

Conjoined public inquiry concerning:

WIN 370-4 Craiginmoddie Wind Farm, Dailly, South Ayrshire, KA26.

WIN 370-5 Carrick Wind Farm, Approximately South Ayrshire, KA19.

WIN 370-6 Knockcronal Wind Farm, Knockcronal, Straiton, South Ayrshire, KA19.

TOPIC : WIND TURBINE NOISE.

ON BEHALF OF Save Straiton for Scotland.

Inquiry Report.

Authors: Susan Crosthwaite & Melvin Grosvenor.

17th April 2023.

1. Introduction.

We still maintain that the submitted Conjoined Inquiry Scope of Evidence (CD.SS1) requires 4 days of noise inquiry sessions for the Reporters to be able to fully examine all of our evidence. A two day hearing will not allow the technical data to be fully explained and examined. The Operational Noise - Statement of Agreed Matters Date: 21st March 2023 Version: FINAL does not address the Cumulative Noise Impact Assessment which incorporates operational Assell Valley, Tralorg, Hadyard Hill, Markhill and Dersalloch industrial wind power plants, as well as Kirkhill (under construction) and the proposed live Scienteuch Planning Application in conjunction with Craiginmoddie, Carrick and Knockcronal wind power plants. Operational noise, methodology for assessment/recognised guidance/industry standards, infra-sound, low frequency noise and amplitude modulation; individual and cumulative effects (including with other applications subject to this inquiry and nearby wind farms); identification of properties most likely to be affected and to what degree; and the general nature of conditions required in different scenarios (cumulative noise limits/site specific noise limits).

- 2. The planning system is intended to protect the health and well being of those who are impacted by planning developments. South Ayrshire Local Development plan adopted in August 2022 on page 79 states:**

*Air, **noise** and light **pollution can have serious effects on health and well-being**. Rather than trying to lessen these effects after a development has taken place, **we think it is more effective to avoid developing areas where these problems could occur**.*

LDP policy: air, noise and light pollution:

We will not allow development which would expose people to unacceptable levels of air, noise or light pollution.

Note: In determining planning applications for development that might generate pollution, we'll take the advice of the Council's Environmental Health.

2.1. Our substantive evidence below, will inform the Reporters and SAC why the following statement in Craiginmoddie Wind Farm - Hearing Statement – Noise:

1.3 On this basis SAC's position remains that the noise impacts associated with all three schemes are acceptable, subject to conditions. Furthermore, SAC is not seeking a single Cumulative Noise Impact Assessment for all three applications. SAC has the power to investigate at a later stage should a potential statutory nuisance be found to exist in terms of the Environmental Protection Act 1990.'

Is fundamentally flawed, as there has been a systemic failure by SAC to adequately investigate and resolve noise nuisance complaints over many years and certainly since the Hadyard Hill Wind turbines commenced operations, along with the ongoing and unresolved complaints at Dochroyle, which is documented at Para 4.4 etc.,

This report also references an abandoned property and at least 1 property which is reported to have been brought out by a wind turbine operator due to complaints. This report's submitted evidence is that local residents are extremely unlikely to receive timely and effective resolution by either SAC, or the 3 applicant's in the event of any Wind Turbine Noise (WTN) nuisance complaints.

3. The Water of Girvan Valley and the Stinchar Valley, protected areas with hundreds of rural homes will have their residential amenity visually and acoustically severely impacted. Many more than the 'receptors' identified in the EIA are deemed to be impacted to unacceptable levels.

Once all this report evidence is considered the Council (SAC) may wish to reconsider their stated position

"The Council have had no issue with the standard of service and advice provided by ACCON to date. ACCON UK has confirmed that they had no conflicts of interest with regards to the review of the noise assessment for the Craiginmoddie

windfarm. Any suggestion that ACONN UK is not acting in the interests of the Council or that the advice that they offer the Council is wrong would require to be evidenced.”

in their response to EIR/2023/3219.

3.1. In the response to a previous EIR/2022/2965, South Ayrshire Council has acknowledged that it has received 89 wind turbine noise complaints up to April 2022 - since 2010:

‘4. How many Noise complaints have been received by South Ayrshire Council about wind turbines/ wind farms in the South Ayrshire Council District? **Since 2010 we have received 89 complaints as per attached excel spreadsheet 73 of them were about Hadyard Hill** as listed in the table below extracted from the excel sheet:

5. Please name the windfarms which have received noise complaints against them? **See attached excel spreadsheet (below)**

1				
2		22/01046/FOI	SAC Wind Turbine Noise Complaints 2010 - Present (22/04/2022)	
3				
4	Year	No of complaints	Wind Farms	Uniform Refence
5				
6	2010	1	Hadyard Hill	10/07409/NOIOTH
7	2011	1	Hadyard Hill	10/02341/NOIOTH
8	2012	0		
9	2013	0		
10	2014	1	Hadyard Hill	14/05484/NOIENQ
11	2015	4	Hadyard Hill x4	15/01888/NOIOTH
12	2016	33	Arecleoch x3	16/03822/NOIIND, 16/04415/NOIIND, 16/02216/NOIIND
13			Hadyard Hill x 29	16/01114/NOIIND. 15/01888/NOIOTH
14			Kilgallioch	16/02216/NOIIND
15	2017	36	Kilgallioch x2	17/01623/NOIIND, 17/02040/NOIIND
16			Hadyard Hill x 34	15/01888/NOIOTH
17	2018	1	Kilgallioch	18/03162/NOIIND
18	2019	8	Hadyard Hillx3	19/01570/NOICON
19			Kilgallioch x5	19/00462/NOIIND
20	2020	2	Clauchrie x2	20/00265/NOIIND, 20/00274/NOIOTH
21	2021	1	Mark Hill	21/0499/NOIOTH
22	2022	1	Kilgallioch	22/00423/NOIIND
23	Total	89		
24				

6. When a noise complaint has been registered, how does South Ayrshire Council currently ensure the protection of the Health and Well Being of windfarm neighbours from the on-going noise pollution from the wind turbines?

We investigate it to the best of our ability. Where a statutory nuisance is found to exist we would serve an abatement notice in terms of the Environmental Protection Act 1990. In some instances the Planning Service can instruct the developer to employ their own third party consultant to investigate.

7. How many of these complaints have been satisfactorily resolved in favour of the complainant?

This information is not recorded, but we advise the complainer to keep in touch if there are further problems and the service request is closed after three months if there are no further complaints to us.

As a result of this EIR we have significant concerns as to the ability of SAC, or any council in Scotland, to be able to fully independently investigate a wind turbine noise complaint or to bring forward a successful Noise Abatement case. The answer to question 7 is also inaccurate as SAC have supplied 60 copies of recorded communications held by SAC which demonstrate incompetence in resolving noise nuisance complaints.

3.2. Complaints both audible and Infrasound and Low frequency Noise ILFN remain unresolved as wind turbine operators almost always can demonstrate compliance. There is currently no guidance or mechanism to deal with ILFN.

- In South Ayrshire, homes have been abandoned due to unbearable health impacts – High Tralorg in 2015 – Mr and Mrs Siddell still pay council tax on their home -see witness statement 1.
- Bought out by developer – Tralorg windfarm - and the complainant family subsequently gagged by a NDA - Low Tralorg see witness statement 2.
- Property Sold on to an unsuspecting buyer complete with a letter from the wind turbine operator saying that the home had no noise issues, even though the owners' health deteriorated, and their complaints could not be satisfactorily resolved - anonymous.
- Ongoing and unresolved cases after years of complaints, having endured long term 'independent' monitoring that found the developer compliant - **Dochroyle** -where pleas for help still remain ignored and unresolved, justified by the EHO advising the complainant to continue to keep in touch if there are further problems see witness statement 3.

Living and suffering from impacts from acoustic pollution from wind turbines is '*dose related*' and it is almost impossible for an investigating EHO to '*perceive*' any noise nuisance on an '*occasional*' visit. These witness complaint statements are logged in **(CD.SS3.)** with video evidence.

3.3. As seen in (6) of the above EIR/2022/2965, the complaint service request is closed after three months if there are no further recorded complaints. This is often the case as living under the shadow of turbines has such debilitating impacts on the health and wellbeing of those suffering, that they do not have the sustained energy to constantly keep up the pressure of pursuing the constant denial of their health complaints, so they give up and are then subjected to a life of misery, through NO Fault of their own. This is completely unacceptable.

This is a significant issue which is causing even greater concern, as the renewable energy policy is driving development of large-scale wind turbines, like these 36 turbines, of even greater size and capacity closer to many more homes.

4. In EIR/2023/3219, SAC were asked for an update on any complaints since April 2022 discussed above in EIR/2022/2965.

Please can you update the excel sheet with complaints since 04.22.

Their answer is at odds with the 89 in the Excel sheet – 73 referencing Hadyard Hill – presumably these are four of the 89?

We have searched our planning records and have listed the cases where noise complaints have been received:

Hadyard Hill, Dailly. Ref. 11/00074/OTHER – received 16.02.2011

Tralorg Hill, Pinmore. Ref. 19/00150/COND – received 08.05.2019 – (Specifically noise from construction vehicles)

Mark Hill, Barrhill. Ref. 20/00062/COND – received 02.03.2020

Mark Hill, Barrhill. Ref. 21/00352/COND – Received 21.12.2021

4.1. Craiginmoddie Noise Report at Para 7.66 state:

7.66 'In respect of the claims that the Hadyard Wind Farm has been switched off due to noise issues, SAC are only aware that individual wind turbines have been turned off during investigation of noise complaints. SAC's records indicate that the affected properties were Laigh Tralorg Cottage, Dobbingsstone Farm and Tralodden Cottage. SAC are not aware of the wind farm as a whole having been turned off. Whilst investigations took place, SAC have no evidence that a statutory nuisance has been caused by the Hadyard Hill Wind Farm. SAC is satisfied that the noise assessments for the three applications have taken adequate account of existing wind farm developments, including Hadyard Hill, to ensure consented noise limits are not breached. To ensure that consented operational noise levels are not breached, subsequent applications must achieve a lower noise level at noise sensitive receptors, with the cumulative noise levels of the proposed development in conjunction with existing development modelled and reported within the noise assessments. SAC is satisfied that, subject to conditions governing operational noise limits, the operation of the Craiginmoddie, Carrick and Knockcronal Wind Farms would not result in an unacceptable effect on any nearby noise sensitive receptors.

7.67 I agree with SACs conclusion and would note that suitable noise limits have been proposed by the Applicants which take account of the noise immissions from existing wind farms, including HHWF.

7.68 I have carefully considered the noise related points raised by third parties. None of the points that have been raised alter my conclusion regarding the potential noise impacts associated with CMWF, I see no reason why consent should

be refused on noise grounds. I am satisfied that noise impacts can be controlled through the imposition of suitably worded noise related planning conditions.

4.2 Whilst James Mackay representing Energy Kontor at Para 7.67, above, may concur with SAC's statement in 7.66:

(CD.SS3.) A Noise Abatement **was** served by SAC on 22nd February 2016 – Ref 15/07888/NOIOTH/1, as a result of extended noise complaints about Hadyard Hill wind turbine noise from 2015. A council meeting was held about it - HADYARD HILL WIND FARM, DAILY MEETING held on Friday 29th April 2016 Fourth Floor Meeting Room, Burns House, Burns Statue Square, Ayr, KA7 1UT Ref 517357 -to discuss the complaint. Ref: **(CD.SS4)** for the full record of the meeting and 60 communications (some of them multiple emails) regarding noise complaints – mainly with regard to this case.

As Hadyard Hill was one of the first ever windfarms to be built the Noise Conditions are inadequate to protect the residents in any way.

Operational Noise

7.11 At properties occupied by persons with a financial interest in the development and night time noise levels must not exceed an L_{A90} (10 minutes) of 45 decibels. At wind speeds above 5.5 metres per second the L_{A90} should not exceed L_{eq} (10 minutes) by more than 5 decibels.

Reason: to ensure operational noise levels do not affect the amenity of those living in the vicinity of the windfarm.

7.12 At residential properties with no such financial interest, for wind speeds of up to 5 metres per second the L_{A90} (10 minutes) should not exceed 38dB (day time) and 43dB (night time) when measured at the external façade of the nearest residential properties.

Reason: to ensure operational noise levels do not affect the amenity of those using premises in the vicinity of the windfarm.

4.3 Years of distress since the first complaint in 2015, endless emails and communications, noise monitoring and a doctor's letter linking sleep disturbance to the health issues caused by the presence of the wind turbines, again left wind turbine victims with no satisfactory recourse, as the developer's acousticians *'found'* their monitoring to be compliant and the council failed to uphold their abatement order. SAC basically abandoned the noise victims and dismissed the case. This again demonstrates the inability of *'noise impacts to be controlled through the imposition of suitably worded noise related planning conditions'*.

All the Hadyard Hill noise communication complaints and responses are listed in **(CD. SS4)**

Below are a very few extracts which make for extremely disturbing reading:

Ref. 53603 *"Just to inform you that who is a resident of has just been released from hospital and last night was again deprived of sleep which is one of the reasons she was in hospital, the doctor has linked her lack of sleep directly to the wind turbines and has kept a record of her ongoing health problems due to them. he has asked us to e-mail you and let you know that these wind turbines are causing ill health due to nuisance and the continuous lack of sleep. We have received a report from SSE lawyer which I believe you have a copy, in it he refers to TNEI having another look at the tonal noise from the turbines between end of 2015 to February 2016 where they have decided that no tonal noise was breached although served an abatement notice on them although albeit on the wrong department which of course does not take away the fact that she believed they were breached. Can you now tell us if she made a mistake in serving this notice and there was no breach of nuisance and she was wrong in her decision to serve the abatement notice, or if you believe she was right could you also confirm if that is the case. Finally could you tell us if it is your intention to reserve the notice if you do agree with decision or do you intend not to reserve the abatement notice. I believe solicitor is going to write to you direct."*

Ref.553865 *"As I have explained previously, we had not witnessed any nuisance conditions from the turbines on the 11 occasions we have attended as a result of complaints from you"*

Ref. 554401 *"Thank you for your letter and i must inform you i have never read anything so ridiculous from any council worker. Firstly there was an abatement notice served on SSE however it was served wrongly and that was the fault of the council. I am aware of the clash between your and that she had to go over his head in order to carry out the proper procedure relating to the nuisance at our property, as there is no change in the operating of the wind turbines and although their own first report supports that there were breaches in the nuisance levels you still tell me now that you cannot identify a nuisance although all the evidence is there. we will now proceed to take our evidence further."*

Ref.560703 *"I would advise that a recent meeting took place between Environmental Health and SSE Generation / TNEI Services Ltd to discuss the noise report produced outlining the findings of the most recent noise monitoring exercise undertaken by them as a result complaints of noise received from you and other residents of in respect of Hadyard Hill Wind Farm.*

I understand you have been sent a copy of the report into the noise levels which were measured between August 2016 and November 2016.

Due to the amended operational control regime which has been put in place, levels were found to be in compliance with the agreed noise levels.

We have accepted the findings contained in the report and SSE Generation's ongoing commitment that the amended operational control regime is retained and if possible automated.

Our investigations into this matter are now concluded.

Regards,"

Ref. 569865 *"I would advise that a recent meeting took place between Environmental Health and SSE Generation / TNEI Services Ltd to discuss the noise report produced outlining the findings of the most recent noise monitoring exercise undertaken by them as a result complaints of noise received from you and other residents of in respect of Hadyard Hill Wind Farm.*

I understand you have been sent a copy of the report into the noise levels which were measured between August 2016 and November 2016. Due to the amended operational control regime which has been put in place in place, levels were found to be in compliance with the agreed noise levels. We have accepted the findings contained in the report and SSE Generation's ongoing commitment that the amended operational control regime is retained and if possible automated.

