dB

Position	Octave Band Center Frequency, Hz									dBA	dBZ
	31.5	63	125	250	500	1000	2000	4000	8000		
1	69	68	68	67	68	63	62	57	52	69.2	75.6
2	66	67	68	67	67	63	63	57	51	68.9	74.6
3	69	68	70	71	75	66	64	62	58	74.3	79.0
4	71	71	74	71	78	71	71	66	64	78.0	81.8
5	69	68	70	71	76	66	63	60	59	74.3	79.2
6	66	67	65	66	69	62	60	56	51	68.7	74.2
7	61	64	64	58	58	54	45	40	35	58.7	69.0
8	65	68	71	65	66	64	59	56	50	68.2	75.2
9	69	69	69	72	75	65	66	61	55	74.0	79.0
10	70	73	74	71	81	71	68	67	62	78.6	83.3
11	69	69	72	72	73	67	65	60	55	73.6	79.0
12	67	68	67	66	70	63	62	58	52	69.9	75.3
13	64	68	68	65	71	60	56	51	47	68.5	74.9
14	69	71	73	71	74	64	63	57	51	72.4	79.2
Average	**68**	**69**	**71**	**69**	**74**	**66**	**64**	**61**	**57**	**73.3**	**78.4**
L_W	**91**	**92**	**93**	**92**	**97**	**88**	**87**	**83**	**80**	**95.9**	**100.9**

Appendix E: Project Sound Level Contours



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