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Orange Creek Energy Pty Ltd
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Construction Management Plan

Banana Range Wind Farm

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1.0 Introduction

This Construction Management Plan (CMP) has been developed for the Banana Range Wind Farm (the Project) in accordance with the State Code 23: Wind Farm Development (State Code 23) and the supporting State Code 23 Planning Guideline. The CMP forms part of the supporting information to obtain planning approval for the construction of at the Project, located in Banana, Queensland.

The purpose of this CMP is to outline:

- What key activities are likely to occur during the construction of the Project;
- What equipment is likely to be required
- Potential impacts that may occur as a result of these activities and how these impacts will be mitigated; and
- How to measure the performance of the Project during construction and operation.

This CMP demonstrates compliance with PO13 of State Code 23.

2.0 Project description

2.1 Location

The Project is located in Banana Shire Council local government area, approximately 120 km south-west of port of Gladstone and 20 km west of the township of Biloela, Central Queensland.

The Project will involve the construction and operation of a wind farm consisting of up to 51 wind turbines that can generate up to around 230 megawatts (MW) of clean, renewable electricity from the power of wind resource at the site. The 'Project Footprint' is approximately 1,215 ha, which includes the proposed wind turbines, access tracks, underground cables, overhead lines and other associated infrastructure.

2.2 Wind turbines

The power output from an operational wind farm largely depends on the strength of the wind blowing across the site at the time. During the operation of the Project, the turbines will automatically start, stop and alter their output as determined by wind speed and other environmental and electrical conditions.

Usually, wind turbines start to generate electricity at a wind speed of between 3 metres per second (m/s) and 5 m/s, and the output increases up to their maximum rated power at a wind speed which varies significantly between the various turbine models. The wind turbines will also have a wind speed at which they automatically shut-down. This also varies amongst the different turbine models available.

The final selection of wind turbines will be determined as part of the detailed design, following approval of the Project. However, the Project has been designed to accommodate the following turbine dimensions so any potential impacts of the Project on environmental values can be adequately considered.

The Project will accommodate turbines each with approximately 4.5 MW in capacity, however this may increase or decrease as further models are developed, between now and construction.

The turbines will be of the horizontal axis type, with a rotor consisting of three blades with a maximum blade length of up to 90 m and a maximum hub height of up to 170 m. The maximum height of the turbine to blade tip is up to 250 m. Blade length chosen and wind turbine hub height will be configured so that the tip height does not exceed 250 m. These maximum specifications are summarised in Table 1.

Table 1 Key generation and wind turbine specifics

Feature	Statistic
Number of turbines	Up to 51
Tip height**	Up to 250 m
Blade length**	Up to 90 m
Hub height	Up to 170 m

*The actual output of the wind farm will depend on the number, size and type of turbine chosen during the detailed design phase. Regardless of the size of the wind farm generation capacity, the Project will still need to comply with the Queensland Wind Farm State Code and supporting Planning Guidelines, particularly in relation to acoustic amenity and setback criteria. The maximum specifications listed in the table provide flexibility for any innovation in turbine design between now and the time of detailed design and construction.

**Dimensions and outputs are approximate to allow for innovation in turbine design prior to construction. Final dimensions will be confirmed during the detailed design phase of the Project.

Each wind turbine may have a transformer located in the base of the tower or in a kiosk adjacent to the turbine. Power and communication cables will be installed underground between the turbines and connect back to the substation, also connecting to medium voltage (33 kV or 22 kV) overhead powerlines and site offices. Wind turbines will be linked together in strings of around eight turbines connected to the same power cable and medium voltage line.

The wind turbines will be coloured light grey or white with a semi-matte finish to reduce their contrast with the background sky and minimise reflections. The wind turbines will be uniform in colour and not contain any prominent company logos.

The maximum turbine tip height and blade length, listed in Table 1 above, is based on estimated wind turbine dimensions to allow for future flexibility and innovation in wind turbine design and development. Generally, larger turbine models on higher towers will more efficiently harness the available wind resource. Furthermore, larger wind turbines are generally installed in lower numbers, thereby reducing the on-ground impacts for a given level of energy generation.

Different areas of the Project Footprint may have different wind speeds and turbulence intensity, which means different turbine models are more suitable in different locations. If this is the case, wind turbines installed may not be uniform in final dimensions, although they would all be the same colour meet the dimensions outlined in Table 1. In addition, if the Project is built in stages over several years, wind turbine model availability may change, which may mean wind turbines installed may not be uniform in final dimensions, although they would all be the same colour meet the dimensions outlined in Table 1.

The final choice of wind turbine will be based on an assessment of the most suitable wind turbine available at the time of procurement, taking the following criteria into account:

- Ability of the wind turbine to maximise power output based on the wind resource at the study area
- Availability of the wind turbine
- Turbine which provides the optimal financial outcome for the Project

One of the key selection criteria for the final wind turbine choice will be the ability to satisfy the environmental constraints and approval conditions. For example, the chosen wind turbine must achieve the determined noise criteria outlined in State Code 23 and not exceed any of the maximum design specifications.

Each wind turbine foundation is located adjacent to a hardstanding and will comprise a buried reinforced concrete footing of approximately 600 m^3. Wind turbine foundations may vary in size depending on imposed loadings, ground conditions, construction methodology and the drainage design. Each turbine manufacturer has individual foundation requirements which will need to be adhered to.

The detailed design of the foundations will be undertaken following approval of the Project and following the final selection of turbine model to be installed at the Project. The final design will also take account of the geotechnical conditions identified through detailed, micro-siting site investigation.

Any of the excavated material to locate the foundation will be stockpiled and reused to cover the foundation. It is envisaged that any surplus material will be reused on site.

2.3 Hardstandings

A hardstanding is a widening of the road to create trafficable access for construction vehicles, plant and machinery. Wind turbine locations will require an area of gravel capped hardstand adjacent to each turbine foundation, (approximately 120 m by 80 m, depending on wind turbine type). These hardstand areas are intended to provide a stable base on which to place wind turbine components ready for assembly and erection, and to locate the crane necessary to lift the wind turbine components into place. In addition to this some hardstanding area will be used for rock crushing purposes, stockpiling of material and temporary laydown areas.

Due to the undulating topography requiring batters from the hardstand to the natural ground level and space required to layout the blades, further vegetation than 120 m by 80 m is required to be removed. At various hardstand locations, the hardstand area will also be used for temporary rock crushing purposes, stockpiling of material and temporary laydown areas.

Hardstand areas will be 1 ha on average. The hardstands are included as part of the design footprint and are not proposed to be additional clearing. To install a 90m turbine blade does not require the assembly of 90m blades to the rotor centre on the ground and for the entire swept area to be cleared. The blades can be lined up side by side on the hardstand and lifted individually on to the rotor hub. However, depending on the particular turbine location, rotors or part rotors (two blades) could be built on the ground within the footprint already identified.

