



Appendix M

Ecological Assessment Report

Ecological Assessment Report

Chalumbin Wind Farm

Prepared for:

Chalumbin Wind Farm Pty Ltd

December 2021





Document Information

DOCUMENT	Ecological Assessment Report
ATTEXO REF	EPU-004
DATE	10-12-2021
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Quality Information

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1.0 Introduction

1.1 Background

Chalumbin Wind Farm Pty Ltd (CWF), a subsidiary of Epuron Projects Pty Ltd (Epuron), proposes to develop the Chalumbin Wind Farm Project (the Project) at a location approximately 15 km south-west of Ravenshoe in Far North Queensland within the Tablelands Regional Council Local Government Area (LGA), see **Figure 1-1**. The Project is a proposed wind farm that consists of up to 94 wind turbine generators (WTGs) and associated infrastructure. A detailed project description is presented in **Section 3.0**.

The Project is proposed to have a maximum nameplate wind farm generation capacity of 658 MW (depending on final turbine specification). The Project will generate around 2,170 GWh of renewable electricity per year, which is equivalent to supplying power to around 350,000 Queensland homes. The Project will connect to the existing 275 kV Chalumbin to Woree transmission line, which is part of the Powerlink network in the central north of the Project area.

Key elements of the Project include:

- up to 94 wind turbine generators (WTGs) and associated hardstands;
- substations and potential battery energy storage system (BESS);
- medium-voltage (≤ 66 kV) overhead and underground powerlines and communication cables;
- high voltage (≤ 275 kV) overhead powerline;
- permanent met masts;
- unsealed access tracks;
- permanent site entrance;
- fencing;
- temporary construction compound/laydown and stockpile area including temporary site offices, workshops, warehouses and amenities;
- operations and maintenance facilities;
- grid support equipment such synchronous condensers or reactive plant at the Project substation; and
- temporary concrete batching plants (not part of this application).

The Project area (which encompasses the land parcels within which infrastructure is proposed, plus intersected road reserves) is a large area that covers a total of 31,620.9 ha, as described in **Section 3.0**. The Project footprint (i.e. maximum area of disturbance) is a much smaller area within these land parcels, and is a total of 1,132 ha (3.58 % of the Project area). The Project footprint is sufficiently wide to allow the micro-siting of infrastructure to respond to site-specific constraints.

Construction of the Project is expected to commence in early 2023, subject to timely approvals and commercial agreements. The construction phase is expected to last for a period of 24-30 months, with approximately 250 to 350 personnel employed at the peak construction period. The workforce will likely reside in Ravenshoe and other surrounding townships, or a dedicated construction accommodation facility. The operational life of the Project is expected to be 30 years, at which point the Project owner will assess the infrastructure and may choose to extend the



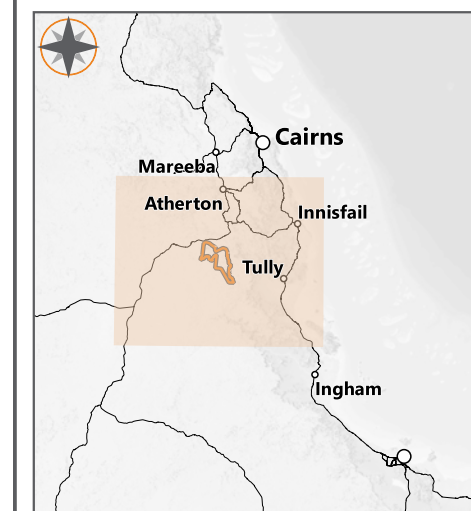
life of the existing plant, or re-power the site with new equipment. Alternatively, the owner may choose to decommission the site and rehabilitate the land in accordance with land agreements in place at that point in time.

