

Project: **COLLECTOR WIND FARM**

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1.0 INTRODUCTION

The Collector Wind Farm is a consented project located in the Upper Lachlan Shire, approximately 3.5 km northwest of Collector, NSW. The consolidated Project Approval¹ for the Collector Wind Farm includes conditions which specify requirements for the control of environment noise associated with the project.

This document represents the Operation Noise Management Plan (ONMP) for the Collector Wind Farm, as required by condition E20 subclause a) of the Project Approval. The overriding objective of the ONMP is to define how the owners and operators of the Collector Wind Farm will meet its commitments and obligations under the Project Approval to achieve, demonstrate and maintain compliance the operational noise criteria specified in the Project Approval.

The requirements of the ONMP, as specified in Condition E20 subclause a), are reproduced in Table 1 below, along with the section of the ONMP which addresses the requirement.

Table 1: Condition E20 subclause a) requirements and relevant ONMP section

Condition	Relevant ONMP section
<i>As part of the Operational Environmental Management Plan required under condition E19 the Proponent shall prepare and implement (but not be limited to) the following:</i>	
(a) <i>an Operation Noise Management Plan to outline measures to minimise noise emission from the operation of the Project. The Plan shall include, but not necessarily be limited to:</i>	All
i. <i>details of the procedures to ensure ongoing compliance with the operational noise limits specified in conditions E6 and E7 as they apply to identified receivers. This should include identification of monitoring requirements;</i>	Procedures to achieve compliance documented in Section 3.0. Monitoring requirements and analysis procedures are documented in Section 4.0 and Section 5.0.
ii. <i>identification and implementation of best practice management techniques for minimisation of noise emissions where reasonable and feasible;</i>	Noise management measures summarised in Section 3.0.
iii. <i>procedures and corrective actions to be undertaken if non-compliance is detected.</i>	Section 7.0

This report therefore documents the following:

- An overview of the processes that have been implemented, and the procedures that will be followed, for achieving and maintaining compliance with the operational noise limits of the Project Approval;
- The procedures that will be used to measure and assess whether the wind farm is operating in accordance with the noise requirements of the Project Approval; and
- An overview of the procedures and corrective actions that would apply if a non-compliance with the noise requirements of the Project Approval is detected.

¹ The modified Project Approval refers to the Project Approval (Application No.: 10_0156) dated 2 December 2013 as amended by notices of modification dated 22 July 2016 (MOD 1), 15 May 2019 (MOD 2), and 16 August 2019 (MOD 3).

The ONMP represents a sub-plan of the broader Collector Wind Farm Operation Environmental Management Plan² (OEMP, approved 24 Feb 2021) which was prepared to address the requirements of Condition 19 of the Project Approval. The OEMP specifies that the operation of the wind farm must be carried out in accordance with this OEMP as approved by the DPIE. As a sub-plan of the OEMP, this ONMP supports the overall objective and commitment established in the OEMP to operate the wind farm in accordance with the requirements of the Project Approval.

This report is to be read in conjunction with the background noise report³ which provides details of:

- The most recent background noise monitoring carried out in the area around the wind farm; and
- The noise limits that were derived in accordance with the Project Approval.

Acoustic terminology used in this report is presented in Appendix A.

The procedures documented in this report were developed on the basis of the wind turbine selection and wind farm layout described in Appendix B and Appendix C respectively.

² Collector Wind Farm Pty Ltd document reference COLWF-2021-02-19-PLN-DPIE OEMP

³ MDA report Rp 002 2015087ML *Collector Wind Farm - Background Noise Monitoring* dated 30 September 2015

2.0 PROJECT APPROVAL

The Project Approval specifies environmental noise requirements in Conditions E6 to E9 inclusive and in Attachment 4. The conditions are summarised in Table 2 and reproduced in full in Appendix D.

Table 2: Project Approval – operational noise conditions summary

Project Approval item	Requirements
Condition E6	Specifies limits for operational wind turbine noise which apply at non-associated residences. Limits are numerically specified for receiver FF. For all other non-associated dwellings, the limits are specified as 35 dB or the background plus 5 dB, whichever is higher.
Condition E7	Specifies a limit of 35 dB for operational ancillary infrastructure noise which applies at non-associated residences.
Condition E8	Specifies a requirement for noise compliance monitoring and submission of the results to the Department and EPA within three (3) months of commencement of operations, unless otherwise agreed by the Secretary. The Department of Planning Industry and Environment (DPIE) subsequently approved an extension of the timing from three (3) months to five (5) months, as detailed in their correspondence dated 18 January 2021 (reproduced in Appendix D).
Condition E9	Specifies that further compliance monitoring shall be carried out if required by the Secretary.
Attachment 4	Specifies noise compliance monitoring and analysis requirements for operational noise associated with the project

In addition to the direct requirements of Conditions E6 to E9 inclusive and Attachment 4, the Terms of Approval also require the Proponent to carry out the project in accordance with the statement of commitments documented in Attachment 5 of the Project Approval. The statement of commitments includes mitigation tasks to address operational noise. The relevant clauses are therefore also reproduced in Appendix D.

The noise limits in accordance with the project approval are detailed in ONMP Section 4.1 and Section 5.1 for the substation and wind turbines respectively.

3.0 NOISE MANAGEMENT PROCEDURES

Managing operational noise associated with the Collector Wind Farm involves multiple steps during the planning, design and operation stage of the project. The key elements of the operational noise management procedures for the Collector Wind Farm are summarised in Table 3.

Table 3: Noise management procedures – key elements & description

Element	Description	Status
Background noise monitoring	Background noise data is required to: • Set operational noise criteria for wind turbines; and • Provide an indication of the potential influence of background noise during the compliance monitoring. Detailed background noise measurements were carried out in 2015. This comprised monitoring at the nearest non-associated receivers, and at intermediate locations positioned nearer to the wind farm which can be used as reference points for assessing noise levels at other distant locations. The results of the monitoring were used to derive the applicable noise limits in accordance with the Project Approval (the relevant results were subsequently documented in the Project Approval as part of the modification approval process in July 2016 – see MOD1) The background noise report contains full details of the background noise levels needed for the compliance monitoring.	Complete
Updated noise assessment	An updated operational noise assessment was listed as an agreed task in the statement of commitments documented in Attachment 5 of the Project Approval. This task was addressed via the updated noise assessment report⁴ prepared after the project was approved. The report detailed revised predicted noise levels for: • the Vestas wind turbine selected for the project; and • the design of the substation The original approved layout was designed to achieve compliance with the noise criteria. The final layout subsequently modelled in the updated noise assessment report was developed to address a range of environmental noise requirements, including the requirement to comply with the environmental noise criteria specified in the Project Approval. In parallel, selection of the final turbine for the site was based on compliance being achieved using standard operating modes (i.e. selecting a turbine with inherently low noise characteristics rather than relying on low noise operating modes). The updated noise assessment report based on the final layout and turbine selection demonstrated that operational noise levels were predicted to comply with the requirements of the Project Approval.	Complete

⁴ MDA report Rp 001 r04 2 20181163 *Collector Wind Farm – Updated Noise Assessment* dated 30 October 2018