The hardstand footprint for clearing is the area within which the wind farm can be installed including the turbine and each location has been assessed as being able to be constructed.

These areas will be left in place following construction to allow for the use of similar plant should major components need replacing during the life of the Project, and for use during decommissioning at the end of the operational period.

2.4 Electrical connections, substations and grid connection

The electricity generated by harnessing the wind's energy must go through a transformer kiosk adjacent to each turbine (or a transfer located in the base of the turbine) in order increase its voltage and efficiently transfer it to the substations. The wind turbines will be connected in 'strings' of approximately eight turbines via a combination of medium voltage (22 kV or 33 kV) underground cable and overhead lines and in turn, to the main transformers located in the substations.

Power and communication cables are installed underground or overhead between the turbines and connect back to the substation and site offices.

The underground power and communication cables will be laid in cable trenches of approximately 0.5 m to 1.5 m in width and a minimum fill of 500 mm to allow for continued agricultural activities. The route of the underground cables is typically adjacent to the roads, with no additional clearing of regulated vegetation required beyond that proposed for the road corridor, in cleared land the cables may be located away from the road.

All of the cable trenches will be located. The total length of cable trenches required will be dependent on the final layout of the substations, turbines, medium voltage overhead powerlines and site offices. Once the trenched areas have been backfilled, the disturbed area will be reinstated to promote the establishment of vegetation.

In addition to the underground cabling, there is approximately 16 km of medium voltage (33 kV or 22 kV) overhead powerlines. Medium Voltage powerlines would be attached to structures up to 15 m high. The majority of these will be located in proximity to the proposed roads to avoid additional clearing requirements. Up to 20 m of clearing is required to install and maintain the line, a 4 m wide track is required to access each structure, and proposed tracks may travel underneath the powerline where required. This access track would typically be unsealed and have no gravel cap.

All high voltage powerlines will be of sufficient height, approximately 63 m, to safely carry the designed voltage and allow for site vehicles to pass beneath.

Two substation options are being considered for the Project, one option for the north of the Project and one option for the south. The final size and design of the Project, as well as electrical network considerations, will determine which substations will be built.

The substations will be the point of connection to the National Electricity Market (NEM) via a 132 kV transmission line (Moura to Biloela Tee). The northern substation option has a proposed area of 4 ha and the southern substation option has a proposed area of 2 ha. The overall footprint of the substation options has been designed to accommodate the addition of approximately 100 MW of energy storage.

2.5 Site offices and workshop

Permanent site offices and workshops are proposed to be located at two locations that are adjacent to each of the two proposed substations within the Project Area. These areas typically contain vehicle parking space, septic ablutions and wash down areas as appropriate. The footprint of the site offices and workshops located to the north of site is around 4 ha, whilst the footprint for the offices and workshops positioned to the south of the Project Area measure approximately 2 ha.

In addition there is a provision for a small office, lunch room and amenities and ablutions elsewhere on the Project Footprint, each around 50 m by 50 m. These could be established on a small portion of the construction compound, towards the end of construction period.

The Project Area does not currently have access to the local reticulated water and sewerage network. Once operational, the Project is expected to utilise water tanks and an on-site septic system will be installed to comply with the Building Code of Australia and will be positioned adjacent to the operations and maintenance compound.

2.6 Wind monitoring towers

2.6.1 Permanent wind monitoring tower

Locations for up to five permanent wind monitoring towers at the Project Area have been assessed primarily to establish measurement of the free stream wind from all directions, and where possible to meet the criteria in the International Electrotechnical Commission (IEC) 61400-12-1 for power performance testing. These requirements include restrictions on the distance between mast and turbine, complexity of the terrain around the test site and the influence of obstacles and other turbines on the wind.

The wind monitoring towers contain measurement instruments and telecommunication equipment. The towers will be either free standing or guyed lattice structures with total concrete footings (30 m²) at mast base and anchor points. The tower will reach up to total height of 170 m.

Full engineering design and certification will be carried out during detailed design once the turbine type and layout of the wind farm has been confirmed. The Material Change of Use proposal plans provides an indicative position for meteorological masts. However, the final number and position of the wind monitoring towers will be determined during the detailed design phase of the Project. The total disturbance required is up to 1 ha for each guyed wind monitoring tower.

2.6.2 Temporary wind monitoring tower

Locations for up to five temporary wind monitoring towers on the sites of future wind turbines are proposed. These locations will be close in proximity to the site of the permanent wind monitoring towers. The temporary wind monitoring towers contain measurement instruments and telecommunication equipment. After a period of concurrent wind speed and direction monitoring during the construction period, the temporary wind monitoring towers are removed, and the permanent wind turbine constructed. The weather data from both the temporary and the permanent wind monitoring towers will then have a record of the wind before and after the wind turbine is installed to allow effective measurement of the performance of the turbines.

The temporary wind monitoring towers will be either free standing or guyed lattice structures reaching up to 170 m. The Material change of use proposal plan provides an indicative position for

meteorological masts for the Project. However, the final number and position of the meteorological masts will be determined during the detailed design phase of the Project. No additional disturbance or clearing is required for this infrastructure as the infrastructure will be wholly located within the disturbance area of the wind turbine hardstand areas.

2.7 Transport routes

The four principal elements to be transported via the road network are the workforce, construction materials, construction equipment and wind turbine components.

A full assessment of the traffic and transport routes and potential impacts is provided in the Traffic Impact Assessment and Route Assessment, Appendix N and Appendix M to the Planning Report.

2.7.1 Public access

All public access roads will remain open during construction, however public access to construction areas will not be permitted.

Appropriate signage will be provided during the construction period for health and safety reasons.

2.7.2 Site access

Based on the assumed transport corridors outlined in the Traffic Impact Assessment and Route Analysis, provided in Appendix N and Appendix M to the Planning Report, access to the Project Area will be provided at one location off Dawson Highway (State-controlled road). This access point will be used during construction and operation of the Project and will be where all the loads will access the Project Area. Appropriate signage will be provided during the construction period for health and safety reasons.

The site entrance will remain open during construction; however public access to construction areas will not be permitted.

New fencing alignments, together with grids and gates, will also be installed on site with no additional clearing requirements.

2.7.3 Access roads

The onsite access track layout has been designed to utilise the existing topography of the land, avoiding steep areas where possible, and minimising impacts to regulated vegetation. Approximately 51 km of access tracks will be required for the Project.

