

Flyers Creek

WIND FARM

Environmental Assessment

CHAPTER 8

Environmental Risk Analysis



8. Environmental Risk Analysis

The Director-General's Requirements for the Flyers Creek Wind Farm Proposal requires a general environmental risk analysis to be undertaken to ensure that all potential environmental issues are captured and assessed, and management options identified.

8.1 Introduction

An environmental risk analysis aims to establish an understanding of the level of risk associated with a project. Combining the consequences and likelihood provides an estimate of how often and to what scale an event or impact is likely to occur. For example, small events with minor impacts could occur frequently, while a major event which could occur very rarely could have more catastrophic consequences.

A summary of the risk analysis carried out for the Proposal using a qualitative risk analysis matrix has been provided in Table 8.4. The risk analysis matrix has been developed based on the definitions and classifications described in detail in Section 8.2.

The environmental risk analysis was prepared in accordance to the general principles outlined in *Australian Standard HB 203:2006 Environmental Risk Management – Principles and process*.

8.2 Risk Assessment Methodology

8.2.1 Definitions

Guide words and descriptive scales have been used in this assessment to define ratings so that there is a common understanding of the meaning. As the events of the project are likely to affect different issues (eg health and safety, environment, community), definitions of consequences for each of these issues has been provided in Table 8.1.

It should be noted that these definitions are used as a guide only in establishing the possible consequence of an impact or event. For any given issue the ranking of consequence is specific to that issue and is based on the conceivable range of possible outcomes.

Table 8.1 – Classification of Consequence

Category	Health and Safety	Environment	Community
Catastrophic	Multiple fatalities or significant irreversible effects	Long term and possible eradication of populations or habitats, serious negative impacts on ecosystem, Permanent damage to a significant area.	Major public or media outcry, major long-term detrimental effects, Community outrage on broader community and substantial formal opposition.
Major	Single fatality and/or sever irreversible injury or disability	Major changes in population or habitat, negative impact on ecosystem, Lasting damage to a significant area.	Significant adverse effects on the local community, resulting in high level of community opposition.
Moderate	Injury or illness (hospitalisation)	Moderate impacts on populations and habitat but no negative impacts on ecosystem function. Damage to a limited area.	Moderate inconvenience leading to general community concern.
Minor	Reversible injury (off-site medical care)	Minor impacts on populations and habitat but no negative impacts on ecosystem function. Limited damage to a limited area.	Minor inconvenience on local community, restricted to localised community concerns
Insignificant	Negligible injury (first aid sufficient)	Impacts on populations and habitat that could be reversed. Insignificant damage to a limited area.	None to Insignificant local community concern

Source: Adapted from Companion to AS/NZS 4360:2004, HB 203:2006

Table 8.2 provides the classification of likelihood or probability of an impact or event occurring during the lifetime of the project.

Table 8.2 – Classification of Likelihood

Category	Description	Frequency
Almost certain	Expected to occur frequently	At least annually or more frequently
Likely	The event has occurred in the past	Once every three years
Possible	The event may occur, unusual but possible	Once every 10 years
Unlikely	Not expected to occur	Once every 30 years
Rare	Conceivable only in exceptional circumstance	Once every 100 years

Source: Adapted from Companion to AS/NZS 4360:2004, HB 203:2006

8.2.2 Level of Risk

Table 8.3 combines the consequences and likelihood of the impact or event to develop the level of management required to minimise the risk of the event or impact occurring.

Table 8.3 – Qualitative risk analysis matrix

		Consequence				
		Catastrophic	Major	Moderate	Minor	Insignificant
Likelihood		1	2	3	4	5
Almost certain	A	Extreme	Extreme	Extreme	High	High
Likely	B	Extreme	Extreme	High	High	Moderate
Possible	C	Extreme	Extreme	High	Moderate	Low
Unlikely	D	Extreme	High	Moderate	Low	Low
Rare	E	High	High	Moderate	Low	Low

Table 8.4 – Level of risk and management requirements

Extreme (Ext)	Immediate action required
High	Senior management attention needed
Moderate (Mod)	Management responsibility and required ongoing monitoring and maintenance
Low	Managed by routine procedure

8.3 Risk Assessment Analysis

Table 8.5 represents a summary of the risk analysis carried out for the Proposal using the qualitative risk analysis matrix shown in Table 8.3. Two levels of risk have been provided:

- **Level of Risk (LoR) column:** This is an assessment of the potential project environmental risk before any project planning, controls or mitigation measures have been considered. This would be considered the worse case scenario in the absence of any environmental consideration during the planning and implementation of the project.
- **Mitigated Risk column:** This column provides the assessment once the environmental issues have been considered and appropriate mitigation measures or controls have been put in place. The safeguards, controls and mitigation measures considered have been included in the table. Therefore, this column represents the risk of the project constructed and operated as proposed in this EA.