Element	Description	Status
Wind turbine procurement	The turbine supply contract for the Collector Wind Farm includes noise performance guarantees that Vestas must achieve in order to fulfil its contract obligations. The performance guarantees were specified to be consistent with the Project Approval requirements. This is an important industry-standard element of the noise management process. Key elements of the turbine procurement are as follows: • The turbines were procured on the basis of achieving compliance without the use of noise-curtalement modes. The benefit of this approach is that turbines have the facility to have their noise emissions reduced via adjusted operating modes in the unlikely event of a non-compliance with Project Approval requirements • The turbines for the project are being supplied with blades which have a serrated trailing edge for reducing noise emissions which is increasingly becoming standard industry practice for the supply of turbines to the Australian market.	Complete
Substation equipment procurement	The updated noise assessment report demonstrated predicted noise levels from the substation significantly lower than the limits which apply under the Project Approval. However, notwithstanding this, the procurement contract included noise performance guarantees that the supplier must achieve in order to fulfil its contractual obligations.	Complete
Operation Environmental Management Plan (OEMP)	The ONMP represents a sub-plan of the broader Collector Wind Farm OEMP which was prepared to address the requirements of Condition 19 of the Project Approval. The approved OEMP specifies that the operation of the wind farm must be carried out in accordance with this OEMP as approved by the DPIE. As a sub-plan of the OEMP, this ONMP supports the overall objective and commitment established in the OEMP to operate the wind farm in accordance with the requirements of the Project Approval. The overarching environmental management framework (including the statutory framework) within which this ONMP is implemented is described in Sections 3, 4, 5, and 6 of the OEMP.	Complete
Compliance monitoring	Noise compliance monitoring procedures have been documented in this report (see subsequent sections), in accordance with the requirements of condition E20 subclause a). Compliance monitoring is to be carried out after commencement of operation. Compliance monitoring at specific locations would then be repeated when directed by the Secretary (as specified in condition E9), and may also be repeated to investigate a noise complaint.	To be carried out after commencement of operation, and then as required.
Corrective actions	Corrective actions are to be instigated in the event of a non-compliance with noise criteria specified in conditions E6 and E7 being detected (detected via either the compliance monitoring undertaken in the first five (5) months of operation, or any subsequent compliance monitoring). Procedures for corrective actions are described in Section 7.0 of this report. Elements of the corrective actions are also detailed in the agreed tasks of the statement of commitments.	To be implemented if and when required

Element	Description	Status
Communications	Communication with local stakeholder and community groups is an important element of the noise management process. In accordance with the requirements of the Project Approval and the statement of commitments, the following key elements have been established to facilitate communications with these groups throughout the project life: • Community Consultative Committee (condition C1 requirement) • Complaints and Enquiries Procedure, with contact phone number, email, and postal addresses (condition C3 requirement) • Community Information Plan (condition C4 requirement) • a project website for the provision of electronic information (condition C6 requirement of and agreed task in the statement of commitments) The Operational Environment Management Plan also provides details of how noise complaints will be managed and investigated.	Complete

4.0 SUBSTATION – COMPLIANCE TESTING REQUIREMENTS

4.1 Noise limits

In accordance with condition E7 of the Project Approval, noise levels associated with operation of the substation must comply with a noise limit of 35 dB $L_{Aeq(15 \text{ minute})}$ when measured and assessed in accordance with the NSW EPA publication *Noise Policy for Industry* (NPI) dated October 2017. The NPI supersedes the *NSW Industrial Noise Policy* referenced in condition E7 and therefore represents the equivalent publication to reference in accordance with condition E7.

The noise limit applies at all non-associated residences (receivers) around the wind farm. At each receiver, the limit applies to locations that are not less than 3 m, and not more than 30 m, from the facade of the dwelling.

4.2 Noise measurement location

The substation of the Collector Wind Farm is located at the north end of the turbine layout (Figure 1 of Section 5.2 illustrates the site layout).

Receiver DD is the nearest receiver to the substation, located over 2.5 km to the north of the substation. At this distance, noise levels associated with operation of the substation are predicted to be low, and therefore comparable to or lower than the background noise. Direct measurement of the noise associated with operation of the substation at the nearest receiver is therefore impractical. Further, noise levels at the nearest receiver, as a result of operation of the substation, will be dependent on atmospheric conditions (wind direction/speed and temperature profile).

Noise compliance monitoring is to be carried out at an intermediate location between the substation and the nearest receiver. This is consistent with the provisions of the NPI.

An intermediate location between the wind turbine layout and receiver DD was identified and surveyed as part of the background noise monitoring undertaken in 2015. Monitoring at this intermediate location is to be repeated after commencement of operations to assess compliance with both the ancillary infrastructure and wind turbine noise performance requirements specified in the Project Approval.

The monitoring location is illustrated in Figure 1 of Section 5.2.

4.3 Noise measurement procedures

Noise monitoring is to be carried out concurrently with the noise monitoring detailed in Section 5.0 for operational wind turbine noise. For this reason, and to account for variations in noise levels associated with atmospheric conditions, the noise monitoring is to comprise unattended noise measurements.

The noise monitoring equipment and measurement procedures shall generally be identical to the procedures described subsequently in Section 5.3.2 for operational wind turbine noise, subject to the following variations:

- Noise levels shall be determined for consecutive 15-minute intervals, per the requirements of the NPI
- Attended measurements and observations of substation noise shall be undertaken during visits to the site for installation and removal of the unattended monitoring equipment
- The measured noise level data shall include:
 - Equivalent noise levels, dB $L_{Aeq(15 \text{ minute})}$
 - The underlying noise level, dB $L_{A90(15 \text{ minute})}$

- One-third octave band frequency spectra from 10 Hz to 10 kHz inclusive, for both the equivalent and underlying noise levels (for the assessment of low frequency noise and tonality in accordance with the NPI).

4.4 Noise measurement timing & duration

Condition E8 of the Project Approval specifies that operational noise monitoring results for the substation are to be submitted to the Department and EPA within three (3) months of operations commencing, unless otherwise agreed with the Secretary. The DPIE subsequently agreed to an extension of the time period from three (3) months to five (5) months (reference DPIE correspondence dated 18 January 2021) to enable the work to be completed effectively.

The noise measurements shall be timed to meet the commitment to submit the results to the DPIE within five (5) months of commencement of operations. Any variation from this commitment for reasons beyond the control of the owners of the Collector Wind Farm (e.g. unexpected equipment damage or failure, COVID interruptions, or interruptions to site operations) would require prior written approval of the DPIE.

For the purposes of the noise compliance testing, commencement of operations is referenced as the date when all fifty-four (54) turbines of the Collector Wind Farm are fully operational and consistently supplying power to the electricity grid. The formal date for the commencement of operations will be nominated to the Department, in accordance with the obligations of Condition A8 subclause d).

4.5 Analysis procedures

Operational noise levels associated with the substation will primarily consist of the steady noise contributions of the electrical elements of the transformers and any associated cooling plant. Accordingly, the measured underlying L_{A90} noise levels are suitable to inform an assessment of equivalent L_{Aeq} noise levels associated with the substation (the L_{A90} being less sensitive than the L_{Aeq} to transitory noise level increases as a result of ambient noise sources that are unrelated to the operation of the substation).

Noise levels measured under atmospheric conditions which increase the noise contribution of the substation at the intermediate measurement location are to be assessed, excluding the following conditions as specified in Attachment 4 of the Project Approval:

- wind speeds greater than 3 m/s at 10 m above ground level; or
- temperature inversion conditions between 1.5 °C and 3 °C per 100 m and wind speeds greater than 2 m/s at 10 m above ground level; or
- temperature inversion conditions greater than 3 °C per 100 m.

The periods to be excluded correspond to conditions which would result in substation noise levels that are equivalent to, or higher than, those which would occur during valid assessment conditions. An analysis which includes these conditions would therefore provide a conservative assessment of compliance (note: reliably quantifying the presence of temperature inversions that are relevant to the path of sound transmission is complex, and may not ultimately be necessary if compliance is able to be demonstrated without identifying and removing these periods).

The results of the unattended monitoring shall be analysed to determine the estimated contribution of the substation to the total measured noise levels at the intermediate location, accounting for relevant data trends and characteristics (e.g. time history profiles and frequency spectra).

The estimated substation noise levels at the intermediate location shall then be extrapolated to the nearest receivers using the procedure documented in Section 11.2 of ISO 1996-2:2017 *Acoustics — Description, measurement and assessment of environmental noise — Part 2: Determination of environmental noise levels* (ISO 1996-2:2017), in conjunction with the noise prediction method

detailed in ISO 9613-2:1996 *Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation* (ISO 9613-2:1996).

The characteristics of the noise associated with operation of the substation shall be assessed for the presence of characteristics which could warrant the application of modifying factor corrections to the noise level. If characteristics are identified and determined to be relevant to the noise levels at the nearest receivers, modifying correction factors in accordance with the NPI shall be applied to the extrapolated substation noise levels prior to comparing the results with the applicable noise limit.