The following design criteria and mitigation measures will be applied to the access track layout to mitigate potential impacts:

- The access roads running width will typically be about 6 m wide, and would be expanded on bends to accommodate crane and delivery vehicle requirements
- Regular passing bays and turning areas
- Roads will not be sealed and constructed from locally sourced aggregate
- The number of water course crossings will be minimised
- Drainage channels 1 m in width (and/or appropriate drainage controls) will be located wither side of the roads
- Road margins will be vegetated to reduce potential sediment-laden run-off.

The construction of access tracks will vary depending on localised ground conditions. Conditions impacting construction include the existing vegetation, nature of the topsoil, level of moisture in the ground, geotechnical base and localised topography.

The clearing required to build roads comes from the need to cut and fill on gradients, create 2:1 batters and the road construction front requiring vehicles to access and egress in a circular motion build the road. On flat and low gradient terrain, the clearing required to build the road would be around 20 m in width and in contrast in the steepest most complication area of the Project Area, the batters may be extended such that the total width is up to 200 m. Any material on-site would be reused in the

design as much as possible (e.g. balance of cut and fill). Material of suitable quality that is excavated will be crushed on site for gravel.

Post construction, the areas cleared to create batters and corners will be rehabilitated. Roads will be maintained and need to remain passable for OSOM loads in the event of a blade replacement during operation, or other maintenance. Therefore, no trees that could grow to become future obstructions will be planted where large oversailing blades could be transport in.

The number of water course crossings will be minimised. The exact requirement and design of the watercourse crossings will be agreed during the detailed design and will be based on the detailed geotechnical site investigation and through discussions with the relevant State authorities.

2.8 Temporary construction compounds, laydown areas and stockpile areas

Five temporary construction compound, laydown areas and stockpile areas are proposed for the Project. These areas will be used to manage construction, with one area proposed in the northern section of the Project Area, and four in the southern section. These compounds will include; portacabins (site offices, first aid facilities, canteen facilities, waste disposal and toilets); storage containers for tools and equipment; storage areas for plant, fuel storage, material and components; wash down facilities; and sufficient parking for the workforce, deliveries and visitors.

These areas will also accommodate temporary storage of construction plant equipment, wind farm components and construction materials prior to moving to their ultimate destination.

Concrete batching plants may also be established and disassembled at several of these compound areas as the project progresses through the construction period. It is noted that a separate approval will be required for any proposed concrete batching plants.

The total footprint proposed for the temporary construction compounds and laydown areas during the construction period is around 9 ha, none of which will be falling within regulated vegetation.

The temporary construction compounds and laydown areas will be formed into hardstand. Prior to forming the hardstand area, the topsoil will be removed and stockpiled adjacent to the hardstand area. Following the completion of the construction phase, the temporary construction compound areas may be reinstated using the stockpiled topsoil depending on the landowner requirements.

The exact locations and nature of the temporary construction laydown will be established in consultation with the relevant landowners when a full construction methodology is determined.

3.0 Sensitive Uses

The Project is located within a rural landscape with no cities or towns in close proximity. Sensitive uses of the land during construction are limited to individual properties that are considered either participating or non-participating landowners. These properties are sensitive to noise, vibration, air quality, traffic and traffic impacts during construction.

There are 6 sensitive land uses within approximately 5 km of any turbine.

4.0 Construction methodology

The chosen Engineering, Procurement and Construction (EPC) contractor will be responsible for the detailed construction methodology for the Project.

The following sections describe a typical construction methodology that is likely to be similar to that used for the Project.

4.1 Timing and sequencing

The Project is likely to be developed in stages and the detailed design of each stage of the Project will be completed and informed by future work on wind energy output, geotechnical investigations, ecological constraints, network capacity connection constraints and the market for renewable energy.

The construction period for the Project will be agreed between the EPC contractor and Orange Creek Energy and will be subject to change depending on the weather conditions, availability of materials and construction speeds. Subject to Project approvals, construction is anticipated to commence in 2020 and the Project will be built 'generally in accordance' with the approved plans.

During the construction phase, works will typically occur for six days during each week, and up to 12 hours per day (06:30 to 18:30). Under such a scenario, materials would be transported to the site approximately 24 days per month (assuming a four week month). Construction activities may take place on a Sunday if desired by the construction contractor. It may also be necessary for construction activities to take place during the night time e.g. turbine installations during favourable weather conditions. In such instances, appropriate mitigation and management measures will be incorporated into the CMP, which will contain an Out of Hours Work (OOHW) Protocol developed for the assessment, management and approval of works outside the approved hours for construction.

These assumptions will be revisited and modified as necessary during detailed design.

Some enabling works will be required between approval of the Project and commencement of construction. This will include:

- Detailed site investigations, including the establishment of roads, and clearing for the purposes of micro-siting the turbines
- Obtaining all necessary permits and consents for construction
- Establishing water supply, through dams and bores
- Possible offsite road works
- Installation of wind monitoring towers and establishment of roads and clearing for their installation.

For the construction of the Project, the following activities are expected to occur:

- Site establishment (temporary site facilities, lay down areas, equipment and materials)
- Earthworks, rock crushing, paving (with gravel cap) and drainage for access roads and wind turbine hardstands
- Excavation for the foundations
- Construction of wind turbine foundations (bolt cage, reinforcement and concrete) and concrete batching on site
- Installation of electrical and communications cabling and equipment (including overhead lines and underground cables to the substation)
- Installation of wind turbine transformers, in parallel with electrical reticulation works
- Installation of towers for the wind turbines, delivery of the wind turbine components to the Project Area
- Installation of wind turbines, using large mobile cranes
- Commissioning and reliability testing of wind turbines
- Progressive rehabilitation and restoration of the Project footprint where possible.

The activities listed above will generally occur in the order listed, however some of these activities may be carried out concurrently to minimise the overall length of the construction programme.

4.2 Construction activities and equipment

It is anticipated that the construction work may include excavation, rock hammering, drilling, bulldozing, crushing and screening, concrete batching and, subject to geotechnical conditions, possible blasting.

Noise will be generated by mobile plant such as excavators, bulldozers, mobile cranes and the movement of heavy vehicles. It is expected that the following typical equipment will be used:

- Site mobilisation – track loader, graders, backhoes, trucks, small crane and generators
- Access roads and hardstands – road loaders, bulldozers, excavators, graders, scrapers, rollers, articulated dump trucks, belly dumper trucks rock crushing plant, semi-trailers, tractors water carts and hydroseed trucks
- Wind turbines – excavators, concrete trucks, rock breaker, concrete trucks, flat-bed trucks, vacuum trucks, large crawlers/all-terrain heavy lift cranes, medium crawler cranes, small crawler cranes, generators, tele-handlers, elevated work platforms
- Electrical reticulation works – trenchers, backhoes, excavators, graders, tractors, cable laying machines, and small terrain cranes
- Concrete batching plants.