Our investigations into this matter are now concluded.

Regards,"

Ref 567819 *"You may recall I responded to your previous email on this subject (further copy attached). I had hoped that would provide the reassurance you were seeking that both officers are more than adequately qualified and experienced to have investigated your complaint about turbine noise.*

Can I politely remind you one more time that the Council has issued its final consideration of your complaint and has nothing further to add. We will not enter into further correspondence with either of you on this matter.

I hope that clarifies the matter."

5. South Ayrshire Council (SAC) has taken the advice of ACCON and Environmental Health to make planning decisions with regard to noise impacts from wind turbine noise on those living in proximity to such developments. ACCON relies on ETSU R 97 and The Good Practice Guide as it states:

The Council's noise consultant, ACCON UK Limited, have been internally consulted to review the submitted documents relating to noise in order to inform Council considerations as whether the noise assessments have been carried out appropriately and to advise on the acceptability or otherwise of the proposals with respect of noise. In their response, ACCON has advised that the methodologies used in the noise chapter represent good practice and are in line with ETSUR-97 (operational noise) and the Institute of Acoustics (IOA) Good Practice Guidance for wind turbines. As part of this, they also endorse the approach to deriving cumulative noise limits and subsequent site-specific noise limits which they conclude are also in line with the same guidance referenced above.

6. We consider having reviewed the evidence submitted by the applicant's acousticians in respect of all 3 proposals, that that ACCON and SAC Environmental Health and therefore SAC, are not fully informed regarding the detrimental operational impacts arising from the significantly increased size and power levels, both individually and cumulatively of the proposed large scale industrial turbines will have on the acoustic environment.

All of the applicant's Environmental Impact Assessment methodology is severely constrained, by only focussing on outdated current noise 'guidance' which fails to consider, monitor or assess the full operational acoustic environmental impacts on Residential Amenity.

Furthermore, Mr Huson states at Para 163 in his Expert Witness Statement that; **(CD.SS5.)**

163 In consideration of the above concerns, the project target noise limits of ETSU-R-97 will not be met and the conjoined projects should not be granted approval.

It is also clear from Mr Huson's thorough appraisal of the 3 application Noise Impact Statements and the Statement of Agreed Matters Noise, that there are significant failures in the cumulative WTN assessment methodology and that our request for a detailed cumulative WTN assessment was sound and justified. This request has been ignored.

- 6.1. Following on from the unresolved complaints at Hadyard Hill and the experience of residents adversely impacted by the Hunterston offshore turbines, we refer to a statement by James Mackay ref Craiginmoddie Hearing statement Noise at Para 7.16:

7.16 *Whilst concerns regarding health impacts associated with wind turbines are sometimes raised / discussed in wind farm appeals I am not aware of any cases where a proposal has been refused on this basis. When considering the appeal for the Mochrum Fell Wind Farm (PPA-170-2152) the Reporter noted, in paragraph 85 that: 'I have noted other concerns raised by objectors that relate to the potential impact of the proposal on human health. However, there is no evidence to support these concerns.'*

6.2. The above statement from the Mochrum Fell decision letter did not reflect the actual evidence given at the hearing and one can only guess as to why the Reporter (Ms Lynch), chose to make the above statement. Susan Crosthwaite had cause to write about this serious concern to Mr S Ferry (Chief Reporter) and Mr Buylla (Principal Reporter), which records the evidence from Mochrum Fell (extracts from the letter sent dated 12th October 2022): Details of this letter are provided below **(CDSS6)** :

6.3. *"During the inquiries and hearings we have put before the DPEA reporters a considerable amount of scientific evidence which demonstrates that the current planning guidance on environmental noise is not fit for purpose and does not protect the health and well being of windfarm neighbours with regard to noise pollution through current Scottish planning and UK legislation. Planning is devolved, yet noise is not!*

*Robust planning conditions are supposed to be designed to protect the amenity, health and well-being for all residents subjected to developments close to their homes. Due to the vast number of windfarm planning applications across Scotland, thousands of lives are being impacted. It is a failure of responsibility for reporters accountable for the planning conditions, to ignore substantial evidence which demonstrates that the guidance ETSU R 97 and the Good Practice Guide are not delivering conditions to **protect local residents from adverse noise generated by the operations of windfarms.***

In our experience reporters ascertain that inquiries and hearings are not the forum to discuss these inadequacies, yet the DPEA and Consent Departments of the Scottish Government are the very forum where these life changing decisions are made.

I would like to refer you to the recent Mochrum Fell hearing: https://dpea.public-i.tv/core/portal/webcast_interactive/668651
<https://www.dpea.scotland.gov.uk/CaseDetails.aspx?ID=121722> Dumfries and Galloway Council (20/01683/FUL)

Below is an extract from the transcript taken from this DPEA online video of the inquiry proceedings.

7 hours into the hearing video, Reporter Ms Lynch asked:

Having said that, is there anyway a condition could be attached, to a consent such as this, that could be enforceable? I have/am still not having a concrete answer I would say, from you?

7:02:15 Professor Alves Pereira answered: *Well, how about monitoring the health of people?*

Reporter: *In terms of?*

Professor Alves Pereira: *Not cholesterol, their neurological respiratory response, monitoring their cognitive ability, which goes down the drain in these homes, monitoring other cardiac function. There's MRI's which can be produced after a year of residing in a contaminated home.....*

.....I would monitor, properly monitor, with medical people, not Environmental Health Officers. I have the greatest respect for them but, they are not trained in Medical Sciences, they are not medical diagnosticians.....

7:15.04 Reporter: *Whilst Mr Grosvenor is trying to rejoin, I am certainly not in disagreement with Miss Pridham and Ms Crosthwaite in terms of how desirable such a condition might be and how beneficial it maybe but my ability to impose such a condition is extremely limited and you should be aware of that and certainly not in disagreement with Ms Crosthwaite in terms of how desirable.*

Glitch with my Mr Grosvenor sound.. aborted..

Ms Crosthwaite: *That was Mr Grosvenor calling saying he won't be rejoining, as he has too many problems. (with his broadband)*

Mr Grosvenor did say you could put a note in your recommendations and express concern and suggest some kind of monitoring is done and suggest some kind of study is set up as well. I am about to speak to Generation Scotland and maybe if it came from you as well, it would help to set something up to look at the health, the general health of wind farm neighbours. 7.21.21.

Reporter: *Okay, okay, I will certainly reflect this discussion in my decision letter, absolutely I think that is a sensible solution .*

Yet, when it came to the Decision letter the Reporter resorted to the usual ETSU-R 97 /Good Practice Guide as the excuse for failing to fulfil this commitment at the inquiry:

It is of immense concern and completely relevant to this Conjoined Inquiry, given the evidence submitted by all three acousticians which continues to postulate the unsound position as stated within the WSP BEIS report that; "*indicates that wind turbine infrasound has no adverse effects on human health at typical exposure levels and that it is not necessary to consider wind turbine infrasound when determining development applications*". Furthermore, *assessment on the basis of 'A' weighted sound levels (the approach in the ETSU-R-97 assessment methodology) provides sufficient control over the potential impact of low frequency noise*".

- 6.4. The ongoing and currently unresolved wind turbine noise nuisance case in respect of the Blary Hill Wind Power Station, is having a devastating impact on the affected residents, to the same extent as experienced by the Hadyard Hill residents at Ref. 53603 above.
- 6.5 The ETSU & 97 Wind Turbine Noise Planning Conditions imposed by the Reporters at the Blary Hill Appeal Case reference: PPA-130-2052 by (Mr S Ferry and Mr C Warren) are failing to protect the residential amenity of the residents and are therefore, not fit for purpose.

6.6. The experience and evidence of Rita Holmes, as one of the residents severely impacted by the Hunterston turbines, **(CD.SS7)** also advises that adversely impacted residents residential amenity, is not protected by the current WTN guidance. How many more cases are there that are hidden or unresolved, whereby residents are not being supported by their Local Planning Authority or Environmental Health Departments?

7. Extract from Onshore Wind Policy Statement 2022 (OWPS) Issued by the Scottish Government December 2022.

3.7. Noise

3.7.1. *'The Assessment and Rating of Noise from Wind Farms' (Final Report, Sept 1996, DTI), (ETSU-R-97) provides the framework for the measurement of wind turbine noise, and all applicants are required to follow the framework and use it to assess and rate noise from wind energy developments.*

3.7.2. *The Institute of Acoustics (IOA) Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise was published in May 2013 to support the use of ETSUR- 97 when designing potential windfarm schemes, and the monitoring of noise levels from generating sites. The Scottish Government recognises this guide as a useful tool which developers can use in conjunction with ETSU-R-97.*

3.7.3. *The Scottish Government is aware that the UK Government has been considering the extent to which ESTU-R-97 may require updating to ensure it is aligned with the potential effects from more modern turbines. The Scottish Government supports this work and anticipate the results of a short-term review project in due course.* (our emphasis)

3.7.4. *Until such time as new guidance is produced, ETSU-R-97 should continue to be followed by applicants and used to assess and rate noise from wind energy developments.*

7.1. As previously stated, there is recognition in this latest update on onshore wind policy that there is a need for an update for ETSU R 97, yet there is no recognition that this guidance, and its subsequent conditions when approved at planning, does not provide the guaranteed, or substantive protection required to make living close to industrial turbines safe from harm.

7.2 The proposed Noise Conditions (WTN) are based on the standard ETSU-R-97 Guidance. It is strongly considered that extensive and worldwide experience gained over the time from the date of publication, has show that the Guidance is fundamentally flawed from the outset, as there was no medical expert on the panel, or consideration of potential health impacts from operational turbines.

7.3. It is abundantly clear the wind turbine blade tip heights have increased from under 50 metres to up to 250 metres plus, and the commensurate generating power output from under 1MW to more than 7 MW, without any notable review of Wind Turbine Noise environmental health impacts. ETSU R 97 only provides for outdated planning conditions, introduced in 1997 when turbines were up to six times smaller and six times less powerful.

7.4 Current UK Government endorsed planning guidance on WTN comprises just ETSU and the IOAGPG, which consider only audible noise, and does not address infrasound or low frequency noise (ILFN) from wind turbines. ETSU, **published in 1997, referred to infrasound (but only twice), yet the IOAGPG, published in 2013, now makes no mention at all of infrasound.** Both ETSU and the IOAGPG were substantially authored by a group of acousticians affiliated to the Institute of Acoustics, the majority of whom worked primarily as consultants to, or employees of the UK wind industry. **There were no medical experts on the panel.**

7.5 The 175-page document, titled “The assessment & rating of noise from wind farms,” has an opening statement which is fully transcribed below:

This report was drawn up under the direction of the Noise Working Group. While the information contained in this report is given in good faith, it is issued strictly on the basis that any person or entity relying on it does so entirely at their own risk, and without the benefit of any warranty or commitment whatsoever on the part of the individuals or organisations involved in the report as to the veracity or accuracy of any facts or statements contained in this report. The views and judgements expressed in this report are those of the authors and do not necessarily reflect those of ETSU, the Department of Trade and Industry or any of the other participating organisations

7.6 It might now be interesting to list the contributors who knowingly co-signed a document of (self-acknowledged) questionable veracity and accuracy.

Members of the Noise Working Group:

Mr R Meir, Chairman	DTI
Dr M L Legerton, Secretary	ETSU
Dr M B Anderson	Renewable Energy Systems
Mr B Berry	National Physical Laboratory
Dr A Bullmore	Hoare Lea and Partners
Mr M Hayes	The Hayes McKenzie Partnership
Mr M Jiggins	Carrick District Council
Mr E Leeming	The Natural Power Company Ltd
Dr P Musgrove	National Wind Power Ltd
Mr D J Spode	North Cornwall District Council
Mr H A Thomas	Isle of Anglesey County Council
Ms E Tomalin	EcoGen Ltd
Mr M Trinick	Bond Pearce Solicitors
Dr J Warren	National Wind Power Ltd

8. We are fully aware of the relevance of paragraph: 3.7.4. Operational Noise Report Craiginmoddie Wind Farm; *"Until such time as new guidance is produced, ETSU-R-97 should continue to be followed by applicants and used to assess and rate noise from wind energy developments, which is now subject of interest, due the publication of the WSP BEIS report (CD012.015) titled 'A review of Noise Guidance of Onshore Wind Turbines'.*

8.1. We also note the Statement of Agreed Matters Noise which states at Para 2.7

The WSP BEIS report itself does not provide new guidance, nor does it form, or function as, a replacement for ETSU-R-97 or supersede any parts of the current policy or guidance frameworks in place, in Scotland or elsewhere in the UK.

and at: Para 2.11

The assessments produced to consider operational noise from all three proposed developments, and the approach used to determine suitable noise limits as discussed in this SoAM, followed the guidance set out in ETSU-R-97 and the IOA GPG.

We agree that the methodologies defined within these documents remain relevant and valid for the purposes of assessing these proposed developments.

Therefore, our position in respect of the inadequacy of ETSU R 97 and the IOAGP remain intact as stated above.

8.2. Due to the introduction, by the applicants, of the WSP BEIS report (CD012.015) titled 'A review of Noise Guidance of Onshore Wind Turbines', authored by Mike Lotinga and Toby Lewis of WSP; we likewise, introduce and reference the Independent Noise Working Group's (INWG) critique (**CD.SS8**) of this recently published report.

Notably, the lead Peer Reviewer was Bernard Berry, who is listed above as a Member of the ETSU R 97 Working Group.

(Note: INWG Critique: Text quoted from the WSP report, website or LinkedIn page is shown in *blue italics*. Text quoted from other documents is shown in *black italics*. INWG comments or statements are shown in **red and highlighted in grey**)

We advise the Inquiry that:

"The INWG's mission is ensuring that the acoustic impacts from wind turbines are properly controlled in order to protect public health and wellbeing".

8.3 The INWG's critique of the WSP BEIS report is highly critical. (Note: Susan Crosthwaite and Melvin Grosvenor are members of INWG.)

The critique's introduction states:

"The report titled; 'A review of noise guidance for onshore wind turbines' was released by acoustic consultant WSP on their company website on 10 February 2023 with an announcement appearing on the WSP LinkedIn social media page, [open here](#). An initial review of the web site report summary, [open here](#) raised some serious concerns regarding the integrity, impartiality and accuracy of this report to Government. As a result, the INWG decided to conduct an analysis of the WSP report.

At 400 pages in length, two or three times longer than needed, repetitive and with an excess of jargon it will dissuade all but the most determined reader to properly evaluate the findings. When we analyse the report, its methodology, authors and invited stakeholders it is concluded this review of ETSU-R-97 is biased with conflicts of interest throughout.

The stakeholder engagement survey at section 4 of the report, is arguably the most important workstream within the review. Whereas the engagement objectives would appear to be reasonable, the implementation is judged to be deficient and compromised by bias. The survey composition of the 'by invitation only' stakeholders creates a bias in favour of the wind industry and is particularly imbalanced as it excludes those with direct experience of living near wind turbines and their representatives.

Despite this overwhelming evidence from the stakeholder survey that ETSU-R-97 has failed, WSP chose to include the written statement from two professional associations (see pages 162 and 163), which recommended to continue with the use ETSU-R-97. The unnamed professional associations in making this statement demonstrate their denial of the shortcomings of using ETSU-R-97 and denigrate the so-called 'objector groups'. This would appear to be an unprofessional attempt to pressure government to retain ETSU-R-97 and to prevent independent scrutiny."

