N

Map Legend

Infrastructure and Study Boundary
- County Borders
- LVIA Study Area
- EIAR Site Boundary
- Proposed Turbines

LVIA Assessment Tools
- Photomontage Viewpoint Locations
- Photowire Viewpoint Locations

Zone of Theoretical Visibility
- 1-3 Turbines Theoretically Visible
- 4-6 Turbines Theoretically Visible
- 7-9 Turbines Theoretically Visible

Visual Receptors
- Co. Galway Protected Views Direction
- Co. Galway Protected Views
- Recreational and Tourist Destinations
- Suck Valley Way
- Railways
- National Roads
- Regional Roads
- Local roads
- Scoped in settlements

Landscape Receptors
- GCDP LCU Map

Other Wind Farm Developments within the LVIA Study Area
- Proposed Clonberne Wind Farm
- Permitted Cloonascragh Single Turbine
- Permitted Clooncon East Single Turbine
- Existing Cloonlusk Wind Farm
- Proposed Gannow Wind Farm
- Proposed Laurclavagh Wind Farm
- Existing Park Athenry Single Turbine

G - LCU 5d
G - LCU 5c
G - LCU 5e
G - LCU 5a
G - LCU 5b
G - LCU 5f
G - LCU 6d
G - LCU 6a
G - LCU 6b
G - LCU 4b
5 km
10 km
15 km
20 km
Glenamaddy
Kilkerrin/Clonbern
Lavally
Richmond Esker Nature Reserve
Tuam
Moylough
Barrownagappul walk - The Living Bog
Mountbellew
Suck Valley Way
VP01
VP02
VP03
VP04
VP05
VP06
VP07
VP08
VP09
VP10
VP11
VP12
VP13
VP14
PW-A
PW-B
PW-C
PW-D
PW-E
0
5
10 km

Drawing No.
Appendix 13-4

Drawing Title
LVIA Baseline Map

Project Title
Cooloo Wind Farm, Co. Galway

Scale	Project No.	Date	Drawn By	Checked By
1:53,000	190723	03.09.2025	JC	RS

MKO

3.7 Transport Infrastructure Ireland (TII)

Transport Infrastructure Ireland (TII) submitted observations related to the provisions of official policy and to national road network maintenance and safety under the following headings:

- Official Policy
- National Road Network Maintenance and Safety
    - Proposed Turbine Component Delivery Route
    - Structures
    - Grid Connection Routing
    - Greenways

The observations made by TII have been responded to in the following sections under the same headings as listed above.

3.7.1 Official Policy

TII highlight the Ministerial Guideline, 'Spatial Planning and National Roads - Guidelines for Planning Authorities', Department of Environment, Community and Local Government, 2012, which concerns development management and access to national roads. Specifically, Section 2.5 which sets out policy that endeavours to avoid the creation of new, additional access points for new development or the generation of increased traffic from existing non-public road accesses off the national road network.

Response

It is noted that TII acknowledge that there are no direct access requirements off the national road network as part of the Proposed Project, as access to the Proposed Wind Farm site will be facilitated via the regional and local road network.

3.7.2 Proposed Turbine Component Delivery Route

Response

TII note the requirement for a temporary over-run area in third party land on the southwest corner of the N63 / R332 junction in order to accommodate the abnormally sized loads and that the temporary access road will only be used for the transportation of abnormally sized loads, which will be delivered with a Garda escort and transient traffic management vehicles operated by the haulage company. The road will not be available for any other traffic and will be closed off and opened only for the delivery of the abnormally sized loads. Upon the completion of the construction phase, the temporary road will be covered with a layer of topsoil and reseeded and will only be used again in the unlikely event that an oversized delivery was required for wind turbine maintenance purposes.

TII note the proposed haul route traverses roads managed by a combination of PPP Concessions, Motorway Maintenance and Renewal Contractors (MmaRC) and local authorities (namely, GCC). Consultation between the Applicant and these companies and authorities will be undertaken prior to the commencement of turbine component delivery to confirm the delivery schedule and to ensure that the strategic function of the national road network is maintained. A Traffic Management Plan (TMP), incorporating all the mitigation measures is included as Appendix 15-2 of the EIAR, and will be finalised and confirmatory detailed provisions in respect of traffic management agreed with the road's authority and An Garda Síochána prior to construction works commencing on Site.

TII also highlight that any damage caused to the surface of the national road network due to the turning of abnormally sized loads (such as turbine blade deliveries) shall be rectified in accordance with TII

Pavement Standards. As stated in Chapter 15, Section 15.1.12.5, of the EIAR, a pre-condition survey of roads associated with the Proposed Project will be carried out immediately prior to construction commencement to record an accurate condition of the road at the time. A post construction survey will be carried out after works are completed to ensure that any remediation works are carried out to a satisfactory standard. Where required the timing of these surveys will be agreed with the local authority [or other relevant authority]. All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers.

Additionally, the Applicant notes the following TII considerations regarding the proposed temporary overrun areas at the N63 / R332 junction and commits to undertake all considerations should they be deemed required by the Commission.

3.7.3 Structures

Response

It is confirmed that no abnormal weight loads will be associated with the Proposed Project and therefore, a technical load assessment was not deemed necessary as part of the scope of the traffic and transport assessment.

Furthermore, as no abnormal weight loads or loads exceeding those permissible under the Road Traffic Regulations will be required during the construction, operation or decommissioning of the Proposed Project, it is not deemed necessary to undertake a full assessment of all structures on the national road network along the turbine delivery route or other construction material haul routes.

It is noted TII recommend the Applicant confirm all national road structures along proposed haul routes can accommodate the proposed load where exceeding that permissible under the Road Traffic Regulations. The Applicant commits to agree full details of transportation of abnormal loads with the planning and road authorities prior to the commencement of any development.

3.7.4 Grid Connection Routing

Response

As noted above in Section 2.1.4, the Proposed Grid Connection is not included in this application and will be subject to a separate application but has been assessed in detail within the EIAR. The construction methodology of providing an underground grid connection cabling route under and along local road networks is well established and accepted nationwide. There are in excess of 300 wind farms currently operational in Ireland and the majority of these are connected to the national grid via underground cable connections predominantly along the public road networks. Based on a construction rate of 100m per day, it is estimated that the grid route will take approximately 210 working days to complete based on one construction crew operating at one location. In practice the construction duration may be significantly reduced using 2 construction crews operating at different locations on the route.

An assessment of the impacts during the construction of the Proposed Grid Connection underground cabling route is set out in Section 15.1.7 of Chapter 15 in the EIAR. The Proposed Grid Connection cabling runs for approximately 21km, of which 4.2km is located within the corridor of the N63 National Secondary Road. As shown in Table 15-26 of Chapter 15 in the EIAR, the construction of the proposed underground grid connection cabling along the N63 would take approximately 42 days. For the purpose of the assessment, a pre-cautionary scenario here a road closure will be required for the entire route is assumed. To facilitate the works along the route, a series of potential diversion routes have been identified which may be used during the construction phase. Prior to the construction of the

Proposed Grid Connection, the final diversion routes that will be used during the construction phase will be discussed and agreed with GCC.

In Section 6 of the Traffic Management Plan (Appendix 15-2), included in the EIAR, states the proposed mitigation measures that will be implemented. Included within the suite of proposed mitigation measures is the proposed re-instatement works of all road surfaces and boundaries to predevelopment condition, as agreed with the local authority engineers. All works will be done in accordance with the Guidelines for the Opening, Backfilling and Reinstatement of Openings in Public Roads, DTToS, September 2015.

In Section 3.5.4 in Chapter 3 of the EIAR, the alternative grid connection options that were considered as part of the assessment was listed and described. Option B would see increased cabling in the national road network compared to the chosen option – Option A. A 'loop-in' overhead line option was not considered as part of the assessment due to various landowner negotiations which proved unsuccessful, and therefore it was deemed that the option of a 'loop-in' grid connection was not a feasible option at this point in time.

TII note that grid connection works in national roads have the potential to result in technical road safety issues such as differential settlement. Should a future application be granted for an underground grid connection in the public road, reinstatement for concrete and asphalt/bitumen and road sections, will be permanently reinstated in accordance with the specification and to the approval of the Local Authority. Reinstatement will also comply with the requirements of the Local Authority and the Specification for the Reinstatement of Openings in National Roads and Transport Infrastructure Irelands (TIIs) design standards for both hardstandings and verges.

3.7.5 Greenways

It is noted TII recommend consultation with GCC's internal project and/or design staff in relation to any Greenway or Active Travel proposals in the vicinity of the Proposed Project.

Response

There are no known Greenway or Active Travel proposals within the Site. However, should any proposals emerge in the future that use infrastructure corridors pertaining to the Proposed Project, consultation will be undertaken with GCC.

In summary, the matters raised in the TII submission have been carefully considered and it has been demonstrated in this section, that they have been comprehensively addressed across the robust documentation which accompanied the application.

3.8 Uisce Éireann

Uisce Éireann, should permission be granted by the Commission, request conditions in relation to refuelling areas, geotextile liner, the monitoring of foundation works, the location of temporary cement washout lagoons, drainage runoff, and compliance with relevant directives and best practice guidance.

Response

The recommended conditions raised by Uisce Éireann are reflected through the mitigations measures in the EIAR. These conditions are considered to be acceptable by the Applicant in the event of a grant of permission.

Further response to the submission by Uisce Éireann is addressed by HES in Appendix 2 of this response document.

4. CONCLUSION

This response document has been prepared to address concerns raised in the observations made in respect of planning application reference ABP Ref. 323761 regarding the Proposed Project. The information provided in this document will directly assist the Commission in their ongoing consideration of the planning application.

It is re-iterated here that a robust EIAR and NIS were carried out and accompanied the planning application for the Proposed Project, and this is demonstrated by the fact that detail from the EIAR has been reproduced and/or referenced in this document in order to respond to the majority of observations made. It is our view that the information provided within this document is confined to the issues raised within the observations received by the Commission and there is no additional information provided that would be considered 'significant' or 'material'.

The information provided in this document constitutes a full and robust response to the matters raised and we trust that this allows the Commission to progress with their assessment of the Proposed Project.

APPENDIX 1

Gavin & Doherty Geosolutions (GDG) Submissions Response

TECHNICAL NOTE

Project title:	Cooloo Wind Farm		
Subject:	Cooloo Wind Farm Submission Responses		
To:	Brandon Taylor, MKO		
Project number:	22098	Document ref.:	TN-22098-01
Prepared by:	Chris Engleman	Revision:	01
Checked by:	Alasdair Pilmer	Date of issue:	26/02/2026
Approved by:	Tim O'Shea		

Table of Contents

1 PEAT STABILITY

This section presents the applicant's response to submissions pertaining to peat stability, and the Peat Stability Risk Assessment (Technical Appendix 8-1 of the EIAR), and has been prepared by GDG. The responses outlined below address the following themes:

- Assertions of inadequate peat stability risk assessment;
- Concerns regarding construction of floated access tracks.

All of the matters raised in the submissions are addressed in Chapter 8 of the EIAR, in particular through the comprehensive suite of mitigations outlined in Section 8.5 (Mitigation Measures), and in Appendix 8-1 (Peat Stability Risk Assessment) and Appendix 4-2 (Peat and Spoil Management Plan). However, the key issues raised in the submissions are summarised and addressed in the following sections.

1.1 PEAT STABILITY RISK ASSESSMENT METHODOLOGY

1.1.1 SUBMISSIONS

Submissions by several 3rd parties, including North East Galway Environmental Protection contend that the peat stability risk assessment presented in Appendix 8-1 (Peat Stability Risk Assessment) is inadequate.

Several Submissions raise points taken from an unattributed "Technical Review Report - Chapter 8: Land, Soils & Geology (Cooloo Wind
Farm EIAR)". The points relevant to the Peat Stability Risk Assessment/Peat Management Plan are summarised below:

- *"The investigation relies on only two boreholes for deep surface stratigraphy in a 9-turbine site, which is inadequate given the varying peat depths and subsurface complexity. The sampling density is insufficient in key areas (e.g. near turbine bases, along access roads crossing bog) to establish confidence in peat/geotechnical stability."*
- *"The PSRA uses a deterministic 2-D infinite-slope model with a FoS ≥1.3 threshold and undrained shear strength of 5 kPa. No transient rainfall or coupled hydro-geotechnical modelling was undertaken. Risks are described as 'low to medium' but this conclusion lacks quantitative verification."*
- *"Key deficiencies include*
    - *Over-reliance on 2-D infinite-slope model, unsuitable for complex peat terrain.*
    - *Absence of rainfall or drainage event sensitivity analysis,*
    - *FoS sensitivity to 2–3 kPa not tested*
    - *Deferred monitoring contrary to Derrybrien precedent. "*

Similar concerns were raised in a submission by North East Galway Environmental Protection CGL (NEGEP). This submission also raised concerns about the use of the Scottish Government (2017) Best

Practice Guidelines for assessment of peat stability in Ireland, arguing that *"the developers risk using a standard that is less stringent, or less appropriate for the specific characteristics of Irish peat soils, than that typically required by Irish regulators (like the EPA or NPWS)."*

The NEGEP submission also raised concerns about the inclusion of the statement "Further inspection will be required during the detailed design and construction stage to inspect for peat instabilities, including bog burst features" (PSRA Section 4.5). The submission asserts that this *"indicates the report has gaps and lacks complete, precise and definitive findings and conclusions capable of removing all reasonable scientific doubt as to the effects of the works proposed on the Lough Corrib Sac and protected habitats"*

1.1.2 RESPONSE

A Peat Stability Risk Assessment (PSRA) has been undertaken for the site and was included as Appendix 8-1 of the EIAR. The PSRA was conducted in accordance with "Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments" (PLHRAG, Scottish Government, 2017). The PSRA included the following studies and investigations to determine the peat risk on the site:

- Desk Study, including review of historic landslides, mapping (geology, hydrology, hydrogeology, topography), current and historic aerial imagery
- Site Reconnaissance and Walkover
- Ground Investigation
- Peat Stability Assessment – quantitative assessment of peat landslide hazard, using the infinite slope model to generate a Factor of Safety (FoS) for each 5m pixel across the Proposed Development site, in line with the Scottish Government PLHRAG (2017)
- Risk Assessment – quantitative assessment of the peat landslide risk at each infrastructure location, combining hazard assessment (including the quantitative FoS and assessment of qualitative hazard factors, scored using expert judgement) and adverse consequences assessment, to calculate an overall risk score at each location.

NEGEP raised concerns that the Scottish Government Best Practice Guidance (2017) is not an Irish document. However, this guidance is the current industry best practice guidance for the assessment of peat landslide risk in Ireland due to the absence of any Irish-specific equivalent guidance.

The PSRA concludes in Section 8 that "*The peat stability risk for the proposed infrastructure is negligible in all locations.".* The individual risk rating scores for each infrastructure element are outlined in Section 5.6 and illustrated in full in Appendix M of the PSRA. In each case, the risk score was calculated to be <0.2 (negligible). This is a clear and unambiguous statement of the assessed peat stability risk across the site, following the rigorous peat stability risk assessment.

As outlined above, submissions have queried the adequacy of the methodology used to carry out this assessment. These assertions are refuted and the assessment has been conducted in line with the current best practice guidelines. The full methodology of the peat stability risk assessment undertaken is outlined in Section 4 and Section 5 of Appendix 8-1 (PSRA), and a full summary of the ground investigations undertaken to inform the assessment is outlined in Section 3.

Ground Investigation

The assessment included intrusive ground investigation at 344 locations, including:

- 306no. peat probes;
- 27no. trial pits;
- 6no. hand shear vanes performed in peat; and
- 2no. rotary boreholes.

Considering the topography and low-lying mixed cut-over/drained raised bog environment at the proposed wind farm site, this level of GI is robust, with strong coverage of the key infrastructure locations, particularly in areas of peat soils. As outlined in Section 3, access to some localised forested areas of the site was limited, however, the peat surveys were extensive outside of these very localised areas.

The findings of the peat investigations are summarised in PSRA Section 3.1:

"Review of the published geological information, site observations, and the results of the ground investigation campaigns indicate that the ground conditions at the proposed wind farm site consists of a generally flat to undulating topography, with prominent ridges of glacial material (Drumlins) separating large, flat-lying raised peat bogs, which have been subject to turbary peat harvesting. Trial pit locations (Appendix K.1) suggest that the peat is typically underlain by granular or cohesive glacial material, with trial pits encountering soft to firm gravelly CLAY/SILT, sandy GRAVELS, and sandy SILT (marl-like silt) underlying the peat. In addition, Petersen Drilling Services Ltd. carried out two boreholes for the purpose of the hydrological assessment (Chapter 9 of the EIAR). These boreholes encountered a similar mix of cohesive and granular glacial tills and encountered limestone bedrock at 4.9m BGL and 2.6m BGL, respectively.

The peat thickness encountered by intrusive investigations across the Proposed Wind Farm site varies from 0m (in areas where peat is absent) to a maximum of 7.1m, with an average of 1.3m, and a median of 0.4m recorded. Areas of the Proposed Wind Farm site containing little to no peat, underlain by cohesive or granular glacial tills, include T01, T04, T6-T8, the substation, the construction compound and the southern and central Proposed Wind Farm site access tracks. Much of the remaining proposed infrastructure, including T2-T3, T6-T7 hardstands and T9, the BESS compound and the majority of the northern access tracks, are in areas of cut-over peat, where turbary peat harvesting has removed significant quantities of peat, reducing peat thicknesses.

The frequency of different peat thicknesses is shown in ***Error! Reference source not found.****. In total, 64% of recorded peat depths were under 1m, and 74% were under 2m.*

Laterally extensive regions of >3m in depth were encountered in raised bog settings, particularly to the north of T5 (approx. 30m), to the southeast of T7 (approx. 120m from the hardstand), to the west of T9 (approx. 200m) and the north of T2 (approx. 100m). These areas of deep peat are restricted to discrete raised bogs, which all major infrastructure positioning has avoided, aside from the proposed floated track between T7 and T9, which passes across one area of raised bog, with recorded peat depths of up to 6.8m."

Video footage has been submitted by Barnaderg Cooloo Windfarm Action Collective that purports to provide evidence for peat depths in excess of 10.5m. GI was undertaken at an appropriate density. However, localised deeper peat pockets can exist beyond the maximum depths identified by the GI and would not have an appreciable impact on the peat stability risk in this case.

