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NEOEN

PRELIMINARY CONSTRUCTION MANAGEMENT PLAN

Mount Hopeful Wind Farm

FINAL

June 2021

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Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Neoen Australia Pty Ltd

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Report No.	7053_R10
Date:	June 2021

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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
V1	Renee Brozovich	08/03/2021	Mark Herod	08/03/2021
V2	Renee Brozovich	27/05/2021	Mark Herod	27/05/2021
V3	Renee Brozovich	10/06/2021	Mark Herod	10/06/2021

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1.0 Introduction

Umwelt Australia Pty Ltd (Umwelt) was commissioned by Neoen Australia Pty Ltd (Neoen) to complete a preliminary Construction Management Plan (CMP) for the Mount Hopeful Wind Farm (the Project). The preliminary CMP is a high-level document to address the requirements of performance outcome (PO) 13 of State Code 23: Wind farm development (DSDMIP 2019) and associated Planning guideline (DSDMIP 2017). PO13 of State code 23 specifies that "construction activities associated with the development avoid, or minimise and mitigate, adverse impacts on environmental values, water quality objectives, amenity, local transport networks and road infrastructure."

The purpose of this preliminary CMP is to provide an overview of key infrastructure required for the Project, construction methodology, the potential impacts that may occur during construction, and how these impacts may be mitigated and monitored. This document will support the development application requirements of the Project and be used as a foundation for the detailed Construction Environment Management Plan (CEMP) which will be developed later as the Project progresses to the detailed design phase. A conceptual Erosion and Sediment Control Plan (ESCP) has been developed as a separate document and complements this preliminary CMP.

1.1 Project Location

The Project is located approximately 45 kilometres (km) south of Rockhampton and 65 km west of Gladstone within the Central Queensland Region. As shown in **Table 1.1**, the Study Area covers 18 lot on plans with a combined area of approximately 16,758 hectares (ha). The Study Area is located on the Ulam Range between Mount Hopeful (on the Dee Range) and Mount Alma (on the Mount Alma Range). The Study Area straddles two local government areas: Banana Shire Council for the southern part of the Study Area, and Rockhampton Regional Council for the northern part of the Study Area.

Table 1.1 Land parcels of the Study Area

Lot and Plan	Area (hectares)	Tenure	Local Government Area
Lot 21 RN1345	5196.6	Freehold	Banana Shire Council
Lot 24 RN34	2752.5	Freehold	Banana Shire Council
Lot 23 RN25	976.2	Freehold	Banana Shire Council
Lot 30 RN72	1723.7	Freehold	Banana Shire Council
Lot 1 RL5827	10.9	Lands Leased (Road Licence)	Banana Shire Council
Lot 21 RN46	1470.6	Freehold	Rockhampton Regional Council
Lot 25 RN25	183.5	Freehold	Rockhampton Regional Council
Lot 2039 RAG4056	801.0	Freehold	Rockhampton Regional Council
Lot 1933 RAG4058	826.3	Freehold	Rockhampton Regional Council
Lot 2057 RAG4059	845.9	Freehold	Rockhampton Regional Council
Lot 15 RN1089	585.9	Freehold	Rockhampton Regional Council
Lot 148 DS151	235.4	Freehold	Rockhampton Regional Council
Lot 2420 DT4077	64.8	Freehold	Rockhampton Regional Council
Lot 2345 DT4077	105.3	Freehold	Rockhampton Regional Council
Lot 50 DT40144	24.3	Freehold	Rockhampton Regional Council

Lot 33DT40123	66.5	Freehold	Rockhampton Regional Council
Lot 38 DT40131	71.5	Freehold	Rockhampton Regional Council
Lot 100 SP289441	595.0	Freehold	Rockhampton Regional Council
TOTAL	**16757.5**		

1.2 Existing Environment

As the Study Area runs along the western edge of Dee Range and Ulam Range and extends west to valleys, the general topography is rugged with elevation ranging from 500 m Australian Height Datum (AHD) to 190 m AHD. There are several prominent hills and mountains within the Study Area, namely Mt Helen at 633 m (east), Mt Isabel at 508m (east), Mt Gelobera / Reilly's Hill at 539m (west), and North Pimple at 454 m (centre). The land surrounding the Study Area is also steep, with several other prominent mountains nearby (including Mt Hopeful at 634 m to the north).

The Study Area is located in a largely rural and sparsely settled landscape that is mostly used for light grazing and livestock production. The closest localities are Fletcher Creek and Nine Mile Creek. The closest towns are Hamilton Creek (13 km north-west), Mount Morgan town (19 km north-west), and Bajool (15 km north-east).

There are no protected areas within the Study Area, however there are several adjacent to or in the surrounding areas, including Gelobera State Forest, Ulam Range State Forest, Don River State Forest, and Mount Hopeful Conservation Park.

There are two residential dwellings located within the Project boundaries (one in the south-west and one in the north). The number of dwellings within 8 km of the closest turbine are listed below:

- No non-participating residences within 3.5 km of the closest turbine
- 2 residences located within 3.5 to 4 km of the closest turbine
- 5 residences located between 4 and 5 km of the closest turbine
- 3 residences located between 5 and 6 km of the closest turbine.
- 3 residences located between 6 and 8 km of the closest turbine.

There are eight mapped dams in the south-west of the Study Area and numerous watercourses across the Study Area. These watercourses contain regulated vegetation which is mapped as matters of state environmental significance (MSES). Many of the watercourses are ephemeral, unnamed streams. Some of the named watercourses (and their relative location within the Study Area) are:

- Capella Creek (north-west) which is non-perennial and stream order 3
- Ginger Creek (centre) which is non-perennial and stream order 1-2
- Centre Creek (centre and south) which is non-perennial and stream order 2-3
- Pomegranate Creek (south-west) which is non-perennial and stream order 2

For further details about the existing environment of the Study Area, refer to the Development Application for this Project.

