



**NAME REDACTED**

**OBJECT**

Submission No: 165539

Organisation:		<i>Key issues: Energy Transition, Biodiversity, Visual impacts, Traffic and transport, Noise and vibration, Heritage, Agricultural impacts and land use, Social and economic, Physiological - infrasound noise / electromagnetic interference / shadow flicker / blade glint</i>
Location:	<i>New South Wales 2354</i>	
Submitter Type:	<i>I am the owner or a tenant of a neighbouring property to the proposed development</i>	
Attachment:	<i>BIMBI Pastoral PL Submission SSD-10807896.pdf, IndAssessTboltEISNoiseReportLes Huson.pdf, HusonPaper2_wtn2015.pdf</i>	

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*Please see attached submission document.*



**Bimbi Pastoral Pty Ltd**

ACN 117 591 152

**Submission to the  
Independent Planning Commission on  
Thunderbolt Wind Farm SSD-10807896**

## Contents

1. Introduction .....	3
2. Background .....	3
3. Our agro ecosystem .....	4
4. EPBC Act (1999) Triggered but not respected .....	4
5. Significant wildfire risk.....	8
6. Public liability insurance not available .....	8
7. Buffer zones inadequate.....	9
8. No project layout negotiations or neighbour agreement .....	9
9. Infrasound and noise impacts are non-compliant.....	10
10. Significant shadow flicker impacts .....	12
11. Turbine lighting dangers.....	13
12. Dangerous traffic conditions.....	13
13. No decommissioning or rehabilitation bond .....	14
14. Cumulative impacts ignored .....	14
15. Poor community consultation.....	15
16. Poor Aboriginal consultation .....	16
17. Community Benefit Fund flawed .....	17
18. No ESG Principles .....	18
19. Flawed NSW Government processes .....	19
20. Conclusion .....	20
Appendix 1: Development Consent issues and recommendations .....	21

## 1. Introduction

This submission is being made by Bimbi Pastoral Pty Ltd as trustee for its related entities, and on behalf of their respective directors and beneficiaries. These parties are referred to as ‘we’, ‘us’ or ‘our’ throughout this submission.

This submission expresses a range of concerns and issues we have about the State Significant Development SSD-10807896, Thunderbolt Wind Farm.

Each section outlines our concerns, how they impact us, our business, our home, our animals, our native fauna, or our environment, and concludes with recommendations we would like the IPC to require of the developer, Neoen.

Appendix 1 lays out in a clear table the issues we have with each section of the Thunderbolt Wind Farm Development Consent document, including additional recommendations.

Please note that we concur fully with the submission to the IPC made by Friends of Kentucky Action Group – a sub-group of RED4NE Inc.

Our recommendations are highlighted in green boxes and continuously numbered throughout the submission.

We look forward to the results of your serious, expert, independent consideration of our submission.

## 2. Background

The authors of this submission are 6<sup>th</sup> and 7<sup>th</sup> generation farmers. We wish our names to remain anonymous to the public.

We operate a regenerative grazing enterprise adjoining the proposal and we have a passionate interest in nature positive agriculture. Between us, we hold a BSc (Hon 1) from Griffith University’s School of Australian Environmental Studies, and a BSc (Hon) in Geology from the University of New England.

One of us has extensive experience working in agricultural extension and Landcare across Queensland and NSW, as well as conducting focus groups with hundreds of farmers in every State, researching barriers to agroforestry extension. Our relevant experience is a key reason one of us was appointed to the board of the NSW Biodiversity Conservation Trust in 2020. Our commitment to action on climate change is demonstrated by our participation in a climate rally in 2018, involving farmers riding their horses in the main streets of Sydney.

We also have extensive experience in the sheep and wool industry and we are well known among the shearing industry. We have spent more than 5 years as a hydrogeologist with the NSW Government, and a further 5+ years working in minerals exploration in both Queensland and NSW.

With our strong science backgrounds, we believe in climate change. We believe in renewable energy. **But not like this.**

### 3. Our agro ecosystem

Our farm and home are located across the New England Highway from the proposed development site. We consider ourselves **immediate neighbours** of the project.

We have installed a rooftop solar and battery system, so we don't notice blackouts, and we share electricity to the grid. We are green in our attitudes and our actions.

We've spent the last 18 years implementing regenerative agriculture projects on farm, to build natural capital and become carbon and nature 'positive', while producing high quality super fine merino wool, fat lambs and beef cattle. We have deliberately built up our natural capital and see it as an integral part of our farm enterprise, contributing real value. Our natural capital contributes to the marketability of our products. Our farm has been the focus of many projects and field days demonstrating ideas and outcomes to other landholders.

Our farm's natural capital includes endangered raptors such as Little Eagles and Square-tailed Kites (Steve Debus, pers comm, 2024). We have a breeding pair of Wedge Tailed Eagles nesting behind our woolshed. We have endangered Bell's Turtles in our stretch of Looanga Creek and we sight endangered koalas regularly. We are also on the migration route for the endangered Bogong Moth.

We've recorded rare native grasses such as Silky Brown Top, Wallaby Grass and Kangaroo Grass, long thought to be grazed out of the landscape. We have a myriad of small, threatened woodland birds and our farm dams are stocked with Yellow Belly, Silver Perch, and Murray Cod.

These are all part of the Critically Endangered Box Gum Grassy Woodland we call home. This ecological community is protected from harm under the Federal Environment Protection and Biodiversity Conservation Act (1999).

It's always been part of our long-term business plan to attract eco-tourists to the property. In the last year, we started with 'HipCamp', and plans include a tiny home or cabin.

However, the potential impacts of the wind farm on our farm enterprises were NOT considered by Neoen in their Environmental Impact Statement, nor by the Department of Planning in their assessment of the proposal: no one asked us, no one surveyed our property, or offered to consider it for any biodiversity offsets required for the project. This is a failure of process and procedural fairness.

1. The IPC should require the proponent to measure the biodiversity values on our property before and during the consent period, modify wind farm operations accordingly should any decline in biodiversity value occur, and compensate any economic losses caused by reduced biodiversity on our farm business.

### 4. EPBC Act (1999) Triggered but not respected

The Department of Planning's Assessment report on the project indicates that the project is located on cleared farmland in poor condition. This is simply not true. Even close inspection of the satellite imagery used in the maps shows it's not fully 'cleared'. Inspection on ground shows a very different story.

This site has critically endangered natural assets under the federal Environment Protect & Conservation Act (1999).

The project site contains:

1. Box Gum Grassy Woodland (critically endangered)
2. New England Peppermint Grassy Woodland (critically endangered)
3. Ribbon Gum – Snow Gum – Mountain Gum woodlands (Endangered Ecological Community)
4. Carex Sedgeland (endangered ecological community)
5. Spotted Harrier (vulnerable)
6. Little Eagle (vulnerable)
7. Square Tailed Kite (vulnerable)
8. Koala (endangered)
9. Bell's Turtle (endangered)

This list was shared with us by a local ecologist who wishes to remain anonymous. Note that Neoen's EIS missed detecting the known endangered species, the Bell's Turtle.

Well-known local ornithologist associated with University of New England, Steve Debus<sup>1</sup>, has shared with us that species likely at or around the site depending on time of year and other factors include the following, and in fact he has seen some of these fly out of our farm and into the project site while waiting at roadworks stoppages on the highway between the two properties:

1. Swift Parrot (critically endangered)
2. Regent Honeyeater (critically endangered)
3. Latham's Snipe (vulnerable)
4. Black Falcon (vulnerable)
5. Barking Owl (vulnerable)
6. Little Lorikeet (vulnerable)
7. Turquoise Parrot (vulnerable)
8. Brown Treecreeper (vulnerable)
9. Speckled Warbler (vulnerable)
10. Black-chinned Honeyeater (vulnerable)
11. Painted Honeyeater
12. Grey crowned Babbler
13. Varied Sittella
14. Dusky Woodswallow
15. Scarlet Robin
16. Fame Robin
17. Hooded Robin
18. Diamond Firetail
19. Bell's Turtle
20. Koala.

We have personally observed visitations of endangered **Bogong Moths** at certain times of the year, attracted to the windows of our house when the lights are on. In the 17 years we have lived here when they migrate, their population has declined noticeably.

Fragmentation is a key threatening process for these endangered systems, and for their inhabitants. We know that Neoen's construction processes significantly fragment the landscapes they are built in, as recent drone imagery from north Queenssand's Kaban Wind Farm<sup>2</sup> shows this clearly.

Neoen should be required to follow the Avoid, Mitigate, Offset hierarchy for biodiversity protection. They have not done this where turbine numbers 22, 23, 24, 25 and 28 are concerned.

An agreement between the State and Federal Government departments enables the NSW Government to act on behalf of the Federal Government in relation to approving projects that trigger the EPBC Act (1999). There is a clear conflict of interest here. There is also a missed opportunity for a 'second set of eyes' over the proposal. This is a very unfortunate circumstance

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<sup>1</sup> Steve Debus, personal communication, March 2024.

<sup>2</sup> Source: <https://www.youtube.com/watch?v=KVpIlt--bY> accessed 24.03.2024.

for the ecosystems being impacted and for the neighbours of the project area like us, who also rely on this biodiverse environment for their business and income.

The NSW Koala Strategy<sup>3</sup> indicates Armidale, Uralla, and Walcha areas are Regions of Koala Significance and 'refuges' for many species under climate change.

Landcare programs funded by the Federal and State Governments over the last 30 years have been instrumental in restoring the Southern New England landscapes after New England Dieback in the 1970s. This has been done by involving and engaging the whole community in the long-term aim of restoring our landscapes for the benefit of the environment and agriculture.

It appears NSW Government objectives conflict in this region – we have been supported for 30+ years to restore the landscape through Landcare and are now listed as being Areas of Koala Significance<sup>4</sup> while at the same time we are declared a Renewable Energy Zone where it seems to be ok to fragment further with significant clearing of critically endangered ecosystems and species. **This is a nonsense.**

### **Koalas and infrasound**

Koalas use infrasound to find mates across large distances. Researchers at James Cook University recently raised the alarm about the impact of infrasound emitted from large wind turbines on koalas:

*Individuals rely on their low frequency contact calls and their great auditory acuity to locate conspecifics. The legislation controlling these developments (the EPBC Act, 1999) predates wind turbines and the amount of low frequency noise that turbines can inflict on wildlife is unregulated. There is an urgent need for scientific investigation of this noise and its wildlife impacts. We suggest that wind turbines could pose a threat to the viability of koala populations...<sup>5</sup>*

Importantly, the EPBC Act (1999) predates wind turbines, and the noise they emit is **unregulated**. Turbines are increasing in size fast as shown in recent transport footage<sup>6</sup>. These researchers suggest urgent scientific investigation of this noise on all wildlife.

### **Species not considered in the EIS**

There has been **no consideration** of endangered **Bell's Turtles** nor endangered **Bogong Moths** by Neoen in their EIS nor by the Department in their Assessment because Neoen did not conduct aquatic biodiversity surveys, nor surveys at key times of the year when the moths

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<sup>3</sup> <https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/programs-legislation-and-framework/nsw-koala-strategy>

<sup>4</sup> <https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/programs-legislation-and-framework/nsw-koala-strategy>

<sup>5</sup> Roger Martin & Richard Hopkinson, (March 2024) *Potential Impacts of Wind Turbine Noise on Upland Koala Populations in FNQ*, James Cook University Centre for Tropical Environmental and Sustainability Science at <https://www.youtube.com/watch?v=KVp1llt--bY>

<sup>6</sup> <https://youtu.be/QOGca05AD0Q?si=15fzalMXeuoeNjR1>

migrate through our area. The moth population has dramatically reduced in the time we have lived here due to light pollution on their migration route.

Endangered Bell's Turtles are frequent across the project site and in creeks and dams on neighbouring properties and crown land<sup>7</sup>. They are in significant numbers in the large dam on Pine Creek, which Neoen plans to pipe water from for a concrete batching plant. This would significantly impact the populations and breeding success. Project creek crossings will increase turbidity in streams, impacting survival of the turtles.

Bogong Moths visit our region in winter. We experience them hitting our kitchen window when the lights are on at night. They are huge. They will be attracted to the turbine lights and are likely to be killed by turbine strike. Neoen has not considered this endangered species in their EIS and the Department has failed to recognize this in their Assessment Report.

2. We recommend the project is rejected based on irreversible damage to critically endangered ecosystems in a climate change refuge region, where community members have spent 30+ years trying to restore agro-ecosystems.
3. We recommend the project is rejected based on a failure to list known endangered species at the site including Bell's Turtle and Bogong Moth.
4. We recommend the proposal is rejected based on inadequate biodiversity compliance by Neoen, and assessment of the EIS by Department of Planning, leading to unacceptable future risk of legal action.
5. We recommend the Federal Department be asked to review the development application given the EPBC Act (1999) was triggered.
6. We recommend removal of turbines 22, 23, 24, 25 & 28 to avoid fragmentation of large areas of remnant vegetation.
7. We recommend any development consent requires turbines to be equipped with modern radar capabilities that detect eagles and turn turbines off.
8. We recommend any development consent requires decommissioning high strike turbines that are identified through compulsory monthly monitoring and publishing of bird, bat and Bogong moth strike counts and locations.
9. We recommend any development consent requires any offsets to be found adjacent to the impacted areas, and should the project proceed, we would be happy to negotiate on this.
10. We recommend the project is rejected until the impacts of infrasound especially on koalas and other endangered wildlife are given further research consideration.
11. We recommend the NSW Government be asked to implement urgent statewide land use planning to clearly identify 'no go zones', where wind farms are not appropriate and will not be considered.
12. We recommend any Development Consent does not approve use of the dam on Pine Creek for piping water to the batching plant and requires Neoen to find an alternative water source.

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<sup>7</sup> Anonymous local ecologist, pers comm, March 2024



## 5. Significant wildfire risk

Prevailing winds are from the west, southwest and northwest, blowing any fire from the project site directly towards firstly our residence and then the rest of the farm.

If this project proceeds, our home and farm stands directly in harm's way because firefighting in the project area will be impeded in two ways:

- Aerial support will not be possible due to a 3 km no-fly zone around turbines.
- Local ground crews are likely to be prevented from suppressing fire within the project site, due to owner sensitivities, despite fire fighter 'entitlement of entry' to suppress fire – last year they refused helicopter access by Local Land Services for the annual feral pig shoot.

A wildfire that crosses the highway into our farm would be devastating for our family and business. As the highway is our only access and evacuation route, if the highway is impacted or closed, we will be trapped.

Fanned by westerly winds, it would take less than one hour for a fire to reach the more densely populated areas of Kentucky.

The devastation would be unacceptable but totally avoidable if the project were located at a more suitable site.

13. We recommend the IPC reject the proposal based on unacceptable risks of wildfire to us, our neighbours, our livestock, and our wildlife, and suggest the developer relocate to a more suitable site.
14. We recommend any Development Consent requires a 3 km buffer zone between turbines and the New England Highway to enable aerial water bombing along this national transport route, an important fire evacuation route, and at our house and sheds.