Chalumbin Wind Farm Project Location

Figure 1.1

-  Project Area
-  Town
-  Major Road
-  Road
-  Local Government Boundary

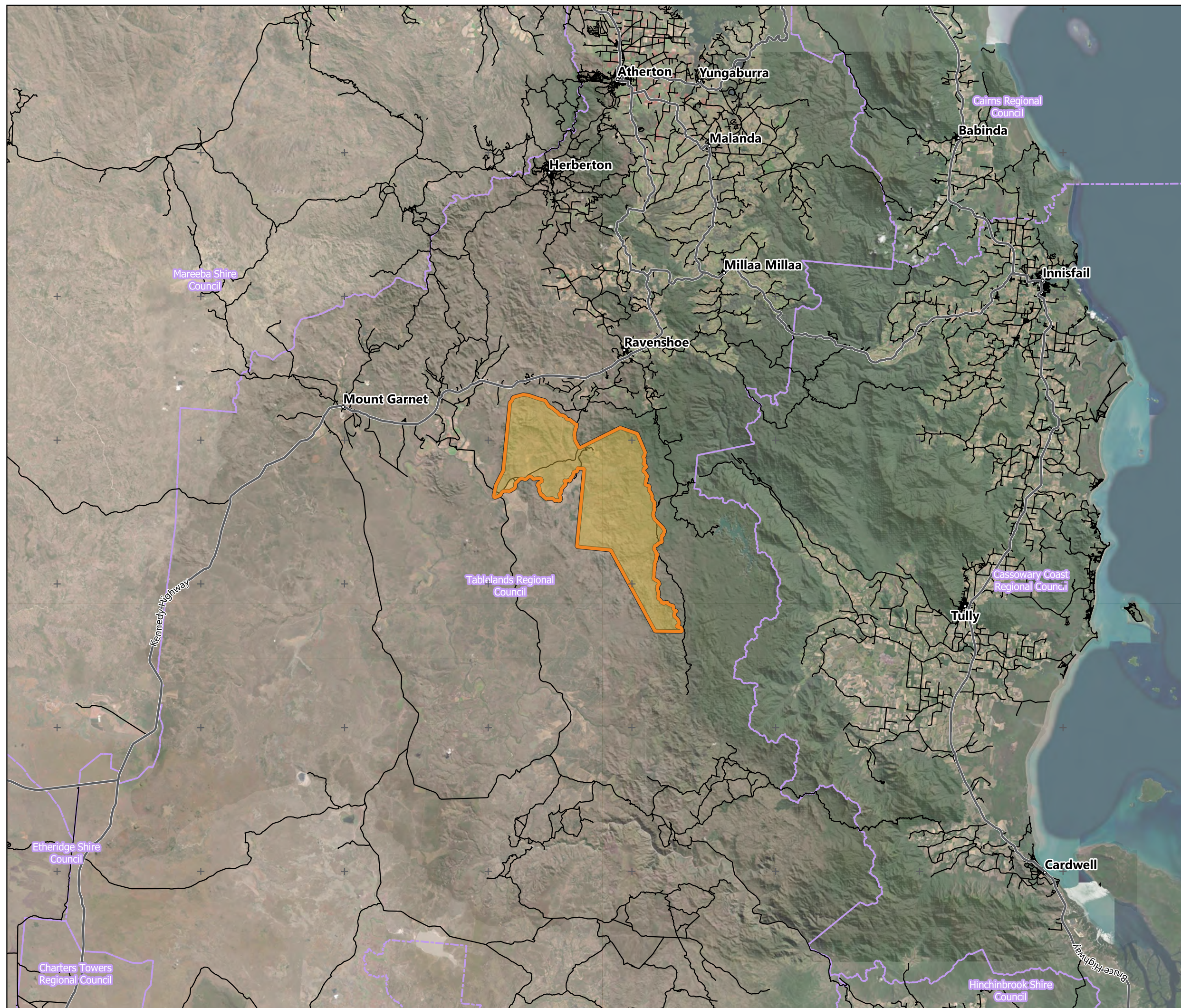
Date: 2021-12-10
 Author: TOD
 Reviewed: CC
 Project: EPU-004



