ENVIRONMENT, RESOURCES AND DEVELOPMENT COURT OF SOUTH AUSTRALIA

MCLACHLAN & ORS v MID MURRAY COUNCIL & TILT RENEWABLES AUSTRALIA PTY LTD

[2018] SAERDC 15

Judgment of Her Honour Judge Cole, Commissioner Nolan and Commissioner Rumsby

7 March 2018

ENVIRONMENT AND PLANNING - ENVIRONMENTAL PLANNING - DEVELOPMENT CONTROL

The second respondent applied in February 2014 for consent to construct a wind farm of 114 turbines in three discrete groups extending from south of Palmer to Cambrai along the eastern face of the Mount Lofty Ranges in South Australia. The development underwent formal public notification under s.38 of the Development Act and numerous representations were received, including from the four appellants. The respondent Council granted development plan consent to an amended proposal involving a reduced, 103 turbine wind farm, in late 2015. This decision has given rise to the appeals the subject of this hearing. Land within the Rural Zone and Policy Areas 13 and 14 of the Mid Murray Development Plan dated 24 October 2013 – the appropriateness of the proposed use found to be in accord with the Development Plan intent – consideration of visual impact, noise, health, fauna and flora, heritage, safety and amenity effects.

Held: Having regard to all of the evidence, the proposal is in sufficient compliance with the relevant provisions of the Development Plan to warrant approval subject to the imposition of appropriate conditions. The appeals are allowed for the limited purpose of varying the conditions attached to the consent for 103 wind turbines, a new substation and associated permanent and temporary infrastructure.

Appellant: GILLON MCLACHLAN (ERD-16-1) No Attendance
Appellant: PETER JOHN ROYAL (ERD-16-12) Counsel: MR G MANOS - Solicitor: BOTTEN LEVINSON
Appellant: EASTERN MOUNT LOFTY RANGES LANDSCAPE GUARDIANS INC (ERD-16-13) Counsel: MR G FINLAYSON - Solicitor: DIASPORA LEGAL
Appellant: STIRLING MCGREGOR (ERD-16-14) Counsel: MR P QUINN - Solicitor: PIPER ALDERMAN
First Respondent: MID MURRAY COUNCIL Counsel: MR G LEYDON - Solicitor: NORMAN WATERHOUSE
Second Respondent: TILT RENEWABLES AUSTRALIA PTY LTD Counsel: MR S HENRY SC WITH MR D BILLINGTON - Solicitor: FINLAYSONS
Hearing Date/s: 06/03/2017 to 10/03/2017, 14/03/2017 to 17/03/2017, 20/03/2017 to 24/03/2017, 03/04/2017 to 05/04/2017, 22/02/2018
File No/s: ERD-16-1, ERD-16-12, ERD-16-13, ERD-16-14
B

Development Act 1993 (SA); *Native Vegetation Act* 1991; *Aboriginal Heritage Act* 1988; *Environmental Protection (Noise) Policy* 2007; *Wind Farms Environmental Noise Guidelines* 2009; *Electricity (Principles of Vegetation Clearance) Regulations* 2010, referred to.

MCLACHLAN & ORS v MID MURRAY COUNCIL & TILT RENEWABLES AUSTRALIA PTY LTD
[2018] SAERDC 15

THE COURT DELIVERED THE FOLLOWING JUDGMENT:

1 The appellants in this matter have appealed against the grant of development plan consent, subject to conditions, by the Mid Murray Council ("the Council") under the *Development Act 1993* ("the Act") to Tilt Renewables Australia Pty Ltd ("Tilt")[1] in respect of its development application to establish a wind farm on the eastern side of the Mt Lofty Ranges near the town of Palmer.

2 The hearing of the appeal took place over 17 days, with written submissions provided after the hearing. The Court viewed much of the site of the proposed wind farm and its locality in the presence of those parties who chose to attend the view. Numerous witnesses gave evidence. Many documents were tendered.

The processing of the application

3 Development Application number 711/072/14 dated 27 February 2014 ("the application") was lodged with the Council on 28 February 2014. In the documents lodged with the Council by the applicant in support of the application, the project was described, by way of summary, as follows:[2]

> The Palmer Wind Farm is generally located on the eastern side of the Mount Lofty Ranges near the areas of Palmer and Sanderston.
>
> ...
>
> More specifically Trustpower are seeking approval for the use of the nominated land for the installation of up to 114 wind turbines and other buildings and related structures needed for the purposes of generating electricity from wind and then transmitting this electricity to the national grid (including above ground and underground transmission cabling and a substation). This includes supporting infrastructure, buildings and structures (including access tracks, wind monitoring masts and management and monitoring facilities) that are necessary for the ongoing operation and maintenance of the development.

4 The application was processed as a Category 3 kind of development under the Act. It was advertised, and 208 representations were received in relation to it.[3] Development plan consent was granted on 18 December 2015, subject to 26 conditions.[4]

---

1 At all times during the processing of the development application, the applicant for development approval was called Trustpower Australia Holdings Pty Ltd. However, by the time of the hearing before the Court, the name had changed to Tilt Renewables Australia Pty Ltd. We will call the applicant for consent Tilt throughout this judgment.

2 Exhibit 1R1 at p 4.

3 Exhibit 1R4 at p 1766.

4 Exhibit 1R6 at p 2747.

The amended application

5 The proposed development was amended prior to the hearing of the appeal. The amended proposal was set out in detail in a document called "Amended Consolidated Particulars of Development".[5]

Element	Description	Notes
Wind Farm	103 WTGs and associated infrastructure across three clusters (Areas A, B, C).	
Wind Turbines	Maximum Height (to blade tip) – 165m. Blade Length – approx. 65m. Tower/Hub Height – approx. 100m. Footings may be either a mass concrete footing (raft style), piled type rock anchors or a combination of both. Depending on final design the footings will be approx. 21-22m diameter (mass concrete) or 8-12m diameter for a rock anchor type.	For the purposes of the noise impact assessment, a Vestas V117 model turbine was used, because the sound power level of this model turbine is representative of a turbine at the upper end of the noise range for current turbines that fits within the turbine dimensions applied for use at the Palmer Wind Farm. Out of an abundance of caution, larger turbine dimensions were used for the other assessments to ensure that the assessments were representative of the maximum dimensions proposed to be covered by the development plan consent. The following dimensions were used in these assessments. • Traffic – tip height of 165m, 65m blades, 100m tower. • Flora/Fauna Assessment – tip height of 165m, 65m blades, 100m tower. • Aviation – tip height of 165m. • EMI – tip height of 165m, 100m tower and rotor diameter of 130m. • Shadow Flicker – Vestas V126 (100m hub height, rotor diameter 126m, maximum blade chord 4m). • Visual Landscape assessment – tip height of 165m, 65m blades, 100m tower. The exact dimensions and output of the turbines will be confirmed post planning consent when the final contractors and suppliers are selected.
WTG laydown & Hardstand area	An area of approximately 50m x 30m around each turbine for footings and crane hardstand areas and an additional 20m x 20m adjacent the turbine footings for laydown area.	Hardstand areas will be required adjacent to the base of each WTG to enable the assembly and erection of the WTG components. The shape and area will vary depending on the construction approach and the site conditions at

[5] Exhibit 2R1 at pp 2 to 5.

	The footings and hardstand area will be a permanent feature. The laydown area will be revegetated following construction.	each WTG location.
External Electrical Transformers	A pad mounted enclosed transformer (kiosk) located at the base of each turbine. Approximate dimensions (4m long x 2m wide x 2m high).	The requirement for external transformers depends on the final WTG model selected. Some models do not require this element.
Site Access	On-site access tracks will be up to 10m wide to accommodate construction activities and cranes.	The main access tracks will provide access to the WTG sites and will be designed to take the weight of WTG transport and construction vehicles and the crane used to erect the turbines. Some sections of the access roads may be wider to accommodate overtaking areas and turning circles.
Underground 33kV and fibre optic cabling	Trench width approximately 500mm per circuit and depth – approximately 1.2m (minimum of 900mm coverage over top of cable). Trench impact area of 5m width for a single cable alignment + 1m for each additional cable.	To be generally located adjacent the access tracks where possible (within approximately 10m of the shoulder of the track). This will connect the WTGs within each cluster. The exact location and dimensions will depend on the installation method used by the contractor.
Overhead 33kV transmission lines	Comprise up to 2 circuits (6 conductors) on a single pole line with steel poles of up to 30m in height and spaced approximately 250-300 metres apart. There will be an underground/overhead terminal station at the poles where the underground 33kV cables terminate and transition to the overhead line. Associated minor connection equipment and structures as may be required to transition between underground and overhead lines.	The overhead 33kV transmission lines will connect clusters of turbines to the substation shown in Area B. The lines will be located within the identified corridors. The exact locations of the poles will be determined at the detailed design stage following planning consent and will depend on the ultimate contractor and pole designs selected.
Substation and Operations and Maintenance Facilities	One permanent 33kV / 275kV substation with approximate dimensions of 150m x 150m co-located with a permanent Operations and Maintenance Facility of approximately 100m x 100m.	Vegetation screening, compliant with industry standards, will be planted and maintained around the perimeter of the combined substation and Operations and Maintenance Facility.

	Total area approximately 3.25 hectares. The Operations and Maintenance Facility will include: • Buildings (including office, control room, staff facilities) • Car park area for staff and visitors • Workshop	
Meteorological masts	• Up to seven permanent masts • These will be approximately 100m in height and at the same height as the constructed WTG hub height.	All masts will be permanent structures supported by small concrete footings and guy wires.
Temporary Construction Compounds	One main temporary construction compound of up to 300m x 300m in area. The size will depend on the facilities required which may include: • Site office and staff facilities • Amenities • Workshops • Car park • Laydown area (20m x 20m) Up to three additional smaller, satellite temporary construction areas mainly used for laydown areas and staff offices/amenities.	The size and use of construction compounds will depend on the ultimate construction approach.
Concrete Batching Plants	Up to three temporary concrete batching plants of around 100m x 100m may be required (if concrete is not sourced offsite).	Temporary concrete batching facilities may be located on or off site (subject to construction contractor's requirements). Indicative potential locations for on-site facilities (which have been agreed with landowners) are shown on proposal drawings.
Public Road Improvements	Access routes for all over-dimensional vehicles will be limited to those specified in the Traffic Management Plan. Roads and intersections will be upgraded to meet load and safety standards as required and agreed in the management plan.	Where possible the project will utilise and/or improve existing access points to the site.

	Public road access will require road upgrades to a width of 6m and a 1m shoulder either side where needed. Localised widening in excess of 6m may be required to support transport and construction activity such as passing bays. All public roads will be left in good repair following construction as agreed in the management plan. All access routes will be subject to DPTI and Council agreement.	

The 103 wind turbine generators (WTGs) are proposed to be clustered in three main groups in the vicinity of Palmer and Sanderston. The indicative layout comprises the following distribution:

- Area A (northern) – 15 WTGs;
- Area B (central) – 50 WTGs; and
- Area C (southern) – 38 WTGs.

6 It was explained in the Amended Consolidated Particulars of Development that the proposed wind farm may be constructed in stages and:[6]

> ... Before the constructions starts, final layout plans showing exact locations of all infrastructure within the project area will be prepared to the satisfaction of the Mid Murray Council with supporting material to demonstrate that any minor alteration or modification will not give rise to a significant adverse change to the assessed landscape, flora and fauna, cultural heritage, visual amenity, shadow flicker, noise, electromagnetic interference, fire risk or aviation effects.

This was referred to during the hearing as "micrositing".

The Site

7 The proposed development is proposed to be sited over numerous parcels of land, which are described and listed in the Amended Consolidated Particulars of Development. The site extends for approximately 30 kilometres in a north-south direction and comprises an area of approximately 11,550 hectares.[7]

8

---

[6] Exhibit 2R1 at p 1, para 3.
[7] Exhibit 2R1 at pp 26 to 32.

Assessment

9 These appeals are appeals under s 86(1)(b) of the Act. Section 86(1)(b) provides as follows:

> **86—General right to apply to Court**
>
> (1) The following applications may be made to the Court—
>
> ...
>
> (b) a person who is entitled to be given a notice of a decision in respect of a Category 3 development under section 38 may appeal to the Court against that decision (subject to the limitations imposed by that section);

10 The Act provides, in s 38(6) as follows:

> **38—Public notice and consultation**
>
> ...
>
> (6) Except as otherwise provided by the regulations, the subject matter of—
>
> (a) any notice required under this section; or
>
> (b) any representations under this section; or
>
> (c) any appeal against a decision on a Category 3 development by a person entitled to be given notice of the decision under subsection (12),
>
> must be limited to the following:
>
> (d) what should be the decision of the relevant authority as to development plan consent;
>
> (e) in a case where a prescribed body is empowered to direct that the application be refused, or that conditions be imposed in relation to the development—what should be the decision of the prescribed body in response to the application.

11 In his written submissions, Mr Leydon reminded us of the role of the Court. Mr Leydon said:

> 1. It is respectfully submitted that it is the task of the Environment, Resources and Development Court to judge the proposed development in its amended form against all of the relevant provisions of the Development Plan and to determine afresh, on the basis of that assessment, whether the proposed development sufficiently complies with those provisions to warrant Development Plan consent. That judgment must be undertaken in light of and in the context of the surrounding circumstances, having regard to the existing physical situation and on ground reality.
>
> 2. In this context, the Development Plan is not to be construed like a statute; but rather as a planning document, couched in the language of planning objectives and principles and not that of legal obligation. The language used is appropriate to expressions of goals and guiding principles rather than that of legal mandates.

3. The proposed development need not be ideal nor a preferable or the best development possible for the site. Suggestions by the Appellants that a preferable or more ideal proposal could involve a smaller wind farm in terms of turbine numbers, the removal of less native vegetation, the undergrounding of certain transmission lines, different turbine heights/blade lengths or that the proposed development would be better sited in Rural Zone – Policy Areas 15 or 16 are therefore unhelpful. The appeal process is not the place to have a "conversation" about renewable energy or the wind industry in particular, as was the suggestion of Dr Kay, but rather is a place where the development as now proposed is to be assessed against all relevant provisions of the Development Plan.

12 We agree with Mr Leydon as to the role of the Court in an appeal under s 86(1)(b) of the Act.

The Development Plan

13 The Development Plan applicable to the assessment of the proposed development under s 33(1)(a) of the Act is the Mid Murray Council Development Plan consolidated on 24 October 2013 ("the Development Plan").

14 The site of the proposed development is located within the Rural Zone under the Development Plan. The Development Plan provides for five policy areas within the Rural Zone, and the proposed development straddles two of those policy areas: the Marne Watercourse Policy Area 13 and the Hills Policy Area 14. Figures HF(MWPA) 3, 4 and 5 in the Development Plan identify part of the site as "Hills Face". Ms Thomas, in her evidence, estimated that just over half of the site is shown as "Hills Face" in Figures HF(MWPA) 3, 4 and 5.

15 Ms Thomas set out all of the provisions of the Development Plan relevant to the planning assessment of the proposed development in her statement.[8] In assessing the proposed development we have had regard to all of the relevant provisions of the Development Plan. Many of them will be discussed below in relation to the particular topics to which they relate.

Land Use

16 The Development Plan, in the Council-wide objectives, provides as follows in relation to renewable energy:[9]

Renewable Energy

Objective 96: Development of renewable energy facilities that benefit the environment, the community and the state.

Objective 97: The development of renewable energy facilities, such as wind farms and ancillary development, in areas that provide opportunity to harvest natural resources for the efficient generation of electricity.

---

[8] Exhibit 2R35 at pp 11 to 24.

[9] Development Plan at pp 16 to 17.

Objective 98: Location, siting, design and operation of renewable energy facilities to avoid or minimise adverse impacts on the natural environment and other land uses.

17 Council-wide Principle of Development Control (PDC) 396(a)[10] says:

Renewable Energy Facilities

396 Renewable energy facilities, including wind farms and ancillary development, should be:

(a) located in areas that maximize efficient generation and supply of electricity;
...

18 PDC 396(b) and PDCs 397, 398 and 399 relate to the impacts and safety of wind farms, and will be discussed in detail below.

19 The Desired Character statement for the Rural Zone[11] relevantly includes the following text:

> Wind farms and ancillary development such as substations, maintenance sheds, access roads and connecting power-lines (including to the National Electricity Grid) are envisaged within that part of the zone outside of the Barossa Valley Character Preservation district [sic] (as defined by Character Preservation legislation) and constitute a component of the desired character of this part of the zone. These facilities will need to be located in areas where they can take advantage of the natural resource upon which they rely and, as a consequence, components (particularly turbines) may need to be:
>
> - located in visually prominent locations such as ridgelines;
> - visible from scenic routes and valuable scenic and environmental areas; and
> - located closer to roads than envisaged by generic setback policy.
>
> This, coupled with the large scale of these facilities (in terms of both height and spread of components), renders it difficult to mitigate the visual impacts of wind farms to the degree expected of other types of development. Subject to implementation of management techniques set out by general/council wide policy regarding renewable energy facilities, these visual impacts are to be accepted in pursuit of benefits derived from increased generation of renewable energy.

20 The Desired Character statement also sets out a list of forms of development which are acceptable in the Rural Zone "other than where qualified by the provisions for the Policy Areas". The list includes:[12]

- wind farm and ancillary development outside of the Barossa Valley Character Preservation District; and

---

[10] Development Plan at p 75.
[11] Development Plan at p 211.
[12] Development Plan at p 212.

- wind monitoring mast and ancillary development outside of the Barossa Valley Character Preservation District.

21 Objective 2 of the Rural Zone,[13] under the heading "Sustainable Industry" is:

> **Sustainable Industry**
>
> ...
>
> **Objective 2:** Accommodation of wind farms and ancillary development outside of the Barossa Valley Character Preservation District as defined by Character Preservation legislation.

22 Both of the policy areas, in their Desired Character statements, set out a list of forms of development which are unacceptable in the policy area. Neither list includes wind farms or ancillary development to wind farms. The site of the proposed development is outside of the Barossa Valley Character Preservation District.

23 The introduction to each of Policy Area 13 and Policy Area 14 provides that the policies which are applicable specifically to the Policy Area "are additional to those for the Rural Zone and the Council Wide provisions." This includes the Desired Character statement, partially quoted above. We reject the suggestion that greater weight should be placed upon those provisions of the Development Plan which relate specifically to the policy areas relative to the provisions of the Rural Zone. In an assessment of the proposed development under the Act, the relevant Rural Zone provisions and the Policy Area provisions must be read together, with no particular weighting being given to one over the other on account of where they appear in the Development Plan. The same is true of the Council-wide provisions.

24 The Development Plan expressly seeks the development of wind farms and ancillary development within the Rural Zone, outside of the Barossa Valley Character Preservation District, and the site of the proposed development meets those criteria.

25 Mr Manos argued at one point in the course of the hearing that the designation of a significant portion of the site of the proposed development as "Hills Face", together with the provisions of the Development Plan in relation to visual amenity in the policy areas, indicated that, on account of the visual impact of the wind turbine generators (WTGs), any wind farm in the Rural Zone would be more appropriately sited in Policy Area Number 16 – Murray Plains Policy Area. We reject this contention. The Development Plan specifically acknowledges, particularly in the Desired Character statement for the Rural Zone, that WTGs must be sited in places where they can take advantage of the

---

[13] Development Plan at p 212.

wind, and that this means that they may need to be sited on visually prominent ridgelines.