## 6. Public liability insurance not available

Recent investigations by NSW Farmers suggests landholders neighbouring such expensive infrastructure that will not be protected with aerial firefighting capabilities, **cannot** currently source public liability insurance to cover the risk of accidental fire burning into the project area<sup>8</sup> and that if it were available, the costs would be prohibitive.

If this is the case, this is unacceptable and must be rectified before approval of this project.

15. We recommend the development is rejected until affordable public liability insurance for neighbours is available from an Australian provider.
16. We recommend the project developer sources and pays for the cost of neighbour's public liability insurance premiums.

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<sup>8</sup> NSW Farmers, March-April 2024, "Solar Exposes Insurance Blackhole", pp. 25-29, The Farmer Magazine. Sourced at <https://thefarmermagazine.com.au/public-liability-insurance/>

## 7. Buffer zones inadequate

Current Wind Farm Guidelines indicate a 2 km buffer zone should be used between the nearest turbine and any residence. We assert that Neoen should be required to site turbines at least 2 km from neighbour **boundaries**, rather than just neighbour residences because anything less, limits our ability to implement future farm plans.

We also reject the idea that Neoen is using the New England Highway corridor and our own land as a buffer for us around their project.

17. We recommend the Development Consent require siting of turbines at least 2 km from neighbour boundary fences
18. We recommend any Development Consent requires a 3 km buffer zone between turbines and neighbour residences, to enable aerial water bombing of homes and farm infrastructure in case of wildfire.
19. We recommend developers not be allowed to use public assets (e.g. New England Highway corridor) as a buffer zone.
20. We recommend the Wind Farm Guidelines be changed to recommend a 2 km buffer between the nearest turbine and the **boundary** of any neighbouring property.

## 8. No project layout negotiations or neighbour agreement

In January 2021, we wrote to the proponent giving ten reasons for withdrawing our expression of interest in hosting turbines, and suggesting a range of ameliorating and compensatory actions should the project proceed. We have never received any offers of negotiation from Neoen. There has been no opportunity for us to discuss and negotiate turbine layout to ameliorate our concerns. This shows Neoen has wilfully neglected neighbour engagement even when invited.

Mapping by the proponent and the Department has been obtuse and unhelpful. The Development Consent document places a map inset completely covering our property – an immediate neighbour of the project. This is unacceptable.

Neoen failed to negotiate any kind of neighbour agreement with us. They made one offer to us of \$6000 per year. We were given legal advice not to sign as it would effectively gag us from making any future complaints. We rejected the offer as being unfair both financially and legally and expected further negotiations. These did not eventuate.

These negotiation processes should be considered necessary best practice. For them not to occur is procedurally unfair, and unacceptable.

21. We recommend the IPC rejects this procedurally unfair proposal until the proponent a. provides clear and detailed maps for neighbours of the project; b. engages with neighbours to discuss and negotiate location of individual turbines and compensatory actions; and c. negotiates meaningful Neighbour Agreements in a way that considers and provides for neighbour's needs without gagging them from making complaints in the future.

## 9. Infrasound and noise impacts are non-compliant

### Infrasound

Neither Neoen nor the Department address non-compliance issues identified by L Huson & Associates Pty Ltd in their independent review. This has been shown to be the case by Les Huson & Associates Pty Ltd:<sup>9</sup>.

*It is unusual for an EIS, that must include 'completed technical studies, including an accurate noise impact assessment for relevant dwellings undertaken consistent with the requirements of the Noise Assessment Bulletin', to state that the wind turbine layout, the turbine type, the consideration of other matters such as tonality, low frequency noise and sound power levels can all change and are issues that will be considered after approval of the EIS.*

*In my opinion, an EIS must address all of these possible changes before any EIS is approved. If the changes suggested are not considered in the EIS then the EIS is deficient, incomplete, should be considered premature and must not be approved. (pp 2-3).*

The Huson review concludes the Neoen EIS is seriously deficient, and the project should not be approved based on noise compliance issues including:

- The EIS has not considered the effect of different layouts or details for the current or other wind turbine candidates.
- There is an additional property to the south of shed ID30 that needs to be considered.
- Background noise measurements have been found to be deficient.
- Serious concerns about the Noise Model used.
- Technical consideration of the cumulative effect of the Winterbourne wind farm [and other developments in the pipeline since the Huson report was prepared] should be included in the NVA, as required in the SEAR.
- Concerns about the lack of evidence for negotiated agreements especially concerning residence 270.

The Sonus Noise Assessment stated that the actual wind turbine model has not yet been identified so their noise assessment is not only deficient but also based on an unknown key element.

Serious concerns have been raised in the last 12 months about the impacts of infrasound on humans and animals.

A study in rural Scotland<sup>10</sup> found rural sheep farm residents have been forced to remain in noxious and toxic noise environments caused by a Wind Power Plant, while their livestock have

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<sup>9</sup> L Huson & Associates Pty Ltd, May 2022, *Review the Thunderbolt Energy Hub – Stage 1 Environmental Impact Statement (EIS) dated March 2022, prepared by Umwelt (Australia) Pty Limited on behalf of Neoen Pty Limited.*

<sup>10</sup> International Acoustics Research Organisations (IARO), 2023, Synopsis of Acoustic Report on Wind Turbine Noise in a Rural Sheep Farm in Scotland, Document Number: IARO24-3. Sourced at <https://iaro.org.nz/wp->

developed unexplained reproductive problems. The study found vulnerable residents (autistic child, history of auto-immune diseases) were unprotected and ignored and there was ongoing reporting of unresolved debilitating health impacts. A non-response from government authorities bordered on medical negligence.

Of grave concern is a call by researchers in Far North Queensland for urgent research into the impacts of infrasound from wind turbines on our endangered koala populations <sup>11</sup>.

The German Government measures infrasound in Bavaria through the Federal Institute of Geo Sciences and Natural Resources as part of a network monitoring for nuclear explosions. In 2004 scientists measured infrasound from a single small (0.2 megawatt) wind turbine to identify how far infrasound emissions could be registered from the source. From that data, scientists (Dr Lars Ceranna) calculated that larger wind turbines (5 megawatt) would generate a detectable infrasound signal for up to 20 kilometres<sup>12</sup>.

If this is the case, this noise type will potentially impact Uralla, Bendemeer, and Walcha townships and the surrounding farms and wildlife populations.

Given recent research cited here, this failure by Neoen to address the impact of infrasound is a gross oversight and needs to be rectified before the project is approved.

### **Operational noise**

We all have a right to live and work free from excessive noise nuisance.

Notably, Neoen's noise mapping curved the noise level contours around our house, placing our residence *just* outside the predicted noise limit. This appears to be the case for other neighbour houses.

The case of Uren vs Bald Hills Wind Farm<sup>13</sup> in Victoria's Supreme Court in 2022 set a precedent in Australia for this right when they found against Bald Hills with respect to Noise Nuisance.

In March 2024 in Ballyduff Ireland, a court made findings against a Wind Farm as follows<sup>14</sup>:

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[content/uploads/2024/02/Synopsis%E2%80%94Acoustics-Rural-Farm-Report-FINAL.pdf](#) on 23.03.2024. Full report entitled *Report on the High-Resolution Infrasonic and Low-Frequency Sound Recordings Conducted Within a Rural Farm in Scotland in 2022 and 2023*, available at [www.iaro.org.nz](http://www.iaro.org.nz).

<sup>11</sup> Roger Martin & Richard Hopkinson (2024), Potential Impacts of Wind Turbine Noise on Upland Koala Populations in FNQ. Presented at Seminar #3 2024: Transition to Extinction pt 1, sourced at <https://www.youtube.com/watch?v=KVpllt--bY> on 23.03.2024.

<sup>12</sup> *Infrasound caused by Industrial Wind Turbines*, November 4, 2018, produced by science programme "planet e" of the second German television ZDF, sourced at [https://youtu.be/ywWNx3OJyuo?si=6Z\\_lb\\_HaLAUEN8lk](https://youtu.be/ywWNx3OJyuo?si=6Z_lb_HaLAUEN8lk) on 24.03.2024.

<sup>13</sup> The Commercial Bar Association of Victoria, 2022, *Bald Hills Wind Farm a nuisance to neighbours: injunction, damages and aggravated damages awarded*, sourced at <https://www.lexology.com/library/detail.aspx?g=65401dd9-5cac-45cb-9486-bca5247168de> on 23.03.2024.

<sup>14</sup> <https://www.irishtimes.com/business/2024/03/08/neighbours-entitled-to-damages-for-unreasonable-interference-from-wind-farm-noise-high-court-rules/#:~:text=In%20a%20decision%20that%20is,enjoyment%20of%20two%20couples'%20properties.>

- The defendant cannot rest its laurels on the proposition that the generation of renewable energy is a socially valuable activity which is in the public interest to continue. There is not a binary choice to be made here between the generation of clean energy by the wind farm and a good night's sleep for its neighbours.
- Planning compliance does not determine if wind turbine noise is reasonable or a nuisance.

By failing to properly assess the non-compliant noise impacts of this development, the NSW Government is failing in its Duty of Care to its citizens and leaving it to the Courts to decide on the impacts once the wind farm is built. Meanwhile developers and operators hide behind claims of compliance.

If these impacts are possible, they are simply not acceptable and we reject the EIS Noise and Vibration Assessment which is deficient in assessing all types of audible and inaudible noise generated by large wind turbines.

If a non-compliant project is approved, our family's health could be jeopardized by non-compliant noise pollution, along with the health of our farm animals, and our wildlife, which are pivotal to our business.

22. We recommend the IPC reject the development until the proponent complies with current noise legislation and regulations in their EIS.
23. We recommend the IPC require the proponent to remove turbines numbers 1, 2, 3, 4, 5, 6, 8, 9 10, 11, and 21 to avoid impacting our family, livestock, wildlife, home, property, and business with noise pollution.
24. We recommend the proponent be required to reduce the height and MW power of all turbines in the project to a safe level for noise and infrasound compliance.
25. We recommend the project is rejected, pending identification of the exact wind turbine model to be used and the completion of a pre-construction Noise Assessment of that model.
26. We recommend the IPC require the Thunderbolt Wind Farm EIS Noise Assessment be referred to an independent expert body to provide an impartial assessment of the noise and vibration impacts of this development.

## 10. Significant shadow flicker impacts

The Development Consent states the proponent should ensure that shadow flicker does not impact residences for more than 30 hours per year.

Our farm and home will be impacted visually and by shadow flicker during the beautiful sunsets we experience on a regular basis.

We would prefer zero hours of shadow flicker as we have read about the impacts on mental health from shadow flicker.

We are also concerned about shadow flicker impacting other parts of our property. This has not been adequately researched or addressed by Neoen. As stated earlier in this submission, future plans include a tiny home or cabin on our land as part of our eco-tourism enterprise.

Shadow flicker across the setting sun will significantly negatively impact that enterprise, particularly from turbines in the southern half of the development.

27. We recommend any Development Consent requires Neoen to negotiate with neighbours regarding shadow flicker caused by individual turbines as the sun moves through different seasons.

## 11. Turbine lighting dangers

The Development Consent states turbines will be lit with steady red lights. However, as the turbine blades move past these lights they will appear to flicker on and off all night.

Because of where we live, we are used to dark night skies and the ability to sleep with our curtains and windows open for at least 6 months of the year. Any light during the night causes us to wake. We are concerned for our ability to sleep as it is likely we will see a significant number of red flashing turbine lights from our bedroom.

We are also concerned for local wildlife, including bats and Bogong Moths, which will be attracted to the turbine lighting. These unfortunate species are likely to be killed by the blades<sup>15</sup>.

The section of the highway adjoining the project is exactly half way between Sydney and Brisbane and well known for serious fatal crashes – sometimes they occur on a weekly basis. The highway has a heavy traffic load of B-Double trucks for several hours every evening. These trucks have a long line of red lights along their bodies – clearance lights.

Red lights on the turbines, steady or flickering as the blades pass them, will be problematic for drivers on the New England Highway at night as they will be easily confused with the red lights on semi-trailers and B-Doubles, potentially increasing the incidence of crashes.

28. We recommend the IPC requires the developer to consult with NSW Transport, key residents, and tourism businesses in the area to negotiate turbine layout that mitigates sleep issues for neighbours, business impacts for local eco-tourism operators, dangers for wildlife caused by lighting and dangers to New England Highway users.

## 12. Dangerous traffic conditions

We are concerned about significantly increased traffic on the New England Highway at our property access point, which is already dangerous for the following reasons:

- When travelling from the north and turning left into our entrance, traffic queued behind us is impatient to change into the overtaking lane which begins at the very same point as our front entrance. Their impatience pushes them over a double line into unseen oncoming traffic due to a low area a short distance beyond our entrance.
- When entering from the south and turning right into our entrance, traffic queued behind us is speeding up along a downhill straight after they have been climbing slowly to the top of Sidling Hill at 1150m elevation. Oncoming traffic is hard to see due to a second low area, so additional time is required to give way, to ensure there is no unseen

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<sup>15</sup> <https://www.theatlantic.com/science/archive/2021/07/bat-dogs-wind-turbines/619482/>

oncoming traffic in the 'hollow' just beyond our entrance. This creates a dangerous situation where traffic speeding up behind is in danger of hitting us as we pause before turning in.

- When exiting our driveway to travel left (south), the same 'hollow' creates the danger of entering before it is safe to do so.
- When exiting our driveway to travel right (north) across the traffic, it is easy to enter before it is safe to do so because of unseen traffic beyond the crest of the mountain top which is not far away.

There have been many accidents along the highway outside our property due to dangerous conditions. With the additional traffic and congestion caused by this project and many others, our driveway will be very dangerous without highway modifications.

29. We recommend the IPC rejects the proposal until traffic impacts on our property entrance are considered and highway modifications are recommended in the Assessment Report and Development Consent.

### **13. No decommissioning or rehabilitation bond**

We are concerned that there is no decommissioning or rehabilitation bond included in the Development Consent.

If the developer or owner walks away from the project at end of life, our property, business and lifestyle stands to be significantly negatively impacted due to the eyesore that the remaining project infrastructure leaves.

30. We recommend the IPC reject the proposal until the NSW Government puts in place a decommissioning and rehabilitation bond for wind turbine projects.

### **14. Cumulative impacts ignored**

If Neoen, the NSW Government and the IPC do not to consider the cumulative impacts of this proposal among all the others up and down the Great Dividing Range, from far north Queensland to Victoria, they will be in breach of their Duty of Care to the environment and current and future generations.

None of us want our iconic Koala to become extinct in the wild. The Federal Environment Minister the Hon Tania Plibersek must be beside herself with worry as she sees her environmental policies in direct conflict with Energy Minister the Hon Chris Bowen's environmental policies. We feel a deep sense of despair as we watch a woman's voice be gagged, again.