The information in Table 8.5 shows that risks associated with key environmental issues have been identified and considered, and that potential impacts can be effectively managed through the mitigation options that have been recommended. It should be noted that for issues that require ongoing monitoring, review and possible corrective action in the event of unforeseen and unacceptable impacts, a minimum residual risk of 'moderate', has been assigned.

The Director-General's Environmental Assessment requirements identified the following key issues (see Appendix A). The key issues are considered in more detail in the relevant Chapters in the Environmental Assessment.

Key Issue	Chapter in the EA
Visual Impacts	9
Flora and Fauna	10
Heritage	11
Noise	12
Traffic and Transport	13
Telecommunications	14
Greenhouse Gas Emissions	15
Safety Risk and Hazards	16
Others including; geology, soils, hydrology and socio-economic factors	7

Table 8.5 – Environmental Risk Analysis

C – consequence, L – Likelihood, LoR – Level of risk

Environmental Aspect	Potential Impact	L	C	LoR	Proposed Management Options	Mitigated Risk	Chapter in EA
Visual							9
Visual characteristics	- Visual impact on local community - Perceived changes to local landscape characteristics caused by large turbines	B	4	High	- Consideration of visual impact during project formulation and assessment of potential visual impact based on proposed project configuration. - Turbines set back at least 1 km from all neighbouring residences. - Two turbines have been removed and one turbine has been moved in response to community concerns. - Tree screening will be provided to reduce impacts where practical.	Mod	9.2.3
Shadow flicker	Shadow flicker exceeding the NSW Government guidelines of 30 hours per year	D	4	Low	- Sophisticated computer modelling undertaken indicates shadow flicker will be less than 3 hours/year at neighbouring residences - Turbines set back at least 1 km from all neighbouring residences reduces shadow flicker effect.	Low	9.12, 9.13 and 16.8 Appendix C2
Blade glint	Sun reflecting off the blade causing annoyance to local community or distraction to drivers on local roads	C	4	Mod	- Low reflectivity finish is utilised on all modern turbine blade manufacture which minimises potential for glint. - Turbines set back at least 1 km from all neighbouring residences. - Turbines are located at differing altitudes. - Relatively low density of settlement in the surrounding areas. - Low volumes of traffic on the local roads.	Low	9.12, 9.13 and 16.8

Environmental Aspect	Potential Impact	L	C	LoR	Proposed Management Options	Mitigated Risk	Chapter in EA
Other infrastructure	Associated infrastructure eg. tracks, cabling, transmission line, substation highly visible	C	4	Mod	- Underground cables installed where practical, and trenches back filled progressively. - Temporary tracks will be removed and reseeded after construction works. - As far as practical, the location of tracks will be chosen to minimise the visual impact. - Overhead lines will largely be located away from roads and within the project area. The will also be mostly located down-slope to minimise visibility. - Routine monitoring and maintenance as required by the site EMP during construction and operation.	Low	9.11
Flora and Fauna							10
Avifauna blade strike	- Large number of native bird and bat deaths resulting from blade strike - Ecologically significant number of threatened bird and bat species impacted by the project	C	3	High	- Flora and fauna investigations undertaken and considered at project development stage. - Only one threatened bird and bat species sighted during extensive avifauna surveys. - Turbines will have no perching places. - Removing dead tree habitats from within 100 m of turbines. - Removing carcasses from areas near turbine. - Preventing lambing near turbines. - No lighting will be located on the turbines (other than safety lights for aviation if required) to minimise attracting nocturnal birds. - Bird and bat monitoring programme will be implemented as part of CEMP with appropriate follow up action in the event unforeseen impacts occur.	Mod	10.5