26 Ms Thomas gave a detailed analysis of the provisions of the Development Plan with respect to land use in her statement, citing the provisions set out above.[14] Ms Thomas concluded that the proposed development "appropriately meets the relevant land use provisions of the Mid Murray Development Plan". We agree with Ms Thomas' analysis. We note that Ms Thomas was the only town planner to give evidence at the hearing of the matter.

27 We determine that a wind farm, together with its ancillary development, is an acceptable form of land use in the Rural Zone consistent with the relevant provisions of the Development Plan concerning land use. That is not, of course, the end of the assessment. It is necessary to assess whether the particular form of wind farm proposed is consistent with the relevant provisions of the Development Plan in relation to the potential impacts of the wind farm.

Visual Amenity

28 Substantial opposition to the proposal was expressed in the second, third and fourth appellants' cases, on the basis of the visual impact of the turbines and associated infrastructure on the environment.

29 Mr Warwick Keates, a landscape architect, prepared, with Dr Brett Grimm, a "Landscape Character and Probable Visual Effect Assessment" ("the Visual Effect Assessment")[15] for the consideration of the Council in its processing of the development application. The Visual Effect Assessment related to an earlier iteration of the proposed development in which 114 turbines were proposed. The reduction from 130 turbines to 123 turbines and then to 114 turbines was noted in the Visual Effect Assessment.[16] Several of the turbines originally proposed had, by the time the Visual Effect Assessment was prepared, been either moved in position or removed altogether in response to concerns about the visual impact of the proposed turbines. In considering the proposed development, we have had regard to the Visual Effect Assessment. It is relevant, notwithstanding that the proposed development is now 103 turbines and associated infrastructure, rather than 114.

30 Mr Keates also provided a report which was tendered in evidence in Tilt's case,[17] and he gave evidence at the hearing of the matter.

31 Mr Stuart Heseltine, a landscape architect, provided a statement[18] and gave evidence in Mr McGregor and Mr Royal's case at the hearing of the matter. Mr Heseltine did not undertake an overall assessment of the likely visual impact

---

[14] Exhibit 2R35 at pp 13 to 16.
[15] Exhibit 1R3 Authority's Book of Documents Volume 3 at p 925.
[16] Exhibit 1R3 Authority's Book of Documents Volume 3 at pp 959 to 961.
[17] Exhibit 2R2.
[18] Exhibit 2A10.

of the wind farm. Mr Heseltine was not an impressive witness. He was evasive and defensive in cross-examination. He reported himself to have been constrained in his preparation by the scope of his instructions. Mr Heseltine based some of his opinions upon assumptions that he made about the attitudes and beliefs of people living in the locality of the proposal, with little or no evidence to substantiate those assumptions. Such evidence is simply unhelpful.

32 Whilst we have taken account of all of the factual information provided by Mr Keates and Mr Heseltine, we have not adopted the evidence of either witness in relation to the likely impact of the proposed development on visual amenity. We have made our own assessment of the visual impact of the proposed development, having regard to the relevant provisions of the Development Plan. In this exercise, we have used, as evidence, our observations from the view the Court took of the locality, in conjunction with the exhibits depicting the predicted approximate siting of the WTGs. We have also had regard to all of the factual evidence with respect to visual impact.

33 The visual impact of the proposed wind turbines and associated infrastructure will vary over the locality. At one extreme, from some vantage points, the WTGs and/or infrastructure will not be able to be seen, and the appearance of the area will remain as it is. At the other extreme, from other vantage points, numerous WTGs will be seen in conjunction with each other, markedly changing the view. At some of these vantage points, the landscape has scenic quality. At some of these vantage points, the view from dwellings will change with the addition of the WTGs. In some places, including the Kratzer residence,[19] the Williams residence,[20] the van Zwol residence,[21] the Gilbert residence[22] and the Kulhmann residence,[23] the view from a residential property will change markedly. The outlook from Mr Royal's land on the western side of Milendella Road, south of the junction with Angas Valley Road, Milendella, where he may build a house, will be changed, and so will the outlook from Royal Heath, the property he presently inhabits. Mr Royal believes that 12 WTGs and the 33 kV transmission line will be visible from his proposed house, and believes that up to 30 WTGs and the 33 kV transmission line will be visible from Royal Heath. This may well be so depending upon the ultimate micrositing of the WTGs.

34 We acknowledge that there is significant, strong objection within the local community to the changes to the landscape which will result from the addition of WTGs, wires, poles and other infrastructure if the wind farm is established. However, it is not our task under the Act to consider what the planning policy ought to be in South Australia with respect to the visual impact of WTGs. Our

---

[19] Exhibit 3A32.
[20] Exhibit 3A31.
[21] Exhibit 3A38.
[22] Exhibit 3A39.
[23] Exhibits 3A40 and 3A41.

task is to apply the planning policy as it is expressed in the Development Plan as we assess the proposed development against the relevant provisions of the Development Plan.

35 As we have said, the Development Plan specifically contemplates the presence of wind farms in the Council area and in the Rural Zone. We have quoted Objectives 96, 97 and 98 above.[24] We also note the following provisions:

COUNCIL WIDE PRINCIPLES

Renewable Energy Facilities

396 Renewable energy facilities, including wind farms and ancillary development, should be:

(a) located in areas that maximize efficient generation and supply of electricity; and

(b) designed and sited so as not to impact on the safety of water or air transport and the operation of ports, airfields and designated landing strips.

Wind Farms and Ancillary Development

397 The visual impacts of wind farms and ancillary development (such as substations, maintenance sheds, access roads and wind monitoring masts) should be managed through:

(a) wind turbine generators being:

(i) setback at least 1000 metres from non-associated (nonstakeholder) dwellings and tourist accommodation;

(ii) setback at least 2000 metres from defined and zoned township, settlement or urban areas (including deferred urban areas);

(iii) regularly spaced;

(iv) uniform in colour, size and shape and blade rotation direction;

(v) mounted on tubular towers (as opposed to lattice towers);

(b) provision of vegetated buffers around substations, maintenance sheds and other ancillary structures.

398 Wind farms and ancillary development should avoid or minimise the following impacts on nearby property owners/occupiers, road users and wildlife:

(a) shadowing, flickering, reflection or glint;

(b) excessive noise;

---

[24] See above at para 15.

(c) interference with television and radio signals and geographic positioning systems;

(d) interference with low altitude aircraft movements associated with agriculture;

(e) modification of vegetation, soils and habitats;

(f) striking of birds and bats.

399 Wind turbine generators should be setback from dwellings, tourist accommodation and frequently visited public places (such as viewing platforms) a distance that will ensure that failure does not present an unacceptable risk to safety.

36 We bear in mind the Rural Zone Desired Character statement and note the following provisions:

Rural Zone

PRINCIPLES OF DEVELOPMENT CONTROL

...

22 Wind farms and ancillary development should be located in areas outside of the Barossa Valley Character Preservation District as defined by Character Preservation legislation which provide opportunity for harvesting of wind and efficient generation of electricity and may therefore be sited:

(a) in visually prominent locations;

(b) closer to roads than envisaged by generic setback policy.

37 The Development Plan, in these provisions, contemplates that wind farms will be established in the Council area, and within the Rural Zone. The Development Plan, in the Rural Zone Desired Character statement, deals expressly with the issue of the visual impact of the turbines and the ancillary development, and contemplates that the turbines may need to be located on ridgelines and be visible from scenic routes and scenic areas. The Desired Character statement[25] says that:

> Subject to implementation of management techniques set out by general/council wide policy regarding renewable energy facilities, these visual impacts are to be accepted in pursuit of benefits derived from increased generation of renewable energy.

38 The management techniques referred to we take to be those set out in Council wide PDC 397. The proposed development complies with PDC 397, although the meaning of turbines being "regularly spaced" is unclear. Some regularity about the spacing of the turbines is evident from the plans, within the limits of the turbines being in three blocks and constrained, inevitably, to some

---

[25] Development Plan at p 211.

extent, by the hilly terrain. However, what appears to be regular from one vantage point will not necessarily appear to be regular from another. In other words, regular spacing does not guarantee an orderly appearance from all vantage points. We also acknowledge that the desire to generate electricity efficiently is a component of the decision-making in relation to the spacing of the WTGs. The precise placement, or micrositing, of the WTGs will be determined subsequent to the grant of development approval, if it is given. It is not practical for the work necessary to determine the best precise site for each WTG to be done prior to the grant of approval. Tilt has made a commitment, as part of the development proposal, to consult with residents of dwellings within 1 km of each 275 kV transmission pylon to discuss whether landscape planting could assist with the screening of the pylon.[26]

39 The Development Plan provides as follows in the Council wide section:

> **Objective 15:** Provision of a system of scenic routes serving the district and their protection from inappropriate development.
>
> ...
>
> **Objective 18:** Amenity of localities not impaired by the appearance of land, buildings and structures including landscape.
>
> Buildings or structures should be sited and designed displaying regard to physical setting qualities and existing built form. In the River Murray Valley in particular buildings should conform to standards covering such matters as building materials, maintenance and colouring, and tree planting.
>
> **Objective 19:** Development of a high architectural standard that responds to and reinforces positive aspects of the local environment and built form.
>
> ...
>
> **Objective 47:** Retention of rural areas for agricultural and pastoral purposes.
>
> **Objective 48:** Maintenance of the character of rural areas.
>
> Rural areas should be retained primarily for agricultural and pastoral purposes and horticultural use where natural resources such as groundwater supplies and surface catchments are not adversely affected. Conservation of bushland and wildlife are also important considerations. The design and siting of buildings in rural areas should be compatible with the object of conserving rural character.
>
> The use of rural land for residential use should be discouraged because it diminishes rural character; makes the provision of public services uneconomic; increases land values with consequential upward pressure on rates and taxes; and contributes to land use conflicts which has the affect [sic] of limiting the right to farm.
>
> The removal of primary production from rural areas also places greater dependence upon the diminishing fertile areas. It is in the community interest therefore as much agricultural

---

[26] Exhibit 2R1 at p 19.

land as possible be retained in primary production and without residential incursions other than where residential use is required to manage land.

...

Objective 50: Protection of scenically attractive areas, particularly natural, rural and riverine landscapes.

...

Objective 53: Minimal disturbance and modification of the natural landform.

...

Objective 54: Conservation, preservation or enhancement of scenically attractive areas, including land adjoining water or scenic routes.

...

Objective 56: Preservation of natural vegetation of historic, local or particular visual significance.

PRINCIPLES OF DEVELOPMENT CONTROL

53 Development, including alterations and additions to buildings, should not be undertaken unless it involves a high standard of design with regard to external appearance, building materials, colours, siting and landscaping, so as to preserve and enhance the character of the locality or desired future character of an Area.

...

54 The design of a building may be of a contemporary nature and exhibit an innovative style provided the overall form is sympathetic to the scale of development in the locality and with the context of its setting with regard to shape, size, materials and colour.

55 Development should not be undertaken unless:

(a) it conforms with the desired future character of an Area; and

(b) it is sited so as to protect scenic views from public roads or reserves, and is not located on visually-significant ridgelines.

...

59 Building form should not unreasonably restrict existing views available from neighbouring properties and public spaces.

Rural Zone

Objective 6: Maintenance and enhancement of the landscape character.

...

Objective 21: Buildings and structures compatible with the environmental qualities, built form and character of the surrounding area and landscape.

PRINCIPLES OF DEVELOPMENT CONTROL

Landscape

4 Development should be designed and sited to respect and maintain the landscape character of an area which is of:

(a) historical (including archaeological) significance;
(b) scientific interest;
(c) scenic value or natural beauty;
(d) other heritage significance; or
(e) conservation significance.

...

18 Buildings and structures which have:

(a) a design scale, appearance and site to enhance the positive environmental qualities, built form and character of the locality;
(b) a site which is unobtrusive and screened from public roads and adjoining properties by:
  (i) natural landforms;
  (ii) existing vegetation;
  (iii) planting of appropriate vegetation;
(c) a requirement for minimal excavation or filling of land;
(d) a requirements [sic] for minimal removal of existing vegetation; and
(e) sites which are grouped together.

...

19 The external appearance and design of buildings and structures visible from a public road or waterway should minimise their visual obtrusiveness by:

(a) reducing the building's profile;
(b) reducing the mass of buildings into smaller components by variations in wall and roof lines; and
(c) using eaves, verandahs and similar techniques to create shadowed areas.

...

22 Wind farms and ancillary development should be located in areas outside of the Barossa Valley Character Preservation District as defined by Character Preservation legislation which provide opportunity for harvesting of wind and efficient generation of electricity and may therefore be sited:

(a) in visually prominent locations;
(b) closer to roads than envisaged by generic setback policy.

40 The Amended Consolidated Particulars of Development,[27] set out the following commitments by Tilt with respect to visual amenity:

---

[27] Exhibit 2R1 at p 19.

4.4 Landscape and Visual Impact Management

1. The final wind farm layout will not locate any wind turbine generator within 1 km of a non-involved landholder dwelling existing at 28 February 2014.

2. Once a micro-siting process has been undertaken for the 275 kV transmission pylons, the Second Respondent will consult with residents of dwellings located within 1 km of these lines regarding the extent of visual impact and whether landscape planting could assist with screening where relevant.

3. The extent of cut and fill requirements for access roads will be minimised by following natural contours and tops of ridgelines where practicable.

4. As far as possible road materials will be sourced locally to blend with existing landscape.

5. Vegetation screening will be established and maintained around the permanent Substation and Operations & Maintenance Compound.

6. Advertising, signs or logos will not be mounted on turbine structures, except those required for safety purposes.

7. Turbines will be located within approved ridgeline segments and spaced in an ellipse of no less than three times the rotor diameter by two times the rotor diameter. The ellipse will be oriented into the predominant wind direction.

8. Any external safety lighting provided for the operational phases will be designed to avoid or minimise light overspill, will be motion activated, and timed unless required for OH&S and maintenance work.

41 WTGs are not proposed to be located in the gullies, which are some of the more scenic areas.

42 We consider that the intent of those provisions which we have set out above is so clearly in favour of the establishment of wind farms in the Rural Zone, and so clearly dictates that the visual impact of the turbines and ancillary development is to be tolerated on account of the benefits perceived to be derived from wind farms, that, given the high degree of compliance by the proposed development with each element of Council wide PDC 397, the effect of reading all of the provisions of the Development Plan with respect to visual amenity is that the proposal must be assessed as acceptable in relation to the issue of visual amenity.

43 We have considered the submissions on behalf of the appellants that the proposed wind farm comprises too many WTGs and that the WTGs are too tall and their blades are too long. Given the size of the site and the varying gradient of the terrain, we do not consider that any of these objections resonates with the relevant provisions of the Development Plan with respect to visual amenity. Wind farms are sought in the Rural Zone.

Noise

44 The following provisions of the Development Plan are relevant to an assessment of the likely noise impact of the proposed WTGs on residents in the locality:

> **COUNCIL WIDE PROVISIONS**
>
> **OBJECTIVES**
>
> **Interface Between Land Uses**
>
> **Objective 25:** Development located and designed to prevent adverse impact and conflict between land uses.
>
> **Objective 26:** Protect community health and amenity and support the operation of all desired land uses.
>
> **Renewable Energy**
>
> **Objective 98:** Location, siting, design and operation of renewable energy facilities to avoid or minimise adverse impacts on the natural environment and other land uses.
>
> **PRINCIPLES OF DEVELOPMENT CONTROL**
>
> **Interface Between Land Uses**
>
> **87** Development should not detrimentally affect the amenity of the locality or cause unreasonable interference through any of the following:
>
> ...
>
> (b) noise;
>
> ...
>
> **88** Development should be designed and sited to minimise negative impact on existing and potential future land uses considered appropriate in the locality.
>
> **Noise**
>
> **92** Development should be designed, constructed and sited to minimise negative impacts of noise and to avoid unreasonable interference.
>
> **93** Development should be consistent with the relevant provisions in the current Environment Protection (Noise) Policy.

45 The "current Environment Protection (Noise) Policy" is the Environmental Protection (Noise) Policy 2007, which refers, in clause 34, to the *Wind Farms Environmental Noise Guidelines 2003.* Those guidelines were prepared and published by the SA Environment Protection Authority (the EPA). The EPA has now prepared and published the *Wind Farms Environmental Noise Guidelines 2009* ("the 2009 Guidelines"), which are clearly intended to supersede the 2003 Guidelines. All of the parties in this matter proceeded on the basis that it is appropriate to apply the 2009 Guidelines, and we will proceed on that basis also.

46 Tilt, as part of its proposed development, has put forward a series of noise impact management measures for both the construction and the operational[28] phase of the proposed wind farm. Among other things, Tilt proposes a management strategy to ensure compliance with the 2009 Guidelines and the World Health Organisation Guidelines for Community Noise (the WHO Guidelines). Tilt is to prepare a Construction Environmental Management Plan (CEMP) which will include a Construction, Vibration and Operational Noise Management Plan. Tilt will commit to comply with the provisions of those plans, and they will be overseen by the Environment Protection Authority (EPA).[29]

47 Mr Steven Cooper, an acoustic engineer, and Dr Bruce Rapley, who holds a BSc in Biological Systems, a MPhil in Technology and a PhD in Health Sciences, gave evidence in Mr McGregor's case. Dr Kristy Hanson, who holds a degree in Mechanical Engineering and a PhD, gave evidence in Mr Royal's case. Mr Chris Turnbull, an acoustic engineer, gave evidence in Tilt's case. The evidence of all of these witnesses related to some extent to the issue of the likely noise impact of the WTGs on the locality.

48 The 2009 Guidelines set out the following noise criteria for wind farms:[30]

> **2.2 Noise criteria – new wind farm development**
>
> The predicted equivalent noise level ($L_{Aeq,\ 10}$), adjusted for tonality in accordance with these guidelines, should not exceed:
>
> - 35dB(A) at relevant receivers in localities which are primarily intended for rural living, or
> - 40dB(A) at relevant receivers in localities in other zones, or
> - the background noise ($L_{A90,\ 10}$) by more than 5dB(A),
>
> Whichever is the greater, at all relevant receivers for wind speed from cut-in to rated power of the WTG and each integer wind speed in between.
>
> The background noise should be as determined by the data collection and regression analysis procedure recommended under these guidelines (Section 3). It should be read from the resultant graph at the relevant integer wind speed.

49 The 2009 Guidelines set out the method to be used in arriving at measurements of background noise and in obtaining wind speed data. They also set out, in considerable detail, the methodology to be used to predict the noise levels which will be associated with a wind farm. The 2009 Guidelines give direction as to the method to be used in analysing the data obtained, and compliance checking. They address tonality, providing that, where wind farm

---

[28] Exhibit 2R1 at p 21.
[29] Exhibit 2R1 at p 21.
[30] 2009 Guidelines at p 3 para 2.2.

noise exhibits a tonal characteristic, a 5dB(A) penalty is to be applied to the criteria.[31]

50 The 2009 Guidelines were developed by the Environment Protection Authority over a period of four years, with the assistance of a technical subgroup and input from stakeholders.[32] They are a refinement of the 2003 Guidelines. The 2009 Guidelines (and the 2003 Guidelines before them) set out the only comprehensive method for predicting and assessing the likely noise impact from a wind farm applicable in South Australia. The purpose of the adoption of a standard such as the 2009 Guidelines is to provide well researched and considered benchmarks against which proposals can be assessed. The process which yielded the 2009 Guidelines, and the 2003 Guidelines before them, is far more rigorous than any process a relevant authority, or this Court, could undertake. It is clear from the Introduction to the 2009 Guidelines, and from Council wide PDC 93, that it is intended, in a planning assessment, that a proposed development be assessed against the Guidelines.