We also despair that the voices of those who host wind turbines the length of our nation are signed up to unfair confidentiality agreements, preventing them from speaking with their neighbours and their communities.

This approach ensures the majority of our people are completely unaware of the damage about to be inflicted as every mountain in eastern Australia is targeted for turbines and every flat piece of ground targeted for mega scale solar panels.

Will they only realise when they find wind turbines encroaching on their beloved Snowy Mountains or their local beach? By then it will be too late as the environmental damage will have been done.

We need an energy transition, but not one that destroys the very environment it is supposedly trying to protect!

31. We recommend the IPC requires Neoen to consider the cumulative impacts of this proposal fully and completely among the other proposals in the Bendemeer, Uralla, Walcha districts.
32. We recommend the IPC requires the NSW Government to consider the cumulative impacts of this proposal fully and completely among all other proposals in eastern Australia, as should be their role.

## 15. Poor community consultation

Neoen's community consultation was a failure in our opinion. While they may have worked well with the host landholder group, of which we were initially a part, they refused to work directly with neighbours to the east of the project area, which partly contributed to us leaving the host group.

Examples of their poor attempt at community consultation include:

- Neoen contacted only a small portion of neighbours and expected them to provide contact details for other neighbours.
- Neoen refused to conduct professionally facilitated community forums at all, where community members could hear each other's questions and generate discussion, despite numerous requests by the community.
- Instead, Neoen insisted on Drop-in Sessions in Uralla, 20-60 km from all neighbours of the project, during Covid restrictions when people were afraid to mix socially. We know that only a handful of community members attended, mainly turbine hosts.
- In addition, Neoen muted community members during an online community consultation meeting when they asked questions like, why didn't the Umwelt consultants conduct aquatic biodiversity surveys? This was our one and only opportunity to ask questions of technical experts.
- Neoen did not open a 'shop front' in the community at any time.
- Neoen conducted radio interviews on ABC New England North West, in which they quoted incorrect information about community attendance at information sessions.
- In a further example of poor conduct in the broader industry, Fiends of Kentucky Action Group conducted a public meeting to share information about this proposal. Days before the meeting, the guest speaker from another region was bullied into not speaking by an employee of the wind farm in their local area. This demonstrates the lengths to which wind farm developers are prepared to go, to prevent sharing of lived experiences.

In our 30+ years as a 'change agent' working in extension and community engagement, we have never seen such poor community engagement processes.



Consequently, not all members of our community have been afforded their right to know relevant details of the project, ask questions and have input. In what way is this fair or equitable?

This poor consultation and engagement process had the impact of:

1. Completely erasing our trust in this developer.
2. Causing us significant uncertainty about information we needed to make family, farming, and business decisions.
3. Creating significant frustration and anxiety that impacted our mental health. One of us required medical advice and counselling. More recently we have become aware of the term 'solastalgia' and we believe we are indeed experiencing this.
4. Exhaustion. This poor process has caused us to volunteer significant amounts of our own time – something we have very little of, to alert the community to the project, the process and the impacts – all of which should be the role of the 'adjudicator' of the process – the NSW Government. As a result, our own family, our hobby communities and our own mental health have suffered.

33. We recommend the IPC reject the proposal based on a lack of appropriate best practice community engagement which has been procedurally unfair, leading to a lack of social license.

## 16. Poor Aboriginal consultation

This proposal sits across the transition zone between Anaiwan and Gomeroi country.

We have been contacted by individual members of the local Aboriginal community, who have expressed their concerns that they have not been consulted at all. This is unacceptable.

A representative from Sunrise Group Aboriginal Corporation, contacted one of us on 6 March 2024, stating serious concerns that traditional owners have about minimising the environmental impacts of these projects. Their concerns included:

- the lack of engagement about the impacts on catchment management and the correct cultural protocols for engaging Aboriginal communities within sensitive cultural areas
- the benefits and outcomes for Aboriginal people because of the project proposals
- the need to do more on-ground cultural work including but not limited to identifying physical objects (artefacts) within the areas.

We reject the idea that the Development Consent enables the developer to move cultural heritage from one location to another. This would seem to go against any cultural training we have participated in over the years.

34. We recommend the project is rejected until the proponent properly engages with all relevant Aboriginal communities.

## 17. Community Benefit Fund flawed

Neoen has negotiated a Community Benefit Fund (CBF) that will not benefit us and other immediate neighbours of the project.

Most of the population impacted by the project live in Uralla Shire Council (USC), unlike us, the minority, who are located at the very outer reaches of Tamworth Regional Council (TRC). Yet, most of the turbines (30 of the proposed 32) are in TRC.

While the Voluntary Planning Agreement <sup>16</sup> recognises this imbalance by allocating 60% of the funds to TRC and the other 40% to USC, we have a very real concern that the small 33% portion of this 60% portion, i.e. the Community Benefit Fund (yes, it's complicated), will not reach our small group of heavily impacted community members.

To explain our fears that we will be ignored by our LGA (as we are some 70 km from the centre of Tamworth), here are two examples:

- Some years ago, given we pay a waste levy with or council rates, we approached TRC by phone, to ask them to supply a wheelie bin or two, while recognising we would still need to transport our own waste to the transfer station as there is no collection service for us. We were refused this request as it was not council policy. In the same conversation, the council staffer advised us to 'steal a wheelie bin from someone who has one', as this would trigger a free bin replacement for that rate payer. This is ludicrous.
- More recently, the General Manager of TRC was heard to state 'there is no community of interest in TRC' around the Thunderbolt Wind Farm. How wrong he is – there are at least 13 non-associated neighbours of the project we can count on the limited area map provided in the Development Consent.

A second concern is that the Department and the LGAs involved seem to be muddling the concepts of Community Benefit Fund with Voluntary Planning Agreement. It appears they have combined the two.

This is unfair because:

- The Community Benefit Fund should be kept separate to benefit the impacted community immediately surrounding the project in a way they wish to see them spent.
- The VPA should be kept separate and made with Councils to boost funds for core business such as additional resourcing needs associated with road repairs, resource provision etc.

Thirdly, we are concerned that because of the VPA mechanism decided on by Neoen in secret consultation with only USC and TRC, the CBF portion is only 33% of what it should be, based on industry best practices.

Fourthly, we reject the idea that a Victorian bank philanthropic arm (Bendigo Bank) is proposed as the grant administrator of the combined or 'muddled' fund in this project.

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<sup>16</sup> <https://www.ipcn.nsw.gov.au/resources/pac/media/files/pac/projects/2024/02/thunderbolt-wind-farm/case-referral-documents/recommended-conditions-of-consent.pdf>

Nearby project proposal Bendemeer Renewable Energy Hub have successfully negotiated a community organisation to manage and administer their Community Benefits Fund<sup>17</sup>. This CBF mechanism is the one topic that both speakers for and against the project at the IPC Public Meeting **agreed** should be implemented.

Considering these four key concerns, the VPA proposed raises significant questions:

- Why was our local community (alongside Councils) not asked for their input on this arrangement? Again, poor consultation.
- Why is Regional Australia bank, with a footprint across the whole project area not being considered or negotiated with? Poor thinking, researching and consultation.
- For the Community Benefit Fund, why are suitably qualified and experienced local NFP organisations who could do the job not involved in negotiations? Poor consultation, perhaps a need to rush the project through?

Neoen has again failed to properly consult the community on this mechanism. Addressing these questions will find a better way that brings more funds to the local community.

We reject the current VPA proposal wholly based on being procedurally and monetarily unfair.

35. We recommend the project is rejected until Neoen negotiates and implement a fair and equitable Community Benefit Fund that is paid based on industry standards and calls for tenders from suitably qualified and structured local NFP organisations to administer it, and a local banking institution to hold the funds. One project – one community – one trusted, local fund administrator. Neoen must allow for an administrative fee to be charged by the successful tenderer.
36. We recommend the project is rejected until Neoen negotiates (in addition to the CBF) Voluntary Planning Agreements with Councils to supplement appropriately core business needs in relation to roads, infrastructure, resources etc. Neoen must allow for an administrative fee to be charged by each of the Councils.

## 18. No ESG Principles

Given their track record on community engagement, we question Neoen’s commitment to Environment, Social and Governance principles.

The French Corporate Duty of Vigilance Law (2017) requires large French companies to establish and implement measures to identify and prevent human rights abuses and environmental damage throughout their supply chains. It aims to ensure companies respect human rights and the environment in their business operations globally.

If this project is approved, is the NSW Government certain they will not be complicit in any breach of this law by French Company Neoen?

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<sup>17</sup> <https://bendemeerenergyhub.com.au/community-benefit-fund/#:~:text=The%20Bendemeer%20Renewable%20Energy%20Hub,the%20lifetime%20of%20the%20project.>

Some in our local community have raised the question of whether Uighur labour has been used in Neoen's supply chain. It's important to find out because our local and state governments have a Duty of Care under the NSW Modern Slavery Act (2022).

37. We recommend the IPC reject or suspend the proposal until Local and State Governments have adequately investigated potentially significant strategic and reputational risks associated with developer behaviours and supply chains under the NSW Modern Slavery Act (2022) and French Corporate Duty of Vigilance Law (2017).

## 19. Flawed NSW Government processes

The whole NSW State Significant Development process is skewed in favour of Developers and against community and the environment. Large corporate developers and their large industrial scale developments are the only energy transition alternative the Government has considered. No other alternatives have been explored.

This was on show at the IPC public meeting at Kentucky on 14<sup>th</sup> March 2024:

- The NSW Department of Planning, Housing and Infrastructure were the first speakers. Their presentation was nothing more than was already in the exhibited documents and it ran well over time, without scrutiny from the 'bell'. The speaker showed clear bias in favour of wind farm developments, and the presentation lacked the sense of adjudication the public might expect from a Government Department that represents the people of NSW.
- Neoen, the developer, were the second speaker, again presenting nothing more than 'glossed over' generalisations about the proposal. They were not scrutinised to any great extent by the Commissioners. After the meeting, we became aware of allegations that Neoen had not told 'the whole truth' when commissioners asked them to elaborate on how they planned to deal with Local Government concerns about gravel resources required for the project.
- Only two of the 23 speakers were speaking in favour of the development. Both were placed last on the speaker list, to finish 'on a positive note' (from the perspective of the organisation who organised the speaking agenda).
- Of the speakers in support of the proposal, one declared his pecuniary interest, stating he was already doing work for the developer relating to this project. How much weight will be placed on this presentation, given this pecuniary interest? If this was the member of a board, they would be expected to recuse themselves from this discussion and any decision altogether!
- The other speaker in support of the proposal did **not** declare a pecuniary interest, however, it is well known among the community that he and his family plan to become hosts should Stage 2 of this development proceed. Not declaring a pecuniary interest is unethical.

We question the power of the Independent Planning Commission (IPC) to make the right decision. When questioned, one commissioner present at the Kentucky Public Meeting held on 14<sup>th</sup> March 2024 admitted the questioner would have to take their question to a higher pay bracket than his.

38. We recommend the IPC takes their role as an **independent** decision-maker very seriously and considers the full scope of future implications of the flaws we have identified.

## 20. Conclusion

**We strongly reject this development as not appropriate in this location.**

Wind turbines of this scale have so much embodied carbon, the clean electricity they generate will never offset them. **They are a nonsense.**

There is a better way to transition from fossil fuels than to place rushed industrial scale wind farms on valuable agricultural land that also has high biodiversity values at the top of the watershed in the Murray Darling Catchment.

With the significant number of recommendations we make in this submission (including those in Appendix 1 below) there is ample evidence that this development is being ‘rushed’ through the broken NSW Government planning system simply to get runs on the board for the NSW Government.

This project is the product of lazy or non-existent regional or state scale land use planning by the NSW Government and lazy developers who are chasing easy access to the current 330 KV power lines.

With groups like Southern New England Landcare Ltd and Z-Net Inc, and businesses like Morelly Solar in Uralla, our community is poised for a renewables transition on the community’s terms: without harm to agriculture, the environment, or our social fabric.

The IPC has the power to stop this approach and allow our community to determine a better, safer renewables transition and we call on the IPC to use their power to do just that.

We thank you for your time in considering our submission. Had the planning system not been broken, it would not have been such a long submission and taken so much of our precious time and personal space to construct. We look forward to hearing your determination.

39. We ask the IPC to reject the proposal and recommend the State Government facilitate our community to determine a much safer, more sustainable renewables transition.

40. We recommend a moratorium on all renewables proposals within the New England REZ until the mess outlined in all sections of our submission are sorted out.

## Appendix 1: Development Consent issues and recommendations

The table below sets out the issues and recommendations we have with the Thunderbolt Wind Farm Development Consent document.

We reject the notion of the Planning Secretary having such significant powers assigned to them throughout this document. The community and the environment could pay dearly if corruption or incompetence are found to be present.

Section	Issue	Recommendation
A1	<p><b>Obligation to minimise harm</b></p> <p>All reasonable and feasible measures have NOT been implemented to prevent or minimise any material harm to the environment as evidenced in our submission document.</p>	41. Reject the proposal until all reasonable and feasible measures have been implemented.
A5	<p><b>Wind turbines</b></p> <p>A maximum of 32 turbines places turbines far too close to neighbouring properties and has negative impacts in all the ways mentioned in our submission above.</p>	42. The number of turbines be reduced to 16, with removal of turbines 22, 23, 24, 25 and 28 for biodiversity reasons, and turbine numbers 1, 2, 3, 4, 5, 6, 8, 9 10, 11, and 21 for noise and shadow flicker impact reasons.
A6	<p><b>Wind turbine height</b></p> <p>Blade tip height 260m will have significant negative biodiversity, noise, and shadow flicker impacts.</p>	43. The height of turbines be reduced to a maximum of 150 m which will reduce impacts on raptors.
A7 (b)	<p><b>Micrositing restrictions</b></p> <p>No wind turbine is micro-sited more than 100 m from its planned coordinates. This will not enable Neoen to complete their neglected neighbour negotiations and relocate turbines accordingly.</p>	44. Reject the proposal until the developer has conducted negotiations with neighbours to relocate turbines so that concerns are mitigated.
A8	<p><b>Upgrading of wind turbines</b></p> <p>The applicant may replace or upgrade wind turbines provided they remain within the approved development disturbance area. This statement neglects to recognise that upgrades will likely increase height and megawattage of the turbines, hence changing noise, visual and biodiversity impacts which will then be non-compliant.</p>	45. Reject the proposal until the turbine model is confirmed, and the appropriate studies and negotiations are completed, before being placed back on public exhibition.
A11	<p><b>Protection of public infrastructure</b></p> <p>Neglects protection of private infrastructure, for example some neighbours of Sapphire Wind Farm near Inverell experience constant rattling of their windows due to the vibrations caused by turbines.</p>	46. The applicant should be required to negotiate upgrades to neighbour houses or other infrastructure which is impacted.
A17 (a)	<p><b>Evidence of consultation</b></p>	47. Reject the proposal and require the applicant to conduct meaningful consultation and engagement.