Noise emissions from construction plant can be reduced by fitting exhaust mufflers, using reversing alarms that emit a broadband noise (e.g. white noise) rather than a beep, maintaining plant in good working order and following industry standard construction methodologies.

Other equipment and machinery may be required, depending on the nominated construction techniques.

4.3 Construction workforce

It is estimated that the workforce required to construct the Project will peak at approximately 170, assuming the Project is built in one construction period of 24 months. It is expected that some of the workforce will live locally in Banana and other regional centres and will not require additional accommodation. Other workers will be accommodated in local rental houses, hotels and motels in the surrounding localities and towns.

4.4 Construction water supply

The provision of water is essential for the construction of the Project. The construction activities likely to require water are:

- Bulk earthworks and material conditioning
- Dust suppression
- Concrete batching
- Drinking water for personnel and water for ablution facilities.

Water demands for the Project will require different water quality standards. Potable water fit for human consumption will be required at the site offices, while both medium (suitable for use in the concrete batching) and low-quality raw water (for earthworks and dust suppression) may be used for construction purposes. Water will be tested from various supply options and allocated to the most appropriate use.

A water sourcing strategy will be developed so that water used during the construction phase does not cause issues to adjacent landowners or other stakeholders. Where possible, potable water will be obtained from the local government water reticulation network or otherwise trucked to the site. The proposed source of medium quality water for concrete production is proposed to be trucked to site. Lower quality water (for earthworks and dust suppression) is likely to be locally sourced from either:

- Groundwater – to include artesian and sub-artesian

- Surface water – to include watercourses, springs and overland flow.

Construction water supply options will be determined during the detailed design of the Project and confirmed with the Department of Natural Resources, Mines and Energy prior to construction.

5.0 Environmental impacts and mitigation measures

There are several potential environmental impacts which may arise during site mobilisation and construction activities. These potential environmental impacts are listed in the following tables along with preventative measures to minimise these impacts throughout design, construction and operation.

5.1 Noise and vibration

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
Noise and vibration	Noise and vibration impacts at residential dwellings	Compliance with State Code 23 and Planning Guidelines	**Prevention**	Ensure that any wind turbine layout within the Project footprint is compliant with the applicable noise criteria Use of low-noise plant and equipment, where possible Select appropriate wind turbines to meet noise criteria	To minimise the impacts of construction noise, a Construction Noise and Vibration Management Plan will be prepared which outlines the proposed methodology and monitoring procedures to be put in place for the duration of the works. Scheduling of construction activities Maintenance of construction equipment Appropriate consultation with surrounding community about scheduling of construction activities Regular community consultation regarding noise created by the Project Management of construction hours to avoid or minimise noise impacts to nearby residents. Limitation of construction hours for noisy activities to Monday to Saturday where	N/A

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
					practicable. Construction work out of hours to be assessed on a case by case basis and the work program assessed against the noise impact on nearest residencies. An Out of Hours Work (OOHW) Protocol will be developed for the assessment, management and approval of works outside of the approved hours for construction. A key feature of this Protocol is considering the need and justification for any OOHW. This is the first step of the OOHW Protocol and will occur prior to any impacts being assessed. Where possible, OOHW will be avoided and scheduled to occur during the approved hours for construction. Where out of hours work are needed for the safe and efficient implementation of the project, or due to exceptional circumstances	

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
					such as need to align with favourable weather, the level of impacts of OOHW will be considered.	
			Contingency measures	N/A	Prepare a noise complaints procedure and register, and investigate any construction noise complaints appropriately Vibration complaints are not expected, but will be investigated	Investigate any operational noise complaints appropriately
			Monitoring	N/A	Where potential sensitive receivers may experience excessive noise, noise monitoring in accordance with the CMP will be undertaken	A Noise Monitoring Plan (NMP) will be developed to assist with determining compliance during the operational phase of the Project. Undertake compliance noise measurements at representative sensitive receivers located in proximity to the Project to ensure compliance with State Code 23 and Planning Guidelines

5.2 Landscape and visual

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
Visual amenity	Reduced visual amenity	Compliance with the visual impact mitigation commitments	**Prevention**	Minimise vegetation removal, where possible Design of facilities to minimise visual impact on surroundings, such as semi-matte finishes on turbines to minimise reflections	Limit works compounds and restrict to areas of lower visual sensitivity and / or lesser visibility where possible to avoid unnecessary visual impact Control after-dark construction lighting to minimise effects on sensitive land uses Reuse of spoil from excavation sites for incorporation into bunding for buffer planting zones Rehabilitation / revegetation of areas disturbed by construction activities that are no longer required for operation	Maintain Project in a tidy manner
			Contingency measures	N/A	CEMP to manage construction waste generated to ensure waste is minimised and reduces impacts to landscape character	N/A
			Monitoring	N/A	N/A	N/A

5.3 Shadow flicker

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
Shadow flicker	Shadow flicker experienced at dwellings and causing nuisance	No exceedance of guideline limits for shadow flicker at non-participating sensitive receptors	**Prevention**	Detailed design to be informed by shadow flicker modelling if wind turbine layout is altered If modelling demonstrates shadow flicker occurrence, a site visit can be arranged to investigate the dwellings expected to experience some shadow flicker to determine site-specific conditions. This will enable further modelling of the detailed design layout to incorporate site conditions at these locations and will identify the need for mitigation measures at these locations	N/A	N/A
			Contingency measures	N/A	N/A	Enable landowners with concerns about shadow flicker to contact the wind farm operator. Any complaints to be investigated appropriately Install screening structures or plant trees

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
						to block shadows cast by wind turbines, where required
			Monitoring	N/A	N/A	N/A

5.4 Electromagnetic interference

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
Electromagnetic interference	Disruption to telecommunications operations in proximity to the wind farm	No EMI impacts or disruption	**Prevention**	Undertake EMI impact assessment and resolve potential issues prior to construction commencing	N/A	N/A
			Contingency measures	Undertake EMI impact assessment and resolve potential issues prior to construction commencing	N/A	Establish a feedback process whereby stakeholders can raise concerns about EMI impacts with the wind farm operator Investigate these complaints appropriately
			Monitoring	Undertake EMI impact assessment and resolve potential issues prior to construction commencing	N/A	N/A
	Disruption to CB radio and mobile phone signals	Minimal temporary disruption to signals	**Prevention**	Educate landowners and stakeholders about potential interference to radio and mobile phone signals	N/A	N/A
			Contingency measures	N/A	Encourage radio and mobile phone users to move a short distance when experiencing signal interference	Encourage radio and mobile phone users to move a short distance when experiencing signal interference
			Monitoring	N/A	N/A	N/A

