Chalumbin Wind Farm Project

Preliminary Rehabilitation Plan

Prepared for:
Chalumbin Wind Farm Pty Ltd

13 October 2022

Document Information

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1.0 Introduction

This Chalumbin Wind Farm Project (Project) Preliminary Rehabilitation Plan (Plan) has been prepared to support (a) the Public Environmental Report (PER) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and (b) the Project development application material under the *Planning Act 2016* (Planning Act) and should be read in conjunction with these documents. A description of the proposed construction activities is provided within section 2.3 of the PER.

The Project has made an industry-leading commitment to rehabilitate temporary construction disturbances and retain only the minimum footprint required for safe operations. A key focus of the rehabilitation program will be to rehabilitate habitat for those Matters of National Environmental Significance (MNES)[1] assessed as having a significant residual impact including koala, magnificent brood frog, masked owl, northern greater glider and spectacled flying-fox (**Table 1-1**), with a goal to rehabilitate 70 % of all other areas.

The Project has made a commitment to rehabilitate these areas above and beyond the requirement of direct and indirect offset requirements, taking into account the sensitive project setting adjacent to the Wet Tropics of Queensland World Heritage Area (WTQWHA).

Table 1-1 Rehabilitation of MNES Habitat

	Stage 1			Stage 2		
MNES	**SRI (ha)**	**Proposed Rehabilitation Area (ha)**	**Proportion of SRI Proposed to be Rehabilitated**	**SRI (ha)**	**Proposed Rehabilitation Area (ha)**	**Proportion of SRI Proposed to be Rehabilitated**
Koala	413.6	361.1	87.3%	430.2	389.6	90.6%
Magnificent brood frog	67.9	63	92.8%	52.6	51.7	98.3%
Masked owl	576.1	513.6	89.2%	450.2	409	90.8%
Northern greater glider	520.4	463.8	89.1%	367.6	335.6	91.3%
Spectacled flying fox	553.3	493.2	89.1%	422.8	384.4	90.9%

[1] These MNES are also Matters of State Environmental Significance (MSES).

ARK ENERGY

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Chalumbin Wind Farm

Project Layout

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Figure 1.1

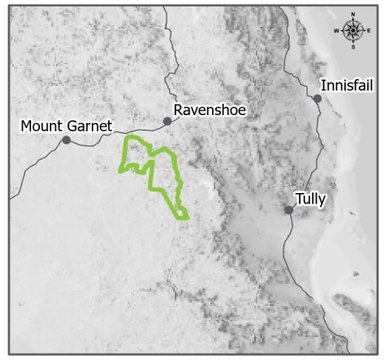
- Project Area Boundary
- Turbine
- Met-mast
- Access Road
- Facilities

Clearance Envelope

- Stage 1
- Stage 2
- Existing HV Transmission Line
- Watercourse
- WTQ Boundary
- WHA Buffer - 500m
- Lot Boundary
- Easement

Date: 13/10/2022 Author: TOD

Project: EPU-004 Reviewed: NOD



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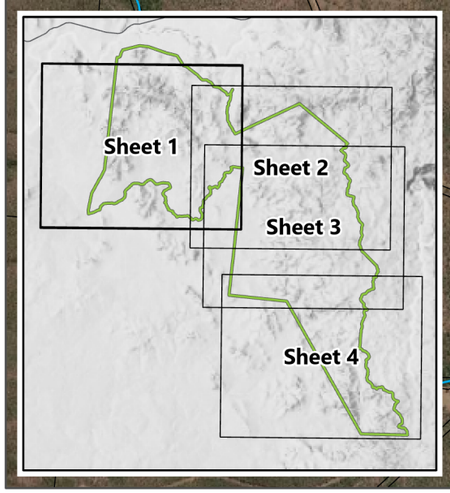