	Consultation has not been carried out with a significant number of impacted direct neighbours of this project.	
A19, A20 and A21	<p><b>Community enhancement</b></p> <p>We assert that the Community Benefit Fund should be separated from the Voluntary Planning Agreement with the two LGAs.</p> <p>We reject the requirement that the applicant must enter a Community Benefit Fund with the two LGAs.</p> <p>We assert that a Community Benefit Fund should be negotiated with an appropriate community based Not for Profit organisation with the skills and experience to manage and administer such a fund. This would bring further benefits to the region.</p>	48. Remove and adjust these clauses based on our recommendation on page
B1	<p><b>Visual impact mitigation</b></p> <p>The period of 5 years from commencement of construction is likely to be insufficient. If the project takes 5 years to construct (possible), non-associated residences within 5.1km will need time in all seasons (at least one year, possibly two) to identify any impacts and then ask for mitigation measures.</p> <p>Provision should also be made for other sites on the property in case of eco-tourism locations being impacted.</p> <p>Mitigation measures should not be restricted to landscaping and vegetation screening.</p>	49. Adjust section B1 to account for these possibilities.
B2	<p><b>Visual appearance</b></p> <p>Best practice blade paint patterns should be used to reduce the incidence of bird strike.</p>	50. Adjust B2 to include paint patterns that reduce bird strike.
B4	<p><b>Shadow flicker</b></p> <p>30 hours per year (or 1 hour per day for 30 days) is still too much impact on residences and local livestock and wildlife.</p>	51. Adjust B4 to reduce to 12 hours or less.
B12	<p><b>Blasting</b></p> <p>There is no mention of how blasting overpressure or ground vibration must be measured at any non-associated residences.</p>	52. Adjust B12 to indicate how blasting overpressure or ground vibrations must be measured at non-associated residences.
B13	<p><b>Wind turbine noise</b></p> <p>This section does not address the non-compliance issues raised in the Huson report submitted by Friends of Kentucky Action Group on the EIS.</p>	53. Reject the proposal until noise compliance issues are resolved.
B15	<p><b>Operational noise monitoring</b></p> <p>This is to be measured in accordance with the relevant requirements of the NSW Noise Policy for Industry (2017) or its equivalent.</p>	54. Require noise monitoring at any neighbouring property by an INDEPENDENT noise expert and paid for by NEOEN.

	Our home and our farm is not an industrial area. The quiet enjoyment of a resident's home should not be put in jeopardy. The development consent does not indicate where monitoring should take place.	
B20 (d)	<b>Operating conditions</b> There is no mention of leaching through the soil of the concrete batching plant. Any contaminants would directly impact Bell's Turtle in Pine Creek.	55. Reject the proposal based on incomplete EIS and no consideration of an endangered species in the creek which is the site of the water extraction and concrete batching plant.
B22 (b) (iii)	<b>Clearing and habitat</b> There is no consideration of impacts on endangered aquatic populations such as Bell's Turtle.	56. Reject the proposal based on incomplete EIS and no aquatic biodiversity study.
B23 (c)	<b>Biodiversity offsets</b> There is evidence from our own situation, that Neoen has avoided speaking to near neighbours about using their properties and inherent biodiversity as offsets for the project.	57. Require the developer to consult with all neighbours of the project to ascertain if they are interested in benefiting from participating in biodiversity offsetting for the project and if so, negotiating this with them.
B25	<b>Biodiversity management plan</b> There is evidence that the developer has not taken steps to avoid impacting important biodiversity areas as per the avoid, mitigate, offset hierarchy. The developer has neglected an aquatic biodiversity study, thereby missing an important endangered Bell's Turtle in their assessment.	58. Reject the proposal based on poor siting and significant impacts on critically endangered ecosystems triggering the EPBC Act.
B26	<b>Bird and bat adaptive management plan</b> The developer and the assessing authority have neglected to ensure best practice technologies are implemented, such as radar on each turbine that detect raptors and turn the turbines off until the birds have left the area.	59. Reject the proposal based on lack of best practice technology being implemented on turbines to prevent bird and bat strike.
B26 (c)	<b>Bird and bat adaptive management plan</b> Turbines 23, 24, 25 (and 28) should be removed from the plan as it is clear they impact an intact and important biodiverse area which should be AVOIDED under the avoid, mitigate, offset hierarchy.	60. Adjust B26 (c) to require removal of turbines 23, 24, 25 and 28.
B26 (f)	<b>Bird and bat adaptive management plan</b> Provision should be made for bird and bat monitoring data to be made publicly available on the developer's website on a monthly basis for every turbine to enable the local community to hold the developer to account.	61. Adjust B26 to incorporate provision for monitoring data to be made available to the public monthly.
B27	<b>Research program</b> This amount is peanuts for a research program!! And the research should provide	62. Reject the project because undertaking it is an experiment on the impacts of wind farms on



	<p>further scientific understanding of the indirect AND DIRECT impacts of wind energy projects to avifauna species. This clause admits that our area is an experiment. Fancy doing an experiment in a Critically Endangered Ecological Community protected by the EPBC Act (1999)! This is a nonsense and unacceptable on all levels.</p>	<p>avifauna in critically endangered ecological communities protected by the EPBC Act (1999).</p>
B28 (a-c)	<p><b>Protection of heritage</b></p> <p>The development admits it will cause direct and indirect impacts to Aboriginal heritage items. Aboriginal communities have not been adequately consulted about their cultural heritage in this area.</p>	<p>63. Reject the proposal until the applicant has carried out proper consultation in a way that is meaningful to local Aboriginal communities.</p>
B29 (a)	<p><b>Heritage management plan</b></p>	<p>64. After the words Planning Secretary, insert the words ‘and local Aboriginal organisations.’</p>
B33	<p><b>Operating conditions</b></p> <p>Dirt is what you get under your fingernails. The document means soil in most cases.</p> <p>An additional clause relating to condition of internal roads is required.</p> <p>Weed seeds need to be recognised as a biosecurity issue and mitigated.</p>	<p>65. Change dirt to soil.</p> <p>66. Add a clause relating to internal roads to ensure they are equipped with regular exit and entry points from the paddocks alongside them that are suitable for emergency vehicles and farm equipment, i.e. they are not built up so high as to prevent entry and exit at any point.</p> <p>67. In (h) adjust to read ‘minimise soil and weed seeds being tracked onto the sealed public road network.</p> <p>68. Add a clause relating to vehicle washdowns for biosecurity to prevent transfer of weed seeds onto or off the property.</p>
B34	<p><b>Traffic management plan</b></p> <p>Dirt is what you get under your fingernails. The document means soil in most cases.</p> <p>Neighbours entrances along New England Highway will become extremely dangerous with additional traffic caused by the development.</p>	<p>69. (c) (ix) change reference to dirt to ‘soil and weed seeds’.</p> <p>70. Add a clause to require neighbour entrances off the New England Highway to be made safer given the huge volumes of extra traffic that will be caused by this project and others in the region. This may require slip lanes for exit and entry to farms located on the highway.</p>
B42	<p><b>Emergency plan</b></p> <p>The emergency plan needs to be provided to two separate Fire Control Centres: Armidale and Tamworth AND to all immediate neighbours of the project.</p> <p>There is no reference to assisting neighbours to source and pay for public liability insurance</p>	<p>71. Adjust clause to read two Fire Control Centres.</p> <p>72. Adjust clause to ensure emergency plan is required by neighbours.</p> <p>73. Adjust clause to require developer to source and pay for public liability insurance for neighbours within 10</p>

		km of any part of the project boundary.
B45	<p><b>Rehabilitation objectives – decommissioning</b></p> <p>Too much power is given to the Planning Secretary to make decisions that will negatively impact the community or the environment.</p> <p>Wind turbine pads to be covered with soil or rock and revegetated. This means thousands of tonnes of concrete will be obstructing the ground water flows in our area forever. Unacceptable and does not enable the Land Use feature to be restored to it’s stated objective.</p>	<p>74. Remove the words ‘unless the Planning Secretary agrees otherwise’ throughout the document.</p> <p>75. Require the developer to remove and recycle the wind turbine pads and rehabilitate the areas to restore ground water flows across the project site.</p> <p>76. Or reject the project and require it to re-site in a less impactful area so that the upper groundwater recharge areas of the Murray Darling Basin are not impacted.</p>
C8 (a)	<p><b>Final layout plans</b></p> <p>C8 (a) is only possible AFTER all neighbours have been satisfactorily negotiated with regarding layout and impacts.</p>	77. Require the developer to negotiate layout with neighbours BEFORE approval.
C19	<p><b>Independent Audit</b></p> <p>Ongoing independent operational audits should never be allowed to cease. This clause is simply not acceptable. The Planning Secretary has been given far too much power here.</p>	78. Remove this clause.
C20	<p><b>Access to information</b></p> <p>C20 (a) (iv) states that the emergency plan is excepted from being publicly available on the applicant’s website. Why? Shouldn’t the emergency plan be available to EVERYONE?</p> <p>C20 (a) (x) fails to state how often the bird and bat monitoring should occur.</p>	<p>79. Remove the words “other than the Emergency Plan”.</p> <p>80. Ensure bird and bat monitoring results are updated monthly for every turbine.</p>
Appendix 1	<p><b>General Layout Map</b></p> <p>The inset maps cover neighbouring properties that are impacted by the project.</p>	81. Remove inset maps from covering neighbouring properties.
Appendix 3	<p><b>General terms of applicant’s offer</b></p> <p>The VPA as stated is unacceptable.</p> <p>VPA and CBP should be separated for clarity and transparency and the amounts should be based on industry best practice.</p> <p>CBP should be administered by a community led organisation with monies held by a local bank such as Regional Australia Bank, not an interstate bank.</p> <p>NSW Government should not be allowed to reduce the amount of the CBF or the VPA if the LGAs do not sign the current VPA within 6 months (A20 and A21). This is tantamount to coercion to get the LGAs to sign an unfair</p>	82. Reject the proposal until the developer re-negotiates more suitable arrangements for a VPA separate to a CBF.

	<p>agreement and rush this inappropriate development through the planning system. If there is hesitancy, it signals that something about the VPA is not satisfactory.</p>	
Appendix 5	<p><b>Biodiversity offset liabilities</b></p> <p>The ecosystem credit liabilities associated with PCT 501, 510, 542, 559 and 582 and Species Phascolarctos cinereus (koala) are huge and simply unacceptable.</p> <p>There should also be offsets associated with Bell's Turtle, an endangered aquatic species found on the site. Their absence is because the biodiversity studies done for the EIS are inadequate and substandard and missed this species.</p> <p>We cannot simply keep 'offsetting' the damage we are doing to our environment. It is not logical. It is not reasonable.</p> <p>Offsetting with like for like rules is still a net loss of biodiversity. When we can no longer offset with like for like, we move to offsetting using variation rules which puts us on a very slippery slope to losing our unique national treasures. This is already occurring.</p> <p>The time has come for us to STOP putting developments on land where there are special ecosystems and limited remaining like for like offsets available.</p> <p>That's the idea of the NSW Biodiversity legislation and it is being thwarted by the Department of Planning and their incompetent knowledge and processes.</p>	<p>83. REJECT the proposal based on inadequate biodiversity studies conducted in the EIS.</p> <p>84. REJECT the proposal based on lack of consideration for Bell's Turtle, which needs to be included on the offset list.</p> <p>85. REJECT the proposal based on too much Offsetting rather than Avoiding and Mitigating as per the Biodiversity Conservation hierarchy.</p> <p>86. REJECT the proposal based on the concept that at some point the State of NSW will have to stop allowing developments in inappropriate places.</p>

**6th International Conference  
on  
Wind Turbine Noise  
Glasgow 20-23 April 2015**

**Constraints imposed by and limitations of IEC 61672 for the measurement of wind farm sound emissions**

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**Summary**

Wind farms are required to comply with noise targets after construction and those same targets are set from a sample of background noise measurements prior to construction. It is not uncommon for predicted and post-construction sound levels from wind farms to show compliance with margins of less than 2dB(A).

With small compliance margins there is a need to consider uncertainties in the instruments taking the measurements. IEC 61672 is a commonly used instrumentation standard for sound level meters to ensure consistent results between different manufacturers. Whilst this and similar older versions of the standard provide some comfort regarding repeatability, they are not necessarily appropriate when trying to push the envelopes of sound level meter use.

This paper details some limitations of the current IEC 61672 sound level meter standard and describes common mal-practice in presentation of sound level data purporting to adhere to this standard.

**1 Background to IEC61672**

The IEC 61672<sup>1</sup> standard for sound level meters specifies accuracy tolerances from test methods in the time and frequency domain. This standard cancelled and replaced IEC 60804<sup>2</sup> and IEC 60651<sup>3</sup> and is applicable to exponentially averaging sound level meters, integrating sound level meters and integrating-averaging sound level meters.

It is useful to reflect upon the earlier versions of this standard to understand the basic objectives. For example, notes in IEC 60651 with regard to 'Time weighting' explain the historical basis of 'S' (Slow), 'F' (Fast), 'I' (Impulse), and 'P' (Peak) in that these time weightings are based on older instruments. Perhaps more importantly, IEC 60651 notes the following:

“In the past, frequency weighting and time weighting have been associated with certain characteristics of the ear. However, recent work has not substantiated these historical associations, so that frequency-weighting and time-weighting characteristics of sound level meters may be considered to be conventional. The A-weighting characteristic is now frequently specified for rating sounds irrespective of level and is no longer restricted to low level sounds. Furthermore, standardisation of the I-weighting characteristic does not imply that the relationship between loudness or hearing damage risk of impulsive sounds and the physical characteristics of sounds is thereby precisely presented.”

IEC 60651 described the Lin frequency-weighting to be unweighted. This terminology changed in IEC 61672 so that Z weighting became the old Lin weighting and unweighted became referred to as ZERO weighting, all of which are the same.

IEC 61672 states that the standard is for sound level meters that are intended to measure sounds generally in the range of human hearing. Early sound level meters were analogue and had moving coil meter displays and the Impulse response was designed to allow an operator to read the display of a transient short lived sound event having a short rise time. This was achieved with a peak hold circuit with long decay time (1500ms). The 1500ms decay time of the impulse response was never intended to track the rise *and* fall of a sound transient.

Modern fully digital sound level meters can successfully emulate the old analogue sound level meter responses of Slow, Fast and Impulse without the need of a peak hold circuit because the sound level maximum can be digitally stored for later display. However, a 1500ms fall time is still provided to ensure compliance with IEC 61672 when showing a result on the meter's display.

Some modern sound level meters have additional time constants such as 1ms, 10ms or 20ms (eg. Ono-Sokki, Rion, 01dB) and 'short Leq' measurements can be logged. However, these are not specified in IEC 61672.