2.0 Project Infrastructure

It is important to note that the proposed Project layout may change as part of the detailed design of the Project. Decisions on the final location of infrastructure (micro-siting) during detailed design and construction will potentially allow for the further protection of species, habitat and features of localised conservation significance. To accommodate on-site constraints, the wind turbines, as well as the required supporting infrastructure (roads and overhead/underground reticulation), may be micro-sited up to 100 m.

As shown in **Table 1.1**, the Study Area has a total area of approximately 16,758 ha. The construction footprint will be approximately 5% (882 ha) of this area. Land occupied by temporary infrastructure will revert to being used for rural and agricultural purposes following construction.

2.1 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 turbine technology 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 up to 116 turbines with approximately 6 MW in generation capacity each, however this may change 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. The maximum height of the turbine to blade tip is up to 260 m. Blade length chosen and wind turbine hub height will be configured so that the tip height does not exceed 260 m. These maximum specifications are summarised in **Table 2.1**.

Table 2.1 Key generation and turbine specifications

Feature	Statistic
Project generation capacity	Up to 700 MW*
Turbine electrical output	Approximately 6 MW
Maximum number of turbines	116
Tip height**	Up to 260 m
Rotor diameter**	Up to 180 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 State code 23 and the Planning guideline, particularly in relation to acoustic amenity and setback criteria. The maximum specifications listed in the table provides flexibility for any innovation in turbine design between now and the time of detailed design and construction.

**Dimensions 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.

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

The maximum turbine tip height and rotor diameter listed in **Table 2.1** 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.

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

- ability of the turbine to maximise power output based on the wind resource at the Project Site
- availability of the turbine will also affect the final choice of turbines
- turbine which provides the optimal financial outcome for the Project.

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

2.2 Wind Turbine Foundations

Each turbine foundation will comprise a reinforced concrete slab, the dimensions of which will be finalised after the wind turbine generator (WTG) is chosen. 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 Site. The final design will also take into account the geotechnical conditions identified through detailed, micro-siting site investigation.

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

The concrete for the foundations will be mixed at concrete batching plants which are currently proposed to be part of laydown areas on-site. Concrete batching material will be sourced off-site.

2.3 Hardstands

Turbine locations will require an area of gravel capped hardstand adjacent to each turbine foundation, (approximately 100 m by 50 m, depending on turbine type). These hardstand areas are intended to provide a stable base on which to place turbine components ready for assembly and erection, and to locate the crane necessary to lift the turbine components into place. In addition to this, some hardstanding areas 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 laydown the blades, a further 100 m by 50 m area is required.

The total clearing per turbine hardstand will vary across the 116 turbines, depending on the extent of vegetation at each location and the topography. If the three blades are joined on the ground to form the rotor, clearing an area to accommodate each blade length will be undertaken to allow construction.

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

The total area of proposed hardstands (including laydown areas, turbine foundations etc.) is approximately 100 ha.

2.4 Electrical Connections, Substation and Grid Connection

The electricity generated by harnessing the wind's energy must go through a transformer kiosk adjacent to (or within) each turbine in order to increase its voltage and efficiently transfer it to a substation.

Up to six substations will be located throughout the Study area. One proposed substation is located in the north-east of the Study Area within Lot 21 RN46 and is proposed to connect to the National Electricity Market (NEM) via the 275kV transmission line east of the Study Area. The area will include:

- Substation (including electrical ancillary services)
- Site office
- Helipad
- Laydown area and construction compound

Another substation is proposed at the connection point with the transmission line to the east of the Study Area. An area of flat, empty land is available to locate this substation, the battery storage system, and the corridor for the easement to the transmission line (which will be 20 to 30 m wide). It is expected that this area will also be used for a battery storage system, a possible synchronous condenser area, and a parking lot. The precise location and size of the infrastructure will be finalised in the detailed design phase.

Other substations, if required, would be located within proposed construction and operation infrastructure areas. The proposed substation areas may also contain a switchyard and switch-room, a step up transformer and high voltage equipment.

The wind turbines will be connected by either overhead or underground cables to the main transformer located in a substation. Power and communication cables will be installed as either overhead lines or underground between the turbines and will connect back to the substation and the operational and maintenance facility. If underground power and communication cables are used, they 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/overhead cables will typically be adjacent to the internal access 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.

The total length of cable reticulation required is predicted to be up to approximately 175 km, but will depend on the final layout of the substations, turbines and operational and maintenance facility. Once the trenched areas have been backfilled, the disturbed area will be reinstated to promote the establishment of vegetation.

2.5 Battery Storage

The proposed battery storage facility compound is included in the area for the proposed substations. The specific battery storage system has yet to be selected, however it will be made of lithium-ion and will have capacity to deliver approximately 400 MW of power for two hours that can be dispatched to the grid as required. This area will be enclosed by chain mesh security fencing and include control boxes and access/circulation around the batteries for maintenance access. The battery storage will be mounted on a bunded concrete pad to accommodate the battery storage and associated equipment. Overhead cables will connect the battery storage facility to the substation and then into the NEM.

The detailed design and layout of the battery storage facility will need to meet a range of technical, access and safety requirements. The compound allows required spacing of equipment as well as safe circulation space. The compound will comply with Australian electricity industry design standards.

2.6 Operational and Maintenance Facility

The proposed area for the substation in Lot 21 RN46 is also proposed to include the operational and maintenance facility. These areas typically contain vehicle parking spaces, septic ablutions and wash down areas as appropriate.

2.7 Construction Compound and Laydown Areas

There are four proposed laydown areas, which will also function as construction compound areas. These four areas total approximately 18 ha.

The construction compound areas will be used to manage construction. These compounds will likely 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. Temporary office / lunch rooms and ablutions may also be established on turbine hardstandings during the construction period.

These areas will also accommodate temporary storage of construction plant equipment, wind farm components and construction materials prior to moving to their ultimate destination. The areas may also be used for rock crushing and stockpiles, and concrete batching equipment.

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

Following the completion of the construction phase, these areas may be reinstated using the stockpiled topsoil depending on the landowner's requirements.

2.8 Meteorological Masts

Up to ten permanent and ten temporary meteorological masts (also known as wind monitoring towers) have been proposed along the eastern Project boundary (aligned with the range). They have been assessed to measure 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.

