APPENDIX 1
GLOSSARY

The information provided in the following appendices was correct at the time of writing. As some of this information may have changed in the interim, proponents should confirm the current status of the items addressed in the appendices before commencing investigations or works.

ACCC

Australian Competition and Consumer Commission

Accreditation

The process by which Auswind accredits that wind power proponents and operators meet the Best Practice Guidelines and relevant federal and state legislation, policies, regulations and other mandatory requirements in the planning and operation (including construction and decommissioning) of wind farms using independent auditors.

AEMC

Australian Energy Markets Commission

AER

Australian Energy Regulator

AGO

Australian Greenhouse Office

AIS

Aeronautical Information Service (RAAF)

ASA

Air Services Australia

Availability

This is the number of hours a wind turbine is available to generate electricity in a year, divided by the total number of hours in the year.

BoM

Bureau of Meteorology

Capacity factor

This is a measure of the energy actually delivered by a wind farm, expressed as a proportion of the theoretical maximum wind farm energy output. It not only depends on the wind speed distribution at the site, but is also affected by the time wind turbines are not productive due to maintenance downtime or other outages.

Capacity of electrical grid

This is the capacity that can be connected to the electrical grid at any nominated connection point. In some rural areas this capacity can be limited and the costs of updating capacity can be high.

CASA

Civil Aviation Safety Authority

Certification

The processes involved in the design and production of the wind turbine generators are usually certified. The norms applied are a result of regulations for safety, damage etc.

Community liaison group

A community liaison group can be made up of representatives from the development company (or the owners and operators as appropriate), the planning authority or local community members. A third party facilitator may also be part of the group.

dB(A)

'dB' stands for decibel and is a measurement for the sound pressure. On the decibel scale, the smallest audible sound (near total silence) is 0 dB. A sound 10 times more powerful is 10 dB. A sound 100 times more powerful than near total silence is 20 dB. A sound 1000 times more powerful than near total silence is 30 dB.

'(A)' refers to the A weighting. This is an adjustment of the measured sound to match perception by the human ear. The human ear does not perceive sound at low and high frequencies as loud as mid-range frequencies. For example:

- 3 dB(A) is the smallest difference one can hear
- 5 dB(A) is a difference which is noted
- 10 dB(A) is heard as a doubling of the noise.

Please note: 'Sound is a judgment-free term, usually used in a technical context relating to a measured level. 'Noise', on the other hand, implies an environmental impact, and is used more frequently in the context of wind farms. Sound can be used in relation to an objectively assessed measured level, or as a subjective perception of nuisance.

Decommissioning

This is the final phase of the development when a site is cleared of above ground equipment associated with the wind energy project and the land is restored to an agreed use or condition.

DEH

Department of Environment and Heritage

DNSP

Distribution Network Service Provider

Electromagnetic interference

Telecommunications systems broadcast information at a variety of frequencies and in a number of ways. Telecommunications systems currently in operation over land use microwave, very high frequency (VHF) and ultra high frequency (UHF) systems. Interference with telecommunications systems is known as electromagnetic interference (EMI).

Energy production

The energy production of a wind turbine generator is very sensitive to the local wind speed conditions at the height of the rotor shaft and the Power to wind speed curve of the wind turbine generator. The following rules apply:

- Doubling the wind speed increases the available energy by a factor of eight
- Doubling the rotor diameter increases the available energy by a factor of four
- Increasing the hub height by one metre increases the available energy by one percent.

Energy yield

This is the term to describe electrical output from a wind energy project. It is strongly influenced by the wind speed of the site.

Environmental Management Plan

An Environmental Management Plan (EMP) is a document that articulates agreed proposals to minimise the environmental impacts of construction activities and working practices. It may specify a method of construction and contain provisions for monitoring environmental effects during operation.

EPA

Environmental Protection Agency

EPBC Act

The Federal *Environmental Protection and Biodiversity Conservation Act 1999*.

GWh

Gigawatt hour – is a unit of energy (equal to 1000 MWh).

Hub height

This is the height of the wind turbine rotor axis above the ground.

Installed capacity

The installed capacity is the product of the number of machines and the nominal Wind Turbine Generator (WTG) rating. It is normally measured in Megawatts (MW).

Local electricity distribution system

This is the electricity distribution network, normally incorporating overhead poles and wires but also sometimes underground wires, which connect individual properties to the regional grid at various voltages.

Megawatt (MW)

A megawatt is unit used to measure power. One MW equals a million watts.

Monitoring mast

This is a mast upon which wind monitoring equipment may be mounted. It is erected to measure the wind speed and wind direction over a particular site. Monitoring masts are usually either tubular or lattice tower structures fixed to the ground with guy wires. Foundations, if needed at all, are usually minimal.

MPF status

Major Project Facilitation (MPF) is offered by the Federal Government to assist in streamlining approvals for large developments. Developers may apply to the Federal Minister for Industry, Science and Resources for MPF status.

NEM

National Electricity Market

NEMMCO

National Electricity Market Management Company

NER

National Electricity Rules

NSP

Network Service Provider

ORER

Office of the Renewable Energy Regulator

Power curve

The power curve is a way of showing the relationship between power output as a function of wind speed. It can be used to estimate the power delivered to the grid at a certain wind speed. It can also be used in combination with a wind speed histogram to calculate the expected yield in a year.

Proponent

The term 'proponent' used in throughout the Best Practice Guidelines and refers to the proponents, developers and operators of wind farms.

REC

Renewable Energy Certificate

Reflected light

Under certain circumstances sunlight may be reflected from wind turbine blades when in motion. The amount of reflected light will depend on the finished surface of the blades and the angle of the sun.

Shadow flicker

Under certain combinations of geographical position and time of day, the sun may pass behind the blades of a wind turbine and cast a shadow. When the blades rotate, the shadow flicks on and off. The duration of this effect, which varies according to the time of the year, can be calculated from the machine geometry and the latitude of the site.

Substation

The electrical substation connects the electrical system of the wind energy project to the local electricity network through a series of automatic safety switches.

TNSP

Transmission Network Service Provider

Water interest study

For wind turbines that require substantial foundations, it may be important to establish the uses of water (for example, drinking or agricultural purposes) from below ground sources within the relevant catchment area. A water interest study will reveal this information and may help to determine the potential effect of the development on spring water supplies.

Wind speed

The wind speed of the site is a crucial factor in determining the economic viability of a wind energy project. This is underlined by the fact that the energy yield varies as the cube of the wind speed (see also Energy Production above).

WTG

Wind Turbine Generator

WTGS

Wind Turbine Generator Specification – is a means of classifying turbines in terms of wind speed and turbulence.

Zone of visual influence

A zone of visual influence provides a representation (often presented as a map with markings or colourings) of the area over which the site and/or a proposed development may be visible.

Details provided in the following appendices were correct at the time of writing, however, there is potential for some elements to change. Proponents should confirm the current status of the items addressed in this appendix prior to commencing investigations or works.

APPENDIX 2

NATIVE TITLE AND CULTURAL HERITAGE

NATIVE TITLE

The following is a summary of information presented in 'About Native Title', a document produced by the National Native Title Tribunal. The material is provided for information only and is not intended as advice. Proponents are encouraged to consult with the National Native Title Tribunal. This and other valuable information is available from the National Native Title Tribunal and may be seen on their website (www.nntt.gov.au).

Native title is a set of rights and interests in relation to land or waters that has the following qualities:

- It is possessed under the traditional laws currently acknowledged by, and the traditional customs currently observed by, the relevant Indigenous people.
- Those Indigenous people have a 'connection' with the area in question by those traditional laws and customs.
- The rights and interests are recognised by the common law of Australia. Native title must come from laws and customs acknowledged and observed by the claimant's ancestors at the time when sovereignty was asserted over the area by the British. Those laws and customs must have been acknowledged and observed in a 'substantially uninterrupted' way from the date of sovereignty to the present.

Administered under the *Native Title Act 1993* (Cwlth), Native title:

- is not granted by governments — it is recognised through a determination made by the Federal Court, the High Court or possibly by some state and territory courts
- can be extinguished (refused recognition) over a particular area because of things the government has done, or allowed others to do, that are inconsistent with native title
- may vary from group to group because it gets its content from the traditional laws and customs of the particular group
- exists alongside, and is subject to, the rights of other people who share the same area — for example, people with leases, licences or a right of public access continue to have those rights, and native title must give way to people exercising those rights (this is sometimes called 'coexistence').

Who holds native title?

Aboriginal and Torres Strait Islander people who, through their traditional law and custom, have maintained a continuing connection with their country may hold native title. They have to prove that the traditional laws and customs that they get their native title from are acknowledged and observed today and have been continued since the time of European settlement.

Where does native title exist?

Native title may exist in places where Indigenous people continue to follow their traditional laws and customs and have maintained a link with their country, and where it has not been extinguished (refused recognition) because of acts done, or allowed, by government. Areas where native title may exist include:

- vacant Crown land (or unallocated state/Crown land)
- some reserve lands
- some types of pastoral lease
- some land held by or for Aboriginal people or Torres Strait Islanders
- beaches, oceans, seas, reefs, lakes, rivers, creeks, swamps and other waters that are not privately owned.

What rights make up native title?

The set, or bundle, of rights that makes up native title may include the right to:

- possess and enjoy traditional country (exclusive possession), including the right to control access to, and use of, the area
- access the area
- visit and protect important places
- hunt and gather food
- take water, wood, stone and ochre
- teach law and custom on country
- collect bush medicines.

Native title to tidal and sea areas can only be non-exclusive. Native title is subject to Australian law. Native title does not give Indigenous Australians the right to veto future developments but it does mean that their native title rights and interests may have to be taken into account, for example, through consultation about proposed developments. Native title holders may have the right to be compensated for loss or impairment of their native title caused by acts done, or allowed, by the government.

Native title cannot take away other people's rights

Native title cannot take away anyone else's valid rights. So, if there is a pastoral lease or a fishing licence over an area where native title is found to exist, that lease or licence continues on unaffected. If native title rights and other, non-native title rights (for example, those under the lease or the licence) come into conflict, the non-native title rights of the other person prevail. Public rights to access places like parks,

recreation reserves and beaches are not affected by native title. Native title cannot be claimed over certain areas including:

- residential freehold
- farms held in freehold
- pastoral or agricultural leases that grant exclusive possession
- residential, commercial or community purpose leases
- public works like roads, schools or hospitals.

Native title on pastoral and agricultural leases

Pastoralists and farmers in Australia have various lease arrangements which are governed by different state and territory laws. It is necessary to look at the lease and the legislation under which it was granted to assess the impact the grant of the lease had on native title. Some native title rights may still exist and, if they do, they will coexist with the rights of the leaseholder. Most pastoral leases around the country are non-exclusive and so the area covered by the lease can be claimed. However, it is important to understand that Indigenous people can usually only claim shared rights with the leaseholder over the lease area. They cannot claim exclusive possession of the lease area.

Only native title holders who have maintained their traditional laws and customs and their connection to the land may have native title rights to non-exclusive lease areas. Pastoralists and farmers may negotiate agreements with native title holders so that native title holders can have access to, and use of, their traditional homelands. That way both the leaseholders' and the native title holders' rights and interests in the land can be accommodated. Where the pastoral or agricultural lease gives the leaseholder a right of exclusive possession, then native title is completely extinguished and the area cannot be claimed. For example, the High Court found that pastoral leases in the New South Wales Western Division are 'exclusive' leases that completely extinguish native title.

Native title and exploration, mining and future development

The *Native Title Act 1993* (Cwlth) sets out the procedures to be used for making valid those developments that affect native title. Developments that may affect native title are called 'future acts'. Native title parties have the right to negotiate about some future acts (usually only those involving the grant of a mining lease) if:

- their application satisfies the registration test conditions
- their claim is registered on the Register of Native Title Claims.

The right to negotiate is not a right to stop, or veto, projects going ahead — it is a right to have some say in whether, and how, the project is done. If the right to negotiate applies, the government, the developer and the registered native title parties must negotiate 'in good faith' about the effect of the proposed development on the registered native title rights and interests of the claimants. The parties can ask the Tribunal to mediate during the negotiations. If the negotiations do not result in an agreement, the parties can ask the Tribunal to decide whether or not the future act should go ahead, or under what conditions it should go ahead.

Role of the Tribunal

The National Native Title Tribunal is the impartial, independent and expert body that assists people to resolve issues over land and waters. The Act provides the foundation of the work of the Tribunal. The objectives of the Act include:

- providing for the recognition and protection of native title
- establishing ways in which future dealings affecting native title may proceed and setting standards for those dealings
- establishing a mechanism for determining claims.

The Tribunal's main functions are:

- providing information about native title processes
- mediating between parties to native title applications and assisting parties to reach agreement about relevant matters
- mediating between parties to assist them in reaching agreement about certain future acts that might take place on areas where native title exists (for example, mining)
- arbitrating in relation to certain future acts where parties are unable to reach agreement
- assisting parties to negotiate legally binding agreements that resolve a variety of native title issues. In carrying out its functions, the Tribunal must be fair, just, economical, informal and prompt. It can take into account the cultural and customary concerns of Aboriginal peoples and Torres Strait Islanders so long as doing this does not prejudice any other party. The Tribunal is not a court and does not decide whether or not native title exists, although it does make arbitral decisions including determinations about some future act matters.

For more information about native title and services of the Tribunal please contact the National Native Title Tribunal:

GPO Box 9973 in your capital city
Freecall 1800 640 501
A wide range of information is also available online at www.nntt.gov.au.

The National Native Title Tribunal has offices in Adelaide, Brisbane, Cairns, Darwin, Melbourne, Perth and Sydney.

Cultural Heritage

State and federal Aboriginal heritage legislation provide protection for Aboriginal sites, objects, and remains (that is, traditional burials) that are significant to Aboriginal cultural tradition, and/or that are significant in archaeological, anthropological, or historical terms. Any land in Australia, developed or undeveloped, can contain sites relating to Aboriginal history. Sites may exhibit evidence of relationships with, and use of, the land and environmental resources such as water, animal and vegetable foods, materials, and medicines, and stone, pigments and minerals by Aboriginal people. Sites may also relate to traditional cultural practices, spiritual beliefs, and ceremonial activities.

Before beginning any project or development that requires ground disturbance or excavation, consideration will be given to whether the area has significance under

the relevant state Aboriginal heritage Act, or may contain significant Aboriginal sites, object, or remains as defined by that Act.

It is recommended that development proponents contract professional heritage consultants (archaeologists & anthropologists) to conduct this research and consultation work.

Archaeology is the science relating to the physical remains of past human activities, and is relevant to the proper identification, recording, interpretation, and conservation of archaeological sites, objects, and remains. Anthropology is the science relating to comparative knowledge of human cultural systems, and is relevant to identification of and consultation with the correct Aboriginal traditional owners, and the recording of cultural information and values regarding the nature, significance, and treatment of Aboriginal sites, objects, and remains. Both of these primary scientific fields are essential for the satisfactory handling of Aboriginal heritage issues. Related historical issues often are dealt with by these professionals, although in some instances the specific services of an historian also may be required.

In addition to possessing appropriate professional qualifications and experience, the heritage consultants should be acceptable to the traditional owners and of suitable gender where gender-specific cultural issues may be concerned. Unqualified or inappropriately qualified heritage consultants may not conduct a comprehensive and satisfactory assessment process, may not be acceptable to the Aboriginal community or produce reporting that is accepted by the state department responsible, may not satisfy the necessary conditions of professional indemnity or public liability insurance, and may not constitute an acceptable expert witness before the court should a difficult case result in litigation.

Desktop survey

A desktop survey will be conducted prior to carrying out any detailed survey or consultation. The desktop study will identify the status of any Native Title claim, traditional owner contact details and the presence of known places or items. Recommendations for the progression of further works can be developed based on this study. These recommendations may include the commencement of a detailed cultural heritage survey to document sites of significance to Aboriginal archaeology, anthropology, history or tradition.

The state department responsible for Aboriginal affairs will be contacted for advice as to whether any Aboriginal sites have been recorded in that area. That department will provide advice on the presence of known Aboriginal sites and objects in the area of interest as well as identifying the relevant traditional owner representative group. Contact details for the relevant state and territory departments are provided below. A listing of representative bodies can also be found at www.ausanthrop.net/research.