5.0 WIND TURBINES – COMPLIANCE TESTING REQUIREMENTS

5.1 Noise limits

The operational noise limits apply at non-associated residences (receivers) in the vicinity of the Collector Wind Farm, as specified in condition E6 of the Project Approval.

The following specific items are noted:

- The limits apply to the noise solely related to the operation of the Collector Wind Farm when measured and assessed in accordance with the procedures detailed in the Project Approval.

Condition E6 of the Project Approval specifies that the noise of the wind farm shall be measured in accordance with the South Australian Environment Protection Authority's *Wind Farms – Environmental Noise Guidelines 2009* (the SA 2009 guidelines), modified by the provisions detailed in Attachment 4 of the Project Approval. However, Condition E6 also notes that if the guideline is replaced by an equivalent NSW guideline, then the noise is to be measured in accordance with the NSW Guideline. The NSW Department of Planning and Environment subsequently published *Wind Energy: Noise Assessment Bulletin - For State significant wind energy development* (the NSW Noise Assessment Bulletin) in December 2016. The NSW Noise Assessment Bulletin is considered to be the 'equivalent NSW Guideline' referred to in condition E6. Accordingly, wind farm noise levels associated with the Collector Wind Farm are to be measured in accordance with the NSW Noise Assessment Bulletin. It is however noted that the NSW Noise Assessment Bulletin continues to reference the SA 2009 guidelines and includes the same modifying provisions detailed in Attachment 4 of the Project Approval. Further information concerning the noise monitoring procedures is set out in Section 5.3 of this ONMP.

- The noise limits are referenced to wind speeds measured at the site of the wind farm.

To enable a meaningful assessment against these noise limits, the measured post-construction noise levels must be correlated with the same wind speed reference used for the background noise monitoring to derive the limits (further information in relation to wind speed for the assessment of post-construction noise levels is provided in Section 5.4 of this ONMP).

- In accordance with the Project Approval, the limits apply to the aggregated noise of the wind farm measured during all time periods (i.e. the noise limits are not specified for separate time periods).

The background noise report details operational noise limits derived from background noise monitoring for receivers FF and Z.

The derived limits for FF were subsequently documented in condition E6 of the Project Approval.

In relation to receiver Z, a Neighbourhood Access Agreement (NAA) was established between RAC and the owners of the residence and allows for the construction of a wind turbine generator (T16) at a distance less than 2 km from the residence. However, turbine T16 was not installed as part of the development of the project. Further, the NAA requires compliance with 'the requirements of any Authorisation relating to the operating noise levels of the wind farm'. Accordingly, the Project Approval limits for non-associated residences apply at receiver Z. The noise limits documented in the background noise report for receiver Z therefore apply.

The applicable noise criteria as specified in condition E6 of the Project Approval, supplemented by the noise limits for receiver Z as documented in the background noise report, are reproduced in Table 4. Compliance will be assessed against these noise criteria.

Table 4: Applicable noise criteria in accordance with Project Approval condition E6, dB L_{Aeq}

Receiver	Hub height wind speed, m/s ^[1]										
	3	4	5	6	7	8	9	10	11	12	13
FF	35	35	35	35	37	39	41	43	45	47	49
Z	35	35	35	35	35	35	37	39	42	45	48
All other receivers	The higher of 35 dB or the background noise level (dB L _{A90}) plus 5 dB										

Note 1: Hub height wind speed at the site – refer to Section 5.4 for details

5.2 Noise measurement locations

Operational noise measurements shall be carried out at the two (2) nearest receivers detailed in Table 5, subject to permission being granted by the landowners.

Table 5: Preferred receiver noise compliance monitoring locations

Receiver	Direction from wind farm
FF	East
Z	West

In the event that permission is not able to be obtained for conducting compliance measurements at the preferred receivers, alternative locations shall be considered.

The measurement systems shall be positioned in the vicinity of the dwelling at each of the preferred receivers for compliance monitoring. In accordance with the NSW Noise Assessment Bulletin, the following requirements apply to the positioning of the noise monitors:

- The measurements shall not occur within 5 m of a vertical reflecting surface
- The measurements shall occur within 30 m of the dwelling
- The measurements shall occur as close as practically possible to the location of the background noise monitoring (photos of the installations locations are contained in the background noise report).

Supplementary measurements shall also be undertaken at six (6) intermediate locations positioned nearer to the wind farm to:

- Assist the evaluation of noise levels solely attributable to the operation of the wind farm
- Provide a basis for assessing noise levels at other more distant locations where direct measurements of wind farm noise would not be practical
- Provide data for reference locations where testing can be repeated, if required, for the purposes of re-assessing compliance in future.

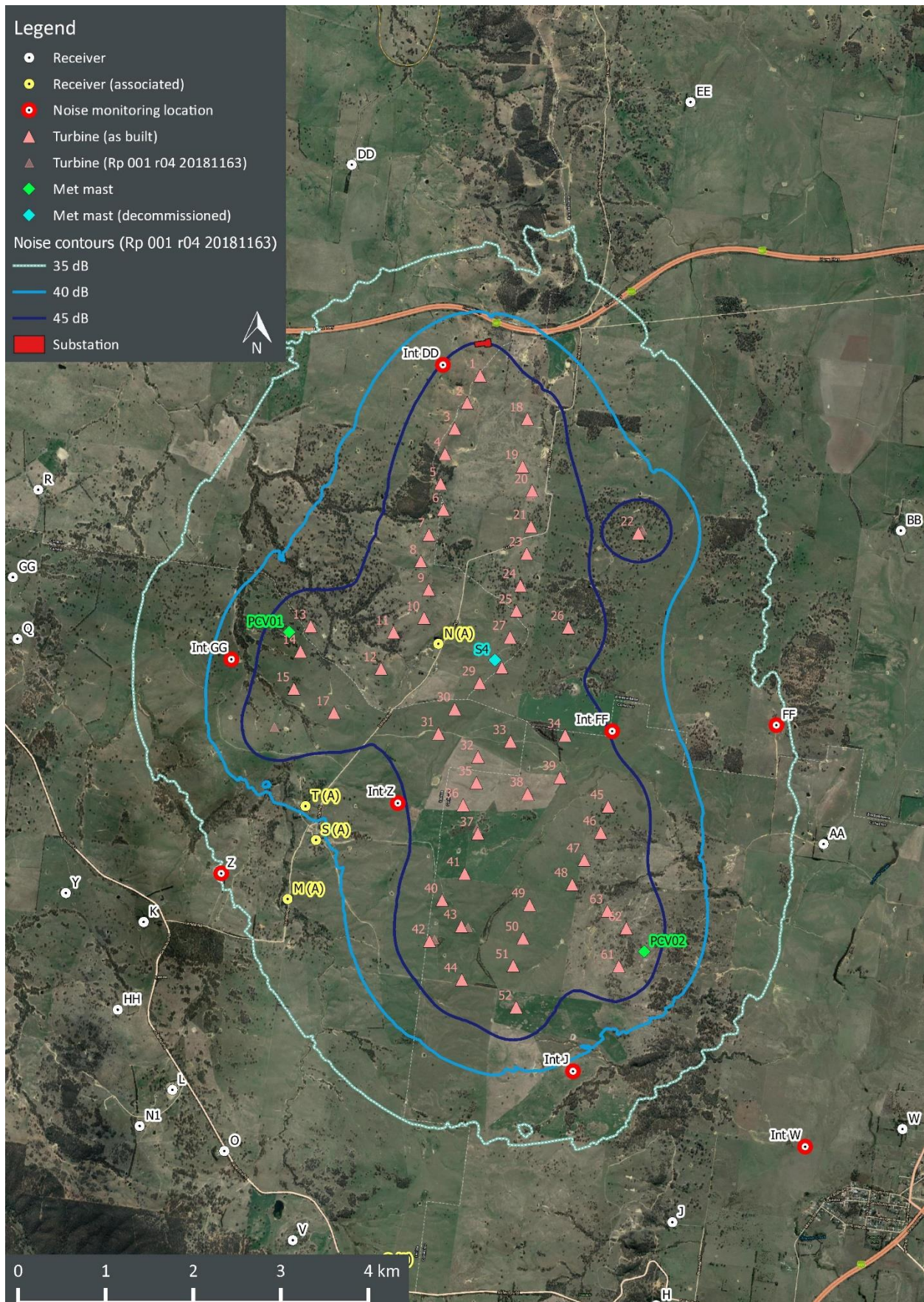
The intermediate locations correspond to locations where background noise monitoring was carried out in 2015. The locations were generally selected to be:

- In the vicinity of the predicted 45 dB L_{A90} contour associated with the wind farm
- As far as practical from any localised sources of increased background noise such as livestock or dense/tall clusters of vegetation.