The towers will be powered and contain measurement instruments and telecommunication equipment. They will either be free standing or guyed lattice structures with concrete footings at mast base and anchor points. The total disturbance required is estimated to be up to 2.5 ha for each permanent guyed wind monitoring tower. The tower will reach up to the hub height of the wind turbines which is up to 180 m. Restrictions on the distance between mast and turbine will be adhered to.

After a period of concurrent wind speed and direction monitoring during the construction period, the temporary wind monitoring towers will be removed and permanent wind turbines constructed in their place. This reduces unnecessary clearing and also provides the benefit of having location specific meteorological data for ten of the turbine locations. Full engineering design and certification will be carried out for permanent meteorology masts during detailed design once the turbine type and layout of the wind farm has been confirmed.

The weather data from both the temporary and permanent wind monitoring towers will create a record of the wind before and after the wind turbine is installed to allow effective measurement of the performance of the turbines.

2.9 External Site Access

Major highways in proximity to the Study Area include the Bruce Highway to the east, Burnett Highway to the west, and the Dawson Highway to the south. These major transport corridors link the Study Area to the cities of Rockhampton and Gladstone, and to the Port of Gladstone which is where the wind turbine components will be shipped to.

A Preliminary Transport Route Assessment has been undertaken to consider two road haulage routes of the wind turbine components from the Port of Gladstone to the Project site.

It is currently proposed that the main access for Project traffic from the state controlled road network will be via the existing intersection of McDonalds Road with the Burnett Highway. From this existing intersection with the Burnett Highway, it is proposed that Project traffic will travel along the Council controlled sections of McDonalds Road and Playfields Road to the proposed Project site entrance at the south-western part of the Study Area.

The final transport corridors to be used during construction and operation of the Project will be outlined in the detailed Traffic Assessment and Route Analysis completed during the detailed design phase.

Within the south-western part of the Study Area, Playfields Road becomes Glengowan Road which provides access to the residential dwelling in Lot 21 RN1345. The residential dwelling on Lot 1933 RAG4058 is accessed via Mount Hopeful Road to the north-east of the Study Area.

Appropriate signage will be installed on relevant roads during the construction period for health and safety reasons.

New fencing alignments, together with grids and gates, will be installed on site. The clearing requirements for this infrastructure will be accounted for in the areas proposed to be cleared as part of the road and access areas and no additional clearing will be required.

2.10 Internal Access Roads

The onsite access track layout will be designed to utilise the existing topography of the land, avoiding steep areas where possible and minimising the amount of land required. It is likely that approximately 175 km of access track will be required for the Project.

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

- The access tracks will be an average of 40 m wide (widths will vary depending on topography and cabling requirements)
- Regular passing places and turning areas
- Minimise watercourse crossings
- Tracks will not be sealed
- Tracks will be constructed from locally sourced aggregate
- Track 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.

Post construction, the areas that were cleared to create batters and corners will be rehabilitated. Roads will be maintained and need to remain passable for oversize over mass (OSOM) loads in the event of a blade replacement during operation. Therefore, trees that could grow to become future obstructions will not be planted where large oversailing blades could be transported in.

2.11 Utilities

A supply of water for firefighting purposes will be maintained on site during construction in accordance with bushfire management guidelines.

The management of sewage will be finalised in the detailed design phase, however it is likely to be managed by a septic system and removed off-site by a certified contractor. Alternatively, an in ground septic system with treated liquid influent through ground bio-irrigation (or equivalent) will be installed to comply with the Building Code of Australia and will be positioned adjacent to the operations and maintenance compound.

2.12 Worker's Accommodation

Worker's accommodation will not be provided for the construction or operation of the Project. Refer to **Section 3.3** for details.

3.0 Preliminary 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.

3.1 Project Delivery Timeframes

The construction period for the Project will be agreed between the EPC contractor and Neoen, and will be subject to change depending on weather conditions, availability of materials and construction speeds. The construction timeframe is estimated to be between 22-28 months. However, a 22 month timeframe has been assumed for the purposes of this report to represent a 'worst case' in terms of potential construction impacts. Subject to Project approvals, construction is anticipated to commence in Quarter 4 of 2022 and conclude in Quarter 3 2024. Commissioning of the Project is scheduled to start in Quarter 4, 2024.

During the construction phase, works will typically occur for six days each week (Monday to Saturday), and up to 12 hours per day (06:30 to 18:30). During certain construction activities, such as foundation pours and turbine lifts, works may be required to run longer than 12 hours for safety and quality purposes. It may also be necessary for construction activities to take place on a Sunday or during the night time. In such instances, appropriate mitigation and management measures will be incorporated into the CEMP. These assumptions will be revisited and modified as necessary during detailed design.

Preliminary details of the proposed construction phase activities have been provided, with a high level summary of the key construction tasks, the likely order of completion and anticipated timeframes provided in **Figure 3.1** below.

Figure 3.1 Proposed Construction Schedule

ID	TASK	DURATION	MONTH																					
			Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
			Q4 2022			Q1 2023			Q2 2023			Q3 2023			Q4 2023			Q1 2024			Q2 2024			Q3
A	Mobilisation	1 M																						
B	Access Roads and Site Entrances	9 M																						
C	Substation and Construction Compound	9 M																						
D	Cabling	8 M																						
E	Turbine Foundations	11 M																						
F	Turbine Transportation	12 M																						
G	Turbine Erection	9 M																						
H	Finalisation / Commissioning / Demobilisation	3 M																						
I	Project Float	1 M																						

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

- detailed site investigations for the purposes of micro-siting the turbines
- obtaining all necessary permits and consents for construction.

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 for access roads and wind turbine hardstands

- excavation for the foundations
- construction of wind turbine foundations (bolt cage, reinforcement and concrete)
- installation of electrical and communications cabling and equipment (including overhead feeders from cable marshalling points to the substation)
- installation of wind turbine transformers, in parallel with electrical reticulation works
- installation of towers for the wind turbines, and delivery of the wind turbine components to the Project site
- erection of wind turbines, using high-level mobile cranes
- commissioning of wind turbines, followed by reliability testing.