51 Mr Turnbull undertook the process of predicting the noise level of the proposed wind farm in accordance with the 2009 Guidelines. Mr Turnbull's choice not to use "hard ground" as one of the parameters for the CONCAWE propagation model used to generate the predicted noise levels was the subject of some dispute. He made this choice because "hard ground" in the CONCAWE propagation model refers to a surface such as concrete or water. Most of the ground between the WTGs proposed and the residences in the locality is earth, much, though not all, of which is vegetated. For this reason, Mr Turnbull decided not to use "hard ground". For all other parameters, he made the most conservative choice. We are confident that Mr Turnbull's process for the prediction of the WTGs noise levels, and for all other things required by the 2009 Guidelines, was performed correctly and in accordance with the 2009 Guidelines. We reject the suggestion that "hard ground" should have been used in the CONCAWE propagation model, or that some other choice should have been made in the process in order to comply with the 2009 Guidelines.

52 The 2009 Guidelines distinguish between premises where the owner does not have an agreement with the wind farm developer and premises where the owner does have such an agreement. The 2009 Guidelines say the following with respect to landowners with agreements:

> **2.3 Agreements with wind farm developers**
>
> Wind farm developers commonly enter into agreements with the owners of private land suitable for a wind farm site. The agreement provides the wind farm developers with the appropriate siting and generally offers the landowner a level of compensation and diversity in their income stream.

---

[31] Exhibit 2R7 at para 22.

[32] 2009 Guidelines at p 1.

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.

However, the existence of an agreement will affect the consideration of whether the interference is unreasonable in a given situation. It is unlikely that there will be unreasonable interference if:

- a formal agreement is documented between the parties,
- the agreement clearly outlines to the landowner the expected impact of the noise from the wind farm and its effect upon the landowner's amenity, and
- the likely impact of exposure will not result in adverse health impacts (eg the level does not result in sleep disturbance).

A risk associated with relying on such agreements still remains where the criteria in these guidelines are exceeded. This is because an interpretation of 'unreasonable' is required in any future assessment of the impact of wind farm noise initiated by a complaint from the landowner (or future landowners).

World Health Organization Guidelines for Community Noise recommend 30dB(A) indoor limit to prevent negative effects on sleep. The Working Group on Noise from Wind Turbines (Final Report, ETSU for DTI, 1996) recommends the outdoor noise limit of 45dB(A) (after any adjustment for tonality) for landowners having financial involvement in the wind farm. If the wind farm noise does not exceed 30dB(A) indoors and 45dB(A) outdoors at the localities belonging to the financial stakeholders it is considered acceptable. In particular situations the expected noise impact can be above the recommended limits. In this case the landowner has to agree in writing with the higher level of exposure and the developer should discuss the issue with the EPA.

53 In his statement, Mr Turnbull noted the World Health Organization (WHO) Guidelines for Community Noise standards, including the indoor level of 30dB(A) to protect against sleep disturbance. Mr Turnbull said:[33]

> ... The indoor limit of 30dB(A) equates to an outdoor noise level of 45dB(A) with windows open or 52dB(A) with windows closed for a standard façade construction.

54 Mr Turnbull's assessment in relation to façade attenuation was substantiated by measurements made across 7 homes in different locations in Australia.[34] We accept Mr Turnbull's evidence on this point.

---

[33] Exhibit 2R7 at p 7, para 27.
[34] Exhibit 4A1.

55 Mr Turnbull applied the baseline of 45dB(A) outdoors at premises where a commercial agreement is in existence, in accordance with the WHO Guidelines. Mr Turnbull noted that one dwelling was the subject of an agreement which provided that, if the wind farm noise at the dwelling were to exceed 45d(B)A, the dwelling would not be inhabited.[35]

56 Mr Turnbull arranged for the monitoring of background noise levels in accordance with the 2009 Guidelines at various wind speeds at 18 locations near the proposed wind farm between 16 October 2013 and 11 June 2014. In selecting the locations, preference was given to residential locations where no commercial agreement exists and where it is likely that the wind farm noise would be at the higher end. Mr Turnbull said, in his statement:[36]

> The resultant background noise data for each monitoring location were correlated with the wind speed data measured at wind mast SAN01. A least squares regression analysis of the data was undertaken to determine the line of best fit for the correlations in accordance with the Guidelines. The data and the regression curves [footnote omitted] are shown in Appendix G. Based on the regression analysis, the background noise level ($L_{A90,\ 10}$) at integer wind speeds for the range between cut-in and rated power wind speeds is provided in Table 6.

Table 6: Background noise levels (dB(A)).

Monitoring Location ID	Background Noise Level (dB(A)) at Integer Wind Speeds											
	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s	14 m/s
ML3	21	22	23	23	24	25	26	27	27	28	28	28
ML14	23	24	25	26	27	27	28	29	30	31	33	34
ML22	30	30	31	31	32	32	33	35	36	38	41	44
ML24	25	25	26	27	28	30	31	33	35	38	41	44
ML28	24	25	25	26	26	26	27	27	27	27	27	28
ML32	27	27	28	28	30	31	33	34	36	37	38	39
ML34	24	23	23	24	26	28	30	33	35	37	39	41
ML42	32	31	31	31	32	33	34	35	37	39	41	43
ML43	24	25	26	28	30	32	34	35	37	38	38	38
ML45	28	28	28	28	29	30	31	32	33	35	37	38
ML51	27	27	27	27	28	29	30	32	33	35	37	39
ML55	25	26	27	28	29	30	30	31	32	34	35	37
ML90	29	28	29	30	31	33	35	37	38	39	40	39
ML91	26	25	25	26	27	28	29	31	32	33	34	34
ML94	25	25	25	26	27	28	29	30	32	33	35	36
ML100	25	25	26	27	28	30	31	32	33	33	32	30
ML116	30	29	28	28	28	29	30	31	32	34	35	37
ML119	27	28	29	30	31	33	34	36	38	40	42	44

57

58 Mr Turnbull then proceeded to make predictions about the noise from the wind farm, in accordance with the 2009 Guidelines. He used the sound power

---

[35] Exhibit 2R7 at para 30.

[36] Exhibit 2R7 at para 45.

levels of Vestas V117-3.3MW WTGs, which have a hub height of 91.5 metres. Mr Turnbull included predictions for the proposed transformers.[37]

59 Mr Turnbull said, in his statement:[38]

> 53. The CONCAWE noise propagation model has been used to model the noise from the WTGs and transformers. The CONCAWE model takes into account the influence of geometrical spreading, topography, ground absorption, air absorption and weather conditions. The CONCAWE model is endorsed in the Guidelines and is widely accepted as an appropriate noise propagation model. The predictions have been based on the following input conditions:
>
> - weather category 6 (night with no clouds);
> - atmospheric conditions at 10°C and 80% relative humidity;
> - wind direction from all WTGs to the particular residence under consideration, even in circumstances where WTGs are located in opposite directions from the residence; and
> - maximum barrier attenuation of 2dB.
>
> 54. The Guidelines provide a default prediction method which incorporates hard ground in the noise propagation model unless justification is provided for using another input. The CONCAWE propagation model separates ground attenuation into the categories of hard ground and ground with finite acoustic impedance. CONCAWE states that hard ground should be used for surfaces such as concrete or water and all other surfaces including grass or soil should be considered as finite acoustic impedance. The ground between the WTGs and residences is not concrete or water, and therefore a finite acoustic impedance (corresponding to grass or rough pasture within the CONCAWE model) has been used.
>
> **Predicted Noise Levels and Comparison against the Relevant Noise Criteria**
>
> 55. The noise level at the residences and vacant land in the rural living zone in the vicinity of the wind farm from the WTGs and transformers has been predicted for integer wind speeds ranging between the WTG cut-in (3 m/s) and rated power wind speeds (14 m/s). The predicted noise levels and the corresponding noise criterion at each residence and wind speed are provided in Table 9.
>
> 56. Based on the predictions, the noise from the 103 Vestas V117-3.3MW WTGs and two 200 MVA transformers will comply with the established criteria at all residences, for each integer wind speed between 3 m/s and 14 m/s.
>
> 57. Appendix I provides the predicted noise level contours at 11 m/s, which is the wind speed associated with the highest predicted noise levels.
>
> 58. The ISO9613-2 noise model has also been used to verify compliance with the criteria. Based on the use of the inputs recommended by the UK Institute of Acoustics, the noise from the 103 Vestas V117-3.3MW WTGs and two 200 MVA

[37] Exhibit 2R7, Tables 7 and 8.
[38] Exhibit 2R7 at paras 53 to 58.

transformers will comply with the established criteria at all residences, for each integer wind speed between 3 m/s and 14 m/s.

60 With respect to tonality, Mr Turnbull relied upon a report from "Delta" which measured the tonality from a Vestas V117-3.3MW WTG in Mode O. Delta found that the highest tonal component 120 metres from the turbine was 31dB. Mr Turnbull was able to extrapolate from this information the predicted tonal component at the residences. He found that the highest predicted tonal component would be -6 dB, which, he said, was below the threshold of perception at the frequency predicted.[39] No penalty therefore applies.

61 With respect to the substations, Mr Turnbull said:[40]

> 61. The noise from the substation will include a tonal component and if the tonal noise at residences is high enough, a penalty for tonality would be appropriate. However, predictions indicate that the highest noise from the substation will be 19 dB(A). At this level, any tonality would be masked by the ambient noise and/or the noise from turbines.

62 Mr Turnbull said:[41]

> 62. This assessment has been based on 103 Vestas V117-3.3MW WTGs to show that the proposed layout can achieve compliance with the Guidelines.
>
> 63. Subject to the project's approval, the final WTG will be selected through a detailed tender procurement process and Trustpower will repeat the assessment at that time to confirm the final selection of the make and model of WTG will achieve compliance with the Guidelines based on the latest noise data available at that time.
>
> 64. A preliminary assessment has been conducted for a scenario where the hub height is increased to 100 m. This assessment indicates that compliance with the Guidelines will still be achieved at all locations. Notwithstanding this preliminary assessment, the final WTG selection, layout and hub height will be assessed against the Guidelines at that time.
>
> 65. An Operational Noise Management Plan has been prepared and submitted as part of the application. This Plan provides a methodology to measure the operational noise from the wind farm following construction to confirm compliance with the Guidelines.

63 Mr Turnbull said the following with respect to infrasound and low frequency noise:[42]

> 66. Early wind turbines were constructed with blades located downwind of the tower. These turbines produced significant levels of infrasound (sound below 20Hz) as a result of the wake caused by the tower. Modern wind turbines are constructed with blades upwind of the tower, resulting in infrasound levels well below the level of perception at residential setback distances.

---

[39] Exhibit 2R7 at para 59.
[40] Exhibit 2R7 at para 61.
[41] Exhibit 2R7 at paras 62 to 65.
[42] Exhibit 2R7 at paras 66 to 76.

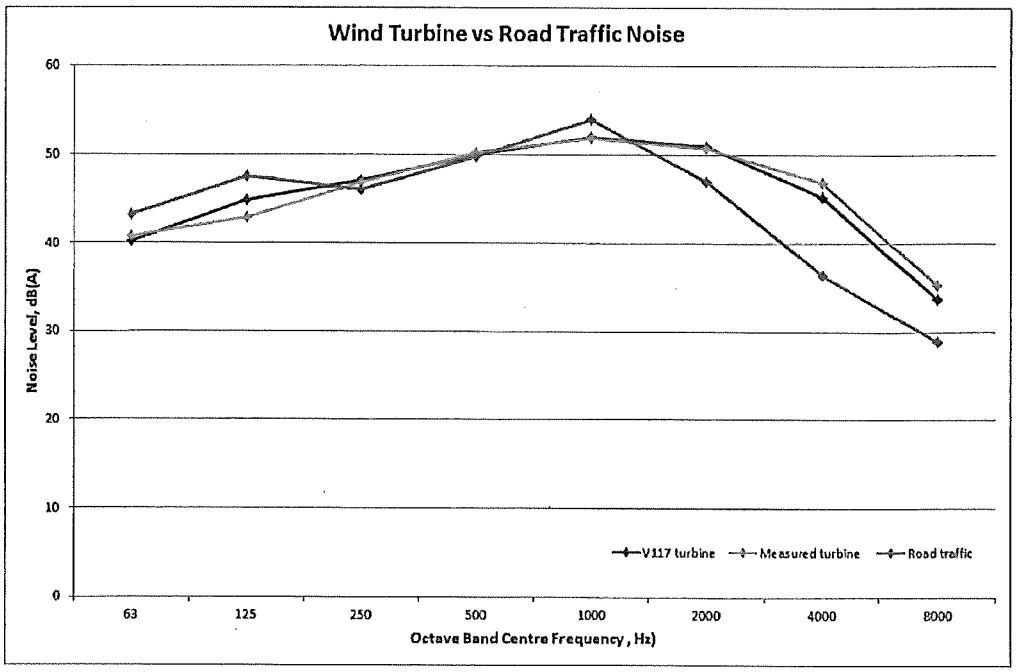
67. I have conducted studies into the level of infrasound produced by wind turbines. These studies confirm that the level of infrasound from wind turbines is no greater than the noise encountered from other natural and non-natural noise sources such as waves breaking. The results of these studies were presented at the fourth International Conference, Wind turbine Noise, 2011 in Rome [footnote omitted] and appeared as a peer reviewed paper in "Acoustics Australia", the journal of the Australian Acoustical Society [footnote omitted].

68. A study by the Environment Protection Authority into infrasound (Infrasound levels near wind farms and in other environments, January 2013) provided findings which were consistent with my studies, including:

- the measured levels of infrasound from wind farms are well below the threshold of perception; and
- the measured infrasound levels around wind farms are no higher than levels measured at other locations where people live, work and sleep; and
- the characteristics of noise produced by wind farms are not unique and are common in everyday life.

69. Noise sources that produce low frequency content (such as a freight train locomotive) have dominant noise content in the frequency range between 20Hz and 200Hz. Low frequency noise is often described as a "rumble".

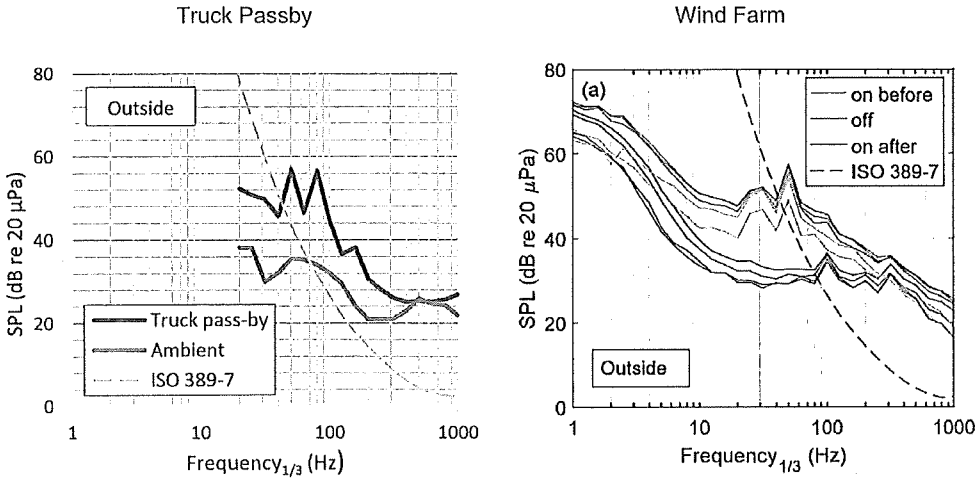
70. Contrary to the statements of Mr Cooper, Dr Hansen and Dr Rapley, the sound from a wind turbine is not dominant in the low frequency range. The main content of sound generated by a wind turbine is often in the area known generically as the mid-frequencies, being between approximately 160Hz and 1000Hz. This is demonstrated by the graph below, which shows a comparison of the spectra for road traffic noise and wind turbine noise.



71. The spectrum for the V117 turbine is based on the sound power level from Table 7, referenced to an overall level of 57 dB(A), which equates to a distance of approximately 120m. The measured turbine was a Vestas V90 3MW turbine measured at 140m from the hub with an overall level of 57 dB(A). The traffic noise measurement was an average over the day of 57 dB(A) at approximately 120m from the Northern Expressway.

72. The graph shows that the low frequency content of a wind turbine is similar to that of road traffic at a similar setback distance.

73. Sound reduces over distance due to a range of factors including atmospheric absorption. The mid and high frequencies are subject to a greater rate of atmospheric absorption compared to the low frequencies and therefore over large distances, whilst the absolute level of sound in all frequencies reduces, the relative level of low frequency sound compared to the mid and high frequency content increases. This is the same for wind turbines and other sources such as road traffic. To demonstrate the similarity in spectral content of a wind farm and road traffic, I have compared Figure 5(a) of Dr Hansen's draft statement with the noise recorded from a truck passby at approximately 1200m. The truck passby was recorded at Virginia, at approximately 1200m from Port Wakefield Road. The ambient noise was recorded immediately prior to the truck passby. The infrasound (sound below 20Hz) was not recorded for the truck passby and is therefore not shown.



74. The graphs show that the sound from a distant wind farm is similar in level and spectral content to the sound from a distant passing truck.

75. Low frequency sound produced by wind farms is not unique in overall level or content. Low frequency sound can be easily measured and heard at a range of locations at levels well in excess of the level in the vicinity of a wind farm.

76. The EPA has conducted a study of the noise from the Waterloo Wind Farm, which included the measurement of infrasound and low frequency noise. A conclusion of the study was that, "The EPA does not consider that there is sufficient evidence from the physical measurements of noise, to warrant a review of the Wind Farm Guidelines".

64 Mr Turnbull was the only witness who conducted measurements and predictions relating to noise in compliance with the 2009 Guidelines. Mr Turnbull has the relevant qualifications and a great deal of experience in the prediction of wind farm noise. His statement is comprehensive and his evidence was given with absolute confidence. We accept Mr Turnbull's evidence in its entirety.

65 Dr Hansen, in her statement, commented that the method of prediction in the 2009 Guidelines involved some "averaging" of the background noise levels.[43] Dr Hansen expressed concern that it would be possible, at times, for low background noise levels to coincide with worst case noise generation by the wind farm, at which time the noise levels specified in the 2009 Guidelines would be exceeded and there would be a detrimental impact upon amenity.

66 The 2009 Guidelines set out the policy in South Australia with respect to wind farm noise. The 2003 Guidelines, which are an earlier version, are referenced in the Development Plan. We do not consider that it is a reasonable approach to a noise assessment to point to a moment in time which would represent the absolute worst case scenario and condemn a proposal on that basis. The Development Plan speaks, in PDCs 87 and 92, of protection against "unreasonable" interference with amenity. The approach taken in the 2009 Guidelines is consistent with this.

