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Appendix 12-2

Operational Noise Report

Carrig Renewables Wind Farm

Carrig Renewables Wind Farm Ltd

IE62-006-R0
01 September 2023

COMMERCIAL IN CONFIDENCE

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Executive Summary

TNEI Services Ltd was commissioned by MKO to undertake an operational noise assessment for the proposed Carrig Renewables Wind Farm (hereinafter referred to as 'the Proposed Development'). The noise assessment was undertaken to assess the potential impact of operational noise from the Proposed Development on the nearest noise sensitive receptors, which are primarily scattered residential dwellings.

The Irish Governments '*Wind Energy Development Guidelines, 2006*' (WEDG 2006), produced by the Department of Environment Heritage and Local Government (DoEHLG), are the current guidelines for setting noise limits for wind energy developments. The information relating to noise in the WEDG 2006, is very limited and it is widely agreed that the limits proposed in the WEDG 2006 were drafted to broadly align with the UK guidance ETSU-R-97 *'The Assessment and Rating of Noise from Wind Farms'.* In 2013, the UK guidance was supplemented by a document produced by the Institute of Acoustics *'A good practice guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise'* (IOA GPG). Reference has been made to guidance contained in ETSU-R-97 and the IOA GPG to supplement the WEDG 2006.

The operational noise assessment has been undertaken in three stages:

- Stage 1 –establish the Total WEDG Noise Limits for each NAL based on measured background noise levels;
- Stage 2 – undertake a cumulative assessment based on likely predictions for all relevant turbines in the area (existing and proposed) and Total WEDG Noise Limits; and
- Stage 3 – establish the Proposed Development's Site Specific Noise Limits (at levels below the Total WEDG Noise Limits, where limit apportionment is required) and compare the noise predictions from the Proposed Development on its own against the proposed Site Specific Noise Limits.

Background noise monitoring was undertaken at five noise sensitive receptors in proximity to the Proposed Development. Wind speed and direction data were measured using a LIDAR unit located within the Proposed Development Site.

There were 61 Noise Sensitive Receptors (NSRs), also labelled H (for houses) which were identified within the ~2 km search area defined from the proposed turbine locations. Of the identified NSRs, a total of 13 were chosen as Noise Assessment Locations (NALs). The NALs were chosen to represent the NSRs located closest to the Proposed Development for a detailed assessment. The modelling results for the NALs have been presented within the main body of this report whilst results for all of the NSRs have also been included within an Annex to the report. For clarity, all buildings were labelled with the letter 'H' and numbered to be consistent with the rest of the Environmental Impact Assessment Report (EIAR).

Analysis of the measured noise and wind data has been undertaken in accordance with the WEDG 2006 to determine the pre-existing background noise environment and to establish the daytime and night-time noise limits at each of the NALs.

Two sets of noise limits have been derived; the Total WEDG Noise limits apply to the cumulative noise level of all turbines operating in the area including the Proposed Development, whilst the Site Specific Noise limits apply to operational noise from the Proposed Development only.

Based on the guidance in the WEDG 2006 and recent planning permissions issued from An Bord Pleanála, the daytime Total WEDG Noise Limit was set at 40 dB(A) where background noise levels were

<30 dB, and 45 dB(A) or background plus 5 dB whichever is the greater where background noise levels were >30 dB. The night-time Total WEDG Noise Limit has been set at 43 dB(A) or background plus 5 dB whichever is the greater. The 'Site Specific Noise Limits' were derived to take account of the proportion of the Total WEDG Noise Limit that has been allocated to, or could theoretically be used by, other wind farm developments (operational or consented) in proximity to the Proposed Development.

Predictions of wind turbine noise for the Proposed Development were made, based upon the sound power level data for a candidate wind turbine which has a maximum rated output capacity of 6.2 MW and serrated trailing edge blades. Two hub heights at 105 m and 110.5 m have been modelled in order to illustrate the noise level differences across the proposed dimension range. Ultimately, the assessment shows that the differences are marginal, within 0.1 dB. The candidate modelled is considered to be representative of the type of turbine that could be installed as part of the proposed development.

Predicted cumulative levels and measured background noise levels indicate that for neighbouring dwellings, wind turbine noise from a candidate turbine would meet the Total WEDG Noise Limit, therefore the operational noise impact is not significant. A Site Specific Noise Limit was also calculated using worst-case assumptions and the assessment has shown that the Proposed Development operating on its own with the candidate turbine assessed in this report would meet that limit, albeit with minor requirements for mode management for the two nearest turbines to NAL9, for certain wind speeds and wind directions (7m/s and westerlies) in daytime only.

The use of Site Specific Noise Limits for the operational phase would ensure that the Proposed Development could operate concurrently with other operational wind farm developments in the area and would also ensure that the Proposed Development's individual contribution could be measured and enforced if required. The wind turbine model in this assessment was chosen in order to allow a representative assessment of the noise impacts. Should the Proposed Development receive consent, the final choice of wind turbine would be subject to a competitive tendering process and the final choice of wind turbine would, however, have to meet the Site Specific Noise Limits presented in the noise assessment.

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ANNEXES

1 Introduction

1.1 Brief

1.1.1 TNEI was commissioned by MKO to undertake an operational noise assessment for the proposed Carrig Renewable Wind Farm (hereinafter referred to as 'the Proposed Development'). The following steps summarise the noise assessment process:

- Measure and analyse existing background noise levels and present the measured noise data with reference to existing government guidance and the recommendations of the Department of Environment Heritage and Local Government (DoEHLG), which are contained in the '*Wind Energy Development Guidelines, 2006*' (1) (WEDG 2006), in conjunction with the guidance produced by the United Kingdom's Department of Trade and Industry Noise Working Group on Noise from Wind Turbines. Reference has also been made to guidance contained within ETSU-R-97 *'The Assessment and Rating of Noise from Wind Farms'* (2) and *'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'* (3) (IOA GPG) to supplement the WEDG 2006;
- Determine the Total WEDG 2006 Noise Limits applicable to all wind farms in the area;
- Assess and undertake a cumulative noise assessment, where required, to take account of other proposed, consented or operational schemes near to the Proposed Development;
- Derive Site Specific Noise Limits for the Proposed Development, suitable for inclusion in a noise related planning condition should An Bord Pleanála be minded to grant planning permission;
- Undertake predictions of the operational wind turbine noise immissions that will be incident at neighbouring noise sensitive receptors from the Proposed Development, considering the minimum and maximum within a range of possible turbine dimensions;
- Compare the predictions of the operational wind turbine noise immissions from the Proposed Development against the Site Specific Noise Limits; and
- Assess the impact of noise from the Proposed Development with reference to existing government guidance and the recommendations of the Department of Environment Heritage and Local Government, which are contained in the WEDG 2006.

1.2 Background

1.2.1 The Proposed Development is located approximately 7 km south west of Birr, Co. Offaly and 10 km to the north east of Borrisokane, Co Tipperary. The approximate Irish Transverse Mercator (ITM) reference for the centre if the site is 606831, 703741 and the proposed layout is composed of 7 wind turbines as shown on Figure A1.1 in Annex 1.

1.2.2 This noise assessment models the Vestas V162 which is a candidate turbine that falls within the range of turbine dimensions proposed as part of this wind farm application. The V162 has a maximum rated capacity of 6.2 MW and serrated trailing edge blades. The minimum and maximum proposed hub heights hub heights of 105 m and 110.5 m have been modelled to illustrate the noise level differences within the proposed turbine dimension range. The assessment shows that the differences are marginal. The candidate turbine modelled is considered representative of the type of turbine that could be installed at the site.

1.2.3 The noise assessment also considers nearby wind turbine schemes that are operational, consented and proposed (planning application submitted). The nearby schemes found to be relevant and therefore considered in the assessment are summarised in Table 1.1.

Table 1.1 Cumulative Wind Farm/ Turbine Developments

Wind Farm/ Wind Turbine	Number of Turbines	Status	Make and Model of Turbine Considered in Modelling
Carrig Renewable Energy Development	7	Proposed	Vestas V162 6.2W, Serrated Blade, 105 - 110.5 m Hub Height
Skehanagh	5	Operational	Vestas V52 850 kW, Standard Blade, 44 m Hub Height
Carrig	3	Operational	Vestas V52 850 kW, Standard Blade, 44 m Hub Height

1.2.4 Figure A1.1a in Annex 1 shows the location of the nearby wind turbine schemes of Skehanagh and Carrig relative to the Proposed Development.

1.2.5 For the purposes of assessing the nearby wind turbine schemes operating in conjunction with the Proposed Development the following terms have been referred to throughout:

- **'Total WEDG Noise Limits'**; defined as being the limit that should not be exceeded by the cumulative operation of all wind farm developments, including the Proposed Development; and
- **'Site Specific Noise Limits'**; defined as being the limit that is specific to the Proposed Development only, and derived through the apportionment (where required), of the 'Total WEDG Noise Limits' in accordance with current good practice (IOA GPG).

1.2.6 Note that the term 'noise emission' relates to the sound power level emitted from each wind turbine, whereas the term 'noise immission' relates to the sound pressure level received at any receptor location, due to the operation of the wind turbines. All references to dB refer to A weighted decibel levels, wind speeds are standardised to 10 m height and grid coordinates are in ITM unless otherwise stated. A full glossary of terms is provided in Section 8.

2 Noise Planning Policy and Guidance

2.1 Overview of Noise Planning Policy and Guidance

2.1.1 In assessing the potential noise impacts of the Proposed Development, the following guidance and policy documents have been considered:

- National Planning Policy;
- Regional Planning Policy;
- Local Policy;
- Department of Environment Heritage and Local Government (DoEHLG) '*Wind Energy Development Guidelines,*' 2006;
- ETSU-R-97 *'The Assessment and Rating of Noise from Wind Farms'*; and
- Institute of Acoustics *'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'* (IOA GPG) May 2013.

2.2 National Planning Policy

2.2.1 The National Planning Framework 'Project Ireland 2040' (4) was adopted on 29 May 2018. The document sets out a number of National Policy Objectives, of which number 65 relates to noise.

2.2.2 National Policy Objective 65 states;

"Promote the pro-active management of noise where it is likely to have significant adverse impacts on health and quality of life and support the aims of the Environmental Noise Regulations through national planning guidance and Noise Action Plans."

2.2.3 The document does not contain specifics with regards to the assessment of noise. Rather, it states (page 5):

'The National Planning Framework, is a planning framework to guide development and investment over the coming years. It does not provide every detail for every part of the country; rather it empowers each region to lead in the planning and development of their communities, containing a set of national objectives and key principles from which more detailed and refined plans will follow.'

2.2.4 Accordingly, it is necessary to look at regional and local guidance and policy for further direction.

2.3 Regional Spatial and Economic Strategy (RSES) - Northern & Western (2020-2032) and Eastern & Midland (2019-2031) Regional Assemblies

2.3.1 The Northern & Western RSES (applicable to Co. Tipperary and Co. Galway) provides a high-level development framework for the Northern and Western Regional Assembly of Ireland, supporting the implementation of the National Planning Framework. In relation to renewable energy, it states (page 163):

'It is important that our region sets out its ambitions concerning renewable energy in this context and shows its ability to help contribute to achieving national targets.'

2.3.2 The RSES does not include any information specific to noise but states the following regarding renewable energy development:

'The forthcoming Renewable Electricity Policy and Development Framework will aim to identify strategic areas for the sustainable development of renewable electricity projects of scale, in a sustainable manner, compatible with environmental and cultural heritage, landscape and amenity considerations. The development of the Wind Energy Guidelines and the Renewable Electricity Development Plan will also facilitate informed decision making, in relation to renewable energy infrastructure.'

2.3.3 The Eastern & Midland RSES (applicable to Co. Offaly) is a strategic plan and investment framework put in place to shape the future development in the Eastern and Midland Regional Assembly of Ireland. In relation to renewable energy, it states (page 178):

2.3.4 *'The Region will need to shift from its reliance on using fossil fuels and natural gas as its main energy source to a more diverse range of low and zero-carbon sources, including renewable energy and secondary heat sources. Decentralised energy will be critical to the Region's energy supply and will ensure that the Region can become. more self-sufficient in relation to its energy needs.'*

2.3.5 The Eastern & Midland RSES does not include any information specific to noise from renewable energy developments, but states the following regarding noise pollution:

'Local authorities shall incorporate the objectives of the EU Environmental Noise Directive in the preparation of strategic noise maps and action plans that support proactive measures to avoid, mitigate, and minimise noise, in cases where it is likely to have harmful effects.'

2.3.6 The Department of Environment, Climate and Communications (DECC) is currently preparing the Renewable Electricity and Policy Development Framework (REPDF).

2.4 Local Policy

2.4.1 The Tipperary County Development Plan (2022-2028) was adopted on 11th July 2022. Appendix 2 *'Renewable Energy Strategy'* of the Development Plan states:

'Tipperary County with the support of the Tipperary Energy Agency (TEA) is committed to supporting investment in renewable energy and to developing an agreed Renewable Energy Strategy.'

2.4.2 Included as Appendix 1 of the *'Renewable Energy Strategy'* is the standalone *'Tipperary Wind Energy Strategy 2016'*. The strategy's aim is to:

'…build upon its predecessors and develop an updated, county-wide tool for identifying potentially suitable locations for wind energy development and to guide future assessment of wind energy planning applications in the county. The Strategy also takes account of new technologies in wind energy development that have evolved since previous strategies were prepared.'

2.4.3 The *'Tipperary Wind Energy Strategy 2016' states, in relation to noise, that:*

'Proposals must also demonstrate that the residential amenity will not be impacted by virtue of noise and all applications should be accompanied by a Noise Impact Statement of noise sensitive locations such as occupied dwellings. The Department of the Environment's most up to date Guidelines on Wind Energy shall be adhered to with regard to…noise issues.'

2.5 Wind Energy Development Guidelines, 2006

2.5.1 The current guidelines for setting noise limits are detailed in the Department of Environment Heritage and Local Government (DoEHLG), *'Wind Energy Development Guidelines, 2006'* (WEDG 2006).

2.5.2 The information relating to noise in the WEDG 2006 is very limited. For example, there is no guidance on where or how to measure background noise levels and how to correlate these with wind speed on the proposed wind farm site. There is also no mention of how to consider cumulative effects). The WEDG 2006 guidelines do, however, include guidance on how to derive limits for daytime and night-time periods.

2.5.3 The daytime limits take account of existing background noise levels and include a fixed limit of 45 dB or background + 5 dB, whichever is the greater, except in low background noise environments where a fixed minimum limit in the range 35-40 dB should be considered. TNEIs interpretation of these limits is that turbine noise should not exceed:

- 45 dB $L_{A90,\ 10\ min}$ or background noise + 5 dB, whichever is the greater, for daytime hours (applicable where background noise levels are greater than 30 dB L_{A90}); or,
- 35 to 40 dB $L_{A90,\ 10\ min}$ where background noise is less than 30 dB L_{A90};

2.5.4 The WEDG states that a *"fixed limit of 43dB(A) will protect sleep inside properties during the night",* however, whilst it is not explicit within the WEDG guidance, the addition of a night-time 'background noise +5 dB' parameter is commonly applied in wind turbine noise assessments. This is detailed in numerous examples of planning conditions issued by local authorities and An Bord Pleanála. On that basis, the night-time noise limits used in this assessment have been based on 43 dB or background noise + 5 dB, whichever is the greater.

2.5.5 It is widely agreed that the limits proposed in the WEDGs were drafted to broadly align with the UK guidance *ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms'*. The Association of Acoustic Consultants of Ireland (AACI) Environmental Noise Guidance (5) states the following in relation to the WEDG 2006:

'The document includes daytime and night-time noise criteria. As criteria included in the document are evidently derived from ETSU-R-97, it is considered more robust to base noise assessments on the ETSU and IOA documents, particularly as the DoEHLG document is somewhat vague. The document has been undergoing a protracted review process for several years.'

2.5.6 In 2013, this UK guidance was supplemented by a document produced by the Institute of Acoustics' (IOA) *'A good practice guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise'* (IOA GPG). Given the lack of detail in parts of the WEDG, information contained in ETSU-R-97 and the IOA GPG is often used to supplement the WEDGs and to inform wind farm noise assessments in Ireland.

Draft WEDG 2019

2.5.7 It is noted that the WEDG 2006 are currently under review and a set of 'draft WEDG 2019' were issued for consultation in December 2019. The draft WEDG 2019 included reference to, and reliance upon, some elements of ETSU-R-97 and the IOA GPG, however, significant concerns were raised during the consultation process regarding the noise section of the draft and at the time of writing this report, no further updates have been issued. Given the limitations of the draft WEDGs 2019 and the likelihood that significant changes would need to be made to them before they could be adopted, an assessment using those draft guidelines has not been undertaken.

2.5.8 Timelines for the conclusion of the WEDG 2019 review are still unclear as of May 2023 when preparing this report. It is possible that an updated version of the WEDG will be issued in due time, although it is expected that it would be materially different to the draft WEDG 2019.

2.5.9 As such, the guidance in the WEDG 2006 remain the applicable guidance and it has been used to assess operational noise from the Proposed Development. This was supplemented with guidance from ETSU-R-97 and the IOA GPG where appropriate.

2.6 ETSU-R-97 The Assessment and Rating of Noise from Wind Farms

2.6.1 As wind farms started to be developed in the UK in the early 1990's, it became apparent that existing noise standards did not fully address the issues associated with the unique characteristics of wind farm developments and there was a need for an agreed methodology for defining acceptable noise limits for wind farm developments. The methodology was developed for the former Department of Trade and Industry (DTI) by the Working Group on Noise from Wind Turbines (WGNWT).

2.6.2 The WGNWT comprised a number of interested parties including, amongst others, Environmental Health Officers, wind farm operators, independent acoustic consultants and legal experts who:

'…between them have a breadth and depth of experience in assessing and controlling the environmental impact of noise from wind farms.'

2.6.3 In this way it represented the views of all the stakeholders that are involved in the assessment of noise impacts of wind farm developments. The recommendations of the WGNWT are presented in the DTI Report – ETSU-R-97 *'The Assessment and Rating of Noise from Wind Farms (1996).'*

2.6.4 The basic aim of the WGNWT in arriving at the recommendations was the intention to provide:

'Indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development or adding to the costs and administrative burdens on wind farm developers or local authorities.'

2.6.5 ETSU-R-97 makes it clear from the outset that any noise restrictions placed on a wind farm must balance the environmental impact of the wind farm against the national and global benefits that would arise through the development of renewable energy sources:

'The planning system must therefore seek to control the environmental impacts from a wind farm whilst at the same time recognising the national and global benefits that would arise through the development of renewable energy sources and not be so severe that wind farm development is unduly stifled.'

2.6.6 ETSU-R-97 states that noise limits should reflect the variation in both turbine source noise and background noise with wind speed. Absolute lower limits, different for daytime and night-time, are applied where low levels of background noise are measured. The wind speed range that should be considered ranges between the cut-in wind speed for the turbines (usually about 2 to 3 ms^{-1}) and up to 12 ms^{-1}, where all wind speeds are referenced to a 10 metre measurement height.

2.6.7 Separate noise limits apply for daytime and for night-time. Daytime limits are chosen to protect a property's external amenity, and night-time limits are chosen to prevent sleep disturbance indoors, with windows open.

2.6.8 The daytime noise limit is derived from background noise data measured during so-called 'quiet periods of the day', which comprise weekday evenings (18:00 to 23:00), Saturday afternoons and evenings (13:00 to 23:00) and all day and evening on Sundays (07:00 to 23:00). Multiple samples of 10 minute background noise levels using the $L_{A90,10min}$ measurement index are logged continuously over a range of wind speed conditions. These measured noise levels are then plotted against concurrent wind speed data and a 'best fit' curve is fitted to the data to establish the background noise level as a function of wind speed. The ETSU–R-97 daytime noise limit, sometimes referred to as a 'criterion curve', is then set at a level 5 dB(A) above the best fit curve over the desired wind speed range; subject to an appropriate daytime fixed minimum limit.

2.6.9 The night-time noise limit is derived from background noise data measured during the night-time periods (23:00 to 07:00), with no differentiation being made between weekdays and weekends. The 10 minute L_{A90} noise levels measured over the night-time periods are plotted against concurrent wind speed data and a 'best fit' correlation is established. The night-time noise limit is also based on a level 5 dB(A) above the best fit curve over the 0 – 12 ms^{-1} wind speed range, with a fixed minimum limit of 43 dB L_{A90}.

2.6.10 The exception to the setting of both the daytime and night-time fixed minimum limits occurs where a property occupier has a financial involvement in the wind farm development. Paragraph 24 of ETSU-R-97 states:

'The Noise Working Group recommends that both day and night-time lower fixed limits can be increased to 45 dB(A) and that consideration should be given to increasing the permissible margin above background where the occupier of the property has some financial involvement in the wind farm.'

2.6.11 ETSU-R-97 provides a robust basis for determining the noise limits for wind turbine(s) and since its introduction has become the accepted standard for such developments across the UK.

2.6.12 As detailed above, for this assessment reference has also been made to guidance contained within ETSU-R-97. The noise limits have been derived in accordance with WEDG 2006.

2.7 Current Good Practice

A Good Practice Guide on the Application of ETSU-R-97

2.7.1 In May 2013, the Institute of Acoustics issued *'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'* (IOA GPG). The document provides guidance on background noise data collection, data analysis and limit derivation, noise predictions, cumulative issues, reporting requirements and other matters such as noise related planning conditions.

2.7.2 The Authors of the IOA GPG sets out the scope of the document in Section 1.2:

"This guide presents current good practice in the application of the ETSU-R-97 assessment methodology for all wind turbine developments above 50 kW, reflecting the original principles within ETSU-R-97, and the results of research carried out and experience gained since ETSU-R-97 was published. The noise limits in ETSU-R-97 have not been examined as these are a matter for Government."

2.7.3 The guidance document was endorsed by all Governments within the UK.

2.7.4 As with ETSU-R-97, for this assessment the recommendations included in the IOA GPG have been used to supplement the guidance provided within the WEDG.

2.7.5 The IOA GPG refers to six Supplementary Guidance Notes and where applicable these have also been considered in this report.

2.7.6 To summarise, the assessment of operational noise from the Proposed Development has been undertaken in accordance with WEDG 2006, with reference to the guidance presented in ETSU-R-97 and the IOA GPG where appropriate.

3 Potential Impacts

3.1 Operational Noise Sources

3.1.1 Wind turbines may emit two types of noise; Firstly, aerodynamic noise is a more natural sounding 'broadband' noise, albeit with a characteristic modulation, or 'swish', which is produced by the movement of the rotating blades through the air. Secondly, mechanical noise may emanate from components within the nacelle of a wind turbine. Potential sources of mechanical noise include gearboxes or generators.

3.1.2 Aerodynamic noise is usually perceived when the wind speeds are fairly low, although at very low wind speeds the blades either do not rotate, or rotate very slowly, and so negligible aerodynamic noise is generated. In higher winds, aerodynamic noise may be masked by the normal sound of wind blowing through the trees and around buildings. The level of this natural 'masking' noise relative to the level of wind turbine noise is one of the several factors that determine the subjective audibility of the wind turbines (6).

3.2 Infrasound, Low Frequency Noise and Vibration

3.2.1 The term infrasound can be defined as the frequency range below 20 Hz, while low frequency noise (LFN) is typically in the frequency range 20 – 200 Hz (7). An average young healthy adult has an audible range from 20 Hz to 20,000 Hz, although the sensitivity of the ear varies with frequency and is most sensitive to sounds with frequencies between 500 Hz and 4,000 Hz. Wind turbines do produce low frequency sounds (8), but our threshold of hearing at such low frequencies is relatively high and they therefore go unnoticed. Infrasound from wind turbines is often at levels below that of the noise generated by wind around buildings and other obstacles.

3.2.2 In 2004, the former DTI commissioned The Hayes McKenzie Partnership to report on claims that infrasound or LFN emitted by wind turbine generators (WTGs) were causing health effects. Of the 126 wind farms operating in the UK, five had reported LFN problems, therefore, such complaints are an exception, rather than a general problem that exists for all wind farms. Hayes McKenzie investigated the effects of infrasound and LFN at three wind farms for which complaints had been received and the results were reported in May 2006 (9). The report concluded that:

- *'infrasound associated with modern wind turbines is not a source which will result in noise levels which may be injurious to the health of a wind farm neighbour;*
- *low frequency noise was measurable on a few occasions but below the existing permitted Night-time Noise Criterion. Wind turbine noise may result in internal noise levels within a dwelling that is just above the threshold of audibility, however at all sites it was always lower than that of local road traffic noise;*
- *that the common cause of complaint was not associated with LFN, but the occasional audible modulation of aerodynamic noise especially at night. Data collected showed that the internal noise levels were insufficient to wake up residents at these three sites. However once awoken, this noise can result in difficulties in returning to sleep.'*

3.2.3 The Applied and Environmental Geophysics Research Group at Keele University was commissioned by the Ministry of Defence (MOD), the DTI and the British Wind Energy Association (BWEA) to undertake microseismic and infrasound monitoring of LFN and vibrations from wind farms for the purposes of siting wind farms in the vicinity of Eskdalemuir in Scotland. Whilst the testing showed that vibration can be detected several kilometres away from wind turbines, the levels of vibration from wind turbines were so small that only the most sophisticated instrumentation can reveal their presence and they are almost impossible to detect. Nevertheless, the Renewable Energy Foundation alleged potential adverse health effects and when that story was picked up in the popular press, notably the Scotsman, the report's authors expressed concern over the way in which their work had been misinterpreted and issued a rebuttal statement (10) in August 2005:

'Vibrations at this level and in this frequency range will be available from all kinds of sources such as traffic and background noise – they are not confined to wind turbines. To put the level of vibration into context, they are ground vibrations with amplitudes of about one millionth of a millimetre. There is no possibility of humans sensing the vibration and absolutely no risk to human health.'

3.2.4 In response to concerns that wind turbines emit infrasound and cause associated health problems, Dr Geoff Leventhall, Consultant in Noise Vibration and Acoustics and author of the Defra Report on Low Frequency Noise and its Effects, said in the article in the Scotsman ('Wind farm noise rules 'dated'- James Reynolds, 5 August 2005'):

'I can state quite categorically that there is no significant infrasound from current designs of wind turbines.'

3.2.5 An article (11) published in the IOA Bulletin (March/April 2009) concluded that there is no robust evidence that either low frequency noise (including 'infrasound') or ground-borne vibration from wind farms, has an adverse effect on wind farm neighbours.

3.2.6 Work (12) by Dr Leventhall looked at infrasound levels within the ear compared to external sources and concluded:

'The conclusion is that the continuous inner ear infrasound levels due to internal sources, which are in the same frequency range as wind turbine rotational frequencies, are higher than the levels produced in the inner ear by wind turbines, making it unlikely that the wind turbine noise will affect the vestibular systems, contrary to suggestions made following the measurements at Shirley. The masking effect is similar to that in the abdomen (Leventhall 2009). The body, and vestibular systems, appear to be built to avoid disturbance from the high levels of infrasound which are produced internally from the heartbeat and other processes. In fact, the hearing mechanisms and the balance mechanisms, although in close proximity, have developed to minimise interaction (Carey and Amin 2006).'

3.2.7 During a planning Appeal (PPA-310-2028, Clydeport Hunterston Terminal Facility, approximately 2.5 km south-west of Fairlie, 9 Jan 2018), the health impacts related to LFN associated with wind turbines were considered at length by the appointed Reporter (Mr M Croft). The Reporter considered evidence from Health Protection Scotland and the National Health Service. In addition, he also considered LFN surveys undertaken by the Appellant and the Local Authority, both of which demonstrated compliance with planning conditions and did not identify any problems attributable to the turbine operations; some periods with highest levels of low frequency noise were in fact recorded when the turbines were not operating.

3.2.8 The Reporter concluded that:

- The literature reviews by bodies with very significant responsibilities for the health of local people found insufficient evidence to confirm a causal relationship between wind turbine noise and the type of health complaints cited by some local residents;
- The NHS's assessment is that concerns about health impact are not supported by good quality research; and
- Although given the opportunity, the Community Council failed to provide evidence that can properly be set against the general tenor of the scientific evidence.

3.2.9 It is therefore considered unnecessary to carry out specific assessments of Infrasound, LFN and Vibration, and it has not been considered further in the noise assessment.

3.3 Amplitude Modulation of Aerodynamic Noise (AM)

3.3.1 In the context of wind turbine noise, amplitude modulation describes a variation in noise level over time; for example, observers may describe a 'whoosh whoosh' sound, which can be heard close to a wind turbine as the blades sweep past. Amplitude Modulation of aerodynamic noise is an inherent characteristic of wind turbine noise and was noted in ETSU-R-97, on page 68:

'The modulation or rhythmic swish emitted by wind turbines has been considered by some to have a characteristic that is irregular enough to attract attention. The level and depth of modulation of the blade noise is, to a degree, turbine-dependent and is dependent upon the position of the observer. Some wind turbines emit a greater level of modulation of the blade noise than others. Therefore, although some wind turbines might be considered to have a character that may attract one's attention, others have noise characteristics which are considerably less intrusive and unlikely to attract one's attention and be subject to any penalty.

This modulation of blade noise may result in a variation of the overall A-weighted noise level by as much as 3dBA (peak to trough) when measured close to a wind turbine. As distance from the wind turbine [or] wind farm increases, this depth of modulation would be expected to decrease as atmospheric absorption attenuates the high frequency energy radiated by the blade.'

3.3.2 In recent times the Acoustics community has sought to make a distinction between the AM discussed within ETSU-R-97, which is expected at most wind farms and as such may be considered as 'Normal Amplitude Modulation' (NAM), compared to the unusual AM that has sometimes been heard at some wind farms, hereinafter referred to as 'Other Amplitude Modulation' (OAM). The term OAM is used to describe an unusual feature of aerodynamic noise from wind turbines, where a greater than normal degree of regular fluctuation in sound level occurs at blade passing frequency, typically once per second. In some appeal decisions it may also be referred to as 'Excess Amplitude Modulation' (EAM). It should be noted that the noise assessment and rating procedure detailed in ETSU-R-97 fully takes into account the presence of the intrinsic level of NAM when setting acceptable noise limits for wind farms.

3.3.3 On 16 December 2013, RenewableUK (RUK) released six technical papers (13) on AM, which reflected the outcomes of research commissioned over the previous three years, together with a template planning condition. Whilst this research undoubtedly improved understanding of Other Amplitude Modulation (OAM) and its effects, it should be noted that at the time of writing it has not been endorsed by any relevant body such as the Institute of Acoustics (IOA).

3.3.4 On 22 January 2014, the IOA released a statement regarding the RUK research and the proposed planning condition to deal with the issue of amplitude modulation from a wind turbine and stated:

'This research is a significant step forward in understanding what causes amplitude modulation from a wind turbine, and how people react to it. The proposed planning condition, though, needs a period of testing and validation before it can be considered to be good practice. The IOA understands that RenewableUK will shortly be making the analysis tool publicly available on their website so that all interested parties can test the proposed condition, and the IOA will review the results later in the year. Until that time, the IOA cautions the use of the proposed planning condition.'

3.3.5 Research regarding amplitude modulation continued. In April 2015, the IOA issued a discussion document entitled *'Methods for Rating Amplitude Modulation in Wind Turbine Noise'*. The document presented three methods that can be used to quantify the level of AM at a given measurement location. After extensive consultation a preferred method of measuring OAM, which provides a framework for practitioners to measure and rate AM, was recommended by the IOA.

3.3.6 On 3 August 2015, the UK Department for Energy and Climate Change (DECC), now the Department for Business, Energy and Industrial Strategy (BEIS), commissioned independent consultants WSP Parsons Brinkerhoff to carry out a literature review on OAM (which they refer to simply as AM). The stated aims were as follows:

- *'To review the available evidence on Amplitude Modulation (AM) in relation to wind turbines, including but not limited to the research commissioned and published by RenewableUK in December 2013;*
- *To work closely with the Institute of Acoustics' AM working group, who are expected to recommend a preferred metric and methodology for quantifying and assessing the level of AM in a sample of wind turbine noise data;*
- *To review the robustness of relevant dose response relationships, including the one developed by the University of Salford as part of the RenewableUK study, on which the correction (or penalty) for amplitude modulation proposed as part of its template planning condition is based;*
- *To consider how, in a policy context, the level(s) of AM in a sample of noise data should be interpreted, in particular determining at what point it causes a significant adverse impact;*
- *To recommend how excessive AM might be controlled through the use of an appropriate planning condition; and*
- *To consider the engineering/cost trade-offs of possible mitigation measures.'*

3.3.7 Their report, which was released in October 2016, concluded that there is sufficient robust evidence that excessive AM leads to increased annoyance from wind turbine noise and recommended that excessive AM is controlled through a suitably worded planning condition, which will control it during periods of complaint. Those periods should be identified by measurement using the metric proposed by the work undertaken by the IOA, and enforcement action would rely upon professional judgement by Local Authority Environmental Health Officers based on the duration and frequency of occurrence.

3.3.8 It is not clear within the body of the report which evidence the authors relied upon to arrive at their conclusions, although the Executive Summary states (page 4);

"It is noted that none of the Category 1 or 2 papers have been designed to answer the main aim of the current review in its entirety. The Category 1 studies have limited representativeness due to sample constraints and the artificiality of laboratory environments, whereas the Category 2 studies generally do not directly address the issue of AM WTN exposure-response. A meta – analysis of the identified studies was not possible due to the incompatibility of the various methodologies employed. Notwithstanding the limitations in the evidence, it was agreed with DECC that the factors to be included in a planning condition should be recommended based on the available evidence and supplemented with professional experience".

3.3.9 The report (14) states that any planning condition must accord with existing planning guidance, and should be subject to legal advice on a case by case basis. Existing guidance would include compliance with the six tests of a planning condition embodied in Circular 4/98. The report's authors did not dictate a particular condition to be used but did suggest that any condition should include the following elements (p5):

- *"The AM condition should cover periods of complaints (due to unacceptable AM);*
- *The IOA-recommended metric should be used to quantify AM (being the most robust available objective metric);*
- *Analysis should be made using individual 10-minute periods, applying the appropriate decibel 'penalty' to each period, with subsequent analysis;*
- *The AM decibel penalty should be additional to any decibel penalty for tonality; and*
- *An additional decibel penalty is proposed during the night-time period to account for the current difference between the night and day limits on many sites to ensure the control method works during the most sensitive period of the day."*

3.3.10 At the time of writing there has been no official response to those recommendations from the IOA Noise Working Group and, as yet, no endorsement from any UK Government Minister or Department. The recommendation to impose a planning condition and the associated penalty scheme is at odds with the advice from the IOA GPG, which currently states (paragraph 7.2.10):

'7.2.1 The evidence in relation to "Excess" or "Other" Amplitude Modulation (AM) is still developing. At the time of writing, current practice is not to assign a planning condition to deal with AM.'

3.3.11 It is therefore considered unnecessary to carry out specific assessments of OAM, and it has not been considered further in the noise assessment.

4 Methodology

4.1 Assessing Operational Noise Impact

4.1.1 To undertake an assessment of the operational noise impact, the following steps are required:

- Specify the location of the wind turbines for the Proposed Development;
- Identify the locations of all nearby noise sensitive receptors (NSRs) and measure the background noise levels as a function of on-site wind speed at a selection of representative Noise Monitoring Locations (NML). Measure wind conditions at the site at the same time;
- Review and analyse noise and wind data to establish prevailing background noise levels at each NML.
- Select a sample of relevant Noise Assessment Locations (NAL). For each NAL, identify the most representative measured background noise dataset;
- Establish for each NAL the Total WEDG Noise Limits, relative to prevailing background levels and also the status of the property (ie. financially involved property or not).;
- Calculate the likely noise immission levels due to the cumulative operation of all relevant wind turbines and compare it to the Total WEDG Noise Limits;
- Determine the Site Specific Noise Limits, which take account of the noise limit already allocated to, or could theoretically be used by, other wind farm developments in the area; and
- Calculate the likely noise immission levels due to the operation of the Proposed Development on its own for the minimum and maximum turbine dimensions within the proposed range and compare it to the Proposed Development's Site Specific Noise Limits.

4.1.2 In order to fully consider cumulative noise, the assessment has been split into three separate stages:

- Stage 1 – determine existing Total WEDG Noise Limits, which are already set for other wind farms within the vicinity of the Proposed Development at each NAL or establish the Total WEDG Noise Limits for each NAL (where noise limits are not already set) based on the measured background noise levels;
- Stage 2 – undertake a cumulative assessment for locations where noise predictions from the Proposed Development are within 10 dB of the total noise predictions from any other wind farms/turbine developments in the area; and
- Stage 3 – establish the Proposed Development's Site Specific Noise Limits (at levels below the Total WEDG Noise Limits, where limit apportionment is required) and compare the noise predictions from the Proposed Development on its own against the proposed Site Specific Noise Limits.

4.2 Consultation

Scoping Opinion

4.2.1 The Applicant issued a Scoping Report (dated 14th September 2022) to consultees and the Environmental Health Service. The scoping section on noise suggested a methodology as described earlier in this report. No scoping response was provided and no further consultation was undertaken.

4.3 Stage 1 Assessment Methodology - Setting the Total WEDG Noise Limits

Identify Existing Noise Limits

4.3.1 It was not possible to determine whether noise limits have already been established at nearby receptors via planning conditions set for the existing operational Skehanagh and Carrig Wind Farms due to the lack of planning documentation available on the Tipperary Planning Portal. As such, this assessment only assumes new Total WEDG Noise limits at all receptors, based on the background noise levels established for this assessment at a sample of properties surrounding the proposed Development.

Wind Shear

4.3.2 Wind shear can be defined as *'the change in the relationship between wind speed at different heights'*. Due to wind shear, wind speeds recorded on one meteorological mast at different heights usually vary, generally the higher the anemometer the higher the wind speed recorded. For example, if a wind speed of 4 ms^{-1} is recorded at 80 m height, 3.5 ms^{-1} may be recorded at 40 m and 2.5 ms^{-1} may be recorded at 10 m.

4.3.3 Hub height wind speed is the key wind speed for a wind farm noise assessment, as it is the wind speed at hub height which will determine the noise emitted by the wind turbines and informs the turbine control system. Ideally, both wind turbine noise predictions and background noise level measurements should refer to hub height wind speed (or a representation thereof), ensuring that there is no discrepancy between the wind speed at which the noise is emitted and the wind speed at which the corresponding background noise is measured.

4.3.4 The IOA GPG states that one of three methods of wind speed measurement may be adopted. For this assessment wind speeds were recorded by a LIDAR device for a range of height between 39m and 200m. In line with 'Method A' of Section 2.6.3 of the IOA GPG, the wind speed at 110 m (near proposed hub) was standardised to 10 m height, with wind shear fully taken into account.

Noise Impact Criteria in the WEDG

4.3.5 Analysis of the measured noise and wind data has been undertaken in accordance with ETSU-R-97 and current good practice to determine the pre-existing background noise environment and to establish the daytime and night-time Total WEDG Noise Limits for each NAL.

4.3.6 The Total WEDG Noise Limits for the daytime have been set at;

- 40 dB(A) where background noise levels are below 30 dB; and,
- 45 dB(A) or background noise plus 5 dB, whichever is the greater, where background noise levels are greater than 30 dB.

4.3.7 Total WEDG Noise Limits at night-time has been set at;

- 43 dB(A) or background plus 5 dB, whichever is the greater.

4.3.8 This 'Total' WEDG Noise limit relates to noise from all wind farm developments in the area (including the Proposed Development). The daytime fixed minimum noise limits limit were chosen with due regard to the limits included within recent planning decisions issued by An Bord Pleanála.

4.3.9 The acceptable limits for wind turbine operational noise are clearly defined for all time periods by the application of the WEDG methodology. Consequently, the test applied to operational noise is whether or not the predicted wind turbine noise immission levels at nearby noise sensitive properties lie below the WEDG Noise Limits. Depending on the levels of background noise, the satisfaction of the WEDG derived limits can lead to a situation whereby, at some locations under some wind conditions and for a certain proportion of the time, the wind turbine noise would be audible.

4.4 Stage 2 Assessment Methodology - Likely effects & cumulative assessment

4.4.1 The WEDG do not include any information on the assessment of cumulative noise impacts, therefore, the guidance provided within the IOA GPG has been adopted, which contains a detailed section on cumulative noise and where a cumulative assessment is required. Section 5.1.4 and 5.1.5 of the GPG state:

'During scoping of a new wind farm development consideration should be given to cumulative noise impacts from any other wind farms in the locality. If the proposed wind farm produces noise levels within 10 dB of any existing wind farm/s at the same receptor location, then a cumulative noise impact assessment is necessary.

Equally, in such cases where noise from the proposed wind farm is predicted to be 10 dB greater than that from the existing wind farm (but compliant with ETSU-R-97 in its own right), then a cumulative noise impact assessment would not be necessary.'

4.4.2 An assessment was undertaken at each of the chosen NALs proximate to the Proposed Development and other nearby operational, consented and proposed wind farm developments to determine whether the wind turbine noise immissions from the Proposed Development were within 10 dB of the wind turbine noise immissions from other wind farm developments. Where predictions were found to be within 10 dB of each other, a cumulative noise assessment was undertaken, however, if wind turbine immissions were more than 10 dB apart, a cumulative noise assessment was not required.

Noise Prediction Model

4.4.3 The ISO 9613-2: 1996 *'Acoustics – Attenuation of sound during propagation outdoors Part 2: General method of calculation'* (15) model algorithm provides a robust prediction method for calculating the noise immission levels at the nearest receptors. A European Commission (EC) research project into wind farm noise propagation over large distances, published as 'Development of a Wind Farm Noise Prediction Model,' JOULE project JOR3-CT95-0051 in 1998, identified a simplified version of ISO 9613-2 as the most suitable at that time, but the full method has been used for this assessment.

4.4.4 Guidance on noise prediction and propagation modelling is not provided within the WEDG, however, the IOA GPG recognises the standard as appropriate for the prediction of wind turbine noise.

4.4.5 There is currently no standard approach to specifying error bands on noise predictions, however, Table 5 of ISO 9613-2 suggests, at best, an estimated of accuracy of ± 3 dB(A). The work undertaken as part of the EC research study concluded that the ISO 9613-2 algorithm reliably predicted noise levels that would generally occur under downwind propagation conditions. The error bands referenced in the ISO standard itself relate to the general application of the standard. Additionally, wind farm specific studies have been undertaken to validate the use of the standard to predict wind farm noise and these are referenced in Section 4 of the IOA GPG, which goes on to conclude that:

"The outcome of this research has demonstrated that the ISO 9613-2 standard in particular, which is widely used in the UK, can be applied to obtain realistic predictions of noise from on-shore wind turbines during worst case propagation conditions (i.e. sound speed gradients due to downwind conditions or temperature inversions), but only provided that the appropriate choice of input parameters and correction factors are made."

4.4.6 TNEI's experience of undertaking compliance monitoring for operational wind farms indicates that the predictions undertaken using the guidance in the IOA GPG show a good correlation with measured levels.

4.4.7 The ISO 9613-2 model can take account of the following factors that influence sound propagation outdoors:

- Geometric divergence;
- Atmospheric absorption;
- Reflecting obstacles;
- Screening;
- Vegetation; and
- Ground attenuation.

4.4.8 The model uses as its acoustic input data the octave band sound power output of the turbine and calculates, on an octave band basis, attenuation due to the factors above, as appropriate.

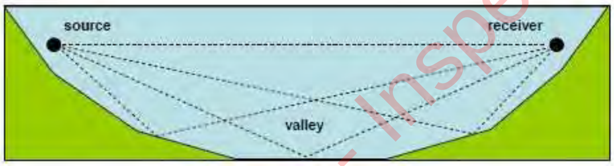
4.4.9 The IOA GPG quotes a comparative study undertaken in Australia that indicated ISO 9613-2 can, in some conditions, under-predict ground attenuation effects and the potential for additional reflection paths 'across a valley', whilst slightly over-predicting on flat terrain. It should be noted, however, that the wind farm layouts studied were untypical, with rows of turbines spreading over 10 km on an elevated ridge. It also should be noted that no correction for background contribution was undertaken and the monitoring locations in the study were located as far as 1.7 km from the nearest turbine, where turbine noise may be at similar levels to background noise and therefore difficult to differentiate. For the study's modelling work topographic height data was included as an input, which is consistent with ISO 9613-2 methodology generally, but not with the requirements of the IOA GPG.

4.4.10 The model used in this assessment does not model barrier attenuation using the method in ISO 9613-2, but instead uses the guidance in the IOA GPG to consider whether any topographical corrections are required as set out below in Sections 4.4.11 to 4.4.14. Any differences in ground height between the receptors and the turbines are considered when calculating the propagation distance between each source and receiver.

4.4.11 The IOA GPG discusses the potential for topographical screening effects of the terrain surrounding a wind farm and the nearby noise sensitive receptors. Although barrier screening effects in ISO 9613-2 can make corrections of up to 15 dB, the IOA GPG states that where there is no line of sight between the highest point on the rotor and the receiver location a reduction of no more than 2 dB may be applied.

4.4.12 The IOA GPG also states that a *'further correction of +3 dB should be added to the calculated overall A-weighted level for propagation 'across a valley', i.e. a concave ground profile or where the ground falls away significantly between a turbine and the receiver location.'* The potential reflection paths are illustrated in Schematic 4.1 below.

Schematic 4.1: Multiple reflection paths for sound propagation across concave ground



Source: IOA GPG, page 21, Figure 5

4.4.13 A formula from the JOULE Project JOR3-CT95-0051 dated 1998 is suggested for determining whether a correction is required.

$$h_m \geq 1.5 \text{ x } (abs\ (h_s - h_r) / 2)$$

where h_m is the mean height above the ground of the direct line of sight from the receiver to the source (as defined in ISO 9613-2, Figure 3), and h_s and h_r are the heights above local ground level of the source and receiver respectively).

4.4.14 The calculation of h_m requires consideration of the digital terrain model and needs to be performed for each path between every turbine and every receiver. Interpretation of the results of the calculation above and the subsequent inclusion of a concave ground profile correction requires careful consideration with any topographical variation considered in the context of a site.

4.5 Noise Propagation Parameters

4.5.1 The noise immission levels have been calculated using the full ISO 9613-2 model with a receiver height of 4.0 m above local ground level, mixed ground (G=0.5) and air absorption based on a temperature of 10 °C and 70 % relative humidity. The modelling parameters reflect current good practice as detailed within the IOA GPG.

4.5.2 The wind turbine noise immission levels are based on the $L_{A90,10\ minute}$ noise indicator in accordance with the recommendations in the WEDG, which were obtained by subtracting 2 dB(A) from the turbine sound power level data (L_{Aeq} indicator).

4.5.3 A topographical assessment has been undertaken between each NSR and wind turbine location to determine whether any concave ground profiles exist between the source and receiver. Analysis undertaken using a combination of CadnaA (16) and an Excel model found that if the formula in the IOA GPG is applied directly, a +3 dB correction is required for most nearby existing turbines at most receptors, as summarised in Annex 6.

4.5.4 In addition, an assessment has been undertaken to determine whether any topographical screening effects of the terrain occur where there is no direct line of sight between the highest point on the turbine rotor and the receiver location. Upon analysis of each NSR, it was found that a barrier correction of -2dB applies for most nearby existing turbines at two receptors as detailed in Annex 6.

4.5.5 The cumulative assessment has taken into account directivity effects in line with good practice. The directivity of wind turbines has been recognised for some time. Building on earlier work by NASA, in 1988 Wyle Laboratories studied sound propagation using an omnidirectional loudspeaker source elevated 80 ft above ground, in upwind, downwind and cross wind situations, and in both flat and hilly terrain, then compared those measurements to measured data from actual wind turbines. Their study quantified directivity factors for a limited frequency range, but was unable to conclusively demonstrate the anticipated directivity effects on real wind turbines. It also highlighted, but was unable to explain, measured differences observed between flat and hilly terrain.

4.5.6 Hubbard (1990) (IOA GPG Section 4.4.3) described a number of factors believed to influence propagation and directivity, notably refraction caused by vertical wind and temperature gradients. In the downwind direction the wind gradient causes the sound rays to bend toward the ground, whereas in the upwind direction the rays curve upward away from the ground. Upwind of the turbine this results in a region of increased attenuation termed the 'shadow zone'. The excess attenuation is frequency dependent, with lowest frequencies least attenuated. Relating this to the earlier NASA studies, Hubbard noted that the distance from the source to the edge of the shadow zone is related to the wind speed gradient and the elevation of the source, which for a typical turbine source was calculated to be approximately 5 times the source height.

4.5.7 This observation was adopted in the IOA GPG, which states (Section 4.4.2) 'Such reductions (due to "shadow zone" refraction effects) will in practice only progressively come into play at distances of between 5 and 10 turbine tip heights', while Section 4.4.3 provides graphical examples of increasing broadband directivity with increasing tip height scaling in both flat and hilly terrain, without qualifying either of those designations.

4.5.8 The IOA GPG recommends (Section 4.4.1) that directivity attenuation factors adopted in any assessment should be clearly stated. The TNEI noise model can consider the effect of directivity and in line with current good practice the attenuation values used are in detailed in Table 4.1 These are based upon the examples given in the IOA GPG (Section 4.4.2), using interpolation where required.

Table 4.1 Wind Directivity Attenuation Factors used in Modelling

Direction (º)	0	15	30	45	60	75	90	105	120	135	150	165
Attenuation dB(A))	-10	-9.9	-9.3	-8.3	-6.7	-4.6	-2	0	0	0	0	0
Direction (º)	**180**	**195**	**210**	**225**	**240**	**255**	**270**	**285**	**300**	**315**	**330**	**345**
Attenuation (dB(A))	0	0	0	0	0	0	-2	-4.6	-6.7	-8.3	-9.3	-9.9

4.6 Stage 3 Assessment Methodology - Site Specific Noise Limits

4.6.1 Summary Box 21 of the IOA GPG states:

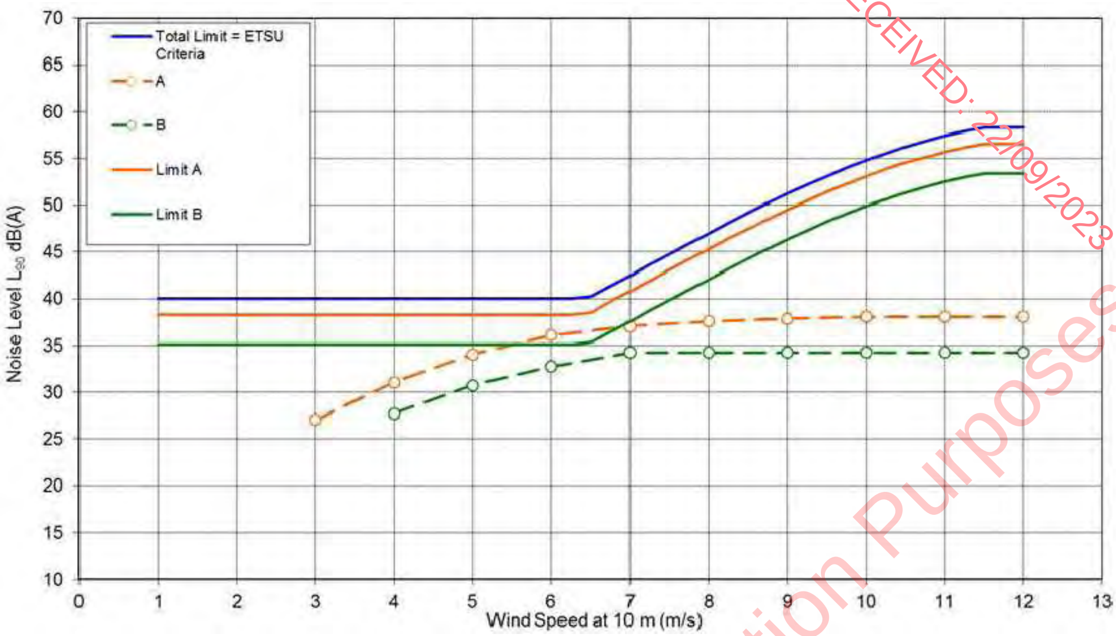
'Whenever a cumulative situation is encountered, the noise limits for an individual wind farm should be determined in such a way that no cumulative excess of the total ETSU-R-97 noise limit would occur.'

4.6.2 In order to determine Site Specific Noise Limits at receptors in proximity to the Proposed Development (where required), the guidance detailed within Section 5.4 of the IOA GPG has been considered. The options detailed within Section 5.4 are summarised below.

Limit Apportionment

4.6.3 Limit apportionment considers the noise limit already allocated to other wind farms in the area. This approach is demonstrated in Graph 4.1 below which is reproduced from the Section 5.4 of the IOA GPG. In this example the total limit (shown in blue) is shared between two proposed wind farms (A and B). The two noise limits for a given receptor (the solid orange and green lines) when added together equate to the total noise limit, and the predicted levels for each wind farm (the dashed lines) meet the specific limits established for each wind farm.

Graph 4.1: Limit Apportionment Example



Significant Headroom

4.6.4 The limit derivation can also be undertaken with consideration of the amount of headroom between another schemes'(s) predictions and the Total Noise Limit. With regard to this, Section 5.4.11 of the IOA GPG states:

'In cases where there is significant headroom (e.g. 5 to 10 dB) between the predicted noise levels from the existing wind farm and the Total Noise Limits, where there would be no realistic prospect of the existing wind farm producing noise levels up to the Total Noise Limits, agreement could be sought with the LPA as to a suitable predicted noise level (including an appropriate margin to cover factors such as potential increases in noise) from the existing wind farm to be used to inform the available headroom for the cumulative assessment without the need for negotiation or cumulative conditioning. This may be the case particularly at low wind speeds.'

4.6.5 With this in mind, and where appropriate, for the sole purpose of calculating site specific limits a cautious additional 2 dB buffer has been added to the wind turbine noise predictions from the nearby wind farm schemes. This is considered to be a suitable buffer in accordance with Section 5.4.11 of the IOA GPG and would represent a 60% increase in emitted noise levels from the other wind farm developments.

10 dB Rule

4.6.6 Where predicted wind turbine noise levels from the individual wind farm/ turbine schemes are found to be >10 dB below the Total WEDG Noise Limits then it has been deemed appropriate to allocate the entire noise limit to the Proposed Development.

4.6.7 Further information on the approaches adopted for the setting of the Site Specific Noise Limits is provided in the Stage 3 assessment section below.

5 Baseline

5.1 Identification of Potential Noise Receptors

5.1.1 A desk-based review was undertaken to identify potential NSRs within proximity to the Proposed Development. Of the identified receptors, a total of five Noise Monitoring Locations (NMLs) were selected as being appropriate locations to determine a representative baseline for all of the identified NSRs. The NMLs were located to the north west, north east, east and south of the Proposed Development.

5.1.2 The NMLs were selected following a detailed review of the area using aerial photography. Where possible, locations were selected that were subject to minimal influence from other noise sources, such as local watercourses, operational wind turbines and vegetation.

5.2 Background Noise Survey

5.2.1 Background noise monitoring was undertaken for the purposes of setting the WEDG Noise Limits. Data was recorded over the period 18th November 2022 to 17th January 2023 at each of the NMLs simultaneously.

5.2.2 Details of the exact monitoring periods, the rationale behind the exact kit location and the dominant noise sources observed at each of the NMLs are detailed in the Field Data Sheets (FDS) and installation report included in Annex 2.

5.2.3 The NML is the position that the sound level meter was sited at each property, as shown on Figure A1.1 (Annex 1) and summarised in Table 5.1 below.

Table 5.1 Noise Monitoring Locations

NML	X (ITM)	Y (ITM)
NML1	596335	701941
NML2	598929	700328
NML3	600241	701417
NML4	599935	703213
NML5	597075	703201

5.3 Noise Monitoring Equipment

5.3.1 Section 2.4 of the IOA GPG includes information on the type and specification of noise monitoring equipment that should be used for background noise surveys and states:

'Noise measurement equipment and calibrators used on site should comply with Class 1/Type 1 of the relevant standard(s). Enhanced microphone windscreens should be used. Standard windshields of a diameter of less than 100 mm cannot be relied upon to provide sufficient reduction of wind noise in most circumstances.'

5.3.2 The noise monitoring equipment used for the background noise survey meets with the requirements of the IOA GPG. Details of the noise monitoring equipment used, the calibration drift recorded and photographs at each NML are detailed in the FDS included in Annex 2. The IOA GPG states that for calibration drift greater than 1 dB, the measurements should be discarded. The maximum calibration drift recorded during the noise survey was 0.4 dB as detailed in the FDS (included in Annex 2) therefore no correction has been applied to the noise data.

5.3.3 Copies of the calibration/conformance certificates for the sound level meters and sound level calibrator used for the noise survey are included in Annex 3. All sound level meters conform to Class 1/Type 1.

5.3.4 The microphones were mounted between 1.2 m and 1.5 m above local ground level and were situated between 3.5 m and 20 m from the dwelling, where possible 'in an area frequently used for rest and relaxation' (Section 2.5.1 of IOA GPG), and away from obvious local sources of noise such as boiler flues, fans and running water. At all locations, the sound level meters were situated as far away from hard reflective surfaces such as fences and walls as practicable.

5.3.5 Permission could not be secured to monitor at the property that was initially proposed for NML1. As an alternative, the noise monitoring equipment was located in an adjacent field and therefore NML1 is approximately 100 m from a property amenity area. From onsite subjective observations, the noise environment in the chosen location was deemed representative of the properties in this area near ML1.

5.3.6 All measurement systems were set to log the L_{A90} and L_{Aeq} noise levels in ten-minute intervals continuously over the deployment period.

5.4 Meteorological Data

5.4.1 The WEDG state on Page 29 that:

'Noise limits should be applied to external locations, and should reflect the variation in both turbine source noise and background noise with wind speed.'

5.4.2 ETSU-R-97 states on Page 84 that:

'background noise measurements should be correlated with wind speed measurements performed at the proposed site, such that the actual operating noise levels from the turbines may be compared with the noise levels that would otherwise be experienced at a dwelling.'

5.4.3 Concurrent wind speed and direction were recorded using a LIDAR unit, which was located within the site (ITM grid reference 597819, 701924). The meteorological data was collected and provided by the applicant. The installation report and calibration information for the LIDAR is included within Annex 2. Average 10 minute wind speed and direction data were collected over the same time period as the noise data to provide the analysis of the measured background noise as a function of wind speed and direction.

5.4.4 The methodology used for measuring or calculating wind shear is detailed in Section 4.3.2.

5.4.5 A tipping bucket rain gauge was installed at NML1 and NML3 for the duration of the noise survey to record periods of rainfall, time synchronised to the sound measurements. As per the recommendations in Section 3.1.9 of the IOA GPG, the rain data was analysed and any 10 minute period that contained registered rainfall events, plus the preceding 10 minute period, was excluded. All excluded rainfall periods are shown on Figures A1.2a - A1.2f (Annex 1) as blue squares.

5.5 Directional Filtering of Background Noise

5.5.1 In Section 3.1.22 of the IOA GPG the need to directionally filter background noise data is discussed. Where a receiver is located upwind of a dominant local noise source whilst also being systematically downwind of the turbines then it may be necessary to filter background noise data particularly when this corresponds to the prevailing wind direction.

5.5.2 For this site, some directional filtering was undertaken due to proximity to the N52 road. The filters applied for each NML are clearly shown as orange data points in the Regression Analysis Figures A1.2a to A1.2e (Annex 1). The data points removed where within 180 degrees downwind of the N52 and as can be seen on the figures. They are broadly within typical noise levels hence this filtering did not result in a significant reduction of the average background noise levels.

5.6 Analysis of Measured Data

5.6.1 Time series graphs are provided in Annex 4, which show the variation in measured wind speed/direction and noise level over the monitoring period. These graphs also show where data was excluded, either due to rainfall, birdsong (dawn chorus) or manual exclusions due to atypical data.

5.7 Prevailing Background Noise Level

5.7.1 Table 5.2 and Table 5.3 summarise the derived prevailing background noise levels from the baseline survey.

Table 5.2 Summary of Prevailing Background Noise Levels during Quiet Daytime Periods (dB(A))

NML	Prevailing Background Noise Level $L_{A90,10\ min}$											
	1	2	3	4	5	6	7	8	9	10	11	12
NML1	20.8*	20.8	21.0	22.0	23.8	26.2	29.1	32.6	36.4	40.6	45.1	49.7
NML2	23.3*	23.3*	23.3	24.0	25.4	27.4	30.1	33.4	37.0	41.1	45.5	50.2
NML3	25.3*	25.3*	25.3*	25.3	25.7	26.7	28.5	31.3	35.2	40.5	47.3	47.3*
NML4	25.4*	25.4*	25.4*	25.4	25.8	26.7	28.2	30.4	33.2	36.6	40.7	40.7*
NML5	20.7*	20.7	21.5	22.7	24.3	26.4	29.0	32.0	35.5	39.4	43.8	48.6

**restricted where derived minimum occurs at lower wind speeds and maximum level recorded at higher wind speeds. See Sections 5.7.4 - 5.7.6.*

Table 5.3 Summary of Prevailing Background Noise Levels during Night-time Periods (dB(A))

NML	Prevailing Background Noise Level $L_{A90,10\ min}$											
	1	2	3	4	5	6	7	8	9	10	11	12
NML1	17.3*	17.3*	17.3	17.8	19.6	22.6	26.4	30.7	35.2	39.6	43.5	46.8
NML2	19.0*	19.0*	19.0	19.7	21.5	24.3	27.8	31.9	36.4	41.2	45.9	50.4
NML3	20.0*	20.0*	20.0	20.3	21.5	23.5	26.3	30.1	34.6	40.1	46.5	46.5*
NML4	21.5*	21.5*	21.5*	21.5	22.2	23.7	26.0	29.1	33.2	38.3	44.4	44.4*
NML5	19.2*	19.2*	19.2*	19.2	20.4	22.7	25.9	29.8	34.2	38.9	43.7	48.5

**restricted where derived minimum occurs at lower wind speeds. See Sections 5.7.4 - 5.7.6.*

5.7.2 A series of graphs are presented for each of the NMLs to illustrate the data collected, these are included as Figures A1.2a - A1.2f (Annex 1). There is a set of graphs for each NML, which show the range of wind speeds and directions recorded during the survey, the 10 minute average wind speed plotted against the recorded $L_{A90,\ 10min}$ noise level, and a calculated 'best fit' polynomial regression line for both quiet daytime and night-time periods. Each Figure also includes a table with the number of measured data points per integer wind speed bin and the prevailing measured background noise level.

5.7.3 The background noise levels have been calculated using a best fit polynomial regression line of no more than a fourth order through the measured $L_{A90,\ 10min}$ noise data, as required by ETSU-R-97 and the IOA GPG.

5.7.4 In line with the recommendations included in Section 3.1.21 of the IOA GPG, for all NMLs the polynomial background curve for low wind speed conditions have been restricted at wind speeds below that where the derived minimum occurs.

5.7.5 ETSU-R-97 states (Page 101) that data may not be extrapolated beyond the measured range of wind speeds. It is, however, reasonable to assume that background noise levels will not decrease at higher wind speeds. As such, in the interest of protecting residential amenity, the noise levels for wind speeds higher than the maximum where noise levels were measured have been set equal to those derived for lower wind speeds, as per Section 3.1.20 of the IOA GPG.

5.7.6 The low wind and high wind restriction assumptions used for each location are illustrated on the Figures, where the final regression analysis curve is shown as a continuous black line and the original polynomial line of best fit is shown as a dashed black line. A summary is also included in Table 5.4 below.

Table 5.4 Analysis of Measured Datasets

NML	Quiet Daytime	Night-time
NML1	Restricted below 2 ms^{-1} (minimum level recorded)	Restricted below 3 ms^{-1} (minimum level recorded)
NML2	Restricted below 3 ms^{-1} (minimum level recorded)	Restricted below 3 ms^{-1} (minimum level recorded)
NML3	Restricted below 4 ms^{-1} (minimum level recorded) and above 11 ms^{-1} maximum level recorded)	Restricted below 4 ms^{-1} (minimum level recorded) and above 11 ms^{-1} maximum level recorded)
NML4	Restricted below 4 ms^{-1} (minimum level recorded) and above 11 ms^{-1} maximum level recorded)	Restricted below 4 ms^{-1} (minimum level recorded) and above 11 ms^{-1} maximum level recorded)
NML5	Restricted below 2 ms^{-1} (minimum level recorded)	Restricted below 4 ms^{-1} (minimum level recorded)

5.7.7 The number of data points measured in each wind speed bin for each receptor, once exclusions were applied, are summarised in Figures A1.2a - A1.2f (Annex 1). The Figures also show the final prevailing background noise levels which have been determined following the analysis detailed above.

6 Noise Assessment Results

6.1 Noise Sensitive Receptors and Noise Assessment Locations

6.1.1 Of all the NSRs surrounding the area, a sample of 13 were chosen as Noise Assessment Locations (NALs) located closest to the Proposed Development. Predictions and assessment of noise at the NALs ensures that the assessment assess the noise impact expected at the most sensitive NSRs surrounding the proposed Development. If predicted wind farm noise levels meet the noise limits at the selected NALs then it infers compliance at other NSRs located further away from the Proposed Development.

6.1.2 The noise impact assessment results for the NALs are presented within the main body of this report, however, an assessment for the individual NSRs has also been included within Annex 5 for completeness.

6.1.3 Each NAL and NSR are shown on Figure A1.1 (Annex 1). All NALs and NSRs are labelled with the letter 'H' and are numbered to ensure consistency with the labelling of these receptors within the rest of the Environmental Impact Assessment Report (EIAR).

6.1.4 Table 6.1 details which NML has been used to set noise limits for each NAL and a similar table detailing which NML has been used to set limits at each NSR has also been included within Annex 5.

Table 6.1 Noise Assessment Locations

Noise Assessment Location (NAL)	X (ITM) (m)	Y (ITM) (m)	Elevation (m above sea level)	Background Noise Monitoring Location Used
NAL1 (H8)	599220	700514	61.62	NML2
NAL2 (H52)	598521	700638	64.53	NML2
NAL3 (H51)	597987	700819	73.12	NML2
NAL4 (H3)	596246	701962	65.93	NML1
NAL5 (H61)	597063	703194	66.83	NML5
NAL6 (H60)	597452	703742	62.33	NML5
NAL7 (H24)	599875	703112	58.78	NML4
NAL8 (H21)	600767	702732	55.6	NML4
NAL9 (H4)	600097	701616	63.59	NML3
NAL10 (H42)	600193	701449	68.1	NML3
NAL11 (H49)	600469	700586	62.37	NML3

Noise Assessment Location (NAL)	X (ITM) (m)	Y (ITM) (m)	Elevation (m above sea level)	Background Noise Monitoring Location Used
NAL12 (H54)	600129	700098	61.86	NML2
NAL13 (H25)	600449	699641	65.54	NML2

6.2 Noise Emission Characteristics of the Wind Turbines

6.2.1 This assessment considers the Vestas V162, a 6.2 MW candidate turbine for the Proposed Development with serrated trailing edge blades and a proposed range of hub heights between 105 m and 110.5 m.

6.2.2 For the cumulative assessment the existing nearby wind turbines of Skehanagh Wind Farm and Carrig Wind Farm are considered. The location of these nearby wind turbines are shown on Figure A1.1a and grid references are included in Annex 7.

6.2.3 Due to the differences in the way in which levels are provided by different manufacturers, TNEI has accounted for uncertainty using the guidance contained within Section 4.2 of the IOA GPG (2013). Details of the sound power level, octave data and measurement uncertainty used for the turbine considered in this assessment are included in Annex 7.

6.2.4 Manufacturer noise level data is usually supplied based on a turbine of a specific hub height although the noise levels are presented as standardised to 10 m height. Accordingly, the noise data used in this assessment corrects the published turbine noise data following the guidance detailed in Section 4.3 of IOA GPG Supplementary Guidance Note 4, where applicable.

6.3 Stage 1 – Setting the Total WEDG Noise Limits

6.3.1 The WEDG Noise Limits have been established for each of the NALs as detailed in Table 6.2 and Table 6.3 below, based on a fixed minimum level of 40dB(A) (daytime) and 43 dB(A) (Night-time).

Table 6.2 WEDG Noise Limits Daytime

Location	Wind Speed (ms^{-1}) as standardised to 10 m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NAL1 (H8)	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
NAL2 (H52)	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
NAL3 (H51)	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
NAL4 (H3)	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.6	50.1	54.7
NAL5 (H61)	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	48.8	53.6
NAL6 (H60)	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	48.8	53.6
NAL7 (H24)	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.7	45.7
NAL8 (H21)	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.7	45.7
NAL9 (H4)	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3

Location	Wind Speed (ms^{-1}) as standardised to 10 m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NAL10 (H42)	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
NAL11 (H49)	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
NAL12 (H54)	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
NAL13 (H25)	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2

Table 6.3 WEDG Noise Limits Night-time

Location	Wind Speed (ms^{-1}) as standardised to 10 m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NAL1 (H8)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
NAL2 (H52)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
NAL3 (H51)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
NAL4 (H3)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	48.5	51.8
NAL5 (H61)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.9	48.7	53.5
NAL6 (H60)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.9	48.7	53.5
NAL7 (H24)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.3	49.4	49.4
NAL8 (H21)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.3	49.4	49.4
NAL9 (H4)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
NAL10 (H42)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
NAL11 (H49)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
NAL12 (H54)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
NAL13 (H25)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4

6.4 Stage 2 - Likely Effects and Cumulative Assessment

6.4.1 A likely cumulative noise assessment was undertaken at all NALs. Figures A1.3a-g (Annex 1) and Table 6.4 and Table 6.5 below show predictions from the cumulative operation of all wind farms (including the Proposed Development with a 110.5 m hub, which is the worst-case modelling scenario of the proposed turbine dimension range i.e. provides the highest predicted levels) against the 'Total WEDG Noise Limits'. The individual contribution of all wind farms is also shown on the figures.

6.4.2 The result of this likely cumulative noise assessment shows that the Proposed Development can operate concurrently with the nearby operational wind farms, whilst still meeting the Total WEDG Noise Limits. The only exception is at NAL 9 where a marginal exceedance of 0.8 dB is observed only in daytime at 7 m/s. Such a minor exceedance would be removed by using low noise mode for the candidate turbine in that specific wind speed and in specific directions only.

Table 6.4 Total WEDG Compliance Table – Likely Cumulative Noise - Daytime

Location		Wind Speed (ms^{-1}) as standardised to 10 m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 (H8)	Total WEDG Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	30.9	35.0	38.6	39.8	39.8	39.8	39.8	39.8	39.8
	Exceedance Level	-	-	-	-9.1	-5.0	-1.4	-5.2	-5.2	-5.2	-6.3	-10.7	-15.4
NAL2 (H52)	Total WEDG Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	31.9	35.9	39.5	40.7	40.7	40.7	40.7	40.7	40.7
	Exceedance Level	-	-	-	-8.1	-4.1	-0.5	-4.3	-4.3	-4.3	-5.4	-9.8	-14.5
NAL3 (H51)	Total WEDG Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	31.1	35.1	38.7	39.9	39.9	39.9	39.9	39.9	39.9
	Exceedance Level	-	-	-	-8.9	-4.9	-1.3	-5.1	-5.1	-5.1	-6.2	-10.6	-15.3
NAL4 (H3)	Total WEDG Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.6	50.1	54.7
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	21.9	26.0	29.5	30.6	30.6	30.6	30.6	30.6	30.6
	Exceedance Level	-	-	-	-18.1	-14.0	-10.5	-9.4	-14.4	-14.4	-15.0	-19.5	-24.1
NAL5 (H61)	Total WEDG Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	48.8	53.6
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	23.0	27.1	30.6	31.8	31.8	31.8	31.8	31.8	31.8
	Exceedance Level	-	-	-	-17.0	-12.9	-9.4	-8.2	-13.2	-13.2	-13.2	-17.0	-21.8
NAL6 (H60)	Total WEDG Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	48.8	53.6
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	22.2	26.3	29.8	31.0	31.0	31.0	31.0	31.0	31.0
	Exceedance Level	-	-	-	-17.8	-13.7	-10.2	-9.0	-14.0	-14.0	-14.0	-17.8	-22.6
NAL7 (H24)	Total WEDG Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.7	45.7
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	26.7	30.8	34.3	35.5	35.5	35.5	35.5	35.5	35.5
	Exceedance Level	-	-	-	-13.3	-9.2	-5.7	-4.5	-9.5	-9.5	-9.5	-10.2	-10.2
NAL8 (H21)	Total WEDG Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.7	45.7
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	24.6	28.8	32.2	33.3	33.3	33.3	33.3	33.3	33.3
	Exceedance Level	-	-	-	-15.4	-11.2	-7.8	-6.7	-11.7	-11.7	-11.7	-12.4	-12.4
NAL9 (H4)	Total WEDG Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	31.9	36.0	39.6	40.8	40.8	40.8	40.8	40.8	40.8

Location		Wind Speed (ms^{-1}) as standardised to 10 m height											
		1	2	3	4	5	6	7	8	9	10	11	12
	Exceedance Level	-	-	-	-8.1	-4.0	-0.4	**0.8**	-4.2	-4.2	-4.7	-11.5	-11.5
NAL10 (H42)	Total WEDG Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	30.9	35.0	38.5	39.7	39.7	39.7	39.7	39.7	39.7
	Exceedance Level	-	-	-	-9.1	-5.0	-1.5	-0.3	-5.3	-5.3	-5.8	-12.6	-12.6
NAL11 (H49)	Total WEDG Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	27.1	31.4	34.6	35.6	35.6	35.6	35.6	35.6	35.6
	Exceedance Level	-	-	-	-12.9	-8.6	-5.4	-4.4	-9.4	-9.4	-9.9	-16.7	-16.7
NAL12 (H54)	Total WEDG Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	26.1	30.5	33.5	34.4	34.4	34.4	34.4	34.4	34.4
	Exceedance Level	-	-	-	-13.9	-9.5	-6.5	-10.6	-10.6	-10.6	-11.7	-16.1	-20.8
NAL13 (H25)	Total WEDG Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	26.8	31.5	33.7	34.2	34.2	34.2	34.2	34.2	34.2
	Exceedance Level	-	-	-	-13.2	-8.5	-6.3	-10.8	-10.8	-10.8	-11.9	-16.3	-21.0

Note: For the noise predictions the noise model considers the range of noise data available for each turbine type modelled. For some turbines noise data was not available for lower wind speeds.

Table 6.5 Total WEDG Compliance Table – Likely Cumulative Noise - Night-time

Location		Wind Speed (ms^{-1}) as standardised to 10 m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 (H8)	Total WEDG Noise Limit, L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	30.9	35.0	38.6	39.8	39.8	39.8	39.8	39.8	39.8
	Exceedance Level	-	-	-	-12.1	-8.0	-4.4	-3.2	-3.2	-3.2	-6.4	-11.1	-15.6
NAL2 (H52)	Total WEDG Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	31.9	35.9	39.5	40.7	40.7	40.7	40.7	40.7	40.7
	Exceedance Level	-	-	-	-11.1	-7.1	-3.5	-2.3	-2.3	-2.3	-5.5	-10.2	-14.7
NAL3 (H51)	Total WEDG Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	31.1	35.1	38.7	39.9	39.9	39.9	39.9	39.9	39.9
	Exceedance Level	-	-	-	-11.9	-7.9	-4.3	-3.1	-3.1	-3.1	-6.3	-11.0	-15.5
NAL4 (H3)	Total WEDG Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	48.5	51.8
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	21.9	26.0	29.5	30.6	30.6	30.6	30.6	30.6	30.6
	Exceedance Level	-	-	-	-21.1	-17.0	-13.5	-12.4	-12.4	-12.4	-14.0	-17.9	-21.2
NAL5 (H61)	Total WEDG Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.9	48.7	53.5
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	23.0	27.1	30.6	31.8	31.8	31.8	31.8	31.8	31.8
	Exceedance Level	-	-	-	-20.0	-15.9	-12.4	-11.2	-11.2	-11.2	-12.1	-16.9	-21.7
NAL6 (H60)	Total WEDG Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.9	48.7	53.5
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	22.2	26.3	29.8	31.0	31.0	31.0	31.0	31.0	31.0
	Exceedance Level	-	-	-	-20.8	-16.7	-13.2	-12.0	-12.0	-12.0	-12.9	-17.7	-22.5
NAL7 (H24)	Total WEDG Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.3	49.4	49.4
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	26.7	30.8	34.3	35.5	35.5	35.5	35.5	35.5	35.5
	Exceedance Level	-	-	-	-16.3	-12.2	-8.7	-7.5	-7.5	-7.5	-7.8	-13.9	-13.9
NAL8 (H21)	Total WEDG Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.3	49.4	49.4
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	24.6	28.8	32.2	33.3	33.3	33.3	33.3	33.3	33.3
	Exceedance Level	-	-	-	-18.4	-14.2	-10.8	-9.7	-9.7	-9.7	-10.0	-16.1	-16.1
NAL9 (H4)	Total WEDG Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	31.9	36.0	39.6	40.8	40.8	40.8	40.8	40.8	40.8

Location		Wind Speed (ms⁻¹) as standardised to 10 m height											
		1	2	3	4	5	6	7	8	9	10	11	12
	Exceedance Level	-	-	-	-11.1	-7.0	-3.4	-2.2	-2.2	-2.2	-4.3	-10.7	-10.7
NAL10 (H42)	Total WEDG Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	30.9	35.0	38.5	39.7	39.7	39.7	39.7	39.7	39.7
	Exceedance Level	-	-	-	-12.1	-8.0	-4.5	-3.3	-3.3	-3.3	-5.4	-11.8	-11.8
NAL11 (H49)	Total WEDG Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	27.1	31.4	34.6	35.6	35.6	35.6	35.6	35.6	35.6
	Exceedance Level	-	-	-	-15.9	-11.6	-8.4	-7.4	-7.4	-7.4	-9.5	-15.9	-15.9
NAL12 (H54)	Total WEDG Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	26.1	30.5	33.5	34.4	34.4	34.4	34.4	34.4	34.4
	Exceedance Level	-	-	-	-16.9	-12.5	-9.5	-8.6	-8.6	-8.6	-11.8	-16.5	-21.0
NAL13 (H25)	Total WEDG Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Predicted Cumulative Wind Turbine Noise LA90	-	-	-	26.8	31.5	33.7	34.2	34.2	34.2	34.2	34.2	34.2
	Exceedance Level	-	-	-	-16.2	-11.5	-9.3	-8.8	-8.8	-8.8	-12.0	-16.7	-21.2

Note: For the noise predictions the noise model considers the range of noise data available for each turbine type modelled. For some turbines noise data was not available for lower wind speeds.

6.5 Stage 3 – Derivation of Site Specific Noise Limits

6.5.1 In order to protect residential amenity, the initial recommendations are that cumulatively, all wind farms (including the Proposed Development) operate within the Total WEDG Noise Limits, as demonstrated in the Stage 2 above.

6.5.2 An other recommendation is that each wind farm should operate within their own limit, whilst the cumulative situation of Stage 2 is still met. To allow this to occur, a set of Site Specific Noise limits for the Proposed Development are required and these have been derived for each NAL.

6.5.3 The Site Specific Noise Limits have been derived to take account of the proportion of the noise limit that has been allocated to, or could theoretically be used by, other wind farm developments in proximity to the Proposed Development. Table 6.6 summarises the approach adopted at each NAL to derive the Site Specific Noise Limits.

Table 6.6 Limit Derivation Strategy

NAL	Limit Derivation Strategy
NALs 1-11	The predicted noise levels from the other wind farm developments were found to be more than 10 dB below the Total WEDG Noise Limits and as such the entire noise limit has been allocated to the Proposed Development.
NALs 12 and 13	At only a few wind speeds, there is less than 10 dB between the predicted noise levels from the other wind farm developments and the Total WEDG Noise Limits, however a significant headroom remains. In this situation, 'cautious' predictions of wind turbine noise from the other wind farms were logarithmically subtracted from the Total WEDG Noise Limits to determine the Site Specific Noise Limits for the Proposed Development. The 'cautious' predictions essentially include an added +2 dB buffer (above typical predictions) for other wind farm developments.

6.5.4 A series of graphs to show the predicted wind turbine noise from the Proposed Development with a 110.5 m and 105 m hub compared to the Site Specific Noise Limits are included as Figures A1.4a - A1.4m (Annex 1). The same figures have also been produced for all 61 identified NSRs and are included as Figures A5.1a -A5.1m (Annex 5).

6.5.5 Table 6.7 and Table 6.8 summarise the figures and show the daytime and night-time Site Specific Noise Limits, noise predictions for the Proposed Development (with 110.5 m hub which is marginally worst case, within 0.1 dB (which, in practice, is a negligible difference and is unlikely to be discernible)) and the exceedance level. A negative exceedance demonstrates compliance with the Site Specific Noise Limits.

6.5.6 The Stage 3 assessment shows that the predicted wind turbine noise levels from the Proposed Development on its own meet the Site Specific Noise Limits, with one small exception at NAL 9 where a marginal exceedance of 0.6 dB is observed only in daytime at 7 m/s. To put the exceedances above into context it is worth noting that decibels are logarithmic units meaning that a 3 dB change represents a doubling (or halving) of the sound energy. In terms of human perception, the WEDG state that '*A 10 dB(A) increase in sound* *level represents a doubling of loudness. A change of 3 dB(A) is the minimum perceptible under normal circumstances.'* The minor exceedance identified could be overcome by using low noise mode for the candidate turbine in that specific wind speed and in specific directions only, or alternatively by using an different candidate wind turbine.

6.5.7 In the event that planning permission is granted for the Proposed Development it would be appropriate to set noise limits equal to the Site Specific Noise Limits.

Table 6.7 Site Specific Noise Compliance Table – Daytime

Location		Wind Speed (ms^{-1}) as standardised to 10 m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 (H8)	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise LA90	-	-	29.2	30.8	34.9	38.5	39.8	39.8	39.8	39.8	39.8	39.8
	Exceedance Level	-	-	-10.8	-9.2	-5.1	-1.5	-5.2	-5.2	-5.2	-6.3	-10.7	-15.4
NAL2 (H52)	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise LA90	-	-	30.0	31.6	35.7	39.3	40.6	40.6	40.6	40.6	40.6	40.6
	Exceedance Level	-	-	-10.0	-8.4	-4.3	-0.7	-4.4	-4.4	-4.4	-5.5	-9.9	-14.6
NAL3 (H51)	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise LA90	-	-	29.2	30.9	34.9	38.5	39.8	39.8	39.8	39.8	39.8	39.8
	Exceedance Level	-	-	-10.8	-9.1	-5.1	-1.5	-5.2	-5.2	-5.2	-6.3	-10.7	-15.4
NAL4 (H3)	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.6	50.1	54.7
	Proposed Development Wind Turbine Noise LA90	-	-	19.6	21.2	25.3	28.9	30.2	30.2	30.2	30.2	30.2	30.2
	Exceedance Level	-	-	-20.4	-18.8	-14.7	-11.1	-9.8	-14.8	-14.8	-15.4	-19.9	-24.5
NAL5 (H61)	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	48.8	53.6
	Proposed Development Wind Turbine Noise LA90	-	-	20.9	22.6	26.6	30.3	31.5	31.5	31.5	31.5	31.5	31.5
	Exceedance Level	-	-	-19.1	-17.4	-13.4	-9.7	-8.5	-13.5	-13.5	-13.5	-17.3	-22.1
NAL6 (H60)	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	48.8	53.6
	Proposed Development Wind Turbine Noise LA90	-	-	20.0	21.7	25.8	29.4	30.6	30.6	30.6	30.6	30.6	30.6
	Exceedance Level	-	-	-20.0	-18.3	-14.2	-10.6	-9.4	-14.4	-14.4	-14.4	-18.2	-23.0
NAL7 (H24)	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.7	45.7
	Proposed Development Wind Turbine Noise LA90	-	-	24.7	26.4	30.4	34.0	35.3	35.3	35.3	35.3	35.3	35.3
	Exceedance Level	-	-	-15.3	-13.6	-9.6	-6.0	-4.7	-9.7	-9.7	-9.7	-10.4	-10.4
NAL8 (H21)	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.7	45.7
	Proposed Development Wind Turbine Noise LA90	-	-	22.2	23.9	28.0	31.6	32.8	32.8	32.8	32.8	32.8	32.8
	Exceedance Level	-	-	-17.8	-16.1	-12.0	-8.4	-7.2	-12.2	-12.2	-12.2	-12.9	-12.9
NAL9 (H4)	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise LA90	-	-	30.0	31.7	35.8	39.4	40.6	40.6	40.6	40.6	40.6	40.6

Location		Wind Speed (ms^{-1}) as standardised to 10 m height											
		1	2	3	4	5	6	7	8	9	10	11	12
	Exceedance Level	-	-	-10.0	-8.3	-4.2	-0.6	**0.6**	-4.4	-4.4	-4.9	-11.7	-11.7
NAL10 (H42)	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise LA90	-	-	28.9	30.6	34.6	38.3	39.5	39.5	39.5	39.5	39.5	39.5
	Exceedance Level	-	-	-11.1	-9.4	-5.4	-1.7	-0.5	-5.5	-5.5	-6.0	-12.8	-12.8
NAL11 (H49)	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise LA90	-	-	23.9	25.6	29.6	33.3	34.5	34.5	34.5	34.5	34.5	34.5
	Exceedance Level	-	-	-16.1	-14.4	-10.4	-6.7	-5.5	-10.5	-10.5	-11.0	-17.8	-17.8
NAL12 (H54)	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	39.1	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise LA90	-	-	23.1	24.8	28.9	32.5	33.7	33.7	33.7	33.7	33.7	33.7
	Exceedance Level	-	-	-16.9	-15.2	-11.1	-6.6	-11.3	-11.3	-11.3	-12.4	-16.8	-21.5
NAL13 (H25)	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	39.0	38.2	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise LA90	-	-	19.9	21.6	25.7	29.3	30.5	30.5	30.5	30.5	30.5	30.5
	Exceedance Level	-	-	-20.1	-18.4	-13.3	-8.9	-14.5	-14.5	-14.5	-15.6	-20.0	-24.7

Note: For the noise predictions the noise model considers the range of noise data available for each turbine type modelled. For some turbines noise data was not available for lower wind speeds.

Table 6.8 Site Specific Noise Compliance Table – Night-time

Location		Wind Speed (ms^{-1}) as standardised to 10 m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 (H8)	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.5	51.1	55.5
	Proposed Development Wind Turbine Noise LA90	-	-	-	30.7	34.8	38.5	39.8	39.8	39.8	39.8	39.8	39.8
	Exceedance Level	-	-	-	-12.3	-8.2	-4.5	-3.2	-3.2	-3.2	-6.7	-11.3	-15.7
NAL2 (H52)	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.5	51.1	55.5
	Proposed Development Wind Turbine Noise LA90	-	-	-	31.5	35.6	39.3	40.6	40.6	40.6	40.6	40.6	40.6
	Exceedance Level	-	-	-	-11.5	-7.4	-3.7	-2.4	-2.4	-2.4	-5.9	-10.5	-14.9
NAL3 (H51)	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.5	51.1	55.5

Location		Wind Speed (ms^{-1}) as standardised to 10 m height											
		1	2	3	4	5	6	7	8	9	10	11	12
	Proposed Development Wind Turbine Noise LA90	-	-	29.2	30.8	34.9	38.5	39.8	39.8	39.8	39.8	39.8	39.8
	Exceedance Level	-	-	-13.8	-12.2	-8.1	-4.5	-3.2	-3.2	-3.2	-6.4	-11.1	-15.6
NAL4 (H3)	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise LA90	-	-	30.0	31.6	35.7	39.3	40.6	40.6	40.6	40.6	40.6	40.6
	Exceedance Level	-	-	-13.0	-11.4	-7.3	-3.7	-2.4	-2.4	-2.4	-5.6	-10.3	-14.8
NAL5 (H61)	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise LA90	-	-	29.2	30.9	34.9	38.5	39.8	39.8	39.8	39.8	39.8	39.8
	Exceedance Level	-	-	-13.8	-12.1	-8.1	-4.5	-3.2	-3.2	-3.2	-6.4	-11.1	-15.6
NAL6 (H60)	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	48.5	51.8
	Proposed Development Wind Turbine Noise LA90	-	-	19.6	21.2	25.3	28.9	30.2	30.2	30.2	30.2	30.2	30.2
	Exceedance Level	-	-	-23.4	-21.8	-17.7	-14.1	-12.8	-12.8	-12.8	-14.4	-18.3	-21.6
NAL7 (H24)	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.9	48.7	53.5
	Proposed Development Wind Turbine Noise LA90	-	-	20.9	22.6	26.6	30.3	31.5	31.5	31.5	31.5	31.5	31.5
	Exceedance Level	-	-	-22.1	-20.4	-16.4	-12.7	-11.5	-11.5	-11.5	-12.4	-17.2	-22.0
NAL8 (H21)	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.9	48.7	53.5
	Proposed Development Wind Turbine Noise LA90	-	-	20.0	21.7	25.8	29.4	30.6	30.6	30.6	30.6	30.6	30.6
	Exceedance Level	-	-	-23.0	-21.3	-17.2	-13.6	-12.4	-12.4	-12.4	-13.3	-18.1	-22.9
NAL9 (H4)	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.3	49.4	49.4
	Proposed Development Wind Turbine Noise LA90	-	-	24.7	26.4	30.4	34.0	35.3	35.3	35.3	35.3	35.3	35.3
	Exceedance Level	-	-	-18.3	-16.6	-12.6	-9.0	-7.7	-7.7	-7.7	-8.0	-14.1	-14.1
NAL10 (H42)	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.3	49.4	49.4
	Proposed Development Wind Turbine Noise LA90	-	-	22.2	23.9	28.0	31.6	32.8	32.8	32.8	32.8	32.8	32.8
	Exceedance Level	-	-	-20.8	-19.1	-15.0	-11.4	-10.2	-10.2	-10.2	-10.5	-16.6	-16.6
NAL11 (H49)	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise LA90	-	-	30.0	31.7	35.8	39.4	40.6	40.6	40.6	40.6	40.6	40.6
	Exceedance Level	-	-	-13.0	-11.3	-7.2	-3.6	-2.4	-2.4	-2.4	-4.5	-10.9	-10.9
NAL12 (H54)	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise LA90	-	-	28.9	30.6	34.6	38.3	39.5	39.5	39.5	39.5	39.5	39.5

Location		Wind Speed (ms^{-1}) as standardised to 10 m height											
		1	2	3	4	5	6	7	8	9	10	11	12
	Exceedance Level	-	-	-14.1	-12.4	-8.4	-4.7	-3.5	-3.5	-3.5	-5.6	-12	-12
NAL13 (H25)	Site Specific Noise Limit, LA90	43	43	43	43	43	43	43	43	43	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise LA90	-	-	23.9	25.6	29.6	33.3	34.5	34.5	34.5	34.5	34.5	34.5
	Exceedance Level	-	-	-19.1	-17.4	-13.4	-9.7	-8.5	-8.5	-8.5	-10.6	-17	-17
Note: For the noise predictions the noise model considers the range of noise data available for each turbine type modelled. For some turbines noise data was not available for lower wind speeds.													

7 Summary and Conclusions

7.1.1 This report has assessed the potential impact of operational noise from the Proposed Development on nearby Noise Sensitive Receptors (NSRs) using the guidance contained within the WEDG 2006. Reference was also made to guidance contained in ETSU-R-97 and the IOA GPG to supplement the WEDG 2006.

7.1.2 A total of 61 NSRs were identified, of which thirteen were chosen as Noise Assessment Locations (NALs).

7.1.3 Background noise monitoring was undertaken by TNEI at five NSRs (or as near to as possible in the case of NML1) neighbouring the Proposed Development. Concurrent wind speed data was collected using a LIDAR unit located within the Wind Farm Site.

7.1.4 Analysis of the measured data was undertaken to determine the pre-existing background noise environment and to establish the daytime and night-time noise limits for each of the assessment locations. A WEDG Noise Limit of 40 dB(A), where background noise levels are below 30 dB, and 45 dB or background noise plus 5 dB, whichever is the greater, where background noise levels are above 30 dB was set for the daytime. A limit of 43 dB(A) or background noise plus 5 dB, whichever is the greater, was used for night-time.

7.1.5 A candidate turbine with a power output of 6.2 MW with serrated trailing edge blades was considered as being representative of the type of turbine that could be installed on the sitebased on the proposed range of turbine dimensions. Two hub heights at 105 m and 110.5 m have been predicted to illustrate the noise level differences across the proposed range of turbine dimensions. The assessment shows that the differences are marginal, within 0.1 dB.

7.1.6 Predicted cumulative levels and measured background noise levels indicate that for neighbouring dwellings, wind turbine noise from the candidate turbine would meet the Total WEDG Noise Limit, therefore the operational noise impact is not significant. A Site Specific Noise Limit was also calculated using worst-case assumptions and the assessment has shown that the Proposed Development operating on its own with the candidate turbine assessed in this report would meet that limit, albeit with minor requirements for mode management for the two nearest turbines to NAL9, for certain wind speeds and wind directions (7m/s and westerlies) in daytime only.

7.1.7 The use of Site Specific Noise Limits for the operational phase would ensure that the Proposed Development could operate concurrently with other operational wind farm developments in the area and would also ensure that the Proposed Development's individual contribution could be measured and enforced if required. The wind turbine model in this assessment was chosen in order to allow a representative assessment of the noise impacts. Should the Proposed Development receive consent, the final choice of wind turbine would be subject to a competitive tendering process and the final choice of wind turbine would, however, have to meet the Site Specific Noise Limits presented in the noise assessment.

8 Glossary of Terms

Amplitude Modulation: a variation in noise level over time; for example observers may describe a 'whoosh whoosh' sound, which can be heard close to a wind turbine as the blades sweep past.

Attenuation: the reduction in level of a sound between the source and a receiver due to any combination of effects including: distance, atmospheric absorption, acoustic screening, the presence of a building façade, etc.

Background Noise: the noise level rarely fallen below in any given location over any given time period, often classed according to daytime, evening or night-time periods. The L_{A90} indices (see below) is often used to represent the background noise level.

Bin: subset or group into which data can be sorted; in the case of wind speeds, bins are often centred on integer wind speeds with a width of 1 m/s. For example the 4 m/s bin would include all data with wind speeds of 3.5 to 4.5 m/s.

Dawn Chorus: noise due to birds which can occur at sunrise.

Broadband Noise: noise with components over a wide range of frequencies.

Decibel (dB): the ratio between the quietest audible sound and the loudest tolerable sound is a million to one in terms of the change in sound pressure. A logarithmic scale is used in noise level measurements because of this wide range. The scale used is the decibel (dB) scale which extends from 0 to 140 decibels (dB) corresponding to the intensity of the sound level.

dB(A): the ear has the ability to recognise a particular sound depending on its pitch or frequency. Microphones cannot differentiate noise in the same way as the ear, and to counter this weakness the noise measuring instrument applies a correction to correspond more closely to the frequency response of the human ear. The correction factor is called 'A Weighting' and the resulting measurements are written as dB(A). The dB(A) is internationally accepted and has been found to correspond well with people's subjective reaction to noise. Some typical subjective changes in noise levels are:

- a change of 3 dB(A) is just perceptible;
- a change of 5 dB(A) is clearly perceptible;
- a change of 10 dB(A) is twice (or half) as loud.

Directivity: the property of a sound source that causes more sound to be radiated in one direction than another.

Frequency: the pitch of a sound in Hz or kHz. See Hertz.

Ground Effects: the modification of sound at a receiver location due to the interaction of the sound wave with the ground along its propagation path from source to receiver. Described using the term 'G', and ranges between 0 (hard), 0.5 (mixed) and 1 (soft).

Hertz (Hz): sound frequency refers to how quickly the air vibrates, or how close the sound waves are to each other (in cycles per second, or Hertz (Hz)).

L_W: is the sound power level. It is a measure of the total noise energy radiated by a source of noise, and is used to calculate noise levels at a distant location. The L_{WA} is the A-weighted sound power level.

L_{eq}: is the equivalent continuous sound level, and is the sound level of a steady sound with the same energy as a fluctuating sound over the same period. It is possible to consider this level as the ambient noise encompassing all noise at a given time. The $LA_{eq,T}$ is the A-weighted equivalent continuous sound level over a given time period (T).

L_{90}: index represents the noise level exceeded for 90 percent of the measurement period and is used to indicate quieter times during the measurement period. It is often used to measure the background noise level. The $L_{A90,10min}$ is the A-weighted background noise level over a ten minute measurement sample.

Noise emission: the noise energy emitted by a source (e.g. a wind turbine).

Noise immission: the sound pressure level detected at a given location (e.g. the nearest dwelling).

Night-time Hours: ETSU-R-97 defines the night-time hours as 23.00 to 07.00 every day.

Quiet Daytime Hours: ETSU-R-97 defines the amenity hours as 18.00 to 23.00 Monday to Friday, 13.00 to 23.00 on Saturdays and 07.00 to 23.00 on Sundays.

Sound Level Meter: an instrument for measuring sound pressure level.

Sound Power Level: the total sound power radiated by a source, in decibels.

Sound Pressure Level: a measure of the sound pressure at a point, in decibels.

Standardised Wind Speed: a wind speed measured at a height different than 10 m (generally measured at the turbine hub height) which is expressed to a reference height of 10 m using a roughness length of 0.05 for standardisation purpose (in accordance with the IEC 61400-11 standard).

Tonal Noise: noise which covers a very restricted range of frequencies (e.g. a range of ≤20 Hz). This noise can be more annoying than broadband noise.

Wind Shear: the increase of wind speed with height above the ground.