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

3.2 Equipment and Machinery

The major equipment and machinery that is likely to be used for each component of construction of the Project includes:

- for site mobilisation: track loader, grader, backhoe, trucks, small crane and generators
- for access roads and hardstands: track loaders, excavators, graders, trucks (with trailer), water carts and rollers
- for wind turbines: excavators, rock breaker, concrete trucks, trucks (with trailer and vacuum), larger crawlers cranes, medium crawler cranes, small crawler cranes and generators
- for electrical reticulation works: trencher, backhoe, excavator, grader, tractor and small terrain crane.

Other equipment and machinery may be required, depending on the construction techniques nominated in the detailed design phase.

It is expected that one of each turbine component type will be delivered in a single day during the haulage operation (i.e. one blade, one tower section, nacelle, cooling tower, and turbine hub). Each individual component will be carried on a single oversize overmass vehicle.

3.3 Construction Workforce

The Project is anticipated to generate multiple employment opportunities. However, it is estimated that the maximum (peak) workforce will compromise up to 300 staff, throughout the 22 month construction period, with ten permanent staff to be employed during operations.

It is expected that some of the workforce will commute from Biloela (approximately 1.5 hour drive), Rockhampton (approximately 2 hour drive) or Gladstone (approximately 2.5 hour drive) and will not require additional accommodation. Other workers will be accommodated in local rental houses, hotels and motels

in the surrounding localities and towns. Therefore, worker's accommodation will not be provided for the construction or operation of the Project.

3.4 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
- stripping
- dust suppression
- concrete batching.

Water demand will vary over time, depending on the stages of the work. The expected water requirement during construction will be calculated during the detailed design of the Project.

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 quality (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. Neoen aims to require no on-site treatment, however this will depend on the quality of water available.

A water sourcing strategy will be developed so that water used during the construction phase does not cause issues to landowners or other stakeholders. Generally, potable water will be obtained from the local government water reticulation network where possible, while the proposed source of raw water (medium and low quality) is likely to be sourced from:

- groundwater (including artesian and sub-artesian)
- surface water (including watercourses, springs and overland flow)
- offsite, and trucked in.

In order to avoid interfering with stream flow in the riparian zone, water for construction and for irrigation of revegetated areas will be obtained from a source other than local waterways.

Construction water supply options will be determined during the detailed design of the Project and confirmed with the Department of Resources (DoR) prior to construction.

4.0 Environmental Impacts and Mitigation Measures

As stated in the State Code 23: Wind farm development Planning guidelines (DSDMIP 2017), the construction of a wind farm can have an adverse impact on environmental values (defined as per the *Environmental Protection Act 1994)*, water quality objectives (defined as per the Environmental Protection

(Water and Wetland Biodiversity) Policy 2019), local amenity, traffic and road infrastructure if not managed and carried out appropriately.

The potential impacts involved with construction of the Project are outlined for each environmental aspect in the following sections. The primary objective for management of each aspect is included, along with broad mitigation measures for the design, construction, and operation phases of the Project to minimise potential adverse impacts.

Where 'nil' is recorded in the tables below, this is due either to there being no relevant mitigation measures for that stage of the Project, or because the risk of impacts in that stage are so low that mitigation is not considered necessary.

4.1 Air Quality

Table 4.1 Air Quality Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Exhaust emissions from site equipment and vehicles	Minimise exhaust emissions	**Prevention**	Consider choosing vehicles and equipment with low emissions.	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, so nil measures are considered necessary.
Fugitive dust emissions from site activities (e.g. construction of access tracks and hardstand areas) causing dust nuisance or human health impacts	Minimise fugitive dust emissions to reduce dust nuisance and human health impacts	**Prevention**	Develop a formal CEMP with consideration of sensitive receptors (including surrounding landowners), and formulation of appropriate mitigation and control measures. Identify a responsible person for dust management.	Plan construction by locating dust generating activities away from sensitive receptors where possible. Access tracks are to be dampened on a regular basis with water, especially during prolonged dry periods. Install washing facilities to prevent mud from construction operations being transported onto adjacent public roads. Regular cleaning of Project Site entrances. Ensure that dusty materials are stored and handled appropriately by: wind shielding or complete enclosure, storage away from site boundaries, restricting drop heights of materials, using water sprays where practicable. Ensuring that dusty materials are transported appropriately (e.g. sheeting	Fugitive dust emissions generated from a wind farm during operation is minimal, so nil measures are considered necessary.

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
				of vehicles carrying spoil and other dusty materials). Minimise dust generating activities on windy and dry days. Restrict vehicle access and/or vehicle speed on haul roads and other unsurfaced areas of the Project Site. No fires on the Project Site.	
		Contingency Measures	Nil	If dust is generated, ensure that a water truck is used to dampen down all access tracks and public access roads.	
		Monitoring	Nil	If dust presents a problem, conduct regular air quality monitoring around the site to ensure that it is in accordance with relevant standards. Include appropriate dust monitoring within site management practices, to inform site management of the success of dust control measures used.	

4.2 Aviation

Table 4.2 Aviation Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Increased risk of collisions by aircraft with wind turbines or meteorological masts	No increase to risk profile for aviation	**Prevention**	Consultation with appropriate authorities, including CASA, Airservices Australia, RAAF, AAAA, GFA and Hang Gliding Federation of Australia regarding the Project.	Notify Airservices Australia, CASA and RAAF when construction commences. 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 if they penetrate navigable airspace in accordance with International Civil Aviation Organisation requirements.	Operate obstacle lighting in accordance with International Civil Aviation Organisation requirements if required.	