The preferred receiver and intermediate monitoring locations are identified in Figure 1 along with the highest predicted noise level contours for the wind farm⁵.

⁵ The predicted noise level contours presented in Figure 1 were sourced from the updated noise assessment report which presented information for a fifty-five (5) turbine layout for the wind farm. The as-built layout was reduced to fifty-four (54) turbines and involved minor location changes for micro-siting, in accordance with the requirements of the Project Approval. These changes are inconsequential to the noise compliance assessment of the wind farm, and the predicted noise contours from the updated noise assessment report remain suitable for illustrating the positioning of the monitoring locations relative to the distribution of predicted wind farm noise levels around the site. For completeness, Figure 1 illustrates both the as-built turbine coordinates and the turbine coordinates referenced in the updated noise assessment report.

Figure 1: Preferred monitoring locations and predicted noise level contours, dB L_{Aeq}



Note: Intermediate W (Int W) was labelled as “Collector Village intermediate” in the background noise report

5.3 Noise measurement procedures

5.3.1 Unattended monitoring

The noise measurements are to comprise unattended monitoring for a range of conditions, supplemented by attended measurements and observations.

The unattended measurements shall comprise six (6) weeks of continuous monitoring. This will satisfy the requirements of the NSW Noise Assessment Bulletin to conduct a survey for up to six (6) weeks in order to obtain a valid quantity of data.

While a survey period of six (6) weeks generally represents the maximum survey duration, in some instances, it may be necessary to extend the survey. For example, extended surveys may be required to:

- Address non-uniform distributions or a sparsity of noise measurement data for certain wind speeds or directions, if conditions during the survey period are atypical for the site
- Address significant variations in measurement data which may be the result of seasonal factors or contaminating sounds, and which cannot be addressed with selective data filtering.

Condition E8 of the Project Approval specifies that operational noise monitoring results for the wind farm are to be submitted to the Department and EPA within three (3) months of operations commencing (as formally notified to the Department), unless otherwise agreed with the Secretary. The DPIE subsequently agreed to an extension of the time period from three (3) months to five (5) months (reference DPIE correspondence dated 18 January 2021) to enable the work to be completed effectively.

The noise measurements shall be timed to meet the commitment to submit the results to the DPIE within five (5) months of commencement of operations. Any variation from this commitment for reasons beyond the control of the owners of the Collector Wind Farm (e.g. unexpected equipment damage or failure, COVID interruptions, or interruptions to site operations) would require prior written approval of the DPIE.

The unattended monitoring shall be conducted in accordance with NSW Noise Assessment Bulletin, subject to the following project-specific procedural clarifications and requirements:

- The measurements shall occur for the measurement durations defined in Section 5.3.2
- The L_{A90} (A-weighted) and L_{C90} (C-weighted) noise level shall be determined in consecutive 10-minute intervals synchronised with the interval commencing on the hour and each 10-minute increment following the start of each hour
- One third octave band L_{90} noise levels from 25 Hz to 10,000 Hz inclusive are to be measured
- All noise measurements shall be conducted using low noise floor (≤ 20 dB) instrumentation that is certified to Class 1 standards (highest standard of instrumentation for field measurements) in accordance with IEC 61672-1:2013 *Electroacoustics - Sound level meters - Part 1: Specifications*
- The independent (laboratory) calibration date of the sound level measurement instrumentation must be within 2 years of the measurement period, as specified in Section 5.5 of Australian Standard AS 1055:2018 *Acoustics – Description and measurement of environmental noise*
- Microphones shall be fitted with enhanced wind shield systems (enlarged primary wind shields or secondary wind shields) designed on the basis of the guidance contained in the UK Institute of Acoustics publication *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* dated May 2013 (the IOA GPG)
- Subject to the consent of the residents, two (2) minute audio recordings shall be obtained for every 10-minute interval of the survey. The sampling rate for audio recordings shall be sufficient to allow assessment of narrow band tonality, if required, across the frequency range 10-5,000 Hz.

5.3.2 Attended observations

The NSW Noise Assessment Bulletin requires potential special noise characteristics to be analysed as part of the compliance assessment. Special noise characteristics refer to the occurrence of excessive tonality or low frequency noise associated with the operation of the wind farm.

The procedures of the NSW Noise Assessment Bulletin are based on applying objective assessment procedures to the measured noise levels (further details of the assessment procedures are detailed subsequently in Section 5.7.7).

The measured noise levels, particularly in certain frequencies, will be significantly influenced by ambient noise sources that are not related to the operation of the wind farm. Therefore, applying the objective assessment procedures to be measured noise levels will indicate false positives in many instances. For example, low frequency sounds of agricultural equipment, and high frequency sounds of insects or birds, are both examples of ambient noise sources which could lead to false positives. The assessment will therefore require information to enable false positives to be addressed.

Accordingly, in addition to the objective assessment procedures of the NSW Noise Assessment Bulletin, the noise compliance monitoring shall comprise:

- Collection of audio records (as detailed in Section 5.3) which will enable the sound to be reviewed, where necessary, to assist with identifying the noise sources contributing to the total measured noise levels
- Attended observations by an acoustic engineer, with the objective of observing the types of noise characteristics that are associated with the wind farm, and also to observe any other environmental noise sources which may result in false positives.

Two (2) sets of attended observations shall be undertaken during the monitoring as follows:

- During deployment of the monitoring instrumentation
- During retrieval of the monitoring installation.

Scheduling of the deployment and retrieval of the monitoring equipment is dependent on practical considerations including timing of access to residential properties. However, the wind farm must be operating at the time of all attended observations, and attempts shall be made to arrange the periods of attendance to coincide with suitable weather conditions for conducting wind farm observations.

Suitable conditions are generally considered to be:

- Wind speeds between approximately 5 m/s and 10 m/s at the turbine hub-height
- Little or no rainfall
- Times when background noise levels are expected to be lower.

During each attended observation, and at all locations, audio samples shall be obtained to provide a record of the sound environment at the time of the inspection and provide a basis for further objective assessment if required.

5.4 Site wind speeds

Site wind speeds shall be collected in 10-minute samples throughout the noise measurement period. The timing of each 10-minute sample shall be synchronised with the interval commencing on the hour and each 10-minute sample following the start of each hour.

Wind speed data is required at 91.5 m above ground level (the hub height of the turbines) at the location of the development mast S4⁶ (location is illustrated in Figure 1 of Section 5.2), consistent with the wind speed reference associated with the noise limits detailed in the Project Approval and the background noise report.

Development mast S4 was decommissioned as part of construction of the wind farm. Two (2) new operations masts have been installed on the eastern and western sides of the wind farm (locations illustrated in Figure 1 of Section 5.2). Data from these mast locations shall be used to synthesise a wake-free time series of wind speeds for the original mast location S4. All procedures used to synthesise the de-waked time series are to be documented in the noise compliance report.

5.5 Local weather data

The following local weather data shall be recorded during the noise survey:

- Local wind speeds: wind speeds at 1.5 m above ground level shall be measured in 10-minute samples at a minimum of one (1) noise compliance monitoring location. The use of enhanced wind shield systems (detailed in Section 5.3) shall be the primary method of addressing the potential for wind-induced extraneous noise across the measurement microphones. However, local wind speeds in the vicinity of the noise measurement systems shall be obtained to provide a secondary reference when reviewing the trends of the measured noise data (particularly in relation to measured C-weighted noise level required for the evaluation of low frequencies)
- Rainfall: rainfall shall be measured in 10-minute intervals at a minimum of one (1) noise compliance monitoring location during the survey.