67 Dr Hansen explained at length in her statement her reservations about the methods of measurement and prediction provided for in the 2009 Guidelines.[44] We have accepted that the 2009 Guidelines set out the method for predicting wind farm noise which is accepted in the Development Plan. We accept that the standards set out in the 2009 Guidelines are adequate to preserve amenity with respect to noise to the degree required by the relevant provisions of the Development Plan. Dr Hansen's complaints about the adequacy of the 2009 Guidelines really amounts to a personal view that a wind farm should be assessed against a very much more restrictive standard. It is not for us to impose such a standard in the face of the specific provisions of the Development Plan and the 2009 Guidelines.

68 Dr Hansen, in her statement, expressed concern at some length about low frequency elements of wind farm noise which, she said, differed from traffic noise.[45] In cross-examination, however, she was taken through those parts of Mr Turnbull's statement which deal with low frequency noise. The following exchange took place:[46]

---

[43] Exhibit 2A2 at para 5.1.
[44] Exhibit 2A2 at paras 6, 7 and 8.
[45] Exhibit 2A2 at para 9.2.
[46] Transcript at p 113, line 33 to p 114, line 22.

Q. Mr Turnbull's comment is that the sound from the distant wind farm is similar in level and spectral content to the sound of a distant passing truck. Now, do you agree with that or disagree with it.

A. I agree. But we don't know whether the truck is using its exhaust brakes and most people couldn't sleep if a truck was going past regularly.

Q. Yes. And one thing we shouldn't do, I would suggest to you, is compare the spectral content of road traffic noise up close to it with the spectral content of wind farm noise a long way away from it, because we know very well that for both sources we have far greater attenuation with distance of the mid to high frequencies and far less attenuation with distance of the low frequencies; correct.

A. Yes.

Q. So, as long as you're careful to compare like with like, I would suggest to you there's no real difficulty in applying the findings from studies that are concerned with road traffic noise to wind turbine noise, I would suggest to you.

A. No, because the studies which are related to road traffic noise consider continuous road traffic noise. Like, the hum that you hear in a typical residence, not the individual traffic noises such as truck pass byes, exhaust brakes and these unusual events.

69 Those paragraphs of Dr Hansen's statement which deal with infrasound, tonality and amplitude modulation really outline her fears that those matters may be inadequately allowed for in the 2009 Guidelines. These fears are not based on reliable data, and that material does not assist us in our assessment of the proposal against the Development Plan. In so far as her evidence touched on human health, we disregard it as it is beyond her expertise.

70 Dr Hansen's qualifications in mechanical engineering gives her the expertise to comment upon noise assessments. Her experience, however, does not include the undertaking of any comprehensive noise predictions of the kind undertaken many times by Mr Turnbull. Where the evidence of the two witnesses is at odds, we rely on Mr Turnbull's evidence.

71 Mr Cooper is a practising acoustic engineer, with some experience in monitoring the noise levels of existing wind farms.

72 Much of Mr Cooper's evidence related to his theories about the potential for a wind farm to have an impact upon human health, and we will deal with that evidence below.

73 With respect to noise, Mr Cooper was critical of the adequacy of the 2009 Guidelines. He had reservations about the use of dB(A) in the 2009 Guidelines. For the same reasons as those set out above in relation to Dr Hansen's evidence, we did not find that evidence useful in our assessment of the noise impacts of the proposal.

74 Mr Cooper did not undertake any noise predictions in relation to the proposed wind farm. He had not visited the site of the proposed wind farm.

75 None of Mr Cooper's evidence persuaded us that the proposed development would not be in conformity with the provisions of the Development Plan with respect to noise.

76 Dr Rapley holds a BSc, an MPhil and a PhD in Health Sciences where his thesis was titled "Sound in the military environment: Detection, measurement and perception".

77 Like Mr Cooper, much of Dr Rapley's evidence related to human health and will be discussed below.

78 In the joint statement of Dr Hansen, Mr Cooper, Dr Rapley and Mr Turnbull,[47] Dr Rapley said that his brief was to review the proposed development "in the context of potential biological and health-related impacts". We will consider those aspects of his evidence below. In so far as Dr Rapley's evidence related to the prediction of noise levels, we reject it as beyond his expertise and prefer the evidence of Mr Turnbull. Dr Rapley properly conceded in the joint statement that the issue of the most appropriate objective method of environmental noise assessment was beyond his expertise.[48]

79 The provisions of the Development Plan with respect to noise must be read together with the other provisions relevant to the assessment of a wind farm. Those provisions include the very clear indication that wind farms are sought in the Rural Zone. On the basis of Mr Turnbull's evidence, the proposed development is in sufficient compliance with the provisions of the Development Plan with respect to noise. The proposed wind farm will comply with the 2009 Guidelines. No credible evidentiary basis has been advanced to suggest that the noise from the wind farm will interfere unreasonably with other land uses.

Health

80 Council wide Objectives 25 and 26 in the Development Plan seek to protect community health and amenity.[49] Those objectives are, of course, to be read in the context of all of the applicable provisions of the Development Plan, including the Desired Character statement for the Rural Zone, which says that wind farms and ancillary development are envisaged in the relevant area of the Rural Zone.[50]

81 Dr Hansen, in her evidence, expressed concern about a potential for adverse effects on amenity or health to arise from infrasound generated by the proposed wind farm. Dr Hansen acknowledged that infrasound is below the normal human

---

47 Exhibit 2A3 at p 3.
48 Exhibit 2A3 at p 7.
49 See above at para 43.
50 Development Plan at pp 211 to 212.

audibility threshold,[51] however, she theorised that it may cause discernible pressure fluctuations which could cause annoyance.[52] We have quoted, above, paragraphs 66 to 76 of Mr Turnbull's statement.[53] As we have said, we accept Mr Turnbull's evidence and therefore accept that the level of infrasound from wind turbines is no greater than from other non-natural and natural noise sources such as waves breaking. We also accept that the characteristics of noise produced by wind farms are not unique and are common in everyday life. We do not consider that Dr Hansen's concerns about infrasound have been substantiated, and those concerns do not therefore weigh against the proposed wind farm.

82 Dr Rapley also put forward, in evidence, a theory about human responses to infrasound and low frequency noise. Dr Rapley believes that infrasound may stimulate the inner hair cells of the human ear.[54] He also believes that low frequency noise can affect the volume of fluid in the inner ear.[55] Dr Rapley is concerned that humans may sensitise to the effects of low frequency noise and infrasound, which will then aggravate adverse health effects.[56] Dr Rapley believes that low frequency noise can lead to stress.[57] Professor Wittert in his statement gave a brief critique of Dr Rapley's statement.[58] Professor Wittert pointed out that much of Dr Rapley's evidence was unreferenced and beyond Dr Rapley's expertise.[59] Professor Wittert said, in response to Dr Rapley's statement, that infrasound and LFN (low frequency noise) are ubiquitous in the environment and without harmful effects unless they reach very high sound pressure levels[60] (ie, well beyond those reached by WTGs). Professor Wittert pointed out that Dr Rapley's evidence about low frequency noise was based upon a paper by Dr Salt in which the theoretical concern was advanced, but it was conceded that no empirical evidence supported the theory.[61] Professor Wittert referred to subsequent data, including a study by Tobin, Brett and Colagiuri,[62] which further negate the notion that low frequency noise or infrasound from wind farms constitutes a health problem.

83 Whilst we accept that Dr Rapley is an expert in human responses to acoustic elements in the environment, we find that Professor Wittert is more qualified than Dr Rapley in the area of health and epidemiology. Professor Wittert's evidence was far better substantiated by scientific studies than Dr Rapley's and Professor Wittert was a more impressive witness. We

---

51 Exhibit 2A2 at para 9.24.
52 Exhibit 2A2 at para 9.26.
53 See above at para 61.
54 Exhibit 4A6 at para 16.13.
55 Exhibit 4A6 at para 16.13.
56 Exhibit 4A6 at para 18.1.
57 Exhibit 4A6 at para 19.
58 Exhibit 2R4 at pp 39 to 43.
59 Exhibit 2R4 at p 41.
60 Exhibit 2R4 at p 4.
61 Exhibit 2R4 at p 42.
62 Exhibit 2R4, Annexure 11.

prefer the evidence of Professor Wittert to the evidence of Dr Rapley with respect to human health.

84 Mr Cooper, in his evidence, also ventured into the area of health. Like Dr Rapley, he was concerned about potential sensitisation to wind farm noise.[63] Ultimately, Mr Cooper's concerns about noise were based upon the anecdotal evidence of nine residents who live in the general locality of the existing Waterloo Wind Farm and two residents who live in the general locality of the Bridgewater Wind Farm.

85 In his statement, Professor Wittert dealt with the problem of relying on anecdotal evidence:[64]

> Anecdotal evidence refers to evidence from anecdotes **(i.e. a short story taken from personal experience or observation)**. Such reports are often *cherry-picked and may not be representative of what is generally experienced by others in the population. Anecdotal evidence is therefore considered dubious support of a claim. This is true regardless of the veracity of individual claims.* Anecdotal evidence is open to misuse in a manner sometimes referred to as to the "person who" fallacy ("I know a person who ..."; "I know of a case where ..." etc). Individual cases prove nothing (e.g. "my grandfather smoked 40 a day until he died at 90" and "my sister never went near anyone who smoked but died of lung cancer").
> [http://en.wikipedia.org/wiki/Anecdotal_evidence]
>
> - Exceptional or confirmatory anecdotes are much more likely to be remembered. Psychologists have found that people are more likely to remember notable examples than typical examples.
>
> - Another problem with anecdotal evidence is that various forms of cognitive bias may affect the collection or presentation of evidence. For instance, someone who claims to have had an encounter with a supernatural being or alien may present a very vivid story. This phenomenon can also happen to large groups of people through a process known as subjective validation, whereby people consider information to be correct if it has any personal context and significance.
>
> - Anecdotal evidence is also frequently misinterpreted because it is easily obtainable, which leads to an overestimation of prevalence. Where a cause can be easily linked to an effect, people overestimate the likelihood of the cause having that effect (availability).
>
> - Vivid, emotionally-charged anecdotes seem more plausible, and are given greater weight.
>
> - Anecdotes may be incorrectly interpreted as evidence as a result of:
>
> - ***Fallacious reasoning*** such as the ***post hoc ergo propter hoc*** fallacy, which is the human tendency to assume that if one event happens after another, then the first must be the cause of the second.

---

[63] Exhibit 4A4 at para 320.
[64] Exhibit 2R4 at para 1.4.2.

- ***Inductive reasoning*** whereby an anecdote illustrates a desired conclusion rather than a logical conclusion, leading to hasty or faulty generalisations. For example, here is anecdotal evidence presented as proof of a desired conclusion:

There's abundant proof that drinking water cures cancer. Just last week I read about a girl who was dying of cancer. After drinking water, she was cured.

- In medicine, anecdotal evidence is also subject to placebo effects: it is well-established that a patient's (or doctor's) expectation can genuinely change the outcome of treatment. Only double-blind randomized placebo-controlled clinical trials can confirm a hypothesis about the effectiveness of a treatment independent of expectations. Moreover, placebo effects have been shown to work in the opposite direction i.e. the nocebo effect whereby expectation or anxiety about an adverse event make its occurrence more likely (Crichton, Dodd et al. 2013).

A further point to consider is that a statistical correlation between things does not in itself prove that one causes the other (a causal link). A study found that television viewing was strongly correlated with sugar consumption, but this does not prove that viewing causes sugar intake (or vice versa).

In science and logic, the "relative strength of an explanation" is based upon its ability to be tested, proven to be due to the stated cause, and verified under neutral conditions in a manner that other researchers will agree has been performed competently and can independently verify.

86 Professor Wittert, in his statement, also dealt with the anecdotal evidence directly.[65] We need not repeat Professor Wittert's evidence on this topic. In summary, Professor Wittert noted the presence of pre-existing health conditions in some of the residents reporting health problems which they attribute to the wind farm in their locality. Professor Wittert also noted some anomalies in the anecdotes, such as pressure in the ears being experienced when the turbines are not moving and the absence of any co-relation between the symptoms experienced and the noise characteristics measured by Mr Cooper at the same time.[66] Professor Wittert was cross-examined at length in relation to the issue of environmental sleep disorder. It was put to him that annoyance causes sleep problems. Professor Wittert said that there is no simple linear relationship from annoyance to sleep problems. There is a weak relationship between annoyance and sleep problems, however, a range of factors may feed into the annoyance, including antipathy, other emotions, depression, the effect of medication and may other things.[67]

87 Professor Wittert concluded in his statement, in relation to the anecdotal evidence:[68]

Opinion relating to Affidavits: It is possible that some people are particularly sensitive to, and annoyed by the noise generated by turbines, however taking all of the data

---

65 Exhibit 2R4 at pp 43 to 46.
66 Exhibit 2R4 at p 44.
67 Transcript at pp 1697 to 1698.
68 Exhibit 2R4 at p 46.

together there is no evidence to suggest that the operation of the turbines, in a compliant wind farm is responsible for Environmental Sleep Disorder. The most likely explanation for the sleep disturbance, when it does occur as described, is the presence of psychophysiological insomnia.

88 In his statement, Professor Wittert said:[69]

> In the report of Wang in relation to the Waterloo Wind Farm, 38% of respondents had raised complaints about noise to the developer, 25% to the local council, and 19% to the EPA, indicating, as the data from the Cullerin Range survey did, that where there is concern, people do complain. In this context, a recent study (Chapman, St George et al. 2013) was conducted across all Australian wind farms (51 with 1634 turbines) operating 1993-2012. Records of complaints about noise or health from residents living near the wind farms were obtained from all wind farm companies, and corroborated with complaints in submissions to 3 government public enquires, news media records and court affidavits. **These are expressed as proportions of estimated populations residing within 5 km of wind farms.** The results of this study show large historical and geographical variations in wind farm complaints. Of Australian wind farms, 33/51 (64.7%) including 18/34 (52.9%) with turbine size >1 MW have never been subject to noise or health complaints. These 33 wind farms have an estimated 21,633 residents within 5 km and have operated complaint-free for a cumulative 267 years. Western Australia and Tasmania have seen no complaints. Across Australia only 1 in 254 residents appear to have ever complained, with 94 (73%) being residents near 6 wind farms targeted by anti-wind farm groups. The large majority 116/129 (90%) of complainants made their first complaint after 2009 when anti wind farm groups began to add health concerns to their wider opposition. In the preceding years, health or noise complaints were rare despite large and small-turbine wind farms having operated for many years. It is considered that the reported historical and geographical variations in complaints are consistent with psychogenic hypotheses that expressed health problems are "communicated diseases" with nocebo effects likely to play an important role in the aetiology of complaints".

89 A nocebo effect in medicine occurs when a patient experiences an adverse effect following from treatment on account of an expectation that a negative effect would be experienced, and not as a result of the objective effect of the treatment. The term has come to be used in the discussion of wind farms to describe the situation where residents who expect to experience adverse health effects on account of the presence of a wind farm in fact experience adverse health effects arising from their negative expectation rather than any objective impact of the wind farm.

90 Dr McBride, an occupational physician, gave evidence in the fourth appellant's case. Dr McBride relied, to some extent, upon the anecdotal evidence referred to above, and, to that extent, we discount his evidence for the reasons set out above.

91 Dr McBride was concerned about the adverse health effects of the persistent interruption of a normal sleep pattern by noise and the possible emergence of environmental sleep disorder as a result. We do not consider, however, that

---

[69] Exhibit 2R4 at p 19.

Dr McBride's attribution of environmental sleep disorder and the disruption of sleep patterns to the operation of wind turbine was substantiated. In addition to his reliance on the anecdotal evidence, Dr McBride assumed that noise from wind turbines possessed "unique impulsive characteristics which, for a significant proportion of individuals, will be extremely annoying.[70] As we have said, above,[71] we accept the evidence of Mr Turnbull that the characteristics of noise produced by wind farms are not unique and are common in everyday life.[72]

92 Of all of the witnesses who gave evidence touching upon the topic of human health, Professor Wittert was the most qualified and experienced. Professor Wittert substantiated his opinion with a thorough and wide ranging literature review.

93 In his statement, Professor Wittert set out these conclusions:[73]

10. Conclusions

10.1 Wind farm Noise and adverse health effects

- There is no evidence that audible noise resulting from the operation of wind turbines constitutes a significant risk to health provided the development is compliant with current guidelines **(Appendix 9).**
- Annoyance is acknowledged to occur in a generally small, but probably variable number of individuals and the extent to which this is problematic in a compliant wind farm may depend more on non-acoustic than acoustic factors.
- There are undoubtedly some particularly noise sensitive individuals, but it would be surprising if their first awareness of this as adults occurred in the context of exposure to wind turbines. However, I am not aware of any specific enquiry in this regard.
- The weight of evidence is that when adverse health effects occur they are either circumstantially related or mediated by psychological distress, or both.
- The extent to which psychological distress and or sleep disturbance and/or other adverse health effects occur is dependent on a number of other internal and external factors (attitude, visual amenity, nocebo effects, financial interest, et cetera).

10.2 Low-frequency noise and Infrasound and adverse health effects.

10.2.1 Low-frequency noise

- The problem with low-frequency noise, as with high-frequency noise, relates to annoyance associated with audibility and the same range of moderating non-acoustic factors. There is no evidence that adverse health effects can be directly attributable to inaudible low-frequency sound emissions.

---

[70] Exhibit 4A23 at para 5.1.
[71] See above at para 62.
[72] Exhibit 2R7 at para 68.
[73] Exhibit 2R4 at para 10.

10.2.2 Infrasound

- There is no evidence that inaudible infrasound is associated with any significant physiological or pathophysiological consequences.
- There is no evidence that the level of infrasound produced by wind turbines constitutes a problem to health.

94 We accept all of Professor Wittert's evidence and his conclusions.

95 We do not consider that the proposed wind farm is at odds with Council wide Objective 26 of the Development Plan with respect to health. As to amenity, we accept that, from time to time, the noise and the appearance of the turbines and associated infrastructure will annoy some of the residents in the locality and some visitors to the locality. In our opinion, however, compliance with the 2009 Guidelines will ensure that the noise from the turbines will be kept within limits such as to preserve amenity to the degree contemplated by the Development Plan having regard to all of the relevant provisions.

Ecology

Native Vegetation Clearance

96 The Development Plan provides:

Council wide Objectives

Natural Resources

Objective 51: Native flora, fauna and ecosystems protected, retained, conserved and restored.

Objective 52: Restoration, expansion and linking of existing native vegetation to facilitate habitat corridors for ease of movement of fauna.

Objective 53: Minimal disturbance and modification of the natural landform. Conservation

Objective 54: Conservation, preservation or enhancement of scenically attractive areas, including land adjoining water or scenic routes.

Conservation

Objective 55: Preservation and replanting of roadside vegetation.

Objective 56: Preservation of natural vegetation of historic, local or particular visual significance.

...

Objective 58: Retention of environmentally-significant areas of native vegetation.

PRINCIPLES OF DEVELOPMENT CONTROL

Biodiversity and Native Vegetation

168 Development should retain existing areas of native vegetation and where possible contribute to revegetation using locally indigenous plant species.

169 Development should be designed and sited to minimise the loss and disturbance of native flora and fauna.

170 The provision of services, including power, water, effluent and waste disposal, access roads and tracks should be sited on areas already cleared of native vegetation.

171 Native vegetation should be conserved and its conservation value and function not compromised by development if the native vegetation does any of the following:

(a) provides an important habitat for wildlife or shade and shelter for livestock;

(b) has a high plant species diversity or includes rare, vulnerable or endangered plant species or plant associations and communities;

(c) provides an important seed bank for locally indigenous vegetation;

(d) has high amenity value and/or significantly contributes to the landscape quality of an area, including the screening of buildings and unsightly views;

(e) has high value as a remnant of vegetation associations characteristic of a district or region prior to extensive clearance for agriculture;

(f) is growing in, or is characteristically associated with a wetland environment.