0 5 10 15 20 km

1:500000 @ A3

Data Source(s):
 Digital Cadastral Database - Department of Natural Resources,
 Mines and Energy (2021)
 Queensland Imagery Whole Of State
 Satellite Public Basemap Service





1.2 Purpose and Scope

Attexo Group Pty Ltd (Attexo) has been engaged by CWF to prepare an Ecological Assessment Report (EAR) for the proposed Chalumbin Wind Farm Project (the Project). This EAR focuses on environmental values prescribed at a State level as Matters of State Environmental Significance (MSES), assessable under the *Planning Act 2016*. The report includes an assessment of potential environmental impacts that may occur to MSES as a result of the Project, and proposes avoidance and mitigation measures. The information in this report will be used to support a Development Application (DA) for the Project to the State Assessment Referral Agency (SARA) under State Code 23: Wind Farm Development and State Code 16: Native Vegetation Clearing.

The main objective of this EAR is to demonstrate that the Project complies with Performance Outcome (PO) 5 of State Code 23; that the Project “ensures that impacts on flora, fauna and associated ecological processes are avoided, or minimised and mitigated, through effective siting, design and operation”.

Assessment of significant residual impacts to Matters of National Environmental Significance (MNES) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are primarily addressed in a separate technical report to support an EPBC Act referral (EPBC 2021/8983). The assessment of the Project under the EPBC Act is ongoing. State and Federal approvals will be issued independently; those MSES which are also listed as MNES will be assessed under the EPBC Act and offset under that Act if required.

1.3 Consultation

The proponent recognises the importance of effective stakeholder engagement in the successful delivery of the Project and the realisation of positive outcomes. Community and stakeholder engagement will be undertaken in accordance with the Clean Energy Council Community Engagement Guidelines for the Australian Wind Industry, ‘Best practice community engagement in wind development’.

The following consultations have been made and form part of an ongoing stakeholder engagement strategy for the Project. A Stakeholder Management Plan is maintained by the project team; this document is updated with contact information and consultation activities throughout the progression of the Project development process. Consultation and engagement for the Project has been broad in nature, and has included:

- regular, ongoing engagement and negotiation of land agreements with involved landowners;
- a pre-referral meeting with representatives of the Department of Agriculture, Water and the Environment (DAWE) in May 2021;
- a pre-lodgment meeting with SARA and other agencies in May 2021;
- Project newsletters distributed to the local population (residences within 15 km of the Project) and available on the Project website. These newsletters provide updates on key development milestones, with an invitation to provide feedback via a website or direct contact. A distribution list for future newsletters is also maintained by CWF, to ensure that anyone expressing interest in the progress of the Project remains informed;
- ongoing engagement with the traditional owner group (the Jirrbal People) including entering into a Cultural Heritage Management Agreement, and negotiation of an Indigenous Land Use Agreement (ILUA) over Wooroora Station;
- ongoing liaison with Tablelands Regional Council, and other key stakeholders such as the Wet Tropics Management Authority (WTMA) and the Cairns and Far North Environment Centre (CAFNEC);



-
- a first Community Information Session at Ravenshoe in September 2021 (this is to be followed by consistent consultation processes that are to be confirmed);
 - establishment of a local community engagement team in Atherton to manage interaction with local groups and interested residents;
 - creation of a shop-front space in Ravenshoe for the holding of small group briefings, and display of relevant Project information as the Project progresses; and
 - creation and maintenance of a regularly-updated Project website (<https://epuron.com.au/wind/chalumbin/>).