Register of Aboriginal sites

The register of Aboriginal sites and objects is not an exhaustive record of all Aboriginal sites, objects and remains. It is possible that there will be undiscovered or undisclosed places or items of significance. Irrespective of this, all Aboriginal sites, objects and remains, are protected whether entered on the register or not.

Consulting Aboriginal traditional owners

Contact will be made with the traditional owners. Note that in some cases there may be more than one traditional owner representative group, depending on the location and extent of the project. After contact has been made with the relevant heritage organisation the Aboriginal Community will, in many cases, seek to enter into an appropriate heritage survey/monitoring agreement with the proponent before the heritage assessment is conducted.

Please note: There may be a range of related requests from Aboriginal traditional owners in relation to development projects, based around employment, joint land management and economic development, including long-term sustainability opportunities. Such requests will be dependent on the nature of the site and the size of the site where the planned excavations are proposed. Such issues should be negotiated between the proponent and the traditional owners at an early stage of a project.

Cultural heritage surveys

It is common that a cultural heritage survey, which incorporates research and consultation processes together with onsite monitoring of construction excavation and earthmoving work, is required. This process ensures that any significant Aboriginal cultural heritage places or items are identified and protected from damage during proposed development. Undertaking a heritage survey and cultural consultation with the traditional owners will give the proponent some certainty regarding the presence or absence of sites in an area. It will also alert the proponent about any requirements needed to address any heritage issues arising from the survey.

Archaeological sites are frequently identified by material that is visible on the surface, or in exposures of sub-surface sediments in gullies or road cuttings. If no archaeological material is visible on the ground surface, or the ground surface visibility is poor, the cultural heritage survey may recommend the use of monitors during earth works.

Culturally significant sites do not always have associated archaeological material, and are identified through a process of anthropological research, fieldwork and consultation, both with monitors and community elders. This is not the same as the field survey work conducted on an archaeological survey. If there are cultural places or knowledge involved that are confidential to men or women in particular, it may be necessary to have an anthropologist of the same gender to work with traditional owners to record such sites.

Monitors (and an archaeologist in larger scale excavations of sensitive locations) will be able to advise whether a previously unidentified site has been uncovered during earthworks and take suitable action to avoid the commission of an offence under the relevant Act.

Monitoring excavations and ground disturbance

Monitoring all ground breaking activity is a common procedural requirement of most Aboriginal cultural heritage organisations. A watching brief or monitoring of disturbance of the ground is appropriate when there is an identified risk of sub-surface Aboriginal sites and/or objects being discovered during impending development. In such cases, there is a need to observe any disturbance to the ground to limit damage to any sub-surface Aboriginal sites, objects, or remains. Such

materials may be present in sediments above the bedrock layer, which have been buried by Aboriginal people in the past, or which relate to Aboriginal activities on a past land surface which has since become buried. If sub-surface sites or objects are identified during disturbance of the ground surface, it will be necessary to halt works whilst appropriate conservation measures are identified, approved and conducted.

The indications that monitoring would be required are:

- evidence of Aboriginal artefacts on the surface which are believed to indicate the presence of sub-surface deposits
- a prediction of sub-surface sites or objects based on data reported from a cultural heritage survey in an adjacent area, or resent in nearby exposures of sub-surface deposits
- previous records of similar sites with sub-surface evidence in the adjacent area, in a similar depositional context, or similar environmental or cultural zones
- archaeologically sensitive landforms
- conditions that restrict the visibility of the ground surface to less than 20 per cent in an area considered to be archaeologically sensitive.

The watching brief will be conducted by suitably qualified people. Since a major part of the evidence to be watched for is archaeological in nature, a qualified archaeologist will be involved, although they may not always be present at the site. Representatives of the traditional owners will be involved to recognise and deal with matters of cultural significance in relation to any discoveries (often requiring two Monitors per excavation).

Engagement of Aboriginal heritage monitors

In order to arrange for monitoring, an initial approach should be made to the Aboriginal Heritage Committee in writing. This will possibly be followed by attendance at a Heritage Committee meeting and, for larger projects, a site visit may be required. The details of cultural heritage survey arrangements are usually organised directly between the Heritage Committee, the cultural heritage consultant, and a representative of the proponent.

In conducting monitoring programmes for site development works the proponent or heritage consultant will:

- keep direct contact with the Chairperson(s) of the Aboriginal Heritage Committee
- allow one weeks notice, for the organisation of monitor before commencing excavation
- ensure the chairperson is able to make monitors are aware of site regulation and requirements
- confirm the length and time of works, monitor times (Saturday and Sunday works will include extra charges), site regulations and requirements, and any other related site details (lunch room, toilets, etc.) by letter or fax directly to the chairperson of the Heritage Committee
- contact the chairperson one day before monitors are engaged, seeking to ensure everyone is ready to start and that there are no problems.

Please note: Aboriginal Heritage committees may require a formal contractual arrangement with the proponent for larger-scale development projects.

Procedures for site supervisors

The site supervisor will carry out the following procedures to ensure that the monitoring process for excavation and ground disturbance activities is conducted efficiently and cost-effectively.

Notification of works variations

If there are unscheduled changes to the works programme due to weather or machinery break down, etc., notification will only be made to senior monitors and the chairperson of the relevant heritage committee to whom the monitors report. This notification will need to be clear and timely.

Dealing with discoveries of sites, objects or remains

If Aboriginal sites, objects, or remains are discovered during earthmoving or construction, work will stop to avoid further damage. Until an assessment of the authenticity, significance and extent of the heritage item is made, and an appropriate course of action has been determined, there may be no work conducted at that location. If a discovery of possible cultural significance is made, it may be necessary to confirm this through consultation and a site inspection by appropriate, knowledgeable elders and an anthropologist. If a discovery of skeletal remains is made the initial step is to report the matter to the police.

A confirmed discovery of an Aboriginal site, object or remains will be reported to the relevant Aboriginal organisation(s) and department. The process of salvaging sites and collecting artefacts will be done under the authorisation of the minister for relevant Act. This is often best handled by the archaeologist.

Aboriginal traditional owners who consider that significant cultural heritage or burial sites have not received adequate protection under state legislation may seek protection for such sites under the terms of Sections 9 and 10 of the Federal *Aboriginal and Torres Strait Islander Heritage Protection Act* (1984) and the recently amended *Environmental Protection and Biodiversity Conservation Act* (1999).

Discovery procedures

If a discovery of a possible Aboriginal site, object, or remains is made:

1. Stop work in the vicinity of the find.
2. Advise the senior monitor, works supervisor and Aboriginal organisation contact. Advise the archaeologist on site (if one is engaged).
3. Confirm the identification of the find: through inspection by the senior monitor, onsite archaeologist or call-out archaeologist or anthropologist.
4. If the find is confirmed, notify the relevant department to arrange a site inspection. If the find involves human skeletal remains, inform the police.
5. If the works programme can be modified to avoid the find, confirm the strategy with the senior monitor, Aboriginal organisation, departmental representative or consultant archaeologist or anthropologist, and continue work with Aboriginal monitors present.
6. If the works programme cannot be modified to avoid the find and resume work, it may be necessary either to seek authorisation to salvage the site, object, or remains, or modify the project design.

Aboriginal Affairs by State Department

Victoria

Aboriginal Affairs Victoria
Phone 03 9208 3333
Fax 03 9208 3292
Email firstname.lastname@dvc.vic.gov.au
Website http://www1.dvc.vic.gov.au/aav/

Level 9
1 Spring St
Melbourne VIC 3000

Postal address
Aboriginal Affairs Victoria
GPO Box 2392
Melbourne VIC 3001

New South Wales

NSW Department of Aboriginal Affairs
Phone 02 9219 0700
Fax 02 9219 0790
Toll Free 1800 019 998, 1300 651 077 (WA, local call)
Email enquiries@daa.nsw.gov.au
Website http://www.daa.nsw.gov.au/

Level 13, Tower B
Centennial Plaza
280 Elizabeth St
Surrey Hills NSW 2010

Postal address
NSW Department of Aboriginal Affairs
Level 13, Tower B
Centennial Plaza
280 Elizabeth St
Surrey Hills NSW 2010

Western Australia

Department of Indigenous Affairs
Phone 08 9235 8000, 08 9235 8088
Email info2@dia.wa.gov.au
Website http://www.dia.wa.gov.au/

Level 1,
197 St Georges Terrace,
Perth, WA

Postal address
PO Box 7770
Cloister's Square
Perth WA 6850

Tasmania

Office of Aboriginal Affairs
Department of Premier and Cabinet
Phone 03 6233 3671
Fax 03 6233 4506
Email oaa@dpac.tas.gov.au
Website http://www.dpac.tas.gov.au/divisions/oaa/

6th Floor
144 Macquarie Street
Hobart TAS

Postal address
GPO Box 1156
Hobart TAS 7001

Queensland

Department of Aboriginal and Torres Strait Islander Policy
Phone 07 3247 5970
Fax 07 3006 4059
Email askus@datsip.qld.gov.au
Website http://www.datsip.qld.gov.au/

Level 6A, Neville Bonner Building
75 William Street
Brisbane QLD 4001

Postal address
PO Box 15397
City East
Brisbane QLD 4002

South Australia

Aboriginal Affairs and Reconciliation Division
Department of Premier and Cabinet
Phone 08 8226 8900
Fax 08 8226 8999
Email enquiries.aard@saugov.sa.gov.au
Website http://www.premcab.sa.gov.au/dpc/department_aard.html

Level 13, State Administration Centre
200 Victoria Square
Adelaide SA 5000

Australian Capital Territory

Aboriginal & Torres Strait Islander Community Consultative Council

ACT ATSICCC Secretariat
Office of Aboriginal & Torres Strait Islander Affairs
Chief Minister's Department
Phone 02 6207 5987
Fax 02 6207 0592
Website http://www.cmd.act.gov.au/oatsi/actatsicouncil.shtml

Level 4
Nara House
1 Constitution Avenue
Canberra ACT 2600

Postal address
GPO Box 158
Canberra City ACT 2601

National Native Title Tribunal

Principal Registry
Phone 08 9268 7272
Freecall 1800 640 501
Fax 08 9268 7299
Email enquiries@nntt.gov.au
Website http://www.nntt.gov.au/about/contact.html

Level 4, Commonwealth Law Courts Building
1 Victoria Avenue
Perth WA 6000

Postal address
GPO Box 9973
Perth WA 6848

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APPENDIX 3
USEFUL WEBSITES

ASSOCIATIONS

Alternative Technology Association	www.ata.org.au
American Wind Energy Association	www.awea.org
Australian Conservation Foundation	www.acfonline.org.au
Australian Business Council for Sustainable Energy	www.bcse.org.au
Australian Wind Energy Association	www.Auswind.com.au
Australian Energy Market Commission	www.aemc.gov.au
Australian Energy Regulator	www.aer.gov.au
Birds Australia	www.birdsaustralia.com.au
British Wind Energy Association	www.britishwindenergy.co.uk
CADDET Centre for Renewable Energy	www.caddet-re.org
Danish Wind Energy Association	www.windpower.dk
European Wind Energy Association	www.ewea.org
Greenpeace Australia Pacific	www.greenpeace.org.au
National Wind Coordinating Committee (USA)	www.nationalwind.org
Standards Association of Australia	www.saiglobal.com/online

NATIONAL BODIES

Air Services Australia	www.airservicesaustralia.com
Australian Communications and Media Authority	www.acma.gov.au
Australian Greenhouse Office	www.greenhouse.gov.au
Australian Heritage Council	www.ahc.com.au
Civil Aviation Safety Authority	www.casa.gov.au
Department of Industry, Tourism & Resources	www.isr.gov.au
Major Projects Facilitation:	www.isr.gov.au
Renewable Energy:	www.isr.gov.au
Department of Transport & Regional Services, National Office Local Government	www.dotars.gov.au
Department of Environment and Heritage	www.deh.gov.au
Greenpower	www.greenpower.com.au
Office of the Renewable Energy Regulator	www.orer.gov.au

NEMMCO	www.nemmco.com.au
RAAFAeronautical Information Service	www.raafais.gov.au

STATE PLANNING AUTHORITIES

Department of Urban Services (ACT)	www.act.gov.au
Department of Urban Affairs & Planning(NSW)	www.planning.nsw.gov.au
Department of Planning & Infrastructure (NT)	www.ipe.nt.gov.au
Department of Communication and Information, Local Government, Planning & Support (QLD)	www.dcilgp.qld.gov.au
Department of Transport, Urban Planning & Arts (SA)	www.planning.sa.gov.au
Department of Justice (Tas)	www.justice.tas.gov.au
Department of Sustainability and Environment (Vic)	www.dse.vic.gov.au
Ministry for Planning (WA)	www.wapc.wa.gov.au

OTHER STATE AUTHORITIES

Australian Local Government Association	www.alga.asn.au
Australian Capital Territory	
ACT Local Government Association	www.lgaq.asn.au
New South Wales	
Department of Energy Utilities and Sustainability	www.seda.nsw.gov.au
NSW Local Government Association	www.lgsa.org.au
Northern Territory	
NT Local Government Association	www.lgant.nt.gov.au
Queensland	
QLD Local Government Association	www.lgaq.asn.au
Environmental Protection Agency - Sustainable Industries	www.epa.qld.gov.au
South Australia	
Energy SA	www.energy.sa.gov.au
SA Local Government Association	www.lga.sa.gov.au
Tasmania	
TAS Local Government Association	www.lgat.tas.gov.au

Victoria

Sustainability Victoria	www.sustainability.vic.gov.au
Municipal Association of Victoria	www.mav.asn.au
Victorian Coastal Council	www.vcc.vic.gov.au

Western Australia

Sustainable Energy Development Office	www.sedo.energy.wa.gov.au
Office of Energy	www.energy.wa.gov.au
Local Government Association	www.walga.asn.au

Details provided in the following appendices were correct at the time of writing, however, there is potential for some elements to change. Proponents should confirm the current status of the items addressed in this appendix prior to commencing investigations or works.

APPENDIX 4
COMMUNITY AND STAKEHOLDER ENGAGEMENT FRAMEWORK

Community and stakeholder consultation should be an integral part of any wind development project.

The wind energy industry acknowledges that there is a wealth of knowledge in local communities which should be considered when making decisions about projects. Effective engagement with the community and stakeholders is a way of ensuring the full range of views and issues can be identified to enable the proponent to make better decisions.

An accurate understanding of community and stakeholder views can only be achieved through consultation programs that seek input from all people who would be affected by a decision.

PURPOSE OF THE FRAMEWORK

The purpose of this framework is to:

- outline the principles that the wind industry will work towards in encouraging community and stakeholder participation in key decisions
- ensure that effective community and stakeholder engagement forms part of the decision-making process for the proponent
- provide some guidance within which this would occur.

This framework should complement existing communication tools and techniques. It is not intended to replace existing communication or other information distribution methods that the industry may currently use.

The wind energy industry understands that consultation will not eliminate conflict, but it can help to establish an open dialogue with members of the community and other stakeholders to inform better decision-making.

BENEFITS OF EFFECTIVE COMMUNITY AND STAKEHOLDER ENGAGEMENT

In approaching community and stakeholder engagement, the wind industry recognises that:

- members of the community and affected stakeholders should have opportunities to participate in discussions about decisions which may affect them
- proponents must be informed about the needs and aspirations of the community and affected stakeholders
- better decision-making can be informed by early, open and ongoing dialogue in a range of settings, and with residents from diverse backgrounds

- effective engagement will assist in building balanced relationships between the proponent/wind industry and the community
- engagement with the community creates a sense of shared ownership of actions and outcomes
- the opinions of all individuals and groups must be voiced and heard, and that everyone needs to work to reduce the potential for conflict.

KEY PLATFORMS FOR EFFECTIVE CONSULTATION

There are three key platforms for effective community and stakeholder consultation. The wind industry acknowledges that consultations need to encompass:

1. Good governance

- Consultations are conducted with respect, honesty and integrity.
- There is open and transparent provision of information.