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
	Disruption to satellite and digital TV reception	No satellite or digital TV reception interference	**Prevention**	Ensure that any changes during detailed design to the wind farm layout are investigated for potential disruption to satellite or digital television	N/A	Educate residents experiencing interference issues on how to tune household antennas to alternative sources
			Contingency measures	N/A	Establish a feedback process whereby stakeholders can raise concerns about EMI impacts with the wind farm operator Investigate complaints accordingly and employ the appropriate mitigation measures as necessary Tune the householder's antenna into alternative sources of the same or suitable TV signal Establish an alternative solution to restore reception (e.g. install a more directional and/or higher gain antenna; relocate the antenna; install satellite TV; or a TV relay station)	Establish a feedback process whereby stakeholders can raise concerns about EMI impacts with the wind farm operator Investigate these complaints appropriately and employ the appropriate mitigation measures as necessary Tune the householder's antenna into alternative sources of the same or suitable TV signal Establish an alternative solution to restore reception (e.g. install a more directional and/or higher gain antenna; relocate the antenna; install satellite TV; or a TV relay station)
			Monitoring	N/A	N/A	N/A

5.5 Aviation

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
Airspace	Increased risk of collisions by aircraft with wind turbines or meteorological masts	No increase to risk profile	**Prevention**	Consultation with appropriate authorities, including aircraft operators, Civil Aviation Safety Authority (CASA), Airservices Australia, Department of Defence and Banana Shire Council regarding the Project	Notify aircraft operators, Airservices Australia and CASA when construction commences Notify Air Information Services to have the Project included on aeronautical charts	Wind farm operator to provide avenues for consultation with aviation stakeholders if any issues arise during the operation of the Project with respect to aviation-related factors
			Contingency measures	Consider inclusion of obstacle lighting on wind turbines in accordance with a lighting plan, if Aviation Risk Assessment recommends or directed by development approval condition	Operate obstacle lighting if required.	Operate obstacle lighting if required.
			Monitoring	N/A	N/A	N/A

5.6 Hazards and risk

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
Bushfire	Increase in prevalence and severity of bushfires	Reduced bushfire risk in the Project Area	**Prevention**	Preparation of a Bushfire Management Plan in consultation with Queensland Fire and Rescue Equipment and machinery to provide high safety standards Develop emergency provisions for property owners neighbouring and containing wind turbines The Project detailed design will be in accordance with relevant industry standards, including requirements for emergency vehicle access and asset protection areas	Maintain fire breaks around construction site Undertake risk assessment for construction activities Visual inspection of construction areas for presence of dry fuel Incorporate Bushfire Risk Plan into the CEMP Ensure buildings meet specifications and requirements of relevant standards, codes and guidelines Install lightning protection devices on wind turbines Observe fire warnings and notices Fit buildings with fire detection systems in accordance with AS1670 Maintain fire extinguishers at site offices and construction vehicles	Observe fire warnings and notices Maintain fire breaks and asset protection areas

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	**Design**	**Construction**	**Operation**
			Contingency measures	Provide suitable ingress and egress to the study area escape routes Roads should be designed to carry fully-loaded fire fighting vehicles Ensure appropriate water supply	Prepare and implement an Emergency Response Plan for construction Investigate the cause of any fire and update facilities or procedures to prevent further incidents Fire Danger Index (FDI) will be monitored daily	Prepare and implement an Emergency Response Plan for operation Investigate the cause of any fire and update facilities or procedures to prevent further incidents
			Monitoring	N/A	N/A	Maintenance of relevant vegetation to reduce risk of fire Regular maintenance and serving of equipment and wind turbines
Mosquitos	Potential creation of artificial breeding sites	Compliance with the *Public Health Act 2005*	**Prevention**	Provide a mosquito management component in the Weed and Pest Management Measures	A Pest Management Technician, licensed under the *Pest Management Act 2001*, will be engaged when pest control activities are required to be undertaken during construction	A Pest Management Technician, licensed under the *Pest Management Act 2001*, will be engaged when pest control activities are required to be undertaken during operation
			Contingency Measures	N/A	Maintain activities as set out in the Weed and Pest Management Measures	Maintain activities as set out in the Weed and Pest Management Measures
			Monitoring	N/A	Visual inspections in accordance with the	Visual inspections in accordance with the

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
					requirements set out in the Weed and Pest Management Measures	requirements set out in the Weed and Pest Management Measures

5.7 Socio-economic

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
Social impact	Missed opportunities in relation to local employment and use of local contractors	Maximise local employment and contractor opportunities	**Prevention**	Develop workforce management arrangement and a Local Procurement Plan (or similar). Implement Stakeholder Consultation and Engagement Plan	Implement workforce management arrangement and a Local Procurement Plan (or similar) Implement and revise where necessary the Stakeholder Consultation and Engagement Plan Use of local contractors wherever feasible and economic for all associated construction work Maximise local employment during construction phase wherever feasible and economic	Maximise local employment during operational phase wherever feasible and economic Implement and revise where necessary the Stakeholder Consultation and Engagement Plan
			Contingency measures	N/A	N/A	N/A
			Monitoring	N/A	N/A	N/A

5.8 Land use

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
Land use and planning	Loss of good quality agricultural land Disruption to agricultural practices	Minimal reduction in rural production or output caused by construction or operation of the wind farm	**Prevention**	Consult with landowners to determine methods to minimise disruption to current agricultural practices Minimise development in areas of Class A and Class B Agricultural Land Classification (ALC), where possible	Minimise disruption of agricultural practices will be minimised during construction, based on discussions with landowners during the design phase	Operate the wind farm in accordance with measures identified during the design phase
			Contingency measures	Where some disruption cannot be avoided, consult with landowners to identify ways to minimise impacts to agricultural practices	Where disruption cannot be avoided, liaise with landowners to reduce potential impacts Investigate the cause of complaints of disrupted activities and address the issue appropriately	Investigate the cause of complaints of disrupted activities and address the issue appropriately Implement a complaint recording, investigation and reporting system for construction and operation
			Monitoring	No monitoring required	No monitoring required	No monitoring required

5.9 Flora and fauna

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
Flora conservation	Direct loss of Least Concern and Of Concern Regional Ecosystems (REs)	Compliance with the EPBC Act, NC Act, VM Act and EP Act	**Prevention**	Avoid and minimise disturbance to areas of Least Concern and Of Concern RE unless there is no suitable alternative Detailed design of the Project to promote the retention of remnant vegetation within the study area Maximise co-locate infrastructure to reduce area of vegetation clearing, where possible	Minimise construction activities within remnant vegetation Maximise siting of construction sites, such as site office, soil stockpiles, machinery / equipment storage within existing cleared areas or disturbed areas Impose strict no-go zones for construction workers and machinery within remnant vegetation excluding areas approved for clearing	N/A
			Contingency measures	Option relevant permits and approvals under the VM Act and NC Act Provision of applicable offsets Develop a management and rehabilitation plan	All vegetation to be removed is clearly marked and clearing contractors briefed on clearing requirements Educate all relevant contractors on the importance of the vegetation, mitigation/management measures and ensure no encroachment occurs on	N/A