8.4 Furthermore, INWG note:

It is evident from this statement that the unnamed professional associations are in denial of the shortcomings with ETSU-R-97. Additionally, they have denigrated the so called 'objector groups' with the misleading statement;

*"The fact that onshore wind development in the UK has attracted little adverse attention from those worried about noise does not mean that such an announcement would not stir up considerable interest from **objector groups with no factual or scientific basis for their assertions.**"*

This assertion by the WSP authors is deeply concerning, as it has no basis in reality and is seeking to unjustifiably undermine one of the recommendations of the WHO's 2018 European Environmental Noise Guidance, which is discussed within this report.

This inquiry report will also contest this unfounded statement by submitting substantive scientific evidence which directly challenges the WSP report statement.

8.5. INWG's critique also draws further attention to the report's deeply concerning survey response methodology and analysis:

In summary, Figures 4-5, 4-6 and 4-7 provide a clear indication that there are concerns with many aspects of the guidance. The wind industry professional associations consider that these concerns can be overcome with some updating, and that others, mostly the LPAs and the civic group consider that the guidance requires substantial revision.

Additionally, WSP conducted interviews with a few selected respondents that seems to have complicated the analysis and introduced an additional layer of topics. The report does not identify which stakeholders were interviewed or even how many out of the 31 were interviewed.

In conducting these interviews to a likely small number of stakeholders in this way, WSP will have created an uneven playing field with either bias or perceived bias favouring the wind industry.

8.6 Likewise, the INWG raises further concerns:

It should be recognised that this stakeholder survey included 31 respondents of which only one, the INWG might be described as an 'objector group'. Almost all the issues raised by stakeholders to question 1.4 as discussed above came from the other 30 respondents. The statement from these two wind industry professional associations ends with; "*While we do not feel there*

is a need for new UK wind turbine noise assessment guidance, any further modifications should include a panel of expert acousticians, wind farm, developers, government representatives and the IOA”.

It is therefore of further concern that the suggested panel fails to include audiologists, physicians or representatives of communities negatively impacted by wind turbine noise.

This statement on page 162 and 163 by the wind industry would appear to be an unprofessional attempt to retain ETSU-R-97 as the official noise guidance and to prevent independent scrutiny.

8.7 In summary, INWG further question the standing and validity of the WSP report and recommendations:

When we delve into the report and identify the authors and stakeholders we see that central government, local government and the wind industry including their acousticians are the only participants other than the INWG. Even the appointed ‘peer reviewer’ is one of the original authors of the ETSU-R-97 guidance and has been closely associated with the wind industry for over two decades. There being no other independent stakeholders identified and the INWG is aware of several unsolicited survey responses have not been acknowledged or included in the review.

It is concluded this review of ETSU-R-97 by WSP is biased throughout in its methodology and execution.

Also of note, INWG state:

On an earlier version of their website, WSP proudly claimed their experience with onshore wind projects stating, “*We have a long track record supporting wind developers, utilities, funders and investors throughout the project life cycle.*”

We also acknowledge, that the acoustician representing the applicant for the Carrick wind turbine proposal is directly associated with WSP.

Likewise, the acoustician representing the applicant for the Craiginmoddie wind turbine proposal, advises in the Hearing Statement Noise

at Para 2.3:

I formed part of the peer review group when the UK Institute of Acoustics produced good practice guidance relating to wind farm noise assessment (the IOA GPG (CD012.002)) and I wrote one of the associated Supplementary Guidance Notes relating to data analysis (CD012.022).

Furthermore, the acoustician representing the applicant for the Knockcronal wind turbine proposal is listed as a Member of the ETSU -R 97 Working Group.

8.8 It is of concern that the Knockcronal Wind Farm Technical Appendix 10.1 Environmental Noise Assessment. - REVISION 4 – 15 NOVEMBER 2021 - AUTHOR: MARK JIGGINS MSc MIOA;

Statement on page 2 is also of questionable veracity:

*“This document has been prepared for Statkraft UK Ltd only and solely for the purposes expressly defined herein.
We owe no duty of care to any third parties in respect of its content. Therefore, unless expressly agreed by us in signed writing, we hereby exclude all liability to third parties, including liability for negligence, save only for liabilities that cannot be so excluded by operation of applicable law. (emphasis added)*

How can this inquiry rely on any of the content of this document?

Who represented the medical community on the ETSU committee?

If no medical expertise was relied upon, why is ETSU-R-97 presumed to incorporate the protection of Public Health against wind turbine noise? ETSU-R-97 does not cover health effects that may arise due to wind turbine noise exposure therefore, how is it possible for the Inquiry Reporters to provide consent that will guarantee safeguards and protection to the public?

9.1 As highlighted by the INWG at Para 11.6 above, not only were there no representation or consideration of any potential health impacts by the original ETSU R 97 Working Group, as referenced in Rita Holmes Hearing Statement, **(CD.SS7)** Hunterston National Offshore Wind Turbine Test Facility at Para 7.10:

Extract: Para 4.22 of the Craiginmoddie Hearing Statement - Noise:

The WSP BEIS report (CD012.015) considered a number of studies which investigated claimed links between adverse health symptoms and infrasound emissions from wind turbines. The report notes on page 116 that:

*Overall, the findings from the existing evidence base indicate that infrasound from wind turbines at typical exposure levels has no direct adverse effects on physical or mental health, and reported symptoms of ill-health are more likely to be *psychogenic in origin.*

Note: Oxford Dictionary definition of *psychogenic - having a psychological origin or cause rather than a physical one.

9.2 The question, Rita Holmes also raises along with the INWG 's critique is substantive and requires addressing:

On what basis should medically unqualified acousticians, (as are the authors of the WSP BIES report) opinions on the health and wellbeing of affected residents, become accepted as statement of fact, on which large scale planning decisions are made?

9.3 Furthermore, Rita Holmes compelling experience and evidence, more than adequately respond to all of the misleading statements and references within the Craiginmoddie Noise Chapter and Hearing Statements or any other submissions by the other 2 applicant's acousticians, in respect of the Hunterston Appeal decision. It is considered there is no need to discuss these further within this Noise Inquiry Report.

9.4 However, it is considered to be important to submit evidence in response to the Craiginmoddie Hearing Statement Para 7.5 copied below and any other references submitted to the inquiry, in respect of the World Health Organisation's (WHO) position on noise impacts in relation to sleep disturbance and specifically wind turbine noise impacts, both at audible frequencies and at low frequencies.

7.5 Third party submissions made reference to a report produced by the World Health Organisation (WHO) in 2018 (CD012.032) which considered the potential health effects associated with a range of noise sources, road, rail, aircraft, leisure noise and wind turbine noise. The WHO report which was titled 'Environment Noise Guidelines for the European Region' (ENGER) made a series of 'strong' and 'conditional' recommendations for each noise source.

9.5 Details of the date and reference of The WHO Community Noise is extracted below:

This WHO document on the *Guidelines for Community Noise* is the outcome of the WHO-expert task force meeting held in London, United Kingdom, in April 1999. It bases on the document entitled "Community Noise" that was prepared for the World Health Organization and published in 1995 by the Stockholm University and Karolinska Institute.

In fact this extremely dated report published in 1999, states:

Since 1980 WHO has addressed the problem of Community Noise. In 1992 the WHO regional office for Europe convened a task force which set up Guidelines for Community Noise presented in this document.

The Preface extract below, sets out the perimeters of the objectives of the guidelines.

Preface

Community noise (also called environmental noise, residential noise or domestic noise) is defined as noise emitted from all sources except noise at the industrial workplace. Main sources of community noise include road, rail and air traffic, industries, construction and public work, and the neighbourhood. The main indoor sources of noise are ventilation systems, office machines, home appliances and neighbours. Typical neighbourhood noise comes from premises and installations related to the catering trade (restaurant, cafeterias, discotheques, etc.); from live or recorded music; sport events including motor sports; playgrounds; car parks; and domestic animals such as barking dogs. Many countries have regulated community noise from road and rail traffic, construction machines and industrial plants by applying emission standards, and by regulating the acoustical properties of buildings. In contrast, few countries have regulations on community noise from the neighbourhood, probably due to the lack of methods to define and measure it, and to the difficulty of controlling it. In large cities throughout the world, the general population is increasingly exposed to community noise due to the sources mentioned above and the health effects of these exposures are considered to be a more and more important public health problem. Specific effects to be considered when setting community noise guidelines include: interference with communication; noise-induced hearing loss; sleep disturbance effects; cardiovascular and psycho-physiological effects; performance reduction effects; annoyance responses; and effects on social behaviour.

9.6 The WHO 1999 Community Noise Guidance does not reference wind turbine noise. All other main sources of community noise are considered, including barking dogs. Indeed the extract below the Introduction does not identify Wind Turbines, as at that time there were very few turbines operating within quiet rural environments. However it is clear the WHO does raise the concern that the general population is increasingly exposed to community noise due to the sources mentioned. Specific effects to be considered include noise-induced hearing loss; sleep disturbance effects; cardiovascular and psycho-physiological effects; performance reduction effect etc;

However, it is abundantly clear that the WHO in 1999 recognised that sleep disturbance was and still is a fundamental concern, especially in quiet rural locations selected for hosting wind turbines which are exponentially increasing in size, as in these 3 applications.

Sleep disturbance is a major effect of environmental noise. It may cause primary effects during sleep, and secondary effects that can be assessed the day after night-time noise exposure. Uninterrupted sleep is a prerequisite for good physiological and mental functioning, and the primary effects of sleep disturbance are: difficulty in falling asleep; awakenings and alterations of sleep stages or depth; increased blood pressure, heart rate and finger pulse amplitude; vasoconstriction; changes in respiration; cardiac arrhythmia; and increased body movements. The difference between the sound levels of a noise event and background sound levels, rather than the absolute noise level, may determine the reaction probability. The probability of being awakened increases with the number of noise events per night. The secondary, or after-effects, the following morning or day(s) are: reduced perceived sleep quality; increased fatigue; depressed mood or well-being; and decreased performance.

For a good night's sleep, the equivalent sound level should not exceed 30 dB(A) for continuous background noise, and individual noise events exceeding 45 dB(A) should be avoided. In setting limits for single night-time noise exposures, the intermittent character of the noise has to be taken into account. This can be achieved, for example, by measuring the number of noise events, as well as the difference between the maximum sound level and the background sound level. Special attention should also be given to: noise sources in an environment with low background sound levels; combinations of noise and vibrations; and to noise sources with low-frequency components.

9.7 It is also notable that the WHO state; ***Special attention should also be given to: noise sources in an environment with low background sound levels; combinations of noise and vibrations; and noise sources with low frequency components.*** The question is then, why are the wind industry acousticians constantly seeking to down play residents complaints and deny the health impacts from adversely impacted residents, especially those who suffer severe sleep disturbance?

Can it really be the case that all other sources of noise nuisance from whatever source rightly needs to be addressed, but only wind turbine noise is benign and causes no ill effects?

This evidence from the WHO totally contradicts the unfounded claim by the WPS authors;

Overall, the findings from the existing evidence base indicate that infrasound from wind turbines at typical exposure levels has no direct adverse effects on physical or mental health, and reported symptoms of ill-health are more likely to be psychogenic in origin.

9.8 To clarify, extracts from the updated WHO 2018 Noise Guidance are copied below:

*"The current evidence on health outcomes related to wind turbine noise is unavailable, or of low/very low quality and mainly comes from cross-sectional studies. **Methodologically robust longitudinal studies with large samples investigating the quantitative relationship between noise from wind turbines and health effects ARE NEEDED.**" (Emphasis added by report author).*

It is abundantly clear completely independent scientific research free of any bias or predetermined out comes is desperately needed. It is imperative that local communities have full confidence in the transparent independence of the research.

Importantly, there is a significant step forward in an admission by WHO on Page 85 of the 2018 Guidance, that;

*"Wind turbines **can generate infrasound or lower frequencies of sound** than traffic sources. However, few studies relating exposure to such noise from wind turbines to health effects are available. It is also unknown whether lower frequencies of sound generated outdoors are audible indoors, particularly when windows are closed".*

Both of these statement by WHO acknowledge there is a need for further studies and that wind turbines can generate infrasound, or lower frequencies of sound.

9.9 The WHO 2018 Guidance also stated:

"Wind turbine noise is characterized by a variety of potential moderators, which can be challenging to assess and have not necessarily been addressed in detail in health studies. As a result, there are serious issues with noise exposure assessment related to wind turbines.";

and further,

*"The noise emitted from wind turbines has other characteristics, including the repetitive nature of the sound of the rotating blades and atmospheric influence leading to a variability of amplitude modulation, which can be a source of above average annoyance (Schäffer et al., 2016). This differentiates it from noise from other sources and has **not** always been properly Characterized."*

*Standard methods of measuring sound, **most commonly including A-weighting, may not capture the low-frequency sound and amplitude modulation** characteristic of wind turbine noise (Council of Canadian Academies, 2015).*

It is clear from WHO statements that ETSU - R - 97, is not adequate to assess the full Characterisation of WTN, in this context Table 42 is informative and identifies failures of adequate research and the ongoing consequences to the health and wellbeing of residents.

Table 42. Summary of the assessment of the strength of the recommendation

Factors influencing the strength of recommendation	Decision
Quality of evidence	<p>Average exposure (L_{day}) <i>Health effects</i></p> <ul style="list-style-type: none"> Evidence for a relevant absolute risk of annoyance at 45 dB L_{day} was rated low quality. <p><i>Interventions</i></p> <ul style="list-style-type: none"> No evidence was available on the effectiveness of interventions to reduce noise exposure and/or health outcomes from wind turbines. <p>Night-time exposure (L_{night}) <i>Health effects</i></p> <ul style="list-style-type: none"> No statistically significant evidence was available for sleep disturbance related to exposure from wind turbine noise at night. <p><i>Interventions</i></p> <ul style="list-style-type: none"> No evidence was available on the effectiveness of interventions to reduce noise exposure and/or sleep disturbance from wind turbines.
Balance of benefits versus harms and burdens	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.
Values and preferences	There is wide variability in the values and preferences of the population, with particularly strong negative attitudes in populations living in the vicinity of wind turbines.
Resource implications	Information on existing interventions (and associated costs) to reduce harms from wind turbine noise is not available.
Additional considerations or uncertainties	There are serious issues with noise exposure assessment related to wind turbines.
Decisions on recommendation strength	<ul style="list-style-type: none"> Conditional for guideline value for average noise exposure (L_{day}) Conditional for the effectiveness of interventions (L_{night})

9.10 Comments in respect of Table 42:

Balance of benefits versus harms and burdens

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.

WHO simply does not indicate (as repeatedly stated by all wind industry acousticians):

'that there is no evidence that any infrasound/low frequency noise from wind turbines directly causes health impacts or can otherwise impact on the amenity of those living or working near wind turbines'. WHO consistently states further research work is needed.

Values and preferences

There is wide variability in the values and preferences of the population, with particularly strong negative attitudes in populations living in the vicinity of wind turbines.

9.11 Comment: The fundamental question that needs to be asked is, why is WHO reporting there is:

"particularly strong negative attitudes in populations living in the vicinity of wind turbines"?

This cannot and must not be explained away by wind turbine operators, by ignoring, or even denying that residents complaints are not substantive, or genuine or, that they may have been predisposed to complain, because they don't like wind turbines due to campaign groups and media exposure or, are stressed because they objected to the consented development, or influenced by; '*non-acoustical factors*', as has been unacceptably postulated in the 2016 WSP/Parsons Brinkerhoff AM Report to Government at Para 3.3.87.

9.12 WHO Identified Need and Implications for Further Research on Health Impacts from Wind Turbine Noise.

Paragraph 4.2 states:

Further research into the health impacts from wind turbine noise is needed so that better-quality evidence can inform any future public health recommendations properly. For the assessment of health effects from wind turbines, the evidence was either unavailable or rated low/very low quality. Recommendations for research addressing this priority are proposed in Table 53.