172 Native vegetation should not be cleared if such clearing is likely to lead to, cause or exacerbate any of the following:

(a) erosion or sediment within water catchments;

(b) decreased soil stability;

(c) soil or land slip;

(d) deterioration in the quality of water in a watercourse or surface water runoff;

(e) a local or regional salinity problem;

(f) the occurrence or intensity of local or regional flooding.

173 Development that proposes the clearance of native vegetation should address or consider the implications that removing the native vegetation will have on the following:

(a) provision for linkages and wildlife corridors between significant areas of native vegetation;

(b) erosion along watercourses and the filtering of suspended solids and nutrients from run-off;

(c) the amenity of the locality;

(d) bushfire safety;

(e) the net loss of native vegetation and other biodiversity.

174 Where native vegetation is to be removed, it should be replaced in a suitable location on the site with locally indigenous vegetation to ensure that there is not a net loss of native vegetation and biodiversity.

175 Development should be located and occur in a manner which:

(a) does not increase the potential for, or result in, the spread of pest plants, or the spread of any non-indigenous plants into areas of native vegetation or a conservation zone;

(b) avoids the degradation of remnant native vegetation by any other means including as a result of spray drift, compaction of soil, modification of surface water flows, pollution to groundwater or surface water or change to groundwater levels;

(c) incorporates a separation distance and/or buffer area to protect wildlife habitats and other features of nature conservation significance.

176 Development should promote the long-term conservation of vegetation by:

(a) avoiding substantial structures, excavations, and filling of land in close proximity to the trunk of trees and beneath their canopies;

(b) minimising impervious surfaces beneath the canopies of trees;

(c) taking other effective and reasonable precautions to protect both vegetation and the integrity of structures and essential services.

177 No change of land use should occur in or near areas of native vegetation which is likely to adversely impact on the vegetation.

178 The provision of services, including power, water, effluent and waste disposal, access road and tracks should be effected over areas already cleared of native vegetation or, if this is not possible, cause the minimum interference or disturbance to native vegetation.

179 Land should not be divided, or allotment boundaries rearranged in a way which increases the number of allotments or part allotments over areas of native vegetation or adjoining areas of native vegetation, and which provides for development to occur without the need to clear native vegetation.

180 Development or change in land use which has the potential to damage or interfere with the hydrology or water regime of a swamp or wetland, or pollution of surface or groundwater, through its proximity of location or other reasons, should not occur.

181 Trees and other vegetation, including native flora and bushland remnants which are of:

(a) special visual, historical, cultural or scientific significance or interest or heritage value;

(b) existing or possible future value in the screening of a building or unsightly views;

(c) existing or possible future value in the provision of shade or as a windbreak;

(d) existing or possible future value in the prevention of soil erosion;

(e) value as a habitat or feeding area for native fauna;

should be conserved and their value and function not compromised by development.

Design Techniques *(Design Techniques illustrate ONE WAY of meeting the criteria in the associated principle of development control)*

181.1 Vegetation within 10m of a watercourse should not be removed other than declared noxious species

181.2 Where noxious species join a watercourse and are removed it should not encourage erosion.

182 Buildings and other structures should not be sited adjacent to native vegetation where such siting will necessitate the clearance of vegetation to ensure the safety of the proposed structure from fire hazard.

183 Development should not increase the potential for, or result in, pest plant infestation of areas of native vegetation.

184 Roadside vegetation should be preserved and replanted where practical.

RURAL ZONE

Vegetation and Landscape Character

Objective 5: Retention and maintenance of wetlands and existing native vegetation for its conservation, biodiversity, and habitat value and environmental management function.

Objective 6: Maintenance and enhancement of the landscape character.

97 These provisions must, of course, be read in context of all of the relevant provisions of the Development Plan, including those which indicate that wind farms are a kind of development which is envisaged in the Rural Zone.

98 On the basis of the evidence of Mr Allen, a civil engineer, we are satisfied that the civil construction works can be undertaken in such a way so that issues

such as stormwater and land stability are managed appropriately.[74] There was no serious challenge to this evidence.

99 In the Flora and Fauna Assessment Report prepared by EBS Ecology ("the EBS Report"),[75] among other things, the results of a vegetation survey, a fauna survey and a bird survey of the site and its locality were given. The report gave the following information about native vegetation:

> **Potential Impacts**
>
> Impact on vegetation will be in the form of direct clearance, trimming and compaction, mostly during the construction phase. The operational phase of the wind farm is less threatening to native vegetation however site management measures will be necessary to prevent impacts associated with vehicle access, disturbance and weeds.
>
> Based on the current turbine and infrastructure layout (at July 2014) the maximum clearance area of native vegetation will be 257.83 hectares. Most of the turbines and associated infrastructure are to be located in degraded areas of grassland with a small percentage of native vegetation cover persisting in the form of scattered native grasses and herbs, *Lomandra effusa* (Scented Mat-rush).
>
> The Significant Environment Benefit (SEB) calculated to offset the clearance of native vegetation is 384.75 ha or a payment of $446,732.75 into the Native Vegetation Fund.
>
> Birds and bats are considered at-risk fauna groups in relation to wind farm developments and are potentially at risk of direct collision with turbines and a range of other disturbance effects. Based on a risk assessment, the likelihood of collision causing mortality was deemed unlikely for the raptor species known from the site, unlikely for five threatened bird species known from the site, and rare for two threatened bird species likely to occur at the site. Mortality as a consequence of collision could impact on local populations but the impact would be insignificant at the species level. The overall level of risk for all species was determined as low.
>
> **Constraints and mitigation measures**
>
> Trustpower made a number of revisions to the turbine and infrastructure layout in response to recommendations by EBS Ecology. An exclusion zone has been adopted around:
>
> - Heritage Agreement;
> - Lomandra exclusion zones (EPBC category B) – nationally threatened ecological community. It is recommended that avoidance of all EPBC sites occur, however if this is not possible, and if there is a potential impact, this will be assessed within an EPBC Referral;
> - Lomandra exclusion zones (Potentially category B) – potential threatened ecological community. It is recommended that avoidance of all EPBC sites occur, however if this is not possible, and if there is a potential impact, this will be assessed within an EPBC Referral;

---

[74] Exhibit 2R26.

[75] Exhibit 1R3 at p 1065.

- Turbine exclusion zones – known Wedge-tailed Eagle (500 m buffer between turbines) and Peregrine Falcons nesting sites (1000 m buffer between turbines).

EBS Ecology recommends that the following sensitive areas should be avoided where possible:

- threatened flora and fauna records;
- native vegetation of good to excellent condition (with a SEB score of 7:1 – 10:1);
- woodland habitats;
- significant roadside sites;
- native vegetation along narrow public roads;
- scattered trees (including dead trees);
- creeklines;
- preferred fauna habitat including riparian habitats and rocky outcrops.

Where possible, avoidance of native vegetation has been embedded into the wind farm design. Where complete avoidance of native vegetation is not possible, Trustpower will endeavour to minimise the level of impact on native vegetation through micro-sighting [sic] of infrastructure. Trustpower is committed to utilising existing access tracks and will avoid clearing individual trees, where possible. EBS Ecology has proposed several alternative access track routes in areas B and C to minimise the impact on sensitive vegetation.

100 Subsequently, as we have said, the number of WTGs was reduced from 114 to 103. Dr How calculated that the footprint of the proposed development before the Court would be approximately 163 hectares. More than 125 hectares of this area is highly degraded grassland dominated by exotic species. The remaining 38 hectares is native vegetation which it is proposed to clear. Dr Debus agreed with those calculations.[76]

101 In evidence, Dr How said that he had calculated that the area of vegetation to be cleared in Milendella Road near to Mr Royal's property would be $40m^2$.[77]

102 In its Amended Consolidated Particulars of Development,[78] Tilt made the following commitments with respect to the clearance of native vegetation:[79]

...

7. Existing access tracks will be used where possible to minimise additional disturbance.

---

[76] Exhibit 3A4 at p 2.
[77] Transcript at p 860.
[78] Exhibit 2R1.
[79] Exhibit 2R1 at p 20.

8. Clearance of significant native vegetation will be minimised as an objective of the detailed layout planning stage and the micro-siting stage, where complete avoidance is not possible.

9. Additional detailed micro-siting in Area C will be undertaken at the detailed layout design stage to incorporate, where practical, alternative access routes in order to minimise impact on Peppermint Box trees.

...

12. Where possible, options for an equivalent on-ground SEB in the local area will be given a priority over a financial contribution to the NVC, provided that the option has the full agreement of the landowners and the NVC.

103 SEB refers to an environmental benefit of significant value under the *Native Vegetation Act 1991*.[80]

104 The EBS Report[81] said that no EPBC (Environment Protection and Biodiversity Conservation Act 1999 Commonwealth) listed flora species were likely to occur within the project area. The report said that the following conservation significant species were likely to occur in the project area:[82]

- *Aristida australis*
- *Austrostipa oligostachya* (Fine-headed speargrass)
- *Lachnagrostis robusta* (Tall Blown-grass)
- *Maireana rohrlachii* (Rohrlach's Bluebush)
- *Eucalyptus fasciculosa* (Pink gum)
- *Mentha diemenica* (Slender mint)
- *Ptilotus erubescens* (Hairy-tails)

105 The report recommended that clearance of these species be avoided. This can be provided for in the Construction Environmental Management Plan (CEMP).

106 Dr Munday, a former member of the Native Vegetation Council of SA, gave evidence in Mr Royal's case. Dr Munday believes that the clearance of roadside vegetation proposed in Milendella Road for the installation of the 33 kV transmission line need not occur, and that the transmission line could be located elsewhere. Dr How, a principal of EBS Ecology who gave evidence in Tilt's case, disagreed. He considered that the siting proposed was an acceptable option.

---

[80] See *Native Vegetation Act 1991* Part 4A.
[81] Exhibit 1R3 at p 1221.
[82] Exhibit 1R3 at p 148.

Mr Royal gave evidence at length with respect to his ideas about the alternative siting for the 33 kV transmission line. It is clear to us from Mr Royal's evidence[83] that, as at the time of trial, no realistic and environmentally superior alternative for the siting of the 33 kV transmission line was available to Tilt.[84]

107 Mr Bonney, who described himself as "a self-educated botanist and ecologist and locally acknowledged authority on South Australian Native Vegetation and Ecosystems",[85] gave evidence in Mr McGregor's case. In summary, Mr Bonney is opposed to the clearing of any native vegetation for a wind farm. He considers that all native vegetation has value as habitat as well as landscape value. Mr Bonney was concerned that construction dust would have a significant, long-term impact on flora and fauna.

108 Dr How has a PhD and several degrees in Applied Science in National Resource Management, including an Honours Degree. He has 15 years experience as an ecologist. EBS Ecology conducted rigorous field and literature investigations for Tilt in relation to this application. We are confident that the potential for impact on native vegetation by the construction and operation of the WTGs and ancillary development has been accurately identified in the EBS Report.[86] Where the evidence of Dr How is different from the evidence of Dr Munday and Mr Bonney, we prefer the evidence of Dr How. We accept Dr How's evidence that, using the advice of Dr How's firm, EBS Ecology, and advice from the Department of Environment Water and Natural Resources, the clearance of native vegetation for the proposed development will be minimised.[87] We do not consider that the removal of roadside vegetation in Milendella Road is of sufficient ecological significance to render the proposed transmission line contrary to the provisions of the Development Plan. In saying this, we bear in mind the provisions of the *Electricity (Principles of Vegetation Clearance) Regulations 2010* generally and with respect to the requirement for buffer zones around power lines.

109 We agree with Dr How that construction dust will not pose an appreciable danger to flora. We accept that impact upon environmentally significant native vegetation will be minimal on account of the micrositing of the WTGs. Dr How said that the siting of the proposed development had avoided important vegetation communities such as Lomandra Grassland and Peppermint Box Woodland.[88] We note that some amendments to the proposal have occurred to minimise interference with environmentally significant native vegetation. There is no doubt that a considerable area, in aggregate, of native vegetation, will be cleared in the construction phase. However, the Development Plan envisages that WTGs and ancillary development will be established in the Rural Zone in

---

83 Transcript at pp 1276 to 1300.
84 See also Exhibit 2R30 at para 40.
85 Exhibit 3A14 at p 2.
86 Exhibit 1R3 at p 1065.
87 Exhibit 2R9 at p 5.
88 Exhibit 2R9 at pp 5, 6 and 19.

visually prominent locations such as ridgelines.[89] It must have been understood that some clearance of native vegetation would be necessary to bring this about. The large scale of a wind farm, in terms of the spread of components, is explicitly acknowledged in the Rural Zone Desired Character statement.

Birds

110 Council wide Objective 58, Council wide PDC 169, 171, 173, 174 and 181, and Rural Zone Objective 5 are all set out above and all speak to the desirability of the preservation of native wildlife. They must be read together with the Desired Character statement for the Rural Zone, which says that wind farms and ancillary development are envisaged within the Zone. They must also be read with the other provisions of the Zone, including Objectives 1 and 2 which provide as follows:[90]

> **Objective 1:** Long-term operation and sustainability of rural production and primary industries.
>
> **Objective 2:** Accommodation of wind farms and ancillary development outside of the Barossa Valley Character Preservation District as defined by Character Preservation legislation.

111 The Rural Zone, in which the proposed development is to be sited, is a Zone for rural production, primary industries and wind farms. It is not, for example, a Conservation Zone. We bear this in mind when considering the evidence with respect to wildlife.

112 Dr Debus, who gave evidence in Mr McGregor's case, was concerned about the potential impact of the WTGs upon Peregrine Falcons, Wedge-tailed Eagles and other raptors. We accept that there are raptor nests in the locality of the site of the proposed development, although there is a dispute of fact about how many nests exist. Dr Debus was concerned about the following possible impacts upon raptors, particularly Peregrine Falcons and Wedge-tailed Eagles:[91]

- disturbance to raptor breeding sites, both during the construction phase and once the wind farm is operational;
- the possible reduction in habitat for raptor prey on account of the clearance of native vegetation; and
- the risk of a raptor colliding with a WTG blade, causing injury and/or death.

113 Dr Debus thought that, in the event that the wind farm proceeded, the buffer distance between a Peregrine Falcon nest and the nearest WTG should be at least

---

[89] Development Plan at p 211.
[90] Development Plan at p 212.
[91] Exhibit 3A3.

1500 metres and the buffer distance between a Wedge-tailed Eagle nest and the nearest WTG should be 2 kilometres.[92]

114 Dr Debus was also concerned about woodland birds. He acknowledged that the clearance of native vegetation was not as extensive as he had thought when he formed his opinion,[93] and he acknowledged that offsets could be offered by way of regenerating areas of vegetation to improve it as habitat, however, he remained concerned that woodland bird habitat might be reduced, and then movement corridors might be disrupted.

115 Mr Bonney, who also gave evidence in Mr McGregor's case, was also concerned about raptors and woodland birds for much the same reasons as those expressed by Dr Debus.

116 Mr Bonney described himself as self-educated.[94] We accept that Mr Bonney has acquired a considerable body of information about wildlife in the Mount Lofty region, however, this does not make him an expert in the legal sense. Dr Debus holds a PhD in Zoology (in addition to a MSc in Zoology, a BA in Biology/Behavioural Science, a Diploma in Natural Resources and a Diploma of Education), which is a relevant qualification. We accept that he is an expert on wildlife.[95]

117 Dr Debus' ability to give persuasive evidence in this matter was, however, impeded by the scope of what he was able to do in preparation for giving evidence. It also became clear in cross-examination that Dr Debus, in his literature review, had been selective in the articles he had chosen to highlight and had interpreted his sources as giving cause for a great deal more concern for the impact of the wind farm upon raptors than was evident from an impartial reading of those sources.[96] Dr Debus was not focussed upon assessing the proposed development in the light of the provisions of the Development Plan which relate to ecology; rather Dr Debus was concerned to try to prevent any risk to raptors or woodland birds arising.

118 Dr How supervised the EBS Ecology Report lodged as part of the application. His qualifications and experience make him an expert in the field of the impact of development on the ecology of the site and its locality. Dr How demonstrated a depth of knowledge about the proposed development which Dr Debus, understandably, had not been able to acquire. Dr How approached the assessment of the proposed development in a balanced manner, paying regard to the relevant provisions of the Development Plan.

---

92 Exhibit 3A3 at p 8.
93 Exhibit 3A4 at p 2.
94 Exhibit 3A14 at p 2.
95 Exhibit 3A3 at p 16.
96 Transcript at pp 429 to 447.

119 In his statement, Dr How said:[97]

> A total of twelve terrestrial native non-avian fauna were recorded across the site, none of which held a conservation rating. Dedicated surveys were undertaken for the EPBC listed Pygmy Blue-tongue Lizard (*Tiliqua adelaidensis*); it was considered unlikely that this species would occur in the project area due to habitat unsuitability. A total of 1,923 individuals from 66 bird species were observed across the Palmer footprint. Out of the 66 bird species, one was listed as migratory under the EPBC Act and five bird species with a State conservation rating were observed.
>
> Key habitat features within the project area are represented by: the vegetation associations recorded on site, within the gorges bordering the project boundary, by the numerous creeklines and low lying areas that provided habitat for waterfowl, from dams that provide artificial water sources for birds, bats and reptiles, rocky outcrops and granite boulders in pasture and woodland areas, and tree hollows present within eucalypt woodland sites. Removal of these key habitats will be avoided by Trustpower with regard to turbine and infrastructure placement. Avoidance of intact native and wooded vegetation has been embedded into the wind farm layout with most turbines located in degraded areas of grassland with a small percentage of native vegetation cover persisting in the form of scattered native grasses and herbs. Conservation Zones such as the Barossa Protection zone and several Heritage Agreements within the wind farm footprint, will not be impacted upon.

120 Dr How considered field observations of the wind farm site and studies on the collision of birds and bats with WTGs. He acknowledged that the WTGs pose a risk to raptors and bats, but assessed the risk as low. He considered that the risk would be adequately mitigated with a buffer of 1000 metres between any WTG and any Peregrine Falcon nest and a buffer of 500 metres between any WTG and any Wedge-tailed Eagle nest. Dr How pointed out that considerable work has already gone into modifying the original proposal so that the layout of the WTGs and ancillary development minimises impact to flora and fauna.[98] Dr How was satisfied that the impact on fauna, including woodland birds, would be acceptable.[99] Dr How was not concerned that the wind farm would adversely affect any of the other fauna raised in the evidence of Dr Debus and Mr Bonney, including echidnas and lizards.[100] There was a dispute as to the location of some raptor nests. The wording of a condition to ensure that all of the nests are located and protected has been agreed between the parties.

121 We accept Dr How's evidence in its entirety. It is obvious that a wind farm cannot be constructed in the Rural Zone without some disturbance to wildlife and vegetation. The same could be said of other land uses sought by the Development Plan in the Rural Zone. We do not consider that the proposed development is contrary to the provisions of the Development Plan which relate to wildlife or native vegetation.

---

[97] Exhibit 2R9 at p 9.
[98] Exhibits 3A4 and 2R9.
[99] Exhibit 2R9 at p 19.
[100] Exhibit 3A15 at p 3.