The timing of each 10-minute sample for the local weather data shall be synchronised with the interval commencing on the hour and each 10-minute increment following the start of each hour.

5.6 Wind farm operational records

The operational status of each turbine shall be recorded in 10-minute samples and shall contain sufficient detail to differentiate whether a turbine was operating (including its mode of operation), available to operate, configured in an atypical mode of operation, or shutdown.

Each 10-minute sample of data shall be synchronised with the interval commencing on the hour, and each 10-minute increment following the start of each hour.

5.7 Compliance analysis

The analysis shall be conducted in accordance with the NSW Noise Assessment Bulletin. The following sub-sections provide specific details on the procedures.

5.7.1 Rainfall

Any 10-minute sample in which rainfall occurred shall be filtered and therefore removed from the analysis. The measurement data shall also be reviewed to identify and filter periods following rainfall in which the trend of the measurements indicates the noise levels are likely to have been elevated as a result of wet roads or flow noise associated with drainage systems and local watercourses.

⁶ Decommissioned mast S4 MGA 94 Zone 55 coordinates: 718443 E : 6140280 N)

5.7.2 Extraneous noise screening

The measured noise data shall be reviewed to identify and filter periods in which extraneous noise sources are likely to have affected the measurements. Extraneous noise sources include, but are not limited to, domestic machinery, agricultural operations, construction noise or elevated bird/frog/insect noise.

Individual 10- minute measurement samples that are likely to have been affected by high frequency extraneous noise shall be identified and filtered from the analysis when the following conditions⁷ are satisfied:

- The highest A-weighted one-third octave band noise level is greater than 1 kHz; and
- The identified one-third octave band A-weighted noise level is greater than a level of 20 dB L_{A90} and is within 5 dB of the broadband A-weighted noise level for the 10-minute sample in question.

The sound of a wind farm is unlikely to result in tones above 1 kHz at noise sensitive locations (due to high levels of atmospheric sound absorption at frequencies above 1 kHz) and, in the unlikely event of such a tone occurring, it is unlikely to control the sound pressure level of a one-third octave band. However, the procedure outlined above shall not be used to remove any measurement sample where the identified one-third octave band corresponds to a frequency in which the attended observations have indicated the potential for tones related to the operation of the wind farm. Further discussion of extraneous noise screening related to seasonal variations is provided in Section 5.7.4.

5.7.3 Atypical wind farm operation screening

The objective of the assessment is to determine whether the noise levels of the wind farm comply with the noise requirements when all of the wind turbines are operating normally. The compliance assessment shall therefore be preferably based on data obtained during periods when the turbines that contribute to noise levels at each assessment location are operating normally.

The operational records for each turbine shall therefore be reviewed for each 10-minute period to identify and remove any periods when noise levels may have been lower as a result of turbines that are relevant to the assessment being shutdown or operating at reduced power levels.

The turbines that are considered not relevant to a receiver location are those turbines with the lowest predicted noise levels which collectively result in a predicted noise level 15 dB lower than the total predicted noise level of the wind farm at the receiver. This means that if any or all of the non-relevant turbines were to not operate during a given measurement period, the reduction in total noise level would be 0.1 dB or less and would therefore be inconsequential to the assessment outcome.

The screening process detailed above can result in the removal of large quantities of data if the wind farm's operations are interrupted by equipment faults or unavoidable external constraints on power generation imposed by the electrical network operator. If the remaining data after application of the screening process is not sufficient for a reliable compliance assessment, an assessment of compliance may be based on the application of a modified screening process, accompanied by an assessment of any potential uncertainties associated with the modified screening process. Further measurements would be required if a conclusive assessment of compliance cannot be determined with a modified screening process.

⁷ Griffin, D., Delaire, C., & Pischedda, P. (2013). Methods of identifying extraneous noise during unattended noise measurements. *20th International Congress of Sound & Vibration*.

5.7.4 Review of seasonal considerations

Seasonal variations can affect both the level of background sound and operational wind farm noise.

Background sound

The main potential sources of seasonal variations in background sound are:

- Rainfall (see data filtering procedures in Section 5.7.1)
- Insect, bird and other fauna noise (see data filtering procedures in Section 5.7.2)
- Local domestic plant such as air-conditioning or heating
- Changes in domestic or agricultural activity in the vicinity of the monitoring location.

Other sources of background sound variation may relate to changes in vegetation, wind direction and wind shear.

The data shall be reviewed to identify any anomalous trends that are indicative of significant seasonal variations. These types of effects may be evident as elevated noise levels at low wind speeds (less than 3 m/s at hub height), or striations in the data characterised by relatively constant levels across a range of wind speeds (e.g. as would occur if domestic or agricultural machinery significantly influences the measurements).

Any identified variations in the measured levels that are likely to be attributable to seasonal changes in background sound levels shall be filtered from the analysis where possible. If the effect cannot be reliably filtered, and the effect is sufficient to preclude an assessment of the wind farm's compliance, supplementary procedures (see Section 5.7.7) or repeat measurements will be required.

Wind farm noise

The main potential source of seasonal variation in wind farm noise levels is wind direction and wind speed.

The wind directions and wind speeds that occurred during the survey shall be reviewed to determine whether the conditions were representative of the range generally expected at the wind farm site, having regard to the long-term wind direction trend for the site. In particular, if upwind or crosswind conditions are found to have occurred more regularly than is generally expected at the site, repeat measurements may be required.

In some cases, a sensitivity analysis or supplementary assessment (see Section 5.7.7 for procedures) may be sufficient to enable an assessment of compliance without measurement extensions.

For example, an analysis limited to the available data obtained under downwind conditions may be sufficient to demonstrate compliance. Additionally, limited data availability for high wind speeds may be addressed by using other information relating to the change in the wind farm's sound emission with increasing wind speed (e.g. sound power level test data obtained in accordance with IEC 61400-11:2012 or measurement data obtained at intermediate locations or other compliance monitoring locations around the wind farm – see supplementary procedures in Section 5.7.7).

5.7.5 Downwind directions

In accordance with the NSW Noise Assessment Bulletin, the analysis is to account for wind directions when the receivers are downwind of the wind farm.

Downwind conditions for each monitoring location were defined in the background noise report as directions that are equal to ± 45 degrees around a central downwind direction. The downwind conditions defined in the background noise report are the applicable downwind directions to consider in the compliance analysis. The central downwind directions are reproduced in Table 6 below.

Table 6: Downwind directions

Location	Central downwind direction (°)	Downwind direction range (°)
FF receiver	271	226 - 316
FF intermediate	255	210 - 300
Z receiver	78	33 - 123
Z intermediate	79	34 - 124
W intermediate	318	273 - 3
DD intermediate	162	117 - 207
GG intermediate	88	43 - 133
J intermediate	350	305 - 35

5.7.6 Adjustment for background noise levels

The background noise levels measured at the site are documented in the background noise report.

This data shall be used as an indication of the potential influence of background noise levels on the total noise levels measured during the compliance monitoring period. The background noise levels shall be subtracted from the measured total noise levels to provide an estimate of the contribution of the wind farm, using the procedure detailed in the SA 2009 guidelines as referenced in the NSW Noise Assessment Bulletin.

The procedure in the SA 2009 guidelines is based on the background noise levels measured under downwind conditions. The background noise levels for downwind conditions (corresponding to directions described in Section 5.7.5) are defined in Appendix F of the background noise report.

5.7.7 Supplementary procedures

The data filtering and background noise adjustment procedures detailed in Section 5.7.1 to Section 5.7.5 shall be used to reduce the influence of background noise levels.

If the residual influence of background sound precludes a definitive assessment of compliance, supplementary procedures shall be used to reduce the uncertainty.

A supplementary analysis shall be undertaken by comparing data measured at the compliance monitoring locations during upwind and downwind conditions. Higher noise levels during downwind conditions are indicative of the results being influenced by the operation of the wind farm. Conversely, comparable noise levels during upwind and downwind conditions are indicative of an environment dominated by the influence of sources that are not related to the operation of the wind farm (primarily for sites where background sound levels are not expected to vary significantly with wind direction).