4.3 Cultural Heritage

Table 4.3 Cultural Heritage Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Disturbance of sites or items of cultural heritage	Minimal impact to cultural heritage values	**Prevention**	Establish a dialogue with the Traditional Owners. Develop a Cultural Heritage Management Agreement/Plan which includes construction and operational phases.	Undertake construction and operation in accordance with the Cultural Heritage Management Agreement/Plan.	
		Contingency Measures	Nil	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. Cultural Heritage Management Agreement/Plan to potentially include recommendations for Traditional Owners on site during construction activities.	Investigate any heritage related complaints and address accordingly. Implement a complaint recording, investigation and reporting system.
		Monitoring	Nil	Visual inspection of items of cultural heritage value in the event of a complaint.	Nil

4.4 Electromagnetic Interference

Table 4.4 Electromagnetic Interference Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Disruption to Radio frequency identification (RFID) in proximity to the wind farm	No electromagnetic interference (EMI) impacts or disruption	**Contingency Measures**	Nil	Establish a feedback process whereby stakeholders can raise concerns about EMI impacts with the wind farm operator. Investigate these complaints appropriately. Implement a complaint recording, investigation and reporting system.	
Disruption to Citizen band (CB) radio and mobile phone signals	Minimal and temporary disruption to signals	**Prevention**	Educate landowners and stakeholders about potential interference to CB radio and mobile phone signals.	Nil	Nil
		Contingency Measures	Nil	Encourage CB radio and mobile phone users to move a short distance when experiencing signal interference.	
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.	Nil	Educate residents experiencing interference issues on how to tune household antennas to alternative sources.
		Contingency Measures	Nil	Establish a feedback process whereby stakeholders can raise concerns about EMI impacts with the wind farm operator. Investigate complaints accordingly and where mitigation measures are necessary, consider undertaking one or more of the following:	

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
				• Tune the householder's antenna into alternative sources of the same or suitable TV signal. • Install a more directional and/or higher gain antenna at the affected dwelling. • Relocate the antenna to a less-affected position. • Install satellite TV at the affected dwelling. • Where all else fails, install a TV relay station.	

4.5 Fauna

Table 4.5 Fauna Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Mortality of native fauna	No significant impact on native fauna populations directly attributable to the Project	**Prevention**	Avoid the removal of large hollow-bearing trees or dead trees wherever possible.	Speed limits will be clearly signed on roads during construction. Known fauna crossing points will be highlighted with signage. Removal and translocation of hollows containing wildlife from habitat trees shall be conducted using a cherry picker, arborist and spotter/catcher. All nests and dreys shall be safely removed from trees prior to any trees being felled. All site personnel shall be made aware of sensitive fauna/habitat areas and the requirements for the protection of these areas. Fauna exclusion devices shall be implemented where practical to discourage fauna from entering the construction site. In accordance with statutory obligations/policies, construction activities will be monitored in accordance with a standardised Flora and Fauna Monitoring Program. Avoid disturbing, removing or breaking up fallen timber (especially larger logs) wherever possible. Wherever it is unavoidable to disturb fallen timber, relocate them adjacent to the turbine footprint or road.	Maintain fauna exclusion systems and structures designed for safe fauna passage, to enable these systems to function effectively.

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Mortality of native fauna	No significant impact on native fauna populations directly attributable to the Project	**Contingency Measures**	Nil	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.	
Mortality of native fauna	No significant impact on native fauna populations directly attributable to the Project	**Monitoring**	Prepare a Flora and Fauna Monitoring Program 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.	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 Records of all mortalities should be kept to ensure that mortality rates are kept to an acceptable level.	
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**	Develop a pre-construction and post-construction monitoring plan for bats and birds. Any turbine lighting is to be minimised, and red lights used to prevent the attraction of insects.	Where possible, construction and clearing of vegetation should be staged to allow for continued wildlife movement outside the immediate danger of the construction site.	Nil
		Contingency Measures	Nil	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.	Nil

4.6 Flora

Table 4.6 Flora Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Direct loss of 'Of Concern' Regional Ecosystem (RE)	Compliance with the EPBC Act, NC Act, VM Act, and EP Act	**Prevention**	Minimise disturbance to areas of 'Of Concern' and 'Endangered' RE unless there is no suitable alternative. Detailed design of the Project to promote the retention of remnant vegetation. Co-locate infrastructure where possible to reduce area of vegetation clearing required.	Minimise construction activities within remnant vegetation. Impose strict no-go zones for construction workers and machinery within remnant vegetation.	Nil
		Contingency Measures	Research viability of compensatory planting. Develop a management and rehabilitation plan.	All vegetation to be removed is clearly marked and clearing contractors briefed on clearing requirements. Educate all contractors on the importance of the vegetation and ensure there is no encroachment on surrounding vegetation. Implement the management and rehabilitation plan.	Nil
		Monitoring	Nil	Daily visual inspection of vegetation clearing boundaries.	Nil
Direct loss of regrowth vegetation	Compliance with the EPBC Act, NC	**Prevention**	Avoid all regrowth vegetation unless there is no suitable alternative.	Minimise construction activities within regrowth vegetation.	Nil

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
	Act, VM Act, and EP Act. Maintain the current extent of regrowth vegetation.		Detailed design of the Project to promote the retention of remnant vegetation. Co-locate infrastructure where possible to reduce area of vegetation clearing required.	Impose strict no-go zones for construction workers and machinery within regrowth vegetation.	
		Contingency Measures	Develop a management and rehabilitation plan.	All vegetation to be removed is clearly marked and clearing contractors briefed on clearing requirements. Educate all contractors on the importance of the vegetation and ensure there is no encroachment on surrounding vegetation. Implement the management and rehabilitation plan.	Nil
		Monitoring	Nil	Regular visual inspection of vegetation clearing boundaries.	Nil
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, NC Act, VM Act, and EP Act. No new infestations of weeds or pests attributable to the Project.	**Prevention**	Avoid further fragmentation of existing small patches (< 5 ha). Maintain, as far as practicable, existing surface drainage paths. Develop and implement a Weed and Pest Management Plan that includes specific controls for environmental and noxious weeds.	Minimise construction activities within remnant vegetation. Detailed weed management methods will be confirmed at a later stage in conjunction with the EPC contractor. Implement the Weed and Pest Management Plan. Imported topsoils/mulches to be weed-free prior to material arriving onsite.	Implement the Weed and Pest Management Plan.