2. Shared values

- The wind industry recognises the value in involving the community and affected stakeholders in the development of each wind farm and in having input to a project's decision-making process.
- There is value for the community in becoming involved in the consultation.

3. Effective communication

- Appropriate modes of information sharing and consultation should be developed.
- Quality, relevant information should be provided to the community and stakeholders.
- Mechanisms are in place to demonstrate how consultation has informed the design of the wind farm, or how views and information from the community and stakeholders have been considered.
- Issues are responded to in a timely and appropriate manner.

FIVE KEY PRINCIPLES OF CONSULTATION

The following principles will be applied to all consultations. They represent the framework that the wind industry and/or proponent will work within to demonstrate its commitment to the process of community and stakeholder engagement.

1. Focus

- Consultation will be purpose-driven.
- The type of consultation methods chosen will be appropriate for the task.
- There is a clear statement about what the consultation aims to achieve.
- There is a clear statement about the role of the proponent and the role of participants in the consultation.

- The proponent will focus consultation activities to ensure robust and effective input into their decision-making process.
- There is appropriate internal coordination to ensure corporate ownership of the consultation.

2. Inclusive

- The way that consultation is set up and implemented encourages the participation of people who are affected by or interested in a decision.
- Groups and individuals that are affected by interested in the decision regarding a wind farm development will be given equal opportunity to participate in the consultation.
- The type of consultation or engagement will be sensitive to the needs of individuals and groups to maximise their ability to contribute.
- The proponent will actively seek out people for consultation.

3. Responsive

- There is a commitment to consider views and respond to participants.
- Consultation will be transparent. All people involved will have a clear understanding of how their feedback and comments are to be used.
- The proponent will maintain openness during the consultation process and be willing to consider new ideas.
- There is respect for the diverse range of interests that may be represented during a consultation.
- All reasonable attempts will be made to resolve conflicts.

4. Open and transparent provision of information

- Information relating to the consultation program will be readily available to allow participants to make informed and timely contributions.
- Information relating to the consultation process can be accessed easily by those involved before key decisions are made.
- Relevant information will be presented in an easily understood format.
- Confidential or commercial details about an issue may not be disclosed to the public.

5. Timely feedback and evaluation

- Participants will receive timely feedback about the outcomes of the consultation, and how the final decision was reached.
- If a difference occurs between the inputs into the consultation and the final decision, the reasons for this will be clearly documented.
- The consultation process will be documented to provide:
  - clear evidence of the activities that were undertaken
  - the input that was received
  - the decisions that were made.

PREPARING FOR COMMUNITY AND STAKEHOLDER CONSULTATIONS

Effective community and stakeholder consultations need to be well planned. In the context of the Five Key Principles of Consultation, a project needs to develop and implement a detailed Community and Stakeholder Communications and Consultation Plan that is consistent with those principles.

The Community and Stakeholder Communications and Consultation Plan needs to demonstrate how the community and affected stakeholders will be informed throughout the development of the project. It should also include opportunities for them to participate in a dialogue at relevant phases of the project.

EFFECTIVE COMMUNITY AND STAKEHOLDER COMMUNICATIONS AND CONSULTATION PLAN

There are ten key steps to developing and implementing an effective Community and Stakeholder Communications and Consultation Plan.

Developing the Plan

1. Identify the issue and decide whether to inform or consult.
2. Appoint a consultation team.
3. Identify the target audiences.
4. Choose appropriate communication and information provision methods.

Implementing the Plan

5. Inform stakeholders and community of consultation methods, objectives and manage expectations.
6. Collect and record views.
7. Analyse findings.
8. Incorporate information from the consultation into the design of the wind farm and document how consultation informed (or did not inform) the design.
9. Inform participants of the outcome.
10. Evaluate the community engagement process and document relevant information in the planning application.

INFORMATION TO INCLUDE IN THE PLAN

The following list is provided as a guide to the type of information that should be included in a Stakeholder Communication and Consultation Plan.

- a list of identified stakeholders
- a list of potential issues
- how information will be provided to different types of stakeholders
- methods of consultation/engagement to be employed with relevant stakeholders

- timelines and responsible persons/roles
- how stakeholders' views will be considered in the project design
- methods to be used to engage those who may be hesitant to participate
- methods of identifying opportunities for community benefits and possible methods for maximising these
- methods of identifying opportunities and promoting community stewardship and pride
- how queries will be dealt with, by whom and within what timeframe
- nominated point of contact for various stakeholders
- how consultation activities and outcomes will be recorded
- methods and timelines for evaluation
- methods and timelines for reporting.

COMMUNICATING WITH COMMUNITY AND STAKEHOLDERS

There are a number of different communication methods that can be used to inform and consult with the community and affected stakeholders, including:

- written correspondence – letters
- letterbox drops
- advertisements in newspapers
- newsletters and brochures
- A dedicated project website
- e-newsletters
- community groups or community-based events
- community consultative committees, community reference groups, stakeholder and participant meetings, focus groups and taskforces
- information displays, such as maps and scale models
- dedicated telephone number and email address.

Using several different methods of communication increases the likelihood of reaching more of the target audiences. It can also improve the likelihood that target audiences will be exposed to the consultation.

As new information comes to light, there may be a need to review and update the Consultation Plan. Where these changes may impact on particular stakeholders, they should be informed of these changes.

Information provided to the public needs to give a clear indication of the decision-making process, and stages of consultation so that individuals know when they can comment on issues they are interested in.

Views expressed by members of the community, interested groups and individuals, as well as the responses to these views, need to be collected. The way in which views and information is collected and recorded needs to be managed throughout

the consultation process. Records of communication and consultation processes, including questions and answers provided at meetings or over the telephone or via the website, should be documented and maintained. It is important to set up processes at the beginning of the project to make record-keeping simple and reliable.

When the consultation is complete, it is important to feed back information to those involved in the process. This is the consultation report which can be used to support the planning application. The proponent will need to decide the most appropriate way to present information in the report to the audience. The report should include:

- key findings and suggestions
- an overview written in plain English for the public
- a methodology section, detailed discussion and references
- charts and graphics
- case studies.

Details provided in the following appendices were correct at the time of writing, however, there is potential for some elements to change. Proponents should confirm the current status of the items addressed in this appendix prior to commencing investigations or works.

APPENDIX 5
AIRCRAFT SAFETY

Wind energy projects need to be sited so as not to cause a hazard to aircraft safety. The first point of contact for wind farm Proponents seeking more information on air traffic issues should be the Civil Aviation Safety Authority (CASA). Proponents may be passed on to Air Services Australia (ASA). Potential impact on aviation should also be verified through consultation with nearby airport and aerodrome operators.

Federal Airports Regulations require major capital city airport operators to notify the Department of Transport and Regional Services of any potential infringement to the prescribed airspace of that airport. In the vicinity of other aerodromes, Civil Aviation Regulations require the operators to notify CASA (Civil Aviation Safety Authority) of any existing or potential structure that may infringe the aerodrome's obstacle limitation surfaces. In areas remote from an aerodrome, proponents of any tall structure 110 metres or more above ground level are required to notify CASA directly of such proposals.

As an adjunct to the above requirements, CASA has produced a Civil Aviation Advisory Publication (CAAP 89W-2, available from the CASA website) entitled "Reporting of Tall Structures" to inform those planning tall structures of the recommended notification process. This document defines tall structures as those within 30 km of a regulated airport and exceeding 30m in height, or 45 m in height elsewhere. However the RAAF Aeronautical Information Service (AIS), which is responsible for maintaining the database of such structures on behalf of CASA, have recommended notification of any planned structures as low as 20 meters in height. Once layout options have been narrowed down, Proponents will provide AIS with details and descriptions of any planned structures exceeding this lower limit.

In December 2003 CASA released for comment a proposed standard for the lighting and marking of wind farms and wind turbines in Australia. Following an extended period of discussion with the wind industry CASA are finalising the elements of what will become the standard for marking and lighting of wind farms and wind turbines in Australia. Details of the revised proposal can be seen in the Notice of Final Change – Amendment to Manual of Standards (MOS) Part 139-Aerodromes at http://rrp.casa.gov.au/download/04_nfc.asp. This document also provides a commentary on how the new standards are to be applied. The final draft standards themselves are provided in a draft Advisory Circular which can be seen at http://casa.gov.au/avreg/aerodromes/draftac.htm.

CASA states that "Advisory Circulars (AC) are intended to provide recommendations and guidance to illustrate a means but not necessarily the only means of complying with the Regulations, or to explain certain regulatory requirements by providing interpretative and explanatory material. Where an AC is referred to in a 'Note' below

the regulation, the AC remains as guidance material. Advisory Circulars should always be read in conjunction with the referenced regulations"

A brief outline of the requirements of the AC are that:

11. CASA must be informed of any proposed wind turbine generator that will penetrate an Obstacle Limitation Surface (OLS) (see note below) to ensure it can be assessed for obstacle lighting requirements. CASA strongly discourages the construction of wind turbine generators in the vicinity of an aerodrome.
12. CASA must be informed of any proposed wind turbine generators that have a blade-tip-height of 110 metres or greater, to ensure that it can be assessed for its risk to aviation safety and the need for obstacle lighting.
13. The obstacle lighting requirements, if wind turbine generators are assessed as hazardous to aviation are:
    - outside an OLS nacelle lighting only (no blade-tip-height lighting required and therefore no requirement for free-standing towers)
    - inside an OLS a free standing light to the full height of the blade tip will be required
    - lighting is to be at intervals of a minimum 900 metres, and a distance that minimises the number of lighted wind turbine generators without diminishing appropriate aviation safety; with the topographically highest wind turbine generator to be included in the lighted turbines.

Obstacle limitation surfaces are a complex of imaginary surfaces associated with an aerodrome. They vary depending on number and orientation of runways, and the instrument-approach type of the runway(s). Some surfaces can extend to 15 km from an aerodrome. Aerodrome operators can provide details for their particular aerodrome.

It is understood from CASA that where a wind turbine generator or wind farm is assessed as a risk to aviation, Proponents will be able to discuss and suggest lighting requirements with the CASA assessment officer.

Please note that at the time of writing the Advisory Circular on wind farm lighting has yet to be finalised by CASA. There remains some potential for further changes although any change is unlikely to be more rigorous.

Details provided in the following appendices were correct at the time of writing, however, there is potential for some elements to change. Proponents should confirm the current status of the items addressed in this appendix prior to commencing investigations or works.

APPENDIX 6
INTERIM LANDSCAPE ASSESSMENT

The following is provided as an interim landscape assessment approach. Auswind and the Australian Council of National Trusts are currently jointly working on a project to develop national landscape values assessment methodologies. These will be inserted into the document once complete.

The existing landscape will be described, and the potential landscape and visual impact of the proposed development assessed and evaluated. It is important to bear in mind that visual amenity must always be considered in the context of the existing environment and with an appreciation of the value that the local community puts on rural character and landscape attributes, and the environmental assessment will reflect this.

Given that the visual impact of the development is likely to be one of the more significant issues in the assessment of the project, it is highly recommended that experts in the analysis of the visual characteristics of the environment are consulted. For example landscape architects may be able to provide professionally presented quantitative descriptions of the visual impact a project is likely to have.

A "Zone of Visual Influence" or "Seen Area Diagram" will be defined and a map produced which indicates where the proposal may be visible from, within a radius agreed with the planning authority. Such a study can then be used in consultation with the planning authority, the community and relevant stakeholders to decide important and representative viewpoints from which the visual impact of the proposal can be assessed. These points are likely to include local settlements, important public viewing points and should include a range of distances from the proposed project and may cross administrative boundaries.

Once these points are selected, visual simulations (or photo-montages) of what the proposed project is expected to look like from these viewpoints will be created and used for further consultation with the community and stakeholders.

Proponents will consider the proximity of the proposed project to existing wind energy projects and whether it will be possible to see one or more such projects from agreed viewpoints in the surrounding area. The significance of any cumulative impact will be assessed.

Other factors that will be considered in the visual impact assessment include turbine colour schemes and how these fit with the local environment, turbine markings and lighting, turbine size, the spacing between turbines and the colour of, and location, of step-up transformers and sub-stations.

It is also often advantageous to investigate the visibility of service roads and any overhead power lines. Roads can be visually intrusive unless cut and fill is minimized. Roads should follow land contours closely and the resulting colour should be sympathetic to that in the area. Overhead power lines may also need to be designed

to follow land contours, such as gullies, to lower their visual affect and can be coloured and designed to blend into the landscape.

The Proponent will also assess the movement of the shadow of the turbine on sunny days at any time of year and the possible impact on residents, commonly referred to as Shadow Flicker. When the sun is just above the horizon, the shadows of the wind turbine generators can be very long and could move across a house for a short period of time. In some cases blade shadows can cause a flickering effect. The time at which this may occur and the exact position of the shadow can be calculated very accurately for each location, and the Proponent will, if necessary, put various mitigation measures in place.

Details provided in the following appendices were correct at the time of writing, however, there is potential for some elements to change. Proponents should confirm the current status of the items addressed in this appendix prior to commencing investigations or works.

APPENDIX 7
NOISE

Wind turbines are unlike a typical industrial noise source, because the character of the noise is more natural (not mechanical, impulsive or tonal), and the level of noise is closely related to the wind, which also provides masking. For example the measurement of noise emissions at very low wind speeds (when there is no wind to mask the noise) is perceived to be the worst case scenario for conventional noise emissions but in these conditions a wind farm emits no noise at all, as there is insufficient wind for the turbines to operate.

Some local councils use their state EPA standard while other councils, and some State Governments, require that wind farms meet the limits given in the New Zealand Standard NZS 6808:1998, Assessment and Measurement of Sound from Wind Turbine Generators. In February 2003 the South Australian EPA released Environmental Noise Guidelines: Wind Farms.

Auswind was active in the development of the draft Australian Standard DR 04173, Measurement, Prediction and Assessment of Noise and Wind Turbine Generators, which was released for public comment in March 2004. This intends to provide a consistent methodology for the measurement, prediction and assessment of the noise of wind turbines at residential and other noise sensitive locations surrounding wind farms. It cannot, however, set a national limit of acceptability for this noise.

Discussion will be required with the local council and the EPA to determine the measurement methodologies that should be employed and the limits that should be applied, in order to meet the common objective that the lives of those around the proposed wind farm are not detrimentally affected by noise from the installation.

Prediction of the noise levels at sensitive locations and assessment of the acceptability will require computer modelling of the noise propagation from each wind turbine. Usually this will be followed up with background noise measurements at any noise sensitive locations such as residences. If in doubt, it is always best to measure background noise directly to verify or improve the accuracy of noise modelling and this is especially important if noise sensitive residences are close by.

Post construction noise compliance testing of a wind farm must show the wind farm to be compliant with the applicable noise standard at all neighbouring residences as specified in the project's development approval. Any instances of post construction testing demonstrating non-compliance with the applicable noise standards must be immediately addressed and rectified by the owner of the wind farm.

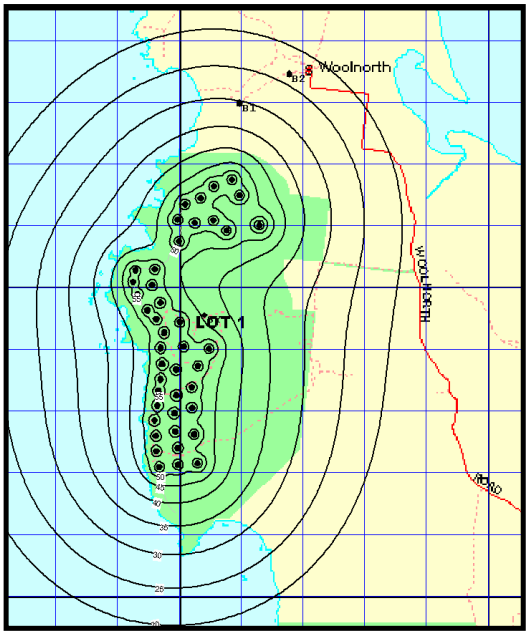


Figure – Simple Noise Contour Plot Showing Predicted Noise Levels at Residences (B1 & B2) (courtesy Hydro Tasmania)

The local authority may also require that measurements are taken at additional sensitive locations.