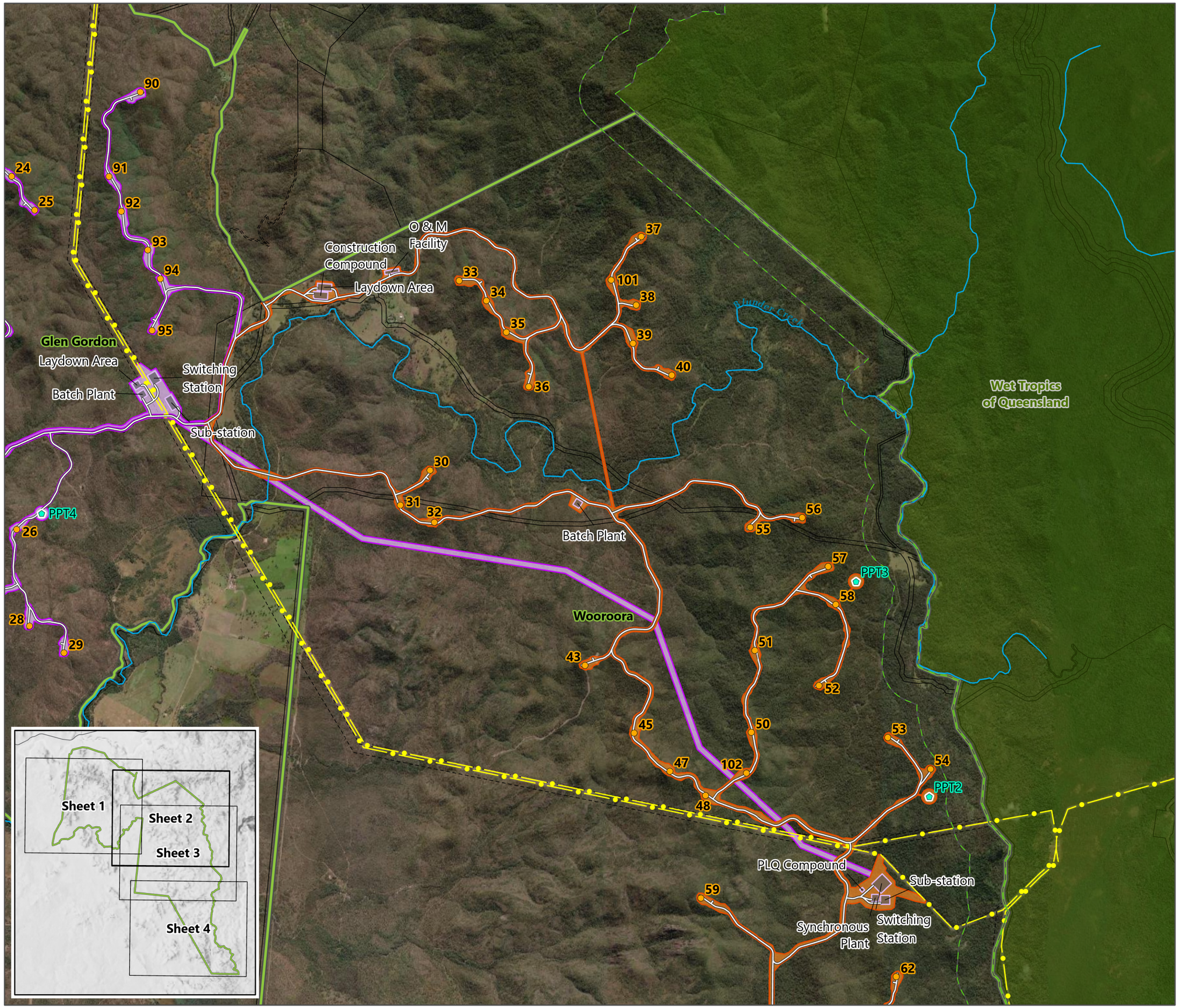

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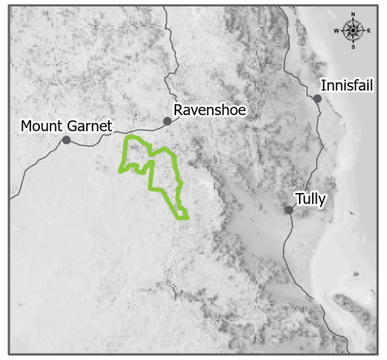

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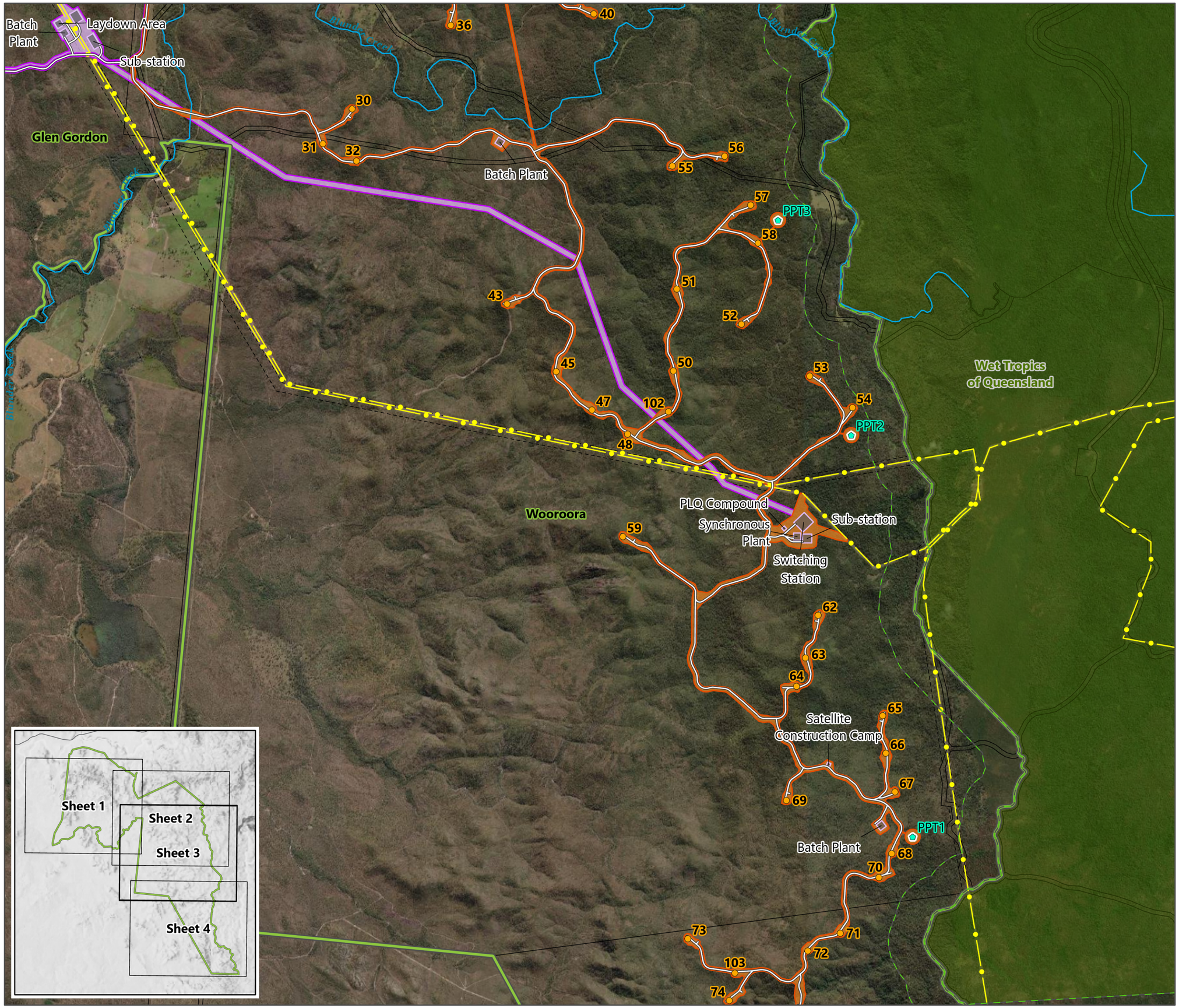

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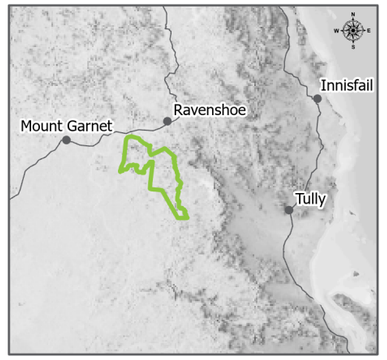