The noise measurement data obtained at intermediate locations shall be used as follows:

- Noise level versus wind speed profile: data obtained at an intermediate location shall be used to define the profile of the change in measured wind turbine noise levels with increasing wind speeds. This profile shall then be compared to the profile measured at the compliance monitoring location to determine if increasing noise levels at the receiver are attributable to the wind farm (i.e. the profiles at the intermediate and the compliance monitoring locations are equivalent) or the influence of wind related background sound levels (i.e. the profiles at the intermediate and the compliance monitoring location are not equivalent)
- Data filtering: any 10-minute period in which the measured noise level at the receiver is higher than the simultaneously measured level at the intermediate location shall be considered background sound affected and may be removed from the analysis
- Extrapolation: data obtained at an intermediate location shall be extrapolated to the compliance monitoring location in accordance with the procedure documented in Section 11.2 of ISO 1996-2:2017. The extrapolation shall be undertaken on the basis of the same prediction methodology utilised for the updated noise assessment report, subject to a ± 1 dB uncertainty margin to the predictions to account for variations in the tolerance of the calculations at intermediate and receiver distances. The procedure may also be used to assess noise levels at other receivers where compliance monitoring is not undertaken.

If the results of an assessment based on measurement data obtained at an intermediate location are inconclusive, or if noise measurement data at an intermediate location is not available, an alternative method of enabling an assessment of the wind farm at the compliance monitoring locations will need to be defined. This may involve:

- Targeted assessment of specific conditions (i.e. wind speeds, wind directions and times of day);
- Additional measurements at a representative location where background sound levels are lower; or
- On/off testing of the wind farm.

5.7.8 Assessment of special noise characteristics

In accordance with the Project Approval and the NSW Noise Assessment Bulletin, the measured noise levels are to be analysed to determine the presence or otherwise of the following special noise characteristics:

- **Tonality:** to be assessed in accordance with Annex D *Objective method for assessing the audibility of tones in noise – Simplified method* of ISO 1996-2: 2007. This assessment using the simplified method is to be based on the measured one third octave band L_{90} noise levels. In accordance with the NSW Noise Assessment Bulletin, an assessment of tonality using narrow band analysis as per the reference method in Annex C of ISO 1996-2:2007 may be required if instructed by the Department (for the purposes of evaluating a tone which is not being adequately identified by the simplified method).

It is noted that ISO 1996-2:2007, as referenced in the NSW Noise Assessment Bulletin, was cancelled and replaced by the revised edition ISO 1996-2:2007. The simplified method of the 2007 and 2017 standard are identical, however the narrow band method of the 2007 standard was replaced by an alternative method documented in ISO/PAS 20065:2016 *Acoustics - Objective method for assessing the audibility of tones in noise – Engineering Method* (ISO/PAS 20065:2016). At the time of preparing this ONMP, guidance on the application of ISO/PAS 20065:2016 to wind farms is under development by the International Electrotechnical Commission. Accordingly, if a narrow band assessment of tonality is ultimately required, it may be appropriate to apply the ISO/PAS 20065:2016 in lieu of ISO 1996-2:2007 as referenced in the NSW Noise Assessment Bulletin, subject to consultations with the Department and the EPA.

- **Low frequency:** to be assessed by comparing C-weighted noise levels (dB L_{C90}) associated with the operation of the wind farm with the 60 dB criterion detailed in the NSW Noise Assessment Bulletin.

The procedures detailed above are prone to indicating false positives as a result of noise sources that are unrelated to the operation of the wind farm. For example, the sounds of birds or insects are frequently characterised by tonal noise that is readily detectable with the simplified method referred to in the NSW Noise Assessment Bulletin, and any tones identified at the corresponding frequencies would need to be removed. Similarly, C-weighted noise levels are prone to the influence of wind-induced turbulence at the microphone, or the low frequency noise of agriculture equipment and transportation.

Analysis will therefore be required to identify and remove false positives, where practical to do so. This may involve a combination of measures including:

- Sample audio listening checks to review the sources of noise influencing the measurements
- Removal of results which can be clearly attributed to noise sources that are unrelated to the operation of the wind farm on the basis of specific frequency characteristics (e.g. high frequencies confirmed to be attributable to insects or birds)
- Comparison of the measured noise levels at the intermediate and receiver locations. Absence of tonality at the intermediate locations is sufficient to demonstrate the absence of tonality attributable to the wind farm at receiver locations.

In accordance with the NSW Noise Assessment Bulletin, where special noise characteristics are attributable to the operation of the wind farm, and are found to be present in more than 10 % of the measurement data, a penalty of 5 dB is to be added to the estimated wind farm noise levels at the wind speeds when the special noise characteristics are evident.

6.0 OPERATIONAL NOISE COMPLIANCE REPORTING

The reporting shall adhere to the documentation requirements of the NSW Noise Assessment Bulletin and acoustic industry standards, and shall include the following additional information:

- Supporting documentation for the site wind speed data referenced in the compliance assessment
- Charts illustrating the noise measurement results which shall clearly identify all samples that have been filtered from the analysis due to rainfall, extraneous noise influences, or atypical wind farm operation (per the screening procedures described in Section 5.7.1. The analysis shall be supplemented by a summary table for each noise monitoring location detailing the total number of measurements points, the number of points that have been removed, and the final number of data points that the analysis has been based on
- Full details of all attended observations conducted for the purpose of identifying where special noise characteristics are potentially present in the sound of the wind farm
- Full details of any supplementary procedures that have been adopted as part of conducting the compliance assessment.

The operational noise compliance reporting shall be completed for submission of the results to the DPIE within five (5) months of commencement of operations. Any variation to this schedule for reasons beyond the control of the owners of the Collector Wind Farm (e.g. unexpected equipment damage or failure, COVID interruptions, or interruptions to site operations) would require prior written approval of the DPIE.

7.0 CORRECTIVE PROCEDURES

Corrective measures will be developed and implemented, in consultation with both the DPIE and the EPA, in the event of a non-compliance with the noise criteria specified in conditions E6 and E7 being detected (detected via either the compliance monitoring undertaken after operation commences, or any subsequent compliance monitoring). The corrective procedures shall be instigated immediately following the detection of a non-compliance.

The process of developing, implementing and verifying the effectiveness of the corrective measures shall be documented in a corrective action plan which would be submitted to the Department and EPA for review.

The following sections describe the corrective measures that are available to reduce the noise if required, and the requirements of the corrective action plan.

7.1 Corrective measures

The wind farm was designed from the outset to meet the applicable noise criteria at neighbouring properties, with the final approved layout based on this approach. This was also a key factor in the final selection of the installed wind turbine, with the pre-construction noise assessment demonstrating full compliance with the specified noise limits in the Project Approval (refer to Section 3.0).

In the unlikely event that the operating wind farm does not comply with the noise obligations in the planning approval, there are a number of available noise management options that would be evaluated as part of a 'corrective action plan' (see below) to achieve compliance. These are summarised as follows:

- Low noise modes: the pre-construction noise assessment demonstrated without the use of noise-curtailment modes. However, the installed wind turbines have the facility to have their noise emissions (and power generation) reduced via adjusted operating modes if required. Such operating modes could be utilised to reduce noise emissions from individual wind turbines, or from the wind farm as a whole, to achieve compliance with the approval noise criteria.
- Wind sector management: the installed wind turbines can be set to operate in different modes (or even temporarily shut-down) to respond to particular wind conditions (speed / direction) that may be resulting in non-compliance with noise criteria at individual neighbouring residences. Such sector management can be implemented within the power plant controller to operate as soon as the specific wind conditions are detected.
- Engineering solutions: the replacement or modification of major turbine components that have been identified as generating excessive noise (e.g. damaged blades or defective gearbox components).

The corrective measures listed above would be prioritised in the development of a corrective action plan. Other corrective measures may be investigated and implemented at affected residences (rather than at the wind farm), such as installation of dwelling sound insulation to reduce noise levels at the receiver rather than the source.