## **2 Sound Level Meter Range and Noise floor**

The following statements have been made in acoustic assessments using the ETSU-R-97<sup>4</sup> methodology.

*“Rion NL31 Class 1 noise loggers were used for these measurements. According to the manufacturer's information, the A-weighted inherent internal noise (noise floor) of the Rion NL31 is below 20dB and typically around 17dB.”*

*“Noise monitoring was conducted using CESVA SC310 Type 1 octave logging sound analysers, CESVA C250 microphones with PA14 preamplifiers and CESVA TK1000 outdoor microphone assemblies at 1.5m microphone height. The loggers have a low noise floor of typically 16dBA.”*

*“Background LA90,10min noise levels range from 17 – 30 dB LA90 at low wind speeds during both night and day times ..”*

The last statement was with the use of a Larson Davis 820 Class 1 sound level meter and all recorded data, apart from rain affected results were used in the background regression analysis.

Such statements are commonplace in acoustic assessments and data is included in Sound Pressure Level vs. Wind Speed charts showing data often at the instrument noise floor. The IoA Supplementary Guidance Note 2<sup>7</sup> contains a number of example charts of this type where it is clear that data at or near the instrument noise floor has been included in the data processing.

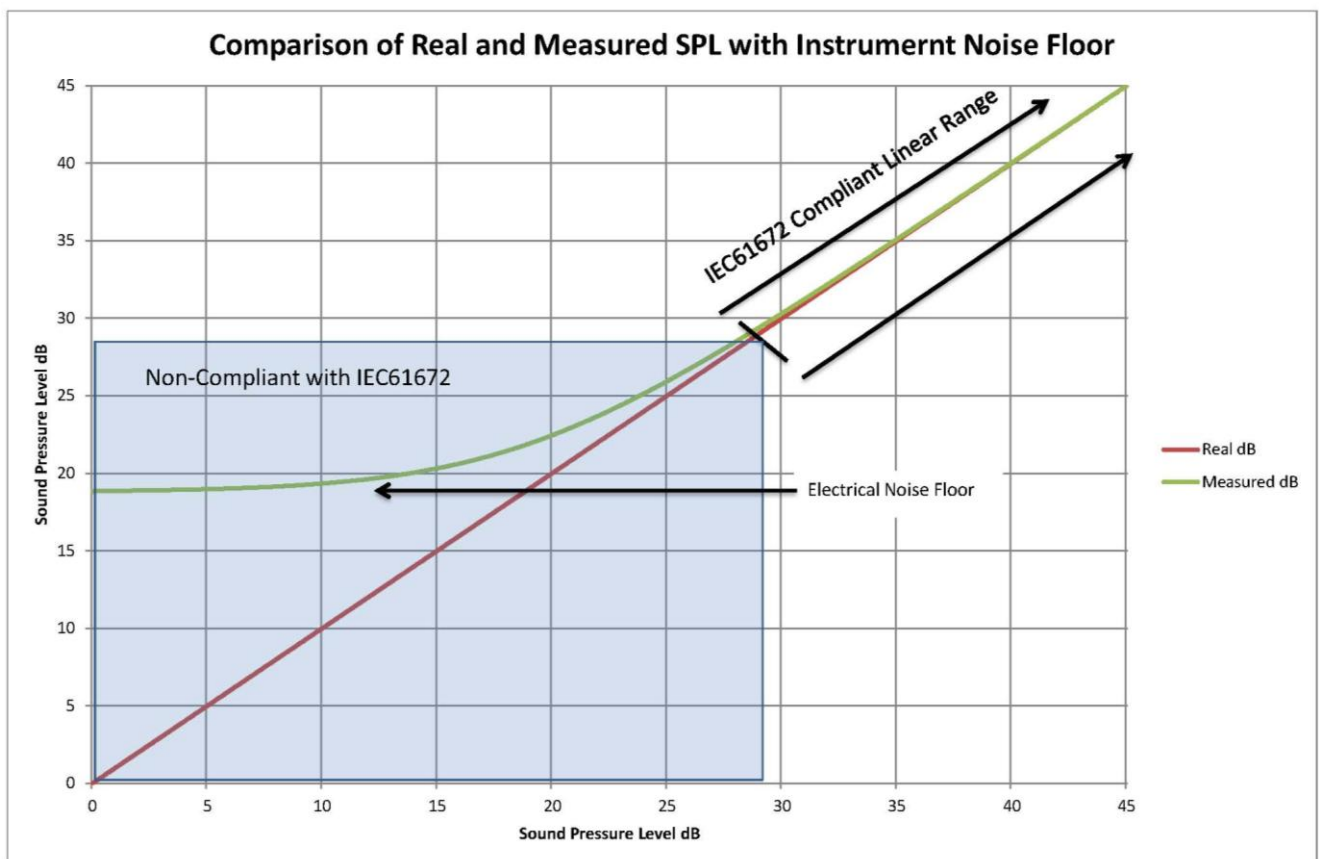
The IoA Supplemental Note 1<sup>6</sup> expands on the specification of noise measuring equipment described in the IoA Good Practice Guide<sup>5</sup> section 2.4.1 and suggests that the measurement systems should preferably comply with current standards IEC 61672 although earlier standards such as BS EN 60804 may be used to accommodate older instruments. Unfortunately, there is no advice given on the performance requirements of

measurement equipment compliant with these standards. It would clearly be inappropriate to use a sound level meter having a noise floor of 40dB(A) to measure background trends, even if it were to comply with IEC 61672.

The Rion NL31 described above indeed has a specification as described, however, the measurement range over which the instrument is compliant with IEC 61672 is only a minimum of 28 dB(A). Similarly, the CESVA SC310 described above is specified to have an electrical noise floor of 15.7 dB(A) but the measurement range to which the instrument is compliant with IEC 61672 and EN 60651 has a lower limit of only 28 dB(A).

The Larson Davis 820 sound level meter has a quoted noise floor of 17.5 dB(A), when used with a 2541 microphone. However, the linearity range for the LD820 is difficult to define since there is a noise floor compensation mode that can extend the linearity by 10 dB<sup>8</sup>. If this mode is not set then the meter reports “Near Noise Floor” when within 10dB of the noise floor as a warning to show potential non-linearity and non-compliance with its standards.

Data presented in wind farm noise assessment reports that are below the lower measurement range of the instrument are not compliant with the specification requirements of IEC 61672. Figure 1 shows the compression effect that sound level meters have as the sound levels approach the instrument noise floor.



**FIGURE 1**

The IoA Good Practice Guide suggests that measurement instruments should be compliant with either Type 1 or Class 1 precision. Beyers<sup>9</sup> describes the effective tightening of specifications in IEC 61672 over the years and notes that calibrations to the latest version (2013) may not be successful for previously conforming instruments. This may rule out much of the instrumentation used in past wind farm approvals unless the

Good Practice Guide allows equipment to be used that has compliance with the 2004 version of IEC 61672, for example.

Clearly, any data used between the instrument noise floor and the lower measurement range is non-compliant and should not be used.

The author has yet to see a noise impact assessment for a wind farm where such data has been excluded from the data processing and the derivation of background curves. Furthermore, the absence of guidance in this regard by the IoA working group is a serious failing. Guidance should be provided on the lower measurement range of instruments that are suitable for the task of setting compliance noise curves for wind farms.

The question then arises; how representative are these background curves upon which compliance limits are set? Figure 18 of the Supplemental Guideline Note 2 shows data clearly influenced by the instrument noise floor. In this example, the data limits at around 18 dB(A) and if instrumentation such as the CESVA 310 or Rion NL31 were used to gather this data then the valid data (compliant with IEC 61672) would only be above 28 dB(A).

We then have a situation where many wind farms have been approved using data non-compliant with the IEC 61672 or IEC 60651.

It would be unreasonable to simply delete all data below the lower measurement range of the sound level meter because this would have the effect of artificially raising the background trend curve upon which target noise limits are set. Can this data be corrected in some way?

The method used by Larson Davis to extend the lower linearity is simply to compensate the measured value by the electrical noise floor value. As a sound level meter approaches the electrical/microphone noise floor it starts to report higher sound levels than actual. If the noise floor is 18dB then the artificially higher reported sound level from the meter is (real dB + noise floor dB). So, a simple correction follows where a better reported sound level will result if you take 18 dB from the reading. If the SLM reads 25 dB then the real level would be  $25\text{dB} - 18\text{dB} = 7\text{dB}$ .

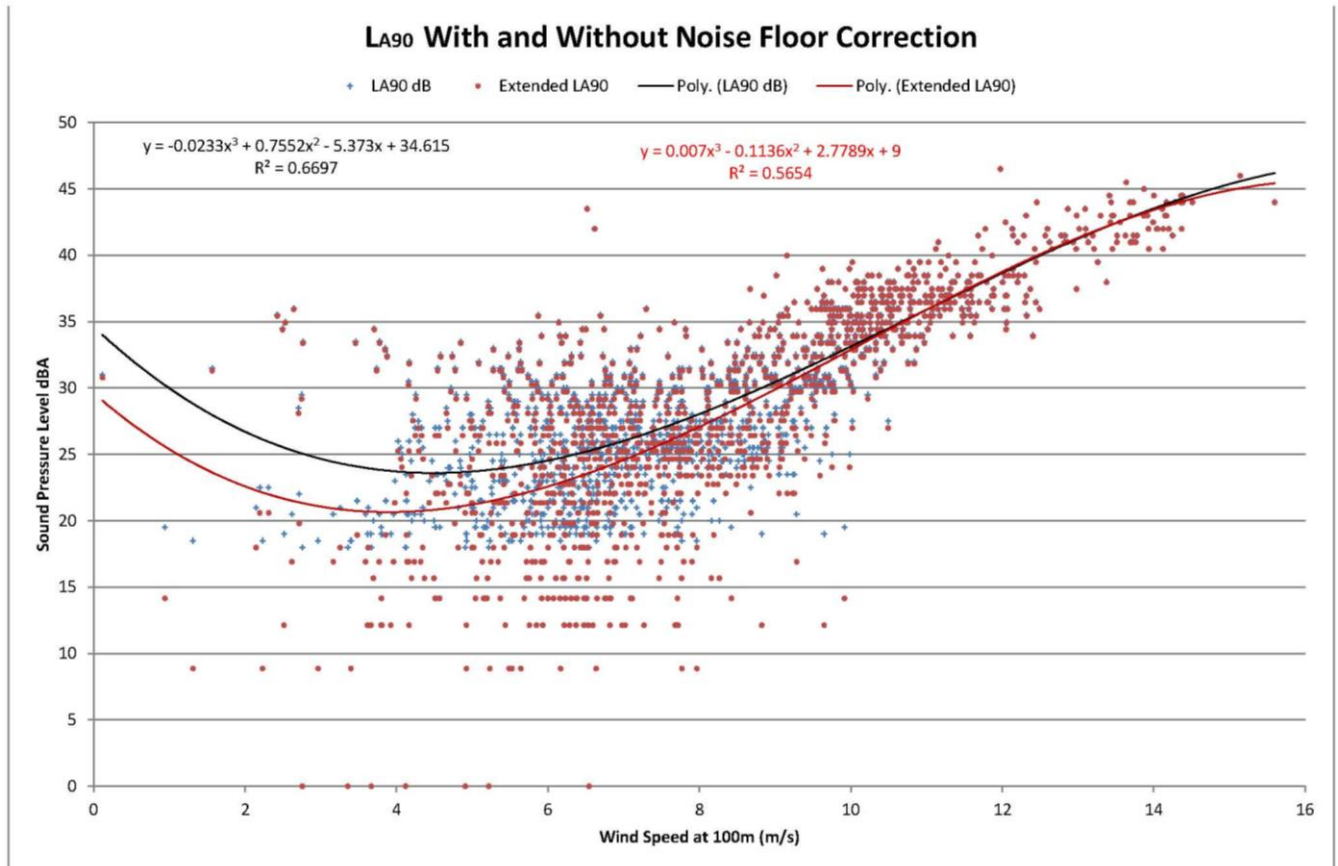
Uncertainty increases near to the noise floor of 18 dB; if the measured reading is 19 dB then the real sound pressure level could be  $19\text{dB} - 18\text{dB} = 1\text{dB}$ .

At a reading of 18dB the actual level would be  $18\text{dB} - 18\text{dB} = 0\text{dB}$  and this is where the technique starts to fail. If this type of correction is applied to measured background readings then a conservative result may be obtained for sound levels close to the noise floor of the instrument. Unfortunately, this technique is only applicable to short Leq data, not statistical data such as the  $L_{AF90,10\text{min}}$ . Mathematically, it is impossible to correct an  $L_{AF90,10\text{min}}$  in this way unless each short  $L_{Aeq}$  that forms the statistic is individually corrected. If the method is applied to the  $L_{AF90,10\text{min}}$  it is not considered rigorous.

The chart in Figure 2 provides an example of such a crude correction on data taken with a CESVA 310 sound level meter. The corrected data is shown as 'Extended LA90'. A simplistic trend analysis is shown in accordance with the IoA Good Practice Guide Supplementary Guidance Note 2.

A 'Flat Lined Background Noise Level'<sup>17</sup> at lower wind speeds would be approximately 3dB higher with uncorrected data. Different measurement data can show a larger discrepancy than 3dB.

Wind farm noise assessments often have very small compliance margins. In such cases the effects of non-linear data become important.



**FIGURE 2**

### 2.1 Use of different instruments in assessments

It is often the case that compliance assessments of wind farms take place many years after original background measurements have been taken and sometimes by different companies.

If instrumentation having a higher noise floor is used to determine a background trend line, upon which wind farm noise targets are set, is then replaced by different instrumentation having a much lower noise floor for the compliance assessment, we have the very real potential to demonstrate from the results that the ambient noise in an area falls after the wind farm is built.

This strange effect is observed in a number of charts produced for compliance assessment reports that the author has seen. For example, a number of charts seen in compliance reports show the electrical noise floor of the instrumentation used to determine the background trend line at 26dB(A), yet a different sound level meter was used by a different organisation for compliance assessment that had a noise floor of 17dB(A). Notwithstanding that the original data used to determine the background trend line was non-compliant with IEC 61672 in the non-linear range from 26 dB(A) to about 32 dB(A), the data was used to demonstrate compliance. In the wind speed range just after turbine cut-in it appears that the post construction trend line is lower than the background



trend. It would be a strange conclusion to draw that the construction and operation of the wind farm is reducing ambient noise in an area.

Again, this is a issue that the IoA Guidelines do not address. Simply referencing IEC 61672 without further qualification is not good practice.

### 3 Infrasound

Sound level meters conforming to IEC61672 have regularly been used in wind farm studies of infrasound<sup>15,16,17</sup> immissions. Often, one-third octave band analysis data is reported below 10Hz, yet, IEC61672 specifies frequency weighting tolerances only down to 10Hz. At 10Hz, for example, the acceptable tolerance on reported sound pressure level is +3dB to minus infinity.