The advisable separation distance between residences and a proposed development to avoid disturbance of neighbours of the wind farm will depend on a variety of factors including local topography, the character and level of local background noise and the size of the development.

TYPICAL ENVIRONMENTAL AND INDUSTRY SOUND LEVELS

Source	Sound Level (A weighted)	Nature of Noise	*Impression*
Defence Siren	140 – 130		*Painful*
Jet Takeoff at 60 meters	120	(Broadband & Tonal)	*Very loud*
Rock Concert	110		*Very loud*
Pile Driver at 15 meters	100	Impulsive	
Ambulance Siren at 30 m	90		
Freight Cars at 15 meters	80	(Broadband & Impulsive)	
Pneumatic Drill at 15 meters	80	Broadband	*Loud*
Freeway at 30 meters	70	Broadband	*Mod. loud*
Vacuum Cleaner at 30 meters	60	Broadband & Tonal	
Light Traffic at 30 meters	50		*Quiet*
Large Transformer at 60 m	40	Tonal	
Soft Whisper at 1.5 meters – quiet bedroom	30		
Soft Whisper at 1.5 meters – recording studio	20		
Soft Whisper at 1.5 meters – threshold of hearing	*0-10*		

From National Wind Coordinating Committee, March 1998

Details provided in the following appendices were correct at the time of writing, however, there is potential for some elements to change. Proponents should confirm the current status of the items addressed in this appendix prior to commencing investigations or works.

APPENDIX 8
ASSESSING BIRD ISSUES AT WIND FARMS

The Australian Wind Energy Association (AusWind) is implementing the Wind Industry Development Project, funded by the Australian Greenhouse Office of the Australian Government. One of the outputs of this project is the development of a standardised approach to assessing avian issues at wind farms. The project has currently provided Wind Farms and Birds: Interim Standards For Risk Assessment, which is available at http://www.auswind.org/auswea/downloads/Bird_Report.pdf. This details strategies for:

- conducting risk assessments of avian issues; and
- monitoring the effects of wind energy developments on birds in Australia.

Overseas studies have revealed that there can be two general effects of wind farms on birds:

14. Collisions with wind turbines; and
15. "Alienation" effects, where birds no longer utilise habitat on or near a wind farm, effectively resulting in habitat loss for the species. Associated with this effect is a possible "barrier effect", where a species is prevented from migrating due to the presence of a wind farm.

Objectives

The objective of this document is to provide a best practice guideline for the assessment of avian issues at wind farms, which will give comfort to the regulatory authorities and the community that this issue is being managed in a stringent and consistent manner. The fundamental principle of this guide is that rigorous, scientifically based approaches are used in the assessment and monitoring of avian issues at Australian wind farms.

The guide provides a structured approach to determining the levels of investigation required to estimate the effects of wind farm on birds, and monitoring of effects after construction.

It is not the purpose of this guide to provide a list of possible studies that could be undertaken during each level of investigation, as it is more appropriate to select and design studies on a site, project and species-specific manner. Similarly, no details of methodology are provided as each study should be designed specifically for the proposal and site. This guide recommends that input be sought from relevant experts and the Regulatory Authorities when determining the surveys to be conducted and their experimental design.

PRE-CONSTRUCTION SURVEYS

Background to assessing avian issues at a site

A number of issues will be considered prior to undertaking a risk assessment of birds at a wind farm.

16. aware of the Acts that cover birds present on or near the wind farm site. This may include the *Environment Protection Biodiversity Conservation Act 1999* (EPBC) and relevant State or Territory Acts. The may be found at the Australian Legal Information Institute internet site (http://www.austlii.edu.au/databases.html). Species listed under these Acts can be deemed a "priority" in the risk analysis (and are hereafter called priority species). However, there may be other avian species that are not listed under an Act, but may also be regarded as priority due to:
    - Significant (which will need to be defined) numbers of a native bird species on or near the site; or
    - Species or taxa that are prone to collision with turbines, or to other effects from wind farms.
17. All studies undertaken to assess avian issues will be scientifically robust and defensible. This requires that the objectives are determined *a priori* and that, when higher level (see descriptions below) studies are undertaken, their experimental design is rigorous (preferably with appropriate technical input from experts, such as an ornithologist and statistician, and appropriate statistical analyses conducted, where necessary.
18. Consideration will be given to avian species on site, and those near* the site that could potentially be impacted by the proposal. (* The term near has not be quantified here, as the distance will vary between sites. However, determining the distance is based on whether species in surrounding areas could be potentially directly affected by the wind farm. For example, if the site is on a flight path for priority species.).
19. Avian habitat on or near the site will be considered. For example, the presence of Ramsar wetlands or other areas that provide habitat for birds.
20. The extent to which particular stages in the life history of a species could be affected (e.g. breeding, migration, moult-migration, etc.).
21. In order to quantify a potential impact, it is often useful to evaluate the proportion of the regional, state or national population of a species, if there available data to do so.
22. It is possible that on site monitoring after the commissioning of a wind farm will be required by the Regulatory Authority/ies. The rigour of such studies will be increased if there is adequate baseline data which will enable before and after comparisons to be made, and a BACI (Before after Control Impact) design is often required in the survey designs. A BACI design enables the impact of the wind farm to be distinguished from the impact of other effects. In order to conduct appropriate BACI surveys it is necessary to incorporate control (or reference sites) into the design of surveys, and to have data from prior to the construction of the wind farm.
23. It is important that all assessments incorporate the requirements of the relevant Regulatory Authorities, and that input from these Authorities be sought as early as

possible in the planning process. Ideally, discussions with these Authorities will result in agreement on:

- The avian issues on the site;
- The objectives of bird studies to be conducted, and their general methodology; and
- Any mitigation/management measures to be used.

24. Determine what constitutes a significant impact. The risk assessment conducted needs to consider whether the potential effect of the wind farm will result in a significant impact to relevant species.

    To assist with clarity, the following terms have been defined:

    Avoidance is defined as birds approaching a turbine, but avoiding collision with it.

    Diversion involves birds diverting around the wind farm, or cluster of turbines.

    Risk matrix

    The framework provided in the Australian standard for risk management and related guidelines, AS/NZS 4360 (Anon 2004a, 2004b), and the associated guide for environmental risk management HB203:2000 (Anon 2000), assesses risk using a combination of consequence (or potential impact) and the likelihood of occurrence of the impact (Table 1).

    This risk matrix can be used in an iterative manner, for example it could be used to assist with:

- Determination of whether a referral under the EPBC is required;
- Initial evaluation of avian issues on site;
- Re-evaluation of risks after more detailed investigations; and
- Re-evaluation of risks after the implementation of mitigation strategies involved birds being displaced from a wind farm site.

Table 1: Qualitative risk analysis (modified from Anon 2000)

Likelihood	Consequence			
	insignificant	minor	moderate	significant
very rare	L	L	M	H
rare	L	L	M	H
possible	L	M	H	H
probable	M	H	H	H

where:

L = low risk

M = medium risk

H = high risk

Strategies for undertaking an assessment of avian issues at a wind farm

A hierarchical approach to the investigation of avian issues is suggested. The lowest level studies are preliminary surveys to identify species on a site, with studies increasing in their complexity and specificity up through the levels. For example, if investigations at a lower level identify a species that is a priority and insufficient data are available to conduct a risk assessment, the next level of investigation should be used.

Three levels of Investigation are provided, and the purpose of each level is to obtain data that will enable estimates of the potential impact of a proposed wind farm on the relevant species of birds.

The three levels of investigation are:

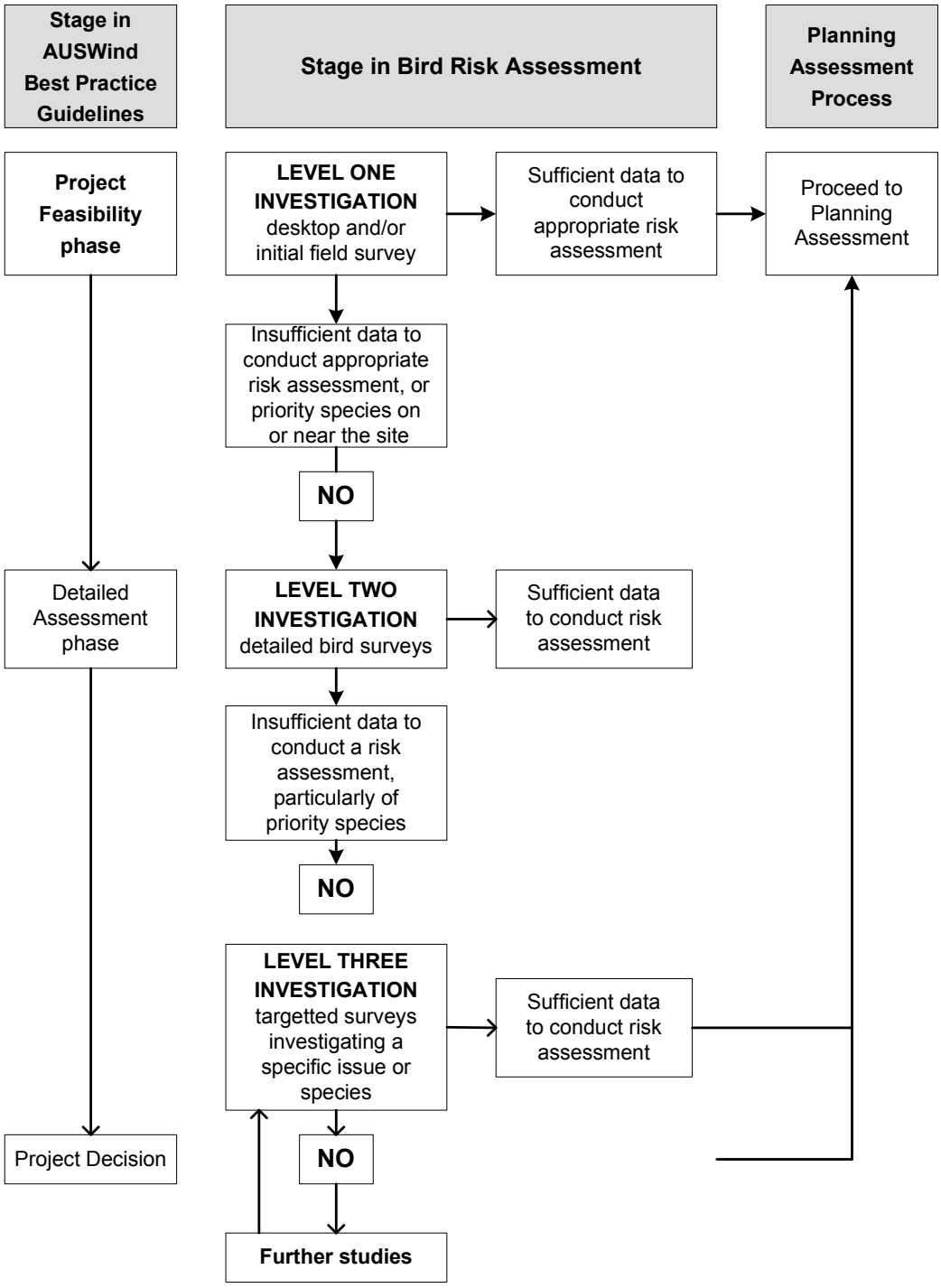
- Level One investigations ascertain the avian species on site (which may be from desk top and/or site surveys) and would usually include a site visit to verify the accuracy of desktop data and habitats present. This information will be used to identify potential effects of the wind farms on these species. If there is insufficient information from these surveys to conduct a risk assessment, Level Two investigations are undertaken;
- Level Two investigations are conducted to obtain further data on the species of bird on site in order that a risk assessment can be undertaken. These surveys are likely to involve field surveys and may include bird utilisation studies where data are obtained on use of the site by species, These surveys may involve seasonal

comparisons. If the data obtained from these more detailed surveys is insufficient to determine the potential effects of the wind farm proposal, or if there are threatened or priority species which require specific information, Level Three investigations will be undertaken;

- Level Three investigations are targeted, focal studies perhaps assessing a particular species, season, or addressing a specific issue.

Figure 1 demonstrates these levels diagrammatically.

Figure 1: Assessing and documenting bird impact risks



LEVEL ONE INVESTIGATIONS – INITIAL SURVEYS

Level One investigations are a minimum requirement for assessing potential bird impacts at a wind farm. Generally, they will:

- Determine the avian species present on or near the site;
- Identify any priority species on or near the site;
- Identify avian habitat (which may include habitat used for foraging, breeding, roosting, etc) of priority species on or near the site;

Level One investigations may involve desk top surveys (see Attachment 1 for sources of desktop information), but a site visit is usually required to verify desktop data (which are sometimes coarse in their resolution, or incomplete). These surveys can also act as pilot studies for higher level investigations. For example, roaming surveys are a good way of identifying avian habitats and areas of avian use within a site, which will assist with the design of higher level investigations.

Outcomes of Level One investigations

It is important to determine if sufficient data have been obtained to conduct a risk assessment, and this can be determined by evaluating whether the assessment:

- Is defensible to the Regulatory Authorities and stakeholders;
- That all species using the site have been adequately identified;
- That all priority species have been identified, and their use of the site is sufficiently understood.

If these criteria cannot be met, level two investigations are required.

LEVEL TWO INVESTIGATIONS – DETAILED SURVEYS

Level Two investigations are designed to obtain more detailed data on birds necessary for a risk assessment than was achieved from through Level One investigations.

Level two investigations may involve (but not be limited to):

- Bird utilisation surveys, which quantify which species are present, the numbers and how they use the site (see Attachment 2). Data from these surveys can be input to collision risk models to estimate the potential collision risk of species;
- Collision risk modelling. The advantage of using a model is that it is a more objective quantification of the risk than can be derived from a subjective assessment. Further, inputs can be modified based on advice from experts and Regulators. In the absence of empirical bird utilisation data, scenario modelling can be conducted, where a series of assumptions are input into the model to examine collision risk. Inputs can be varied to test an array of scenarios (for more details, see Attachment 2);
- Gradient studies may be a suitable method in some circumstances.

Outcomes of Level Two investigations

It is important to determine if sufficient data has been obtained to conduct a risk assessment, and this can be determined by evaluating whether the assessment:

- Is defensible to the Regulatory Authorities and stakeholders; and
- That all issues pertaining to species (particularly priority species) have been adequately addressed.

If these criteria cannot be met, level three investigations are required.

LEVEL THREE INVESTIGATIONS – TARGETTED SURVEYS

The objectives of Level Three investigations are to investigate specific issues that Level Two investigations have been unable to adequately address. Studies may be (but are not limited to):

- Population viability analysis for priority species (if a PVA is available, or if there are sufficient data to undertake one);
- Other modelling exercises;
- Detailed studies examining a specific issue.

Population viability analyses

Population viability analysis (PVA) was developed as a modelling tool for determining the viability (extinction probability) of threatened species, but is predicated on the availability of suitable data on a range of population variables (Boyce 1992).

PVA can be used to explore a range of future scenarios using input from estimated potential impacts from a wind farm. The use of a PVA may be limited by the data available for a particular threatened species (see Attachment 2 for more details).

Outcomes of Level Three investigations

It is important to determine if sufficient data have been obtained to conduct a risk assessment, and this can be determined by evaluating whether the assessment:

- Is defensible to the Regulatory Authorities and stakeholders; and
- That all issues pertaining to species (particularly priority species) have been adequately addressed.

If these criteria cannot be met, further level three investigations are required.

POST-CONSTRUCTION MONITORING

Once a wind farm has been approved, it is possible post-construction monitoring of species of interest will be required by the Regulatory Authorities. The objectives of post-construction monitoring are often to:

- Validate the risk assessment conducted during the approval process; and
- Monitor the actual effects of the operating wind farm.

Post-construction surveys may involve (but not necessarily be limited to):

- Monitoring of bird collisions with turbines. The methodology of these may require scavenger surveys to determine carcass removal rates, and observability trials (to determine how well observers detect carcasses);
- Assessing the effects of the wind farm on bird utilisation rates (to determine if there is an alienation effect operating).