9 References

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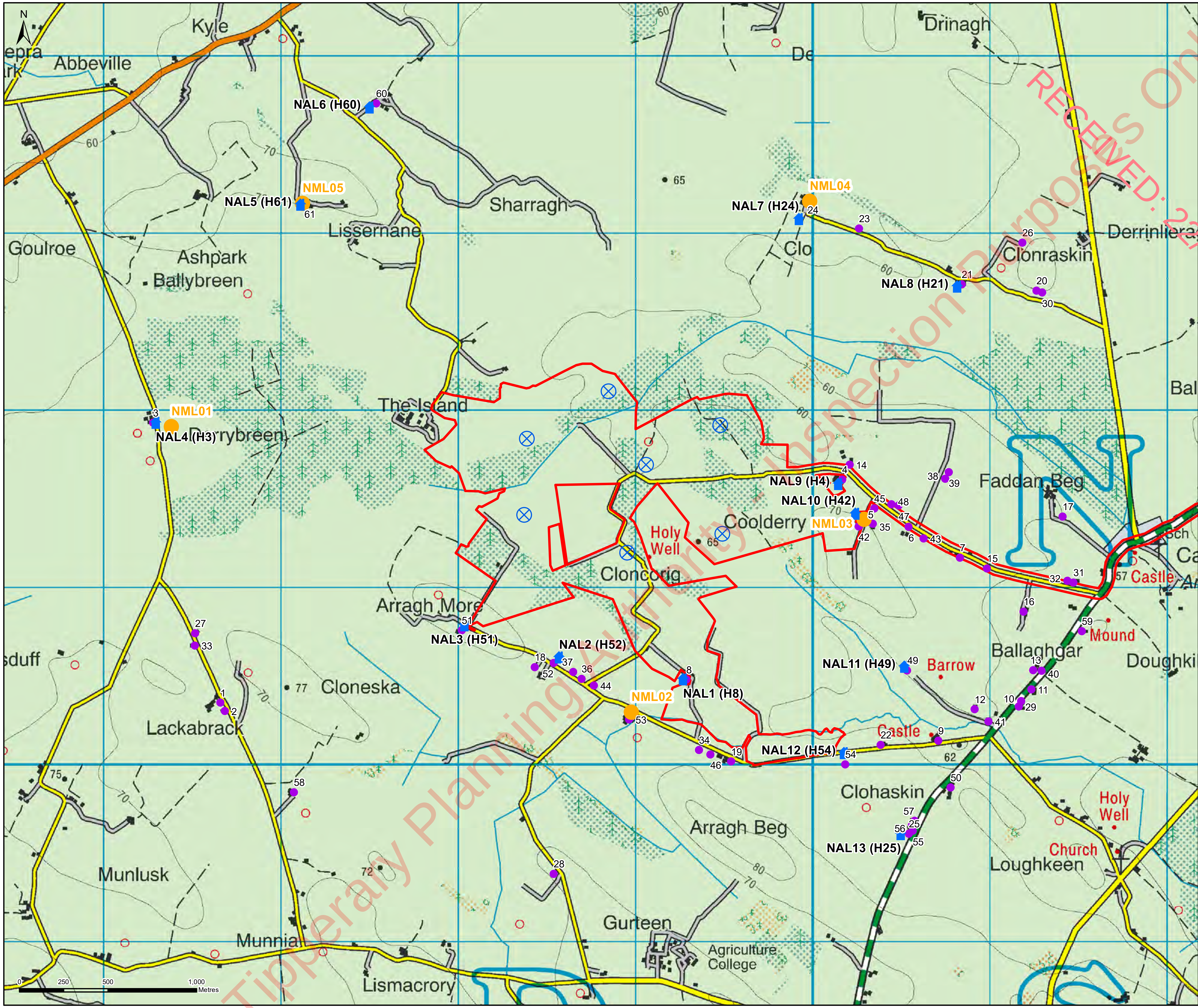
Annex 1 – Figures



NOTES

- EIAR Site Boundary
- Proposed Turbine Location
- Noise Monitoring Location (NML)
- Noise Assessment Location (NAL)
- Noise Sensitive Receptor (NSR)

Rev.	Date	Amendment Details	Drw'n	Chk'd	App'd
3	29/08/23	FINAL ISSUE	EW	EW	MC
2	01/08/23	THIRD ISSUE	EW	EW	MC
1	31/05/23	SECOND ISSUE	CB	EW	MC
0	22/05/23	FIRST ISSUE	EW	MC	MC

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Client: CARRIG RENEWABLES WIND FARM LTD

Drawing Status: FOR PLANNING

Project Title: CARRIG RENEWABLE ENERGY DEVELOPMENT

Drawing Title: FIGURE A1.1 - NOISE MONITORING AND ASSESSMENT LOCATIONS

Scale	Designed	Drawn	Checked	Approved
1:20,000	EW	EW	MC	MC
Original Size: A3	Date: 29/08/2023	Date: 29/08/2023	Date: 29/08/2023	Date: 29/08/2023

Drawing Number: IE62-007 | Revision: 3

NOTES

- EIAR Site Boundary
- Proposed Turbine Location
- Noise Monitoring Location (NML)
- Noise Assessment Location (NAL)
- Noise Sensitive Receptor (NSR)
- Skehanagh Wind Farm
- Carrig Wind Farm

Rev.	Date	Amendment Details	Drw'n	Chk'd	App'd
3	11/09/23	FINAL ISSUE	EW	EW	MC
2	01/08/23	THIRD ISSUE	EW	EW	MC
1	31/05/23	SECOND ISSUE	CB	EW	MC
0	22/05/23	FIRST ISSUE	EW	MC	MC

tnei

Client: CARRIG RENEWABLES WIND FARM LTD

Drawing Status: FOR PLANNING

Project Title: CARRIG RENEWABLE ENERGY DEVELOPMENT

Drawing Title: FIGURE A1.1a - CUMULATIVE WIND TURBINE LOCATIONS

Scale	Designed	Drawn	Checked	Approved
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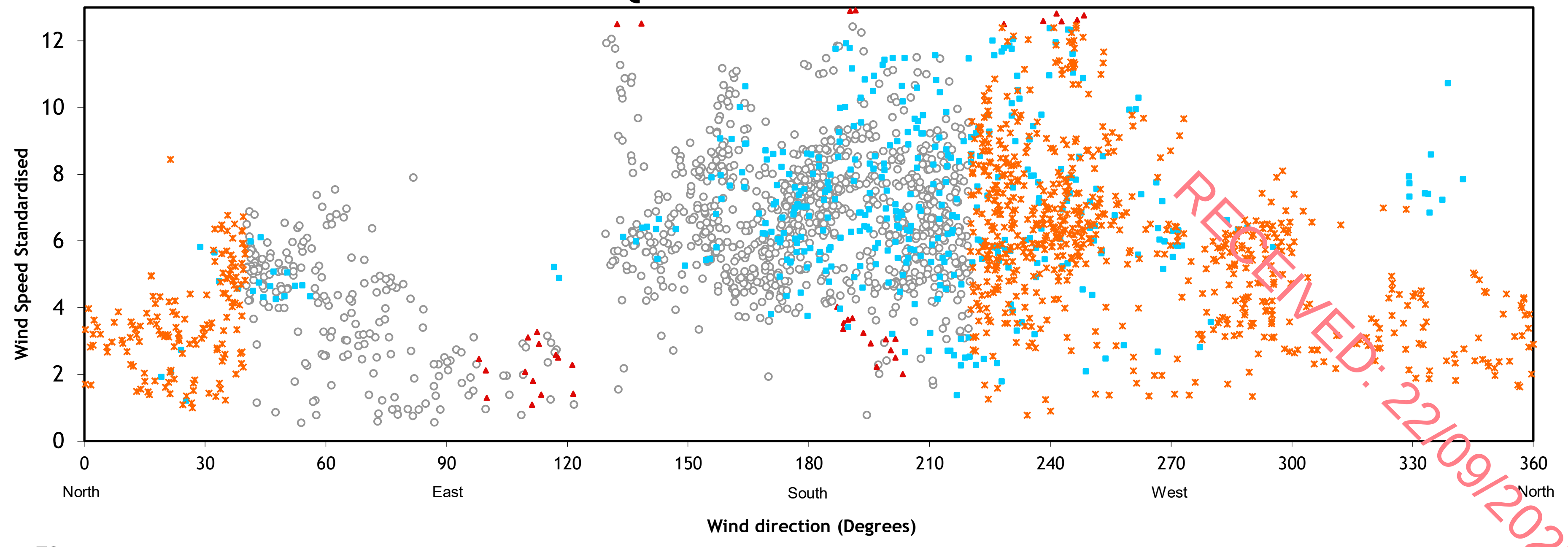
Original Size: A3	Date: 11/09/2023	Date: 11/09/2023	Date: 11/09/2023	Date: 11/09/2023

Drawing Number: IE62-008

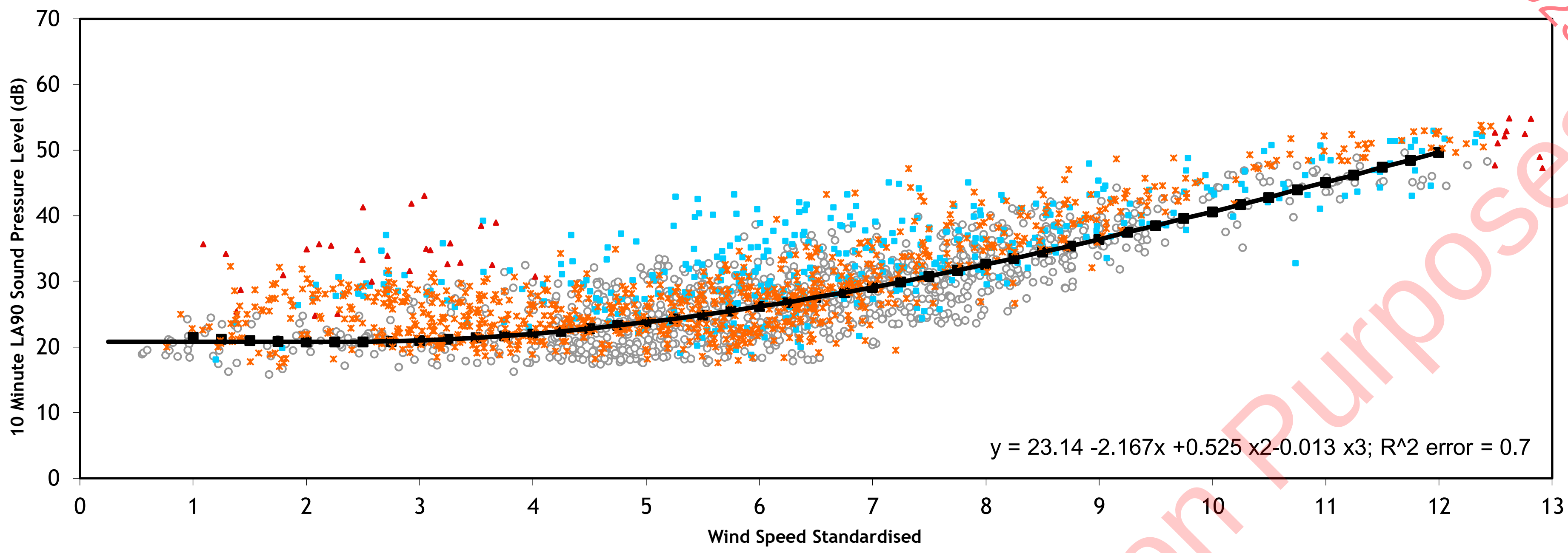
Revision: 3

ETSU-R-97 QUIET DAYTIME - NML01

Wind Conditions Quiet Daytime



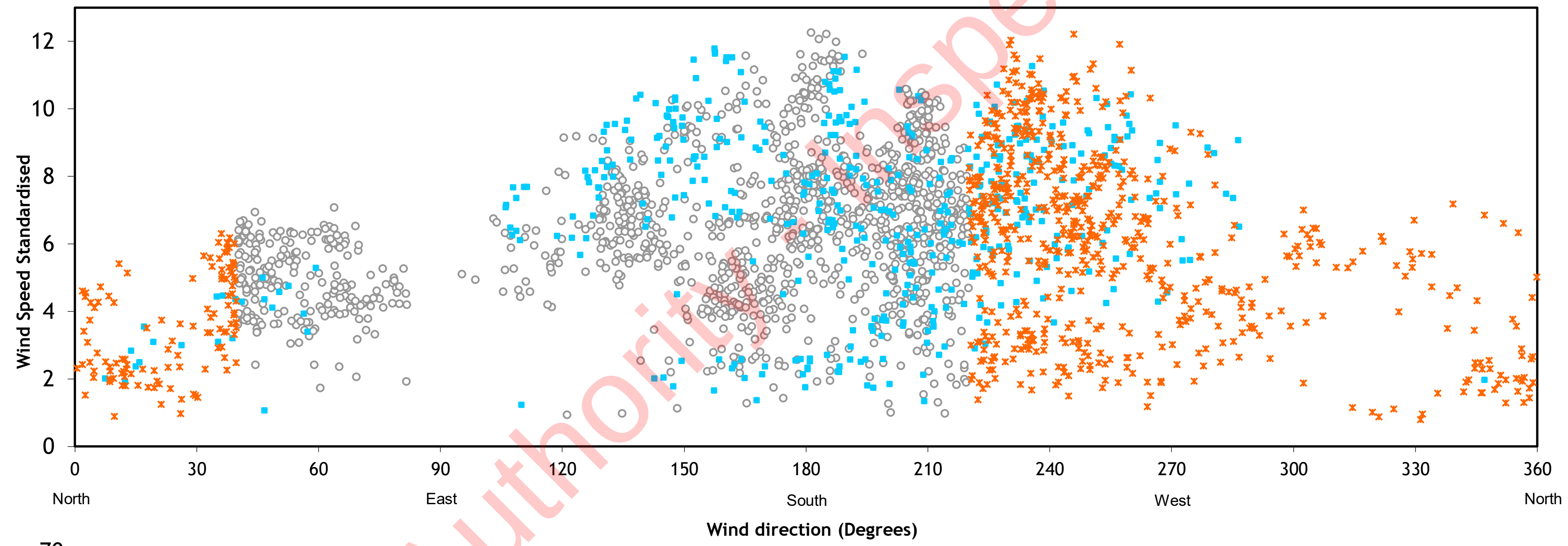
Regression Analysis Quiet Daytime



Wind Speed (m/s)	2	3	4	5	6	7	8	9	10	11	12	Total
Number of data points	31	43	80	201	202	193	168	88	27	25	9	1067
Prevailing Background	20.8	21	22	23.8	26.2	29.1	32.6	36.4	40.6	45.1	49.7	

ETSU-R-97 NIGHT-TIME - NML01

Wind Conditions Night-Time



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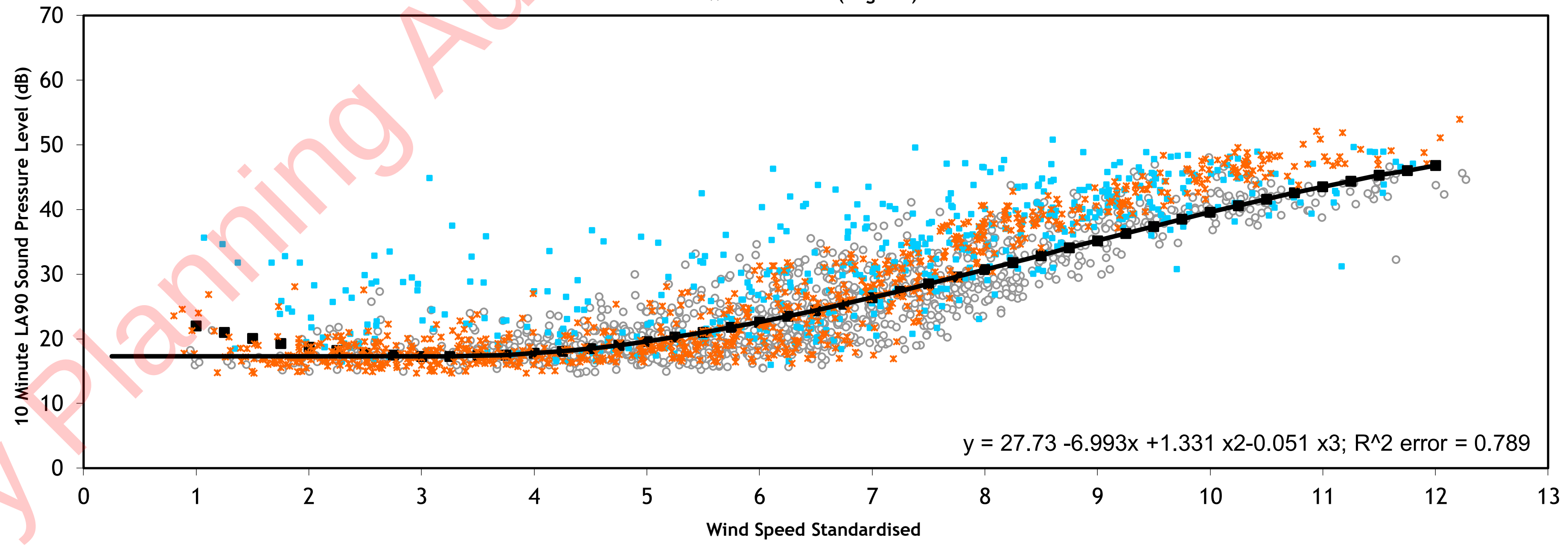


Wind Speed (m/s)	2	3	4	5	6	7	8	9	10	11	12	Total
Number of data points	33	54	163	208	246	232	171	92	67	31	10	1307
Prevailing Background	17.3	17.3	17.8	19.6	22.6	26.4	30.7	35.2	39.6	43.5	46.8	

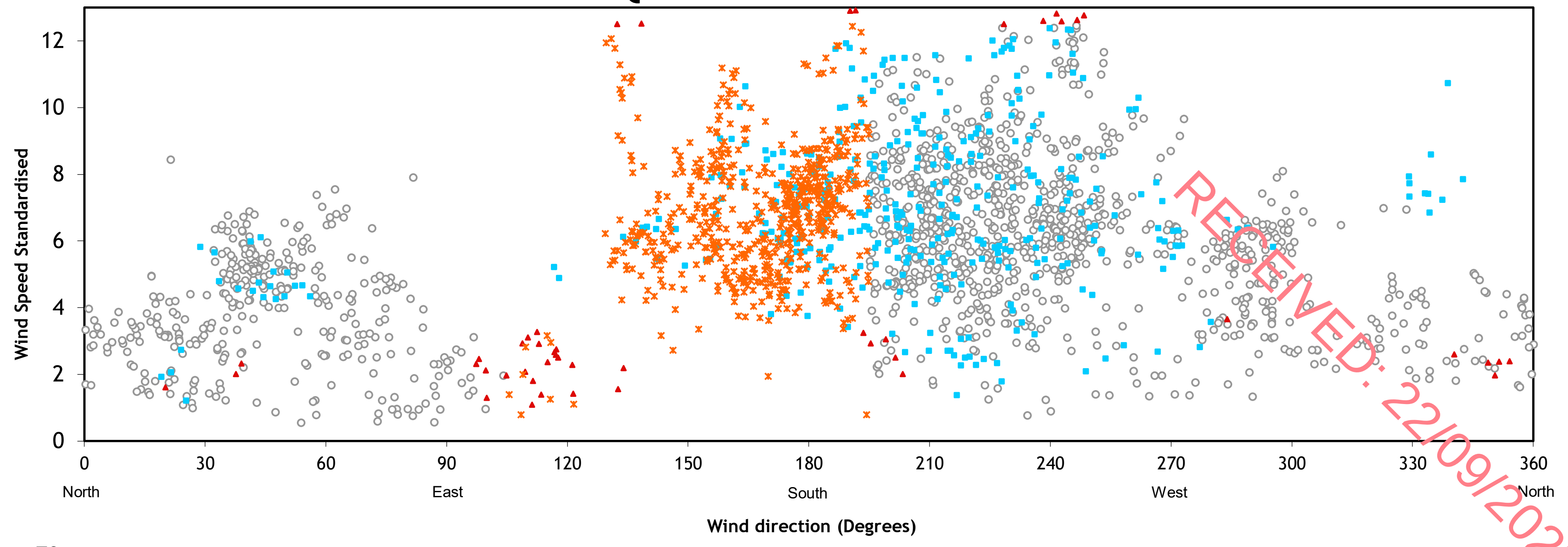
Legend:

- L_{A90} 10 Minute Measurement Point
- Line of best fit
- Line of best fit flat lined where appropriate(Prevailing Background)
- Excluded Data-Manual exclusion
- Excluded Data-Rain
- Excluded Data-Filtered Wind Direction

Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Wind Conditions&Regression Analysis NML01
Figure Number	A1.2a
Drawn	CB
Checked	MC
Date	07/07/2023
Document Reference	IE00062 - ETSU BG

ETSU-R-97 QUIET DAYTIME - NML02

Wind Conditions Quiet Daytime



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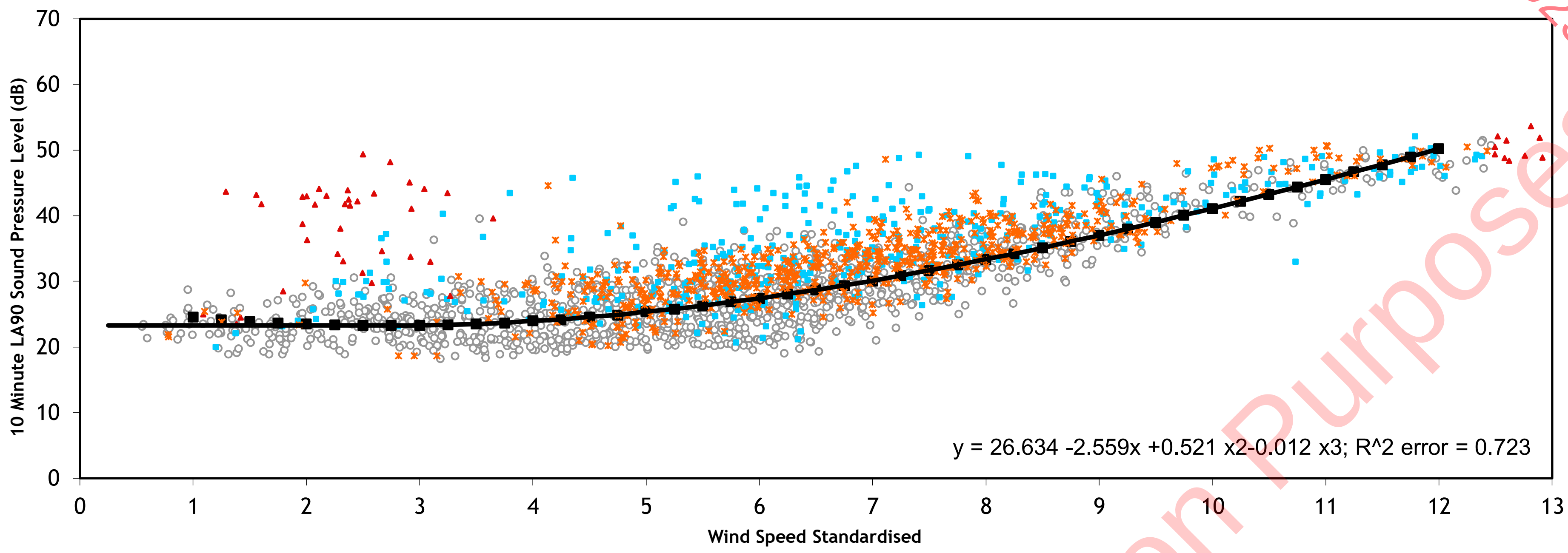
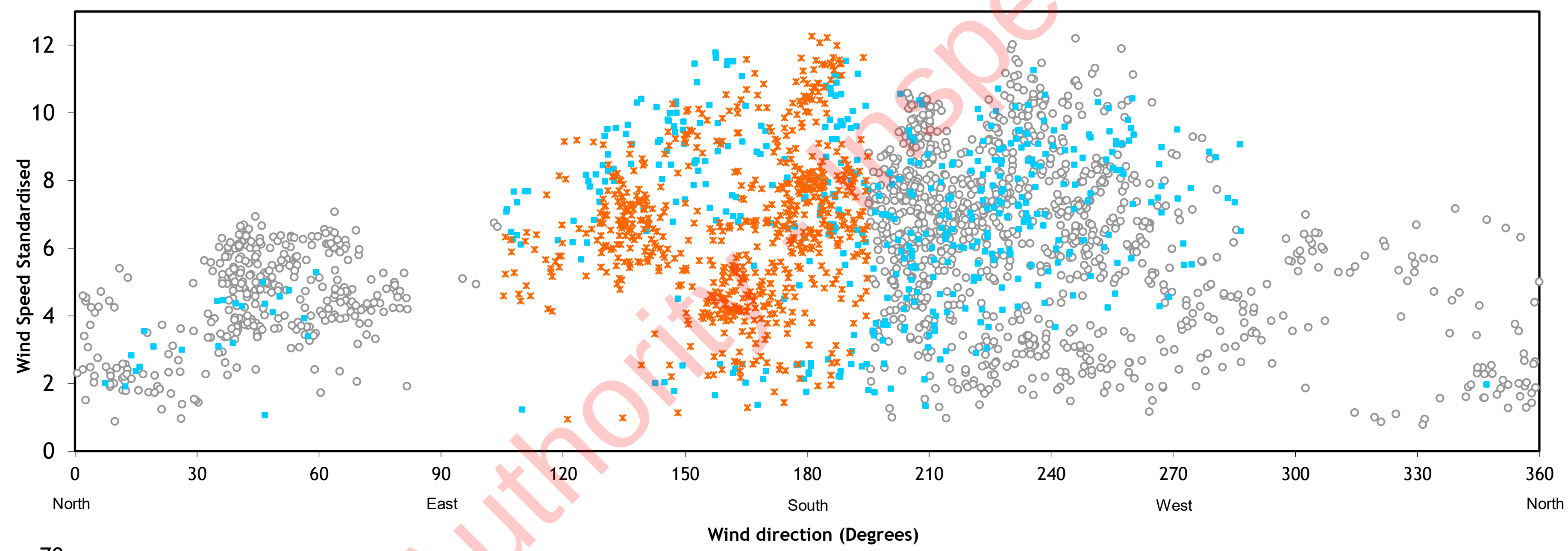


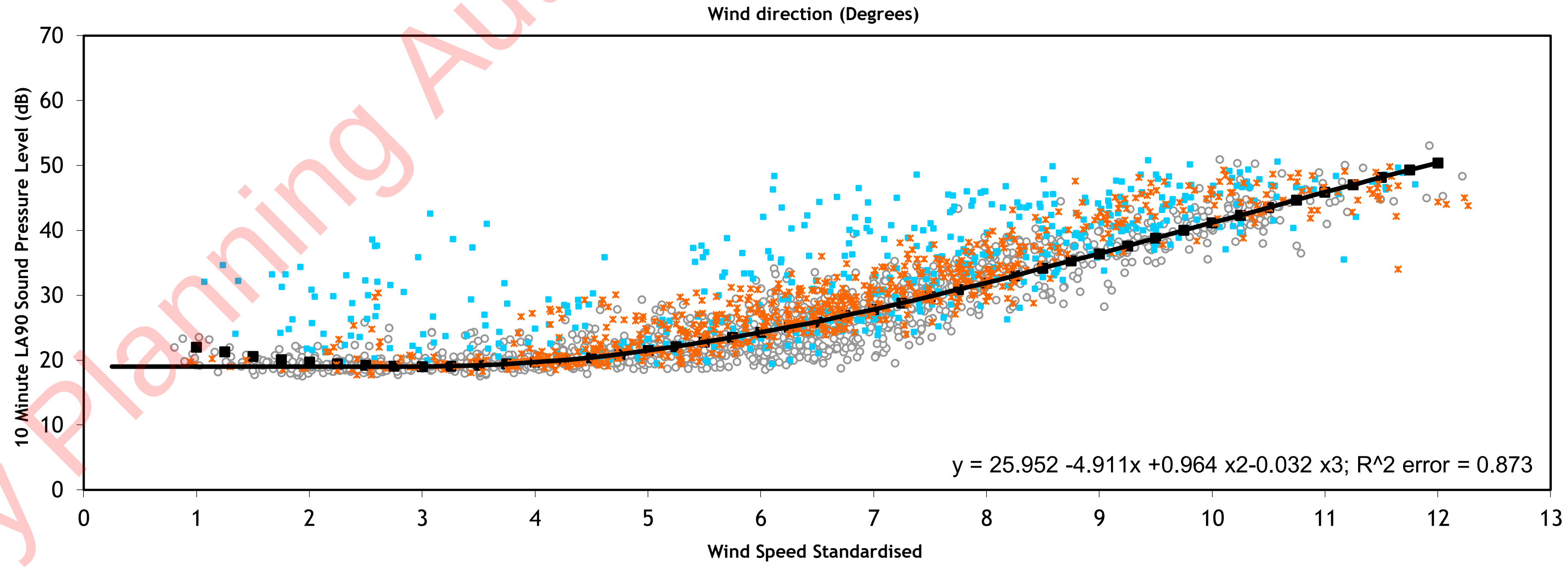
Wind Speed (m/s)	2	3	4	5	6	7	8	9	10	11	12	Total
Number of data points	73	146	159	204	240	161	109	74	28	26	16	1236
Prevailing Background	23.3	23.3	24	25.4	27.4	30.1	33.4	37	41.1	45.5	50.2	

ETSU-R-97 NIGHT-TIME - NML02

Wind Conditions Night-Time



Regression Analysis Night-Time



Wind Speed (m/s)	2	3	4	5	6	7	8	9	10	11	12	Total
Number of data points	113	115	168	189	240	190	148	94	80	25	5	1367
Prevailing Background	19	19	19.7	21.5	24.3	27.8	31.9	36.4	41.2	45.9	50.4	

Legend:

- O L_{A90} 10 Minute Measurement Point
- Line of best fit
- Line of best fit flat lined where appropriate(Prevailing Background)
- ▲ Excluded Data-Manual exclusion
- ■ Excluded Data-Rain
- X Excluded Data-Filtered Wind Direction

Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Wind Conditions&Regression Analysis NML02
Figure Number	A1.2b
Drawn	CB
Checked	MC
Date	05/07/2023
Document Reference	IE00062 - ETSU BG

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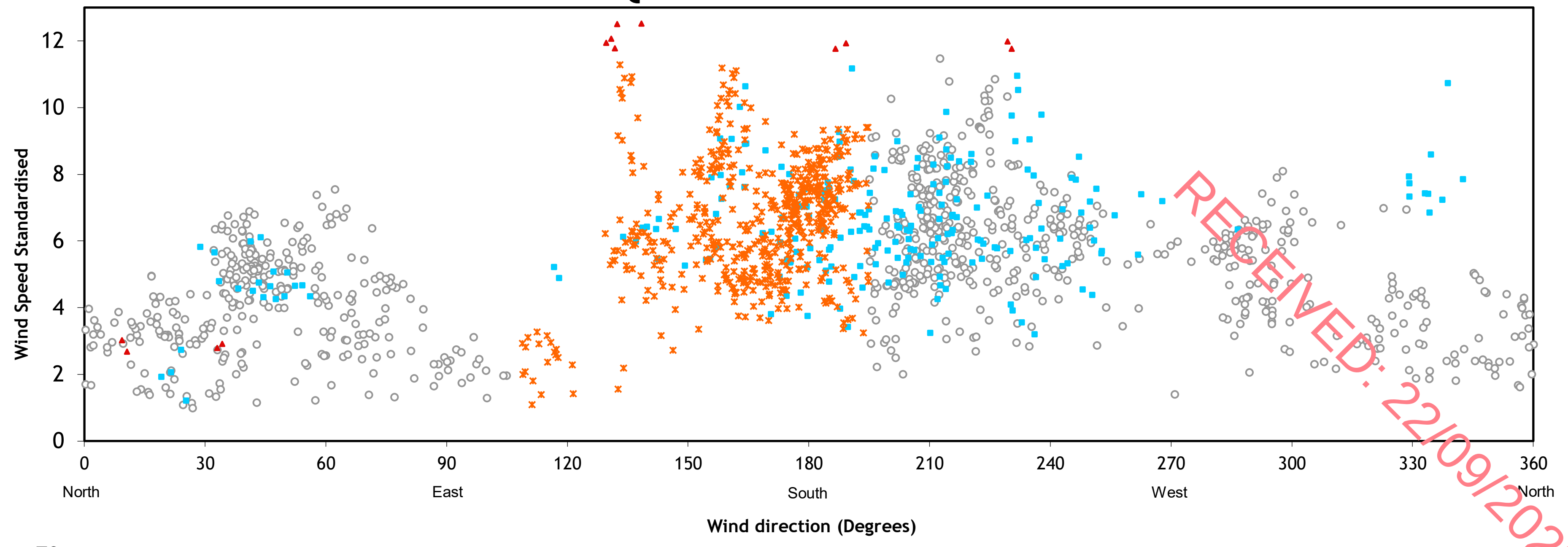
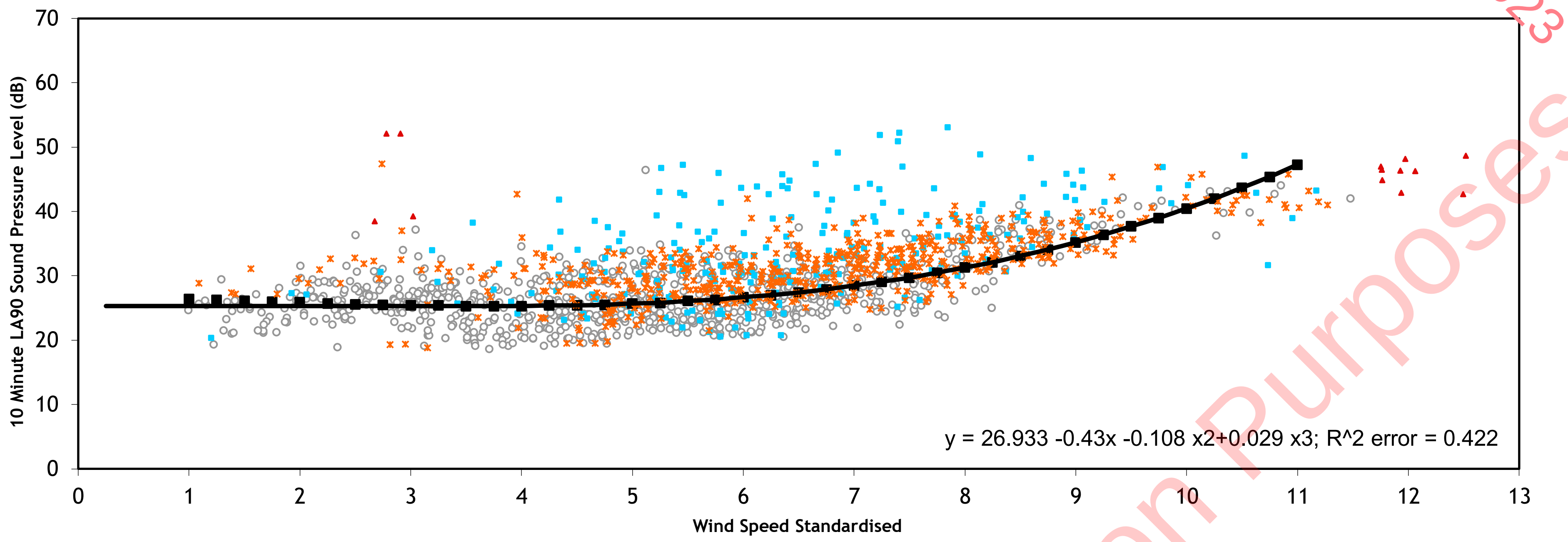
ETSU-R-97 QUIET DAYTIME - NML03

Wind Conditions Quiet Daytime



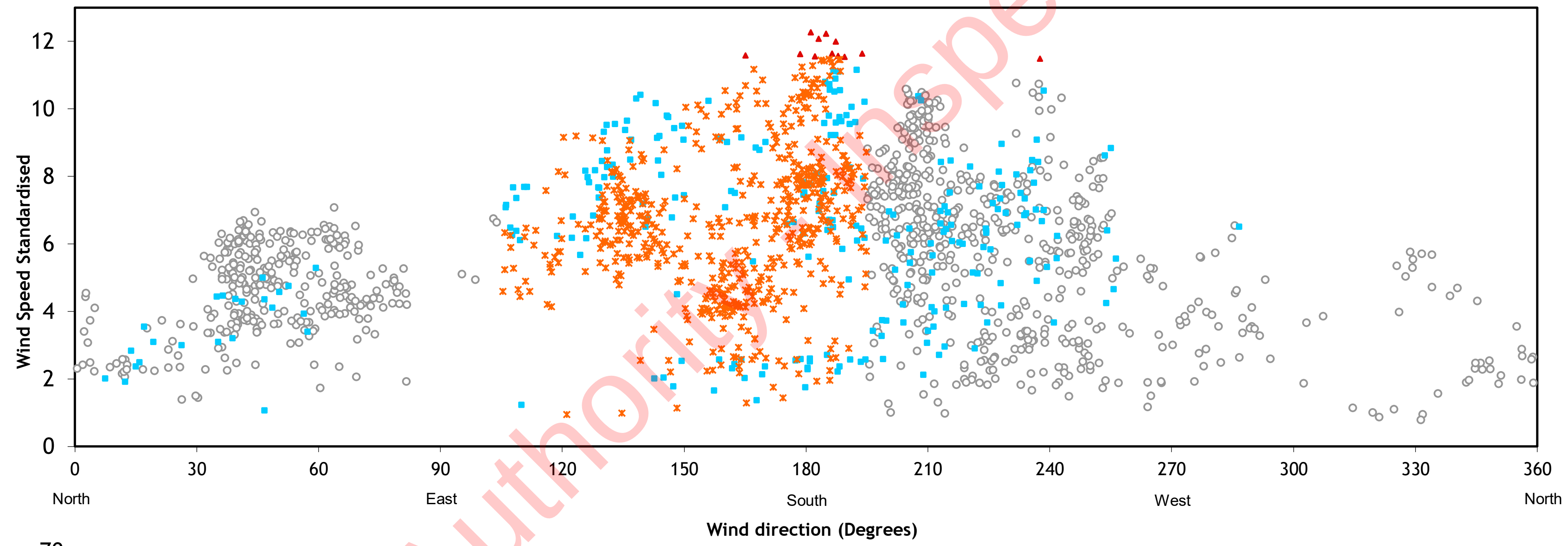
Regression Analysis Quiet Daytime



Wind Speed (m/s)	2	3	4	5	6	7	8	9	10	11	12	Total
Number of data points	62	113	124	166	159	94	56	25	9	4	0	812
Prevailing Background	25.3	25.3	25.3	25.7	26.7	28.5	31.3	35.2	40.5	47.3	-	

ETSU-R-97 NIGHT-TIME - NML03

Wind Conditions Night-Time



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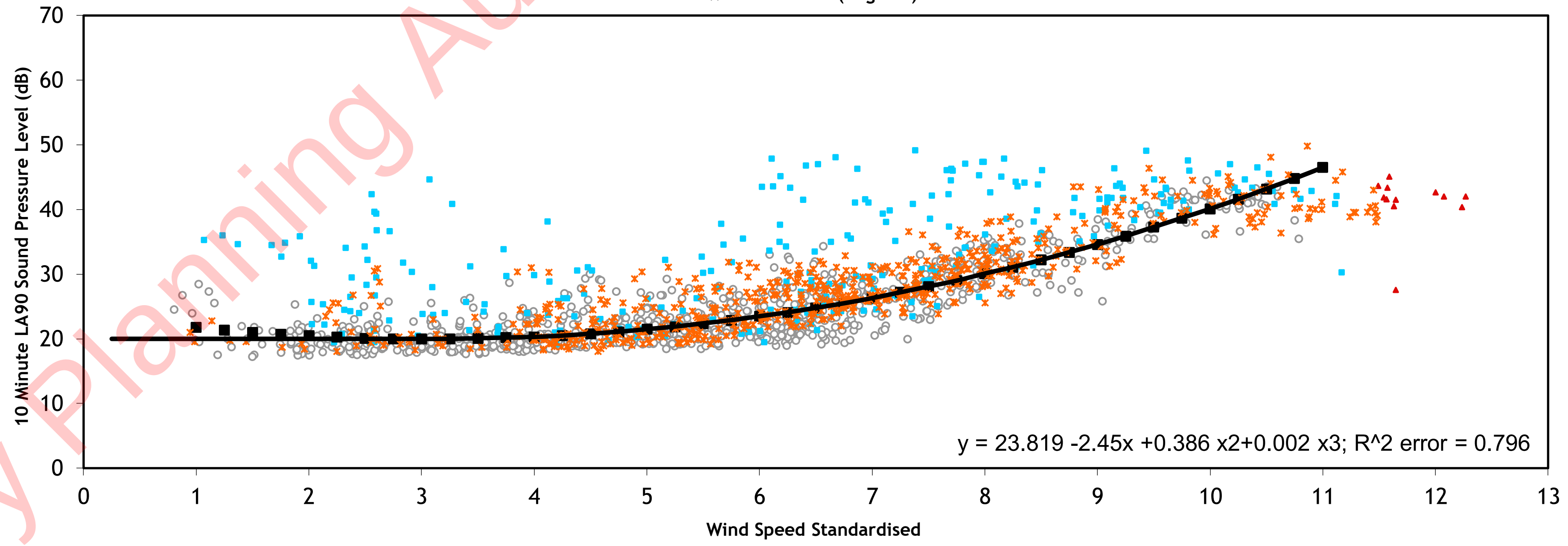


Wind Speed (m/s)	2	3	4	5	6	7	8	9	10	11	12	Total
Number of data points	78	94	132	143	179	111	80	39	35	5	0	896
Prevailing Background	20	20	20.3	21.5	23.5	26.3	30.1	34.6	40.1	46.5	-	

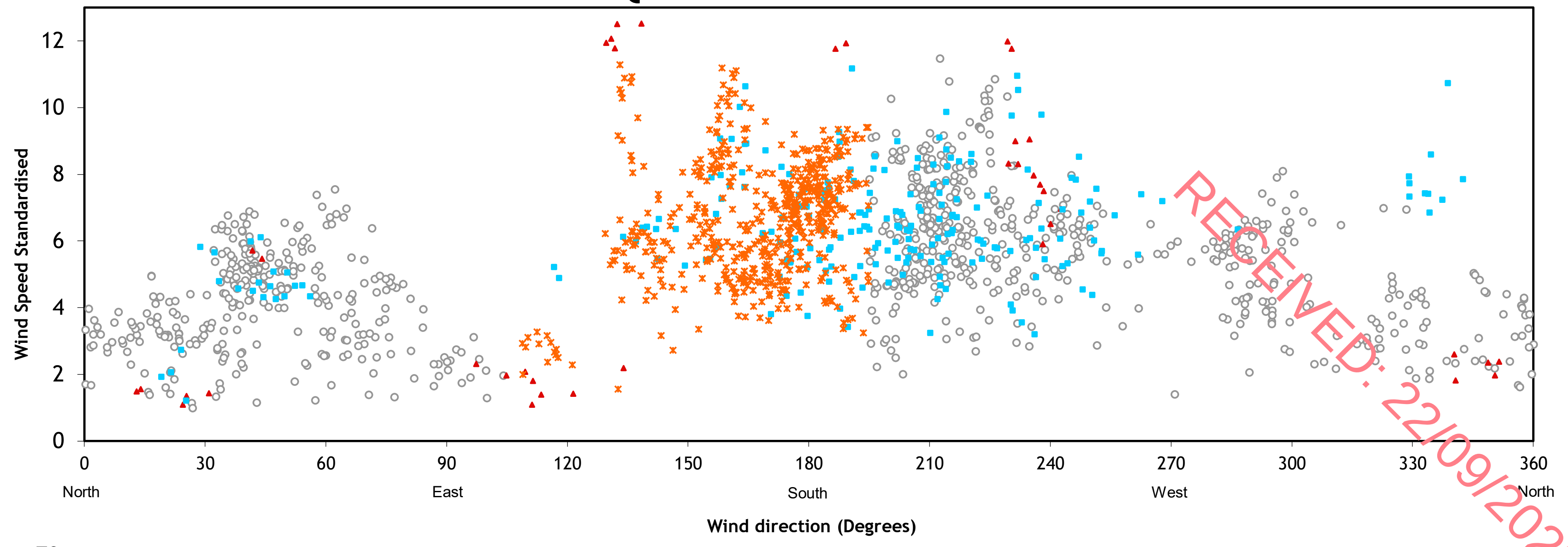
Legend:

- O — L_{A90} 10 Minute Measurement Point
- Line of best fit
- Line of best fit flat lined where appropriate(Prevailing Background)
- Excluded Data-Manual exclusion
- Excluded Data-Rain
- Excluded Data-Filtered Wind Direction

Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Wind Conditions&Regression Analysis
	NML03
Figure Number	A1.2c
Drawn	CB
Checked	MC
Date	07/07/2023
Document Reference	IE00062 -ETSU BG

ETSU-R-97 QUIET DAYTIME - NML04

Wind Conditions Quiet Daytime



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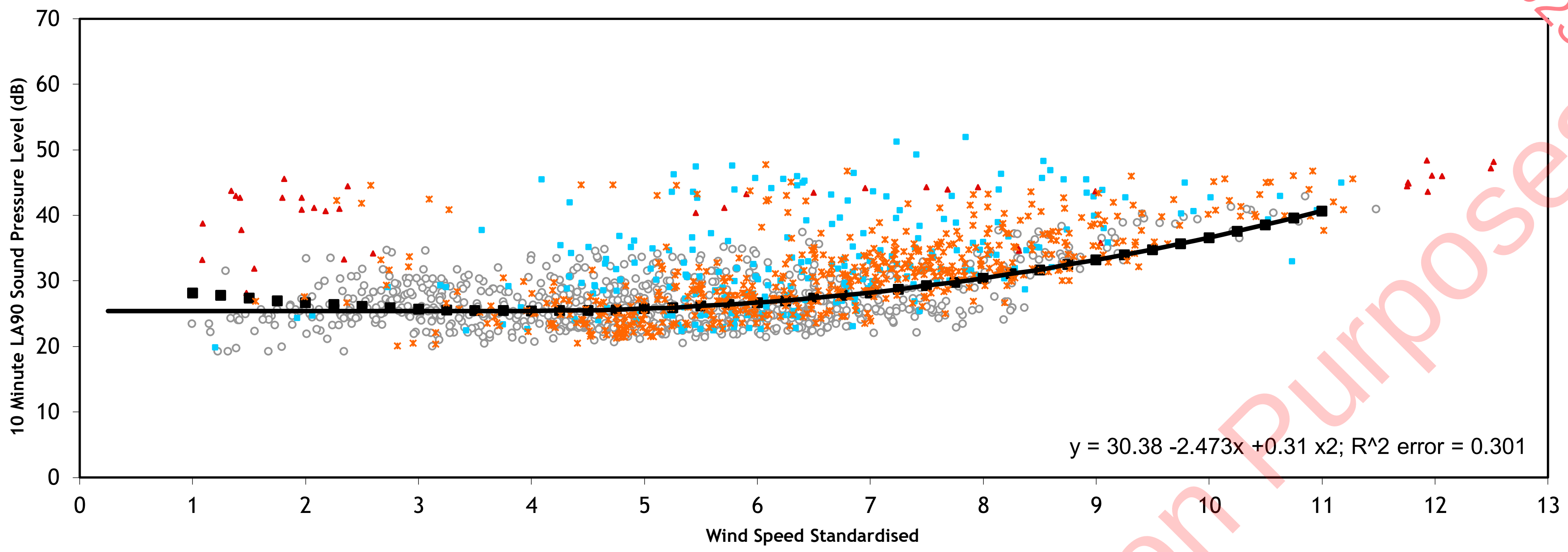
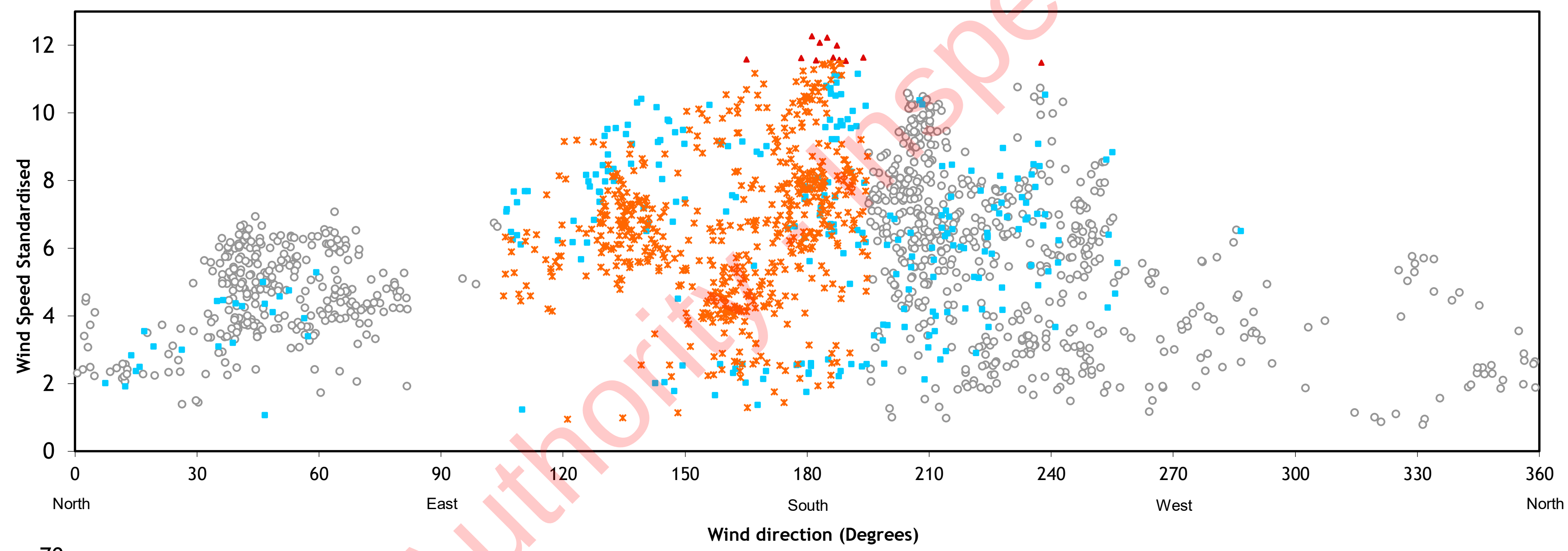


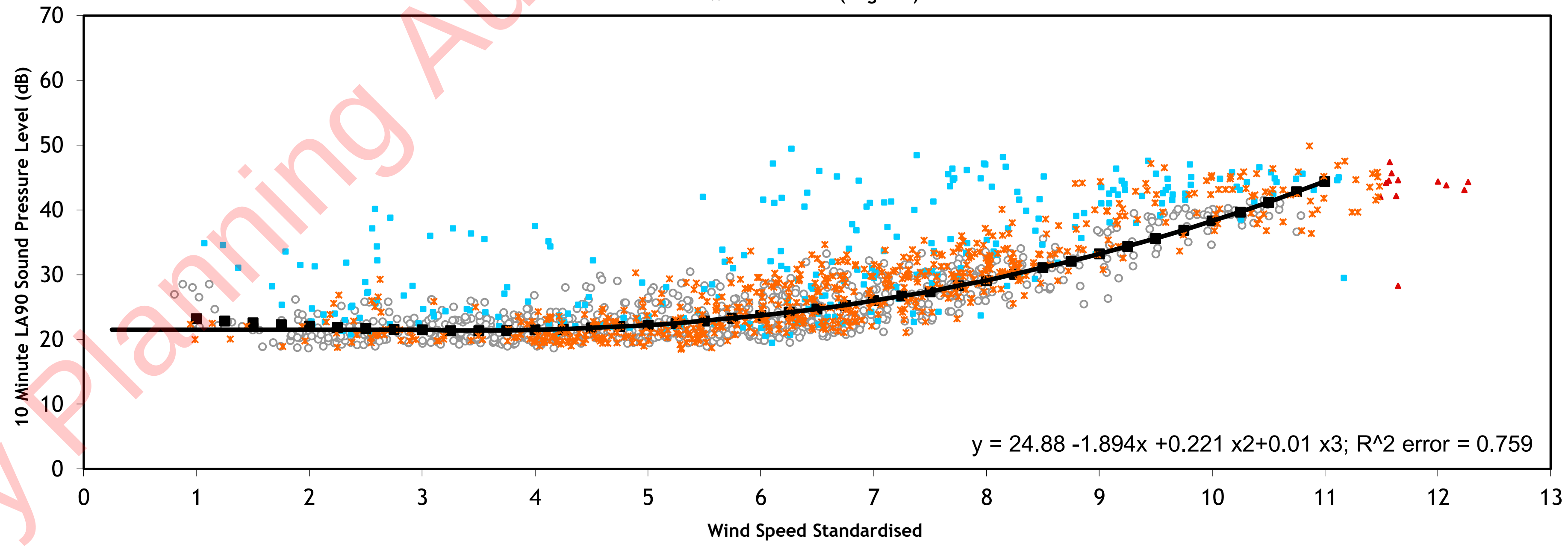
Wind Speed (m/s)	2	3	4	5	6	7	8	9	10	11	12	Total
Number of data points	55	116	124	165	157	91	53	25	9	4	0	799
Prevailing Background	25.4	25.4	25.4	25.8	26.7	28.2	30.4	33.2	36.6	40.7	-	

ETSU-R-97 NIGHT-TIME - NML04

Wind Conditions Night-Time



Regression Analysis Night-Time



Wind Speed (m/s)	2	3	4	5	6	7	8	9	10	11	12	Total
Number of data points	78	94	132	143	179	111	80	39	35	5	0	896
Prevailing Background	21.5	21.5	21.5	22.2	23.7	26	29.1	33.2	38.3	44.4	-	

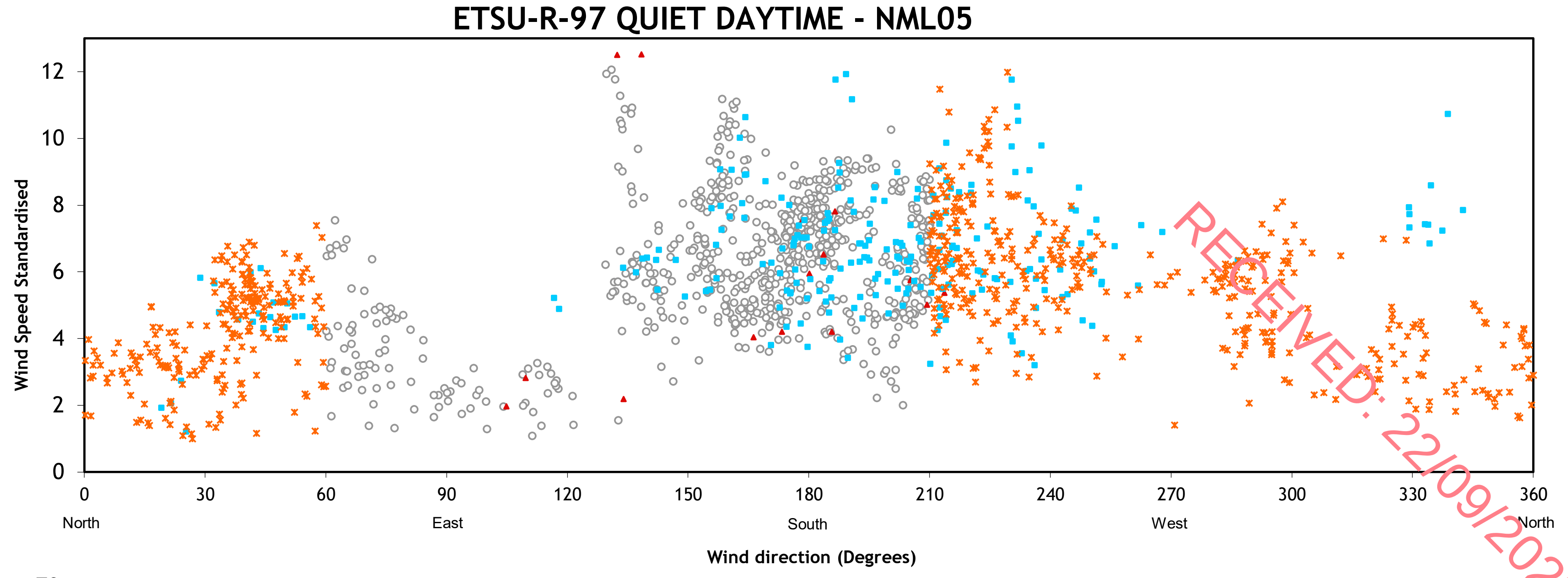
Legend:

- L_{A90} 10 Minute Measurement Point
- Line of best fit
- Line of best fit flat lined where appropriate(Prevailing Background)
- Excluded Data-Manual exclusion
- Excluded Data-Rain
- Excluded Data-Filtered Wind Direction

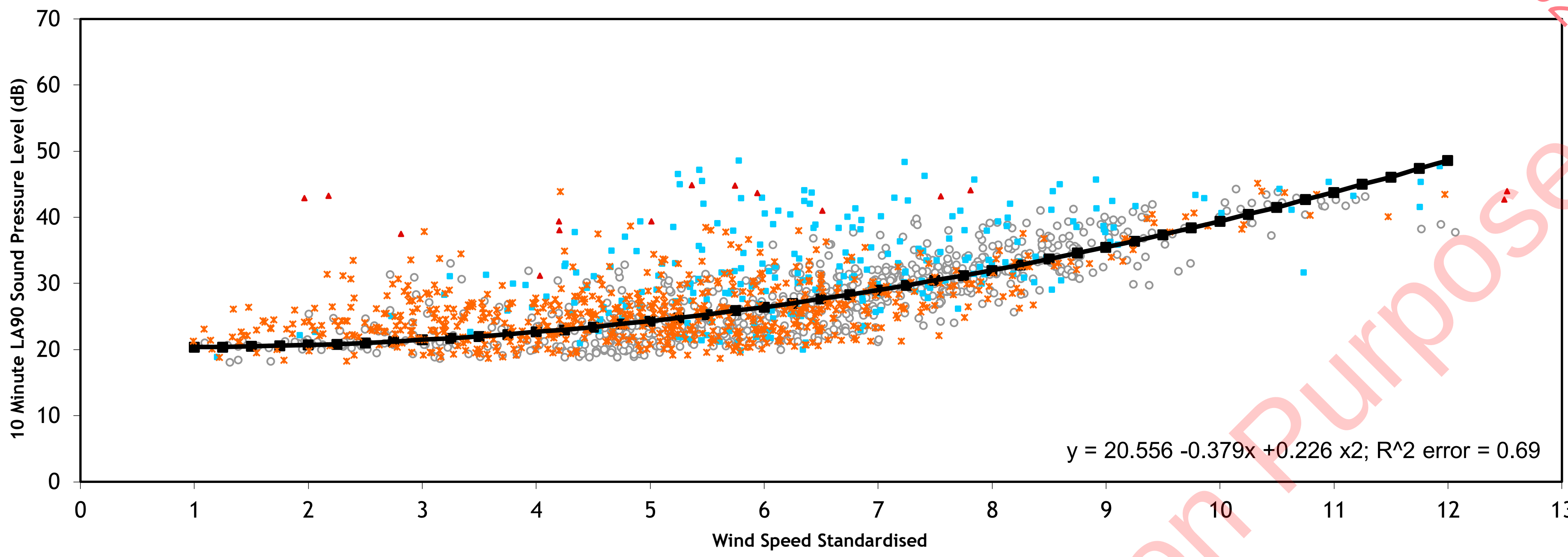
Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Wind Conditions&Regression Analysis NML04
Figure Number	A1.2d
Drawn	CB
Checked	MC
Date	07/07/2023
Document Reference	IE00062 - ETSU BG

ETSU-R-97 QUIET DAYTIME - NML05

Wind Conditions Quiet Daytime



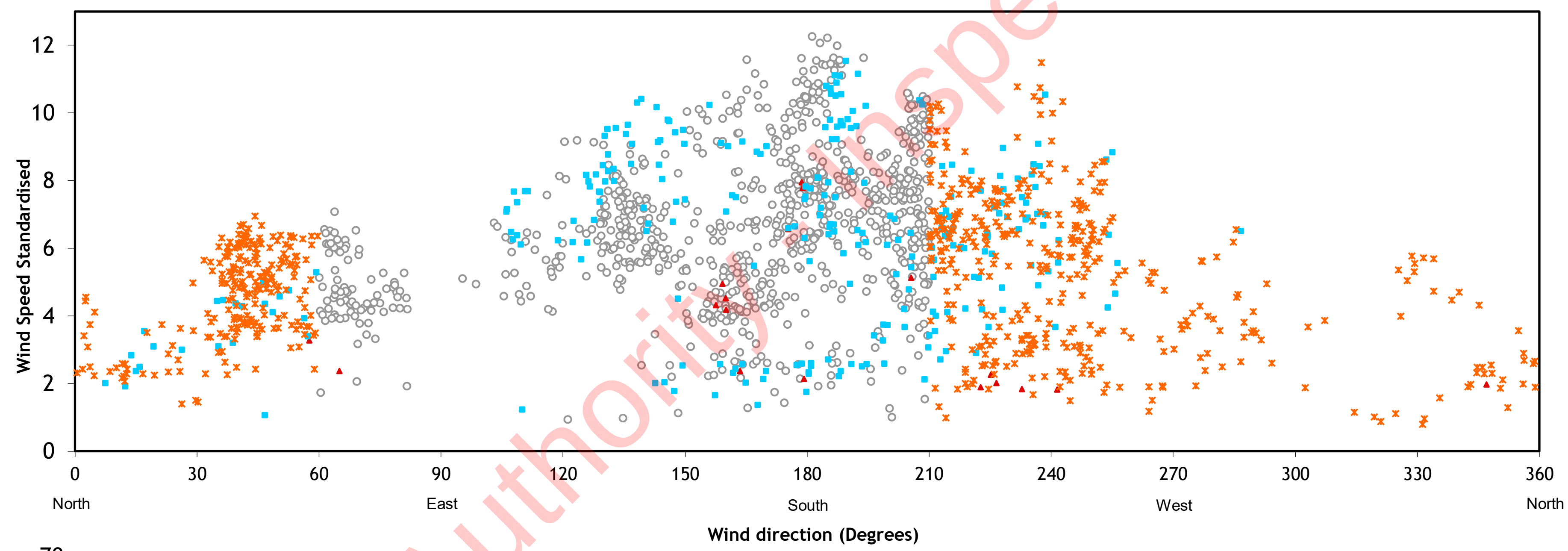
Regression Analysis Quiet Daytime



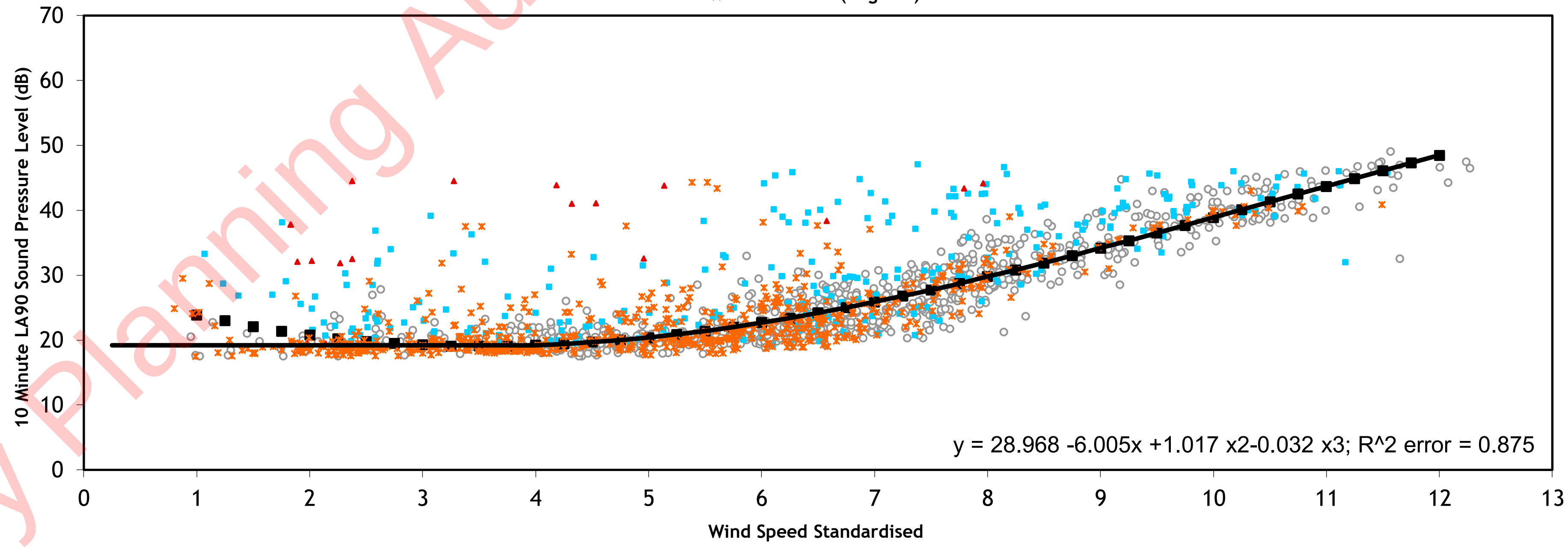
Wind Speed (m/s)	2	3	4	5	6	7	8	9	10	11	12	Total
Number of data points	26	41	54	132	124	142	111	63	16	11	3	723
Prevailing Background	20.7	21.5	22.7	24.3	26.4	29	32	35.5	39.4	43.8	48.6	

ETSU-R-97 NIGHT-TIME - NML05

Wind Conditions Night-Time



Regression Analysis Night-Time



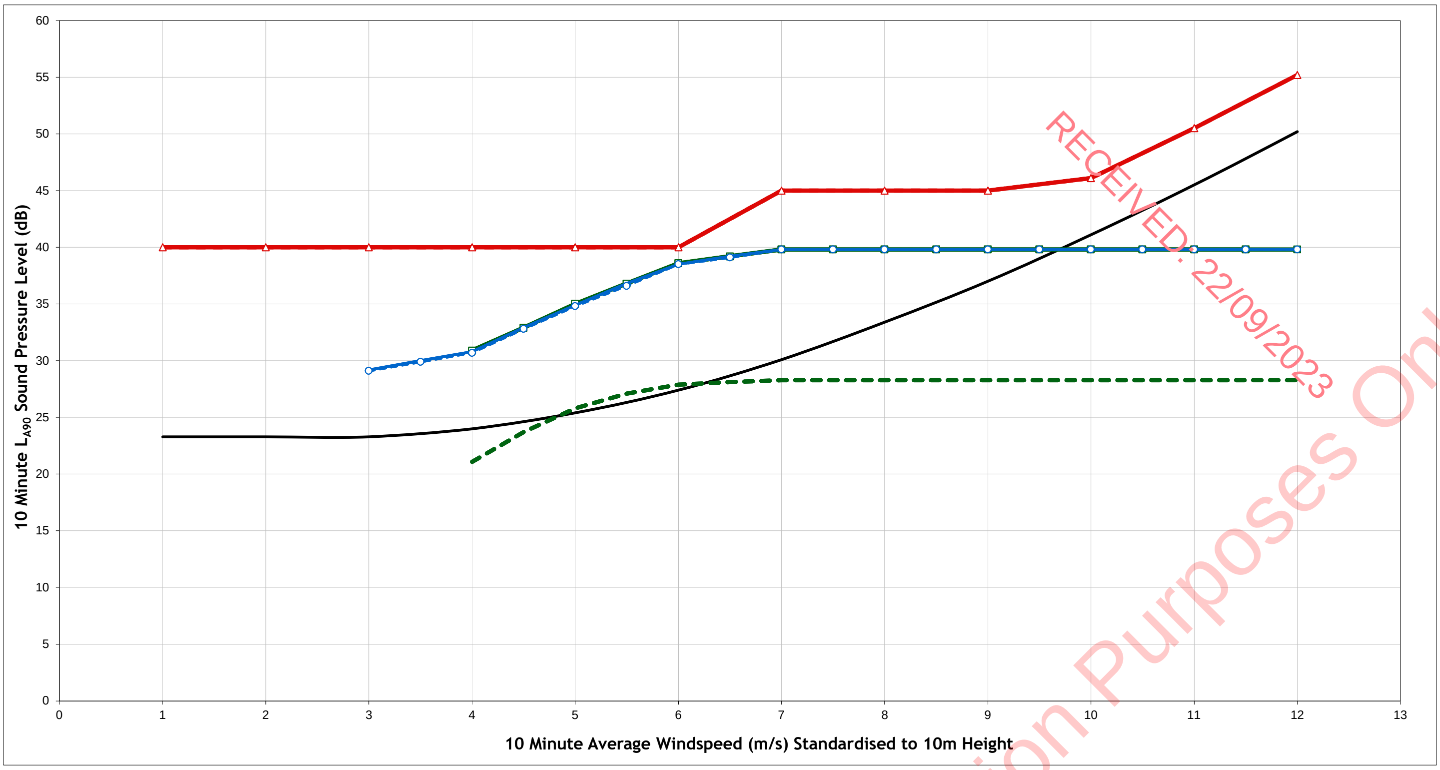
Wind Speed (m/s)	2	3	4	5	6	7	8	9	10	11	12	Total
Number of data points	18	34	92	128	142	157	133	65	57	31	10	867
Prevailing Background	19.2	19.2	19.2	20.4	22.7	25.9	29.8	34.2	38.9	43.7	48.5	

Legend:

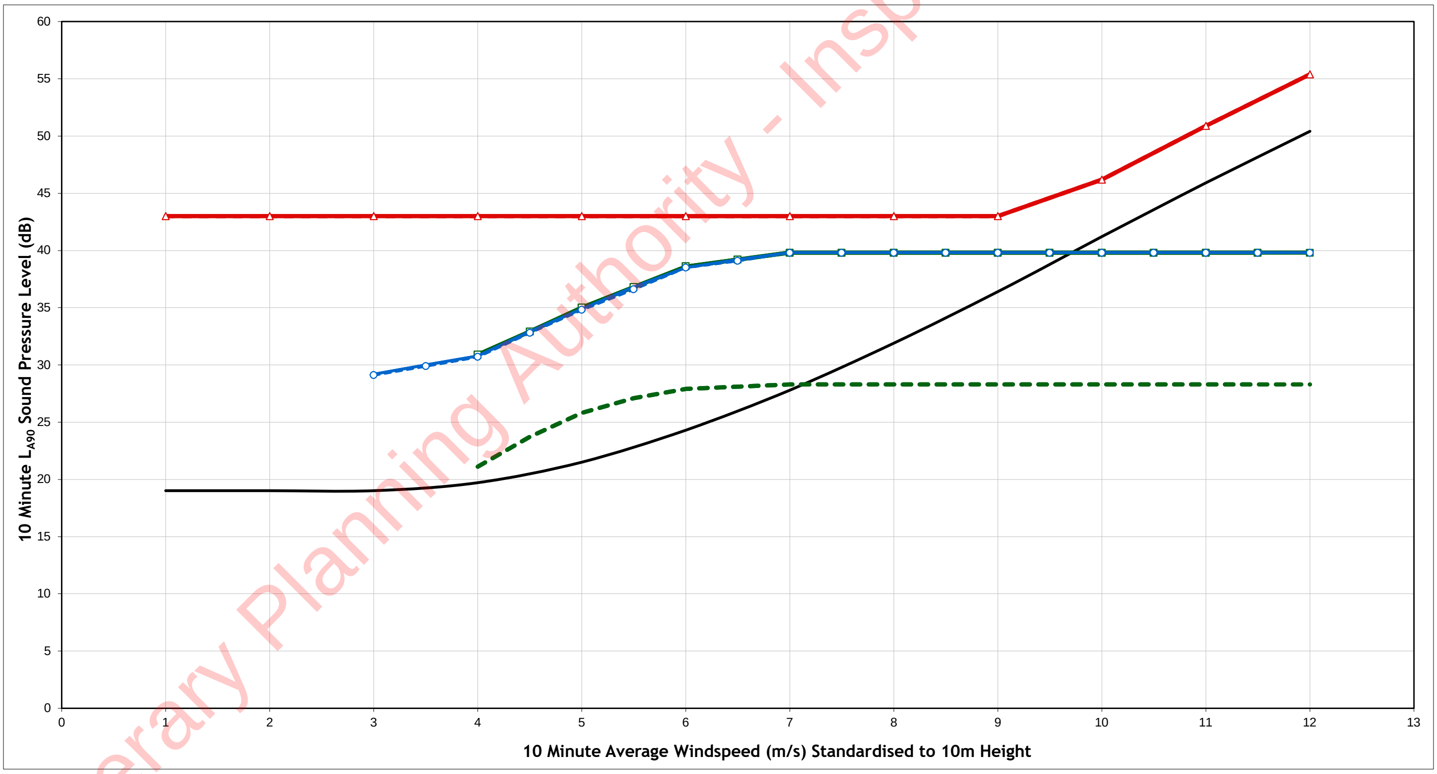
- O L_{A90} 10 Minute Measurement Point
- Line of best fit
- Line of best fit flat lined where appropriate(Prevailing Background)
- Excluded Data-Manual exclusion
- Excluded Data-Rain
- X Excluded Data-Filtered Wind Direction

Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Wind Conditions&Regression Analysis NML05
Figure Number	A1.2e
Drawn	CB
Checked	MC
Date	07/07/2023
Document Reference	IE00062 - ETSU BG

Daytime - NAL1 (H8)



Night Time - NAL1 (H8)

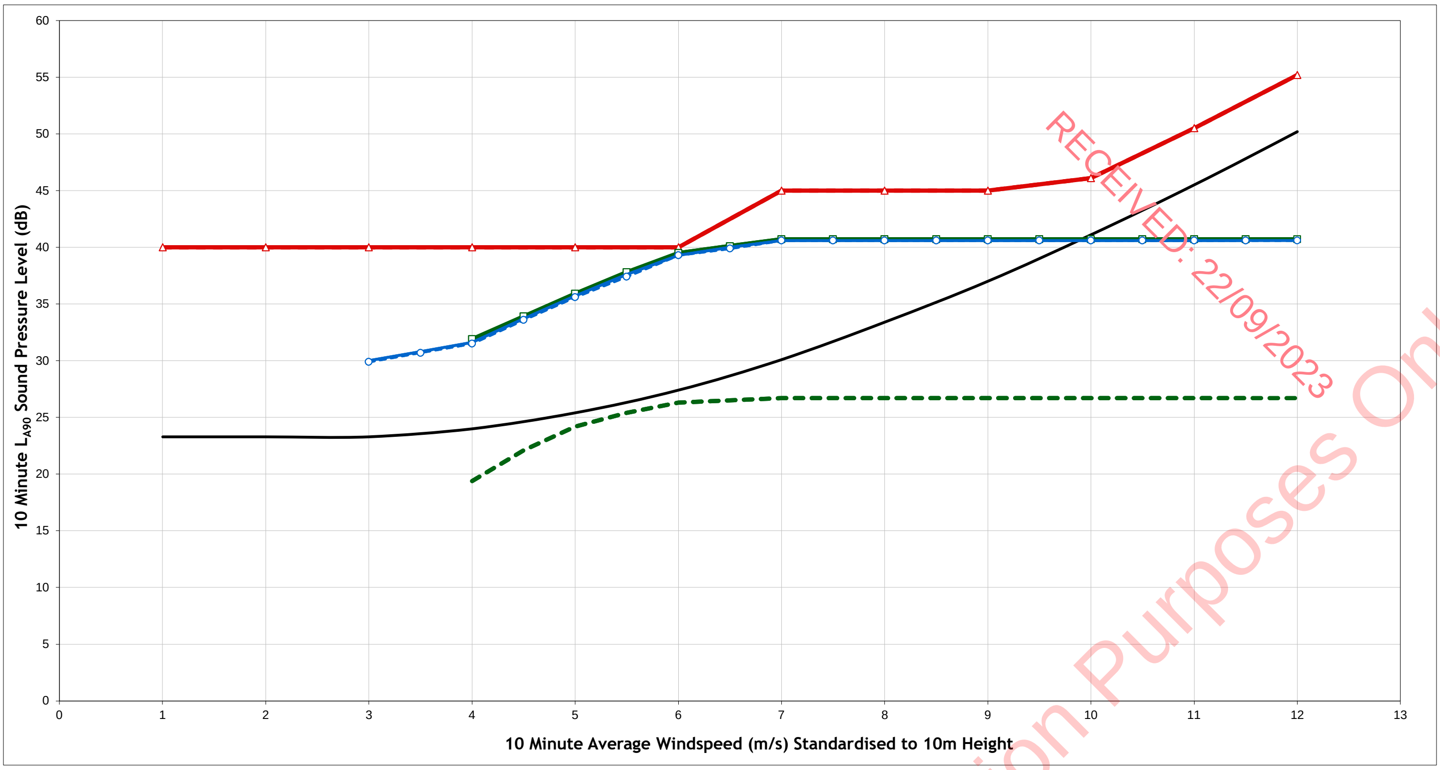


Legend:

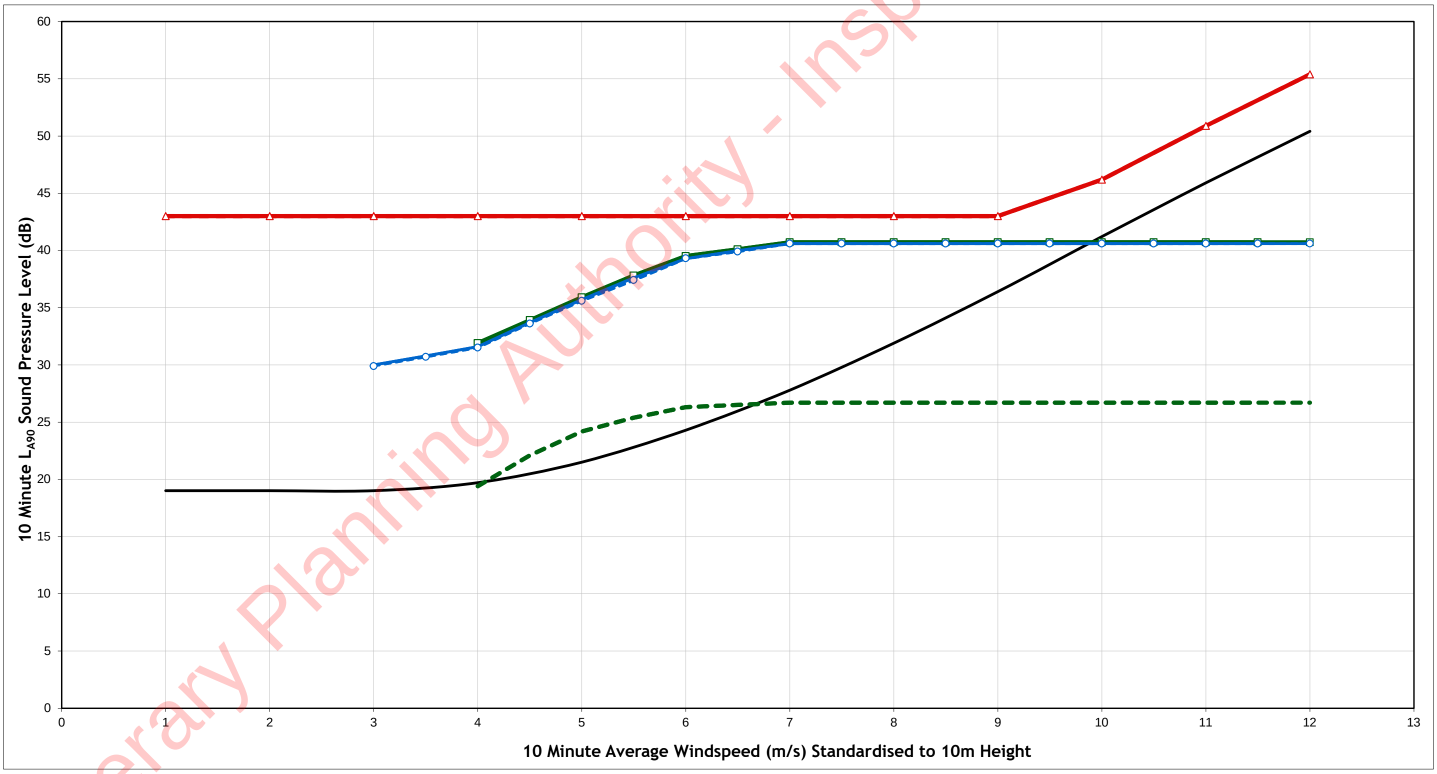
- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @105m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (NALs only) NAL1 (H8)
Figure Number	Figure A1.4a
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

Daytime - NAL2 (H52)



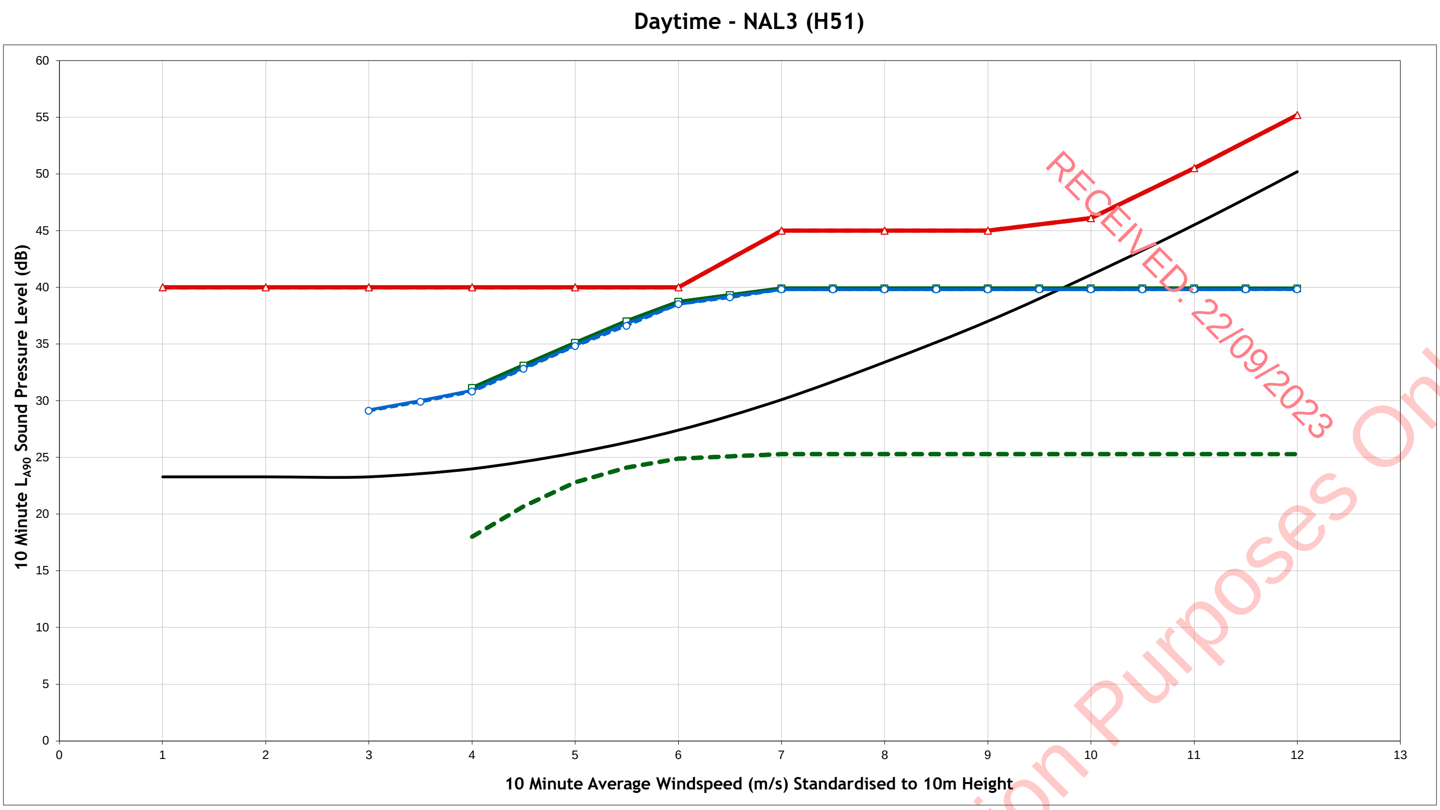
Night Time - NAL2 (H52)

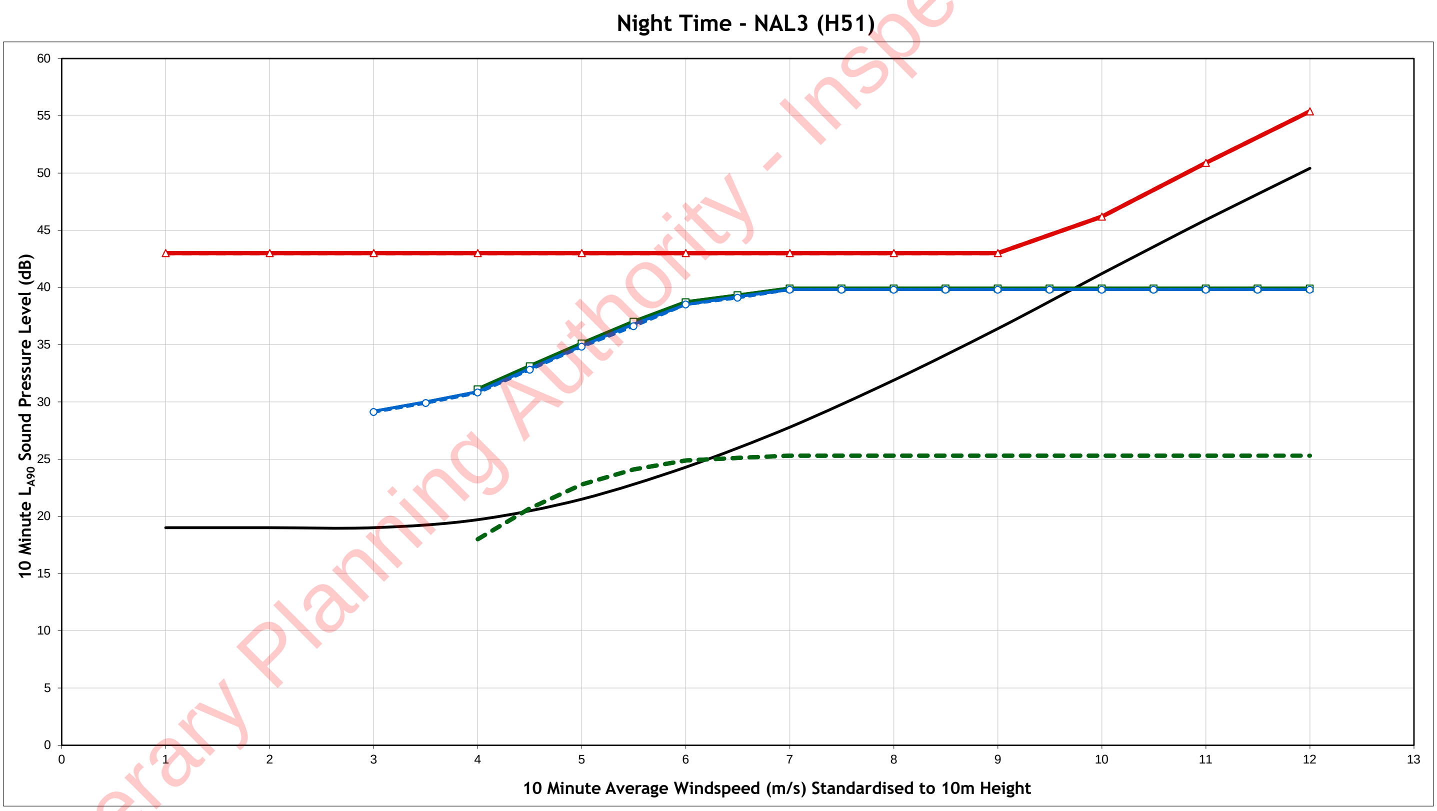


Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @105m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (NALs only) NAL2 (H52)
Figure Number	Figure A1.4b
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models





Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @105m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (NALs only) NAL3 (H51)
Figure Number	Figure A1.4c
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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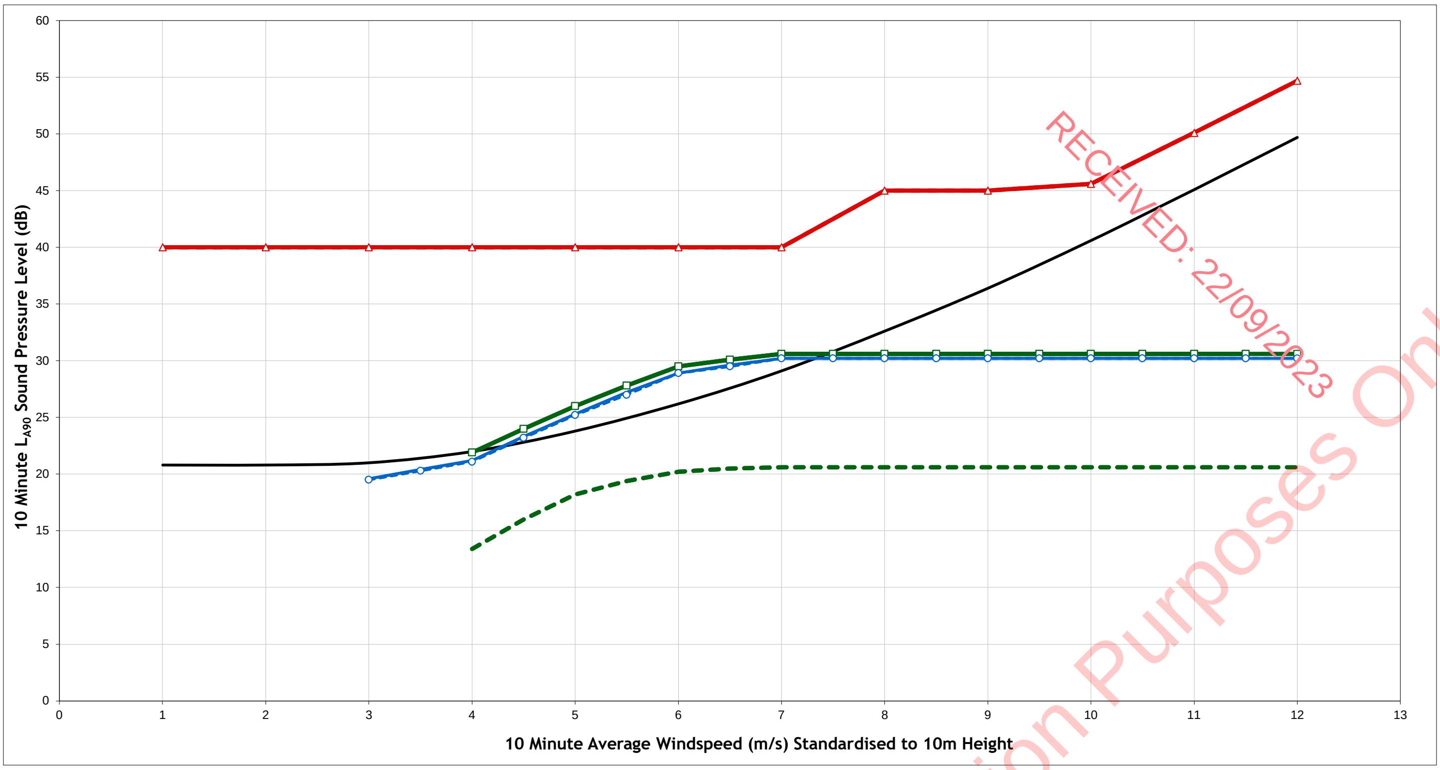
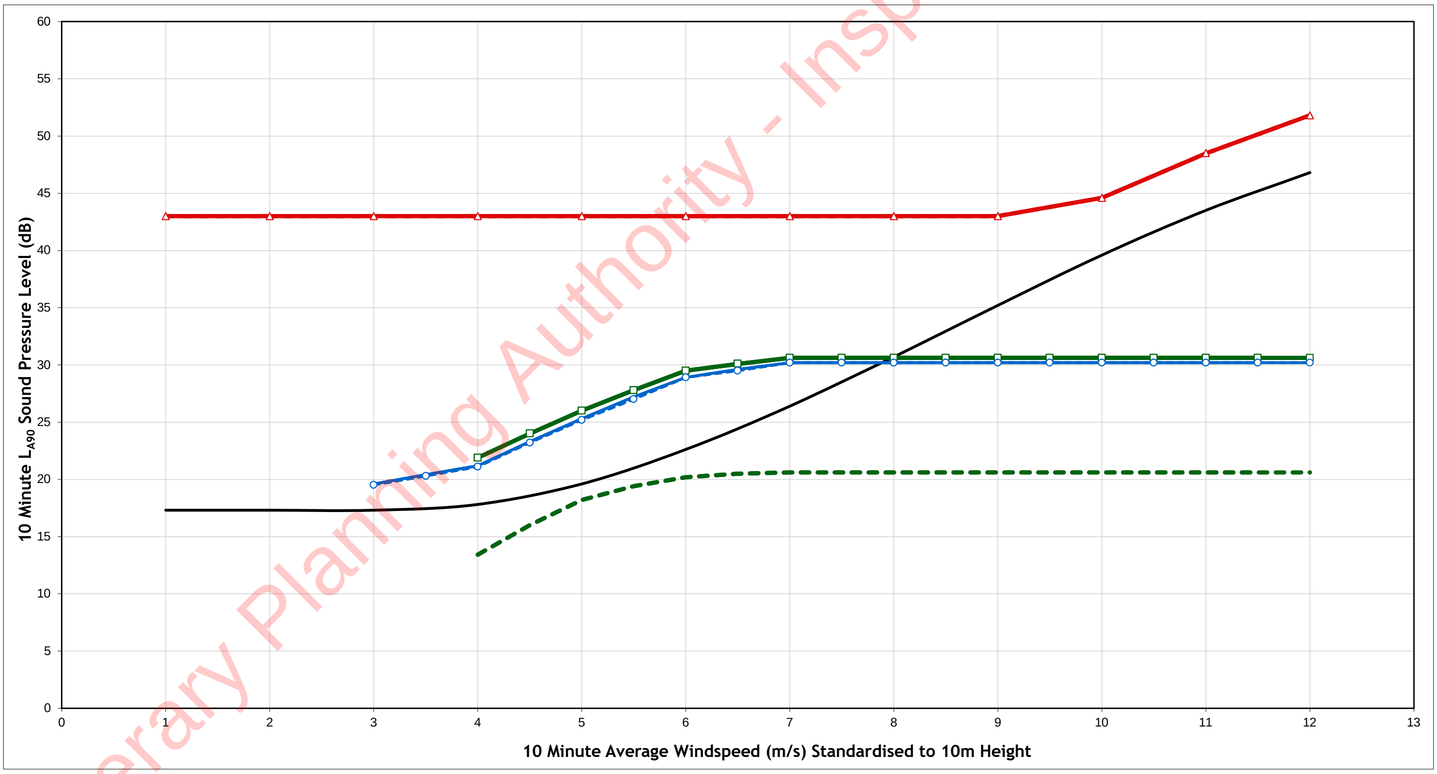
Daytime - NAL4 (H3)



Night Time - NAL4 (H3)



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @105m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (NALs only) NAL4 (H3)
Figure Number	Figure A1.4d
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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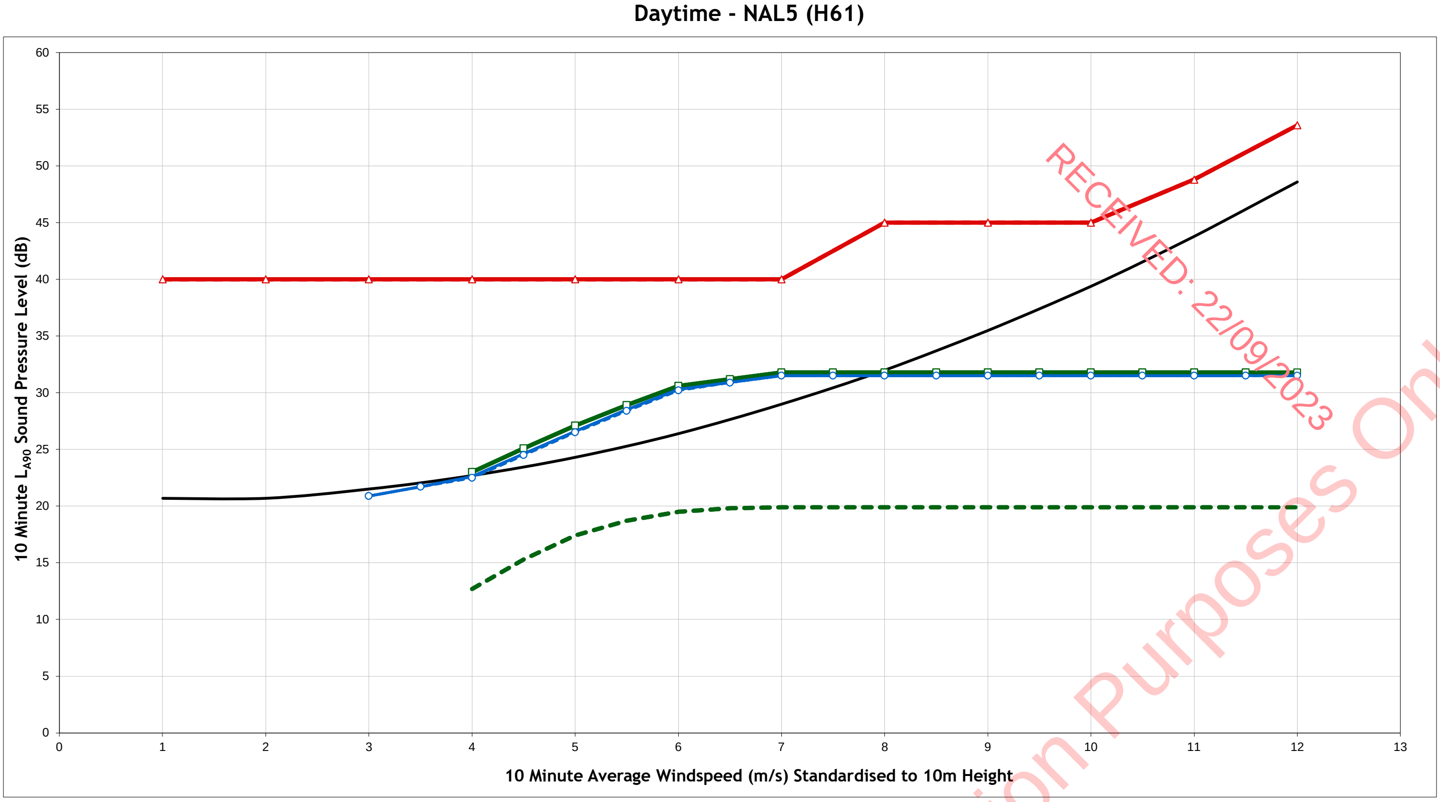

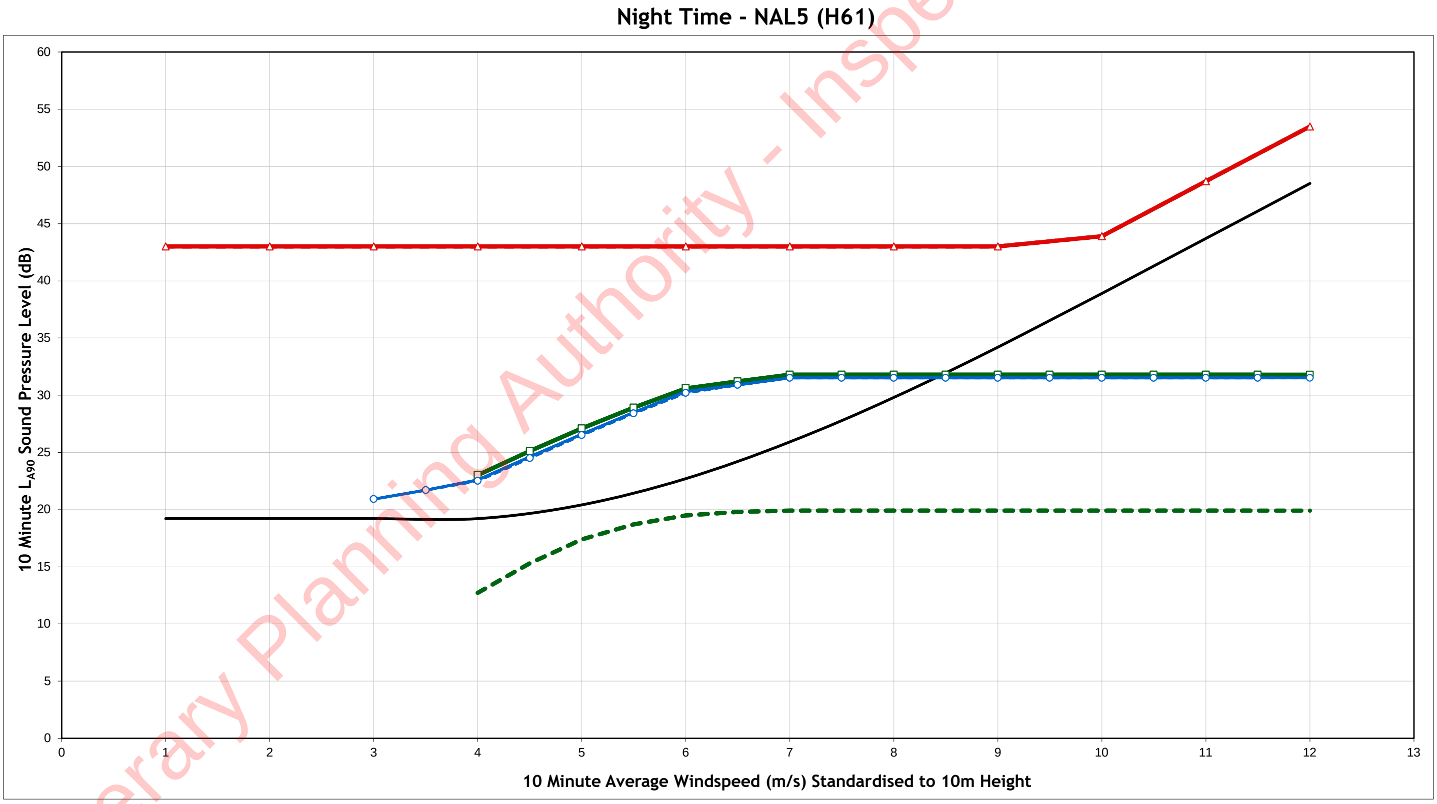

Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @105m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (NALs only) NAL5 (H61)
Figure Number	Figure A1.4e
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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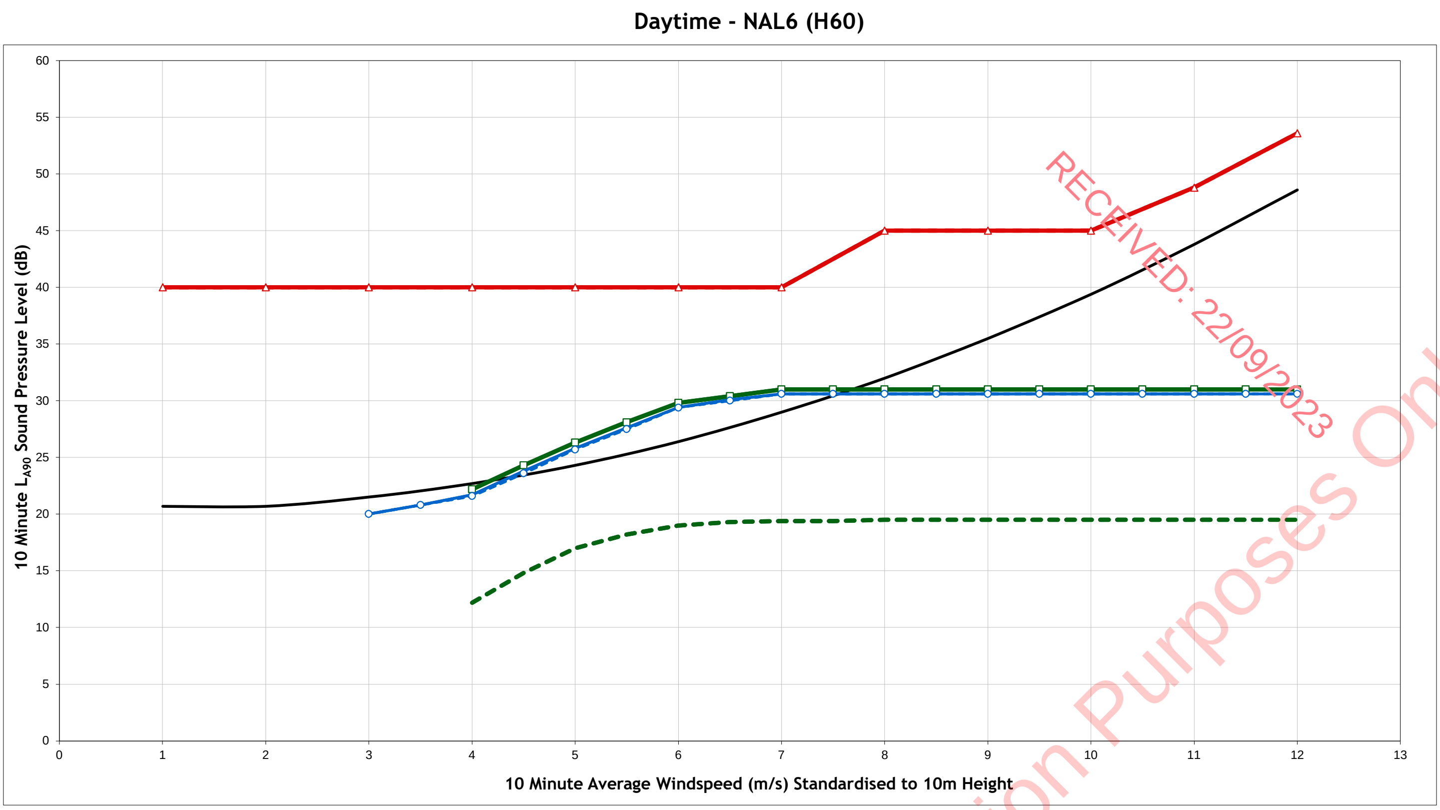
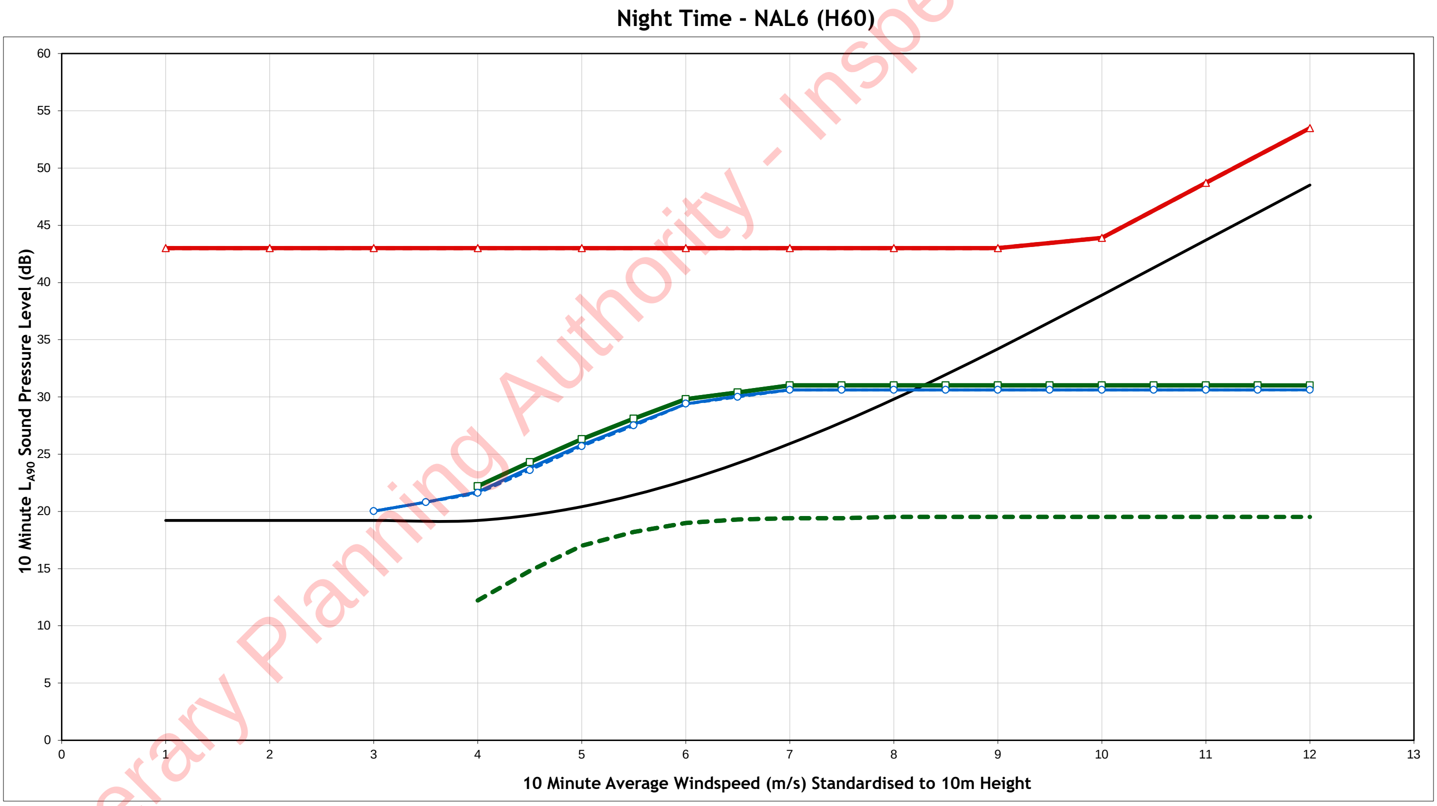


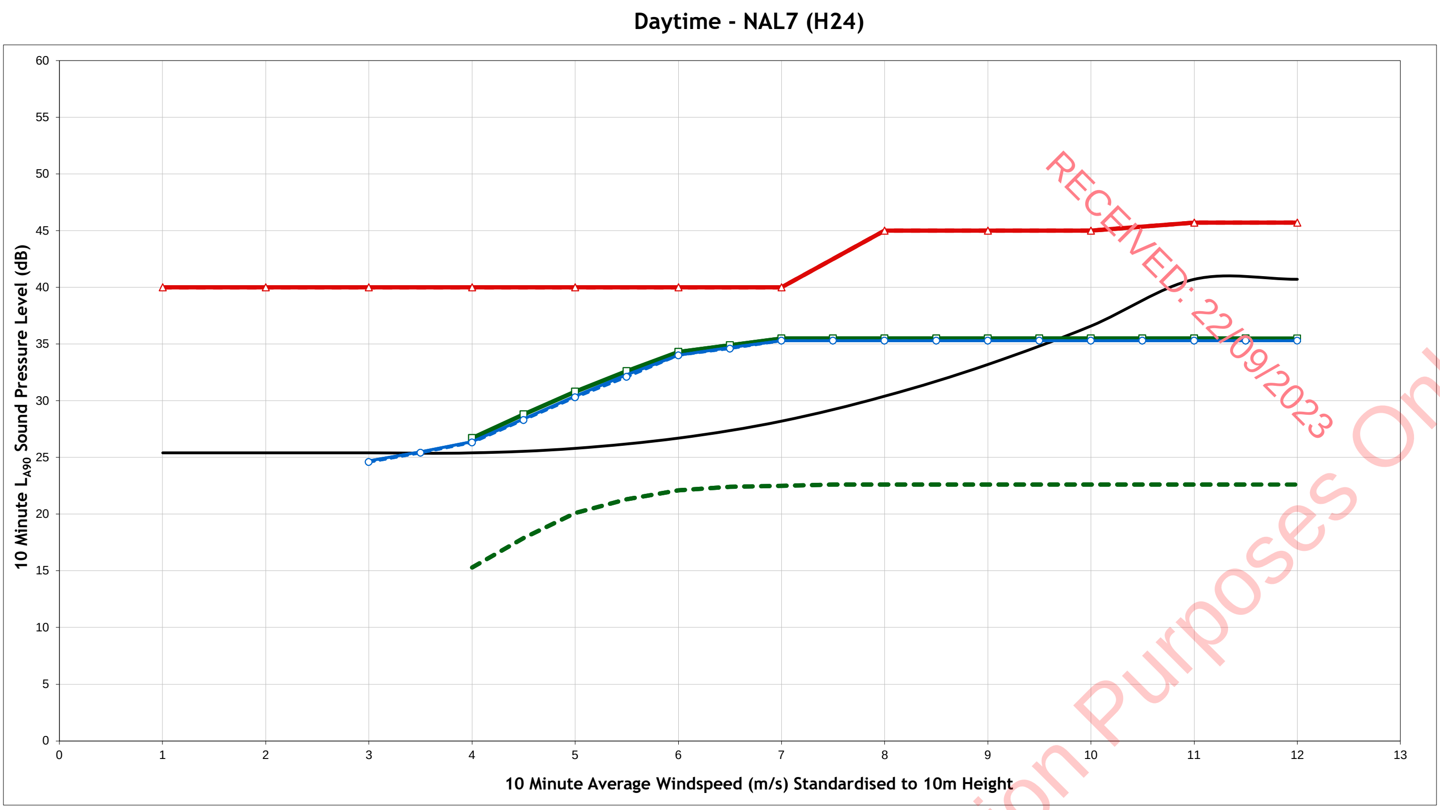


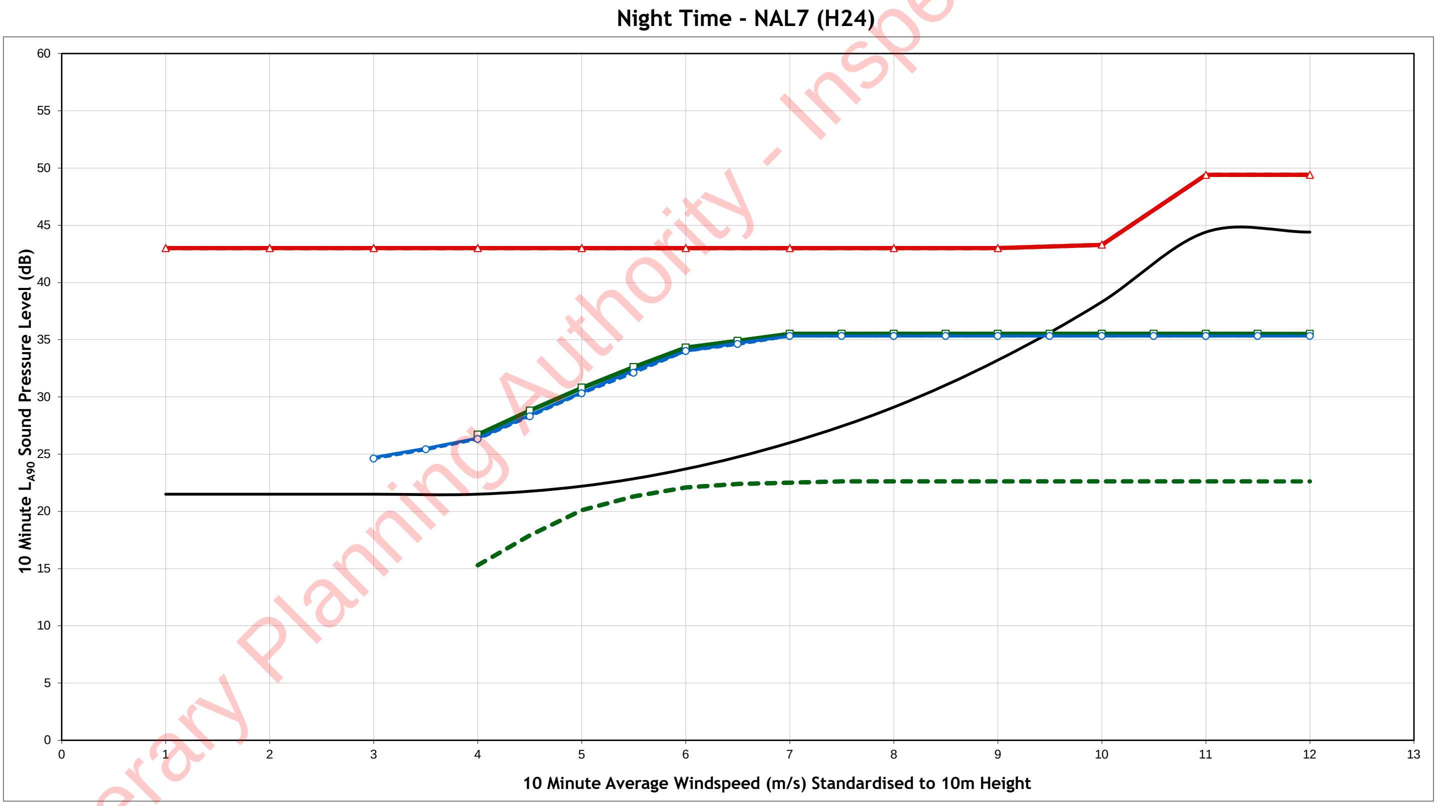
Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @105m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (NALs only) NAL6 (H60)
Figure Number	Figure A1.4f
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

tnei



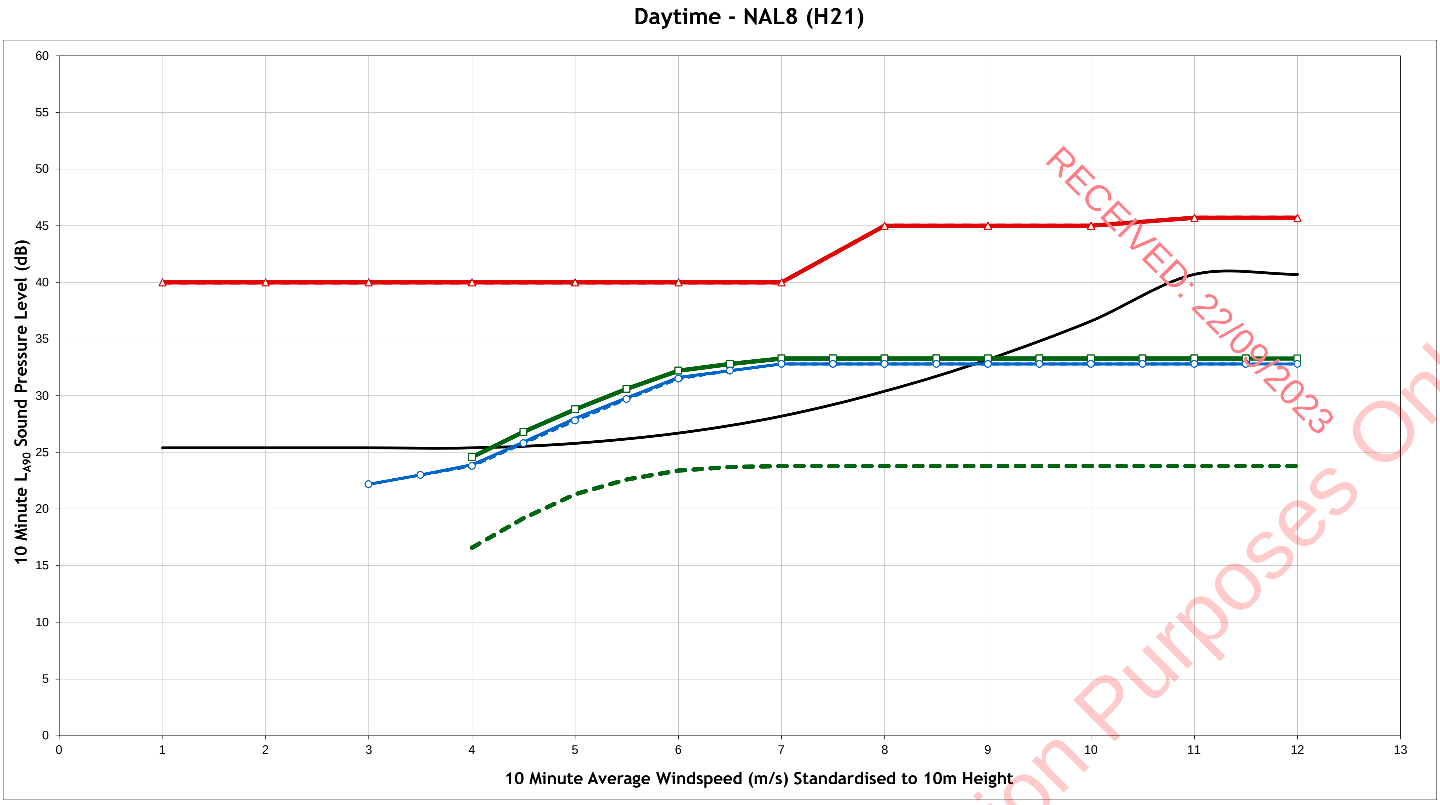


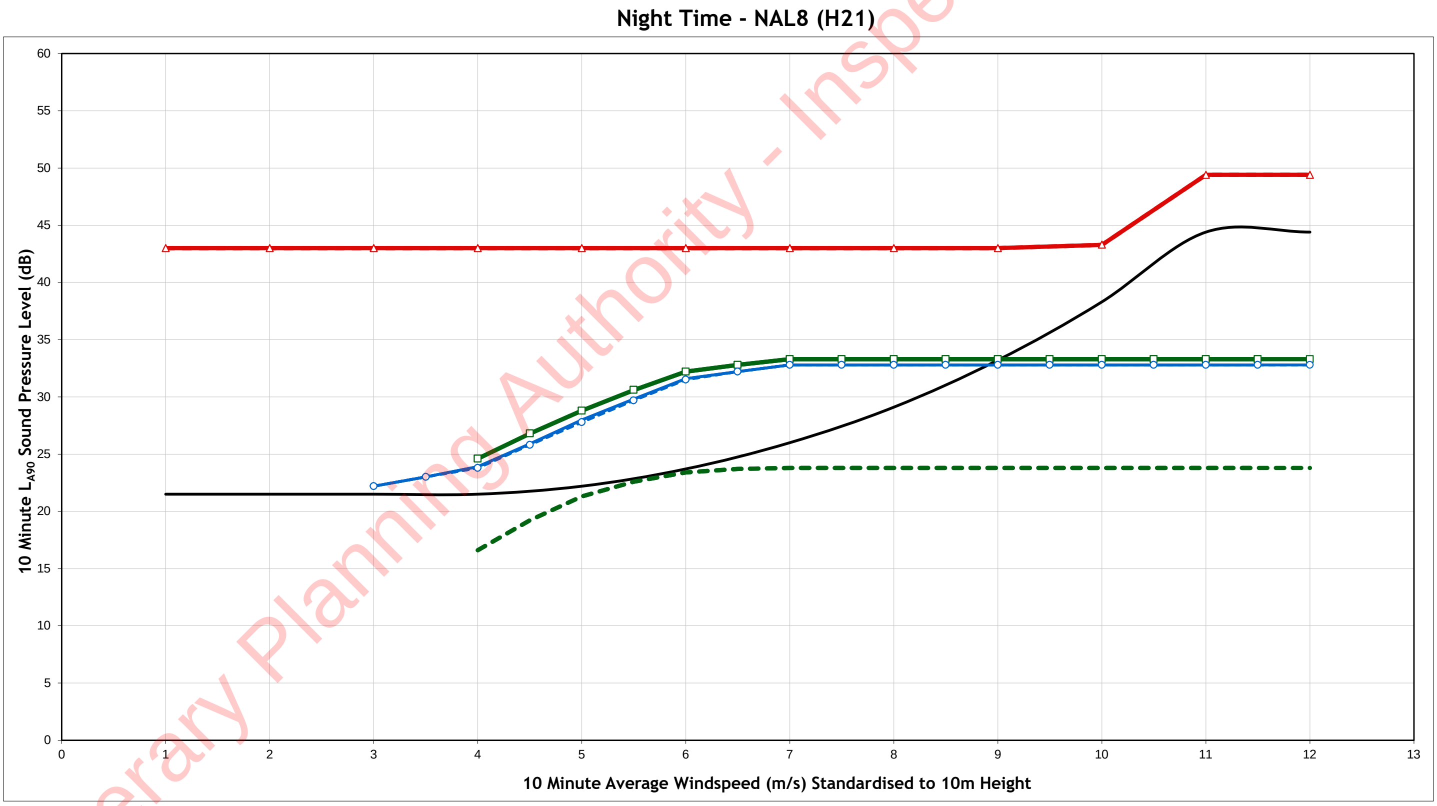
Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @105m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (NALs only) NAL7 (H24)
Figure Number	Figure A1.4g
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

tnei





Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @105m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (NALs only) NAL8 (H21)
Figure Number	Figure A1.4h
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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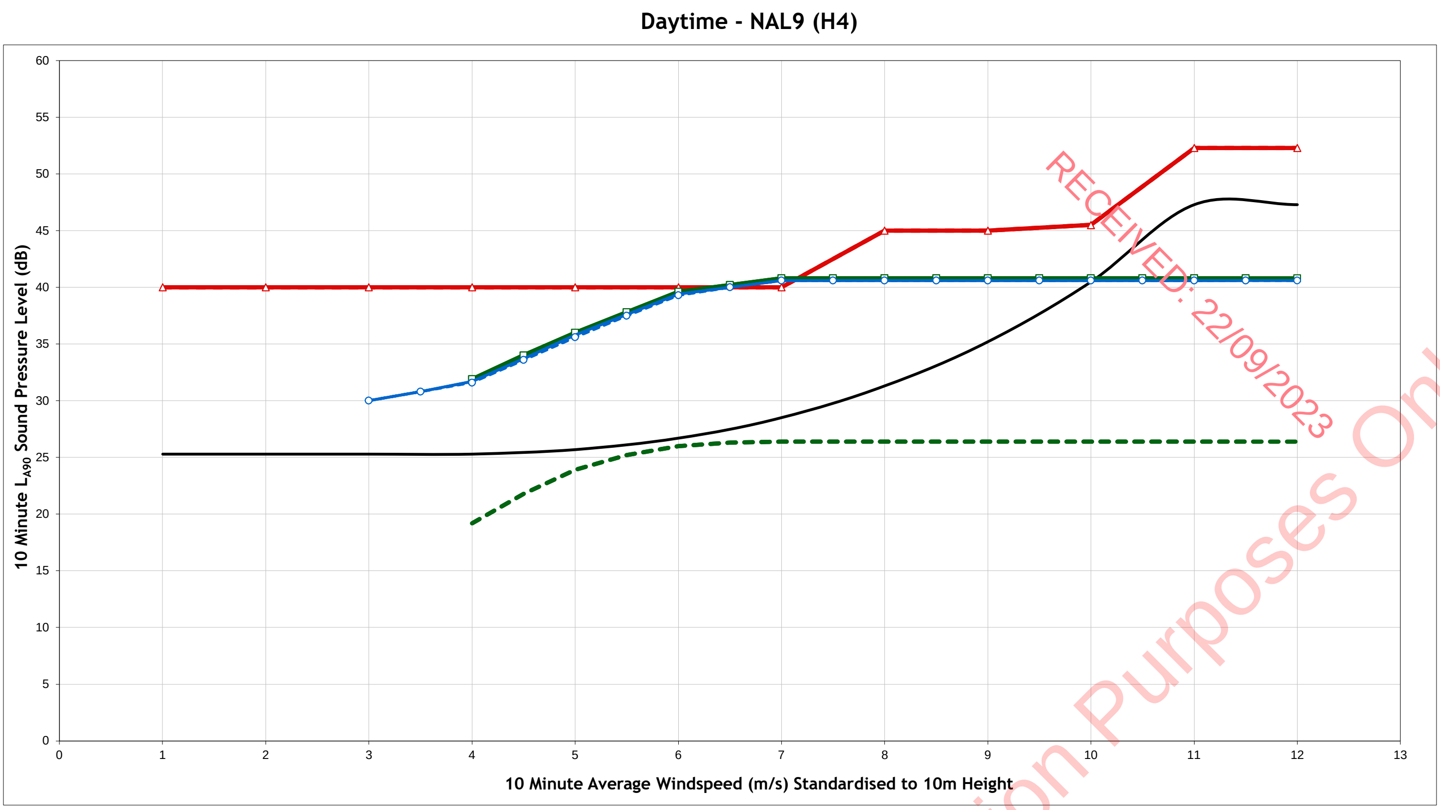