Shadow flicker, blade glint, blade throw and ignition risk

122 Shadow flicker was described by Dr Gilbert, in his statement, as follows:[101]

> Shadow flicker involves the modulation of light levels resulting from the periodic passage of the blade of a rotating wind turbine blade between the sun and a viewer.

123 Council wide PDC 398(a) says:-

> **398** Wind farms and ancillary development should avoid or minimise the following impacts on nearby property owners/occupiers, road users and wildlife:
>
> (a) shadowing, flickering, reflection or glint;

124 Dr Gilbert holds a PhD in Aerospace Engineering. He is a Principal Engineer at DNV GL (formerly Garrad Hassan). We accept that he is an expert in relation to shadow flicker. Dr Gilbert gave evidence in Tilt's case.

125 In his evidence, Dr Gilbert referred to the Australian Draft National Wind Farm Development Guidelines (Draft National Guidelines), published by the Environment Protection and Heritage Council (EPHC) in 2010 (The Draft National Guidelines). In his statement, Dr Gilbert said:[102]

> ... The Draft National Guidelines provide recommendations for shadow flicker limits that may be considered relevant to wind farms in South Australia. In addition, the Draft National Guidelines provide background information, a proposed methodology, and a suite of assumptions for assessing shadow flicker durations in the vicinity of a wind farm.
>
> The Draft National Guidelines recommend that the modelled theoretical shadow flicker duration predicted using the recommended methodology should not exceed 30 hours per year, and that the measured actual shadow flicker duration should not exceed 10 hours per year. The Draft National Guidelines also recommend that the shadow flicker duration at a dwelling be assessed by calculating the maximum shadow flicker occurring within 50 m of the centre of the dwelling.
>
> The method used to calculate the theoretical annual shadow flicker duration at a dwelling examines the possibility of experiencing shadow flicker from a purely geometrical standpoint. The shadow flicker analysis was performed using the *DNV GL WindFarmer Analyst* software package. WindFarmer incorporates a model which describes the path of the sun throughout the year, and can calculate the relative position of the sun, wind turbines, dwellings, and terrain to predict the shadow flicker durations in the vicinity of the wind farm site.

126 Dr Gilbert undertook a shadow flicker assessment of the proposed development. His conclusion was as follows:[103]

> When assessed under the Draft National Guidelines, and considering likely reductions in shadow flicker due to cloud cover and turbine orientation, the predicted annual shadow

---

[101] Exhibit 2R27 at p 2.
[102] Exhibit 2R27 at pp 2 to 3.
[103] Exhibit 2R27 at p 4.

> flicker durations at dwellings in the vicinity of the proposed Palmer Wind Farm are within the recommended limits, with the sole exception of a stakeholder dwelling that will be vacated once the wind farm is operational. These shadow flicker limits have been established to limit the potential annoyance caused by shadow flicker to reasonable and acceptable levels for persons residing in the vicinity of a wind farm. In the unlikely event that an individual finds that the annoyance caused by shadow flicker durations below the recommended limits is unacceptable, vegetation, screening structures, or heavy blinds or shutters may be used to reduce the shadow flicker experienced at the affected dwelling.
>
> Based on these results, it is my opinion that the proposed Palmer Wind Farm is compliant with the shadow flicker limits recommended in the Draft National Guidelines, having been designed to restrict the impacts of shadow flicker to acceptable levels, and is therefore consistent with Principle of Development Control 398(a).

127 Mr Formby, a local resident and member of the Eastern Mount Lofty Landscape Guardians Inc ("the Landscape Guardians"), gave evidence in relation to shadow flicker. Mr Formby accepted that he had no formal expertise in relation to shadow flicker. In his written statement,[104] Mr Formby expressed some concern about shadow flicker from the proposed wind farm, particularly in relation to vehicle drivers on roads near the WTGs.

128 Dr Gilbert has the relevant expertise and applied it in undertaking modelling to assess the proposed development against the most appropriate standard. We accept his evidence. We consider that the proposed development is sufficiently compliant with Council wide PDC 398(a) with respect to shadow flicker.

129 Blade glint is the reflection of the sun from a rotating WTG blade. Dr Gilbert said, in his statement, that blade glint is not a problem for modern turbines when the blades are coated with a non-reflective paint.[105] Such paint is standard among WTGs made by all major WTG manufacturers.[106] We accept Dr Gilbert's evidence and we are satisfied that Council wide PDC 398(a) will be complied with in relation to blade glint.

130 Dr Gilbert provided a statement in relation to blade throw in which he said:[107]

> Blade throw describes the phenomenon in which a structural failure occurring in a blade of a wind turbine during operation results in parts of the blade being propelled into the surrounding area.

131 Dr Gilbert further said:[108]

> Modern wind turbines and turbine components supplied by major manufacturers are generally designed and certified in accordance with recognised international standards to

---

[104] Exhibit 3A21 at p 4.
[105] Exhibit 2R27 at p 5.
[106] Exhibit 2R27 at p 6.
[107] Exhibit 2R28 at p 2.
[108] Exhibit 2R28 at pp 2 to 3.

ensure structural integrity and safe operation over the lifetime of the turbine. Besides meeting the required design and manufacturing standards, modern wind turbines incorporate sophisticated lightning protection systems to guard against damage caused by lightning strikes and are designed to shut down during high wind speed conditions and in response to a range of faults. Additionally, high quality operational monitoring and maintenance programs at wind farms ensure that turbine faults are prevented or are detected and rectified at an early stage, thus minimising the risk of serious or dangerous problems developing.

International Standard IEC 61400-1 "Wind turbines – Part 1: Design requirements" establishes the minimum requirements for the design of wind turbines and turbine components with the objective of avoiding structural failure and the consequential risk of personal injury or damage to property throughout the lifetime of the turbine. Other international standards that apply to the design and certification of wind turbine blades include IEC 61400-23 "Wind turbine generator systems – Part 23: Full-scale structural testing of rotor blades", which specifies the requirements for testing the structural integrity of turbine blades, and IEC 62305-1/3/4 "Protection against lightning". Turbines installed in Australia typically have certification that they have been designed in accordance with IEC 61400-1.

Blade throw incident rates established by researchers developing guidelines for the Dutch Wind Turbine Risk Zoning Handbook (**Dutch Handbook**) based on the equivalent of 43,000 turbine years of operational data, suggest that the likelihood of loss of an entire blade is 8.4×10^{-4} incidents per turbine per year (1 incident per 1190 years per turbine) [i]. In the same study, the risk of loss of a blade tip fragment was found to be 1.2×10^{-4} incidents per turbine per year (1 incident per 8333 years per turbine). The 2014 revision of the Dutch Handbook also gives the risk of loss of an entire blade as 8.4×10^{-4} incidents per turbine year (1 incident per 1190 years per turbine), based on turbine operational data recorded from 2001 to 2010 [ii]. Another study performed on behalf of the UK Health and Safety Executive calculated the likelihood of blade failure and detachment based on historical records to be in the order of 10^{-3} to 10^{-4} incidents per turbine per year (1 incident per 1000 to 10,000 years per turbine) [iii].

These figures are expected to represent conservative estimates of the probability of blade throw incidents for modern wind turbines, as the underlying data sets contain information for turbines that may not have been certified to modern standards and are therefore unlikely to have had the sophisticated control and safety systems of a modern wind turbine. This inference is supported by data presented in the 2014 Dutch Handbook showing a downward trend in the frequency of blade throw incidents from 2001 to 2010, with the five-year rolling average for the loss of an entire blade decreasing to a rate of less than 2.5×10^{-4} incidents per turbine per year (1 incident per 4000 years per turbine) [ii].

Therefore a reasonable upper-limit for the probability of an entire blade or a portion of a blade detaching from a turbine and being thrown is approximately 10^{-3} incidents per turbine per year (or 1 incident per 1000 years per turbine). To state this another way, if a person picked a turbine at random, on average they would need to wait 1000 years before a blade or section of blade was thrown from that turbine.

132 Dr Gilbert assessed the likelihood of injury or damage occurring from blade throw as extremely remote. We accept his evidence. Council wide PDC 399 says:[109]

> **399** Wind turbine generators should be setback from dwellings, tourist accommodation and frequently visited public places (such as viewing platforms) a distance that will ensure that failure does not present an unacceptable risk to safety.

133 We are satisfied that PDC 399 is sufficiently complied with.

134 Mr Too gave evidence in relation to ignition risk. Mr Too holds a Bachelor of Engineering (Natural Resources, Hons) and a Bachelor of Science (Physics). Mr Too, in his statement, described the components of a WTG and explained the measures which are built in to reduce ignition risk. Those measures include temperature monitoring and a turbine control system which will automatically shut the turbine down if temperature limits are exceeded.[110] Oil levels, voltages and currents are also monitored, with automatic shut down if levels fall outside acceptable limits.[111] Modern WTGs are fitted with lightning protection systems.

135 Mr Too's conclusion, in his statement, was as follows:[112]

- Wind turbines contain a number of mechanical and electrical components that may be a source of ignition or fuel for a fire.
- Wind turbines are fitted with control and protection systems which continually monitor the turbines and will shut the turbines down in the event of a malfunction.
- Wind turbines are fitted with lightning protection systems designed to safely conduct lightning to ground.
- Good maintenance, housekeeping and procedures contribute to the mitigation of fire risk.
- There are a number of improvements in modern wind turbines that have in my view reduced the risk of turbine fires.

136 We consider that the proposed development will minimise the risk of ignition posed by the WTGs. We do not consider that the risk posed will be any greater than many land uses in the Rural Zone, including agricultural activities.

137 Dr Chalk, who holds a PhD in Mechanical, Materials and Manufacturing Engineering provided a statement in Tilt's case.[113] Dr Chalk assessed the probability of a turbine fire occurring at the proposed wind farm. Dr Chalk

---

[109] Development Plan at p 75.
[110] Exhibit 2R25 at p 4.
[111] Exhibit 2R25 at p 4.
[112] Exhibit 2R25 at p 6.
[113] Exhibit 2R24.

researched wind farms worldwide to establish the probability of a WTG fire. In his statement, Dr Chalk said:[114]

> Using the results of our research the probability of a turbine fire has been calculated, using the following assumptions:
>
> - Turbines in China have been excluded from the calculation as the reported incident rate is disproportionally low and inclusion of the data may result in an artificially low probability being calculated;
>
> - The calculation only uses incident reports from post-2001, as before this reporting appears poor and inclusion of the data may result in an artificially low probability being calculated.
>
> The average incident rate between 2002 and 2016 is 16.2 per annum. The installed number of turbines at the end of 2015 according to GWEC data, excluding China, is 221,019 (Reference 1). This results in a 0.0073% probability of an individual wind turbine catching fire per annum, or approximately one fire per 13,500 turbines a year.
>
> Insurance company GCube has published a report (Reference 2), based on its experience, which estimates that there are approximately 50 incidents of turbine fire a year worldwide. This is a rate of one fire per 6,000 turbines a year (assuming 300,000 turbines in-service) and results in a probability of 0.017% per year.
>
> This is a higher probability then [sic] has been calculated using the results of our research, likely due to the GCube report including estimates for countries such as China. It is my opinion that a probability of 0.0073% per turbine (or approximately one fire per 13,500 turbines a year) is more likely to reflect the probability of fire ignition at the Palmer Wind Farm as this reflects the experience of Europe and North America, which is most relevant to Australia.

138 Dr Chalk discussed the probability of a fire within a residential home and the probability of a bushfire.

139 His conclusion was as follows:[115]

> Based on research into the occurrence of wind turbine fires the probability of an individual wind turbine at the Palmer Wind Farm catching fire is, in my view, 0.0073% per annum or approximately one fire per 13,500 turbines a year.
>
> In comparison with the probability of fire ignition in other situations, the construction of a single residential property would represent a greater increase in the probability of a fire occurring in the Palmer area than construction of a Wind Turbine. Table 1 shows a comparison between the probabilities of fire ignition from different sources.

---

[114] Exhibit 2R24 at pp 4 to 5.
[115] Exhibit 2R24 at p 5.

Source of Fire Ignition	Annual Probability
Wind Turbine (Frazer-Nash research)	One in 13,500 turbines per year
Wind Turbine (GCube)	One in 6,000 turbines per year
Residential Property (USA)	One in 286 properties per year
Human Activity along roads	One per 50km per year

Table 1 Comparison of the probability of fire ignition from different sources

Firefighting

140 Concerns about the impact of the proposed wind farm upon both aerial and ground based firefighting capacity, were raised in the Landscape Guardians' case.

141 Mr Formby gave evidence based upon his personal experience of fighting fires in the area. Mr Formby was concerned that aerial firefighting support would be precluded near the WTGs.[116]

142 Ms Willson, an asset management specialist who, in January 2017 was working at the Waterloo Wind Farm, gave evidence in Tilt's case.[117]

143 Ms Willson gave an account of a grass fire which occurred on 17 January 2017 near the Waterloo Wind Farm. Ms Willson said that, during the fire, the CFS asked her to pause some of the WTGs, and she arranged for that to occur. Ms Willson observed four fixed-wing water bombers drop water or retardant upon the fire. The aircraft flew between WTGs and through the wind farm. They flew below hub height, as close as 25 metres to the WTGs.[118] Ms Willson observed the aircraft and initiated the pausing of further WTGs. Eventually, some of the WTGs were shut down. Trucks were used to fight the fire. The Court viewed a video and some photographs from 17 January 2017 at the Waterloo Wind Farm.

---

[116] Exhibit 3A20 at para 7.5.
[117] Exhibit 2R19.
[118] Exhibit 2R19 at pp 4 to 5.

144 Mr Ferguson, the former Chief Officer of the Country Fire Authority, Victoria and former Chief Officer and CEO of the SA Country Fire Service, gave evidence in Tilt's case.[119]

145 Mr Ferguson described the aircraft used in firefighting. He said that aircraft can operate quite close to obstacles, subject to visibility.

146 Mr Ferguson noted that Tilt has undertaken to shut down the wind farm if a fire occurs or is threatened. He further noted that Tilt is prepared to install firefighting water tanks.

147 We accept that, in the event of a fire near the WTGs, firefighting tactics, including aerial tactics, may be different from what they would have been in the absence of the WTGs, depending upon the nature of the fire and weather conditions.

148 In Mr Ferguson's opinion, the tracks associated with the proposed wind farm will improve ground access for the CFS.[120] Mr Formby was concerned that some of these tracks may be dead ends and create false confidence in CFS vehicle drivers in the area.[121] Mr Ferguson disagreed. He acknowledged that some of the tracks would be dead ends, but believed, overall, that the network of tracks would improve access to the area for CFS ground crews. We accept Mr Ferguson's evidence on this point.

149 Mr Ferguson said that the wind farm would not pose an unacceptable bushfire risk, and nor would it prevent aerial firefighting, although it may change routes and tactics to some extent.

150 We are satisfied that the proposed development is acceptable in relation to its impact upon firefighting capacity. Any new land use in a rural area will need to be considered in the event of a fire, and may change the approach to firefighting. The proposed wind farm will generate new considerations for the CFS and also offer new opportunities.

Traffic

151 Some traffic issues were raised in the appeal documents. Ms Mellen, a traffic engineer, provided a statement.[122] Her analysis was not contested. Ms Mellen's conclusion was as follows:[123]

> In summary, I have undertaken an assessment of the potential road safety and driver distraction associated with the Palmer Wind Farm. I consider the relevant aspects of the road design standards that should be applied to the assessment are the clear zone adjacent

---

[119] Exhibit 2R20.
[120] Transcript at p 1212.
[121] Exhibit 3A25 at p 5, para 10.
[122] Exhibit 2R23.
[123] Exhibit 2R23 at p 21.

a road and the cone of vision for drivers. I am of the view that the cone of vision assessment should focus on the hub of the turbine.

The analysis confirms that the clear zone requirements will be met with respect to the turbines. Further, in so far as the criteria relating to advertising signage is relevant to the proposal, the locations of the turbines will satisfy the criteria for lateral clearance requirements to mitigate driver distraction associated with such devices.

I am of the view that, with the exception of the indicative location of Turbine B01, the cone of vision requirements will be met for each turbine location. I recommend that the location of B01 be modified to satisfy this criterion. Further, in the event that the turbines could be relocated in detailed design, I recommend that the zones nominated within the turbine segment boundaries adjacent Turbines B01, B02, B05, B29 and B31 be identified as areas where a turbine be excluded to ensure that the clearance requirements are maintained to the adjacent roads.

In relation to the Particulars of Appeal, I do not consider that the proposed turbines will interfere with the free flow of traffic on the adjacent road nor do I consider that they will impact the safe and efficient movement of people and goods by road. Further, it is my opinion that the conditions applied to the Development Plan consent by Council and DPTI relate to the detailed assessment required to effect the development and construction of the project. They can, in my view, be readily prepared and are consistent with the detailed assessment required (and indeed conditions imposed) for many projects to ensure the safe functionality of the road network.

I am of the view that the proposal generally satisfies the relevant provisions of the Development Plan. Adoption of the exclusion zones would, in my view, mitigate a potential safety issue and result in the Development Plan provisions being met.

152 Tilt has adopted Ms Mellen's suggested amendments. The proposed development, with those amendments, is sufficiently in compliance with the relevant provisions of the Development Plan as to traffic and driver safety. Those provisions are Council wide Objectives 14 and 16, Council wide PDC 34, 38, 39, 40, 365, 381, 383 and 398(a), all of which are set out in Ms Mellen's statement.

Aviation

153 Mr Norris, a pilot and flight instructor, gave evidence in the Landscape Guardians' case.[124] In essence, Mr Norris was concerned at the possible impact of the proposed wind farm upon the activities of the flight school at the Parafield airport.

154 Presently, the flight school uses a route from Parafield to the east and Murray Bridge for an early stage of visual flight rules training.[125] Mr Norris was concerned that, at times from May to October, in particular cloud conditions, the presence of the WTGs would prevent the occurrence of a training flight at a time when, were there no WTGs, a training run could take place. Mr Norris explained that a visual flying rules flight must not fly into cloud, so that when there was a

---

[124] Exhibit 3A16.

[125] Transcript at p 831.

low cloud no flight could occur regardless of the presence of WTGs. When there is no cloud, a flight could occur whether or not the WTGs were present. Mr Norris agreed that the training flight in question could be undertaken from the Aldinga airport or the Murray Bridge airport. In Mr Norris' opinion, however, the Parafield airport would not be able to offer that particular training flight on days when the cloud conditions were unfavourable.

155 Mr Jennings, an aviation consultant, gave evidence in Tilt's case.[126] In Mr Jennings' opinion, there are alternative routes for visual flying rules training flights from Parafield on those days when cloud cover prevents the use of the route presently used. Mr Jennings said that the flights could go due east, over the Warren Reservoir and over the ranges and then south, south-east to Murray Bridge. Alternatively, Mr Jennings thought there would be a route available between Adelaide and Edinburgh to the coast, then east, then south over the ranges. A further route would require Adelaide Airport clearance.

156 We accept that, on some days between May and October when there is partial cloud cover, if the proposed wind farm is built, the Parafield flight school will be unable to offer a training flight that it has previously been able to offer on such days. However, we also accept that there are alternative routes and alternative starting points for that particular training flight. We bear in mind that the Development Plan seeks the establishment of wind farms in the Rural Zone. We do not consider that the issue raised is of sufficient impact to count against the proposed development in a planning assessment.