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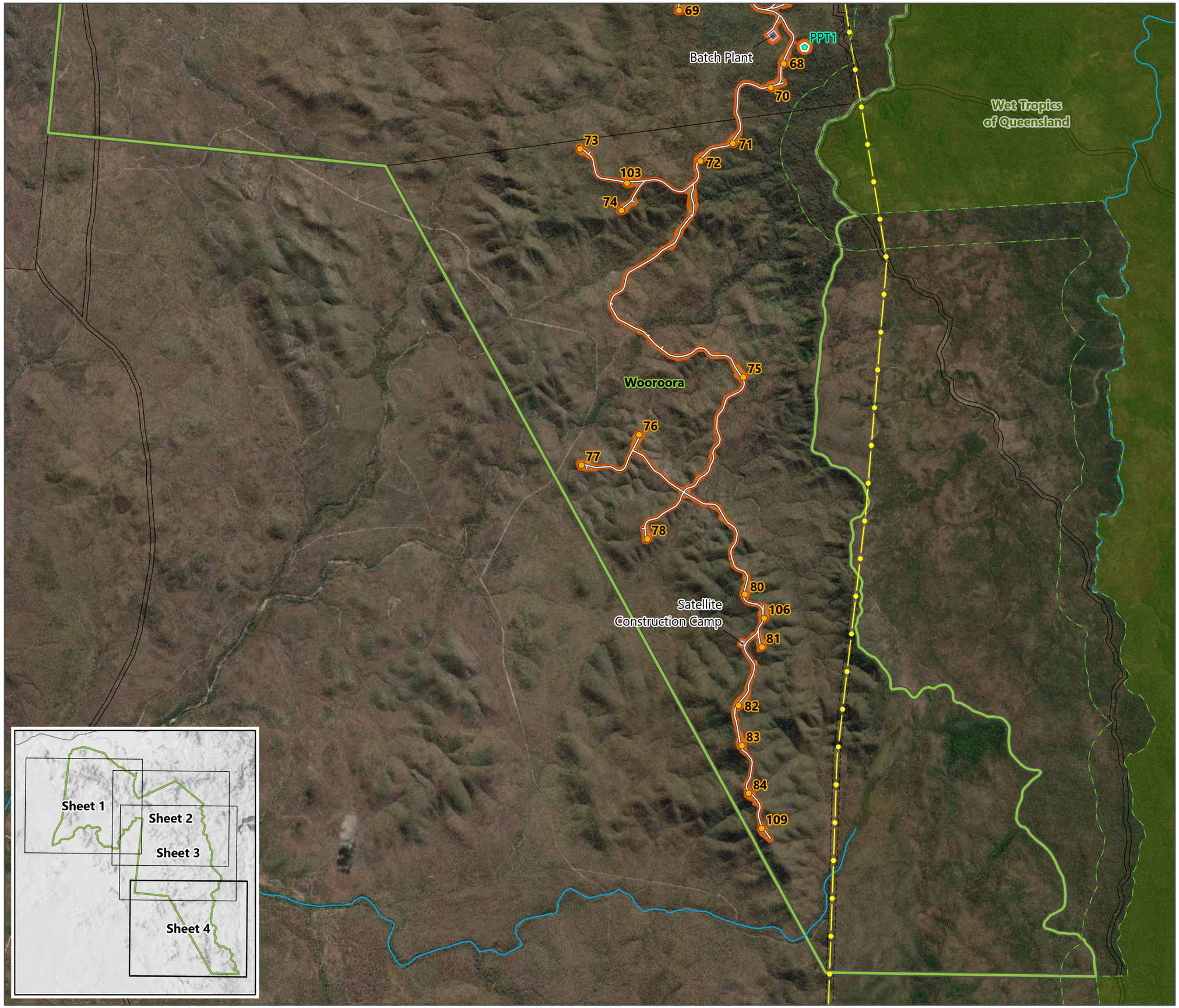

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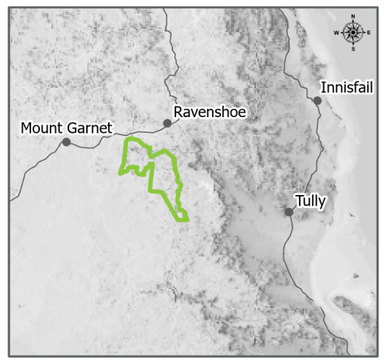

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This Plan addresses Section 8 of the *Guidelines for the Content of a Draft Public Environmental Report: Chalumbin Wind Farm, near Ravenshoe, Queensland (reference: 2021/8983)* (PER Guidelines), issued by the Department of Agriculture, Water and the Environment (DAWE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), which relates to the rehabilitation requirements for the Project.

Section 8 of the PER Guidelines requires:

> *Rehabilitation acceptance criteria, including for the restoration of habitat for relevant listed threatened species and communities.*
>
> *A summary of the procedures, including contingency measures, that will be undertaken to achieve the rehabilitation acceptance criteria.*
>
> *A summary of a monitoring program to determine the success of rehabilitation activities implemented by the proponent.*
>
> *The details of any rehabilitation activities proposed to be undertaken as required by Commonwealth, State or Territory, and local government legislation. Attach relevant Commonwealth, State or Territory, and local government approvals and permits as supporting documents to the PER.*
>
> *Maps showing the areas that will be rehabilitated within the Project area and the size in hectares of these areas.*
>
> *A summary of the vegetation community that is being rehabilitated and the dominant species that will be included in the rehabilitation site.*
>
> *Information on management of the rehabilitation site including, but not limited to weed and pest management.*

This Plan also responds to Performance Outcome (PO) 5 of *State Code 23 – Wind Farm Development* (State Code 23) which requires that:

> *Development is designed, sited and operated to ensure that flora, fauna and associated ecological processes are protected from adverse impacts.*

This Plan is not intended as a detailed Rehabilitation Plan for implementation purposes, nor as a stand-alone report, and therefore does not:

- describe the Project (a comprehensive Project description is provided within Section 2.0 of the PER, and within Section 3.0 of the Planning Report);
- describe the proposed Project construction works (a description of the proposed construction activities is provided within Section 2.3 of the PER, and within Section 3.4.1 of the Planning Report);
- provide a detailed description of environmental values and assessment of impacts associated with MNES (this analysis is provided within Sections 4.0 and 5.0 of the PER respectively) or MSES (this is provided in the Project's Ecological Assessment Report (EAR), Appendix M of the Planning Report);
- identify mitigation and management measures not related to rehabilitation (the proposed safeguards and mitigation measures are provided within Section 6.0 of the PER and within Appendix M of the Planning Report).

1.1 Purpose and Scope

The purpose of this Preliminary Rehabilitation Plan is to facilitate the re-establishment of native ecosystems that are self-sustaining in the long-term and provide comparable habitat value to the pre-construction ecosystems. As the majority of the Project area currently supports remnant vegetation, this means the intention is for rehabilitated vegetation communities to have reached remnant status by the end of the operational lifetime of the proposed wind

farm (approximately 30 years), as determined by comparing the rehabilitated vegetation communities with published benchmarks for the relevant regional ecosystems.

This Preliminary Rehabilitation Plan provides a framework that outlines how rehabilitation will be managed broadly across the site. It is intended that the Rehabilitation Plan will be developed further during the post approvals stage and that it remains a dynamic document that functions as an adaptive management tool.

Any monitoring, training, data interpretation, reporting and the design of management measures associated with this Preliminary Rehabilitation Plan will be undertaken by a suitably qualified ecologist.

1.2 Roles and Responsibilities

All personnel are responsible for the environmental performance of their activities and for complying with their General Environmental Duty as outlined in the *Environmental Protection Act 1994* (EP Act). General roles and responsibilities relating to the management of rehabilitation activities are described in **Table 1-2**.