Assessment methodology

As outlined in Section 4 of the PSRA (Appendix 8-1), a quantitative assessment of peat stability across the site has been performed, using the infinite slope model to generate a factor of safety (FoS) for each 5m pixel across the site. This analysis has been conducted in line with industry best practice (in particular the 2017 Scottish guidelines), and has considered four different scenarios:

- Undrained conditions;
- Undrained conditions considering 1m of peat surcharge;
- Drained conditions; and
- Drained conditions considering 1m of peat surcharge.

These scenarios simulate a range of potential peat conditions, with consideration of both hydrological factors and loading of the peat due to construction/placement of peat stockpiles, in line with the recommendations of the Scottish best practice guidance (2017) and the findings of Lindsay and Bragg (2004) – as discussed in the literature review in Section 2.14 of the PSRA.

Selection of the critical parameters, in particular the undrained shear strength (c_u) effective cohesion (c'), and effective friction angle (ø') have been discussed at length in Section 4.3 of the PSRA. Several submissions argue that the selected undrained shear strength (c_u) value of 5kPa does not constitute a conservative value, and that sensitivity analysis should have been performed with c_u values of 2-3kPa. The value of 5kPa was selected as it is significantly lower than the lowest recorded hand shear vane value of 12kPa (1m bgl in HSV-TP15- Section 3.1 of the PSRA) and is based on GDG's experience in the assessment of similar raised peats and values reviewed in the literature, as outlined in Section 2.14 of the PSRA. This methodology is sufficiently conservative to constitute a robust assessment.

As outlined in Section 5 of the PSRA, a further quantitative risk assessment has been performed across the key infrastructure locations, taking into account the factor of safety, and a series of hazard (Section 5.4) and adverse consequence factors (Section 5.5) to produce an overall risk rating at each location prior to mitigation.

Deferred Investigation and Monitoring

Section 4.5 of the PSRA (Appendix 8-1) does state "*The lack of evidence for historical peat slides, and translational and flow slides does not preclude the possibility that these may occur. Further inspection will be required during the detailed design and construction stage to inspect for peat instabilities, including bog burst features. The design and construction teams will develop their own inspection and testing criteria to satisfy and de-risk the possibility of peat landslides at these locations. Further mitigation and monitoring measures are outlined in Section 6*".

This statement was included to ensure that best practice is adhered to at detailed design and construction stages. It does not imply that there is uncertainty relating to peat landslide risk on the site. Further detail is provided below:

- "The lack of evidence for historical peat slides, and translational and flow slides does not preclude the possibility that these may occur." This statement identifies that the lack of historical landslides on the site is not the only indicator of the future risk. The actual risk of future peat instability is determined by the PSRA process.
- "Further inspection will be required during the detailed design and construction stage to inspect for peat instabilities, including bog burst features." The PSRA is based on current information and site conditions at the time of the assessment. The timeline between EIA and detailed design/construction is often several years. It is therefore good practice to undertake confirmatory inspections of the proposed site at detailed design stage.
- "The design and construction teams will develop their own inspection and testing criteria to satisfy and de-risk the possibility of peat landslides at these locations." The use of Inspection and Test Plans (ITP) is standard in the construction industry. It this case, ITPs will be used to verify site conditions and parameters such as peat strength, thereby validating the design.

Conclusions

A comprehensive PSRA was carried out for the proposed site. The peat stability risk without mitigation was determined to be negligible. To further reduce the risk, a conservative approach has been taken by including additional mitigation measures. These include identifying Safety Buffer Zones where no infrastructure is located and Peat Stockpile Restriction Areas where no peat deposition is permitted. In accordance with the PLHRAG, Scottish Government, 2017, negligible peat stability risk means the project should proceed with monitoring and mitigating peat landslide hazards at these locations as appropriate. Therefore, best practice has been followed in the PSRA.

Assertions that there is an absence of complete, precise and definitive findings in relation to the peat stability risk on the proposed site are refuted. The PSRA carried out by GDG was carried out by experienced and competent specialists in accordance with best practice guideline and determined conclusively that the peat risk on the site is negligible.

1.2 FLOATED ACCESS TRACKS

1.2.1 SUBMISSIONS

A number of submissions, including by the Barnaderg Cooloo Windfarm Action Collective raise concerns about the construction of floated access track at the proposed wind farm site, especially a *"c.0.6 km floating access road over intact raised bog to turbine T7".* More than one of these submissions raises the guidance prepared for Scottish Natural Heritage and the wind energy industry ("Floating Roads on Peat – A Report into Good Practice in Design, Construction and Use of Floating Roads on Peat with particular reference to Wind Farm Developments", Forestry Civil Engineering, 2010) as evidence that construction of floated access tracks is inherently high risk and should never be consented.

Several submissions raise concerns over disruption to the hydrological regime and ecological state of the bog. We emphasise that these issues are not relevant to the scope of our work and will be addressed elsewhere by the appropriate topic experts, as Appendix 8-1 is concerned only with peat stability.

1.2.2 RESPONSE

Concerns were raised regarding the construction of floated access tracks, particularly in the wake of the 2020 Meenbog landslide. The PSRA assessment considers the findings of previous investigations of the Meenbog and Derrybrien failures, and has selected peat parameters appropriate to the site conditions (outlined above). The PSRA factor of safety analysis considers a surcharged scenario designed to simulate peat stockpiling and construction loading, which concluded that all areas of floated track are located in areas of FoS >1.3 in the undrained and drained conditions with application of surcharge.

This approach is aligned with the recommendations of the 2010 "Floating Roads on Peat – A Report into Good Practice in Design, Construction and Use of Floating Roads on Peat with particular reference to Wind Farm Developments" report cited by the submissions. Contrary to the concerns raised in the submissions, the existence of a good practice guidance for construction of floated tracks does not mean that this track type is inherently too high-risk to be safely constructable. Instead, this document outlines good practices for construction of floated tracks on peat, and outlines key pre-construction considerations, including:

- Carrying out a robust peat landslide hazard assessment;
- Ranking the perceived hazard and risk;
- Taking risk avoidance measures;
- Considering construction methodologies to construct the works, i.e. the "buildability" of the development;
- Identifying mitigation measures and preparing contingency plans to deal with any residual risks

The assessment outlined in the PSRA (Appendix 8-1) provides a robust landslide hazard risk assessment across the site, outlines mitigation measures, and risk avoidance measures, while the Peat and Spoil Management Plan (PSMP, Appendix 4-2) outlines floated track construction methodologies in line with the best practice Scottish guidance (2010 and 2017).

2 KARST RISK ASSESSMENT

This section presents the applicant's response to submissions pertaining to the Karst Risk Assessment (Technical Appendix 8-2 of the EIAR), and has been prepared by GDG. The responses outlined below address the following themes:

- Concerns regarding lack of consideration of hydrogeology in the Karst Risk Assessment (KRA);
- Concerns regarding the KRA methodology.

All of the matters raised in the submissions are addressed in Chapter 8 and/or Chapter 9 of the EIAR, in particular through the comprehensive suite of mitigations outlined in Section 8.5 (Mitigation Measures), and in Appendix 8-2 (Geotechnical Karst Risk Assessment). However, the key issues raised in the submissions are summarised and addressed in the following sections.

2.1 CONSIDERATION OF HYDROGEOLOGY

Multiple submissions voiced concerns that the impact of the development on the hydrogeology, water supply and local aquifers was not sufficiently addressed by the KRA. Section 1.1 of the KRA (Appendix 8-2) states: "*This assessment is limited to consideration of the geotechnical risks posed by karstic features to the Proposed Wind Farm. Consideration of the impact of the Proposed Wind Farm on the hydrology and hydrogeology of the Proposed Wind Farm site is outside the scope of this report.*"

Assessment of the hydrology and hydrogeology is considered in full in Chapter 9 – Hydrology and Hydrogeology. Assessment of the karst features within Appendix 8-2 is limited solely to geotechnical risk.

2.2 KRA METHODOLOGY

2.2.1 SUBMISSIONS

A small number of submissions, and North East Galway Environmental Protection raise concerns over the methodology of geotechnical karst risk assessment, and the quantity of GI across the proposed wind farm site.

An additional submission raises concerns about the existence of a Geotechnical Risk Register (Appendix I of the KRA- Appendix 8-2), stating *"This risk assessment reflects 193 impacts under the Precautionary Principle that determines this site is unsuitable for a windfarm".*

2.2.2 RESPONSE

The KRA (Appendix 8-2) provides a clear summary of the methodology used to classify and quantify karst risk throughout the report, with a summary of the workflow and basis for the assessment in published literature and previous project experience in similar lowland karst environments in Co. Galway outlined in Section 1.5. While no specific standard or best practice guidance for the assessment of geotechnical karst risk exists in Ireland, the methodology employed in the KRA constitutes a robust risk assessment, in line with industry best practice.

The KRA included the following studies and investigations to determine the peat risk on the site:

- Desk Study, including review of published mapping (geology, hydrology, hydrogeology, topography) and current and historic aerial imagery (Section 2);
- Site Reconnaissance and Walkover (Section 4);
- Ground Investigation (Section 4); and
- Risk Assessment – quantitative assessment of the geotechnical karst risk at each infrastructure location, combining hazard assessment (assessment of qualitative hazard factors, scored using expert judgement – Section 5.3-5.6) and adverse consequences assessment (Section 5.7), to calculate an overall risk score at each location (Section 5.8).

This methodology considered the available ground investigation data, including 2no. boreholes, and 27no. trial pits, with ERT and seismic geophysical surveys conducted in the area of highest identified risk. Following the calculation of risk scores, the KRA applied mitigation measures where considered

appropriate, with a full geotechnical risk register (GRR) developed and presented in Appendix I of the KRA. Section 8 concludes that:

"The assessment findings showed that the majority of the proposed infrastructure locations are located in areas of low to medium karst hazard, with localised areas of high and very high hazard identified. One turbine (T4) was identified as being located in an area of high karst hazard, with a section of access track immediately north of T4 also identified as having a high karst hazard. The karst risk assessment shows that the risk at each infrastructure location ranges from medium to very high (at T4) prior to the application of mitigation measures.

Following the implementation of mitigation measures, the residual risk at each infrastructure location ranges from low to medium, indicating that development can proceed as long as mitigation measures are implemented and that the risk assessment is further refined following further confirmatory ground investigation."

A robust geotechnical karst risk assessment has been carried out, identifying areas of high karst risk, proposing and implementing mitigation measures to reduce to low or medium risk in all infrastructure locations, and proposing confirmatory GI to further refine the risk assessment and allow for further reduction of risk and detailed design of infrastructure foundations and appropriate mitigation measures if required.

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APPENDIX 2

Hydro-Environmental Services (HES) Submissions Response

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Our Ref: P1611-1-0001

MKO
Tuam Road,
Galway, Ireland,
H91 VW84

F.A.O. Mr Brandon Taylor

Dear Mr Taylor,

Re: An Coimisiún Pleanála Third Party Submissions Response regarding Cooloo Wind Farm, Co. Galway

ABP Ref: PAX07.323761

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1 INTRODUCTION

Hydro-Environmental Services (HES) were requested by MKO to respond to third party submissions made to An Coimisiún Pleanála (ACP) regarding the proposed Cooloo Wind Farm, Co. Galway (ACP Case Ref: PAX07.323761).

The Proposed Project (Proposed Wind Farm site and Proposed Grid Connection) is described in full in Chapter 4 of the submitted EIAR.

2 STATEMENT OF EXPERIENCE

Hydro-Environmental Services ("HES") are a specialist geological, hydrological, hydrogeological and environmental practice that delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core areas of expertise and experience include hydrology, hydrogeology and karst hydrogeology and wind farm drainage design and management.

HES has extensive wind farm drainage and hydrogeological experience relevant to this project. Wind farm environmental impact assessment in respect of geology, hydrology, and hydrogeology has and is a core business area for HES presently and also over the past 20 years. Wind farm drainage design/management requires experience both as a civil/drainage engineer, a hydrologist, and as a hydrogeological specialist. HES has these combined experiences and expertise. HES has worked on over 100 wind farm projects in Ireland and Northern Ireland. Many of these required assessments of geological conditions, existing drainage features, and streams and water quality data. HES work at all stages of wind farm developments including feasibility stage, layout design & preliminary drainage design/planning stage, FRAs, and also at construction management stage.

HES also specialises in wetland and peatland eco-hydrology. We are very familiar with all type of peatland sites (i.e. blanket, fen, raised bogs, and other types of wetlands).

Relevant to the Cooloo Wind Farm project, HES has completed over 40 Source Protection Assessments for the GSI/NFGWSs, and for Irish Water, and for private developments across the country in a wide variety of hydrogeological settings.

HES has also been involved in over 80 Uisce Éireann water supplies to date in Counties Tipperary, Wicklow Waterford, Kilkenny, Wexford, Cork, Limerick, and Carlow. HES have prepared hydrogeological audit reports for these sites, with follow-on works including water level monitoring, water quality monitoring, camera surveys, and borehole maintenance and remediation works. HES has also completed specification and tendering, and follow-on supervision and management of trial well and production well drilling works and pumping tests works.

All these experiences are particularly relevant to this project, and they have been applied through the project development phase, the constraints mapping phase, and EIAR preparation work, including the cumulative impact assessment.

This response submission has been prepared by David Broderick (P.Geo) and Michael Gill (P.Geo). David and Michael prepared the Land Soil and Geology and Water Chapters of the submitted EIAR, and their qualifications, competencies, and experience are already presented in the EIAR (refer to Section 9.1.2 of Chapter 9).

3 RESPONSE LAYOUT

Firstly, direct responses are presented relating to concerns/or commentary raised in the following submissions:

- Galway County Council
- Uisce Éireann
- Inland Fisheries Ireland (IFI)
- National Office for Environmental Health Services (HSE)
- Hydro-G
- North-East Galway Environmental Protection (NEGEPC)

Following the direct responses, we then present responses to recurring topics raised in the other third-party submissions. These recurring topics include the following:

- Effects on local group scheme and public water supplies;
- General surface water and groundwater quality effects;
- Potential effects on local private wells;
- Potential impacts on Lough Corrib SAC; and,
- Increased flood risk.

Please note regarding the response approach below. Where ***bold italics*** are used it indicates text directly referenced from the third-party submission response itself. Regular italics indicates text referenced from the previously submitted EIAR or associated documents.

4 GALWAY COUNTY COUNCIL

Overall, the Galway County Council submission was positive with regard the proposed project:

> ***"Having particular regard to the National Planning Framework – Project Ireland 2040, Climate Action Plan 2024, The Regional Spatial and Economic Strategy 2020 - 2032 (RSES) for the Northern and Western Region and the Galway County Development Plan 2022-2028, it is considered that the proposed development is acceptable".***
>
> ***"Having reviewed the documents as submitted and having regard to the content of the consultation response received from the Environment Department, Galway County Council are of the opinion that the proposal would not result in adverse impacts on Population, Human Health and Residential Amenity".***

28 no. Conditions were recommended by Galway County Council and apart from the requirement for appropriate management of surface water runoff generated by the development, no other matters were raised with regard the water or soil/geology environment.

The surface water drainage plan is proposed for the wind farm site which is described in Section 9.4.1 of Chapter 9 of the EIAR and with the drainage drawings attached as Appendix 4-3 of the EIAR. The key components of the drainage plan are as follows:

- The first method involves 'keeping clean water clean' by avoiding disturbance to natural drainage features, minimising any works in or around artificial drainage features, and diverting clean surface water flow around excavations, construction areas and temporary storage areas;
- The second method involves collecting any drainage waters from works areas within the Site that might carry silt or sediment, and nutrients, to route them towards stilling ponds prior to controlled diffuse release over vegetated surfaces. There will be no direct discharges to surface waters;
- During the construction phase all runoff from works areas (i.e. dirty water) will be attenuated and treated to a high quality prior to being released within the site at Greenfield rates;
- No runoff will be permitted to enter third party lands that neighbour or are downstream of the proposed wind farm site; and,
- The drainage plan will ensure there is no risk of increased downstream flooding as there will be no alteration of the existing hydrology of the local watercourses.

The drainage measures detailed in Chapter 9 of the submitted EIAR are tried and tested, best-practice mitigation measures for the protection of the hydrological (surface water) and hydrogeological (groundwater) environment. These mitigation measures are used at construction sites across the country and have been used in the construction of the countless existing wind farm developments.

All new river/stream crossings will require a Section 50 application (Arterial Drainage Act, 1945). The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent (refer to Section 9.5.2.9 for mitigation relating to watercourse crossing proposal).

Also, a site-specific Flood Risk Assessment was also completed for the project (refer to Appendix 9-1 of the EIAR). The Proposed Project has no interaction with OPW mapped fluvial flood zones.

5 UISCE ÉIREANN

Uisce Éireann reviewed the proposed mitigation measures with regard the Mid Galway Public Water Supply (PWS) abstraction and requested the additional measures listed below be conditioned should the development be approved. Please refer Section 9.5.2.1 of the EIAR for mitigation measures relating to the PWS and GWS.

It should be noted that Uisce Éireann did not note any specific shortfall in the proposed mitigation as presented in the EIAR. The list of recommended additional requirements outlined in the table below all relate to mitigation measures already proposed in the Chapter 9 of the EIAR.