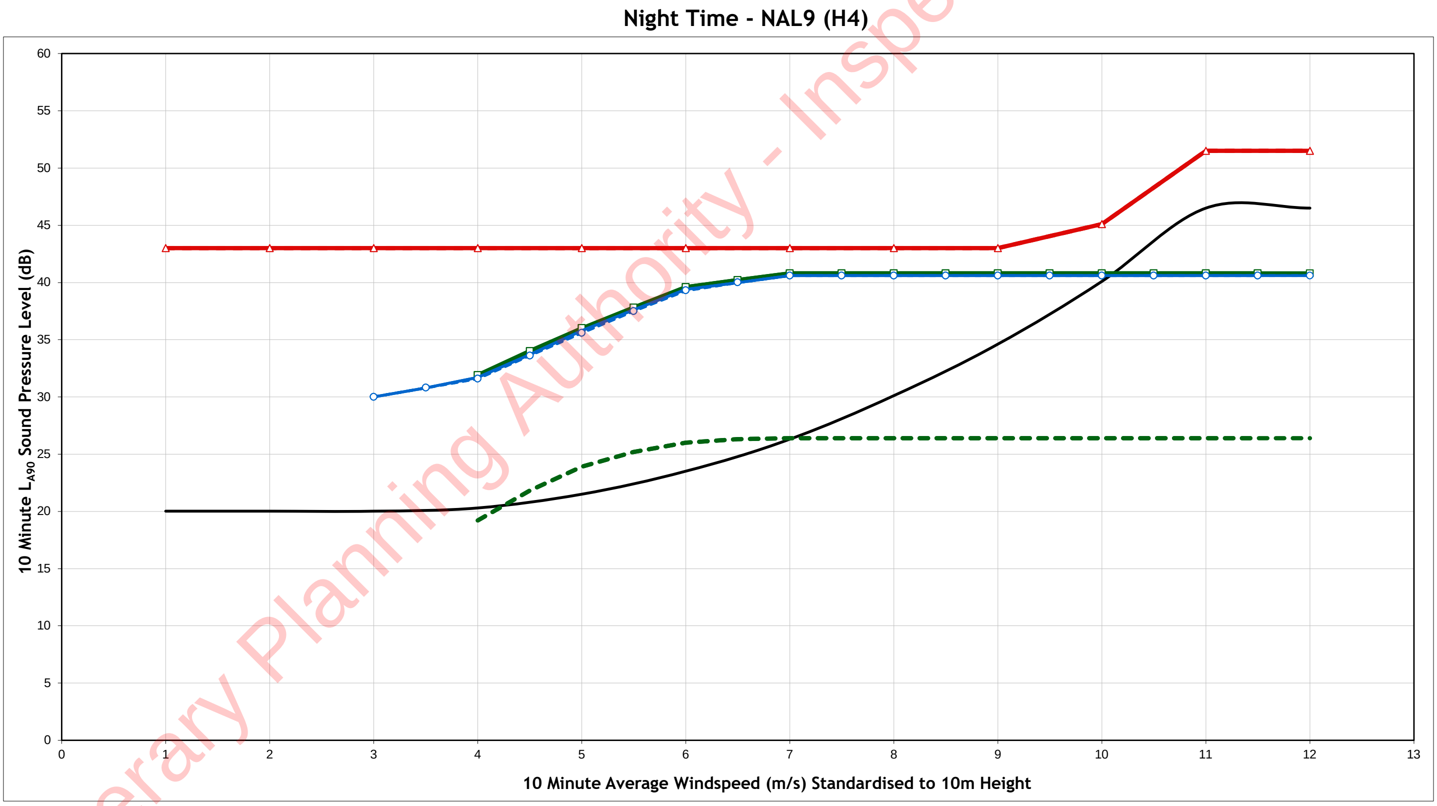

Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @105m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (NALs only) NAL9 (H4)
Figure Number	Figure A1.4i
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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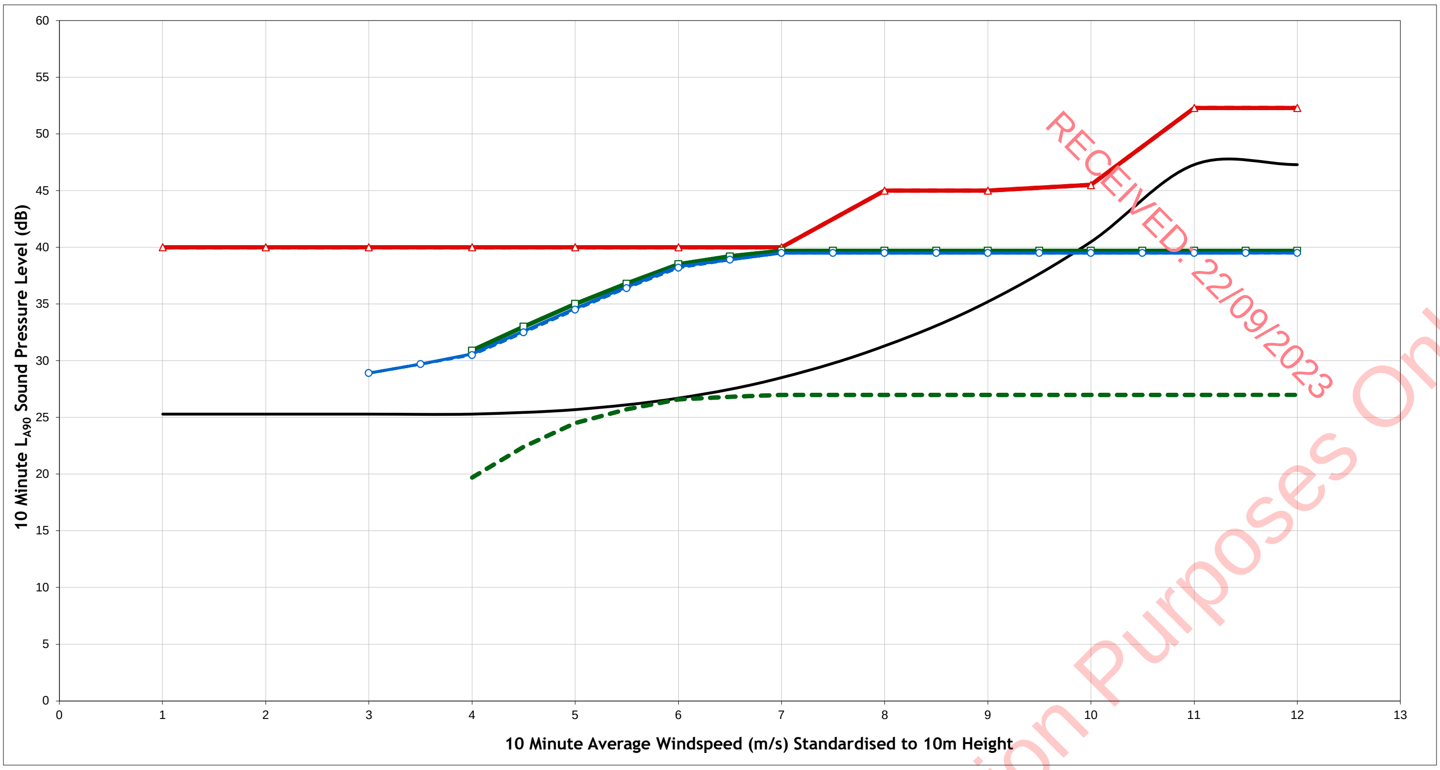
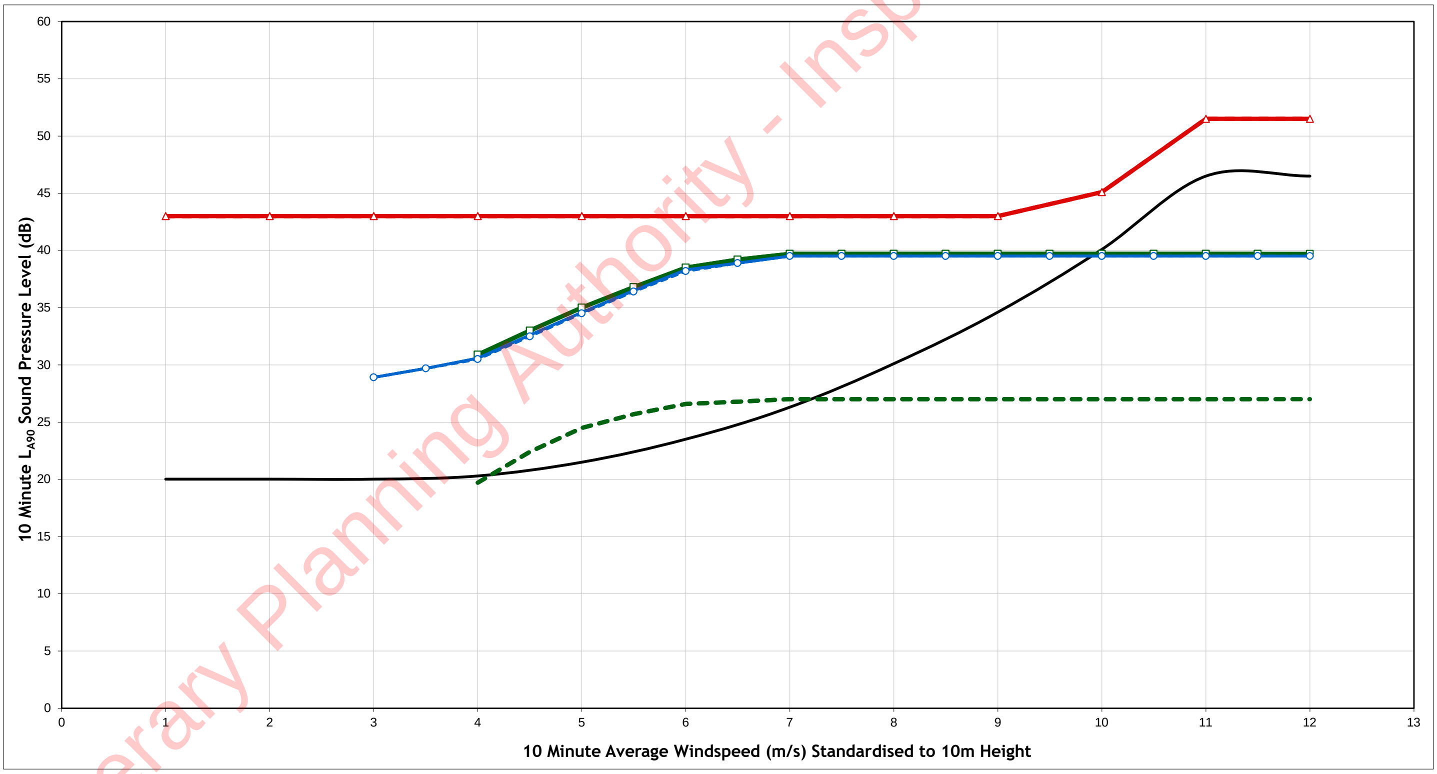


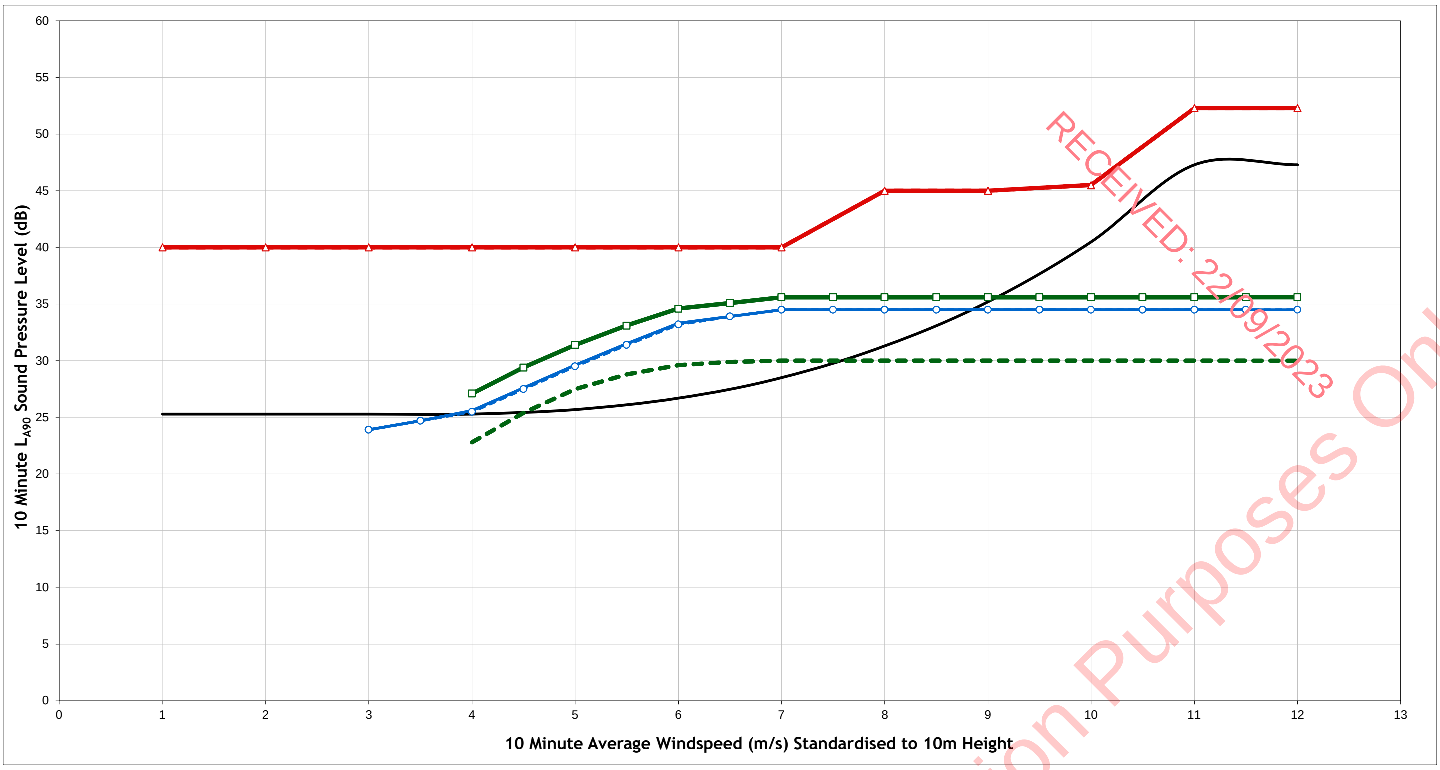


Legend:

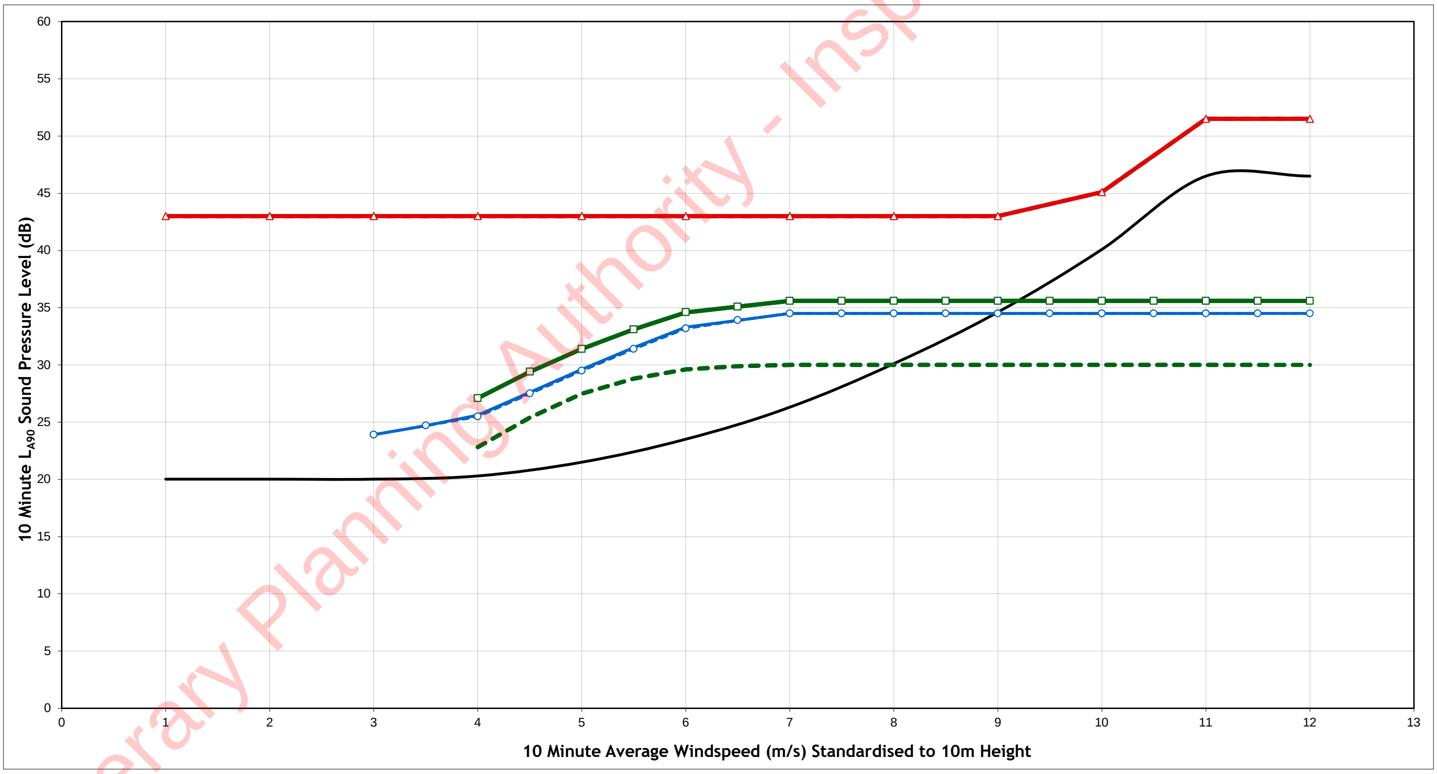
- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @105m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (NALs only) NAL10 (H42)
Figure Number	Figure A1.4j
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

Daytime - NAL11 (H49)



Night Time - NAL11 (H49)



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @105m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (NALs only) NAL11 (H49)
Figure Number	Figure A1.4k
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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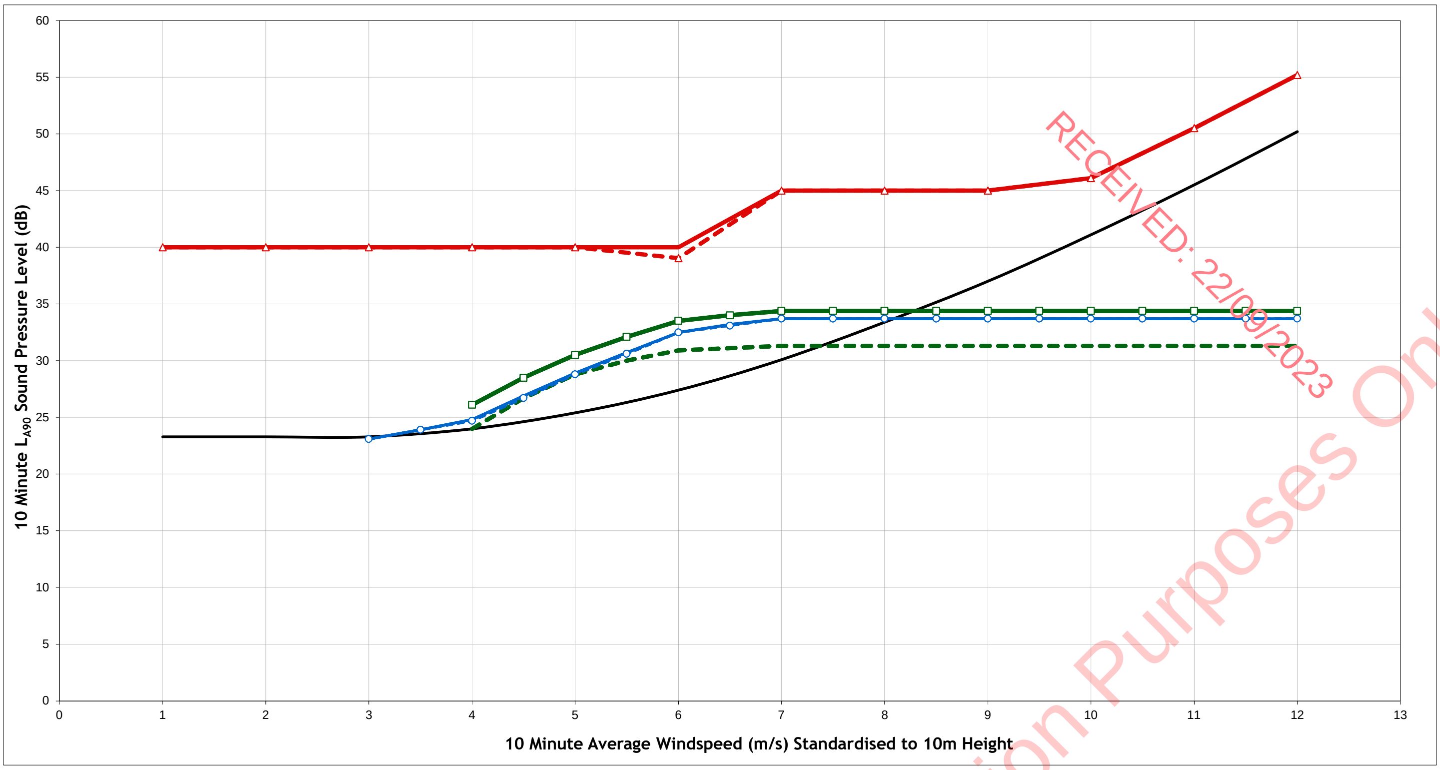
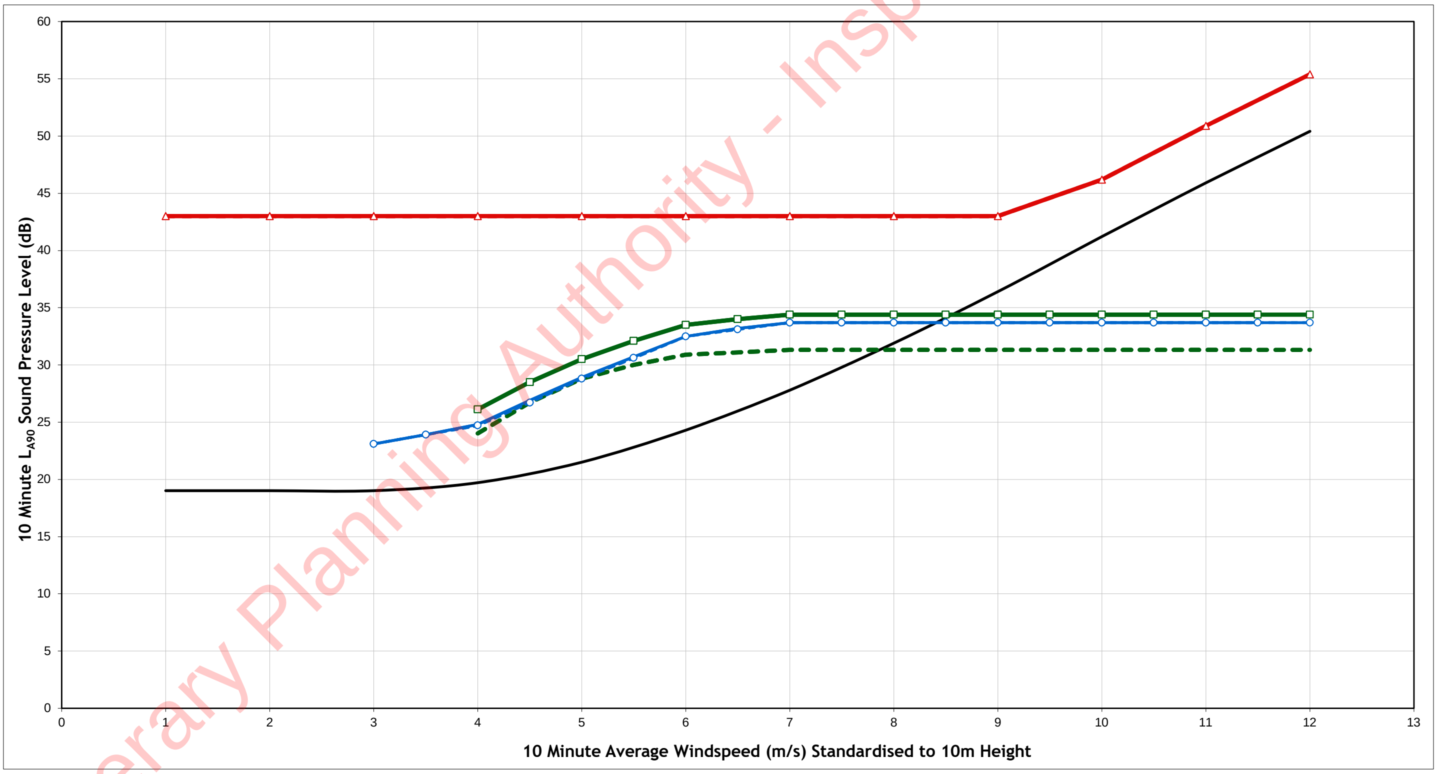
Daytime - NAL12 (H54)



Night Time - NAL12 (H54)



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @105m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (NALs only) NAL12 (H54)
Figure Number	Figure A1.4l
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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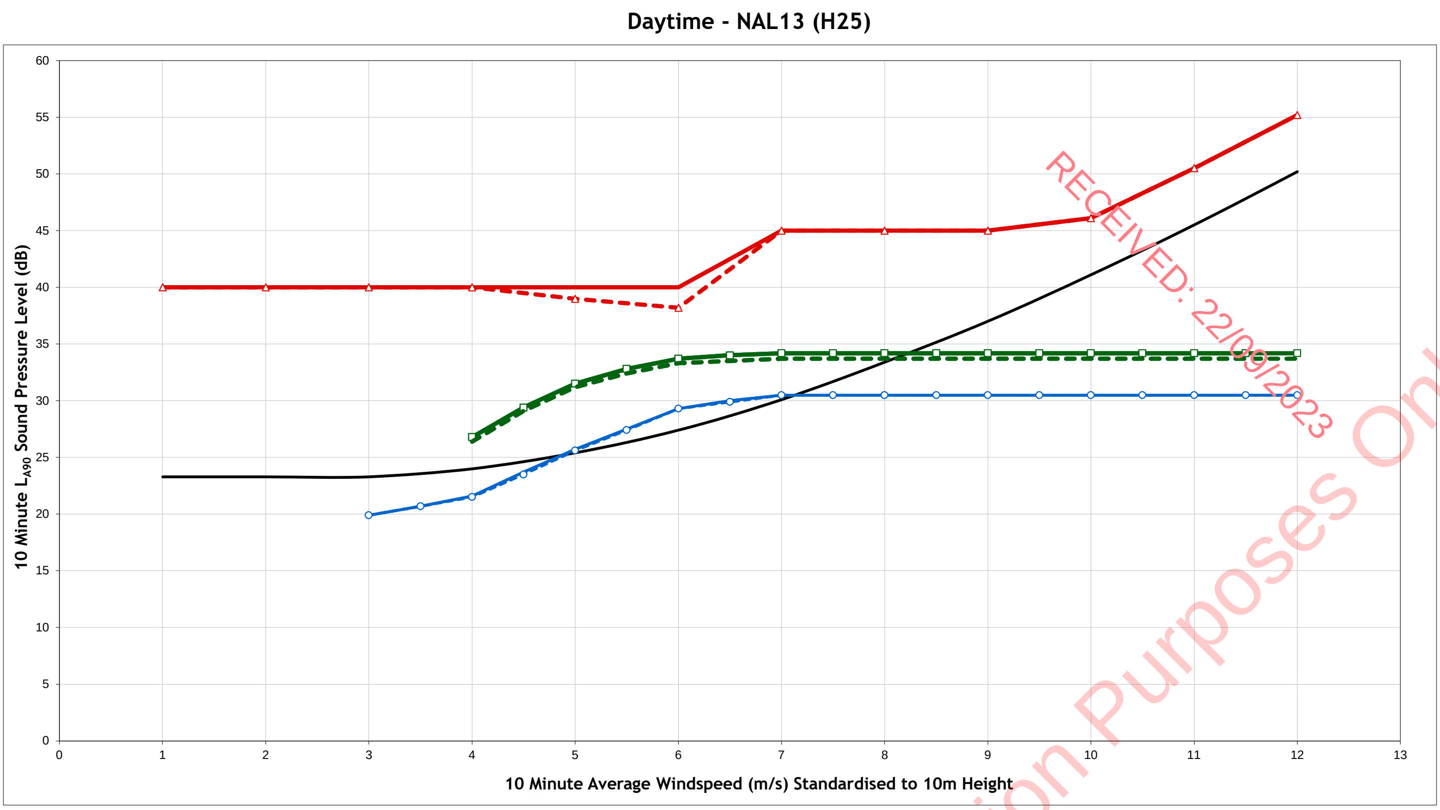

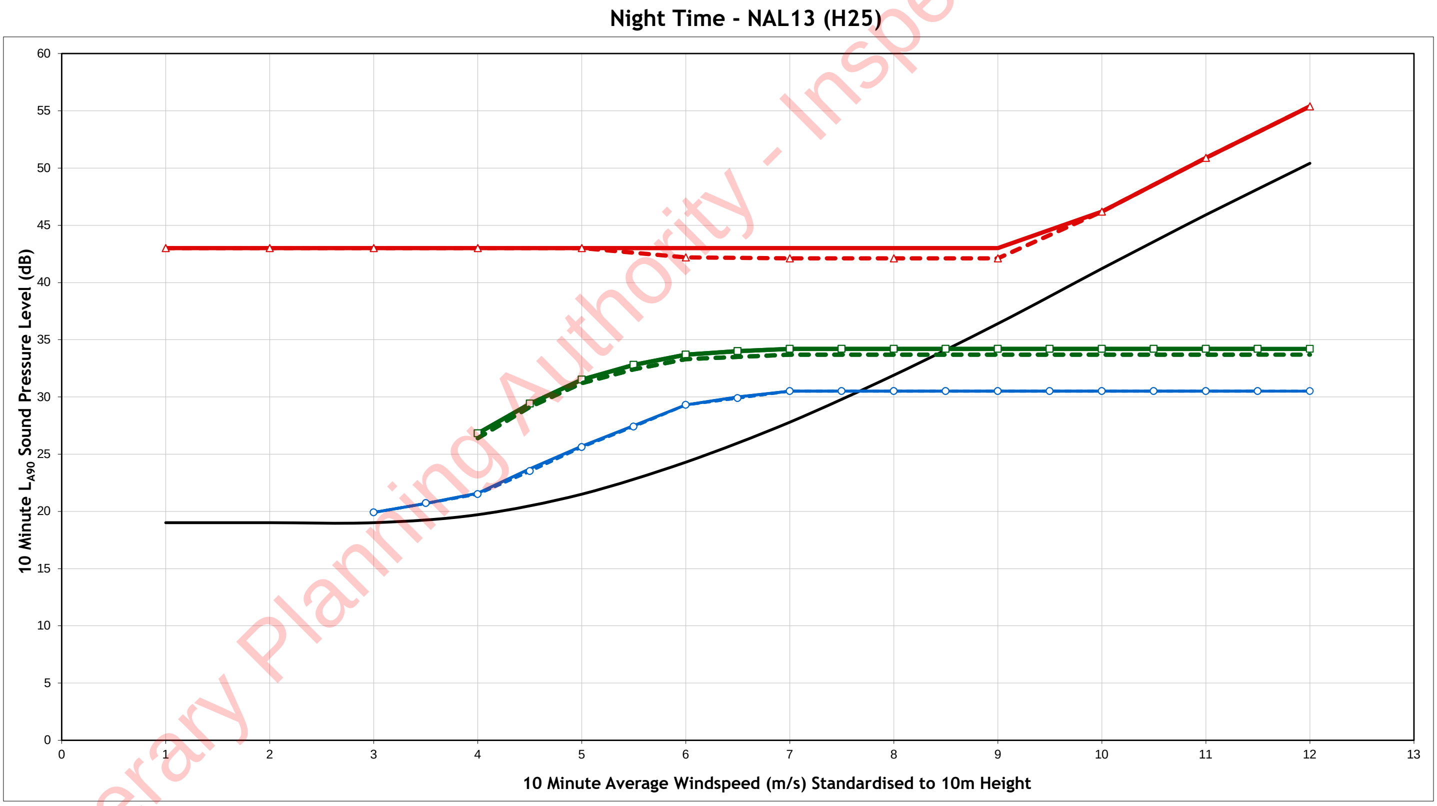

Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @105m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (NALs only) NAL13 (H25)
Figure Number	Figure A1.4m
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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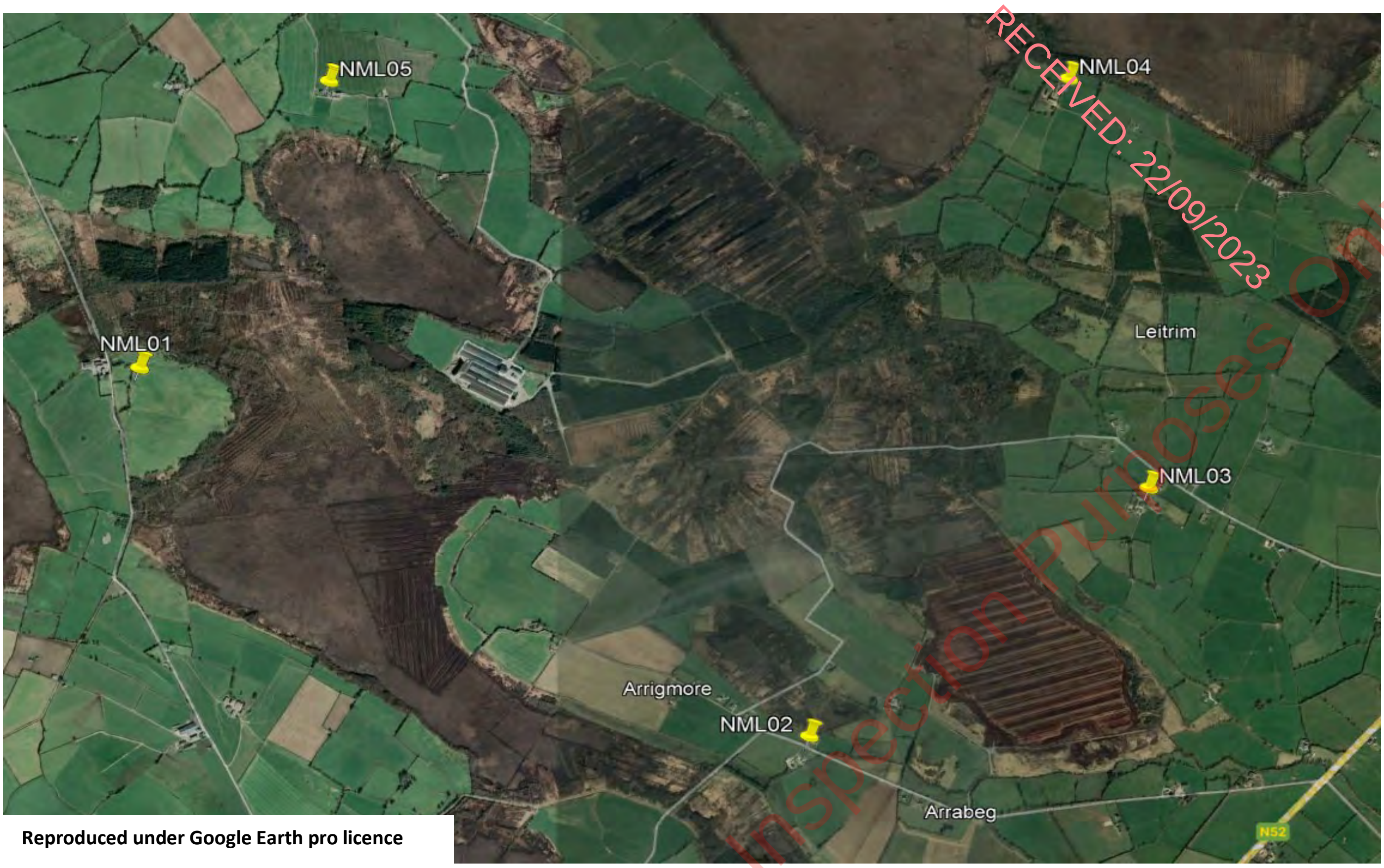
Annex 2 – Field Data Sheets / Installation Reports for Noise Monitoring Equipment and LIDAR

Carrig Wind Farm Noise Survey - Installed Noise Monitoring Locations



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Present during the course of the installation:

- Colum Breslin, TNEI Ireland Ltd

Unless specified, all noise meters were installed at least 3.5 m from any hard-reflecting surface except the ground and less than 20 m from the dwelling and away from obvious noise sources, such as boiler flues.

Detailed information and pictures for each of the installed locations are provided below. The original full-size pictures are available on request.

Noise Monitoring Location (NML) Coordinates - ITM

NML	ITM X	ITM Y
NML 01	596335	701941
NML 02	598929	700328
NML 03	600241	701417
NML 04	599935	703213
NML 05	597075	703201

NML01

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North	South
	
East	**West**
	

Description
The noise monitoring equipment was installed at a proxy location to the east of a derelict property. This location was chosen as other occupied dwellings in this location did not want to participate and as such a suitable proxy location was chosen instead. The location was chosen due to its proximity to the west of the proposed development. The kit was positioned in what was considered to be the area where contamination was least likely on the more sheltered side of the farm next to the trees. The location was seen to be representative of the other properties in the area to the west. The predominant sounds that were audible during the installation were noise from the wind in the trees, sheep and birdsong. The noise meter was located in a free field position, greater than 3.5m from any hard reflecting surface except the ground. Fencing was erected around the noise kit. A rain gauge was installed at this location.

NML02	
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North	South
	
East	West
	

Description
The noise monitoring equipment was installed in front of the property which was north-east of the house. The location was chosen due to its proximity to the south of the proposed development and was seen to be representative of other properties to the southern regions. The predominant sounds that were audible during the installation were from birdsong and noise from the trees and bushes. Secondary noises were from the odd car passing and multiple dogs constantly barking while installing. A farmyard with machinery and farm vehicles is towards the back of the property but no noise from this area while present. The noise meter was located in a free field position, greater than 3.5m from any hard reflecting surface except the ground.

<table>
<tr><th colspan="2">NML03</th></tr>
<tr><td colspan="2">

Reproduced under Google Earth pro licence</td></tr>
<tr><th>North</th><th>South</th></tr>
<tr><td></td><td></td></tr>
<tr><th>East</th><th>West</th></tr>
<tr><td></td><td></td></tr>
</table>

Description
The noise monitoring equipment was installed in front of the property which was south of the house. This location was chosen to maximise the distance from farmyard noise sources that could contaminated the noise data. The location was chosen due to its proximity to the east of the proposed development and was also seen to be representative of the other properties in the area to the east. The predominant sounds that were audible during the installation were from the farm machinery, tractor, and birdsong. Secondary noises were from the trees adjacent and the cows lowing. The noise meter was located in a free field position, greater than 3.5m from any hard reflecting surface except the ground. A rain gauge was installed at this location.

NML04

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North	South
	

East	West
	

Description
The noise monitoring equipment was installed in the amenity area to the east of the property and away from sources that could contaminate the noise data i.e. farm yard area, boiler flue, clothes line, shed workstation. The location was chosen due to its proximity to the north-east of the proposed development and was also seen to be representative of the other properties in the area to the east and north-east. The predominant sounds that were audible during the installation were from the cow sheds, birdsong and wind in the trees and vegetation. Other noises were from traffic passing seldomly, however, was quite loud. The noise meter was located on a grass patch area adjacent to the property, greater than 3.5m from any hard reflecting surface except the ground.

NML05	
 Reproduced under Google Earth pro licence	
North	South
	
East	West
	

Description
The noise monitoring equipment was installed in a location considered to provide representative data for the property to the west. The location was chosen due to its proximity to the north of the proposed development and was also seen to be representative of the other properties in the area to the north. The predominant sounds that were audible during the installation were from the surround bushes and vegetation. A very isolated area that was very quiet. The noise meter was located in a free field position, greater than 3.5m from any hard reflecting surface except the ground.

Noise Monitoring Field Data Sheet

MONITORING LOCATION

Location Name	NML01
Description	The noise monitoring equipment was installed at a proxy location to the east of a derelict property. The location was chosen due to its proximity to the west of the proposed development. The kit was positioned in what was considered to be a representative area within a field and was protected by fencing.
Comments	Measurements were undertaken in November (2022) until January (2023) to quantify the baseline noise measurements at this location. The noise meter was located in a free field position, greater than 3.5m from any hard reflecting surface except the ground.
Approximate ITM Grid Reference	596335, 701941
Survey Period	12/11/22 – 17/01/23
Noise sources noted during installation, weekly inspection and removal	The predominant sounds that were audible were rustling of trees, birdsong and distant traffic.

NOISE MONITORING EQUIPMENT DETAILS

Survey	Kit Number	Model	Serial Number	Last Calibrated/ Conformance Checked
Sound Level Meter	SLM 055	NL52	00520923	26/07/2022
Pre Amplifier	SLM 055	NH-21		26/07/2022
Microphone	SLM 055	UC-53A		26/07/2022
Calibrator	CAL 003	NC-74	35173441	01/04/22

NOISE MONITORING EQUIPMENT SETTINGS

	Network (A,B,Z)	Index and Time	Time Weighting (Slow, Fast)	Range (dB)	Audio
Parameters Recorded	A	$L_{A9010min}$, $L_{Aeq10min}$	Fast	20-110	No

DATA

File Name	Start Time	End Time	Cal. at Start	Cal. at End	Drift	Observations
0101	12:20 18/11/22	12:00 15/12/22	94.0	93.6	0.4	**18/11: Installation** Trees rustling in wind Cattle yard in distance Birdsong Rain gauge installed
0102	12:20 15/12/22	12:25 17/01/23	94.0	94.2	0.2	**15/12: Maintenance** Fencing erected around kit Birdsong constant and loud Cows lowing Distant traffic **17/01: Equipment Decommissioned** Birdsong and crowing Distant traffic Slight breeze (constant)

PHOTOGRAPHS




Noise Monitoring Field Data Sheet

MONITORING LOCATION

Location Name	NML 02
Description	The noise monitoring equipment was installed in the front amenity area towards the bottom of the garden to stop contamination and discrepancy from people passing. The location was chosen due to its proximity to the west of the proposed development.
Comments	Measurements were undertaken in November (2022) until January (2023) to quantify the baseline noise measurements at this location. The noise meter was located in a free field position, greater than 3.5m from any hard reflecting surface except the ground.
Approximate ITM Grid Reference	598929, 700328
Survey Period	12/11/22 – 17/01/23
Noise sources noted during installation, weekly inspection and removal	The predominant sounds that were audible were tractor and farm machinery noise, distant traffic and birdsong.

NOISE MONITORING EQUIPMENT DETAILS

Survey	Kit Number	Model	Serial Number	Last Calibrated/ Conformance Checked
Sound Level Meter	SLM 057	NL52	00520921	26/07/2022
Pre Amplifier	SLM 057	NH-21		26/07/2022
Microphone	SLM 057	UC-53A		26/07/2022
Calibrator	CAL 003	NC-74	35173441	01/04/22

NOISE MONITORING EQUIPMENT SETTINGS

	Network (A,B,Z)	Index and Time	Time Weighting (Slow, Fast)	Range (dB)	Audio
Parameters Recorded	A	$L_{A9010min}$, $L_{Aeq10min}$	Fast	20-110	No

DATA

File Name	Start Time	End Time	Cal. at Start	Cal. at End	Drift	Observations
0201	13:00 18/11/22	12:30 15/12/22	94.0	93.7	0.3	**18/11: Installation** Noise from tractor in the adjacent field (constant) Birdsong Quiet otherwise
0202	12:50 15/12/22	12:45 17/01/23	94.0	94.2	0.2	**15/12: Maintenance** Farm machinery noise from adjacent field Birdsong constant Road traffic audible **17/01: Equipment Decommissioned** Distant traffic Dogs barking Quiet

PHOTOGRAPHS

Noise Monitoring Field Data Sheet

MONITORING LOCATION

Location Name	NML 03
Description	The noise monitoring equipment was installed in the front amenity area towards the bottom of the garden to stop contamination and discrepancy from people passing. The location was chosen due to its proximity to the east of the proposed development.
Comments	Measurements were undertaken in November (2022) until January (2023) to quantify the baseline noise measurements at this location. The noise meter was located in a free field position, greater than 3.5m from any hard reflecting surface except the ground.
Approximate ITM Grid Reference	600241, 701417
Survey Period	12/11/22 – 17/01/23
Noise sources noted during installation, weekly inspection and removal	The predominant sounds that were audible were birdsong, farm activity noise and distant traffic.

NOISE MONITORING EQUIPMENT DETAILS

Survey	Kit Number	Model	Serial Number	Last Calibrated/ Conformance Checked
Sound Level Meter	SLM 025	NL32	00703296	15/11/2021
Pre Amplifier	SLM 025	NH-21		15/11/2021
Microphone	SLM 025	UC-53A		15/11/2021
Calibrator	CAL 003	NC-74	35173441	01/04/22

NOISE MONITORING EQUIPMENT SETTINGS

	Network (A,B,Z)	Index and Time	Time Weighting (Slow, Fast)	Range (dB)	Audio
Parameters Recorded	A	$L_{A9010min}$, $L_{Aeq10min}$	Fast	20-110	No

DATA

File Name	Start Time	End Time	Cal. at Start	Cal. at End	Drift	Observations
0301	09:50 18/11/22	10:40 15/12/22	94.0	94.4	0.4	**18/11: Installation** Birdsong Cattle lowing Farmer working with no machinery Distant traffic Tractor in distant field audible
0302	11:00 15/12/22	11:50 17/01/23	94.0	94.3	0.3	**15/12: Maintenance** Cold day (-3 degrees) Noise from distant motorway audible Cows lowing Birdsong **17/01: Equipment Decommissioned** Birdsong Cows noisy in adjacent barn Calm day, freezing temperatures

PHOTOGRAPHS

Noise Monitoring Field Data Sheet

MONITORING LOCATION

Location Name	NML 04
Description	The noise monitoring equipment was installed in the front amenity area beside a field that was occupied by a bull. As well, this location was away from the cattle barn. The location was chosen due to its proximity to the north-east of the proposed development.
Comments	Measurements were undertaken in November (2022) until January (2023) to quantify the baseline noise measurements at this location. The noise meter was located in a free field position, greater than 3.5m from any hard reflecting surface except the ground.
Approximate ITM Grid Reference	599935, 703213
Survey Period	12/11/22 – 17/01/23
Noise sources noted during installation, weekly inspection and removal	The predominant sounds that were audible were birdsong, farm activity noise and distant traffic.

NOISE MONITORING EQUIPMENT DETAILS

Survey	Kit Number	Model	Serial Number	Last Calibrated/ Conformance Checked
Sound Level Meter	SLM 014	NL31	01273102	04/08/2021
Pre Amplifier	SLM 014	NH-21		04/08/2021
Microphone	SLM 014	UC-53A		04/08/2021
Calibrator	CAL 003	NC-74	35173441	01/04/22

NOISE MONITORING EQUIPMENT SETTINGS

	Network (A,B,Z)	Index and Time	Time Weighting (Slow, Fast)	Range (dB)	Audio
Parameters Recorded	A	$L_{A9010min}$, $L_{Aeq10min}$	Fast	20-110	No

DATA

File Name	Start Time	End Time	Cal. at Start	Cal. at End	Drift	Observations
0401	10:30 18/11/22	11:00 15/12/22	94.0	94.4	0.4	**18/11: Installation** Barn was very noisy with constant machinery noise whilst onsite Birdsong
0402	11:20 15/12/22	12:10 17/01/23	94.0	94.3	0.3	**15/12: Maintenance** Birdsong Distant traffic audible (constant) Cows lowing **17/01: Equipment Decommissioned** Birdsong Calm day

PHOTOGRAPHS

Noise Monitoring Field Data Sheet

MONITORING LOCATION

Location Name	NML 05
Description	The noise monitoring equipment was installed in the back amenity area. The location was chosen due to its proximity to the north-west of the proposed development.
Comments	Measurements were undertaken in November (2022) until January (2023) to quantify the baseline noise measurements at this location. The noise meter was located in a free field position, greater than 3.5m from any hard reflecting surface except the ground.
Approximate ITM Grid Reference	597075, 703201
Survey Period	12/11/22 – 17/01/23
Noise sources noted during installation, weekly inspection and removal	The predominant sounds that were audible were distant traffic and birdsong.

NOISE MONITORING EQUIPMENT DETAILS

Survey	Kit Number	Model	Serial Number	Last Calibrated/ Conformance Checked
Sound Level Meter	SLM 009	NL32	00972337	08/06/2021
Pre Amplifier	SLM 009	NH-21		08/06/2021
Microphone	SLM 009	UC-53A		08/06/2021
Calibrator	CAL 003	NC-74	35173441	01/04/22

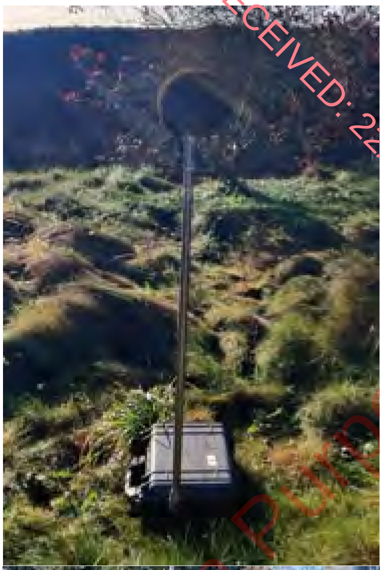
NOISE MONITORING EQUIPMENT SETTINGS

	Network (A,B,Z)	Index and Time	Time Weighting (Slow, Fast)	Range (dB)	Audio
Parameters Recorded	A	$L_{A9010min}$, $L_{Aeq10min}$	Fast	20-110	No

DATA

File Name	Start Time	End Time	Cal. at Start	Cal. at End	Drift	Observations
0501	11:10 18/11/22	11:30 15/12/22	94.0	93.8	0.2	**18/11: Installation** Distant traffic Birdsong Slight humming noise in distance (unsure, possibly farm machinery)
0502	11:50 15/12/22	12:40 17/01/23	94.0	93.9	0.1	**15/12: Maintenance** Birdsong Distant traffic audible (constant and loud) **17/01: Equipment Decommissioned** Birdsong Distant traffic

PHOTOGRAPHS



Site Details

Site Name: Sharragh WF (Sharragh Pigfarm) **Client Name:** Atlantic Infrastructure Partners AIP

Project Number: 211027

Site Information			
Deployment Start date & Time	10/11/2022 @ 12.00pm	**Client Contact Details**	
Landowner contact details	(057)9139102	**Site Access Procedure**	Call Landowner or Operating Manager
Site Access Route	L1109	**Nearest Town/ Postcode**	Birr

Observed Conditions			
Wind Speed	**Wind Direction**	**Precipitation**	**Visibility**
3.08m/s	195 degrees (S)	0	Clear

Deployment Information	
Installation Engineer(s)	Owen Cahill & David Robb
Model of Device	Zephir ZX300
Device Serial Number	1379

Location Information	
Irish Grid Coordinates	53.06794 -8.03254
Elevation	67.5m
Location Description	Beside an on site canteen, placed on concrete
Road Type	Concrete Site Routes
Distance from Access Road	On Access Route
Vehicle Requirements	Large moving Van
Terrain Type	Flat Concrete
Current Land Use	Site office
Seasonal Land Use (e.g., crops)	Pig Farms (Indoors)

Communications			
Router Hardware	**Sim Card Number**	**Sim Card IP address**	**Signal Strength**
Waltz Software	No SIM card	N/A	N/A

Power Supply			
Type	**Distance From Device (Cable Length)**	**Fuel Level**	**Lifespan**
Plugged into mains	50M	NA	NA

Photos	
360° from North	Figures 1, 2, 3 & 4
Ground Conditions	Flat and Dry
Other	See notes below

Device Configuration		
Alignment	Due North	
Scan Type	FD Horizontal Wind Speed (m/s) at Scan Centre at Rm	
Max Range	Met Station is positioned on the ZX300. Clear span around field is approx. 10m	
VAD Processing	ON	OFF
Hourly Scan Home	ON	OFF
Hourly Window Wipe	**ON✓**	OFF
Auto Clean	**ON✓**	OFF
Heat up Before Start	ON	OFF
Software Version	Zephir Lidar ZP573	
Target Description	N/A	
Distance to Target	N/A	
Target Coordinates	53.06794 -8.03254	
Target Elevation	67.5m to 199m	

Settings			
Segments	**Scan file – Number of beams**	**Azimuth**	**Elevation**

Notes
ZX300 measurement heights set to: 199m ,179m, 169m, 149m, 139m, 129m, 119m, 109m, 99m, 54m, 38m
Site Description: From the ZX300 – • North – Ground remains level and includes warehouses and silos approx. 100m away • East – Ground falls for 10 m into clear fields for 200m and forestry thereafter • South – Ground remains level and leads to construction areas at low levels followed by forestry • West – Ground remains level for 10 m then a pig shed occurs of 7m height. **Note:** ZX300 is elevated off ground level so therefore a 1m offset approx. in reported height vs ground level set in software.

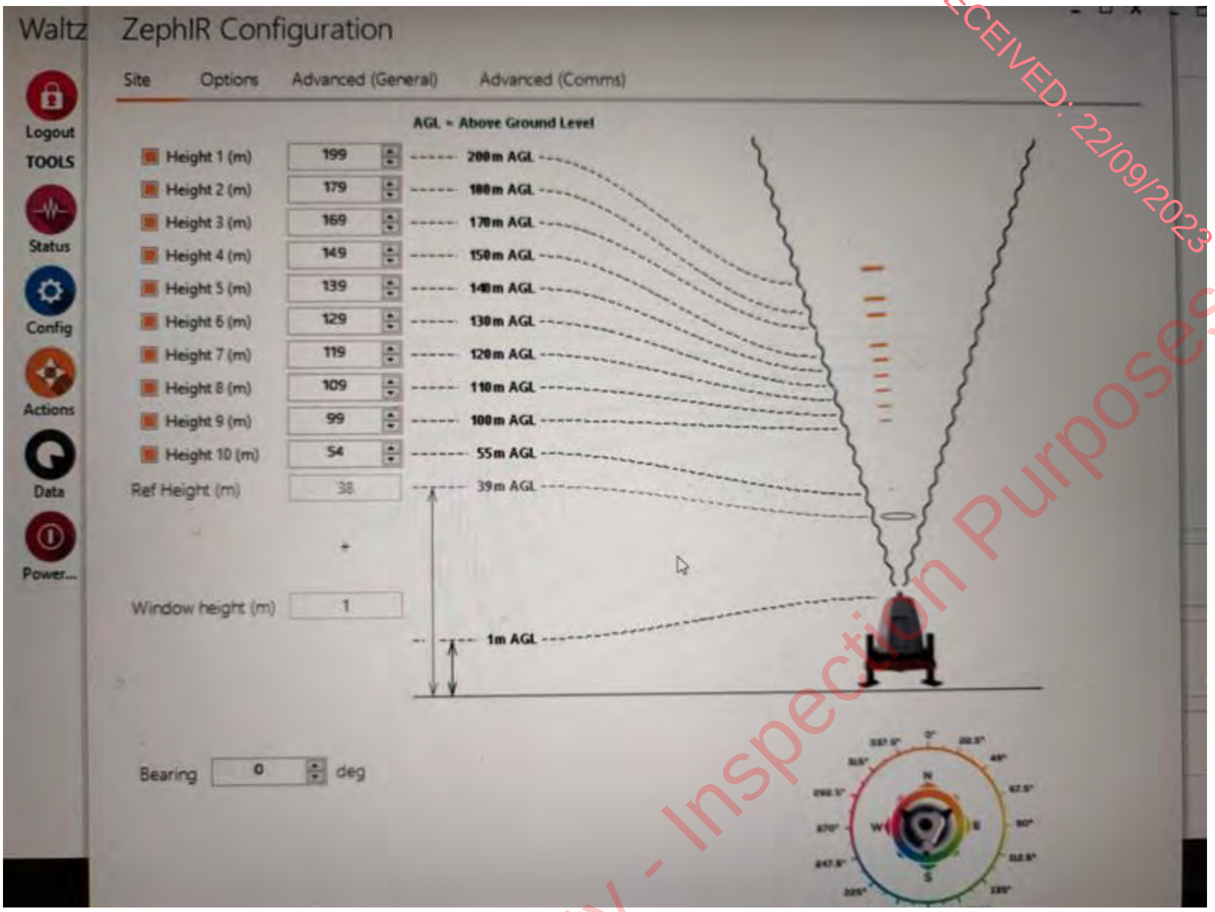
Figure 1: Unit facing North

Figure 2: Unit facing East

Figure 3: Unit facing South

Figure 4: Unit facing West

Figure 5: ZX300 Configuration



Annex 3 – Calibration/ Conformance Certificates for Sound Level Meters and Calibrator

NSAI

National Metrology Laboratory

Certificate of Calibration

Issued to	TNEI Ireland Limited Unit S12 Synergy Centre Technological University Campus Tallaght Dublin 24
Attention of	Ewan Watson

Certificate Number	221332
Item Calibrated	RION NC-74 Sound Level Calibrator
Serial Number	35173441
ID Number	None
Order Number	6
Date Received	24 Mar 2022
NML Procedure Number	AP-NM-13
Method	The above calibrator was allowed to stabilize for a suitable period in laboratory conditions. It was then calibrated by measuring the sound pressure level generated in its measuring cavity. The calibrator's operating frequency was also measured.
Calibration Standards	Norsonic 1504A Calibration System incorporating: Agilent 34401A Digital Multimeter, File No. 0736 [Cal Due: 10 Jun 2022] B & K 4134 Measuring Microphone, File No. 0744 [Cal Due: 03 Jun 2023] B & K 4228 Pistonphone, File No. 0740 [Cal Due: 04 Jun 2023]

Calibrated by	David Fleming	**Approved by**	Paul Hetherington
Date of Calibration	01 Apr 2022	**Date of Issue**	01 Apr 2022

CIPM MRA

This certificate is consistent with Calibration and Measurement Capabilities (CMC's) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures. Under the MRA, all participating institutes recognize the validity of each other's calibration certificates and measurement reports for quantities, ranges and measurement uncertainties specified in Appendix C (for details see www.bipm.org)

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Decision Rule and Compliance Statement

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(https://www.nsai.ie/images/uploads/metrology/Decision_Rule.pdf).

The symbols used to indicate the state of compliance of the instrument calibration and their meanings are given in the following table.

Statement of compliance and associated symbol	Description
PASS	The absence of a symbol indicates that the measurement result is inside the specification limit by a margin greater than its associated expanded uncertainty; the instrument meets its accuracy specification.
Conditional PASS Symbol: **£**	The measurement result is inside the specification limit by a margin less than or equal to its associated expanded measurement uncertainty; it is therefore not possible to state compliance. There is a risk that the instrument fails to meet its specification.
Conditional FAIL Symbol: **&**	The measurement result is on the specification limit or is outside the specification limit by a margin less than or equal to its associated expanded measurement uncertainty; it is therefore not possible to state non-compliance.
FAIL Symbol: **$**	The measurement result is outside the specification limit by a margin greater than its associated measurement uncertainty; the instrument fails to meet its accuracy specification.
Unc. > Spec Symbol: **#**	The expanded measurement uncertainty is greater than the instrument's accuracy specification. It is not possible to determine compliance or otherwise with the specification. The user should expand the in-use accuracy specification to make allowance for the calibration uncertainty.
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Where no specification exists, and none is prescribed by the client, the Decision Rule policy of the NSAI NML does not apply and results are provided without a statement of compliance.

NSAI
National Metrology Laboratory

Measuring Conditions:

Ambient Pressure:	(102.0 ± 0.5) kPa
Ambient Temperature:	(21.5 ± 1.0) °C
Ambient Rel. Humidity:	(32 ± 5) %RH

Results:

The measured sound pressure levels (SPL) reported below refer to the ambient laboratory conditions at the time of calibration.

Calibrator Setting	Measured Parameter	Measured Value (1)		Tolerance (3)	Meas. Uncertainty
		Before Adj.	After Adj.	(±)	(±)
94 dB	Sound Pressure Level(2)	93.95 dB	*	0.40 dB	0.15 dB
	Frequency	1001.8 Hz	*	10 Hz	0.25 Hz

Notes: (1) * indicates that no calibration adjustment was made.
(2) The measured sound pressure level was that generated in the calibrator's cavity when loaded by the microphone specified on page 1 of this certificate (including protection grid).
(3) Tolerance limits set out in IEC 60942:2003, Sound Calibrators, Class 1.

Comments:

Where used in the results table, further information on the meaning of symbols is given in the table on page 2 of this certificate.

The instrument was found to comply with the requirements of IEC 60942 (2003), Class 1, for the sound pressure level and frequency outputs measured at the time of calibration.

Note that for acoustic calibrators which meet IEC 60942 (2003), the instrument is considered out of tolerance if the measured deviation from the set level, extended by it associated uncertainty, exceeds the specified tolerance limits.

Note that the measured values refer to the ambient conditions given above.

When using the calibrator with a sound level meter any manufacturer's guidelines regarding free-field corrections should be observed.

The reported measurement results are traceable, via national standards maintained by NSAI National Metrology Laboratory (NML) or by other national metrology institutes, to internationally accepted realisations of the SI units.

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor k = 2 which, for a normal probability distribution, corresponds to a coverage probability of approximately 95%. It has been determined in accordance with the "Guide to the Expression of Uncertainty in Measurement (GUM)". These uncertainties apply only to the measured values and do not carry any implication regarding the long-term stability of the instrument.

IAC Ltd
Emerald House
11 Fitzwilliam Terrace
Strand Road, Bray
Co Wicklow A98R8X9

Sysmex Nederland B.V.
Ecustraat 11
4870 AG Etten Leur

CALIBRATION CERTIFICATE

Certificate number: 311465401983

Applicant: TENI
2nd Floor Bainbridge House 86-90 London Road
MANCHESTER M1 2PW
England

Instrument:

	Make	Type	Serial number
Sound level meter :	Rion	NL-32	00972337
Microphone :	Rion	UC-55A	316005
Preamplifier :	Rion	NH-21	25122

Calibration date: 08 Jun. 2021

Calibration method: The sound level meter with microphone and microphone preamplifier has been verified against the requirements as specified in the IEC 61672 standards (method AC10 and AC20) for the applicable class of accuracy (class 1 or class 2).
Before and after the tests the sound level meter is calibrated with an acoustic calibrator (nominal sound level 94.0 dB; frequency 1 kHz) and adjusted if necessary.

Results: The results of the verification are stated on page 2 of this certificate. The ambient temperature during the measurements was 23,0 °C ± 3 °C.

Traceability: The measurements have been executed using standards for which the traceability to (inter)national standards has been demonstrated towards the Raad voor Accreditatie.

Executed

Etten Leur, 08 Jun. 2021

Valère van Unen

V. van Unen
Product Application Specialist Calibration

 Certificate number: 311465401983

Status of the instrument				
Measurement		Upon receipt (Pass/Fail)	Adjusted (Yes/No)	After adjustment (Pass/Fail)
1*	Reading under reference conditions IEC 61672-3 (2013) 10	Fail	Yes	Pass
2	Frequency response (acoustic), C frequency weighting IEC 61672-3 (2013) 12	Pass	No	Pass
3	Supplied acoustic calibrator IEC 61672-3 (2013) 3.6	Refer to separate certificate		
4	Frequency weighting (electrical input), A, C and Lin frequency weigthing IEC 61672-3 (2013) 13	Pass	No	Pass
5	Frequency and Time weighting at 1 kHz (A, C and Lin frequencyweighting) IEC 61672-3 (2013) 14	Pass	No	Pass
6	Accuracy of the attenuator IEC 61672-3 (2013) 16, 17	Pass	No	Pass
7	Toneburst F, S, SEL and Cpeak IEC 61672-3 (2013) 18, 19	Pass	No	Pass
8	Linearity of the indicator IEC 61672-3 (2013) 16	Pass	No	Pass

Measurement uncertainty:
Measurement 1: Reading under reference conditions: ± 0.3 dB
Measurement 2: Frequency response: 125 Hz – 2 kHz: ± 0.3 dB, 8 kHz: ± 0.6 dB
Measurement 4 to 8: Electrical properties: ± 0.15 dB / 0.1 Hz

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, which provides a confidence level of approximately 95 %. The standard uncertainty has been determined in accordance with EA-4/02.

* Refer to table below for detailed results x: Not applicable

Measurement results before and after adjustment (acoustic calibration)			
Measurement		Upon receipt Deviation (dB)	After adjustment Deviation (dB)
1	Deviation of the reading under reference conditions (at 94.0 dB – 1 kHz). IEC 61672-3 (2013) 10, 15	-,- ***	0,0 **

** After verification of all properties

*** Replaced microphone, historical values are no longer traceable

NSAI
National Metrology Laboratory

Certificate of Calibration

Issued to	TNEI Group Floor 7 West One Forth Banks Newcastle Upon Tyne England
Attention of	Ewan Watson

Certificate Number	**212990**
Item Calibrated	Rion NL-31 Sound Level Meter, complete with Rion UC53A Microphone
Serial Numbers	01273102 (Sound Level Meter) and 313359 (Microphone)
ID Number	SLM014
Order Number	1696
Date Received	20 Jul 2021
NML Procedure Number	AP-NM-09
Method	The above sound level meter was allowed to stabilise for a suitable period in laboratory conditions. It was then calibrated by carrying out the verification tests detailed in IEC 61672-3 (2006), *Periodic tests, specification for the verification of sound level meters*. This standard specifies a procedure for the periodic verification of conformance of a sound level meter or integrating-averaging meter to IEC 61672-1 (2003).
Calibration Standards	Norsonic 1504A Calibration System incorporating: SR DS360 Signal Generator, No. 0735 [Cal Due Date: 10 Jun 2022] Agilent 34401A Digital Multimeter, No. 0736 [Cal Due Date: 10 Jun 2022] B&K 4134 Measuring Microphone, No. 0743 [Cal Due Date: 27 May 2022] B&K 4228 Pistonphone, No. 0741 [Cal Due Date: 26 May 2022] B&K 4226 Acoustical Calibrator, No. 0150 [Cal Due Date: 02 Sep 2021]

Calibrated by	David Fleming	Approved by	Paul Hetherington
Date of Calibration	04 Aug 2021	Date of Issue	04 Aug 2021

CIPM MRA

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(https://www.nsai.ie/images/uploads/metrology/Decision_Rule.pdf).

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Outside CIPM MRA Symbol: ¢	Indicates that the calibration result is traceable to SI units but is not currently included in the table of NSAI NML's calibration and measurement capabilities approved under the CIPM MRA.

Where no specification exists, and none is prescribed by the client, the Decision Rule policy of the NSAI NML does not apply and results are provided without a statement of compliance.

Ambient laboratory conditions:

Barometric Pressure:	100.7 kPa ± 0.5 kPa
Temperature:	21.8 °C ± 1 °C
Relative Humidity:	52 %RH ± 5%RH

Summary of Results:

The following table summarises the results of the verification tests. The detailed results are given in the subsequent tables.

IEC 61672 Test	Test Title	Status
10	Self-generated Noise (Electrical)	/
11	Acoustical Signal	PASS
12	Frequency Weighting	PASS
13	Frequency and Time Weighting @ 1 kHz	PASS
14	Level Linearity Test on Reference Level Range	PASS
15	Level Linearity including Range Control	PASS
16	Toneburst Response	PASS
17	Peak C	PASS
18	Overload Indication	PASS

Detailed Results.

Prior to carrying out the verification tests the sound level meter was adjusted to read correctly for pressure response through application of a reference acoustical calibrator.

Self-generated Noise Test (Electrical Input) (Test #10) (1)

Range: 20 - 80 dB
Mode: Leq

SLM Configuration	Freq. Weighting Network	SLM Reading(2)
Microphone installed	A	19.8 dB
Microphone replaced by electrical signal device and Fitted with a short-circuit	A	17.4 (U/R)(3)
	C	25.1
	Z (Linear)	31.1

Acoustical signal test of a frequency weighting (Test #11) (1)

Range: 20 - 110 dB
Frequency Weighting setting: C
Time Weighting response: Slow

Input Level(4)	Input Freq.	SLM Error of Indication(5)	Tolerance(6) (±)	Uncertainty of Measurement (±)
94.0 dB	1000 Hz	0.0 dB (Ref)	1.1 dB	0.3 dB
	125	+0.1	1.5	0.3
	4000(7)	+0.3	1.6	0.5

Electrical signal tests of frequency weightings (Test #12) [1]

Range: 20 - 110 dB

Freq. (nominal)	Input Level[4]	SLM Reading	SLM Error of Indication[5]	Tolerance[6] (±)	Uncertainty of Measurement (±)
		A-Weighting			
63 Hz	93 dB	92.8 dB	-0.2 dB	1.5 dB	0.20 dB
125	93	92.8	-0.2	1.5	0.20
250	93	92.8	-0.2	1.4	0.20
500	93	92.9	-0.1	1.4	0.20
1000	93	93.0	0.0	1.1	0.20
2000	93	93.0	0.0	1.6	0.20
4000	93	93.1	+0.1	1.6	0.20
8000	93	93.0	0.0	2.1, -3.1	0.20
16000	93	93.1	+0.1	3.5, -17	0.20
		C-Weighting			
63 Hz	93 dB	92.9 dB	-0.1 dB	1.5 dB	0.20 dB
125	93	93.1	+0.1	1.5	0.20
250	93	93.1	+0.1	1.4	0.20
500	93	93.1	+0.1	1.4	0.20
1000	93	93.2	+0.2	1.1	0.20
2000	93	93.2	+0.2	1.6	0.20
4000	93	93.3	+0.3	1.6	0.20
8000	93	93.2	+0.2	2.1, -3.1	0.20
16000	93	93.4	+0.4	3.5, -17	0.20
		LIN Weighting			
63 Hz	93 dB	93.1 dB	+0.1 dB	1.5 dB	0.20 dB
125	93	93.1	+0.1	1.5	0.20
250	93	93.1	+0.1	1.4	0.20
500	93	93.2	+0.2	1.4	0.20
1000	93	93.3	+0.3	1.1	0.20
2000	93	93.3	+0.3	1.6	0.20
4000	93	93.4	+0.4	1.6	0.20
8000	93	93.2	+0.2	2.1, -3.1	0.20
16000	93	92.7	-0.3	3.5, -17	0.20

Frequency and time weightings at 1 kHz (Test #13) [1]

Range: 30 - 120 dB

Time Weighting Setting	Frequency Weighting Setting	Input Level[4]	Deviation from Reference	Tolerance[6] (±)	Uncertainty. of Measurement (±)
Fast	A	94.0 dB	0.0 dB	0.4 dB	0.20 dB
	C		+0.1	0.4	0.20
	Z		+0.2	0.4	0.20
Slow	A	94.0 dB	-0.1 dB	0.3 dB	0.20 dB
Leq.	A	94.0 dB	0.0 dB	0.3 dB	0.20 dB
SEL	A	114.0 dB	0.0 dB	0.3 dB	0.20 dB

Linearity level on the reference range (Test #14)[1]

Range: 40 to 130 dB
Input Frequency: 1 kHz
SLM Measuring Mode: SPL

Range	Input Level[4]	SLM Reading	SLM Error of Indication[5]	Tolerance[6] (±)	Uncertainty of Measurement (±)
130 dB	94 dB	94.0 dB	0.0 dB	1.1 dB	0.20 dB
	99	99.0	0.0	1.1	0.20
	104	103.9	-0.1	1.1	0.20
	109	108.9	-0.1	1.1	0.20
	114	113.9	-0.1	1.1	0.20
	119	118.9	-0.1	1.1	0.20
	124	123.9	-0.1	1.1	0.20
	129	128.9	-0.1	1.1	0.20
	132	131.9	-0.1	1.1	0.20
	133	132.9	-0.1	1.1	0.20
	134	133.9	-0.1	1.1	0.20
	135	134.9	-0.1	1.1	0.20
	136	135.9	-0.1	1.1	0.20
	94	94.0	0.0	1.1	0.20
	89	88.9	-0.1	1.1	0.20
	84	83.9	-0.1	1.1	0.20
	79	78.9	-0.1	1.1	0.20
	74	73.9	-0.1	1.1	0.20
	69	68.9	-0.1	1.1	0.20
	64	63.9	-0.1	1.1	0.20
	59	58.9	-0.1	1.1	0.21
	54	53.9	-0.1	1.1	0.21
	49	48.9	-0.1	1.1	0.21
	44	43.9	-0.1	1.1	0.21

Level Linearity including Range Control (Test #15)[1]

Input Frequency: 1 kHz
SLM Measuring Mode: SPL

Range	Input Level[3]	SLM Reading	SLM Error of Indication[5]	Tolerance[6] (±)	Uncertainty of Measurement (±)
130 dB	94.0 dB	94.0 dB	0.0 dB	1.1 dB	0.20 dB
	125.0	125.0	0.0	1.1	0.20
120 dB	94.0 dB	94.0 dB	0.0 dB	1.1 dB	0.20 dB
	115.0	115.0	0.0	1.1	0.20
110 dB	94.0 dB	94.0 dB	0.0 dB	1.1 dB	0.20 dB
	105.0	105.0	0.0	1.1	0.20
100 dB	94.0 dB	94.0 dB	0.0 dB	1.1 dB	0.20 dB
	95.0	95.1	+0.1	1.1	0.20
90 dB	85.0 dB	84.9 dB	-0.1 dB	1.1 dB	0.20 dB
80 dB	75.0 dB	74.9 dB	-0.1 dB	1.1 dB	0.20 dB

Toneburst response (Test #16)[1]

Range: 40 to 130 dB

Burst Type	SLM Mode	Input Level[4]	SLM Error of Indication[5]	Tolerance[6] (±)	Uncertainty of Measurement (±)
200 ms	LAF	116.0 dB	0.0 dB	0.8 dB	0.3 dB
2.0 ms	LAF	99.0	0.0	1.3	0.3
0.25 msec	LAF	90.0	-0.1	1.3, -3.3	0.3
200 ms	LAS	109.6 dB	-0.1 dB	0.8 dB	0.3 dB
2.0 ms	LAS	90.0	-0.1	1.3, -1.8	0.3
200 ms	SEL	110.0 dB	0.0 dB	0.8 dB	0.3 dB
2 .0 ms	SEL	90.3	0.0	1.3	0.3
0.25 ms	SEL	81.0	-0.1	1.3, -3.3	0.3

Peak C sound level (Test #17)[1]

Range: 40 to 130 dB

Pulse Type	Pulse Frequency	Input Level[4] (peak value)	SLM Error of Indication[5]	Tolerance[6] (±)	Uncertainty of Measurement (±)
1 cycle	8 kHz	133.4 dB	-0.2 dB	2.4 dB	0.35 dB
Pos. ½ cycle	500 Hz	132.4 dB	-0.4 dB	1.4 dB	0.35 dB
Neg. ½ cycle	500 Hz	132.4 dB	-0.4 dB	1.4 dB	0.35 dB

Overload indication (Test #18)[1]

Range: 40 to 130 dB
SLM Measuring Mode: LAEq

Test description	Overload occurred at (±)	Meas. Diff. (Pos – Neg)	Tolerance[6] (±)	Uncertainty of Measurement (±)
Positive ½ cycle at 4 kHz	139.3 dB	-	-	-
Negative ½ cycle at 4 kHz	139.2 dB	-	-	-
Level difference of positive & negative pulses	-	0.1 dB	1.8 dB	0.30 dB

Notes:

(1) The test number, given in parentheses after the section heading, refers to the relevant clause in IEC 61672-3 (2006).

(2) SLM denotes Sound Level Meter

(3) U/R denotes Under Range

(4) All input levels are given in dB relative to a 20 µPa reference level.

(5) The SLM Error of Indication is defined as follows:
SLM Error of Indication = SLM Reading - Input Level

(6) The figures in the column labelled 'Tolerance' are the acceptance limits given in IEC 61672-1(2003). These tolerance limits include an allowance for the maximum expanded uncertainty of the test laboratory. The criteria for compliance with the tolerance is that the measurement result, extended by its associated uncertainty, lies within the specified limits.

(7) Microphone response at 4 kHz was measured using an electrostatic actuator. A Free Field correction of +1.2 dB was applied to the measured actuator response.
This measurement is not included in NML's tables of Calibration and Measurement Capabilities, approved under the CIPM MRA.
For information, the measured sensitivity and frequency response of the microphone is given in an addendum to this certificate.

Comments:

Where used in the results table, further information on the meaning of symbols is given in the table on page 2 of this certificate.

The instrument was found to meet the requirements of IEC 61672-1 (2003) in accordance with the verification procedures set out in IEC 61672-3 (2006) at the time of calibration.

The reported measurement results are traceable, via national standards maintained by NSAI National Metrology Laboratory (NML) or by other national metrology institutes, to internationally accepted realisations of the SI units.

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ which, for a normal probability distribution, corresponds to a coverage probability of approximately 95%. It has been determined in accordance with the "Guide to the Expression of Uncertainty in Measurement (GUM)". These uncertainties apply only to the measured values and do not carry any implication regarding the long-term stability of the instrument.

NSAI
National Metrology Laboratory

Addendum to Certificate 212990

Rion
Type: UC53A

Serial no: 313359

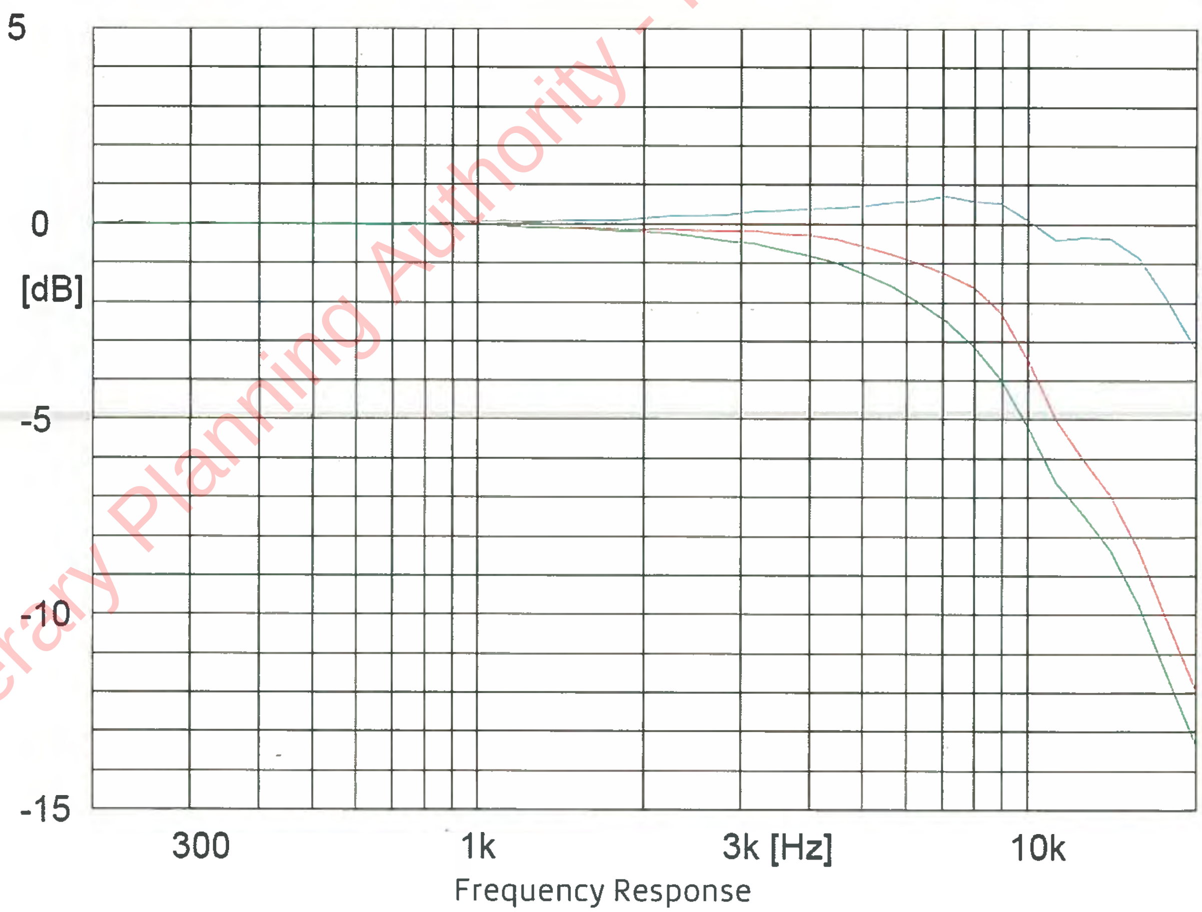
Sensitivity: 43.0 mV/Pa
-27.3 ±0.10 dB re. 1 V/Pa

Date: 03/08/2021

Measurement conditions:	
Polarisation voltage:	0.0 V
Pressure:	100.82 ±0.02 kPa
Temperature:	22.1 ±1.0 °C
Relative humidity:	50.7 ±2.6 %RH

Results are normalized to the reference conditions.

Free field response
Diffuse field response
Pressure (Actuator) response



MEASUREMENT SYSTEMS

CERTIFICATE OF CONFORMANCE

Date of Issue	**26 July 2022**
Customer	**TNEI Services Ltd**
Certificate Number	**CONF072211**

	Manufacturer	Type	Serial Number
Sound Level Meter	Rion	NL-52	00520923
Preamplifier	Rion	NH-25	11770
Microphone	Rion	UC-59	21320

This is to certify that the instrument was tested and calibrated at the Manufacturer's factory according to their specification and that the product satisfied all the relevant requirements of the following Standards:

IEC 61672-1:2013 Class 1.

The instrument also received a functional check by ANV Measurement Systems prior to despatch in the UK, in accordance with our standard procedures.

Signed.. Position. Calibration Technician Date. 26 July 2022

B. Bogdan

MEASUREMENT SYSTEMS

CERTIFICATE OF CONFORMANCE

Date of Issue	**26 July 2022**
Customer	**TNEI Services Ltd**
Certificate Number	**CONF072209**

	Manufacturer	Type	Serial Number
Sound Level Meter	Rion	NL-52	00520921
Preamplifier	Rion	NH-25	11768
Microphone	Rion	UC-59	21318

This is to certify that the instrument was tested and calibrated at the Manufacturer's factory according to their specification and that the product satisfied all the relevant requirements of the following Standards:

IEC 61672-1:2013 Class 1.

The instrument also received a functional check by ANV Measurement Systems prior to despatch in the UK, in accordance with our standard procedures.

Signed.................................... Position. Calibration Technician Date. 26 July 2022

B. Bogdan

BEAUFORT COURT, 17 ROEBUCK WAY, MILTON KEYNES, MK5 8HL
☎ 01908 642846 🖷 01908 642814
✉ info@noise-and-vibration.co.uk 💻 www.noise-and-vibration.co.uk

ACOUSTICS NOISE AND VIBRATION LIMITED. REGISTERED IN ENGLAND NO. 3549028. REGISTERED OFFICE AS ABOVE.

NSAI

National Metrology Laboratory

Certificate of Calibration

Issued to	TNEI Ireland Limited Unit S12 Synergy Centre Technological University Dublin Campus Tallaght Dublin D24 A386
Attention of	Ewan Watson

Certificate Number	**214283**
Item Calibrated	Rion NL-32 Sound Level Meter, complete with Rion UC53A Microphone
Serial Numbers	00703296 (Sound Level Meter) and 617048 (Microphone)
ID Number	SLM025
Order Number	3
Date Received	18 Oct 2021
NML Procedure Number	AP-NM-09
Method	The above sound level meter was allowed to stabilise for a suitable period in laboratory conditions. It was then calibrated by carrying out the verification tests detailed in IEC 61672-3 (2006), *Periodic tests, specification for the verification of sound level meters*. This standard specifies a procedure for the periodic verification of conformance of a sound level meter or integrating-averaging meter to IEC 61672-1 (2003).
Calibration Standards	Norsonic 1504A Calibration System incorporating: SR DS360 Signal Generator, No. 0735 [Cal Due Date: 10 Jun 2022] Agilent 34401A Digital Multimeter, No. 0736 [Cal Due Date: 10 Jun 2022] B&K 4134 Measuring Microphone, No. 0744 [Cal Due Date: 03 Jun 2023] B&K 4228 Pistonphone, No. 0740 [Cal Due Date: 04 Jun 2023] B&K 4226 Acoustical Calibrator, No. 0150 [Cal Due Date: 07 Oct 2022]

Calibrated by	David Fleming	**Approved by**	Paul Hetherington
Date of Calibration	15 Nov 2021	**Date of Issue**	15 Nov 2021

CIPM MRA

This certificate is consistent with Calibration and Measurement Capabilities (CMC's) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures. Under the MRA, all participating institutes recognize the validity of each other's calibration certificates and measurement reports for quantities, ranges and measurement uncertainties specified in Appendix C (for details see www.bipm.org)

Standard Terms & Conditions for Calibration, Testing and Consultancy Assignments

1. Reports issued by the National Metrology Laboratory Division of NSAI are copyright to NSAI and shall not be used, either in whole or in part, for the purposes of advertising, publicity or litigation without the written consent of the Chief Executive or his nominee.
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4. This certificate relates only to the item(s) described on the front page and shall not be reproduced, except in full.
5. This contract is governed by the laws of Ireland whose courts shall have exclusive jurisdiction.

Decision Rule and Compliance Statement

The rule that describes how measurement uncertainty is accounted for when stating conformity with a specified requirement is known as a decision rule. The rule used by NSAI NML follows the guidelines set out in the document ILAC-G8:09/2019 published by the International Laboratory Accreditation Co-operation. Further information on the decision rule is available on the NSAI website:
(https://www.nsai.ie/images/uploads/metrology/Decision_Rule.pdf).

The symbols used to indicate the state of compliance of the instrument calibration and their meanings are given in the following table.

Statement of compliance and associated symbol	Description
PASS	The absence of a symbol indicates that the measurement result is inside the specification limit by a margin greater than its associated expanded uncertainty; the instrument meets its accuracy specification.
Conditional PASS Symbol: £	The measurement result is inside the specification limit by a margin less than or equal to its associated expanded measurement uncertainty; it is therefore not possible to state compliance. There is a risk that the instrument fails to meet its specification.
Conditional FAIL Symbol: &	The measurement result is on the specification limit or is outside the specification limit by a margin less than or equal to its associated expanded measurement uncertainty; it is therefore not possible to state non-compliance.
FAIL Symbol: $	The measurement result is outside the specification limit by a margin greater than its associated measurement uncertainty; the instrument fails to meet its accuracy specification.
Unc. > Spec Symbol: #	The expanded measurement uncertainty is greater than the instrument's accuracy specification. It is not possible to determine compliance or otherwise with the specification. The user should expand the in-use accuracy specification to make allowance for the calibration uncertainty.
Outside CIPM MRA Symbol: ¢	Indicates that the calibration result is traceable to SI units but is not currently included in the table of NSAI NML's calibration and measurement capabilities approved under the CIPM MRA.

Where no specification exists, and none is prescribed by the client, the Decision Rule policy of the NSAI NML does not apply and results are provided without a statement of compliance.

Ambient laboratory conditions:

Barometric Pressure:	102.3 kPa ± 0.5 kPa
Temperature:	21.4 °C ± 1 °C
Relative Humidity:	48 %RH ± 5%RH

Summary of Results:

The following table summarises the results of the verification tests. The detailed results are given in the subsequent tables.

IEC 61672 Test	Test Title	Status
10	Self-generated Noise (Electrical)	/
11	Acoustical Signal	PASS
12	Frequency Weighting	PASS
13	Frequency and Time Weighting @ 1 kHz	PASS
14	Level Linearity Test on Reference Level Range	PASS
15	Level Linearity including Range Control	PASS
16	Toneburst Response	PASS
17	Peak C	PASS
18	Overload Indication	PASS

Detailed Results.

Prior to carrying out the verification tests the sound level meter was adjusted to read correctly for pressure response through application of a reference acoustical calibrator.

Self-generated Noise Test (Electrical Input) (Test #10) [1]

Range: 20 - 80 dB
Mode: Leq

SLM Configuration	Freq. Weighting Network	SLM Reading[2]
Microphone installed	A	19.5 dB (U/R)[3]
Microphone replaced by electrical signal device and Fitted with a short-circuit	A	17.1 (U/R)[3]
	C	21.1
	Z (Linear)	24.7

Acoustical signal test of a frequency weighting (Test #11) [1]

Range: 20 - 110 dB
Frequency Weighting setting: C
Time Weighting response: Slow

Input Level[4]	Input Freq.	SLM Error of Indication[5]	Tolerance[6] (±)	Uncertainty of Measurement (±)
94.0 dB	1000 Hz	0.0 dB (Ref)	1.1 dB	0.3 dB
	125	+0.2	1.5	0.3
	4000[7]	+0.1	1.6	0.5

Electrical signal tests of frequency weightings (Test #12) [1]

Range: 20 - 110 dB

Freq. (nominal)	Input Level[4]	SLM Reading	SLM Error of Indication[5]	Tolerance[6] (±)	Uncertainty of Measurement (±)
A-Weighting					
63 Hz	93 dB	92.7 dB	-0.3 dB	1.5 dB	0.20 dB
125	93	92.8	-0.2	1.5	0.20
250	93	92.8	-0.2	1.4	0.20
500	93	92.9	-0.1	1.4	0.20
1000	93	93.0	0.0	1.1	0.20
2000	93	93.0	0.0	1.6	0.20
4000	93	93.1	+0.1	1.6	0.20
8000	93	93.1	+0.1	2.1, -3.1	0.20
16000	93	93.3	+0.3	3.5, -17	0.20
C-Weighting					
63 Hz	93 dB	93.0 dB	0.0 dB	1.5 dB	0.20 dB
125	93	93.0	0.0	1.5	0.20
250	93	92.9	-0.1	1.4	0.20
500	93	93.0	0.0	1.4	0.20
1000	93	93.0	0.0	1.1	0.20
2000	93	93.1	+0.1	1.6	0.20
4000	93	93.1	+0.1	1.6	0.20
8000	93	93.1	+0.1	2.1, -3.1	0.20
16000	93	93.3	+0.3	3.5, -17	0.20
LIN Weighting					
63 Hz	93 dB	92.8 dB	-0.2 dB	1.5 dB	0.20 dB
125	93	92.8	-0.2	1.5	0.20
250	93	92.9	-0.1	1.4	0.20
500	93	92.9	-0.1	1.4	0.20
1000	93	93.0	0.0	1.1	0.20
2000	93	93.1	+0.1	1.6	0.20
4000	93	93.2	+0.2	1.6	0.20
8000	93	93.0	0.0	2.1, -3.1	0.20
16000	93	92.6	-0.4	3.5, -17	0.20

Frequency and time weightings at 1 kHz (Test #13) [1]

Range: 30 - 120 dB

Time Weighting Setting	Frequency Weighting Setting	Input Level[4]	Deviation from Reference	Tolerance[6] (±)	Uncertainty of Measurement (±)
Fast	A	94.0 dB	0.0 dB	0.4 dB	0.20 dB
	C		+0.1	0.4	0.20
	Z		0.0	0.4	0.20
Slow	A	94.0 dB	-0.1 dB	0.3 dB	0.20 dB
Leq.	A	94.0 dB	0.0 dB	0.3 dB	0.20 dB
SEL	A	114.0 dB	0.0 dB	0.3 dB	0.20 dB

Linearity level on the reference range (Test #14) [1]

Range: 40 to 130 dB
Input Frequency: 1 kHz
SLM Measuring Mode: SPL

Range	Input Level[4]	SLM Reading	SLM Error of Indication[5]	Tolerance[6] (±)	Uncertainty of Measurement (±)
130 dB	94 dB	94.0 dB	0.0 dB	1.1 dB	0.20 dB
	99	99.0	0.0	1.1	0.20
	104	104.0	0.0	1.1	0.20
	109	109.0	0.0	1.1	0.20
	114	113.9	-0.1	1.1	0.20
	119	118.9	-0.1	1.1	0.20
	124	123.9	-0.1	1.1	0.20
	129	129.0	0.0	1.1	0.20
	132	132.0	0.0	1.1	0.20
	133	133.0	0.0	1.1	0.20
	134	134.0	0.0	1.1	0.20
	135	135.0	0.0	1.1	0.20
	136	136.0	0.0	1.1	0.20
	94	94.0	0.0	1.1	0.20
	89	89.0	0.0	1.1	0.20
	84	84.0	0.0	1.1	0.20
	79	79.0	0.0	1.1	0.20
	74	74.0	0.0	1.1	0.20
	69	69.0	0.0	1.1	0.20
	64	64.0	0.0	1.1	0.20
	59	59.0	0.0	1.1	0.21
	54	54.0	0.0	1.1	0.21
	49	49.0	0.0	1.1	0.21
	44	44.0	0.0	1.1	0.21

Level Linearity including Range Control (Test #15) [1]

Input Frequency: 1 kHz
SLM Measuring Mode: SPL

Range	Input Level[3]	SLM Reading	SLM Error of Indication[5]	Tolerance[6] (±)	Uncertainty of Measurement (±)
130 dB	94.0 dB	94.0 dB	0.0 dB	1.1 dB	0.20 dB
	125.0	125.0	0.0	1.1	0.20
120 dB	94.0 dB	93.9 dB	-0.1 dB	1.1 dB	0.20 dB
	115.0	115.0	0.0	1.1	0.20
110 dB	94.0 dB	94.0 dB	0.0 dB	1.1 dB	0.20 dB
	105.0	105.0	0.0	1.1	0.20
100 dB	94.0 dB	94.0 dB	0.0 dB	1.1 dB	0.20 dB
	95.0	95.0	0.0	1.1	0.20
90 dB	85.0 dB	85.0 dB	0.0 dB	1.1 dB	0.20 dB
80 dB	75.0 dB	75.0 dB	0.0 dB	1.1 dB	0.20 dB

Toneburst response (Test #16)(1)

Range: 40 to 130 dB

Burst Type	SLM Mode	Input Level(4)	SLM Error of Indication(5)	Tolerance(6) (±)	Uncertainty of Measurement (±)
200 ms	LAF	135.0 dB	0.0 dB	0.8 dB	0.3 dB
2.0 ms	LAF	118.0	-0.1	1.3	0.3
0.25 msec	LAF	109.0	-0.2	1.3, -3.3	0.3
200 ms	LAS	128.6 dB	-0.1 dB	0.8 dB	0.3 dB
2.0 ms	LAS	109.0	-0.1	1.3, -1.8	0.3
200 ms	SEL	129.0 dB	0.0 dB	0.8 dB	0.3 dB
2 .0 ms	SEL	109.3	0.0	1.3	0.3
0.25 ms	SEL	100.0	-0.2	1.3, -3.3	0.3

Peak C sound level (Test #17)(1)

Range: 40 to 130 dB

Pulse Type	Pulse Frequency	Input Level(4) (peak value)	SLM Error of Indication(5)	Tolerance(6) (±)	Uncertainty of Measurement (±)
1 cycle	8 kHz	130.4 dB	-0.8 dB	2.4 dB	0.35 dB
Pos. ½ cycle	500 Hz	132.4 dB	-0.5 dB	1.4 dB	0.35 dB
Neg. ½ cycle	500 Hz	132.4 dB	-0.4 dB	1.4 dB	0.35 dB

Overload indication (Test #18)(1)

Range: 40 to 130 dB
SLM Measuring Mode: LAEq

Test description	Overload occurred at (±)	Meas. Diff. (Pos – Neg)	Tolerance(6) (±)	Uncertainty of Measurement (±)
Positive ½ cycle at 4 kHz	139.4 dB	-	-	-
Negative ½ cycle at 4 kHz	139.1 dB	-	-	-
Level difference of positive & negative pulses	-	0.3 dB	1.8 dB	0.30 dB

Notes:

(1) The test number, given in parentheses after the section heading, refers to the relevant clause in IEC 61672-3 (2006).

(2) SLM denotes Sound Level Meter

(3) U/R denotes Under Range

(4) All input levels are given in dB relative to a 20 µPa reference level.

(5) The SLM Error of Indication is defined as follows:
SLM Error of Indication = SLM Reading - Input Level

(6) The figures in the column labelled 'Tolerance' are the acceptance limits given in IEC 61672-1(2003). These tolerance limits include an allowance for the maximum expanded uncertainty of the test laboratory. The criteria for compliance with the tolerance is that the measurement result, extended by its associated uncertainty, lies within the specified limits.

(7) Microphone response at 4 kHz was measured using an electrostatic actuator. A Free Field correction of +1.2 dB was applied to the measured actuator response.
This measurement is not included in NML's tables of Calibration and Measurement Capabilities, approved under the CIPM MRA.
For information, the measured sensitivity and frequency response of the microphone is given in an addendum to this certificate.

Comments:

Where used in the results table, further information on the meaning of symbols is given in the table on page 2 of this certificate.

The instrument was found to meet the requirements of IEC 61672-1 (2003) in accordance with the verification procedures set out in IEC 61672-3 (2006) at the time of calibration.

The reported measurement results are traceable, via national standards maintained by NSAI National Metrology Laboratory (NML) or by other national metrology institutes, to internationally accepted realisations of the SI units.

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ which, for a normal probability distribution, corresponds to a coverage probability of approximately 95%. It has been determined in accordance with the "Guide to the Expression of Uncertainty in Measurement (GUM)". These uncertainties apply only to the measured values and do not carry any implication regarding the long-term stability of the instrument.

NSAI
National Metrology Laboratory

Addendum to Certificate 214283

Rion
Type: UC53A

Serial no: 617048

Sensitivity: 41.4 mV/Pa
-27.7 ±0.01 dB re. 1 V/Pa

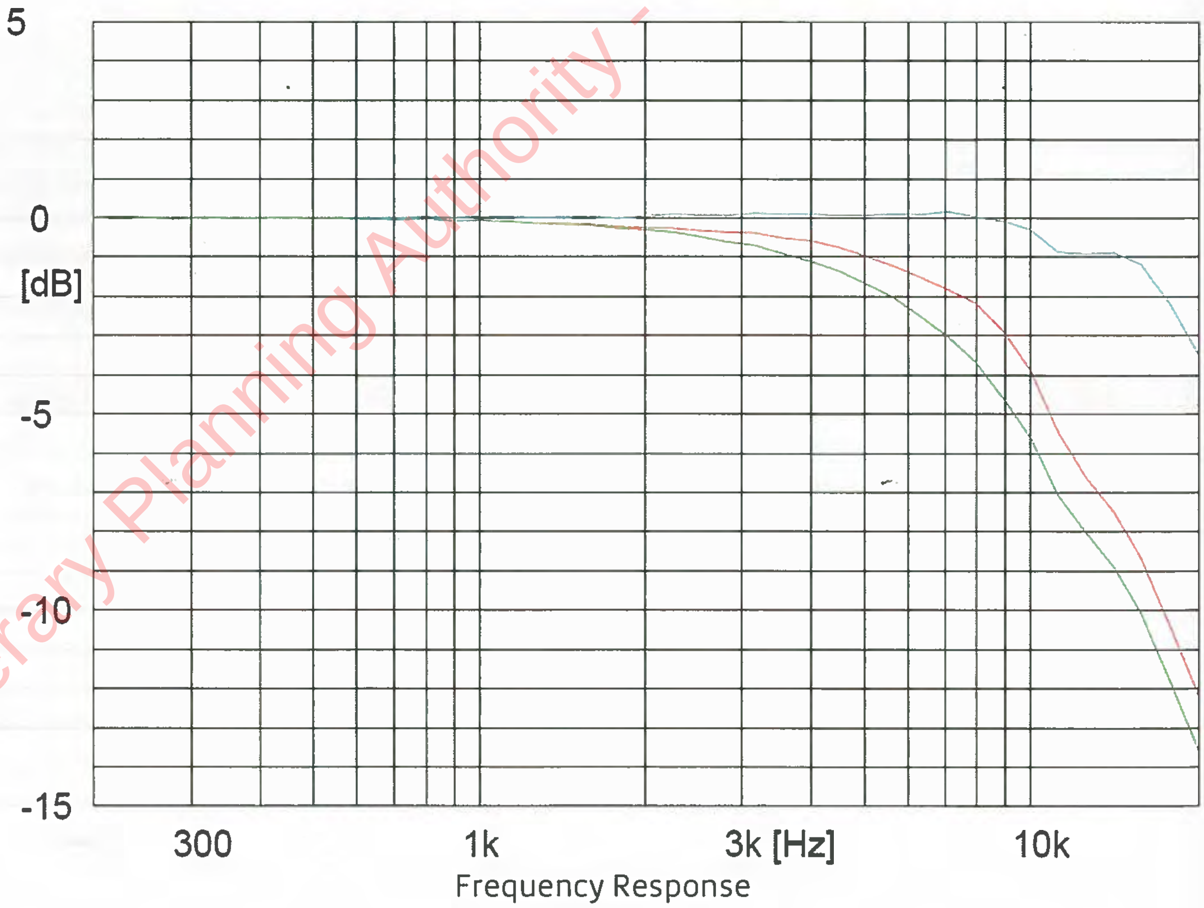
Date: 15/11/2021

Measurement conditions:

Polarisation voltage:	0.0 V
Pressure:	102.28 ±0.01 kPa
Temperature:	21.2 ±1.0 °C
Relative humidity:	48.2 ±2.1 %RH

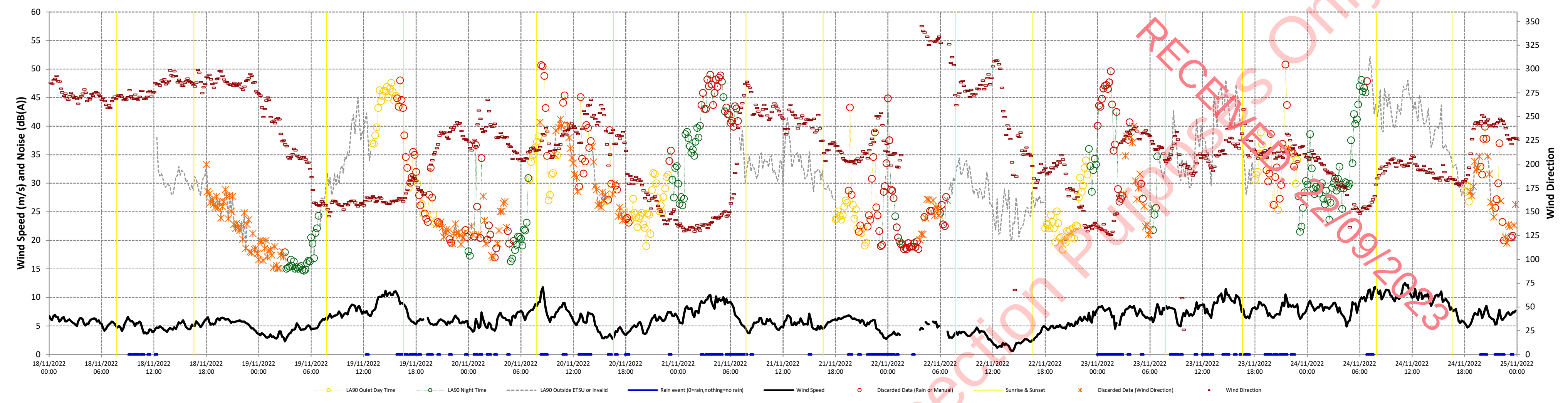
Results are normalized to the reference conditions.