Compliance with IEC61672 does not provide any assurance of accuracy below 10Hz. This fact was realized by Schomer<sup>12</sup> in the Shirley wind farm study who stated that:

“A-weighting is totally inadequate and inappropriate for description of this infrasound. In point of fact, the A-weighting, and also the C and Z-weightings for a Type 1 sound level meter have a lower tolerance limit of 4.5 dB in the 16 Hz one-third-octave band, a tolerance of minus infinity in the 12.5 Hz and 10 Hz one-third-octave bands, and are totally undefined below the 10 Hz one-third-octave band. Thus, the International Electrotechnical Commission (IEC) standard needs to include both infrasonic measurements and a standard for the instrument by which they are measured.”

ISO 7196<sup>10</sup> describes the G-weighting filter. Unfortunately, this standard does not provide acceptable tolerance limits and refers back to detectors having characteristics no less stringent than those specified for Type 1 sound level meters having the F or S time-weighting characteristics of IEC 61672. However, measurements of wind farm emissions<sup>13, 14</sup> below 20Hz show that the G-weighting filter does not encompass the frequency range of emissions that contain the majority of wind farm generated infrasound, which generally is below 6Hz. The G-weighting is unresponsive to and is unrepresentative of wind farm infrasound emissions.

An example of the challenges posed in taking infrasound measurements using different sound level meter models from the same manufacturer, each having compliance with IEC 61672 is described by Cooper<sup>13</sup>.

There are limitations to any IEC 61672 compliant system that uses a microphone to quantify pressure variations in the low infrasound region. For example, one of the best infrasound microphones, the GRAS 40AN, attenuates pressure variations at 0.1 Hz by approximately 9 dB, and more so at lower frequencies. Another microphone example is the GRAS 40AZ that has a 25 dB sensitivity reduction at 0.1 Hz. Furthermore, the phase response changes significantly as the high pass filter knee (-3dB point) is approached.

Changing phase response characteristics can alter the pressure waveform significantly and lead to incorrect estimates of peak pressures. In contrast, a microbarometer can measure absolute pressure. These devices are often high-pass filtered around 0.05 Hz to increase sensitivity by reducing the effects of weather pattern changes and atmospheric turbulence. Microbarometer based instrumentation should have regard to ISO 10843<sup>11</sup> to keep phase distortion to less than +/- 10 degrees, something not considered in IEC 61672.

### **3.1 Zero weighting dB(Z)**

The dB(Z) or ZERO weighted response described in IEC 61672 is generally not well understood. A dB(Z) value from a sound level meter compliant with IEC 61672 can produce a totally different dB(Z) value from another IEC 61672 compliant sound level meter for the same input signal.

The dB(Z) values recorded by different sound level meters simply mean a decibel sound pressure result that is the best that that particular sound level meter can achieve without any weighting applied. Because the tolerance at 10Hz in IEC 61672 is +3dB to minus infinity, two sound level meters measuring sound levels containing a significant amount of sound energy around 10Hz can produce results differing within the full dynamic range of either instrument.

Infrasound emissions from wind farms can produce wildly different results using the dB(Z) parameter in different sound level meters that are compliant with IEC 61672. It is therefore unwise to compare reports having dB(Z) data recorded with different instruments.

## **4 Time Constants and Amplitude Modulation**

Methods of assessing amplitude modulation (AM) from wind turbines are currently being reviewed. A common requirement is to track the rise and fall of sound level to quantify the amount of AM.

Some of the AM assessment methods being considered are based upon the amplitude variation of A-weighted sound levels with time. Older analogue sound level meters would output a voltage that was proportional to the dB sound pressure level to a chart recorder to record AM. This signal would be the output from the DC connector of the sound level meter.

Modern IEC 61672 compliant digital sound level meters have the ability to store sound level data at different rates into memory for later download to a computer that can then prepare a printed chart. Sound levels stored in the memory of sound level meter loggers are sampled at varying rates. A modern digital logging meter can often vary the storage sampling period, yet there is no standardisation between different sound level meter models from different or even the same manufacturer. The storage sample rates can vary from 1ms through seconds to many minutes.

Older analogue sound level meters 'stored' sound level variations with the use of external chart recorders. The chart recorders could change the pen response and data from the sound level meter was often obtained directly after the rms detector prior to any time weighting circuit. The time weighting was determined from the pen speed in the chart recorder.

The ability to drive external chart recorders is still an option on modern digital sound level meters where AC and DC outputs are provided, however, there is a wide variation on the signal that is observed from the DC out connector. For example, Larson Davis 700 and 800 series sound level meters are part analogue and part digital. The analogue part provides the same functionality as the earlier fully analogue meters that had moving coil needle displays. The digital part of these meters simply stored the sampled analogue dB voltage levels to provide Ln statistics and Leq values. The DC output from the 700 and 800 series sound level meters provide a voltage level proportional to dB before the time weighting circuitry. The DC output response was therefore faster than that required to

address the rise time specification for Impulse response and is independent of the time weightings of Fast, Slow or Impulse.

The latest fully digital sound level meters from Larson Davis have a voltage level proportional to the dB sound level at the DC out connector, but the signal is pre-conditioned to have time weighting limited to the options of Fast, Slow and Impulse. IEC 61672 does not standardise the type of output signal available at the AC or DC output connectors. The AC output also suffers from this lack of standardisation. For example, some sound level meters have AC outputs that reflect the frequency weighted signal after the microphone preamplifier. Others pass the signal from the preamplifier through a power-amplifier to drive headphones that introduces a non-linear frequency response or dynamic range change that may result in non-compliance with IEC 61672 specified limits. However, the meter may still comply with IEC 61672 test requirements.

A manual method of assessing amplitude modulation from an A-weighted chart trace has been developed for use in a wind farm planning approval condition in the UK (Den Brook Condition)<sup>18</sup>. An automated method has been proposed by RES<sup>19</sup> to emulate the manual method. However, the RES automated method has been shown to be deficient<sup>20, 21</sup> in this regard. The basic approach in the Den Brook amplitude modulation assessment method is to sample the A-weighted sound level outside a dwelling using Fast time weighting response at a sample rate of 125 ms.

IEC 61672 defines the rise time (exponential time constant) of Fast response to be 125ms. However, the fall time of Fast response is defined to be 'at least 25 dB per second'. The ability of a sound level meter to track the fall of sound level is important in quantifying the trough of the AM time signal. Obviously, sound level meters having a faster fall time can track the trough of an A-weighted sound level more accurately and different sound level meters compliant with IEC 61672 can produce different AM values if they have different fall times.

IEC 61672 shows the expected difference,  $\bar{d}_{ref}$ , in  $L_{AFmax}$  to  $L_A$  for 4kHz tone bursts having different durations. For example, the measured  $L_{AFmax}$  for a 100ms tone burst is 2.6 dB lower than the actual  $L_A$  value of the tone burst with IEC 61672 specifying an allowable uncertainty of +/- 1.3 dB. An equation is provided to estimate  $\bar{d}_{ref}$  for different time constants, as follows

$$\bar{d}_{ref} = 10 \lg ( 1 - e^{(-T_b / t)} )$$

Where  $T_b$  is the tone burst duration and  $t$  is the exponential time constant.

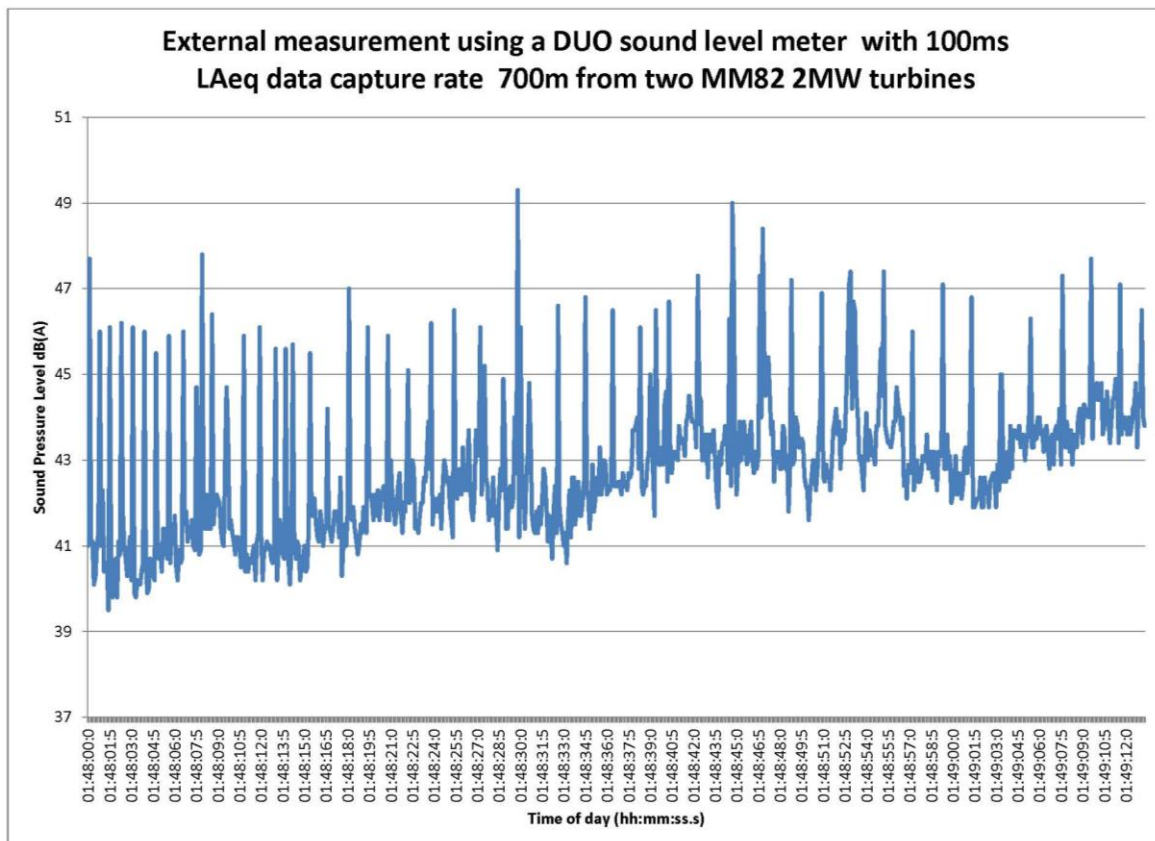
For Fast response,  $t = 125$ ms. If a response time of 1ms or 10ms is used, then, for a 100ms tone burst,  $\bar{d}_{ref} = 0$  and for a response time of 100ms and 100ms tone burst,  $\bar{d}_{ref} = 2$ .

AM does not generally have a sinusoidal pattern and can have dips within each modulation. Time traces of A-weighted sound levels exhibiting AM from wind turbines can be very complex. When there are multiple turbines the AM patterns are even more complicated. Figure 3 shows a 72-sec time trace 700m from two MM82 wind turbines.

Research from the University of Salford<sup>23</sup> has concluded that "Faster modulation increased annoyance rating" but tests were not completed on the rates of change of modulation typical of the sample shown in figure 3. The team also concluded that there were no clear effects with changing pulse shape in their tests. However, the tests were based on synthesised sounds having constant modulation envelopes.

The AM repetition at the start of the time trace in figure 3 is around 2 Hz but AM peaks can be separated by <1ms to 1.2s (blade pass frequency) as the phase between the rotors change. In such circumstances a Fast response may greatly underestimate the real magnitude of AM.

A better method of tracking the real AM would be to use short Leq values that are available from many modern integrating sound level meters. Alternatively, sample the output from the DC connector if the output is derived directly after the rms detector, before any slower time constant is applied (eg. Larson Davis 700 and 800 series meters).



**FIGURE 3**

The Fast time weighting is conventional and does not reflect the capabilities of the human ear. Oberfield<sup>22</sup> describes the results of two experiments assessing the perceived loudness of multiple 100ms wide-band noise segments. The results suggest two independent mechanisms, one being the primacy/recency weighting pattern of the sound segments. Thus, AM perception may not simply be a function of modulation depth, but can depend upon onset / decay rates and modulation frequency (as also reported by Salford University<sup>23</sup>).

Future AM investigations should not be limited by the Fast response sampled at, say, 100ms. Greater resolution of the amplitude time history, than can be afforded using the Fast response, would be beneficial in future AM research to better resolve the detail in AM and to minimise amplitude uncertainty.

## 5 Conclusions

IEC 61672 specifies acceptable performance tolerances for sound level meters used generally in the audible frequency range and it is referenced by the IoA Noise Working Group<sup>6</sup> as a standard to meet for the 'good practice' measurement of sound from wind

turbines. The reference to IEC 61672 is simply made without qualification, except for the Class of instrument.

The author is aware of numerous wind farm assessments, made in accordance with the ETSU-R-97 methodology, where data has been used in preparing trend lines from background and post-construction operating conditions that is outside the range of measurement for which the sound level monitoring equipment is compliant with IEC 61672. Such charts are presented as examples of good practice in the loA Good Practice Guide. The author knows of no ETSU-R-97 type assessment where account has been made for such non-compliant data that is outside the measurement range of the instruments. The loA Supplemental Guideline Note 1 'Data Collection'<sup>6</sup> needs to be amended to address these issues.

A correction methodology to extend the noise floor of instruments has been presented; however, this method would not be compliant with IEC 61672 and is not rigorous.

It is recognised that the time and frequency weightings described in IEC 61672 are conventional and do not represent the characteristics of the human ear. The loA Good Practice Guide<sup>5</sup> and its supplementary Notes should provide guidance on appropriate time constants and short Leq sample rates that better define emissions from wind turbines.

Guidance is required on the temporal weighting of the loudness of time-varying sounds as it relates to amplitude modulation and the uncertainty associated with different short Leq sample rates to better define amplitude peak and trough determinations (AM). It is recommended that future research into AM record time histories utilising currently available sound level meters with sample rates of around 10ms as short Leq (not time weighted with Fast response). Such equipment is also compliant with IEC 61672.

Z-weighting can provide large differences in readings between different sound level meters if the source contains infrasound typically found in wind turbine noise emissions at frequencies below 6 Hz. It would be a mistake to assume that dB(Z) results are accurate because there is compliance with IEC 61672.

IEC 61672 currently does not include the standardisation of instruments suitable for the measurement of infrasound. Such a standard would prove useful considering the amount of planned research in this area.

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Our Reference: L447/Let1/WLH

20 May 2022

Dear Karen

**Re: Thunderbolt Wind Farm Noise Assessment - Review**

L Huson & Associates Pty Ltd has been commissioned by the Friends of Kentucky Action Group to review the Thunderbolt Energy Hub – Stage 1 Environmental Impact Statement (EIS) dated March 2022 that was Prepared by Umwelt (Australia) Pty Limited on behalf of Neoen Pty Limited.