7.2 Corrective action plan

If required as a result of non-compliance, a corrective action plan will be prepared and submitted to the Department and EPA which documents the following:

- A concise summary of the testing that has been undertaken to determine that the wind farm is not compliance with the Project Approval
- The receiver(s) where non-compliance has been detected

- A performance specification for the noise reduction that must be achieved in order for the wind farm to be compliant at all receivers. The performance specification shall be expressed in terms of the magnitude of the noise level reduction that must be achieved, and the wind speeds and wind directions that the performance specifications apply to
- Details of the corrective measures to be implemented in order to achieve the performance specification and, where appropriate, supporting evidence to demonstrate that the measures are expected to enable compliance to be achieved (e.g. sound power level information for low noise modes)
- A time frame for implementing the proposed noise mitigation measures
- A brief statement describing the selected method of additional noise testing that will be undertaken in order to assess the effectiveness of the mitigation measure(s) and reassess compliance with the requirements of the Project Approval
- A time frame for conducting additional noise testing and producing a noise compliance report.

In situations where rectification of the source of an identified non-compliance is expected to involve longer term design, development and implementation, the remediation plan shall identify intermediate mitigation strategies that will be implemented until the final mitigation strategy is implemented. Intermediate mitigation strategies shall also be defined in situations where a non-compliance has been identified, but the precise magnitude of the non-compliance remains to be quantified through additional noise testing. The

If intermediate mitigation strategies are to be utilised, the corrective action plan shall document both the intermediate and long-term mitigation strategies, including details of the implementation timing and the additional testing that will be undertaken to assess compliance after each measure is implemented.

8.0 ORGANISATIONS & RESPONSIBILITIES

Operational noise compliance testing in accordance with the requirements of the Project Approval will involve a number of organisations. Their roles and responsibilities are summarised in Table 7.

Table 7: Summary of organisations and their responsibilities

Organisation	Responsibility
Wind farm owner	- Commissioning the relevant organisations as follows - Acoustic consultant - Wind engineering consultant - Liaising with residents to obtain permission to conduct the compliance monitoring - Supply of the wind farm's operating records for the duration of the compliance surveys - Submission of compliance reports to the DPIE and EPA - Instigation of correction procedures and execution of a corrective action plan in the event of a non-compliance
Acoustic consultant	- Conduct testing, analysis and reporting in accordance with the Project Approval, the approved OEMP and ONMP - Preparation of a corrective action plan if corrective procedures are instigated
Wind engineering consultant	- Verify the sources of wind data to be referenced in the compliance monitoring, prior to the commencement of the noise surveys - Supply of the assessment wind speed data sets, comprising hub height wind speed data that is representative of wake-free conditions at the reference mast locations - Supply of a statement for inclusion in the operational noise compliance reports detailing all measurement and analysis procedures used to synthesise the assessment wind speed data set
DPIE & EPA	- Approval of the ONMP prior to implementation - Review of the compliance reports - Determining whether the Project Approval requirements for post construction compliance monitoring and compliance assessment have been satisfactorily addressed

APPENDIX A GLOSSARY OF TERMINOLOGY

A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
C-weighting	A set of frequency dependent adjustments which are used for measuring low frequency noise in accordance with the NSW Noise Assessment Bulletin
dB	Decibel. The unit of sound level.
Frequency	The number of pressure fluctuation cycles per second of a sound wave. Measured in units of Hertz (Hz).
Hertz (Hz)	Hertz is the unit of frequency. One hertz is one cycle per second. One thousand hertz is a kilohertz (kHz).
L_{Aeq}	The equivalent continuous (time-averaged) A-weighted noise level. This is commonly referred to as the average noise level.
L_{A90}	The A-weighted noise level equalled or exceeded for 90 % of the measurement period. This is commonly referred to as the background noise level.
L_{C90}	The C-weighted noise level equalled or exceeded for 90 % of the measurement period.
L_w	The sound power level. The level of total sound power radiated by a sound source.
L_{WA}	The “A” weighted sound power level.
Special noise characteristics	Features of a sound which, when present, increase the likelihood of adverse reaction the sound. The NSW Noise Assessment Bulletin defines tonality and low frequency noise
Tonality	Sound characterized by a single frequency component or narrow-band components that emerge audibly from the total sound (e.g. whines or hissing sounds)

The basic quantities used within this document to describe noise adopt the conventions outlined in ISO 1996-1:2016⁸. Accordingly, all frequency weighted sound pressure levels are expressed as decibels (dB) in this report. For example, sound pressure levels measured using an “A” frequency weighting are expressed as dB L_A. Alternative ways of expressing A-weighted decibels such as dBA or dB(A) are therefore not used within this report.

⁸ ISO 1996-1:2016 *Acoustics - Description measurement and assessment of environmental noise – Part 1: Basic quantities and assessment procedures*

APPENDIX B COLLECTOR WIND FARM TURBINE SPECIFICATION

Table 8: Wind turbines

Detail	Turbine model
Make	Vestas
Model	V117 4.2MW
Rotor diameter	117 m
Hub height	91.5 m
Blade orientation	Upwind
Turbine regulation method	Variable blade pitch
Operating configuration	Power optimised - noise curtailment modes not proposed
Maximum rated power generating capacity	4.2 MW
Cut-in wind speed (hub height)	3 m/s
Rated power wind speed (hub height)	14.5 m/s
Cut-out wind speed (hub height)	32 m/s

APPENDIX C COLLECTOR WIND FARM TURBINE COORDINATES

The following table sets out the as-built coordinates of the Vestas V117 wind turbine layout of the Collector Wind Farm (data supplied by RAC on 13 January 2021).

Table 9: Turbine coordinates – MGA 94 Zone 55

No.	Easting	Northing	No.	Easting	Northing
WTG1	718469	6143531	WTG29	718256	6140030
WTG2	718303	6143229	WTG30	717952	6139751
WTG3	718143	6142944	WTG31	717751	6139480
WTG4	718016	6142661	WTG32	718185	6139187
WTG5	717945	6142326	WTG33	718566	6139341
WTG6	717959	6142028	WTG34	719192	6139375
WTG7	717778	6141753	WTG35	718149	6138894
WTG8	717667	6141456	WTG36	717982	6138651
WTG9	717737	6141127	WTG37	718131	6138315
WTG10	717665	6140808	WTG38	718725	6138734
WTG11	717307	6140667	WTG39	719106	6138897
WTG12	717140	6140259	WTG40	717678	6137581
WTG13	716368	6140791	WTG41	717952	6137867
WTG14	716234	6140511	WTG42	717507	6137124
WTG15	716134	6140091	WTG43	717880	6137271
WTG17	716574	6139788	WTG44	717848	6136663
WTG18	718978	6143004	WTG45	719633	6138534
WTG19	718891	6142467	WTG46	719531	6138241
WTG20	718983	6142183	WTG47	719325	6137942
WTG21	718945	6141778	WTG48	719170	6137671
WTG22	720164	6141628	WTG49	718670	6137468
WTG23	718878	6141471	WTG50	718574	6137092
WTG24	718785	6141111	WTG51	718443	6136785
WTG25	718722	6140825	WTG52	718448	6136312
WTG26	719303	6140601	WTG61	719646	6136708
WTG27	718632	6140529	WTG62	719757	6137135
WTG28	718518	6140188	WTG63	719554	6137347

APPENDIX D PROJECT APPROVAL

This Appendix reproduces the Project Approval⁹ requirements concerning environmental noise.

The Project Approval text is coloured to indicate modification approval changes, as per the legend reproduced from the Project Approval in Figure 2.

Figure 2: Project Approval extract – legend of text colours identifying modification approval changes

Red type represents 22 July 2016 modification (MOD 1)
Green type represents 15 May 2019 modification (MOD 2)
Blue type represents 16 August 2019 modification (MOD 3)

⁹ The modified Project Approval refers to the Project Approval (Application No.: 10_0156) dated 2 December 2013 as amended by notices of modification dated 22 July 2016 (MOD 1), 15 May 2019 (MOD 2), and 16 August 2019 (MOD 3).