In order to compare mitigation outlined in the EIAR to the additional UÉ requirements, we have prepared the following table to allow direct comparison:

UÉ Requirement	Existing mitigation outlined in commitments made in Section 9.5.2.1 of the EIAR
The refuelling for mobile plant and machinery, to be used in construction shall be located outside of the Source Protection Area as 'committed to in the EIAR. Uisce Eireann requires that refuelling take place in a dedicated and designated location. The applicant shall agree the location of the refuelling area with Uisce Eireann prior to commencement.	*"Refuelling of mobile plant (i.e. diggers, dumpers etc) will only be permitted outside the SPA".*
The EIAR notes that a geotextile liner will be placed below the founding layer (lean mix concrete) where concrete is to be poured to prevent vertical loss of wet concrete at turbine bases. Uisce Eireann requires that details of this geotextile shall be recorded and logged on the risk register.	*"A geotextile liner will be placed below the founding layer (lean mix concrete) where concrete is to be poured. These both prevent vertical loss of wet concrete at turbine bases".*
The EIAR notes that perimeter shuttering is to be used at turbine bases to prevent lateral loss of wet concrete. Uisce Eireann requires that a consultant hydrogeologist /engineering geologist shall be employed to monitor and supervise foundation works and in particular any grouting works.	*"Use of perimeter shuttering at turbine bases to prevent lateral loss of wet concrete".*
The EIAR notes that all temporary cement washout lagoons are proposed be located outside the Public Water Supply (PWS) Source Protection Area (SPA). The location of these lagoons, in hardstanding areas outside the PWS SPA, shall be designated and agreed with Uisce Eireann prior to commencement. The washout lagoons shall be lined and a consultant hydrogeologist / engineering geologist shall be employed to monitor and supervise the activities at these lagoons.	*"All temporary cement washout lagoons will be located outside the SPA".*
The EIAR notes that no wind farm drainage will be released inside the 50m watercourse buffer on the Lecarrow 30 Stream. Any runoff from hardstanding areas shall also be treated for settlement of suspended solids prior to discharge, Turbines T1 and T2 are located within the Source Protection Area for the Mid Galway Public Water Supply.	*"No wind farm drainage will be released inside the 50m watercourse buffer on the Lecarrow 30 Stream".*
Down-gradient Groundwater quality monitoring of T1 and T2 shall be undertaken prior to construction and during the construction phase of the project. The procedure for groundwater monitoring shall be generated by a consultant hydrogeologist, submitted to, and agreed with Uisce Eireann prior to commencement. A record of groundwater monitoring shall be submitted to Uisce Eireann at agreed intervals during the project	HES can confirm that this groundwater monitoring requirement requested by Uisce Éireann can be implemented during the construction phase.
The applicant/operator shall comply with the Water Framework Directive and River Basin Management Plan objectives to ensure that the development will not negatively impact on the water quality of source/receiving waters during both construction and operational phases.	A WFD Compliance Assessment Report was prepared for the Proposed Project (Appendix 9-4 of EIAR). The assessment shows that with implementation of the proposed mitigation measures, no significant effects on waterbody WFD status will occur.

As can be seen, other than minor additional requirements, the existing mitigation in the EIAR already largely address the UÉ requirements.

HES can confirm that all of the additional requirements requested by Uisce Éireann can be implemented during construction, operational and decommissioning phases of the proposed project (as relevant) should the development be approved.

6 INLAND FISHERIES IRELAND (IFI)

IFI provide a more general submission on the topic of surface water quality protection. The following key topics listed below, all of which are already addressed in the EIAR, are summarised from the IFI submission. No EIAR scoping response was received from the IFI, but many of matters raised in the IFI submission were previously observed in scoping responses from IFI relating to other wind farm developments and are also contained in their guideline document IFI (2016). As such and based on our own experience the matters raised by IFI are already addressed in the Cooloo Wind Farm EIAR.

The section of the EIAR that addresses each topic is cross-referenced as follows:

- Managing surface water drainage to prevent erosion and soil instability (refer to EIAR Sections 9.4.1, 9.5.2.3, 9.5.2.5 and Appendix 4-3 (drainage plan);
- Ensuring proper drainage and sediment control through settlement ponds and silt traps (Refer to EIAR Sections 9.4.1, 9.5.2.3 and Appendix 4-3 (drainage plan);
- Addressing waste disposal and runoff from stockpiled soils (refer to EIAR Sections 9.5.2.3 & 9.5.2.15);
- Containing pollutants like cement leachate and hydrocarbons (refer to EIAR Sections 9.5.2.6 and 9.5.2.8);
- Management of pumped water from excavations and appropriate use of silt fencing inside 50m hydrological buffer zones (refer to EIAR Section 9.5.2.5);
- Maintenance of natural surface water flowpaths and drainage patterns (refer to EIAR Section 9.5.2.3, 9.5.2.9 and 9.5.2.16);
- Tree felling and surface water quality effects (refer to EIAR Section 9.5.2.2);
- Avoiding sedimentary rocks like shale in road construction to prevent water pollution (refer to EIAR Section 9.5.3.2);
- Consulting IFI for watercourse crossings and minimizing their impact (refer to EIAR Section 9.5.2.9); and,
- Scheduling instream works for the period July 1–September 30) which is outside salmonid spawning seasons (refer to EIAR Section 9.5.2.9).

All of the IFI recommendations are already addressed in the EIAR and appropriate mitigation measures are proposed.

7 NATIONAL OFFICE FOR ENVIRONMENTAL HEALTH SERVICES (HSE)

Overall, the HSE submission was positive with regard the proposed project and determined the proposed mitigation measures would provide adequate protection of surface water and groundwater:

> **"The NEHS has considered Chapter 9 of the EIAR and the sections referenced based on the information provided in chapter 9 and particularly the surface water management plan detailed in appendix 4.5 Construction and Environmental Management Plan".**
>
> **"The NEHS would concur with the conclusions that there is adequate protection of surface and groundwater during construction and operation of the proposed development if all the mitigation identified is implemented in full. This would include drinking water sources identified in the EIAR".**

No response to HSE is required.

8 HYDRO G

We have split our responses to issues raised by Hydro-G into 9 items.

8.1 Hydro-G – Item 1

The following statement from page 9 of the Hydro-G submission is addressed below.

> **"No defensible assessment of groundwater flow systems has been submitted to An Coimisiún Pleanála regarding the groundwater system beneath the areas proposed for excessively abnormal loads, including all haul roads, crane pads, foundations and turbine masts. A Geotechnical Karst Risk Assessment (GDG, 2025) in "support of the application". However, that Geotechnical Karst Risk Assessment was completed by geologists and not hydrogeologist".**
>
> **"The Geotechnical Karst Risk Assessment (GDG, 2025), in "support of the application", fails to convey the connection between the widespread evidence of surface expression of karst on the proposed project's landscape with the known conduit system conveying large volumes of groundwater in the immediate vicinity of the PWS sources and two GWS sources".**

8.1.1 HES Response to Hydro-G Item 1:

As detailed in the Land, Soils and Geology Chapter (Chapter 8) and the Hydrology/Hydrogeology Chapter (Chapter 9) an array of ground investigations as well as drainage surveys, field mapping, karst feature mapping and follow up seasonal groundwater monitoring were carried out between 2022 and 2025 to assess the geological and hydrogeological setting (groundwater flow system) at the Proposed Wind Farm site ('the Site').

Also, it should be noted that the hydrological/hydrogeological impact assessment and assessment of potential effects on the Mid Galway Public Water Supply (PWS) and Barnaderg Group Water Scheme (GWS) was carried out by HES (Hydrogeologists) and not Gavin and Doherty Geosolutions (GDG) who are overseeing solely the peat stability and geotechnical aspects of the project.

Please note, the Barnaderg GWS source springs and borehole is located in close proximity to the Mid Galway PWS abstraction, and they share the same groundwater zone of contribution (ZoC).

The Geotechnical and Karst Risk Assessment carried out by GDG was only one element of the investigations/assessments that informed the potential hydrological/hydrogeological impact assessment with regard the Mid Galway PWS and Barnaderg GWS.

We provide a summary of the groundwater flow system assessment and highlight the key findings below.

8.1.2 Summary of Investigation Approach

A total of 26 no. trial pits were carried out across the Site. The borehole drilling investigations (2 no. monitoring wells were drilled) were targeted around the area where the Mid Galway PWS/Barnaderg GWS Source Protection Area (SPA) overlaps with the Site. Refer to Section 8.3.2 and Section 8.3.3 of the Land, Soils and Geology Chapter of the EIAR for detailed discussion of site investigation data and site investigation mapping and interpretation.

Investigation boreholes BH1 and BH2 were intentionally drilled in close proximity of proposed turbine locations T1 and T2 respectively in order to assess overburden and bedrock conditions (including aquifer/groundwater flow characteristics) at these Proposed Wind Farm locations.

Only these two turbines (T1 & T2) are located inside the GSI/EPA mapped Mid Galway PWS SPA/Barnaderg GWS SPA. Both boreholes were finished as groundwater monitoring wells to allow long-term seasonal water level monitoring to be completed at the Site. Groundwater

level monitoring was carried out between October 2022 and February 2025 to assess seasonal changes and variations in the groundwater levels (refer to Section 9.3.9.4 of the EIAR).

In addition, one rotary core borehole (GSI-17-003) from the GSI borehole database was previously drilled on the north of the Site, which also provides geological and hydrogeological information for the Proposed Wind Farm areas (refer to Section 8.3.3.2 of the EIAR for details on this borehole).

Also, geophysical surveys (2D Resistivity and seismic) were targeted in areas of the Site to assess bedrock conditions, particularly to assess the potential for bedrock karstification and the possible presence of potential dolines/enclosed depressions which are karst features. The total combined length of the 4 no. 2D Resistivity survey lines was 0.5km. (refer to Section 8.3.3.5 of the EIAR for details of the geophysical survey).

The geophysical survey report is attached to the Geotechnical Karst Risk Assessment report (EIAR Appendix 8-2).

Therefore, as outlined above an extensive array of site investigations and follow up monitoring and surveys was carried out to assess the hydrogeological setting (groundwater flow system) at the Site.

One of the main aims of the investigations was to assess potential pathways (extent of hydrological/ hydrogeological connectivity) between the Site and the Mid Galway PWS and Barnaderg GWS which are both located to the south of the Site.

8.1.3 Summary of Investigation Findings

LIMESTONE bedrock was encountered in all trial pits which terminated on rock. 10 of the 14 no. trial pits that terminated on bedrock encountered competent, unweathered, grey massive LIMESTONE.
While weathered and/or fractured LIMESTONE was only encountered in 4 of the 14 no. trial pits. No epikarst[1] weathering was reported in any of the trial pits that encountered bedrock.

Bedrock was also confirmed at 7 no. of the proposed 9 no. turbines (T1, T2, T3, T4, T5, T6 & T8), where the bedrock was typically observed as 'grey massive LIMESTONE' with no evidence of an epikarst layer on the top of bedrock (refer to Table 8-8 of the Land, Soils and Geology Chapter for bedrock conditions at turbine locations from trial pitting).

Both investigation boreholes (BH1 & BH2), located in the proximity of proposed turbine locations T1 and T2 on the south of the Site, encountered strong to very strong, dark grey, argillaceous (clay impurities) LIMESTONE with MUDSTONE layers.

Notably, a dark grey argillaceous LIMESTONE and calcareous MUDSTONE was also reported in the GSI exploration borehole (GSI-17-003) located on the far north of the Site.

What's notable about the known bedrock geology of the Site is that all investigation drilling data available to date (i.e. BH1, BH2 and GSI-17-003) encountered impure, argillaceous LIMESTONE with interbedded MUDSTONE layers. Impure, argillaceous limestone is typically much less prone to karstification. MUDSTONE is not prone to karstification.

The seasonal groundwater level variation/fluctuation at the borehole locations (BH1 & BH2) ranged between 0.91m (BH2) and 1.6m (BH1) which is a relatively small range of fluctuation/variation. The low seasonal groundwater level variation is typical of peatland/bog settings where groundwater flows/recharge is generally impeded, and groundwater levels are relatively consistent across all seasons. Groundwater level monitoring data is discussed in detail in Section 9.3.9.4 of the EIAR.

[1] *The epikarst is a heavily weathered layer of rock extending less than 10 m below the base of the soil/subsoil (D. Drew, 2018).*

Typically, groundwater levels in karst limestone bedrock are highly variable and flashy due to well-developed networks of conduits and fractures that allow for rapid groundwater flow, making water levels fluctuate significantly in response to rainfall and drought conditions.

This type of groundwater level response is not observed in BH1 or BH2 and is consistent with the bedrock type encountered at the Site (i.e. impure LIMESTONE/MUDSTONE). The presence of MUDSTONE layers in the bedrock is likely to significantly impede groundwater flowpaths through the aquifer. Hence, the overall poor land drainage characteristics of the Site.

The subdued groundwater level responses indicate that there is limited recharge/vertical groundwater flow from the overlying glacial deposits down into the underlying bedrock aquifer at the Site. This is also confirmed by the high stream density, man-made drainage density and indeed presence of raised bog at the Site. The presence of drainage features implies there is a need to drain surface water, as it cannot recharge/drain readily to the underlying bedrock aquifer underneath.

If there was significant underground drainage occurring because of deeper karstified bedrock (conduit systems), these observed conditions, and indeed the raised bog itself, would likely not even exist at the Site. All site investigation data indicate a poorly developed/localised groundwater flow system below the Site. This hydrogeological setting explains why a large proportion of the Site is covered by raised bog.

No GSI karst features are mapped within the Site, however several karst features ('enclosed depressions') are mapped by the GSI approximately 0.5km to the southeast of the Site, with a very high density of karst features mapped approximately 2km further to the southeast of the Site (refer to Figure 9-6 of the EIAR for GSI karst mapping).

As a direct comparison to the Site area, what's notable about the high density of GSI karst features mapped 2km to the southeast of the Site is that there is an overall lack of surface water drainage (watercourses) in that area. This indicates a well-developed underground karst drainage system (i.e. very high groundwater recharge rates) where all surface drainage goes to ground (rapid recharge). There is also an overall lack of peat bogs in that area due to the area being very well drained (refer to Figure 8-1 of the EIAR for GSI subsoils mapping).

Conversely, in the area of the Site there is extensive raised bog present, several watercourses, two wetland/lake waterbodies and numerous man-made drains draining the area of the Site, thereby strongly suggesting a poorly developed groundwater system which impedes recharge to the underlying aquifer. This is consistent with the geological/hydrogeological regime of the Site based on site walkover surveys and site investigation data (i.e. peat and poorly draining overburden over impure LIMESTONE/MUDSTONE bedrock with high groundwater levels).

During field surveys carried out by HES and GDG, several 'enclosed depressions' type features were mapped in the area of proposed turbine location T4 on the southeast of the Site. The features present as shallow, nearly flat depressions and are present within glacial deposits. The base of the depressions is underlain by several metres of glacial till as demonstrated by the trial pitting conducted in that area. A review of aerial photography (www.geohive.ie) as far back as 1995, indicate that none of the potential enclosed depressions/dolines have changed in size or appearance over the 30-year period. Refer to Section 9.3.9.3 for details of the karst surveys.

There is also no evidence of a swallow hole/sink hole function or any channelling/funnelling of surface water runoff to ground via the depression. The larger of the depressions were actually noted to hold surface water during wet periods and therefore they appear to not have a significant surface water drainage function at the Site.

A follow up geophysical surveying including 2D Resistivity (4 no. lines) and Seismic (1 no. line) was targeted in this area of proposed turbine location T4 to assess the potential for karstification at a number of observed shallow enclosed depression features (Refer to Figure 8-4 and Figure 8-8 of the EIAR for the geophysical survey locations).

All 4 no. 2D Resistivity survey lines interpreted competent, fresh unweathered LIMESTONE bedrock below the 'enclosed depressions'. No epikarst layer or deeper karstification was found to be present at the survey locations or underneath the enclosed depressions. The total length combined length of the 4 no. 2D Resistivity survey lines was 0.5km, and no evidence of karstification was identified over this significant distance.

The results of the geophysical survey are also consistent with the findings of trial pits TP01 and TP11 which were carried out at proposed turbine location T4 and access road. Both trial pits encountered grey to dark grey, competent, massive LIMESTONE. Refer to Table 8.8 of the Land, Soils and Geology Chapter for a summary of bedrock conditions at trial pit locations.

The geophysical surveys targeted in the area of turbine T4 and its access road, show that the ground surface depressions present in that area have not formed due to karstification in the underlying bedrock, but are a geomorphological feature of the overburden.

Also, the presence of peat/poorly draining soil along with high drainage density at the Site is further evidence of low recharge and poorly developed groundwater drainage system that would not be expected in highly karstified bedrock with conduit flow.

Therefore, all investigations/assessments and hydrological conditions at the Site do not suggest the presence of bedrock conduit system conveying large volumes of groundwater in the immediate vicinity Site towards the PWS and GWS sources. The hydrology of the Site is dominated by a surface water drainage regime.

What also needs to be considered when assessing the potential effects of the proposed project is that wind farms are typically near surface construction activities, where earthworks is largely limited to overburden removal and cease at competent strata (i.e. top of bedrock). We noted that competent massive limestone was observed at most trial pit locations that encountered bedrock.

The potential to intercept deep groundwater flow systems might be problematic if tunnelling or deep bedrock quarrying were part of the Proposed Project, however, all turbine base excavation works will typically cease when competent strata is encountered which is likely to be the top of bedrock. There are no borrow pits proposed for the Site.

Therefore, even if deep bedrock conduits were present (albeit there has been no evidence of this to date), they will not be intercepted by the Proposed Project.

8.2 Hydro-G – Item 2

The following statement from page 9 of the submission is addressed below.

> **"*Over 10,000m³/day of groundwater is abstracted for public consumption each day in the vicinity of the proposed development. The Source Protection Report for the Mid Galway PWS scheme (EPA, 2012) is presented as Appendix B to this report*** *[appendix to Hydo-G submission report]***. *Whilst the karst conduit system is well described in EPA (2012), and each of the GWSs are also documented and evaluated, An Coimisiún Pleanála is advised that the Mid Galway report did not have a focus on the actual application area's subterranean Karst systems. Therefore, the level of detail is not available for the applicant's proposed development area. EPA (2012) is provided as an example only of how much work and risk is involved in this hydrogeological setting. As stated, the applicant's agents approached the situation from a geotechnical rather than hydrogeological perspective*".**

8.2.1 HES Response to Hydro-G Item 2:

HES can confirm to ACP that the assessment presented in the EIAR clearly considers the hydrogeology of the area.

As stated above, the GSI/EPA (2012) SPA mapping for the Mid Galway PWS shows that the southeastern portion of the Site lies inside the SPA. This includes proposed turbine locations T1 and T2. Proposed turbine T4, positioned more northerly to the northeast, is located just outside the boundary of the mapped SPA.

To overcome the limitation of the EPA/GSI (EPA, 2012) reporting/mapping for the Site's application area, an array of focused site investigations (as summarised above) were carried out to assess the hydrogeological setting at these Proposed Wind Farm locations.