Extracts from Table 53 are copied below;

Table 53. Implications for research on health impacts from wind turbine noise

Current state of the evidence	The current evidence on health outcomes related to wind turbine noise is unavailable or of low/very low quality and mainly comes from cross-sectional studies. Methodologically robust longitudinal studies with large samples investigating the quantitative relationship between noise from wind turbines and health effects are needed.
Population of interest	Research is needed into effects of exposure on children and adults exposed and living near sources of wind turbine noise. Studies should assess subgroup differences in effects for vulnerable groups such as children, elderly people and those with existing poor physical and mental health.
Exposure of interest	Exposure to noise at a wide range of levels and frequencies (including low-frequency noise), with information on noise levels measured outdoors and indoors (particularly relevant for effects on sleep) at the residence is needed. The noise exposure should be measured objectively and common protocols for exposure to wind turbine noise should be established, considering a variety of noise characteristics specific to wind turbine noise.

9.13 It is apparent the recommendations of WHO 2018 Noise Guidance has been largely ignored by the wind industry and policy/decision makers within Government. There are consistent calls by impacted residents whose complaints are not being addressed and resolved.

Table 53 particularly states:

"Research is needed into effects of exposure on children and adults living near sources of wind turbine noise",

yet the wind industry acousticians as evidenced in the WSP BEIS report are **deliberately** avoiding this serious public health matter.

In addition, it is extremely concerning that whilst WHO specifically state:

*Exposure to noise at a wide range of levels and frequencies (**including low - frequency noise**), with information on noise levels measured outdoors and indoors (particularly relevant for effects on sleep) **at the residence is needed.***

9.14 Compared with the WHO recommendations the INWG WSP critique **(CD.SS8)** confirms:

At page 116, WSP claim:

"Overall, the findings from the existing evidence base indicate that infrasound from wind turbines at typical exposure levels has no direct adverse effects on physical or mental health, and reported symptoms of ill-health are more likely to be psychogenic in origin".

On what basis should medically unqualified acousticians, (as are the WSP authors) opinions on the health and wellbeing of adversely affected residents, become accepted as a statement of fact, on which large scale planning decisions are made and on which government policy is determined?

9.14 Furthermore the WSP Report repeated at Par 3.1 - Statement of Agreed Matters is unacceptably fundamentally flawed by stating:

3.1 We note the WSP BEIS report considered the topics of infrasound and low frequency noise and the advice contained therein. Whilst it may be feasible to measure infrasound from wind turbines⁹, the current weight of evidence (see WSP BEIS report) indicates that wind turbine infrasound has no adverse effects on human health at typical exposure levels and that it is not necessary to consider wind turbine infrasound when determining development applications.

Furthermore, assessment on the basis of ‘A’ weighted sound levels (the approach in the ETSU-R-97 assessment methodology) provides sufficient control over the potential impact of low frequency noise.

This statement is totally contradicted by the WHO which state:

*Standard methods of measuring sound, **most commonly including A-weighting, may not capture the low-frequency sound and amplitude modulation** characteristic of wind turbine noise (Council of Canadian Academies, 2015).*

9.15 The INWG WSP critique extract below, references the following:

Then at page 232, WSP are mischievously recommending that government make a position statement indicating that;

“infrasound from wind turbines at typical exposure levels has no direct adverse effects on health”.

These conclusions and recommendation are completely at odds with the evidence review findings by the INWG at Work Package 2.1, open here and more recent evidence, bringing to mind the age old saying; *“The absence of evidence is not evidence of absence”.*

and;

The INWG findings from 2015 are summarised in the WP 2.1 Executive Review at Para 5;

“The evidence regarding low frequency noise (LFN), a significant component of WTN including AM, is compelling. Despite the wind industry’s continual denial of the significance of LFN, the available evidence demonstrates conclusively that:

- LFN including infrasound is an integral component of WTN;
- Complaints regarding WTN currently classified as AM or EAM or OAM by the wind industry is an obfuscation of the true nature of the problem;

- Conditions giving rise to noise complaints are often characterised by 'sensation' as being the major form of disturbance. In some cases, the 'noise' may not even be audible;

- **Noise measurement using the A weighting may be unsuitable for WTN where low frequency components are present;**

- Noise measurements should be made inside homes when investigating noise complaints;

- Noise measurements where LFN is present should be made using suitable instrumentation. IEC 61672 compliant 'Class 1' instrumentation may be unsuitable for LFN measurement or where background noise levels are low as in typical rural areas."

9.16 In conclusion: INWG's critique (**CD.SS8**) provide substantive evidence to this Conjoined Inquiry and;

Following this review of the WSP report, the INWG make the following recommendations to Government, expanded below;

ONE	Reject the recommendations made by WSP in their review for ETSU-R-97 to be retained albeit with some revisions.
TWO	Replace ETSU-R-97 with BS4142:2014+A1:2019 as the official guidance for wind turbine noise assessment.
THREE	Reject the WSP suggested proposal for a government position statement on low frequency noise. This proposal is unsupported by the evidence and would conflict with the World Health Organisation (WHO) position.
FOUR	Conduct independent research into the effects on health and well-being of wind turbine noise including impacts from long term exposure, low frequency noise, infrasound, amplitude modulation and tonal noise as recommended by the WHO.
FIVE	Introduce licencing and regulation of wind power generation by a national agency such as the Environment Agency. This to include continuous monitoring and recording of noise and turbine data (SCADA) with the data available for compliance and complaint purposes.

10. Our team has the expertise to challenge the Noise Environmental Impact Assessment (NIA) data submitted by the 3 Applicant', with reference to ETSU standards.

Witness: William Leslie Huson BSc (Hons) MSc CPhys MInstP MloA MAAS. Applied Physics, UK.

- Background: MSc Sound and Vibration Studies, Institute of Sound and Vibration Research, Southampton, UK
- Certificate of Competence in Workplace Noise Assessment
- Member of the Institute of Physics, UK
- Affiliations: Chartered Physicist, UK
- Member of the Institute of Acoustics, UK
- Member of the Australian Acoustical Society
- Member of the AV003 and AV004 acoustics working groups for Standards Australia since 2001 (now combined into AV0001)

Australian representative for the International Institute of Noise Control Engineers (I-INCE) Technical Study Group 5 A GLOBAL APPROACH TO NOISE CONTROL POLICY (Now disbanded after completion of the scope of work defining this group – see <http://www.i-ince.org/data/iince061.pdf>)

- 44 years of professional acoustics consulting experience covering terrestrial and underwater acoustics in a wide range of industries with expertise in sound and vibration measurement, noise and vibration modelling and compliance assessments. I have experience as an expert witness at Planning Tribunals/Courts, in the High Court and have been invited to provide submissions to two Senate Inquiries.

10.1 Mr Huson states: **(CD.SS1.)**

“The three noise impact assessment reports were prepared by separate companies on behalf of the respective proposed wind farm developments. The reports total some 171 pages and cross reference various technical issues and approaches, in part, between the authors. However, there are significant differences in terms of the choice for appropriate sound level targets for the purposes of assessing development compliance. Ambiguities exist and there are concerns over the validity of background sound level measurements that have been used to determine target noise limits for at least two of the proposed developments.”

Once our report is prepared, that will highlight areas of concern in the noise impact assessments, then the Reporters will need sufficient time to explore the issues raised.

We still believe that a time allocation of 2 days for the subject of noise will not be sufficient to adequately explore the issues and request that the 2 day allocation be extended to 4 days.”

However, we note that the 3 applicant's acousticians' as referenced previously, have submitted a Statement of Agreed Matters Noise

10.2. In response to an appraisal of the WTN evidence to the Conjoined Inquiry, a summary of Mr Huson Expert Witness Statement is extracted below: **(CD.SS5.)**

SCOPE OF THIS REPORT.

22 The requested scope of this report is to complete a peer review of the Craiginmoddie, Carrick and Knockcronal Wind Farm applications (WIN 370-4, WIN 370-5 and WIN 370-6) and to express my own expert opinion as to whether the Applications should be granted in the terms sought by the proponent, given any noise/vibration issues I may identify.

23 The questions fall within my area of expertise and in preparing this report I have endeavoured for it to be complete and accurate.

GENERAL COMMENTS.

24 ETSU-R-97 and the subsequent IoA Good Practice Guide (GPG), that attempts to reduce the interpretation options within ETSU-R-97, are both under review by the UK Government.

25 Although the UK Government has yet to officially respond to a report by WSP on the issue of whether stakeholder parties consider a change to ETSU-R-97 warranted, the WSP report does advise the UK Government that both ETSU-R-97 and the GPG would benefit from further review and update.

26 ETSU-R-97 and the GPG remain open to interpretation and contain technical errors.

27 The Scottish Government has in Policy Statement 2022 recognised that the UK Government may require that ETSU-R-97 and the GPG may require updating, but in the meantime all wind farm development applications are required to follow current guidance.

28 Given that there are questions raised about the future validity of ETSU-R-97, I submit that any interpretations of the current framework for assessing a wind farm development must err on the side of caution.

29 For example, the GPG acknowledges that a ground absorption factor, G, in section 4.3.4 *“is commonly used, as it will tend to provide robust predictions in most situations”* but also notes that *the predictions can be too high*. I also suggest that predictions can also be too low.

36 I recommend that a cautious approach should be used in the noise modelling and that the models must be repeated with G=0 and a receiver height of 1.5m.

37 To gauge if more cautious noise model inputs will have any significant outcome for the proposed three wind farm developments it is simply a matter of adding 4 dB to all predicted sound levels.

38 Other corrections to ISO 9613-2 are suggested in the GPG for barrier attenuation from the terrain and for areas where a ‘valley’ effect occurs

39 Table 1 of Annex 4 in the TNEI report “Operational Noise Report, Craiginmoddie Wind Farm”, 18 March 2023 lists corrections due to the topographic barrier effect and ‘valley’ effect that were applied to the noise model outputs. A valley effect attracts a 3 dB penalty and a maximum of -2 dB terrain barrier attenuation is applied where necessary. However, it is noted that where both effects apply that only the -2 dB correction was applied. This is inconsistent with the GPG and a total of +1 dB correction should apply in these circumstances.

40 Table 1 of Annex 4 does not identify where both corrections apply but in these circumstances the predictions in accordance with the GPG are 3 dB too low.

Sound power level

44 The GPG suggests that test results that have a test uncertainty attached should account for expanded uncertainty which is 1.65 times the standard uncertainty of test results.

45 This means that the sound power levels for Hadyard Hill wind farm in the TNEI Craiginmoddie wind farm and Knockcronal wind farm noise predictions are approximately 1.6 dB too low when compared to the Carrick wind farm assessment of sound power levels.

46 It may appear pedantic to investigate details of one or two dB but these discrepancies become important when no margins of compliance are predicted for many dwellings, such as NAL1, NAL5, NAL7 and NAL9.

Background Sound Levels.

47 ETSU-R-97 uses Background sound levels to set the target noise limits applicable for a dwelling. Unrepresentative Background sound levels at integer wind speeds can lead to overly lax noise limits to the detriment of a resident.

10.3 Comment: Paragraphs' 48 - 58 raise numerous failures in assessment methodology, due to a lack of data and inconsistencies in the application of the available data. For example:

52 I have reviewed raw wind speed and noise data used in the Knockcronal assessment and found that the LiDAR and SODAR data regularly missed measurements and cannot be relied upon to meet the measurement requirements of the GPG. The GPG Supplementary Guidance Note 1, section 2.6 cautions about the limitations of LiDAR and SODAR wind speed measurements.

53 No details have been provided on the accuracy of the LiDAR and SODAR systems deployed.

54 The Background data used from the Hadyard Hill Extension wind farm development used a met mast at Hadyard Hill that did not represent wind speed at the Craiginmoddie wind farm site and an attempt has been made to correct this using a process described in Annex 3 of the TNEI report of 18 March 2023. Unfortunately, original survey data was unavailable and Annex 3 does not provide the extent of uncertainty associated with the methods of correction employed or if the method ultimately complies with the accuracy requirements of the GPG.

55 Background survey data obtained whilst other wind farms were operating nearby are described in the Knockcronal and Carrick wind arm noise reports. These reports have applied wind direction filtering to investigate the contributions from the nearest operating wind farms and conclude that they have no influence on the Background data recorded. I disagree.

56 For example, Genoch Cottage has had noise predictions made solely for the influence of the nearest wind farm that is Dersalloch. The optimistically predicted sound level at Genoch Cottage is 30.3dBA at a wind speed of 8 m/s. The measured 'Background' level at 8 m/s was 33.4 dBA during the quiet daytime and 32.7 dBA at night. Clearly, one would expect that the Dersalloch wind farm will influence Background sound levels measured at Genoch Cottage when it operates. The operating status of the Dersalloch wind farm at the time of the survey was not provided.

57 If one were to follow the GPG of allowing corrections for Background then the true Background at 8 m/s for the quiet daytime would become 33.4 dB – 30.3 dB which translates to 30.3 dB using logarithmic subtraction.

58 Correction for the true Background at night at Genoch Cottage is not possible due to the arithmetic difference being only 2.4 dB, but it can be expected that the long-term average 'Background' noise level measured is dominated by sound from the Dersalloch wind farm.

10.4 **Noise Sensitive Receptors (NSR)** - Paragraphs 59 - 65.

59 The three noise assessments acknowledge in the Statement of Agreed Matters, 21 March 2023, that only a sample of dwellings in the area surrounding the proposed wind farms have been assessed, but that these are representative to assess if the three projects should be approved.

60 However, ETSU-R-97 target noise limits are suggested to protect sleep and the outdoor target noise level of 43 dB was determined after assuming a noise reduction correction for sound outdoors to indoors in a bedroom with an acceptable target sound level in the bedroom of 30 dBA, Leq.

61 Temporary accommodation such as a motel would be considered a NSR but so would a camp site.

62 The target outside noise limit to protect sleep for a tent will be the same as the indoor sleep protection level because a tent does not attenuate sound significantly.

63 I have briefly checked online for camping and caravan sites in the area and note that the area does have camping sites. For example; The Walled Garden Caravan and Camping Park near Kilkerran (30 U, 394361 E, 6128996 N).

64 This NSR would attract a target base noise limit of 30 dBA, Leq or 28 dBA, L90 in accordance with ETSU-R-97, and an assessment of noise impact for such places should be included in each of the three wind farm proposals.

65 I consider that tourists using camping and caravanning sites in the area will be adversely affected.

10.5 **INFRASOUND**, (Para's 66 -77) **LOW FREQUENCY SOUND** (Para's 78 - 87) **AND VIBRATION** - (Para's 88 - 92.)

66 Measurements of infrasound emissions at the Macarthur wind farm are described in Huson (2015). I found that overall infrasound levels below 8 Hz changed little for the V112-3MW wind turbines, which are smaller than the candidate wind turbines proposed for this Project, when the wind farm was completely shutdown from maximum power generation in high winds to a standstill in the same winds due to a substation fault.

67 Indoor Measurements were also shown in this paper for the wind turbine off/on (start-up) operation at Cape Bridgewater. At Cape Bridgewater the wind turbines are smaller and the residual infrasound was not so apparent when the turbines stopped rotating. The overall infrasound level below 6Hz increased by over 20 dB after start-up of the Cape Bridgewater wind turbines. This finding shows a very large and noticeable increase in the wind turbine blade passing frequency signature and has no equal in the ambient infrasound environment near to the coast or inland.

68 Accordingly, I disagree with Section 3 of the Statement of Agreed Matters, 21 March 2023 regarding infrasound from wind turbines being comparable to the normal ambient environment and that A-weighted sound levels present sufficient control over the potential impact of low frequency noise.