As with all surveys, it is important the post-construction monitoring involve:

- The identification of objectives;
- Development of appropriate, rigorous methodologies that will obtain data to answer the objectives;
- Input from experts to assist with the design and completion of surveys; and
- That the requirements of the Regulatory Authorities be satisfied.

REFERENCES

Anon (2000) 'Environmental risk management - Principles and process'. Standards Australia/Standards New Zealand HB 203:2000.

Anon (2004a) 'Risk management'. Standards Australia/Standards New Zealand AS/ANZ 4360:2004.

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FURTHER INFORMATION

There is a great deal of information on the issue of birds and wind farms in reports from the USA and Europe. There is also some information now being published in scientific journals. Some relevant texts are listed below, but the list is far from exhaustive.

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Winkelman, J E (1994) 'Bird/Wind Turbine Investigations in Europe.' Proceedings of Second Avian – Wind Power Planning Meeting, National Wind Coordinating Committee, Washington, USA.

ATTACHMENT 1 SOURCES OF DESKTOP AVIAN DATA

Information of records of birds in a region can be obtained from a range of sources and include (but are not limited to):

- Public databases held by Government agencies (e.g. Atlases of NSW or Victorian Wildlife, electronic databases held by State Government Agencies);
- The Web-based Protected Matters Search Tool of the Australian Government Department of the Environment and Heritage on matters of national environmental significance (http://www.deh.gov.au/erin/ert/epbc/index.html);
- Databases held by a range of non-government organisations (e.g. Birds Australia's The New Atlas of Australian Birds (Barrett et al. 2003));
- Published and unpublished reports on the biodiversity of the region concerned (e.g. Biodiversity Action Plans in Victoria, or the Regional Biodiversity Plans in South Australia);
- Scientific papers (such as Austral Ecology, Wildlife Research, etc);
- Personnel from State Parks and/or wildlife agencies, particularly regional fauna and/or biodiversity officers with local knowledge of wildlife in a region; and
- Personnel or local members of national or regional non-Government bird, wildlife or field naturalists' organisations.

ATTACHMENT 2 AVIAN FIELD STUDIES

Pre-construction surveys

Below is a list of some of the types of studies that have been undertaken which have allowed an estimation of the risk of a wind farm to birds. Not all these studies may be required, and conversely, there may be instances where different studies should be considered if these ones cannot achieve the necessary objectives:

Bird Utilisation Surveys

These surveys aim to identify the avian species on site, the numbers present, the height birds fly, and describe utilisation across the site (this often includes describing "behaviour" which should be defined, and usually refers to activities such as feeding, resting, or moving, as these can aid the understanding of potential wind farm effects). The survey design is likely to include reference (or control) points and treatment points to allow for a BACI design. The reference sites would be placed at a sufficient distance from the proposed turbine locations to obtain data outside the zone of influence of the turbines. The surveys may be conducted over different seasons, and would normally sample different relevant habitats on the site. Data are quantitative and are collected at pre-determined fixed points. A number of replicates of each point are obtained and sampling is randomised to limit the effects of time of day, or differing observer abilities. Data are usually collected in a manner that allows them to be input into a collision risk model for estimating the potential collision risk of species;

Collision risk modelling

Collision risk modelling aims to estimate the number of birds at risk of colliding with wind turbines on a site. The model uses bird distribution data from the site (usually from bird utilisation surveys), bird sizes, flight speed, population sizes, and avoidance rates, along with inputs about wind turbines and wind direction. The advantage of modelling is that it is a more objective quantification of the risk than can be derived from a subjective assessment. Further, inputs can be modified based on advice from experts and Regulators. In the absence of empirical bird utilisation data, scenario modelling can be conducted, where a series of assumptions are input into the model to examine collision risk. Inputs can be varied to test an array of scenarios;

Gradient Studies

There may be some instances when a wind farm proposal lends itself to a gradient analysis, where data are obtained along a gradient to describe an effect. However, gradient studies are not always the most cost-effective design, and may not be suitable for some sites.

Population Viability Analysis

Population viability analysis (PVA) was developed as a modelling tool for determining the viability (extinction probability) of populations of threatened species, where suitable information was available on a range of population variables (Boyce 1992). It provides a means of organising and analysing information about the population of a threatened species. PVA is a useful modelling approach to explore a range of

future scenarios arising from the impacts of a wind farm on the population of a bird. It is a well researched, formalised approach, and its information requirements are well documented. However, a PVA is unlikely to exist for most threatened species in Australia, and for many others, there are unlikely to be sufficient data to conduct one.

Post-construction Surveys

Bird Utilisation Surveys

The Regulatory Authorities may require that bird utilisation surveys continue for a period following construction and commissioning of a wind farm. The purpose is usually to assess whether the use of the site by birds changes once turbines have been installed. The methodology and sampling design would be the same as pre-construction surveys to allow for pre- and post-construction comparisons to be made, and will need to include reference sites in order that turbine effects can be distinguished from other effects (part of a BACI design).

Dead bird searches

The Regulatory Authorities may require that dead bird searches be undertaken around turbines. The purpose of these is usually to quantify collision rates which can be used to validate the risk assessments conducted for the wind farm, particularly if there are threatened species present on site. The monitoring strategy used should be based on the species of interest, the scavenging rates on the site and the ability of observers to detect carcasses. Monitoring intensity may vary with time of year, based on the species present.

Behaviour around turbines

At some sites, targeted studies have been designed to obtain data on the avoidance rates of birds around turbines. These have been necessary due to the scarcity of specific information on avoidance rates of birds (which are input into collision risk models). Data from overseas is limited and the assumption that Australian species have similar avoidance rates to overseas birds needs to be tested. Once sufficient data have been obtained on avoidance rates, it is not expected that these studies will be a normal requirement at wind farms.

Other surveys

It is possible that there may be other specific studies required at a wind farm, and the nature of these will depend on the species present, and the potential risk to those species. These surveys may involve assessing effects on breeding success, foraging behaviour, etc.

Details provided in the following appendices were correct at the time of writing, however, there is potential for some elements to change. Proponents should confirm the current status of the items addressed in this appendix prior to commencing investigations or works.

APPENDIX 9
ASSESSING BAT ISSUES AT WIND FARMS

The Australian Wind Energy Association (AusWind) is developing a standardised approach to assessing bat issues at wind farms. This guide makes reference to the "Bats and Windfarms" brochure produced by the Australasian Bat Society, Inc. This details strategies for:

- conducting risk assessments of bat issues; and
- monitoring the effects of wind energy developments on bats.

Australian and overseas studies have revealed that bats can collide with wind turbines.

Objectives

The objective of this document is to provide best practice guidelines for the assessment of bat issues at wind farms, which will give comfort to the Regulatory Authorities and the community that this issue is being managed in a stringent and consistent manner. The fundamental principle of this guide is that rigorous, scientifically based approaches are used in the assessment and monitoring of bats at Australian wind farms.

The protocols provide a structured approach for the different levels of investigation.

It is not the purpose of this guide to provide a list of possible studies that could be undertaken during each level of investigation, as it is more appropriate to select and design studies on a site-, project- and species-specific manner. Similarly, no details of methodology are provided as each study should be designed specifically for the proposal and site. This guide recommends that input be sought from relevant experts and the Regulatory Authorities when determining the surveys to be conducted and their experimental design.

PRE-CONSTRUCTION SURVEYS

Background to assessing bat issues at a site

A number of issues will be considered prior to undertaking a risk assessment of bats at a wind farm.

25. Crucial to the appropriate assessment of bat issues is that the Proponent is aware of the Acts that cover bats present on or near the wind farm site. This may include the Environment Protection Biodiversity Conservation Act 1999 (EPBC) and relevant State or Territory Acts. Species listed under these Acts can be deemed a "priority" in the risk analysis (and hereafter are called priority species). However, there may be other bat species that are not listed under an Act, but may also be regarded as priority due to:
    - Significant or high level of activity (which will need to be defined) numbers of a native bat species on or near the site;

- species or taxa that are prone to collision with turbines, or to other effects from wind farms.

26. All studies undertaken to assess bat issues must be scientifically robust and defensible. This requires that the objectives of all studies are determined *a priori* and that, when higher level (see descriptions below) surveys are undertaken, the experimental design of studies is rigorous (preferably with input from a statistician), and appropriate statistical analyses conducted, where necessary.
27. Consideration needs to be given to bat species on site, and those near *the site that could potentially be impacted by the proposal. * The term near has not be quantified here, as the distance will vary between sites. However, determining the distance is based on whether species in surrounding areas could be potentially directly affected by the wind farm. For example, if the site could be on a flight path for priority species.
28. Significance of any bat habitat or features (such as roost sites, caves, large old trees with hollows, wetlands, or remnant vegetation, etc_ on the wind farm site needs to be considered in the assessment.
29. The extent to which particular stages in the life history of a species could be affected and seasonal activity levels (e.g. breeding, foraging, etc.).
30. In order to quantify a potential impact, it is often useful to evaluate the proportion of the regional, state or national population of a species, if possible.
31. It is possible that monitoring conducted after the commissioning of a wind farm will be required by the Regulatory Authority/ies. The rigour of such studies will be increased if there is adequate baseline data which will enable before and after comparisons to be made, and a BACI (Before After Control Impact) design is often required in the survey designs. A BACI design enables the impact of the wind farm to be distinguished from the impact of other effects. In order to conduct appropriate BACI surveys it is necessary to incorporate control (or reference sites) into the design of surveys, and to have data from prior to the construction of the wind farm.
32. It is important that all assessments incorporate to the requirements of the relevant Regulatory Authorities, and that input from these Authorities be sought as early as possible in the planning process. Ideally, discussions with these Authorities will result in agreement on:
    - the bat issues on the site;
    - the objectives of bat studies to be conducted, and their general methodology; and
    - any mitigation measures to be used.
33. Determine what constitutes a significant impact. The risk assessment conducted needs to consider whether the potential effect of the wind farm will result in a significant impact to relevant species.

Risk matrix

The framework provided in the Australian standard for risk management and related guidelines, AS/NZS 4360 (Anon 2004a, 2004b), and the associated guide for environmental risk management HB203:2000 (Anon 2000), assesses risk using a combination of consequence (or potential impact) and the likelihood of occurrence of the impact (Table 1).

This risk matrix can be used in an iterative manner, for example it could be used to assist with:

- Determination of whether a referral under the EPBC is required;
- Initial evaluation of issues on site;
- Re-evaluation of risks after more detailed scientific investigations; and
- Re-evaluation of risks after the implementation of mitigation strategies.

Table 2: Qualitative risk analysis (modified from Anon 2000)

Likelihood	Consequence			
	insignificant	minor	moderate	significant
very rare	L	L	M	H
rare	L	L	M	H
possible	L	M	H	H
probable	M	H	H	H

where:

L = low risk

M = medium risk

H = high risk

Strategies for undertaking an assessment of bat issues at a wind farm

A hierarchical approach to the investigation of bat issues is suggested. The lowest level studies are preliminary surveys to identify species on a site, with studies increasing in their complexity and specificity up through the levels. For example, if investigations at a lower level identify a species that is a priority and insufficient data are available to conduct a risk assessment, the next level of investigation will be used. This might include studies of activity levels. Currently, there is not a model which can estimate collision rates of bats with turbines. Hence, the methodologies

may exist for level 1 and 3 studies, but there may not currently be any developed for level 2 studies.

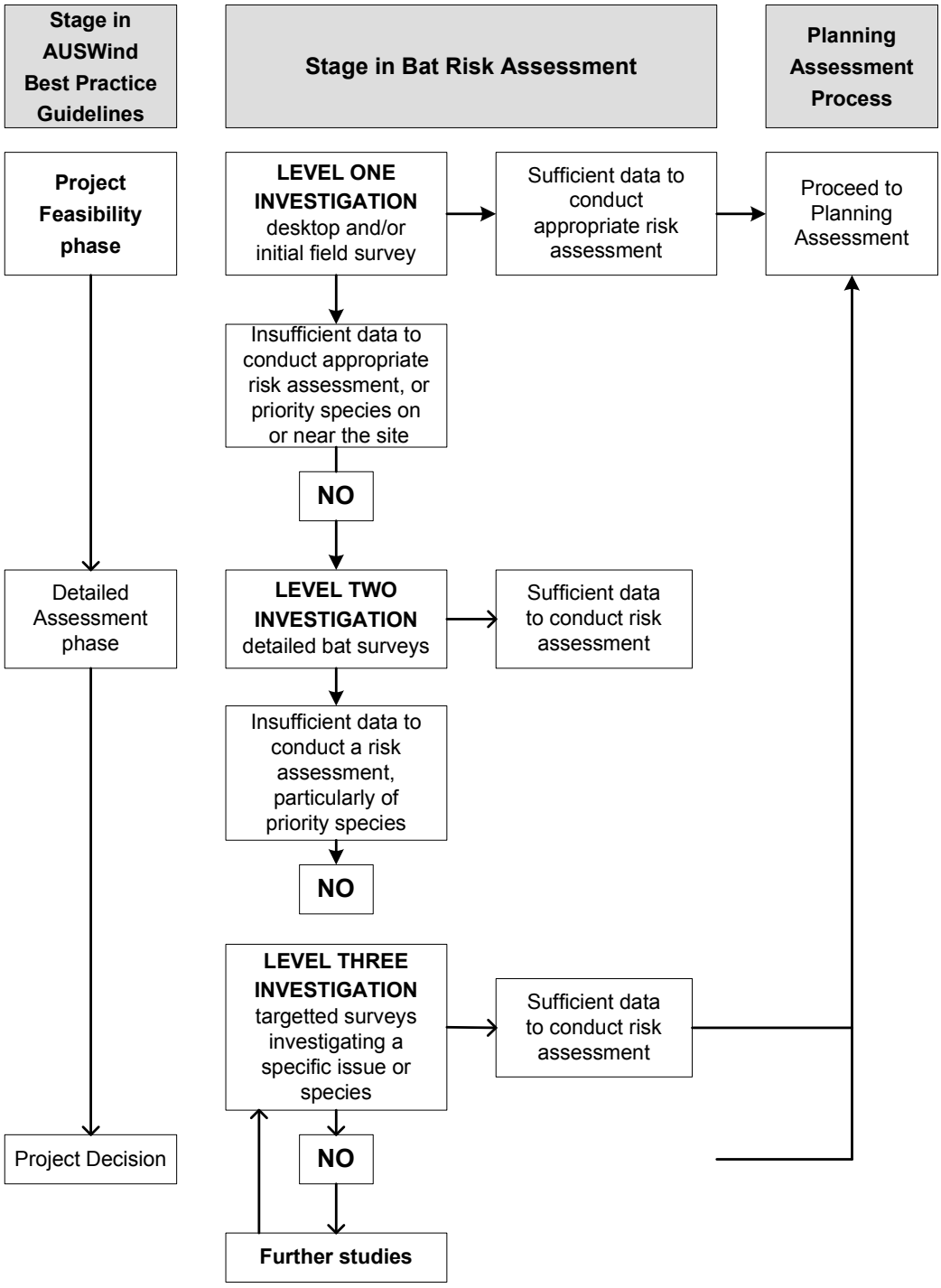
However, three levels of Investigation are provided as a conceptual framework, and the purpose of each level of investigation is to obtain data that will enable estimates of the potential impact of a proposed wind farm on the relevant species of bats.

The three levels of investigation are:

- Level One investigations ascertain the bat species on site (which may be through desk top and/or site surveys) and identify potential effects of the wind farms on these species. If there is insufficient information from these surveys to conduct a risk assessment Level Two investigations are undertaken;
- Level Two investigations are conducted to obtain further data on the species of bats on site in order that a risk assessment can be undertaken. These surveys are likely to involve field surveys and may include seasonal and relative activity level comparisons. If the data obtained from these more detailed surveys are insufficient to determine the potential effects of the wind farm proposal, or if there are threatened or priority species which require specific information, Level Three investigations are undertaken;
- Level Three investigations are targeted, focal studies perhaps assessing a particular species, season, or addressing a specific issue.

Figure 1 demonstrates these levels diagrammatically.