The investigations are summarised above and key points include:

- Bedrock conditions below the location of proposed turbine locations T1 and T2 comprise competent dark grey, impure, argillaceous LIMESTONE with MUDSTONE layers;
- No epi-karst, subterrain karst conduits, significant fractures or groundwater strikes were encountered due to the lithology competent nature of the bedrock;
- Any groundwater inflows recorded were slow, suggesting an overall low permeability LIMESTONE/MUDSTONE formation;
- Consistently high groundwater levels at the borehole locations with little fluctuations suggesting a poorly developed groundwater flow system;
- Similar argillaceous LIMESTONE with MUDSTONE was encountered on the north of the Site at GSI investigation hole GSI-17-003 suggesting similar geology across the Site; and,
- No epikarst layer or deeper subterrain karstification was found to be present at the geophysics survey locations carried out near proposed turbine T4 (surveys spanning a distance of 0.5km).

Therefore, the site-specific investigations carried out provided a sufficient level of information to inform the quantitative and qualitative impact assessment of the PWS and GWS with regard the proposed wind farm (refer to Section 9.5.2.1 of the EIAR). There was no single reliance on EPA or GSI mapping for the proposed wind farm impact assessment. The assessment was completed using the array of available data, including the site-specific investigation data.

8.3 Hydro-G – Item 3

The following statement from page 10 of the submission is addressed below.

> "***Turloughs are a groundwater feature. Turloughs are surface expressions of groundwater moving from the conduit groundwater flow system upwards, often in vertical shafts, to ground level in ephemeral lakes. The proposed construction area is between Horseleap Lough, Summervile Lough and Levally Lough. An underground conduit groundwater flow system connects these Loughs. This is documented in EPA (2012), which is Appendix B to this report*** [appendix to Hydo G submission report]***. Never have excessive and abnormally excessive loads been applied to the landscape of east Galway and there are no site testing data presented for the applicant in which the shear loading capacity is demonstrated for the lands proposed for haul roads or the 9 crane pads and 9 turbine pads suggested***".

8.3.1 HES Response to Hydro-G Item 3:

Firstly, it needs to be pointed out that Horseleap Lough and Summerville Lough are not mapped as turloughs by the GSI, neither does EPA (2012) refer to them as turloughs in the Mid Galway PWS source protection report. EPA (2012) refers to them as 'significant surface water features' on page 5 of the report.

Levally Lough, which is located 6km to the north of the Proposed Wind Farm site (north of the Grange River), is mapped in the GSI karst database as a turlough.

There are no GSI mapped tracer lines connecting these water features.

More to the point of the Hydro-G statement above, nowhere in the EPA (2012) report is it stated that there is an underground conduit system connecting the 3 lakes (Horseleap Lough, Summerville Lough and Levally Lough) and there is also no mention of Levally Lough in the EPA (2012) report.

Therefore, the above statement is completely unfounded, unsupported by fact, and incorrect.

8.4 Hydro-G Item 4:

The following statement from page 10 and 11 of the submission is addressed below.

> ***"Groundwater and Surface Water are connected in this karst system. Hence the concern regarding the applicant's agent's presentation that:***
>
> ***The topography of the Proposed Wind Farm site is undulating with gentle slopes typical of a low-lying raised bog setting with surrounding local hills. The elevation of the Proposed Wind Farm site ranges from approximately 65m OD (metres above Ordnance Datum) to 80m OD, with slopes falling to the north and southeast from a high point located centrally with the Proposed Wind Farm site which also coincides with a surface water catchment topographic divide between the Grange River to the north and the Abbert River to the south". & "The Proposed Wind Farm site is drained by several 1st order watercourses that emerge from the peatland areas. There is also a high density of man-made drainage associated with the peatland and grassland areas. The man-made drainage density is evident on the OSI 6", 25" mapping and aerial imagery" (Appendix 9-1 Flood Risk Assessment, EIAR 2025 Cooloo Wind Farm).***
>
> ***The potential for organic matter release from the bogs, during all phases of the project, to the drainage system has potential to react with the chlorination systems of the Water Treatment plants (WTPs) and has potential to create Trihalomethanes".***

8.4.1 HES Response to Hydro-G Item 4:

Regarding, the point made that '*groundwater and surface water are connected in this karst system'*. Indeed, in well-developed karst areas where swallow holes, dolines and losing streams are prevalent, there is a strong surface water / groundwater connection. However, no such strong groundwater / surface water interaction is evident at the proposed wind farm site. The hydrology of the Site is dominated by surface water flows.

The large coverage of peat bogs, poorly draining soil/subsoil, high drainage density and consistently high groundwater levels (*i.e.* shallow and close to ground level) within the site would indicates a poorly developed underlying groundwater drainage system.

As pointed out previously in this submission response (last para pg 7, in Section 8.1.3), a very high density of karst features is present approximately 2km further to the southeast of the Site, with the same area displaying an obvious lack of surface water drainage (streams/watercourses) as well as absent peat bog coverage (opposite conditions to those present at the Site). This indicates a well-developed underground karst drainage system (*i.e.* very high groundwater recharge rates and strong surface water / groundwater connection) where all drainage occurs underground. Please note, surface waters leaving the proposed wind farm site does not drain towards the southeast into this high-density karst area. These baseline drainage patterns are explained in Section 9.3.4.1 of the EIAR.

It is important to reiterate that the low groundwater recharge rates and high groundwater levels at the Proposed Wind Farm site are consistent with the expected low permeability and competent nature of the impure, argillaceous LIMESTONE/MUDSTONE encountered during

drilling at all 3 no. locations within the Site (BH1, BH2 and GSI-17-003). The Site's hydrology is therefore characterised by high surface water runoff rates and low groundwater recharge rates.

As assessed in Section 9.5.2.1 of the EIAR, the dominant drainage pathway from the Site to the Mid Galway PWS abstraction point is via surface water flows in the Lecarrow Stream. There are 2 no. proposed turbines (T1 and T2) located within that stream catchment. The Mid-Galway PWS abstraction point is from the Lecarrow Stream approximately 2km downstream of Horseleap Lough (3km downstream of the proposed Wind Farm site itself).

Most of the Proposed Wind Farm site (including 7 no. of the proposed 9 turbines) drains to the north towards the Grange River and therefore are not upstream of the Mid Galway PWS abstraction point from the Lecarrow Stream. Neither are they upstream of the Barnaderg GWS abstraction location (which is purely a groundwater abstraction). The closet downstream abstraction point in the Grange River is at Lough Corrib, which is ~40km away.

Therefore, the potential for Trihalomethanes effects on Mid Galway PWS/Barnaderg GWS due to organic carbon/matter in surface water drainage from the proposed wind farm is very limited for these reasons.

As described in Section 9.5.2.1 of the EIAR, another important factor mitigating potential organic carbon/Trihalomethanes water quality effects on the Mid Galway PWS in particular is that on leaving the Site, surface water flow in the Lecarrow stream must pass through Horseleap Lough before reaching the Mid Galway PWS abstraction point further downstream.

Horseleap Lough is therefore effectively a large natural wetland which will have significant attenuation/retention capacity, offering natural dilution and also removal of organic carbon/matter from any wind farm drainage prior to flows reaching the Mid Galway PWS abstraction point further downstream.

We note that there is no concern raised by UÉ in their submission with respect to organic carbon/Trihalomethanes.

8.5 Hydro-G Item 5:

The following statement from page 10 of the submission is addressed below.

> ***"Whilst the agents cite a 2012 Source Protection Zone report for the Mid Galway Scheme, the GSI and the EPA (2012) state very clearly that "Source Protection Zones are a land use planning tool which enables a more objective, geoscientific assessment of the risk to groundwater quality to be made". The emphasis is on quality: A source Protection Zone is defined by a 100-day time of travel to the source and is designed to protect the source from microbial and viral contamination (DELG/EPA/GSI 1999). It is wholly inappropriate for wind farm applications to attempt to portray that their proposed development area does not wholly overlap a Source Protection Zone for a PWS or a GWs. Some of the Turbines proposed do overlap the mapped Source Protection Zone. However, ALL of the turbines proposed overlap the groundwater system feeding the Mid Galway and Barnaderg Gortbeg GWS sources. The connectivity to Brierfield GWS is also an issue".***

8.5.1 HES Response to Hydro-G Item 5:

Firstly, it is important to point out to ACP that the presence of proposed development within mapped SPAs/ZOCs for existing water supplies does not preclude development. Source Protection Area/Zone of Contribution mapping are intended to be a planning tool that "*aims to maintain the quantity and quality of groundwater, and in some cases improve it, by applying a risk assessment-based approach to groundwater protection and sustainable development*", (DOELG/EPA/GSI, 1999).

As is required by the Groundwater Protection Scheme guideline document (DOELG/EPA/GSI, 1999), we have completed site-specific investigations to further characterise the geological and hydrogeological baseline conditions at T1 and T2, and arising from the site-specific data we have recommended appropriate mitigation for the construction and operational phase of the development to ensure protection of the water supply sources. In other words, we have identified the risks, we have completed further investigations and based on the accumulated knowledge with have mitigated the identified risks.

Furthermore, in response to the above paragraph there are several important facts to reiterate here.

- Nowhere in the EPA (2012) Source Protection Zone report for the Mid Galway PWS does it state that the area of the Proposed Wind Farm outside the EPA mapped source protection area (*i.e.* area of the Site including proposed turbine locations T3 to T9 (refer to Figure 9-12 of the EIAR) is also potentially within the groundwater zone of contribution to the Mid Galway PWS source.
- In a karst environment the 100-day time of travel distance is normally applied to the entire groundwater catchment / zone of contribution to the source, which is what was done for the Mid Galway PWS. Typically, in non karst areas, the 100-day time of travel defines the inner protection zone (SI) only and not the outer protection zone (SO). In karst areas the entire zone of contribution is mapped as the inner protection zone.
- If the authors of the EPA (2012) report thought that the area where the entirely of the wind farm is located is inside the groundwater catchment to the PWS source, the zone of contribution mapping would reflect that (i.e. it would be bigger).
- The estimated groundwater zone of contribution for Mid Galway PWS is shown on Figure 18 of the EPA (2012) source protection report as well as Figure 9-12 of the EIAR, and it does not show the entirety of the proposed wind farm site within the zone of contribution, only proposed turbine locations T1 and T2.
- The hydrological boundaries of the Mid Galway GWS source protection area are described in Section 9.2 of the EPA (2012) report. These are the boundary assumptions that are used to delineate the groundwater zone of contribution.
- The hydrological boundary of the source protection area that intercepts the southern portion of the Proposed Wind Farm site (referred to as the northwestern boundary by EPA 2012) is a topographic groundwater divide boundary and not a boundary defined by the 100-day time of travel to the source (i.e. the inner protection zone boundary).
- The boundary is defined by the topographic divide between the Grange River to the north and the Abbert River to the south, which is also assumed to be a groundwater divide, hence the 100-day time of travel does not apply as the boundary is the full mapped extent of the groundwater zone of contribution.
- As the wastewater systems used during the construction phase of the Proposed Wind Farm are enclosed (with no discharge to ground or surface water (wastewater is tankered offsite to a wastewater treatment plant) such developments do not generate microbial and viral contamination.

Therefore, the statement that ***"ALL of the turbines proposed overlap the groundwater system feeding the Mid Galway and Barnaderg Gortbeg GWS sources"*** is clearly incorrect.

[Please note, EPA (2012) refers to the Barnaderg GWS, and others refer to it as the Barnaderg Gortbeg GWS, i.e. Barnaderg GWS and Barnaderg Gortbeg GWS are the same scheme].

The Brierfield GWS abstraction point is located centrally within the Mid Galway PWS and Barnaderg GWS SPA and therefore their groundwater zones of contribution overlap. The Brierfield GWS has no EPA/GSI mapped groundwater zone of contribution or source protection

area itself. The location of the Brierfield GWS abstraction from Pollifrin Spring can be seen on Figure 6 of EPA (2012).

The Brierfield GWS abstraction (Pollifrin Spring) is located approximately 2km further away from the Proposed Wind Farm site than the Mid Galway and Barnaderg abstractions.

Albeit, the Brierfield GWS was not directly assessed in the EIAR, a conservative assumption would be to assume that the Brierfield GWS groundwater zone of contribution is a subset of the Mid Galway PWS and Barnaderg GWS SPA. It is likely to be a much smaller area due to lower abstraction rates. The demand of the Brierfield GWS is relatively small, 90 m^3/day.

Therefore, the findings of the qualitative and quantitative impact assessment for the Mid Galway PWS and Barnaderg GWS (Section 9.5.2.1 of the EIAR) can be directly applied as an impact assessment for the Brierfield GWS.

A summary of the qualitative and quantitative impact assessment is also provided in Section 8.6.1 below.

As such, and similar to the assessment completed for the Mid Galway PWS and Barnaderg GWS (refer to Section 9.5.2.1 of the EIAR), it can be concluded that with the implementation of the proposed mitigation measures no significant effects will occur on the quantity or quality of water available for use at the Brierfield GWS.

8.6 Hydro-G Item 6:

The following statement from page 10 of the submission is addressed below.

> ***"In this conduit karst groundwater setting the potential for collapse of surface karst into subterranean karst is high when the scale of the abnormal and excessively abnormal loads are considered. The issue here is that all groundwater in this GWB has potential to flow to the Mid Galway PWS, Barnaderg Gortberg GWS and Briarfield GWS. Even groundwater outside the 100-day time of travel Source Protection Zone, that was mapped by the EPA and GSI (2012) for microbial and viral contamination, can travel to the sources for the Mid Galway PWS, Barnaderg Gortberg GWS and Briarfield GWS. Therefore, the issue of QUANTITATIVE IMPACT is more relevant, and this has not been adequately assessed in the context of interruption of the PWS in either the Water Chapter or the Geotechnical Risk Assessment".***

8.6.1 HES Response to Hydro-G Item 6:

Firstly, the statement that ***"all groundwater in this GWB*** [Clare-Corrib GWB] ***has potential to flow to the Mid Galway PWS, Barnaderg, Gortberg GWS and Brierfield GWS"*** is incorrect.

The Clare-Corrib Groundwater Body (GWB) is very large, 1,338km^2 in area, it extends into three counties (namely Galway, Roscommon, and Mayo) and includes major towns such as Tuam, Claregalway and Ballyhaunis as well as the outskirts of Galway City. The regional groundwater direction in the GWB is towards Lough Corrib which is the focal point of groundwater and surface water collection/drainage.

It is hydraulically impossible (due to topography, main drainage rivers, and the sheer expanse of the GWB) that all the Clare-Corrib Groundwater Body supplies groundwater to the Mid-Galway PWS, Barnaderg GWS or Briarfield GWS.

The statement ***"even groundwater outside the 100-day time of travel Source Protection Zone, that was mapped by the EPA and GSI (2012) for microbial and viral contamination, can travel to the sources for the Mid Galway PWS, Barnaderg Gortberg GWS and Briarfield GWS"*** is also incorrect and shows a lack of understanding of the correct application of the 100-day time of travel in a karst environment. This statement is addressed in the previous response above with regard its application within the groundwater zone contribution.

With regard the adequacy of the impact assessment, both a **qualitative** and **quantitative** impact assessment was carried out in Section 9.5.2.1 of the EIAR Hydrology/hydrogeology chapter with regard potential effects on Mid Galway PWS and Barnaderg GWS.As stated above the impact assessment findings of the Mid Galway PWS and Barnaderg GWS assessment can be applied to the Brierfield GWS.

A summary of the **quantitative** impact assessment findings is as follows:

- Boreholes at proposed turbines T1 and T2 both encountered competent dark grey, impure LIMESTONE with MUDSTONE layers;
- No epi-karst, karst conduits, significant fractures or groundwater strikes were encountered due to the lithology competent nature of the bedrock;
- Investigations indicate limited recharge/vertical groundwater flow from the glacial deposits down into the underlying bedrock aquifer at the Proposed Wind Farm site within the source protection area;
- Therefore, due to the nature of the underlying geology (LIMESTONE/MUDSTONE formation) and the prevailing surface water drainage regime within the portion of the Proposed Wind Farm site within the SPA, no effects on groundwater flowpaths towards the Mid Galway PWS or Barnaderg GWS sources are likely to occur due to excavations which will typically terminate at the top of bedrock (*i.e.* there will be no requirement for excavations that extend deep into bedrock).

A summary of the **qualitative** impact assessment findings are as follows:

- Intercepting/unearthing a bedrock conduit/fracture during the construction works would potentially create a direct pathway between the construction work area (i.e. turbine base) and the source for potential water quality effects;
- However, the prevailing geology/hydrogeology described above as well as the relatively shallow excavations makes this very unlikely;
- Investigations and groundwater level monitoring data indicates that the majority of the recharge water in the glacial tills actually discharges to drains and the Lecarrow Stream that drains the area of the proposed wind farm site within the Mid Galway PWS source protection area;
- Therefore, the most likely pathway from the proposed wind farm site to the Mid Galway PWS abstraction point is surface water flows in the Lecarrow Stream;
- However, flow in the Lecarrow Stream leaving the Site must pass through Horseleap Lough before reaching the downstream abstraction location;
- Horseleap Lough is effectively a large natural wetland which will have significant attenuation/treatment capacity. Therefore, even in the absence of any wind farm surface water drainage control mitigation (which won't be the case), surface water quality effects downstream of Horseleap Lough in the Lecarrow Stream are not likely.