The Electricity Market

157 Dr Kay gave evidence in Mr McGregor's case about the possible impact of the proposed wind farm on the National Electricity Market power system security, among other things. Dr Kay holds a PhD in Electronic Systems Engineering. Wind farms are not his field of study or work. Dr Kay was a representor in opposition to the development application. We accept that Dr Kay is an expert in the field of electrical engineering.

158 Mr Bones gave evidence in Tilt's case. Mr Bones holds a Bachelor of Engineering (Hons). Mr Bones has specialised in the design and analysis of power transmission systems. Since 1994, he has worked in Australia in various positions to do with the energy market. He is presently the Executive Manager, Risk and Regulation, GHD Advisory. Mr Bones is an expert in the field of electrical engineering and in relation to the national electricity market.

159 Dr Kay had the following concerns about the proposed wind farm:

- wind farms have reliability and stability problems which are associated with the intermittency of wind power. The addition of approximately 340 MW of

---

[126] Exhibit 2R22.

wind capacity near Palmer may disrupt grid stability unless there are further network mitigations;[127]

- ElectraNet has proposed network mitigations which comprise transmission network modifications, rather than providing new base load supply;[128]

- further modifications, which may include an interconnector upgrade or a new interconnector between South Australia and New South Wales, may be needed to improve South Australia's access to sufficient quantities of base load power;

- all of these modifications to the network would be costly, and the cost would be passed to the consumer.[129]

160 Dr Kay believed that application of the principle "form, fit and function" dictates that, when updating the electricity system:[130]

> ... replacement generating plant should be selected so that the new plant meets the new requirements whilst meeting or exceeding performance levels of the old plant and without requiring substantial systems architecture changes.

161 Dr Kay did not believe that wind power conforms to this principle because it requires new infrastructure and wind power does not perform the same startup functions as a base load generator therefore increasing reliance on interconnectors.[131]

162 Nationally, Dr Kay found that there had been a reduction in coal consumption. However, he believed that it was attributed to falling electricity consumption and increasing use of gas, with only a small component attributable to wind power.[132] In cross-examination, Dr Kay acknowledged that, in South Australia, the closure of the Playford and Northern coal-fired power stations had reduced the greenhouse gas emissions by power generators within the State.[133]

163 Mr Bones, in his statement, provided detailed information about the operation and regulation of the national electricity market ("the NEM") and system. Mr Bones said the following (among other things):[134]

- the South Australian transmission network is almost entirely owned and operated by ElectraNet;[135]

---

[127] Exhibit 3A28 at pp 2 and 5.
[128] Exhibit 3A28 at p 6.
[129] Exhibit 3A28 at pp 6 to 7.
[130] Exhibit 3A28 at p 9, para 25.
[131] Exhibit 3A28 at p 9.
[132] Exhibit 3A28 at p 12.
[133] Transcript at p 1176.
[134] Exhibit 2R18.
[135] Exhibit 2R18 at p 6.

- ElectraNet is required to plan the transmission network to meet the standards in the Electricity Transmission Code (ETC) maintained by the Essential Services Commission of South Australia (ESCOSA). ESCOSA sets reliability standards with which ElectraNet must comply;[136]

- the Australian Energy Market Operator (AEMO) is responsible for the secure operation of the power system. ElectraNet, as the transmission network owner and operator, undertakes the physical switching of the network elements under instructions from AEMO;

- the following operational measures are employed in the national electricity market to manage power system security;[137]

    - Defining the secure transfer limits for the transmission network. These are described as transfer limit equations which define limits that will provide sufficient spare capacity such that following a credible contingency event the power system will remain in a satisfactory state.

    - Monitoring the power system to detect when it has moved beyond a secure state and taking appropriate actions to quickly move the power system back to a secure state. This is typically achieved within 30 minutes or sooner.

    - Monitoring the power system to assess whether any non-credible contingencies should be re-classified as credible and following any reclassification implementing revised secure transfer limits for the power system.

    - Reviewing in advance any requests for transmission outages to assess their impact on power system security. Outages are not allowed to proceed unless AEMO is satisfied that the system will remain in a secure state for the duration of the outage.

    - AEMO uses the following facilities and systems to monitor the power system and manage system security:

        - National control rooms are staffed continuously to provide continual monitoring of the power system;

        - The NEM Dispatch Engine (NEMDE) allows AEMO to generate security constrained dispatch instructions to all schedule and semi-schedule generators;

        - Network outage scheduler (NOS) is used to review and approve network outages; and

        - Online security assessment tools provide early identification of any departure from a secure operating state.

- in relation to equipment:[138]

    27. Transmission equipment is designed with appropriate tolerances and safety margins to keep the likelihood of unplanned failures very small. Examples

---

[136] Exhibit 2R18 at p 9.
[137] Exhibit 2R18 at pp 9 to 10.
[138] Exhibit 2R18 at p 10.

include equipment being designed to accommodate expected short-term transient increases in voltage and current; protection systems designed to rapidly clear faults and restore supply through automatic reclosing of transmission lines and the use of overhead earth wires to provide lightning protection of substations and incoming an [sic] out-going circuits.

- South Australia is connected to Victoria via two interconnectors; the Heywood Interconnector and the Murraylink Interconnector;
- the National Electricity Rules oblige AEMO to monitor the state of the power system and to take action to correct any issues identified that threaten the ability of the power system to remain in a secure operating state.

164 Mr Bones, in his statement, set out the following information with respect to system stability:[139]

Contribution of Synchronous Generators to System Stability

59. Power system contingencies, load and generation fluctuations all disturb the power system causing responses in the power system voltage, frequency and power flows. Power system stability requires that all such responses are well damped and quickly settle to a new operating state which is within the specified limits for satisfactory power system operation. The technical characteristics, size and location of generation and supplementary control devices can have a significant impact on power system stability or rather the magnitude of the secure power transfer limits. Large synchronous generators with properly tuned controls have particular characteristics that assist to lift secure transfer limits. These characteristics include:

    a) The ability to provide high speed voltage regulation;

    b) The ability to ride through faults on the power system;

    c) The ability to provide supplementary damping of power system oscillations;

    d) The ability to follow a dispatch schedule by raising or lowering output to help control power flows within power system limits. This is referred to as an ability to operate as a scheduled generator; and

    e) The ability to raise or lower power output to correct frequency disturbances by providing FCAS.

Contribution of Wind Farms to System Stability

60. Some of these characteristics can also be provided by wind farms particularly if they are fitted with supplementary devices such as DVAR systems which provide a high speed injection of reactive power to control voltages, provide additional power system damping and assist wind farms to ride through power system faults.

61. Other characteristics are more difficult for wind farms to match mainly as a result of the intermittent nature of wind and the inability therefore to control the amount

---

[139] Exhibit 2R18 at pp 16 to 18.

of power output available at any time. The impact of intermittency of wind farm output on the security of the power system is mitigated by the development of sophisticated forecasting systems that use historical weather patterns to develop forecasts of the expected wind generation output from live weather data from each wind farm location. The Australian Wind Energy Forecasting System (AWEFS) is maintained by AEMO. AWEFS forecasts the expected generation from wind farms over a number of timeframes extending from the current dispatch period out to 2 years into the future.

62. AEMO produces a range of forecasts to assist schedule generators to know when they are likely to be required. The pre-dispatch system provides a forecast that stretch up to two days ahead of the current dispatch and provides indicative pricing over that two-day timeframe. The same forecasting system is used in the dispatch timeframe. Collectively AWEFS assists to manage the power system within its secure operating technical envelope by forecasting the possible need for scheduled generation.

63. While it is not possible for wind farms to follow dispatch targets that require an increase in generation they can follow dispatch targets that require a reduction in output. The requirement for larger wind farms (greater than 30 MW) to operate as semi-scheduled generators means that NEMDE can constrain those wind farms to lower power outputs when it is required to maintain power flows within secure transfer limits.

64. This capability is utilised in the NEM by requiring all large wind farms greater than 30 MW to be classified as semi-scheduled by AEMO and therefore requiring control systems to constrain the wind farm to a level to maintain power system security.

65. Network constraint equations are developed and implemented within NEMDE which define secure power transfer limits and the way in which the output from scheduled and semi-scheduled generators contribute to power flows across particular network elements. Once the power flow on a transmission network element reaches the secure transfer limit the constraint equation will bind and instructions will be issued by NEMDE to alter generation outputs to prevent power flows increasing any further. The actions taken may include constraining or reducing the generation from semi-scheduled wind farms and scheduled generators.

66. In summary with supplementary devices fitted, requiring registration of larger wind farms as semi-scheduled generators and utilising constraint equations in NEMDE and the forecast output of wind farms from AWEFS provide many of the beneficial characteristics outlined above which are emulated by wind farms.

67. Of the items listed the ability to respond to frequency control is the characteristic that is difficult for wind farms to match. Although the latest generation of wind turbines have the capability to offer this service the financial incentives to do so have been insufficient for wind farm operators to provide this service.

Role of Parties impacting system security

68. AEMO, Transmission Network Service Providers (TNSP) such as ElectraNet, wind farms and regulators (ESCOSA and AER) all contribute to maintaining a secure power system that can withstand credible single contingencies.

69. During the connection, registration, commissioning and post commissioning processes the TNSP and AEMO become involved in assessing the potential impact of a proposed wind farm on the power system. This process can result in the wind farm developer being required to provide supplementary equipment to avoid adverse power system security impacts.

70. In South Australia the mandatory provisions in the ESCOSA generation licence conditions require a higher set of performance obligations that wind farms must meet than in the rest of the NEM.

71. In all cases an agreed set of generator performance standards need to be established prior to AEMO and the TNSP allowing the wind farm to connect to the NEM. Detailed modelling data for the wind farm must also be provided by the wind farm and accepted by the TNSP and AEMO prior to the registration and connection approval. These arrangements are described in more detail in the Generator Connection section below.

72. Once commissioned the wind farm must adhere to the semi-scheduled requirements in the NER and participate in the AWEFS process. The semi-scheduled arrangements enable constraint equations developed by the TNSP to be used by AEMO to maintain the loading of power system elements to within secure transfer limits. Semi-scheduled wind farms must follow the instructions from AEMO and be able to follow any dispatch instructions to lower their output if required to maintain power system security.

73. The generator performance standard established as part of the connection and registration process establish enforceable compliance obligations on the wind farm. The wind farm is required to have a compliance program in place to demonstrate the ongoing compliance with those performance standards. The compliance program and the records produced can be audited by the AER and sanctions imposed if untreated and undisclosed non-compliance are identified. The AER undertakes an audit program where they check that the compliance testing is being undertaken and the results of the testing demonstrate that the wind farm is complying with the compliance template.

165 Mr Bones set out the process which must be undertaken before a new wind farm may connect to the South Australian Transmission Network. The operator must be registered with AEMO. The operator must enter into an agreement with the local Network Service Provider (NSP). The NSP will advise the operator of the requirements for connection. If the operator wishes to proceed the NSP will undertake a detailed assessment of the connection options. These must be agreed before connection can occur.[140] The operator, in the process of registering with AEMO, must demonstrate its ability to comply with the technical requirements of the National Electricity Rules. Approved Generator Performance Standards must be agreed prior to the registration of the generator. In Mr Bones' opinion:[141]

> ... The requirement to provide sufficient evidence to satisfy AEMO and the local NSP prior to registration provides a key control measure that makes it very unlikely that any registered generator will have a detrimental impact on power system security.

---

[140] Exhibit 2R18 at pp 19 to 20.
[141] Exhibit 2R18 at p 20, para 81.

166 ESCOSA issues generator licences in South Australia and a generator is not permitted to generate electrical power unless and until a generator licence is issued.

167 Mr Bones said that in order to obtain that licence:[142]

> ... wind generators must demonstrate that they have control settings or have additional equipment to ride through more onerous power system faults than other generators. In addition, wind generators must meet the automatic access standard for reactive power capability by providing half of that capability by dynamic reactive support thereby assisting them ride through power system faults.

168 After registration, a further approval from AEMO and the connecting NSP is required before commissioning. Mr Bones said:[143]

> The commissioning tests must be undertaken to ensure that the generator:
>
> - Minimises impact on other market participants;
> - Does not affect power system security; and
> - Does not affect the quality of supply of the power system.

169 Post commissioning, within 6 months, the generator must establish a generator compliance program, demonstrating compliance with the Approved Generator Performance Standards.[144] Any non-compliance must be reported to AEMO.

170 Mr Bones set out some of the obligations of AEMO:[145]

> AEMO is responsible for the secure operation of the NEM. AEMO fulfils this obligation in a number of ways, including:
>
> - Using online operating tools to continually monitor the state of the power system and identify departures from a secure operating state. These tools include transient stability analysis, small signal oscillatory monitoring, voltage stability monitoring, contingency analysis and thermal loading assessment tools;
> - Defining the secure technical envelope of the power system;
> - Approving planned transmission outages;
> - Managing the dispatch of generation to stay within the secure technical envelop; and
> - Ongoing review of power system security requirements. This includes recommending changes to the NER recognising the growth of renewable generation, review of operating practices and requirements, investigation into

---

[142] Exhibit 2R18 at p 21, para 84.
[143] Exhibit 2R18 at p 21, para 86.
[144] Exhibit 2R18 at p 22.
[145] Exhibit 2R18 at pp 25 to 26, para 117.

longer term power system requirements and power system incident reports which consider the operation of each part of the power system including generators.

171 Mr Bones said:[146]

Should the connection process identify an adverse system security impact, there are [sic] number of remedial measures that might be implemented to address the issue and allow the connection of the wind farm to proceed. Some of the measures employed within South Australia include:

- Providing supplementary voltage control through the inclusion of DVAR systems as part of the wind farm development;
- Developing limit equations to restrict the operation of wind farms when necessary to maintain system security; and
- Implementing automatic control schemes to reduce the output of wind farms following contingencies that trip particular transmission circuits.

172 Frequency control measures may need to be implemented in the system by AEMO if the wind farm is developed and commissioned to accommodate the rare event of the trip of the Heywood Interconnector (10 occasions in the last 18 years[147]).

173 The following measures involve no change to the systems:[148]

- Pre-emptively dispatching additional local FCAS [Frequency Control Ancillary Service] services within South Australia to increase the frequency control services available to manage frequency should the interconnector trip.
- Invoking constraint equations that limit the transfer of power across the Heywood Interconnector to reduce the disturbance caused by a trip of the interconnector; and
- Invoking a constraint equation to force the dispatch of synchronous generation in South Australia to improve the inertia of the power system and reduce the rate of change of frequency following contingencies that lead to the loss of the Heywood Interconnector or occur with the Heywood Interconnector out of service.

174 The following measures, which will require systems change, may also be necessary:[149]

- Implementing frequency control using the Murraylink Interconnector. While the Murraylink Interconnector is currently not configured to provide frequency control, the HVDC [high voltage direct current] technology employed by the Murraylink Interconnector is used elsewhere in the world to provide frequency control;

---

[146] Exhibit 2R18 at p 27, para 125.
[147] Exhibit 2R18 at p 30.
[148] Exhibit 2R18 at p 31, para 133.
[149] Exhibit 2R18 at p 31, para 135.

- Implementing changes to the scheduling of hot water switching in South Australia to reduce the frequency disturbance during periods with the Heywood interconnection out of service;

- Redesigning under frequency load shedding schemes and over-frequency generation shedding schemes to work better with lower inertia power systems; and

- The development of battery storage schemes in South Australia to provide additional FCAS sources.

175 We note that some battery storage has been installed in South Australia subsequent to Mr Bones' evidence.

176 Mr Bones concluded:[150]

> In summary the NEM connection and registration process will ensure that the potential impact of the Palmer Wind Farm on the ability to operate the power system will be thoroughly assessed by AEMO and ElectraNet. This process results in a set of generator performance standards being defined that the wind farm must meet in order to not adversely impact power system security.

177 Mr Bones commented:[151]

> Many of the facts presented by Dr Kay are not in dispute. However not all features of the NEM and how it operates have been considered by Dr Kay. When all of the NEM processes are considered they do not support the conclusions reached by Dr Kay.

178 Dr Kay and Mr Bones actually disagreed about very little. Their disagreement in relation to the likely impact of the proposed wind farm on grid stability is summarised in their joint statement:[152]

> That the proposed wind power station at Palmer would adversely affect grid stability – Dr Kay does not believe that the present AEMO, ElectraNet and ESCOSA requirements are adequate to assure reliability of supply in South Australia due to the high proportion of non-synchronous generation already installed. He notes that AEMO plans to review compliance with generator performance standards and make recommendations in this area for non-synchronous generators, with regard to generator fault ride-through [footnote omitted]. Mr Bones' view is that the measures laid down in the NEM are such that any permitted connection of the proposed Palmer installation would be very unlikely to have an adverse impact on grid stability as it would need to comply with the requirements that exist at the time the connection is negotiated.

179 Where the experts disagree, we prefer the evidence of Mr Bones. Mr Bones had a much greater depth of knowledge of the system than Dr Kay, and therefore better judgment about the potential risks posed by the proposed wind farm. We accept Mr Bones' evidence in its entirety.

180 The Development Plan, in Objective 1 seeks:[153]

---

[150] Exhibit 2R18 at p 31, para 136.
[151] Exhibit 2R18 at p 32, para 139.
[152] Exhibit 3A29 at p 4, para 14.

Objective 1: Orderly development with the economic extension of services and facilities in accordance with Structure Plan for the District Map MiMu/1 (Overlay 2).

Orderly development achieves economy in the provision of public utilities, and is conducive to the creation of a safe, convenient and pleasant environment in which to live. Orderly development contributes to the retention of rural land for the purposes of primary production, recreation, and water and nature conservation.

181 Map MiMu/1 (Overlay 2) does not depict electricity infrastructure.

182 The regulatory system in relation to the transmission of electricity nationally and in South Australia is complex and sophisticated. The technical merits of the competing options for electricity generation and transmission is not, in itself, a town planning issue. The development control system in South Australia does not seek to regulate the type of generators used in this State or the technical specifications for the generation and transmission of electricity.

183 The proposed development is orderly in the sense of Objective 1 in that it is the kind of development sought in the Rural Zone and it does not preclude other forms of development which are also sought in that zone. It can be connected to the Tungkillo substation by means of the 275 kV connection over about 10 kilometres.

184 Had the proposed development been a form of development which had not been addressed in the Development Plan, and had there been no complex State and National regulatory system in relation to the kind of development proposed, and had there been a risk of disruption to an essential service posed by the proposed development, then assessment of its technical impact may have formed part of a planning assessment as to whether it constitutes orderly development. In this case, that issue is pre-empted.

185 It was suggested, in the closing submissions made on behalf of the Landscape Guardians that Tilt ought to be required to prove that the proposed wind farm would confer an environmental benefit. No such requirement arises under the Act. Again, we point to the fact that the policy document, the Development Plan, seeks the establishment of wind farms in the Rural Zone.

Heritage
Aboriginal Heritage

186 It was suggested in the Landscape Guardians' case that the appropriate representative body for the relevant Aboriginal kinship group had not been consulted in relation to the proposed development.