Table 1-2 Roles and Responsibilities for Rehabilitation Activities

Role	Responsibilities
Project Owner	▪ Development of this Preliminary Rehabilitation Plan and communication of the plan (and its commitments) to the Construction Contractor and relevant subcontractors. ▪ Communicating the contents of the Preliminary Rehabilitation Plan to, and addressing appropriate feedback received from, key stakeholders including Government agencies, landowners, Traditional Owners, natural resource management groups and others that may be identified throughout ongoing consultation processes. ▪ Auditing the performance of the Construction Contractor and rehabilitation subcontractors throughout all stages of rehabilitation works.
Construction Contractor	▪ Develop and maintain Construction Environmental Management Plans (CEMPs), Erosion and Sediment Control Plans (ESCPs) and other plans as required to guide Project construction environmental management. ▪ Develop and implement an environmental assurance program, maintain associated records, and initiate improvement actions as required. ▪ Establish, monitor and maintain effective environmental controls onsite. ▪ Allocate sufficient resources for environmental management. ▪ Respond to, report and investigate environmental incidents as appropriate and identify corrective actions to prevent reoccurrence. ▪ Ensure that reportable environmental incidents are communicated with the Project Owner and the relevant regulatory authority if required. ▪ Ensure that sufficient training is provided to construction personnel to achieve awareness of environmental management requirements. ▪ Procurement, management and supervision of specialist rehabilitation subcontractors. ▪ Develop and implement site rehabilitation plans.

1.3 Training, Awareness and Competencies

Environmental training is a requirement to work and will comprise the following:

- Project induction – this will be mandatory for all Construction Contractor and subcontractor personnel before they are permitted to commence work on site.
- Toolbox talks – these will be tailored to the site and job description to allow personnel to complete assigned tasks specified in this Preliminary Rehabilitation Plan.
- Task-orientated training – this is given on the job and focuses on specific critical activities such as emergency response.
- External training as appropriate e.g. weed identification and management.

2.0 Relevant Site Attributes

The following sections provide a summary of the Project area attributes (climate, topography, soils, drainage and vegetation communities) that are relevant to the proposed rehabilitation of the Project area.

2.1 Climate

The Project area is located on the western edge of the Wet Tropics of Queensland and the dominant rainfall pattern is monsoonal. Alternating wet and dry seasons typically last for four to eight months although this can vary considerably, depending on the severity of the El Nino / Southern Oscillation.

Table 2-1 provides a summary of climate data relevant to the Project area, with rainfall measurements taken from:

- the Ravenshoe Alert gauge during the period 2001 to 2021 (weather station 31200, approximately 17 km from the Project area); and
- the Woodleigh Station during the period 2001 to 2021 (weather station 031119, approximately 6 km west of the Project area).

Temperature readings were measured at the Walkamin Research Station during the period 1969 to 2021 (weather station 31108, approximately 70 km from the Project area).

Mean annual rainfall in the area is between 1,462 mm and 820 mm[2], with the wettest month being February, and the driest months being August and September. Most rain (approximately 74 % for the Ravenshoe Alert, and 85% for Woodleigh) falls within the months December to April.

Seasonally, temperatures are hottest from October to February. The mean maximum daily temperature in summer was 30.8°C in December, with a winter minimum of 13.1°C in July.

The highest aspects of the Project area are approximately 990 m asl, which are considerably higher in elevation than the Walkamin Research Station at 594 m asl. The change in temperature as a function of elevation is typically between 0.6°C and 1°C but this can vary significantly with the influence of factors such as wind speed and moisture.

[2] This is consistently lower than coastal parts of the Wet Tropics such as Cairns (1,998 mm, 1943-2021), Innisfail (3,548 mm, 1881-2019) and Tully (4,086 mm, 1925-2021)

Table 2-1 Summary of Climate Data (BoM)

	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Ravenshoe Alert (station 31200) – 2001 to 2021													
Mean rainfall (mm)	255.3	287	272.4	121.9	64.8	58	45.2	27.3	23.1	46.3	57.8	139.3	1,462.4
Lowest rainfall (mm)	80	53	44	12	2	12	7	0	1	0	0	15	617
Highest rainfall (mm)	525	626	879	296	144	187	109	114	85	163	225	508	2,194
Woodleigh (station 031119) – 2001 to 2021													
Mean rainfall (mm)	189.6	206	136.5	39.1	20	17.2	10.6	7.9	8.8	26.7	66.6	122.3	819.8
Lowest rainfall (mm)	43	25	6	0	0	0	0	0	0	0	0	3	551
Highest rainfall (mm)	381	464	411	140	72	68	56	53	51	145	217	377	1,162
Walkamin Research Station (station 31108)													
Mean max. temp (°C)	30.1	29.3	28.2	26.7	25.1	23.7	23.4	24.9	27.2	29.4	30.6	30.8	27.4
Mean min. temp (°C)	20.3	20.5	19.6	18.1	16.2	14	13.1	13.3	14.8	16.7	18.5	19.8	17.1

2.2 Topography

The Project area is defined by a taller series of hills forming ridgelines, connected by numerous saddles or knolls, that extend along the eastern edge of the Wooroora property, and across the north of Wooroora and Glen Gordon. These ridges form the boundary of the local watershed formation, draining southwest through low plains and alluvial areas towards the Herbert River. The majority of the hills are associated with emergent granite formations rising to approximately 990 m AHD in the north of Glen Gordon, with the alluvial plains in the south of Wooroora being the lowest point within the Project Area at approximately 671 m AHD.

The proposed wind turbine locations are predominantly situated on the eastern and northern ridgelines described above, or occasionally located on other isolated scattered hills within the properties, with elevations ranging from 730 m to 990 m.

2.3 Soils

The Project area displays characteristics associated with both the Wet Tropics and Einasleigh Uplands bioregions, with a mix of soils and regional ecosystems (REs). The higher hills and ranges within the landscape are predominantly granite and occasionally rhyolite formations associated with Land Zone 12. Soils within this land zone are mainly tenosols on steeper slopes with chromosols and sodosols on lower slopes and gently undulating areas (Wilson and Taylor 2012). The Project's proposed wind turbines are exclusively located on these formations.

Lower areas within the Project area range from the imperfectly or poorly drained soils in the north, to the non-sodic soils on alluvia that dominate the central and southern extent. Glen Gordon is defined by broad areas of weakly to moderately pedal yellow and grey soils formed after sediments from the Glen Gordon acid volcanics covered a basaltic plain. The soils have a pale or bleached A2 horizon grading to a D horizon of heavy clay over decomposing basalt (Heiner & Grundy 1994). Organic carbon and total nitrogen levels in these soils are generally low, and carbon/nitrogen ratios generally tends to be high (Heiner & Grundy 1994). By contrast, Wooroora has a much broader coverage of soils associated with alluvia. This is generally described as an acidic duplex humic gley formed from quaternary alluvium with a thin organic surface and grey or gleyed B horizon formed by seasonal swamps. The higher organic carbon and nitrogen levels in these soils also reflect the surface texture and the generally lower position in the landscape (Heiner & Grundy 1994). Some infrastructure, such as access roads, will be located within these lower areas.