In addition, a range of mitigation measures are proposed in Section 9.5.2.1 of the EIAR for dealing with potential water quality effects. For ease of reference these measures are listed again below:

- *No storage of fuels, oils, cements, or chemicals will be permitted within the SPA*
- *Refuelling of mobile plant (i.e. diggers, dumpers etc) will only be permitted outside the SPA;*
- *Refuelling of large immobile plant (i.e. cranes) will only be carried out with a refuelling truck that will be removed from SPA immediately after use;*

- *Spill kit stations will be present at each turbine location (T1 & T2), temporary construction compound and along the Proposed Grid Connection cable route works areas;*
- *There are no proposed peat or spoil repositories within the SPA as part of design mitigation;*
- *A geotextile liner will be placed below the founding layer (lean mix concrete) where concrete is to be poured. These both prevent vertical loss of wet concrete at turbine bases;*
- *Use of perimeter shuttering at turbine basis to prevent lateral loss of wet concrete;*
- *All temporary cement washout lagoons will be located outside the SPA;*
- *Works inside the Lecarrow Stream 50m watercourse buffer limited to 1 no. proposed watercourse crossing culvert which will be clear spanning;*
- *No wind farm drainage will be released inside the 50m watercourse buffer on the Lecarrow 30 Stream;*
- *No wind farm drainage will be released inside the 30m buffer for the 1 no. potential enclosed depression/doline mapped inside the SPA at the Proposed Wind Farm site*
- *Drainage control measures at works areas along the Proposed Grid Connection; and,*
- *There will be clear signage in place inside the refined SPA to remind construction workers that the area is inside a drinking water protection area.*

In summary, the statements outlined above are incorrect. The impact assessment included in the EIAR (at Section 9.5.2.1) includes **qualitative** and **quantitative** assessments with regard potential effects on Mid Galway PWS and Barnaderg GWS. And robust and appropriate mitigation are outlined in the EIAR to protect against potential water quality effects.

8.7 Hydro-G Item 7:

The following statements from page 10 of the submission is addressed below.

> ***"There are many issues with the Mitigation Measures Proposed. However, most significantly, there is no Mitigation Measure proposed in relation to the potential for Human Health Impact on the people who receive groundwater and groundwater-fed Surface Water from the three local PWS and GWS sources in the immediate vicinity of the proposed development area. As previously outlined by Hydro-G and as published by the GSI in their description of the groundwater flow mechanism in the Clare Corrib GWB. Relative to the PWS and GWS abstraction source locations, the proposed haul roads, construction pads, crane pads and turbine erection sites are within the 9km published groundwater flow path length (GSI, 2004). There are no Mitigation Measures proposed for true risks to the source waters for public and GWS supply relating to issues, as follows:***
>
> - ***Increased turbidity in the karst conduit or surface water system. Increased turbidity has the potential to affect the disinfection process in the WTPs and thereby compromises the sterility and safety of the water supplied to the public. There is no information presented by the applicant for baseline turbidity in surface waters or groundwaters of the area.***
> - ***Increased Dissolved Organic Carbon in groundwater or surface waters. Construction in peatlands has the potential to exacerbate release of Dissolved Organic Carbon and this constituent is a driver on increased Trihalomethane formation potential in water supplied to the public after the statutory obligation of chlorination prior to discharge to the water mains. No silt buster will remove Dissolved Organic Carbon in waters discharging from***

the site. There is no information presented by the applicant for baseline Dissolved Organic Carbon in surface waters or groundwaters of the area.

- ***There is no information presented by the applicant for baseline lubricants and oils that will be in each hub and supplemented in the lifetime of the development, no information on hydrocarbon baseline, no details for the baseline surface water and groundwater constituents relatable to the proposed surface finishes of the coated turbines or those constituents that will be used in the cleaning of the turbine infrastructure".***

8.7.1 HES Response to Hydro-G Item 7:

A Human Health assessment and associated mitigation (cross references) is included at Section 9.5.6 of the EIAR. It concludes:

> "*Potential health effects arise mainly through the potential for surface and groundwater contamination which can have negative effects on public and private water supplies. A portion of the Proposed Project site is located inside the Mid Galway PWS and Barnaderg GWS SPA, but investigations have been carried out to assess the risk (see Section 9.5.2.1* [of the EIAR]*) posed by the Proposed Project. Notwithstanding this, the Proposed Project design and mitigation measures ensures that the potential for effects on the water environment will not be significant.*"

Secondly, Uisce Éireann reviewed the proposed mitigation measures (refer to Section 5 of this response) and no short fall in the proposed mitigation as presented in the EIAR were raised.

We note that there is no concern raised by UÉ with respect to organic carbon in their submission.

8.7.2 HES Response to Bullet Point 1:

The findings of investigations with regard groundwater flow system below the Proposed Wind Farm site have been discussed in Section 8.1.3 above in this submission report. The key finding is that the bedrock lithology below the Site is a combination of impure LIMESTONE with MUDSTONE which will reduce the overall permeability of the aquifer and its recharge capacity. The site investigations carried out to date at the Site (i.e. trial pits, borehole drilling and geophysical surveys) did not reveal any evidence of significant underlying karstification.

Therefore, all investigations/assessments and hydrological conditions at the Site do not suggest the presence of bedrock conduit system conveying large volumes of groundwater in the immediate vicinity of the PWS sources and two GWS sources. The hydrology of the Site is dominated by a surface water drainage regime. Therefore, no significant groundwater quality effects are expected, with surface water potential being the primary receptor due to the high runoff rates.

With regard potential surface water quality effects, the mitigation measures detailed in Chapter 9 of the submitted EIAR are tried and tested, best-practice mitigation measures for the protection of the hydrological (surface water) and hydrogeological (groundwater) environment.

8.7.3 HES Response Bullet Point 2:

Organic carbon causing Trihalomethane contamination is dealt with above in this submission response (Section 8.4.1 above). Due to poor groundwater recharge coefficients at the proposed wind farm site, the likely potential pathway for organic carbon reaching the Mid Galway PWS abstraction point is surface water flows in the Lecarrow Stream from where the water is abstracted from. Barnaderg GWS is solely and groundwater abstraction and therefore cannot be affects by organic matter in surface water.

We have already discussed above the presence of Horseleap Lough as a large natural wetland which will have significant attenuation/retention capacity, offering natural dilution

and treatment (organic carbon removal) of wind farm drainage prior to flows reaching the Mid Galway PWS abstraction point further downstream on the Lecarrow Stream.

8.7.4 HES Response to Bullet Point 3:

Oils and lubricants are common potential hazards at all construction sites (such as road works and industrial sites). These potential contamination sources will be carefully managed at the Site during the construction; operational and decommissioning phases of the Proposed Wind Farm and mitigation measures are proposed below to deal with these common hazards. Please note that total hydrocarbons were part of the baseline groundwater quality monitoring suite carried out for the EIAR (refer to Appendix 9-2 of the EIAR for groundwater quality monitoring data).

8.8 Hydro-G Item 8:

The following statements from page 10 of the submission is addressed below.

> **"As is shown in the DWGS** [drainage drawings] **for the application, there will be extensive areas of Spoil Management and water management treatment systems adjacent to each of the proposed 9 turbines, the proposed substation construction site and along all trench excavation routes. All water management will be by infiltration into the epikarst of the underlying Clare Corrib Groundwater Body and the Regionally Important Karst aquifer feeding Lough Corrib and multiple GWS BHs: refer to Drainage Drawings and BH Logs".**

8.8.1 HES Response to Hydro-G Item 8:

Firstly, we refer back to previous responses above, the hydrology of the Site is dominated by a surface water drainage regime with low groundwater recharge rates. Secondly, no epikarst system was observed at the Site.

The excess peat/spoil proposed for permanent storage will be placed on virgin ground and therefore storage areas will be underlain by several metres of poorly draining soils/subsoils with low infiltration capacity/rates.

Attenuated discharge/runoff from proposed peat/spoil areas will be released onto the naturally vegetated ground surface via buffered outfalls. The water management treatment system design does not include infiltration drains, french drains or soakaways and therefore water management will not be by infiltration into groundwater.

It also should be noted that all proposed peat/spoil storage areas are located outside the Mid Galway PWS/Barnaderg source protection area. There are also no proposed peat/spoil storage areas located inside the Lecarrow Stream catchment from where the Mid Galway PWS abstraction occurs (3km downstream of the wind farm site).

8.9 Hydro-G Item 9:

The following statements from page 10 of the submission is addressed below.

> **"Moreover, streams are the headwaters of the Clare River and hence supply sources for the Corrib SAC. All tributary streams to the Corrib are salmonid. Hence a windfarm in the headwaters of the catchment represents a risk to that water supply and ecology, especially in quality, notwithstanding the same tributaries are ancillary to an arterial drainage scheme. However, under Nature Restoration, such arterial drainage is itself under review for rehabilitation to more natural conditions (OPW) – building turbines should not be allowed to impede this restoration. The generic drainage system depicted in the report for draining roads and hardstands is unlikely to work since the low permeability soils will accelerate this drainage into the existing network – soil infiltration is likely to be poor, but no field assessment was made. Moreover, the proposed system with 'silt traps' is unlikely to work in detaining colloidal solids which, themselves carry Dissolved Organic Carbon (DOC) arising from the extensive excavations/roads on site, as well as from windfarm enhanced**

drainage from the peatbogs. Such losses conflict with the role of wind farms as climate mitigation devices"

8.9.1 HES Response to Hydro-G Item 9:

The proposed drainage measures for the Proposed Wind Farm are used at construction sites across the country and have been used in the construction of the countless existing wind farm developments. It is noted that similar mitigation measures for the protection of the receiving water environment were proposed in the EIARs for the recently permitted Glenard Wind Farm (ABP Case No: 312659) and the permitted Seven Hills Wind Farm (ABP Case No. 313750).

The drainage design, which is site specific, is based on recommendations from Inland Fisheries Ireland (IFI) relating to other recent wind farm projects (i.e. Cahermurphy Wind Farm, Co. Clare - Planning Ref P20/658).

The site-specific drainage design was created by dividing the footprint has been into drainage catchments (based on topography, outfall locations, and catchment size) and stormwater runoff rates based on the 10-year return period rainfall event were calculated for various catchment areas in order to size the settlement ponds to achieve Greenfield discharge rates.

Lidar DTM data is used to tailor the design with regard catchment areas and drainage flow paths. Therefore, to call the design **'generic'** shows a lack of understanding of the design (Refer Appendix 4-3 of the EIAR for the drainage layout).

The statement **'soil infiltration is likely to be poor but no field assessment was made'** is a direct contraction to the statement referenced on page 16 above where it states, ***'all water management will be by infiltration into the epikarst'.***

The criticism '**but no field assessment was made'** on filtration rates has no relevance as the Proposed Wind Farm drainage design does not propose infiltration as a water disposal solution. Nonetheless, the observed drainage conditions at the Site would indeed indicate low infiltration rates.

The next statement above **'draining roads and hardstands is unlikely to work since the low permeability soils will accelerate this drainage into the existing network'** is perplexing coming from Hydro-G which is a company with a water engineering background. The purpose of the drainage design is to slow down runoff from low permeability hardstand surface and release at Greenfield runoff rates.

Finally, the proposed system does not have just **'silt traps'** but a treatment train of water quality improvement/control systems (i.e. source controls → check dams → silt traps → settlement ponds → level spreaders → silt fences → vegetation filters → watercourse buffer zones) which will all contribute to the reduction of suspended and colloidal solids.

8.10 Summary statement on the Hydro-G submission

- As outlined the Hydro-G submission includes several statements that are misleading and factually incorrect;
- The incorrect statements create uncertainty, may lead to confusion, and undermine the factual and science-based assessment presented in the EIAR; and,
- This section of the submission respectfully seeks to clarify or address statements made in this 3rd party submission that could be misleading, and/or where they are factually and/or scientifically incorrect.

9 NORTH-EAST GALWAY ENVIRONMENTAL PROTECTION (NEGEPC)

We have split our responses to issues raised in the NEGEPC submission into 3 items.

9.1 NEGEPC Item 1:

The following statement from page 3 of the submission is addressed below.

> ***"The location of two proposed wind turbine foundations within the Source Protection Area (SPA) of the Mid-Galway Public Water Supply (PWS) poses an extreme contamination risk due to the underlying karst limestone hydrogeology, which facilitates the rapid, unfiltered transport of pollutants such and hydrocarbons directly to the abstraction point. The construction activity, particularly excavation and dewatering, directly impacts a primary groundwater recharge zone, requiring stringent protective measures to adhere to the Water Supplies Act, 1942. This zone is also legally protected by the Water Framework Directive (WFD), which mandates a commitment of no deterioration to water body status"***

9.1.1 HES Response to NEGEPC Item 1:

The investigations and impact assessment with regard the Mid-Galway Public Water Supply (PWS) have been addressed in the Hydro-G response above. In particular refer to Section 8.2.1 above, which summaries the investigation findings in the area of the two proposed turbine (T1 & T2) within the SPA (source protection area).

9.2 NEGEPC Item 2:

The following statement from page 3 of the submission is addressed below.

> ***"The Karst Risk Assessment limited its scope to only geotechnical risk and the Hydrology chapter must address the hydrogeological risks to water. While the Hydrology chapter concludes that with mitigation, there will be no significant effect, the KRA's findings of "High Karst Hazard" at T4 (within) inherently increase the risk of contamination entering the groundwater system, making the Hydrology Chapter's "no significant effect" conclusion more difficult to substantiate beyond reasonable doubt".***

9.2.1 HES Response to NEGEPC Item 2:

The assessment of no significant effects and in particular relating to hydrogeological effects, does not relying on mitigation alone to come to this conclusion, but in fact the geological and hydrogeological setting of the proposed wind farm site as determined by an array of site investigations which are described above in this submission. This also applies to the assessment of effects relating to Mid Galway PWS and Barnaderg GWS.

What's notable about the known bedrock geology of the Site is that all investigation drilling data available to date (i.e. BH1, BH2 and GSI-17-003) encountered impure argillaceous LIMESTONE (i.e. clay impurities) with MUDSTONE layers. Impure limestone is typically less prone to karstification. MUDSTONE is not prone to karstification.

The majority of the trial pits that met bedrock encountered competent, unweathered, grey, massive LIMESTONE. No epi-karst weathering was encountered in any of the trial pits that encountered limestone. Also, targeted geophysical surveys in the area of proposed turbine T4 did not reveal any evidence of underlying karstification.

The large coverage of peat bogs, poorly draining soil/subsoil and high drainage density within the Proposed Wind Farm site would also suggest a poorly developed groundwater drainage network. Hence the presence of several surface watercourse at the Proposed Wind Farm site due to low groundwater recharge rates.

The presence of drainage features implies there is a need to drain surface water, as it cannot recharge/drain readily to the underlying bedrock aquifer underneath.

9.3 NEGEPC Item 3:

The following statement from page 6 and 7 of the submission is addressed below.

> ***"Hydrology and Hydrogeology (e.g., Chapter 9): Accurate precipitation data is essential for determining existing flood risk, calculating runoff volumes for drainage design, and modelling potential impacts on local watercourses. Inaccurate or distant rainfall measurements directly lead to questionable hydrological models and potentially inadequate mitigation measures for construction-phase runoff".***
>
> ***In summary, the use of remote meteorological data violates the principle of site-specificity required for a robust EIA. The conclusions drawn in any chapter dependent on weather including, but not limited to, Ecology, Hydrology, and Noise–must therefore be treated with caution, as the underlying environmental parameters are based on surrogate data that is too distant to be scientifically representative of the Proposed Development site"***

9.3.1 HES Response to NEGEPC Item 3:

Accurate and relevant climate data was used in the EIAR. Met Eireann do not record data at every location and therefore point data (such as that from Dunmore Garda Station or Claremorris Synoptic Station are what is available (refer to Section 9.3.2 of the EIAR)).

In additional to point data, average long-term data are also used. This is also explained in Section 9.3.2 of the EIAR. Climate change implications for rainfall data are also detailed in Section 9.3.2 of the EIAR.

The application of long-term average rainfall data for general baseline assessment and extreme whether event data for drainage design purposes is explained in Section 9.3.5 of the EIAR.

> *"The rainfall depths used in this water balance* [Section 9.3.5 of the EIAR]*, which are long term averages, are not used in the design of the sustainable drainage system for the Proposed Wind Farm site. The Proposed Wind Farm Site drainage design is based on the 10-year return period rainfall event as described further in Sections 9.4.1 and 9.5.2.3 below".*

The 10-year return period event is a recommendation from Inland Fisheries Ireland (IFI) relating to other recent wind farm projects (i.e. Cahermurphy Wind Farm, Co. Clare - Planning Ref P20/658).

The application and use of the available climate data as outlined in the EIAR is appropriate and in line with best practice guidelines and industry standards.

10 3RD PARTY SUBMISSIONS – GENERAL RESPONSES

This section presents our responses to recurring themes included in the various 3rd party submissions relating to the water, land, soils and geological environment. Some of these themes/matters have previously been dealt with in the detailed responses provided above (we cross reference to relevant paragraphs for ease of reading).

- Effects on local group water scheme supplies (Sections 8 & 9);
- Surface water and groundwater quality affects (Section 8);
- Potential effects on local private wells;
- Potential impacts on Lough Corrib SAC; and,
- Potential Increased flood risk (Section 4).

10.1 Effects on local group water scheme supplies

The following statement is recurring in many of the third-party submission letters:

> ***"I use the water from Barnaderg Gortbeg Group Water Scheme as my main source of drinking water for my household. The water is of excellent quality, and I am very concerned that pollution of various types such as silt, sediment and other contaminants will enter the water source, causing me and my family harm. With the location of two Turbines within the Source Protection Area (SPA) I believe the Cooloo Windfarm should not be granted permission whatsoever, especially in such a highly karstified and hydrologically sensitive area".***

The investigations and impact assessment with regard the Mid-Galway Public Water Supply (PWS) have been addressed in the Hydro-G response. In particular refer to page 9 which summaries the investigation findings in the area of the two proposed turbine (T1 & T2) within the SPA.

As stated previously above, the impact assessment included in the EIAR (at Section 9.5.2.1) included **qualitative** and **quantitative** assessments with regard potential effects on the Barnaderg GWS (i.e. no significant effects on Barnaderg GWS).

10.2 Surface Water and Groundwater Quality Effects

The mitigation measures prescribed in the EIAR for the protection of the hydrological/hydrogeological environment are proven, tried and tested, best in class mitigation measures which will ensure that the Proposed Project has no potential for significant effects on the receiving water environment.

The Proposed Project drainage system will ensure that there is no discharge of untreated or unattenuated waters. The EIAR also prescribes best practice mitigation measures in relation to hydrocarbons, cement-based products and wastewater. With the implementation of the prescribed mitigation measures, there will be no potential for significant effects on the hydrological/hydrogeological environment.

10.3 Effects on Local Private Wells

Potential effects on local private wells are assessed in Section 9.5.2.4 of the EIAR.

For the reasons provided in Section 9.5.2.4 (repeated below for ease off reference), we are satisfied that the Proposed Project site will not impact in any significant way on any potential down-gradient private wells.