69 The issue associated with the larger wind turbines is that they emit resonant infrasound tones in the presence of wind even when they are not rotating. This makes it impossible to assess the ambient infrasound levels around the wind farms until after they are decommissioned and removed. I presume that the same will apply for the candidate wind turbines used as examples in the three wind farms of this conjoined inquiry. (emphasis added)

70 If ambient infrasound levels are deemed to be important it would be wise to collect samples before construction of the proposed developments, so that ambient infrasound measurements can be compared to when the developments are operational.

71 The effects of infrasound from wind turbines on health have yet to be evaluated properly, a situation that the latest World Health Organisation recommendations on noise recognises. The Australian National Health and Medical

Research Council (NHMRC) and the findings of a Senate Committee Inquiry: “The social and economic impact of rural wind farms” June 2011 have reached the same conclusion and a tender with a value of AU\$3,300,000 has recently been let by the NHMRC to conduct such missing research into the possible link between wind farm generated infrasound and health. The research project was awarded to universities in NSW and SA. The researchers have yet to produce a final report of their findings.

72 This research is ongoing and one of the published papers in 2019 by researchers at Flinders University (Nguyen, D. P., Hansen, K. et al. Wind farm infrasound delectability and its effects on the perception of wind farm noise amplitude modulation, Acoustics 2019) stated in its conclusions that: *“Overall these preliminary results suggest that WF noise complaints could potentially be governed to some degree by the presence of infrasound”* and that *“ We found that self-reported noise sensitive individuals can detect the presence of low-level infrasound (48 ± 2 dB(G)) above chance.”*

73 The finding that infrasound at levels of 48 ± 2 dB(G) can be observed by individuals is in stark contrast to the generally used limit of perception, which suggest that a conservative human perception threshold of 85 dB(G) might be appropriate to account for variations in sensitivity of human hearing.

77 The issue of adverse health effects from wind farm generated infrasound remains contentious and this Inquiry may wish to consider an appropriate condition if the ongoing Australian, or other relevant international research, finds adverse health effects from infrasound.

78 Footnote 9 in the Statement of Agreed Matters, 21 March 2023 refers to infrasound from wind turbines and suggests that measurements of infrasound must comply with the sound level meter standard IEC 61672-2:2013+AMD1:2017. This IEC standard is totally unsuitable for the type approval of infrasound measurement instrumentation because it is designed only for the audible frequency range and has an acceptable tolerance of +3dB to minus infinity at 10 Hz for Class 1 sound level meters. (emphasis added)

Low Frequency Noise

78 The Statement of Agreed Matters, 21 March 2023, does not consider low frequency sound or infrasound from the proposed three wind farms to be of any concern, citing the WSP BEIS report for its information.

79 However, measured tones around 14 Hz inside a home 2km from two MM82 2MW wind turbines, that are caused by the wind turbines, are accentuated by room resonances (Huson, 2015).

80 The owners have vacated this recently built brick veneer property citing unacceptable health problems believed to be caused by the two wind turbines.

81 Low frequency noise can be generated by a wind turbine. It is not uncommon for a generator input shaft rotation tone to be modulated by the blade pass frequency of the rotor.

82 Recent measurements (2022) of a wind farm comprising Vestas V136 4.2 MW wind turbines exhibit tonal audible characteristics around 150 Hz. This frequency is within the frequency range of DEFRA NAN-R45 and would also qualify as a tonal penalty for measurements outside in accordance with ETSU-R-97.

83 Compliance noise measurements were taken at a wind farm with Vestas V126 3.6 MW wind turbines. The measurements showed tonality, which means there were specific tones that were present. Despite the manufacturer's assurance during the planning phase that the wind turbines would not exhibit these tones, the measurements revealed that they did. As a result, penalties were necessary for the observed measurements at the nearby dwellings. The tones observed were present in the low frequency range covered by DEFRA-NAN-R45 and were also observed outside the dwellings in accordance with the ETSU-R-97 measurement methodology that would qualify for an added tonal penalty.

85 The use of A-weighted sound levels for the assessment of a wind farm will not quantify infrasound or low frequency noise impacts correctly.

86 Unfortunately, low frequency sound and infrasound are a common feature of modern wind turbines.

87 I recommend that a condition requiring compliance with DEFRA NAN-R-45 (recommended indoor levels of low frequency sound) be adopted for these wind farm developments at any NSR to protect occupants from excessive low frequency sound, that is known to be caused by some wind turbines.

89 However, it has been postulated by Kelly (1982) that lightweight building structures can be excited by infrasound pressure from wind turbines and can be one of the major causal agents responsible for the annoyance of nearby residents. Part of the conclusions in Kelly's paper follows: *"In this paper we have presented evidence to support the hypothesis that one of the major causal agents responsible for the annoyance of nearby residents by wind turbine noise is the excitation of highly resonant structural and air volume modes by the coherent, low frequency sound radiated by large wind turbines. Further, there is evidence that the strong resonances found in the acoustic pressure field within rooms actually measured indicates a coupling of subaudible energy to human body resonances at 5, 12*

and 17-25 Hz, resulting in a sensation of whole-body vibration. The audible sounds indoors associated with the impulsive excitation of the structure appear to be due to the coupling of energy from the higher frequency discrete bands in the impulse to higher frequency room resonances related to the air volume itself.”

90 My own measurements of infrasound inside residences near Macarthur and Cape Bridgewater show infrasound pressure levels similar to those measured by Kelly in 1982. Infrasound causing whole-body vibration is a plausible explanation for the commonly reported symptoms described by residents living near to wind farms.

91 Huson (2015) also covers the propagation of infrasound so that the ‘vibration’ experienced in homes by people near a large wind farm can be estimated. Infrasound levels can vary significantly over a short time period (seconds) depending upon the phase relationships between each turbine rotor and with local wind speed variations.

92 Infrasound measurements from a residence located 5.4km away from the nearest turbines in the Macarthur array of 140 V112-3MW units and 1.3km away demonstrate very little infrasound attenuation in the near field and that the infrasound levels at this distance (5.4km) are comparable to those reported by Kelly(1982).

AUDIBLE CHARACTERISTICS IN ACCORDANCE WITH ETSU-R-97

Tones

93 It is notable that the proposed candidate wind turbines are assumed not to emit tonal sound.

94 In my experience many wind turbines do emit tonal sound and in the absence of test results proving otherwise then an appropriate penalty should be added to any noise prediction.

Amplitude Modulation (AM) (Paragraphs 95 - 123 Including figures.)

95 ETSU-R-97 incorrectly addressed amplitude modulation and made a sweeping assumption that such a characteristic was rare in modern wind farms. This is not the case and it is now recognised that amplitude modulation is the most significantly intrusive sound characteristic of wind turbines.

96 The GPG refers in section 7.2 to ongoing research. Since the publication of the GPG there has been much ongoing research and amplitude modulation is known to be a significant concern for residents near modern wind farms.

123 If approved, I suggest that Condition 20 of the Denbrook Wind Farm be included as a condition for each of the three wind farms that are the subject of this inquiry.

NOISE PREDICTIONS (Para's 124 -136) Highlights methodology failures in prediction assessments for all three applications.

124 Without an understanding of the uncertainty of measurement and limitations of equipment and models, apparently detailed technical analysis work can lead to misleading conclusions.

125 No uncertainty analysis has been included in the three wind farm applications.

SUBSTATIONS

137 The treatment of these issues is acceptable in the applications. However, substation noise emissions can cause room resonances that could disturb neighbours.

138 If the DEFRA NAN-R-45 recommended indoor low frequency noise targets are applied in conditions for the ongoing operations of the Project for all sound sources (with the exception of short-term construction activities) then adverse impacts from room resonance effects can be managed.

WIND SPEED DATA

139 Wind speed data accounts for half of all the data required to assess a wind farm using ETSUR-97. 140 Wind speed data used for the assessment of Background noise levels for the Craiginmoddie and Knockcronal Wind Farms are suspect and do not comply with the GPG.

140 Wind speed data used for the assessment of Background noise levels for the Craiginmoddie and Knockcronal Wind Farms are suspect and do not comply with the GPG.

141 The ETSU-R-97 evaluation process requires an accurate synchronisation of each 10-minute Background sound level to be compared with wind speed which is representative of that on the wind farm site where the nearest wind turbines are proposed to be constructed to a NSR.

142 Background data for the Carrick wind farm application has used the correct evaluation process, but there are concerns that the results have been influenced by sound from other operating wind farms nearby.

143 The Knockcronal wind farm application has used suspect wind speed LiDAR and SODAR data that is not robust and may not comply with the accuracy requirements of the GPG.

144 The Craiginmoddie wind farm application has used wind speed data from an unrepresentative location on another wind farm and attempted to correct this data.

145 The correction process is not part of ETSU-R-97 or the GPG and in all probability will exceed the required tolerance for wind speed data that is +/-0.2 m/s in the wind speed range from 4m/s to 12 m/s.

SUMMARY OF OPINIONS Para's 146 -163 Listing non compliance with ESTU - R 97 & GPG - concluding at Para 163.

146 The three wind farms have a zero margin of compliance with ETSU-R-97 when operating together.

163 In consideration of the above concerns, the project target noise limits of ETSU-R-97 will not be met and the conjoined projects should not be granted approval.

11. In respect of Amplitude Modulation.

11.1 We will submit substantive and material evidence both written and orally at the Inquiry, which will challenge and contest the unsustainable position of the applicants, which put at risk the health and wellbeing of affected residents and the local community.

We will substantively contest the position statements within the following NIA's:

Carrick Wind Farm. Environmental Impact Assessment Volume 1. 9.3 Consultation. Para 91 Table 5. Extract:

Wind turbine low frequency noise, infrasound and excess amplitude modulation.

"It was agreed that the assessment of wind turbine low frequency noise and infrasound should be scoped out of the assessment on the basis that guidance referenced by Scottish Planning Policy that there is no evidence of health effects arising from infrasound or low frequency noise generated by wind turbines".

It was also agreed that an assessment of excess amplitude modulation could be scoped out on the basis that guidance referenced Scottish Planning Policy found low incidents of AM and the numbers of people adversely affected in the UK.

This statement is found to be unsound, reference Mr Huson's Evidence at Para 95 & 96.

95 ETSU-R-97 incorrectly addressed amplitude modulation and made a sweeping assumption that such a characteristic was rare in modern wind farms. This is not the case and it is now recognised that amplitude modulation is the most significantly intrusive sound characteristic of wind turbines.

96 The GPG refers in section 7.2 to ongoing research. Since the publication of the GPG there has been much ongoing research and amplitude modulation is known to be a significant concern for residents near modern wind farms.

The INWG state:

- Complaints regarding WTN currently classified as AM or EAM or OAM by the wind industry is an obfuscation of the true nature of the problem;

This statement in respect of Infrasound & Low Frequency Noise has been robustly challenged throughout this report, including in Mr Huson's expert witness report which states:

154 Low frequency sound is not considered separately in ETSU-R-97 and I propose that a condition be included in a permit, if approved, to assess low frequency noise in accordance with DEFRA-NAN-R45.

155 Infrasound remains an area of contention and any permit for wind farm developments should include a provision that: if it is demonstrated that infrasound from wind farms have an adverse effect on health that the wind farms must comply with such infrasound level limits that prevent adverse health effects. (emphasis added)

Furthermore, Mr Huson at Para's 68 -69 & 70 concludes;

68 Accordingly, I disagree with Section 3 of the Statement of Agreed Matters, 21 March 2023 regarding infrasound from wind turbines being comparable to the normal ambient environment and that A-weighted sound levels present sufficient control over the potential impact of low frequency noise.

69 The issue associated with the larger wind turbines is that they emit resonant infrasound tones in the presence of wind even when they are not rotating. This makes it impossible to assess the ambient infrasound levels around the wind farms until after they are decommissioned and removed. I presume that the same will apply for the candidate wind turbines used as examples in the three wind farms of this conjoined inquiry.

70 If ambient infrasound levels are deemed to be important it would be wise to collect samples before construction of the proposed developments, so that ambient infrasound measurements can be compared to when the developments are operational.

It is of note that evidence of baseline acoustic Soundscape monitoring is submitted as an integral part of our Inquiry Report - Reference IARO Conjoined Inquiry Report **(CD.SS9.)**

12. Craiginmoddie Wind Farm.

Environmental Impact Assessment Report – Volume I Chapter 10: Noise Wood on behalf of Energiekontor UK Ltd | December 2020 22
Amplitude Modulation

10.70 The RenewableUK research programme on amplitude modulation (AM) has concluded⁸ that high levels of AM can occasionally be heard at long distances from turbines. While the mechanisms of EAM are well documented, an industry consensus on a methodology for its prediction is yet to be reached. It is noted that at this time Government advice towards the assessment of EAM has not changed from that included within the ETSU-R-97 Guidance, which indicates no specific consideration for EAM is required and no planning condition is necessary.

Yet again, this statement is challenged by Mr Huson at Para 156;

156 Excess amplitude modulation has been shown to be common near modern wind farms but prediction of this form of SAC is currently not possible. If the wind farms are permitted then a condition should be included in any Permit that provides an appropriate limit for amplitude modulation. Such a condition is already in force at the Denbrook Wind Farm as Condition 20 and this should be included for each of the proposed wind farms, and be renumbered appropriately. (emphasis added)

12.1 Knockcronal Wind Farm.

Technical Appendix 10.1 - Environmental Noise Assessment. Revision 4 – 15 November 2021 author: Mark Jiggins
MSC MIOA.

5.9 Low Frequency Noise, Vibration and Amplitude Modulation

5.9.1 Low frequency noise and vibration resulting from the operation of wind farms are issues that have been attracting a certain amount of attention over recent years. Consequently, Annex A includes a detailed discussion of these topics. In summary of the information provided therein, the current recommendation is that ETSU-R-97 should continue to be used for the assessment and rating of operational noise from wind farms.

5.9.2 Annex A also discusses the most recently published research on the subject of wind turbine blade swish Amplitude Modulation (or AM). A penalty-type approach to account for instances of increased AM outside of what is expected from 'normal' blade swish has been proposed. This approach is a consequence of the combined results of this research and, in particular, the development by the IOA of an objective technique for identifying and quantifying AM noise, as well as a review of the subjective response to AM noise by a Government-commissioned research group. Some uncertainty remains at this stage over the application of such a penalty and this will be subject to a period of testing and review over the next few years.

Mr Huson's expert witness report at Paragraphs 95 - 123 - Including figures provide a detailed and informative analysis of Amplitude Modulation.

13. Craiginmoddie in its hearing statement refer to evidence from a newly published Australian Report:

4.23 Since the publication of the WSP BEIS report, the study that was granted funding by NHMRC (the National Health and Medical Research Council of Australia) was published in the Environmental Health Perspectives (EHP) journal which is published by the United States National Institute of Environmental Health. The study (CD012.039) aimed to test the effect of exposure to 72 hours of infrasound (designed to simulate a wind turbine infrasound signature⁵) exposure on human physiology, particularly sleep.

The study concluded that:

'Our findings did not support the idea that infrasound causes WTS⁶. High level, but inaudible, infrasound did not appear to perturb any physiological or psychological measure tested in these study participants.'

The IARO team considered this study and questioned the "spectrum" on the left has insufficient resolution to determine if there are harmonic peaks.

Further it is not clear how the time domain signal is generated, The measured spectrum alone (right hand side figures) is insufficient to generate the time domain signal. It tells us only that the signal is periodic, at the ~1Hz frequency. Further the (signal) power is all in the fundamental frequency and its multiples (harmonics) 2 Hz, 3 Hz, etc.