2.4 Drainage

The Project area is located on the north-eastern edge of the Herbert River catchment, the largest catchment of the Wet Tropics region. The Herbert River flows in a generally south-eastern direction intersecting 15 major tributaries before discharging into the Coral Sea near Lucinda, Queensland. The Herbert River catchment averages rainfall of 1,222 mm per year, and discharges approximately 5,081 GL annually into the ocean (DES 2019). The upper section of the catchment has primarily been developed for grazing, with the central section predominantly reserved for conservation, and the lower floodplains dominated by sugarcane farming (DES 2019). The Herbert River is a contributor of both dissolved inorganic nitrogen and fine sediments being released into the Great Barrier Reef Marine Park and is therefore managed under the Reef 2050 Water Quality Improvement Plan to reduce the amounts of fine sediments, nutrients (nitrogen and phosphorus) and pesticides flowing to the Great Barrier Reef (DES 2019).

Blunder Creek is the largest waterway to traverse the Project area with a catchment of 142 km^2 (Heiner & Grundy 1994). Blunder Creek flows east to west across both Wooroora and Glen Gordon before joining the Herbert River approximately 9 km to the west. Blunder Creek is identified as a stream order 4 where it traverses the Wooroora property and becomes a stream order 5 waterway within Glen Gordon. The riparian vegetation associated with this waterway, and the waterway itself, provide habitat for a range of native species. Having permanent water available in various stretches of the creek, this waterway will also likely provide refuge habitat for wildlife during drier periods. The Project design includes one new road crossing of Blunder Creek.

In addition to Blunder Creek, there is a series of stream order 1, 2 and 3 watercourses across the Project area, including within the Project footprint. Third order streams present include Lily, Pandanus, Oaky and Kara Creeks; all of which are tributaries to Blunder Creek. Waterways include creeks with a soft substrate bottom, and rocky gullies with distinct water holes and densely vegetated riparian vegetation.

The majority of the lower order waterways within the Project area were not running or were holding stagnant water at the time of the dry-season flora surveys (October 2020). During the wet-season fauna surveys (January-March 2021), all waterways were at the upper limit of their capacity with scattered flooding events. Based on conversations with landholders, this seasonal and episodic inundation is considered typical for the area.

2.5 Reference Communities

Vegetation within the Project area is generally of remnant status and dominated by various communities associated with woodlands or open forests. The following four regional ecosystems (REs) account for the majority (approximately 74 %) of the proposed clearing associated with the Project:

- 7.12.27a *Eucalyptus reducta* medium open forest and woodland. Uplands and highlands on shallow granitic and rhyolitic soils, of the moist rainfall zone.
- 7.12.34 *Eucalyptus portuensis* and/or *E. drepanophylla +/- C. intermedia +/- C. citriodora*, *+/- E. granitica* open woodland to open forest on uplands on granite
- 7.12.52 *Eucalyptus resinifera*, *Corymbia intermedia*, *Allocasuarina littoralis*, *Syncarpia glomulifera*, *E. drepanophylla +/- E. reducta* woodland on granite and rhyolite in the dry to moist rainfall zone
- 9.12.2 *Eucalyptus portuensis*, *Corymbia citriodora* subsp. *citriodora*, *E. granitica* or *E. crebra*, *C. intermedia* or *C. clarksoniana* mixed woodland on steep hills and ranges on igneous hills close to Wet Tropics boundary

The Queensland Herbarium is in the process of preparing technical descriptions for remnant regional ecosystems and their component vegetation communities based on site survey data held within the CORVEG database. Technical descriptions provide a detailed description of the normal range in structure and floristic composition of each RE, including the attributes of tree canopy height and cover, and native plant species composition of the predominant layer.

Technical descriptions are available for select REs within the Einasleigh Uplands bioregion (including RE 9.12.2, see **Appendix C**) but have not yet been completed for REs within the Wet Tropics bioregion. In the absence of technical descriptions, local reference sites should be used to describe the typical attributes of a particular RE following the process described in Neldner et al 2020.

3.0 Rehabilitation Management

3.1 Rehabilitation Principles

The following principles, adapted from the Roads in Rainforests: Best Practice Guidelines for Planning, Design and Management (Goosem et al. 2010) and Roads in the Wet Tropics. Part D Planning (DTMR 1998), will guide all rehabilitation activities:

- The area cleared for construction will be the minimum required for the safe, effective construction of the wind farm.
- The Project will maximise the proportion of cleared areas that will be rehabilitated on completion of construction as outlined in **Table 3-1**.
- Disturbed areas will be rehabilitated to reflect the species composition and density of pre-existing vegetation.
- To reduce the risk of erosion, the Project will develop and implement a Sediment and Erosion Control Plan (ESCP) to meet the International Erosion Control Association (IECA) 2008 Best Practice Erosion and Sediment Control Standard. A preliminary Sediment and Erosion Management Plan (SEMP, see Appendix J of the PER) has been prepared to provide a framework for the ESCP, which will be further developed by the Construction Contractor. A Preliminary Erosion and Sediment Control Plan is provided in the Preliminary Construction Management Plan as Appendix L to the Planning Report.
- The Project will minimise the time the Project footprint is left unvegetated; once nominated rehabilitation areas are no longer required for construction, the topsoil will be reinstated and revegetation activities will commence.
- Fragmentation by linear infrastructure will be minimised to allow future movement of fauna species across the Project footprint.
- Cleared vegetation will be reused during rehabilitation activities, through retention of hollow stages, salvage, tub-grinding, mulching and wood chipping.
- Weed management measures will be required at all Project sites before, during and after revegetation activities, generally in accordance with the Preliminary Weed and Pest Management Plan prepared as Appendix F to the PER.
- Disturbed areas will be revegetated with appropriate native species at staged intervals during construction. Planning will also determine needs for ongoing revegetation after the construction phase is completed.
- The use of native species, of local provenance as far as practicable, will minimise the requirement for ongoing maintenance. As seed collection times vary for different species, a twelve-month period prior to rehabilitation activities will be allowed for the collection of seeds from areas of adjacent, undisturbed vegetation. The Tablelands Regional Council-run revegetation nursery may also be used.
- During the detailed planning process, rehabilitation strategies which will minimise maintenance requirements and environmental impacts will be identified; for example, the use of species mixes that include fire retardant species may be selected for use in buffer areas between the Project area and the WTQWHA.

Table 3-1 Rehabilitation Commitment

	Stage 1 Area (ha)	Stage 1 & 2 Area (ha)
Area of disturbance	607.1	1071.1
Operational footprint	65.8	107.3
Area theoretically available for rehabilitation	**Up to 541.3 ha ~ 89 %**	**Up to 963.8 ha ~ 90 %**
Minimum overall rehabilitation target	**424.94 ha (70%)**	**753.31 ha (70%)**

Indicative cross-section plans have been prepared to illustrate the proposed rehabilitation of different parts of the Project area as described in **Table 3-2**, communicated in the form of construction and operational principles for rehabilitation within these areas.