Also, similar to the assessment of groundwater level effects, the assessment on private wells is supported by extensive site investigations and follow-up groundwater level monitoring:

- *The large set back distances between turbine locations and downstream potential well locations (720m);*
- *The proposed project will involve relatively shallow excavations (3 – 3.5mbgl) as no borrow pit is proposed;*
- *The moderate - low permeability of the glacial deposits in which the turbine gravity base foundations will be constructed;*
- *The low recharge characteristics of the underlying LIMESTONE/MUDSTONE aquifer that underlies the Proposed Wind Farm site;*
- *Localised groundwater flow patterns in the glacial deposits which is towards local streams that flow through the Site;*
- *Groundwater flow patterns are expected towards the watercourses that drain the Wind Farm site; and,*
- *The shallow excavation depths required for Grid Connection cable, Substation and BESS.*

10.4 Effects on Lough Corrib SAC

Lough Corrib SAC is ~40km downstream of the Site (note the distance quoted here relates to the drainage pathway and is not a straight-line distance).

A comprehensive impact assessment was completed for the Lough Corrib in Section 9.5.2.10 of the EIAR. All other designated sites were screened out of the impact assessment due to the lack of hydrological and/or hydrogeological connectivity.

Drainage mitigation measures for surface water quality protection during the construction phase are summarised again below: (Please refer to Sections 9.5.2.2, 9.5.2.3 & 9.5.2.5 of the EIAR for the full description of these measures and how they will be applied)

- The proposed mitigation measures which will include 50m buffer zones for avoidance of sensitive hydrological features (streams and rivers);
- Pre-construction drainage control measures;
- Robust drainage control measures (i.e. interceptor drains, swales, settlement ponds and treatment trains such as Siltbuster) will ensure that the quality of runoff from Proposed Project areas will be very high; and,
- Best practice measures with regard use of oils, fuels (Section 9.5.2.6) and cement-based compounds (Section 9.5.2.8).

Tried and tested, best-practice mitigation measures (as detailed in the EIAR and clarified further in this response) for the protection of surface and groundwater water quality will be implemented during the construction phase of the proposed project to ensure that there is no deterioration in local or downstream water quality at Lough Corrib SAC.

10.5 Potential Increased Flood Risk

Submissions raise concerns for water quality and flood risk affecting neighbouring lands and lands downstream.

A site-specific Flood Risk Assessment (FRA) undertaken for the Site. The full FRA report is attached Appendix 9-1 of the EIAR.

The proposed site, including all 9 no. turbines, battery storage facility, 110kV substation and peat/spoil repositories, are at an elevation above the 1000-year flood level (i.e. are in Flood Zone C) where there is a low risk of fluvial flooding.

The Proposed Wind Farm drainage will not significantly alter the existing drainage regime at the Proposed Wind Farm site. Moreover, the proposed drainage system will be fully integrated into the existing bog, forestry and agricultural drainage systems.

Existing drains will be routed under/around the Proposed Wind Farm site access tracks using culverts as required.

Runoff from access tracks, turbine bases, and developed areas (construction compounds, sub-station, met masts etc) will be collected and treated in local (proposed) silt traps and settlement ponds and then discharged to existing local drains.

All new proposed watercourse crossings at the Proposed Wind Farm site will be designed to accommodate a 100-year fluvial flood with allowance for climate change (20 - 30%).

The Proposed Project will not result in increased downstream flood risk.

11 SUBMISSION RESPONSE SUMMARY

In summary and in response to ACP's submission response request:

- Overall, the Galway County Council submission was positive with regard the proposed project as well responses from the Prescribed Bodies (refer to Section 5, 6 & 7);
- Uisce Éireann did not note any short fall in the proposed mitigation as presented in the EIAR but did suggest some additional complementary requirements which will be implemented by the developer;
- A comprehensive site investigation dataset, comprising of trial pits, boreholes, geophysics and long-term groundwater level monitoring and water sampling was accrued as part of the baseline assessment of the Proposed Wind Farm site in the EIAR;
- The hydrological/hydrogeological impact assessment and assessment of potential effects on the Mid Galway PWS and Barnaderg (Gortbeg) GWS was carried out by HES (Hydrogeologists) and not Gavin and Doherty Geosolutions (GDG) who are overseeing solely the peat stability and geotechnical aspects of the project;
- Robust scientific reasoning has been provided in the EIAR to support the lack of potential effects on Mid-Galway PWS and Barnaderg (Gortbeg) GWS;
- The Brierfield GWS was not directly assessed in the EIAR. A qualitative and quantitative impact assessment is included in this response which is effectively the same as that completed for the Mid Galway PWS and Barnaderg GWS (Section 9.5.2.1 of the EIAR). The conclusion of the assessment is that with the implementation of the proposed mitigation measures there will be no significant effects on the Brierfield GWS from the Proposed Project;
- All investigations/assessments and hydrological conditions at the site indicate the lack of karst bedrock conduit system conveying large volumes of groundwater in the immediate vicinity Site towards the PWS and GWS sources;
- Robust scientific reasoning has been also provided in the EIAR to support the lack of potential effects on Lough Corrib SAC and local wells;
- Any potential significant issues with regard flood risk were dealt with at the early design stage of the project in order to ensure all the proposed wind farm infrastructure is placed outside of mapped fluvial flood zones; and,
- With the implementation of the tried and tested, best practice mitigation measures there will be no potential for significant effects on surface or groundwater quality/quantity.

HES has responded to all matters raised in the ACP 3rd party submissions.

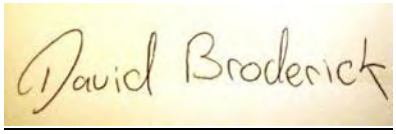
We respectfully submit to An Coimisiún Pleanála that this letter response reiterates the conclusions of the robust and comprehensive impact assessments presented in EIAR Chapter 8 (Land, Soils and Geology), EIAR Chapter 9 (Hydrology and Hydrogeology), the associated Flood Risk Assessment (Appendix 9-1), WFD Compliance Assessment Report (Appendix 9-3) and drainage design plan (Appendix 4-3).

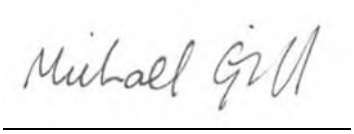
The impact assessments presented in the EIAR are informed by a comprehensive site investigation dataset and rely upon the tried and tested, best practice mitigation measures which ensure the protection of the receiving environment. Similar mitigation measures have been successfully applied during the construction of countless wind farm developments across the country and were also presented in the EIARs for several recently permitted wind farm developments.

12 CLOSURE

We trust the above response meets your requirements. Please contact the undersigned if you have any questions regarding the above.

Yours sincerely,





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APPENDIX 3

TNEI Submissions Response

Cooloo Wind Farm: Response to Submissions (Noise)

MKO Ireland

IE00015-023-R0

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1 Introduction

This report has been produced in response to the invitation to respond to submissions from An Coimisiún Pleanála (ACP) in respect of *Construction of wind energy development and all associated works located within Cloondahamper, Cloonascragh, Elmhill, Cooloo, Lecarrow, Dangan Eighter, Lissavally and Slievegorm, Co.Galway* (letter from ACP of 19th December 2025 to MKO) for case number ACP-323761-25. The report provides responses to submissions received (the Submissions) in respect of the potential for operational and construction noise and vibration associated with the Proposed Project.

The report addresses the submissions received in respect of noise and vibration only.

1.1 Overview of Submissions

1.1.1 Submissions from Prescribed Bodies.

Eight submissions were received from Prescribed Bodies in respect of the Proposed Project. Of these, only one refers to noise, which is from the National Office for Environmental Health Services (NEHS). No submissions refer to vibration.

TNEI's response to the submission from HSE is included as Section 2.1.

1.1.2 Submissions from Other Stakeholders

213 submissions were received from other stakeholders in respect of the Proposed Project. Many of these submissions referred to noise and/or vibration. TNEIs response to these submissions are included as Section 3.1 to Section 3.9

Most of the submissions are from individuals or families living in proximity to the Proposed Project, although some submissions have also been made from groups and organisations. Those that included observations related to noise and vibration include Barnaderg Cooloo Windfarm Action Collective CLG, one early years educational facility, Killererin Development Company and Killerein Community Council.

Many of the submissions express concern in respect of noise, primarily from the operation of the wind turbines, though there are also some concerns raised in respect of construction noise and noise from the operation of the BESS.

It should be noted that only two of the submissions have commented on any of the technical elements of the Noise and Vibration EIAR Chapter or the associated Technical Appendices. Specifically, one submission discusses the measured baseline noise levels and the associated limits, and one submission refers to the findings of the Battery Energy Storage System (BESS) noise assessment. These are addressed in Section 3.9.1 and Section 3.9.2.

The general concerns raised relate to the potential for adverse health impacts, in particular from low frequency noise and/or infrasound, however, other issues have also been raised, and the following list seeks to summarise those concerns;

- The use of noise assessment standards, guidelines and legislation
- Health impacts from noise pollution
- Low Frequency Noise (LFN) and infrasound
- Amplitude Modulation (AM)

- Potential impacts on animals (livestock)
- BESS noise
- Construction noise
- Vibration

Each of the above areas of concerns is addressed in Section 3.

1.2 Overview of the EIAR Noise Assessment

This section provides an overview of the noise assessment methodology that was adopted within Chapter 12 of the EIAR. It is useful to detail this here, as reference is made to these standards and guidance throughout this report.

- The assessment of operational noise from the proposed wind turbines is made against noise level limits derived from the noise limit criteria defined in the Wind Energy Development Guidelines (WEDG2006) [1].
- The operational noise assessment methodology is supplemented with the guidance set out in ETSU-R-97 *The Assessment and Rating of Noise From Wind Farms* (ETSU-R-97) [2] and the Institute of Acoustics' *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* (the IOA GPG) [3].
- The prediction of noise from the operation of the wind turbines is undertaken in accordance with ISO 9613-2:1996 *Acoustics — Attenuation of sound during propagation outdoors* [4], with additional modifying factors as detailed within the IOA GPG.
- The prediction of noise from construction activities and from the operation of the BESS is undertaken in accordance with ISO 9613-2:2024 *Acoustics — Attenuation of sound during propagation outdoors* [5].
- The construction noise assessment methodology follows the guidance in BS 5228-1 *Code of practice for noise and vibration control on construction and open sites - Noise* [6] and noise is assessed against the threshold levels presented in that document.
- The noise assessment methodology for the operation of the BESS follows the guidance in BS 4142:2014+A1:2019 (BS 4242) *Methods for rating and assessing industrial and commercial sound* [7] and noise is also assessed against the noise limits set out in NG4 *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities* [8].

Chapter 12 of the EIAR presents an EIA assessment of the likely significant effects. This includes an assessment of construction and operational noise. Separately, a construction noise impact assessment and two operational noise impact assessments are provided as Technical Appendix 12-1 *Construction Noise Report*, Technical Appendix 12-2 *Operational Noise Report* and Technical Appendix 12-3 *Battery Energy Storage System (BESS) Noise Report*. The technical appendices (TAs) are used to inform the assessment presented in Chapter 12 and contain much more technical detail in respect of data collection and analysis, noise level predictions and assessment methodology.

2 Response to Statutory Bodies

2.1 Response to National Environmental Health Service Submission

The NEHS Submission (in respect of noise) can be split into two parts.

The first part, titled *Project Specific Guidance for Wind Energy Development*, is generic in nature i.e. it does not refer specifically to the Proposed Project. Rather, it could be applied to all wind turbine developments. The text provides some commentary regarding guidance that can be referred to when assessing the potential for health effects from operational wind turbine noise.

The second part of the NEHS Submission, titled *Likely Significant Effects from Noise and Vibration (Chapter 12 of EIAR),* provides specific commentary in respect of the Proposed Project and the Environmental Impact Assessment Report (EIAR) noise and vibration chapter.

2.1.1 NEHS Submission – 'Project Specific Guidance for Wind Energy Development'

The NEHS Submission states that the current guidelines for wind energy development are the 2006 Wind Energy Development Guidelines (WEDG 2006) but goes on to note that since the publication of those guidelines the nature of wind turbine development has changed e.g. larger turbines, cumulative effects etc. It also states that there have been *"substantial increases in the body of knowledge around the likely significant effects of the operation of wind farm development on Population Health, in particular around the characteristics of the noise emissions and health effects of shadow flicker",* however, no specific reference is made to this additional knowledge and how it should be considered - though it is noted that World Health Organisation (WHO) publications are referred to in Part 2 of the Submission (this is addressed in 2.1.2).

The Submission then refers to the 2019 Draft Wind Energy Development Guidelines (Draft WEDG 2019) [9], which were published for consultation in 2019 but are yet to be adopted, however, it is not clear whether NEHS is supportive or not of the use of Draft WEDG 2019.

Finally, the Submission refers to the High Court decision in *Webster/Rollo v Meenaclogher (Wind) limited (2014 IEHC 136) 8th March 2024* [10] and suggests that this should be considered*; "… if the Planning Authority are now considering that they are under a duty to incorporate the likelihood of a Private Nuisance into their decision making".* This was a private nuisance case in respect of noise received at a dwelling from the operation of a nearby wind turbine development i.e. not a planning matter. NEHS note that the judge stated that she could consider nuisance irrespective of any compliance with consent conditions, and whilst this is true, it is nothing new and is true of all noise generating developments, not just wind turbines.

TNEI recognise that compliance with a set of conditioned noise limits is not normally sufficient on its own to demonstrate that no nuisance is present. We have not, however, identified anything new in this particular decision that should influence how a noise impact assessment for a wind turbine development should be undertaken or how it should be considered differently in a planning context.

Care needs to be taken not to confuse nuisance with the planning regime, which is what is of concern here. Nuisance and planning operate under completely different legal frameworks and what is relevant here is the planning system, not nuisance. The planning process needs to consider each proposed development on its own merit. It would be incorrect to assume that just because one development caused a nuisance that all future, similar developments would also cause a nuisance.

2.1.2 NEHS Submission – 'Likely Significant Effects from Noise and Vibration' (Chapter 12 of the EIAR)

Part 2 of the Submission in relation to noise is split out into ten paragraphs denoted as *a-j*. These are replicated below (blue text in italics) followed by a TNEI response, where necessary.

a) *The 2006 guidelines include guidance on how to derive noise limits for daytime and night-time periods, which can be summarised as: daytime limits take account of existing background noise levels and include a fixed limit of 45 dB, or background +5dB, whichever is the greater, except in low background noise environments where a fixed minimum limit in the range of 35-40 dB should be considered.*
b) *This criteria is therefore that turbine noise at noise sensitive locations should not exceed for daytime periods: 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.*

TNEI Response: The principal of WEDG 2006 is to start from a position of setting a fixed noise limit (generally 45 dB(A)), however, a limit of background noise level + 5 dB can be used in higher noise environments. In this regard the WEDG 2006 states; *"In general, a lower fixed limit of 45 dB(A)10min or a maximum increase of 5dB(A) above background noise at nearby noise sensitive locations is considered appropriate to provide protection to wind energy development neighbours."*

As detailed above, when the existing noise environment is very quiet then a lower fixed level limit can be used, to be set between 35 dB (A) and 40 dB (A).

c) *This criteria can potentially see a predicted increase of up to 15 dB(A) change in the noise environment as compliant with the criteria. Any change in the noise environment of this magnitude is highly likely to cause complaints and/or nuisance. BS 4142:2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound identifies an increase of 10 dB above the existing rated noise levels will have a significant adverse impact and is highly likely to cause complaints.*

TNEI Response: This is an incorrect assumption and an oversimplification of BS 4142 [7], which employs a two-stage assessment process. Initially, an estimate of the impact is made by subtracting the measured Background Sound Level from the calculated or measured Rating Level. The second part of the assessment is to then consider the context in which the sound occurs, which can modify the findings of the initial estimate. The reference to "*an increase of 10 dB …*," is in respect of the Stage 1 initial estimate i.e. the NEHS Submission only considers the first stage of the assessment process, and completely disregards the second stage of the assessment, which considers, amongst other things, the absolute level of sound.

It should also be noted that BS 4142 does not state anywhere within the standard that an increase in 10 dB is highly likely to cause complaints. In fact, the only real quote in reference to complaints in BS 4142, is*; "Adverse impacts may include but not be limited to annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact".*

In respect of the absolute level of sound, BS 4142 suggests that in instances where the existing sound environment is considered either particularly low (below 30 dBA), or particularly high, then absolute levels may be more relevant, which would modify the initial estimate of impact. The standard states:

"Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night." This is the approach that both the WEDG 2006 and ETSU-R-97 takes, through the setting a fixed lower-level limit for locations with low background noise levels.

Regardless, BS 4142 is not an appropriate assessment method for evaluating wind turbine noise and a number of pages are given over to this within the ETSU-R-97 document, under the heading; '*Problems with interpretation and the literal application of BS 4142'.*

It is acknowledged that the ETSU document refers to an older version of BS 4142 than the version currently in use, however, with reference to the most recent release, BS 4142:2014+A1:2019, the following should also be noted;

- The Standard is intended for the assessment of noise at low wind speeds, however turbine noise increases proportionately with wind speed and it is at wind speeds above the range of those considered in BS 4142 that a wind farm noise assessment is centred around.
- There is no method to set noise level limits in BS 4142, the standard simply provides a mechanism to determine whether there may be an adverse noise impact for noise generating developments or noise sensitive developments that fit within the scope of the standard; and,
- BS 4142 itself states at 1.3; "*The standard is not intended to be applied to the rating and assessment of sound from: a, b, c, … h) other sources falling within the scopes of other standards and guidance."* In this case wind turbines fall 'within the scope of other standards and guidance', namely ETSU-R-97 The Assessment and Rating of Noise from Wind Farms and WEDG 2006.

Accordingly, no further consideration of BS 4142 is considered necessary.

d) From the 2006 Guidelines "However, in very quiet areas, the use of a margin of 5dB(A) above background noise at nearby noise sensitive locations is not necessary to offer a reasonable degree of protection and may unduly restrict wind energy developments which should be recognised as having wider national and global benefits. Instead, in low noise environments where background noise is less than 30dB(A), it is recommended that the daytime level of the LA90, 10min of the wind energy development be limited to an absolute level within the range of 35 - 40dB(A). " There is no evidence base to support the statement that this limit is not necessary to offer a reasonable degree of protection in low noise background areas.