Figure 2: Assessing and documenting bat impact risks



LEVEL ONE INVESTIGATIONS – INITIAL SURVEYS

Level One investigations are a minimum requirement for assessing potential bat impacts at wind farms. In general, they would:

- Determine the bat species present on or near the site;
- Identify if there are any priority species on or near the site;
- Identify bat habitat (which may include habitat used for foraging, breeding, roosting, etc) of priority species on or near the wind farm;

Level One investigations can act as pilot studies for higher level investigations, should these be required.

Outcomes of Level One investigations

It is important to determine if sufficient data have been obtained to conduct a risk assessment, and this can be determined by evaluating whether the assessment:

- Is defensible to the Regulatory Authorities and stakeholders;
- That all species using the site have been adequately identified;
- That all priority species have been identified, and their use of the site is sufficiently understood.

If these criteria cannot be met, level two investigations are required.

LEVEL TWO INVESTIGATIONS – DETAILED SURVEYS

Level Two investigations allow more detailed quantification for assessing potential impacts than is possible through Level One investigations.

Level two investigation may involve (but not be limited to):

- More detailed bat surveys, which quantify which species are present and relative activity levels, the numbers and how they use the site; and
- Gradient studies may be a suitable method in some circumstances.

Outcomes of Level Two investigations

It is important to determine if sufficient data have been obtained to conduct a risk assessment, and this can be determined by evaluating whether the assessment:

- Is defensible to the Regulatory Authorities and stakeholders; and
- That all issues pertaining to species (particularly priority species) have been adequately addressed.

If these criteria cannot be met, level three investigations are required.

LEVEL THREE INVESTIGATIONS – TARGETTED SURVEYS

The objectives of Level Three investigations are to investigate specific issues that level two investigations have been unable to adequately address. Studies may be (but are not limited to):

- Population viability analysis for priority species (if one is available, or if there are sufficient data to undertake one);
- Other modelling exercises;
- Detailed studies examining a specific issue.

Population viability analyses

Population viability analysis (PVA) was developed as a modelling tool for determining the viability (extinction probability) of threatened species, but is predicated on the availability of suitable data on a range of population variables (Boyce 1992).

PVA can be used to explore a range of future scenarios using input from estimated potential impacts from a wind farm. However, few threatened species in Australia have sufficient data to enable a PVA.

Outcomes of Level Three investigations

It is important to determine if sufficient data have been obtained to conduct a risk assessment, and this can be determined by evaluating whether the assessment:

- Is defensible to the Regulatory Authorities and stakeholders; and
- That all issues pertaining to species (particularly priority species) have been adequately addressed.

If these criteria cannot be met, further level three investigations are required.

POST-CONSTRUCTION MONITORING

Once a wind farm has been approved, it will be clear if there are species of interest on the site, and if there are, it is likely post-construction monitoring of these will be required by the Regulatory Authorities. The objectives of post-construction monitoring are often to:

- Validate the risk assessment conducted in the approval process; and
- Monitor the actual impacts of the wind farm.

Post-construction surveys may involve (but not necessarily be limited to):

- Monitoring of bat collisions with turbines. The methodology of these may require scavenger surveys to determine carcass removal rates, and observability trials (to determine how well observers detect carcasses);
- Assessing the effects of the wind farm on bat numbers on site (to determine if there is an alienation effect operating).

As with all surveys, it is important the post-construction monitoring surveys involved:

- The identification of objectives;

- Development of appropriate, rigorous methodologies that will obtain data to answer the objectives;
- That input for sought from experts to assist with the design and completion of surveys; and
- That the requirements of the Regulatory Authorities be satisfied.

REFERENCES

Anon (2000) 'Environmental risk management - Principles and process'. Standards Australia/Standards New Zealand HB 203:2000.

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Anon (2004b) 'Risk management guidelines - Companion to AS/NZS 4360:2004'. Standards Australia/Standards New Zealand AS/ANZ HB436:2004.

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FURTHER INFORMATION

There is a reasonable amount of information on the issue of bats and wind farms in reports from the USA and Europe. Some relevant texts are listed below, but the list is far from exhaustive.

Australasian Bat Society. http://abs.ausbats.org.au

Environment Australia (2000). EPBC Act Administrative guidelines on significance. At http://www.deh.gov.au/epbc/assessmentsapprovals/guidelines/administrative/index.html.

Garnett, S T and Crowley, G M (2000) 'The Action Plan for Australian Bats 2000.' Environment Australia, Canberra.

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ATTACHMENT 1 SOURCES OF DESKTOP BAT DATA

Information of records of bats in a region can be obtained from a range of sources and include (but are not limited to):

- Public databases held by Government agencies (e.g. Atlases of NSW or Victorian Wildlife, electronic databases held by State Government Agencies);
- The Web-based Protected Matters Search Tool of the Australian Government Department of the Environment and Heritage on matters of national environmental significance (http://www.deh.gov.au/erin/ert/epbc/index.html);
- Published and unpublished reports on the biodiversity of the region concerned (e.g. Biodiversity Action Plans in Victoria, or the Regional Biodiversity Plans in South Australia);
- Scientific papers (such as Austral Ecology, Wildlife Research, etc);
- Personnel from State Parks and/or wildlife agencies, particularly regional fauna and/or biodiversity officers with local knowledge of wildlife in a region; and

  Personnel or local members of national or regional non-Government wildlife or field naturalists' organisations.

Details provided in the following appendices were correct at the time of writing, however, there is potential for some elements to change. Proponents should confirm the current status of the items addressed in this appendix prior to commencing investigations or works.

APPENDIX 10
FIRE MANAGEMENT GUIDELINES

Fire management is an important part of both wind farm project planning and the community consultation process. Despite the low fire risk that wind farms present, planning for fire prevention and an effective and informed response is necessary. It gives the rural fire service the knowledge and confidence needed to plan and execute an effective response. It provides wind farm proponents and owners with the confidence that minimum damage would result from a fire incident, and it reassures the local community that the appropriate measures have been taken with regards to fire prevention and response.

Listed below are the core actions that wind farm proponents should undertake during the development, construction, operation and decommissioning of wind farm projects to minimise fire risk and ensure for effective response if there is a fire.

WIND FARM PLANNING

Before submitting any planning applications for a wind farm development proponents will:

- Contact the relevant regional or state rural fire office, which deals with development assessment or provides core advice, to discuss the project and management actions. Local fire service groups that would service the wind farm site should also be notified and consulted. The rural fire service should be informed of the location and scale of the project for their planning purposes.
- Undertake to provide the regional and local rural fire groups with the details of the wind farm site (such as turbine, access tracks and gate locations) to assist their internal response planning.
- Consult the regional and local rural fire service groups on proposed fire management and response procedures for the wind farm site, and reach agreement on appropriate fire management actions. Such actions may include:
  - adherence to all regulations under the relevant state fire protection Acts
  - development of an Emergency Response Plan, which would include agreed notification protocols, contacts and response actions
  - installation of access tracks at least 5 metres wide (7 metres for corners) and with a minimum 4 metres vertical clearance
  - access track surfaces to be all-weather condition

- gradient not to exceed a 14 per cent slope on roads and 12.5 per cent in the entry and exits of dips
- access tracks and watercourse crossovers constructed for a minimum of 15 tonne fire appliance
- dead-end roads/access to have turn-around diameter of at least 25 metres or 'T' or 'T' shapes with leg lengths of at least 17 metres
- adherence to fuel control regulations and local fire service requirements regarding fuel control, around electrical compounds, buildings and other structures (pending native vegetation clearance regulations and landowner agreement);
- provision of basic fire fighting equipment at each active site, including fire extinguishers, knapsacks, and other equipment suitable for initial response actions
- identification of water reserves in the local area which could be used for fire fighting, or provision of static water supply tanks and appropriate fittings for fire fighting, with a capacity of 22,500 litres (5000 gallons) at agreed locations adjacent to main access tracks
- provision for mobile telephone and UHF radio communications at construction sites
- provision of onsite identification of individual turbine locations and access gates for fire fighting services, and an undertaking to provide local rural fire service groups with keys/access cards to gates.

PRE-CONSTRUCTION ACTIVITIES

In the pre-construction activities, proponents will:

- Provide the appropriate regional and local rural fire service groups with:
  - a construction works schedule
  - maps of final turbine layout and identification information for individual turbine sites
  - access road plans and locations of access gates
  - security information such as location of locked gates and restricted access areas
  - location of any additional water supplies installed for construction activities
  - location of potential landing pads for fire fighting aircraft or helicopters.
- Develop a Fire Hazard Management Plan (FHMP) for the project in consultation with relevant regional and local rural fire service groups, including agreed fire response actions and communication protocols.

CONSTRUCTION AND DECOMMISSIONING ACTIVITIES

During construction and decommissioning phases, proponents will:

- provide the local rural fire services with access keys or cards to locked gates and restricted areas (where appropriate)
- incorporate fire prevention and response actions (as per FHMP) and contractor's Emergency Response Plan (ERP)) in staff inductions
- ensure the FHMP and ERP is accessible to all staff and local rural fire services
- incorporate fire response planning into any Occupational Health & Safety (OH&S) audits conducted onsite
- keep local rural fire services updated about any changes to works schedules or access arrangements.

OPERATION OF A WIND FARM

During wind farm operations, regular maintenance vans visit the sites to undertake turbine maintenance. Proponents will ensure the following fire management actions are carried out:

- Ensure operations staff are inducted in fire response and have access to the FHMP and ERP.
- Ensure the regional and local rural fire service has up-to-date maps, access gate keys/cards and turbine numbering information.
- Inform the local rural fire service of the wind farm maintenance schedule (if available) and any planned activities
- Liaise with the local rural fire service on high-fire risk days.

Details provided in the following appendices were correct at the time of writing, however, there is potential for some elements to change. Proponents should confirm the current status of the items addressed in this appendix prior to commencing investigations or works.

APPENDIX 11
ELECTROMAGNETIC INTERFERENCE

Telecommunication systems often use high points in the landscape in vicinity of projective wind farm sites and telecommunications service providers, and users may have concerns about electromagnetic interference and degradation of signals as a result of a proposed wind farm development. A diverse range of telecommunications including radio and television companies, mobile phone companies, local and national utilities, and emergency services such as ambulance and coastguard using microwave communication systems could be involved in any particular development. In rare cases Proponents may be faced with complying with statutory separations from certain communications equipment for example those associated with microwave sites or airports.

The scope for wind turbines to impact such systems is summarised as follows:

- The turbine tower may obstruct, reflect or refract the electromagnetic waves used in a range of communications systems for transmission.
- The rotating blades may have similar effects, on a time-variable basis. In some cases ghosting of TV receivers close to the wind farm may occur where metal blades (or those with metallic cores or metal components such as the lightening protection system) act as an aerial to on-transmit the communication signal.
- The turbine's electrical generator itself can produce electromagnetic interference, which may need to be suppressed by shielding design and maintenance of turbines (although in practice, a generator is little different from a typical electrical motor and it is quite rare for a wind turbine generator to present such a problem).

It is normally possible for the potential for the electromagnetic interference effects mentioned above to be minimised, if not eliminated altogether through special technical solutions and appropriate turbine siting.

In general the effects of wind turbines on electromagnetic waves will usually be relatively limited. The tower and blades are slim and curved, and consequently will disperse rather than obstruct or reflect the waves. Where blades are of a material transparent or absorbent to the waves, as is commonly the case, problems are likely to be minimal. However, the location, size and design of the turbines may be important, depending on the location and nature of the communication transmission facilities.

The communications systems most likely to be affected are those which operate at super high frequencies (particularly microwave systems operating at frequencies above about 300 MHz). These rely on line of sight between transmitter and receiver. Any obstruction in the vicinity of a straight line between these two points may cause interference and signal degradation.

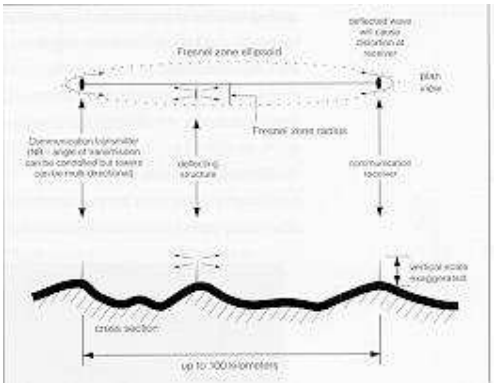

Figure A-3 Potential effect of structure on microwave links, in plan and cross-section.

The key area of potential interference is called the first Fresnel zone. This is an ellipsoid around and forming a path between the transmitting and receiving stations based on transmission, frequency, distance and local atmospheric conditions. A turbine within the first Fresnel zone may be acceptable, particularly if it is a solitary obstacle with a width less than 0.3 times the radius of the zone. However, every case needs to be considered on its particular circumstances. Potential effects can be calculated from information about the signal, the local conditions, and the turbine design and location.

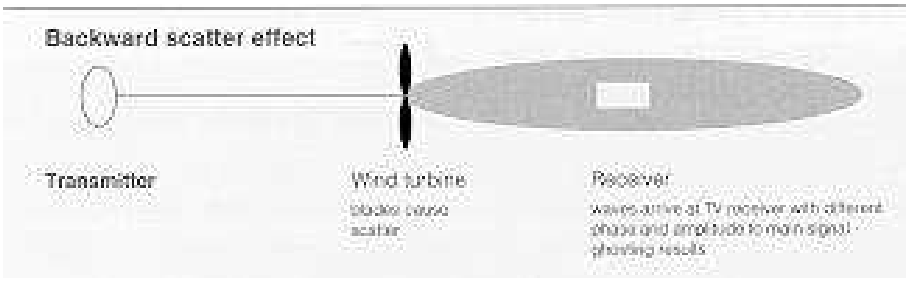

Figure A-4 Potential for interference with TV reception, backward and forward scatter effects.

For all electromagnetic effects, means of mitigation, avoidance, and remedy can be found. These may include specific location of particular turbines, choice of wind turbine generator type, tower design, or specific blade material. Relocating, adjusting or enhancing existing communications installations may also present as options for reducing the potential for interference. For example a small change in a line of sight radio path can make a large difference to whether the path is obstructed by the turbine or not. An example is Trustpower's Tarurua Wind Farm in New Zealand (see below) where wind turbines were carefully placed to avoid the line of sight of several microwave beams traversing the site. Despite the telecommunications facilities being located virtually within the wind farm boundary, no interference has been reported.

For domestic receptors it may be possible to enhance reception by upgrading the quality of existing television aerials or installing a repeater.

Whilst the presence of telecommunications structures on a proposed site is an obvious indicator that electromagnetic interference issues will need to be taken into

consideration, even if there are no such structures present, it is advisable for Proponents to identify and consult with communications operators at an early stage, so that any potential adverse effects can be identified and addressed. Proponents will seek to identify and address any electromagnetic interference issues through private agreements with the stakeholders prior to seeking planning approval for the project.

Telecommunications stakeholders are best identified through a search of the Australian Communications and Media Authority's Register of Radio-communications Licences. This can be searched in a number of ways; probably the most useful for a proposed wind farm site is a search by postcode. This will identify all license holding sites within the postcode district and these can be individually examined in detail and contacted if required. The database can be accessed on-line www.acma.gov.au, or through the purchase of a CD of the database.

The electromagnetic radiation resulting from generation and export of electricity from a wind farm does not pose a threat to public health. Typically electrical cabling between wind turbines will be direct buried in the ground and grid connection cabling is usually made at no more than 66kV or 132kV; similar voltages to those routinely used by utilities in existing distribution networks. As part of the engineering specification however, Proponents will require that installation contractors adhere to prescribed electrical cabling standards.

Details provided in the following appendices were correct at the time of writing, however, there is potential for some elements to change. Proponents should confirm the current status of the items addressed in this appendix prior to commencing investigations or works.

APPENDIX 12
WIND TURBINE STANDARDS

Wind turbines connecting to the NEM must meet the technical performance standards in Chapter 5 of the NER. New standards have currently been drafted and are under consultation on the AEMC website. These standards are expected to be applied by December 2006.

This appendix lists some of the standards, procedures, codes of practice and guidelines that have been developed specifically for wind turbine generators and wind farms. However it is not exhaustive and Proponents should ensure that any proposed development conforms to relevant State and Federal Laws and Regulations as well as applicable Australian and International Standards and Codes.