To reconstruct the signal from the spectrum, the phase information is required for each harmonic component. The phase determines whether the time domain signal is a square wave, triangular, or some other variant. Many wave shapes are possible using a "harmonic synthesizer".

The proper test is to use a real turbine pulse, measured in the field.

Also we should to compare the scientific validity of the methodology of this study against the study below **(CD.SS10.)**

REPORT ON ICPE COMPLAINTS FROM THE FRENCH AISNE AREA SUBMITTED BY THE NGO 'SOS DANGER EOLIEN' JL REMOUIT – V BERNARDEAU version V2 November 2022:

The purpose of this document is to present the results of a health survey on the effects of wind farms carried out by the French association SOS Danger Eolien in the department of Aisne.

ICPEs, Installations Classified for the Protection of the Environment, of which wind farms are a part and specifically governed by legislation. A reminder of the framework is specified at the beginning of the note. After developing the ICPE survey in a geographical area around the town of Marle, the association filed 250 complaints with the local Prefecture, which followed up on an examination of the cases by the ARS (Regional Health Agency).

This divided the symptoms into three classes, the wind syndrome which we called neurological, tumors and cancers, endocrinological effects to which we added the cardiac effects observed. The ARS considered that only the wind syndrome was relevant given the number of occurrences. The fact remains that we show that beyond the proportion of patients who, out of fear, do not dare to sign a complaint, beyond the proportion of the population sampled, we conclude that for the most affected villages the proportion of patients exceeds 60% of the population.

14. Scientific evidence is accumulating from all over the world evidencing that inaudible low frequency noise and vibration is contributing to the misery being experienced by affected residents. These residents being a rural based minority are least able to mount the expensive legal challenges to the acoustic intrusions into their lives.

Our team Includes Professor Mariana Alves Pereira Professor Degree in Physics, Masters in Biomedical Engineering and Doctoral in Environmental Sciences who will give evidence on the contents of the IARO Conjoined Inquiry report. **(CD.SS9)**

The IARO Report for the Conjoined Public Inquiry Concerning: WIN 370-4 Craiginmoddie Wind Farm, Dailly, South Ayrshire, KA26 WIN 370-5 Carrick Wind Farm, South Ayrshire, KA19 WIN 370-6 Knockcronal Wind Farm, Knockcronal, Straiton, South Ayrshire, KA19.

A summary of the report:

1. Craiginmoddie, Carrick and Knockcronal Wind Power Plants (WPPs) are currently being proposed for South Ayrshire.
2. High-resolution recordings of low-frequency sound and infrasound were obtained at several locations near these proposed WPPs.
3. The purpose of these recordings was to document the baseline Soundscape prior to, and in anticipation of, a formal consent for these proposed WPPs.
4. The presence or absence of existing Wind Turbine Acoustic Signatures (WTAS) was determined for each of the locations and their likely sources are indicated.
5. The following locations are already subjected to WTAS from several other, WPPs: Knockskae Cottage, Glenalla Farm, Little Garroch, Glengennet, Tairlaw House, Glenhead, and Barnfield.
6. A further WTAS source, with a BPF at or above 1 Hz, affected Knockskae Cottage, Glenalla Farm, Little Garroch, Glengennet, Glenhead and Barnfield. Its source could not be identified.
7. All locations affected by this unknown source were also affected by a 20-hertz tone, also of unknown origin.

And our goal is:

8. Acoustical monitoring of the baseline soundscape in vicinity of the proposed Craiginmoddie, Carrick and Knockcronal WPPs in anticipation that consent may be granted.

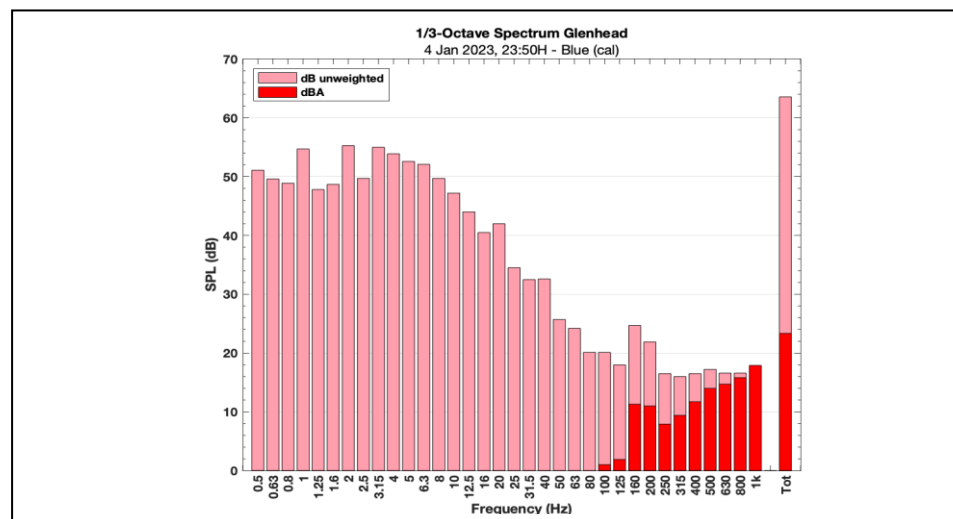
14.1. SAM not only gathers the data in WAV files to be analysed by the IARO team, but it allows us through DAT files to compare the acoustic environment in the field in different weightings including A Weighting, used by acousticians and the wind industry based on a

complicated logarithm calculation as stated in ETSU-R-97, and Unweighted data which just shows the full untampered acoustic environment – i.e. what acoustic energy is present at any one time.

14.2 Acousticians normally work with A-weighted sound as this is supposed to align with the human hearing system. In this system the level of each frequency is adjusted to account for the fact that humans are not equally sensitive to all frequencies.

Two examples from a home close to an operational RES development, show the effect of this method on analyses in the infrasound and low-frequency parts of the sound spectrum.

The following figure shows a spectrogram with each frequency band 1/3 of an octave wide. Figure 14: from the IARO report page 22: Spectrogram in 1/3 octaves for the Blue microphone from Glenhead from 23:50H 4 January 2023. Unweighted (pink) and A-weighted (red). The total energy is shown in the final bar on the right.



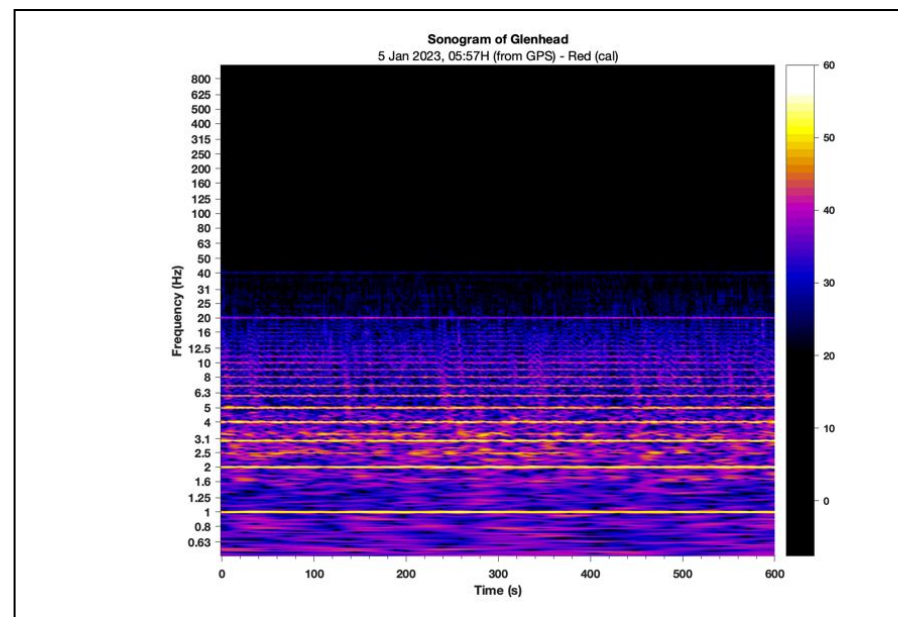
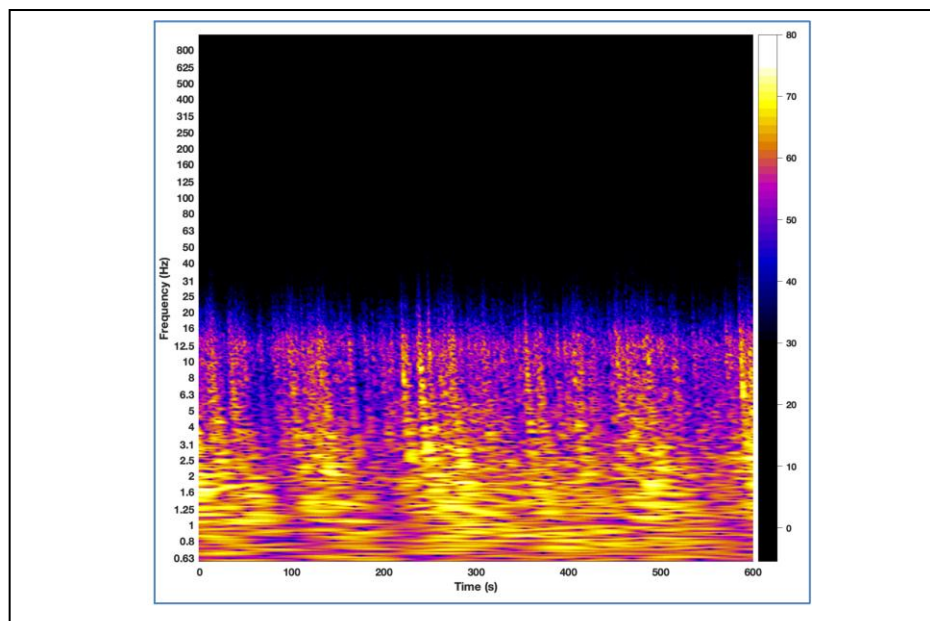
14.3. Natural Infrasound versus Infrasound from Industrial Wind Turbines

Sound is created by a series of troughs and peaks in air pressure. The frequency or pitch of the sound is measured by the number of peaks that arrive in each time interval. For audible noise the peaks arrive closer together than in infrasound, which is why we can hear it. The

distance between peaks, the wavelength, is in the order of centimetres. Humans hear well at 3000Hz (3000 peaks per second). Babies cry at 3500Hz.

To protect against a noise the thickness of a barrier must be at least in the same order as the wavelength. This would be centimetres for audible noise, which is achievable. But at 20 Hz the wavelength is 17 metres, so we do not have the means of creating a barrier of sufficient thickness to protect from the lower frequencies. Consequently, low frequency sound will travel through objects and may cause them to resonate in response to the sound stimulation as well.

It is often asserted by the wind industry that infrasound generated by IWT is no different to that found in urban or natural environments.

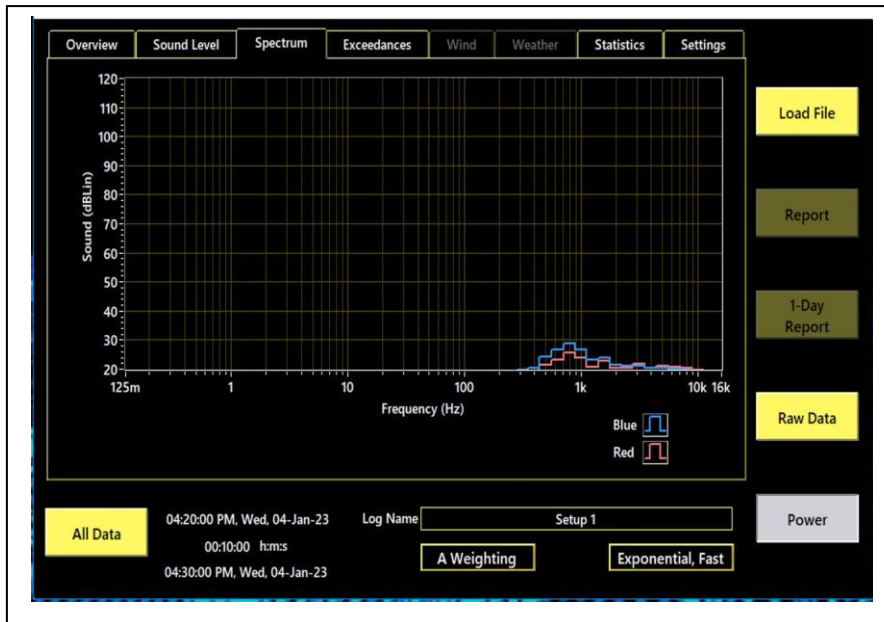


There is a clear difference when comparing the natural acoustic environment of the ocean, (Sonogram of Romo Beach, Denmark on 13th December 2016 seen on the left) with the figure of a residence close to Dersalloch where the acoustical output of the operational IWT is captured as a mathematical pattern (see IARO analysis).

The time scale of the peaks associated with the IWT acoustic signature are of a different time scale than the peaks associated with natural phenomena.

Harmonic series with fundamental acoustic signatures as seen at most of the homes in the vicinity of the three applications dominate the harmonic analysis (peaks with red dots) and the horizontal lines in the sonograms – see SS..... *V paragraphs 68-75 and Figures 12 and 13*
 The fact the peaks associated with the IWT acoustic signature occur in a mathematical sequence with a blade pass frequency indicates that this can only be originating from a human-made machine, and not Nature. This is confirmed by looking at the shape of the sound waves, which shows a train of pulses (dips) at the blade-pass frequency.

14.4 Here we see two screen shots below of SAM recording data: Figures 1 (left) and 2 (Right) from 04.20pm – 04.30am on 4th January 2023 at Glenhead close to Straiton. Figure 1 shows the acoustic environment when only A weighting is used to examine the data. It shows very low levels of audible noise and nothing in the lower frequencies. Figure 2 is same recording data measurements unweighted showing the full acoustic environment at this location. We can see high levels of acoustic data in the lower frequencies (this could be from Dersalloch wind power plant) compared to low levels of noise in the audible ranges. This can be observed in the field on site visits to already impacted properties.



15. The following published, peer reviewed Chapter (**CDSS11**) and Whitepaper (**CD.SS12**) explains more about what this data tells us:

Chapter Infrasound Exposure: High-Resolution Measurements Near Wind Power Plants.

Huub Bakker, Mariana Alves-Pereira, Richard Mann, Rachel Summers and Philip Dickinson.

The Abstract, introduction and conclusion have been included here, but it is essential that the Reporters read the whole chapter.

Abstract

This chapter focuses on infrasonic (20 Hz) noise exposure as captured in and around homes located in the vicinity of wind power plants. Despite persistent noise complaints by local residents, no satisfactory acoustical event has yet been identified to justify this troublesome (worldwide) situation. Continuous (days), high-resolution recordings—spectral segmentation of 1/36 of an octave and 1-second temporal increments— have been acquired in many homes across the world revealing the presence of wind turbine acoustic signatures. These consist of trains of airborne pressure pulses, identified in the frequency domain as harmonic series with the fundamental frequency equal to that of the blade-pass frequency of the wind turbine. This report documents three such cases (Portugal and Scotland). The highest peaks of the wind turbine acoustic signature (up to 25 dB over background noise) occurred within the 0.5–5 Hz window which is classically defined as below the human hearing threshold; and yet these ‘inaudible’ phenomena appear to trigger severe biological reactions. Based on the prominence of the peaks in the harmonic series, a new measure is proposed for use in determining dose–response relationships for infrasonic exposures. This new methodology may be applicable to infrasonic exposures in both environmental and occupational settings.