This peer review considers the assessment of predicted operational wind farm noise and compliance with the NSW Secretary's Environmental Assessment Requirements (SEAR) for the EIS.

The SEAR lists the following that are relevant to this review:

- an assessment of the likely impacts of all stages of the development (including the cumulative impacts of the development with existing and proposed developments in the New England region, including the Thunderbolt Energy Hub more broadly, New England Solar Farm and the proposed Salisbury Solar Farm and Winterbourne Wind Farm), taking into consideration any relevant State and Commonwealth legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice and including the *NSW Wind Energy Guideline for State Significant Wind Energy Development* (2016);
- a description of the measures that would be implemented to avoid, mitigate and/or offset residual impacts of the development and the likely effectiveness of these measures, including details of consultation with any affected non-associated landowners in relation to the development of mitigation measures, and any negotiated agreements with these landowners.

The NSW Wind Energy Guideline for State Significant Wind Energy Development (2016) refers specifically to a guideline Bulletin, as follows:

‘To ensure an adequate assessment of potential noise impacts, the Department has developed a Noise Assessment Bulletin’ and notes that the EIS must include ‘completed technical studies, including an accurate noise impact assessment for relevant dwellings undertaken consistent with the requirements of the Noise Assessment Bulletin’.

The SEAR specifically references the Noise Assessment Bulletin (Noise Bulletin) and requires that the EIS must; ‘assess wind turbine noise in accordance with the NSW Wind Energy: Noise Assessment Bulletin (EPA/DPE, 2016).’ The Noise Bulletin, in turn, refers to a South Australia EPA Guideline, as follows:

‘The NSW Government has adopted the 2009 South Australian document *Wind farms – environmental noise guidelines* (SA 2009)1. SA 2009 will form the basis of the regulatory noise standard and assessment methodology that will apply when SSD wind energy proponents are

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Page 1 of 12

assessed and determined in NSW. Adopting SA 2009 will facilitate increased regulatory consistency between states and result in consistent standards applying to significant areas of Australia with high quality accessible wind resources.’

In summary, an accurate noise impact assessment in accordance with the Noise Bulletin is required for an EIS and detail is required of any negotiated agreements. SA 2009 is the regulatory noise standard and assessment methodology that will apply when SSD wind energy proponents are assessed and determined in NSW. SA 2009 has a section dealing with negotiated agreements with wind farm developers and notes that:

‘The criteria have been developed to minimise the impact on the amenity of premises that do not have an agreement with wind farm developers.

Notwithstanding this, the EPA cannot ignore noise impacts on the basis that an agreement has been made between the developer and the landowner. Developers cannot absolve themselves of their obligations under the EP Act by entering into an agreement with a landowner.

If it is shown that a development is having an ‘adverse effect on an amenity value of an area that ... unreasonably interferes with the enjoyment of the area’, then appropriate action can be taken under the EP Act.’

In a recent decision of the Victorian Supreme Court in *Uren v Bald Hills Wind Farm Pty Ltd* [2022] VSC 145 (**Uren**) it was found that noise nuisance (unreasonable interference) could still apply even if a wind farm development complied with noise limits imposed through the planning process.

### **Negotiated Agreements**

I have been unable to find any example of negotiated agreements in the EIS that would inform the consideration of adequate noise protection for Hosts and non-associated landowners.

The EIS states that:

‘In addition to the Neighbour Benefit Sharing Program, Neoen has a number of negotiated agreements in place with neighbouring landowners (identified as ‘associated landholders’) to address various impacts associated with the Project specific to their dwellings. The agreements were developed in accordance with the Wind Energy Guidelines’ and have been signed by Neoen and the relevant landholder. The impacts of the Project on these residences whilst noted in the technical assessments as relevant, are addressed by the agreements in place.’

The EIS does not explain how any adverse noise impacts have been addressed in the agreements or if there is adequate protection from, for example, adverse health effects that can be caused by noise.

The EIS also relies upon the Noise and Vibration Assessment (NVA), February 2022 referenced as report S6576.1C10 prepared by Mr Turnbull of Sonus Pty Ltd in regard to negotiated agreements, as follows:

‘The NVA notes that once the detailed design is complete, a pre-construction noise assessment will be made based on the final WTG model selection, layout, guaranteed sound power levels, consideration of tonality and low frequency noise from the WTGs, and final agreements with landowners. This pre-construction noise assessment will ensure that the noise impacts of the final design comply with the relevant criteria and are generally consistent with or lower than the noise impacts predicted in the NVA.’

It is unusual for an EIS, that *must* include ‘completed technical studies, including an accurate noise impact assessment for relevant dwellings undertaken consistent with the requirements of the Noise Assessment Bulletin’, to state that the wind turbine layout, the turbine type, the consideration of other matters such as tonality, low frequency noise and sound power levels can all change and are issues that will be considered *after* approval of the EIS.



In my opinion, an EIS must address all of these possible changes before any EIS is approved. If the changes suggested are not considered in the EIS then the EIS is deficient, incomplete, should be considered premature and must not be approved.

The EIS states:

Due to the nature of the Project, specific project details will be subject to the detailed design phase and will be influenced by the technology applicable at the time. However, any uncertainty in the data used for the assessment has been appropriately identified, an appropriate assumption has been applied to represent a conservative worst-case analysis and/or sensitivity analysis has been undertaken to assess a range of potential impact scenarios.

I have been unable to find any reference to uncertainty considerations associated with the detailed design changes flagged by this statement in the EIS. For example, there has been no consideration in the NVA for different WTG, layout, possible tonality and low frequency noise.

A full assessment of the effect of all detailed design changes that may be considered by the proponent must be covered in the EIS.

The EIS has identified a shed (ID 30) on the southern side of the New England Highway to the south of WTG T11. There appears to be a residence on this property that has not been identified which is a short distance further south of the shed that could be influenced to the same extent as dwellings 27, 28 and 41.

### **Peer review by SLR dated 1 Nov 2021 on Sonus report S6576.1C2**

Wind Farm noise assessments must be completed as per the SEAR which references the SA 2009 noise guide, which in turn provides two acceptable noise prediction models: CONCAWE and ISO9613-2. Guidelines designed to assist in interpreting the ETSU-R-97 UK planning document for wind farms from 2014 by the UK Institute of Acoustics (IoA) are not described in the SEAR and should not be used.

I disagree with the assertion by SLR that the IoA guidelines are contemporary and should be preferred. The NSW government policy has formally adopted the SA 2009 guidelines in their Bulletin 2016.

The recent Victorian Supreme Court in *Uren v Bald Hills Wind Farm Pty Ltd* [2022] VSC 145 (**Uren**) was critical of the loose interpretations that the acoustic consultants acting for the wind farm company (Marshall Day Acoustics and Mr Turnbull of Sonus) used in addressing planning permit requirements. A similar criticism could also be levied at SLR when they wish to skew the SEAR to using IoA guidelines rather than SA 2009.

Overall, I find that the SLR peer review is superficial and has not addressed the key problems with the Sonus NVA that will be addressed further in this review. Furthermore, the SLR review is of an earlier Sonus NVA report S6576.1C2 and not the NVA included in the EIS which is report S6576.1C10.

To be an appropriate peer review of the NVA in the EIS there should be a peer review of the report included in the EIS as Appendix 10 to ensure that issues raised in an earlier peer review have been adequately addressed.

In the absence of a contemporary peer review being included in the EIS then this independent peer review may be considered in lieu.

## Detailed review of EIS Appendix 10 (Sonus report S6576.1C10)

The body of the EIS suggests that cumulative effects of the Winterbourne Wind Farm have been addressed yet there is no mention in the Sonus report of any cumulative noise impact assessment.

Section 6.3.1.2 states that Table 6.6 shows non-associated dwellings and lists dwelling 270 as such. However, other figures and the EIS body suggest that 270 is an associated dwelling.

Evidence of any negotiated agreement for dwelling 270 should be provided to show how any adverse noise issues have been addressed.

### Background Noise Measurements

#### *Wind Speed*

Accurate determination of background noise levels is fundamental to setting target noise limits that the developed wind farm must meet.

Background noise measurements must be correlated to wind speed across the wind farm site. SA 2009 notes that wind speed measurement locations must be determined, as follows:

#### **Measurement location**

The same location should be used for measuring wind speed and direction for all of the following procedures:

- background noise measurements,
- noise predictions,
- compliance checking.

Therefore the wind speed measurement location at the wind farm site should not:

- be significantly affected by the operation of the WTGs in their final location,
- provide lower wind speed results than other locations on the wind farm site, where those locations will house WTGs that affect the noise level at a relevant receiver.

For large or topographically diverse wind farm sites, the suitability of the wind speed measurement location may need to be confirmed as part of the development assessment process.

I note there is a temporary mast next to T31. Wind speed data from this location is unsuitable for background measurement purposes since the location will subsequently be affected by operation of the proposed nearby wind turbine. An alternative temporary mast location should have been chosen that will not be subject to influence from any future turbine.

It is unclear where the wind speed measurements used by Sonus actually come from. The Sonus report references a mast location remote from the wind farm site that is some 48km away to the ESE from the wind farm. Table 6 notes the met mast is at 385152 Easting, 6580287 Northing (WGS84 56J).

SA 2009 states:

A community concern is that the developer may measure during a limited (minimum two weeks) period that is not representative of the whole year.

This guideline recommends that compliance checking be repeated at different periods of the year where valid concerns exist.

The developer must collect representative background noise data.

The NVA has not provided information to demonstrate that background noise data is representative of other times of the year.

Sonus refer to wind speed data that had been corrected to hub height wind speed by Neoen.

SA 2009 states:

Evidence that the wind speed and direction sensor is certified for the accurate determination of wind parameters is to be supplied as a part of the report. Accuracy of the wind speed measurements should be  $\pm 0.5\text{m/s}$  and wind direction measurements  $\pm 3^\circ$  or better.

The location for the met mast supplying data used in the Sonus Background measurements needs to be checked and evidence supplied regarding the accuracy of the measurements, including the uncertainty in the method used to determine hub height wind speeds.

Clarification is required about the suitability of locating the met mast given the proximity of wind turbine T31 that shows probable adverse turbulence influence on the met mast shown in EIS figures.

Explanation is also required that the met mast location meets the SA 2009 requirement that ‘the wind speed measurement location at the wind farm site should not .. provide lower wind speed results than other locations on the wind farm site, where those locations will house WTGs that affect the noise level at a relevant receiver.’

### ***Background measurement equipment***

SA 2009 states:

#### *Equipment*

Background noise levels should be collected for continuous 10-minute intervals using sound level meters or loggers of at least Class 2 certification in accordance with Standard AS IEC-61672. The lower limit of the instrument measurement range must be chosen to provide accurate measurements which might be limited by the noise floor of the data acquisition device.

Sonus used RION NL-21 sound level meter loggers. The measurement range over which the RION NL-21 complies with AS IEC-61672 is 28 dBA to 138 dBA, as shown in the RION specifications.

Below 28 dBA the NL-21 does not provide accurate results and the levels reported fall outside of the required accuracy for Class 2 equipment according to AS IEC-61672. The effect of this equipment limitation is that if the Background sound levels are shown to be below 28 dBA then the reported measurements will be artificially elevated and the corresponding target noise limits will be too high<sup>1</sup>.

Many measurements (estimate >30%) fall below 28 dBA in the results presented for Background measurements in Appendix D of the Sonus NVA report. Because the trend line regression analysis considers dB values without consideration of data point accuracies, this can have a marked effect on the trend line and the validity of the target noise limits proposed in the Sonus report is questionable.

When the base line target noise limit is 35 dBA, or Background plus 5 dB, it is important to recognise that measurement equipment must remain accurate to AS IEC-61672 Class 2 limits below 28 dBA. If such poor low level accuracy equipment is considered then it would be appropriate to adjust the trend line determination lower to compensate.

To meet the requirement of SA 2009 that ‘The lower limit of the instrument measurement range must be chosen to provide accurate measurements which might be limited by the noise floor of the data

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<sup>1</sup> Huson, W.L.: Constraints imposed by and limitations of IEC 61672 for the measurement of wind farm sound emissions. 6<sup>th</sup> International Conference on Wind Turbine Noise, Glasgow 2015

acquisition device’, then Background noise measurements should be repeated with sound level loggers capable of accurately recording sound levels lower than 28 dBA.

Sound level loggers capable of achieving measured results compliant with Class 2 AS IEC-61672 accuracy limits are readily available down to < 23 dBA. A typical sound level meter from Larson Davis states in its manual:

The measurement ranges over which the Model 831 meets the standards, which depend upon the selected frequency weighting, as shown in ‘Performance Specifications’ on page A-4.

Measurements which include levels outside this range should not be considered accurate. An overload indication will appear when levels above the range appear.

However, the user should take care not to rely on measurements whose levels are below the lower limit of the specified range.

### **Equipment wind screens**

Photographs of the equipment deployed to measure Background levels suggest that the type of wind screen used is the RION WS-15 Outdoor microphone protection system although the wind screen used at Dwelling 270 is not a RION WS-15. The Sonus report does not disclose the type of wind screens used.

SA 2009 states:

Microphones should be protected with windshields in accordance with the microphone manufacturer’s instructions, and the protection should be sufficient to ensure the noise level threshold of the monitoring equipment does not adversely affect the data used in the analysis. If microphones cannot be appropriately protected then affected data should not be collected. As part of the development application, developers should confirm that the reported noise levels are not influenced by high wind speed across the microphone, particularly where wind speeds at the noise measurement position are expected to exceed 5 m/s (a high wind speed for the purposes of noise level measurement conditions). It is permitted to report noise measurement data at higher wind speeds if they have been taken with special windshields. The windshield performance should be confirmed by sufficient technical information proving accuracy of such measurements.

RION provide the following for their WS-15 wind shield:

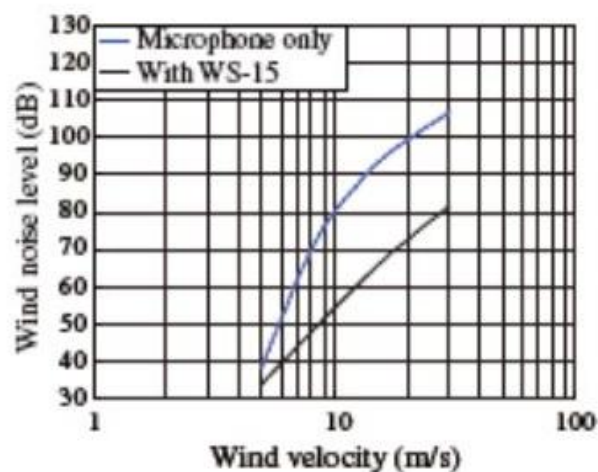


Fig. 12-1 Frequency weighting A

Extrapolating the local wind speed velocity to 4 m/s it is expected that wind generated artificial noise on the microphone is 30 dBA. Such influences on the measured Background noise measurements are required by SA 2009 to be addressed in the development application (EIS).