A.1 ORGANISATIONS INVOLVED IN PRODUCING WIND STANDARDS

The following organisations are or have been involved in the preparation and publishing of standards relevant to wind energy systems:

- SA - Standards Australia, SNZ - Standards New Zealand
- IEC – International Electrotechnical Commission
- IEA – International Energy Agency
- AWEA – American Wind Energy Association
- NWCC – National Wind Coordinating Committee (US based)
- MEASNET – Measuring Network of Wind Energy Institutes

A.2 STANDARDS AUSTRALIA AND STANDARDS NEW ZEALAND

Standards Australia (website www.saiglobal.com) is an independent, not for profit organisation. It has a memorandum of understanding with the Commonwealth Government that recognises Standards Australia as the peak standards writing body in Australia.

Standards Australia is the Australian representative in the International Organisation for Standardisation (ISO) and the International Electrotechnical Commission (IEC). Standards Australia often works with Standards New Zealand in the preparation of joint Australian/New Zealand Standards and related documents. Both Australian and joint Australian/New Zealand Standards are recognised as being authoritative documents. They have wide legislative acceptance in all states and territories in Australia with an increasing legislative acceptance by the Federal Government.

Because of the fairly recent evolution of the wind industry in this country, Standards Australia has not to date published any standards specifically targeting wind turbines and wind farms. Exception are a draft standard on measurement of noise levels and two IEC standards which have recently been adopted as AS 61400.2(Int)-2006 and AS 61400.2(Int)-2006 and AS 61400.21-2006 which have been adapted from the IEC standards IEC 61400-2 Ed. 2 (2006) and IEC 61400-21 Ed. 1 (2001)).

SA has two technical committees which address wind turbine standards (EVL-048 for wind turbine standards and EV-016 for acoustic wind turbine noise).

However, many of the existing Australian Standards do hold relevance to the civil, structural, mechanical, electrical and instrumentation engineering of wind farms. Although by no means an exhaustive listing, some of the key standards that Proponents wish to refer to are listed in this section. Proponents can access titles and summaries via www.saiglobal.com where all of the standards published by SA can be purchased on line in either hard copy or electronic form.

AS/NZS 3000:2000 SAA Wiring Rules

Provides requirements for the selection and installation of electrical equipment, design and testing of electrical installations, especially with regard to the essential requirements for safety of persons and livestock from physical injury, fire or electric shock. Many of the prescriptive work practices contained in previous editions of AS 3000 have been removed and this Standard incorporates internationally accepted practices. (290 pages)

AS/NZS 3008.1.1:1998 Electrical installations - Selection of cables

Part 1.1: Cables for alternating voltages up to and including 0.6/1 kV—Typical Australian installation conditions

Sets out the procedures to be followed for the selection of cables to satisfy typical Australian installation conditions where the ambient air temperature is 40 degrees Celsius and ambient soil temperature is 25 degrees Celsius. Criteria given are current-carrying capacity, voltage drop and short-circuit temperature rise. (95 pages)

AS/NZS 3100:2002 Approval and test specification - General requirements for electrical equipment

Specifies essential safety requirements for approval and test purposes. It is a parent specification for a series of approval and test specifications.

AS/NZS 3820:1998 Essential safety requirements for low voltage electrical equipment

Specifies a set of outcomes-oriented criteria for the safety of electrical equipment for use by electrical regulators in relation to products for which regulatory approval before sale is not required (non-declared articles). This Standard is intended to be consistent with the criteria of the European Union low voltage directive. (5 pages)

AS 60038-2000 Standard voltages

Specifies standard voltages for 50 Hz AC transmission distribution and utilization systems, standard voltages for AC or DC traction systems and nominal voltages for AC and DC equipment less than 120 V AC or 750 V DC This Standard is based on,

and contains, the full text of IEC 60038:1983 incorporating its Amd. 1:1994 and Amd. 2:1997. Text not applicable in Australia has been struck through for clarity. Added text for Australian conditions has been shaded and inserted in its appropriate place. An appendix summarizes variations for Australian conditions. (8 pages)

AS/NZS 1768(Int)-2003 Lightning protection

Sets out guidelines for the protection of persons and property from hazards arising from exposure to lightning. In particular, it covers: the protection of persons from both direct and indirect effects of a lightning strike; the protection of various buildings and structures from the risk of physical damage or fire; and the protection of sensitive equipment from overvoltages resulting from a lightning strike to a building or its associated services. The nature of lightning and the principles of lightning protection are discussed and guidance is given to assist in determining if a particular building or structure should be protected. Identical with NZS 1768:1991 and produced as a Joint Australian/New Zealand Standard.

AS 1170.1-2002 Structural design actions - Permanent, imposed and other actions

Provides design values of permanent, imposed and other actions to be used in the limit state design of structures and members. It is intended to be used in conjunction with AS/NZS 1170.0. Other actions covered include liquid pressure, ground water, rain water ponding and earth pressure.

AS 1170.2–2002 Structural design actions – Wind actions

Provides design values of wind actions for use in structural design. It is intended to be used in conjunction with AS/NZS 1170.0, which gives the procedure for structural design. Wind speeds and direction factors are provided for a range of probabilities of exceedance. Other factors cover the environment around the structure, the geometry of the structure and the dynamic interaction of the structure with the wind.

AS 1170.4-1993 Minimum design loads on structures (known as the SAA Loading Code) - Earthquake loads (Amdt 1 October 1994).

Sets out data and procedures for determining minimum earthquake loads on structures and their components, and also minimum detailing requirements for structures. It does not consider related phenomena such as settlement, slides, subsidence, liquefaction or faulting in the immediate vicinity of a structure. It does not include nuclear reactors, dams, transmission towers, bridges, piers and wharves, which may require special consideration. The Standard is in limit states format. New earthquake maps are defined in terms of an acceleration coefficient instead of the zoning system used in the previous Standard AS 2121. Domestic structures are now included.

AS 61400.2(Int)-2006 Wind turbines - Design requirements for small wind turbines

This Interim Standard specifies design requirements for small wind turbines (viz with a swept area up to 200 m^2). Adapted from the IEC standard 61400-2 Ed. 2 (2006).

AS 61400.21-2006 Wind turbines - Measurement and assessment of power quality characteristics of grid connected wind turbines

Specifies a methodology for the measurement and assessment of the power quality characteristics of grid connected wind turbines. Identical to IEC standard IEC 61400-21 Ed. 1 (001).

NZS 6808:1998 Acoustics - the assessment and measurement of sound from wind turbine generators

Provides methods for prediction, measurement, and assessment of noise produced by WTGs, specifically dealing with the presence of wind. Does not specify limits, but states: "As a guide to the limits of acceptability, the sound level (L_{eq}) of the WTG (or wind farm) should not exceed, at any residential site, and at any of the nominated wind speeds, the background sound level (L_{95}) by more than 5 dBA, or a level of 40 dBA L_{95}, whichever is the greater."

This standard was originally intended as a joint Australian/New Zealand Standard, but was not approved in Australia although it has been the basis of planning conditions for several Australian wind farms. It forms the basis of draft Australian Standard DR 04173., released for public comment in March 2004.

Refers to NZS 6801:1991 and NZS 6802:1991.

A.3 INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

The IEC, (website http://www.iec.ch) is a global organisation that prepares and publishes international standards for all electrical, electronic and related technologies. Its membership consists of more than 60 participating countries, including all the world's major trading nations and a growing number of industrialising countries. The IEC's mission is to promote, through its members, international cooperation on all questions of electrotechnical standardization and related matters, such as the assessment of conformity to standards, in the fields of electricity, electronics and related technologies.

The IEC produces standards relating to all electrotechnologies including electronics, magnetics and electromagnetics, electroacoustics, multimedia, telecommunication, and energy production and distribution, as well as associated general disciplines such as terminology and symbols, electromagnetic compatibility, measurement and performance, dependability, design and development, safety and the environment.

The IEC is one of the bodies recognized by the World Trade Organization (WTO) and entrusted by it for monitoring the national and regional organisations agreeing to use the IEC's international standards as the basis for national or regional standards as part of the WTO's Technical Barriers to Trade Agreement.

Around 200 technical committees (TCs) and subcommittees (SCs), and some 700 working groups carry out the standards work of the IEC. The technical committees prepare technical documents on specific subjects within their respective scopes, which are then submitted to the full member National Committees (IEC's members) for voting with a view to their approval as international standards. The main technical committee for wind turbine systems is TC88, which publishes the standards listing in this section.

A.3.1 IEC Published Standards

IEC 60050-415 (1999-04) Ed. 1.0 International Electrotechnical Vocabulary - Part 415: Wind turbine generator systems

IEC 61400-1:2005 Wind turbines Part 1: Design requirements

Specifies essential design requirements to ensure the engineering integrity of wind turbines. Provides an appropriate level of protection against damage from all hazards during the planned lifetime. Is concerned with all subsystems of wind turbines such as control and protection mechanisms, internal electrical systems, mechanical systems and support structures. Applies to wind turbines of all sizes. See IEC 61400-2 for small wind turbines.

IEC 61400-2:1996 Wind turbines Part 2: Design requirements for small wind turbines

Deals with safety aspects, quality assurance, and engineering integrity and specifies requirements for the safety of small wind turbines including design, installation, maintenance and operation under specified external conditions. Provides the appropriate level of protection against damage from hazards from these systems during their planned lifetime.

IEC 61400-11 Ed 2.0:2002 Wind turbine generator systems Part 11: Acoustic noise measurement techniques

Presents noise measurement procedures that enable noise emissions of a wind turbine to be characterized. This involves using measurement methods appropriate to noise emission assessment at locations close to the machine, in order to avoid errors due to noise propagation, but far enough away to allow for the finite source size. The procedures described are different in some respects from those that would be adopted for noise assessment in community noise studies. They are intended to facilitate characterization of wind turbine noise with respect to a range of wind speeds and directions. Standardization of measurement procedures will also facilitate comparisons between different wind turbines.

Presents measurement procedures that enable noise emissions of a wind tubine to be characterized with respect to a range of wind speeds and directions. Allows comparisons between different wind turbines.

IEC 61400-12-1:2005 Wind turbines Part 12-1: Power performance measurements of electricity producing wind turbines

Specifies a procedure for measuring the power performance characteristics of a single wind turbine and applies to the testing of wind turbines of all types and sizes connected to the electrical power network. Also describes a procedure to be used to determine the power performance characteristics of small wind turbines (as defined in IEC 61400-2) when connected to either the electric power network or a battery bank.

The WTG power performance characteristics are determined by the measured power curve and the estimated annual energy production (AEP). The measured power curve is determined by collecting simultaneous measurements of wind speed and power output at the test site for a period that is long enough to establish a

statistically significant database over a range of wind speeds and under varying wind conditions. The AEP is calculated by applying the measured power curve to reference wind speed frequency distributions, assuming 100% availability.

The standard describes a measurement methodology that requires the measured power curve and derived energy production figures to be supplemented by an assessment of uncertainty sources and their combined effects.

See also MEASNET.

IEC/TS 61400-14 Ed. 1.0 (English 2005) Wind turbines - Part 14: Declaration of apparent sound power level and tonality values

Gives guidelines for declaring the apparent sound power level and tonality of a batch of wind turbines. Is to be used in conjunction with IEC 61400-11 which gives measurement procedures for apparent sound power level and tonality.

IEC/TS 61400-14:2005 Wind turbines - Part 14: Declaration of apparent sound power level and tonality values

Gives guidelines for declaring the apparent sound power level and tonality of a batch of wind turbines. Is to be used in conjunction with IEC 61400-11 which gives measurement procedures for apparent sound power level and tonality.

IEC 61400-21:2005 Wind turbine generator systems - Part 21: Measurement and assessment of power quality characteristics of grid connected wind turbines

Describes measurement procedures for quantifying the power quality of a grid connected wind turbine and the procedures for assessing compliance with power quality requirements. (85 pages)

IEC/TS 61400-23:2001 Wind turbine generator systems Part 23: Full-scale structural testing of rotor blades

This technical specification provides guidelines for the full-scale structural testing of wind turbine blades and for the interpretation or evaluation of results, as a possible part of a design verification of the integrity of the blade. The following tests are considered in this technical specification:

- static strength tests;
- fatigue tests;
- other tests determining blade properties.

It is assumed that the data required to define the parameters of the test are available. In this technical specification, the design loads and blade material data are considered starting points for establishing and evaluating the test loads. The evaluation of the design loads with respect to the actual loads is outside the scope of this technical specification.

IEC/TR 61400-24:2002 Wind turbine generator systems - Part 24: Lightning protection

Identifies the generic problems involved in lightning protection of wind turbines; describes appropriate methods for evaluating the risk of lightning damage to wind turbines; describes and outlines suitable methods for lightning protection of wind turbine components.

IEC WT 01:2001 System for Conformity Testing and Certification of Wind Turbines — Rules and procedures

Defines a certification system for wind turbines (IEC WT). It specifies rules for procedures and management to carry out conformity evaluation of WTs, with respect to specific standards and other technical requirements, relating to safety, reliability, performance, testing and interaction with electrical power networks. (52 pages)

Produced by TC 88 in conjunction with CAB

A.3.2 Additional IEC Standards (Work in Progress)

IEC 61400-3 Ed 1.0 Wind turbines - Part 3: Design Requirements for offshore wind turbines

IEC 61400-4 Ed 1.0 Wind turbines – Part 4: Design and specification of gear boxes

IEC TS 61400-21 Ed 1.0 Wind turbine generator systems Part 21: Measurement and assessment of power quality characteristics of grid connected wind turbines.

Provides a uniform methodology that will ensure consistency and accuracy in the measurement and assessment of power quality characteristics of grid connected wind turbine generator systems (WTGS). In this respect the term power quality includes those electric characteristics of the WTGS that influence the voltage quality of the grid to which the WTGS is connected.

IEC TS 61400-12-2 Ed 1.0 Wind Turbines - Part 12-2: Power performance measurements verification of electricity producing wind turbines

IEC TS 61400-25 Ed 1.0 Wind turbine generator systems Part 25-1 to -6: Communications for monitoring and control of wind power plants

A.4 INTERNATIONAL ENERGY AGENCY (IEA)

The IEA, (website www.iea.org) based in Paris, is an autonomous agency linked with the Organisation for Economic Co-operation and Development (OECD). The IEA is the energy forum for http://www.iea.org/about/overmem.htm26 member countries, who have agreed to share energy information and to co-ordinate their energy policies. One of the IEA's aims is to stimulate the development and deployment of new energy technologies through a network of Implementing Agreements. The Implementing Agreement on Wind Turbines (website www.ieawind.org) aims to promote and foster collaborative research. Current activities under the Agreement

include the development of recommended practices for wind turbine testing and evaluation. The IEA co-operates closely with the IEC and many of the recommendations of the IEA have been incorporated into the IEC standards. However, it may be appropriate to refer to IEA recommended practices in areas where IEA standards are still under development.

A.5 EUROPE

In addition to national standards bodies within some member nations, there are two regional bodies. The European Committee for Standardisation (CEN) performs a similar function to ISO. The European Committee for Electrical Standardisation (CENELEC) is similar to the IEC and in fact some 90% of all CENELEC standards are identical or very closely based on IEC international standards. The CENELEC website can be found at http://www.cenelec.org

A.6 USA

The American Wind Energy Association (AWEA) has been designated by the American National Standards Institute (ANSI) as the lead organization for the development and publication of industry consensus standards for wind energy equipment and services in the United States. The AWEA website is at www.awea.org. AWEA recognises that American wind turbine standards must be compatible with European standards. Therefore the AWEA focuses on developing guidelines and recommendations which impact on international standard, to assess adoption of international standards as USA domestic standards and to develop standards for aspects of wind technology which are not yet covered by international standards.

A.7 MEASNET

The international Measuring Network of Wind Energy Institutes produces procedures taking high quality wind measurements. These procedures outline the interpretation of standards and recommendations on techniques. The aims of these procedures are to ensure inter-changeability of results taken by different organisations. MEASNET also acts as an accreditation body for organisations which undertake wind measurements for wind farm projects. The MEASNET website is at http://www.measnet.com.