Environmental Aspect	Potential Impact	L	C	LoR	Proposed Management Options	Mitigated Risk	Chapter in EA
Vegetation clearance	- Excessive clearing of native vegetation for turbines, cables and access tracks - Significant disturbance of native fauna habitats	C	4	Mod	- Flora and fauna investigations undertaken and considered at project development stage. - Flora and fauna management sub-plan will be prepared as part of the CEMP. - Final turbine layout will ensure that levels of vegetation clearing and impacts upon threatened and species of notational significance are avoided. - Micrositing of turbines and tracks will be undertaken where tree removal may be required. - Any tree removal will be undertaken in the presence of an ecologist. - Areas where trees need to be avoided have been identified.	Low	10.5
Heritage							11
Aboriginal heritage	Potential disturbance or damage to Aboriginal artefacts	C	3	High	- Comprehensive heritage investigations undertaken as part of project definition and assessment of impacts. - A Heritage plan sub-plan will be prepared as part of the CEMP. - Turbine, track and cabling locations have been modified to avoid sites of known heritage significance. - Turbines have also been moved to avoid areas where heritage sites are more likely to be located. - Awareness of heritage included in site induction for all project staff. - If heritage items are encountered work will cease immediately and be reported to allow for proper processing.	Low	11.2
Non-Indigenous heritage	Potential disturbance of Non-Indigenous heritage, primarily trig stations and mining areas	D	4	Low	- Assessment of potential impacts undertaken as part of project formulation. No non-indigenous heritage structures of significance have been identified in the project area. - Where wind farm construction works are to be carried out around an identified heritage item, a temporary fence will be constructed around the heritage item to avoid damage.	Low	11.7

Environmental Aspect	Potential Impact	L	C	LoR	Proposed Management Options	Mitigated Risk	Chapter in EA
Noise and vibration							12
Construction noise	- Exceedance of construction noise limits resulting from operation of mechanical equipment such as cranes, excavators, earth moving activities. - Vibration related to construction activities - Potential that noise from construction will impact on amenity and health	C	4	Mod	- Comprehensive modelling undertaken for project formulation against established DECCW guidelines. - A Construction noise management plan would be developed when details of the construction activities are finalised. - Informing neighbours of details of construction times prior to commencement. - Adherence to standard hours of operation for the construction works ie Monday to Friday (7am to 6pm), Saturdays (8am to 1pm) and no work to be conducted on Sundays or public holidays with limited exceptions. - Complaints register will be maintained. The proponent will investigate noise complaints and will reduce noise levels to meet standards in the unlikely event of exceedance.	Low	12.10
Operational noise	- Exceedance of operational noise limits of SA EPA Wind Turbine noise guidelines. - Exceedance of noise limits as a result of maintenance activity. - Potential that low frequency noise from turbine operation will impact on health	C	4	Mod	- Project designed to ensure that operational noise is compliant with noise guidelines. - Compliance testing at nearest relevant receivers carried out within three months of commissioning will verify noise standards are not exceeded. - Noise reduction modes in modern turbines can ensure wind farms meet noise standards in the very unlikely event compliance testing shows an exceedance. - Community complaints procedure established as part of Noise Management plan. - There exists no scientific or medical evidence that infrasound, or low frequency noise, from wind turbines causes adverse health effects - Recent infrasound measurements at two Australian wind farms showed infrasound levels to be well below worldwide health limits and less than at the beach or Adelaide CBD.¹	Low	11.2

¹ *Infrasound Measurements from Wind Farms and Other Sources*, Sonus Pty Ltd, November 2010

Environmental Aspect	Potential Impact	L	C	LoR	Proposed Management Options	Mitigated Risk	Chapter in EA
Traffic							13
Off-site traffic impacts	• Movement of oversize and overmass vehicles in the area impacting traffic flows • Increased numbers of vehicles transporting other supplies and workers impacting traffic flow in local area. • Increased traffic impacting on road safety in local area • Heavy loads causing degradation to locals roads	B	4	High	• Consideration of transport issues in project formulation and impact assessment. • Transport management plan will be prepared in consultation with the local Councils, RTA. • Community information and awareness program. • Warning and general signposting on access routes. • Provision of traffic control personnel where required. • Restrictions on timing of delivery of large equipment by oversize trucks. • Establishment of inspection and maintenance program for local roads in conjunction with Blayney Shire. • Community complaints procedure established. • Induction of staff to ensure awareness of traffic management requirements.	Low	13.1
On-site impacts	• Vehicles driving off road causing disturbance to natural habitats and causing erosion and sedimentation. • Degradation of access tracks due to vehicle movements.	C	4	Mod	• A Transport management plan will be prepared in consultation with the local Councils, RTA. • Implementation of sediment and erosion control programs. • Construction of tracks near environmentally sensitive areas will be avoided or guided by relevant specialist. • At conclusion of construction, any tracks no longer needed will be restored and revegetated. • Induction of staff to ensure awareness of traffic management requirements.	Low	13.1
Telecommunications							14
Radio broadcasts	• Possible interference with Radio broadcasts and reception in the area.	E	5	Low	• Siting of wind turbines considered communications impacts and potential issues addressed. • Overseas and local experience demonstrates that radio broadcasts are unlikely to be impacted by wind farm operation.	Low	14.3