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
		Monitoring	Nil	Visual inspections in accordance with the requirements set out in the Weed and Pest 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).	Nil	Nil

4.7 Hazard and Risk

Table 4.7 Hazard and Risk Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Increase in prevalence and severity of bushfires	No increase in bushfire risk in the Study Area	**Prevention**	Prepare a Bushfire Management Plan in consultation with Queensland Fire and Emergency Services (QFES). Develop a fuel management strategy, including planned fuel reduction burns. Avoid higher risk areas when siting buildings or other infrastructure. Keep electricity services underground where possible (e.g. between turbines). Select equipment and machinery (including the turbines) with high safety standards. Develop emergency provisions for neighbouring property owners. Design roads to carry fully loaded fire fighting vehicles.	Maintain fire breaks around construction site. Visual inspection of construction areas for presence of dry fuel. Incorporate Bushfire Management Plan into the CEMP. Ensure buildings meet specifications and requirements of AS3959. Install lightning protection devices in wind turbines. Observe fire warnings and notices. Maintain fire extinguishers at site offices and in construction vehicles.	Observe fire warnings and notices. Maintain vegetation levels to remove any potential high-risk forest fuels.

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
			The detailed Project design will be in accordance with relevant industry standards, including requirements for emergency vehicle access.		
		Contingency Measures	Provide suitable ingress and egress to the Project Site and escape routes. Prepare an Emergency Response Plan which covers construction and operation.	Ensure appropriate water supply is available on site. Implement the Emergency Response Plan. Investigate the cause of any fire, and update facilities or procedures to prevent further incidents. Monitor Fire Danger Index (FDI) daily. Regularly maintain and service equipment and turbines.	
		Monitoring	Nil	Regular inspections of fire break areas.	
Potential creation of artificial breeding sites for mosquitos	Compliance with the *Public Health Act 2005*	**Prevention**	Provide a mosquito management component in the Weed and Pest Management plan.	A Pest Management Technician, licensed under the *Pest Management Act 2001*, will be engaged when pest control activities are required to be undertaken.	
		Contingency Measures	Nil	Maintenance activities as set out in the Weed and Pest Management Plan	
		Monitoring	Nil	Visual inspections in accordance with the requirements set out in the Weed and Pest Management Plan	

4.8 Land Use

Table 4.8 Land Use Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
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 prevent disrupting current agricultural practices. Minimise development in areas classified as Class A and B under the Agricultural Land Class (ALC) scheme.	Develop and implement a CEMP, outlining how 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.		Nil
			Nil	Investigate the cause of complaints relating to disrupted agricultural activities, and address the issue appropriately. Implement a complaint recording, investigation and reporting system for construction and operation.	

4.9 Landscape and Visual

Table 4.9 Landscape and Visual Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Reduced visual amenity of the Study Area and surrounds for residents and visitors	Nil complaints relating to reduced visual amenity	**Prevention**	Minimise vegetation removal, where possible. Design facilities to minimise visual impact on surrounds, such as turbines with white or off-white colouring and semi-matte finishes to minimise reflections. Use the natural line of the existing landscape wherever practicable to reduce visibility and assist integration of the wind farm infrastructure.	Manage construction lighting used for night-works to minimise visual effects on sensitive receptors. Use of spoil from excavation sites for incorporation into bunding for buffer planting zones. Limit works compounds and restrict to areas of lower visual sensitivity and/or lesser visibility where possible to avoid unnecessary visual impact.	Maintain access roads in a tidy manner.
		Contingency Measures	Nil	Construct overhead electrical infrastructure below the ridgeline, where possible. Consider native plantings to assist in visual screening, where necessary. Ensure any screening consists of mixed plants of local provenance including some fast-growing species, as appropriate to the landscape character. Implement the CEMP to control landscape and visual effects.	Nil

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
				Site waste management plan will be enacted to ensure waste is minimised and reduces impacts to landscape character.	
		Monitoring	Nil	Regular visual inspection of construction areas for new infestations of weeds. Regular inspections of weed treatment areas to determine efficacy of measures.	Regular visual inspections of rehabilitation areas for weed invasion for 12 months, or until established. Inspection of the Project Site during scheduled maintenance for weed infestation. Prepare a post-decommissioning rehabilitation plan to reinstate the Project Site to determined rehabilitation outcomes.

4.10 Noise and Vibration

Table 4.10 Noise and Vibration Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Impacts on sensitive receptors such as residential dwellings	Compliance with Queensland Wind Farm State Code and Planning Guideline	**Prevention**	Ensure that any wind turbine layout within the Project Site is compliant with the applicable noise criteria. Use of low-noise plant and equipment. Preparation of a CEMP.	Determine schedule for construction activities. Consult with stakeholders about scheduling of construction activities. Limit construction hours to Monday to Saturday where practicable. Construction work on Sunday will be specifically addressed in the CEMP. Maintain construction equipment in good working order. Use low-impact construction methods, where practicable.	Nil
		Contingency Measures	Nil	Maintain a noise and vibration complaints procedure and register. Investigate any construction or operational noise complaints appropriately.	
		Monitoring	Nil	Noise monitoring in accordance with the CEMP.	Undertake compliance noise measurements at sensitive receivers located in proximity to the Project to ensure compliance with the Queensland Wind Farm State Code and supporting Planning Guidelines.

4.11 Shadow Flicker

Table 4.11 Shadow Flicker Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Nuisance caused by shadow flicker experienced at sensitive receptors	No exceedance of guideline limits for shadow flicker at non-participating sensitive receptors	**Prevention**	Detailed design to be informed by shadow flicker modelling if turbine layout is altered. If modelling demonstrates shadow flicker occurrence, arrange a site visit to modelled affected dwellings to investigate and 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.	Nil	If determined to be necessary, implement control strategies to shut down certain turbines when shadow flicker is likely to occur at particular dwellings.
		Contingency Measures	Nil	Nil	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 to block shadows cast by turbines during operation, where required.