Free field response
Diffuse field response
Pressure (Actuator) response

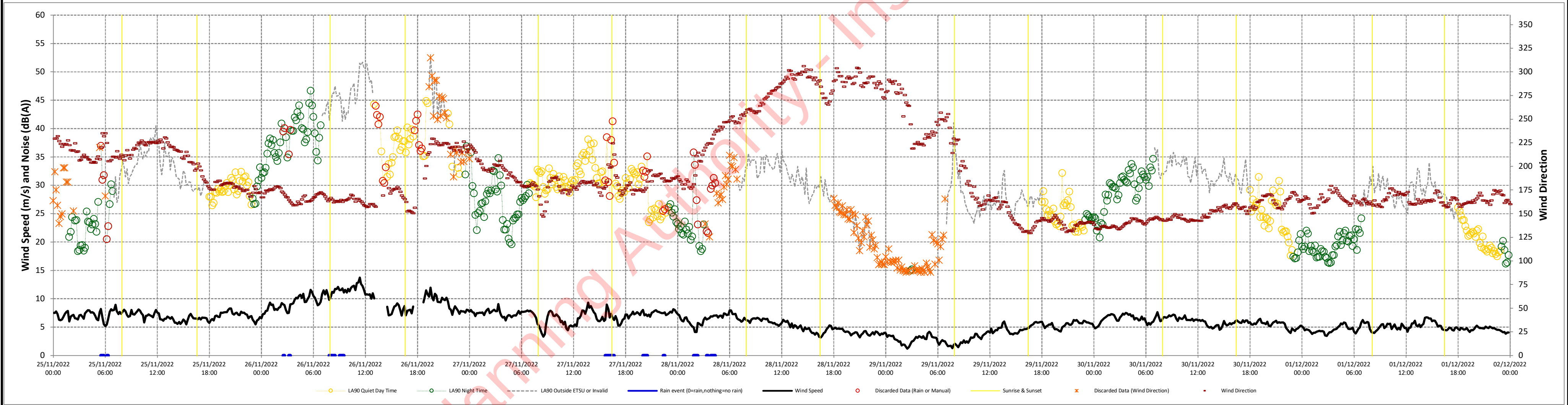


Annex 4 – Time Series Graphs

18/11/2022 to 25/11/2022



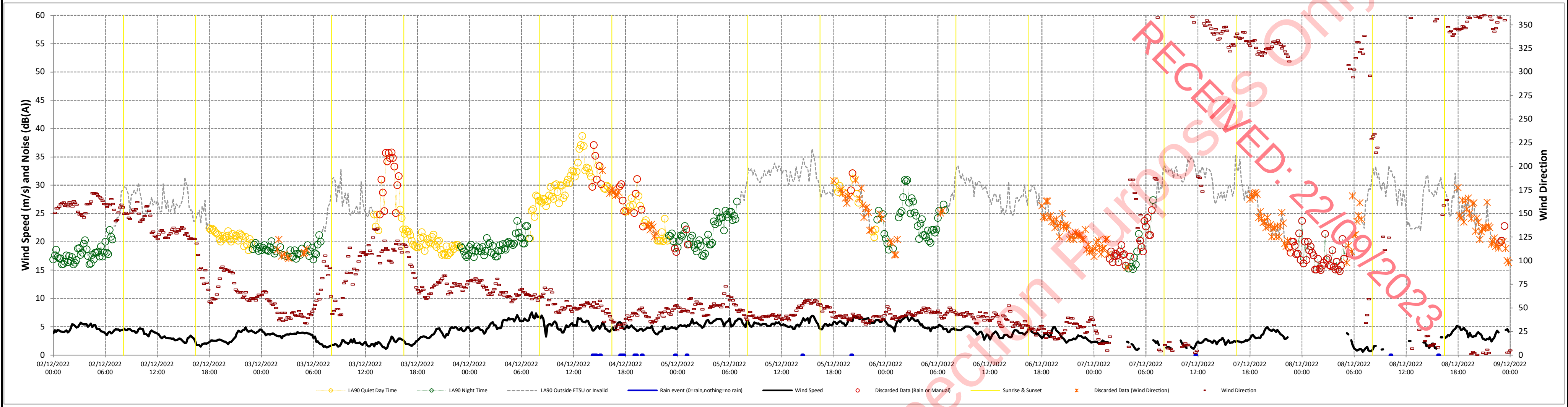
25/11/2022 to 02/12/2022



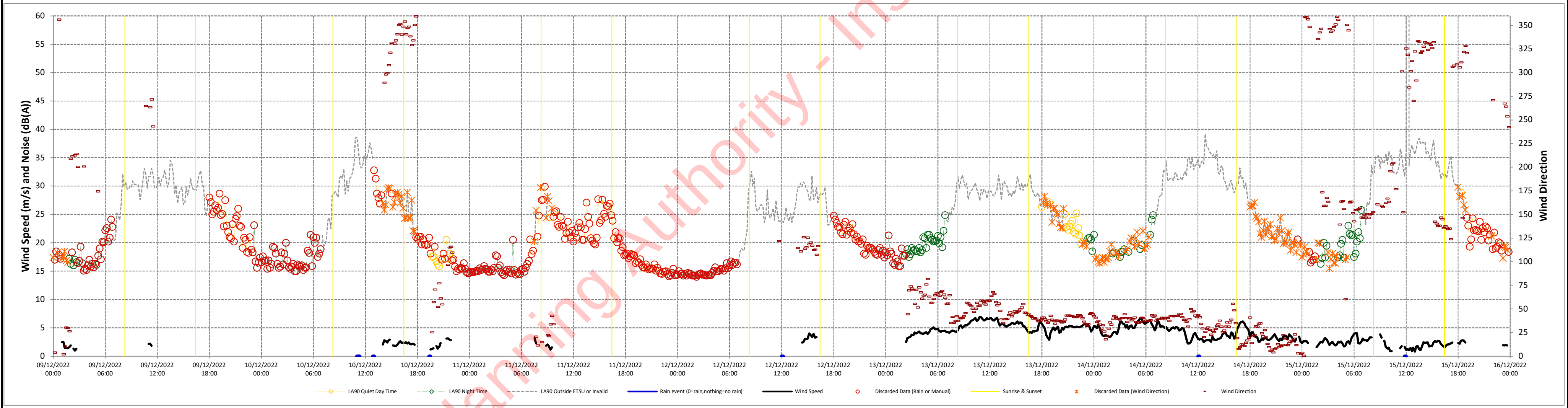
Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1a-NML01 Time Series Page 1 of 5
Date	12/07/2023

tnei

02/12/2022 to 09/12/2022



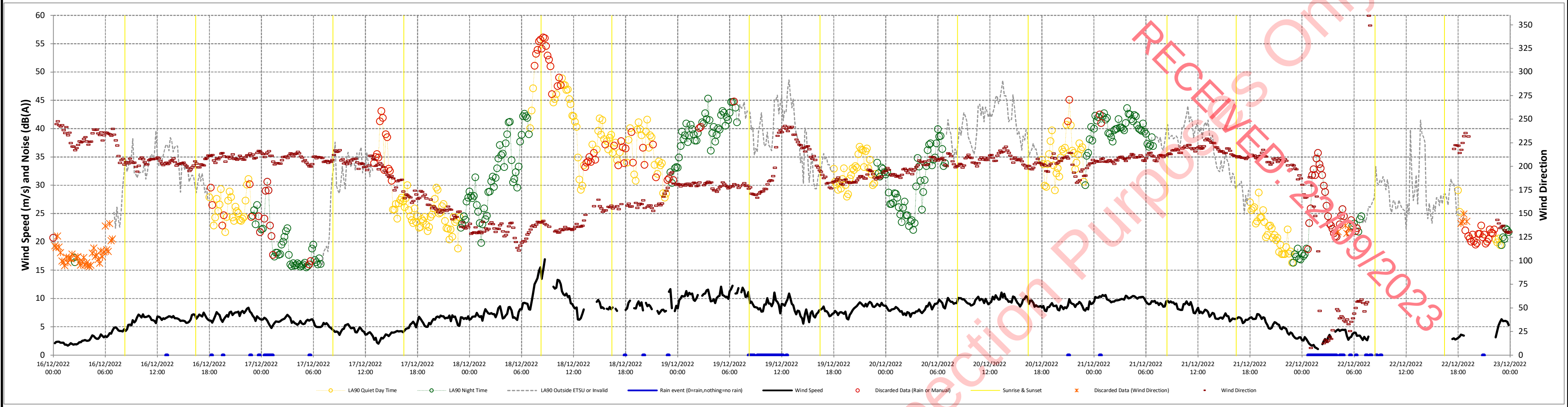
09/12/2022 to 16/12/2022



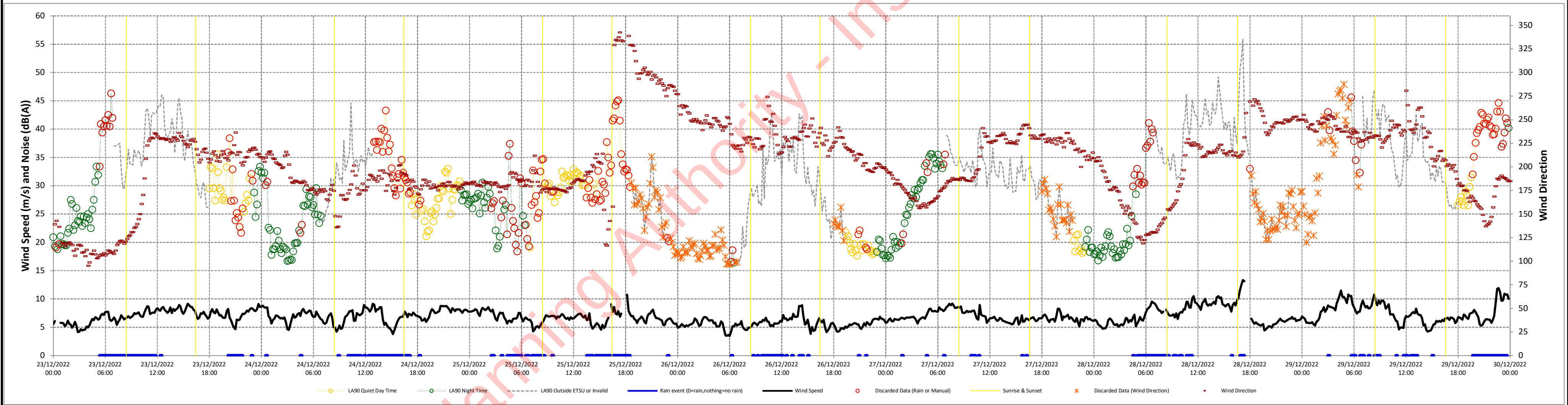
Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1a-NML01 Time Series Page 2 of 5
Date	12/07/2023

tnei

16/12/2022 to 23/12/2022



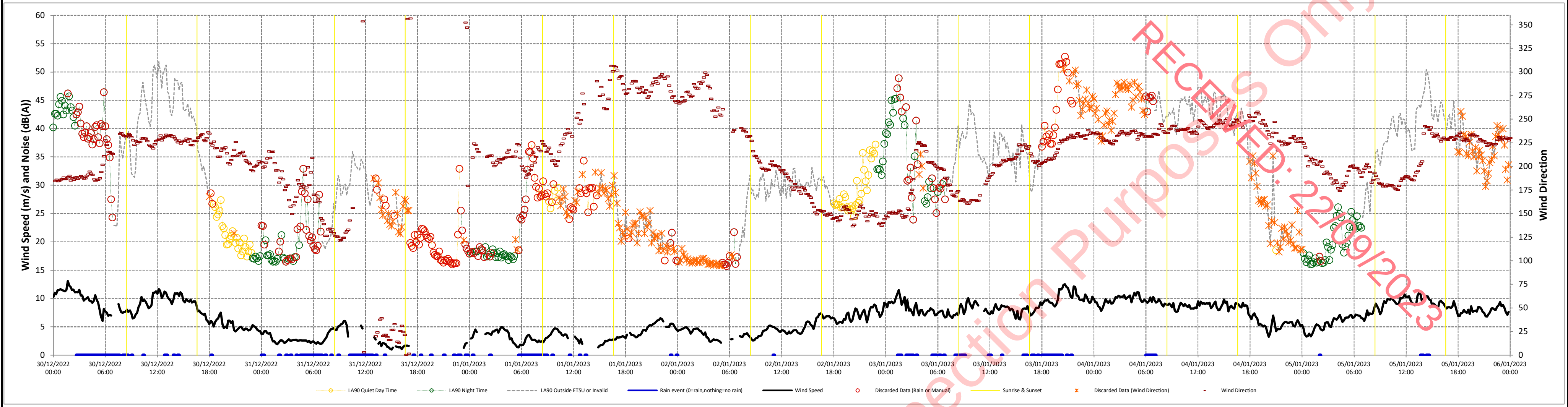
23/12/2022 to 30/12/2022



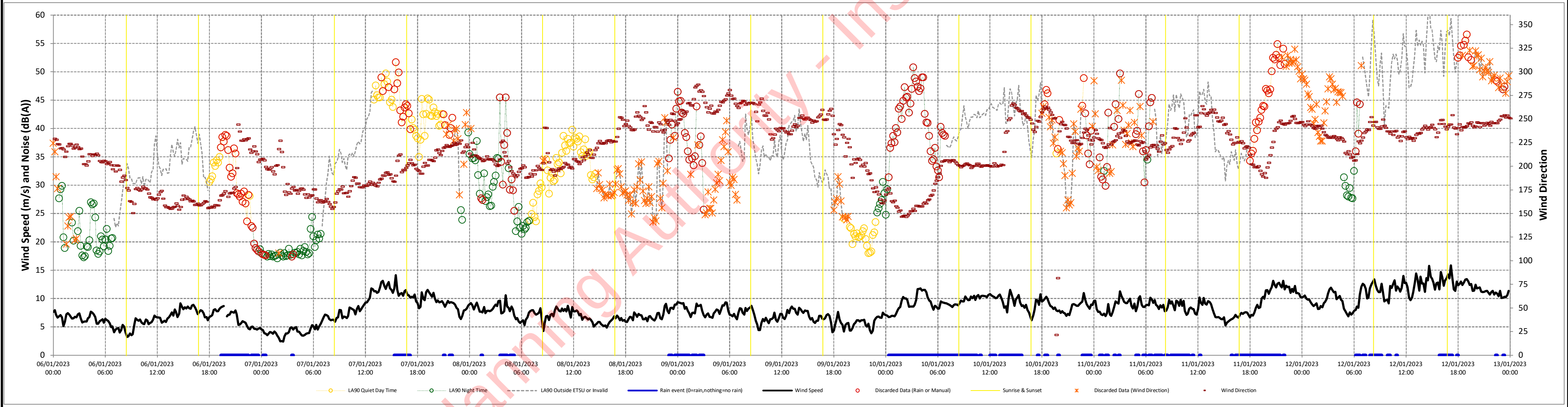
Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1a-NML01 Time Series Page 3 of 5
Date	12/07/2023

tnei

30/12/2022 to 06/01/2023



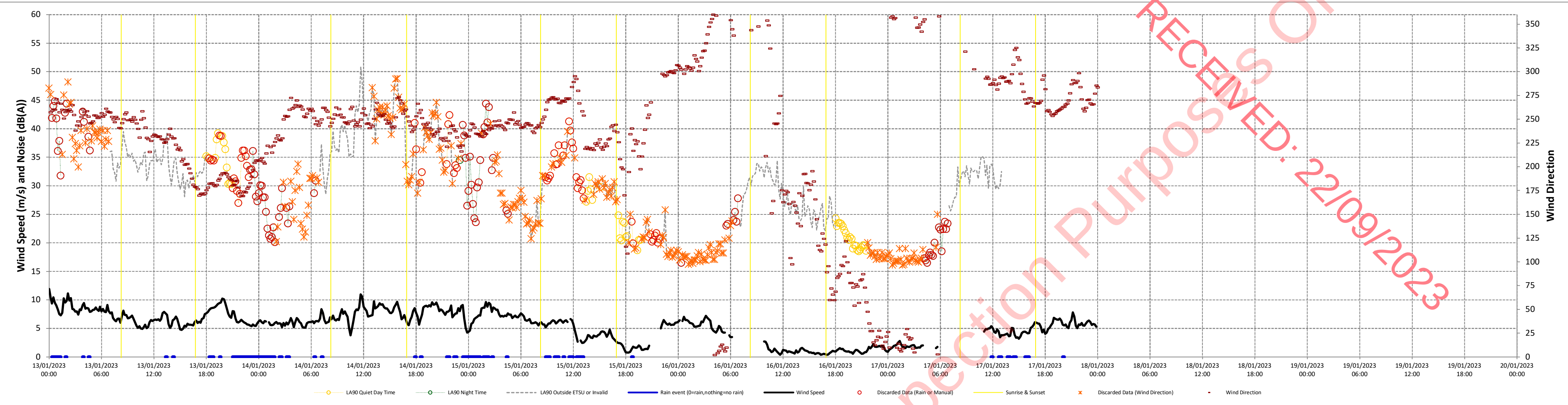
06/01/2023 to 13/01/2023



Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1a-NML01 Time Series Page 4 of 5
Date	12/07/2023

tnei

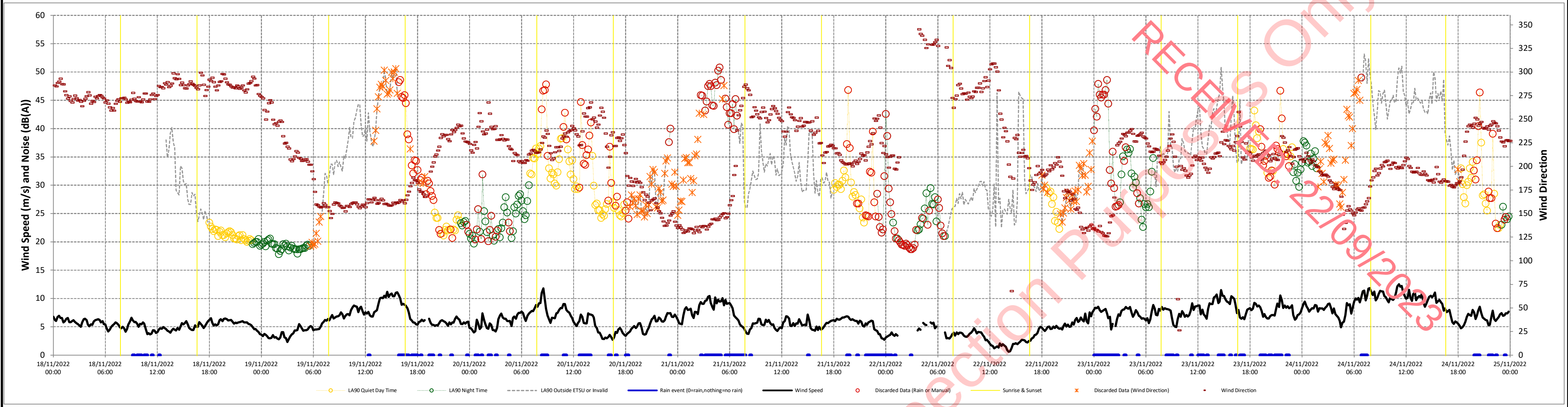
13/01/2023 to 20/01/2023



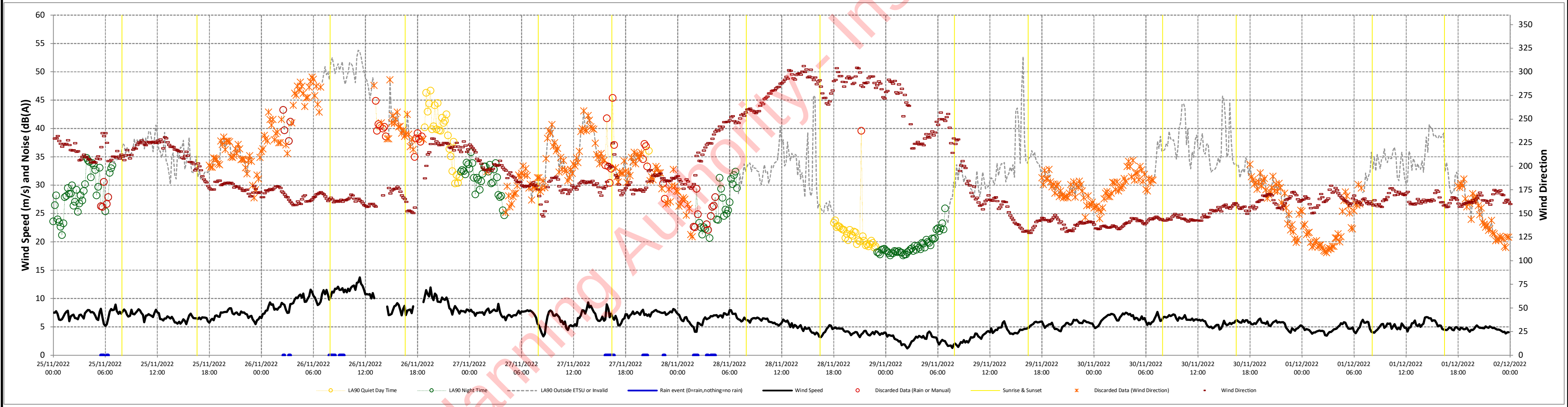
Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1a-NML01 Time Series Page 5 of 5
Date	12/07/2023

tnei

18/11/2022 to 25/11/2022



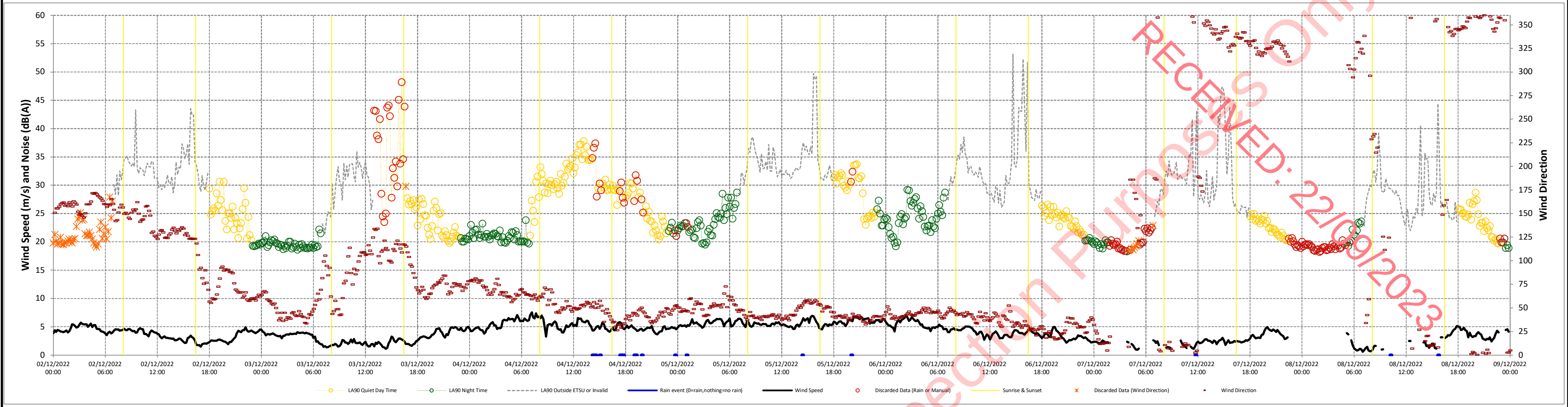
25/11/2022 to 02/12/2022



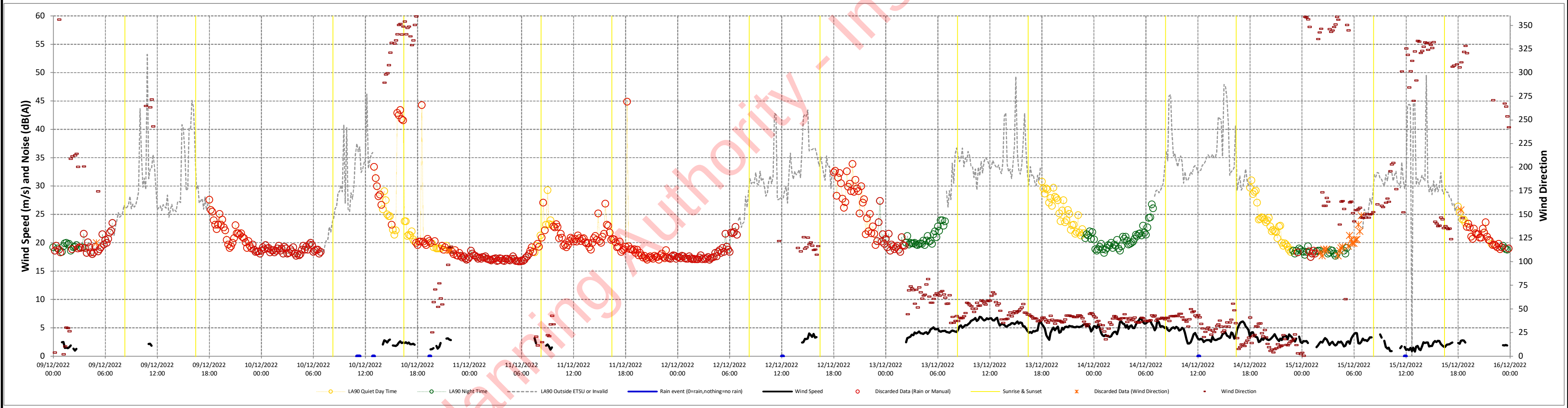
Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1b-NML02 Time Series Page 1 of 5
Date	12/07/2023

tnei

02/12/2022 to 09/12/2022



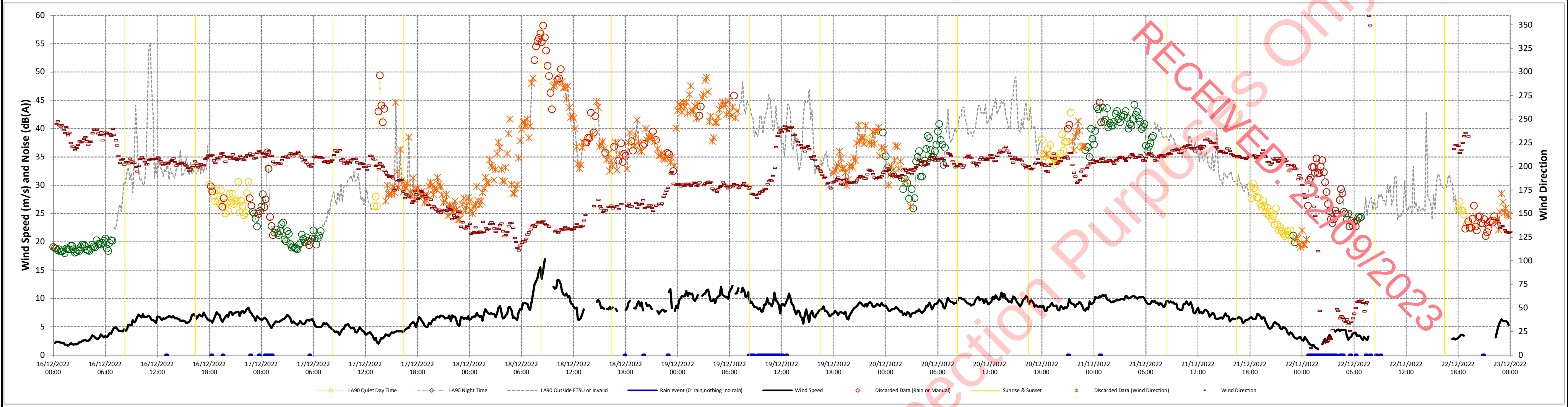
09/12/2022 to 16/12/2022



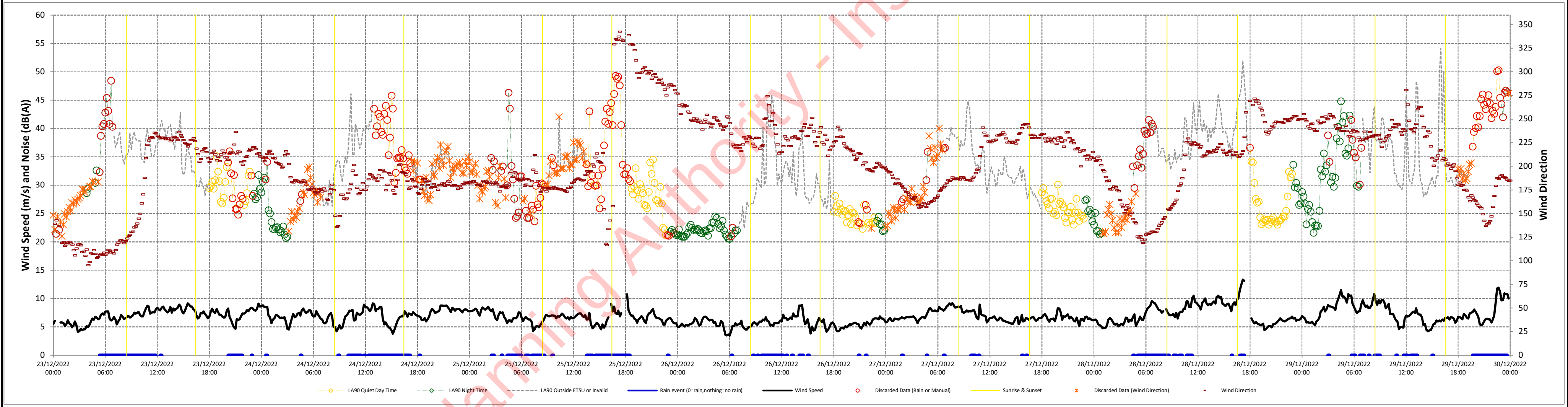
Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1b-NML02 Time Series Page 2 of 5
Date	12/07/2023

tnei

16/12/2022 to 23/12/2022



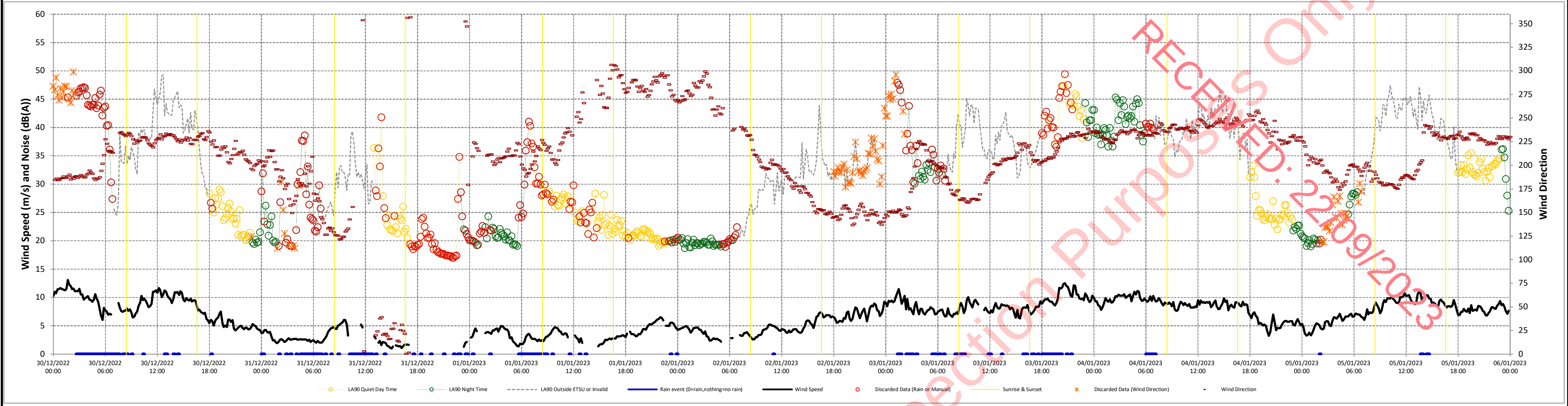
23/12/2022 to 30/12/2022



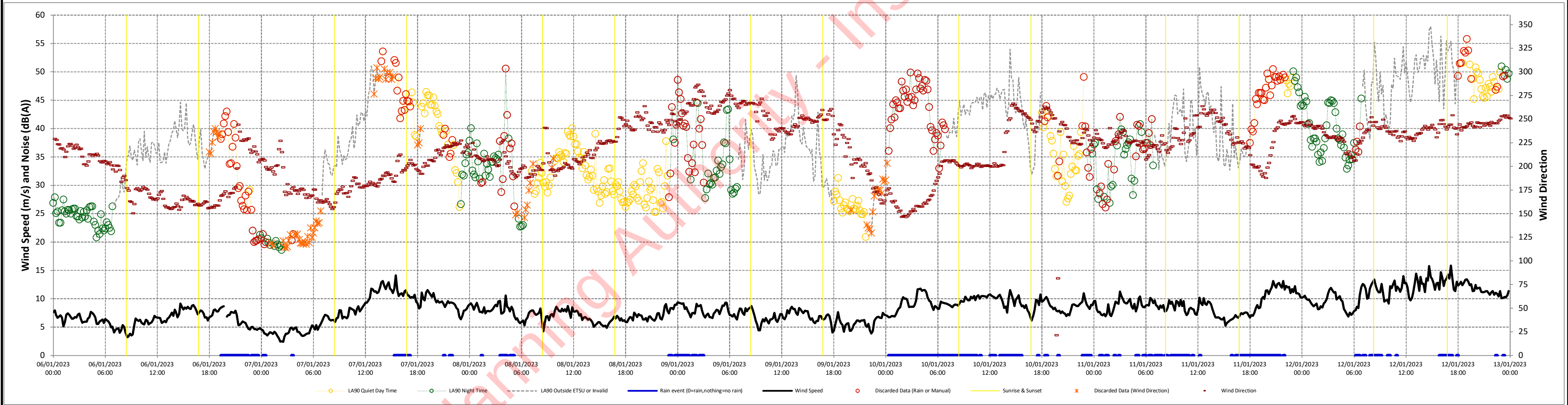
Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1b-NML02 Time Series Page 3 of 5
Date	12/07/2023

tnei

30/12/2022 to 06/01/2023

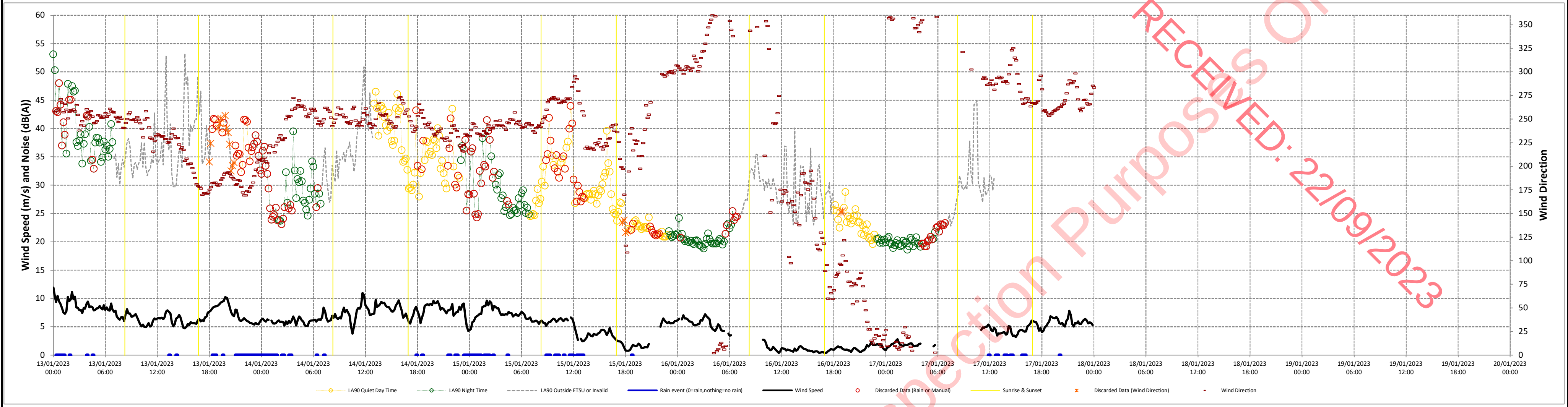


06/01/2023 to 13/01/2023



Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1b-NML02 Time Series Page 4 of 5
Date	12/07/2023

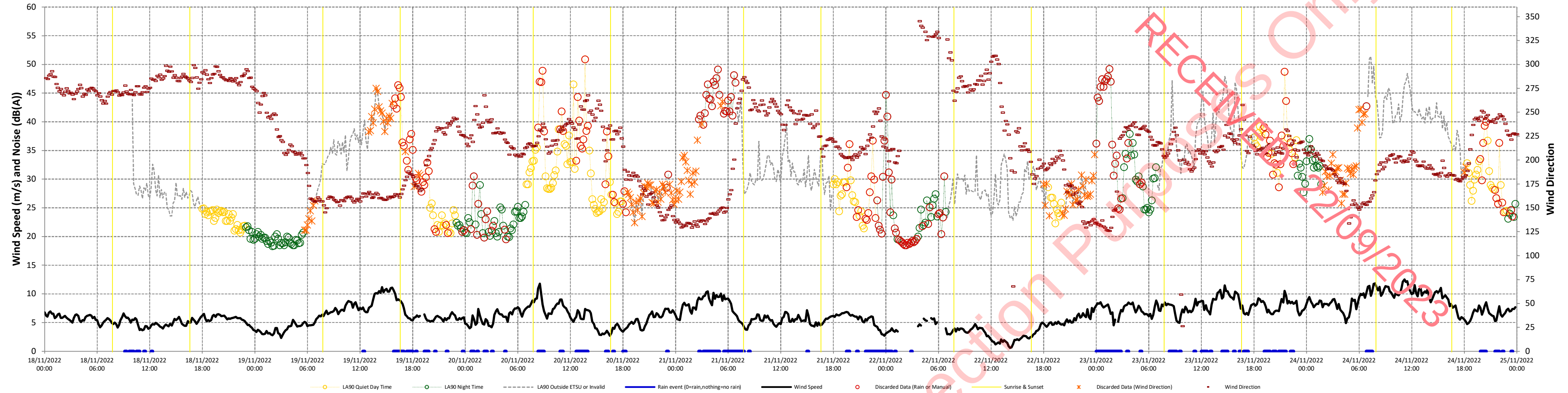
13/01/2023 to 20/01/2023



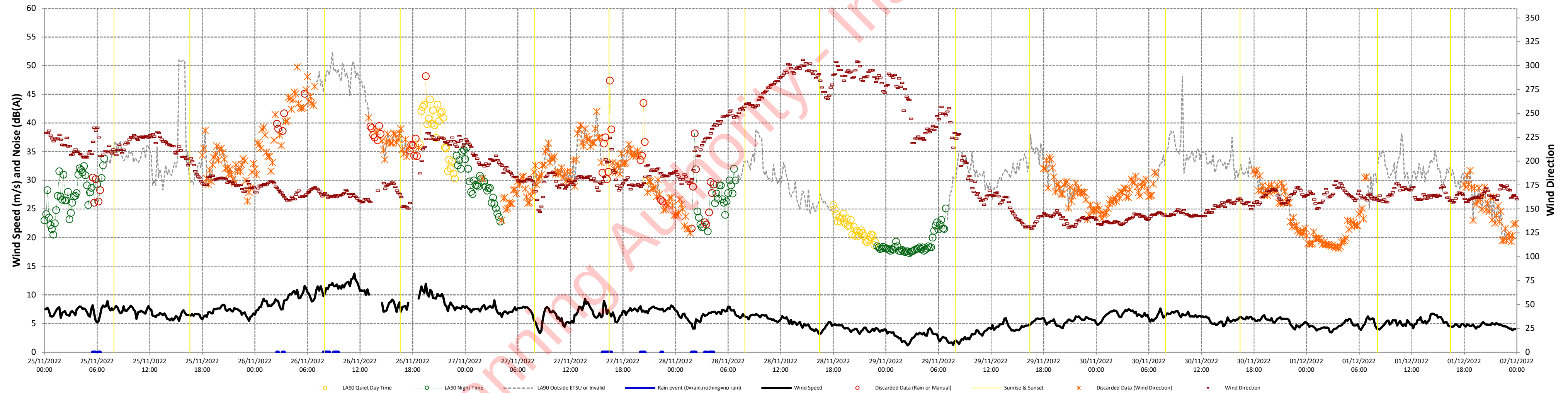
Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1b-NML02 Time Series Page 5 of 5
Date	12/07/2023

tnei

18/11/2022 to 25/11/2022



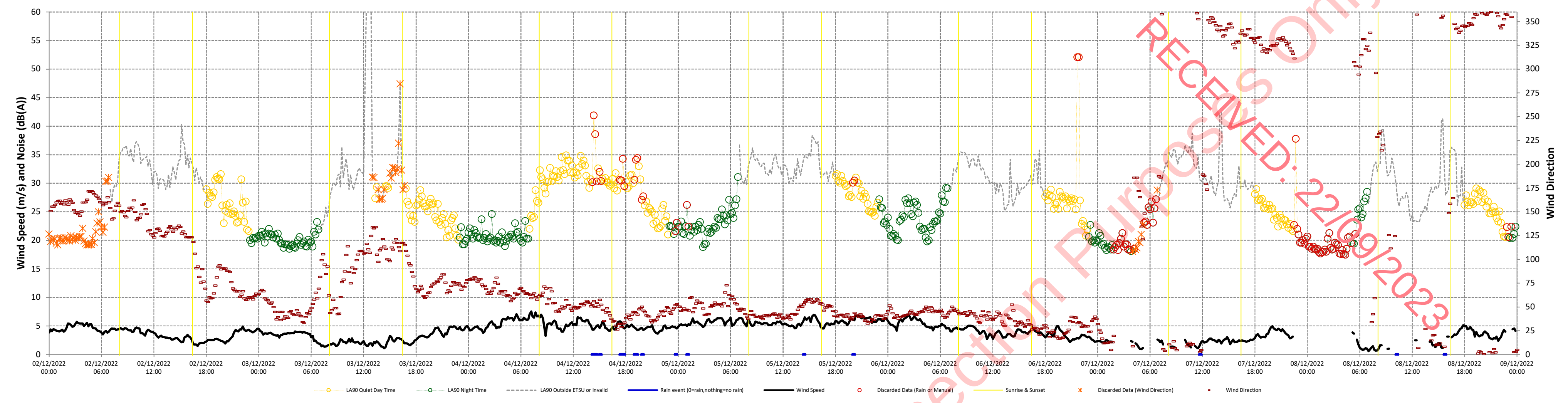
25/11/2022 to 02/12/2022



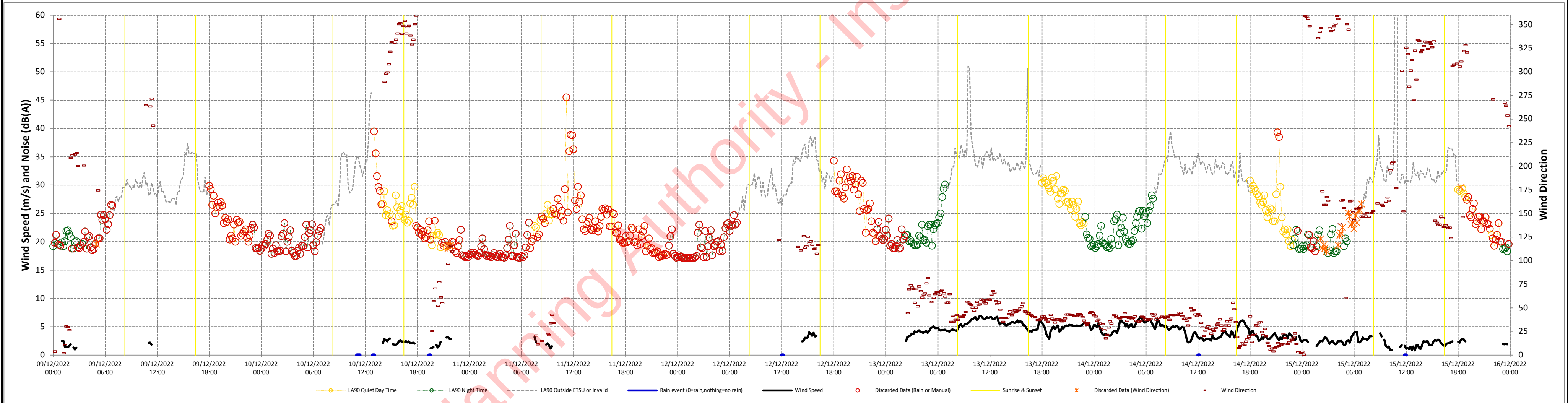
Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1c-NML03 Time Series Page 1 of 5
Date	12/07/2023

tnei

02/12/2022 to 09/12/2022

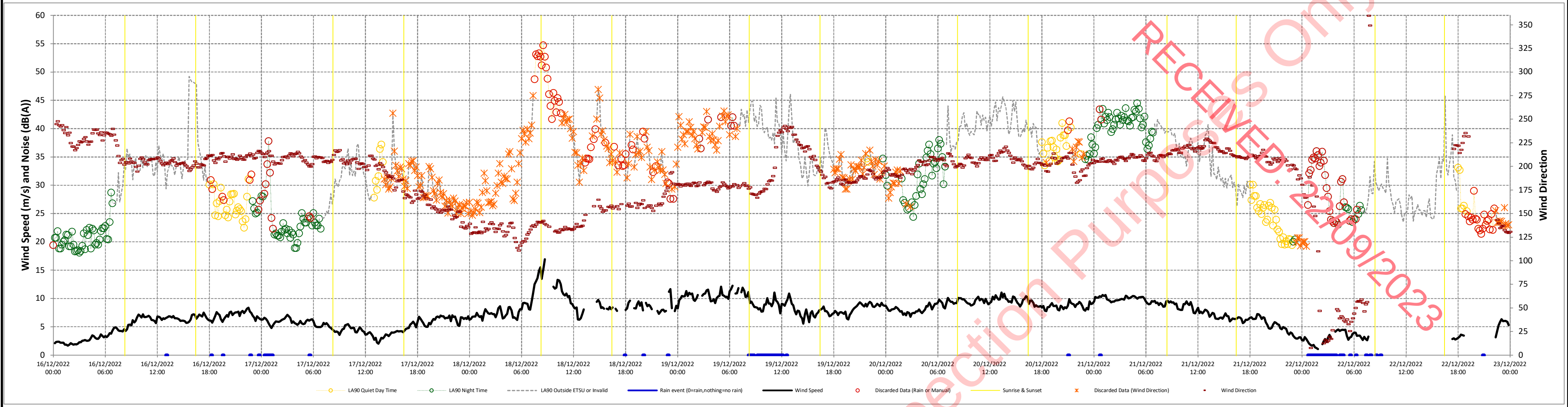


09/12/2022 to 16/12/2022

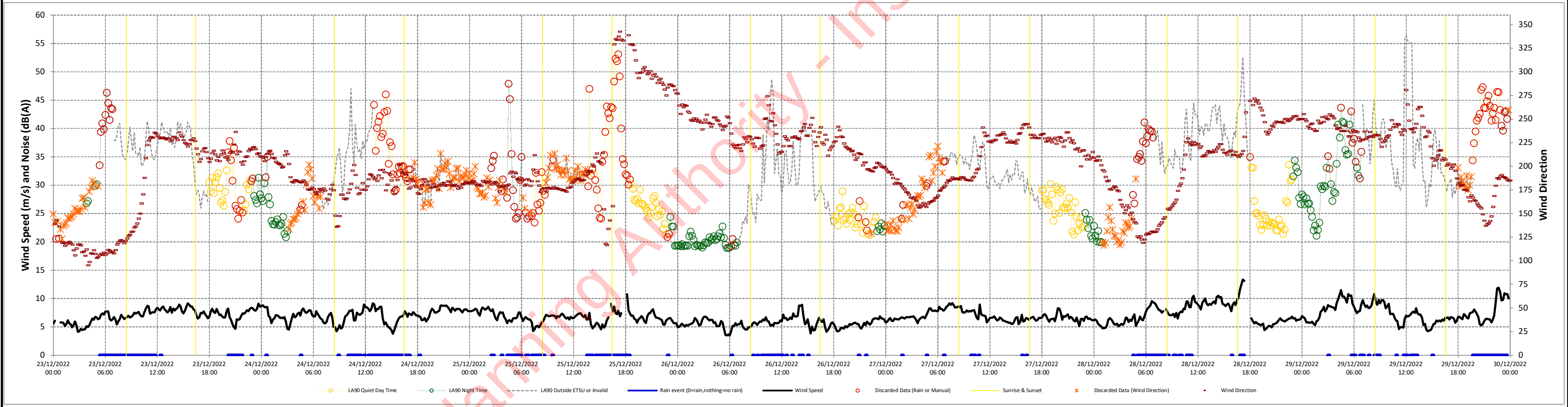


Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1c-NML03 Time Series Page 2 of 5
Date	12/07/2023

16/12/2022 to 23/12/2022



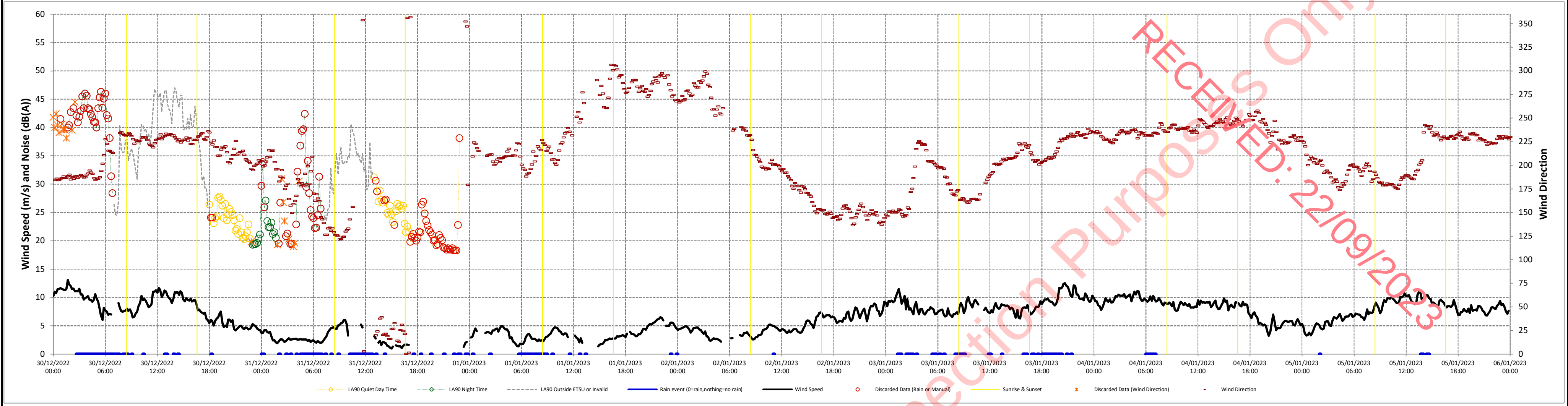
23/12/2022 to 30/12/2022



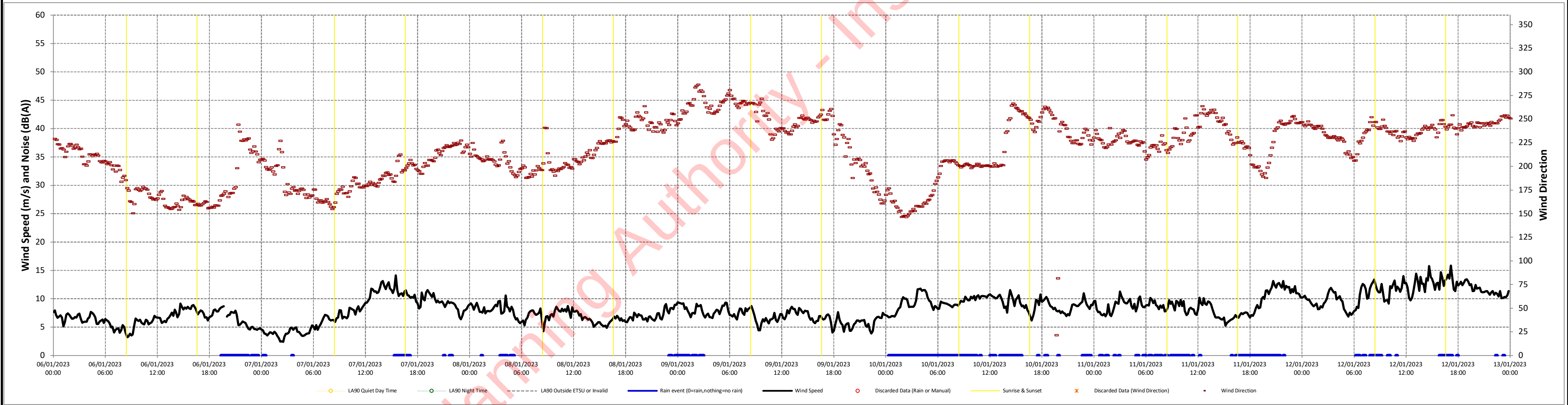
Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1c-NML03 Time Series Page 3 of 5
Date	12/07/2023

tnei

30/12/2022 to 06/01/2023

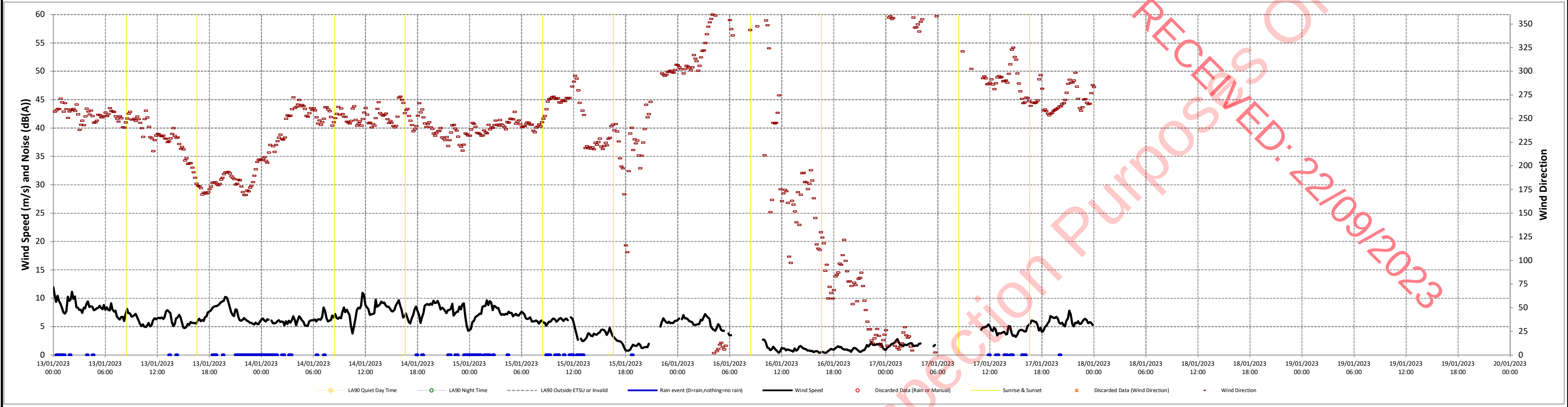


06/01/2023 to 13/01/2023



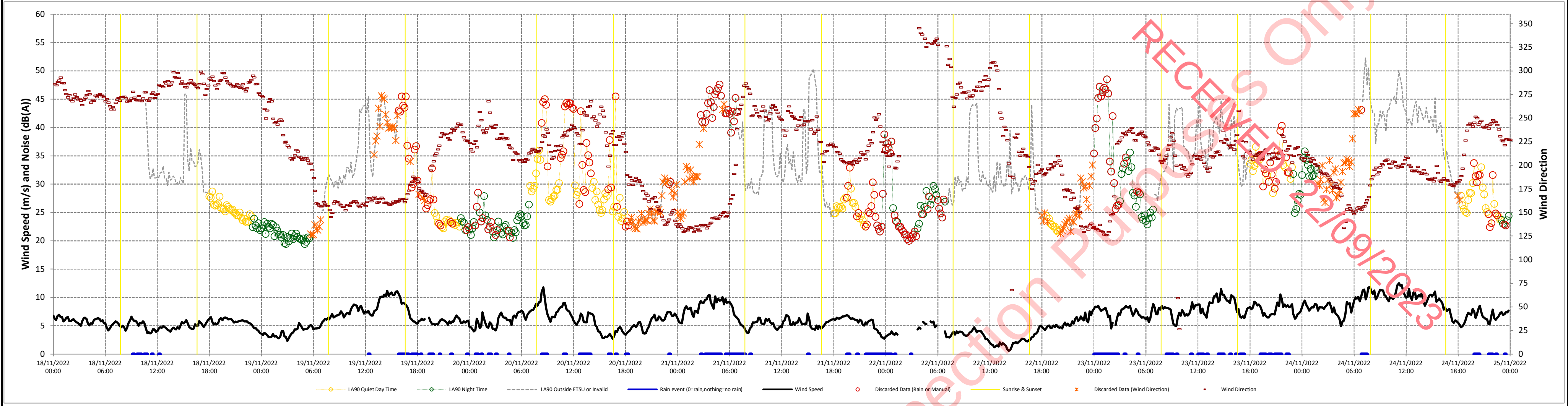
Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1c-NML03 Time Series Page 4 of 5
Date	12/07/2023

13/01/2023 to 20/01/2023

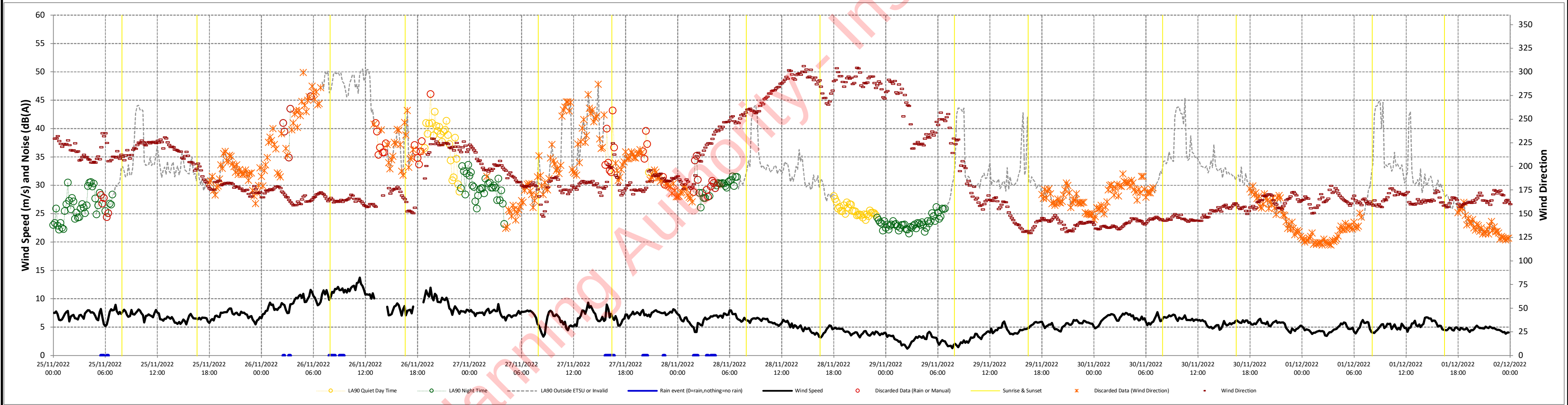


Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1c-NML03 Time Series Page 5 of 5
Date	12/07/2023

18/11/2022 to 25/11/2022



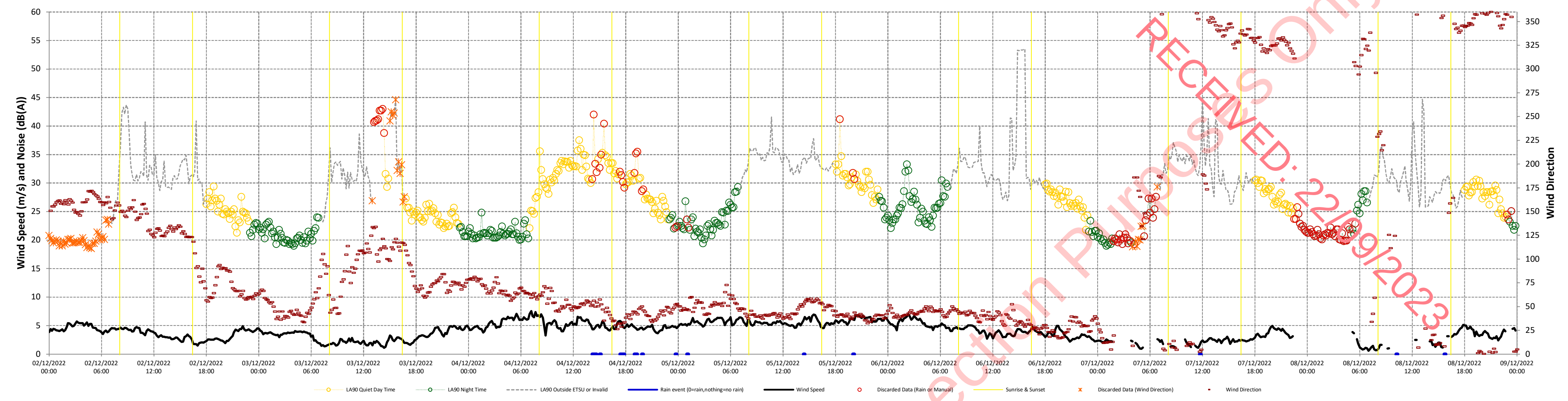
25/11/2022 to 02/12/2022



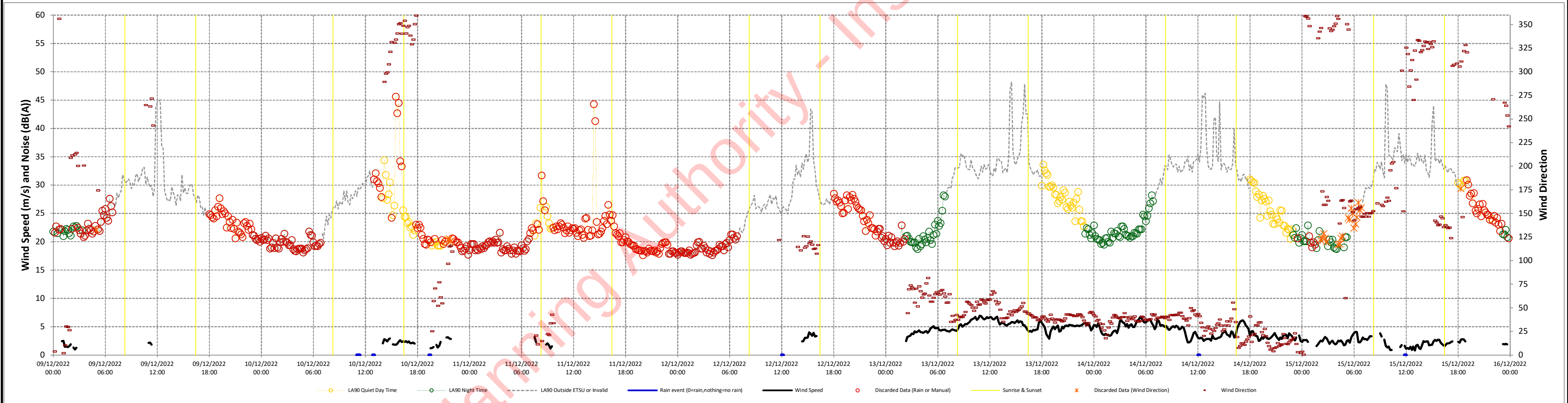
Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1d-NML04 Time Series Page 1 of 5
Date	12/07/2023

tnei

02/12/2022 to 09/12/2022

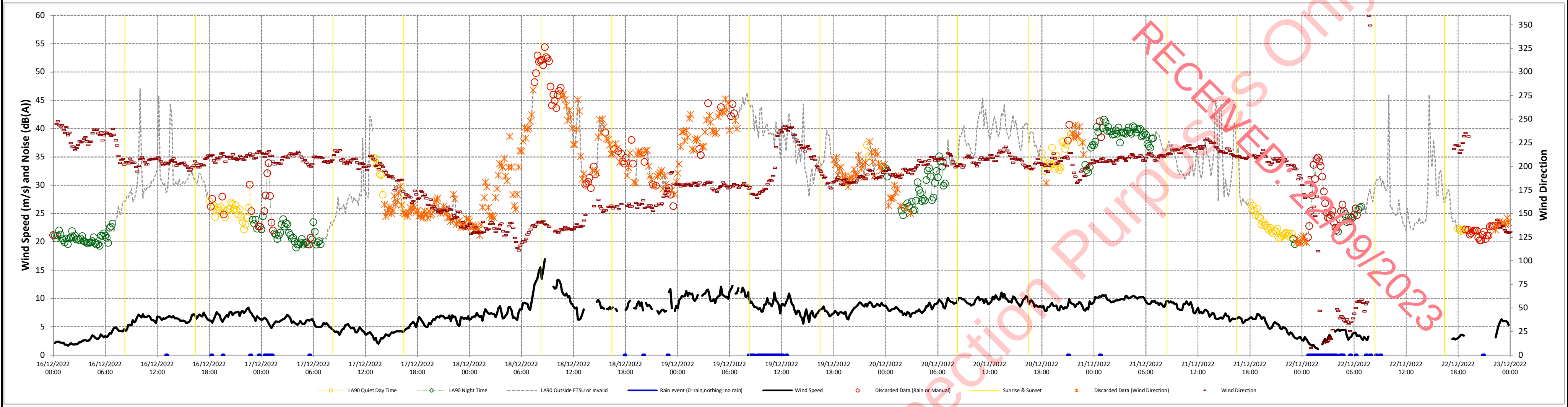


09/12/2022 to 16/12/2022

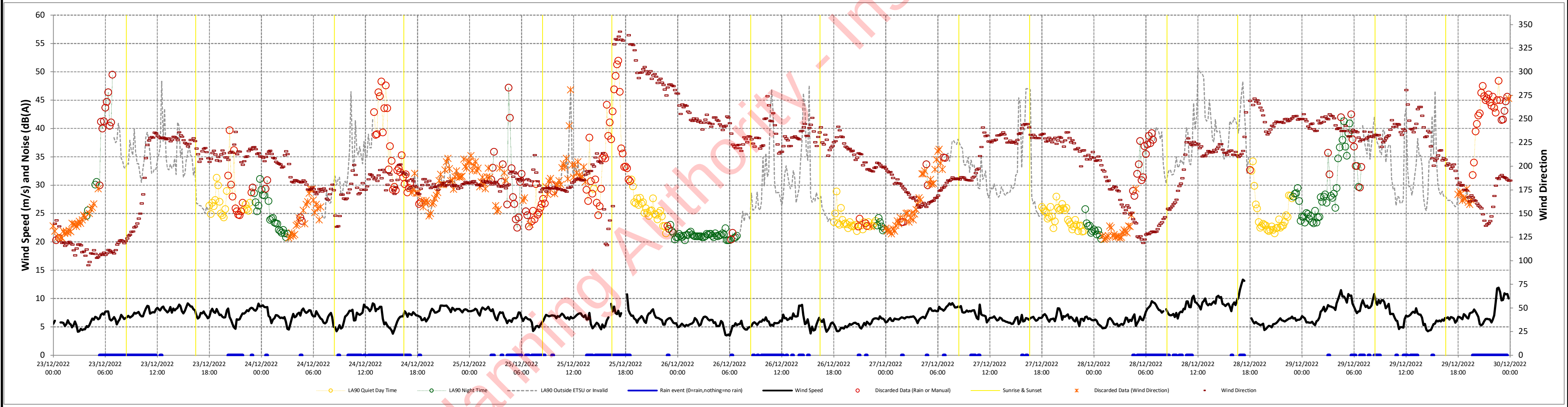


Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1d-NML04 Time Series Page 2 of 5
Date	12/07/2023

16/12/2022 to 23/12/2022



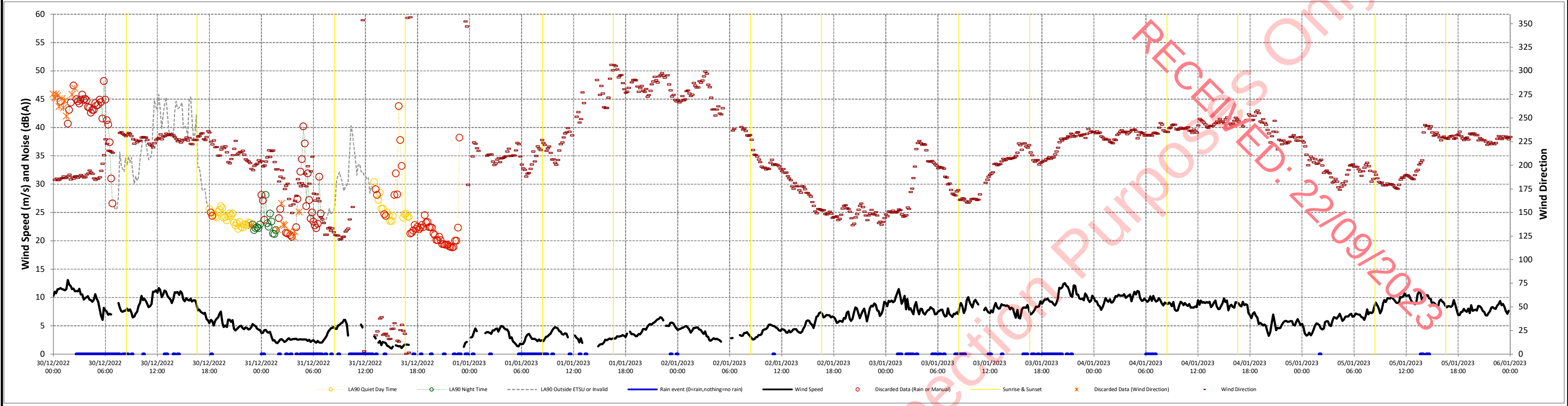
23/12/2022 to 30/12/2022



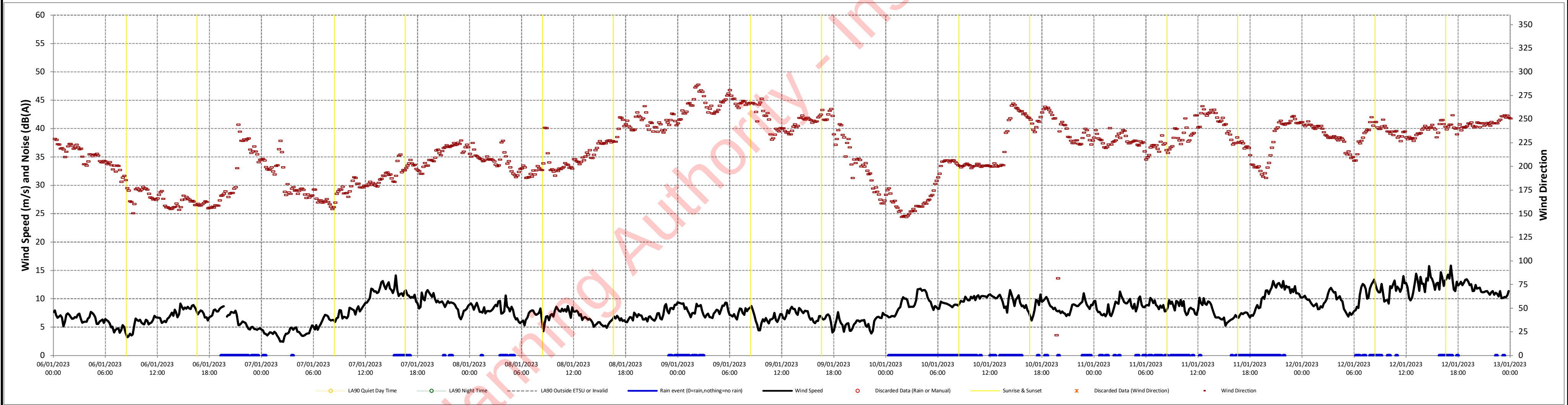
Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1d-NML04 Time Series Page 3 of 5
Date	12/07/2023

tnei

30/12/2022 to 06/01/2023



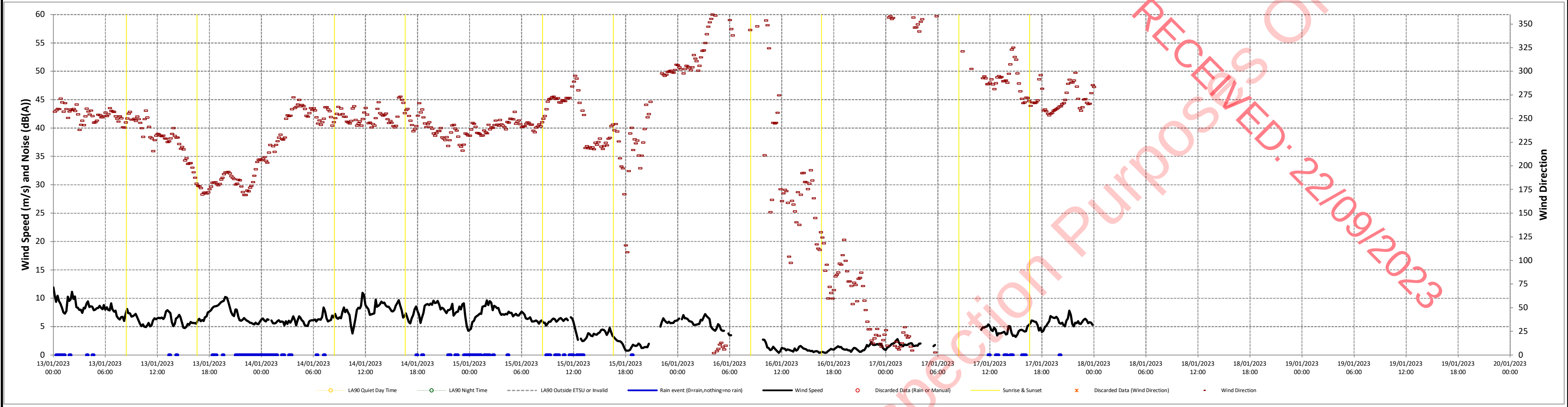
06/01/2023 to 13/01/2023



Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1d-NML04 Time Series Page 4 of 5
Date	12/07/2023

tnei

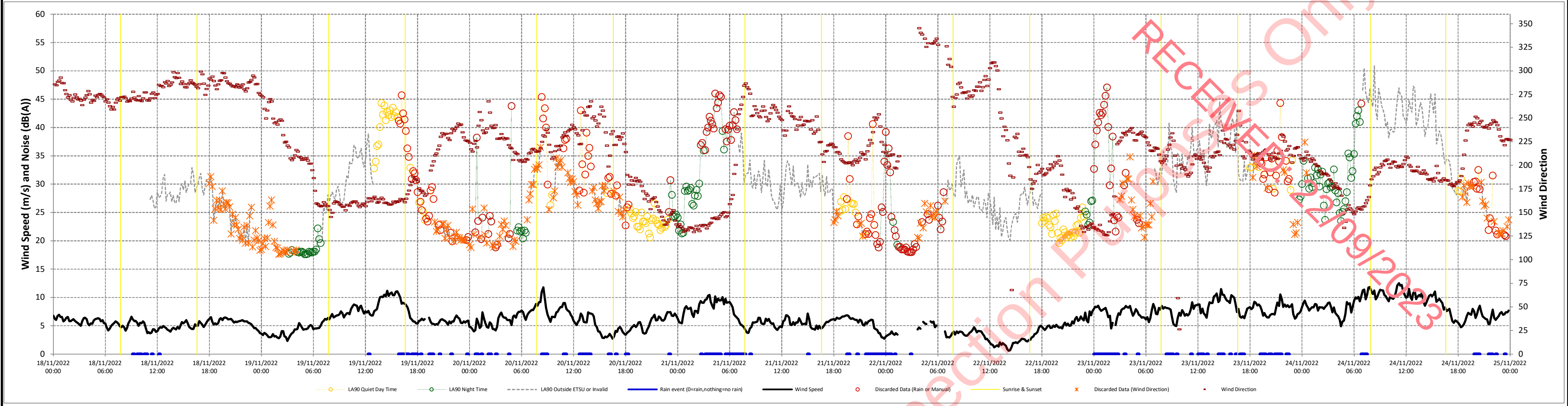
13/01/2023 to 20/01/2023



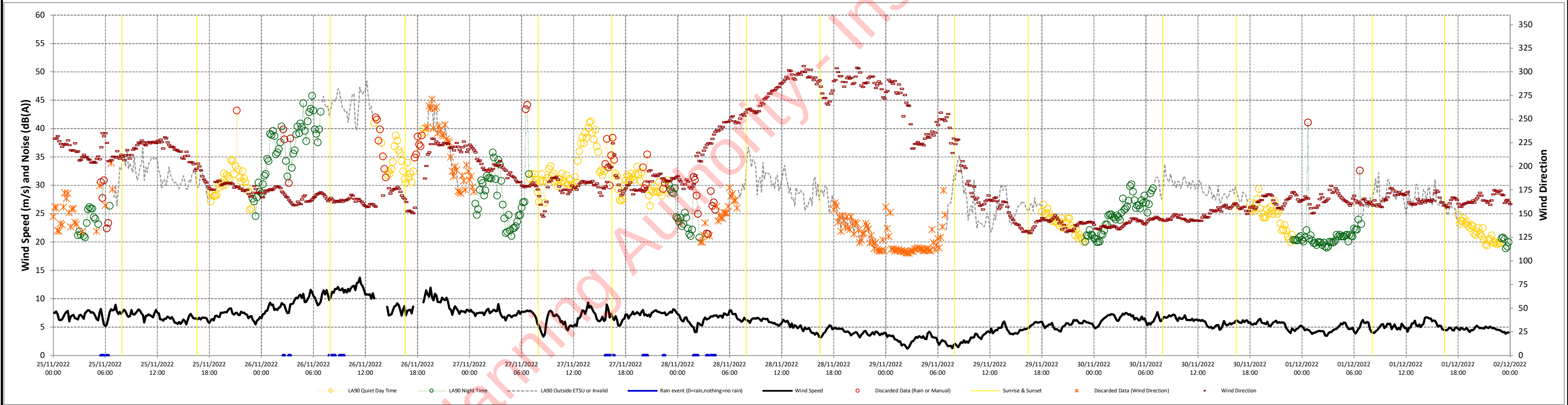
Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1d-NML04 Time Series Page 5 of 5
Date	12/07/2023

tnei

18/11/2022 to 25/11/2022

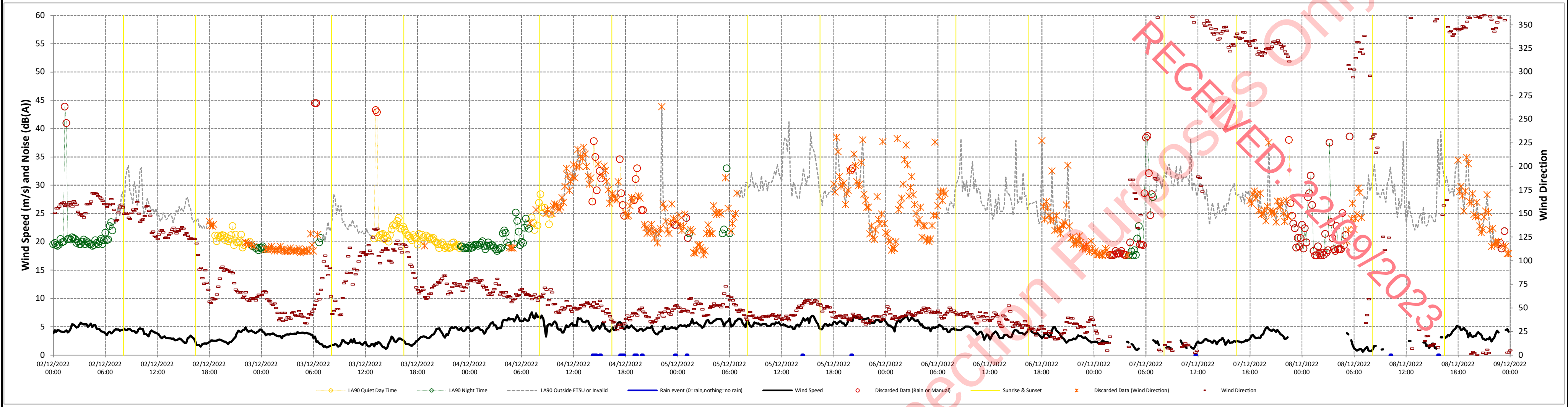


25/11/2022 to 02/12/2022

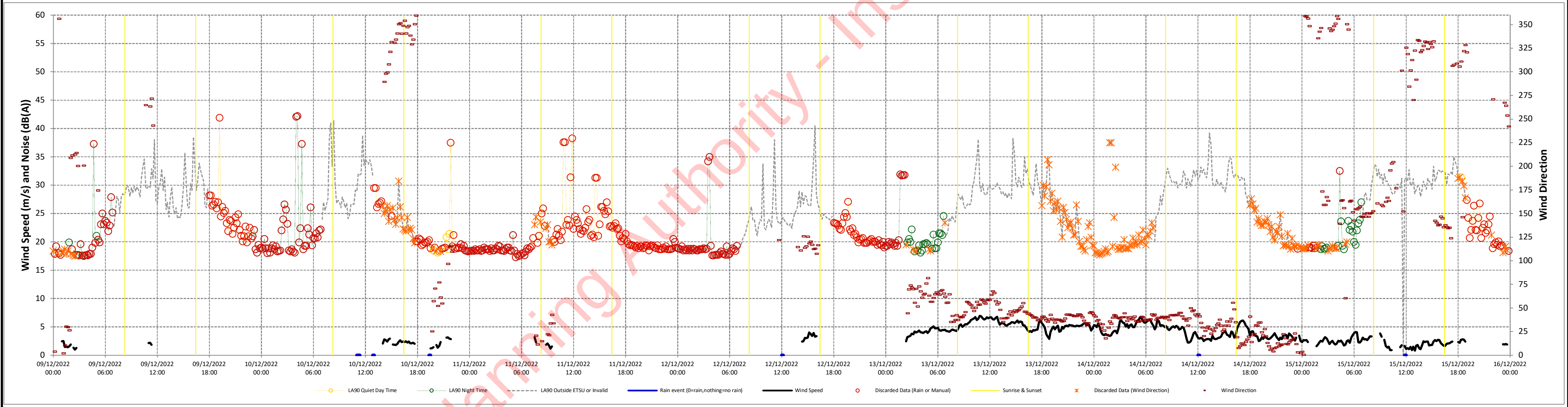


Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1e-NML05 Time Series Page 1 of 5
Date	12/07/2023

02/12/2022 to 09/12/2022

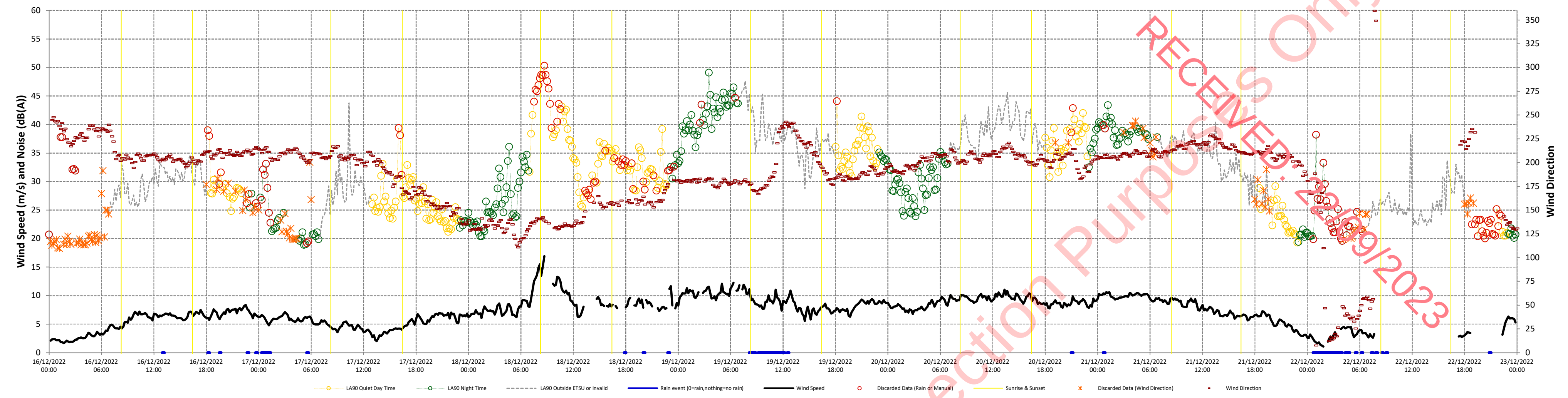


09/12/2022 to 16/12/2022

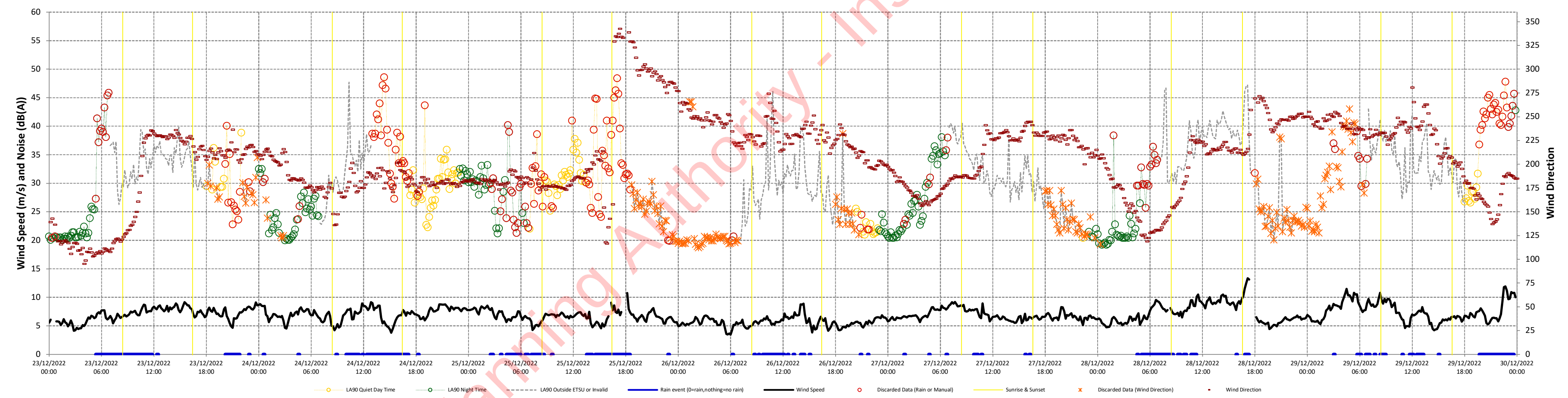


Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1e-NML05 Time Series Page 2 of 5
Date	12/07/2023

16/12/2022 to 23/12/2022



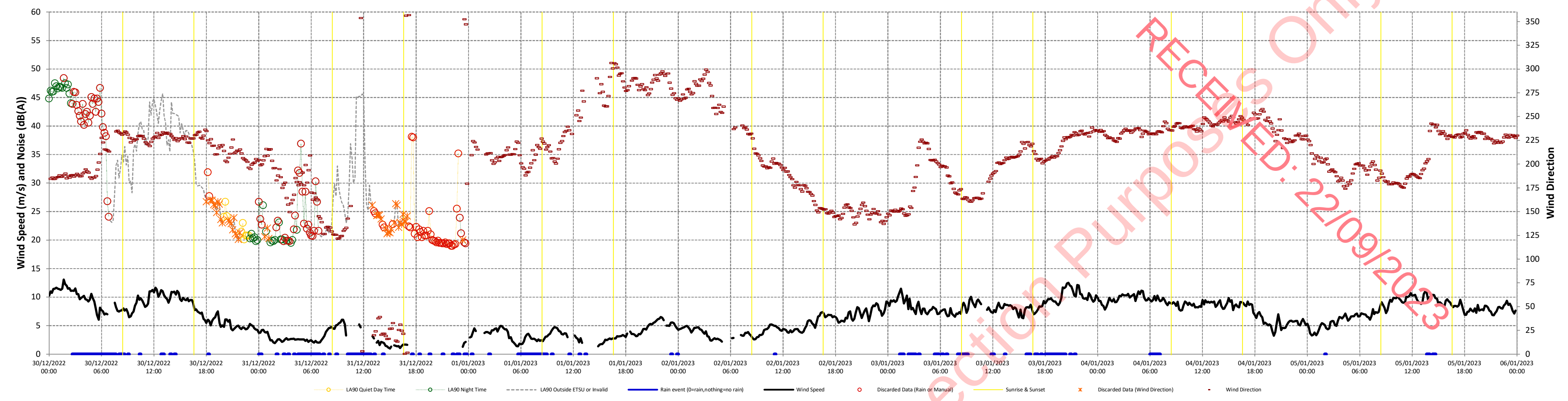
23/12/2022 to 30/12/2022



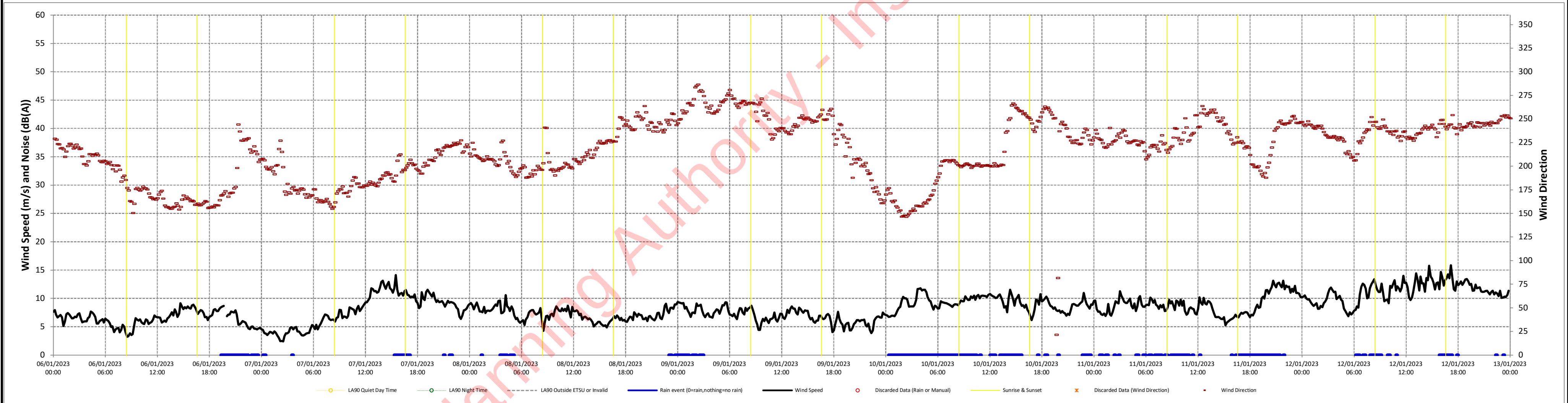
Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1e-NML05 Time Series Page 3 of 5
Date	12/07/2023

tnei

30/12/2022 to 06/01/2023



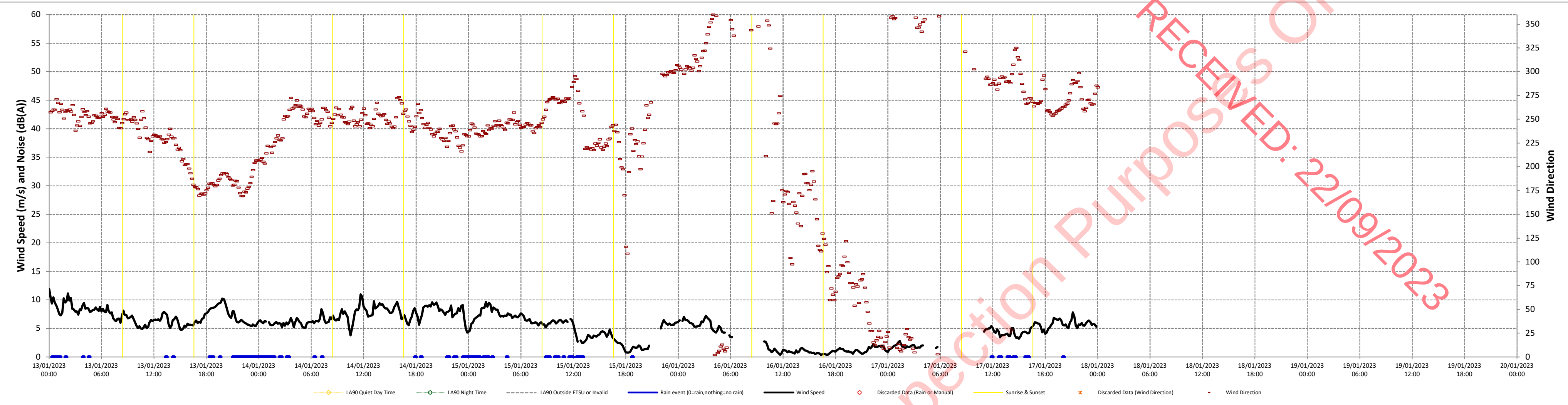
06/01/2023 to 13/01/2023



Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1e-NML05 Time Series Page 4 of 5
Date	12/07/2023

tnei

13/01/2023 to 20/01/2023

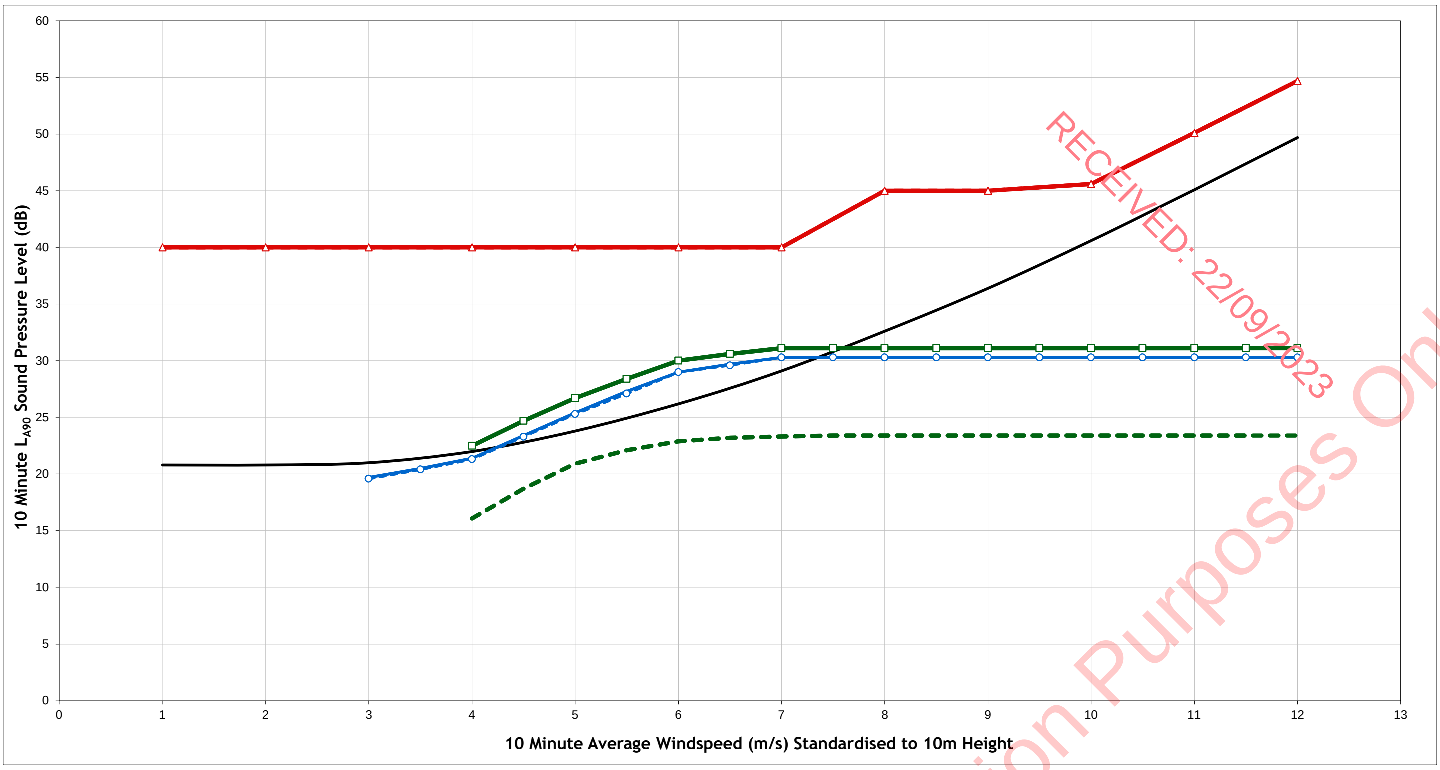


Project	Carrig Renewable Energy Development
Client	Carrig Renewable Energy Ltd
Title	Figure A4.1e-NML05 Time Series Page 5 of 5
Date	12/07/2023

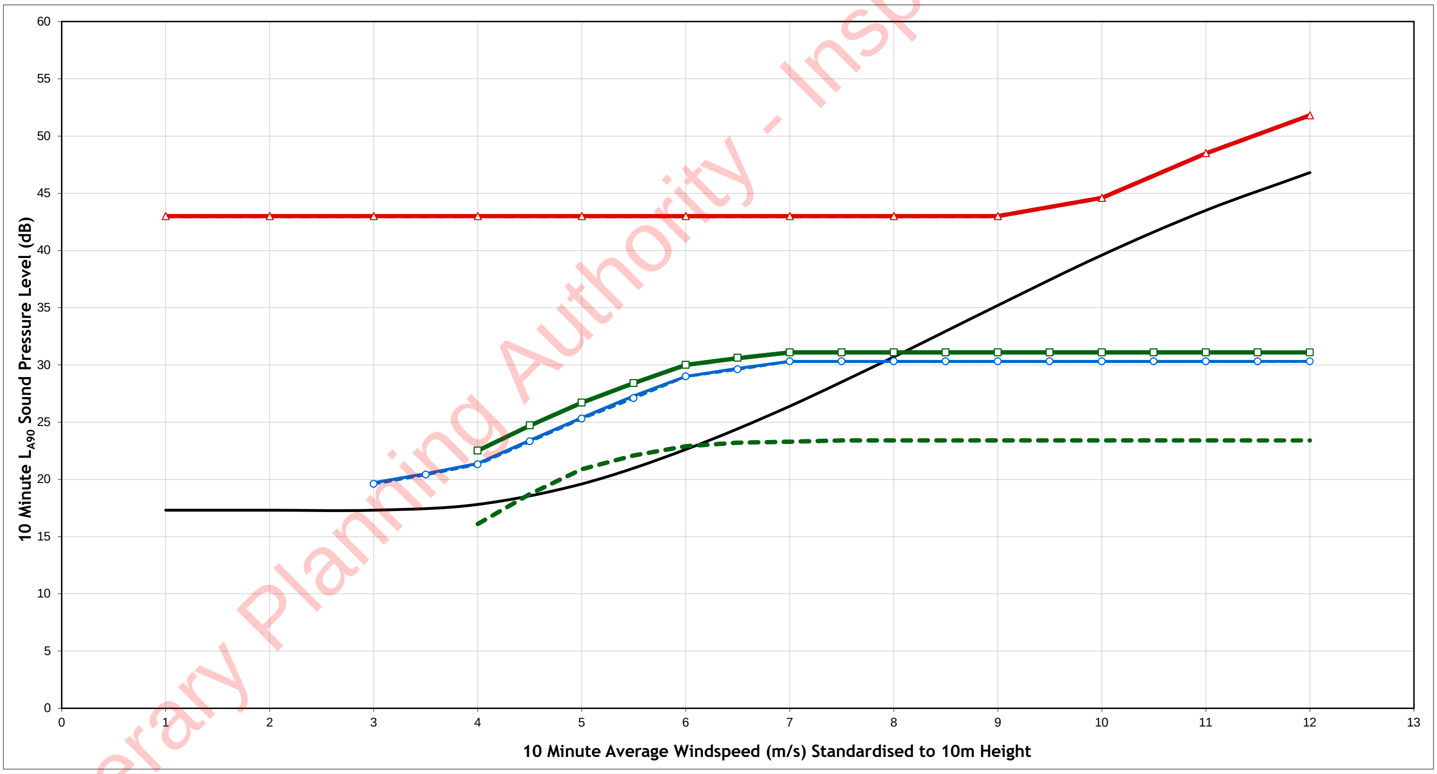
Annex 5 – NSR Coordinates and Prediction Modelling Results

Noise Sensitive Receptor	X (ITM)	Y (ITM)	Elevation	Background Noise Monitoring Location Used
	(m)	(m)	(m AOD)	
H1	596611.05	700381.36	66.67	NML1
H2	596635.5	700334.49	66.49	NML1
H3	596246	701962	65.93	NML1
H4	600097	701616	63.59	NML3
H5	600226.83	701429.3	67.57	NML3
H6	600492.92	701374.23	67.13	NML3
H7	600782.85	701199.83	62.32	NML3
H8	599220	700514	61.62	NML2
H9	600659.97	700166.69	57.45	NML2
H10	601127.58	700389.85	54.47	NML3
H11	601184.88	700456.89	54.2	NML3
H12	600864.3	700344.28	58.76	NML3
H13	601195.69	700565.23	55.83	NML3
H14	600159.79	701724.45	62.88	NML3
H15	600934.79	701139.8	61.11	NML3
H16	601141.67	700895.03	56.69	NML3
H17	601360.68	701432.51	58.35	NML3
H18	598383.77	700582.59	67.01	NML2
H19	599492.23	700049.42	63.32	NML2
H20	601214.39	702708.21	56.92	NML4
H21	600767	702732	55.6	NML4
H22	600334.76	700143.81	62.98	NML2
H23	600212.59	703057.67	59.68	NML4
H24	599875	703112	58.78	NML4
H25	600449	699641	65.54	NML2
H26	601134.89	702977.98	56.73	NML4
H27	596468.18	700772.91	64.79	NML1
H28	598490.15	699414.82	67.34	NML2
H29	601114.76	700360.6	54.84	NML3
H30	601246.9	702697.21	57.01	NML4
H31	601421.83	701059.12	56.74	NML3
H32	601388.98	701069.2	56.65	NML3
H33	596466.08	700704.59	64.71	NML1
H34	599310.94	700114.79	62.54	NML2
H35	600290.43	701392.34	68.17	NML3
H36	598648.09	700516.6	62.77	NML2
H37	598600.68	700555.49	63.3	NML2
H38	600698.84	701645.61	64.87	NML3
H39	600719.62	701682.1	64.13	NML3
H40	601242.28	700561.89	55.43	NML3
H41	600942.53	700275.31	57.9	NML3
H42	600193	701449	68.1	NML3
H43	600577.71	701308.92	64.83	NML3
H44	598718.19	700479.13	62.4	NML2
H45	600298.75	701477.24	66.29	NML3
H46	599375.35	700089.21	63.48	NML2
H47	600437.43	701494.2	66.71	NML3
H48	600395.84	701501.9	66.31	NML3
H49	600469	700586	62.37	NML3
H50	600728.75	699903.37	59.52	NML2
H51	597987	700819	73.12	NML2
H52	598521	700638	64.53	NML2
H53	598916.18	700286.68	61.57	NML2
H54	600129	700098	61.86	NML2
H55	600515.6	699658.35	66.07	NML2
H56	600511.74	699689.92	66.63	NML2
H57	600525.91	699714.2	66.46	NML2
H58	597025.97	699875.9	64.68	NML1
H59	601470.23	700784.96	57.15	NML3
H60	597452	703742	62.33	NML5
H61	597063	703194	66.83	NML5

Daytime - H1



Night Time - H1



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H1
Figure Number	Figure A1.5a
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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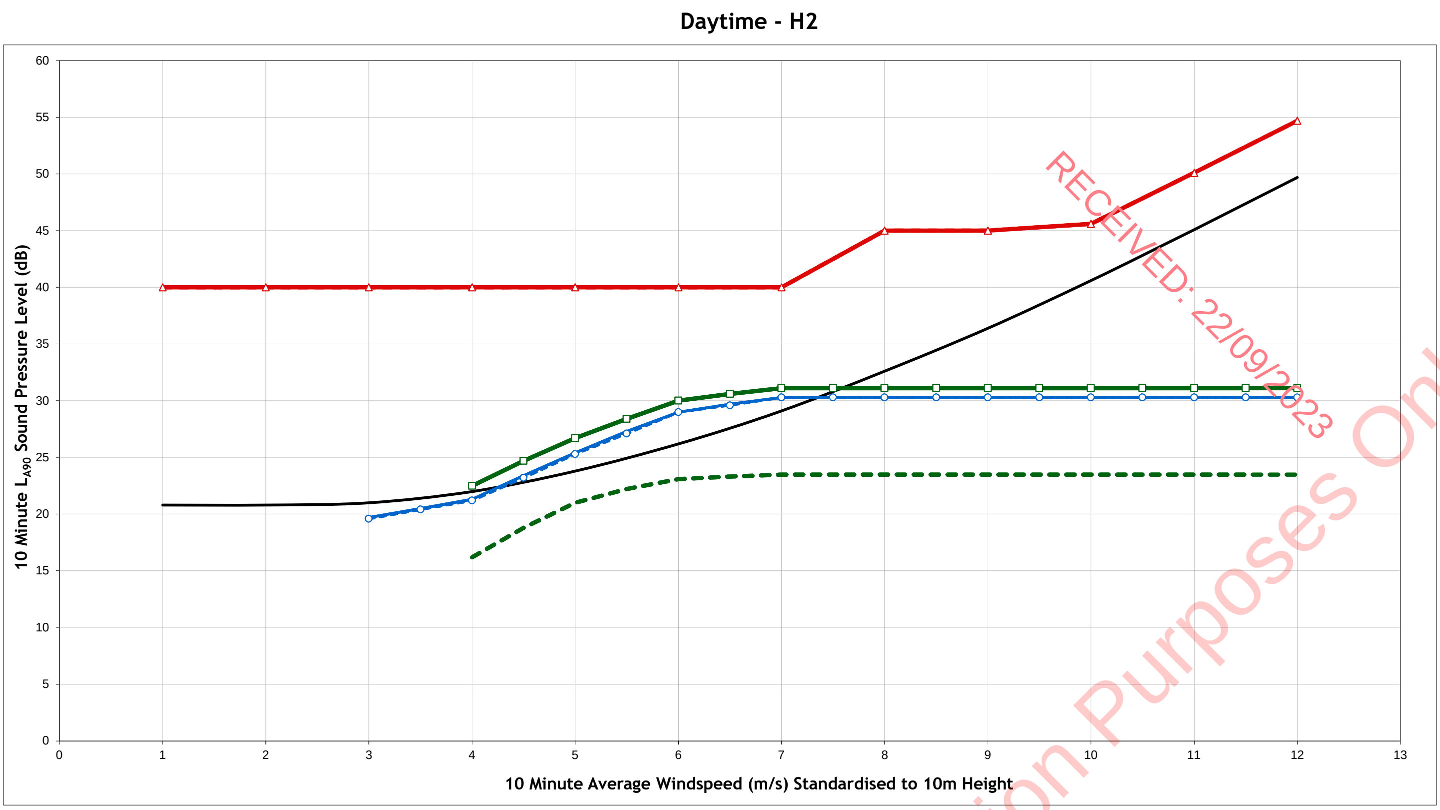

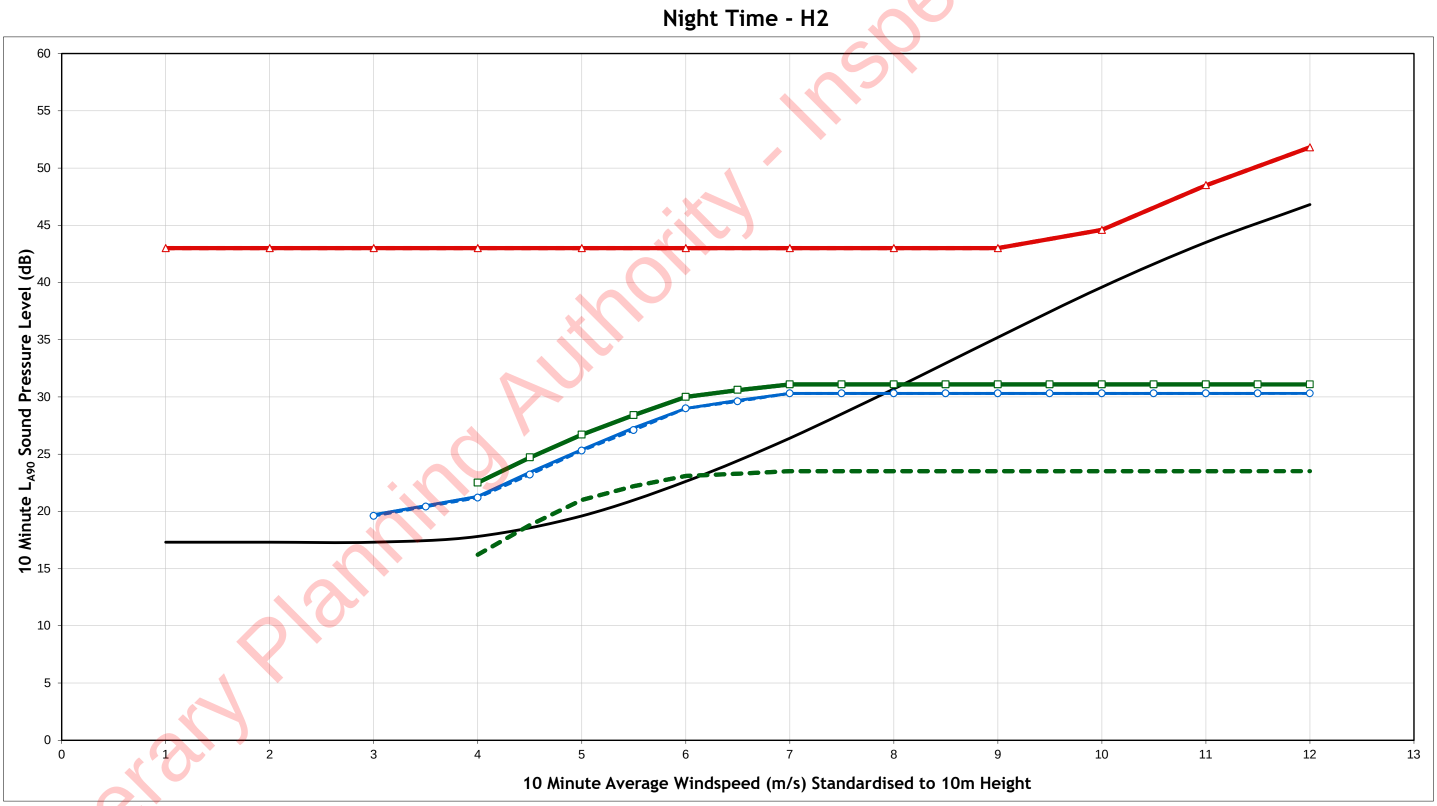

Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H2
Figure Number	Figure A1.5b
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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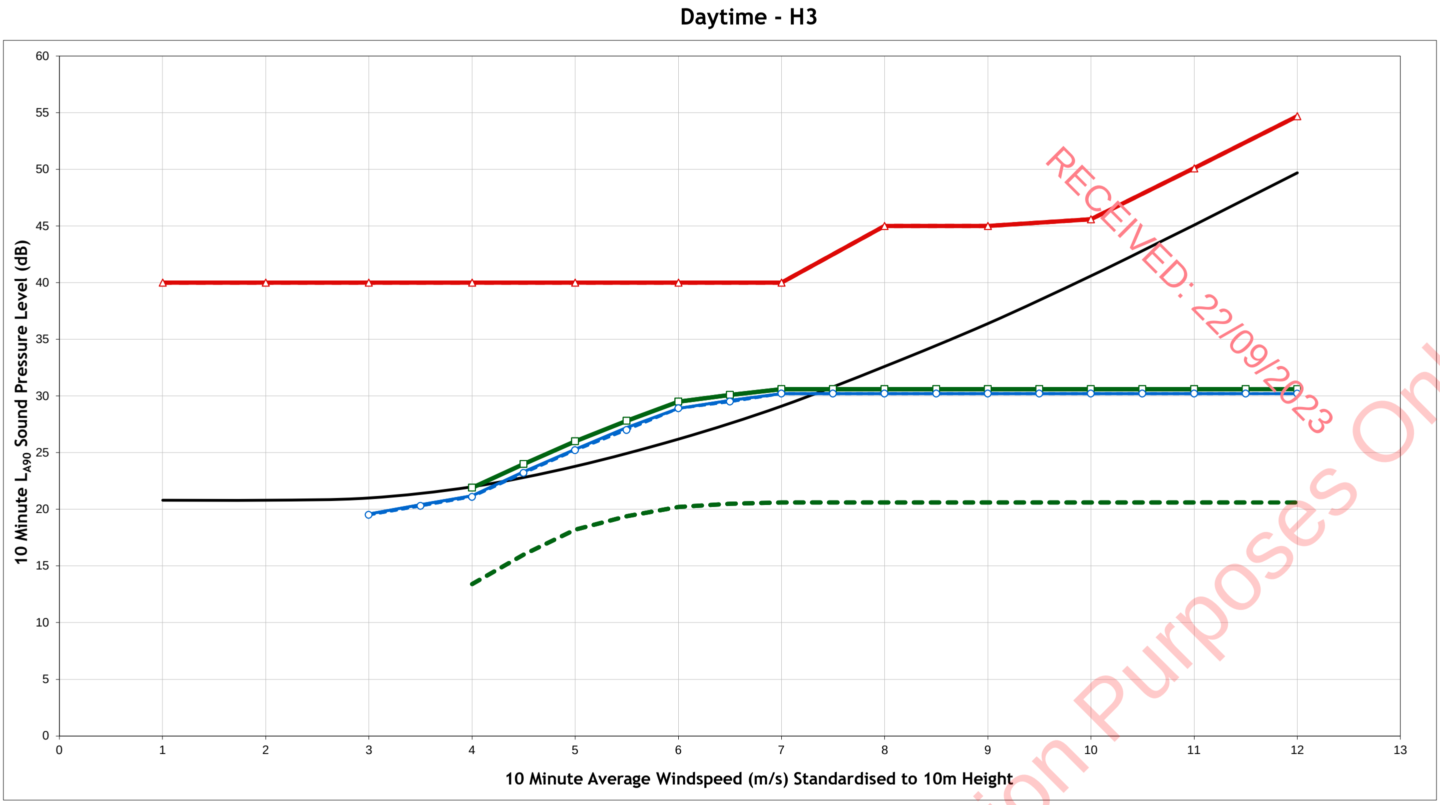

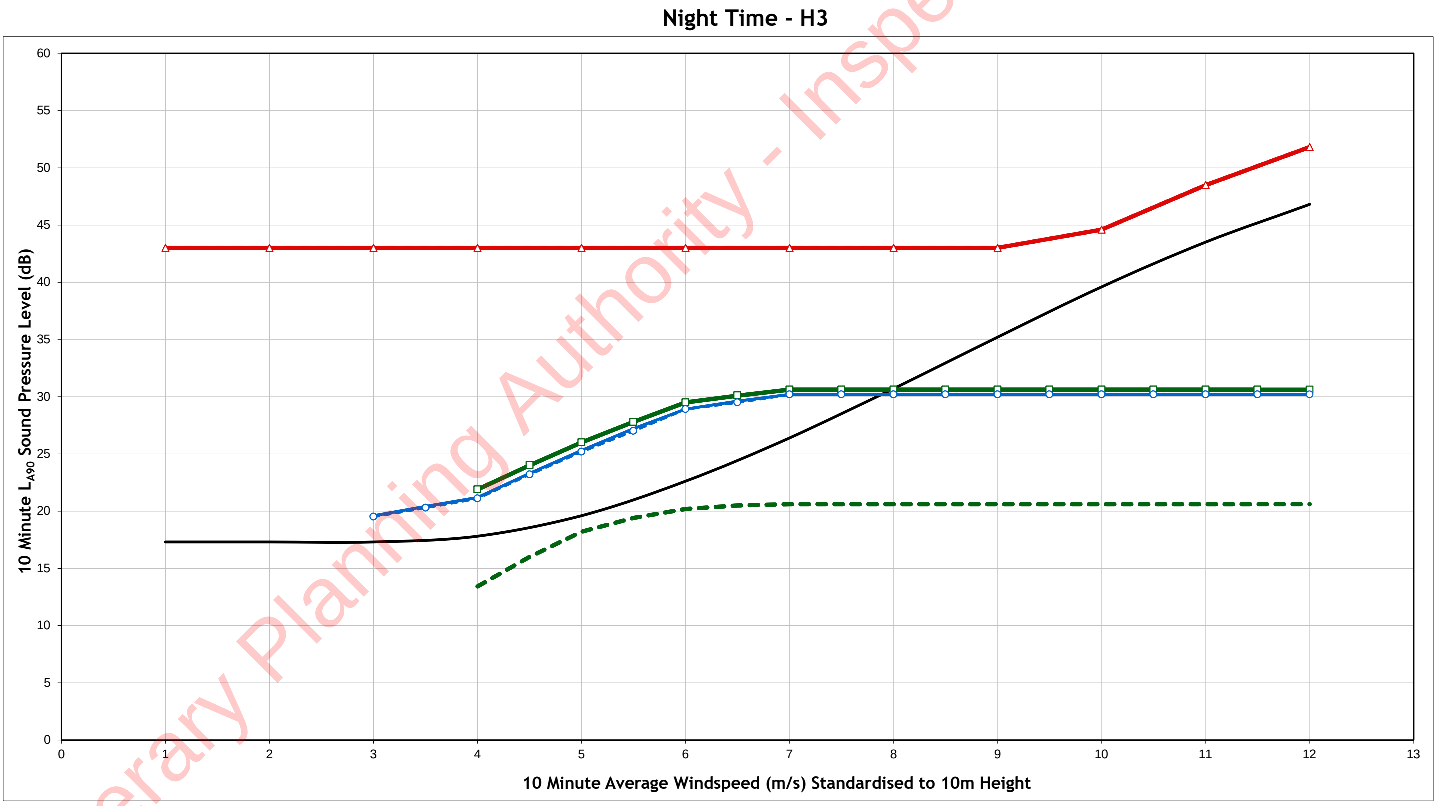

Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H3
Figure Number	Figure A1.5c
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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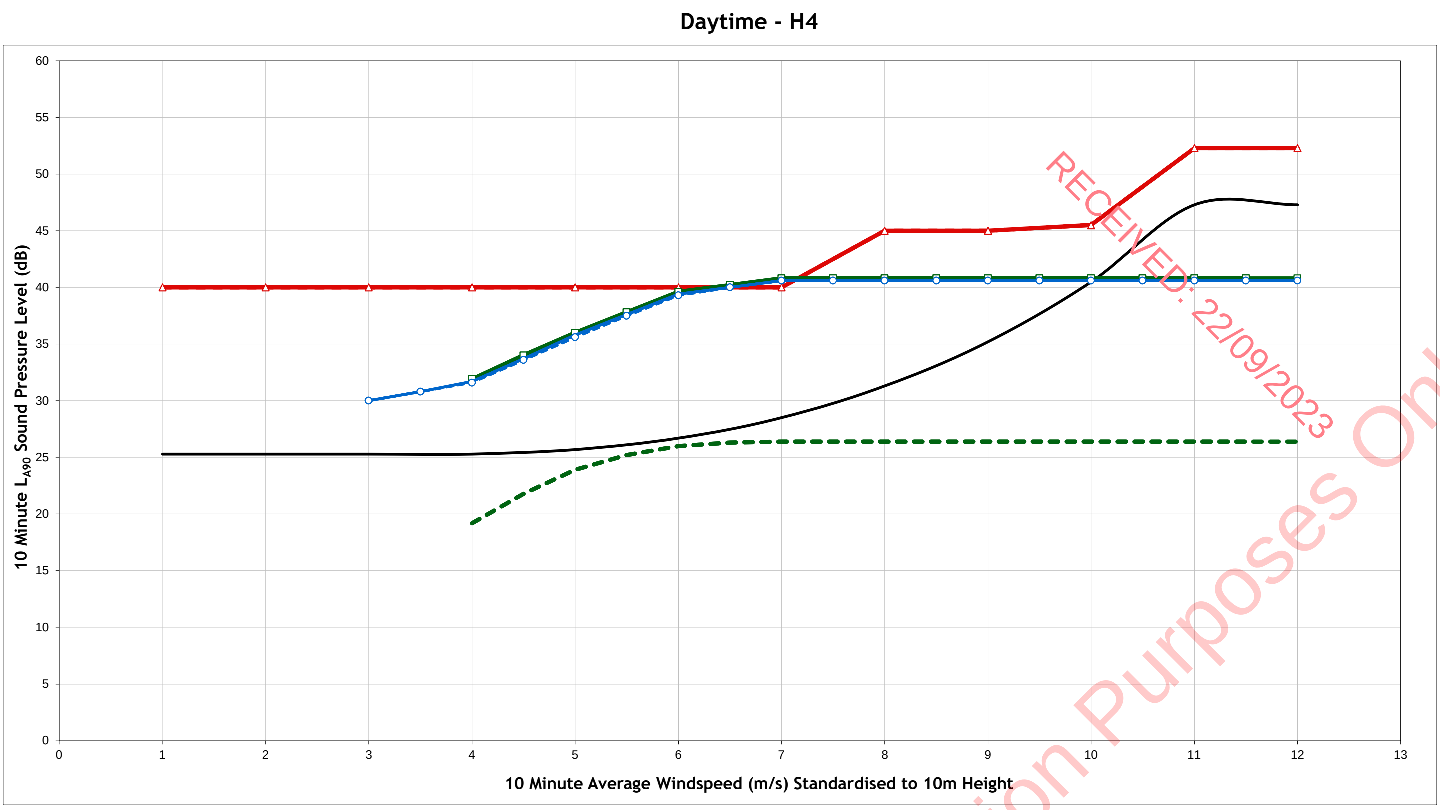