Table 3-2 Rehabilitation Scenarios and Principles

Rehabilitation Scenario	Rehabilitation Principles – Construction	Rehabilitation Principles – Operation
Narrow access track *Cross-section A in Appendix B* *Example: RE 9.12.2 as encountered across much of Glen Gordon Station*	General rehabilitation principles listed above will apply.	Canopy connectivity to be re-established to the greatest extent possible. Ongoing weed control as required. Rehabilitated areas achieve threshold condition of remnant vegetation for the relevant pre-construction RE during the operational lifetime of the Project.
Wide access track *Cross-section B in Appendix B* *Example: RE 7.12.65k as encountered to the south of the existing OHTL on Wooroora Station*	Installation of fauna crossing infrastructure (rope bridge, culverts, etc.) at locations to be determined prior to construction commencing.	Canopy connectivity to be re-established to the greatest extent possible. Ongoing weed control as required. Rehabilitated areas achieve threshold condition of remnant vegetation for the relevant pre-construction RE during the operational lifetime of the Project.
Battered access track *3D Illustrative Render H in Appendix B* *Example: access track along the ridgeline between turbines 7 and 8 on Glen Gordon Station*	Topsoil imported for use on batters to be certified weed-free. A sterile ground cover may be applied using hydromulching immediately on completion of construction, to stabilise the batters. Active seeding / planting of tubestock on batters to be undertaken, using native species of local provenance that reflect the diversity and density of pre-clearing vegetation. In sclerophyll forest, include shrub species in planting schedules. Installation of fauna crossing infrastructure (rope bridge, culverts, etc) at locations to be determined prior to construction commencing.	Canopy connectivity to be re-established to the greatest extent possible. Ongoing weed control as required.
Watercourse crossing *Cross-sections F & G in Appendix B* *Example: A watercourse crossing within RE 7.3.26 as will be encountered with*	Canopy connectivity will be maintained throughout construction to the extent practicable. Best practice sediment and erosion control measures.	Canopy connectivity to be re-established to the greatest extent possible. Re-establish hydrological flows as soon as practicable, in line with pre-construction conditions.

Rehabilitation Scenario	Rehabilitation Principles – Construction	Rehabilitation Principles – Operation
the proposed access road crossing Blunder Creek. *3D Illustrative Render I in Appendix B* *Example: proposed crossing of Oaky Creek within Glen Gordon Station*		Ongoing weed control as required. Rehabilitated areas achieve threshold condition of remnant vegetation for the relevant pre-construction RE during the operational lifetime of the Project.
Access track within northern greater glider habitat *Cross-section J in Appendix B* *Example: access track approaching turbine 75 from the west on Wooroora Station*	Canopy connectivity will be maintained throughout construction to the extent practicable Project ecologist to identify and tag hollow-bearing trees that are to be cleared prior to construction commencing Care to be taking during vegetation clearing so that sections of tree trunk with hollows are retained and securely stockpiled on site during construction. These will then be re-attached to adjacent, undisturbed trees at a similar height and aspect to their original situation during the rehabilitation stage. Instal glider poles and rope bridges where the Project footprint bisects known or potential northern greater glider habitat. Instal artificial nest boxes at either end at an appropriate height. Monitor natural revegetation from the seed bank to ensure rehabilitated areas support a diversity of northern grater glider forage species (eucalypts, particularly *E. tereticornis* but also other *Eucalyptus* and *Corymbia* species). Where necessary, undertake additional seeding or tubestock planting.	Canopy connectivity to be re-established to the greatest extent possible. Artificial nest boxes and relocated hollow-bearing stages combined should provide a minimum density of 4 per every 2ha. Ongoing weed control as required. Rehabilitated areas achieve threshold condition of remnant vegetation for the relevant pre-construction RE during the operational lifetime of the Project.
Access track within magnificent brood frog habitat *Cross-sections K & L in Appendix B* *Example: access track approaching turbine 9 on Glen Gordon Station*	Best practice soil handling, storage and reinstatement techniques within areas mapped as potential or known habitat for the magnificent brood frog.	Re-establish hydrological flows and groundwater seepages as soon as practicable, in line with pre-construction conditions. Annual surveys to determine the presence of the species in rehabilitated habitat until a positive observation is recorded

Rehabilitation Scenario	Rehabilitation Principles – Construction	Rehabilitation Principles – Operation
	Best practice sediment and erosion control measures to minimise sedimentation of stream order 1 watercourses and seeps. Stringent application of weed and disease prevention and control measures, with a particular focus on measures to control chytrid fungus. At locations where an access track bisects an area of potential or known habitat for magnificent brood frog, design and instal a culvert crossing suitable for the location and species (e.g. of a sufficient size, with soil substrate and drift fencing to encourage use of the culvert) Natural revegetation from the seed bank is preferred, in order to minimise the risk of importing potential pathogens (particularly the chytrid fungus). The exception to this is to undertake planting of appropriate cover vegetation (such as *Themada triandra* and sedges) around the entrance of culverts to encourage their use by the magnificent brood frog.	(noting that the species is naturally not always recorded in the same location year on year) Ongoing weed control as required. Rehabilitated areas achieve threshold condition of remnant vegetation for the relevant pre-construction RE during the operational lifetime of the Project.
Wind turbine hardstand *Cross-section D and 3D Illustrative Render D2 in Appendix B* *Example: WTG 65 including hardstand and blade laydown located within RE 7.12.34*	General rehabilitation principles listed above will apply.	30m separation distance to be maintained between the wind turbine and rehabilitated vegetation No height restrictions on rehabilitated vegetation as the lowest point of the blade is approximately 70m above the ground and the maximum height of existing vegetation is approximately 35m. Rehabilitated areas achieve threshold condition of remnant vegetation for the relevant pre-construction RE during the operational lifetime of the Project.

Rehabilitation Scenario	Rehabilitation Principles – Construction	Rehabilitation Principles – Operation
Overhead transmission line corridor *Cross-section E in Appendix B* *Example: The OHTL within RE 7.12.52 within Wooroora Station*	General rehabilitation principles listed above will apply.	As per Powerlink requirements, typically only ground cover vegetation would be rehabilitated within the conductor shadow area plus 5m either side, with a maximum vegetation height of 3m for the remainder of the cleared easement. Ongoing weed control as required.

The map series in **Appendix A** indicates where rehabilitation is proposed throughout the Project area. **Appendix B** presents the illustrative cross-section plans and 3D renders.

3.2 Site Establishment and Vegetation Clearing

While the majority of rehabilitation works are undertaken post-construction, vegetation management decisions taken during the planning and construction phases of the Project also relate to rehabilitation. For example, chipping and retaining cleared vegetation provides mulch for use in restoration.

Aims:

- Maximise recycling or re-use of cleared vegetation; and
- Minimise the impacts of habitat loss due to removal of vegetation or loss of trees with habitat value (e.g. hollow bearing trees).