It is a common approach in the assessment of environmental noise to set an absolute lower level limit (also known as fixed 'minimum limits', rather than just consider the level above background where background sound levels are particularly low. This is not just confined to WEDG 2006 but is the basis of setting noise limits in ETSU-R-97, and is also discussed in BS 4142 (see quote in response above).

In this regard ETSU-R-97 states; *"We are of the opinion that if the noise is limited to an LA90,10min of 35dB(A) up to wind speeds of 10m/s at 10m height then this condition alone would offer sufficient protection of amenity, and background noise surveys would be unnecessary".* To state that there is no evidence base to support this approach is incorrect and significant consideration of the setting of a lower level limit was undertaken at the time of writing ETSU-R-97; the ETSU document itself gives over an entire section (22 pages) considering noise limits and recommended guideline levels from WHO, British Standards and international standards, before coming to this conclusion.

More recently, the WSP report, *A Review of Noise Guidance For Onshore Wind Turbines* [11] presented a detailed evidence review, which states;

"*It is clear from this review that the investigation and evidence on the effects of wind turbine sound has progressed substantially since ETSU-R-97 was published."* But also states;

"The ETSU-R-97 daytime minimum limits appear to be broadly consistent with the approaches taken in overseas national or regional guidelines, and are among the more stringent limits imposed."

e) *The evaluation of significance of an effect is based on the most up to date scientific knowledge and data. The EIA process specifically requires the assessment to be 'the likely significant effects' and if the knowledge on an evaluation criteria of significance has developed since the publication of a guidance, then it is reasonable and correct to use the developed knowledge base in assessing the significance of any effect. This is particularly relevant to the protection of public health. Statutory Guidance issued under the Planning Development Act 2000 (as amended) has to be considered by the Planning Authority when making a decision, but it is not a consideration that precludes all other evidence and knowledge. In Webster/Rollo V Meenaclogher (Wind) Limited (2024 IEHC 136) 8th March 2024 the judgement supports this position, in that the judgement makes it clear that compliance with the current Planning guidance does not preclude a private noise nuisance.*

TNEI Response: The assessment has been undertaken in accordance with Wind Energy Development Guidelines (WEDG) 2006, which is the current guidance in effect in Ireland. However, whilst the WEDG 2006 sets out the noise level limit criteria, the actual assessment method is based on the application of ETSU-R-97 and the associated IOA GPG, which represents current best science.

ETSU-R-97 is still very much in use today in all countries of the UK, and to inform WEDG 2006 assessments in Ireland, and it is still relevant. The UK Government has been considering the extent to which ETSU-R-97 may require updating and a report produced for the (former) UK Government Department for Business, Energy & Industrial Strategy (BEIS) was published on 10th February 2023 (the WSP BEIS report), which provided some recommendations. The UK government has now acted on these recommendations by commissioning an update to ETSU-R-97, however, it is unclear when any updated guidance would be finalised or how it would be implemented.

An initial consultation period for the update to ETSU-R-97 (referred to as Assessment and Rating of Wind Turbine Noise 2025) has recently ended (August 2025) however, it should be noted that the consultation document states: *"This draft guidance update does not represent a final position from government. It should not be used by local planning authorities during or after the consultation period in relation to ongoing planning applications. Following this consultation, we will analyse responses and issue a formal government response. Until this time, the current guidance remains suitable for assessing wind turbine noise. Planning authorities should continue to use existing guidance and are advised not to delay planning decisions on the basis of this consultation."*

In 2013 the Institute of Acoustics (IOA) published 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (IOA GPG), to set out best practice methodology. This document has been endorsed by all UK governments. For example, the Scottish Government document 'Onshore Wind Turbines: Planning Advice' [12] states that the IOA GPG, "*should be used by all IOA members and those undertaking assessments to ETSU-R-97. The Scottish Government accepts that the guide represents current industry good practice."*

It is also noted that the Scottish Government 'Onshore Wind Policy Statement 2022' [13] states, *"Until such time as new guidance is produced, ETSU-R-97 should continue to be followed by applicants…."*.

The IOA GPG is a live document that can be updated to reflect best practice, although since publication it has not been updated and the original document still represents best available science.

The use of WEDG 2006, supported by ETSU-R-97 and the IOA GPG, is routinely used for the assessment of wind turbine noise in Ireland and continues to be used for planning applications submitted in 2026. Whether this assessment methodology is appropriate, how it is incorporated into EIA, and whether it is in keeping with the most up to date knowledge, was challenged during the planning application for the Coom

Green Energy Park, a 22 wind turbine development in County Cork, Ireland [14]. The Inspector nonetheless considered the approach appropriate[1] and this was upheld when it was again challenged at a subsequent Judicial Review.

To summarise, TNEI consider the noise impact assessment methodology to represent both current national guidance and best available science.

f) In the opinion of the NEHS, tabulation of the predicted change in the noise environment from the proposed development and the cumulative change in the original baseline noise environment before any wind farm development in the area is the most informative way of reporting the likely effect of operational noise in an EIAR.

g) The NEHS would consider the most appropriate criteria for assessing significance of the predicted noise is consideration would be consideration of the ENVIRONMENTAL NOISE GUIDELINES for the European Region, 2018. The 2018 WHO Guidance set health protection levels from environmental noise. https://iris.who.int/bitstream/handle/10665/279952/9789289053563-eng.pdf?sequence=1 [2]

TNEI Response: TNEI do not agree that the Environmental Noise Guidelines for the European Region, WHO 2018 (the WHO Guidelines) [15] are appropriate criteria for the assessment of wind turbine noise. We would also note that the WHO Guidelines only set out guideline noise levels, and do not present any assessment methodology.

The main purpose of The WHO Guidelines, as set out on page xiii is: "*to provide recommendations for protecting human health from exposure to environmental noise originating from various sources: transportation (road traffic, railway and aircraft) noise, wind turbine noise and leisure noise*."

The WHO Guidelines make recommendations in relation to each of the noise sources considered and each recommendation is rated as either 'strong' or 'conditional,' which are defined as follows:

"A strong recommendation can be adopted as policy in most situations. The guideline is based on the confidence that the desirable effects of adherence to the recommendation outweigh the undesirable consequences. The quality of evidence for a net benefit – combined with information about the values, preferences and resources – inform this recommendation, which should be implemented in most circumstances.

A conditional recommendation requires a policy-making process with substantial debate and involvement of various stakeholders. There is less certainty of its efficacy owing to lower quality of evidence of a net benefit, opposing values and preferences of individuals and populations affected or the high resource implications of the recommendation, meaning there may be circumstances or settings in which it will not apply."

The strength of recommendation was determined following a two-step procedure. Initially the strength of the recommendation was set as strong or conditional based on a qualitative assessment of the quality of the evidence, this was then either adopted or confirmed having due consideration to contextual parameters that might have a contributory role. There were seven additional contextual parameters, which were assessed qualitatively. The WHO Guidelines provided three strong recommendations for each of the transportation noise sources (road traffic, railway and aircraft), one strong and two conditional recommendations for leisure noise, and two conditional recommendations for wind turbine noise.

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[1] See Inspector's Report ABP-308885-20 dated 22/23 July 2021 & 6 December 2022

[2] Note: The quoted link does not work. The WHO document (as of 4/11/25) can be found here; https://www.who.int/europe/publications/i/item/9789289053563

Accordingly, the recommendations for Wind Turbine Noise should not be given the same weight as other recommendations detailed within the document.

The recommendations included for wind turbine noise (presented on page xvii of the Guidelines) are reproduced here as Table 2-1. It should be noted that the metrics used for quantifying noise levels throughout the WHO Guidelines are Lden and Lnight, which are different from those used in WEDG 2006 and ETSU-R-97.

Table 2-1: WHO Environmental Noise Guideline Recommendations for Wind Turbine Noise

Recommendation	Strength
For average noise exposure, the GDG conditionally recommends reducing noise levels produced by wind turbines below 45 dB Lden, as wind turbine noise above this level is associated with adverse health effects.	Conditional
No recommendation is made for average night noise exposure Lnight of wind turbines. The quality of evidence of night-time exposure to wind turbine noise is too low to allow a recommendation.	N/A
To reduce health effects, the GDG conditionally recommends that policymakers implement suitable measures to reduce noise exposure from wind turbines in the population exposed to levels above the guideline values for average noise exposure. No evidence is available, however, to facilitate the recommendation of one particular type of intervention over another.	Conditional

The Lden metric is an annual (day-evening-night) weighted sound pressure level. The metric, which considers annual exposure to noise, effectively gives additional weight to noise occurring during the evening and further weight to noise occurring at night. The Lden metric is commonly used for assessment of transportation noise and in strategic mapping exercises but there is no guidance in Ireland (or indeed in the WHO Guidelines) to outline how a wind farm noise Lden could be predicted or measured. There are very considerable practical difficulties involved with the use of Lden for wind farm noise and accordingly, it is very rarely used for wind turbine noise assessment.

When considering the recommendations in the WHO Guidelines it is important to consider them in the context of the entire document and there are a number of important points which are set out here;

The recommendations in the Guidelines are based on a 10% absolute risk of High Annoyance in the population. Table 36 of the Guidelines details that this is based on a review of four studies. Table 37 identified that six studies were available that considered sleep disturbance but they did not reveal consistent results about the effects of wind turbine noise on sleep. Consequently, the Guidelines do not make a recommendation on Lnight. No other studies were identified in the Guidelines that were sufficient to allow for the consideration of any other health effects.

The recommendations are 'conditional,' and such recommendations: "*requires a policy-making process with substantial debate and involvement of various stakeholders".*

Table 42 of the Guidelines, "*provides a comprehensive summary of the different dimensions for the assessment of the strength of the wind turbine recommendations."* Within the table it states: "*Evidence for a relevant absolute risk of annoyance at 45 dB Lden was rated low quality. No statistically significant evidence was available for sleep disturbance related to exposure from wind turbine noise at night.*"

Table 42 also sets out additional context in relation to the balance of benefits versus harms and burdens, stating: *"Further work is required to assess fully the benefits and harms of exposure to environmental noise from wind turbines and to clarify whether the potential benefits associated with reducing exposure to environmental noise for individuals living in the vicinity of wind turbines outweigh the impact on the development of renewable energy policies in the WHO European Region."*

As noted previously, the Lden metric is not currently used in Ireland for the prediction, measurement or assessment of wind turbine noise and this is also highlighted in Table 42 of the Guidelines, which states (in relation to additional considerations or uncertainties) that: "*There are serious issues with noise exposure assessment related to wind turbines.*" This is consistent with earlier text in the Guidelines (on page 84), which notes that: "*Based on all these factors, it may be concluded that the acoustical description of wind turbine noise by means of Lden or Lnight may be a poor characterization of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes.*"

Whilst the Guidelines provide a useful overview of the information available relating to health effects at the time of the WHO review, the recommendations need to considered in the context of the entire document and the Guidelines note that the quality of evidence upon which the recommendations are based is low quality. This is reflected in the fact that the recommendation is conditional, and the Guidelines note that the recommendation should be subject to a policy-making process with substantial debate and involvement of various stakeholders.

In relation to wind turbine noise assessment, no formal changes have been made to the 2006 WEDG. Similarly, the UK continues to rely on ETSU-R-97 and the IOA GPG as an appropriate method of assessment. It is also noted that the Institute of Acoustics has not made any changes to the good practice guidance set out in the IOA GPG to incorporate the WHO guidelines.

With due regards to the above, assessment of operational wind turbine noise against the levels presented in the WHO Guidelines is not considered to be appropriate or necessary.

h) *The use of the 2006 Guidance with regards to noise exposure, and in particular the 'balance between development and public health' stated are resulting in a significant volume of complaints from communities exposed to noise from wind turbines post development. This position that the absolute noise exposure limits set in the 2006 Guidance do not necessarily protect Public health in specific development situations is now supported by Judgements of the Irish Courts, as reference previously in this submission.*

TNEI Response: NEHS do not provide any evidence in their submission of the 'significant volume of complaints,' nor how these are linked to the use of WEDG 2006. Reference to one or two wind turbine developments that have been ruled to have caused a noise nuisance is not sufficient to determine that the noise limits set by WEDG 2006 are not able to offer appropriate levels of protection. Indeed, it should be noted that the development referred to in the Webster/Rollo V Meenaclogher (Wind) Limited case had noise limits that were not set in accordance with WEDG 2006. If the planning condition and noise limits for

that development had been written using the WEDG 2006 guidance, then noise levels from the wind farm development would have been regulated differently.

i) *It should be noted that concern with the 2019 draft guidance by acoustic consultants were concerns due to assessment methodology and not the proposed standards set to protect health. In the response from the institute of Acoustics they specifically state: "The group agreed and stressed in their responses that they believe the setting of suitable noise limits is a matter for government policy. The group was only concerned with aspects of technical accuracy and clarity"*

TNEI Response: As lead authors of the acoustic consultants' response, we would note that significant discussion was presented in that response in respect of the appropriateness of the use of the WHO guideline levels. In particular, we would note that the acoustician's response covered the same and similar points to those raised above in respect to the WHO 'conditional' recommendation, stating;

"Table 42 of the WHO document provides a summary of the strength of the recommendation and states: "Evidence for a relevant absolute risk of annoyance at 45 dB Lden was rated low quality."

In addition, the WHO document itself is based on a very limited data set, which only estimated the Lden for the sites studied, rather than assessing it directly from wind statistics (see Appendix 2). This is acknowledged in the WHO document, whist states that is "may be concluded that the acoustical description of wind turbine noise by means of Lden or Lnight might be a poor charecterization of wind turbine noise".

Additionally, the use of how the WHO guideline levels could be incorporated into an assessment methodology was questioned in respect of both technical accuracy and clarity.

j. Wind Energy Development Guidelines (WEDG) for consultation for Irish Department of Housing, Planning, Community and Local Government (DHPLG) I Institute of Acoustics

This final paragraph presents a link to an article written by Jim Singleton (author of this report) regarding the acoustician's consultation response to the draft WEDG2019. We would note that the link within that article to the acoustician's response is broken but it can be found using this link.

https://www.dickbowdler.co.uk/content/publications/wedg_consultation_joint_response_r0.pdf

It is noted that the NEHS submission concludes the 'noise section', under the heading Predicted Operational Noise, which states;

"The NEHS notes that the table of predicted noise at NSL in Table 12.15 and 12.17[3] and that the predicted noise levels are below the adopted standard."

And;

"The NEHS is of the opinion that there is no requirement for additional noise mitigation measures during the construction phase providing those measures identified in the in the EIAR are implemented in full".

The response also states that construction should be limited to 08:00 – 19:00 Monday to Friday and Saturday 09:00 – 14:00. Section 1.3 of the Construction Noise Assessment (Appendix 12-1 of the EIAR) notes construction activities are expected to be limited to 07:00 – 19:00 Monday to Saturday and standard

[3] Tables 12.15 through to 12.17 of EIAR Chapter 12 present the predicted noise levels from the operation of the wind turbines compared to the Total Noise Limits and the Site Specific Noise Limits.

construction activities are not anticipated outside of these, however some activities outside of the core hours could arise under certain conditions.

The Applicant commits to upholding construction within the limits recommended by NEHS should they be conditioned by the consenting planning authority.

3 Response to Third Party Submissions

The following sections seek to provide an overarching response to the common themes found across the range of submissions. It should be noted that in the majority of cases, the submissions relate to noise from wind turbines generally and do not focus specifically on the Proposed Project or raise questions in respect of the noise impact assessments submitted as part of the planning application.

Table 3-1 signposts the sections for each of the issues addressed. Where project specific questions have been raised, however, we have sought to address these (see Section 3.9).

Table 3-1: Issues Addressed

Issue	Section
Noise assessment standards, guidelines and legislation	3.1
Health impacts from noise pollution	3.2
Low Frequency Noise (LFN) and infrasound	3.3
Amplitude Modulation (AM)	3.4
Potential impacts on animals (livestock)	3.5
BESS noise	3.6
Construction noise	3.7
Vibration	3.8

Whilst it is recognised that the issues detailed in Table 3-1 represent legitimate concerns, it should be noted that many of the submissions refer to articles, technical papers, court hearings and similar, which in most cases are often mis-understood, mis-quoted or misrepresented. For example, multiple responses refer to the paper '*Importance of Noise Hygiene in Dairy Cattle Farming—A Review*' [16], with one submission stating, "*The paper also discusses how exposing animals to noise from an unfamiliar source can cause them stress. Therefore we can conclude that the noise associated with the wind farm will negatively affect animal and milk production*". This completely misrepresents the paper, which primarily focuses on noise inside farm buildings that is generated from the use of machinery, such as may be used for milking. Sound levels from wind turbines in outdoor environments, which are likely to range between 30 to 50 dBA depending on distance and wind conditions, are in no way comparable to the sounds that are occurring inside farm buildings, which are quoted as between 60 to 80 dBA.

Similarly, many submissions misunderstand the nuances of the different assessment standards that are used; for example, it is not possible or correct, to apply guideline noise levels from WHO documentation to ETSU-R-97 style wind turbine assessments, nor is it appropriate to refer to BS 4142 background sound levels for the assessment of operational wind turbine noise. This is understandable, as the topic of environmental noise assessment can be highly complex, and it is not reasonable to assume that the technicalities of such assessments should be understood by all. Conversely, however, it is not reasonable to simply ignore the findings of the technical assessments and instead focus any objections to the Proposed Project (or any development) based on soundbites, news headlines and generalisations. Care needs to be taken when considering the content of many of the submissions, as to the validity of the claims, which are often based on assumptions rather than science.

It is noted that many submissions make reference to the Webster/Rollo v Meenaclogher (Wind) Limited noise nuisance case, discussed previously in Section 2.1.1. This is understandable, as it was a high profile case that gained lots of media coverage. Reference to this case, however, and similar references to media reported noise issues, needs to be considered in context and with a full understanding of the facts. In that particular case, a two-turbine scheme whose nearest turbine was extremely close to the complainants' property (approximately 380 m), was found to be causing a noise nuisance. The operator did not appear to acknowledge the noise complaints over a long period of time (several years) or attempt to reduce the noise output. Most importantly (in relation to this report), the noise level limits set in the planning conditions were not set in accordance with WEDG2006, ETSU-R-97 or any other recognised guidance. Had the noise limits been set appropriately (and assuming the development complied with those limits), this would have reduced the likelihood of nuisance occurring in the first place.