Introduction

Hearing loss, speech intelligibility and noise annoyance are some of the most studied impacts of noise exposures on human health and well-being. A common denominator of these three outcomes is the audibility of the sound. Exposure to loud noise over extended periods of time can cause hearing impairment; noisy environments can interfere with the correct understanding of speech; and certain types of continuous or intermittent sounds can cause people to feel annoyed by noise, which can, in turn, exacerbate underlying disorders or diseases. There are, however, additional features of sonic environments that are unrelated to the human audibility of sound, but that can also deleteriously affect human health and well-being, specifically, infrasound (20 Hz).

Conclusions

This chapter provides a different approach to the measurement and analysis of infrasound in and around homes located in the proximity of wind power plants. Examples show how using higher temporal- and spectral-resolutions (1 second and 1/36 of an octave), and without any frequency weighting, can reveal acoustical features in the infrasonic range that may indicate a causal relationship with self-reported medical symptoms. This possibility is usually considered non-existent since the infrasonic range is generally viewed as inaudible, and thus innocuous, to humans. The suggestion therefore arises that current noise protection procedures are insufficient to protect public and occupational health. The approach used by these authors offers a more solid framework with which to pursue the establishment of dose–response relationships for infrasonic exposures. Future studies are being extended into noisy occupational environments and different environmental settings where wind power is not the acoustic source.

16. The White Paper. (CD.SS12.)

Preamble Harmonic series are rare in nature. They are far more commonly associated from human activity. This paper looks at several measures that can be calculated from harmonic series, more specifically those that can be calculated from the frequency spectrogram of a recording.

Two separate classes of metrics are considered; those that deal with the SPL of the series and those that deal with the prominence of the series above the sound background.

The definition of prominence for these metrics comes from the Matlab function ‘findpeaks,’ which returns a list of peaks from (in this case) the 1/36th-octave, narrow-band-filter frequency spectrum of a sound file. The prominence of these peaks is defined as part of this function and reproduced in the appendix.

17. It is the responsibility of the wind industry and their acousticians to prove beyond doubt that their turbines will not cause unacceptable levels of environmental acoustic pollution: Statements in the Craiginmoddie hearing Report such as:

*4.25 In relation to the need to control LFN, the WSP BEIS report (CD012.015) states, on page 129, that:
‘controls on A-weighted wind turbine sound levels are expected to be sufficient to control the effects of low frequency noise.’*

do not make common sense, let alone any scientific sense.

18. Evidence from our scientific independent monitoring in this area demonstrate that there is already significant acoustic immissions from the operational wind turbines impacting residences. Reference Table 2 from the IARO report **(CD.SS9)** below.

81. Recordings were taken at the following locations and times during late 2022 and early 2023.

Table 2: SAM 1 recordings and locations.

Location	Date	Recording Time	Microphone Positions
<u>Knockskae</u>	14 November 2022	1-hour	Both in Bedroom
<u>Knockskae Cottage</u>	21 - 25 November 2022	Continuous over days	Both in Bedroom
<u>Glenalla Farm</u>	25 - 29 November 2022	Continuous over days	Both in Bedroom
<u>Little Garroch</u>	29 November – 6 December 2022	Continuous over days	Both in Art Studio
<u>Tairlaw House</u>	21 - 29 December 2022	Continuous over days	Both in Work Studio
<u>Glenhead</u>	4 - 7 January 2023	Continuous over days	Both in Bedroom
<u>Glenhead</u>	10 March 2023	4-hours	Bedroom & Outside
<u>Glenapp Castle</u>	13 - 14 March 2023	Overnight	Bedroom & Bathroom
<u>Glengennet</u>	20 March 2023	3-hours	Bedroom & Hallway
<u>Glengennet</u>	24 - 25 Mar 2023	Overnight	Bedroom & Hallway
<u>Barnfield</u>	3 April 2023	4-hours	Bedroom & Garden

The conclusions from the noise monitoring in the IARO report:

High-resolution recordings of low-frequency sound and infrasound from several locations in the Barr/Straiton area, and subsequent analyses, indicate that the following locations are already subjected to WTAS from several WPPs: Knockskae Cottage R1, Glenalla Farm R2, Little Garroch R3, Glengennet R6, Tairlaw House R4, Glenhead R5, and Barnfield R7.

A further WTAS source, with a BPF at or above 1 Hz, affected Knockskae Cottage, Glenalla Farm, Little Garroch, Glengennet, Glenhead and Barnfield. Its source could not be identified.

All locations affected by this unknown source were also affected by a 20-hertz tone, also of unknown origin.

No sign of WTAS or a pervasive tone were identified High Tralorg R8 or Glenapp Castle. In the former the recording period was too short to suggest that the absence was typical.

19. The separation distances to the nearest properties is a matter of material significance.

'The term 'residential amenity' (**CD.SS13**) refers to the living conditions at a house, including its gardens and domestic curtilage'.

There are **685** households registered in the areas of Straiton, Barr, Dailly and Crosshill and impacts on homes depend on location and topography. The Noise receptors selected by the wind operators consider their location choices to be representative, but they are often as a result of desk top studies without timeless local knowledge or experience.

The 3 applicant's NIA reports frequently conclude that; *in no case would effects be of such nature and / or magnitude that it potentially affects living conditions at any property to the point it becomes an unattractive place to live, when judged objectively in the public interest."*

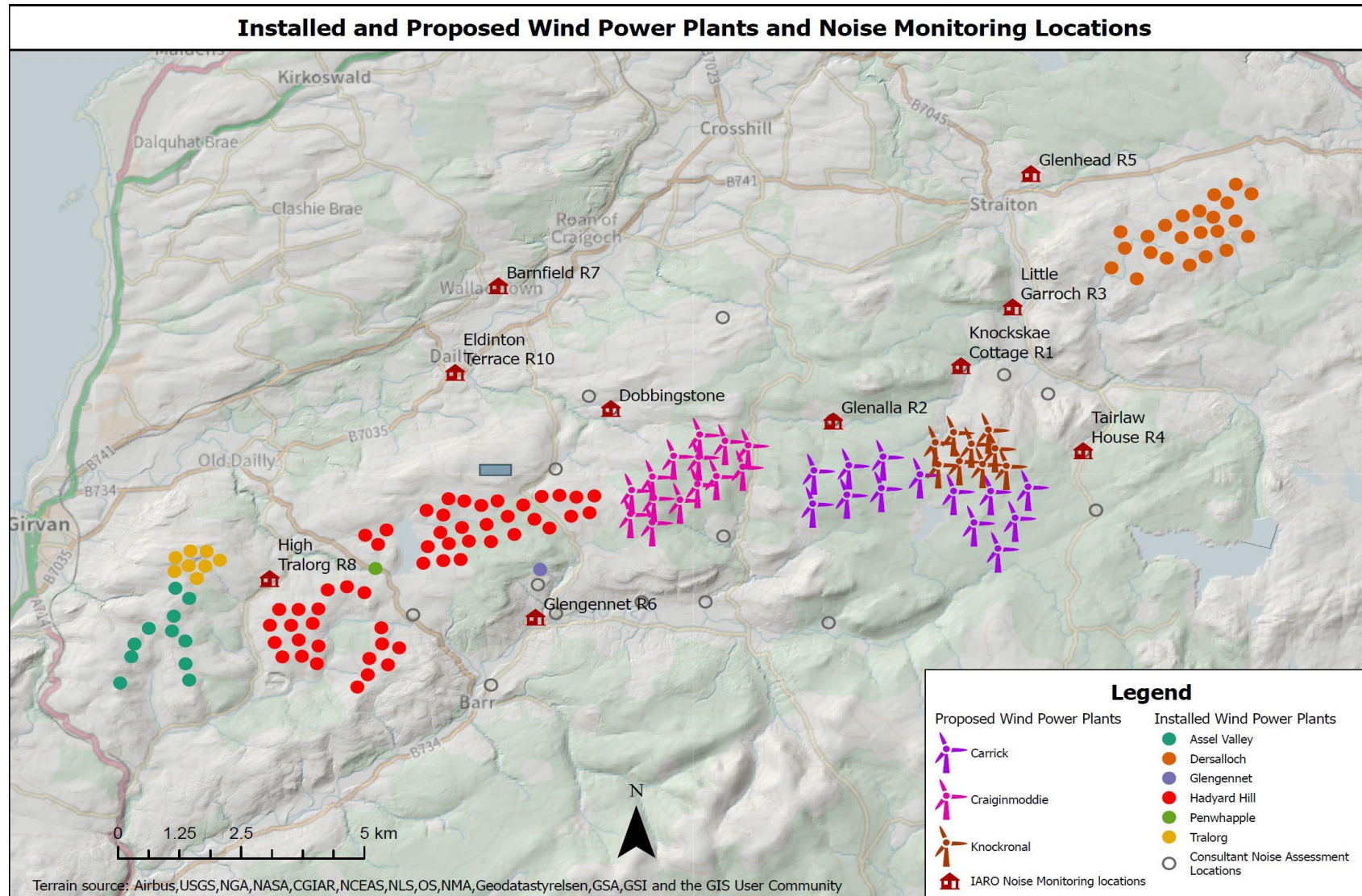
(It is notable that in virtually all NIA's submitted by applicants this conclusion is reached, when in reality these assessments can be found to be fundamentally flawed, as in the Blary Hill wind turbine noise case in Argyll & Bute, which has caused immense harm and distress to the adversely impacted residents and was approved by the Chief Reporter based on the residential amenity assessment.)

19.1. The Maps below illustrates the enormous impact these 200m turbines will have on the villages of Straiton, Barr and Dailly as the Wind turbine acoustic sound power propagation funnels along the valleys towards these villages from these wind power plants. The natural river valleys of the Girvan and the Stinchar and their tributaries form valleys with steep sides as these rivers are close to their source in these locations.

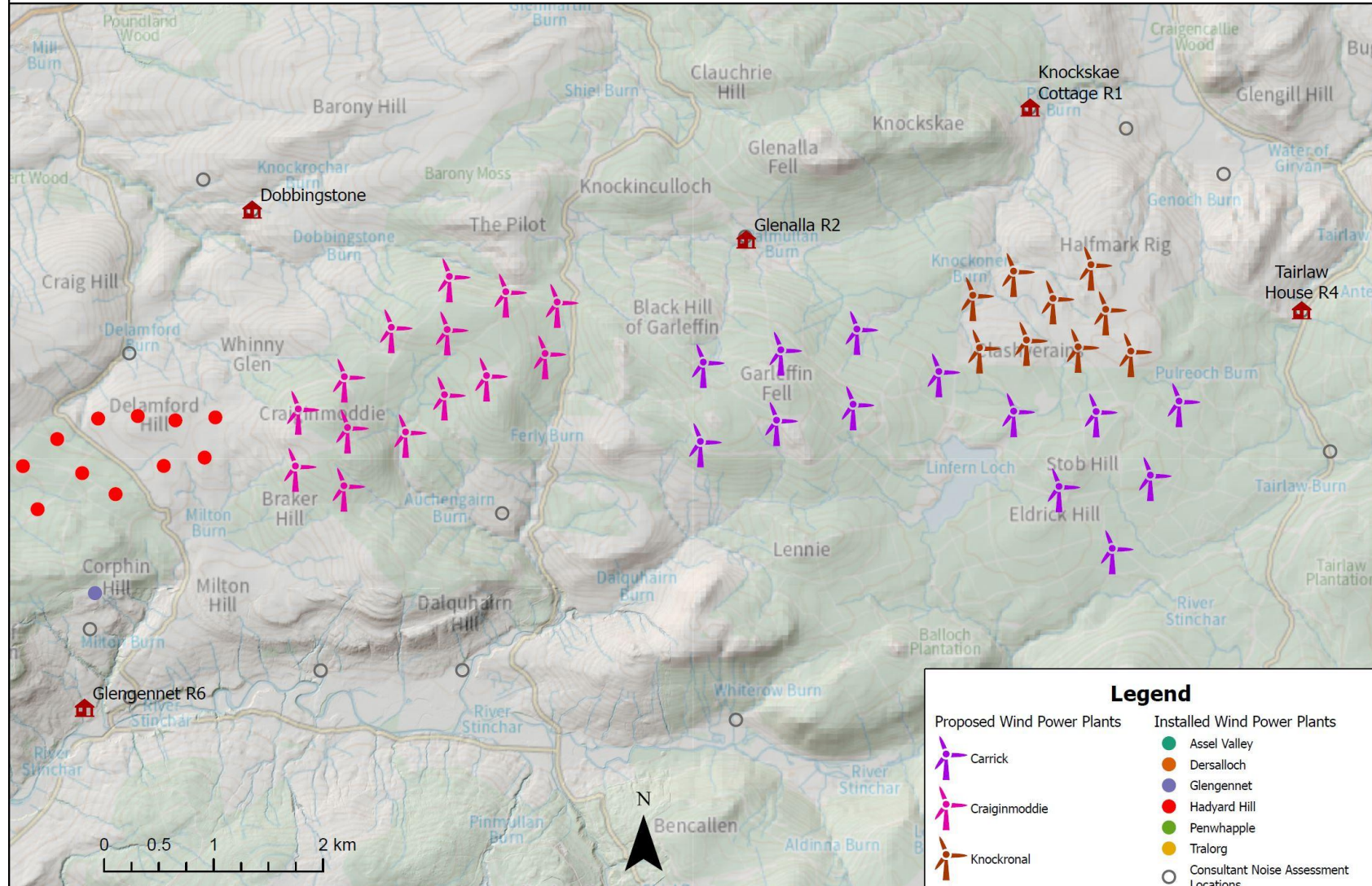
19.2. **Installed and proposed Wind Power Plants Glengennet to Knockskae** illustrates how Glenella will become inhabitable as all valleys lead to Glenella in this isolated beautiful location in the middle of these applications. Glenella will be uninhabitable if these turbines are consented as the acoustic sound power waves propagate around Glenella from the different wind power plants.

19.3. **Installed and Proposed Wind Power Plants near Barr** illustrates how the Stinchar Valley, Milton Burn and Pingerrach Burn will carry the acoustic waves towards the village of Barr to the south and towards Dailly and Wallacetown to the north.