4.12 Socio-economic

Table 4.12 Socio-economic Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Noise exceedances at sensitive receptors surrounding the wind farm	Compliance with all applicable noise criteria	**Prevention**	Final turbine layout within the Project Site will ensure compliance with operational noise criteria. Application of operational noise criteria and setbacks from sensitive receptors.	Nil	Nil
		Monitoring	Nil	Nil	Undertake compliance noise measurements at sensitive receivers located in proximity to the Project to ensure compliance with the Queensland Wind Farm State Code and supporting Planning Guideline.
Missed opportunities in relation to local employment and use of local contractors	Maximise local employment and contractor opportunities	**Prevention**	Develop a workforce management arrangement and a Local Procurement Plan. Develop a Stakeholder Consultation and Engagement Plan.	Implement workforce management arrangement and Local Procurement Plan. 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 operational phase wherever feasible and economic. Implement and revise where necessary the Stakeholder Consultation and Engagement Plan.

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
				Maximise local employment during construction phase wherever feasible and economic.	
Reduced safety within the area.	No reduction in safety indicators within the Project Site.	**Prevention**	Ensure that the final turbine layout minimises bushfire risk.	Implement the Bushfire Management Plan to control bushfire risk appropriately.	
Nuisance impacts associated with operation.	No nuisance impacts.	**Contingency Measures**	Ensure that the final turbine layout is compliant with noise guidelines, shadow flicker guidelines and minimises EMI impacts.	Undertake activities in accordance with the CEMP to control nuisance impacts appropriately. Implement a complaint recording, investigation and reporting system for construction and operation. Investigate the source of complaints and address the issue appropriately.	
		Monitoring	Nil	Undertake compliance noise measurements at sensitive receivers located in proximity to the Project to ensure compliance with the Queensland Wind Farm State Code and supporting Planning Guideline.	

4.13 Surface Water, Riparian Areas and Groundwater

Table 4.13 Water Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Sediment from disturbed areas may enter nearby waterways and reduce water quality	Compliance with current State and Commonwealth legislation and standards. No visible evidence of sediment leaving construction sites. No visible increase in turbidity attributable to construction or operation of the wind farm.	**Prevention**	Develop an Erosion and Sediment Control Plan in accordance with Engineers Australia's Soil Erosion and Sediment Guidelines for Queensland Construction Sites.	Operate in accordance with the Erosion and Sediment Control Plan.	Maintain vegetation along easements to prevent soil erosion.
		Contingency Measures	Nil	Implement erosion and sediment control measures if areas are causing high sediment loads or turbidity in nearby waterways. Maintain, repair or reinstate damaged erosion and sediment control infrastructure. Investigate cause of increased turbidity or released sediment and address accordingly.	
		Monitoring	Nil	Regular visual inspections of sediment control infrastructure, discharge water sources, and receiving water bodies. Visual inspections of discharge water and receiving water bodies after rainfall. Turbidity monitoring in the event of turbid plumes.	
Physical damage or alteration to riparian areas	No net degradation of riparian areas	**Prevention**	Locate structures outside riparian areas where practicable. Design activities to minimise scour and erosion of riparian areas. Develop CEMP to clarify guidelines on activities	Minimise vegetation removal and construction activities within waterways. Operate in accordance with the CEMP.	Nil

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
			around riparian areas in the Project construction zone.		
		Contingency Measures	Nil	If unforeseen impacts on riparian areas occur during construction or operation, appropriately address the impacts using best available technical information.	
		Monitoring	Nil	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.	Nil
Interference with stream flow in the riparian zone	No interference with stream flow	**Prevention**	Locate structures outside riparian areas where practicable. Develop CEMP to clarify guidelines on activities around riparian areas in the Project construction zone. Assess construction water supply requirements as part of design. Use the Department of Agriculture and Fisheries self-assessable codes for low-impact development activities to design waterway barrier developments.	Obtain construction water from sources other than local waterways.	Obtain water for irrigation of revegetated areas from a source other than local waterways.

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
		Contingency Measures	Nil	Cease abstraction of water from local waterways if necessary. Acquire construction water from an alternative source.	
		Monitoring	Develop a monitoring program for streamflow including location and frequency of monitoring.	Regularly gauge streamflow at pre-determined points. Should streamflow reduce in the immediate vicinity of the Project, investigate if Project activities are the cause.	
Introduction of weeds and pests in the riparian zone	No introduction of weeds or pests into riparian areas	**Prevention**	Locate structures outside riparian areas where practicable.	Develop and implement a Weed and Pest Management Plan, detailing procedures for cleaning and checking construction vehicles entering the construction site. Minimise vegetation removal and construction activities within waterways.	Maintain vegetation within the Project Site to prevent the establishment of weed species.
		Contingency Measures	Nil	Manually remove weed species in riparian areas within and adjacent to wind farm infrastructure. Remove overabundant or notifiable pest species in accordance with advice from the Department of Agriculture and Fisheries.	
		Monitoring	Nil	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 Site during maintenance activities for weed infestation.
Degradation of groundwater resource	No significant variation to local groundwater levels due to construction. No contamination of local	**Prevention**	Determine water requirements for construction and identify suitable water sources. Identify surface water bodies sensitive to	All chemicals, fuel and oil will be stored in above ground tanks in bunded areas, with accurate records maintained of volumes purchased and stored, to ensure any contamination of land or water is prevented, and any spill is detected quickly. Contain poor quality discharge water and treat prior to disposal, subject to achieving water quality guidelines.	

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
	groundwater system.		groundwater movement (i.e. dams).		
		Contingency Measures	Nil	In the event of a spillage/leak of potentially hazardous substances: • Comply with the Emergency Spill Containment Plan. • Investigate the nature and extent of the spillage/leakage, and implement clean-up and mitigation measures, as necessary.	
		Monitoring	Develop a monitoring program for groundwater levels and quality, including location and frequency of monitoring.	Regularly monitor groundwater levels in nearby privately owned and registered bore holes (with permission). Regularly conduct groundwater quality sampling, using the existing registered bore hole network, and also following a major spillage/leakage event. If a decrease in groundwater quality is observed in the immediate vicinity as a result of the Project's activities, monitor down-gradient groundwater quality.	