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	**Design**	**Construction**	**Operation**
					surrounding vegetation Implement the management and rehabilitation	
			Monitoring	N/A	Visual inspection of vegetation clearing boundaries during clearing	N/A
	Direct loss of regrowth vegetation	Compliance with the EPBC Act, NC Act, VM Act, and EP Act. Maintain the current extent of regrowth vegetation	**Prevention**	Avoid all regrowth vegetation unless there is no suitable alternative Detailed design of the Project to promote the retention of regrowth vegetation within the Project Area Maximise the co-location of infrastructure to reduce area of vegetation clearing required, where possible	Minimise construction activities within regrowth vegetation Maximise siting of construction sites, such as site office, soil stockpiles, machinery / equipment storage within existing cleared areas or disturbed area Impose strict no-go zones for construction workers and machinery within regrowth vegetation that has not been approved as part of the Project Footprint	N/A
			Contingency measures	Research viability of compensatory planting or / seeding	All vegetation to be removed is clearly marked and clearing contractors briefed on	N/A

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
				Develop a management and rehabilitation plan	clearing requirements Educate all contractors on the importance of the vegetation and ensure no encroachment on surrounding vegetation Implement the management and rehabilitation plan	
			Monitoring	N/A	Regular visual inspection of vegetation clearing boundaries	N/A
	Degradation of vegetation communities and habitats through indirect impacts, including edge effects, spread of weeds, introduced pests, modified surface water drainage, light and noise intrusion	Compliance with the EPBC Act, Biosecurity Act, NC Act, VM Act, and EP Act No new infestations of weeds or pests attributable to the Project	**Prevention**	Avoid fragmentation of existing small patches (<5 ha), where feasible Maintain, as far as practicable, existing surface drainage paths	Minimise construction activities within remnant vegetation. Install wash-down facilities at main site entry / exit points to remove soil and weeds Develop and implement a Weed Management Plan that includes specific controls for environmental and noxious weeds	Progressively revegetate disturbed areas as soon as practicable after works with appropriate native species suitable for cattle grazing
			Contingency Measures	N/A	Maintain activities as set out in the Weed Management Plan	Maintain activities as set out in the Weed Management Plan

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
			Monitoring	N/A	Imported topsoils / mulches to be weed-free prior to material arriving onsite Visual inspections in accordance with the requirements set out in the Weed Management Plan	Visual inspections in accordance with the requirements set out in the Weed Management Plan
	Removal of prescribed environmental matters that are regulated vegetation communities	Compliance with Planning Act, VM Act and *Environmental Offsets Act* 2014	**Contingency measures**	Determination of offsets, if required Confirmation on delivery of offsets Delivery of financial offset, if appropriate	N/A	N/A
Fauna conservation	Mortality of native fauna	No significant impact on a native fauna population directly attributable to the Project	**Prevention**	Minimise the removal of large hollow-bearing trees or dead trees, where possible	Speed limits will be clearly signed on access roads and roads during construction and known fauna crossing points highlighted with signage Removal of hollow bearing trees to follow Tree Felling protocol All site personnel shall be made aware of sensitive fauna / habitat areas and the requirements for the	Maintenance of fauna exclusion systems and structures designed for safe fauna passage to enable these systems to function effectively if applicable

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	**Design**	**Construction**	**Operation**
					protection of these areas	
			Contingency measures	N/A	Investigate the cause of any fauna injury or death Information gained through investigations to be applied in adaptive management to prevent or minimise further losses or injuries where possible and practical and/or implement compensatory actions.	N/A
			Monitoring	Develop a Vegetation and Fauna Management Plan and Bird and Bat Management Plan	Prepare a Vegetation and Fauna Management Plan that includes assessment of mortality of native fauna and adaptive management processes to prevent or minimise further losses or injuries and/or identifies measures to be implemented as compensatory actions. Visual inspections in accordance with the Vegetation and Fauna Management Plan	Continued visual inspection of Project Site for fauna mortality in conjunction with scheduled maintenance works and according to the requirements established in Vegetation and Fauna Management Plan to include targeted monitoring of birds and bats including mortalities

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
	Impediment to movement of at risk wildlife (birds and bats) through natural wildlife corridors	Compliance with the EPBC Act, NC Act, VM Act, and EP Act	**Prevention**	Any turbine lighting is to be minimised, and red lights used to prevent the attraction of insects, if required	All construction activities, e.g. site offices, stockpiles etc. to remain within approved Project Footprint In accordance with statutory obligations, spotter/catchers will be present at all vegetation clearing to ensure minimal disturbance to onsite fauna and recover and rescue any injured or orphaned fauna during construction	N/A
			Contingency measures	N/A	N/A	N/A
			Monitoring	N/A	Visual inspections in accordance with the Vegetation and Fauna Management Plan	Continued visual inspection of wind farm for fauna mortality in conjunction with scheduled maintenance works and according to the requirements established in the Flora and Fauna Monitoring Program

5.10 Traffic

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
Traffic impact	Delays to traffic on State Controlled Roads and local roads	Manage increased traffic volumes appropriately	**Prevention**	Preparation of a Traffic Management Plan in consultation with the Department of Transport and Main Roads (DTMR) and relevant Councils Investigate opportunities to use alternative routes for deliveries avoiding school bus routes and populated areas	Implementation of the Traffic Management Plan for construction traffic	Implementation of the Traffic Management Plan for operational traffic
			Contingency measures	Specific traffic planning elements to be considered will include road diversions, construction route options and scheduling of deliveries, services and shift patterns	Any necessary road closures will be described within the Road Use Management Plan or Traffic Management Plan and necessary approval obtained from DTMR and relevant councils Access points to be located with adequate sight lines and advance warning signs provided if necessary	N/A
			Monitoring	N/A	N/A	N/A

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
Stock routes	Disruptions to stock movement along a stock route	No stock movement disruptions along stock routes	**Prevention**	Investigate detailed design solutions to minimise impact on existing roads and stock routes	Ensure all stock routes remain open during construction phase, and any works or improvements to the road infrastructure must consider potential stock movement	Ensure all stock routes remain open throughout the operational period where possible
			Contingency measures	N/A	N/A	N/A
			Monitoring	N/A	N/A	N/A