Furthermore, it is not reasonable to assume that because a noise nuisance was found at one wind turbine development that all future turbine developments are liable to cause a nuisance. Similarly, that development cannot be compared directly to the Proposed Project in terms of noise; setback distance and topography are different, turbine technology has advanced; noise mitigation measures can be designed in (mode management), and the noise level limits for the Proposed Project are derived in accordance with recognised, best practice.

There are many instances of references to other turbine developments in the submissions, however, the planning system needs to consider each Proposed Project on its own merit. The inclusion, for example, of the Huson & Associates review of the Noise Impact Assessment report for the Ballynisky Wind Farm in Limerick, which is appended to the Barnaderg Cooloo Windfarm Action Collective CLG submission, is not relevant to the Proposed Project. Similarly, inclusion of a policy document of the Environmental Protection Authority of Tasmania is not relevant here and it is not, as is claimed, 'best practice', it is simply a regional policy document.

3.1 Noise assessment standards, guidelines and legislation

Many of the submissions question whether the use of WEDG 2006 and ETSU-R-97 is appropriate for the assessment of operational noise. Similarly, many of the submissions state WHO guideline levels should be used for assessment. This has already been addressed in Section 2.1.1 and Section 2.1.2, so does not need to be discussed further here.

3.2 Health impacts from noise pollution

Many submissions present statements regarding alleged adverse health effects attributable to wind farms but these comments do not specifically address the Proposed Project. Rather, the submissions discuss wind turbines in general and the tone of many of the submissions infer that adverse health effects are likely from all wind farm developments.

Understandably, many residents are anxious and concerned about potential health impacts related to noise from the turbines, however, the fact that high levels of noise (from any noise source) may contribute to adverse health effects is not under debate here; nor is the evidence that lack of sleep as a result of noise disturbance may contribute to adverse health effects. Both of these issues are well documented, for example, in publications such as those published by the WHO. What is important is not whether high levels of noise contribute to adverse health effects but how levels of noise are assessed and controlled, to remove, reduce or mitigate this risk. In this case, the assessment has been undertaken in accordance with

recognised best science and the most up to date good practice. As already presented in detail in Section 2.1.2 but worth repeating here, it is not appropriate to assess wind turbine noise against the WHO Guidelines published in 2018.

Particular concern has been raised in respect of low frequency noise and infrasound, and this is addressed separately in Section 3.3, as it features in many of the submissions.

Concerns have been raised regarding the ability for wind turbine noise to affect nearby residents that are neurodivergent. Responses to third-party observations regarding human health are addressed in Section 2.5.4 of the main response document.

Some of the submissions refer to 'vibroacoustic disease,' which the WSP BEIS report covers within a literature review of effects of noise from wind turbines, and details the following:

Tonin 2018

"Tonin (2018) presented a narrative literature review focussed on wind turbine infrasound, including hypotheses for potential explanations for reported health symptoms and emerging research evidence. The range of hypotheses discussed included 'vibroacoustic disease', a specific 'wind turbine syndrome', and suggestions that exposure to infrasound below perception thresholds may impart stimulation of inner ear components not directly associated with auditory sensations, or vestibular activation, which may be linked with 'motion sickness' symptoms. Tonin noted that, from those reviewed, the only observational study to examine infrasound was the Health Canada study, which employed year-long measurements to demonstrate that wind turbine infrasound could sometimes be detected up to 10 km, but was often below residual levels; infrasound levels measured near the turbine base were around a perception threshold corresponding to the most sensitive 1% of people. Tonin reported the results from the author's own experimental study, which used controlled infrasound exposure based on a real wind turbine signal. It was found that exposure to either real or sham infrasound had no influence on the reporting of health symptoms by participants. However, the expectation of effects connected with the participants' attitudes prior to the experiment did have a significant effect, which supports a nocebo explanation for reported health symptoms associated with wind turbine infrasound. Tonin also reviewed an earlier experimental study that used lower levels of infrasound exposure (Tonin asserted these levels were too low, such that the experimental comparison for exposure groups would have been sham/sham rather than real/sham), but arrived at similar conclusions; symptom reporting could be explained by nocebo effects rather than infrasound exposure". [17]

Van Kamp et al (2018)

"*The authors identified that the symptoms proposed to be connected with exposure to inaudible infrasound are already described in the manual of health disorders as associated with generalised anxiety disorder, and noted that anxiety could be brought about by negative feelings about new or planned wind farms. It was concluded that there is little scientific evidence to support any new or unique health effects associated with wind turbine infrasound or low frequency sound. Reported symptoms linked with wind turbine infrasound could be explained by stress. Suggestions of wind turbine syndrome and vibroacoustic disease are not supported."* [18]

3.3 Low Frequency Noise (LFN) and infrasound

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. 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. Accordingly, the average human can hear LFN but cannot hear infrasound.

Wind turbines do produce low frequency sounds, but our threshold of hearing at such low frequencies is relatively high i.e. low frequency sounds need to have a high level of amplitude before they are audible. Therefore, LFN will usually go unnoticed.

Infrasound from wind turbines is often at levels below that of the infrasound generated by other local noise sources, for example, from the wind around buildings and other obstacles.

Many of the submissions express concern with regards to the potential for LFN and / or infrasound generated by the proposed wind turbines and the potential for adverse health impacts attributable to exposure to certain levels of LFN. However, levels of LFN and infrasound have been found to be particularly low from wind turbines and this is backed up by a large body of work, some of which is detailed here:

In 2004, the former UK Department for Trade and Industry (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 at that time, 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 of the wind farms for which complaints had been received and the results were reported in May 2006 [19]. 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 [UK] 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.'*

The Applied and Environmental Geophysics Research Group at Keele University was commissioned by the UK Ministry of Defence (MOD), the DTI and the British Wind Energy Association (BWEA) to undertake micro-seismic and infrasound monitoring of LFN and vibrations from wind farms for the purposes of siting wind farms in the vicinity of the Eskdalemuir Seismic Array 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 [20]. 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 in August 2005, stating:

'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.'

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' - 5 August 2005') [21]:

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

An article 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.

Further work 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).'

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) [22]. 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.

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.

To summarise, it is acknowledged that LFN can be generated from operational wind turbines, however, the levels are below that at which adverse impacts may occur. Levels of infrasound associated with wind turbine operations are particularly low and no higher than is experienced in everyday settings with no wind turbines present. Accordingly, no adverse health effects, including loss of sleep, are anticipated.

3.4 Amplitude Modulation (AM)

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 (AM) 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."

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 and as indicated by Association of Acoustic Consultants of Ireland (AACI) in *Noise Guidelines for Local Authorities* [23], the noise limits in the Wind Energy Development Guidelines (WEDG 2006), although not explicit, "are evidently derived from ETSU-R-97".

On 16 December 2013, Renewable UK (RUK) released six technical papers 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).

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. [24]"

Research regarding amplitude modulation continued. In April 2015, the IOA issued a discussion document entitled '*Methods for Rating Amplitude Modulation in Wind Turbine Noise*' [25]. 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.

On 3 August 2015, the UK's Department for Energy and Climate Change (DECC), 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."*

Their report, which was released in October 2016 [26], 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.

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".

The report 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, which are embodied in various UK documents depending on the country e.g. Circular 4/98 in Scotland.

In Ireland the same six tests are detailed within Section 28 Development Management Guidelines for Planning Authorities, 2007 [27], and the Office of the Planning Regulator (OPR) Practice Note PN03, 2022 [28]. The six tests are; Necessary; Relevant to planning; Relevant to the development to be permitted; Enforceable; Precise; and Reasonable.

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; [tonality means mechanical sound already covered by ETSU noise limits]; 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."

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 Government.

At present there is no method available to predict AM and, as a result it is not possible to predict what impact the inclusion of an AM condition would have on the operation of the wind farm.

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):

"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."

It is noted that OAM, should it occur on a site, can be controlled through statutory nuisance powers and in the absence of robust research this is considered to be the most appropriate way to control OAM where required. In this respect it is worth noting a recent Appeal decision in Scotland. For Clachaig Glen Wind Farm (WIN-130-7), in the report produced for Scottish Ministers, the Reporter, J Alasdair Edwards, stated;

"… I also follow the applicants witness evidence that residents would continue to be protected against excessive amplitude modulation as it would be covered under statutory nuisance powers" [29].

The Decision Notice for that development (DOC17) stated;

"In relation to concerns about amplitude modulation, which were also discussed at the public inquiry, it is noted by the Scottish Ministers that the Reporter concluded that if there is excessive amplitude modulation it would be covered under statutory nuisance powers concluding that there was no necessity for a condition to be applied" [30].

3.5 Potential impacts on animals (livestock)

Several submissions have expressed concern in respect of operational noise effects on cattle, including health effects and reduced milk production.

A number of studies have been published considering noise levels in general and their effects on cattle, one of which, *Importance of Noise Hygiene in Dairy Cattle Farming—A Review* [16], is referred to several of the submissions.

Effects of Noise on Wildlife and Other Animals (1971) [31], written for the US Environmental Protection Agency includes a section looking at the Effects of Noise on Farm Animals, including pigs, cattle and poultry, but found that noise effects had little impact on milk production.

A number of studies have been carried out on the effects of noise on cattle from low-flying aircraft, including jets, helicopters and sonic booms and in response to concerns about noise effects on both milk

production and pregnancies in cattle, the U.S. Air Force prepared a handbook for environmental protection summarising these studies. No link was identified between either reduced milk production or disturbance to pregnancies and in a report to congress in 1992 the U.S. Forest Service stated; "*there is no proven cause-and-effect link between startling cattle from aircraft overflights and abortion rates or lower milk production.*" [32]

Whilst noise from low-altitude flights is not directly comparable to continual noise produced by wind turbines, it should be noted that impact or impulsive noise i.e. noise levels that increase and decrease rapidly such as may occur from a low-altitude flypast, is much more likely to cause disturbance to animals than the continual and consistent noise generated by wind turbines. In this regard Head et al states, "*Many studies indicate that sudden, novel sounds seem to affect cattle behaviour more than continuous high noise*" (1993) [33].

With regards to the ability of cattle to discern LFN it is worth noting the paper '*Effect Of Noise On Performance, Stress, and Behaviour of Animals*' (J Brouçek) [34], which states; *"Cattle hear high-frequency sounds much better than humans, their high-frequency hearing limit being 37 kHz, compared with only 18 kHz for humans (Heffner, 1998). Their best audible sound is also at a higher frequency, at about 8 kHz, compared with 4 kHz for humans (Phillips, 2009). However, thresholds for discomfort for cattle was noted at 90-100 dB, with physical damage to the ear occurring at 110 dB. (Phillips, 2009). Indeed, cattle, with an auditory range between 25 Hz and 35 kHz, can detect lower pitched sounds than other farm species (Heffner and Heffner 1993). Dairy breeds are more sensitive to noise than beef breeds (Lanier et al., 2000)".* Therefore, cattle have a similar low frequency threshold to humans (25Hz compared to 20 Hz), but their higher frequency response extends beyond the human range and they are more sensitive to noise at higher frequencies than humans. Accordingly, it is reasonable to assume that cattle will be no more affected by LFN than a human would.

The 2023 paper *Importance of Noise Hygiene in Dairy Cattle Farming—A Review,* is referred to in several of the submissions, however, the findings of this paper are misrepresented and / or misunderstood. Whilst the paper does discuss the potential for adverse noise impacts on cattle, the sound levels quoted, which are predominantly based on measurements inside farm buildings, are many times higher than the noise levels that cattle would be exposed to from the operation of a wind turbine. The paper is primarily concerned with noise from farmyard plant, such as milking machines, mechanical ventilation etc, and routinely refers to measured noise levels in farms in the range of 60 – 80 dB. In fact, the only recommendation in the paper in respect of what would be an appropriate noise level is; *"When milking dairy cows, the noise level should not exceed 65–70 dB, or if it exceeds this value, it should be for a short time"*. Operational noise levels from the Proposed Project would be much lower than this.

The findings in the paper that have been reported in the submissions have been taken out of context and have little relevance to the Proposed Project.

3.6 BESS noise

Operational noise from the BESS has been assessed in accordance with BS 4142 and against the noise level limits presented in NG4. The noise limits used from NG 4 are those that are set for areas that are classified within NG4 as an 'Area of Low Background Noise'.

BS 4142 is a two stage assessment process. The full BS 4142 assessment i.e. after completion of both stages of assessment, concludes that there would be a low impact at all residential receptors during both the

daytime and night-time. It is noted that some submissions only refer to the first stage of the assessment process and ignore the actual assessment outcome. This is discussed further in Section 3.9.2.

The assessment, which is presented in detail in Technical Appendix 12-3 also indicates that operational noise from the BESS would be below the NG4 noise limits at all residential receptors for all time periods.

3.7 Construction noise

Several submissions present concerns in respective of construction levels that are likely to be experienced. The construction noise assessment, which is inherently conservative, has indicated that noise levels from construction activities will remain below the thresholds for potentially significant effects, as defined in BS 5228-1:2009+A1:2014.

3.8 Vibration

Many submissions refer to vibration using language that suggests vibration impacts from the Proposed Project are inevitable. For example, *"…. and constant turbine noise and vibration could cause pain, anxiety, and loss of concentration, reducing quality of life."*

To clarify, there will be no perceptible ground borne vibration at any residential receptor in the proximity of the Proposed Project from the operation of the wind turbines. Responses to third-party observations regarding human health are addressed in Section 2.5.4 of the main response document.

3.9 Project Specific Observations

The following sections address specific technical points that were raised in the submissions.

3.9.1 Background Noise Level and Limits

One submission provides screenshots from the EIAR document and presents comments. In respect of Chapter 12, the Noise and Vibration Chapter, Tables 12.10 and 12.11 are included and commentary provided that incorrectly states what the allowable operational turbine noise should be. The suggestion is that wind speeds of 7 and 8 m/s should be used to set the noise limits and that the lowest noise level measured at these wind speeds should be applied.

Table 12.10 is provided below for reference. Table 12.11 is identical except that noise levels are presented for night-time background noise levels, rather than quiet daytime. For clarity, Tables 12.10 and 12.11 should be read as follows;

- The first column presents the Noise Monitoring Locations. Seven locations were used for the baseline survey for the Proposed Project.
- The remaining 12 columns present the background noise level at each monitoring location across the range of wind speeds, 1m/s through to 12 m/s.
- The measured levels are used to set noise limits for each wind speed bin. There is a separate limit calculated for each integer wind speed.
- It is not correct to select the lowest measured noise level to set the limits. Rather a set of limits are calculated for every monitoring location and then those limits allocated appropriately to nearby residential receptors e.g. NML01 may be used to set the limits at one cluster of houses, NML02 at the next cluster of houses, and so. In this way, the most appropriate levels of protection are afforded to all residential receptors.

Table 12-10 Summary of Prevailing Background Noise Levels during Quiet Daytime Periods (dB(A))

Noise Monitoring Location	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NML1	30.1*	30.1*	30.1*	30.1	30.5	31.4	32.9	34.9	37.5	40.6	44.3	48.5
NML2	24.9*	24.9*	24.9	25.4	26.5	28.3	30.6	33.4	36.6	40.2	44.2	48.4
NML3	22.3*	22.3*	22.3	22.6	23.7	25.6	28.1	31.3	35	39.3	44.1	49.3
NML4	34.4*	34.4*	34.4	34.5	34.9	35.5	36.5	37.9	39.8	42.3	45.5	49.4
NML5	26.3*	26.3*	26.3	26.7	27.5	28.7	30.3	32.6	35.5	39.3	43.9	49.6
NML6	28.6*	28.6	29.0	29.5	30.2	31.1	32.4	34.1	36.3	39.2	42.7	47.1
NML7	30.8*	30.8	30.9	31.6	32.8	34.6	37	39.9	43.4	47.4	52	57.2

** Flatlined where derived minimum occurs at lower wind speeds, see Section 5.8 of Appendix 12.2: Operational Noise Report.*

3.9.2 BESS Noise Impact Assessment outcomes

The Barnaderg Cooloo Windfarm Action Collective CLG submission states;

"The developer's own Appendix 12-3 Battery Storage Noise Assessment (Sept 2025) identifies fifteen CATL EnerC+ battery containers – a commercial lithium-ion ($LiFePO_4$) system manufactured by CATL – with predicted operational noise levels of up to 31 dB LAeq at homes near the compound, representing an increase of +11 to +14 dB above background levels and classed within the report as a 'significant adverse impact' on residential amenity".

This is a misunderstanding of the assessment, which does not conclude that there would be a 'significant adverse impact'. As previously stated in Section 2.1.2, a BS 4142 assessment is a two-stage process. Initially, an estimate of the impact is made by subtracting the measured Background Sound Level from the Rating Level, and in this regard the standard states:

"Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level, and consider the following…

a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."

The submission quotes from the Stage 1 assessment only, however, the second part of the assessment, which the submission ignores, is to then consider the context in which the sound occurs, and this may modify the findings of the initial estimate. There are many elements of context that can be considered, and the following list, which is not exhaustive, gives some examples that could be relevant to the assessment:

- the absolute level of sound;
- the character and level of the residual sound compared to the character and level of the specific sound;
- whether specific sound insulation and noise control measures have already been incorporated into a receptor (which would lower the sensitivity of the receptor);
- former uses, at or close to the site;
- the legitimacy of the industrial use, e.g. planning permissions or environmental permits;
- implementation of best practicable means for a given process or activity; and,
- whether the Rating Level represents typical levels, realistic worst-case levels, unlikely worst-case levels etc.

In this case the assessment, which is provided in full in Technical Appendix 12-3, considered the following elements of context;

- the absolute level of sound;
- the character and level of the residual sound compared to the character and level of the specific sound;
- the sensitivity of the receptors;
- operational scenarios; and
- the NG4 noise level limits

Following the BS 4142 assessment through to the end, the assessment concluded as follows;

"the full BS 4142 assessment concludes that there would be a low impact at all residential receptors during both the daytime and night-time."

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