The Sonus report states that measured sound levels in local wind speed above 5 m/s were discarded but the report does not describe how the wind speed below 5 m/s affects the measured results. For equipment using the WS-15 wind screen it would be appropriate to correct measurements with local wind speeds around 4 m/s generating artificial noise around a level of 30 dBA, as described in SA 2009 as follows:

If wind data from the single wind speed monitor are not representative for all of the noise monitoring locations, the wind speed should be measured separately at each of the locations. This information would then be compared with both the collected data for that interval and the manufacturer's specifications for the windshield performance under those conditions:

- Where manufacturers' specifications indicate that wind induced noise on the microphone is 10dB(A) or more below the background noise, the data is acceptable.
- Where manufacturers' specifications indicate that wind induced noise on the microphone is 10dB(A) to 4dB(A) below the background noise, the affected data may be retained with the wind induced noise subtracted from the measured background.
- Where manufacturers' specifications indicate that wind-induced noise on the microphone is within 4dB(A) of the affected data, the affected data should be discarded and the data should be re-analysed. If the procedure causes the regression curve to change significantly, then additional data will need to be collected within an improved wind screen.

Data from only two local wind speed measurement locations have been used for the four Background survey locations. No microphone height local wind speed measurements were taken for Background measurements at Dwellings 219 or 270. It is questionable if microphone height wind speeds at Dwellings 6 and 29 are representative of wind speeds across microphones at Dwellings 219 and 270.

### ***Background Data Filtering***

The Sonus report explains that Background data has only been presented from cut-in wind speeds at the chosen met mast at hub height at 3 m/s to 12 m/s. The upper limit of 12 m/s has been chosen assuming that the text from SA 2009; 'wind speed of rated power' means the lowest wind speed at which rated power is achieved, not the rated power at which the WTG can operate. The WTG can operate in wind speeds from 3 m/s to cut-out, which is typically around 25 m/s.

The Sonus report puts forward the argument that compliance is only considered over 'at least the range of wind speeds from cut-in to rated power of the WTGs' and interprets that this means the minimum wind speed at which rated power is generated. I disagree. Trend line analyses extending beyond the minimum wind speed at which rated power is achieved is important since higher wind speed data points can significantly influence the trend line. The Sonus report has been selective in not providing reference to the following.

SA 2009 states (my underlining):

Background noise is measured at relevant receiver locations at continuous 10-minute intervals and particularly over the range of wind speeds at which the WTGs operate.

The Victorian Supreme Court case in *Uren v Bald Hills Wind Farm Pty Ltd* [2022] VSC 145 (**Uren**) decision recognised the approach suggested by Sonus as being inappropriate noting that limiting the higher wind speed data is unnecessary since the same elevated Background data at higher wind speed is effectively considered in the Background plus 5 dB method used in setting noise limits.

## Noise model predictions

SA 2009 states:

### Noise Model

A conservative approach should be used for predicting wind farm noise by calculating noise levels in octave bands from at least 63 to 4,000Hz to determine an overall predicted level and using the following inputs:

- atmospheric conditions at 10°C and 80% humidity,
- weather category 6 (if CONCAWE method is utilised),
- hard ground (zero ground factor).

The NVA has not used all of these input parameters. In a recent decision of the Victorian Supreme Court (**Uren**) relating to wind turbine noise the expert representing the wind farm (Mr Turnbull of Sonus Pty Ltd) incorrectly interpreted “the method for assessing wind farm noise prescribed” and the interpretation was accordingly not accepted by Judge Richards. It would be inappropriate for the Sonus NVA noise model to use input parameters other than those required in the SA 2009 guidelines.

Noise models produce sound pressure level output predictions based upon sound power levels (SWL) input to the noise model and various factors that address sound propagation from each sound source (WTG at hub height) to receiver dwellings. SA 2009 requires weather category 6 to be used in CONCAWE with particular atmospheric conditions and a parameter defining reflections from the ground (zero ground factor which means the ground is fully reflective of sound).

Sound predictions can also be penalised if dB(C) predicted levels exceed 60 dB(C) or if tones are observed in measured test data.

### **Sound Power Level (SWL)**

SA 2009 states:

The sound power level data at wind speeds from cut-in speed to the speed of rated power and each integer speed in between should be specified in the development application as determined in accordance with International Electrotechnical Standard IEC 61400–11. The sound power level determined in accordance with other relevant standard or procedure might be acceptable for the purpose of the guidelines.

At the time of development application, the contractual arrangements for a particular WTG model may not have been finalised between the developer and WTG supplier. If the WTG model to be installed differs from that indicated at the time of development application, the developer should assess and discuss the effect on the propagation model with the EPA.

The last sentence from the extract above can be problematic if the applicant Neoen plans to change the candidate WTG for final construction. If Neoen are considering alternative WTGs then they should include those in the EIS NVA. Neoen should have sufficient experience to firm up on their WTG choice and understand the extent of altered layout that may be required. Each of the alternative ‘final design’ parameters should be included in a NVA report.

The SWL data included in the NVA has not been referenced to come from any IEC61400-11 independent measurements. The NVA states that IEC61400-11 test report tonality data was unavailable for the Vestas V162 6MW WTG. To consider the validity of the SWL data listed in the NVA it is a requirement that an alternative measurement standard or procedure should be offered for consideration in the EIS. This has not been done.

### **Tonality**

No predictive correction penalty has been applied to the SWL of the candidate WTG for tonality. However, recent Vestas installations of their WTGs has demonstrated tonal noise emissions, as measured by Sonus at the Salt Creek Wind Farm for the Vestas V126 3.6MW turbines using the 1/3 octave band assessment method used in this EIS, that were not considered in earlier predictions for development approval.

The tones were identified in hub height wind speeds between 3 m/s and 7 m/s which are below the minimum wind speed of rated power. The Vestas V126 and V162 share the same proven underlying mechanical platform development. The Vestas website:

<https://www.vestas.com/en/products/enventus-platform/v162-6-2-mw>

describes the sound power level for the V162 6.2 MW turbine as:

“With a standard Sound Power Level of 104.8dB(A) and up to 30 percent higher energy production than the V150-4.2 MW<sup>TM</sup>, the V162-6.2 MW<sup>TM</sup> establishes a new benchmark in competitiveness.”

This is 0.5 dB higher than the data used by Sonus in the NVA.

It is of interest to note that there is no V162 6MW WTG listed as a current product on the Vestas website so that could explain the lack of an independent IEC61400-11 test report. V162 6MW WTGs are being installed currently in Finland but the current offering from Vestas is the 6.2MW WTG.

If tonality has been demonstrated to be a problem below rated power output of Vestas WTGs then it would be appropriate to insist on a proper IEC61400-11 test report to be provided with this application.

If tonality is demonstrated just below the wind speed of rated power then a 5 dB penalty would be applicable to predicted sound levels.

If an IEC61400-11 test is unavailable for the proposed WTG then an alternative that has such a test should be offered as candidate. It is not uncommon for a WTG manufacturer to offer predicted SWL data rather than measured SWL data but in such circumstances it would be appropriate to add some measure of uncertainty in the predictions.

The Vestas V162-6.2MW WTG has yet to be installed at any wind farm. The first installation is due to commence in the second quarter of 2022 in Finland:

<https://www.globalenergyworld.com/news/sustainable-energy/2021/07/02/vestas-wins-192-mw-order-finland-increases-rating-v16260-mw-enventus-turbine-62-mw>

The V162 6.2MW WTG is as yet unproven. The V162 6.0 MW WTG will probably see commercial operation at a wind farm in Finland by the end of the first quarter of 2022:

<https://www.globalenergyworld.com/news/sustainable-energy/2020/12/08/vestas-debuts-new-v16260-mw-turbine-winning-74-mw-order-two-projects-finland>

Without an IEC61400-11 test report it is not possible to evaluate tonality or provide confidence to predicted sound power levels.

From the Bulletin:

SA 2009 requires that development applications for wind energy projects report the following:

“To help determine whether there is tonality, the method and results of testing (such as in accordance with IEC 61400–11) carried out on the proposed WTG model to determine the presence of tonality should also be specified in the development application.”

In NSW, in addition to the SA 2009 requirements, for both environmental assessment and compliance purposes, the presence of excessive tonality (a special noise characteristic) shall be consistent with the methodology described in ISO 1996.2: 2007 Acoustics - Description, measurement and assessment of environmental noise – Determination of environmental noise levels (Annex D – Objective method for assessing the audibility of tones in noise – Simplified method). Tonality is defined as when the level of one-third octave band\* exceeds the level of the adjacent bands on both sides by:

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

Sonus only used the 1/3 octave band method, not that of IEC61400-11 preferred by SA 2009.

**Ground Effect**

The Sonus NVA has use *soft ground* as an input parameter in the CONCAWE noise model.

An example prediction at a range of 500m is shown in CONCAWE. With hard ground the predicted sound level can be >10dB higher than if soft ground is used. An example calculation from CONCAWE is shown below (worked example 1 from section 5.3 in CONCAWE).

The Ground Effect correction factor K3 is determined from a set of equations or from a chart in Figure 1 in CONCAWE. If hard ground is used then K3= -3.

The predicted sound level is determined by subtracting different factors K1 to K6 from the WTG sound power levels. The effect of using hard ground compared to soft ground is to increase the predicted sound level in octave bands by values of + 3dB to +14 dB in this example, depending upon the octave band chosen.

For the most influential octave band of 500 Hz for wind turbine sound emission and propagation we see that at 500m the use of soft ground compared to hard ground is to change the predicted sound level by 11 dB (8 dB reduction to 3 dB increase). For 500 Hz the same attenuation value (K3) for soft ground also extends out to 2000m.

DESCRIPTION		dB(A)	Octave Band Centre Frequency, Hz						
			63	125	250	500	1k	2k	4k
Plant Sound Power Level	L <sub>W</sub>	118	127	123	120	113	111	112	108
Directivity (Omnidirectional source)	D		0	0	0	0	0	0	0
Geometrical Spreading (d = 500 m)	K <sub>1</sub>		65	65	65	65	65	65	65
Atmospheric Attenuation (Temperature = 10 deg C, Humidity = 75%)	K <sub>2</sub>		0	0	0	1	2	3	10
Ground Effects (Figure 1)	K <sub>3</sub>		0	5.5	11	8	4.5	2.5	1.5
Meteorological Correction (Vector wind speed + 2 m/s Pasquill Stability Factor D, Category 5)	K <sub>4</sub>		-1	-2.5	-3.5	-4	-4.5	-3	-4
Source Height Correction (Source at 1.5m)	K <sub>5</sub>		0	0	0	0	0	0	0
Barrier Attenuation (3m high wall, 10m from source)	K <sub>6</sub>		5	6	7	10	11	14	17
	ΣK		69	74	79.5	80	78	81.5	89.5
	L <sub>P</sub>	40	58	49	40.5	33	33	30.5	18.5

Worked example 1 from section 5.3 in CONCAWE



CONCAWE is an empirical noise model and predicted results can be overly optimistic if soft ground is used to represent the K3 correction factor, as has been done in the Sonus NVA noise model. The NVA incorrectly used soft ground in the noise model, contrary to the requirements of SA 2009.

In summary, the CONCAWE noise model must be recalculated using ‘hard ground’ as required in SA 2009 before a valid assessment can be made of the noise impact of this development.

### ***Low frequency noise***

A noise model re-calculation will also affect the low frequency noise assessment in terms of dB(C). Predicted dB(C) levels are dominated by sound power levels in the 250 Hz octave band. From the example shown in CONCAWE at 500m above, in this 250 Hz octave band the predicted dB(C) level will increase from an attenuation of 11 dB with soft ground to an increase in level of 3 dB with hard ground. Thus, the predicted dB(C), with a change from soft ground to hard ground in the CONCAWE example above, is an increase of 14 dB.

The margin of compliance in the Sonus NVA is only 10 dB for non-associated dwelling 29.

For distances representative of dwellings to the proposed WTGs the 250 Hz ground effect value K3 for soft ground increases to 15 dB (at 2000m) from 11 dB (at 500m), which would change the predicted dB(C) level by +18 dB compared to that listed in the NVA. This will demonstrate non-compliance with the low frequency limits imposed in the Bulletin that then requires a 5 dB penalty to predicted noise levels in the NVA.

## **Summary**

### ***General***

The EIS has stated that “once the detailed design is complete, a pre-construction noise assessment will be made based on the final WTG model selection, layout, guaranteed sound power levels, consideration of tonality and low frequency noise from the WTGs, and final agreements with landowners.” The EIS has not considered the effect of different layouts or details for the current or other wind turbine candidates. Also, there seems to be an additional property to the south of shed ID30 that needs to be considered.

In my opinion, an EIS must address all of these possible changes before any EIS is approved. If the changes suggested are not considered in the EIS then the EIS is deficient, incomplete, should be considered premature and must not be approved.

Technical consideration of the cumulative effect of the Winterbourne wind farm should be included in the NVA, as required in the SEAR.

### ***Background Noise Measurements***

For the reasons identified and detailed in this review there are concerns over wind speed measurements used in the Background noise scatter charts and the adequacy of sound level measurement equipment used (poor sound level meter low level performance and corrections required for wind noise caused by the wind screens below 5 m/s). Derived target noise limits are artificially elevated due to the poor performance of the equipment used and the scatter charts have been incorrectly limited to a maximum wind speed of 12 m/s.

In my opinion the Background sound levels need to be repeated with improved sound level meters that must have a wind speed measurement near to each microphone location. The wind speed measurements representing wind across the proposed wind farm should be located where there is no potential influence from subsequently constructed wind turbines that can cause errors due to wake effects.

The wind speed measurements must comply with the uncertainty requirements of SA 2009 at hub height.

The location of the wind met mast used to provide data in the NVA needs to be checked.

The NVA has not provided information to demonstrate that background noise data is representative of other times of the year.

### **Noise Model**

I have detailed the deficiencies of the CONCAWE noise model input parameters used in the Sonus NVA.

The deficiencies relate to unverified sound power levels and the incorrect application of the Ground Effect term in the recognised CONCAWE noise model, as specified in SA 2009.

The NVA significantly underestimates the noise impact in the community surrounding the proposed wind farm.

The noise model should be re-calculated with the correct ‘hard ground’ term K3 set to -3.

In addition, a sensitivity analysis is required of any alternative layout and different candidate wind turbine generator (WTG) using test results rather than predictions.

The predicted dB(C) levels should also be reviewed together with possible tonal qualities of the candidate WTG.

The EIS should confirm the availability of the candidate WTG. The currently available 6.2MW Vestas V162 has a published sound power higher than that used in the NVA.

### **Negotiated Agreements**

Evidence of any negotiated agreement for dwelling 270 and others should be provided to show how any adverse noise issues have been addressed.

Yours sincerely,



W Les Huson BSc(Hons) MSc CPhys MInstP MIoA MAAS MEIANZ

Referenced paper attached.