5.11 Surface water, riparian areas and groundwater

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
Water quality	Sediment from disturbed areas may enter nearby waterways	Compliance with current State and Commonwealth legislation, guidelines, strategies and standards No visible evidence of sediment leaving construction site No visible increase in turbidity attributable to construction or operation of the wind farm	**Prevention**	Develop Conceptual Erosion and Sediment Control Plan	Develop and implement an Erosion and Sediment Control Plan in accordance with Engineers Australia's *Soil Erosion and Sediment Guidelines for Queensland Construction Sites*, to manage rainfall, water used in road formation and dust suppression, Stormwater and Dewatering activities. Progressively rehabilitate areas disturbed by construction works that do not need to be retained for operations or by the landowner	Maintain revegetated / rehabilitated areas Maintain roads, hardstands and other infrastructure ensuring drainage controls are operational and effective
			Contingency measures	N/A	Maintain, repair or reinstate damaged erosion and sediment control infrastructure Investigate cause of increased turbidity or released sediment and address accordingly	Implement erosion and sediment control measures if areas are causing high sediment loads or turbidity in nearby waterways
			Monitoring	No background	Regular visual	N/A

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	**Design**	**Construction**	**Operation**
				monitoring required	inspections of sediment control infrastructure Regular visual inspections of discharge water and receiving water bodies (particularly after rainfall) Turbidity monitoring in the event of turbid plumes from construction activities	
Riparian Zone	Physical damage or alteration to riparian areas	No net degradation of riparian areas attributable to construction or operation	**Prevention**	Design to avoid structures within riparian areas where practicable Design to include rehabilitation of riparian areas Design to minimise scour and erosion of riparian areas Clarify guidelines on construction activities around riparian areas in the project construction zone	Minimise vegetation removal and construction activities within waterways Progressively rehabilitate riparian areas as soon as practicable after construction.	N/A
			Contingency measures	N/A	N/A	Maintain rehabilitation areas

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	**Design**	**Construction**	**Operation**
			Monitoring	No background monitoring required	Regular visual inspection of construction site for clearing or construction activities beyond designated areas Regular visual inspection of rehabilitated areas until construction period is complete	N/A
	Interference with stream flow	Compliance with *Water Act 2000, Environmental Protection Act 1994* and *Fisheries Act 1994*	**Prevention**	Design to minimise construction within riparian areas where practicable Assess construction water supply requirements as part of design Department of Agriculture and Fisheries (DAF) self-assessable codes for low-impact development activities will be used to design waterway barrier developments within the project footprint during construction	Obtain construction water in accordance with the rights under the *Water Act 2000* and any other approval Obtain water for irrigation or revegetated areas during establishment of vegetation from an approved source	Obtain construction water in accordance with the rights under the Water Act and any other approval Obtain water for irrigation of revegetated areas during establishment of vegetation from an approved source
			Contingency	N/A	N/A	N/A

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	**Design**	**Construction**	**Operation**
			measures			
			Monitoring	N/A	N/A	N/A
	Introduction of weeds and pests	No introduction of weeds or pests into riparian areas	**Prevention**	Design to minimise construction within riparian areas where practicable Design to include rehabilitation of riparian areas to prevent establishment of new weed and pest species	Develop and implement a Weed Management Plan, detailing procedures for cleaning and checking construction vehicles entering the construction site Manage existing weed infestations in accordance with weed management requirements prior to construction disturbance in these areas Minimise vegetation removal and construction activities within waterways Rehabilitate riparian areas as soon as practicable after construction	Maintain vegetation within the project footprint to prevent the establishment of weed species
			Contingency measures	N/A	Review and update weed management procedures Remove overabundant or notifiable pest species in accordance with advice	Review and update weed management procedures

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	**Design**	**Construction**	**Operation**
					from the DAF	
			Monitoring	Establish a baseline of Weeds present on site prior to disturbance / clearing	Regular visual inspection of construction areas for new infestations of weeds or pests Regular visual inspections of weed or pest treatment areas to determine efficacy of measures	Inspection of project footprint during maintenance activities for weed infestation
Groundwater	Degradation of groundwater resource	Compliance with *Water Act 2000* and *Environmental Protection Act 1994* No contamination of local groundwater system	**Prevention**	Determine water requirements for construction and identify suitable water sources Identify surface water bodies sensitive to groundwater movement (i.e. dams)	Comply with Emergency Spill Containment Plan in the event of a spillage/leak of potentially hazardous substances Contain poor quality discharge water and treat prior to disposal, subject to achieving water quality guidelines Manage any groundwater abstraction in accordance with approved permit conditions	No specific mitigation measures are considered necessary due to low potential risk
			Contingency measures	N/A	Investigate the nature of any spilled / leaked potentially hazardous / contaminating substances	N/A

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
					Investigate the extent of any spillage / leakage of potentially hazardous / contaminating substances	
			Monitoring	N/A	N/A	N/A

5.12 Topography, geology and soils

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
Topography, geology and soils	Erosion	Effective erosion and sediment control measures implemented and maintained	**Prevention**	Incorporation of stable embankments and cuts, with catch drains to minimise longer term erosion	Prepare and maintain a project-specific Erosion and Sediment Control Plan Keep land clearance to a minimum Avoid wherever possible clearing areas of highly erodible soils which are prone to water and wind erosion The interval between clearing and rehabilitation should be kept to an absolute minimum Coordinate work program to minimise extent of time disturbed land is exposed prior to stabilisation Attempt to program construction activities so that the area of exposed soil is minimised during times of the year when the potential for erosion is high, for example	Maintain project infrastructure such as roads and hardstands, ensuring drainage controls are effective

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
					during summer when intense rainstorms are common Stabilise the site and install and maintain erosion controls in accordance with the project-specific Erosion and Sediment Control Plan Keep vehicles to well-defined access roads	
			Contingency measures	N/A	Identify and investigate the site of erosion and address in accordance with the project-specific Erosion and Sediment Control Plan Maintenance of road surfaces and cleared footprints will be conducted prior to and immediately following extreme rainfall events during the construction phase and throughout the life of the project, reducing the potential of mass movement of sediment	Identify and investigate the site of erosion and provide suitable erosion controls, in accordance with the Erosion and Sediment Control Plan Investigate areas showing signs of excessive erosion and implement appropriate solution

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	**Design**	**Construction**	**Operation**
			Monitoring	No background sampling required	Erosion and sediment control measures documented Regular visual inspection and check sheets maintained	N/A
	Mass wasting	No mass wasting / landslip events	**Prevention**	Geological and geotechnical investigations in areas requiring cuts – areas for turbine foundations and hardstand, and access roads Geological profile of slopes, with slope stability reports issued prior to undertaking earthworks	Construction activities undertaken in accordance with relevant work method statements	Visual inspection of susceptible areas following heavy rainfall / landslip inducing event
			Contingency measures	N/A	Identify and investigate the site of mass wasting and provide suitable remediation	Identify and investigate the site of mass wasting and provide suitable remediation
			Monitoring	No background sampling required	Mass wasting and landslip control measures documented Daily visual inspection and check sheets	No background sampling required