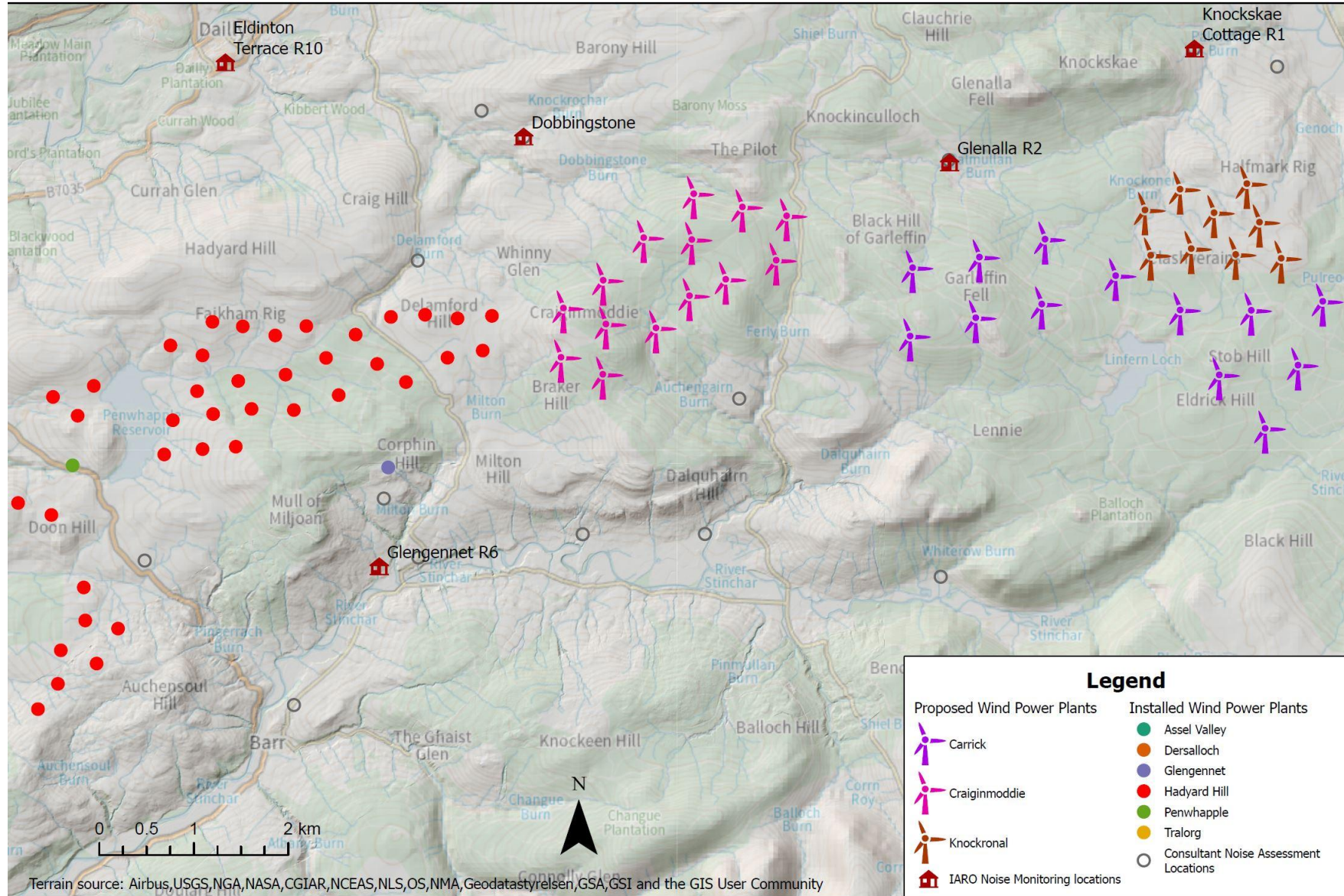
19.4. Installed and Proposed Wind Power Plants Daily to Straiton illustrates the gorge formed by the Girvan Valley towards Straiton which will force the acoustic waves to follow this direction towards homes, schools and rural businesses. The steep sides of Cawin Burn also focus the acoustic waves towards Knockskae and other rural homes in the Straiton area.



Installed and Proposed Wind Power Plants Glengennet to Knockskae



Installed and Proposed Wind Power Plants Near Barr

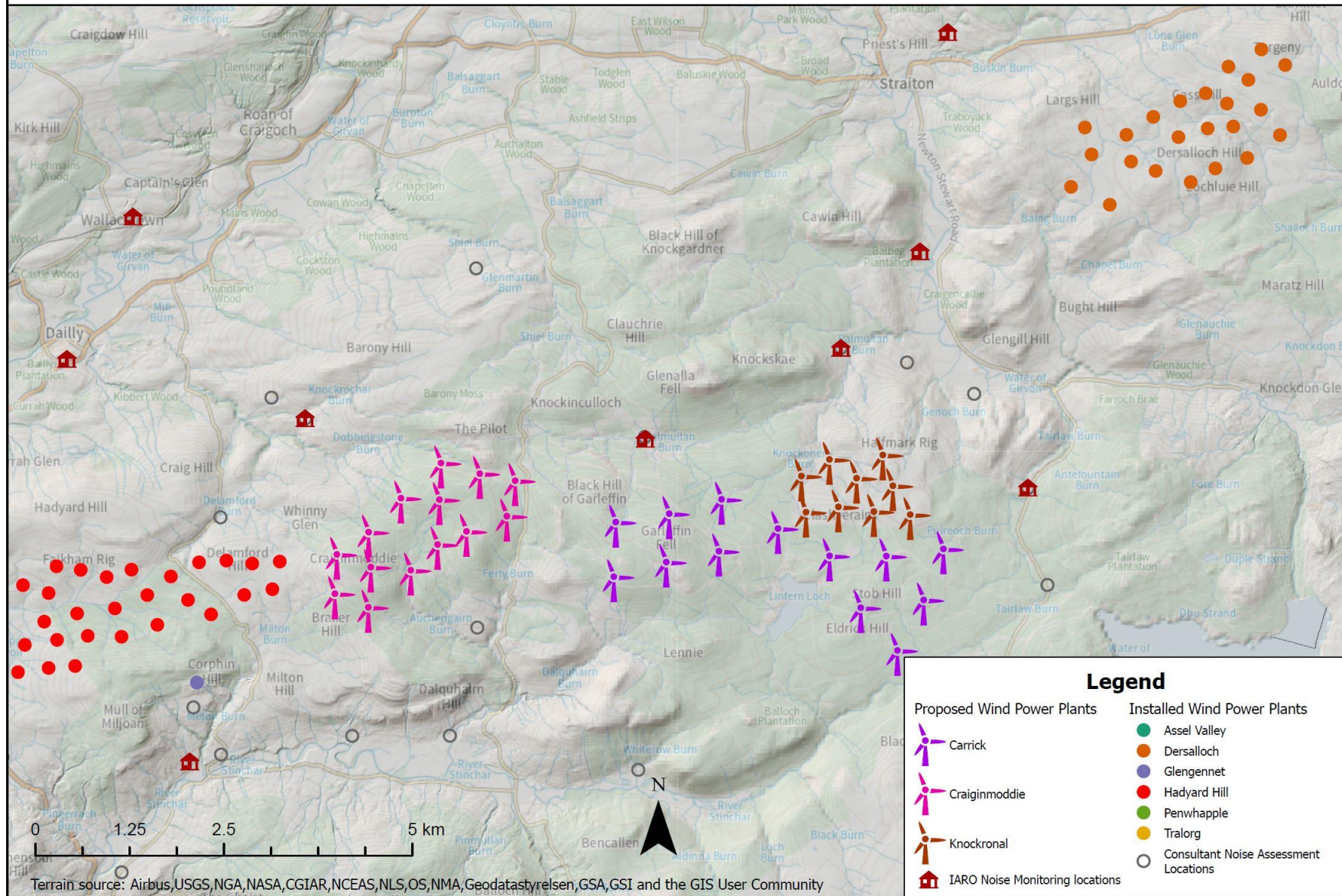


Legend

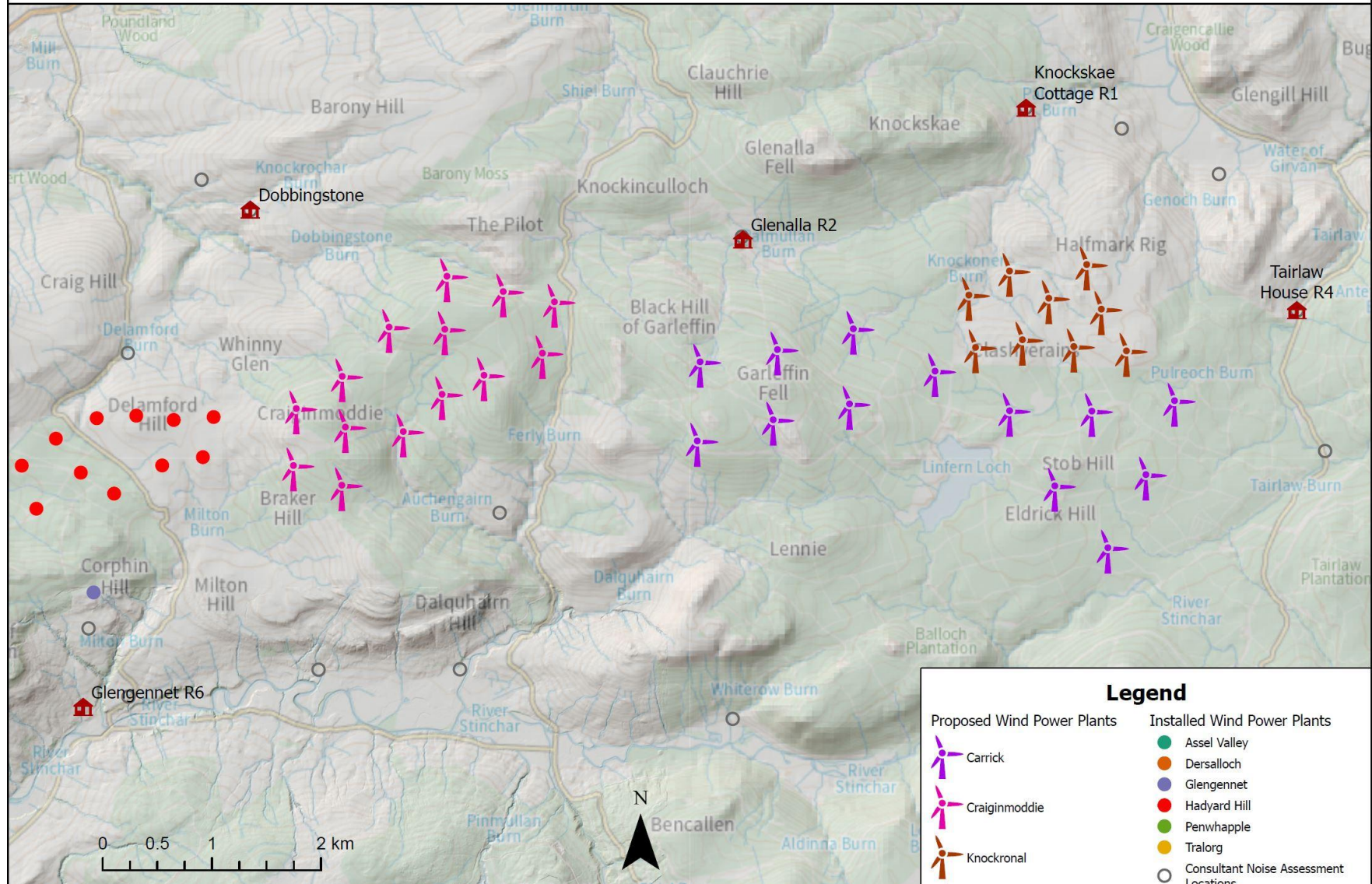
<p>Proposed Wind Power Plants</p> <ul style="list-style-type: none"> Carrick Craiginmoddie Knockronal 	<p>Installed Wind Power Plants</p> <ul style="list-style-type: none"> Assel Valley Dersalloch Glengennet Hadyard Hill Penwhapple Tralorg Consultant Noise Assessment Locations
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IARO Noise Monitoring locations

Installed and Proposed Wind Power Plants Daily to Straiton



Installed and Proposed Wind Power Plants Glengennet to Knockskae



19.5 .Extracts from witness statements: **(CD.SS14.)**

This Knockcronal wind farm proposal results in all three of the above effects from the scale of the proposal and the oppressive and intrusive feelings induced on my home and its curtilage that result in my home suffering significant overbearing impact on its residential amenity to the point where it will become uninhabitable.

We already get the noise from Dersalloch when the wind is from the north east. It is a low sound but makes sleep difficult. The prevailing wind is from the south and west so they would get the full impact of the Carrick and Knockcronal turbines.

I'm a man who likes a bit of peace and quiet having worked for 40 odd years in a very noisy industry, I chose South West Scotland to retire to because it offered all the requirements I was looking for. Somewhere a bit out of the way of the rest of the world and at the same time exquisitely beautiful. This was some years ago.

Recently, I walked to the top of the Merrick to see the view of wind turbines across Galloway. A paradise for turbine lovers. Last week I walked up Tinto in Lanarkshire on a very busy Good Friday to be greeted with a similar view of wind turbines. Again, a paradise for turbine lovers. I frequently walk up the Byne Hill near Girvan – same story. Maxwellston Hill near Dailly. Same story. The Monument at Straiton, Cairnsmore of Carsphairn – same story. Last year we walked the Whithorn Way from Glasgow to Paisley. The road from Barrhill to New Luce – awash with wind turbines.

Anyone with an appreciation for nature and beauty knows that to introduce industrial machines into the landscape in this very special valley would be to destroy the very essence of what we who live here most enjoy about our lives here. This is defined as a Pastoral Valley, in other words one which is totally and utterly rural.

Craiginmoddie, Carrick and Knockcronal wind power stations will engulf the surrounding countryside and it won't matter which way the wind is blowing as the noise from one or other wind turbine station will always be present. Since one of the reasons fell runners and walkers love the countryside is to experience the peace and quiet of a remote wild place, this noise is extremely off putting and they will avoid the whole area.

The proposed three windfarms would be located around 2km south of our home and would completely destroy the unparalleled landscapes, and we would be subject to the noise and disturbance they will generate. Little Garroch is positioned in a slightly elevated site on the west side of the Girvan Valley, with Bennan Hill to the west and Craigenallie Hill to the east. The topography of these features creates a natural tuning effect, which would concentrate noise disturbance from the proposed scheme on our property.

20. **The Bald Hill Judgement: (CD.SS15.)** JUDGE: Richards J. Dates: 6–10, 13–17, 20–23 September, 12 October 2021. Date of judgment: 25 March 2022 cited as: Uren v Bald Hills Wind Farm Pty Ltd. Medium neutral citation: [2022] VSC 145 Wind Turbine noise, vibrations and infrasonic pulsations cause turbine sickness and sleep disturbance.

Turbines are distinctively noisy in rural areas, particularly during certain times of the year when the atmospheric conditions increase noise transfer. In the Bald Hills court case, Justice Richards did not consider the industrial wind development as one of the established uses in the locality.

“The locality is rural, relatively quiet, and remote..... The rural activities of stock grazing and farm activities do not cause intrusive noise at night”

Justice Richards reaffirms within the Bald Hills judgement: 20220325 Uren v Bald Hills WF [2021] VSC 145ix , the significance of the planning balance between the protection of affected residents residential amenity and the deployment of wind turbines by commenting:

*“(6) What is the social and public interest value in operating the turbines to generate renewable energy?
The generation of renewable energy by the wind farm is a socially valuable activity, and it is in the public interest for it to continue.
However, there is not a binary choice to be made between the generation of clean energy by the wind farm, and a good night’s sleep for its neighbours. It should be possible to achieve both.”*

22. **Site visits** We consider that Noise site visits are an important part of the evidence with particular reference to understanding the reasons for selection for SAM monitoring in relation to these 3 wind power plants.

(CD.SS6.) Covering letter to DPEA Reporters re Arnicle also explains the value in the Reporters making a site visit to physically experience living in over bearing adverse conditions, as a result of siting wind turbines too close to residential properties.

Conclusion:

1. **There are substantive material grounds for all three Windpower plants to be refused on the grounds of Noise.**

Mr Huson states at **(CD.SS5.)**

163 *In consideration of the above concerns, the project target noise limits of ETSU-R-97 will not be met and the conjoined projects should not be granted approval.*

2. The WTN assessment evidence submitted by all 3 applicant's, along with SAC's statements at Para's 2.1, 5 & 6 is found to be fundamental and materially flawed, to such an extent that the proposed Wind Power Plants, both singly or cumulatively, fail to demonstrate adequate protection of residential amenity from adverse noise impacts.

3. It is also of significant concern that there is compelling evidence should the Reporters be minded recommend approval, of all or any proposed development that SAC will likewise not resolve any potential noise nuisance complaints and therefore putting at an unacceptable risk to the health and welfare of affected residents especially given the large number of properties over an extensive area of up to 25km.

This report's submitted evidence is that local residents are extremely unlikely to receive timely and effective resolution by either SAC, or the 3 applicant's in the event of any Wind Turbine Noise (WTN) nuisance complaints.

END.