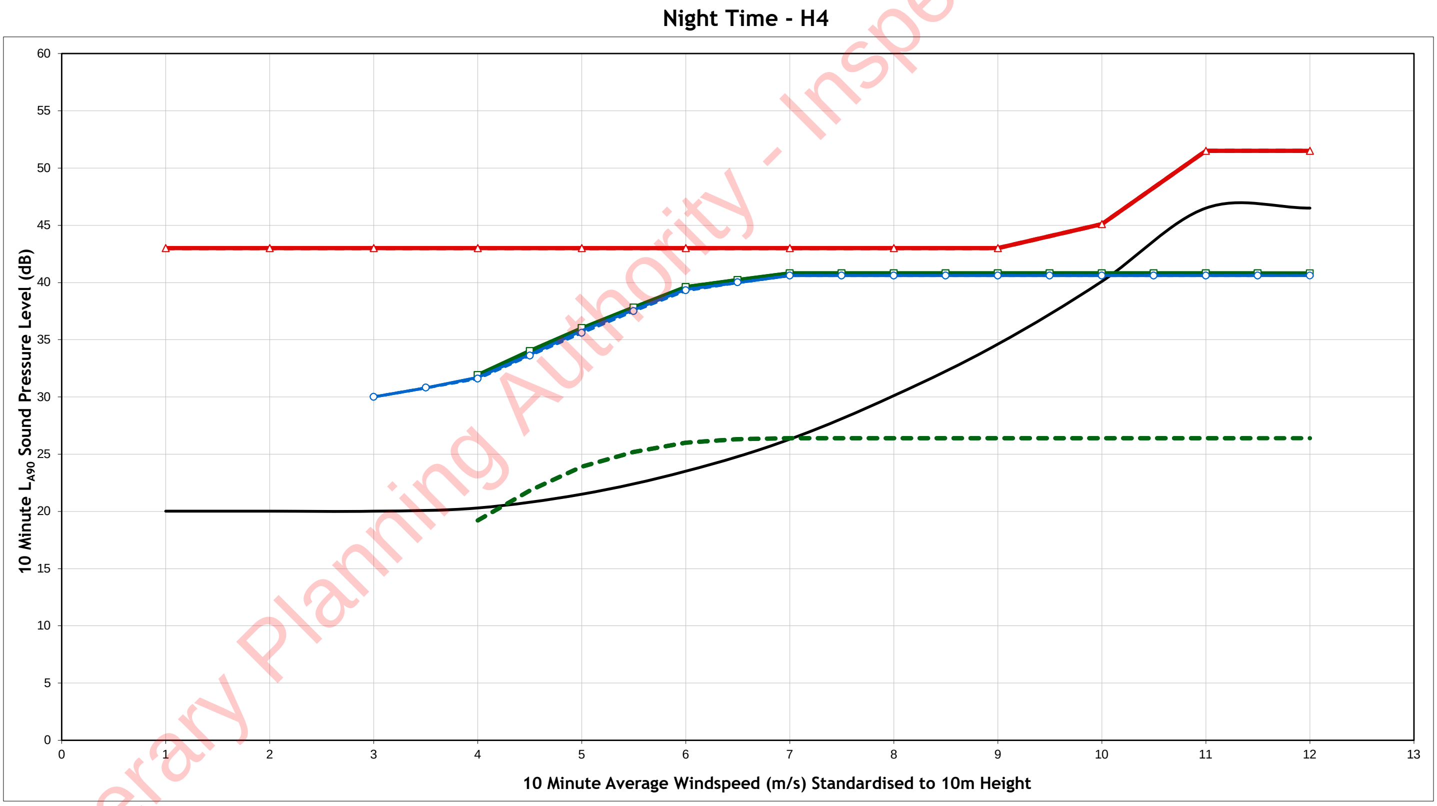

Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H4
Figure Number	Figure A1.5d
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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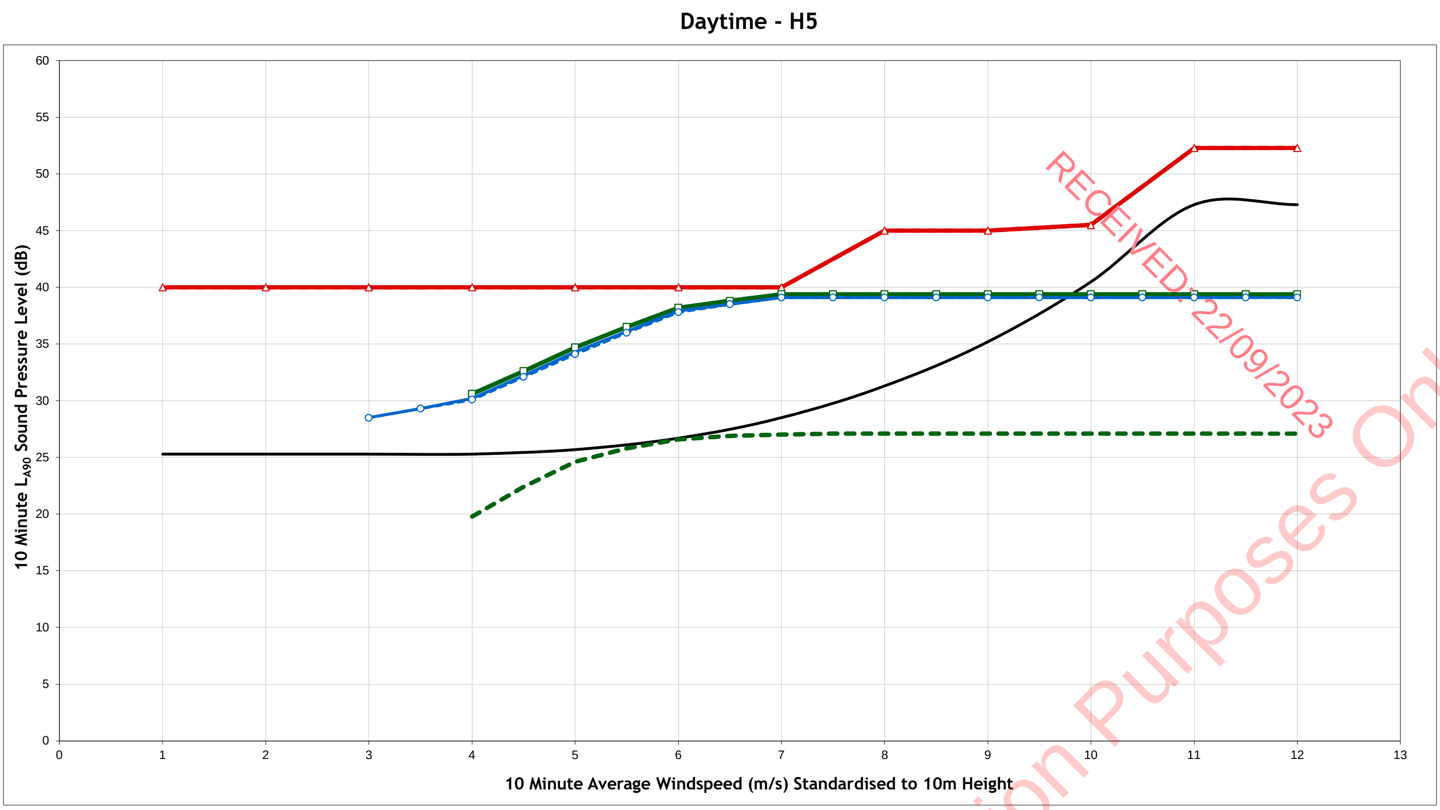

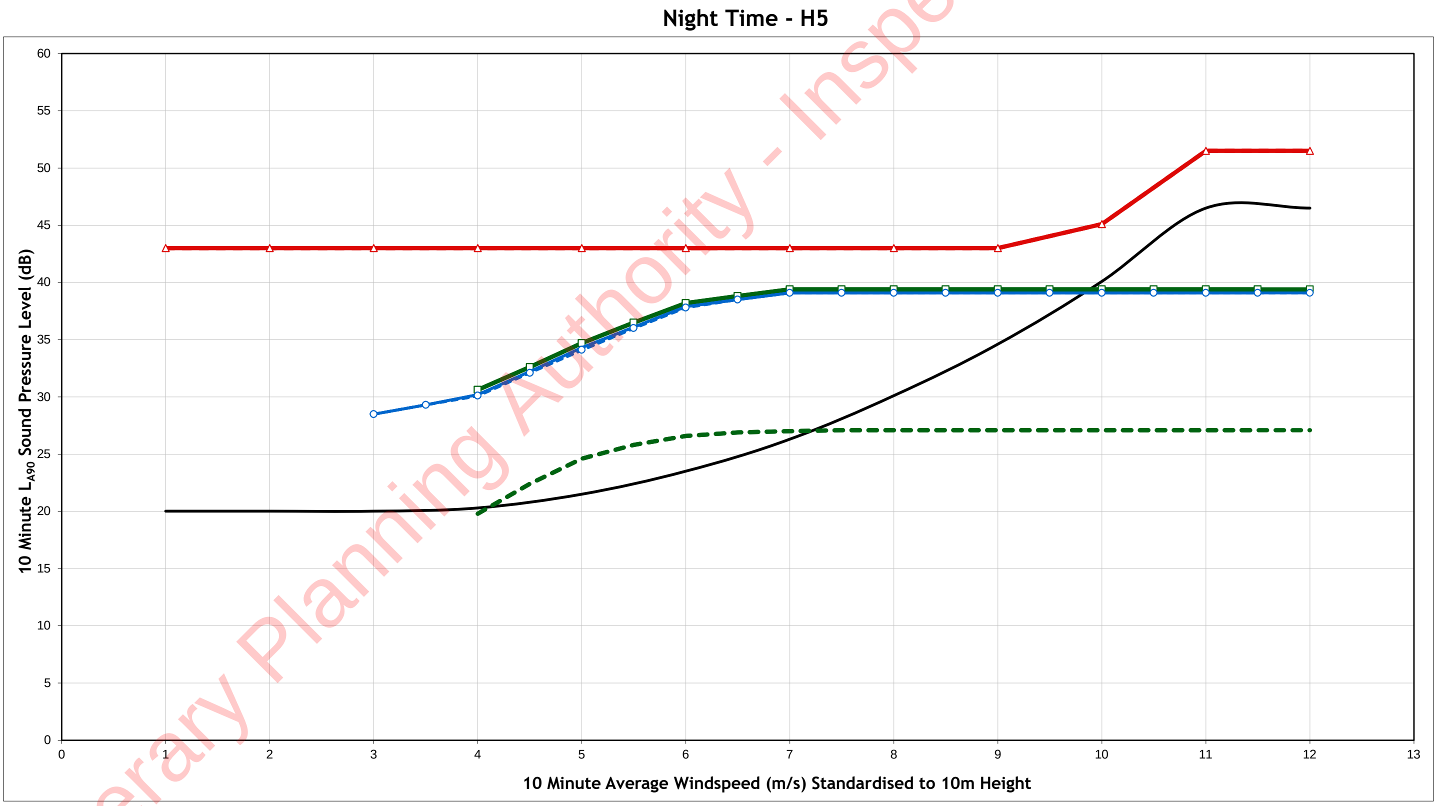

Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H5
Figure Number	Figure A1.5e
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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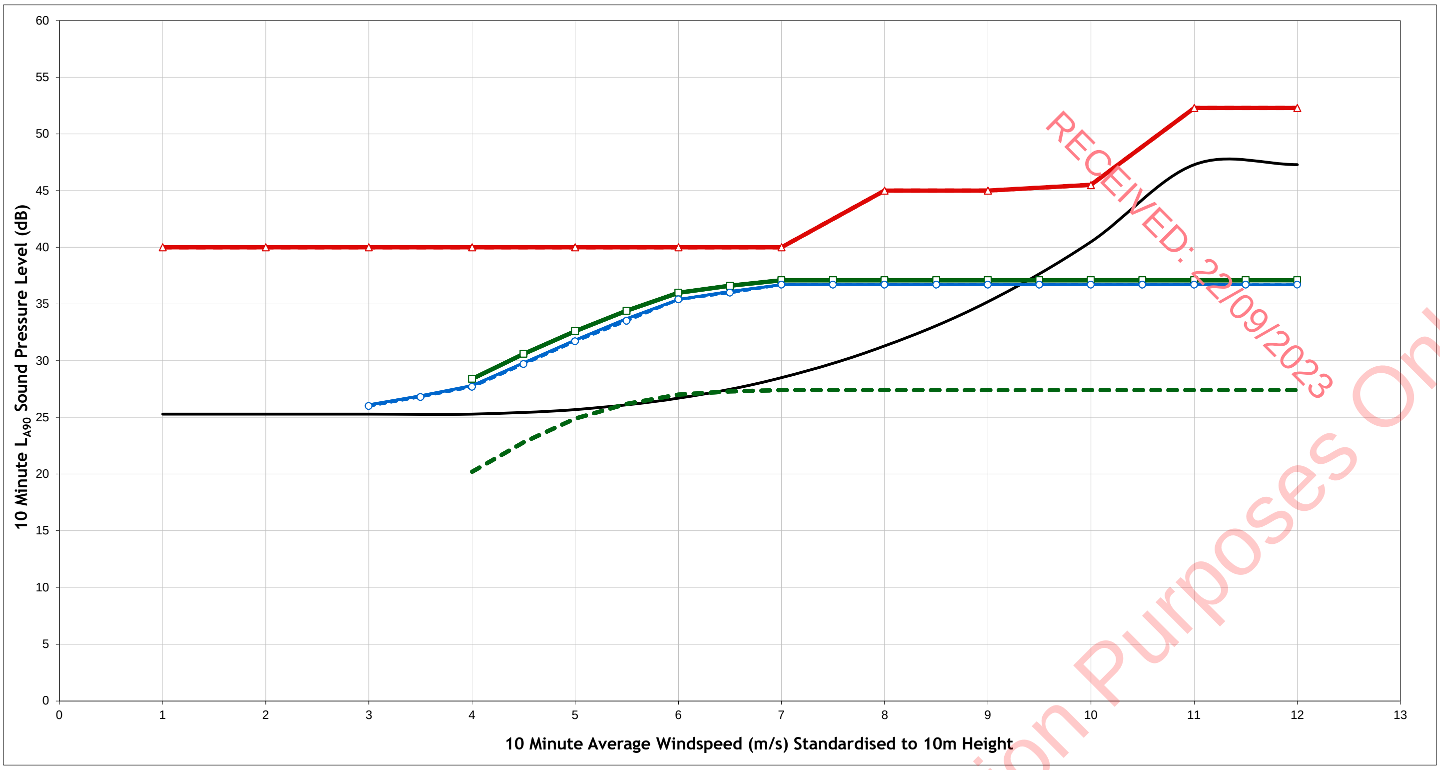
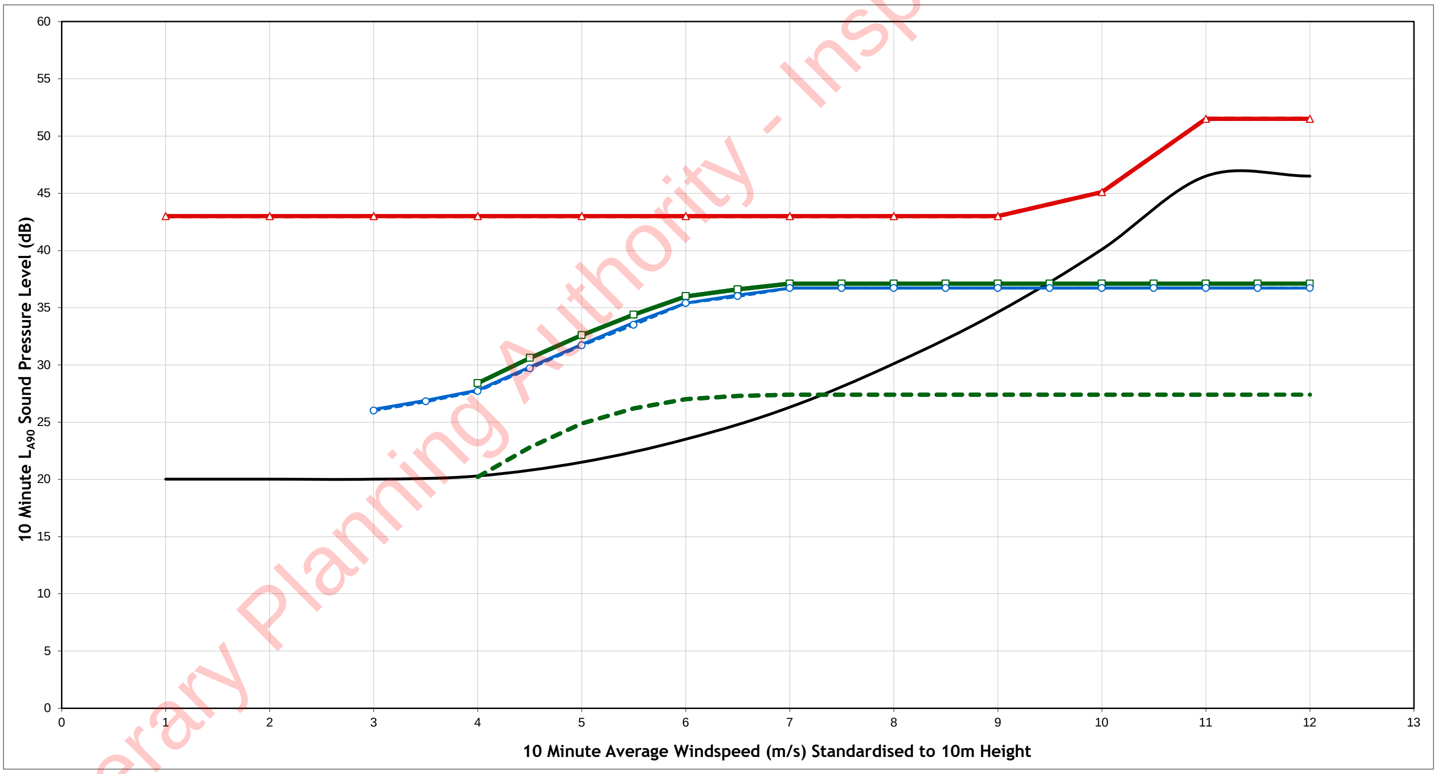
Daytime - H6



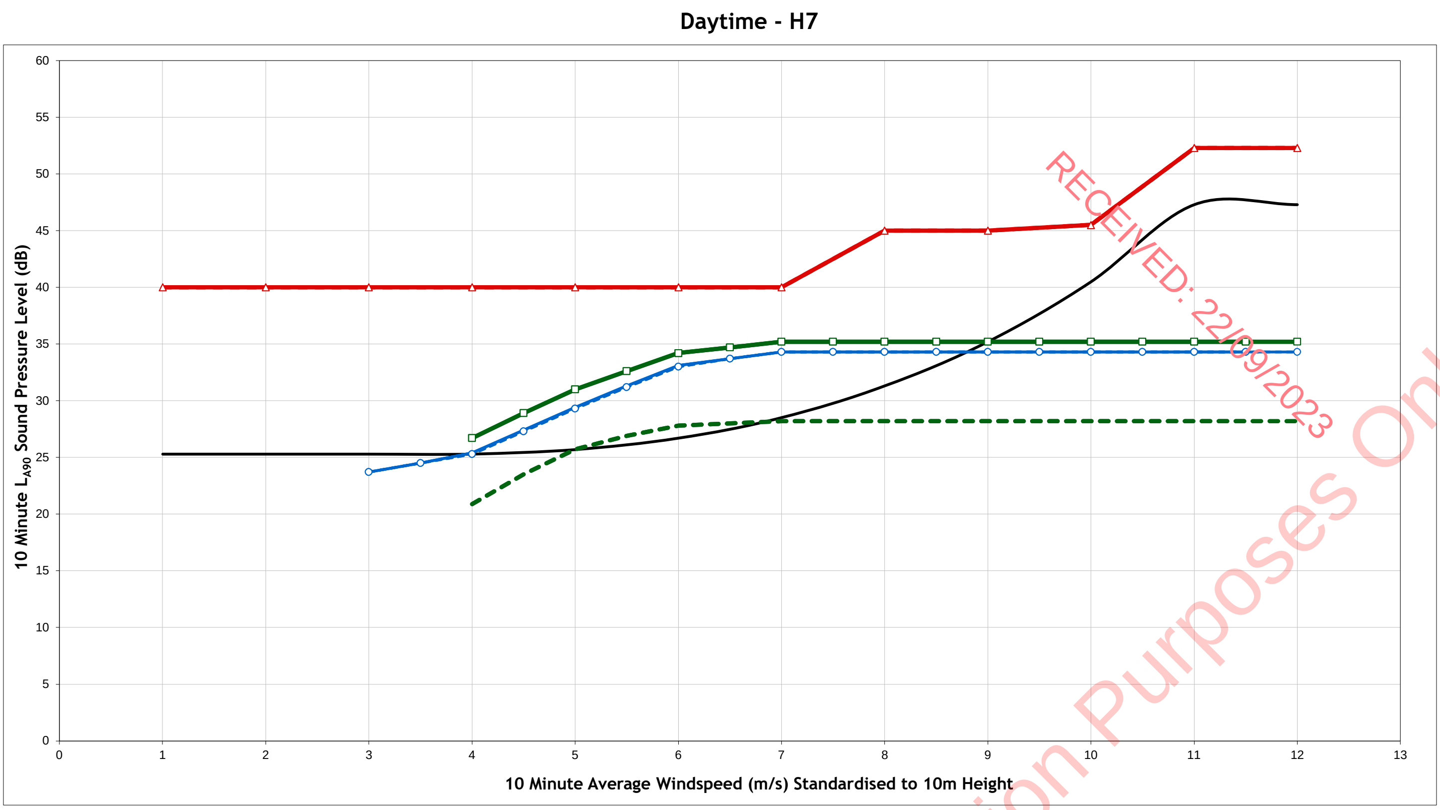
Night Time - H6

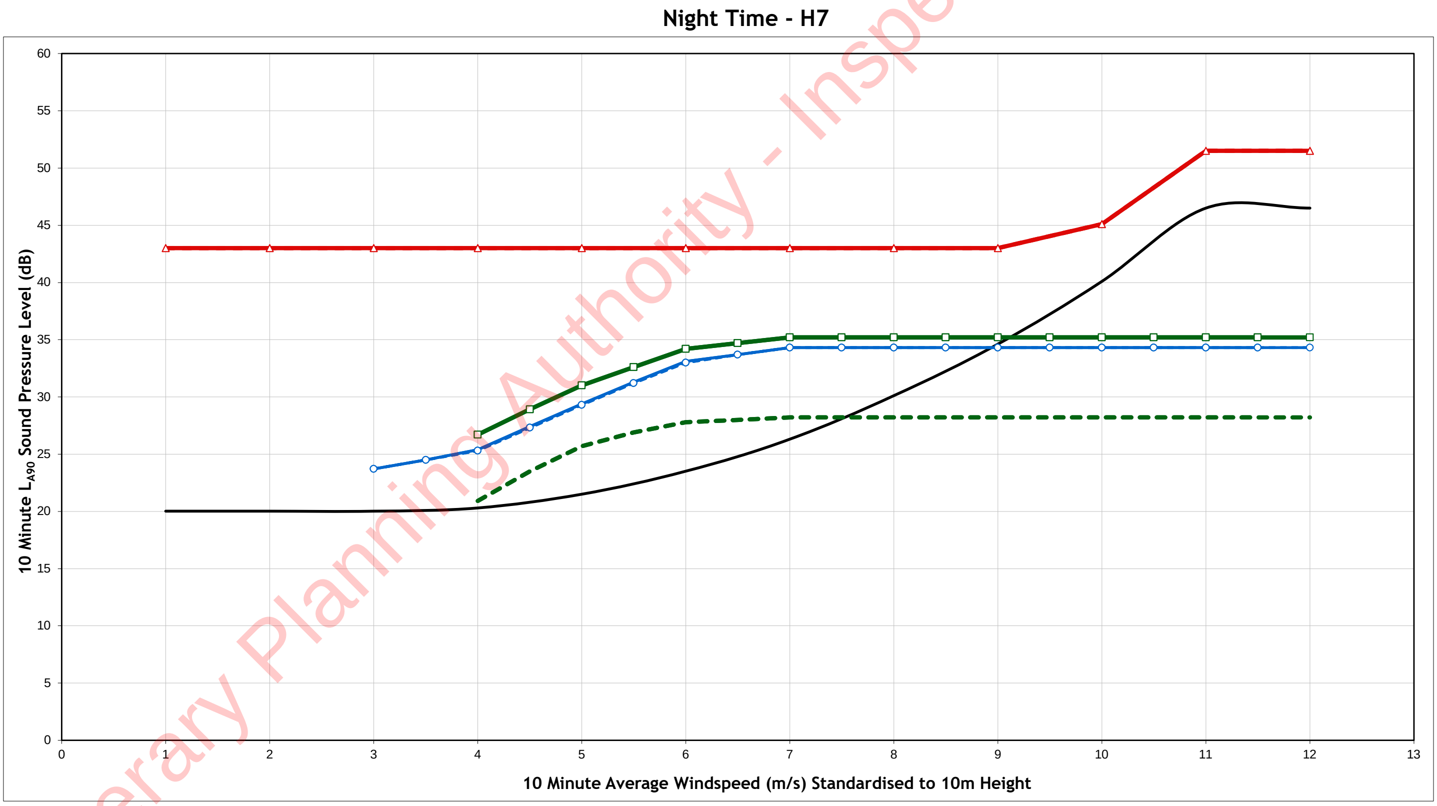


Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H6
Figure Number	Figure A1.5f
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models





Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H7
Figure Number	Figure A1.5g
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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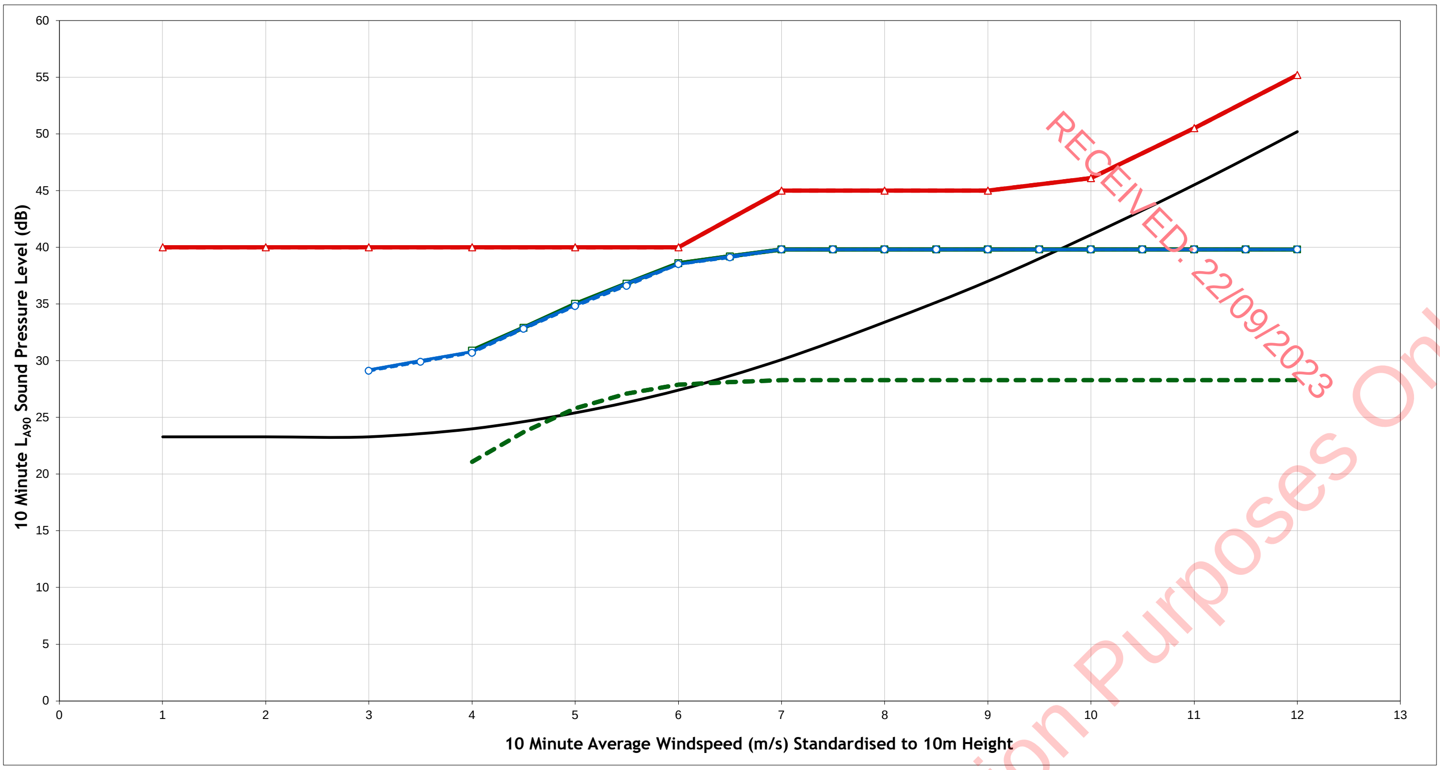
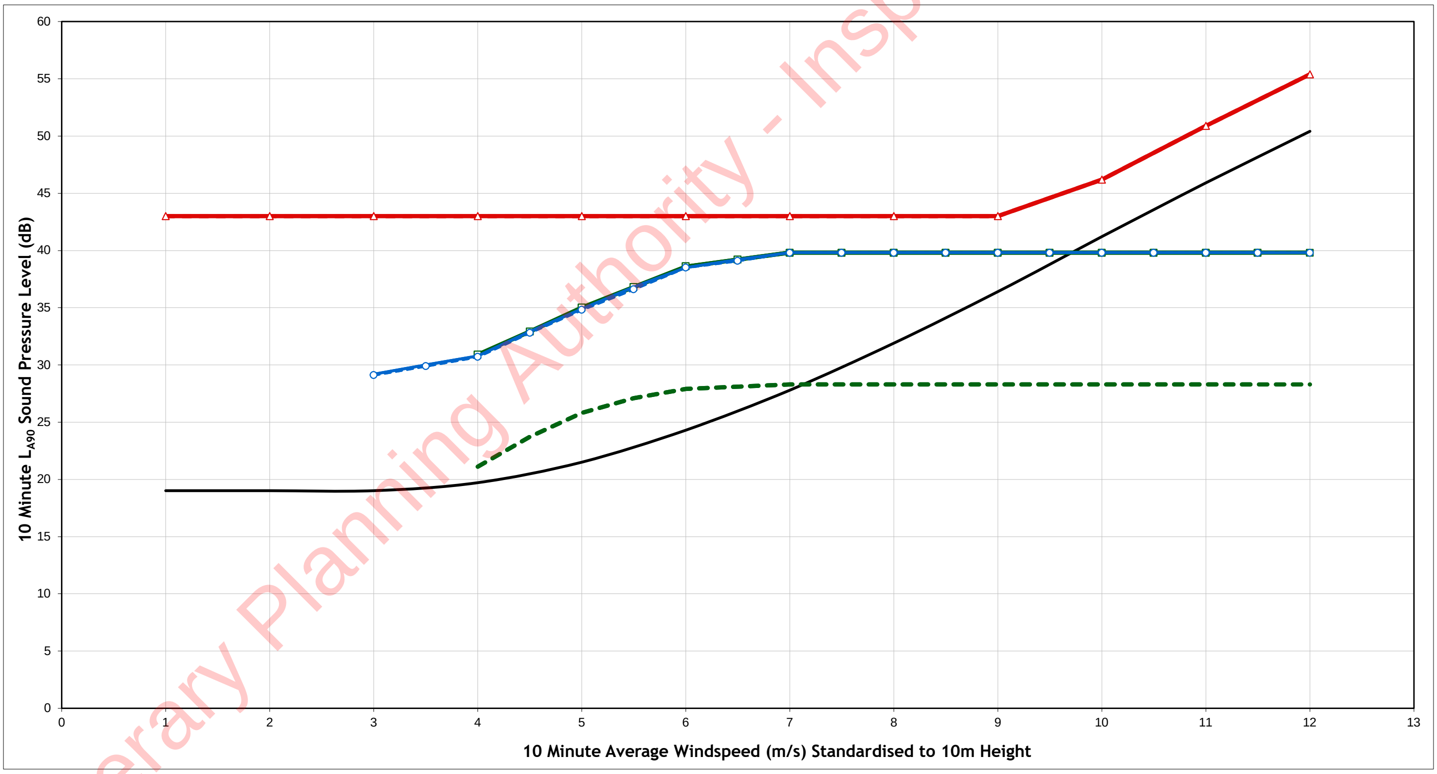
Daytime - H8



Night Time - H8



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H8
Figure Number	Figure A1.5h
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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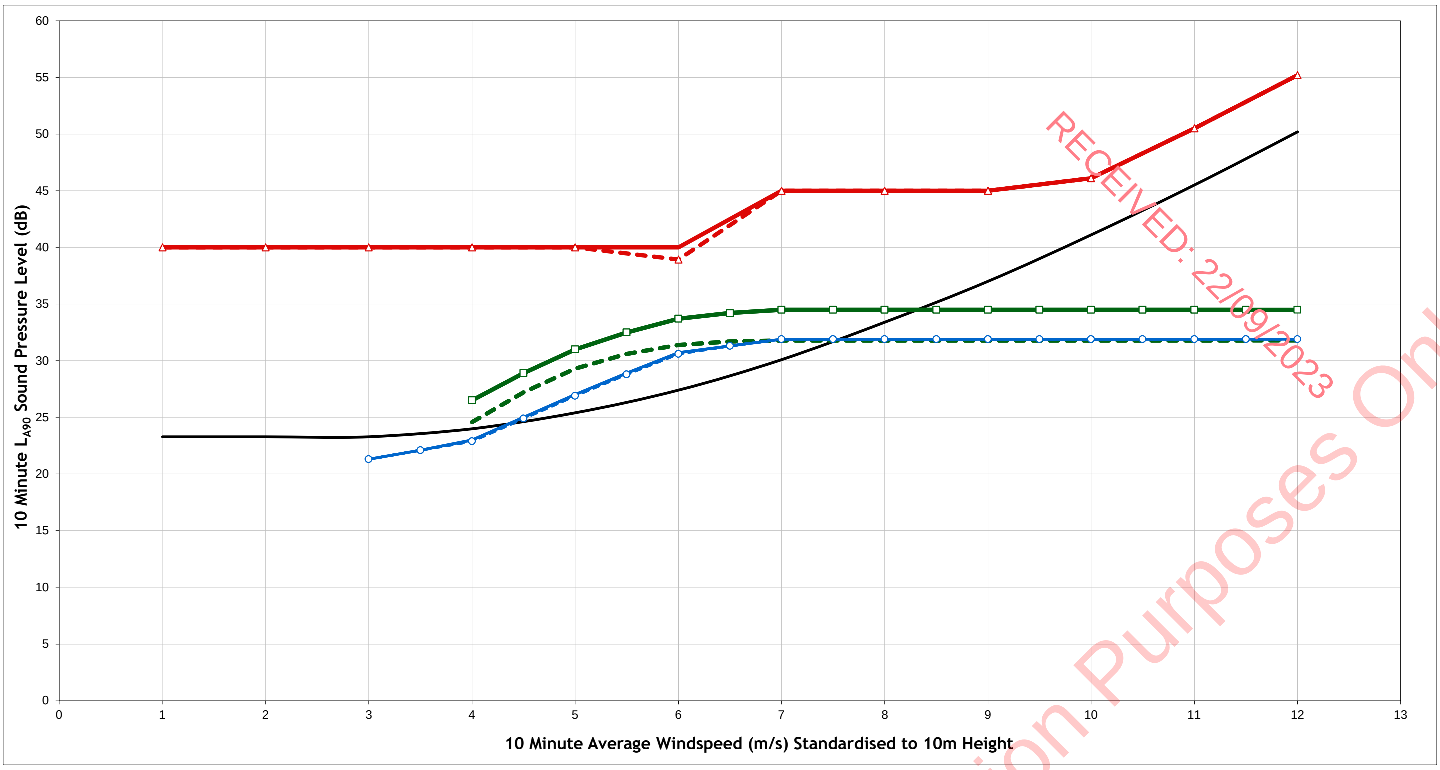
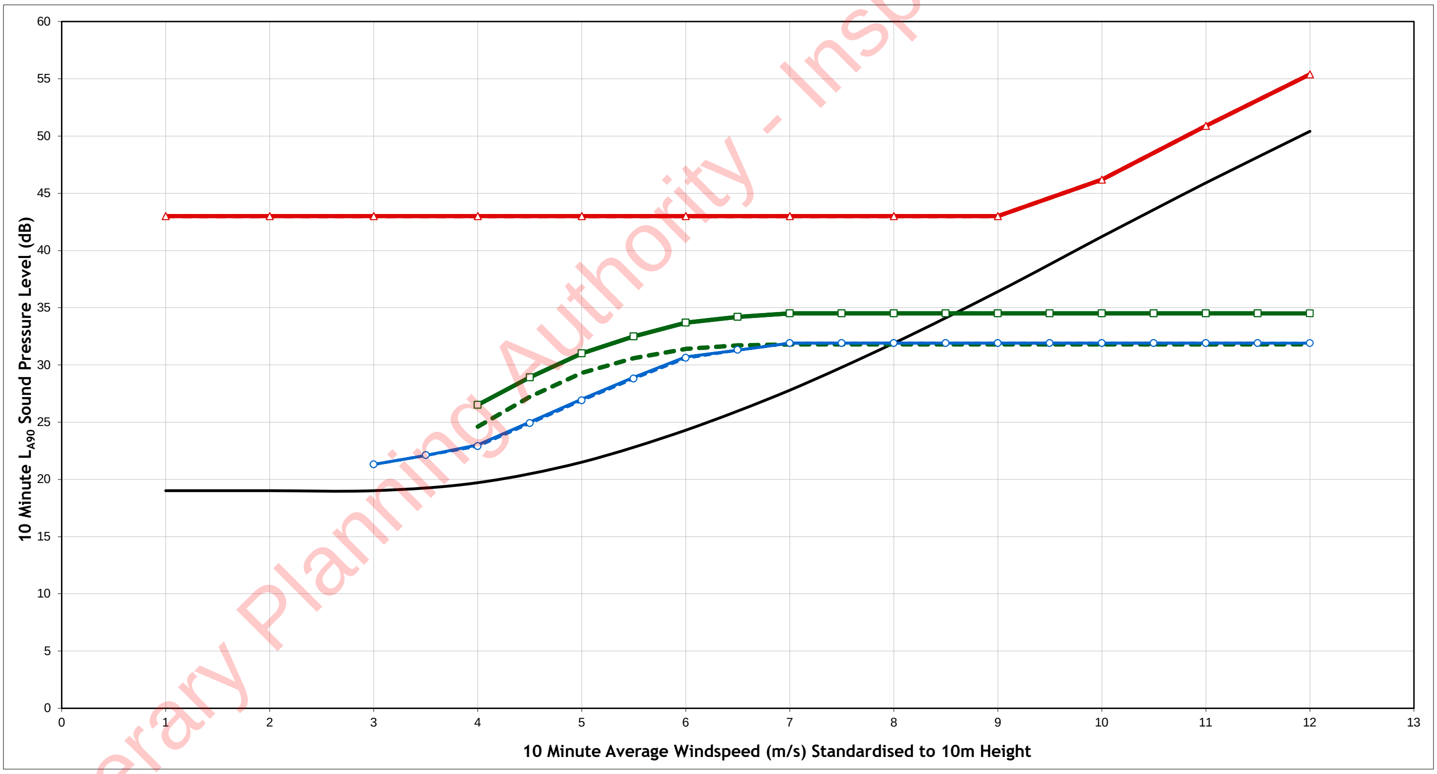
Daytime - H9



Night Time - H9



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H9
Figure Number	Figure A1.5i
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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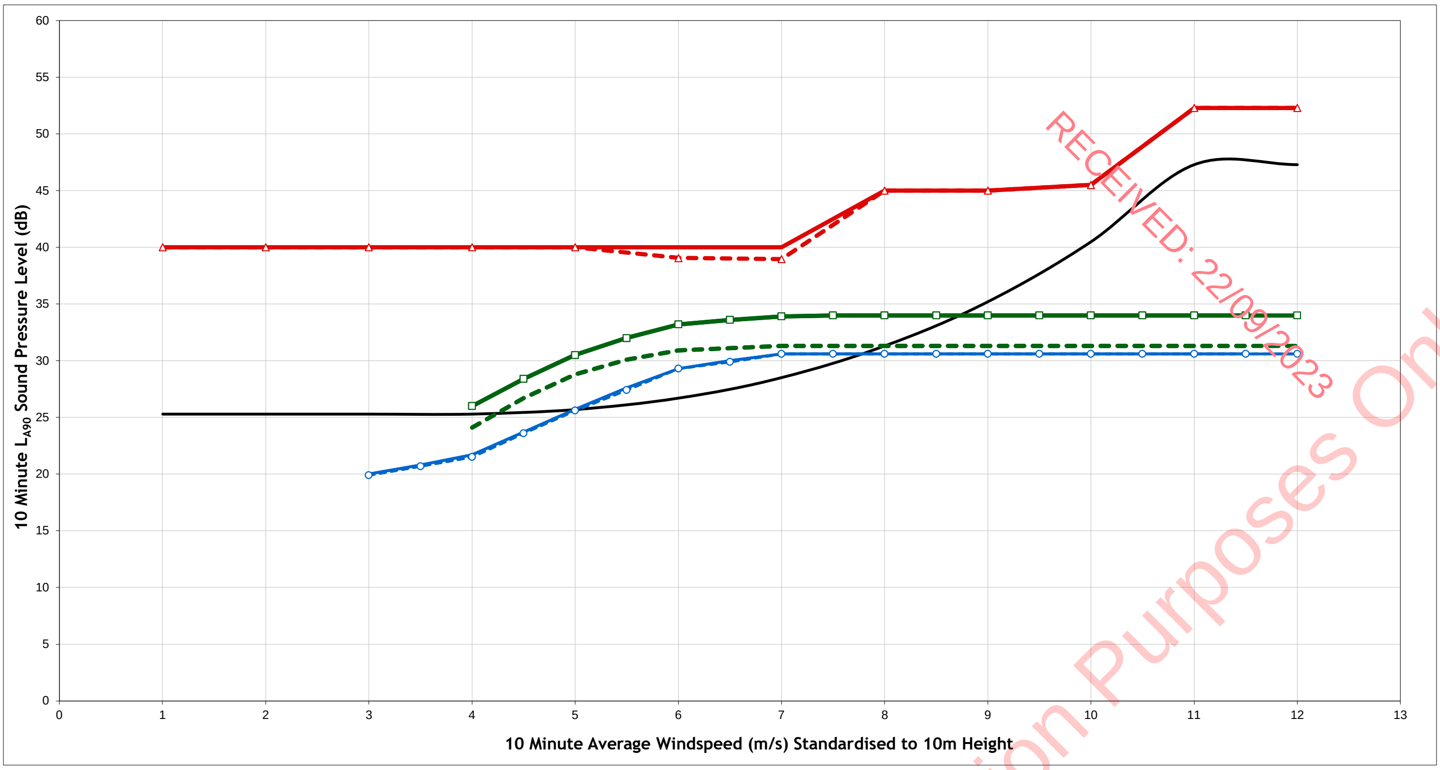
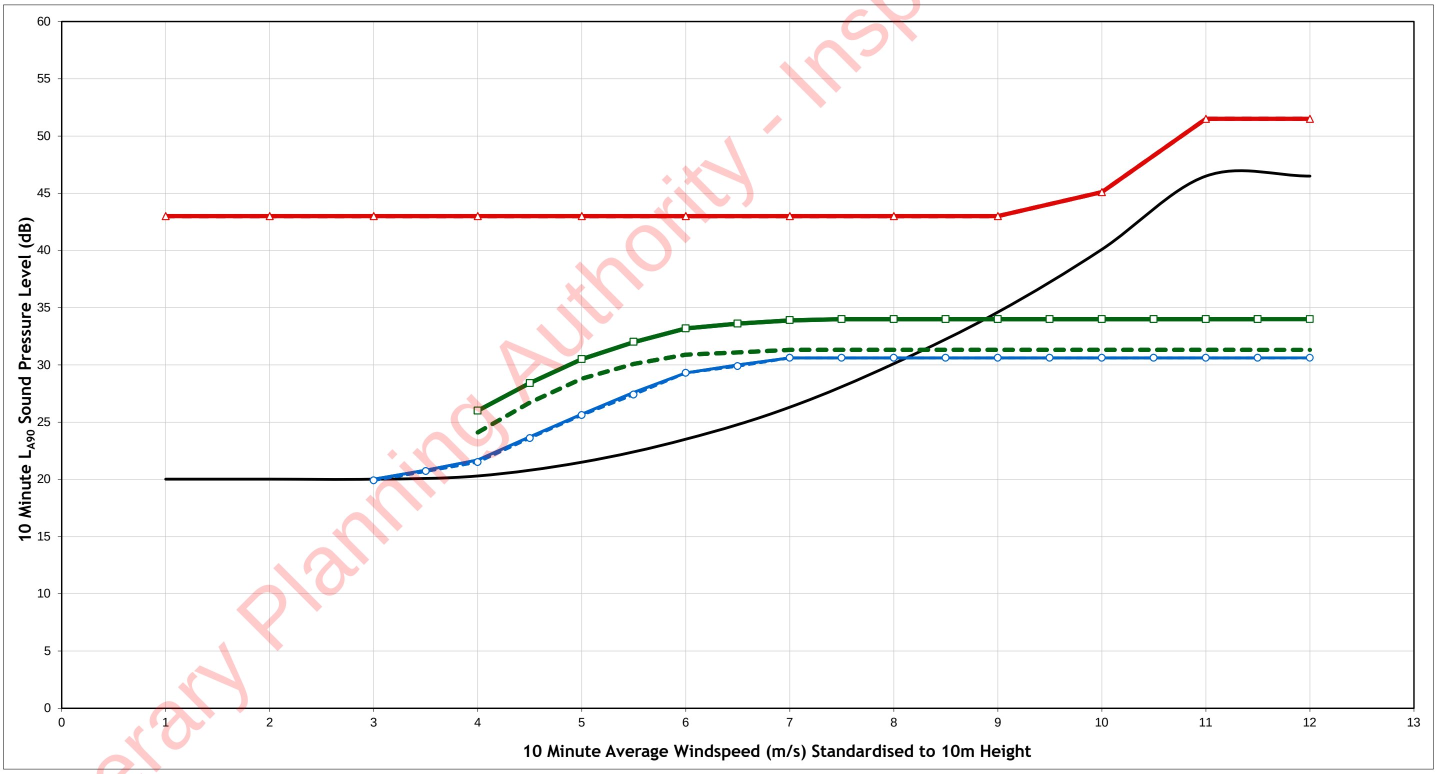
Daytime - H10



Night Time - H10

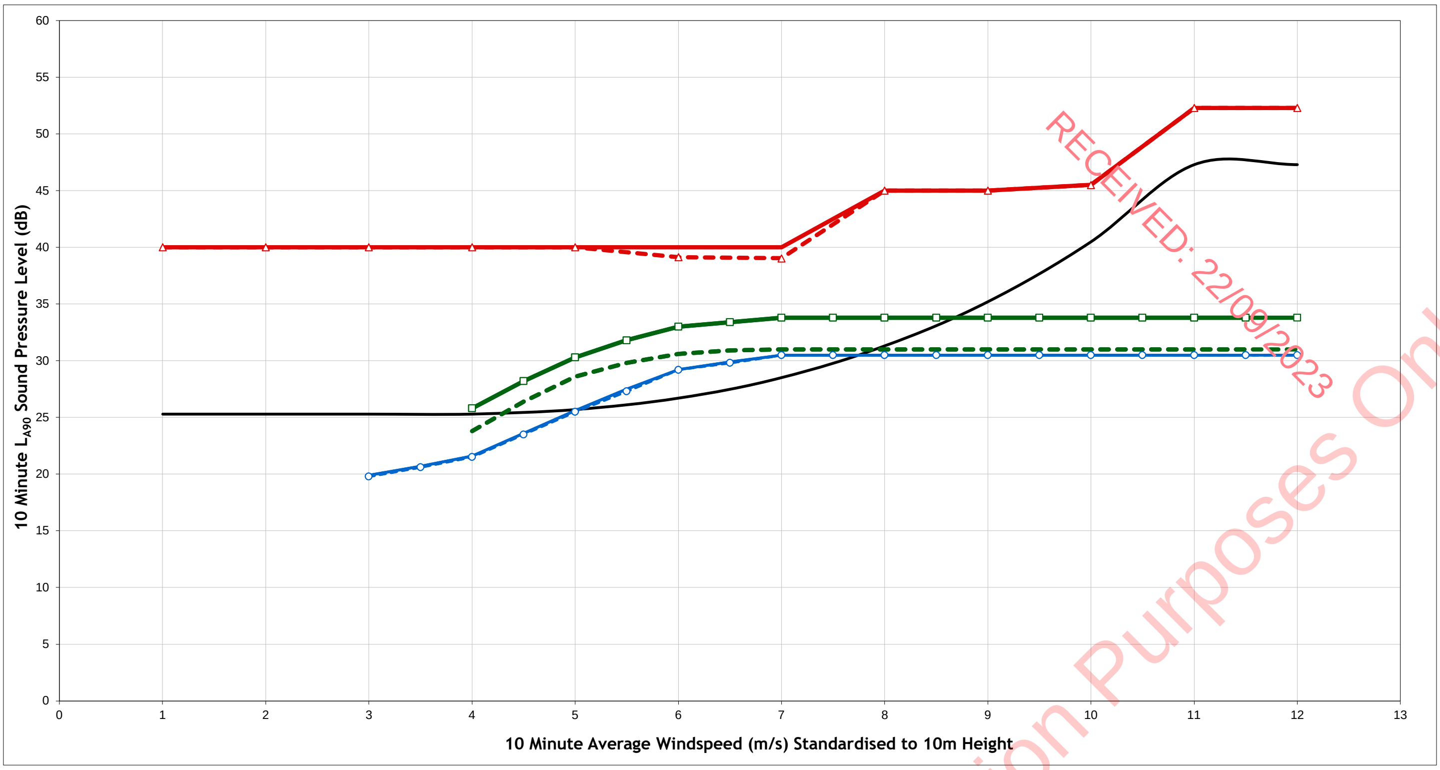


Legend:

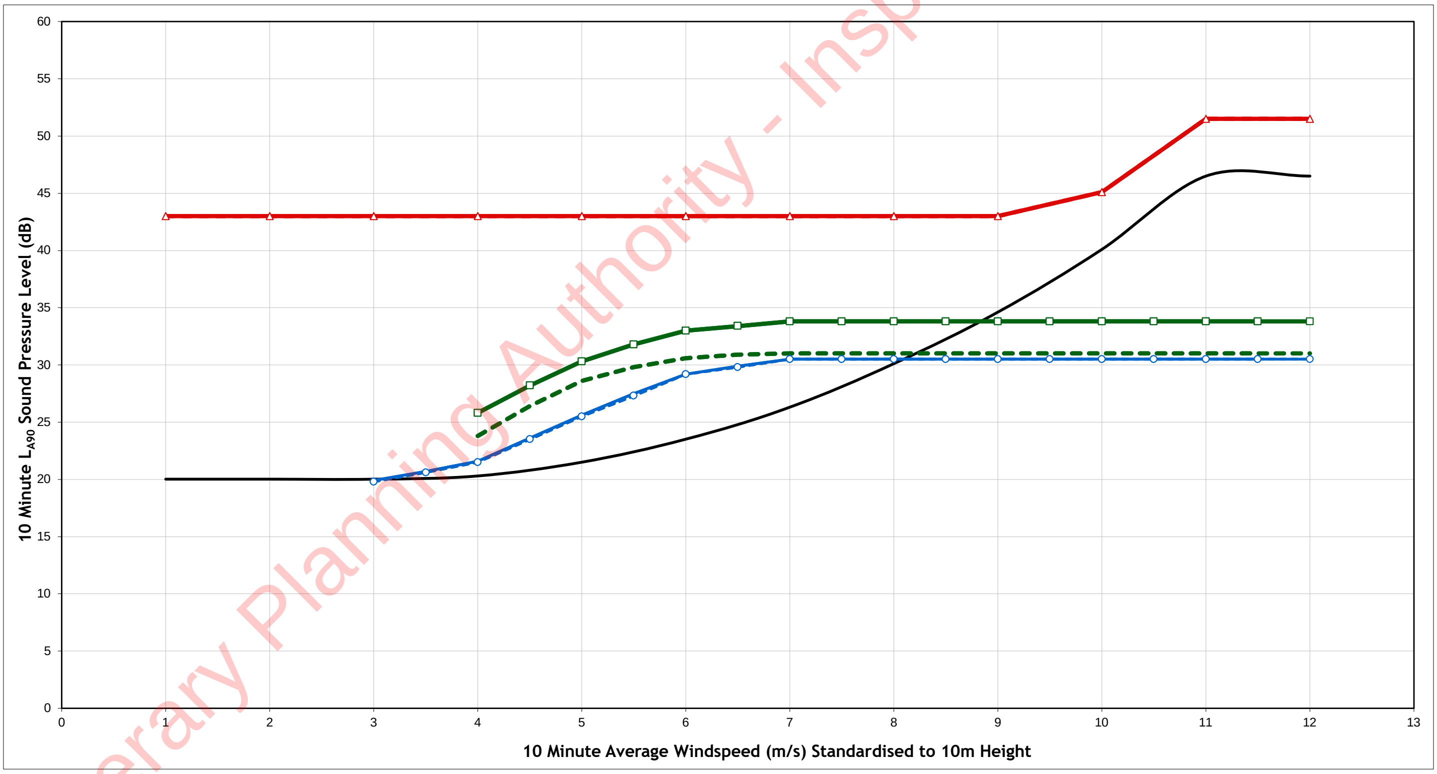
- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H10
Figure Number	Figure A1.5j
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

Daytime - H11



Night Time - H11



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H11
Figure Number	Figure A1.5k
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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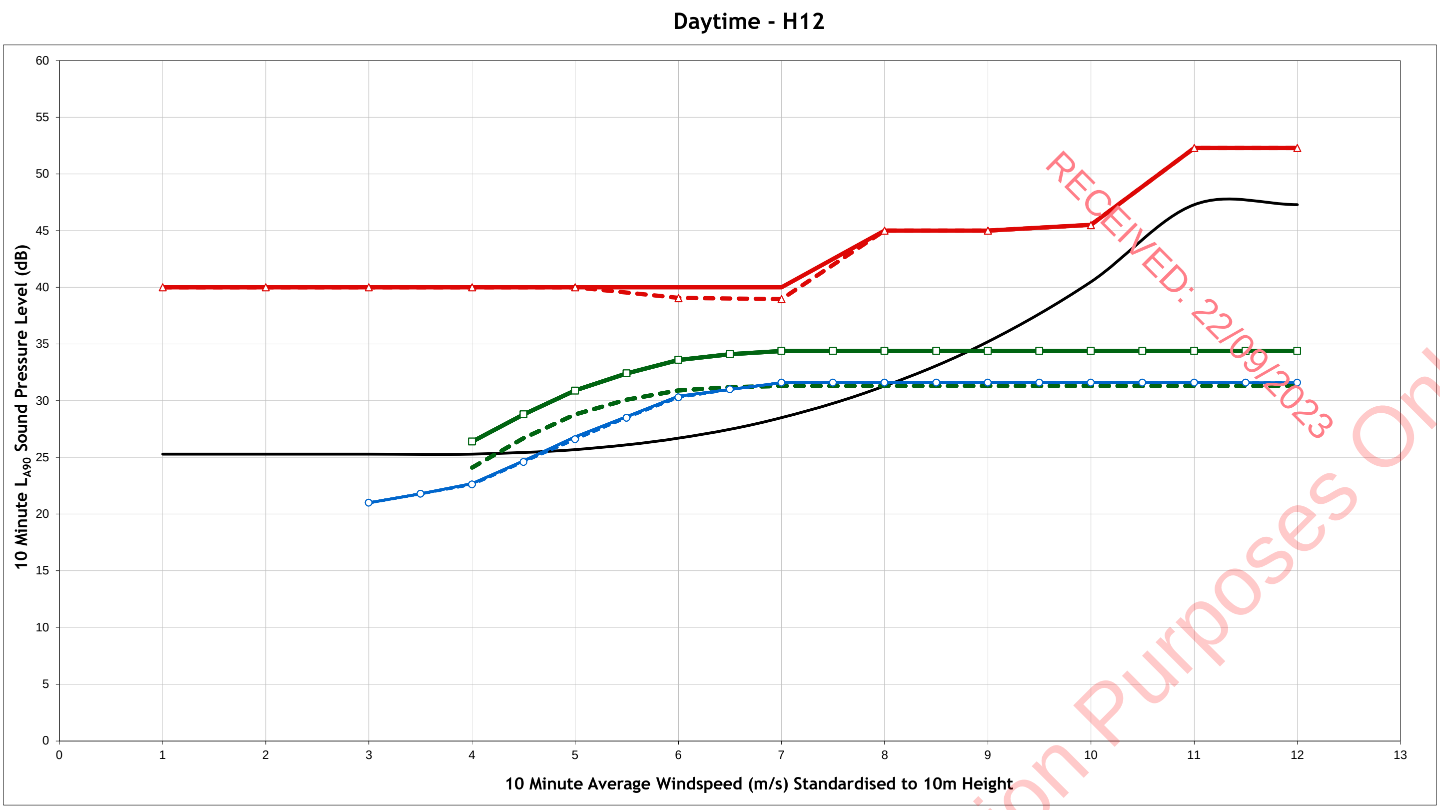

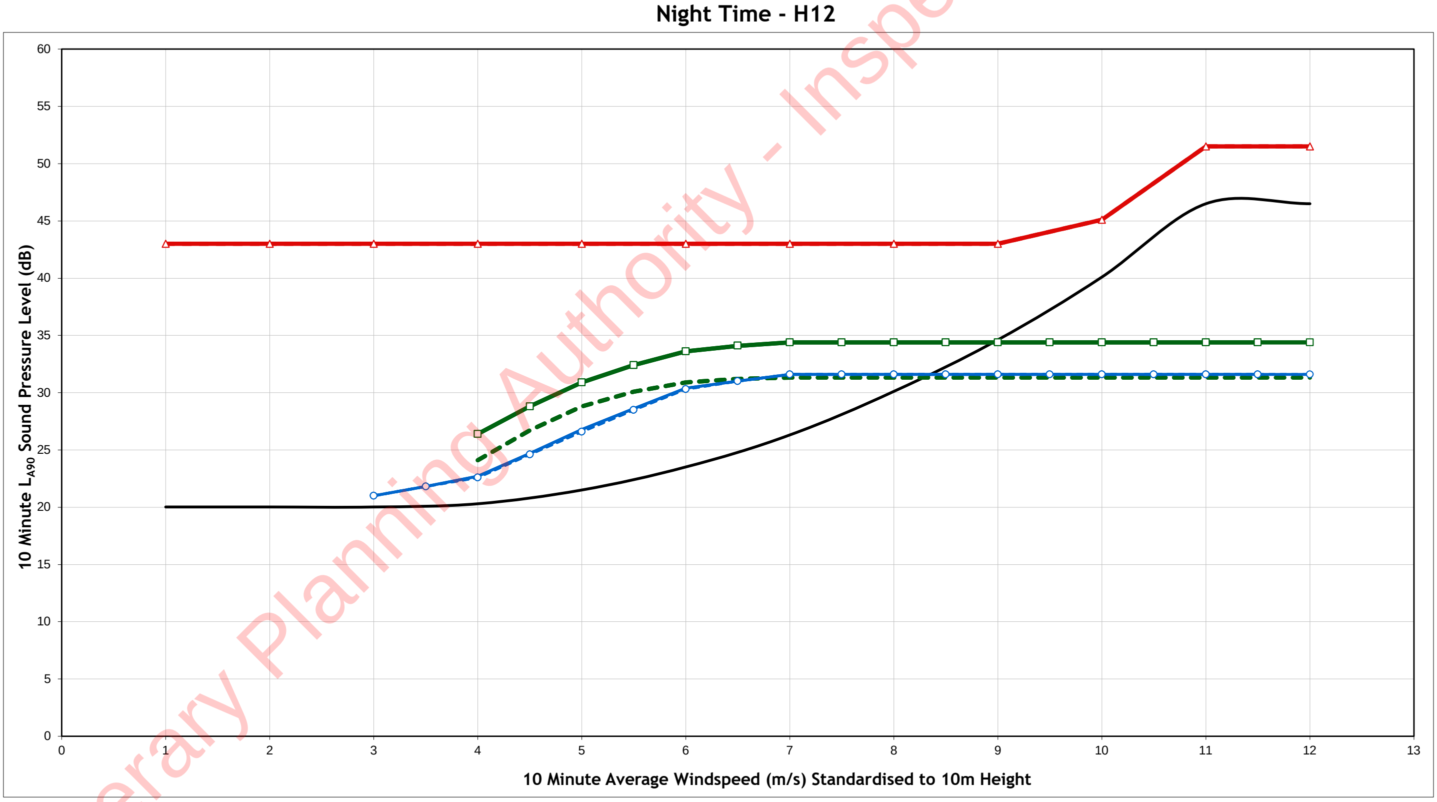

Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H12
Figure Number	Figure A1.5l
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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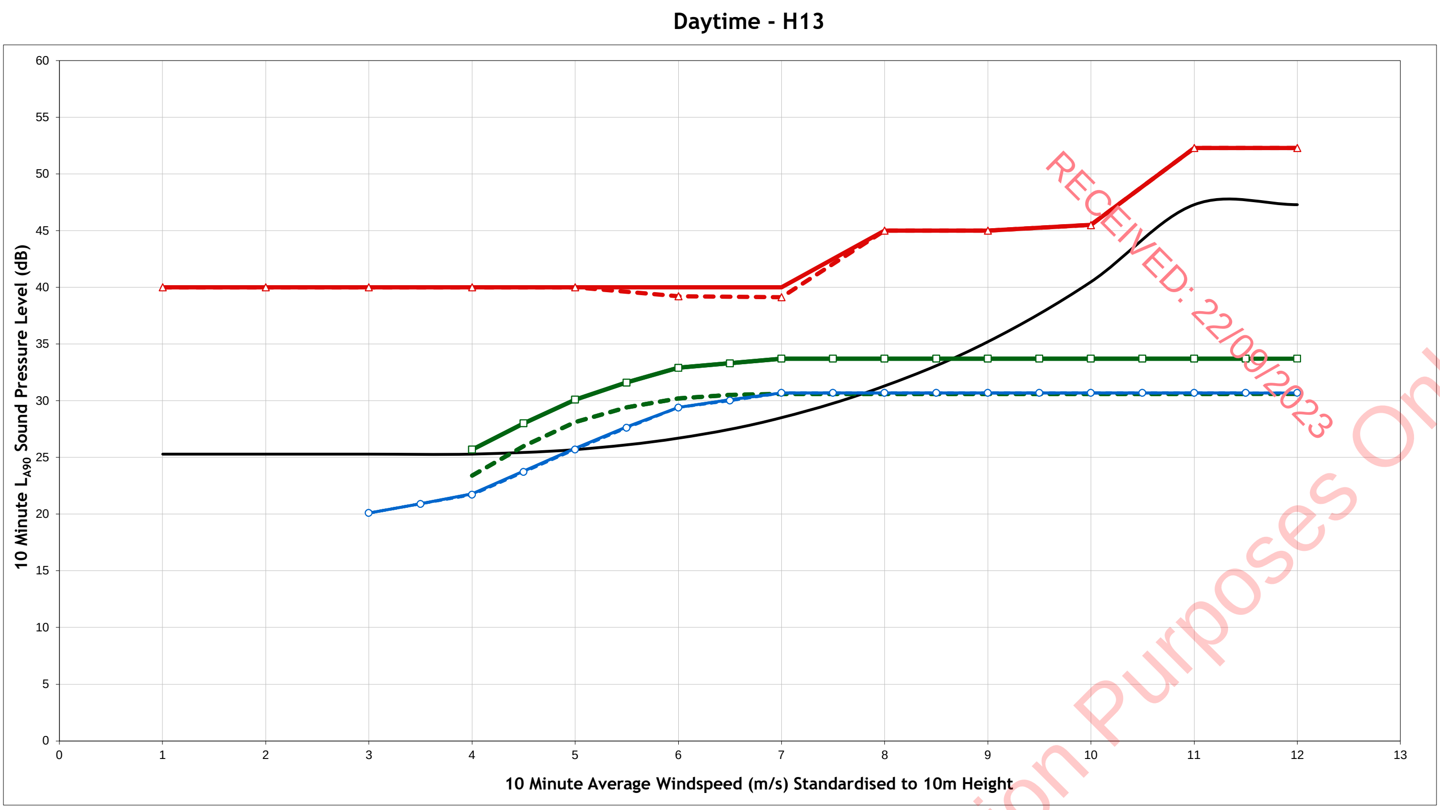
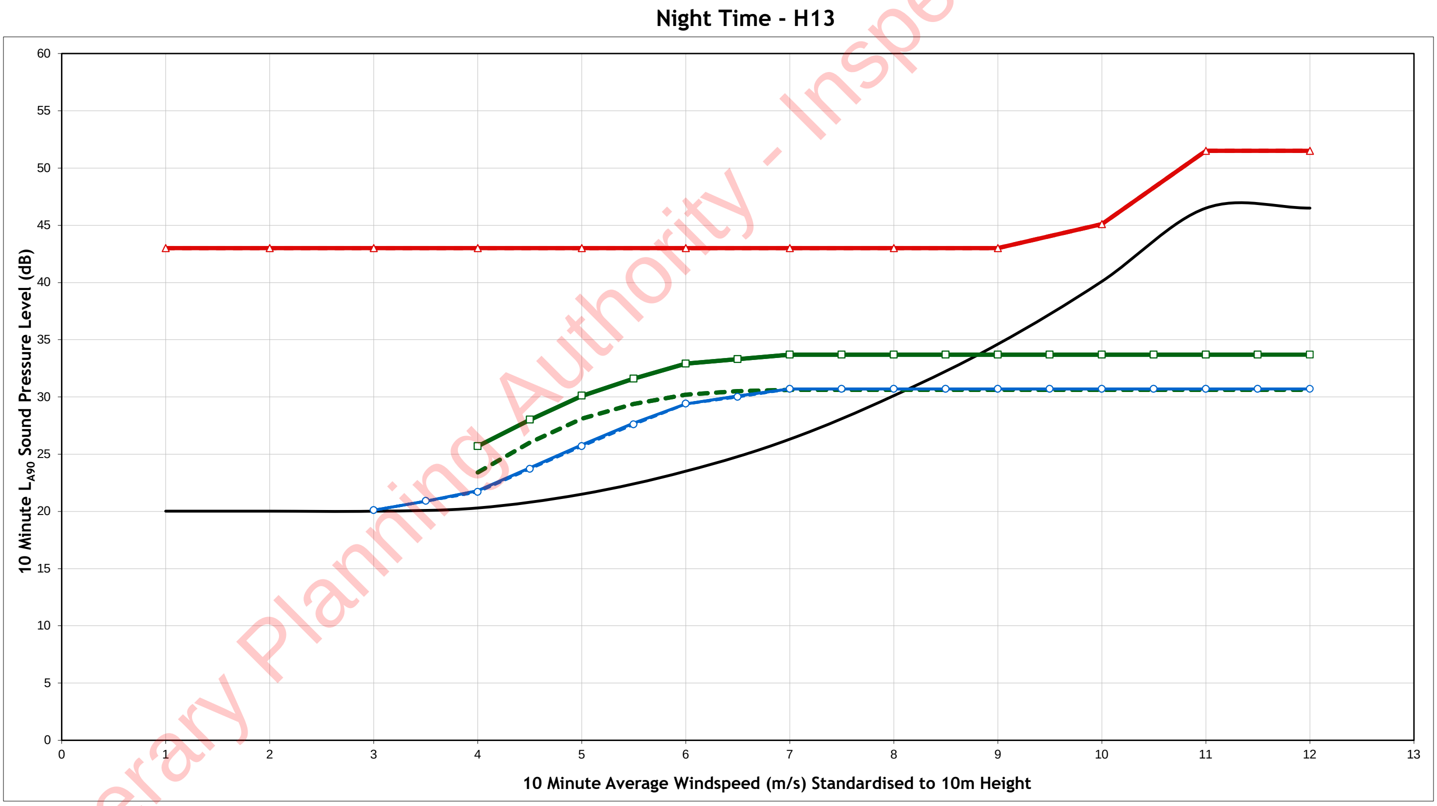
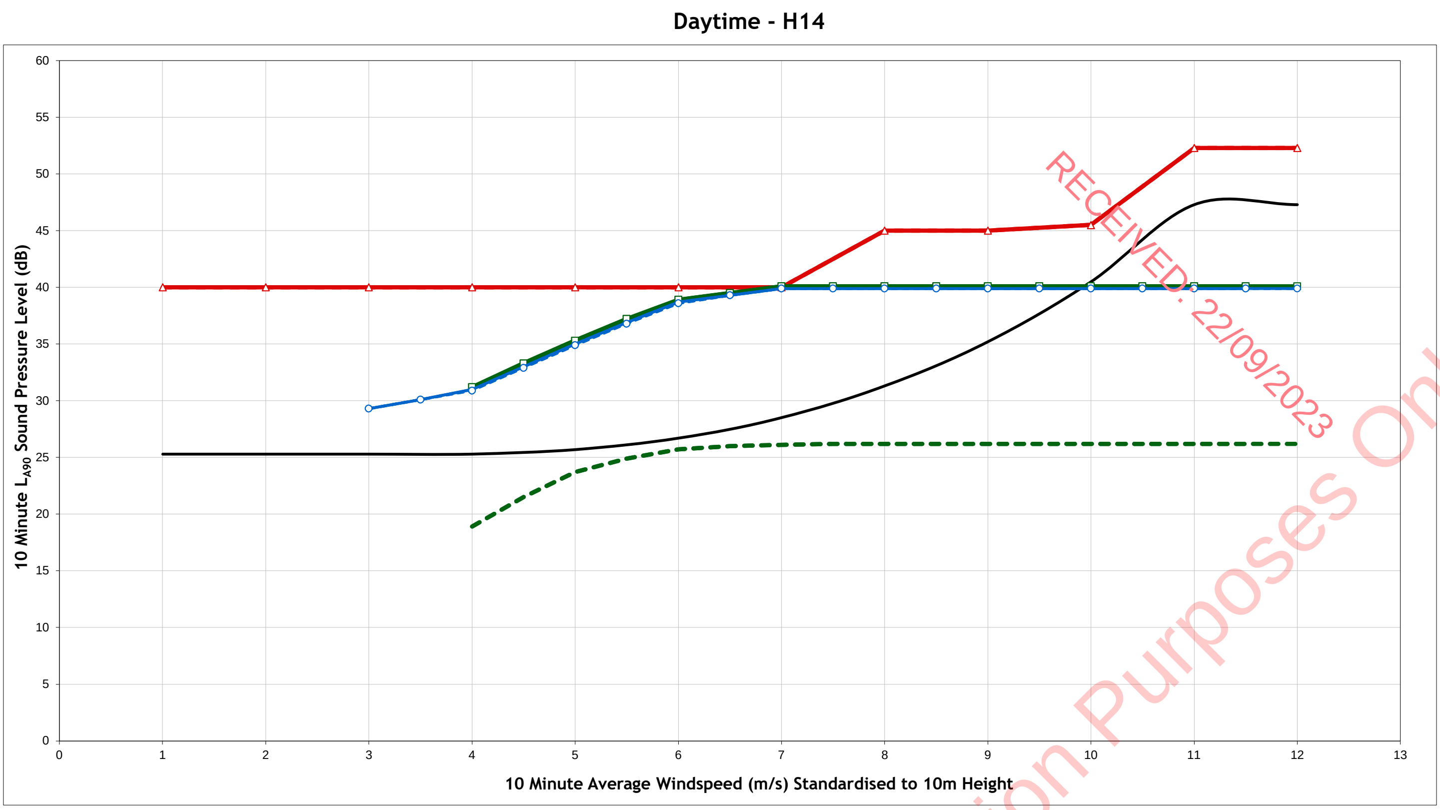


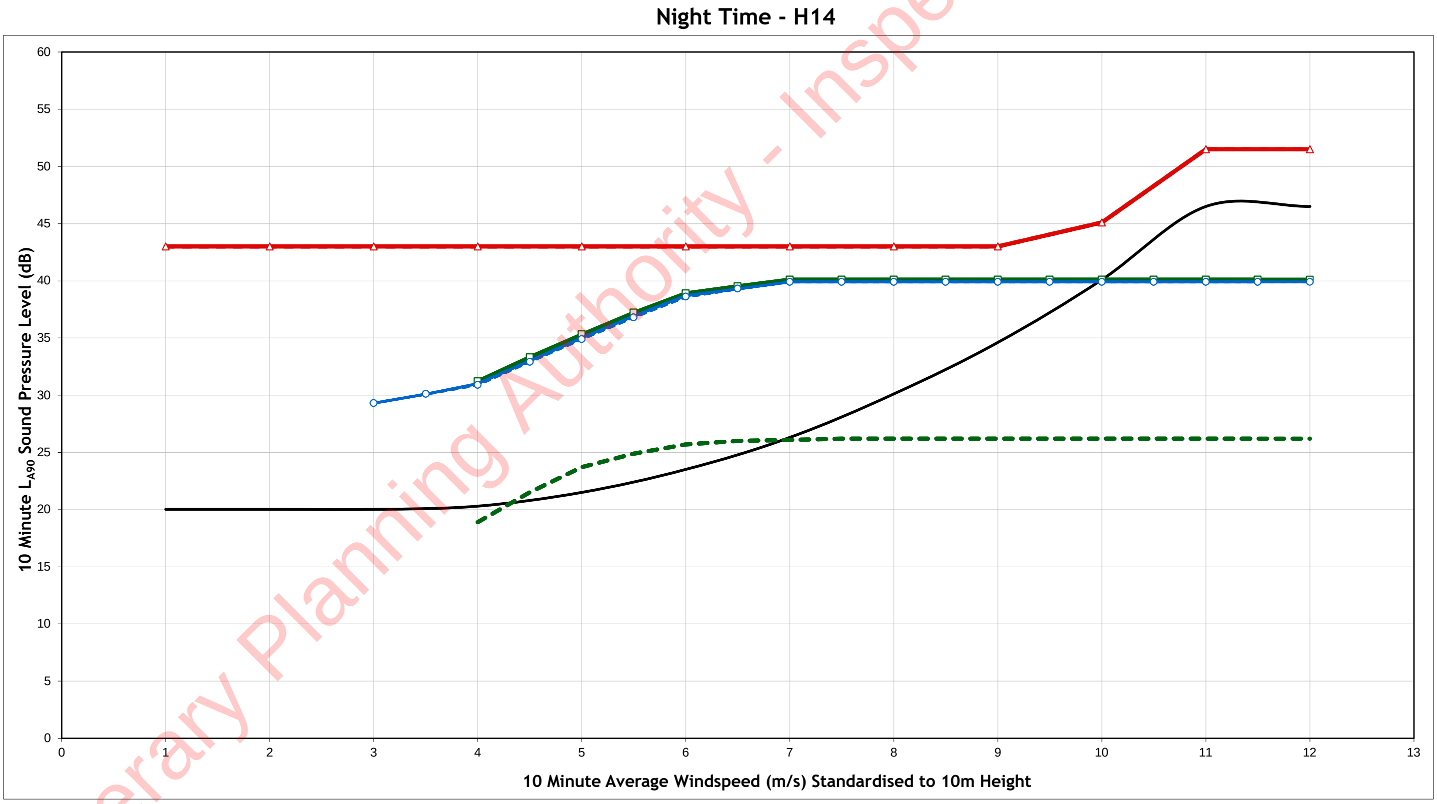


Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H13
Figure Number	Figure A1.5m
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

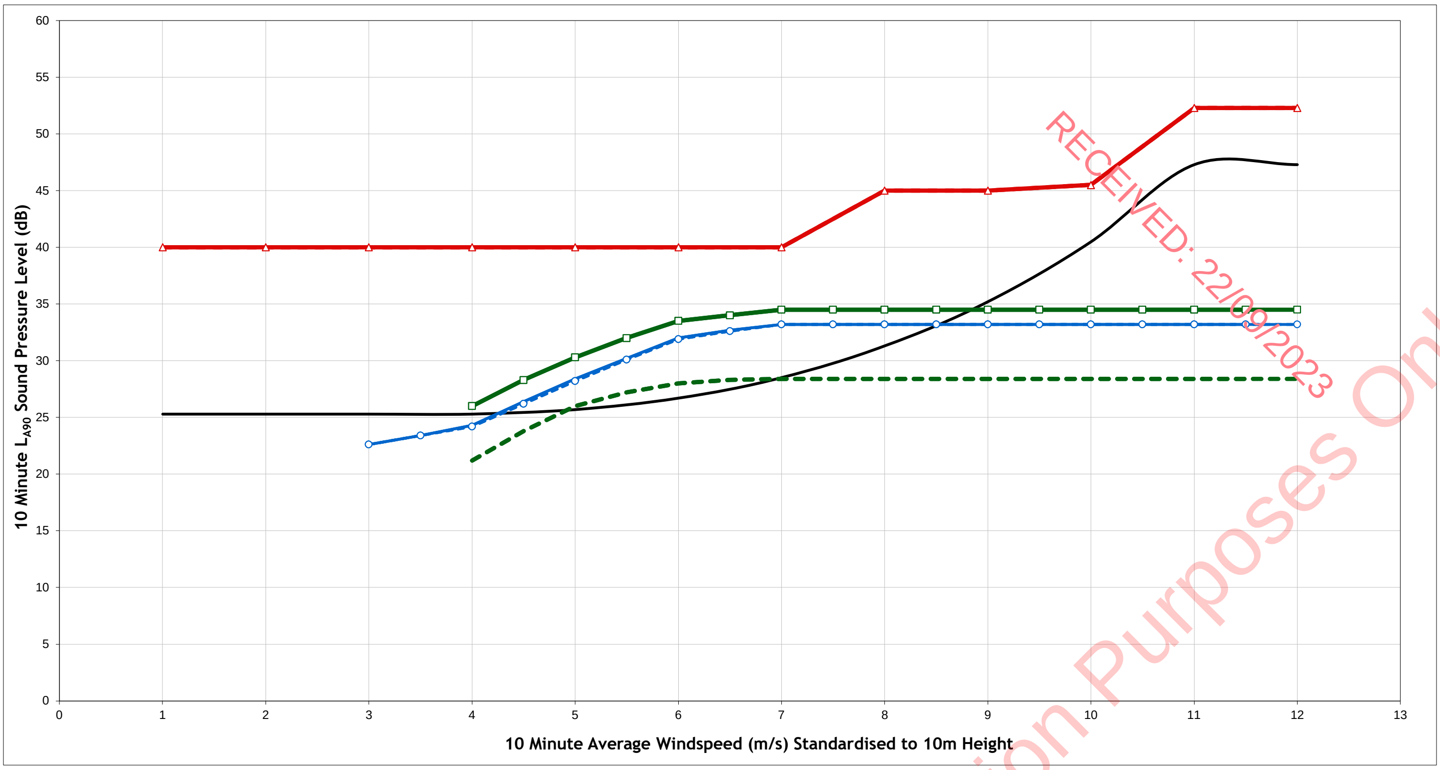


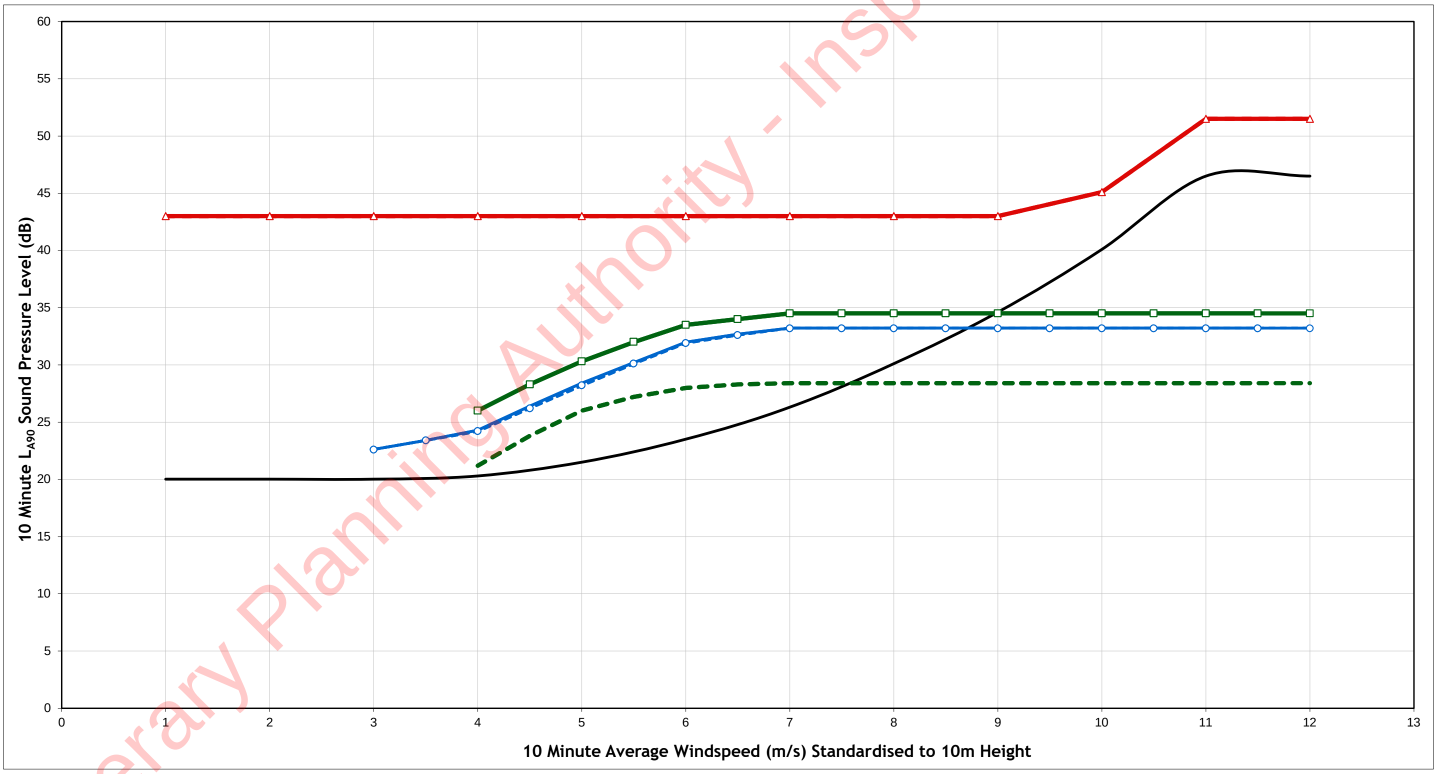


Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H14
Figure Number	Figure A1.5n
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models





Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H15
Figure Number	Figure A1.5o
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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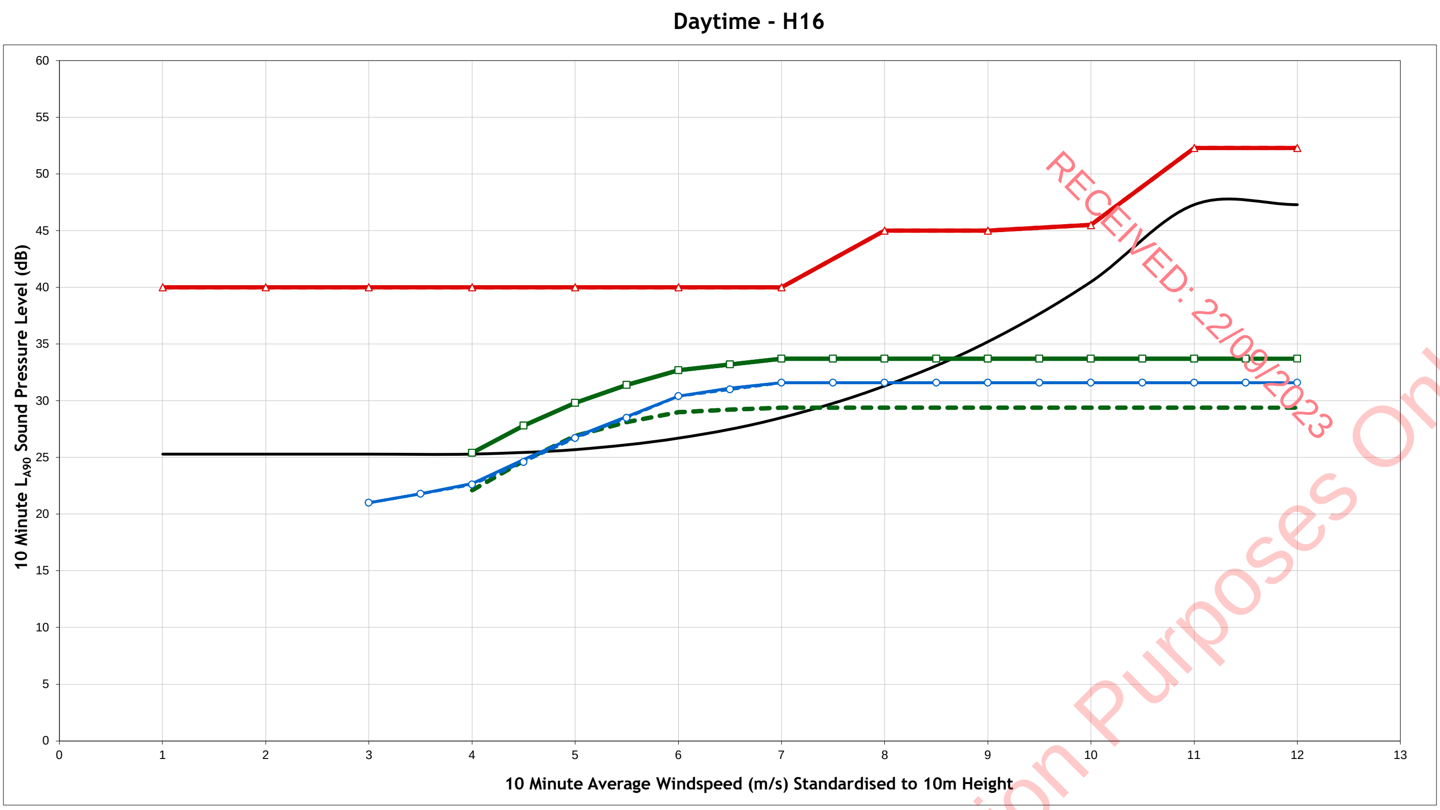

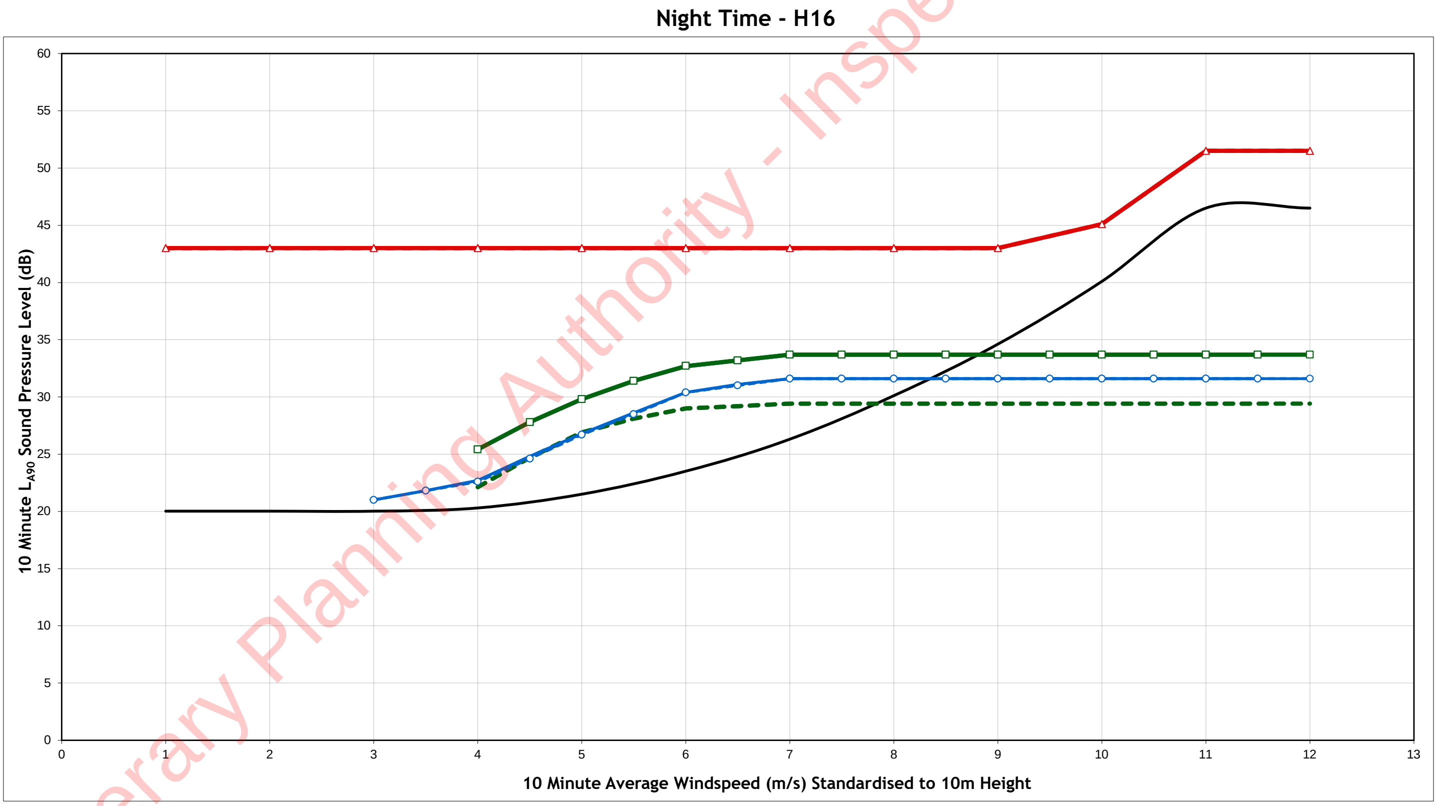

Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H16
Figure Number	Figure A1.5p
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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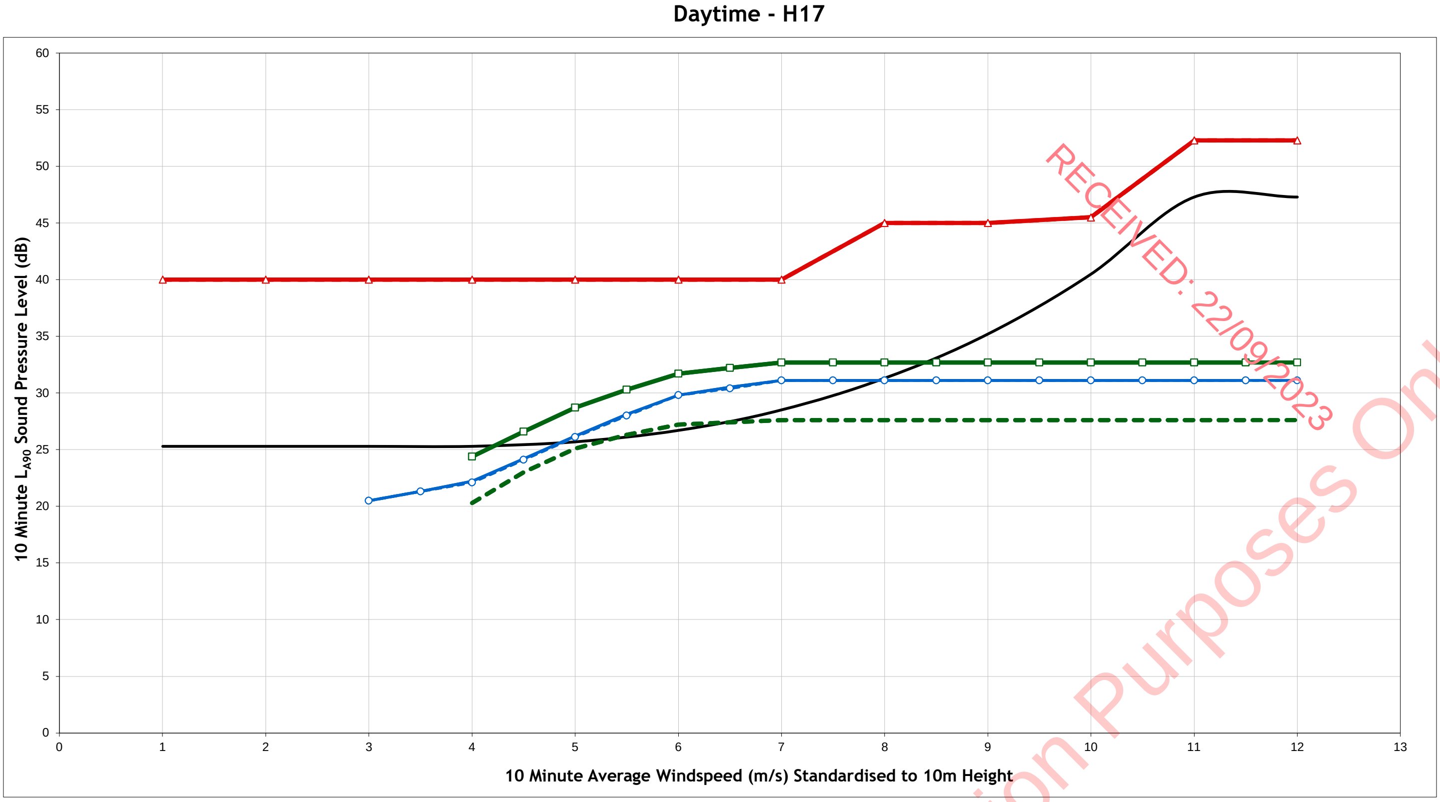

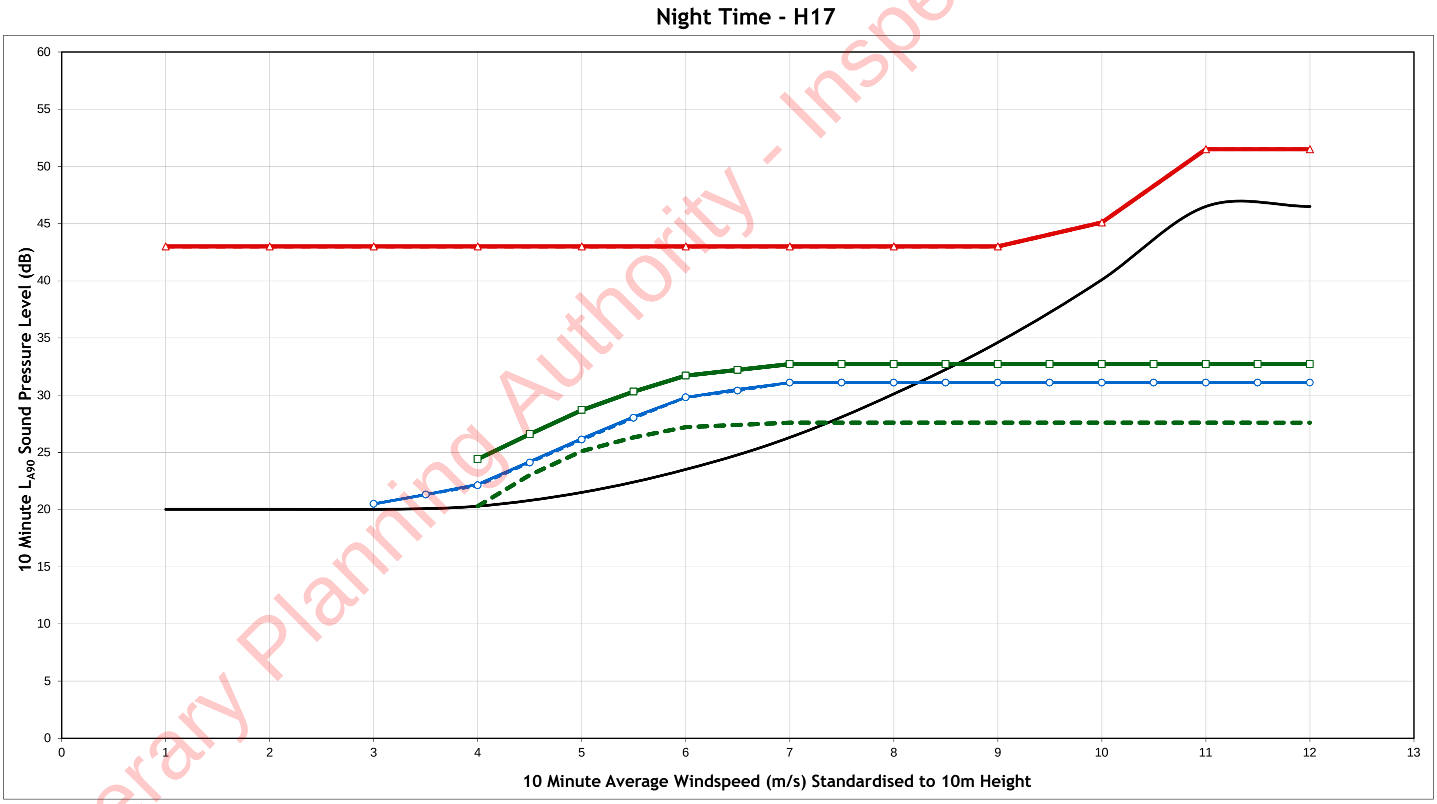

Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H17
Figure Number	Figure A1.5q
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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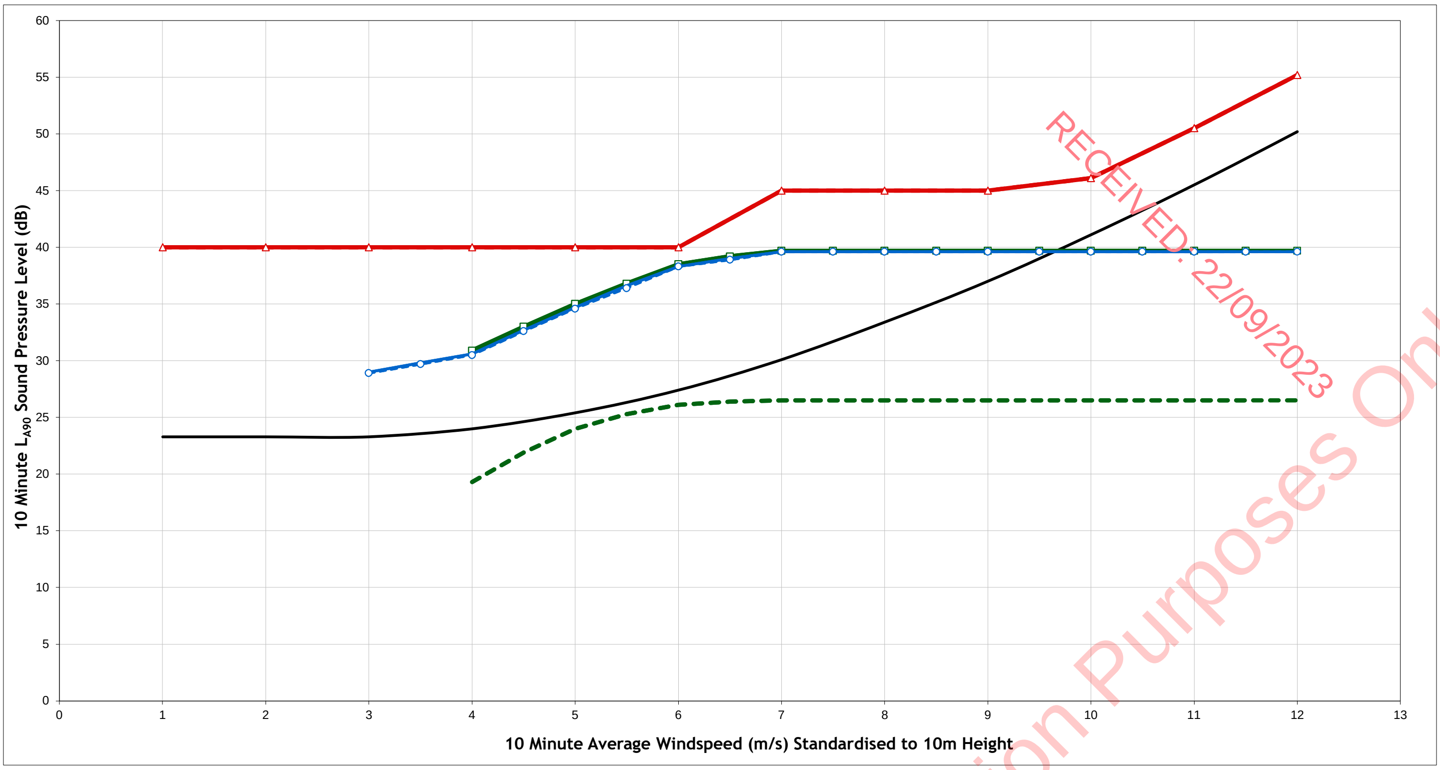
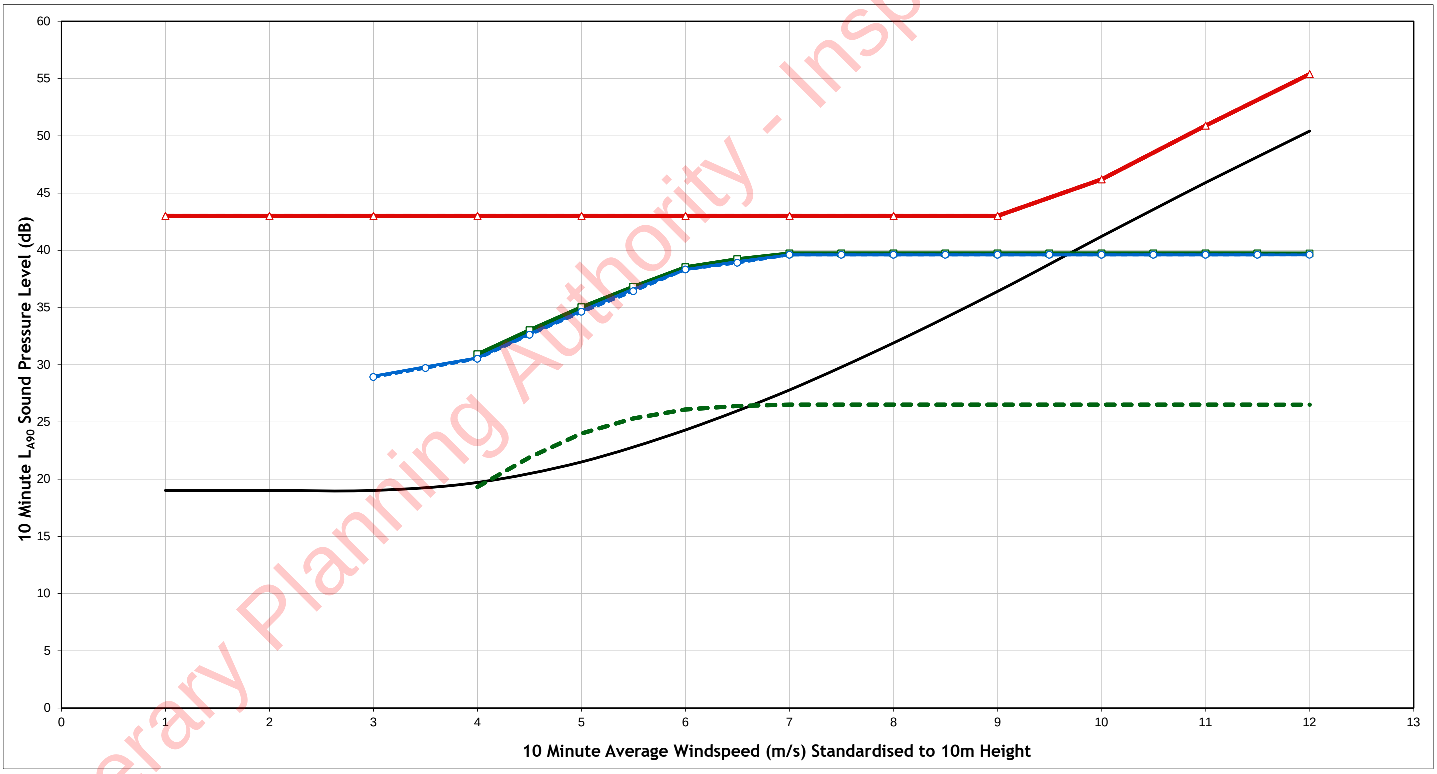
Daytime - H18



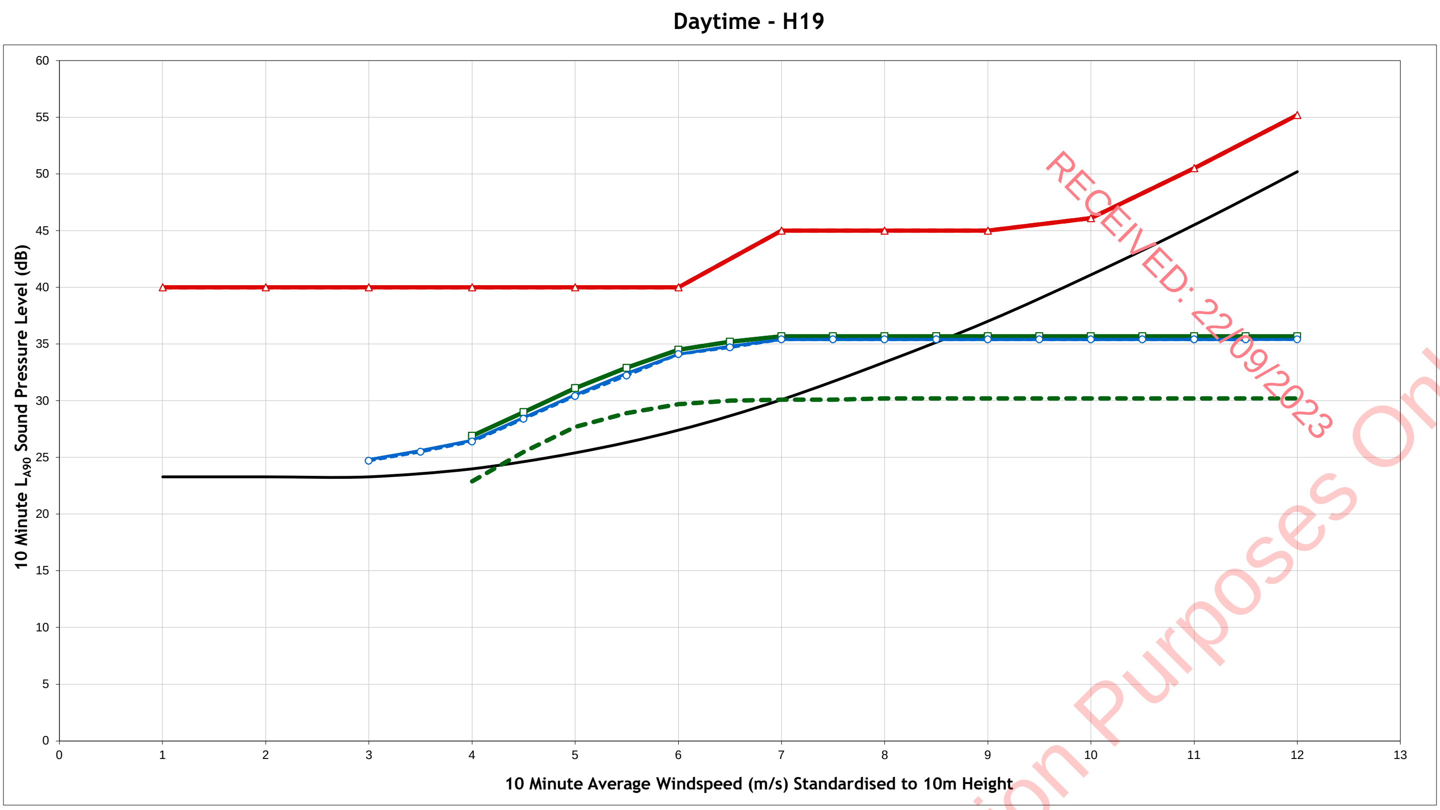
Night Time - H18

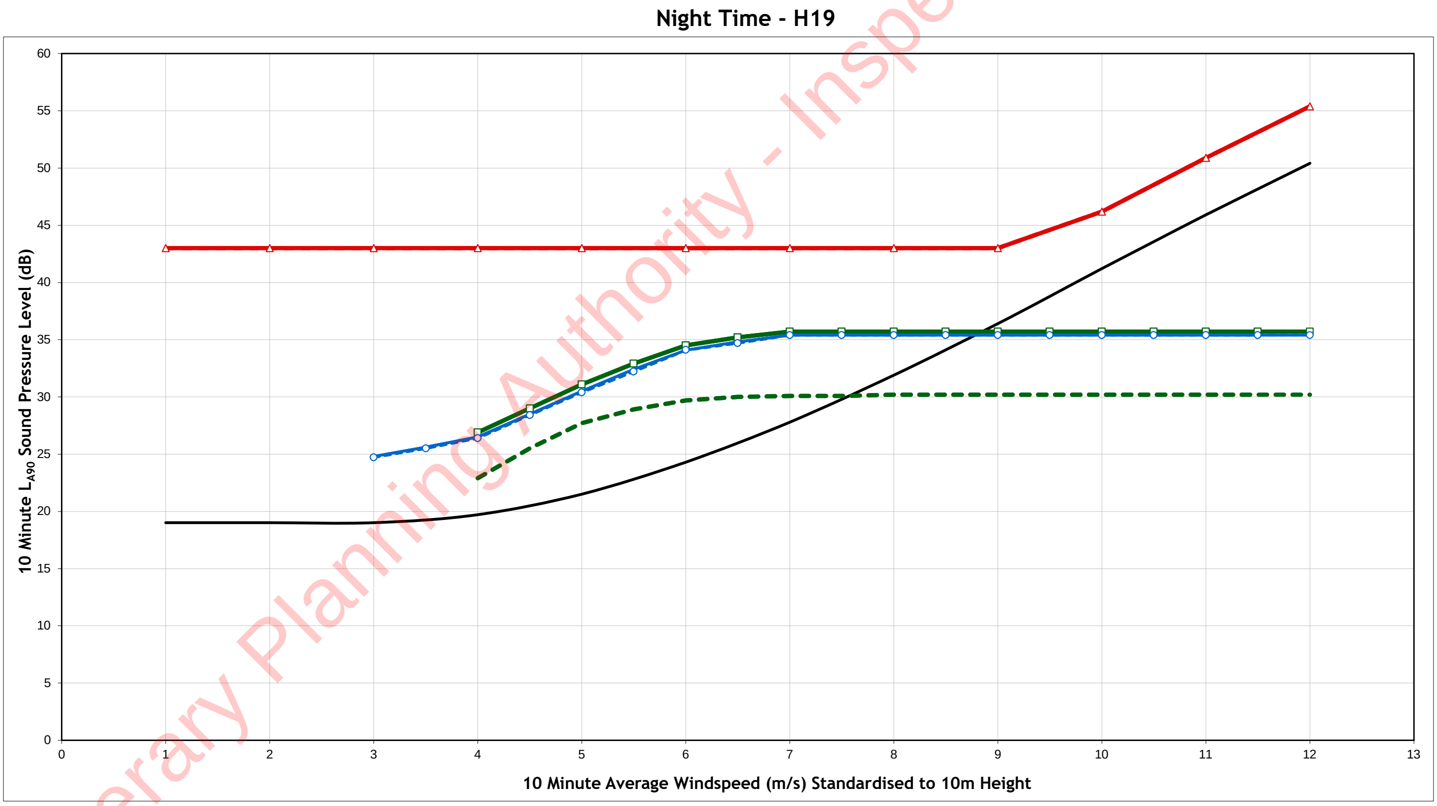


Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H18
Figure Number	Figure A1.5r
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models





Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H19
Figure Number	Figure A1.5s
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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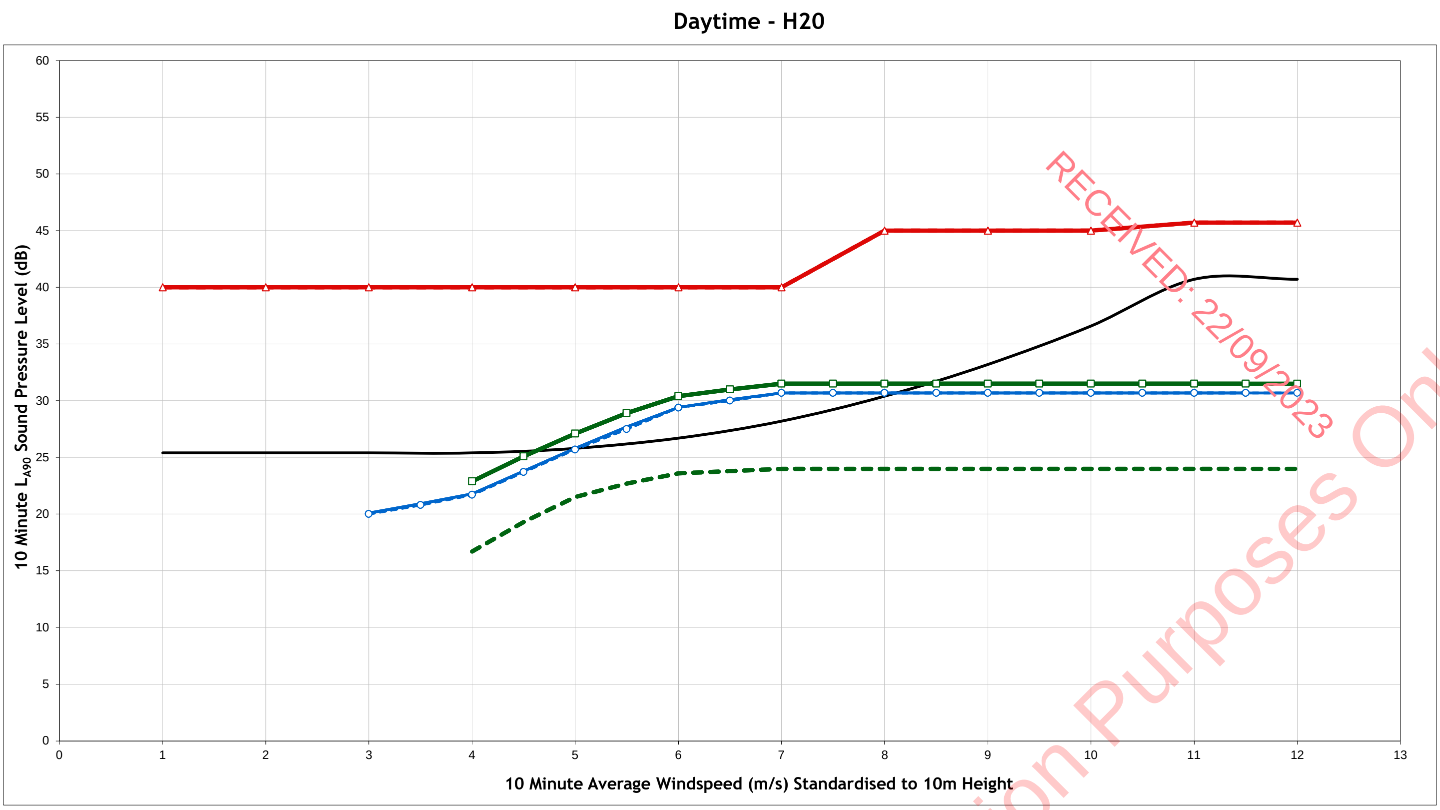
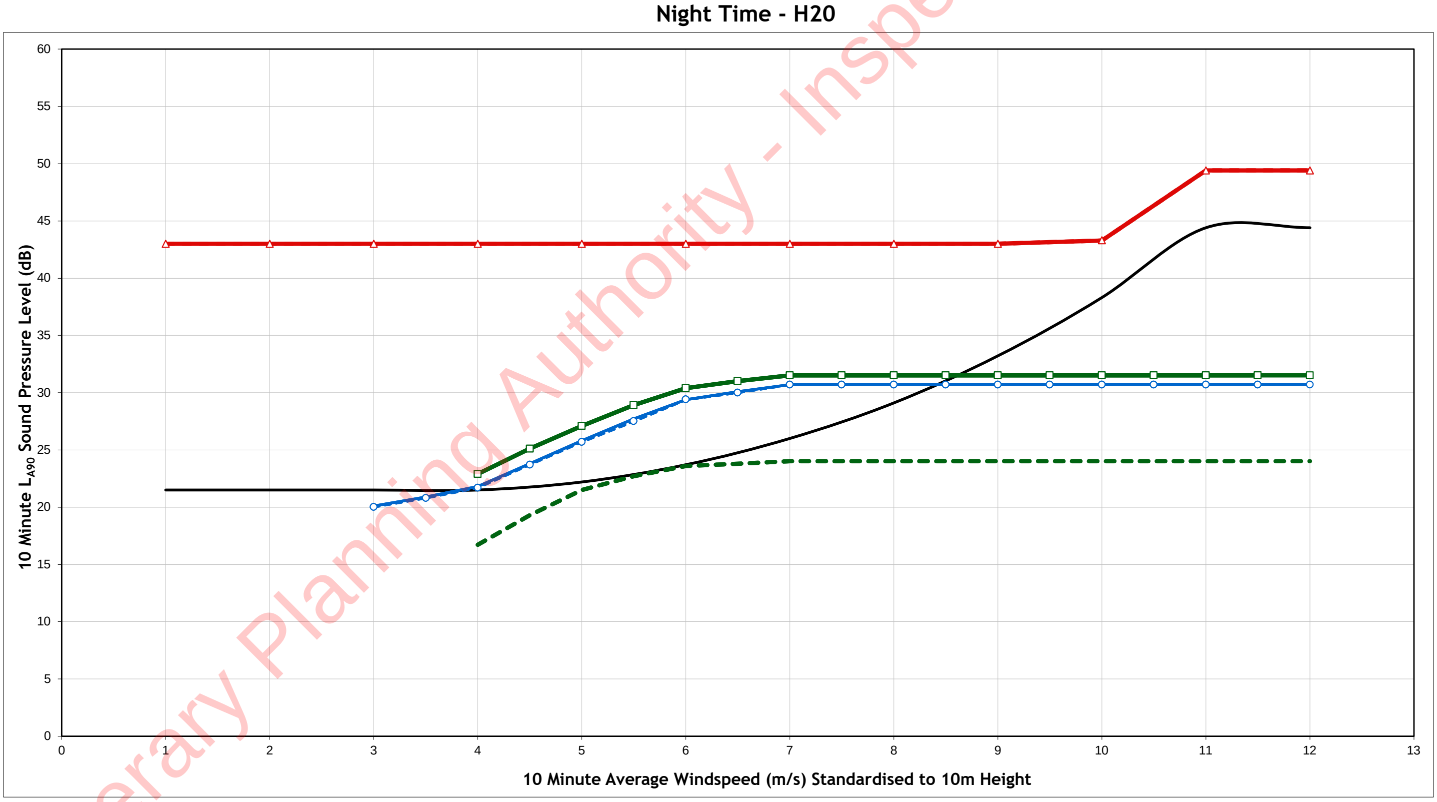
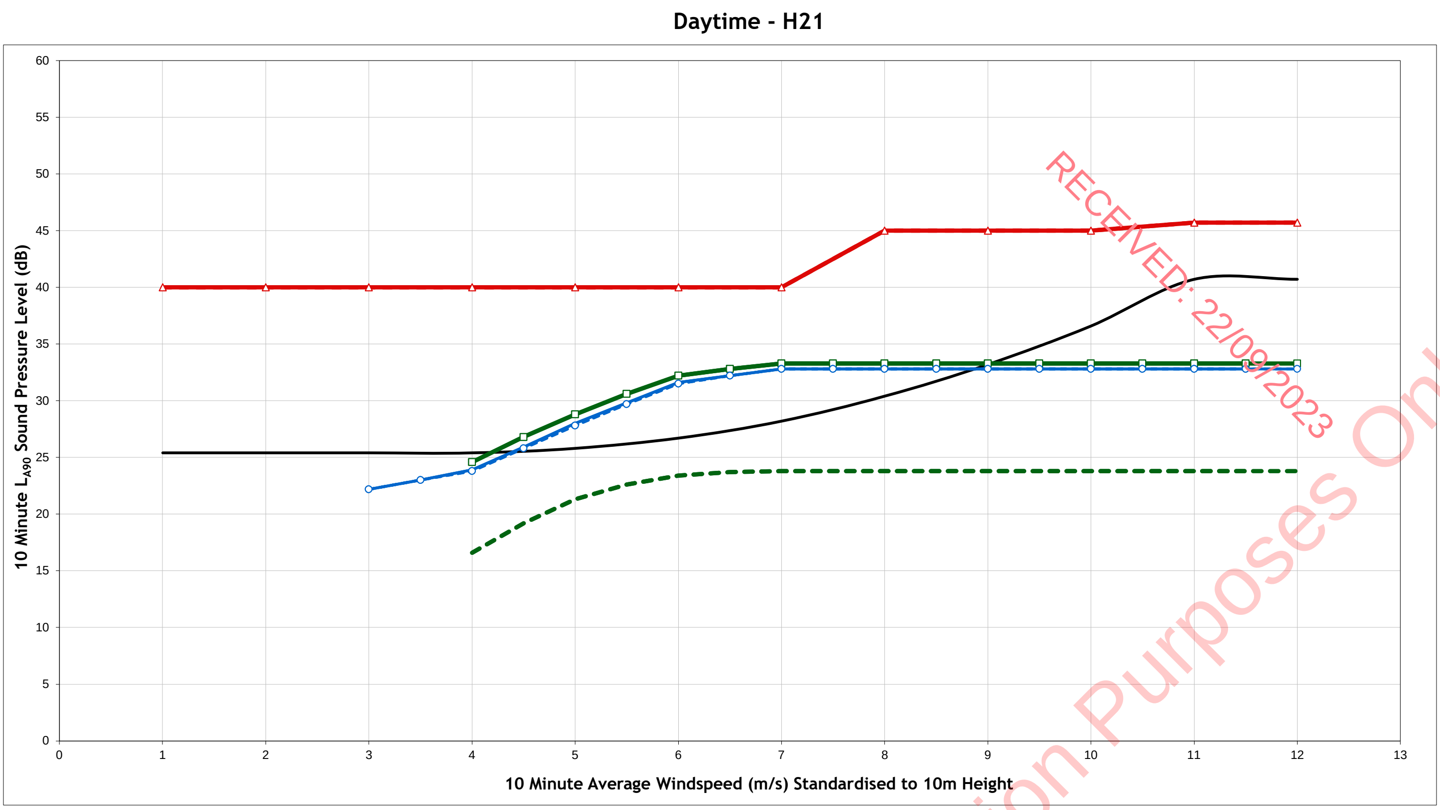


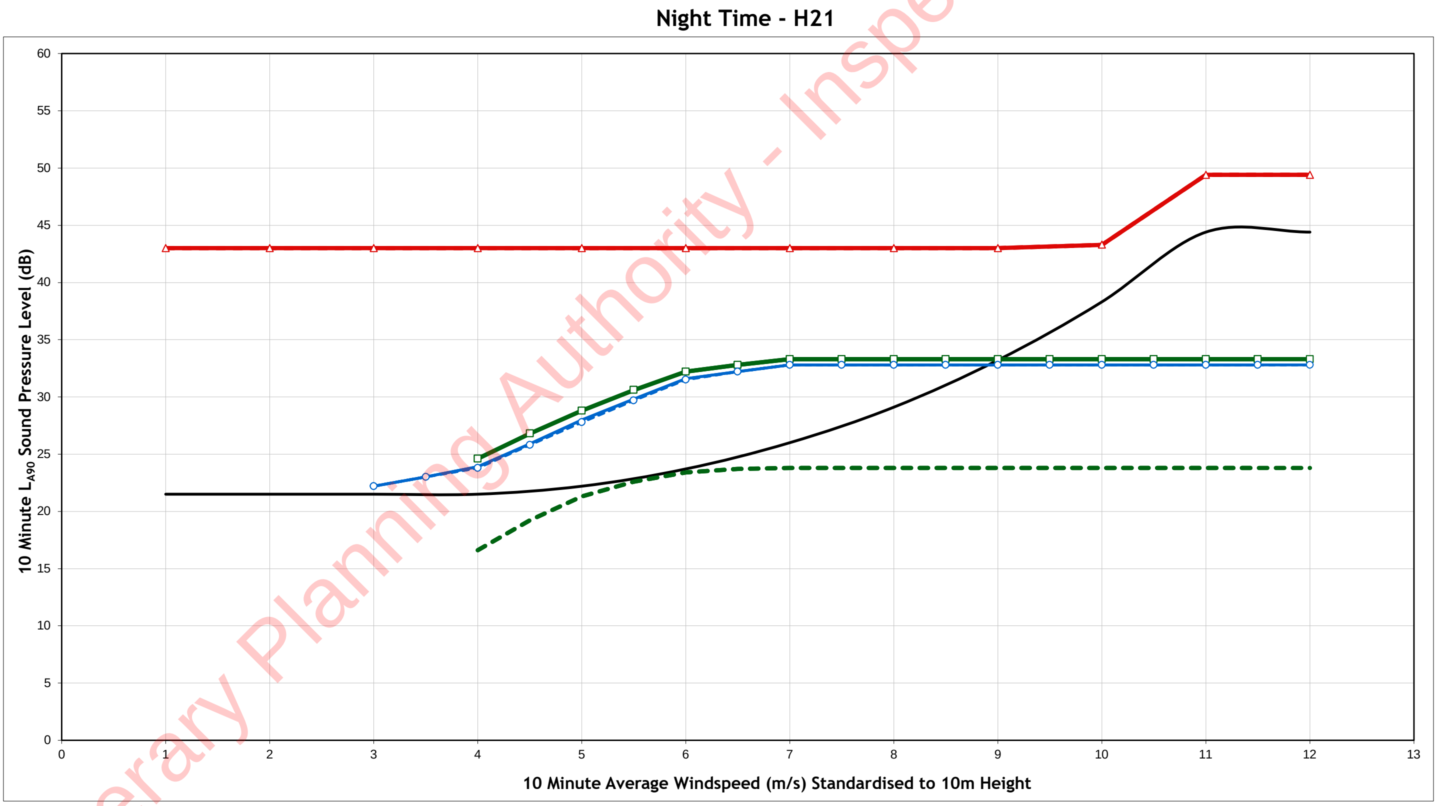


Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H20
Figure Number	Figure A1.5t
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models





Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H21
Figure Number	Figure A1.5u
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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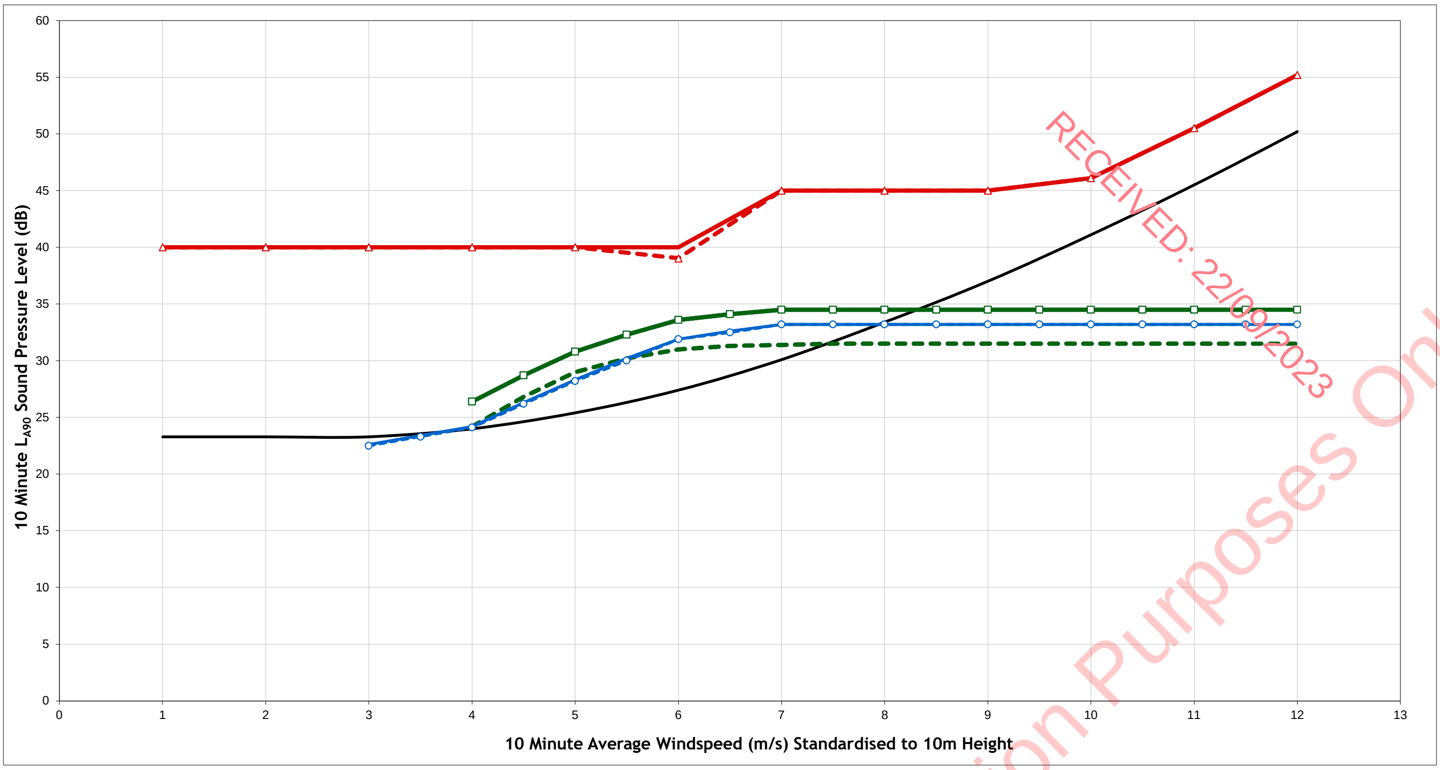
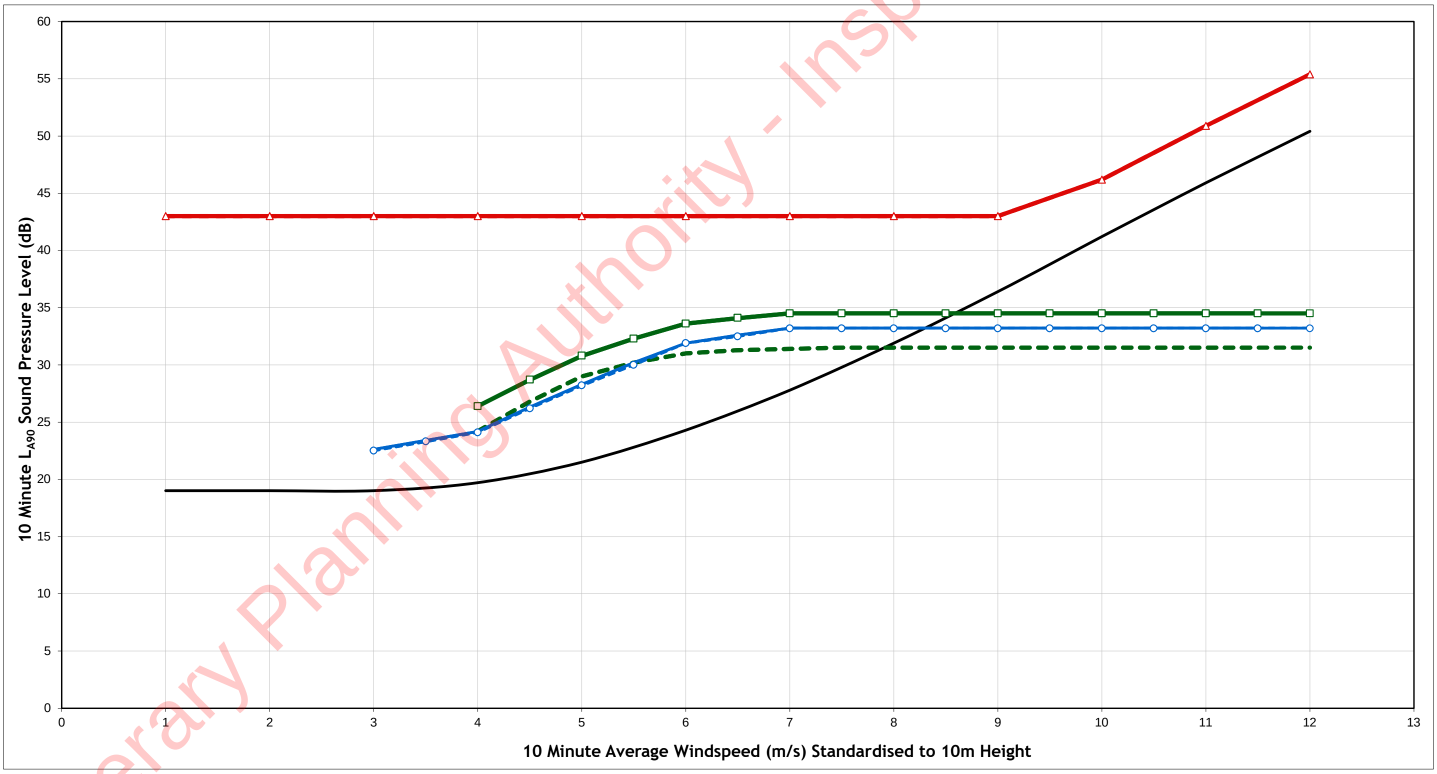
Daytime - H22



Night Time - H22



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H22
Figure Number	Figure A1.5v
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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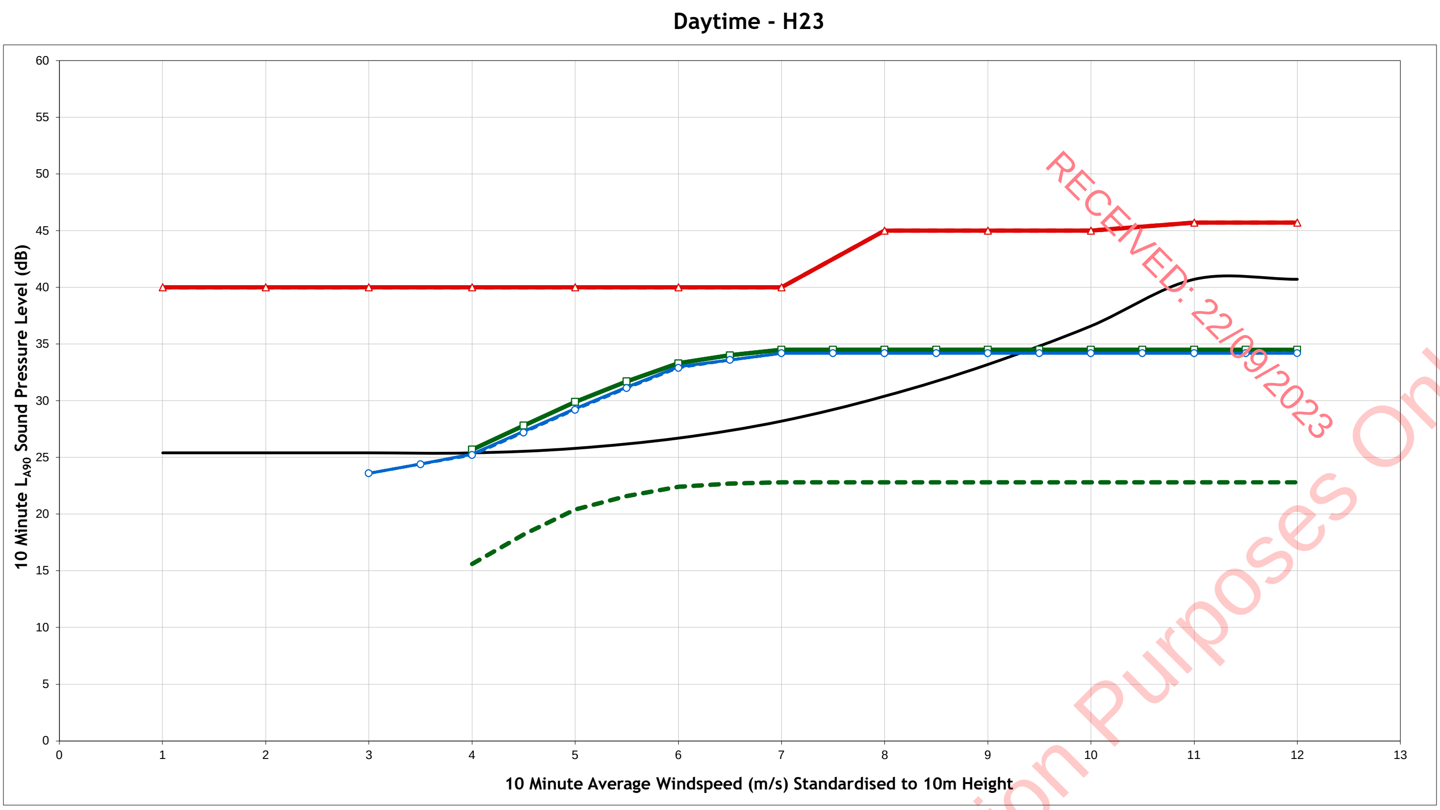

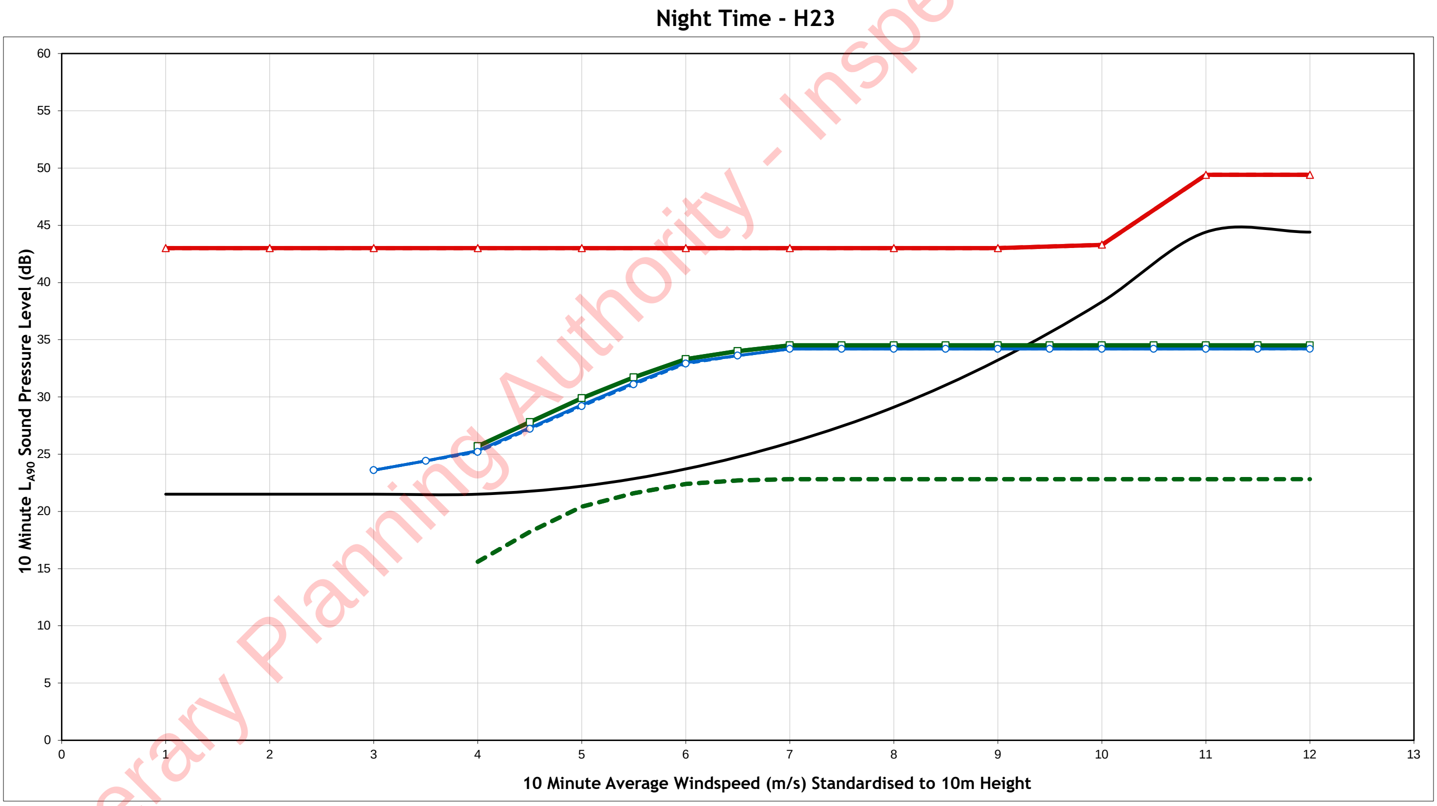

Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H23
Figure Number	Figure A1.5w
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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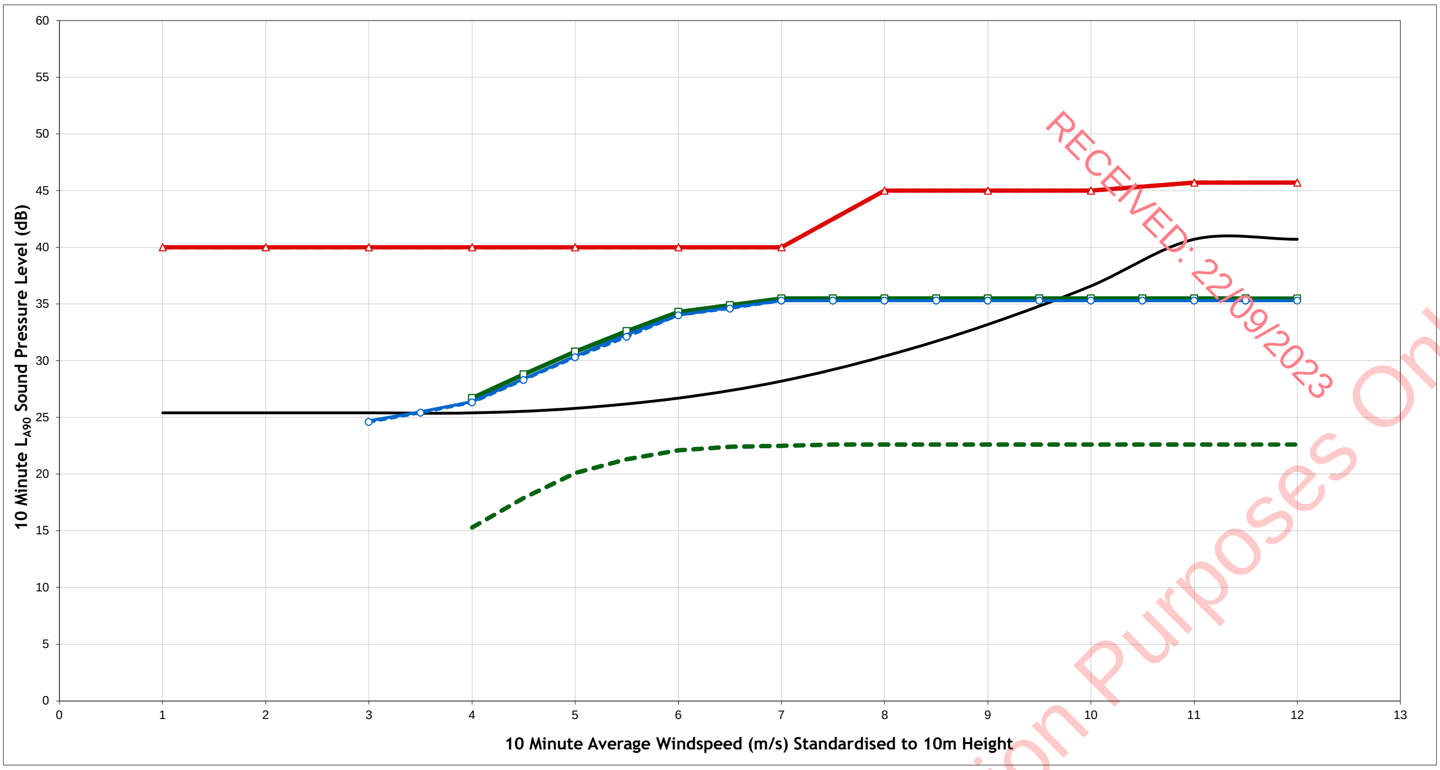
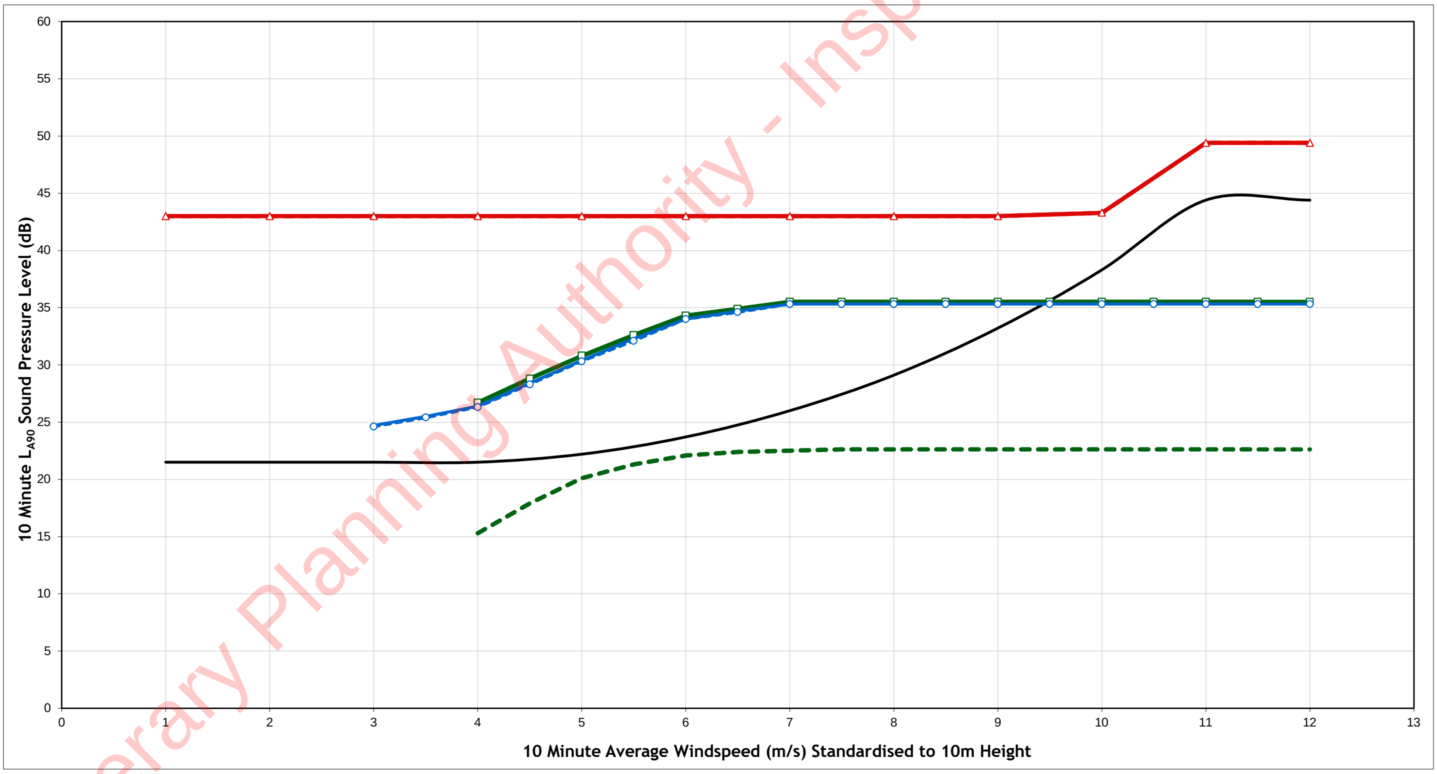
Daytime - H24



Night Time - H24



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H24
Figure Number	Figure A1.5x
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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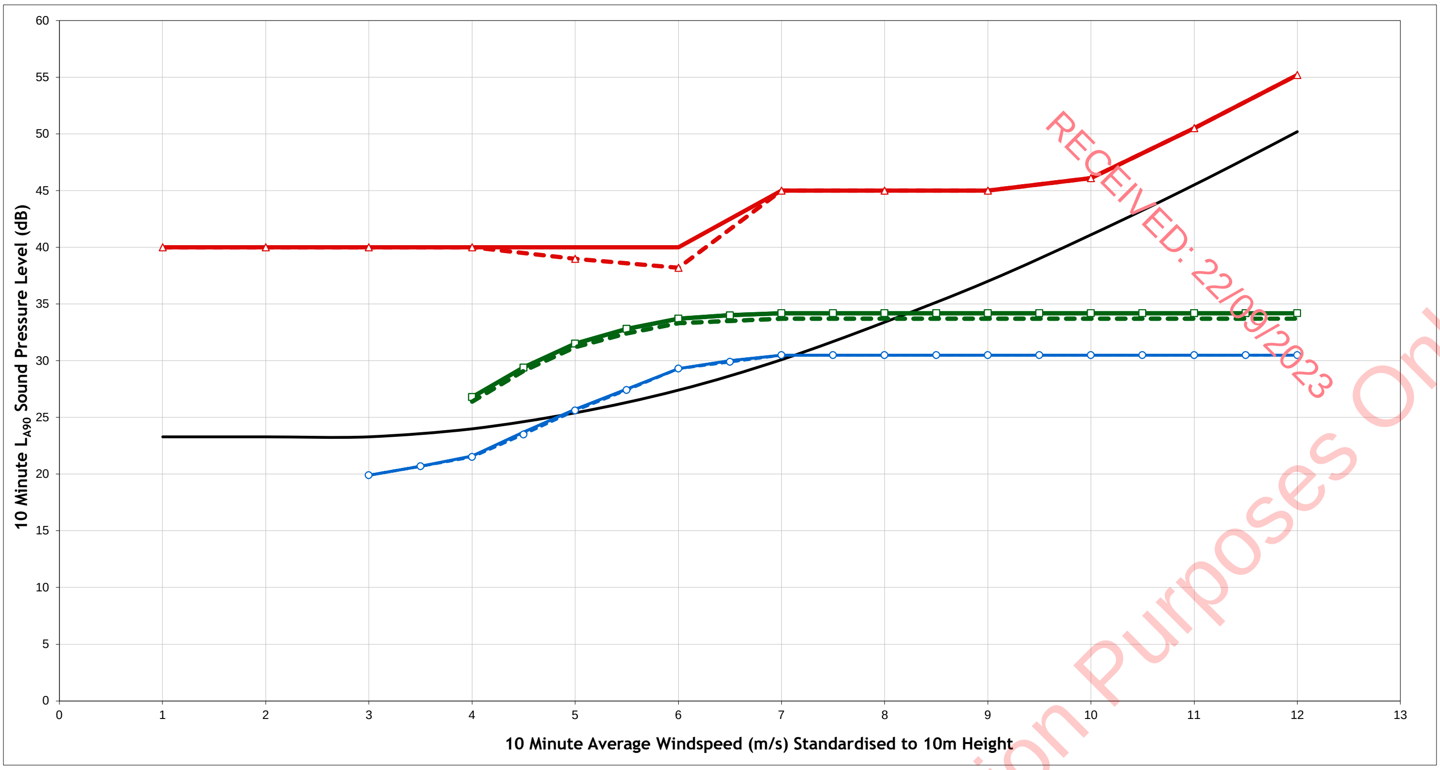
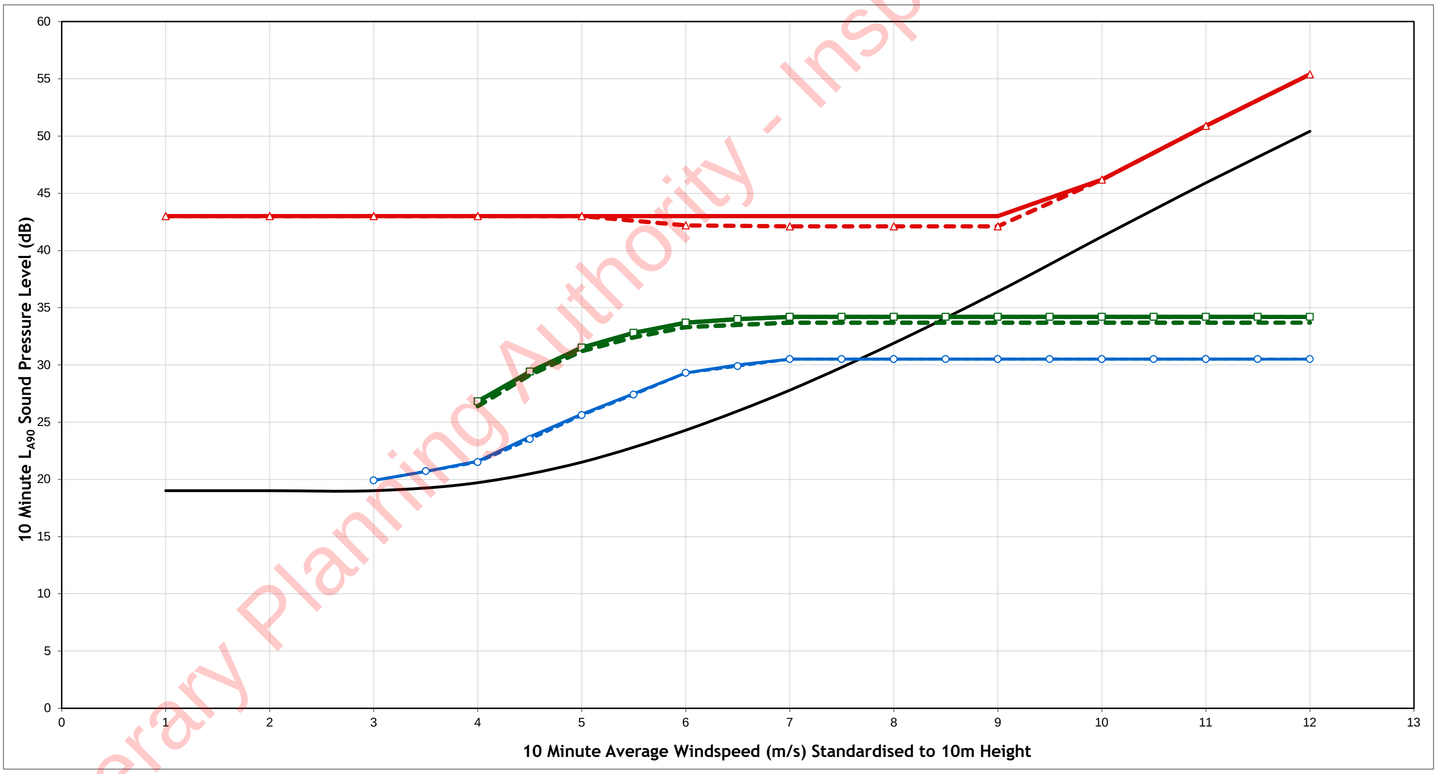
Daytime - H25



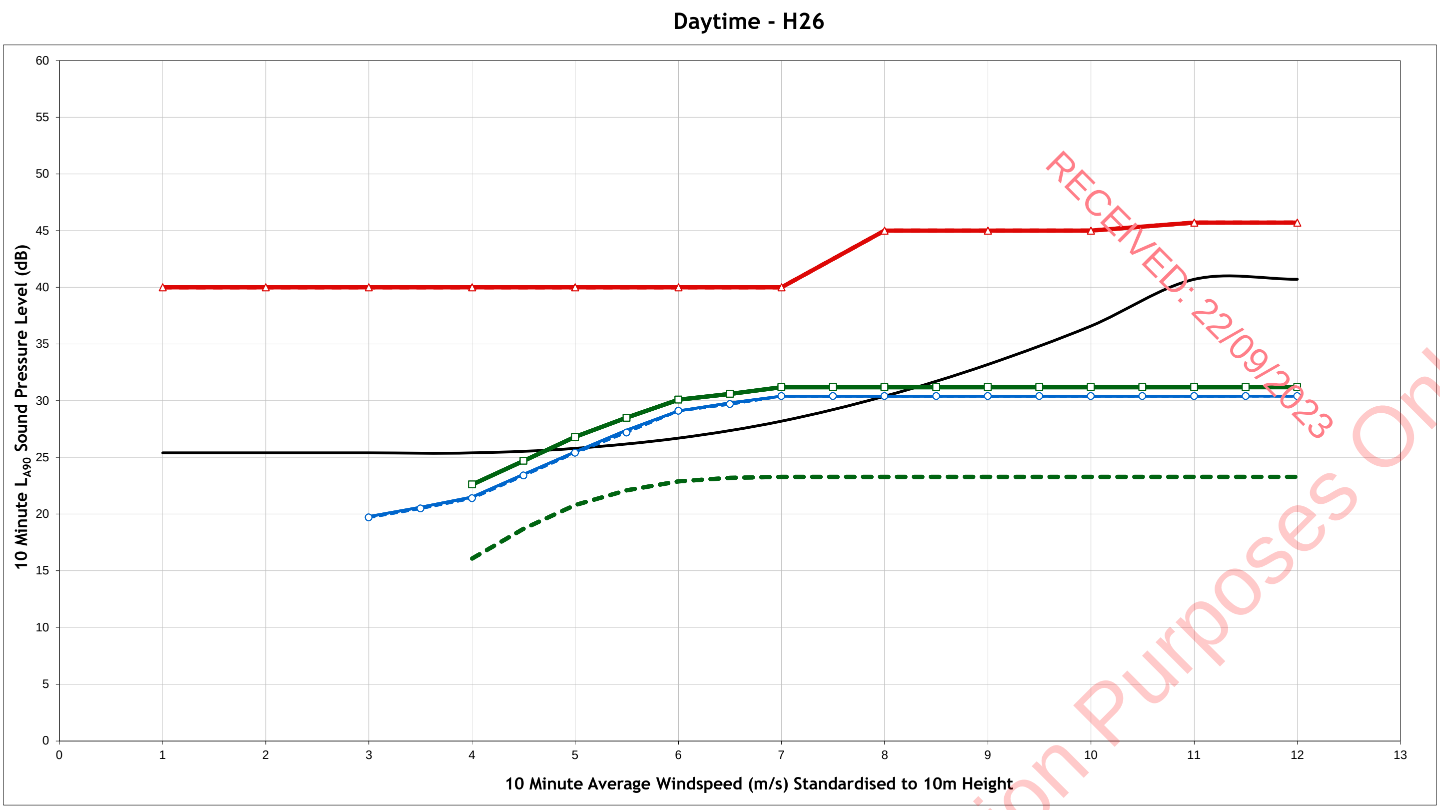
Night Time - H25

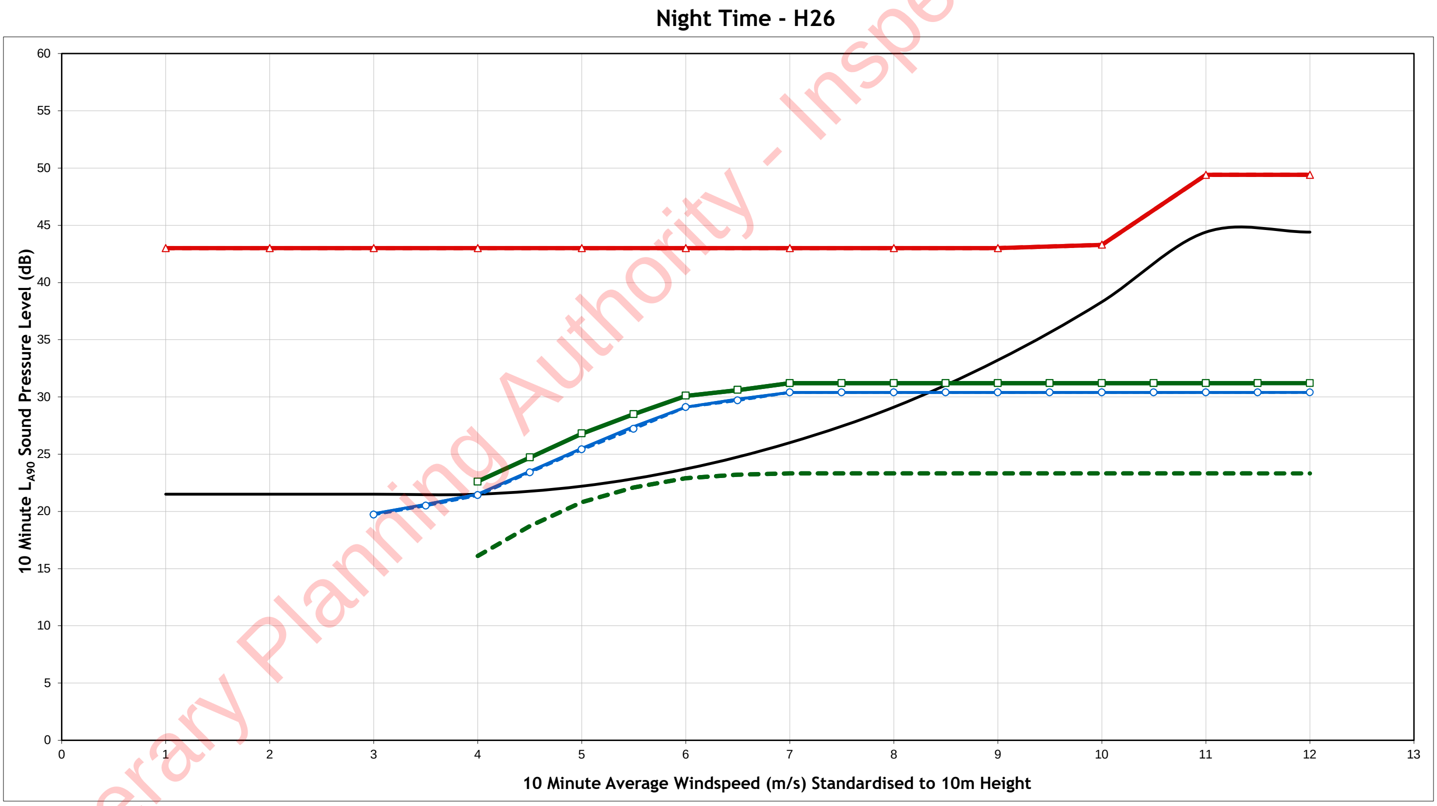


Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H25
Figure Number	Figure A1.5y
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

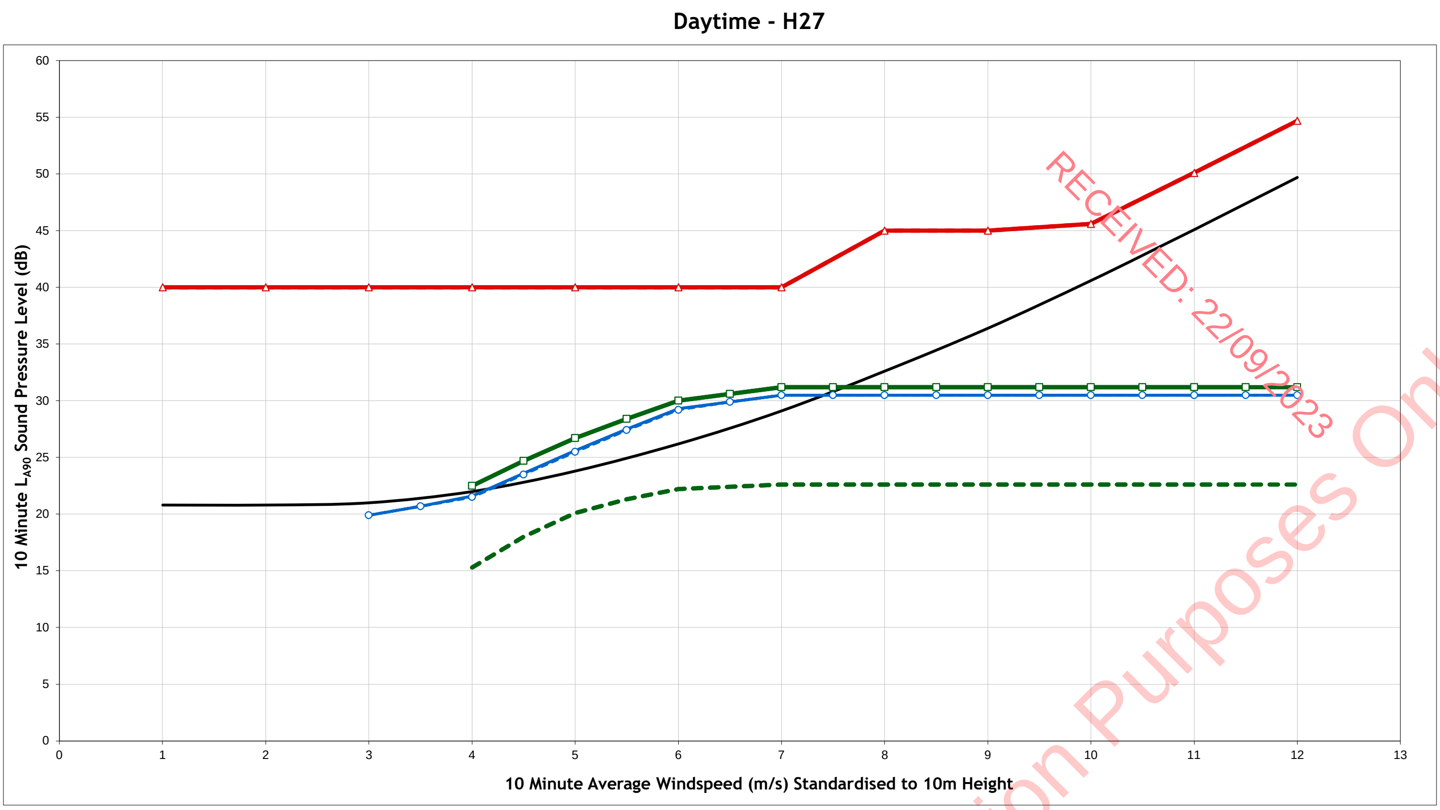


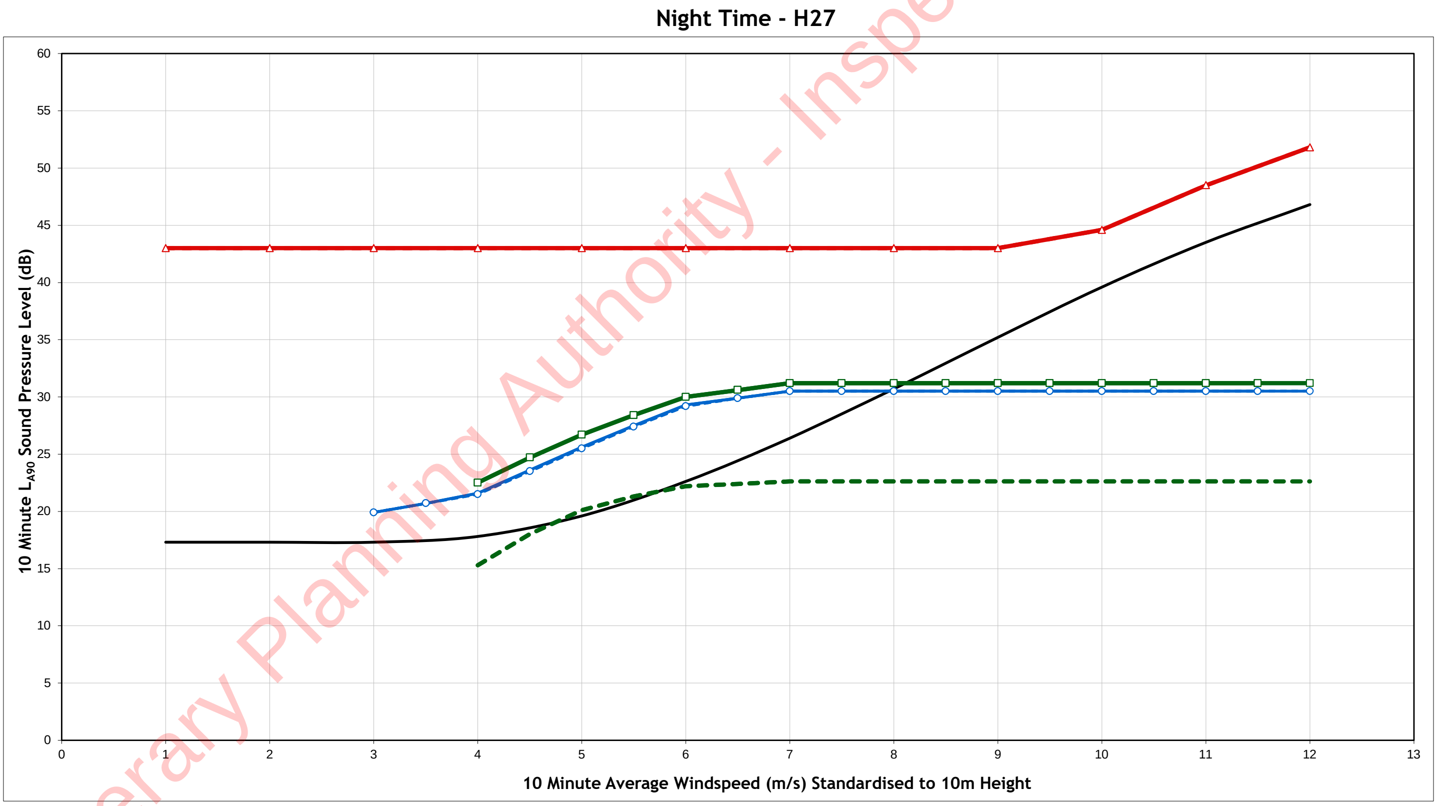


Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H26
Figure Number	Figure A1.5z
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models





Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H27
Figure Number	Figure A1.5aa
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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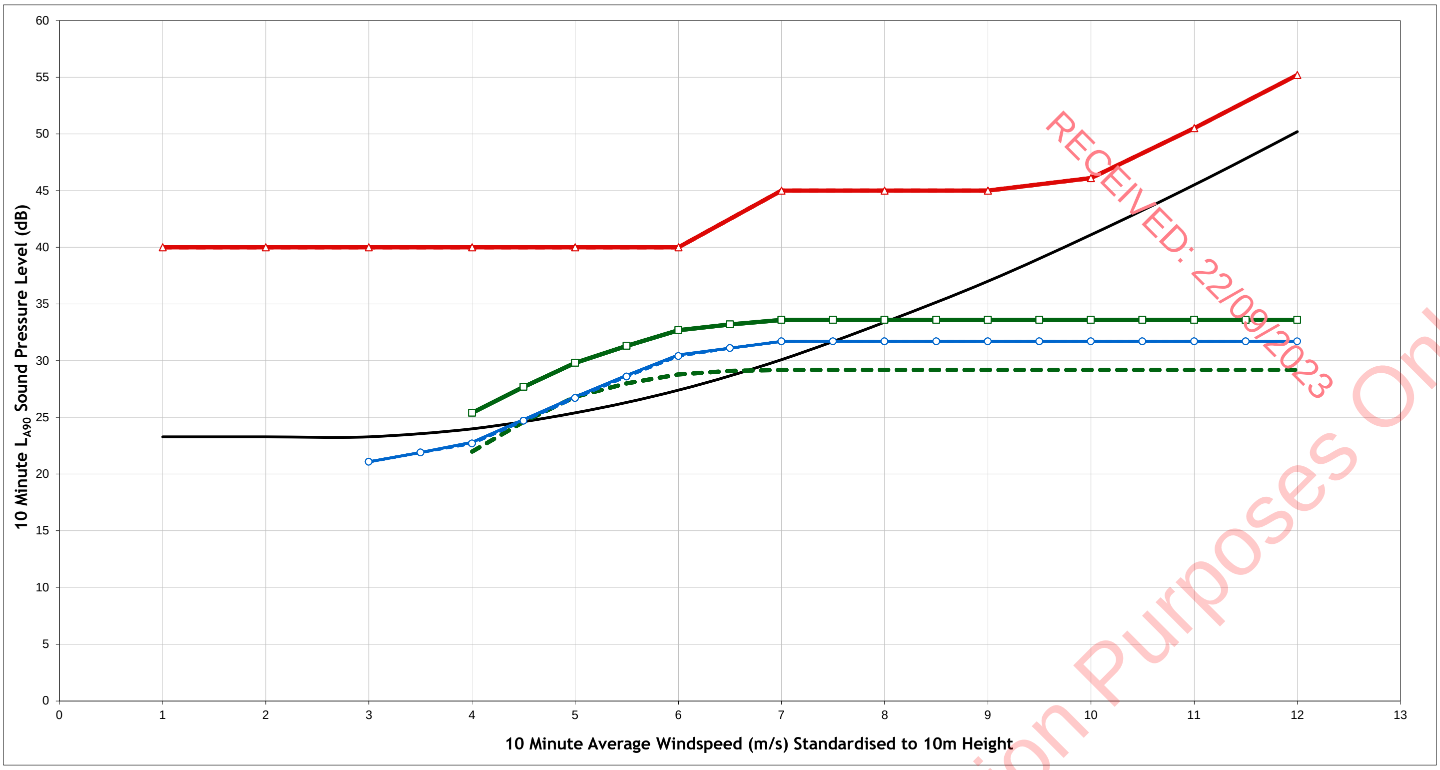
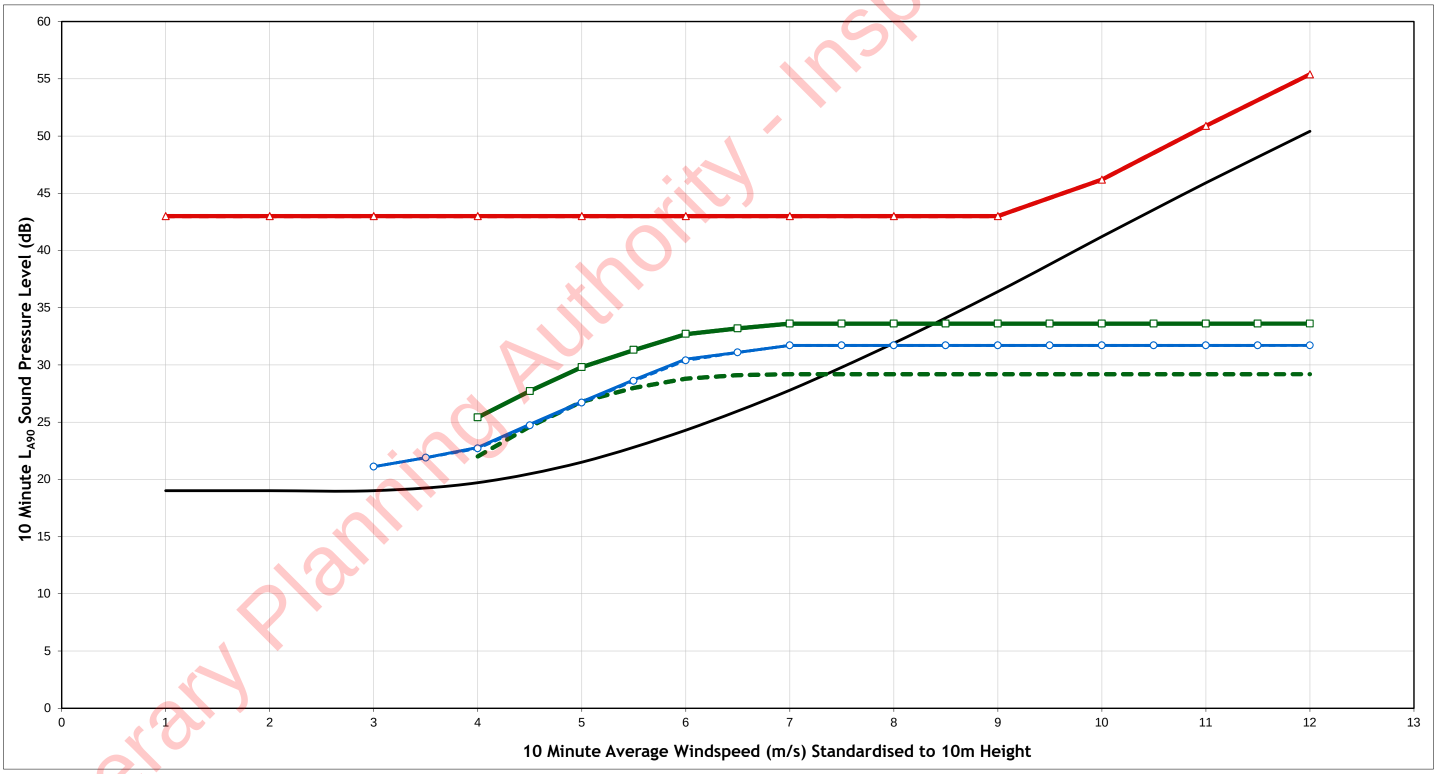
Daytime - H28



Night Time - H28



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H28
Figure Number	Figure A1.5ab
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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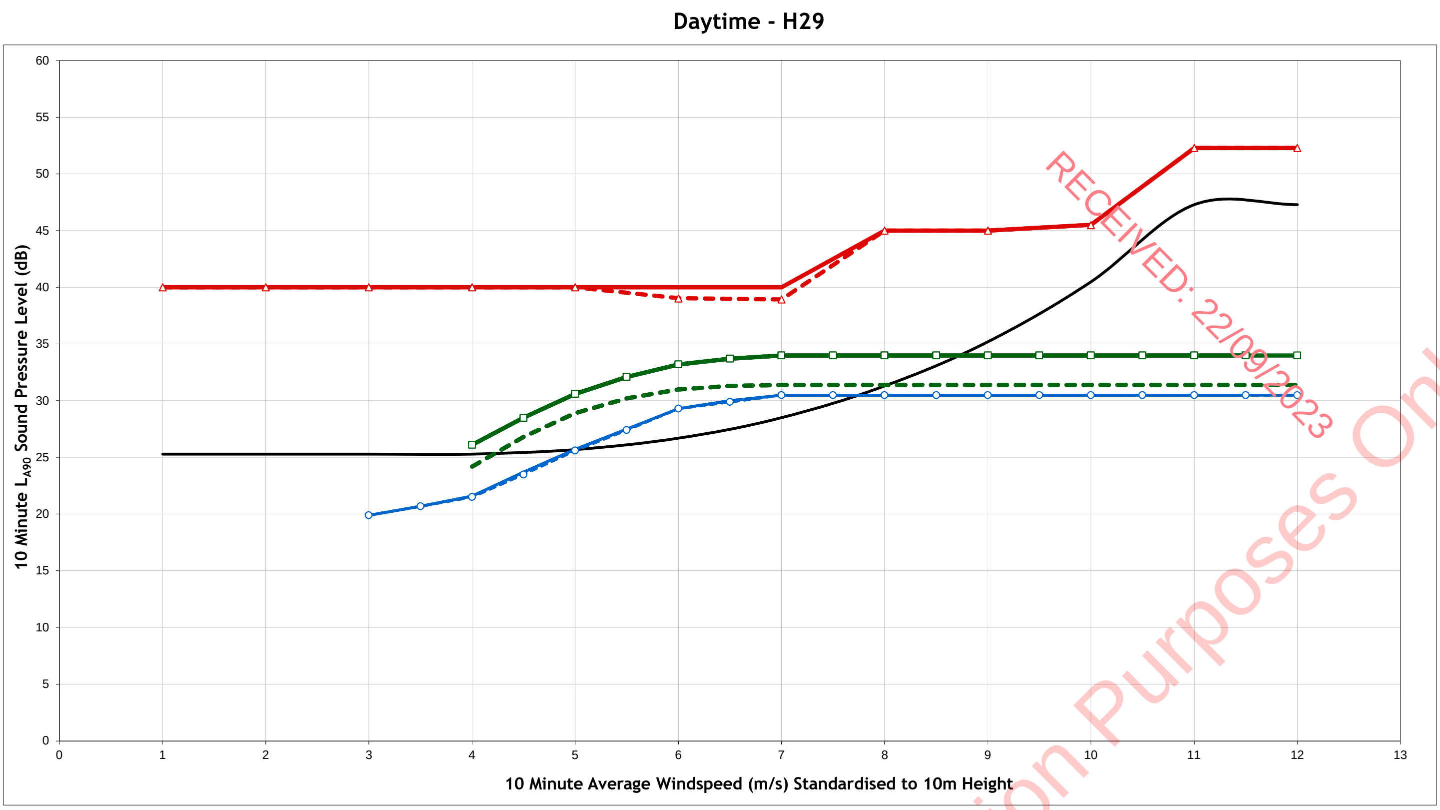
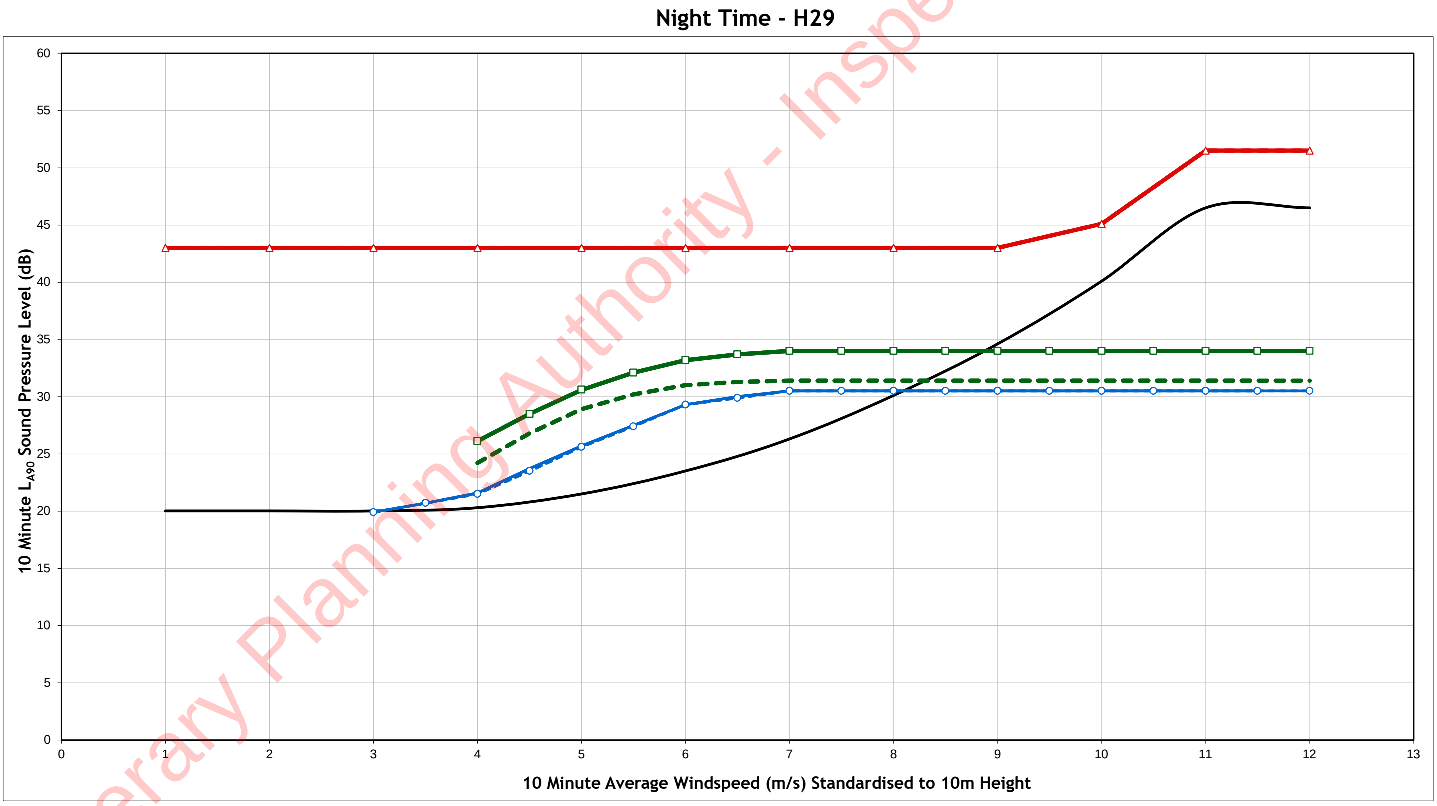
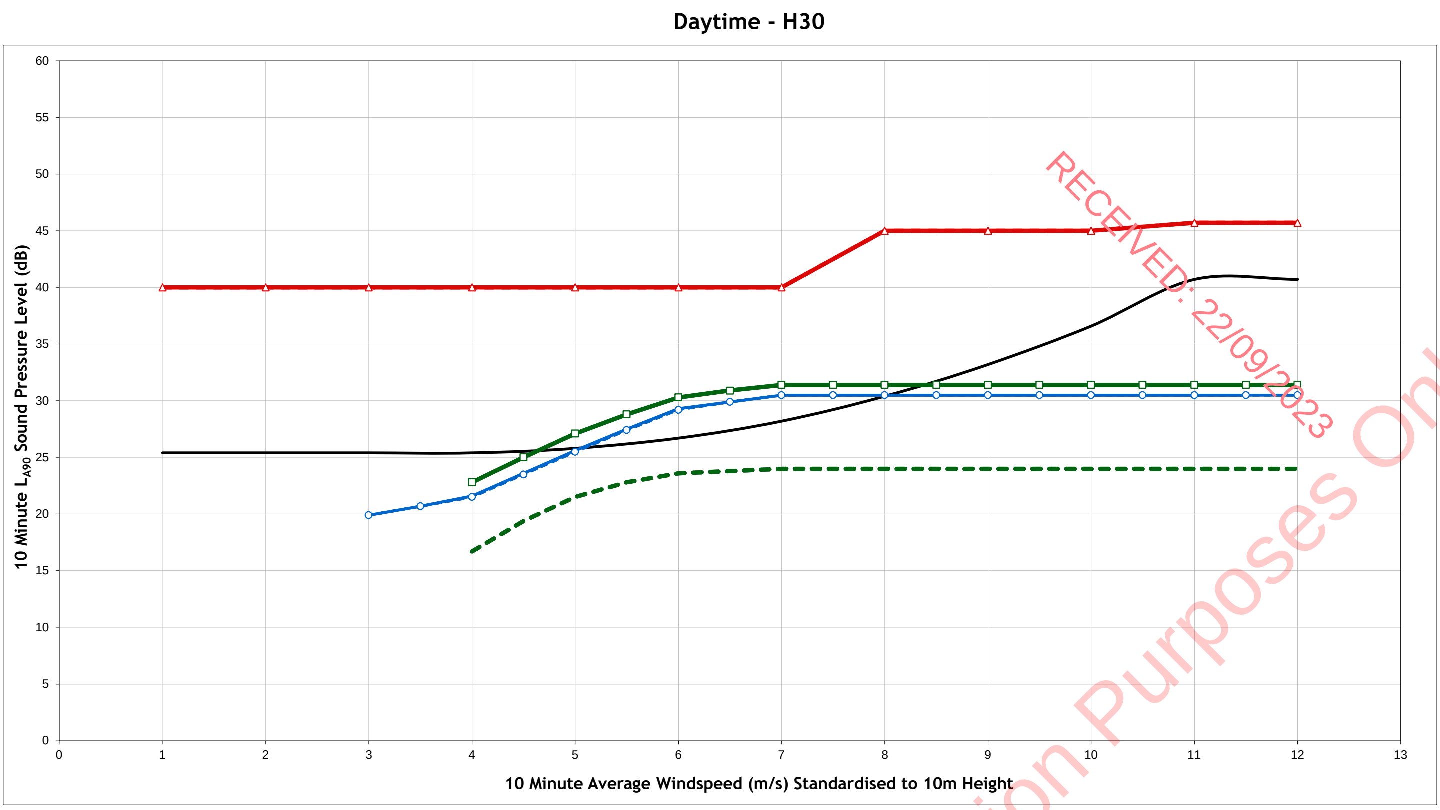


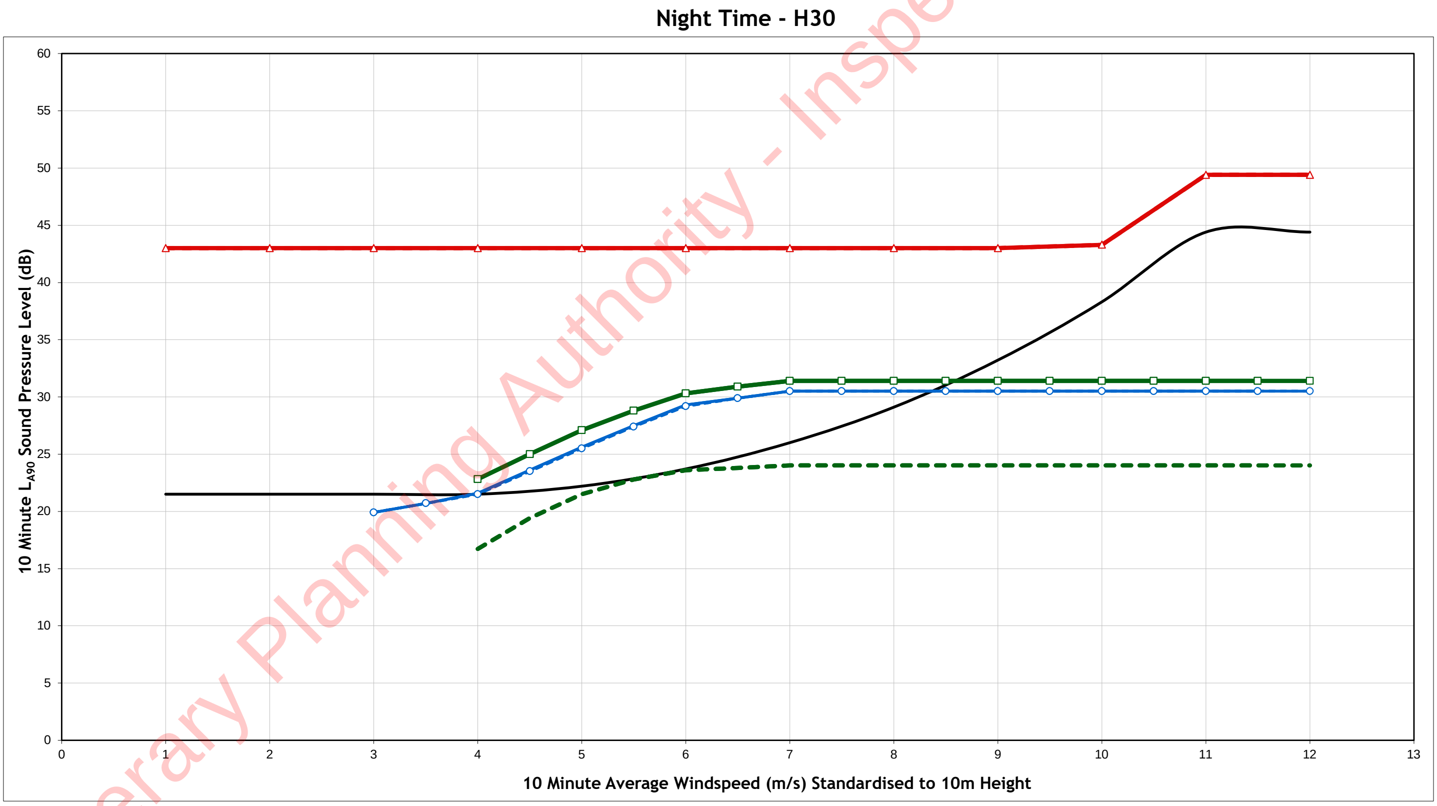


Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H29
Figure Number	Figure A1.5ac
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models





Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H30
Figure Number	Figure A1.5ad
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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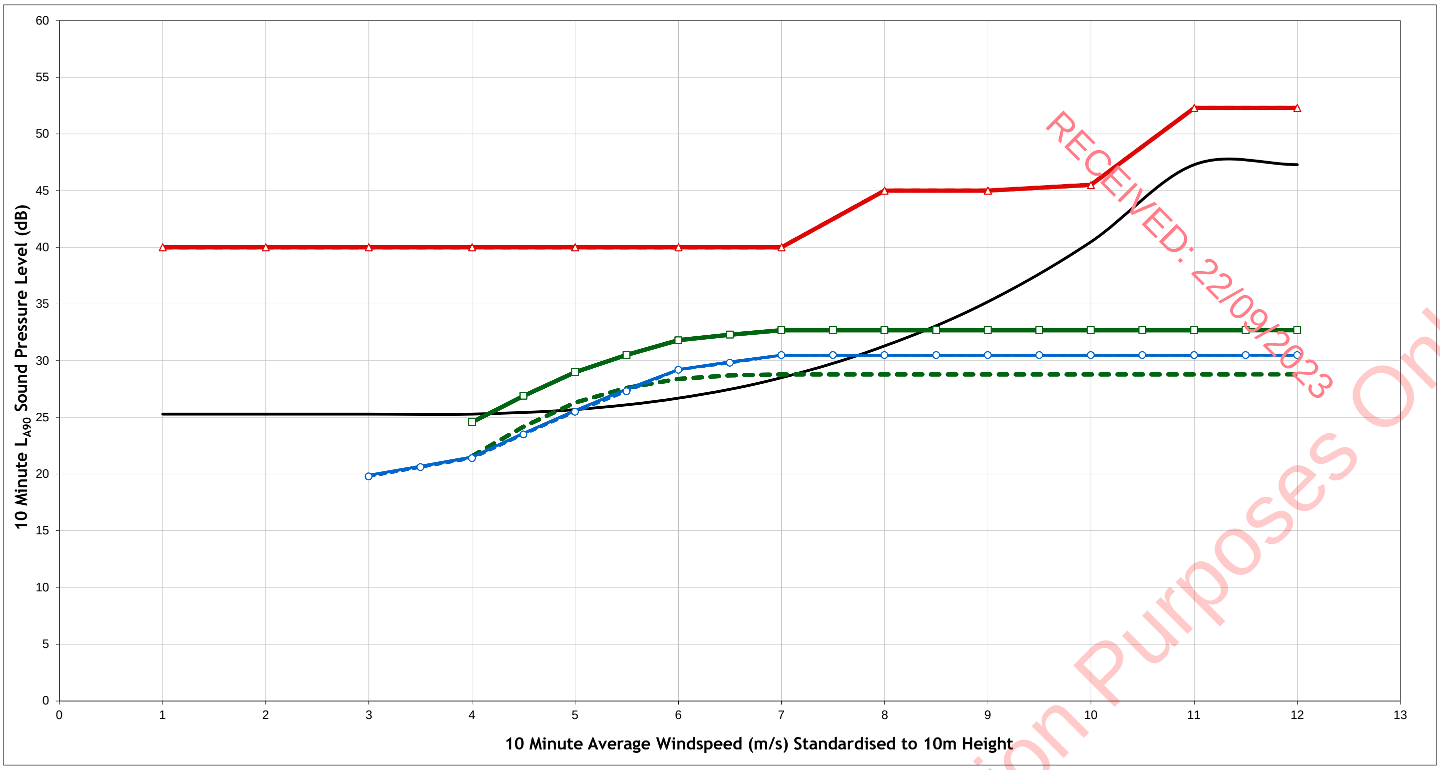
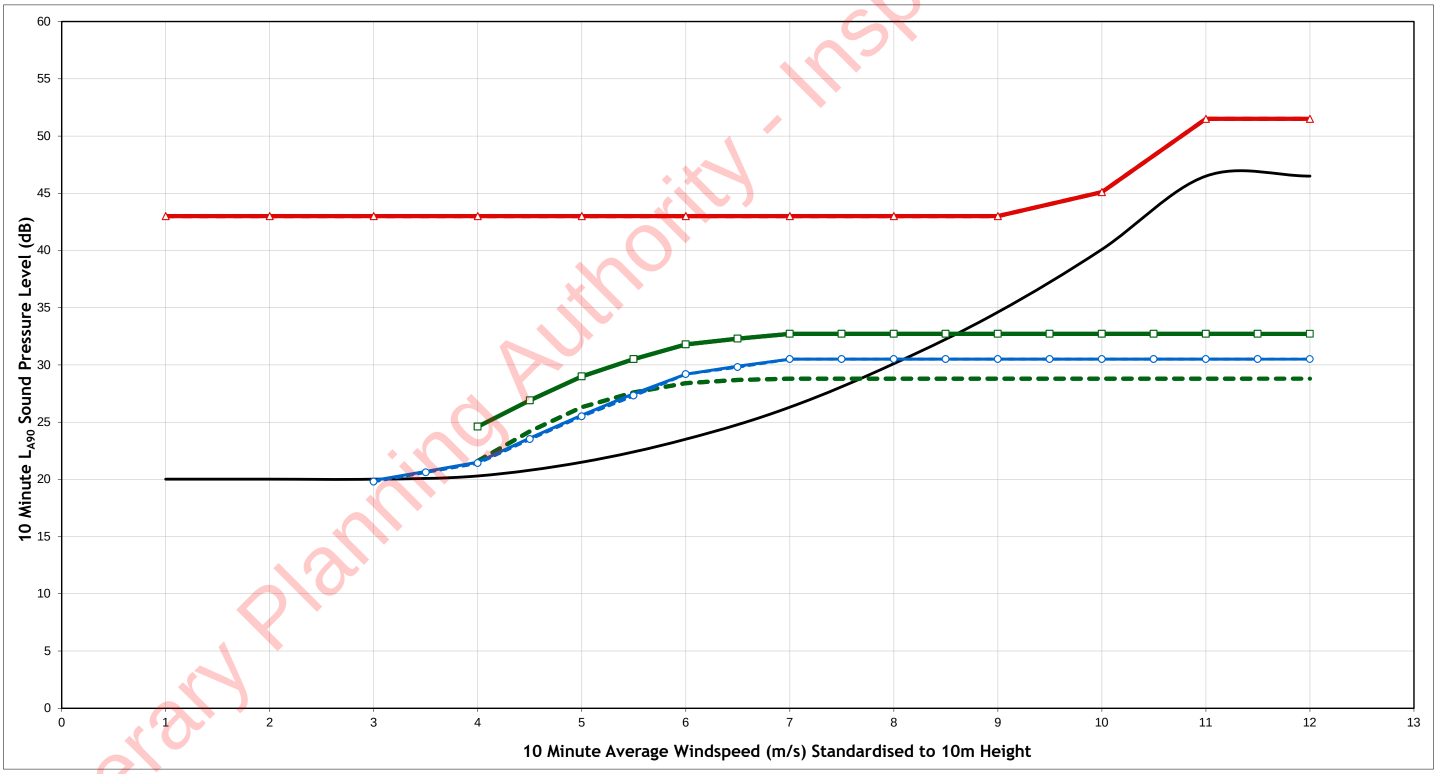
Daytime - H31



Night Time - H31



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H31
Figure Number	Figure A1.5ae
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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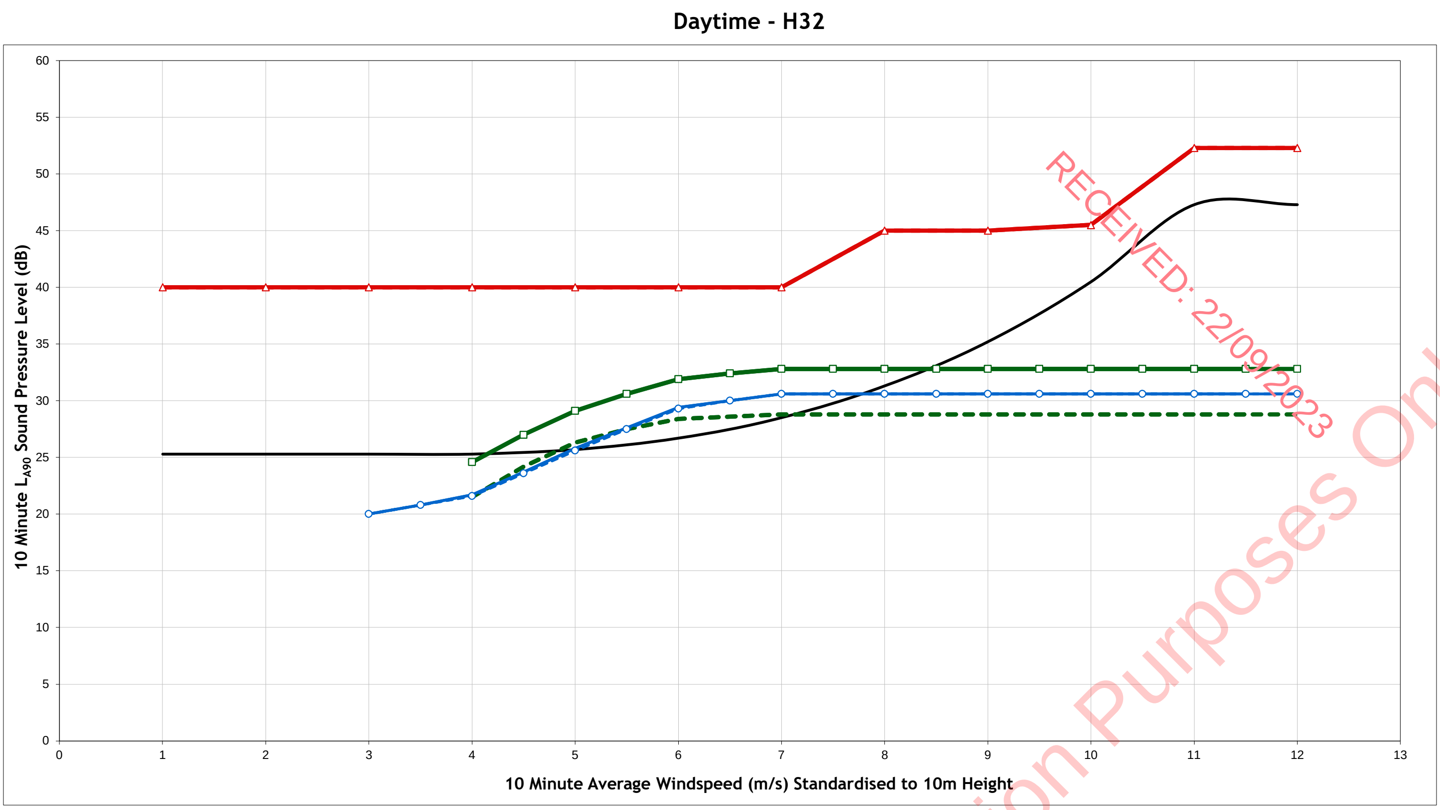

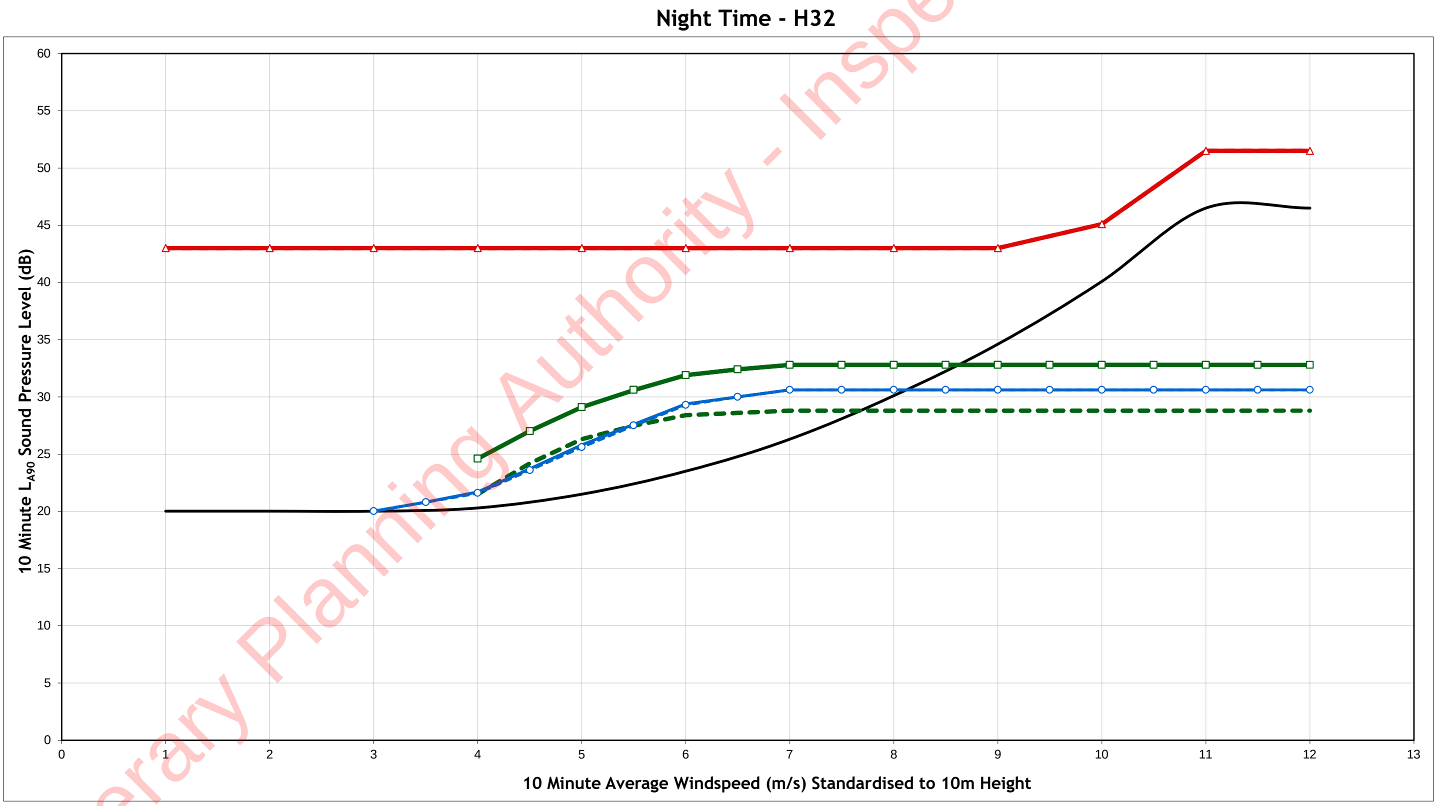

Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H32
Figure Number	Figure A1.5af
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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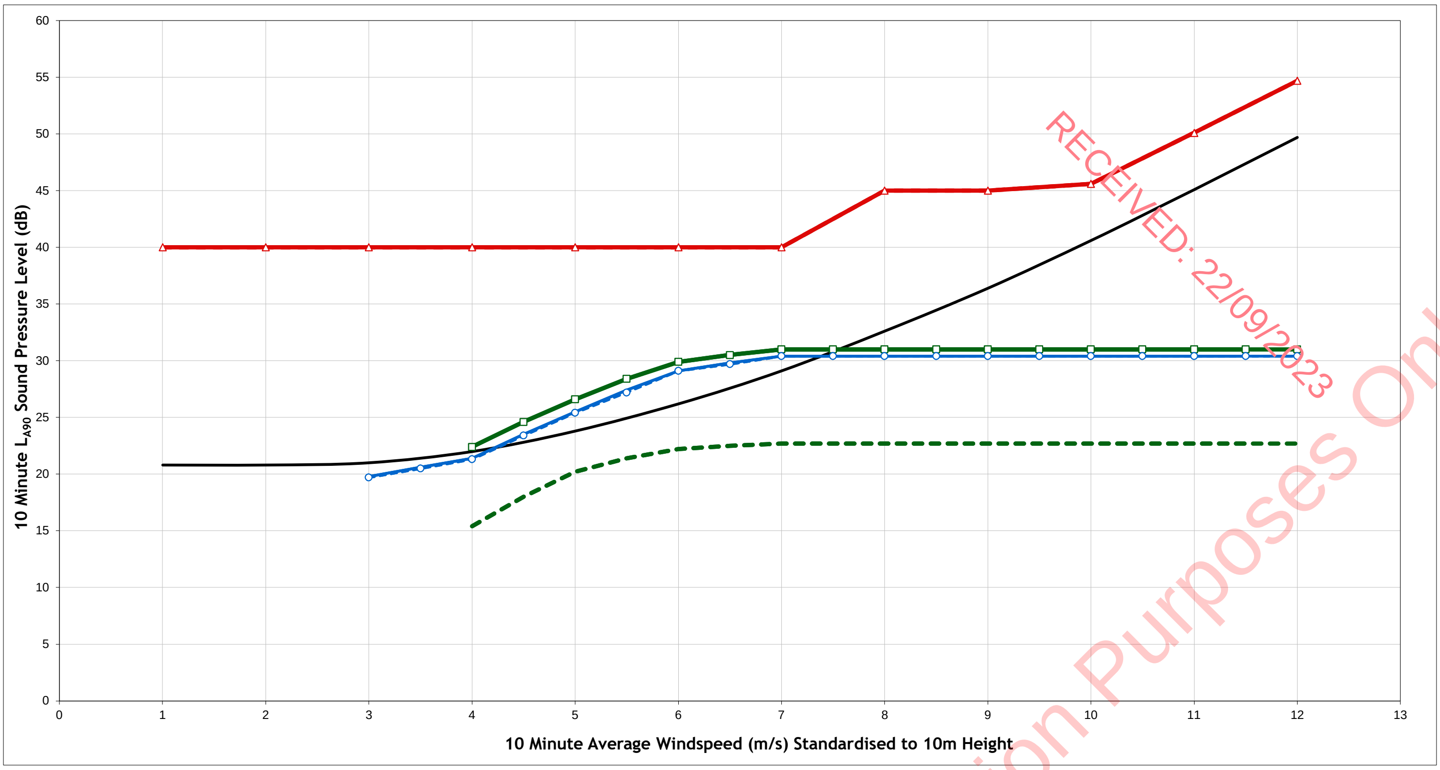
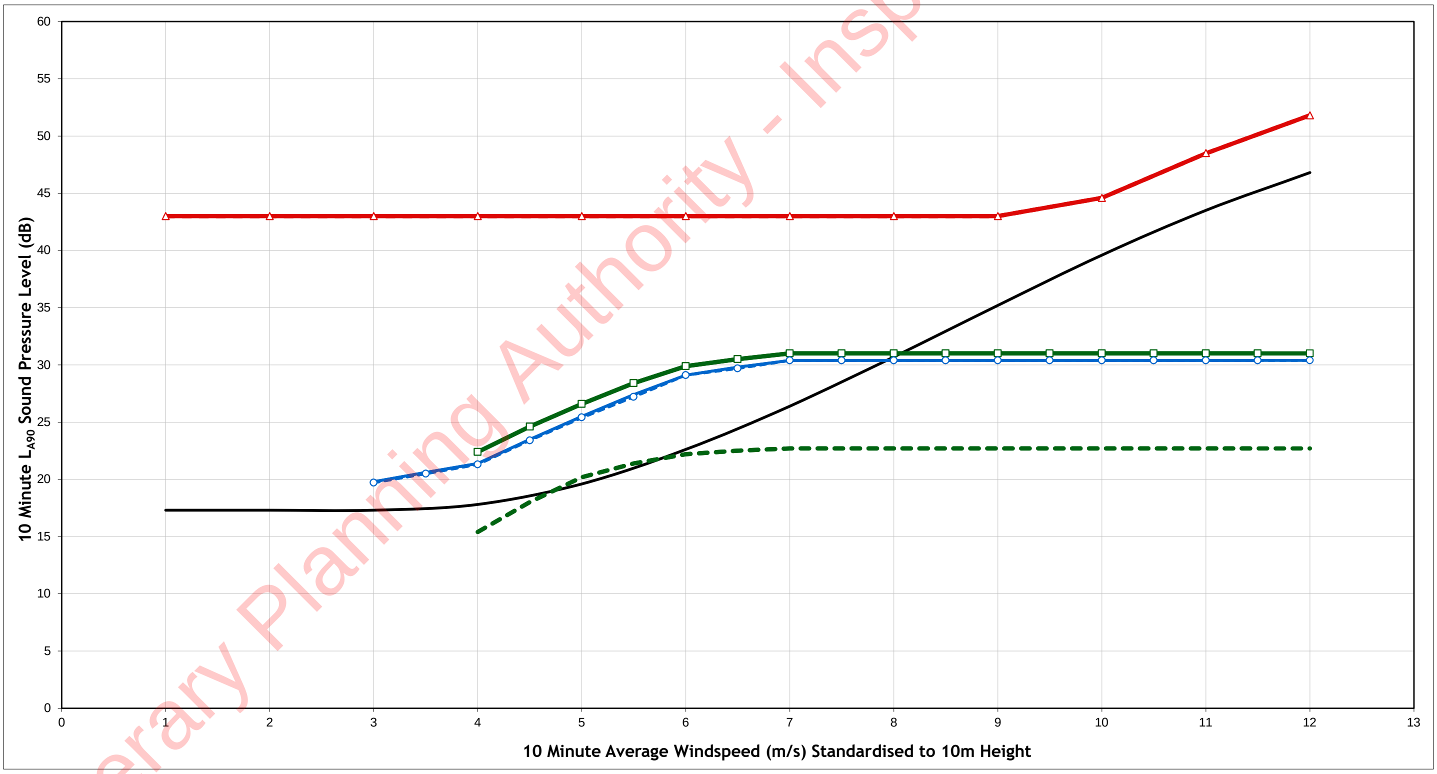
Daytime - H33



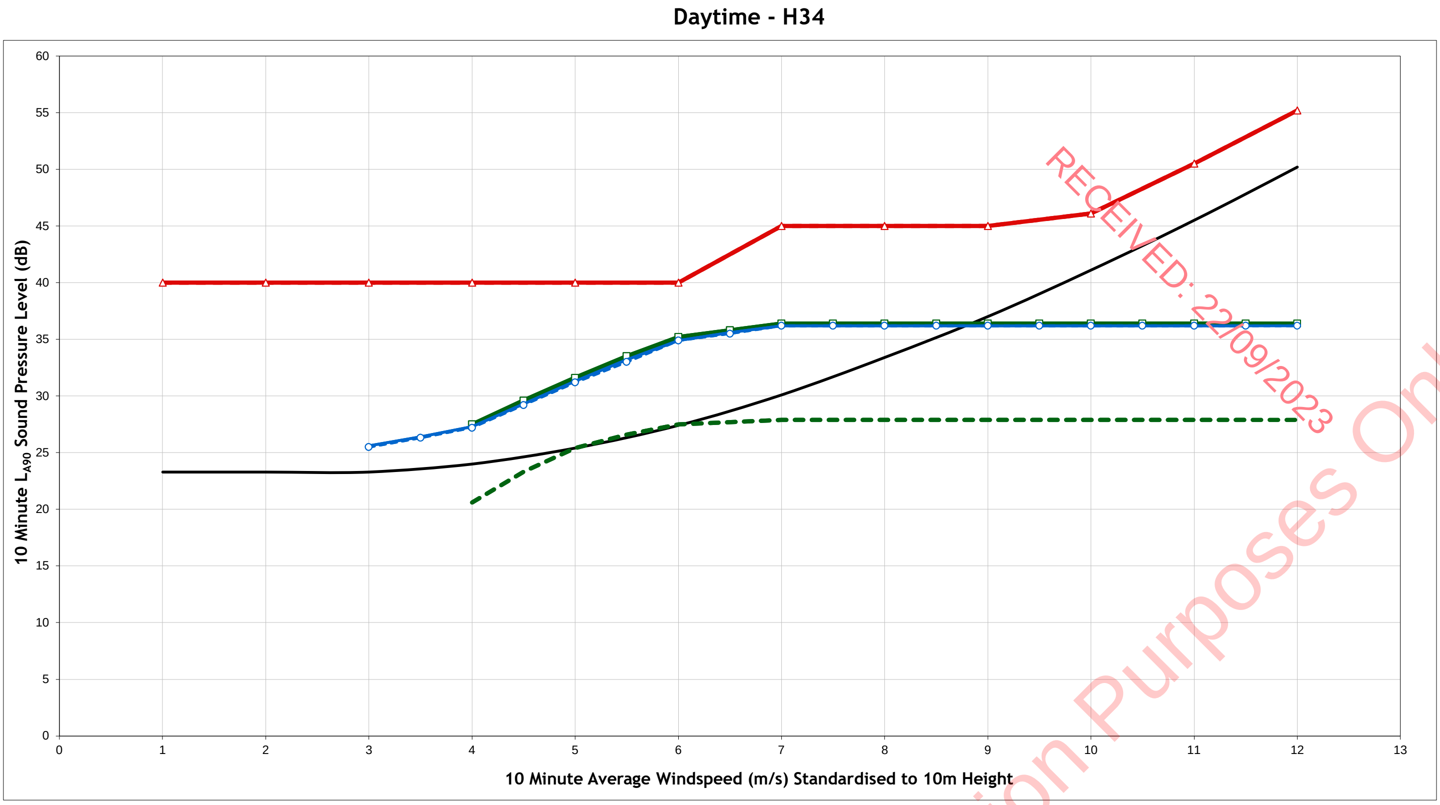
Night Time - H33

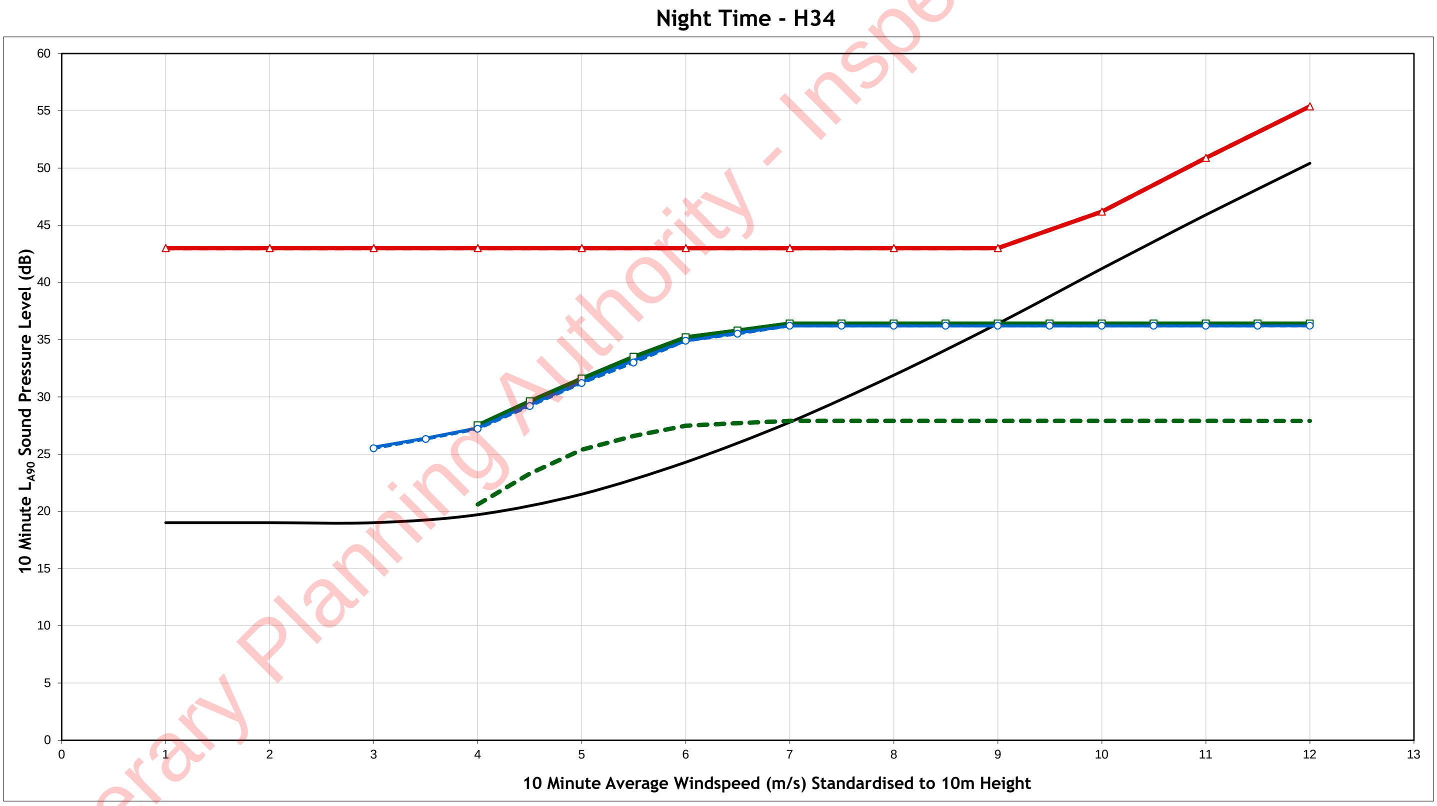


Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H33
Figure Number	Figure A1.5ag
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models



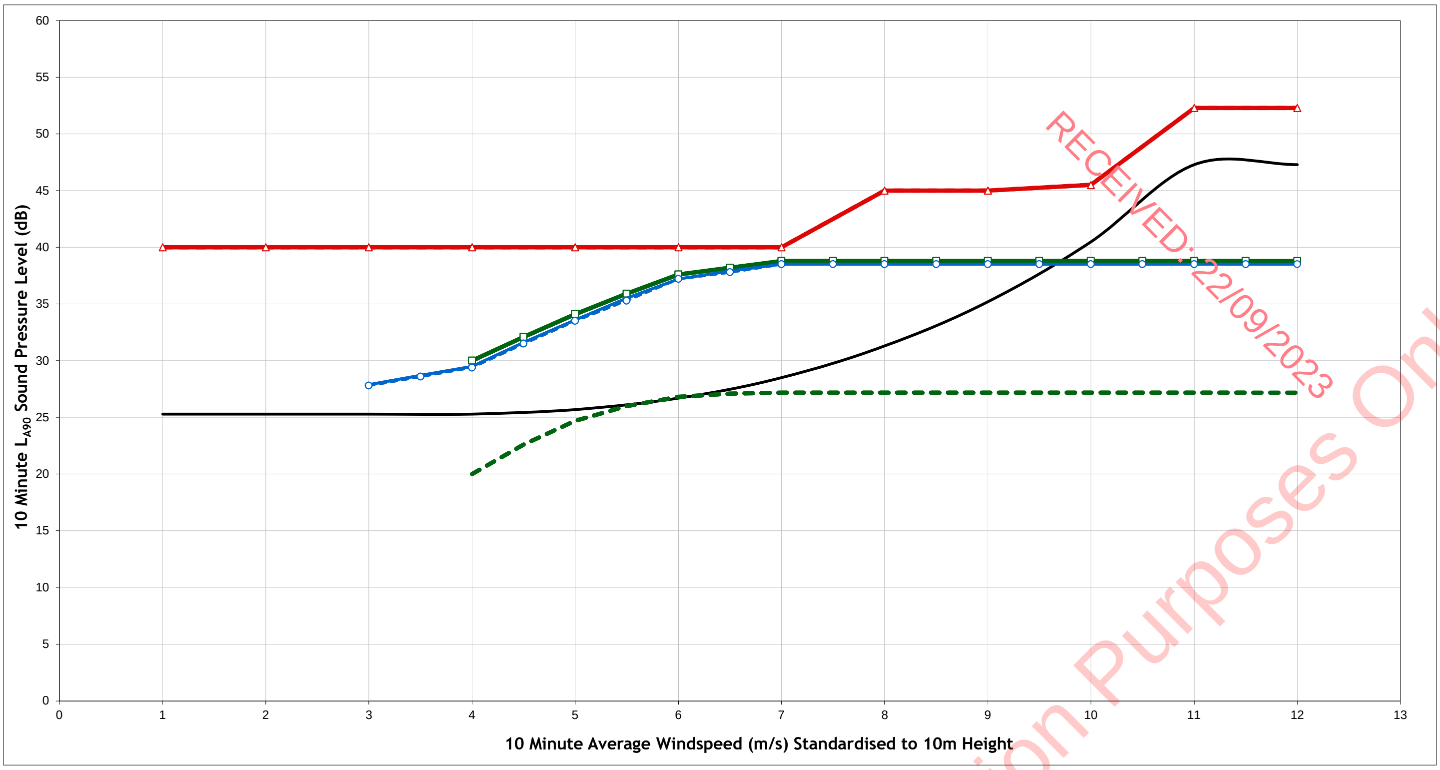


Legend:

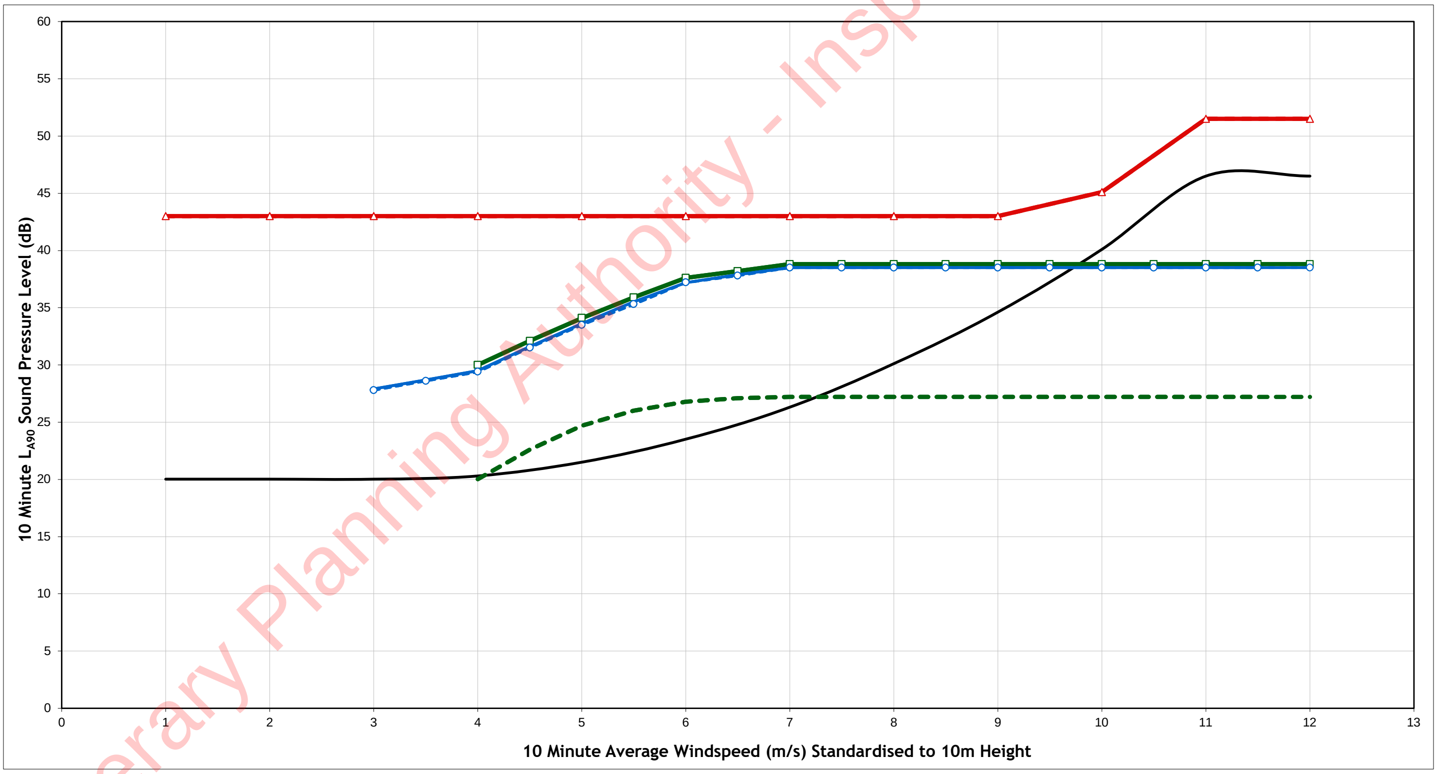
- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H34
Figure Number	Figure A1.5ah
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