187 Mr Mott, a qualified and experienced archaeologist, gave evidence in Tilt's case. Mr Mott included in his statement the Cultural Heritage Report which

---

[153] Development Plan at p 7.

formed part of the development application.[154] Mr Mott's conclusion with respect to Aboriginal Heritage in his statement, was as follows:[155]

> **4.1.5 Aboriginal Heritage – Conclusions**
>
> In relation to **the extent to which the Palmer Wind Farm will impact matters of Aboriginal heritage significance** I make the following points:
>
> 1. A comprehensive, well-resourced cultural heritage survey has been undertaken over the majority of the project area resulting in Exclusion Zones excising known Aboriginal heritage sites from the proposed project footprint;
>
> 2. Considerable background research and analysis of general principles of association between Aboriginal sites and environmental features has been undertaken over the general project area assisting to inform Exclusion Zones boundaries in contemplation with Point 1;
>
> 3. Impacts are to be avoided to Aboriginal heritage sites, objects and remains and those identified features have been excised from the proposed project area. Any future discovers of heritage sites, objects or remains are to be treated in accordance with the requirements of Section 23 of the *Aboriginal Heritage Act 1988* (SA) and will be avoided.
>
> 4. All recommendations provided in the Cultural Heritage Report have been incorporated into the commitments in the Consolidated Particulars of Development (Section 4.7).
>
> Therefore, based on the current extent of work undertaken to date and in light of the Exclusion Zones set up to avoid the identified Aboriginal heritage sites I find ***the extent to which the Palmer Wind Farm will impact matters of Aboriginal heritage significance*** to be effectively nil.
>
> For any potentially unidentified heritage sites (i.e. buried) the Aboriginal heritage discovery procedure, monitoring regime and heritage induction processes are sufficient to enable the identification and management of any potential discoveries during the ground disturbance phase.

188 Members of the Mannum Aboriginal Community Association (MACAI) participated in the heritage survey. It was suggested, on behalf of the Landscape Guardians that the Peramangk Heritage Association should have been consulted. This suggestion was not substantiated. We are satisfied, on the basis of the evidence before us, that the consultation to date with respect to Aboriginal heritage issues has been adequate. We note that the *Aboriginal Heritage Act 1988* imposes ongoing obligations upon Tilt should the proposed development proceed.

Dry Stone Walls

---

[154] Exhibit 2R29.
[155] Exhibit 2R29 at p 17.

189 There are some dry stone walls in the locality of the proposed wind farm. On the basis of the evidence of Mr Mott, we accept that those dry stone walls are of a kind which is common in the region. They have no particular, formally recognised, heritage value.

190 The dry stone walls were addressed in the Cultural Heritage Report which formed part of the application. Tilt has undertaken to avoid impacts upon dry stone walls where possible. Where impacts are unavoidable (i.e. for access), then Tilt has undertaken to minimise and mitigate any impact upon a wall in accordance with the recommendations of the Dry Stone Wall Association. We are satisfied that these measures will be adequate. On the evidence, the proposed development is acceptable in relation to heritage issues.

Summary and conclusion

191 This matter involves a number of appeals under s 86(1)(b) of the Act against the grant, by the Council, of development plan consent to the application by Tilt to establish a wind farm and ancillary development near the town of Palmer in the Mt Lofty Ranges in the Rural Zone. The primary task of this Court in such an appeal is to assess whether the proposed development is sufficiently in compliance with the relevant provisions of the Development Plan to warrant the grant of development plan consent. The Court does not have the function of providing a forum for the discussion of whether the policies set out in the Development Plan are the best policies or the most popular policies. The Court, like the Council, must accept and apply to its assessment of the proposed development the policies in the Development Plan as it was at the date that the development application was made.[156]

192 We have considered all of the evidence adduced by each of the parties. The Development Plan makes it clear that wind farms and ancillary development are envisaged in the Rural Zone. The Desired Character statement for the Rural Zone says that wind farms and ancillary development are to "constitute a component of the desired character" of that part of the Rural Zone which is outside of the Barossa Valley Character Preservation District. The site for the proposed development is in that part of the Rural Zone.

193 We understand the strong opposition to the wind farm on the part of some of the residents in the area whose views will be substantially affected by the introduction of new elements to their view, namely WTGs. The poles and wires forming part of the ancillary development have also drawn objection. We have assessed the visual impact of the proposed development against the relevant provisions of the Development Plan. The Development Plan anticipates and encourages the introduction of wind farm infrastructure as new components of the landscape in that part of the Rural Zone in which the site of the proposed wind farm is located. We consider that the wind farm applied for is sufficiently in

---

[156] S 53 of the Act.

conformity with the provisions of the Development Plan with respect to its appearance and impact upon visual amenity.

194 In relation to noise, we prefer the evidence of Mr Turnbull over the other witnesses. Again, to a significant extent, the provisions of the Development Plan anticipate that a wind farm, typically, will be a source of noise, and sets a standard for it to adhere to. We are satisfied that the proposed wind farm and its ancillary development will conform to that standard. There is no reason to anticipate that the proposed wind farm will have any impact with respect to noise beyond what is typical for a contemporary wind farm. The proposed development is sufficiently in accordance with the relevant provisions of the Development Plan with respect to noise.

195 In relation to the issue of human health, we have accepted the evidence of Professor Wittert. The proposed development will comply sufficiently with Council wide Objectives 25 and 26 with respect to health.

196 We are satisfied that the provisions of the Development Plan with respect to native vegetation, birds and other wildlife will be sufficiently complied with on the basis of the evidence before us, and having regard to the management measures proposed by Tilt.

197 We are satisfied on the basis of the evidence before us that the proposal is acceptable in relation to Aboriginal heritage, subject to ongoing compliance with the *Aboriginal Heritage Act 1988.* The arrangements offered with respect to the dry stone walls are adequate.

198 We do not consider that the proposal poses an unacceptable risk on account of shadow flicker, blade glint, blade throw or ignition risk. It will not disrupt the activities at the Parafield Airport to an unacceptable extent. It will not impede firefighting efforts.

199 The proposed development warrants the grant of development plan consent.

Validity of terms and conditions of development plan consent

200 The submissions made in Mr McGregor's case argued that certain of the terms and conditions attached to the development plan consent granted by the Council are invalid and not severable. Under the Act, this Court has jurisdiction in an appeal under s 86(1)(b) to decide whether to grant development plan consent to a development application *de novo;*[157] the planning merits of the application are considered afresh and a new decision is made.

201 We have decided that the development application should be granted development plan consent.

---

[157] See s 88(2)(b) of the Act.

Conditions

202 A memorandum in the above terms was provided to the parties. The parties were given the opportunity to make submissions in relation to the terms and conditions upon which development plan consent should be given to the proposed development. A draft set of conditions was put forward on behalf of Tilt.

203 Mr Formby made submissions on behalf of the Landscape Guardians. Mr Formby sought to have the Court require that further surveys of wedge tailed eagle nests and peregrine falcon nests be undertaken during the nesting and breeding season, which he said was from June to August for wedge tailed eagles and from August to December for peregrine falcons. Having regard to the evidence before us, we are satisfied that condition 6, below, will provide an adequate and appropriate degree of protection for wedge tailed eagles and peregrine falcons.

204 Mr Formby expressed a concern about the micrositing of the WTGs. He believes that the impact of the WTGs will be less if the turbines are set out in a line. We have dealt with the issue of regular spacing in our reasons, above. Mr Formby also sought a setback between a cluster or group of WTGs and a non-stakeholder residence of 3 kilometre. The anticipated impacts of the WTGs have been dealt with above. We do not consider that a 3 kilometre setback is warranted.

205 We are satisfied that the layout of the WTGs proposed in the development application before us, subject to micrositing, is sufficiently in compliance with the relevant provisions of the Development Plan.

206 Mr Formby sought to have a condition imposed reducing the height of the proposed WTGs. We have, above, assessed the development application and determined that the height of the WTGs proposed is sufficiently in compliance with the relevant provisions of the Development Plan.

207 Finally, Mr Formby sought a condition that no WTG and no infrastructure is to be sited so that it 'damages, destroys or in any way compromises the unique rocky features which are the endemic stone heritage of the Eastern Mount Lofty Ranges'. The micrositing process will take into account the nature of the ground. We have dealt with the issue of visual amenity above. We do not consider that it is necessary to impose a condition concerning this topic.

208 Mr Royal made submissions in relation to the protection of his house site, and those have been taken into account in condition 5. Mr Royal was also concerned about the material for the infrastructure poles. We do not consider that it is necessary to impose a condition on this topic.

209 We have considered whether it is appropriate to extend the periods of time allowed for the substantial commencement and the substantial completion of the

proposed development. Having regard to the size and complexity of the proposed development, we have determined that it is appropriate that those periods of time be extended.

Conclusion

210 There will be an order in the following terms:

A. Action 1 of 2016 is dismissed.

B. Actions 12, 13 & 14 of 2016 are allowed only for the purpose of making the following orders.

C. The decision of the First Respondent, Mid Murray Council, to extend various time periods in respect of Development Application No.711/072/14, is confirmed, so that pursuant to s 40(3) of the *Development Act* 1993 and regulation 48(2) of the Development Regulations 2008, the periods prescribed by reg 48(1) are extended so that the consent will lapse if the development has not been substantially commenced within five (5) years of the granting of Development Plan Consent and substantially completed within eight (8) years of the granting of Development Plan Consent.

D. The decision of the First Respondent, Mid Murray Council, to reserve a particular matter in respect of Development Application No.711/072/14 for further consideration, is reversed.

E. The conditions imposed upon the Development Plan Consent granted by the First Respondent, Mid Murray Council, in respect of Development Application No.711/072/14, are varied by the deletion of all conditions and, in lieu thereof, the substitution of the following conditions:

1. Except where minor amendments may be required by other relevant Acts, or by conditions imposed by this Development Plan Consent, the development shall be established in strict accordance with the Amended Consolidated Particulars of Development (Exhibit 2R1) ('aCPoD').

2. The final layout plan, or layout plans for each stage, and associated details including the final colour selection of the wind turbines and ancillary infrastructure (including the overhead powerlines), shall be submitted to the Council. The Council shall confirm its satisfaction with this additional information prior to the granting of Development Approval or prior to Development Approval for each stage.

3. A driver safety assessment report that identifies appropriate mitigation measures (if any) shall be submitted to the Council. The Council shall confirm its satisfaction with this additional information prior to the granting of Development Approval or, in the case of a staged approval, prior to Development Approval for the first stage.

4. Within two years of the wind farm becoming non-functional all above ground infrastructure will be decommissioned and removed from the site by the applicant.

5. In respect of the site of the dwelling and associated buildings (namely, those buildings – excluding tanks, poles and the like – shown on the site plan dated 29/07/15 rev C as 'existing historic stone building retained', 'existing structure', existing structures', 'proposed carport' and 'prop new dwelling') described in Development Approval 711/013/14 (Exhibit 2A4) and located on section 654, Hundred of Jutland (with access via section 79, Hundred of Finniss) certificate of title volume 5604 folio 632 ('the Royal building site'):

   a) noise levels at the Royal building site must meet the requirements of the Environment Protection Authority's Wind Farms Environmental Noise Guidelines (2009) for a relevant receiver;

   b) no turbine may be constructed within 1 kilometre of the area of the Royal building site shown as the precise site of the new dwelling approved in Development Approval 711/013/14 (the dwelling envelope); and

   c) theoretical shadow flicker duration at the dwelling envelope and within 50 metres of the dwelling envelope must be less than 30 hours per year and actual shadow flicker at the dwelling envelope and within 50 metres of the dwelling envelope must not exceed 10 hours per year.

Condition agreed between the third appellant and second respondent and notified to the Court on Wednesday 5 April 2017

6. The final wind farm layout required by condition 2 of the Development Plan Consent:

   a) shall show all wedge tailed eagle and peregrine falcon nests which have been either:

      i. recorded by EBS Ecology at the time of preparation of the final layout; or
      ii. identified by Ian Falkenberg to the proponent and:
         A. verified by EBS Ecology (or other suitably qualified environmental consultant engaged by the proponent); or
         B. after consideration by EBS Ecology (or other suitably qualified environmental consultant engaged by the proponent), verified by a suitably qualified environmental consultant nominated by the President of the Law Society of South Australia,

      at the time of preparation of the final layout; and

   b) shall not show any wind turbine within:

      i. 500 metres of any wedge tailed eagle nest shown on the layout; or
      ii. 1000 metres of any peregrine falcon nest shown on the layout.

Conditions as advised by the Environment Protection Authority

7. Noise levels at the noise sensitive receivers in the vicinity of the Wind Farm development shall meet the requirements of the EPA's Wind Farms Environmental Noise Guidelines (2009). The noise level at the relevant receivers* shall not exceed:

    i. 35dB(A) if receivers are situated in a Rural Living zone, or

    ii. 40dB(A) for noise sensitive receivers in other zones, or

    iii. the background noise (LA90, 10) by more than 5dB(A),

    whichever is the greater.

    * A relevant receiver is defined as an occupied dwelling where the owners do not have an agreement with the wind farm developer. The above measured noise levels shall be adjusted in accordance with the Wind Farms Environmental Noise Guidelines (2009) by the inclusion of a penalty for the tonal characteristic where necessary.

8. Warranted maximum sound power characteristic for the wind turbine generators installed in accordance with the proposed layout shall not exceed levels in Table 5.1[158] of the Environmental Noise Assessment report prepared by Sonus Pty Ltd and dated August 2014 unless otherwise agreed to by the Council, having consulted with the Environment Protection Authority. The warranted sound power levels shall be measured and reported in accordance with IEC61400-11, Ed.3.0: Wind turbines - Part 11: Acoustic noise measurements techniques.

9. Noise emitted by the selected wind turbine generators shall not include tones audible at the noise receivers ($\Delta La,k>0$) when tested in accordance with the tonality test procedure defined in IEC 61400-11, Ed.3.0: Wind turbines - Part 11: Acoustic noise measurement techniques. Alternatively, the absence of tones shall be confirmed by results of post-construction acoustic testing performed at locality R40 as shown in the Environmental Noise Assessment report (Sonus Pty Ltd, August 2014). The results of any such post-construction tonality testing shall be submitted to the Council within 3 months of the proposed development commencing operation. The Council shall confirm its satisfaction with any post-construction tonality testing, having consulted with the Environment Protection Authority.

10. Sound power of each of the two transformers to be installed in the electric substation shall not exceed levels indicated in Table 5.2 of the Environmental Noise Assessment report (Sonus Pty Ltd, August 2014) unless otherwise agreed to by the Council, having consulted with the Environment Protection Authority.

11. An independent acoustical consultancy (other than the company that prepared the predictive acoustical report) shall monitor noise levels at seven localities at

---

[158] Exhibit 1R3 at p 1303.

least: R13, R22, R28, R39, R45, R55 and R100 (as shown on the map in the Environmental Noise Assessment report prepared by Sonus Pty Ltd and dated August 2014) or such other localities agreed to by the Council, having consulted with the Environment Protection Authority. Monitoring shall be undertaken with reference to the Environment Protection Authority Wind Farms Environmental Noise Guidelines when all of the noise sources associated with the wind farm are in operating mode. The results of this monitoring shall be submitted to the Council within 3 months of the proposed development commencing operation. The Council shall confirm its satisfaction with the results of the post-construction noise monitoring, having consulted with the Environment Protection Authority.

12. If post-construction noise monitoring results reveal non-compliance with the noise criteria specified in the EPA's 2009 Wind Farms Environmental Noise Guidelines, the proponent shall implement measures to ensure compliance with such noise criteria.

Conditions as advised by Department of Planning, Transport and Infrastructure

13. A Traffic Management Plan for the proposal shall be submitted to the Council. The Council shall confirm its satisfaction with this additional information, having consulted with the Department of Planning, Transport and Infrastructure, prior to the granting of Development Approval or, in the case of a staged approval, prior to Development Approval for the first stage. This plan shall incorporate the following points:

    - The final access route for areas A, B and C;
    - Details of all road upgrades required to facilitate the development;
    - Details of delivery times;
    - Details of proposed road closures and their management;
    - Details of permits required;
    - Details of all required road signs and advisory signs;
    - A route risk assessment for roads intended for transportation of over-dimensional/over mass wind farm components.

14. The transmission line shall be designed to minimise its impact on the arterial road network. Evidence of how this impact has been minimised via the consideration of alternative options shall be provided to the satisfaction of Council, having consulted with the Department of Planning, Transport and Infrastructure. All power poles adjacent arterial roads shall be constructed in accordance with Austroads Guide to Road Design Part 6: Roadside Design, Safety and Barriers.

15. All power lines over arterial roads shall provide a minimum vertical clearance of 7.5 metres.

16. All underground cabling (including boring) on or adjacent arterial roads shall be designed to minimise its impact on the arterial road network. All

reinstatement works shall be undertaken to Department of Planning, Transport and Infrastructure standards and requirements at the applicant's cost.

17. All access points serving the temporary construction facilities (including but not limited to, workers compounds and batching facilities) located on, or requiring access to, arterial roads shall be located to the satisfaction of the Council, having consulted with Department of Planning, Transport and Infrastructure, to ensure road safety is maximised during the construction phase of the project. All temporary access points shall be decommissioned to Department of Planning, Transport and Infrastructure requirements at the applicant's cost.

18. All road works deemed to facilitate safe access shall be designed and constructed to comply with Austroads Guides and Australian Standards and to the satisfaction of the Council, having consulted with the Department of Planning, Transport and Infrastructure, with all costs (including, but no limited to, design, construction, project management and any changes to road drainage) to be borne by the applicant. Prior to the applicant undertaking any detailed design, the applicant shall contact Department of Planning, Transport and Infrastructure Traffic Operations, A/Project Liaison Engineer, Mrs Christina Canatselis on telephone (08) 8226 8262 or mobile 0401 120 490 (christina.canatselis@sa.gov.au) to discuss any technical issues regarding the required works.

19. Any modification to road side drainage as a result of a temporary access, or modifying an existing access on an arterial road shall be suitably designed to Department of Planning, Transport and Infrastructure standards in order to maximise road safety on the adjacent arterial road network.

20. The applicant shall notify the Commissioner of Highways by submitting a "Notification of Works Impacting Department of Planning, Transport and Infrastructure Roads" form at least five (5) working days before construction works begin. This form is available from the following internet address: http://www.sa.gov.au/topics/transport-travel-and-motoring/transport-industry-services/road-construction-and-maintenance/getting-permission-to-carry-out-roadworks

21. All vehicles shall enter and exit to/from arterial roads in a forward direction.

22. All car parking facilities shall be designed and constructed in accordance with AS/NZS 2890.1:2004 and 2890.6.2009.

23. All heavy vehicle manoeuvring areas shall be consistent with AS 2890.2.2002.

Conditions as required by the Minister for Water and the River Murray

24. During construction activities the subject land shall be managed in a manner as to prevent erosion and pollution of the subject site and the environment, including keeping the area in a tidy state and ensuring any waste materials are appropriately contained to ensure no pollutants (including excavation or fill material) enter the River Murray system.

25. Any fill material brought to development sites shall be clean and not contaminated by construction or demolition debris, industrial or chemical matter, or pest plant or pathogenic material.

26. Any excavation or fill material surplus to the requirements of the development shall be disposed of such that it will not:

    a. be located within the floodplain of any watercourses;
    b. adversely impact native vegetation;
    c. impede the natural flow of any surface waters;
    d. allow sediment to re-enter any water body;
    e. facilitate the spread of pest plant and pathogenic material.

27. Wind turbines shall be positioned such that no portion of the structure, including blades, overhang into adjacent parcels of Crown Land.