4.14 Topography, Geology and Soils

Table 4.14 Soil Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
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 a Project specific Erosion and Sediment Control Plan. Determine the erosion potential of soils in planned construction areas.	Operate in accordance with the Erosion and Sediment Control Plan, including installing erosion controls to stabilise the site. Keep land clearance to a minimum. Avoid, where possible, clearing areas with a high erosion potential. If more than one contractor is working on a site, coordinate work schedules so that there are minimal delays in construction activities resulting in disturbed land remaining destabilised. Schedule construction activities so that the area of exposed soil is minimised during times of the year when the erosion potential is increased (e.g. during summer when intense rainstorms are common). Keep vehicles to well-defined access roads. Avoid locating access roads on sloping terrain, wherever practical.	Operate in accordance with the Erosion and Sediment Control Plan.
		Contingency Measures	Nil	Identify and investigate the site of erosion and address in accordance with the 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	

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
				the Project, reducing the potential of mass movement of sediment. A land rehabilitation program will be established progressively, to reinstate a suitable soil profile.	
		Monitoring	Nil	Document erosion and sediment control measures undertaken. Regular visual inspection and check sheets maintained. In-situ turbidity monitoring of local receiving surface waters, in accordance with the requirements of the Erosion and Sediment Control Plan.	
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. Determine geological profile of slopes, with slope stability reports issued prior to undertaking earthworks. Incorporate rock bolting, retaining walls and stable cuts with associated catch drains if required to maintain slope stability.	Construction activities undertaken in accordance with relevant work method statements.	Visual inspection of susceptible areas following heavy rainfall or landslip inducing event.
		Contingency Measures	Nil	Identify and investigate the site of mass wasting and provide suitable remediation	
		Monitoring	Nil	Document mass wasting and landslip control measures undertaken.	

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
				Regular visual inspection and check sheets maintained.	
Generation of Acidic Material	No generation of acidic waste water or other acidic material	**Prevention**	Conduct a geotechnical investigation which includes inspection of intrusive igneous rock bodies for disseminated sulphides	Any exposed acid producing material will be neutralized and contained according to the *Queensland Acid Sulfate Soil Technical Manual, Soil Management Guidelines.*	Nil
		Contingency Measures	Nil	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.*	Nil
		Monitoring	Nil	pH monitoring of surface run-off 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 run-off from construction sites, at times and in locations where generation of acidic runoff is likely. Submit samples of suspected acidic material to a NATA accredited laboratory for characterisation.	Nil
Land contamination by on-site construction activities or by	No contamination of land	**Prevention**	Determine whether any Notifiable Activities will	Record the nature, quantity and location of all hazardous materials on-site in a manifest.	Apply good practice in the storage and handling of dangerous and

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
export of contaminated material from site or importation of contaminated material			be undertaken as part of the Project. Search the Project properties for listing on the Contaminated Land Register or Environmental Management Register. Develop an Emergency Spill Containment Plan. Design 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 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 offsite will 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 the disposal of such material.	hazardous goods and appropriate responses to manage impacts from potential spills.
		Contingency Measures	Nil	If potentially contaminated soils are encountered, investigation by a qualified contaminated land specialist should be undertaken. Visual and olfactory observation of all in-situ material excavated during construction.	
		Monitoring	Nil	Submission of samples of suspected contaminated material to a NATA accredited laboratory for characterisation.	

4.15 Traffic

Table 4.15 Traffic Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Traffic delays on State-controlled roads (SCRs) and local roads	Manage increased traffic volumes appropriately	**Prevention**	Preparation of a Road Use Management Plan or Traffic Management Plan in consultation with the Department of Transport and Main Roads (TMR) and local councils. Investigate opportunities to use alternative routes for deliveries avoiding school bus routes and populated areas.	Implementation of the Road Use Management Plan or Traffic Management Plan for construction and 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 TMR and local councils. Access points will be located with adequate sight lines and advance warning signs provided.	Nil
Disruptions to stock movement along stock routes	No disruptions to stock movement along mapped stock routes	**Prevention**	Investigate detailed design solutions to minimise impact on existing roads and mapped stock routes.	Ensure all mapped stock routes remain open during construction phase. Any works or improvements to the road infrastructure must consider potential stock movement.	Ensure all mapped stock routes remain open throughout the operational period where possible.

4.16 Waste Management

Table 4.16 Waste Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Excessive waste generation, causing over-demand on local landfills or requirement for transport to larger landfills, and loss of resources	Minimise waste generation	**Prevention**	Detailed design for infrastructure to carefully specify material needs to avoid over-estimating requirements. Develop a site waste management plan.	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. Implement site waste management plan.	
		Contingency Measures	Nil	Where waste cannot be avoided, waste materials will be segregated by type for collection and removal (for processing or disposal) by licensed contractors.	

5.0 Conclusion

This preliminary CMP was developed for the Project to address the requirements of PO13 of State Code 23: Wind farm development and associated Planning guideline (DSDMIP 2017). This document outlined the potential impacts that may occur as a result of the construction of the wind farm and how these impacts are planned to be mitigated and monitored.

As the Project continues through its design and development stages and details are finalised, construction management requirements will be reviewed and a Construction Environment Management Plan (CEMP) will be prepared by a suitably qualified person prior to the commencement of any construction activities.

The CEMP will consider the measures put forward in this preliminary CMP, and any conditions of approval applied to the Project. The CEMP will include details of the construction programme, construction techniques to be employed, location of sensitive receptors, specific environmental mitigation measures to control construction impacts, description of the methods to be used to monitor performance and receive, record and respond to complaints, and contact details for queries and reporting incidents.

6.0 References

Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) 2019, *State Development Assessment Provisions v2.6 – State code 23: Wind Farm development*, https://dsdmipprd.blob.core.windows.net/general/sdap-2-6-state-code-23.pdf

Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) 2017, *State code 23: Wind Farm development - Planning Guidelines*, https://dsdmipprd.blob.core.windows.net/general/Statecode23Windfarmdevelopment-PlanningguidelineJuly2017.pdf

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