Environmental Aspect	Potential Impact	L	C	LoR	Proposed Management Options	Mitigated Risk	Chapter in EA
Mobile phone reception	Possible interference with mobile phone reception in area	E	4	Low	- Assessment undertaken during project formulation. - Deterioration in signal strength is unlikely and would be transitory as mobile phone moves through area. - In the unlikely event of deterioration, investigations and steps to rectify the situation would be carried out.	Low	14.4.1
Microwave communication	Potential to interfere with point-to-point microwave communication links in the area	D	3	Mod	- Turbine locations have taken into account communication links and adjustments have been made. - Micrositing will take into account, and confirm, no impact upon point-to-point links.	Low	14.4.2
Digital television signals	Rotating blades of wind turbine causing interference with digital television signals	D	5	Low	- The construction of wind farm is not anticipated to occur until well after discontinuation of local analogue television broadcasts in June 2012. - Studies have shown digital broadcast signals are much less vulnerable to disruption than analogue TV signals. - Mitigation measures are readily available and will be implemented to rectify any negative impacts identified.	Low	14.5
Greenhouse Gas							15
Greenhouse gas emissions	Net generation of greenhouse gases from manufacture, construction, operation and decommissioning	D	4	Low	- Within three months of operation, the wind farm will offset any greenhouse emissions resulting from the manufacture, construction, operation and decommissioning. - Significant savings to national greenhouse emissions will be provided in the long term.	Low	15
Safety Aspects							16
Aircraft safety	Presence of turbines may impact upon the safe operation of aircraft in the area	E	2	High	- Potential aviation impacts considered and assessed; the wind farm is not near the Orange Aerodrome's Obstacle Limitation Surface. - The CASA, Orange Aerodrome, Orange City Council, Airservices Australia, AAAA and the Department of Defence have all been advised of the details of the proposed wind farm. - Final as built locations of turbines will be provided to the relevant stakeholders for inclusion on aviation charts. - The wind farm will be readily apparent to recreational air space users, and therefore can be avoided as required.	Low	16.2

Environmental Aspect	Potential Impact	L	C	LoR	Proposed Management Options	Mitigated Risk	Chapter in EA
Construction safety	- Generation and transmission of high voltage electricity involves inherent risk. - There is a potential for vehicle accidents resulting from activities occurring on steep slopes, vehicles not adhering to speed limits, lack of communication between drivers of various vehicles, low visibility.	C	4	Mod	- Site induction to ensure staff awareness of safety issues. - Electrical safety will be achieved through ensuring that plant, equipment and overall installation are in accordance with the relevant standards or, where necessary, approval is obtained for an alternative specification. - Routine monitoring, inspection and maintenance of equipment, roads and areas identified as potentially dangerous. - Areas of risk will be identified ahead of time and risk mitigation measures will be put in place eg barriers, warning signs, hazard tapes and in cases observers to alert and warn drivers of risks. - Adherence to road safety regulations, as identified in the transport management plans	Mod	16.3, 16.4 and 16.6
Operation safety	- Physical safety issues such as tower failure, blade separation, ice throw, and contact with moving blades. - Generation and transmission of high voltage electricity involves inherent risk. - Accidents resulting from poor road safety	D	3	Mod	- Site induction to ensure staff awareness of safety issues. - Adherence to relevant safety standard codes. - Adherence to road safety regulations, as identified in the transport management plans - Advising landowners to avoid turbine proximity during rare periods where freezing temperatures occur. - Electrical safety will be achieved through ensuring that plant, equipment and overall installation are in accordance with the relevant standards or, where necessary, approval is obtained for an alternative specification. - Routine monitoring, inspection and maintenance of turbines to further decrease the very unlikely chance of structural failures	Mod	16.3, 16.4 and 16.6

Environmental Aspect	Potential Impact	L	C	LoR	Proposed Management Options	Mitigated Risk	Chapter in EA
Bushfire	- There is the potential for construction and operational activities to initiate a bushfire. - A Bushfire could also start as a result of a lightning strike	E	2	High	- Site bushfire risk assessment undertaken. - Bushfire risk management plan will be developed by the project contractor in consultation with the RFS, and incorporated into the project EMP. - Water tanks will be provided on site where there are currently limited resources. - New tracks will improve fire fighting access for RFS vehicles - Emergency response plans will be prepared for construction and operation activities as part of the Bushfire plan. - Site induction to ensure staff awareness of bushfire risks. - On going monitoring and maintenance will be required, particularly during bushfire season. - Modern wind turbines have lightning strike protection integrated into the blades.	Mod	16.5
EMF	The possibility that Electric and Magnetic Fields created around high voltage power lines may have potential health impacts has not been entirely ruled out.	E	4	Low	- Potential impacts considered and assessed for medium voltage (132 kV) electricity generation and transmission occurring as part of the project. - Location of turbines and substation are in areas not frequented by public; construction and operation will be in accordance with relevant electrical safety codes	Low	16.4.1
Gas pipeline	Damage caused to the natural gas pipeline during construction	D	3	Mod	- The gas pipeline has been taken into account in the design of the wind farm, and other than three to four access tracks and an overhead powerline, no other wind farm structures will be constructed in the pipeline easement. - A risk assessment will be undertaken in consultation with the pipeline owner prior to construction of the wind farm	Low	16.7