Management:

- Minimise clearing areas;
- Undertake vegetation clearing in accordance with the Vegetation Management Plan that forms part of the CEMP;
- Prior to clearing, fauna spotter catchers will identify and clearly demarcate hollow-bearing trees that are to be removed;
- Relocate wildlife (including native beehives) prior to the removal of habitat trees;
- Trees with hollows should have the hollow section preserved and this section will be attached to adjacent, undisturbed habitat at a similar height and aspect to its original location, in order to maintain the denning resource; and
- Recycle cleared vegetation for reuse on site (e.g. mulching, tub-grinding, wood chipping and custom milling).

3.3 Site Stabilisation

Depending on specific conditions across the project area (i.e. slope and soil characteristics), the following stabilisation and rehabilitation methods may be required in accordance with the *Best Practice Erosion and Sediment Control* (IECA 2009):

- Geotextiles (i.e. erosion control blankets, turf reinforcement mats, bonded fibre matrix). As a general guide, covering the soil surface with a 30 % cover of non-erodible material will reduce soil loss by approximately 80 % (US Soil Conservation Service 1983);
- Mulching (i.e. rock, gravel, compost, woodchips, sugarcane);
- Revegetation via hydroseeding and hydro-mulching (see **Section 3.4**); and
- Suppressants or soil binders (chemical surface stabilisers).

Standards for rehabilitation will be developed to include criteria for landform stability and erosion control across the Project area; a general rule of thumb is that at least 60 % of the surface area should be protected by some form of physical cover (either matting or vegetation) (WTMA 1998). However, this depends on the soil characteristics, slope and likely rainfall intensity.

Standards will also be developed to address the issue of directing the flow of existing waters and the direction of new discharges from disturbed soils. Again, the rule of thumb for much of the Wet Tropics region is that any flow velocity greater than 2 m/s should be stabilised with some material other than vegetation (WTMA 1998). However, for any grade above 1 % and any flow velocity greater than 1 m/s, stabilisation requirements should be determined on a site-by-site basis.

3.4 Rehabilitation Activities

Aims:

- To reinstate and enhance disturbed areas in the post-construction phase.
- To maximise survival opportunities for areas of retained vegetation and newly rehabilitated areas.
- To reinstate fauna habitat and maintain connectivity across the Project area.
- To improve the visual amenity of the working areas after construction.
- To prevent new outbreaks of weeds in revegetation areas.

Management:

- Determine the rehabilitation techniques suitable for different parts of the Project area, taking into account the topography, soils and ecological processes.
- Determine recommended native species lists for rehabilitation, as well as priority weed species for control. Ensure recommended plant species will not aggressively compete or displace existing native species.
- Determine planting densities and techniques as required.
- Specify a maintenance program to ensure the long-term health and vigour of retained vegetation and the healthy growth of new plantings and/or direct seeded areas.
- Determine mulching, watering and fertiliser regimes, regular inspection schedules for damage or disease, replacement planting criteria and weed eradication measures.
- Implement a monitoring program to measure the effectiveness of adopted measures.

Rehabilitation to achieve pre-disturbance land use that meets the relevant RE benchmarks will include methods that enhance:

- Stem density;
- Large trees;
- Vegetation species richness; and
- Coarse woody debris (CWD).

There may be some areas where it is appropriate to allow the site to regenerate naturally on completion of construction (weed management requirements would still apply in such areas). In other cases, one or more of the following techniques will be required.

3.4.1 Hydro-seeding

Hydro-seeding is a method by which mulch and plant seed is applied to the topsoil using water as a carrier. Hydro-seeding encourages vegetation cover and provides protection against raindrop erosion. The following requirements would apply to all areas of hydro-seeding:

- Seed of local provenance will be used and fertiliser will be added to the mulch as necessary.
- Management of fertiliser for areas within close proximity to natural waterbodies is required.
- Preferably the mulch will be derived from vegetation previously cleared from the Project area. Where this is insufficient in volume or inappropriate due to a high proportion of weeds, mulch may be imported. Suppliers of mulch will be required to be certified weed and yellow ant-free.

- Hydro-seed mix will be applied at a rate determined on a specific site by site basis.
- Seed mixes will reflect pre-existing vegetation.

3.4.2 Direct Seeding

Direct seeding is the delivery of native seeds or seed as requested by the landowner into the soil using a mechanical seeder known as a "rodden". Direct seeding is a very cost-effective method of revegetation for species that are suitable for this kind of application, such as native *Acacia* species.

3.4.3 Tube Stock

The following general rules apply to planting from tube-stock:

- Only native species will be planted.
- Stock will be of local provenance (preferably within 25 km) as far as practical (note the Tablelands Regional Council revegetation nursery would be contacted in the first instance).
- All stock will be provided in standard native tube plant sizes (typically 50 x 70 mm pots).
- All planting stock will be true to schedule nomenclature, well formed and hardened off to suit final location. The root system shall be firmly established without large roots extruding from the container.
- Mulch will be applied in a donut shape around individual plantings or small groups of plantings however it will not be blanket-applied to the entire alignment as this would suppress natural regeneration of native plants from the seed bank as well as weeds.
- The density of revegetation is to reflect that of the surrounding undisturbed environment and will be in accordance with all relevant conditions of statutory approval.
- A slow-release fertiliser such as Aussie Apex Native™ with an N:P:K ratio of 23:1.1:14.6 should be used in direct tube-stock areas only. Fertiliser should not be placed directly in the hole as this encourages root balling and increases the risk of plants falling over with age. Instead, fertiliser should be distributed away from the plant, up to the distance in length of its canopy to encourage a stronger root system.
- Use of tree guards is required over the majority of the rehabilitation due to the presence of wallabies and other grazing animals. However, the Project may use any alternative methods for reducing plant loss by grazing such as fencing entire revegetation areas, subject to landowner agreement.

3.5 Rehabilitation Management

Rehabilitation management will include one or more of the following actions:

- Planting and thinning will occur every 5 years to aid in vertical forest structure development and to maintain relative abundance and establish any missing structural elements based on the RE.
- Weed and pest control in accordance with the Preliminary Weed and Pest Management Plan (see Appendix F of the PER).
- Livestock management.
- Management of fire fuel loads in accordance with the Bushfire Management Plan that will be developed for the Project.

Further work will be undertaken in the post-approvals period to identify specific management actions required in different parts of the Project area.

3.6 Future Rehabilitation Activities

In very rare cases, it may be necessary for the Project to replace an existing turbine blade during the operational lifetime of the Project. Delivery of the new blade would require clearing of areas that had previously been rehabilitated, on specific access roads only. In this instance, new rehabilitation activities would be undertaken as soon as possible on completion of the works, following the principles described in this Plan.

Some clearing of rehabilitated road verges may be required during decommissioning to facilitate the movement of large equipment, to be determined by a swept-path analysis at the time. Any clearing of rehabilitated areas would be rehabilitated on completion of decommissioning. This, however, is not expected to impact the proponent's target of at least 70% of the temporary construction footprint being rehabilitated, as outlined in **Table 3-1**.