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	**Design**	**Construction**	**Operation**
					maintained	
	Generation of acidic material	No generation of significant amounts of acidic waste water No generation of acidic material	**Prevention**	Inspection of intrusive igneous rock bodies for disseminated sulfides will be conducted as part of the geotechnical investigation	Any exposed acid producing material will need to be neutralized and contained according to the *Queensland Acid Sulfate Soil Technical Manual, Soil Management Guidelines*	No specific mitigation measures are considered necessary due to low potential risk
			Contingency measures	N/A	Divert potentially acidic surface run-off away from local waterways, into established sedimentation basins Neutralise the contained surface run-off by chemical / biological means, in accordance with the *Queensland Acid Sulfate Soil Technical Manual, Soil Management Guidelines*	N/A
			Monitoring	No background sampling required	Submission of samples of suspected acidic material to a NATA accredited laboratory for characterisation	No background sampling required

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
					pH monitoring of surface runoff generated from operational construction sites, at times and in locations where generation of acidic runoff is likely pH monitoring of local surface waters receiving surface runoff from construction sites, at times and in locations where generation of acidic runoff is likely	
	Land contamination by on-site construction activities or by export of contaminated material from site or importation of contaminated material	No contamination of land	**Prevention**	Investigate the presence of any Notifiable Activities as listed in the *Environmental Protection Act 1994* on properties within the Project Area An Emergency Spill Containment Plan to be produced	Nature, quantity and location of all hazardous materials on-site recorded in a manifest Chemical / Fuel storage areas to consist of a compacted base, bunding to contain spillages and roofing to prevent contamination and infiltration of stormwater (as per AS1940 and AS3780) Residual hazardous materials will be	In accordance with legislated requirements and Australian Standards of the storage and handling of dangerous and hazardous goods will provide appropriate practical responses to manage impacts on occupational health and safety and minimise the risk of a spill occurring

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
					removed from the construction site and returned to an appropriate storage area or a suitable waste facility Spillages of all dangerous goods and contaminated materials will be rendered harmless through investigation, collection and disposal at a suitable disposal facility Fill material imported from off-site to be procured from a licensed quarrying facility and accompanied by relevant documentation to verify it is contaminant / acid sulfate soil free Contaminated fill material exported from site will be disposed at a facility licensed for disposal of such material	

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	**Design**	**Construction**	**Operation**
			Contingency measures	N/A	If potentially contaminated soils are encountered, a preliminary site investigation should be undertaken Visual and olfactory observation of all in-situ material excavated during construction	Preliminary site investigation of land exposed to leaked or spilled potentially hazardous substances / material
			Monitoring	No background sampling required	Submission of samples of suspected contaminated material to a NATA accredited laboratory for characterisation	Submission of samples of suspected contaminated material, generated from operational activities, to a NATA accredited laboratory for characterisation

5.13 Waste management

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
Waste	Excessive waste generation	Minimal waste generation	**Prevention**	Detailed design for infrastructure to carefully specify material needs to avoid over estimating requirements	Use a hierarchical approach to waste management, from the most preferable (reduce, reuse or recycle wastes) to the least preferable (disposal), and prioritise waste management strategies to avoid waste generation	The waste stream generated from a wind farm during operation is minimal
			Contingency measures	N/A	Where waste cannot be avoided, waste materials will be segregated by type for collection and removal (for processing or disposal) by licensed contractors	Where waste cannot be avoided, waste materials will be segregated by type for collection and removal (for processing or disposal) by licensed contractors

5.14 Air quality

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
Air quality	Exhaust emissions • Mono-nitrogen oxides (NO_x) • Particulate matter (PM_{10} and $PM_{2.5}$) • Volatile organic compounds (VOC) • Carbon monoxide (CO)	Minimise exhaust emissions	**Prevention**	Assess traffic and haulage routes	Vehicle engines to be switched off when not in use Avoid idling vehicles where possible	The vehicle emissions generated from a wind farm during operation is minimal
			Contingency measures	N/A	N/A	N/A
	Fugitive dust	Minimise fugitive dust emissions	**Prevention**	Preliminary site investigation prior to construction would be undertaken to reveal the quality of sub-grade material	Plan construction by locating dust activities away from sensitive land uses where possible Access tracks are to be dampened on a regular basis with water, especially during prolonged dry periods Washing facilities to prevent mud from construction operations being transported onto adjacent public roads Ensure that dusty materials are stored and handled appropriately (wind shielding and storage is away from site boundaries, drop heights of	Fugitive dust emissions will be minimal during operation

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	**Design**	**Construction**	**Operation**
					materials are restricted, water sprays are used where practicable to reduce dust emissions) Minimise dust generating activities on windy and dry days Restrict vehicle access on haul roads and other unsurfaced areas of the project footprint No fires on project footprint.	
			Contingency measures	N/A	If dust is generated, ensure that a water truck is used to dampen down all access tracks and public access roads	N/A
			Monitoring	N/A	Visually monitor work areas for dust emissions. Conduct air quality monitoring where there are complains and / or excessive dust generation in the vicinity of sensitive land uses	N/A

5.15 Cultural heritage

Environmental factor	Potential impact	Target	Management objective			
			Mitigation type	Design	Construction	Operation
Cultural heritage	Disturbance of items of cultural heritage	Minimal reduction of cultural heritage values	**Prevention**	Establish a dialogue with the Traditional Owners Development of a Cultural Heritage Management Agreement / Plan	Implement Cultural Heritage Management Agreement / Plan to satisfy Duty of Care requirements	Include operation phase within the Cultural Heritage Management Agreement / Plan
			Contingency measures	N/A	If items of potential cultural heritage significance are discovered during construction, work is to cease immediately in the vicinity of the construction works and a cultural heritage professional is to be invited to investigate prior to works recommencing in that area	Investigate any heritage related complaints and address accordingly Implement a complaint recording, investigation and reporting system
			Monitoring	N/A	N/A	Visual inspection of items of cultural heritage value in the event of a complaint

6.0 Conclusions and recommendations

This CMP has been developed for the Banana Range Wind Farm in accordance with the State Code 23 and Planning Guidelines and complies with PO13 of State Code 23.

As the Project continues through its design and development stages, construction management requirements will be reviewed and a construction environmental management plan (CEMP) will be prepared by the EPC contractor prior to the commencement of any construction activities. The CEMP will include details of the construction programme, construction techniques to be employed, environmental mitigation measures to control construction impacts, monitoring and audit regime, and contact details for queries and reporting incidents.

The CEMP will consider the measures put forward in this document and any conditions of approval applied to the Project.