Environmental Aspect	Potential Impact	L	C	LoR	Proposed Management Options	Mitigated Risk	Chapter in EA
Other Environmental Risks							7
Soil management	- Construction activities may initiate erosion of soils. - Controls are inadequate to minimise erosion and sedimentation.	C	3	High	- Assessment undertaken to identify potential issues and environmental constraints. - Soil and Water Management Plan will be prepared at part of the site EMPs. - Extent of soil disturbance minimised. - Wind farm will affect 1-2% of total land area. - The majority of the construction activity is expected to be on soils which have a low to moderate potential for erosion. - Ongoing monitoring and maintenance of activities will be undertaken to ensure erosion is minimised.	Mod	7.5
Air quality	- Dust and minor air emissions generated during construction phase may impact upon air quality in local area - Emissions resulting from vehicle use	C	4	Mod	- Examination of potential issues and appropriate controls based on current best practise has been undertaken and included in the Environmental Assessment. - An air quality management plan will be prepared as part of the site EMPs to control dust and particulates. - Rolling and wetting of tracks. - Stabilisation of exposed soils. - Placement of stockpiles in sheltered locations on a stabilised surface where more than short duration storage is required. - Restoration to be carried out as soon as practical following completion of work - Idling of vehicles minimised in accordance with the transport management plan and air quality management plan.	Low	7.3

Environmental Aspect	Potential Impact	L	C	LoR	Proposed Management Options	Mitigated Risk	Chapter in EA
Water management	- Waterways impacted by sediment runoff resulting from works for tracks, cables and transmission lines crossing watercourses. - Sewage effluent incorrectly managed - Spills from fuel, oil, chemicals and battery leakage	C	3	High	- Soil and Water Management Plan will be prepared as part of the site EMPs. - Sediment traps and erosion controls will be used, particularly in areas of high risk. - If waterways are crossed during construction appropriate measures will be put in place to ensure minimal disruption will occur. - Fuel, oil, chemicals and batteries safely stored in areas with back up containment in case of leaks. - Procedures for handling and storage of oils, fuel and chemicals will be documented and followed by construction and maintenance staff. - Ongoing monitoring and maintenance of activities will be required.	Mod	7.6
Waste management	Improper management of excavated material, garbage, construction waste.	C	4	Mod	- Potential for waste generation has been examined as part of the assessment. - Waste management plan will be developed as part of the CEMP - Reduce, reuse, recycle policy. - Register of wastes generated to ensure proper disposal or recycling occurs.	Low	3
Water use	Use of excessive local water supplies	D	4	Low	- An evaluation of the water requirements for the project was undertaken and potential water supply options examined. - A number of water supplies exist, however it is most likely that the water required for the construction phase of the project will be provided by the local water supplies, subject to the agreement of Council. - If unregulated water supplies or boreholes are to be used, necessary permits and licenses required for the extraction will be obtained. - Use of an off-site batching plant would reduce the water supply requirements on site. - The construction phase is expected to use about 10ML of water while the operational phase will use negligible amounts of water.	Low	7.6.7

C – consequence, L – Likelihood, LoR – Level of risk

Environmental Aspect	Potential Impact	L	C	LoR	Proposed Management Options	Mitigated Risk	Chapter in EA
Trig stations	Wind turbines may impact usability of trigonometric station in area by interrupting sight lines.	C	4	Mod	- Potential impacts on the trig stations were examined as part of the project formulation and design. - Consultation with Surveying Infrastructure and Geodesy section of Land and Property Management Authority has been undertaken. - Turbines locations selected so as not to impact upon trig station operation. - Micrositing of turbines could minimise further impacts.	Low	7.7.4
Property values	Potential for wind farm to impact upon land and property values in surrounding area	C	4	Mod	Review of available studies and evidence in NSW and the USA suggest that wind farms do not have a measureable adverse impact upon property values.	Low	7.8.3