Daytime - H35



Night Time - H35



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H35
Figure Number	Figure A1.5ai
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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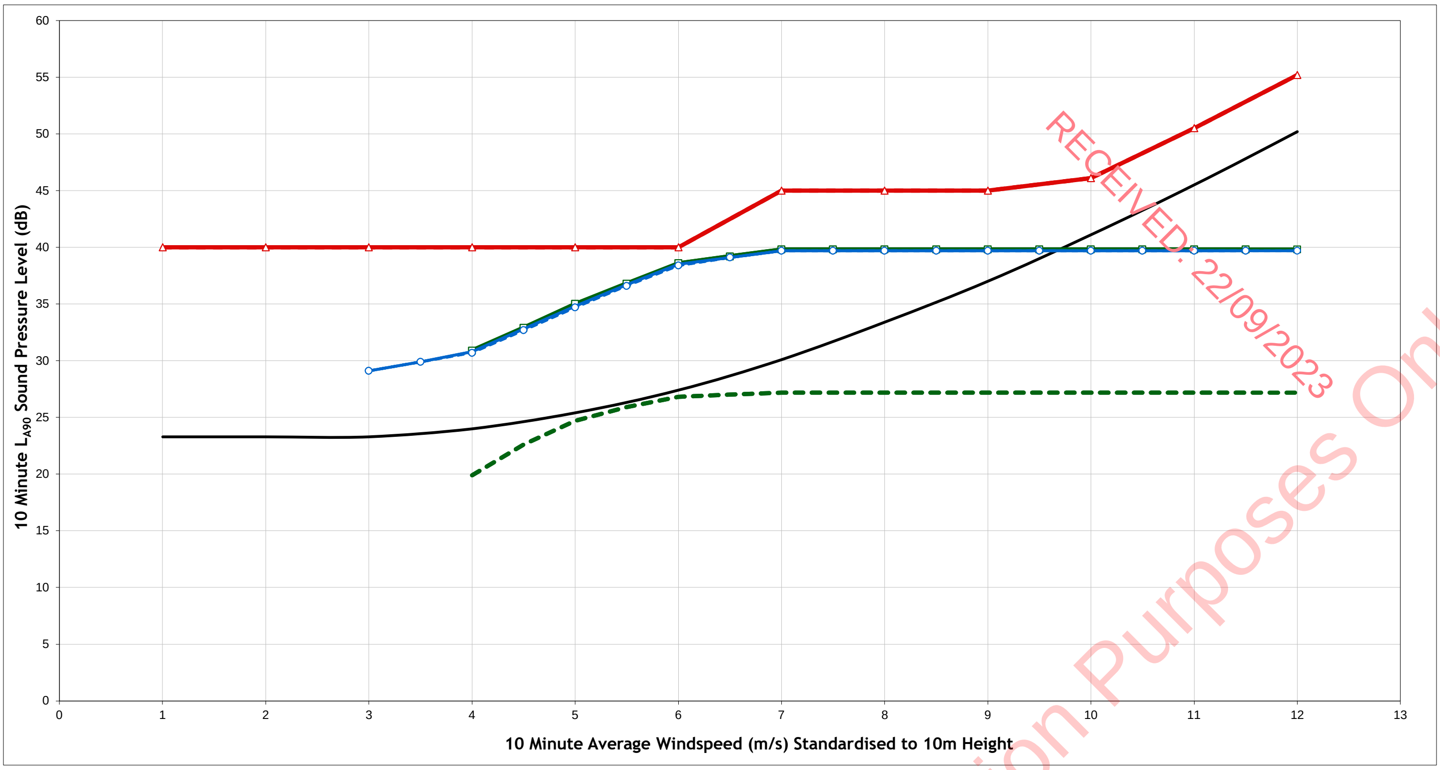
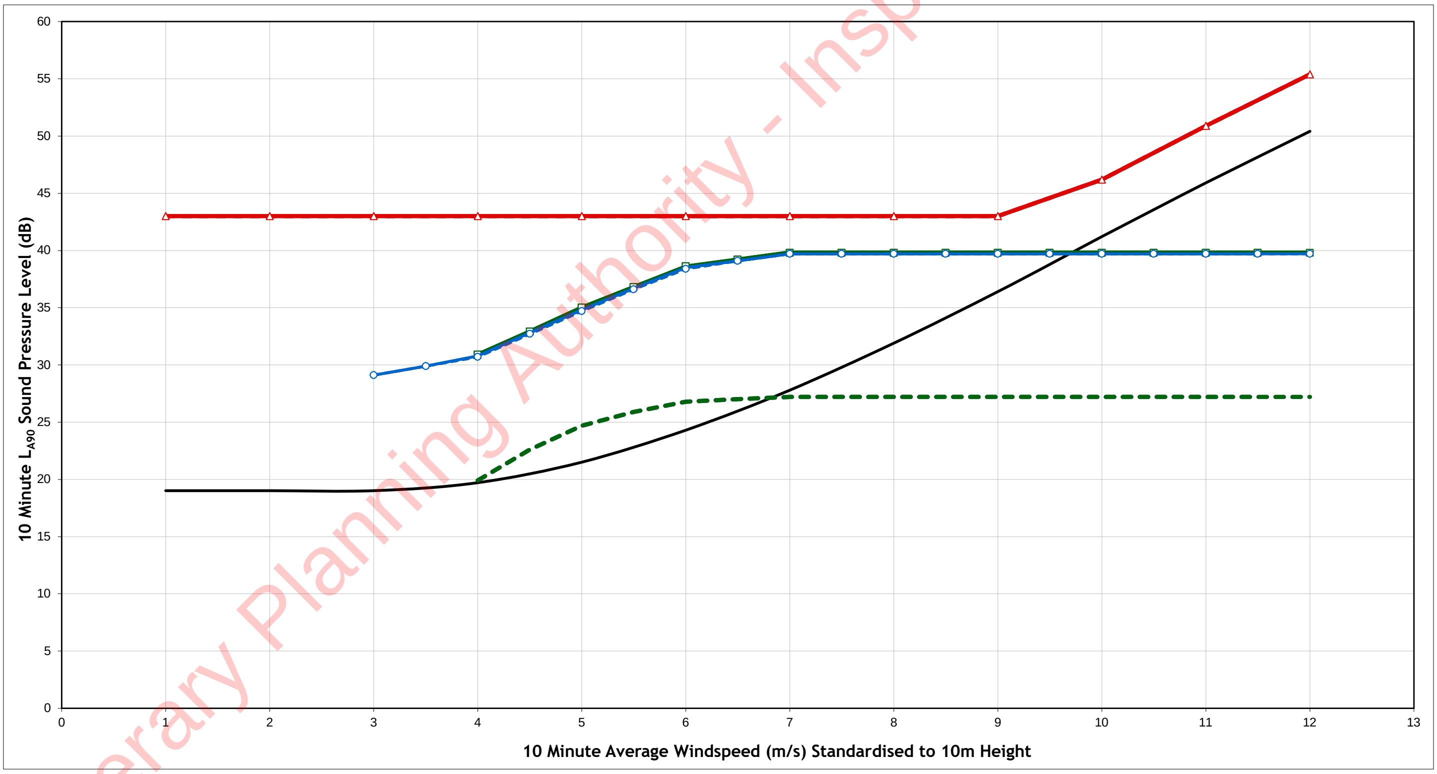
Daytime - H36



Night Time - H36



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H36
Figure Number	Figure A1.5aj
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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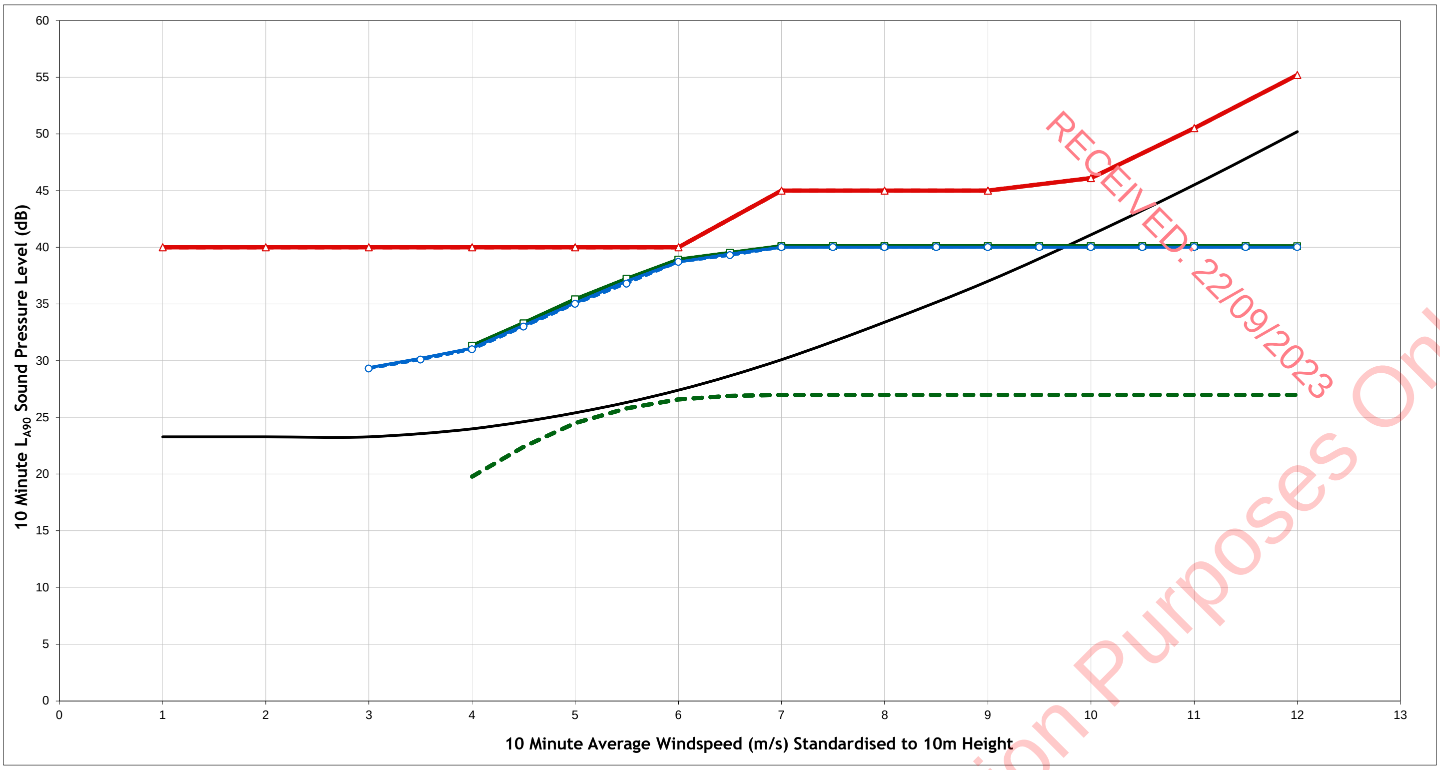
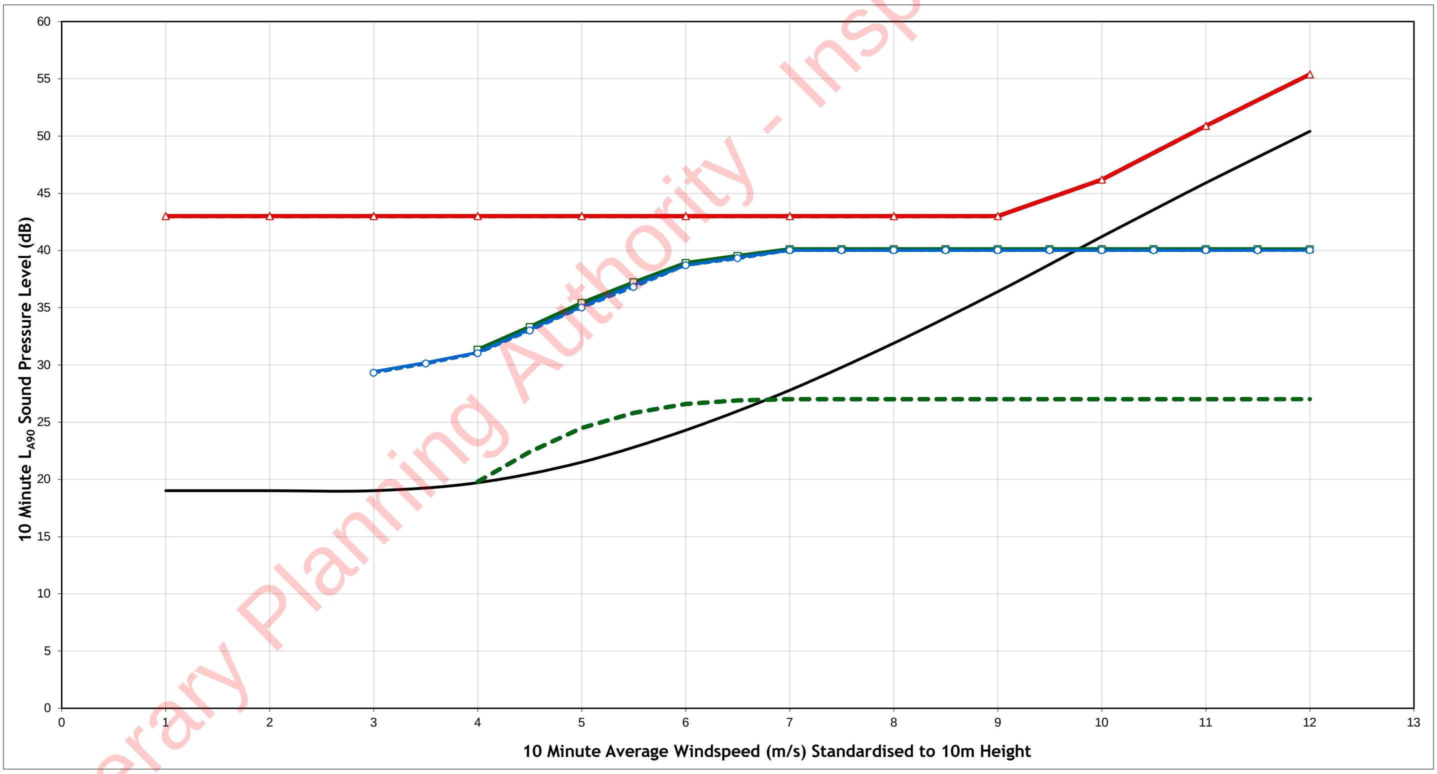
Daytime - H37



Night Time - H37



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H37
Figure Number	Figure A1.5ak
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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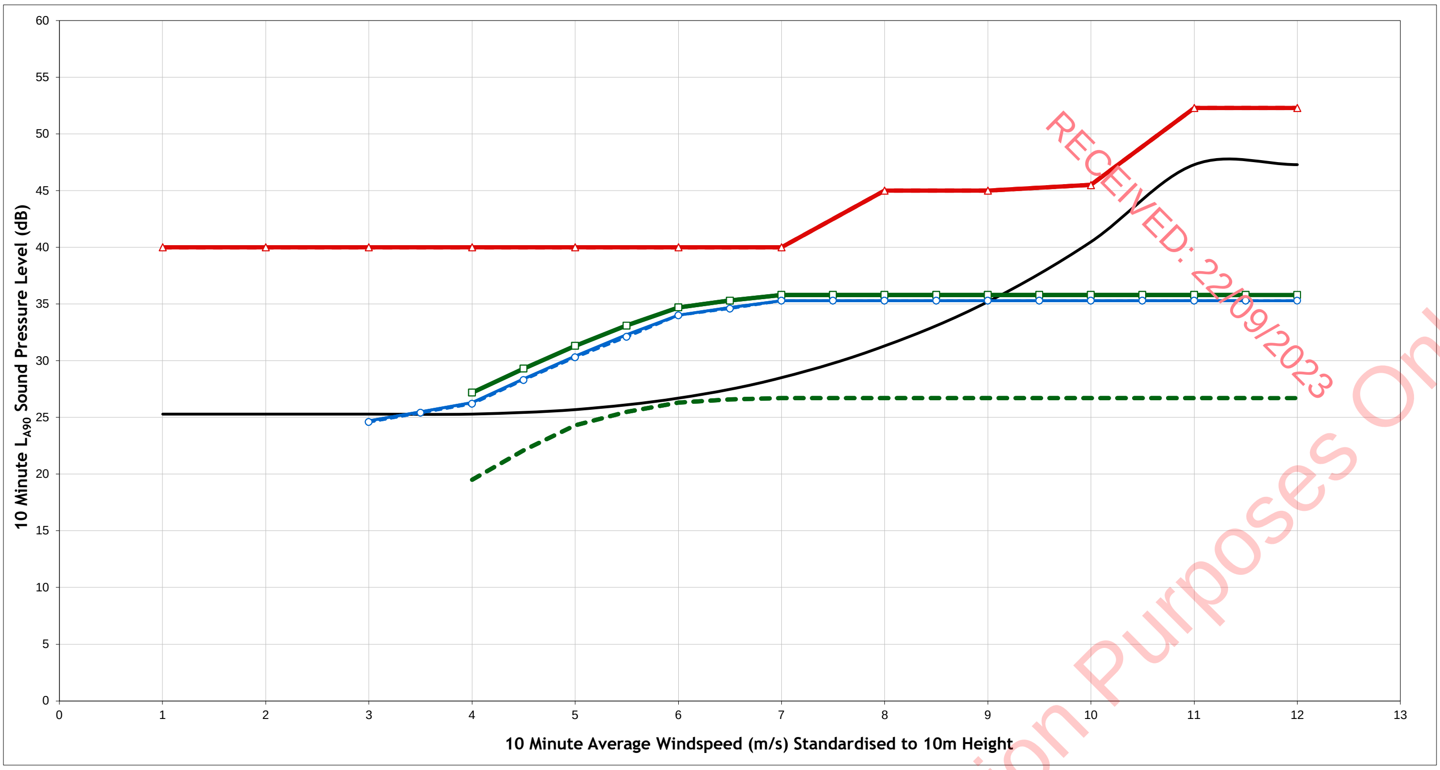
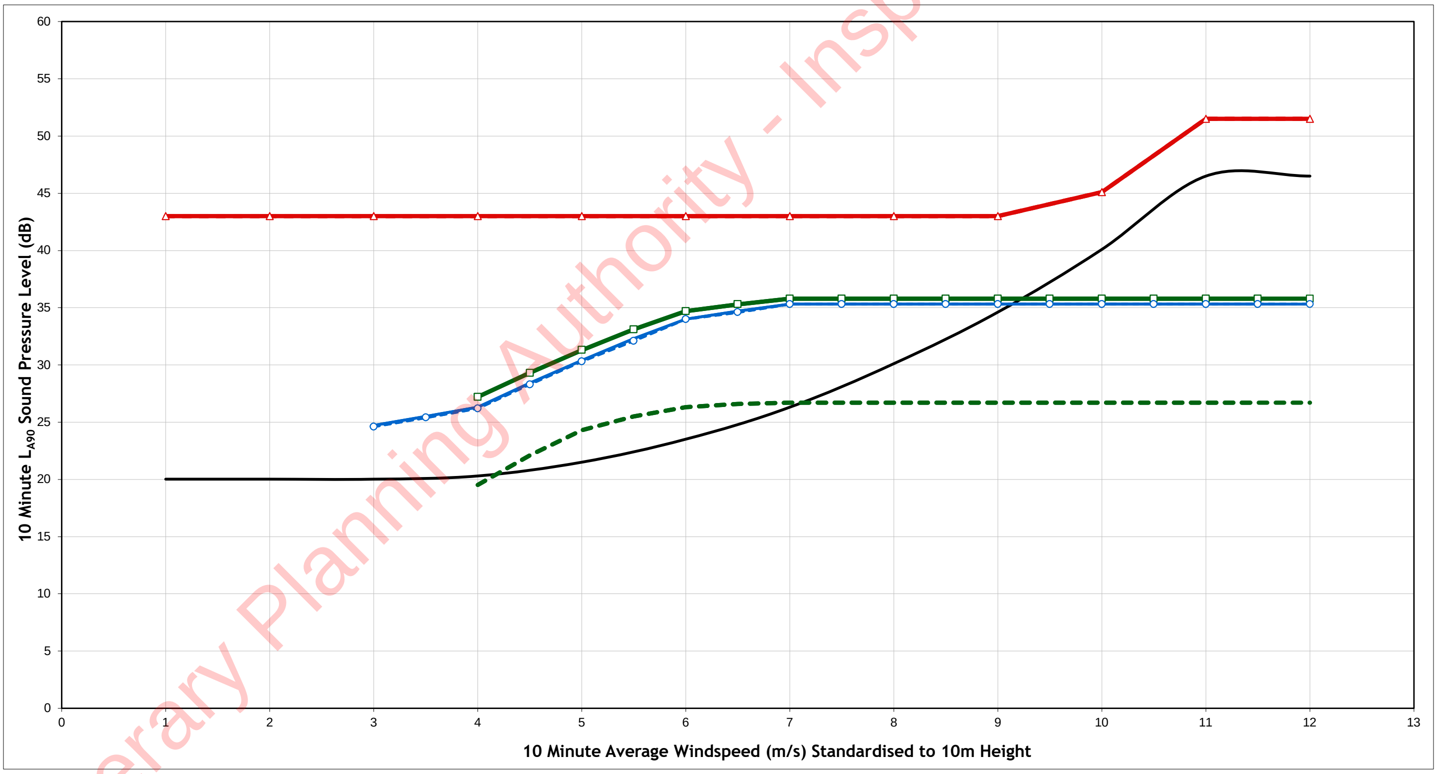
Daytime - H38



Night Time - H38



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H38
Figure Number	Figure A1.5al
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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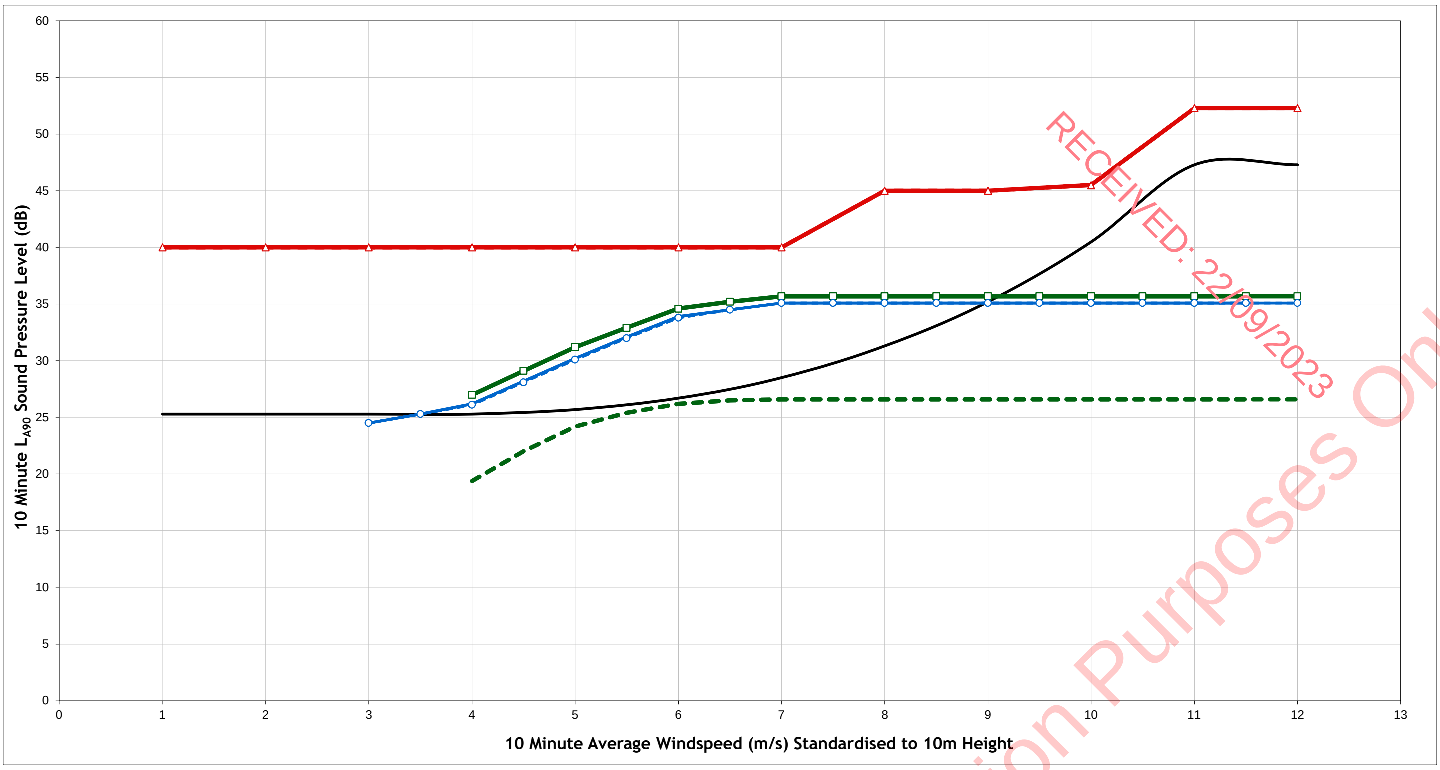
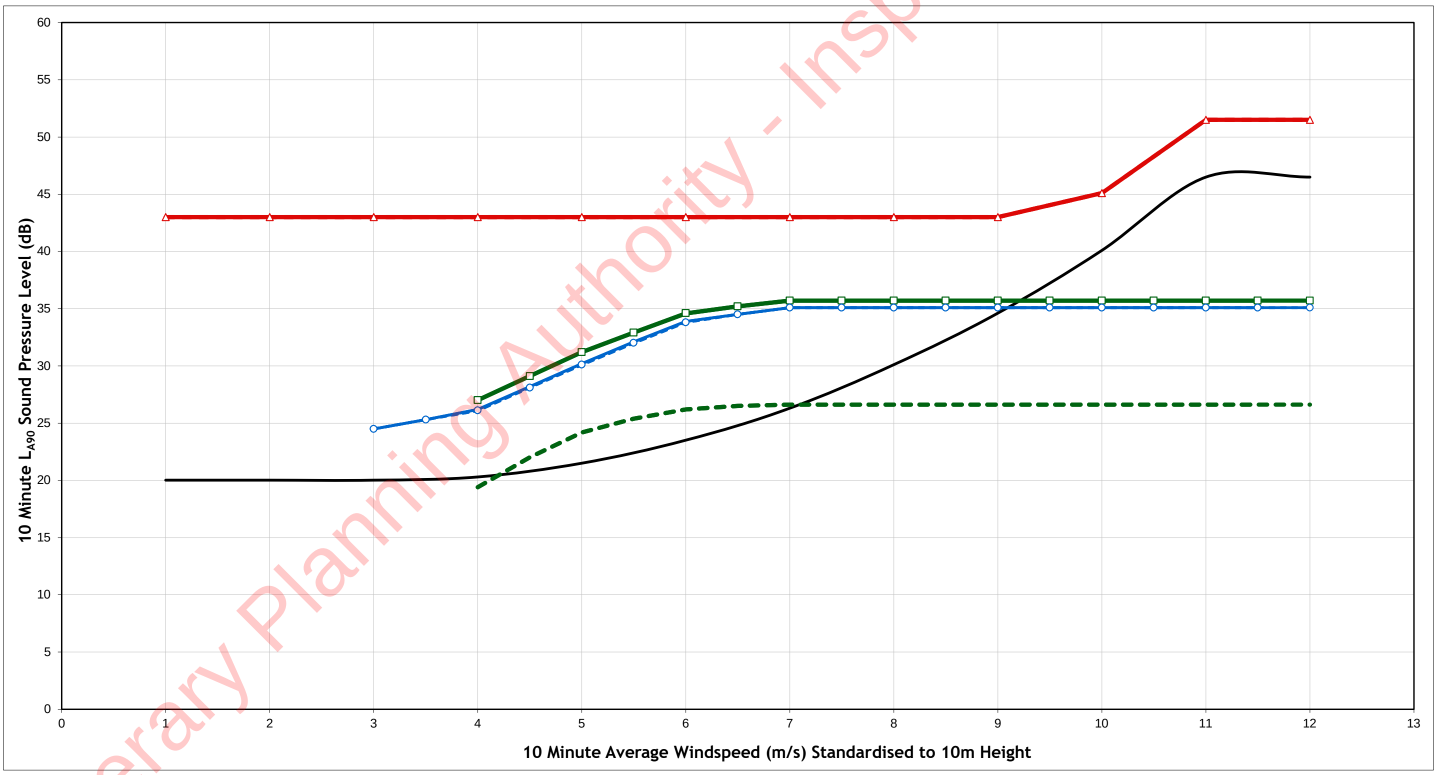
Daytime - H39



Night Time - H39



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H39
Figure Number	Figure A1.5am
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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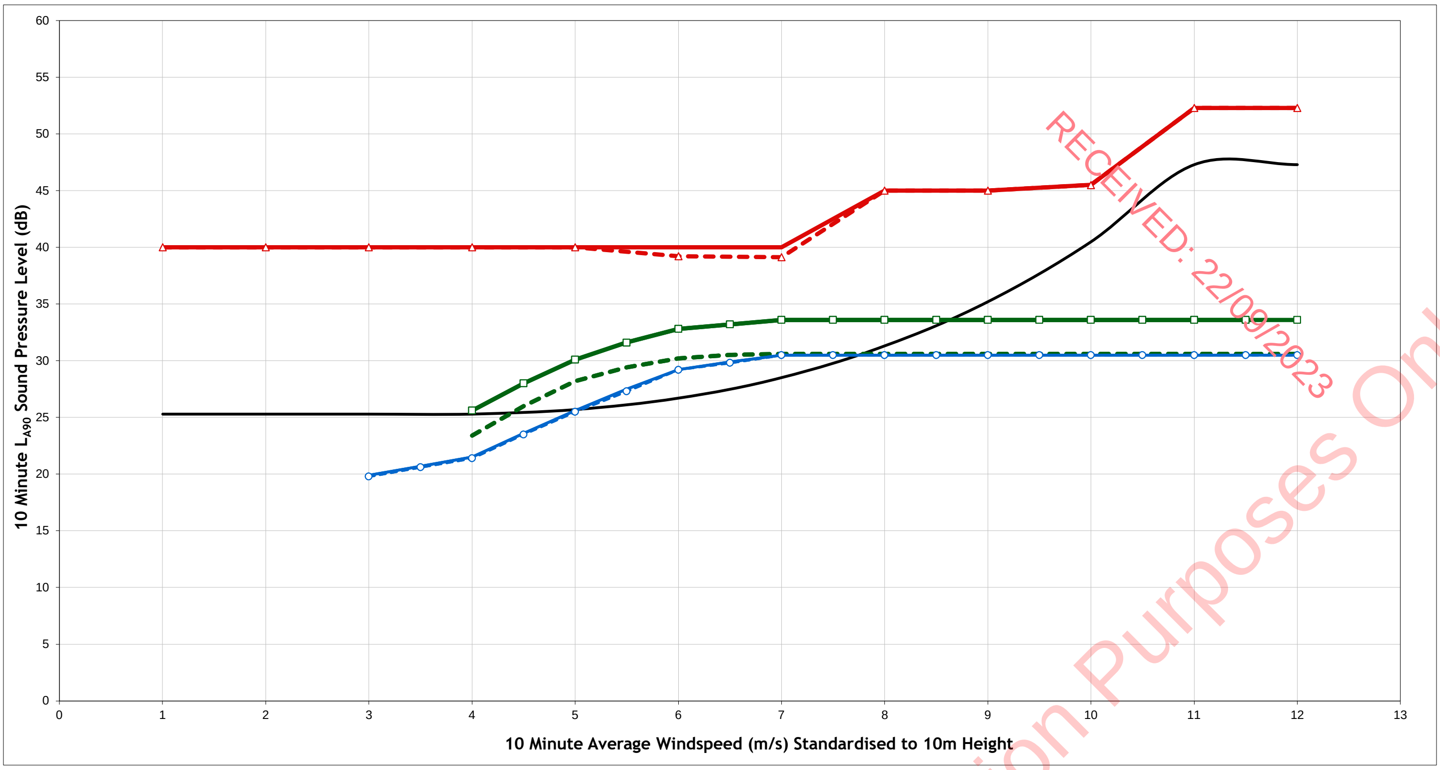
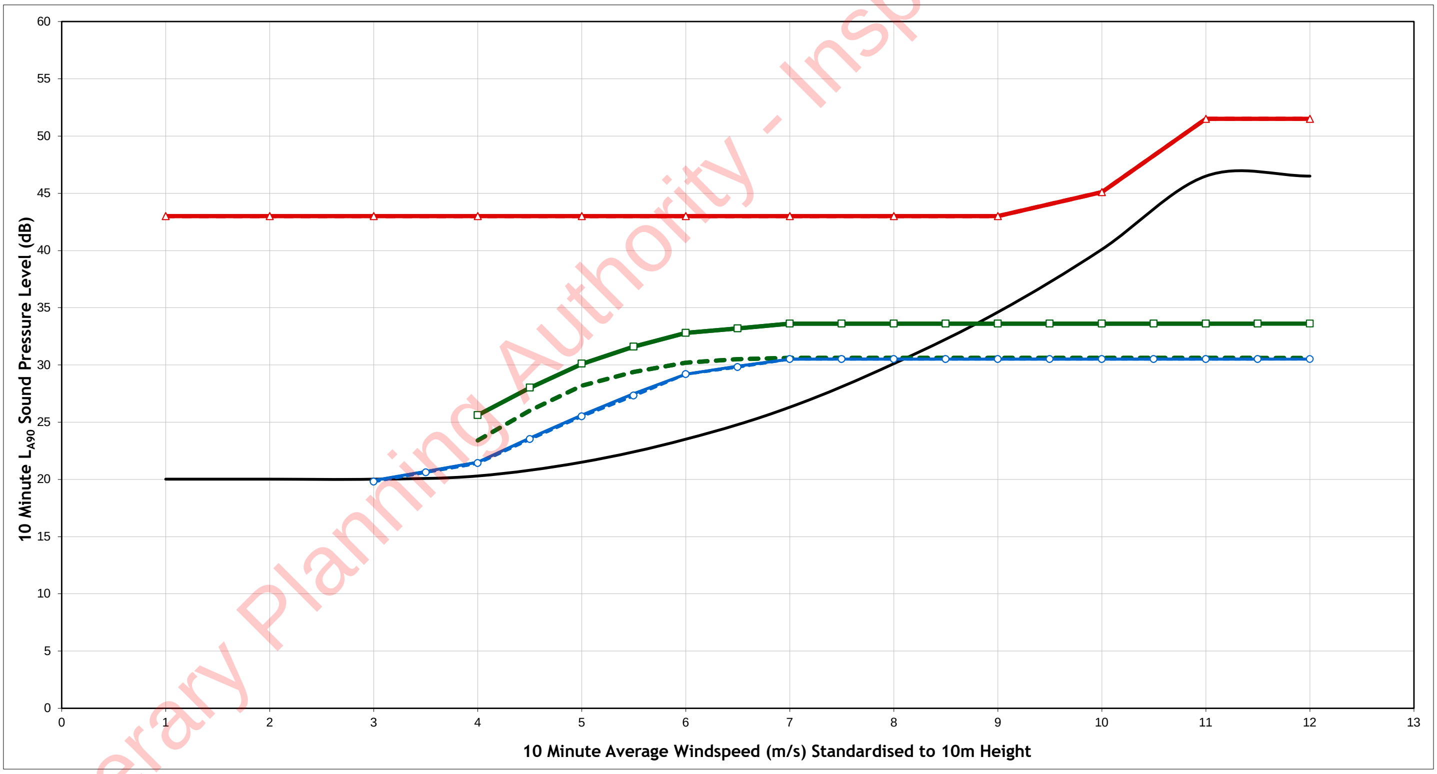
Daytime - H40



Night Time - H40

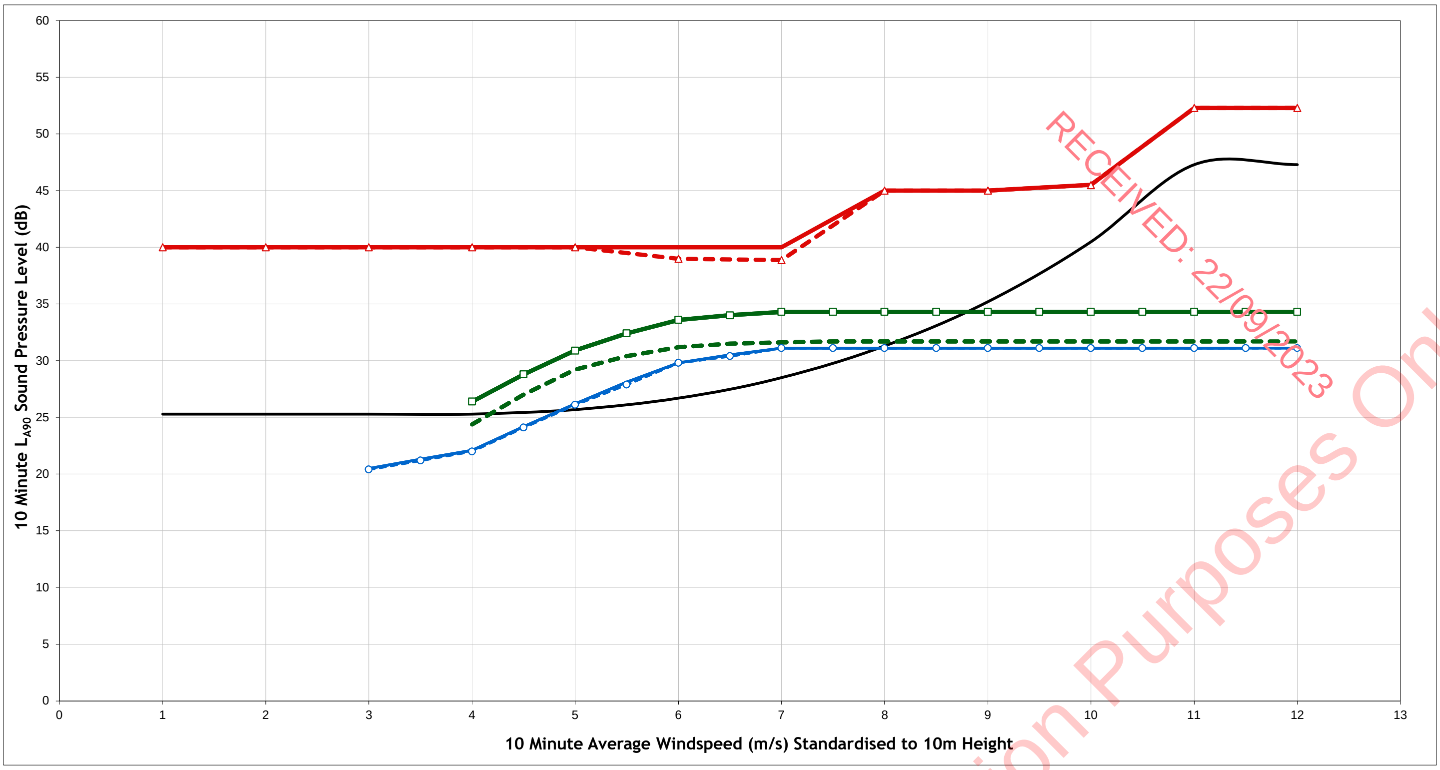


Legend:

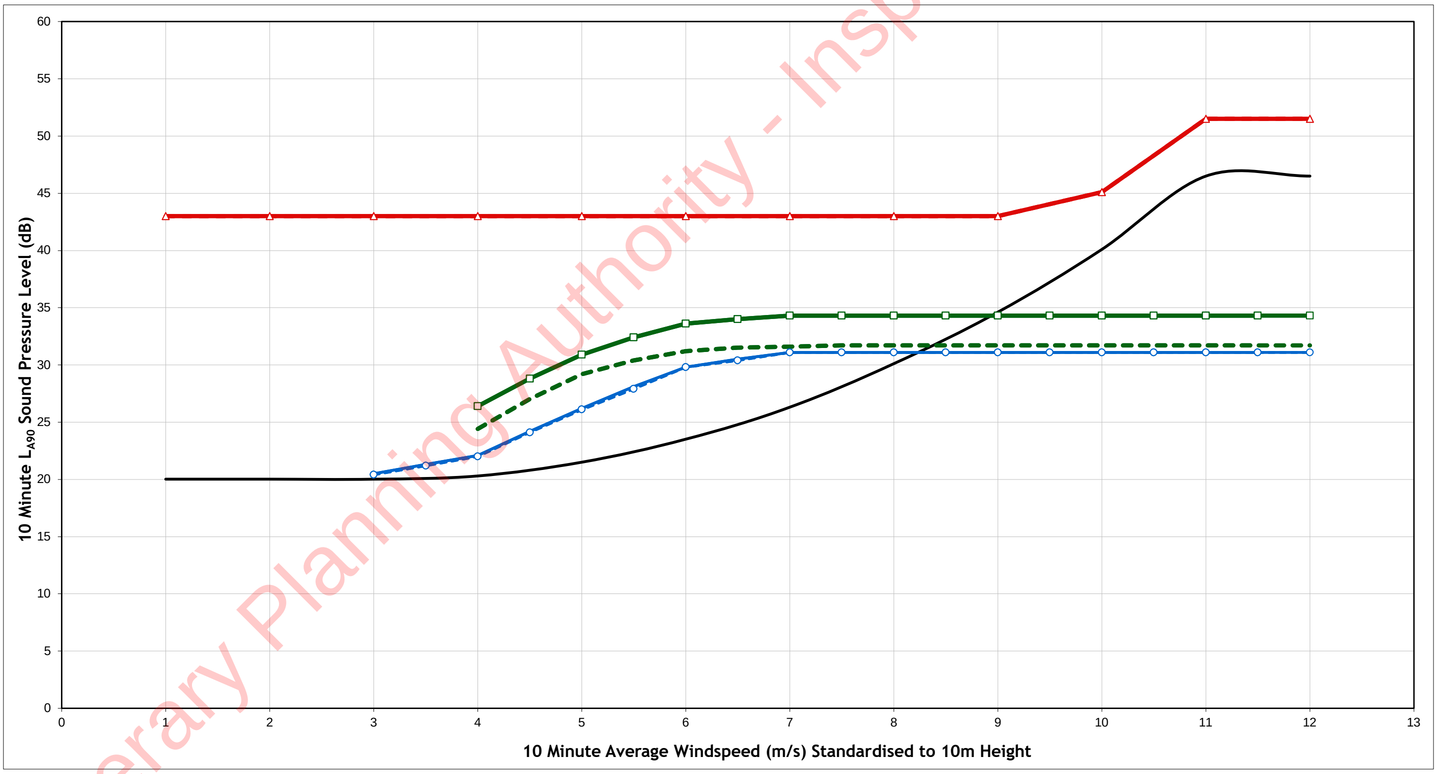
- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H40
Figure Number	Figure A1.5an
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

Daytime - H41



Night Time - H41



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H41
Figure Number	Figure A1.5ao
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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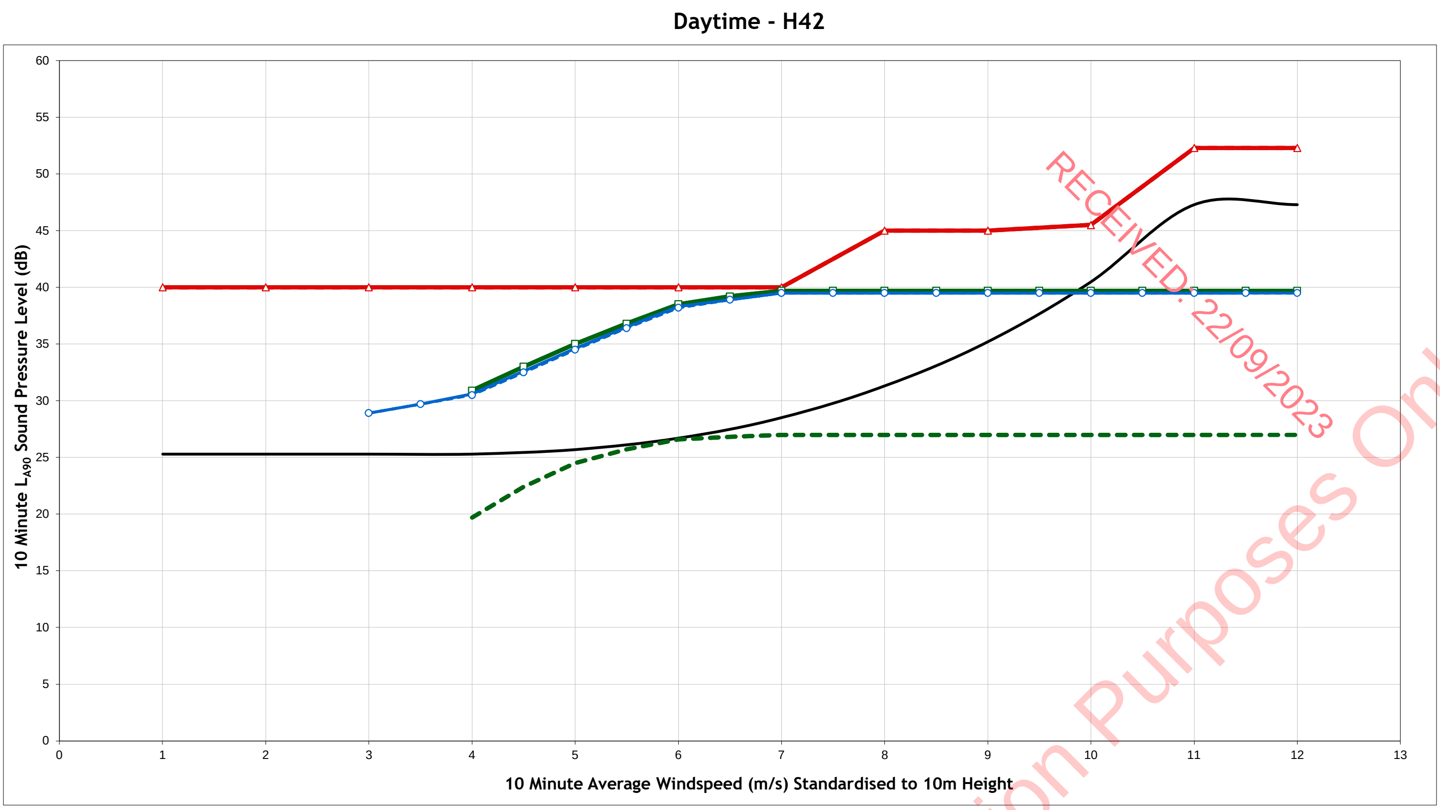

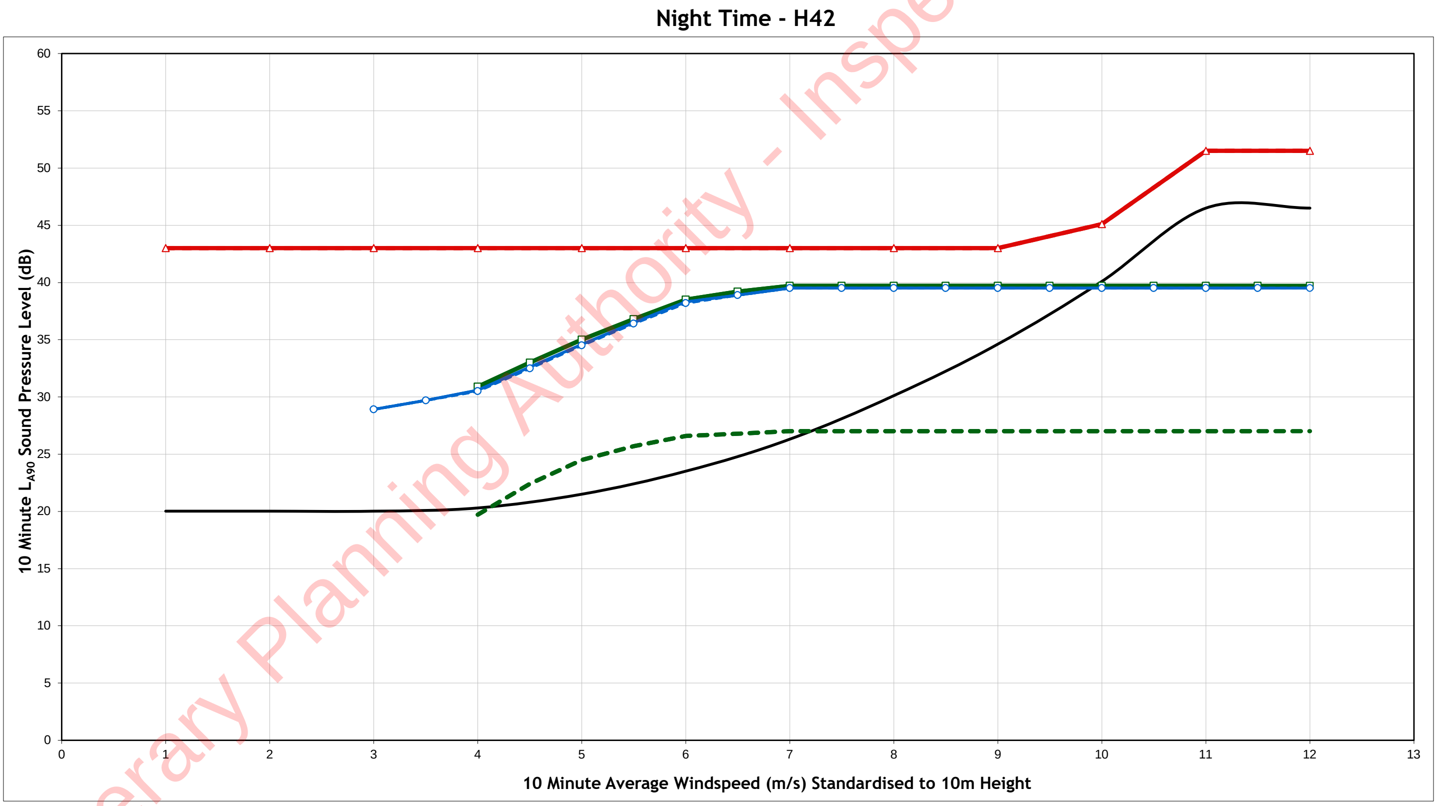

Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H42
Figure Number	Figure A1.5ap
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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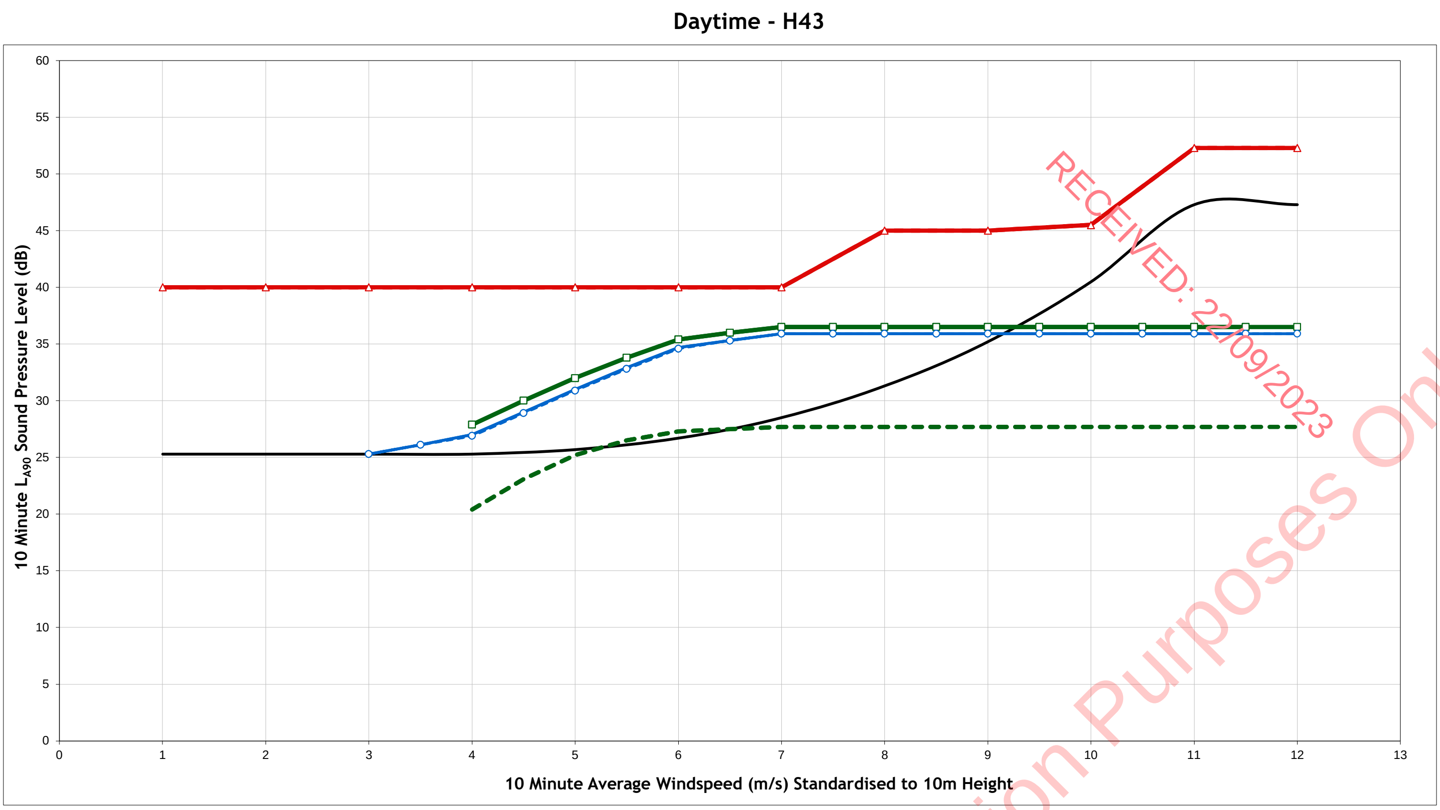
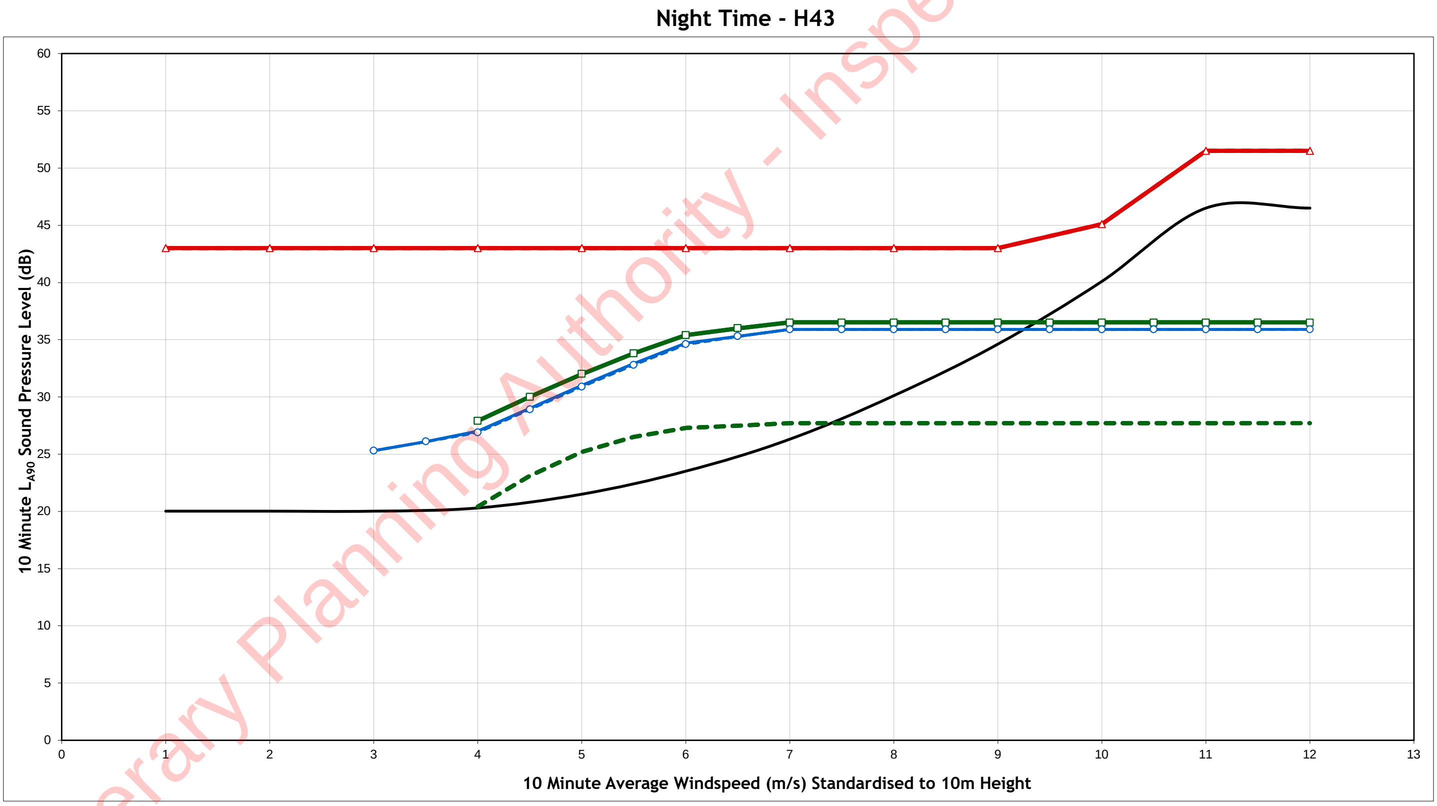


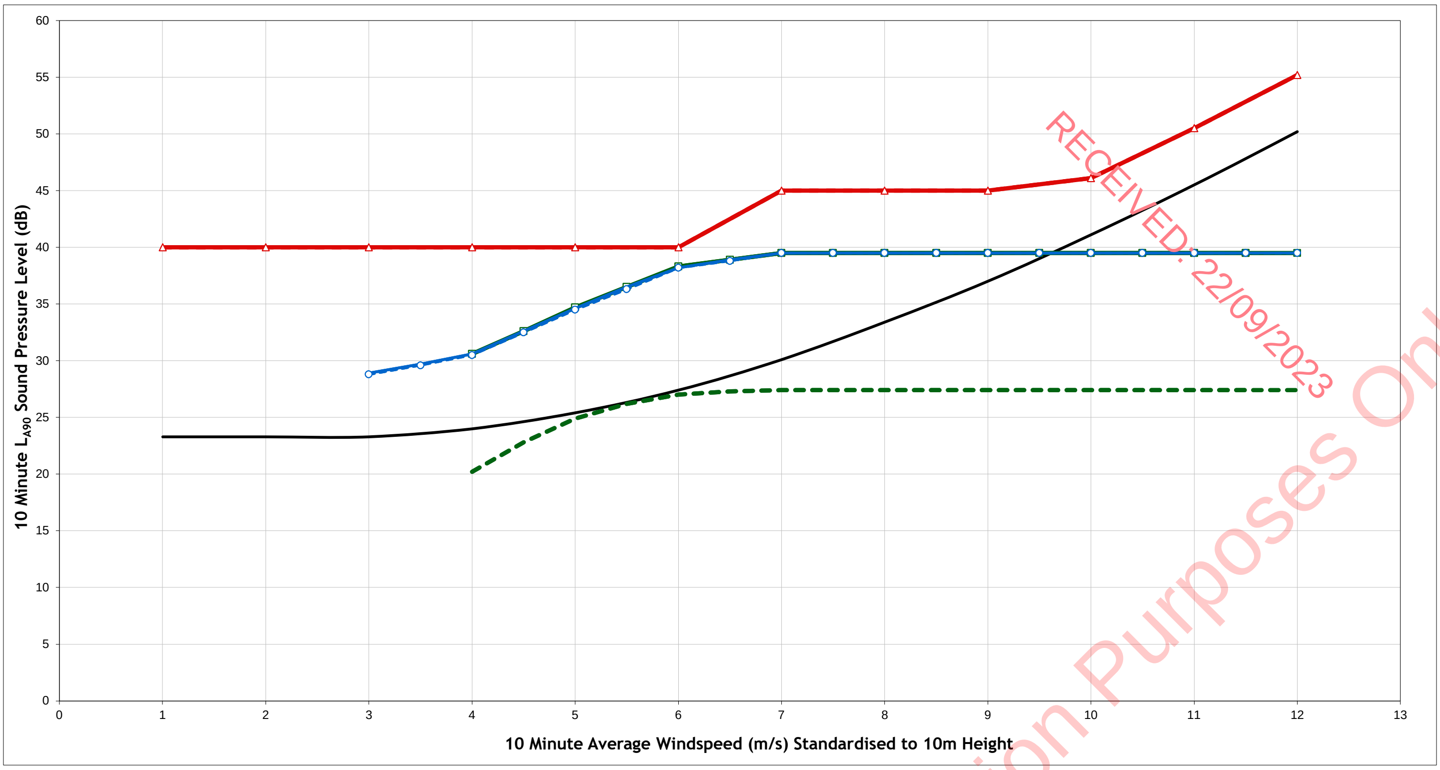


Legend:

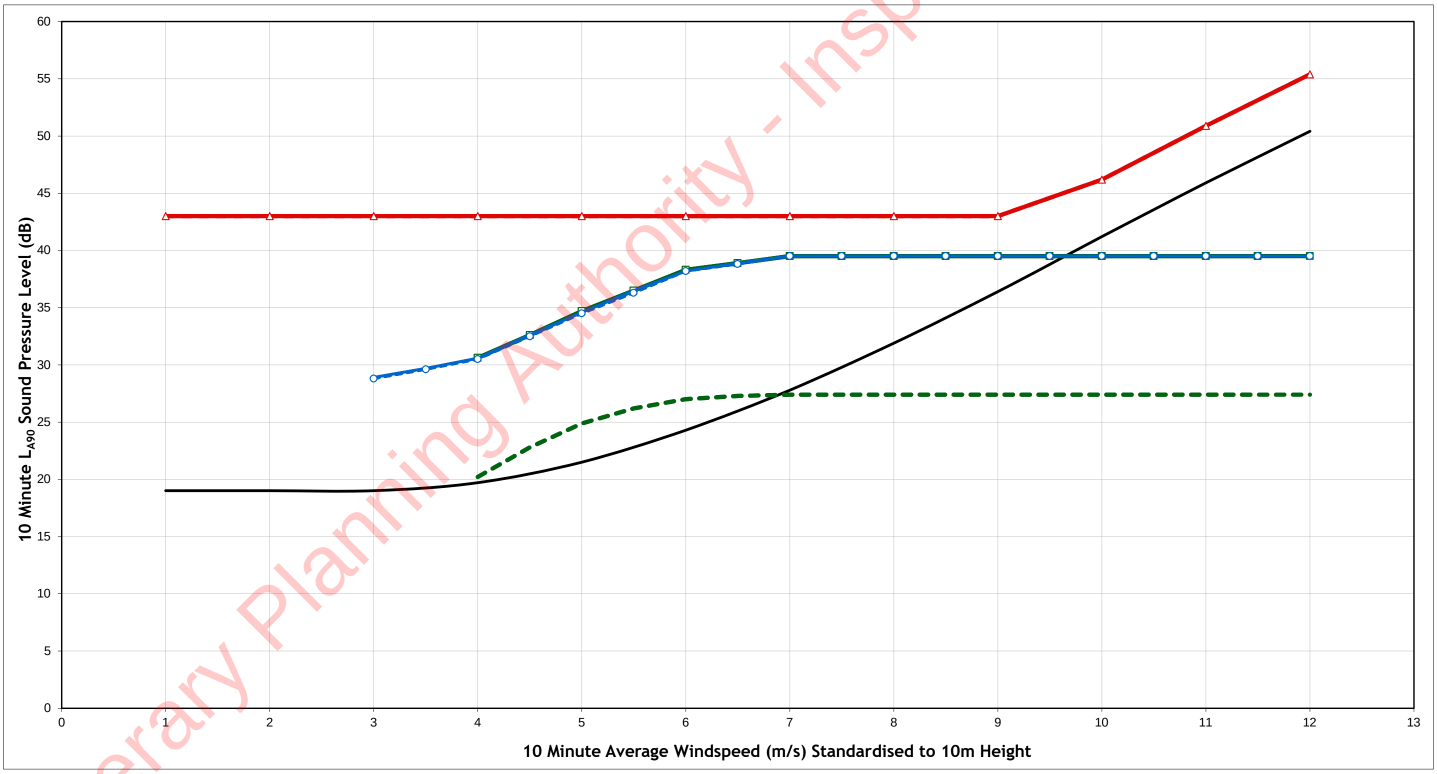
- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H43
Figure Number	Figure A1.5aq
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

Daytime - H44



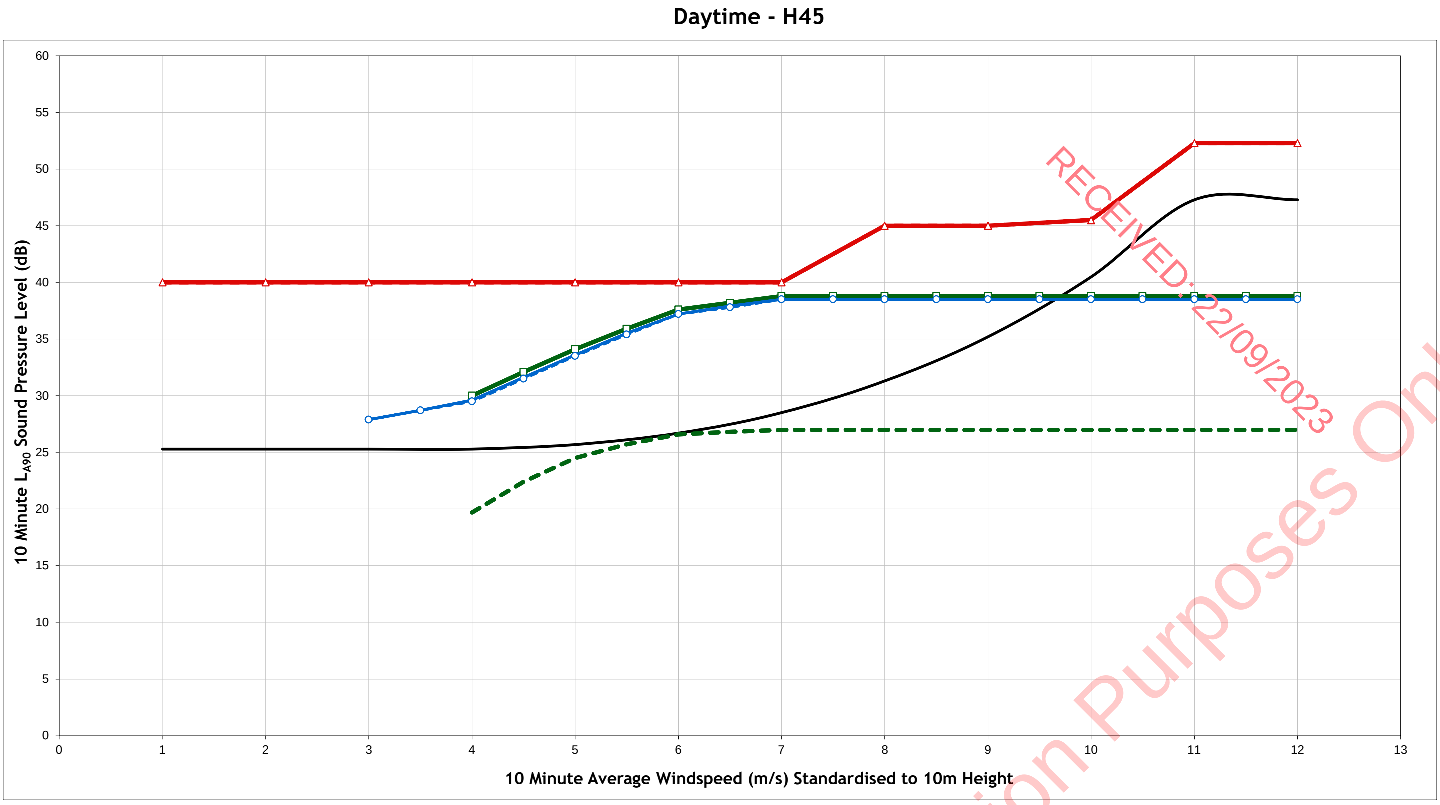
Night Time - H44

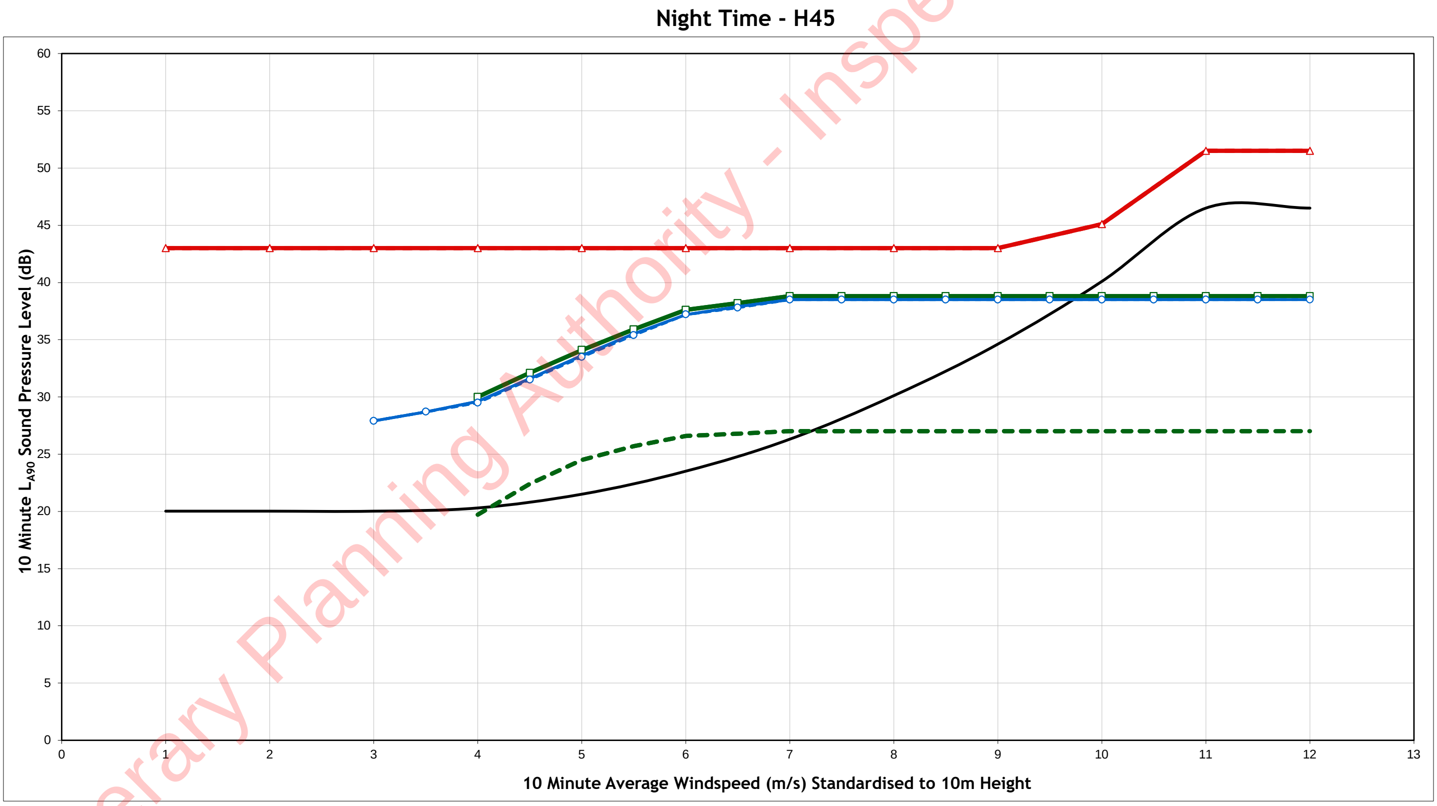


Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H44
Figure Number	Figure A1.5ar
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models



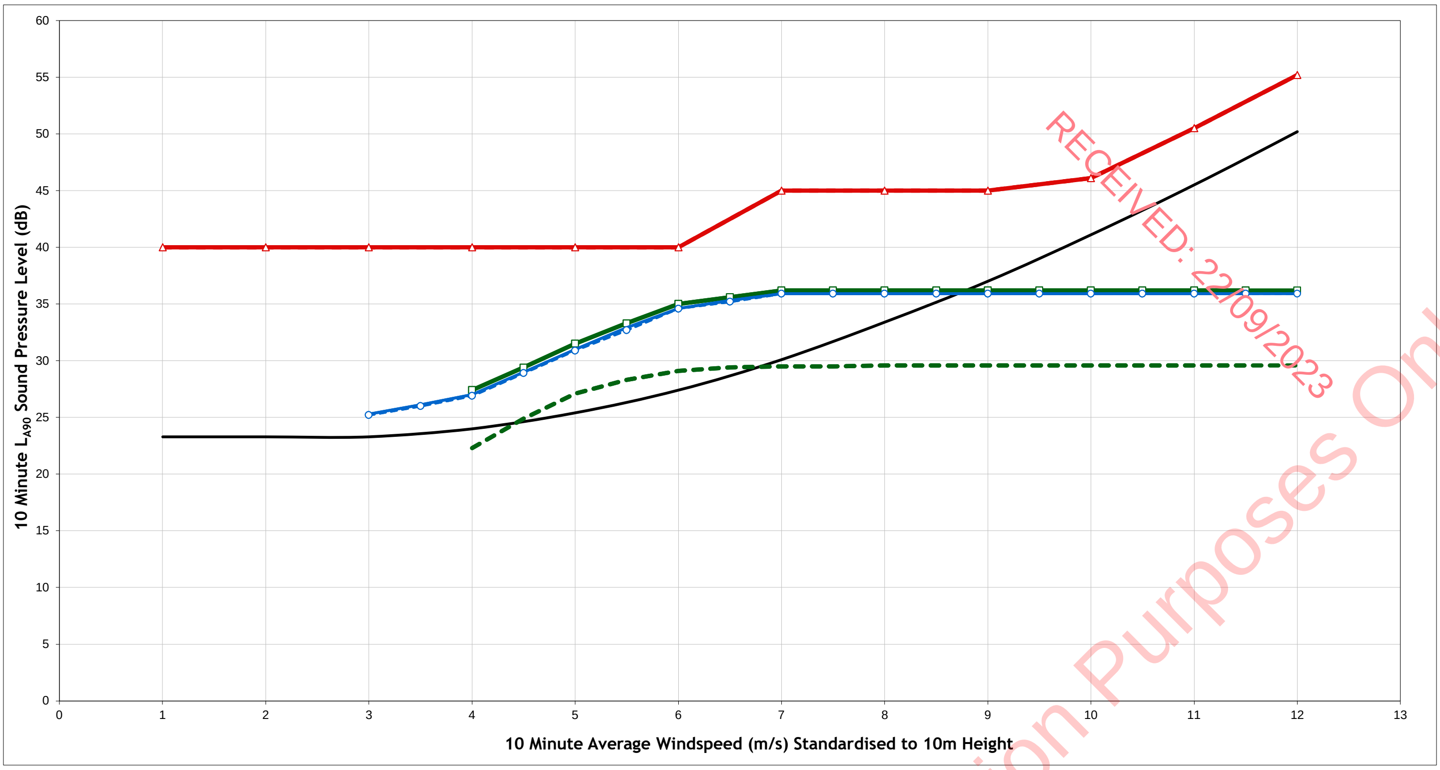


Legend:

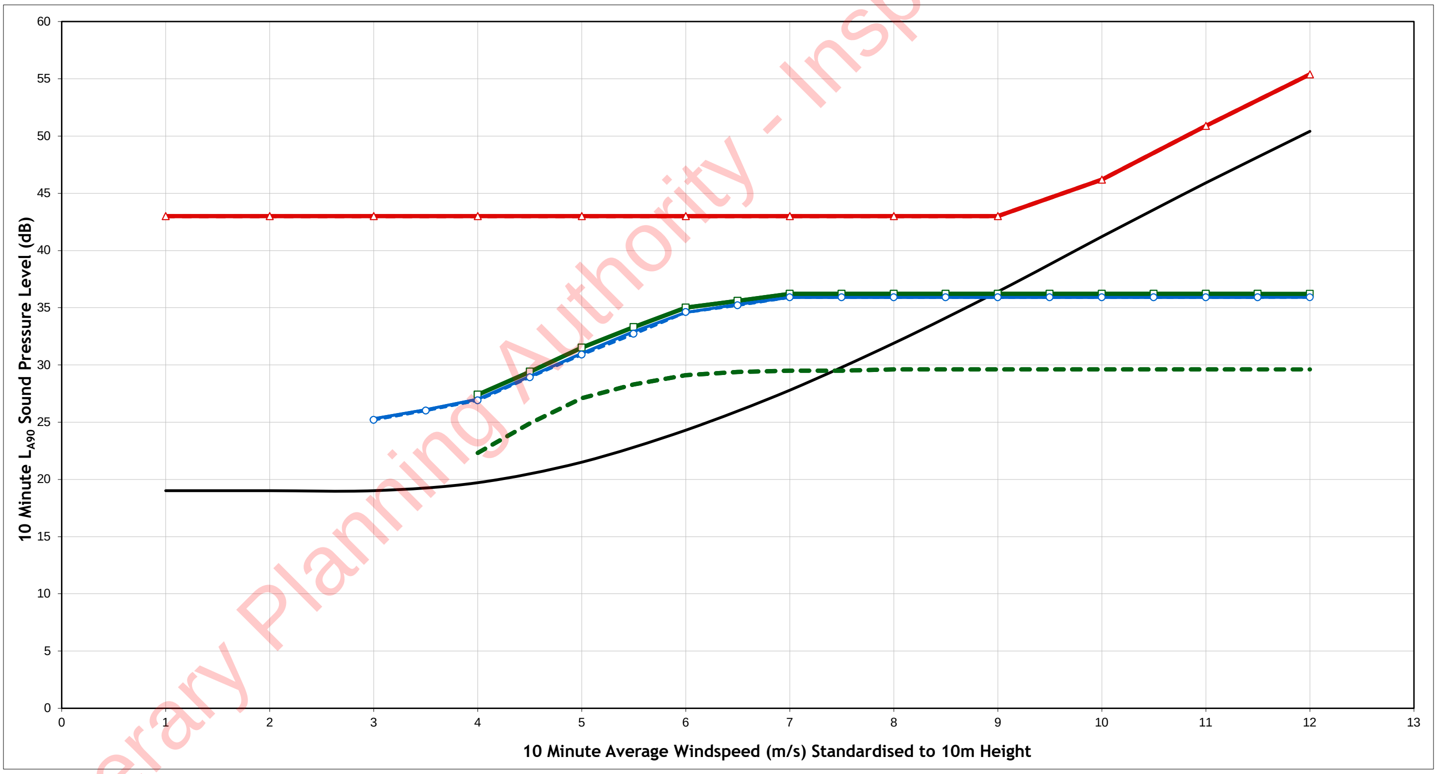
- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H45
Figure Number	Figure A1.5as
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

Daytime - H46



Night Time - H46



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H46
Figure Number	Figure A1.5at
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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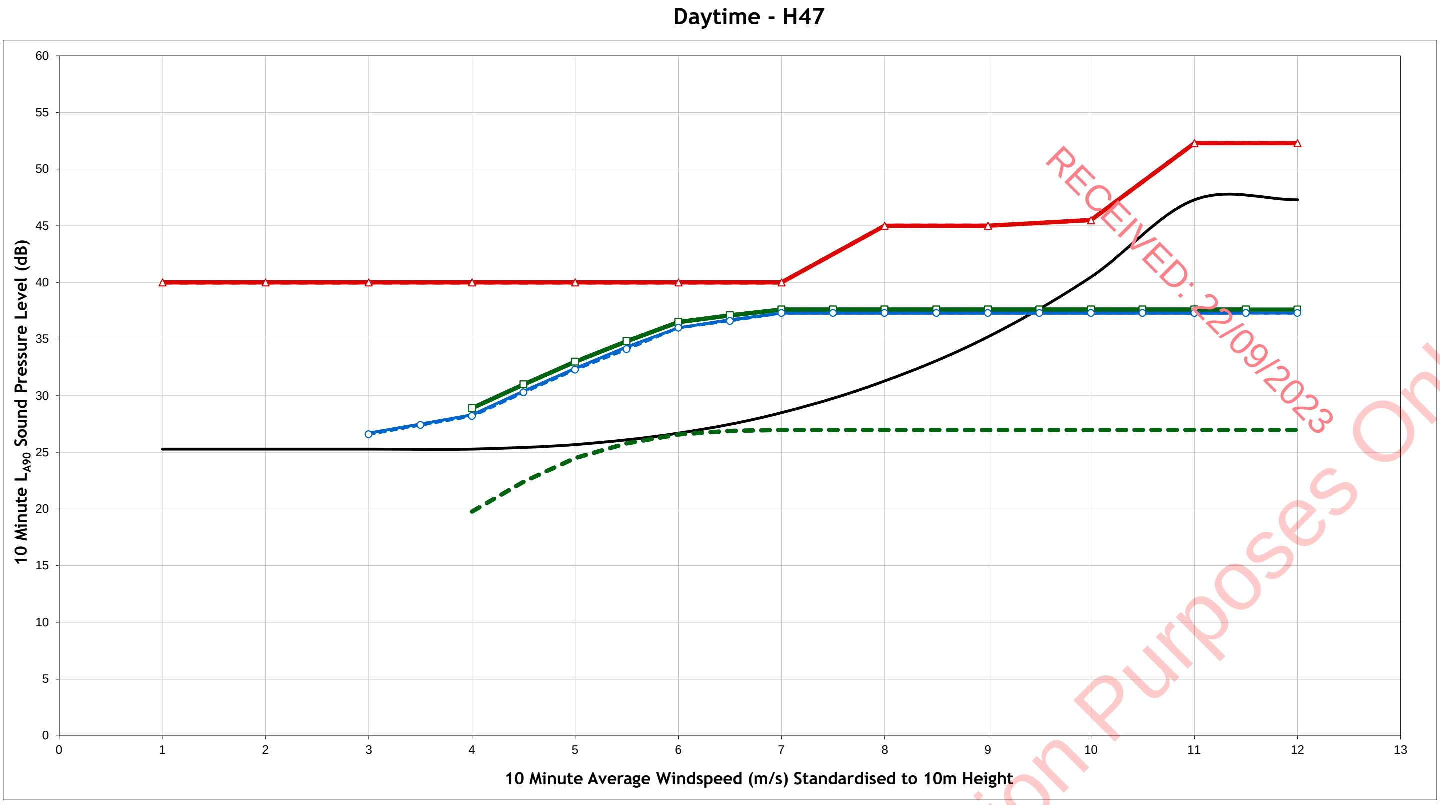
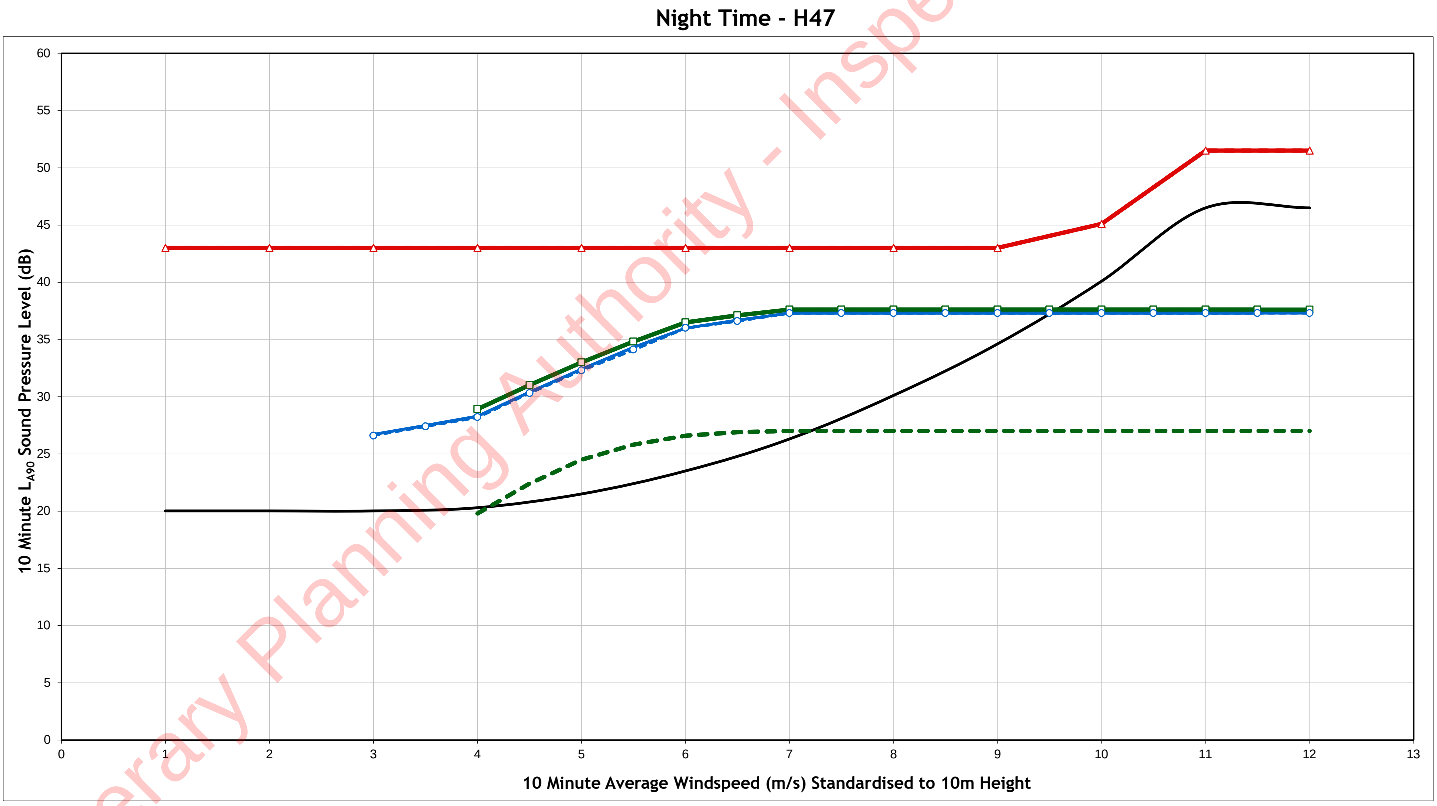
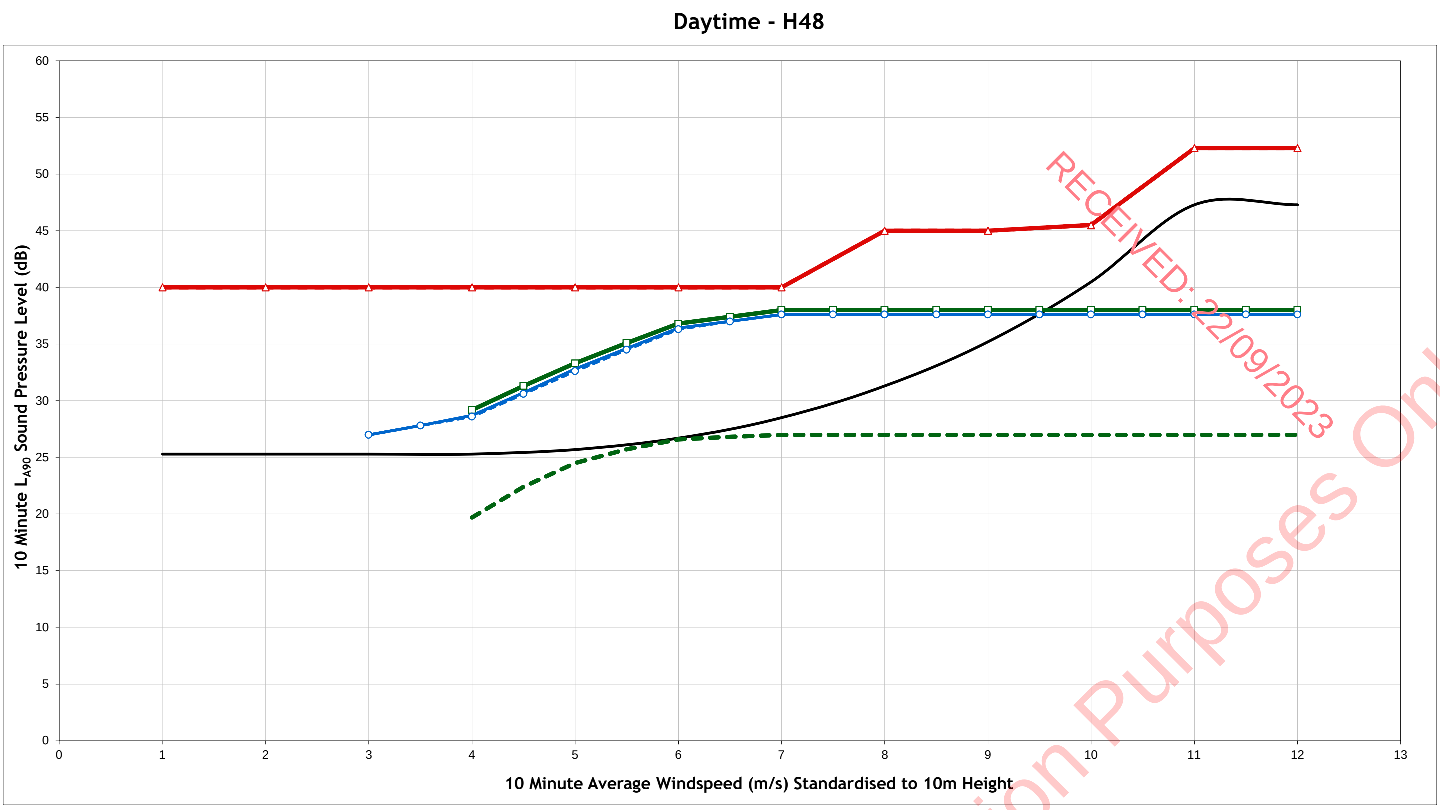


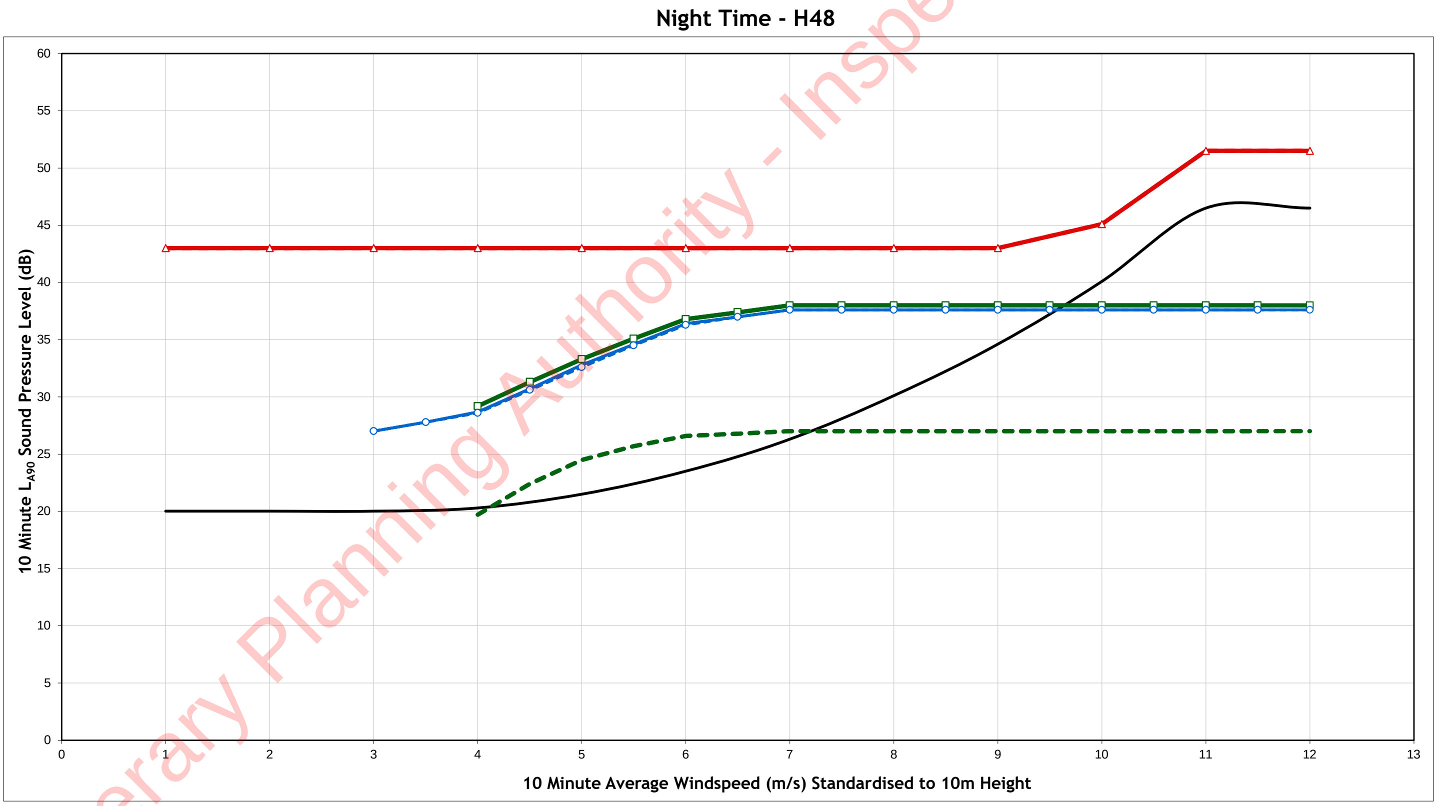


Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H47
Figure Number	Figure A1.5au
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models





Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H48
Figure Number	Figure A1.5av
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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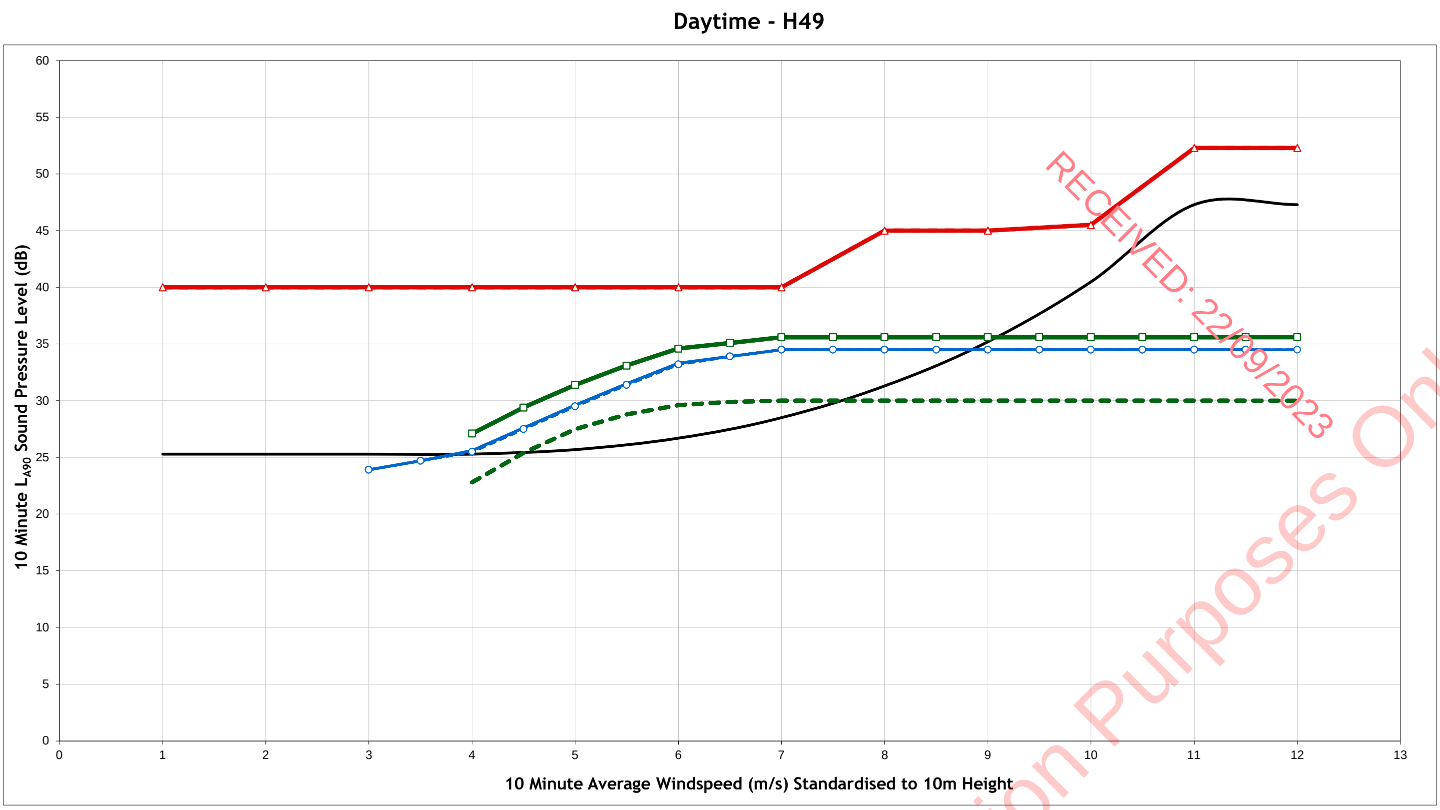

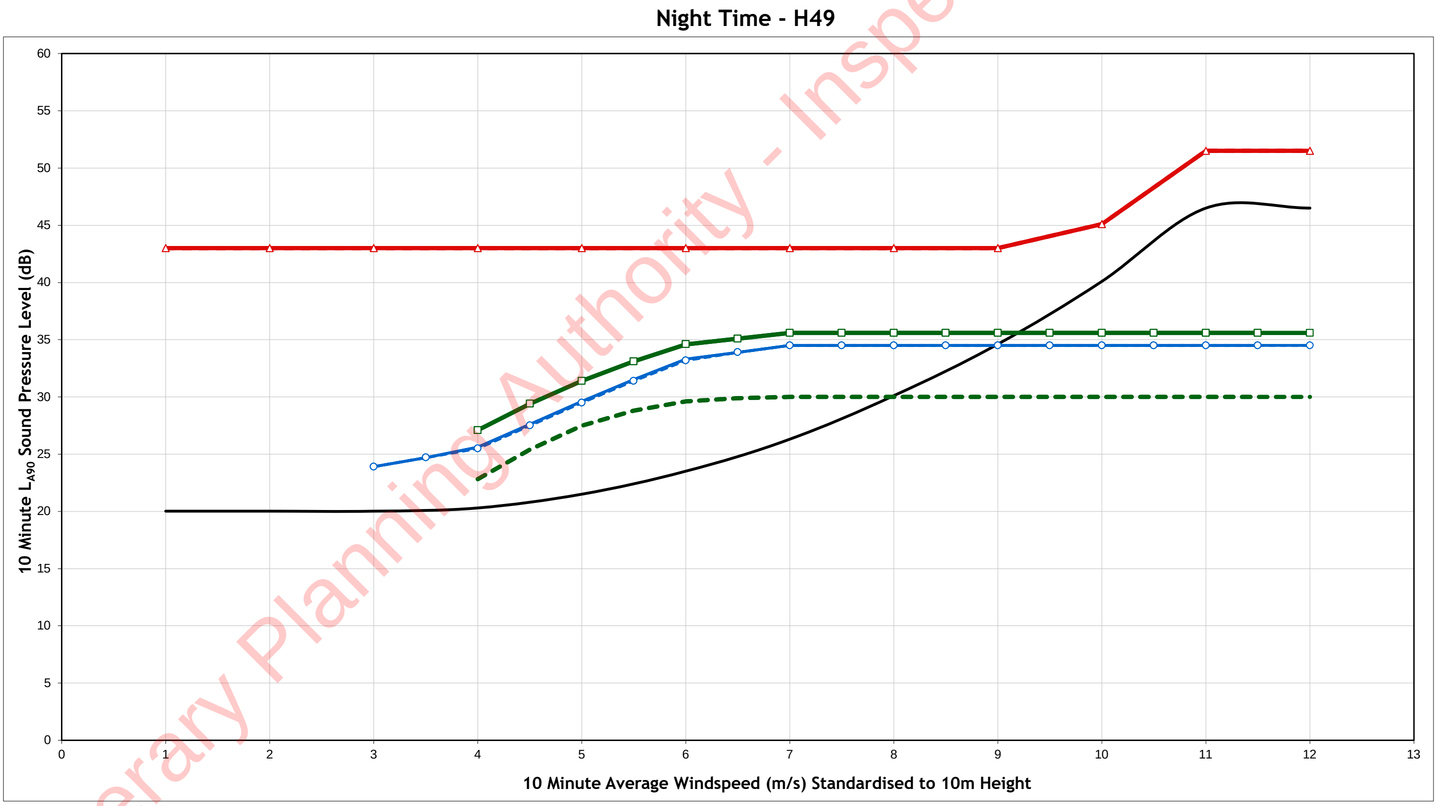

Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H49
Figure Number	Figure A1.5aw
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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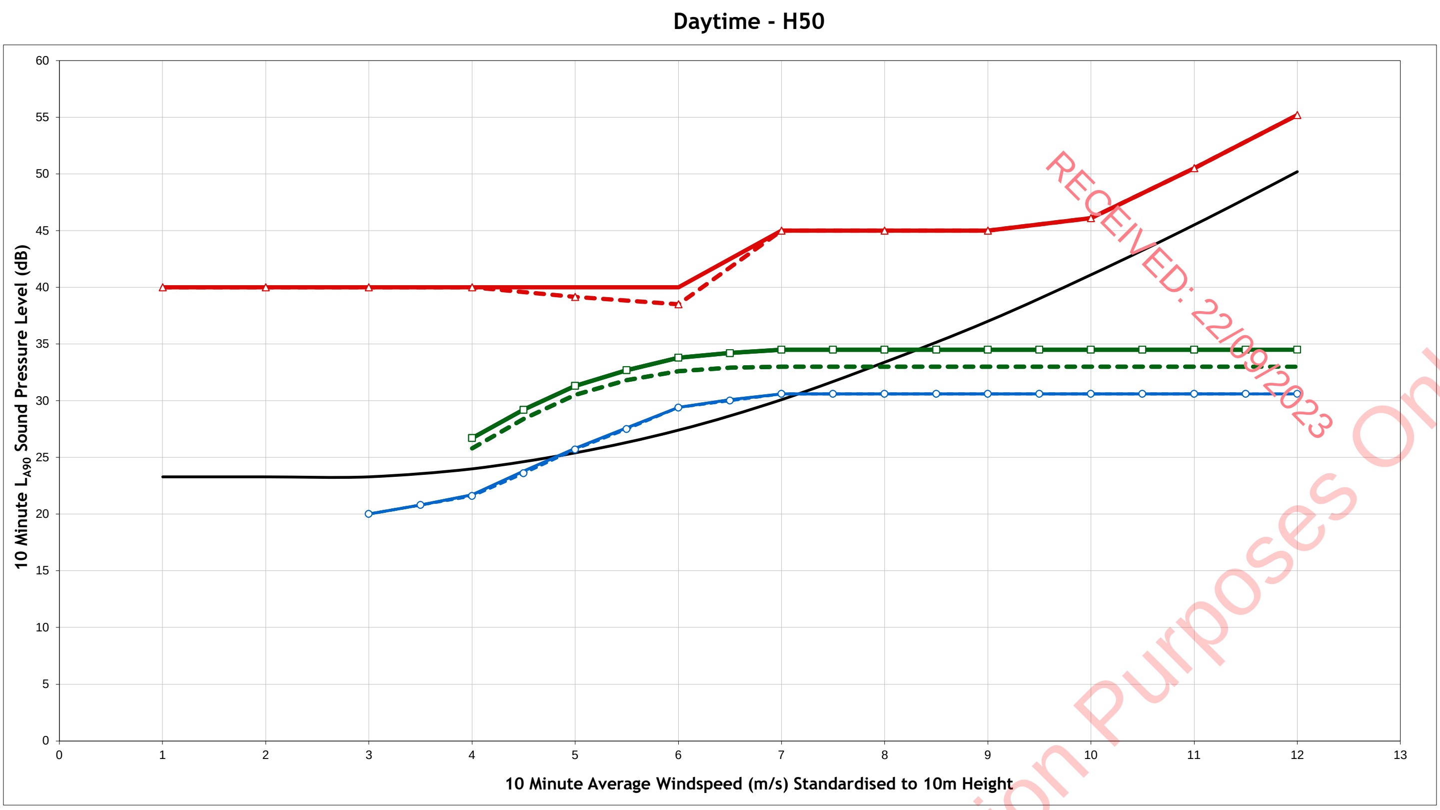

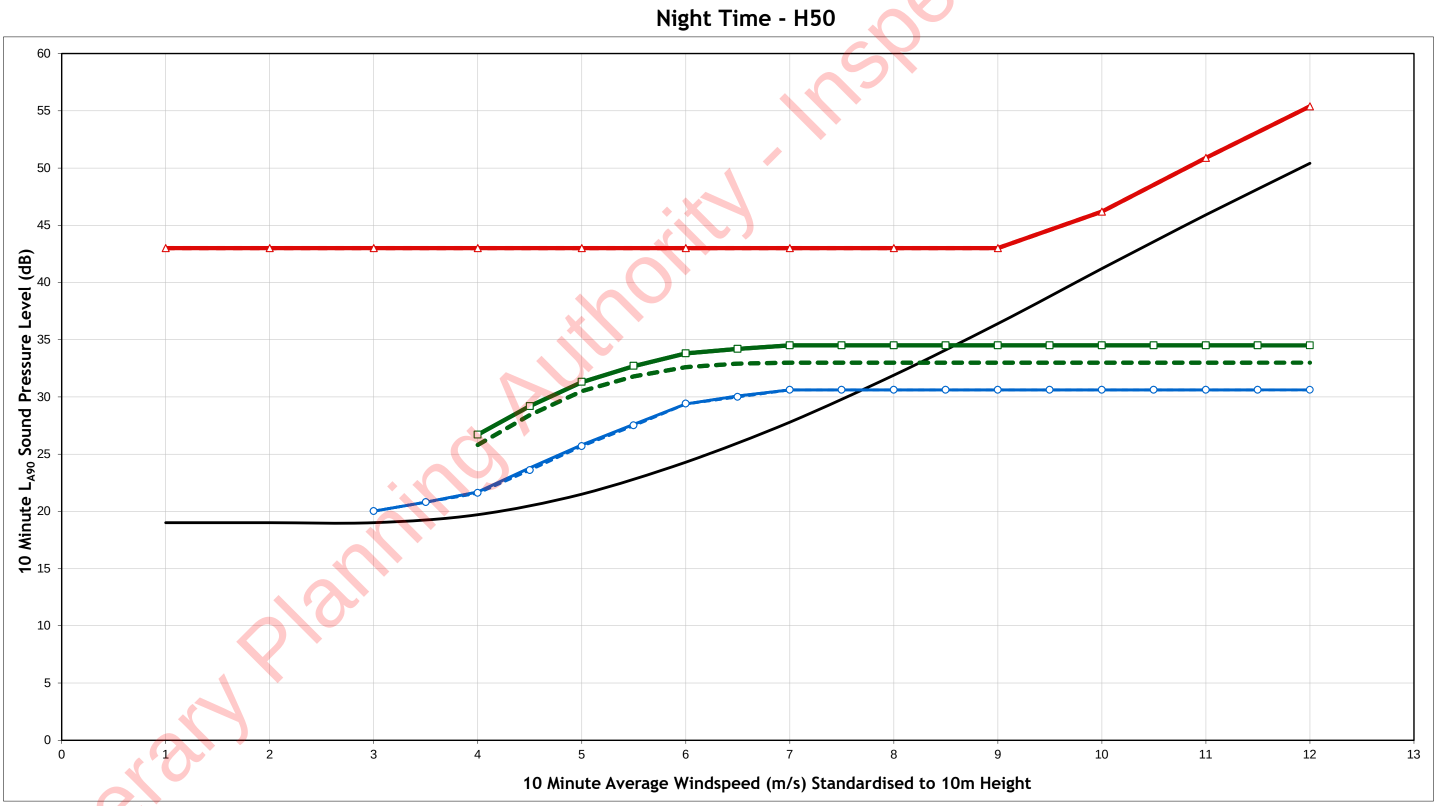

Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H50
Figure Number	Figure A1.5ax
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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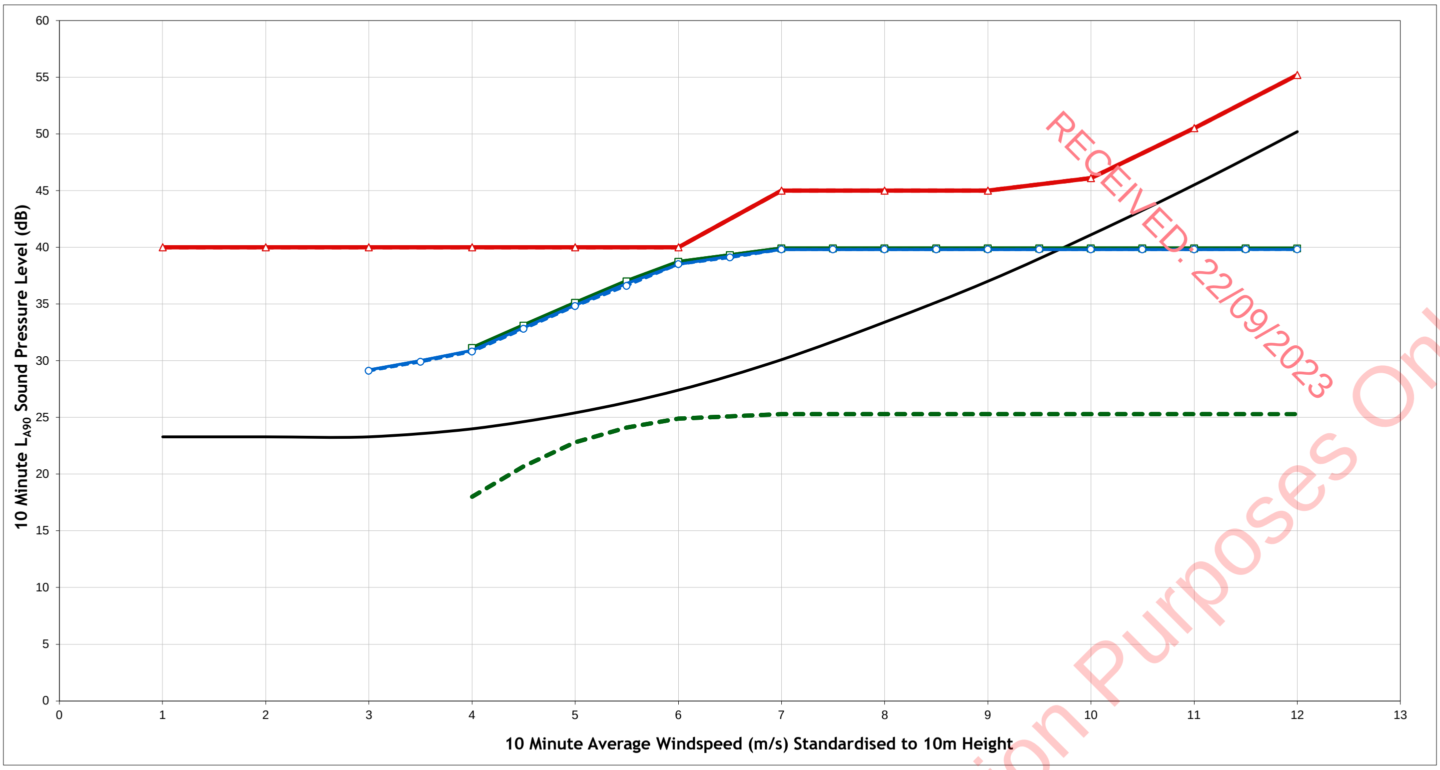
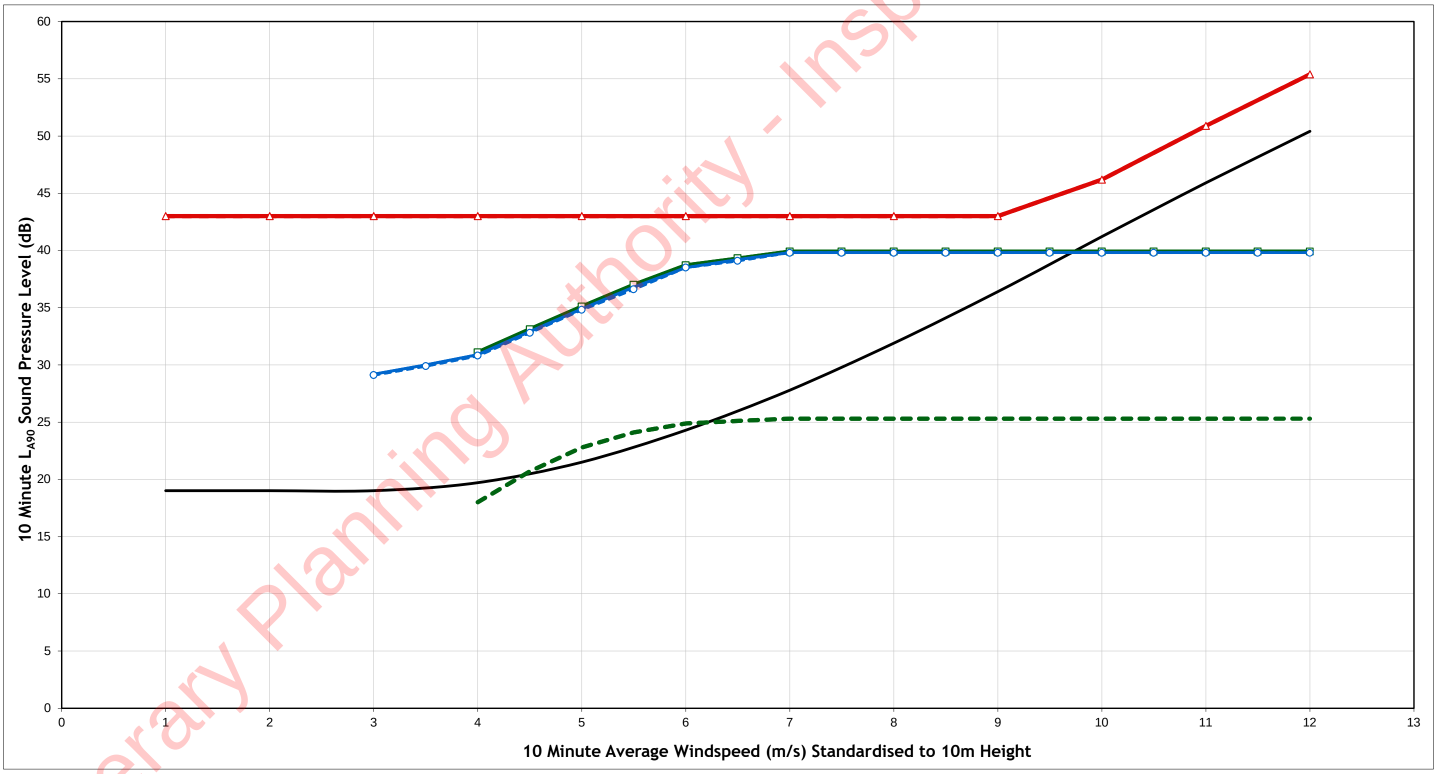
Daytime - H51