Figure 3: Project Approval extract – conditions E6 to E9

NOISE

Operational Noise Criteria – Wind Turbines

- E6. The Proponent shall ensure that the noise generated by the operation of wind turbines does not exceed the relevant criteria in Table 4 at any non-associated residence.

Table 4 – Noise Criteria dB(A)

Residence	Criteria (dB(A)) with Reference to Hub Height Wind Speed (m/s)										
	3	4	5	6	7	8	9	10	11	12	13
FF	35	35	35	35	37	39	41	43	45	47	49
All other non-associated residences	The higher of 35 dB(A) or the existing background noise level (LA90 (10-minute)) plus 5 dB(A)										

Note: To identify the residences referred to in Table 4, see the figure in Attachment 2.

Noise generated by the operation of the wind turbines is to be measured in accordance with the relevant requirements of the South Australian Environment Protection Authority's *Wind Farms – Environmental Noise Guidelines 2009* (or its latest version), as modified by the provisions in [Attachment 4](#). If this guideline is replaced by an equivalent NSW guideline, then the noise generated is to be measured in accordance with the requirements in the NSW guideline.

Operational Noise Criteria – Ancillary Infrastructure

- E7. The Proponent shall ensure that the noise generated by the operation of ancillary infrastructure does not exceed 35 dB(A) $L_{Aeq}(15 \text{ minute})$ at any non-associated residence.

Noise generated by the project is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy* (or its equivalent) as modified by the provisions in [Attachment 4](#).

Noise Monitoring

- E8. Within 3 months of the commencement of operations, [unless otherwise agreed by the Secretary](#), the Proponent shall:
- undertake noise monitoring to determine whether the project is complying with the relevant conditions of this approval; and
 - submit a copy of the monitoring results to the Department and the EPA.
- E9. The Proponent shall undertake further noise monitoring of the project if required by the Secretary.

Figure 4: Project Approval extract – Attachment 4 – noise compliance assessment requirements

ATTACHMENT 4

NOISE COMPLIANCE ASSESSMENT

PART A: SOUTH AUSTRALIAN WIND FARMS: ENVIRONMENTAL NOISE GUIDELINES 2009 (MODIFIED)

South Australian Wind Farms: *Environmental Noise Guidelines 2009* (Modified) refers to the South Australian EPA document modified for use in NSW.

The modifications are as follows:

Tonality

The presence of excessive tonality (a special noise characteristic) is consistent with that described in *ISO 1996.2: 2007 Acoustics — Description, measurement and assessment of environmental noise – Determination of environmental noise levels* and is defined as when the level of one-third octave band measured in the equivalent noise level $L_{eq(10\text{minute})}$ exceeds the level of the adjacent bands on both sides by:

- 5dB or more if the centre frequency of the band containing the tone is in the range 500Hz to 10,000Hz;
- 8dB or more if the centre frequency of the band containing the tone is in the range 160 to 400Hz; and/or
- 15dB or more if the centre frequency of the band containing the tone is in the range 25Hz to 125Hz.

If tonality is found to be a repeated characteristic of the wind turbine noise, 5 dB(A) should be added to measured noise levels from the wind farm. If tonality is only identified for certain wind directions and speeds, the penalty is only applicable under these conditions. The tonal characteristic penalty applies only if the tone from the wind turbine is audible at the relevant receiver. Absence of tone in noise emissions measured at an intermediate location is sufficient proof that the tone at the receiver is not associated with the wind farm's operation. The assessment for tonality should only be made for frequencies of concern from 25 Hz to 10 KHz and for sound pressure levels above the threshold of hearing (as defined in *ISO 389.7: 2005 Acoustics - Reference zero for the calibration of audiometric equipment - Part 7: Reference threshold of hearing under free-field and diffuse-field listening conditions*).

Low Frequency Noise

The presence of excessive low frequency noise (a special noise characteristic) [i.e. noise from the wind farm that is repeatedly greater than 65 dB(C) during the day time or 60 dB(C) during the night time at any relevant receiver] will incur a 5 dB(A) penalty, to be added to the measured noise level for the wind farm, unless a detailed internal low frequency noise assessment demonstrates compliance with the proposed criteria for the assessment of low frequency noise disturbance (UK Department for Environment, Food and Rural Affairs (DEFRA, 2005)) for a steady state noise source.

Notes:

- For the purposes of these conditions, a special noise characteristic is defined as a repeated characteristic if it occurs for more than 10% of an assessment period. This equates to being identified for more than 144 minutes during any 24 hour period. This definition refers to verified wind farm noise only.
- The maximum penalty to be added to the measured noise level from the wind farm for any special noise characteristic individually or cumulatively is 5 dB(A).

PART B: NOISE COMPLIANCE ASSESSMENT

Applicable Meteorological Conditions – Wind Turbines

1. The noise criteria in Table 4 of the conditions are to apply under all meteorological conditions.

Applicable Meteorological Conditions – Other Facilities

2. The noise criteria in Condition E7 are to apply under all meteorological conditions except the following:
 - a) wind speeds greater than 3 m/s at 10 m above ground level; or
 - b) temperature inversion conditions between 1.5 °C and 3°C/100m and wind speeds greater than 2 m/s at 10 m above ground level; or
 - c) temperature inversion conditions greater than 3°C/100m.

Figure 5: Project Approval extracts – Attachment 5 statement of commitments – operational noise

Item	Impact	Objectives	Mitigation Task	Responsibility	Project Phase		
					C	O	D
			contacted to identify the source of noise and suitable mitigation measures that may be required.				
2.09	Operational Noise	Turbine model / layout noise assessment	A revised noise assessment will be prepared for the final turbine model and layout, prior to commissioning to the wind farm.			✓	
2.10	Operational Noise	Reduction of turbine numbers as required	The wind farm layout will be determined by compliance of the chosen turbine model with the noise criteria applicable to the development, as outlined in the conditions of approval. If required, non-compliant turbines will be removed from the layout.	Proponent	✓	✓	
2.10A	Operational Noise	Monitor compliance with noise criteria	Within three months of commissioning, noise compliance monitoring would be undertaken to assess compliance with noise criteria.	Proponent		✓	
2.11	Operational Noise	Address any non-compliance with noise criteria	Where operational noise monitoring indicates the Proposal exceeds noise limits set in the development approval conditions, the following noise mitigation measures shall be implemented to achieve compliance. • using active noise control functions of turbines; • rectify any manufacturing defects or control settings so that noise can be reduced; or • if excesses still occur, acoustic treatment of non-involved receiver dwellings.	Proponent		✓	
2.12	Operational Noise	Monitoring the effectiveness of operational noise mitigation measures	Should any of the measures in item 2.12 be adopted, their effectiveness will be verified through noise monitoring in the first 12 months following the implementation of mitigation measures.			✓	
9.0 Health and Safety							
9.01	Wind farm noise	Manage community concerns with respect to wind farm noise	The Proponent will establish a complaints management system to respond to noise complaints from the community.	Proponent		✓	

Figure 6: DPIE approval of extension of time period for completion of compliance testing and reporting



Planning,
Industry &
Environment

Mr Neil Weston
Project Manager
RATCH-Australia Corporation Pty Limited
Level 7, 111 Pacific Highway,
North Sydney NSW 2060 Australia

18/01/2021

Dear Mr Weston

**Project Approval MP10_0156 - Collector Wind Farm
Extension of Time for Noise Monitoring-Condition E8**

I refer to your request MP10_0156-PA-10 for an extension of time for Noise Monitoring as required under condition E8 of MP10_0156 (the approval) for the Collector Wind Farm (the project).

The Department notes the reasons justifying the request provided in the letter dated the 12 January 2020.

Accordingly, the Planning Secretary grants an extension of time from 3 months to 5 months, from the commencement of operations, for the Proponent to;

- (a) Undertake noise monitoring to determine whether the project is complying with the relevant conditions of the approval; and
- (b) Submit a copy of the monitoring results to the Department and the EPA

If you wish to discuss the matter further, please contact myself on 0429400261 or at katrina.oreilly@planning.nsw.gov.au

Yours sincerely



Katrina O'reilly
Team Leader - Compliance
As nominee of the Planning Secretary