A.8 WIND MONITORING

Wind speed varies with height above ground level (a phenomenon known as wind shear). In general the measurement of wind speeds as close as possible to the hub height of a modern wind turbine is desirable and indeed this type of data is sometimes necessary in order to obtain external finance for a project. However, the cost of wind speed data increases with its height above ground level due to increasing tower costs. Depending on the level of confidence inspired in the wind speed at the site from preliminary investigations, a Proponent may initially elect to

monitor at a lower level to confirm a site's potential prior to investing in more expensive wind monitoring at or close to hub height.

It should be noted that in some areas of Australia thermal inversion effects may mean that measurements taken at lower levels bear little relationship to wind speeds at turbine hub height, particularly at night.

Wind anemometry equipment may be mounted on guyed pole masts or climbable lattice towers. The advantage of the latter is that instruments can be replaced without lowering the tower, although they are somewhat more expensive than pole towers. One or more of these masts may be required depending on the size and complexity of the topography at the site.

In siting of an anemometry mast it may be appropriate to consider security issues and the potential for vandalism or tampering with the equipment by curious parties. In addition, depending on the particular site, it may be necessary to fence the affected area to keep cattle clear.

The duration of the wind monitoring programme will depend on a number of factors, including the availability of suitable correlation sites for use in extrapolating the data gained during the measurement programme over a longer period. Typically commercially funded projects require energy predictions based on at least one year of wind data, at (or as near as possible) to wind turbine hub height. As modern turbines may have a hub height in excess of 70m, in practice a compromise is often required that involves using a lower tower (often 50m or so in height) and utilising wind shear information deduced from data obtained from different levels of instrumentation on the tower to extrapolate wind speed to turbine hub height.

Once on-site data has been recorded, a long-term assessment is required to remove uncertainty due to the annual wind resource variability. This is usually done by comparing the data measured at the site, with a nearby long-term record. Since this analysis provides information crucial to the viability of the project, it is advisable for the Proponent to consult an expert with experience in wind data analysis for the purpose of wind farm development.

Many of these issues are addressed in detail in the publication by Coppin, P A, Ayotte, K A and Steggle, P, (2003), *Wind Resource Assessment in Australia - A Planner's Guide*, Wind Research Unit, CSIRO Australia.

Details provided in the following appendices were correct at the time of writing, however, there is potential for some elements to change. Proponents should confirm the current status of the items addressed in this appendix prior to commencing investigations or works.

APPENDIX 13
ENVIRONMENTAL IMPACT ASSESSMENT

Dependent on state environmental and/or planning laws, proponents may be required to carry out a full Environmental Impact Assessment (EIA) to identify all relevant environmental, social, health and economic effects associated with a proposal. This Appendix provides a guide to the typical sections and information that should be contained in an EIA.

(Environmental Impact Assessment is covered in section 3.3.2 of the Guidelines.)

INTRODUCTION

This section would include name and contact details of the proponent, as well as a brief description of the project and the rationale behind it.

PROJECT DESCRIPTION AND RATIONALE

This section would include a detailed description of the project and may include discussion of technical aspects associated with the project (for example, wind turbine details).

SITE DESCRIPTION AND REASONS FOR SITE SELECTION

The setting for the project should be described, summarising characteristics such as the existing environment including site location, topography, climate and existing land use.

STATUTORY AND DEVELOPMENT CONTROLS

An analysis of the development control framework and how it is understood to relate to the development should be included. Analysis of the planning framework is important because in many cases existing planning policy will contain no reference to wind energy development.

DESCRIPTION OF WORKS TO BE UNDERTAKEN

A description of construction processes covering a range of pre-construction and construction tasks, including civil works (that is, access tracks, hard-standing turbine foundations), turbine erection, electrical connection works.

VISUAL AND LANDSCAPE ASSESSMENT

The existing landscape must be described, and the potential landscape and visual impact of the proposed development assessed and evaluated. It is important that visual amenity is always considered in the context of the existing environment, particularly regarding the value that the local community puts on rural character and landscape attributes.

Please note: Auswind and the Australian Council of National Trusts are jointly developing Wind Farms and Landscape Values – National Assessment Methodologies. These methodologies are not yet finalised and the Guidelines will be updated to incorporate them once completed.

ASSESSMENT OF TURBINE NOISE

Most state Environmental Protection Agencies (EPAs) have set limits for the emission of noise from industrial sources in country areas. These limits are usually given in either absolute dB(A) or dB(A) above background noise, and require that noise emissions be measured according to appropriate Australian Standards. At present, neither the specified limits, nor the measurement and assessment methodologies contained in the current Australian Standards are entirely appropriate for wind turbines.

Discussion will be required with the relevant authorities and the EPA to determine the measurement methodologies that should be employed, and the limits that should be applied, in order to meet the common objective that the lives of those around the proposed wind farm are not detrimentally affected by noise from the installation.

Further discussion of noise is provided in Appendix 7.

GENERAL ECOLOGICAL ASSESSMENT

The flora and fauna (particularly avifauna) present at the proposed site will be considered in relation to loss of habitat and sensitivity to disturbance, as well as to their importance as identified by national and/or local law or policy. As there are significant seasonal changes in flora and the presence and/or detectability of many fauna due to migration, it is important that ecological survey work is undertaken at the appropriate time of year, or for a suitable seasonal duration.

The proponent will meet with the planning authority and relevant stakeholders to discuss the timing of construction and scope for adjustment of wind turbine positions to avoid important species or habitats. There may be a requirement for ongoing monitoring or development of an overall environmental management plan to be followed during construction or for a defined number of years post construction.

These can be included in an Environmental Management System. These issues will be discussed with the planning authority and with the relevant stakeholders.

Any study will also include power line routes and any other areas that would be disturbed during construction, such as turbine lay down areas, site offices and storage sheds.

Further discussion on the impact on birds and bats are contained in Appendices 8 and 9.

Vegetation

An assessment of vegetation that may be disturbed will be conducted by a flora specialist who can advise on the types, locations and significance of species in the area. This should include consideration of turbine footings, lay-down areas, wind monitoring towers and access road. The assessment will also identify weed and disease issues in the study area. Where practicable it is good practice to initiate provenance seed collection for use in rehabilitation.

Birds and bats

A detailed assessment of the potential impacts on avifauna is required, and should bring together the results of any previous investigations of the site or local area. Information gained in these assessments will be used to provide detailed input into the design, such as the location of wind turbines, and will support development application documentation for the project. This study will involve a scientifically rigorous study of the activities of birds and bats and will incorporate an assessment of cumulative impact from other wind developments such as effects on migratory routes.

Due to the range of considerations in such studies it is recommended that expert advice on bird and bat risks from the project should be obtained early in the feasibility study. Further discussion on how such studies might be approached is given in Appendices 8 and 9.

Other fauna

An assessment of potential impact on terrestrial fauna is required. It should not be assumed that grazing or farming land does not contain native fauna. While large mammals may not be present, smaller mammals and Herpatofauna may be present. It is, however, generally considered that impacts on terrestrial fauna, including domestic and grazing animals, can be managed without difficulty.

ARCHAEOLOGICAL AND HISTORICAL ASSESSMENT

The existence of known sites of significant archaeological or historical importance within or near to the site will have been determined by the completion of feasibility studies. There remains, however, a potential for further, as yet undiscovered, places or items of Aboriginal heritage significance. A site assessment of Aboriginal and non-Aboriginal cultural heritage values at the site will be undertaken and documented in the impact assessment.

Further discussion on how such studies might be approached is given in Appendix 2.

FIRE MANAGEMENT

Fire is a threat to land under crop or covered in remnant native vegetation. A fire mitigation strategy will be prepared in consultation with the local fire brigade or fire control specialist.

A more detailed discussion of fire management activities is provided in Appendix 10.

HYDROLOGICAL ASSESSMENT

An assessment of the impact of the proposed development on water courses, their quality and quantity will be necessary if the proposed site is within or adjacent to a stream, river or water supply catchment area. In some cases an assessment of ground water supplies may also be appropriate.

ELECTROMAGNETIC INTERFERENCE ASSESSMENT

Although rare, wind energy projects can potentially cause interference to nearby television and microwave systems. An assessment of the potential for communication interference will be completed and should include discussion with communication system providers. Adverse impacts on microwave or television links can usually be avoided by resiting wind turbines to avoid the line of sight between transmitter and the receiver. These studies should be carried out before and after wind farm construction to enable a comparative assessment of the impact the wind farm.

A more detailed discussion of electromagnetic interference is in Appendix 11.

AIRCRAFT SAFETY ASSESSMENT

An assessment of aircraft safety may be required. In some circumstances it may be a requirement for aircraft obstruction lighting to be installed at the wind farm. This potential should be determined in consultation with CASA.

Further information on aircraft safety and Civil Aviation Safety Authority (CASA) consultation requirements is provided in the Appendix 5.

SAFETY ASSESSMENT

Potential safety issues and the means taken to mitigate these will be described in the assessment. This could include reference to the structural integrity of the wind turbines, access, construction, security, public crowd management, heavy haulage and emergency procedures.

The assessment will determine whether wind turbines conform with both state and federal Occupational Health & Safety (OH&S) requirements. For example, while ladders, fall arrest systems, access to towers and numerous other features of the turbine may conform to European or international standards, they do not meet Australian requirements.

CONSTRUCTION TRAFFIC ASSESSMENT

A broad indication of traffic movements likely to be associated with the proposed wind energy project during construction will be provided in the development application. This will include approximate number, size and types of load. This should be discussed with the local council and the main roads authority prior to submitting the development application to ensure that issues of concern are raised early. In some cases, this type of information will also be required as part of the environmental assessment of the project. A traffic management plan, including liaison with the local police traffic department during the transportation of equipment, is often included in the environmental assessment.

The impacts of construction (including access roads within the site boundary) will be addressed as part of visual, ecological, hydrological and archaeological assessments. Any essential road improvements needed to accommodate the development should be discussed and agreed with the local main roads authority and documented.

ELECTRICAL CONNECTION ASSESSMENT

An assessment of the potential impacts on the environment and land use associated with providing electrical connection will be taken.

SOCIAL IMPACT

The environmental assessment may include a discussion on community attitudes towards the project and consideration of projected acceptance levels post installation. In addition the impact on local infrastructure, such as health and emergency services, accommodation and community facilities should be addressed.

The environmental impact assessment may include an estimate of the number of temporary or permanent jobs created and the value of the contracts available locally. Projected impacts of the development on the local economy, based on experience with other wind energy projects, may also be of interest to the local community.

COMMUNITY CONSULTATION

A chapter describing the community consultation that has been undertaken and providing an analysis of the outcomes of that consultation is required.

More information about community engagement is available in Appendix 4.

GLOBAL ENVIRONMENTAL AFFECTS

The environmental assessment may include estimates of the amount of electricity the wind energy project will produce and the quantity of polluting emissions that would be avoided from a conventional power station producing the equivalent amount of energy.

TOURISM AND RECREATIONAL TRAFFIC

Visitor facilities, if appropriate, should be discussed with the local authority and relevant stakeholders and any proposed developments will be reviewed in the appropriate assessment.

Public rights of way within the site will be identified and clearly shown on a site plan.

DECOMMISSIONING

The environmental assessment will propose decommissioning activities required for the end of the wind energy project. Consideration will be given to restoration measures including the removal of above ground equipment, landscaping and rehabilitating any disturbed areas including roads and tracks. It is usual for in-ground components of the wind farm (principally footings and cables) to be left in situ.

Details provided in the following appendices were correct at the time of writing, however, there is potential for some elements to change. Proponents should confirm the current status of the items addressed in this appendix prior to commencing investigations or works.

APPENDIX 14
ENVIRONMENTAL MANAGEMENT PLANS

An Environmental Management Plan(s) (EMP) that addresses all construction and operational activities will be prepared and is usually required by the approving authority.

An alternative approach is for the proponent and/or contractor to prepare an EMP to address construction and operational activities as follows:

- Document the environmental obligations associated with the project. These include obligations set out by the approving authorities and determined by the relevant laws and regulations, as well as the by the particular design of the wind farm and the size [ed note: is this better than 'delineating'?] of the construction site.
- Define the processes for ensuring that the environmental and amenity obligations of the project are implemented to the satisfaction of the project and regulatory authorities.
- Define the procedures for monitoring and reporting so that they conform to the project's environmental obligations.
- Establish procedures for assessing effectiveness of environmental controls and providing continual improvement in environmental performance as the contract works progress.
- Audit the implementation of the EMP.
- Ensure all employees and sub-contractors are not only competent but also aware of their environmental obligations.
- Develop community consultation and complaint management procedures.
- Audit the implementation of the EMP and ensure senior management are involved.
- Describe incident management and emergency procedures.
- Describe the organisational structure, including nominating an accountable person responsible for the EMP.

Irrespective of the approach taken, the EMP should address the following:

- organisational structure, including nomination of an accountable person for the EMP
- delineating the construction site
- environmental procedures, targets and controls
- hazardous materials management
- checking the performance of activities/outcomes
- incident management
- emergency procedures
- performance reporting
- banned activities and no-go areas

- complaint management
- auditing the achievement of the EMP
- senior management review of the achievement of the EMP.

Details provided in the following appendices were correct at the time of writing, however, there is potential for some elements to change. Proponents should confirm the current status of the items addressed in this appendix prior to commencing investigations or works.

APPENDIX 15
WIND ENERGY REFERENCE PUBLICATIONS

AUSTRALIAN PUBLICATIONS

Sustainable Energy Development Authority, ***NSW Wind Energy Handbook,*** 2002

Sustainable Energy Authority Victoria (now Sustainability Victoria), Policy and Planning Guidelines for development of wind energy facilities in Victoria, 2003.

Department of Urban Affairs and Planning, ***EIA Guideline for Wind Farms***, NSW Government, Sydney, 2002

Planning SA, ***Advisory Notice, Planning Wind Farms***, Department for Transport, Urban Planning and the Arts, 2002

Greenpeace Australia Pacific, ***Wind Force 10: The Australian Contribution***, Greenpeace, Sydney, 2001

Australian EcoGeneration Association***, Guide for Connection of Embedded Generation***, 2002

CSIRO, ***Wind Resource Assessment in Australia – A Planners Guide***, (scheduled 2002)

Wind Corporation Australia, ***Comprehensive Guidelines for the Development of Small Embedded Wind Farms in Rural Australia,*** (scheduled 2003)

INTERNATIONAL PUBLICATIONS

Pasqualetti et al, ***Wind Power in View: Energy Landscapes in a Crowded World,*** Academic Press,2001

Bishop et Proctor (1994), ***Love Them or Loathe them? Public Attitudes Towards Wind farms in Wales***, Cardiff.

Gipe, P. (1995) ***Wind Energy Comes of Age***, New York

Omnibus Report (1995). ***Public Attitudes Towards Wind Energy***, Canadian Wind Energy Association and Environmental Monitor, Toronto.

Wolsink, M (1988). ***The Social Impact of a Large Wind Turbine***, Environmental Impact Assessment Review no. 8.

Wolsink, M. (1996). ***Dutch Wind Power Policy*** , Energy Policy Vol. 24 No. 12

Simon, A. M. (1996), ***A Summary of Research Conducted into Attitudes to Wind***

Wolsink & Sprengers (1993). ***Windturbine Noise: A New Environmental Threat?***, University of Amsterdam

H Nacfaire (1988**),** ***Grid Connected Wind Turbines,*** Elsevier Applied Science, London

P Gipe 1993, ***Wind Power For Home & Business,*** Chelsea Green Publishing

JOURNALS

***Wind Power Monthly* -** Monthly by Vrinners Hoved, 8420 Knebel, Denmark

ReNew – Quarterly by Alternative Technology Association

Ecogeneration – Monthly by Australian Business Councils for Sustainable Energy

Wind *Directions* - Quarterly by British and European Wind Energy Associations

Details provided in the following appendices were correct at the time of writing, however, there is potential for some elements to change. Proponents should confirm the current status of the items addressed in this appendix prior to commencing investigations or work.