Night Time - H51



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H51
Figure Number	Figure A1.5ay
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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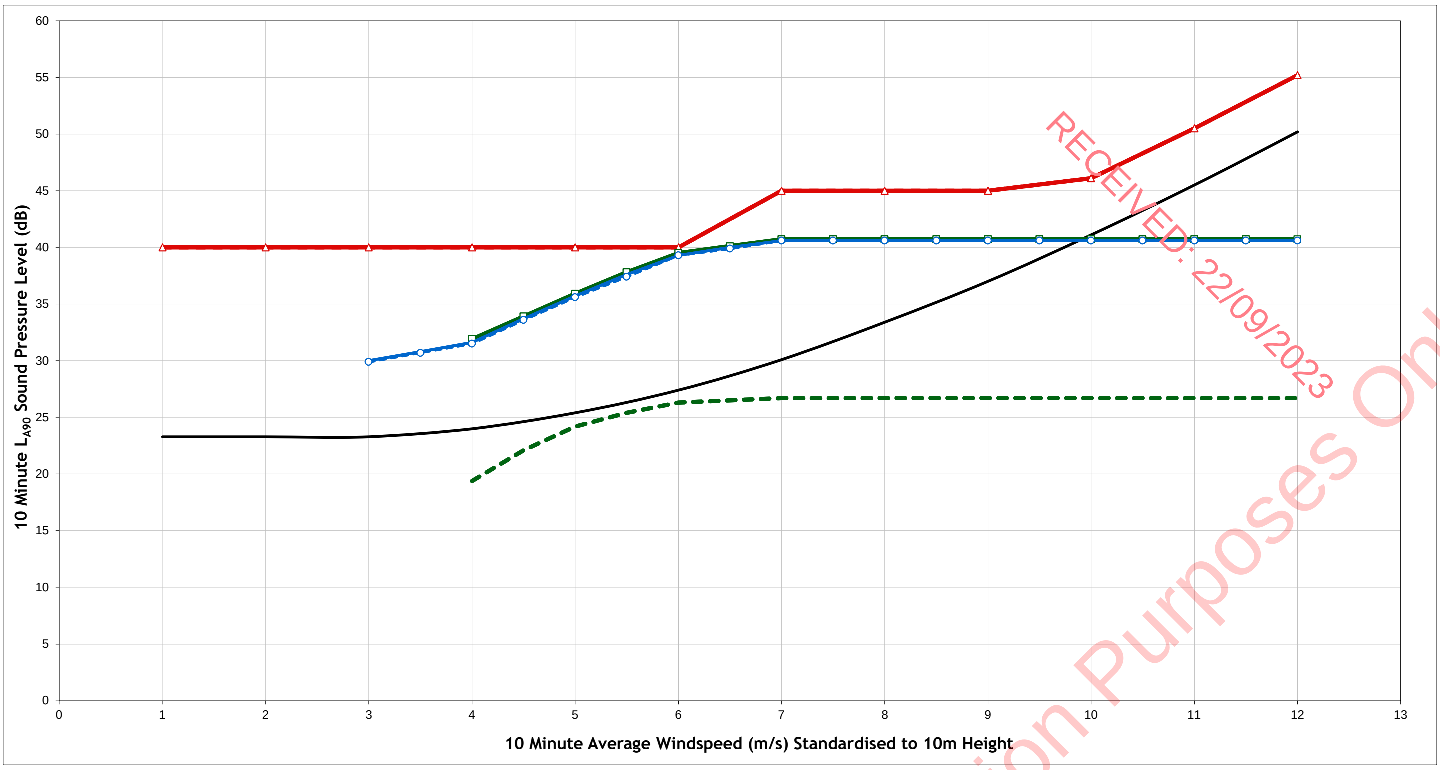
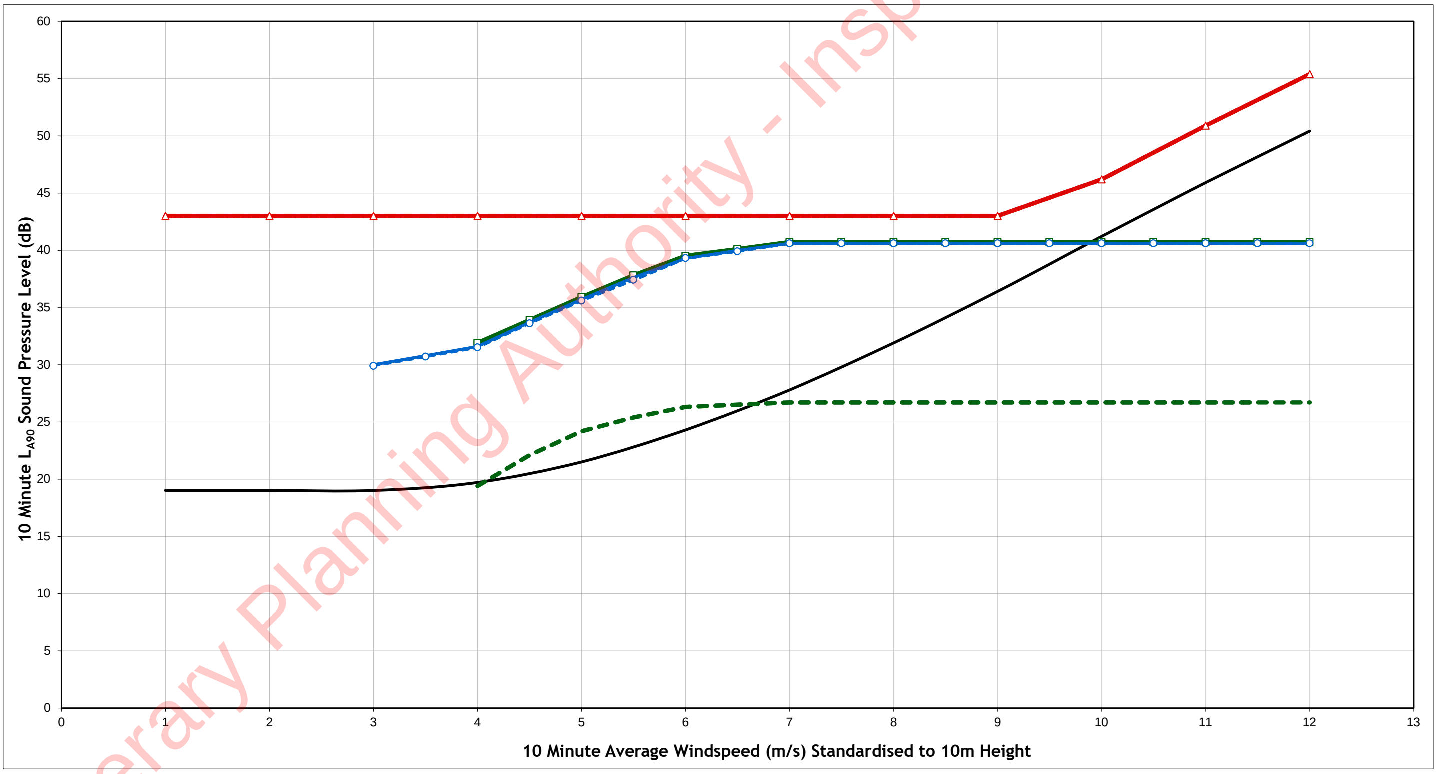
Daytime - H52



Night Time - H52



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H52
Figure Number	Figure A1.5az
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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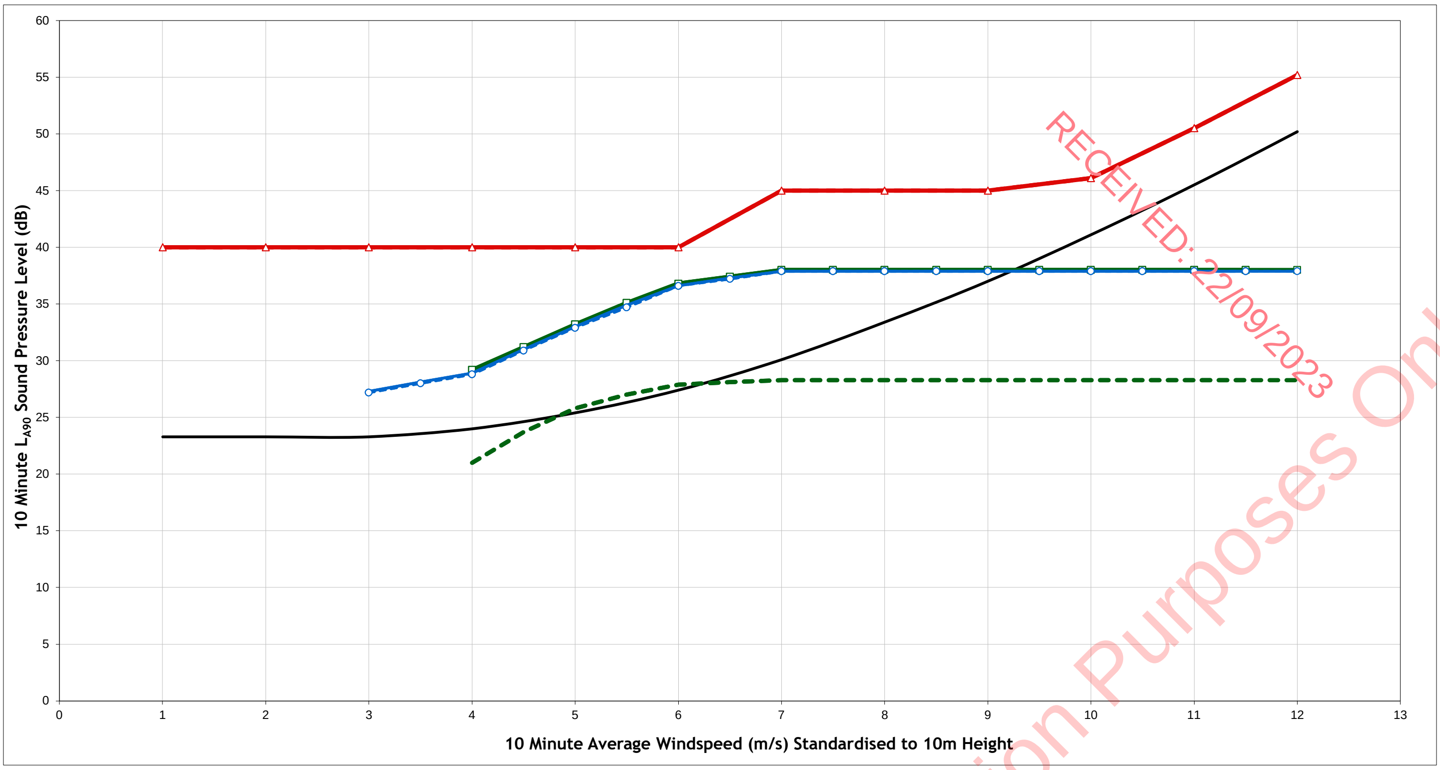
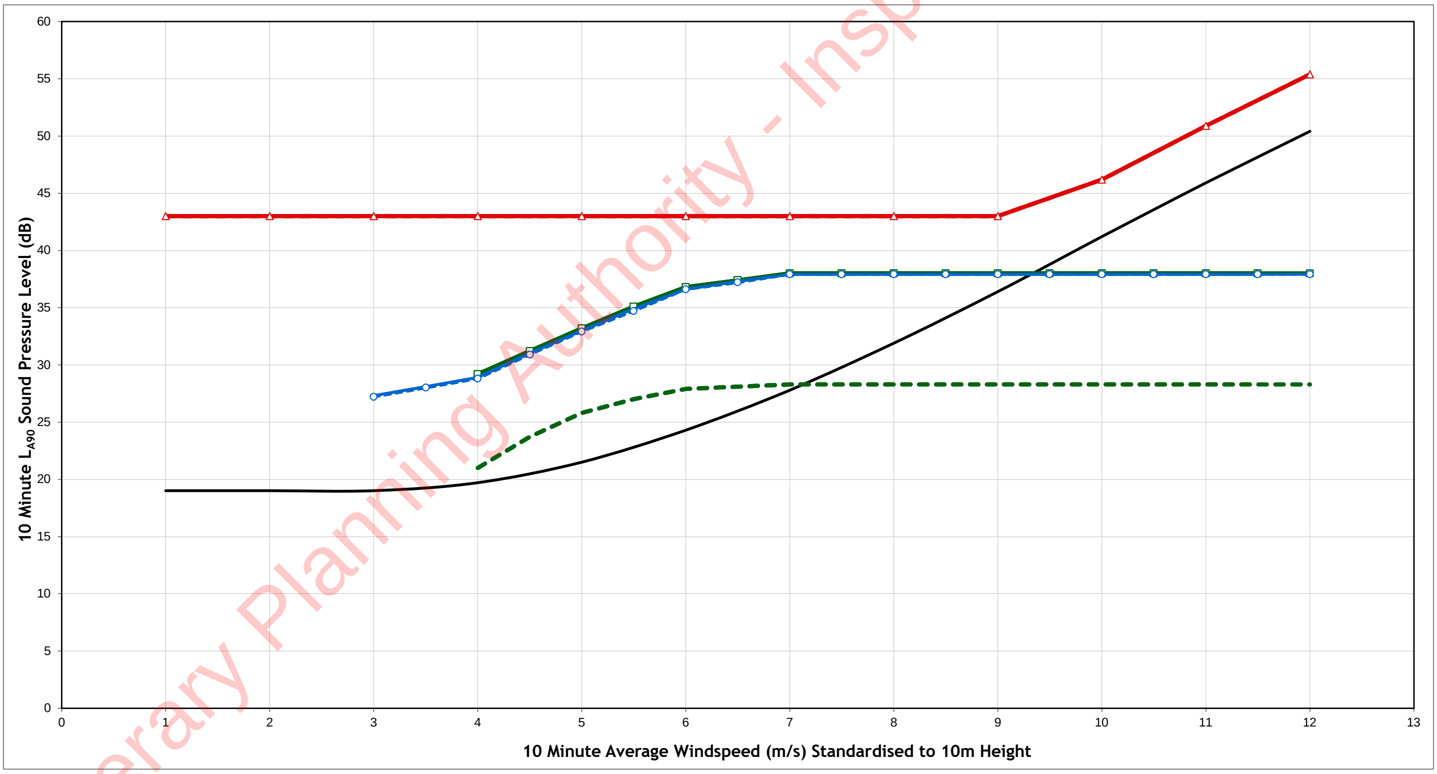
Daytime - H53



Night Time - H53



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H53
Figure Number	Figure A1.5ba
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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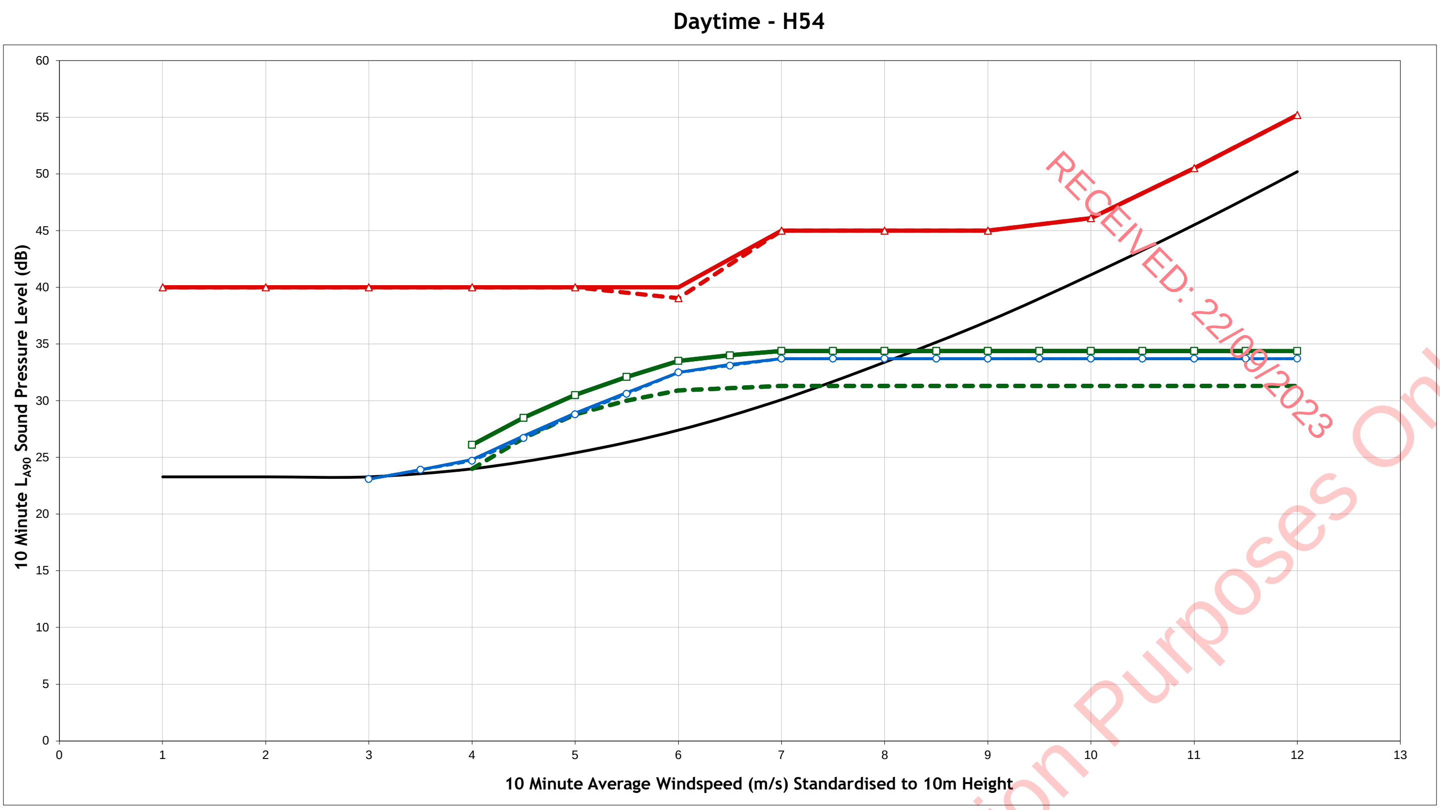

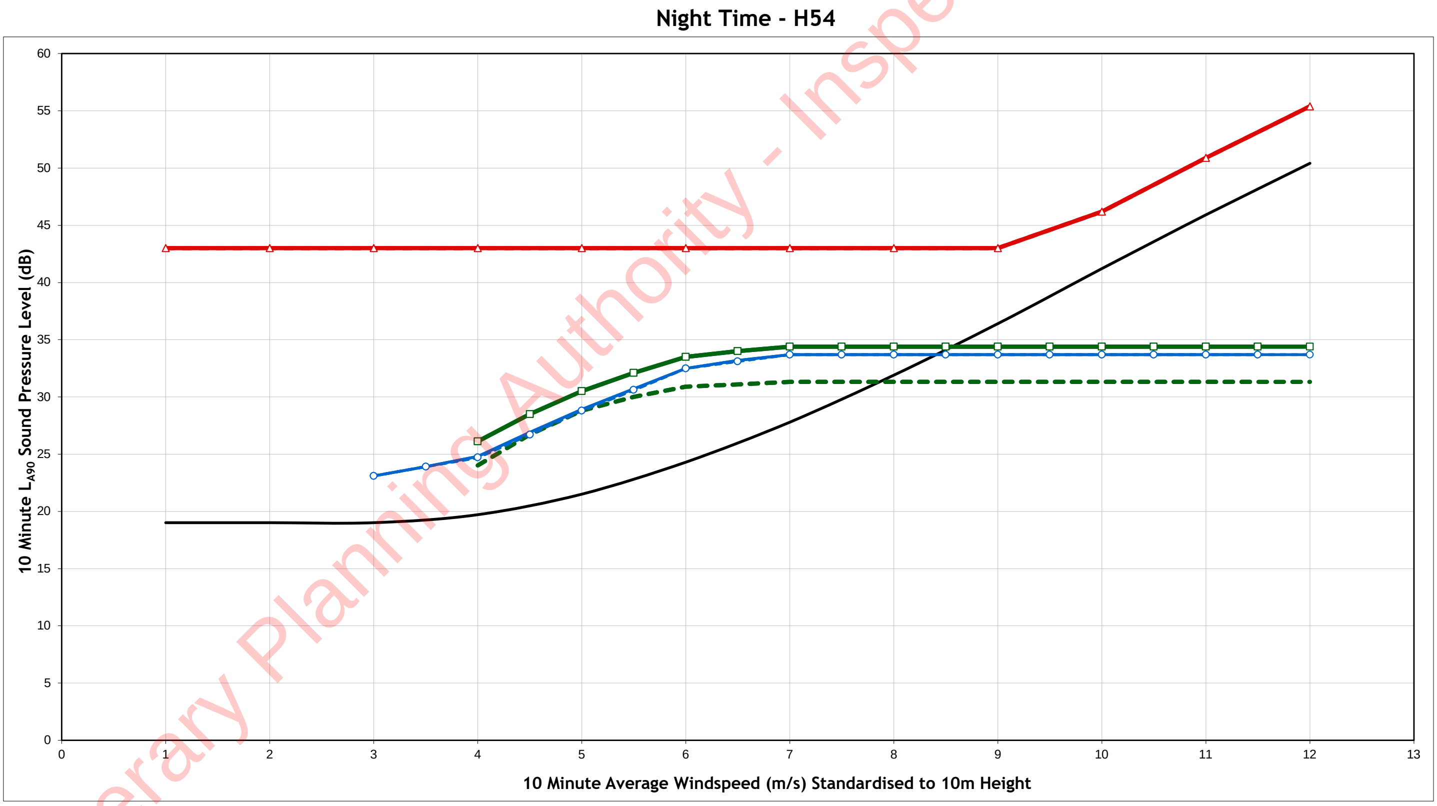

Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H54
Figure Number	Figure A1.5bb
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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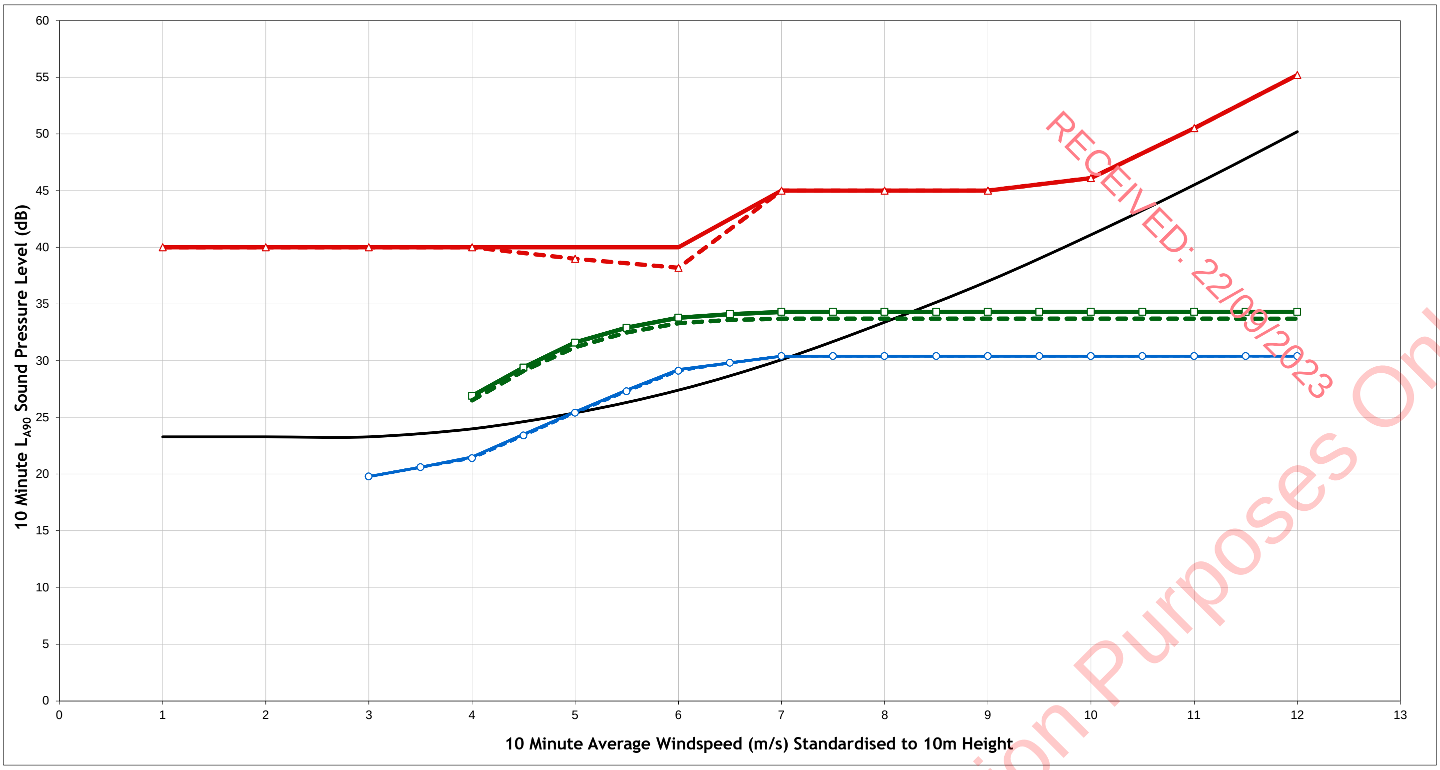
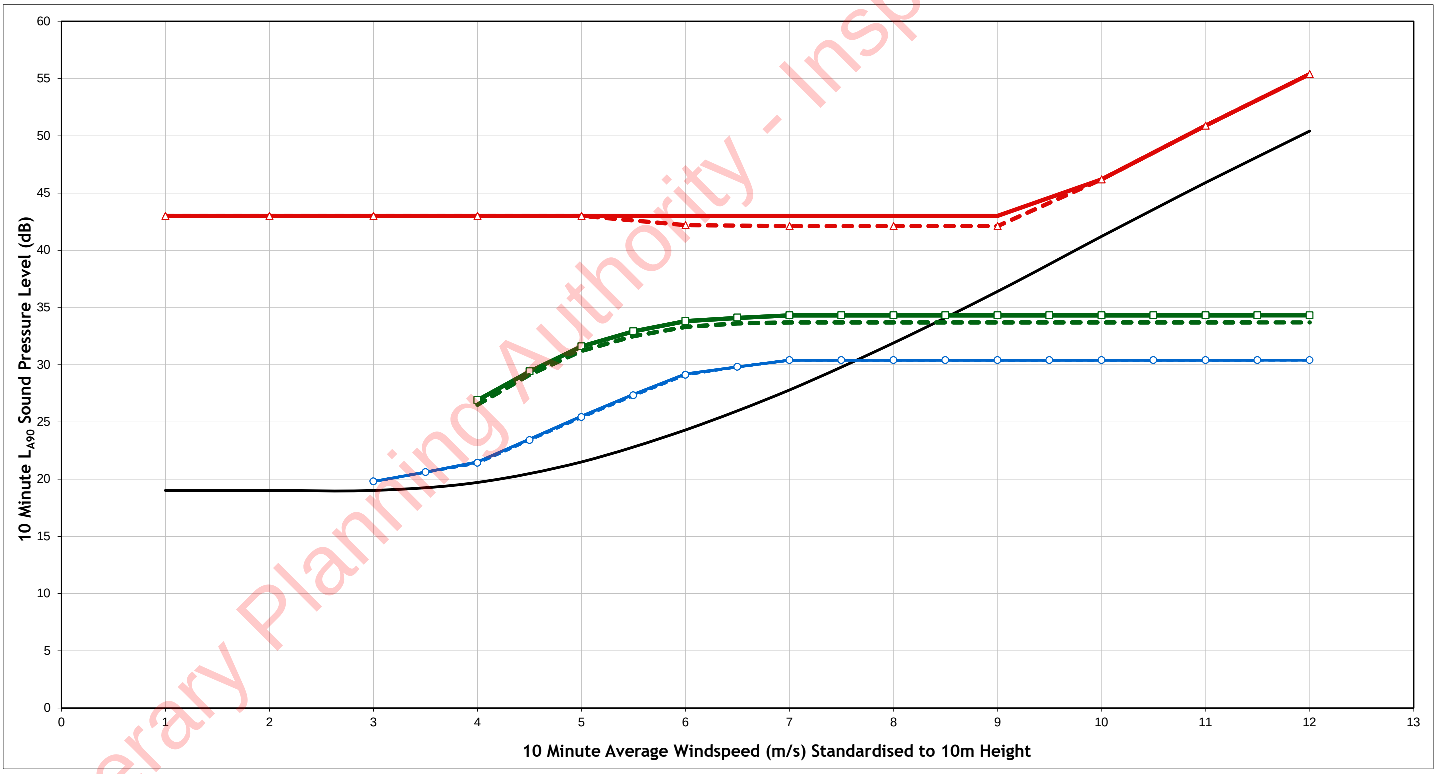
Daytime - H55



Night Time - H55



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H55
Figure Number	Figure A1.5bc
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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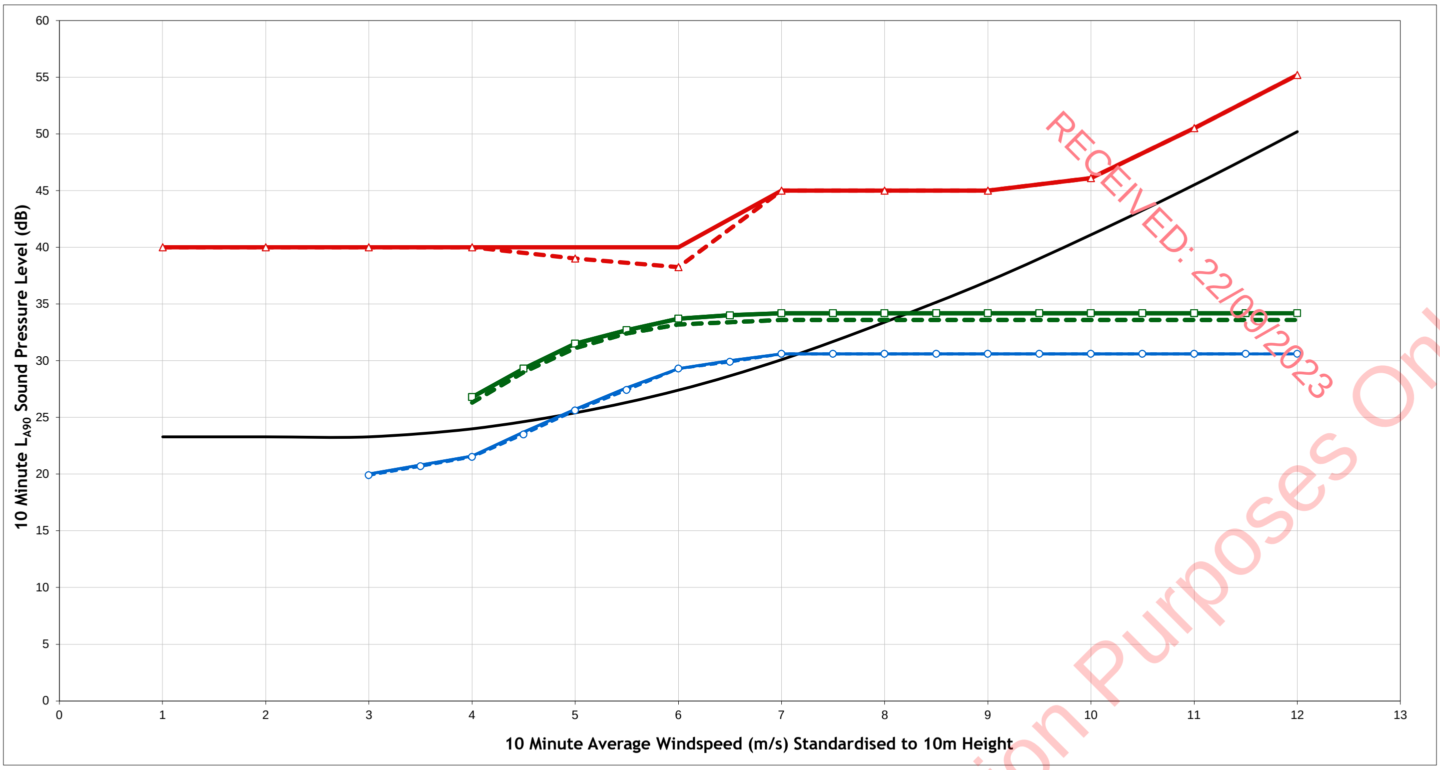
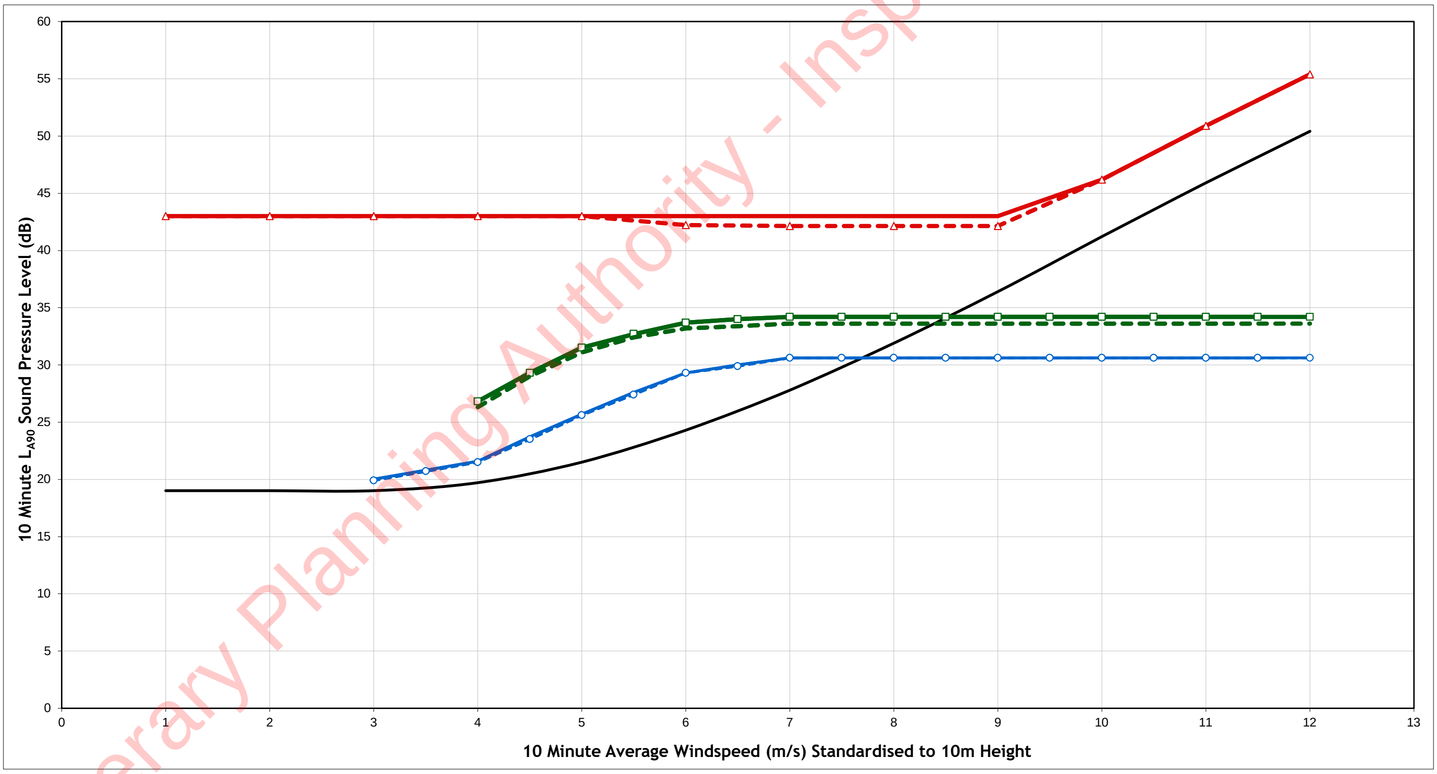
Daytime - H56



Night Time - H56



Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H56
Figure Number	Figure A1.5bd
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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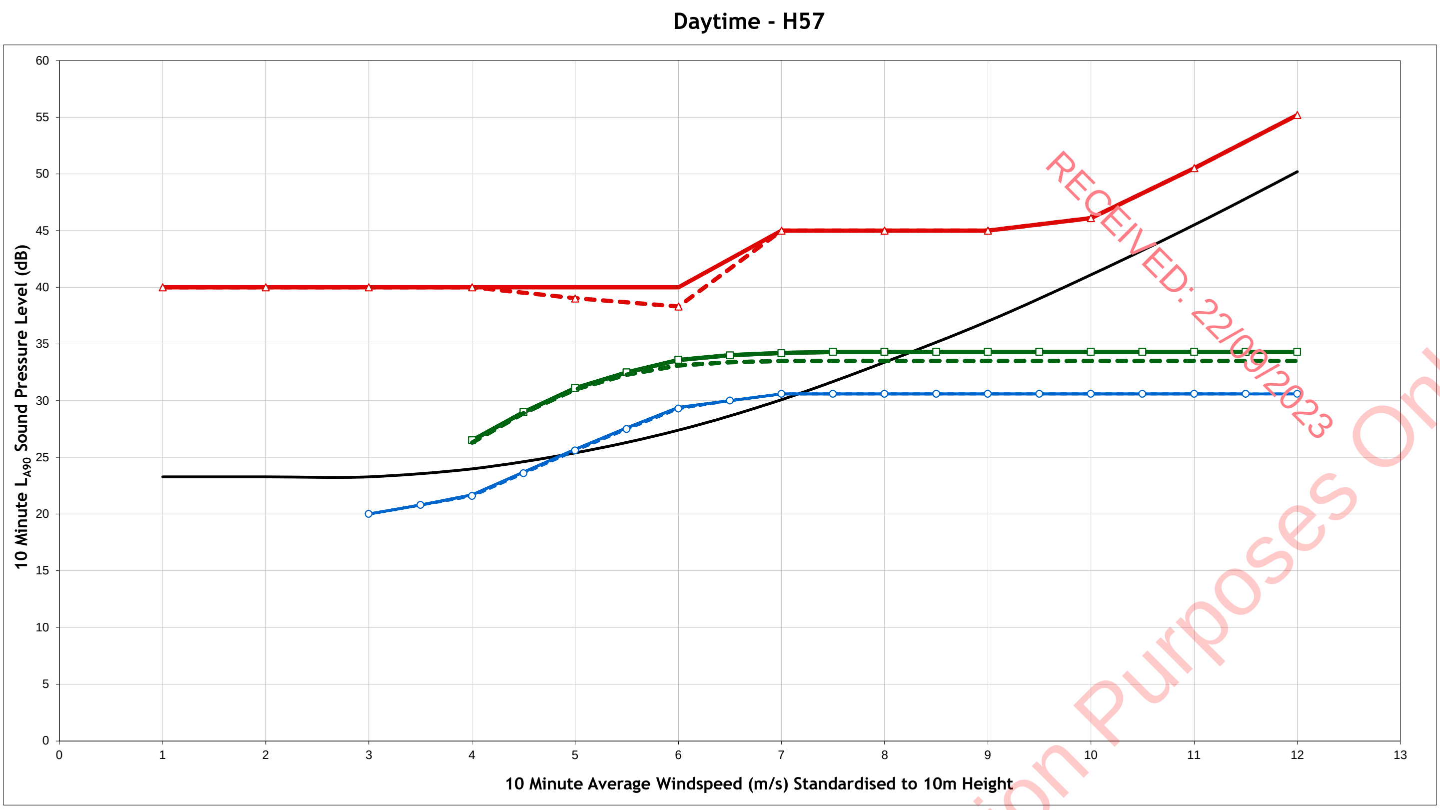

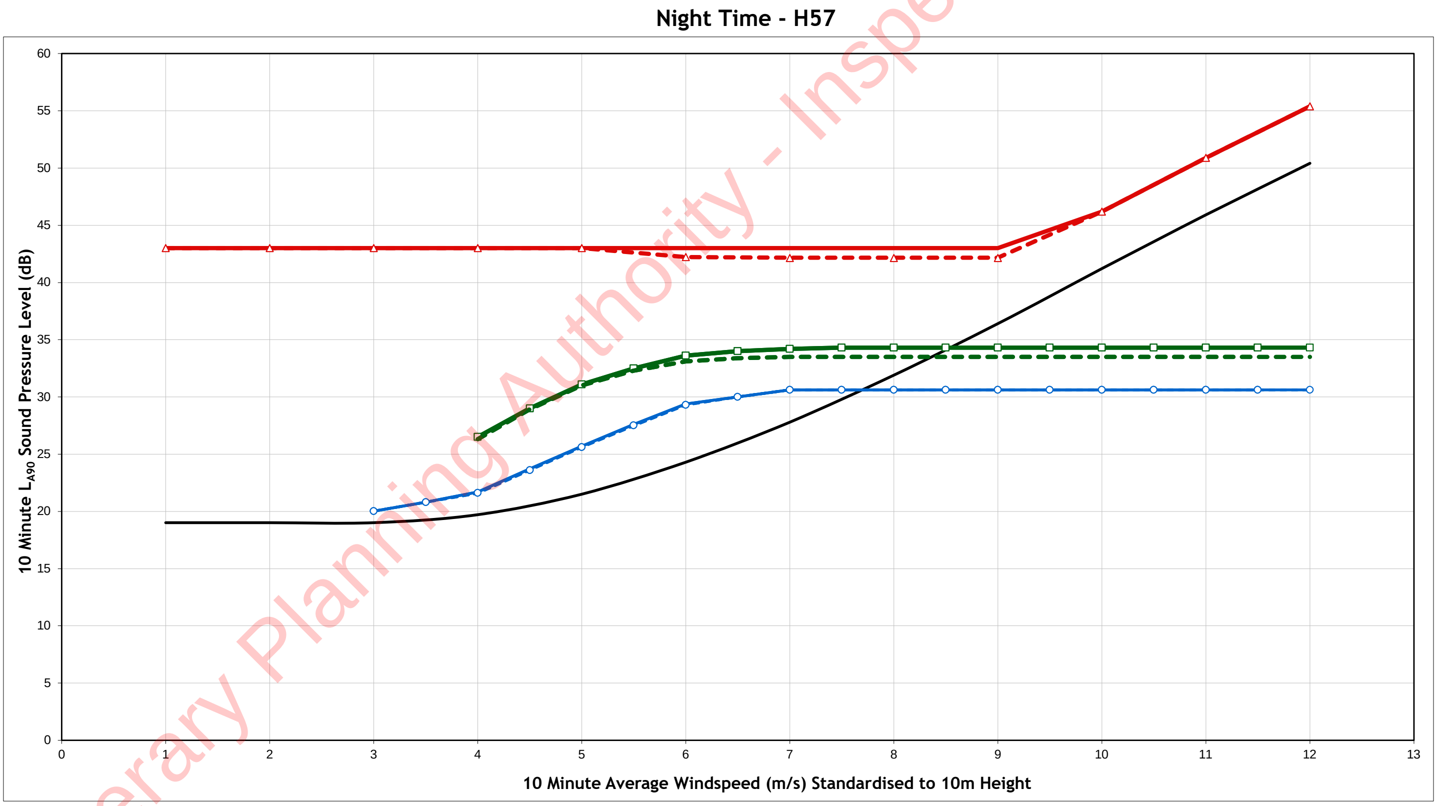

Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H57
Figure Number	Figure A1.5be
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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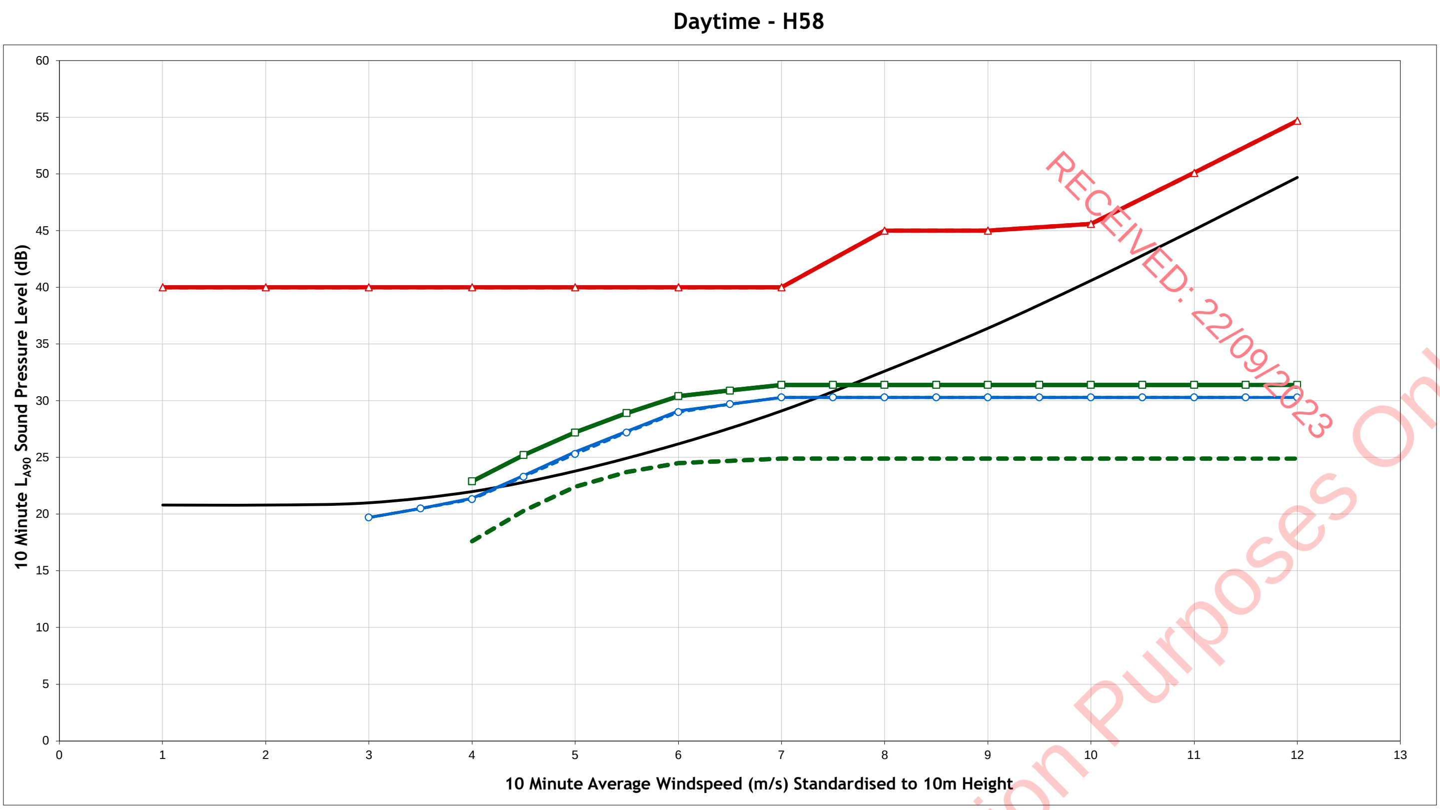

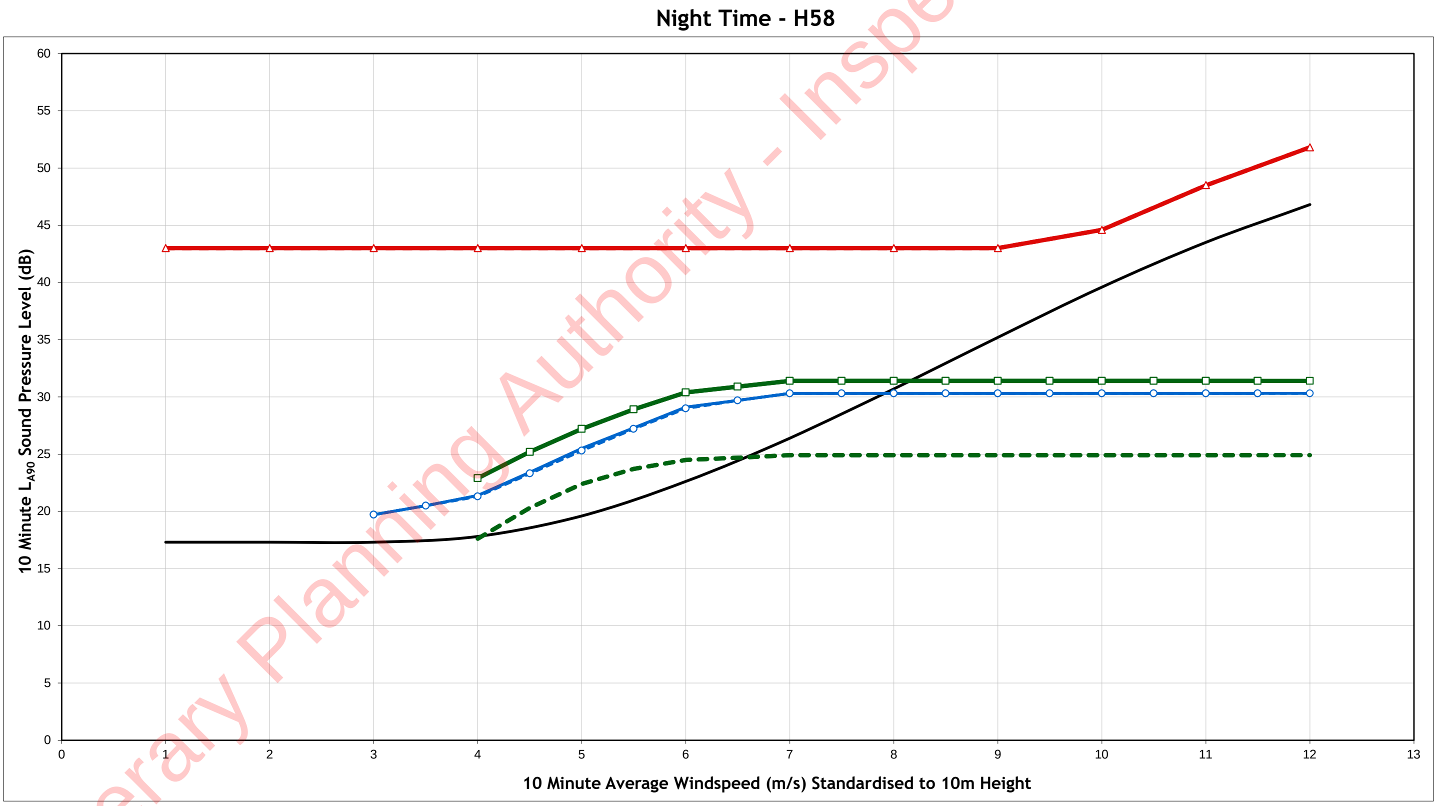

Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H58
Figure Number	Figure A1.5bf
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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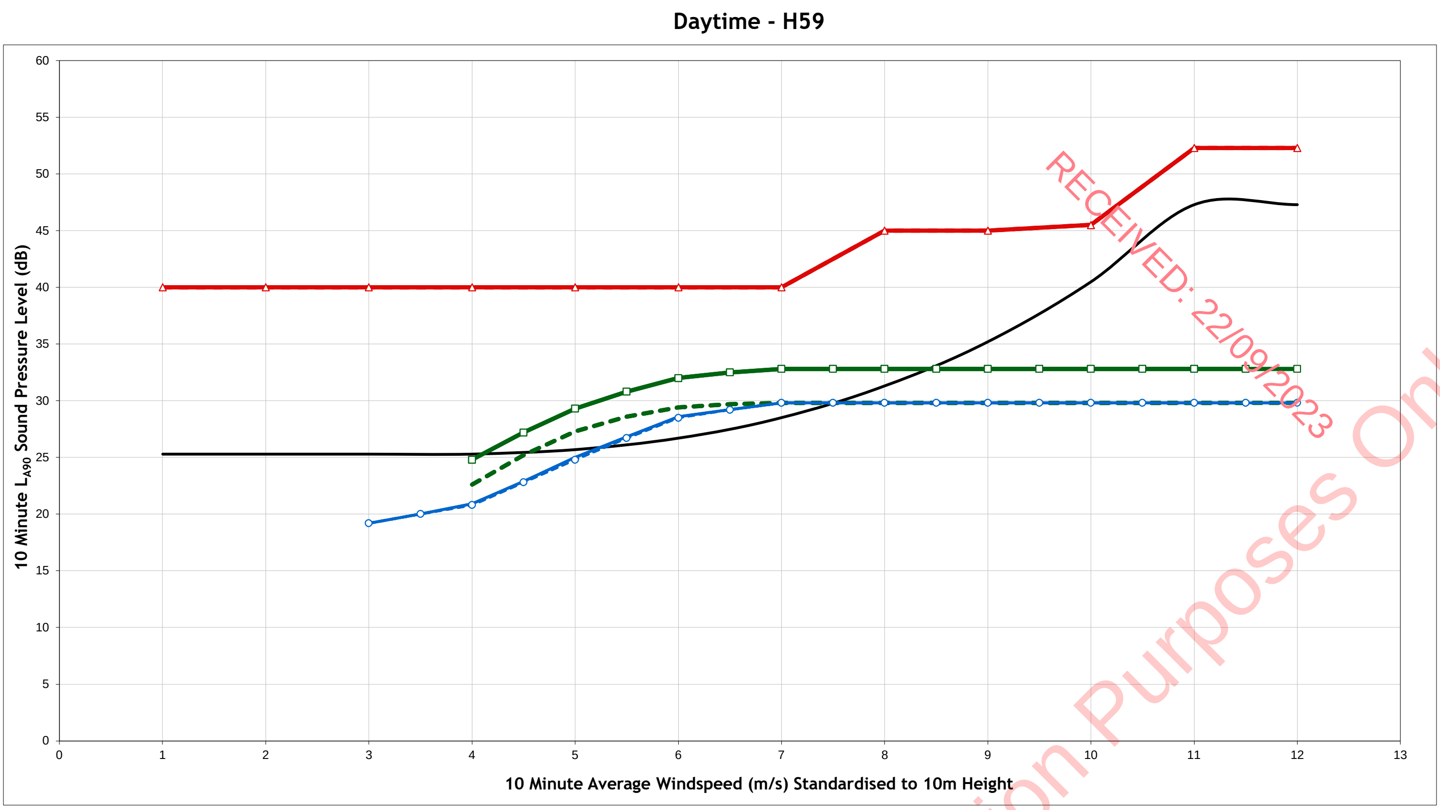
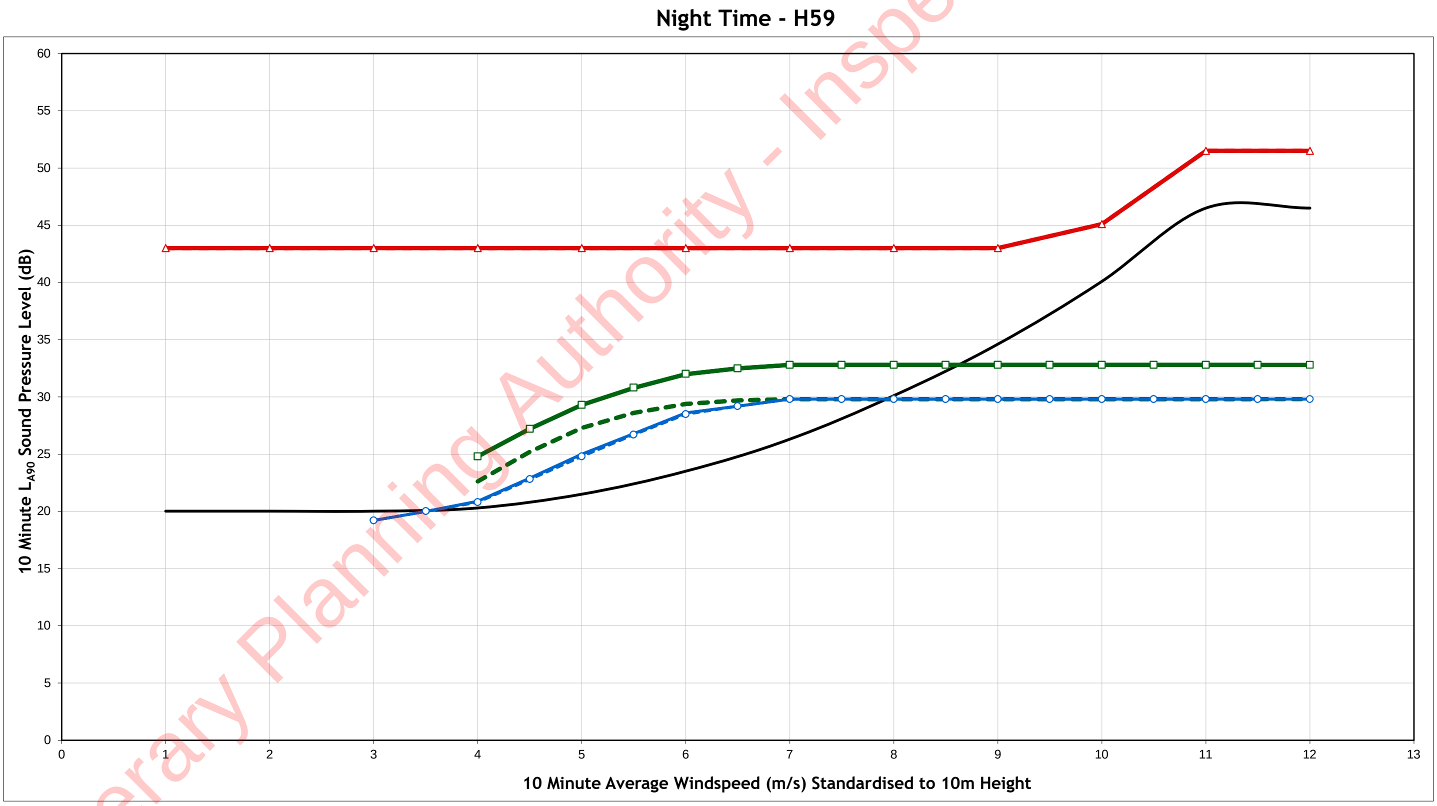
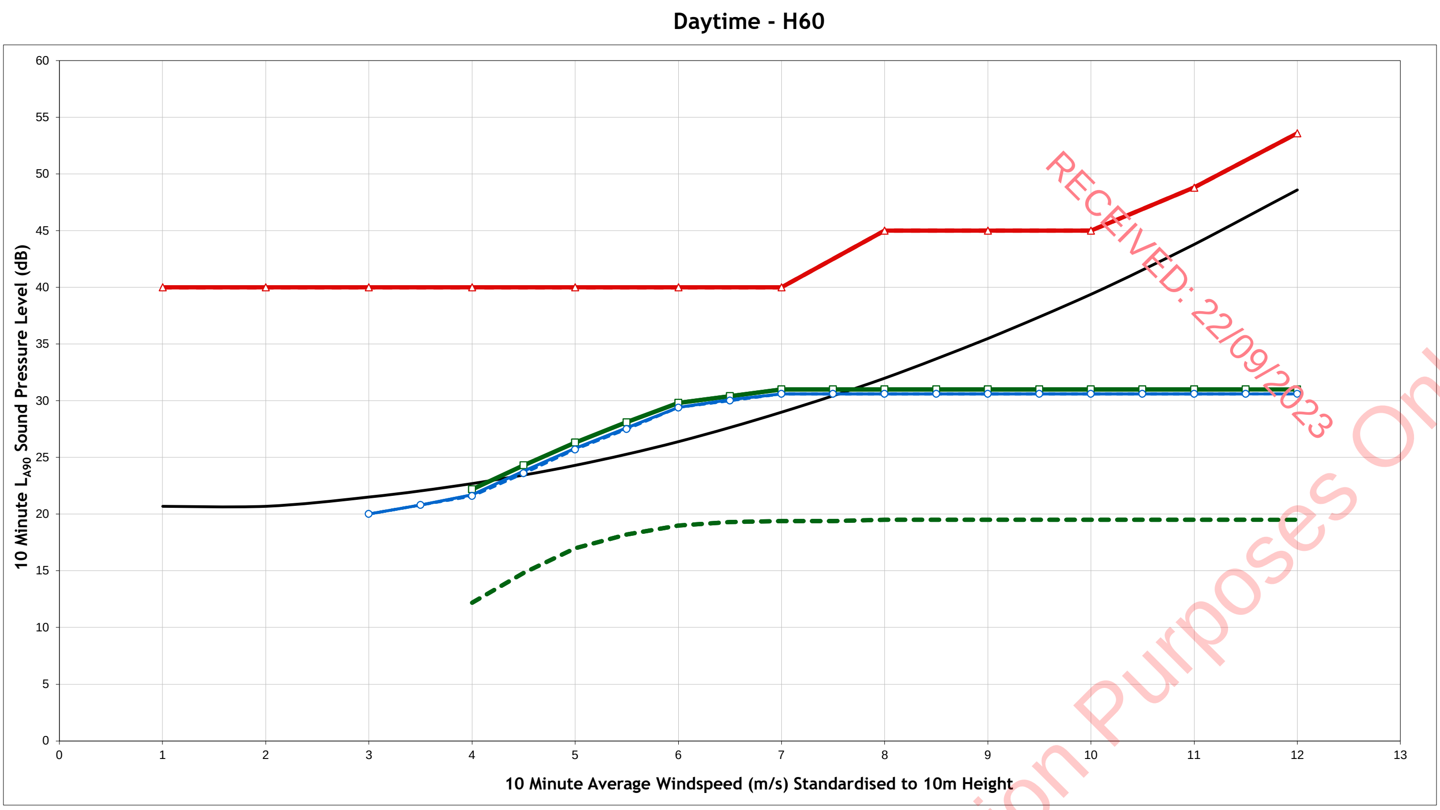


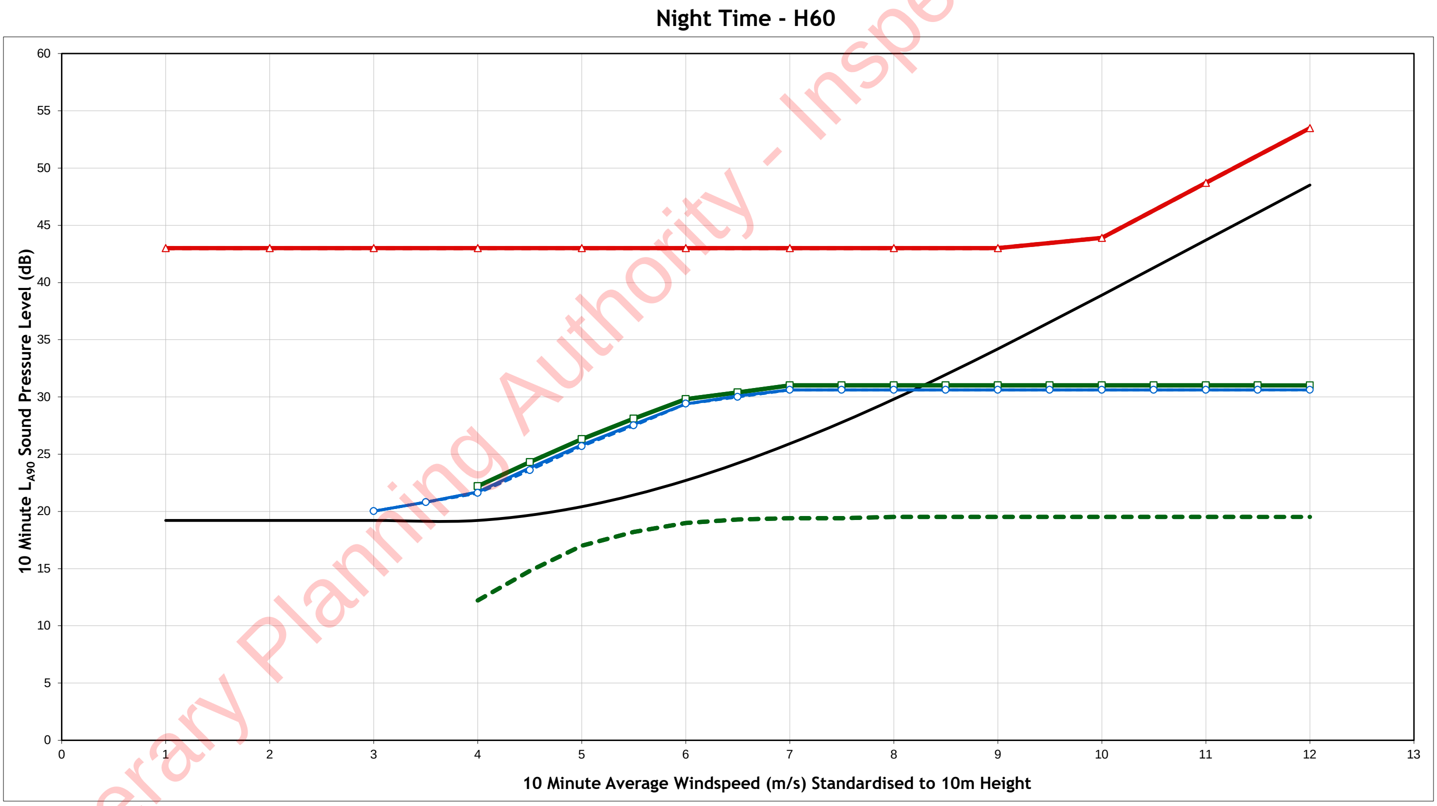


Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H59
Figure Number	Figure A1.5bg
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models





Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H60
Figure Number	Figure A1.5bh
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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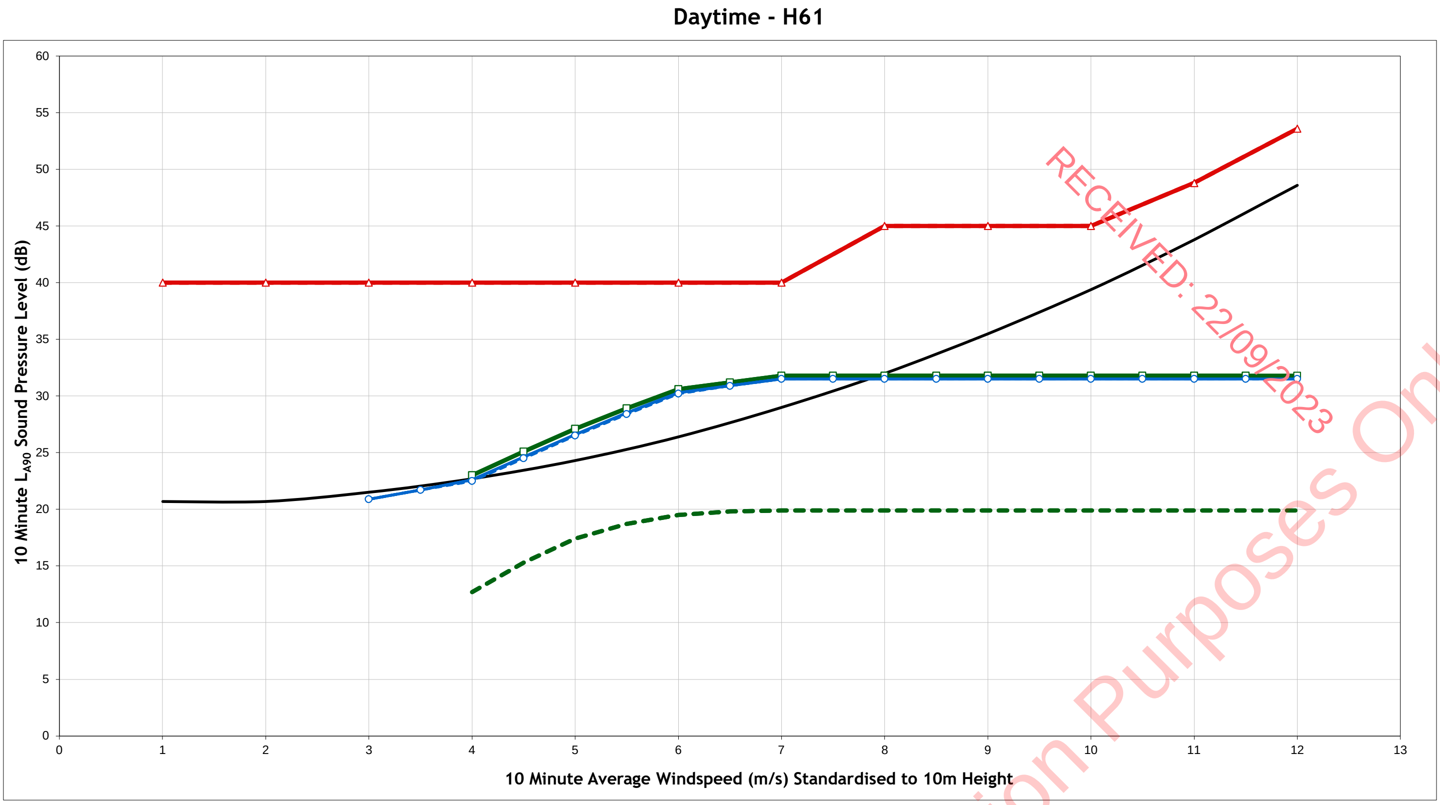

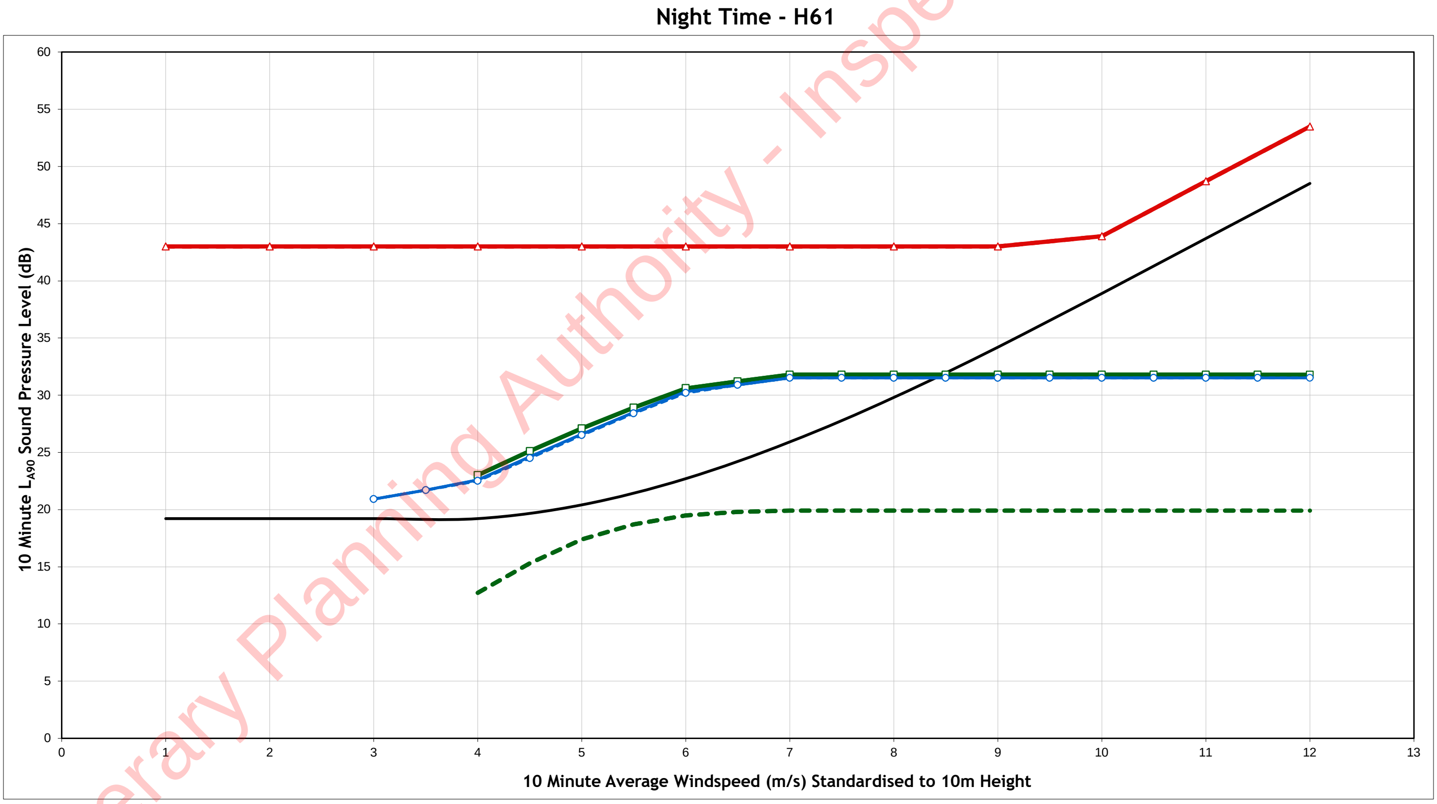

Legend:

- Background Noise Trendline
- WEDG Noise Limit
- Site Specific Limits
- Cumulative (existing Skehanagh&Carrig and proposed CR with V162 @110.5m Hub)
- Cumulative (existing Skehanagh&Carrig, excluding proposed CR)
- Proposed Carrig Renewable Wind Farm (CR) only with V162 @110.5m Hub
- Proposed Carrig Renewable Wind Farm (CR) only with v162 @105 m Hub

Project	Carrig Renewables Wind Farm
Client	Carrig Renewables Wind Farm Ltd
Title	Noise Stage 3 - SSNLs and Predictions (All NSRs) H61
Figure Number	Figure A1.5bi
Scale	NTS
Drawn	EW
Checked	MC
Date	12/07/2023
Document Reference	IE62-Noise Models

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Site Specific Noise Compliance Table – Daytime (All NSRs), 110.5 m Hub

Location		Wind Speed (ms^{-1}) as standardised to 10 m height											
		1	2	3	4	5	6	7	8	9	10	11	12
H1	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.6	50.1	54.7
	Proposed Development Wind Turbine Noise, LA90	-	-	19.7	21.4	25.4	29.0	30.3	30.3	30.3	30.3	30.3	30.3
	Exceedance Level	-	-	-20.3	-18.6	-14.6	-11.0	-9.7	-14.7	-14.7	-15.3	-19.8	-24.4
H2	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.6	50.1	54.7
	Proposed Development Wind Turbine Noise, LA90	-	-	19.7	21.3	25.4	29.0	30.3	30.3	30.3	30.3	30.3	30.3
	Exceedance Level	-	-	-20.3	-18.7	-14.6	-11.0	-9.7	-14.7	-14.7	-15.3	-19.8	-24.4
H3	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.6	50.1	54.7
	Proposed Development Wind Turbine Noise, LA90	-	-	19.6	21.2	25.3	28.9	30.2	30.2	30.2	30.2	30.2	30.2
	Exceedance Level	-	-	-20.4	-18.8	-14.7	-11.1	-9.8	-14.8	-14.8	-15.4	-19.9	-24.5
H4	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	30.0	31.7	35.8	39.4	40.6	40.6	40.6	40.6	40.6	40.6
	Exceedance Level	-	-	-10.0	-8.3	-4.2	-0.6	0.6	-4.4	-4.4	-4.9	-11.7	-11.7
H5	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	28.5	30.2	34.3	37.9	39.1	39.1	39.1	39.1	39.1	39.1
	Exceedance Level	-	-	-11.5	-9.8	-5.7	-2.1	-0.9	-5.9	-5.9	-6.4	-13.2	-13.2
H6	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	26.1	27.8	31.8	35.4	36.7	36.7	36.7	36.7	36.7	36.7
	Exceedance Level	-	-	-13.9	-12.2	-8.2	-4.6	-3.3	-8.3	-8.3	-8.8	-15.6	-15.6
H7	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	23.7	25.4	29.4	33.1	34.3	34.3	34.3	34.3	34.3	34.3
	Exceedance Level	-	-	-16.3	-14.6	-10.6	-6.9	-5.7	-10.7	-10.7	-11.2	-18.0	-18.0
H8	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise, LA90	-	-	29.2	30.8	34.9	38.5	39.8	39.8	39.8	39.8	39.8	39.8
	Exceedance Level	-	-	-10.8	-9.2	-5.1	-1.5	-5.2	-5.2	-5.2	-6.3	-10.7	-15.4
H9	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	38.9	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise, LA90	-	-	21.3	23.0	27.0	30.7	31.9	31.9	31.9	31.9	31.9	31.9
	Exceedance Level	-	-	-18.7	-17.0	-13.0	-8.2	-13.1	-13.1	-13.1	-14.2	-18.6	-23.3
H10	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	39.1	39.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	20.0	21.7	25.7	29.3	30.6	30.6	30.6	30.6	30.6	30.6
	Exceedance Level	-	-	-20.0	-18.3	-14.3	-9.8	-8.4	-14.4	-14.4	-14.9	-21.7	-21.7
H11	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	39.1	39.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	19.9	21.6	25.6	29.2	30.5	30.5	30.5	30.5	30.5	30.5
	Exceedance Level	-	-	-20.1	-18.4	-14.4	-9.9	-8.5	-14.5	-14.5	-15.0	-21.8	-21.8
H12	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	39.1	39.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	21.0	22.7	26.8	30.4	31.6	31.6	31.6	31.6	31.6	31.6
	Exceedance Level	-	-	-19.0	-17.3	-13.2	-8.7	-7.4	-13.4	-13.4	-13.9	-20.7	-20.7
	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	39.2	39.1	45.0	45.0	45.5	52.3	52.3

H13	Proposed Development Wind Turbine Noise, LA90	-	-	20.1	21.8	25.8	29.4	30.7	30.7	30.7	30.7	30.7	30.7
	Exceedance Level	-	-	-19.9	-18.2	-14.2	-9.8	-8.4	-14.3	-14.3	-14.8	-21.6	-21.6
H14	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	29.3	31.0	35.0	38.7	39.9	39.9	39.9	39.9	39.9	39.9
	Exceedance Level	-	-	-10.7	-9.0	-5.0	-1.3	-0.1	-5.1	-5.1	-5.6	-12.4	-12.4
H15	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	22.6	24.3	28.4	32.0	33.2	33.2	33.2	33.2	33.2	33.2
	Exceedance Level	-	-	-17.4	-15.7	-11.6	-8.0	-6.8	-11.8	-11.8	-12.3	-19.1	-19.1
H16	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	21.0	22.7	26.8	30.4	31.6	31.6	31.6	31.6	31.6	31.6
	Exceedance Level	-	-	-19.0	-17.3	-13.2	-9.6	-8.4	-13.4	-13.4	-13.9	-20.7	-20.7
H17	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	20.5	22.2	26.2	29.8	31.1	31.1	31.1	31.1	31.1	31.1
	Exceedance Level	-	-	-19.5	-17.8	-13.8	-10.2	-8.9	-13.9	-13.9	-14.4	-21.2	-21.2
H18	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise, LA90	-	-	29.0	30.6	34.7	38.3	39.6	39.6	39.6	39.6	39.6	39.6
	Exceedance Level	-	-	-11.0	-9.4	-5.3	-1.7	-5.4	-5.4	-5.4	-6.5	-10.9	-15.6
H19	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise, LA90	-	-	24.8	26.5	30.5	34.1	35.4	35.4	35.4	35.4	35.4	35.4
	Exceedance Level	-	-	-15.2	-13.5	-9.5	-5.9	-9.6	-9.6	-9.6	-10.7	-15.1	-19.8
H20	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.7	45.7
	Proposed Development Wind Turbine Noise, LA90	-	-	20.1	21.8	25.8	29.4	30.7	30.7	30.7	30.7	30.7	30.7
	Exceedance Level	-	-	-19.9	-18.2	-14.2	-10.6	-9.3	-14.3	-14.3	-14.3	-15.0	-15.0
H21	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.7	45.7
	Proposed Development Wind Turbine Noise, LA90	-	-	22.2	23.9	28.0	31.6	32.8	32.8	32.8	32.8	32.8	32.8
	Exceedance Level	-	-	-17.8	-16.1	-12.0	-8.4	-7.2	-12.2	-12.2	-12.2	-12.9	-12.9
H22	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	39.0	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise, LA90	-	-	22.6	24.2	28.3	31.9	33.2	33.2	33.2	33.2	33.2	33.2
	Exceedance Level	-	-	-17.4	-15.8	-11.7	-7.1	-11.8	-11.8	-11.8	-12.9	-17.3	-22.0
H23	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.7	45.7
	Proposed Development Wind Turbine Noise, LA90	-	-	23.6	25.3	29.3	33.0	34.2	34.2	34.2	34.2	34.2	34.2
	Exceedance Level	-	-	-16.4	-14.7	-10.7	-7.0	-5.8	-10.8	-10.8	-10.8	-11.5	-11.5
H24	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.7	45.7
	Proposed Development Wind Turbine Noise, LA90	-	-	24.7	26.4	30.4	34.0	35.3	35.3	35.3	35.3	35.3	35.3
	Exceedance Level	-	-	-15.3	-13.6	-9.6	-6.0	-4.7	-9.7	-9.7	-9.7	-10.4	-10.4
H25	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	39.0	38.2	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise, LA90	-	-	19.9	21.6	25.7	29.3	30.5	30.5	30.5	30.5	30.5	30.5
	Exceedance Level	-	-	-20.1	-18.4	-13.3	-8.9	-14.5	-14.5	-14.5	-15.6	-20.0	-24.7
	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.7	45.7

H26	Proposed Development Wind Turbine Noise, LA90	-	-	19.8	21.5	25.5	29.1	30.4	30.4	30.4	30.4	30.4	30.4
	Exceedance Level	-	-	-20.2	-18.5	-14.5	-10.9	-9.6	-14.6	-14.6	-14.6	-15.3	-15.3
H27	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.6	50.1	54.7
	Proposed Development Wind Turbine Noise, LA90	-	-	19.9	21.6	25.6	29.3	30.5	30.5	30.5	30.5	30.5	30.5
	Exceedance Level	-	-	-20.1	-18.4	-14.4	-10.7	-9.5	-14.5	-14.5	-15.1	-19.6	-24.2
H28	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise, LA90	-	-	21.1	22.8	26.8	30.5	31.7	31.7	31.7	31.7	31.7	31.7
	Exceedance Level	-	-	-18.9	-17.2	-13.2	-9.5	-13.3	-13.3	-13.3	-14.4	-18.8	-23.5
H29	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	39.0	38.9	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	19.9	21.6	25.7	29.3	30.5	30.5	30.5	30.5	30.5	30.5
	Exceedance Level	-	-	-20.1	-18.4	-14.3	-9.7	-8.4	-14.5	-14.5	-15.0	-21.8	-21.8
H30	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.7	45.7
	Proposed Development Wind Turbine Noise, LA90	-	-	19.9	21.6	25.6	29.3	30.5	30.5	30.5	30.5	30.5	30.5
	Exceedance Level	-	-	-20.1	-18.4	-14.4	-10.7	-9.5	-14.5	-14.5	-14.5	-15.2	-15.2
H31	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	19.9	21.5	25.6	29.2	30.5	30.5	30.5	30.5	30.5	30.5
	Exceedance Level	-	-	-20.1	-18.5	-14.4	-10.8	-9.5	-14.5	-14.5	-15.0	-21.8	-21.8
H32	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	20.0	21.7	25.8	29.4	30.6	30.6	30.6	30.6	30.6	30.6
	Exceedance Level	-	-	-20.0	-18.3	-14.2	-10.6	-9.4	-14.4	-14.4	-14.9	-21.7	-21.7
H33	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.6	50.1	54.7
	Proposed Development Wind Turbine Noise, LA90	-	-	19.8	21.4	25.5	29.1	30.4	30.4	30.4	30.4	30.4	30.4
	Exceedance Level	-	-	-20.2	-18.6	-14.5	-10.9	-9.6	-14.6	-14.6	-15.2	-19.7	-24.3
H34	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise, LA90	-	-	25.6	27.3	31.3	34.9	36.2	36.2	36.2	36.2	36.2	36.2
	Exceedance Level	-	-	-14.4	-12.7	-8.7	-5.1	-8.8	-8.8	-8.8	-9.9	-14.3	-19.0
H35	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	27.9	29.5	33.6	37.2	38.5	38.5	38.5	38.5	38.5	38.5
	Exceedance Level	-	-	-12.1	-10.5	-6.4	-2.8	-1.5	-6.5	-6.5	-7.0	-13.8	-13.8
H36	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise, LA90	-	-	29.1	30.8	34.8	38.5	39.7	39.7	39.7	39.7	39.7	39.7
	Exceedance Level	-	-	-10.9	-9.2	-5.2	-1.5	-5.3	-5.3	-5.3	-6.4	-10.8	-15.5
H37	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise, LA90	-	-	29.4	31.1	35.1	38.7	40.0	40.0	40.0	40.0	40.0	40.0
	Exceedance Level	-	-	-10.6	-8.9	-4.9	-1.3	-5.0	-5.0	-5.0	-6.1	-10.5	-15.2
H38	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	24.7	26.3	30.4	34.0	35.3	35.3	35.3	35.3	35.3	35.3
	Exceedance Level	-	-	-15.3	-13.7	-9.6	-6.0	-4.7	-9.7	-9.7	-10.2	-17.0	-17.0
	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3

H39	Proposed Development Wind Turbine Noise, LA90	-	-	24.5	26.2	30.2	33.9	35.1	35.1	35.1	35.1	35.1	35.1
	Exceedance Level	-	-	-15.5	-13.8	-9.8	-6.1	-4.9	-9.9	-9.9	-10.4	-17.2	-17.2
H40	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	39.2	39.1	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	19.9	21.5	25.6	29.2	30.5	30.5	30.5	30.5	30.5	30.5
	Exceedance Level	-	-	-20.1	-18.5	-14.4	-10.0	-8.6	-14.5	-14.5	-15.0	-21.8	-21.8
H41	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	39.0	38.9	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	20.5	22.1	26.2	29.8	31.1	31.1	31.1	31.1	31.1	31.1
	Exceedance Level	-	-	-19.5	-17.9	-13.8	-9.2	-7.8	-13.9	-13.9	-14.4	-21.2	-21.2
H42	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	28.9	30.6	34.6	38.3	39.5	39.5	39.5	39.5	39.5	39.5
	Exceedance Level	-	-	-11.1	-9.4	-5.4	-1.7	-0.5	-5.5	-5.5	-6.0	-12.8	-12.8
H43	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	25.3	27.0	31.0	34.7	35.9	35.9	35.9	35.9	35.9	35.9
	Exceedance Level	-	-	-14.7	-13.0	-9.0	-5.3	-4.1	-9.1	-9.1	-9.6	-16.4	-16.4
H44	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise, LA90	-	-	28.9	30.6	34.6	38.2	39.5	39.5	39.5	39.5	39.5	39.5
	Exceedance Level	-	-	-11.1	-9.4	-5.4	-1.8	-5.5	-5.5	-5.5	-6.6	-11.0	-15.7
H45	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	27.9	29.6	33.6	37.2	38.5	38.5	38.5	38.5	38.5	38.5
	Exceedance Level	-	-	-12.1	-10.4	-6.4	-2.8	-1.5	-6.5	-6.5	-7.0	-13.8	-13.8
H46	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise, LA90	-	-	25.3	27.0	31.0	34.6	35.9	35.9	35.9	35.9	35.9	35.9
	Exceedance Level	-	-	-14.7	-13.0	-9.0	-5.4	-9.1	-9.1	-9.1	-10.2	-14.6	-19.3
H47	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	26.7	28.3	32.4	36.0	37.3	37.3	37.3	37.3	37.3	37.3
	Exceedance Level	-	-	-13.3	-11.7	-7.6	-4.0	-2.7	-7.7	-7.7	-8.2	-15.0	-15.0
H48	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	27.0	28.7	32.8	36.4	37.6	37.6	37.6	37.6	37.6	37.6
	Exceedance Level	-	-	-13.0	-11.3	-7.2	-3.6	-2.4	-7.4	-7.4	-7.9	-14.7	-14.7
H49	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	23.9	25.6	29.6	33.3	34.5	34.5	34.5	34.5	34.5	34.5
	Exceedance Level	-	-	-16.1	-14.4	-10.4	-6.7	-5.5	-10.5	-10.5	-11.0	-17.8	-17.8
H50	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	39.1	38.5	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise, LA90	-	-	20.0	21.7	25.8	29.4	30.6	30.6	30.6	30.6	30.6	30.6
	Exceedance Level	-	-	-20.0	-18.3	-13.3	-9.1	-14.4	-14.4	-14.4	-15.5	-19.9	-24.6
H51	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise, LA90	-	-	29.2	30.9	34.9	38.5	39.8	39.8	39.8	39.8	39.8	39.8
	Exceedance Level	-	-	-10.8	-9.1	-5.1	-1.5	-5.2	-5.2	-5.2	-6.3	-10.7	-15.4
	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2

H52	Proposed Development Wind Turbine Noise, LA90	-	-	30.0	31.6	35.7	39.3	40.6	40.6	40.6	40.6	40.6	40.6
	Exceedance Level	-	-	-10.0	-8.4	-4.3	-0.7	-4.4	-4.4	-4.4	-5.5	-9.9	-14.6
H53	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise, LA90	-	-	27.3	28.9	33.0	36.6	37.9	37.9	37.9	37.9	37.9	37.9
	Exceedance Level	-	-	-12.7	-11.1	-7.0	-3.4	-7.1	-7.1	-7.1	-8.2	-12.6	-17.3
H54	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	39.1	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise, LA90	-	-	23.1	24.8	28.9	32.5	33.7	33.7	33.7	33.7	33.7	33.7
	Exceedance Level	-	-	-16.9	-15.2	-11.1	-6.6	-11.3	-11.3	-11.3	-12.4	-16.8	-21.5
H55	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	39.0	38.2	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise, LA90	-	-	19.8	21.5	25.5	29.2	30.4	30.4	30.4	30.4	30.4	30.4
	Exceedance Level	-	-	-20.2	-18.5	-13.5	-9.0	-14.6	-14.6	-14.6	-15.7	-20.1	-24.8
H56	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	39.0	38.3	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise, LA90	-	-	20.0	21.6	25.7	29.3	30.6	30.6	30.6	30.6	30.6	30.6
	Exceedance Level	-	-	-20.0	-18.4	-13.3	-9.0	-14.4	-14.4	-14.4	-15.5	-19.9	-24.6
H57	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	39.0	38.3	45.0	45.0	45.0	46.1	50.5	55.2
	Proposed Development Wind Turbine Noise, LA90	-	-	20.0	21.7	25.7	29.4	30.6	30.6	30.6	30.6	30.6	30.6
	Exceedance Level	-	-	-20.0	-18.3	-13.3	-8.9	-14.4	-14.4	-14.4	-15.5	-19.9	-24.6
H58	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.6	50.1	54.7
	Proposed Development Wind Turbine Noise, LA90	-	-	19.7	21.4	25.5	29.1	30.3	30.3	30.3	30.3	30.3	30.3
	Exceedance Level	-	-	-20.3	-18.6	-14.5	-10.9	-9.7	-14.7	-14.7	-15.3	-19.8	-24.4
H59	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.5	52.3	52.3
	Proposed Development Wind Turbine Noise, LA90	-	-	19.2	20.9	25.0	28.6	29.8	29.8	29.8	29.8	29.8	29.8
	Exceedance Level	-	-	-20.8	-19.1	-15.0	-11.4	-10.2	-15.2	-15.2	-15.7	-22.5	-22.5
H60	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	48.8	53.6
	Proposed Development Wind Turbine Noise, LA90	-	-	20.0	21.7	25.8	29.4	30.6	30.6	30.6	30.6	30.6	30.6
	Exceedance Level	-	-	-20.0	-18.3	-14.2	-10.6	-9.4	-14.4	-14.4	-14.4	-18.2	-23.0
H61	Site Specific Noise Limit, LA90	40.0	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	48.8	53.6
	Proposed Development Wind Turbine Noise, LA90	-	-	20.9	22.6	26.6	30.3	31.5	31.5	31.5	31.5	31.5	31.5
	Exceedance Level	-	-	-19.1	-17.4	-13.4	-9.7	-8.5	-13.5	-13.5	-13.5	-17.3	-22.1

Site Specific Noise Compliance Table – Night-time (All NSRs), 110.5 m Hub

Location		Wind Speed (ms^{-1}) as standardised to 10 m height											
		1	2	3	4	5	6	7	8	9	10	11	12
H1	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	48.5	51.8
	Proposed Development Wind Turbine Noise, LA90	-	-	19.7	21.4	25.4	29.0	30.3	30.3	30.3	30.3	30.3	30.3
	Exceedance Level	-	-	-23.3	-21.6	-17.6	-14.0	-12.7	-12.7	-12.7	-14.3	-18.2	-21.5
H2	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	48.5	51.8
	Proposed Development Wind Turbine Noise, LA90	-	-	19.7	21.3	25.4	29.0	30.3	30.3	30.3	30.3	30.3	30.3
	Exceedance Level	-	-	-23.3	-21.7	-17.6	-14.0	-12.7	-12.7	-12.7	-14.3	-18.2	-21.5
H3	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	48.5	51.8
	Proposed Development Wind Turbine Noise, LA90	-	-	19.6	21.2	25.3	28.9	30.2	30.2	30.2	30.2	30.2	30.2
	Exceedance Level	-	-	-23.4	-21.8	-17.7	-14.1	-12.8	-12.8	-12.8	-14.4	-18.3	-21.6
H4	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	30.0	31.7	35.8	39.4	40.6	40.6	40.6	40.6	40.6	40.6
	Exceedance Level	-	-	-13.0	-11.3	-7.2	-3.6	-2.4	-2.4	-2.4	-4.5	-10.9	-10.9
H5	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	28.5	30.2	34.3	37.9	39.1	39.1	39.1	39.1	39.1	39.1
	Exceedance Level	-	-	-14.5	-12.8	-8.7	-5.1	-3.9	-3.9	-3.9	-6.0	-12.4	-12.4
H6	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	26.1	27.8	31.8	35.4	36.7	36.7	36.7	36.7	36.7	36.7
	Exceedance Level	-	-	-16.9	-15.2	-11.2	-7.6	-6.3	-6.3	-6.3	-8.4	-14.8	-14.8
H7	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	23.7	25.4	29.4	33.1	34.3	34.3	34.3	34.3	34.3	34.3
	Exceedance Level	-	-	-19.3	-17.6	-13.6	-9.9	-8.7	-8.7	-8.7	-10.8	-17.2	-17.2
H8	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise, LA90	-	-	29.2	30.8	34.9	38.5	39.8	39.8	39.8	39.8	39.8	39.8
	Exceedance Level	-	-	-13.8	-12.2	-8.1	-4.5	-3.2	-3.2	-3.2	-6.4	-11.1	-15.6
H9	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise, LA90	-	-	21.3	23.0	27.0	30.7	31.9	31.9	31.9	31.9	31.9	31.9
	Exceedance Level	-	-	-21.7	-20.0	-16.0	-12.3	-11.1	-11.1	-11.1	-14.3	-19.0	-23.5
H10	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	20.0	21.7	25.7	29.3	30.6	30.6	30.6	30.6	30.6	30.6
	Exceedance Level	-	-	-23.0	-21.3	-17.3	-13.7	-12.4	-12.4	-12.4	-14.5	-20.9	-20.9
H11	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	19.9	21.6	25.6	29.2	30.5	30.5	30.5	30.5	30.5	30.5
	Exceedance Level	-	-	-23.1	-21.4	-17.4	-13.8	-12.5	-12.5	-12.5	-14.6	-21.0	-21.0
H12	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	21.0	22.7	26.8	30.4	31.6	31.6	31.6	31.6	31.6	31.6
	Exceedance Level	-	-	-22.0	-20.3	-16.2	-12.6	-11.4	-11.4	-11.4	-13.5	-19.9	-19.9
	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5

H13	Proposed Development Wind Turbine Noise, LA90	-	-	20.1	21.8	25.8	29.4	30.7	30.7	30.7	30.7	30.7	30.7
	Exceedance Level	-	-	-22.9	-21.2	-17.2	-13.6	-12.3	-12.3	-12.3	-14.4	-20.8	-20.8
H14	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	29.3	31.0	35.0	38.7	39.9	39.9	39.9	39.9	39.9	39.9
	Exceedance Level	-	-	-13.7	-12.0	-8.0	-4.3	-3.1	-3.1	-3.1	-5.2	-11.6	-11.6
H15	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	22.6	24.3	28.4	32.0	33.2	33.2	33.2	33.2	33.2	33.2
	Exceedance Level	-	-	-20.4	-18.7	-14.6	-11.0	-9.8	-9.8	-9.8	-11.9	-18.3	-18.3
H16	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	21.0	22.7	26.8	30.4	31.6	31.6	31.6	31.6	31.6	31.6
	Exceedance Level	-	-	-22.0	-20.3	-16.2	-12.6	-11.4	-11.4	-11.4	-13.5	-19.9	-19.9
H17	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	20.5	22.2	26.2	29.8	31.1	31.1	31.1	31.1	31.1	31.1
	Exceedance Level	-	-	-22.5	-20.8	-16.8	-13.2	-11.9	-11.9	-11.9	-14.0	-20.4	-20.4
H18	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise, LA90	-	-	29.0	30.6	34.7	38.3	39.6	39.6	39.6	39.6	39.6	39.6
	Exceedance Level	-	-	-14.0	-12.4	-8.3	-4.7	-3.4	-3.4	-3.4	-6.6	-11.3	-15.8
H19	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise, LA90	-	-	24.8	26.5	30.5	34.1	35.4	35.4	35.4	35.4	35.4	35.4
	Exceedance Level	-	-	-18.2	-16.5	-12.5	-8.9	-7.6	-7.6	-7.6	-10.8	-15.5	-20.0
H20	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.3	49.4	49.4
	Proposed Development Wind Turbine Noise, LA90	-	-	20.1	21.8	25.8	29.4	30.7	30.7	30.7	30.7	30.7	30.7
	Exceedance Level	-	-	-22.9	-21.2	-17.2	-13.6	-12.3	-12.3	-12.3	-12.6	-18.7	-18.7
H21	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.3	49.4	49.4
	Proposed Development Wind Turbine Noise, LA90	-	-	22.2	23.9	28.0	31.6	32.8	32.8	32.8	32.8	32.8	32.8
	Exceedance Level	-	-	-20.8	-19.1	-15.0	-11.4	-10.2	-10.2	-10.2	-10.5	-16.6	-16.6
H22	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise, LA90	-	-	22.6	24.2	28.3	31.9	33.2	33.2	33.2	33.2	33.2	33.2
	Exceedance Level	-	-	-20.4	-18.8	-14.7	-11.1	-9.8	-9.8	-9.8	-13.0	-17.7	-22.2
H23	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.3	49.4	49.4
	Proposed Development Wind Turbine Noise, LA90	-	-	23.6	25.3	29.3	33.0	34.2	34.2	34.2	34.2	34.2	34.2
	Exceedance Level	-	-	-19.4	-17.7	-13.7	-10.0	-8.8	-8.8	-8.8	-9.1	-15.2	-15.2
H24	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.3	49.4	49.4
	Proposed Development Wind Turbine Noise, LA90	-	-	24.7	26.4	30.4	34.0	35.3	35.3	35.3	35.3	35.3	35.3
	Exceedance Level	-	-	-18.3	-16.6	-12.6	-9.0	-7.7	-7.7	-7.7	-8.0	-14.1	-14.1
H25	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	42.2	42.1	42.1	42.1	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise, LA90	-	-	19.9	21.6	25.7	29.3	30.5	30.5	30.5	30.5	30.5	30.5
	Exceedance Level	-	-	-23.1	-21.4	-17.3	-12.9	-11.6	-11.6	-11.6	-15.7	-20.4	-24.9

H26	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.3	49.4	49.4
	Proposed Development Wind Turbine Noise, LA90	-	-	19.8	21.5	25.5	29.1	30.4	30.4	30.4	30.4	30.4	30.4
	Exceedance Level	-	-	-23.2	-21.5	-17.5	-13.9	-12.6	-12.6	-12.6	-12.9	-19.0	-19.0
H27	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	48.5	51.8
	Proposed Development Wind Turbine Noise, LA90	-	-	19.9	21.6	25.6	29.3	30.5	30.5	30.5	30.5	30.5	30.5
	Exceedance Level	-	-	-23.1	-21.4	-17.4	-13.7	-12.5	-12.5	-12.5	-14.1	-18.0	-21.3
H28	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise, LA90	-	-	21.1	22.8	26.8	30.5	31.7	31.7	31.7	31.7	31.7	31.7
	Exceedance Level	-	-	-21.9	-20.2	-16.2	-12.5	-11.3	-11.3	-11.3	-14.5	-19.2	-23.7
H29	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	19.9	21.6	25.7	29.3	30.5	30.5	30.5	30.5	30.5	30.5
	Exceedance Level	-	-	-23.1	-21.4	-17.3	-13.7	-12.5	-12.5	-12.5	-14.6	-21.0	-21.0
H30	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.3	49.4	49.4
	Proposed Development Wind Turbine Noise, LA90	-	-	19.9	21.6	25.6	29.3	30.5	30.5	30.5	30.5	30.5	30.5
	Exceedance Level	-	-	-23.1	-21.4	-17.4	-13.7	-12.5	-12.5	-12.5	-12.8	-18.9	-18.9
H31	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	19.9	21.5	25.6	29.2	30.5	30.5	30.5	30.5	30.5	30.5
	Exceedance Level	-	-	-23.1	-21.5	-17.4	-13.8	-12.5	-12.5	-12.5	-14.6	-21.0	-21.0
H32	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	20.0	21.7	25.8	29.4	30.6	30.6	30.6	30.6	30.6	30.6
	Exceedance Level	-	-	-23.0	-21.3	-17.2	-13.6	-12.4	-12.4	-12.4	-14.5	-20.9	-20.9
H33	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	48.5	51.8
	Proposed Development Wind Turbine Noise, LA90	-	-	19.8	21.4	25.5	29.1	30.4	30.4	30.4	30.4	30.4	30.4
	Exceedance Level	-	-	-23.2	-21.6	-17.5	-13.9	-12.6	-12.6	-12.6	-14.2	-18.1	-21.4
H34	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise, LA90	-	-	25.6	27.3	31.3	34.9	36.2	36.2	36.2	36.2	36.2	36.2
	Exceedance Level	-	-	-17.4	-15.7	-11.7	-8.1	-6.8	-6.8	-6.8	-10.0	-14.7	-19.2
H35	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	27.9	29.5	33.6	37.2	38.5	38.5	38.5	38.5	38.5	38.5
	Exceedance Level	-	-	-15.1	-13.5	-9.4	-5.8	-4.5	-4.5	-4.5	-6.6	-13.0	-13.0
H36	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise, LA90	-	-	29.1	30.8	34.8	38.5	39.7	39.7	39.7	39.7	39.7	39.7
	Exceedance Level	-	-	-13.9	-12.2	-8.2	-4.5	-3.3	-3.3	-3.3	-6.5	-11.2	-15.7
H37	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise, LA90	-	-	29.4	31.1	35.1	38.7	40.0	40.0	40.0	40.0	40.0	40.0
	Exceedance Level	-	-	-13.6	-11.9	-7.9	-4.3	-3.0	-3.0	-3.0	-6.2	-10.9	-15.4
H38	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	24.7	26.3	30.4	34.0	35.3	35.3	35.3	35.3	35.3	35.3

	Exceedance Level	-	-	-18.3	-16.7	-12.6	-9.0	-7.7	-7.7	-7.7	-9.8	-16.2	-16.2
H39	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	24.5	26.2	30.2	33.9	35.1	35.1	35.1	35.1	35.1	35.1
	Exceedance Level	-	-	-18.5	-16.8	-12.8	-9.1	-7.9	-7.9	-7.9	-10.0	-16.4	-16.4
H40	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	19.9	21.5	25.6	29.2	30.5	30.5	30.5	30.5	30.5	30.5
	Exceedance Level	-	-	-23.1	-21.5	-17.4	-13.8	-12.5	-12.5	-12.5	-14.6	-21.0	-21.0
H41	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	20.5	22.1	26.2	29.8	31.1	31.1	31.1	31.1	31.1	31.1
	Exceedance Level	-	-	-22.5	-20.9	-16.8	-13.2	-11.9	-11.9	-11.9	-14.0	-20.4	-20.4
H42	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	28.9	30.6	34.6	38.3	39.5	39.5	39.5	39.5	39.5	39.5
	Exceedance Level	-	-	-14.1	-12.4	-8.4	-4.7	-3.5	-3.5	-3.5	-5.6	-12.0	-12.0
H43	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	25.3	27.0	31.0	34.7	35.9	35.9	35.9	35.9	35.9	35.9
	Exceedance Level	-	-	-17.7	-16.0	-12.0	-8.3	-7.1	-7.1	-7.1	-9.2	-15.6	-15.6
H44	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise, LA90	-	-	28.9	30.6	34.6	38.2	39.5	39.5	39.5	39.5	39.5	39.5
	Exceedance Level	-	-	-14.1	-12.4	-8.4	-4.8	-3.5	-3.5	-3.5	-6.7	-11.4	-15.9
H45	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	27.9	29.6	33.6	37.2	38.5	38.5	38.5	38.5	38.5	38.5
	Exceedance Level	-	-	-15.1	-13.4	-9.4	-5.8	-4.5	-4.5	-4.5	-6.6	-13.0	-13.0
H46	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise, LA90	-	-	25.3	27.0	31.0	34.6	35.9	35.9	35.9	35.9	35.9	35.9
	Exceedance Level	-	-	-17.7	-16.0	-12.0	-8.4	-7.1	-7.1	-7.1	-10.3	-15.0	-19.5
H47	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	26.7	28.3	32.4	36.0	37.3	37.3	37.3	37.3	37.3	37.3
	Exceedance Level	-	-	-16.3	-14.7	-10.6	-7.0	-5.7	-5.7	-5.7	-7.8	-14.2	-14.2
H48	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	27.0	28.7	32.8	36.4	37.6	37.6	37.6	37.6	37.6	37.6
	Exceedance Level	-	-	-16.0	-14.3	-10.2	-6.6	-5.4	-5.4	-5.4	-7.5	-13.9	-13.9
H49	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	23.9	25.6	29.6	33.3	34.5	34.5	34.5	34.5	34.5	34.5
	Exceedance Level	-	-	-19.1	-17.4	-13.4	-9.7	-8.5	-8.5	-8.5	-10.6	-17.0	-17.0
H50	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise, LA90	-	-	20.0	21.7	25.8	29.4	30.6	30.6	30.6	30.6	30.6	30.6
	Exceedance Level	-	-	-23.0	-21.3	-17.2	-13.6	-12.4	-12.4	-12.4	-15.6	-20.3	-24.8
	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4

H51	Proposed Development Wind Turbine Noise, LA90	-	-	29.2	30.9	34.9	38.5	39.8	39.8	39.8	39.8	39.8	39.8
	Exceedance Level	-	-	-13.8	-12.1	-8.1	-4.5	-3.2	-3.2	-3.2	-6.4	-11.1	-15.6
H52	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise, LA90	-	-	30.0	31.6	35.7	39.3	40.6	40.6	40.6	40.6	40.6	40.6
	Exceedance Level	-	-	-13.0	-11.4	-7.3	-3.7	-2.4	-2.4	-2.4	-5.6	-10.3	-14.8
H53	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise, LA90	-	-	27.3	28.9	33.0	36.6	37.9	37.9	37.9	37.9	37.9	37.9
	Exceedance Level	-	-	-15.7	-14.1	-10.0	-6.4	-5.1	-5.1	-5.1	-8.3	-13.0	-17.5
H54	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise, LA90	-	-	23.1	24.8	28.9	32.5	33.7	33.7	33.7	33.7	33.7	33.7
	Exceedance Level	-	-	-19.9	-18.2	-14.1	-10.5	-9.3	-9.3	-9.3	-12.5	-17.2	-21.7
H55	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	42.2	42.1	42.1	42.1	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise, LA90	-	-	19.8	21.5	25.5	29.2	30.4	30.4	30.4	30.4	30.4	30.4
	Exceedance Level	-	-	-23.2	-21.5	-17.5	-13.0	-11.7	-11.7	-11.7	-15.8	-20.5	-25.0
H56	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	42.2	42.1	42.1	42.1	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise, LA90	-	-	20.0	21.6	25.7	29.3	30.6	30.6	30.6	30.6	30.6	30.6
	Exceedance Level	-	-	-23.0	-21.4	-17.3	-12.9	-11.5	-11.5	-11.5	-15.6	-20.3	-24.8
H57	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	42.2	42.1	42.1	42.1	46.2	50.9	55.4
	Proposed Development Wind Turbine Noise, LA90	-	-	20.0	21.7	25.7	29.4	30.6	30.6	30.6	30.6	30.6	30.6
	Exceedance Level	-	-	-23.0	-21.3	-17.3	-12.8	-11.5	-11.5	-11.5	-15.6	-20.3	-24.8
H58	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	48.5	51.8
	Proposed Development Wind Turbine Noise, LA90	-	-	19.7	21.4	25.5	29.1	30.3	30.3	30.3	30.3	30.3	30.3
	Exceedance Level	-	-	-23.3	-21.6	-17.5	-13.9	-12.7	-12.7	-12.7	-14.3	-18.2	-21.5
H59	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.1	51.5	51.5
	Proposed Development Wind Turbine Noise, LA90	-	-	19.2	20.9	25.0	28.6	29.8	29.8	29.8	29.8	29.8	29.8
	Exceedance Level	-	-	-23.8	-22.1	-18.0	-14.4	-13.2	-13.2	-13.2	-15.3	-21.7	-21.7
H60	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.9	48.7	53.5
	Proposed Development Wind Turbine Noise, LA90	-	-	20.0	21.7	25.8	29.4	30.6	30.6	30.6	30.6	30.6	30.6
	Exceedance Level	-	-	-23.0	-21.3	-17.2	-13.6	-12.4	-12.4	-12.4	-13.3	-18.1	-22.9
H61	Site Specific Noise Limit, LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.9	48.7	53.5
	Proposed Development Wind Turbine Noise, LA90	-	-	20.9	22.6	26.6	30.3	31.5	31.5	31.5	31.5	31.5	31.5
	Exceedance Level	-	-	-22.1	-20.4	-16.4	-12.7	-11.5	-11.5	-11.5	-12.4	-17.2	-22.0

Annex 6 – Topographical Corrections/ Turbine Coordinates

Adjustment Table

Notes/Comments

Requirement to include a concave ground profile correction of +3dB has been calculated in accordance with section 4.3.9 of the IOA GPG (July 2011)

A barrier correction of -2dB is included where the landform completely obscures a turbine at the noise assessment location

Where analysis indicates that both are required the barrier correction take precedence and a correction of -2dB is applied

			Noise Assessment Locations																																																										
Wind Farm	**Hub**	**T ID**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**	**61**
Carrig Renewables 01	104	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carrig Renewables 02	104	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carrig Renewables 03	104	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carrig Renewables 04	104	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carrig Renewables 05	104	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carrig Renewables 06	104	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carrig Renewables 07	104	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Skehanagh 01	56.5	8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	-2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Skehanagh 02	56.5	9	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	-2	3	3	3	3	3	3	3	3	3	3	3	-2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Skehanagh 03	56.5	10	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	-2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Skehanagh 04	56.5	11	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	-2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Skehanagh 05	56.5	12	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	-2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Carrig 01	56.5	13	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Carrig 02	56.5	14	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Carrig 03	56.5	15	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Annex 7 – Summary of Wind Turbine Noise Source Data

Wind Farm	Easting	Northing	Height (m)	Hub Height Modelled (m)
Carrig Renewables 01	599443	701335	60.8	110.5
Carrig Renewables 02	599430	701949	58.5	110.5
Carrig Renewables 03	599012	701725	58	110.5
Carrig Renewables 04	598906	701230	57.5	110.5
Carrig Renewables 05	598324	701442	59.8	110.5
Carrig Renewables 06	598800	702139	56.2	110.5
Carrig Renewables 07	598339	701872	58.4	110.5
Skehanagh 01	600968	696538	152.7	56.5
Skehanagh 02	601249	696429	153.8	56.5
Skehanagh 03	601318	696633	151.1	56.5
Skehanagh 04	600994	696744	153.8	56.5
Skehanagh 05	601041	696939	139.9	56.5
Carrig 01	601495	697671	128.8	56.5
Carrig 02	601500	697904	134.4	56.5
Carrig 03	601510	698133	126.6	56.5

Sound Power Level Data

Wind Farm	Wind Turbine Model	Hub height of source data	Uncertainty Included	Reference Wind Speed (ms^{-1}) Standardised to 10m Height									
				3	4	5	6	7	8	9	10	11	12
Skehanagh & Carrig	Vestas V62	56.5	2	-	98.5	103.6	106.0	106.5	106.5	106.5	106.5	106.5	106.5

Table A7.2: Octave Band Data

Scheme	Turbine Modelled	Octave Band (Hz)								
		63	125	250	500	1000	2000	4000	8000	Overall
Skehanagh & Carrig	Vestas V62	87.9	93.6	98.6	100.6	100.1	97.9	92.1	77.0	106.0