A conceptual example of this scenario is shown in **Figure 3-1**.

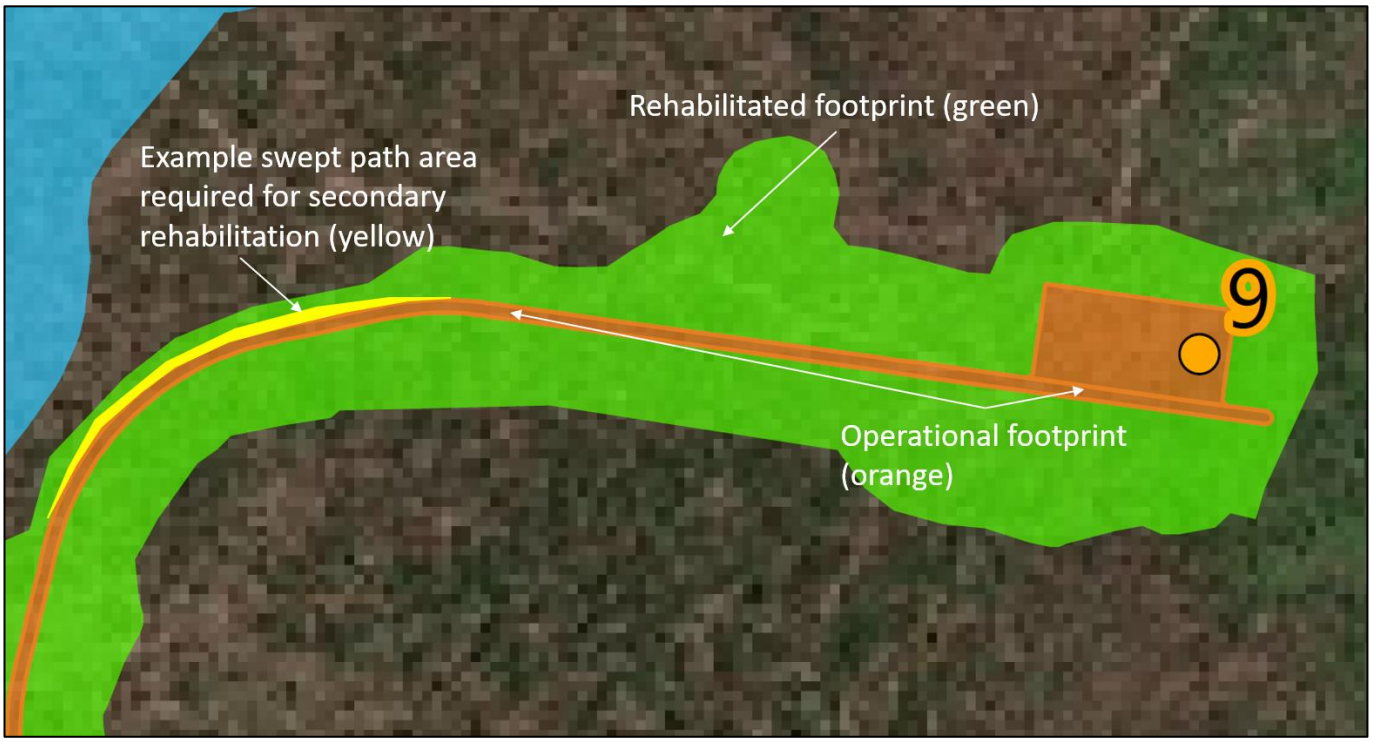

Figure 3-1 Conceptual scenario showing potential swept path secondary rehabilitation area

4.0 Monitoring and Reporting

Monitoring of rehabilitated areas will be undertaken annually for the first five years, with subsequent monitoring events being undertaken bi-annually until it can be demonstrated that the rehabilitated vegetation communities are self-sustaining. Monitoring plans will be developed in conjunction with the detailed management plans and will reflect the specific management actions at different parts of the Project area.

A brief report will be prepared after each monitoring event, which will address following issues:

- Plant growth, % cover and survival rates;
- Plant losses through herbivores, disease, vandalism, storm damage, etc;
- Weed regrowth and control measures;
- Plant replacement;
- Guard repair and weeding inside guards; and
- Maintenance watering regime (if required based on prevailing weather conditions).

Monitoring reports will be used to inform ongoing management actions and be supplied to regulators as they are completed, to demonstrate progress towards the rehabilitation objectives.

4.1 Achievement of Final Objectives

The environmental requirements for meeting the final objectives for rehabilitated areas are:

- Revegetation of all areas such that plantings areas are viable without further management and 70% ground cover has been achieved (subject to natural disaster such as floods or bushfires).
- No new weeds have become established and weed infestation levels are no greater than pre-construction levels (or as evident on immediately adjacent lands).
- All areas are stabilised from erosion (temporary sediment and erosion control measures may remain in place).
- Surface water flows have been reinstated, including sheet flows and flows in defined drainage lines, and invert levels on all streams and drainage lines have been restored.
- Landowner requirements have been discharged in relation to reinstatement, fencing, removal of rubbish, etc.
- A written report is provided documenting compliance with conditions of all permits and approvals, with evidence provided as appropriate.

During a final rehabilitation audit, photos will be taken to provide an accurate record of the survival and growth of vegetation and establishment of weeds during the maintenance period.

Once final rehabilitation objectives have been achieved, sites are returned to the control of their respective landowners; however, the Project owner retains responsibility for the easement for the operational lifetime of the Project. The intention is for rehabilitated vegetation communities to have reached remnant status by the end of the operational lifetime of the proposed wind farm (i.e. within 30 years), as determined by comparing the rehabilitated vegetation communities with published benchmarks for the relevant regional ecosystems.

5.0 References

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Appendix A

Site Rehabilitation Plan

ARK ENERGY

Attexo

Chalumbin Wind Farm

Proposed Rehabilitation Plan

Sheet 1 of 25

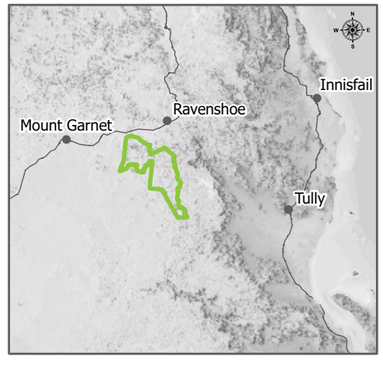
- Project Area Boundary
- Watercourse
- Turbine
- Met-mast
- Existing HV Transmission Line
- Lot Boundary
- Easement
- Alternate Access -Innot Springs
- Stage 1
- Stage 2

Rehabilitation

- Complete Rehabilitation
- Operational Footprint
- Height-Sensitive Rehabilitation

Date: 13/10/2022 Author: TOD

Project: EPU-004 Reviewed: NOD



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Data Source(s):

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