2.0 Regulatory Framework

2.1 Commonwealth Environment Protection and Biodiversity Conservation Act

The EPBC Act is the Australian Government's central piece of environmental legislation that provides a legal framework to protect and manage MNES, many of which are also internationally important. If a proposed development or other action is likely to have a significant impact on a protected matter, then it must be referred for assessment under the EPBC Act. Protected matters under the EPBC Act are:

- World Heritage properties;
- National Heritage places;
- Wetlands of international importance (as listed under the Ramsar Convention)
- Listed threatened ecological communities (TECs) and listed threatened species;
- Migratory species protected under international agreements;
- Commonwealth marine areas;
- The Great Barrier Reef Marine Park;
- The environment, where nuclear actions are involved;
- A water resource, in relation to coal seam gas and large coal mining developments;
- The environment, where actions are proposed on or will affect Commonwealth land; and
- The environment, where Commonwealth agencies are proposing to undertake the action.

Known MNES occur within the Project area including threatened flora, fauna and migratory species. A referral to the Department of Agriculture, Water and the Environment (DAWE) (EPBC 2021/8983) was submitted on 23 July 2021. On 10 August 2021 DAWE determined that the Project is a controlled action and will be assessed by Public Environment Report.

2.1.1 Significant Impact Guidelines

Under the EPBC Act an action will require approval from the minister if the action has, will have, or is likely to have a significant residual impact on MNES. The *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* (DoE 2013) provide detailed criteria to determine whether or not a referral may be required and if the proposed action may have a significant residual impact on MNES. Thresholds provided in the Significant Impact Guidelines vary according to the threat status of the MNES. This EAR does not assess the potential impacts of the Project on MNES in accordance with the Significant Impact Guidelines as they are addressed in a separate technical report to support the EPBC Act referral (EPBC 2021/8983). However, as some MNES are also MSES, they are applicable to the assessment of compliance with PO5 of State Code 23.

2.1.2 EPBC Act Environmental Offsets Policy

Environmental offsets are required to be delivered in accordance with the *EPBC Act Environmental Offsets Policy* (DSEWPC 2012a). The Environmental Offsets Policy outlines the Australian Government's approach to the use of



environmental offsets under the EPBC Act. Offsets are defined as measures that compensate for the residual adverse impacts of an action on the environment. Where appropriate, offsets are considered during the assessment phase of an environmental impact assessment under the EPBC Act. The mitigation hierarchy requires that avoidance, minimisation and mitigation measures are the primary strategies for managing the potential significant impacts of a proposed action. Offsets do not reduce the likely impacts of a proposed action, but instead compensate for any significant residual impact.

Where significant residual impacts are found to occur to MNES, and environmental offsets are required, an offsets package should be provided. An offsets package is a suite of actions that a proponent undertakes in order to compensate for the significant residual impacts to the identified MNES. It can comprise a combination of direct offsets and other compensatory measures. Offsets should align with conservation priorities for the impacted protected matter and be tailored specifically to the attribute of the protected matter that is impacted, in order to deliver a conservation gain.

To support any offset assessments that may be required for the Project, it is important to evaluate the specific MNES attributes that occur within the proposed disturbance area (e.g. foraging versus breeding habitat versus traverse areas) and the habitat quality of the mapped habitat areas. This information is required to inform offset calculations.

Significant residual impacts to MNES, and any offsets that may be required, are addressed through the EPBC Act assessment and approval process.

2.2 Queensland Planning Act 2016

In Queensland, wind farms require a development permit under the *Planning Act 2016* for a Material Change of Use (MCU) for a windfarm and for Operational Works for clearing regulated vegetation (OPW). The MCU requires assessment under *State Code 23 – Wind Farm Development* and the OPW requires assessment under *State Code 16 – Native Vegetation Clearing*. The material for the development permit is provided in one comprehensive package and is submitted to the State Assessment and Referral Agency (SARA), as assessment manager.

An ecological assessment that addresses prescribed matters at a State level is required to support the development application for the Project. The presence of MSES within the proposed impact area will need to be identified and impacts quantified. Significant residual impacts to MSES will be assessed under the Significant Residual Impact Guideline for Planning Act approvals (DSDIP 2014) associated with vegetation clearing (State Code 16). This includes the following MSES:

- Endangered and Of Concern regional ecosystems (REs);
- Remnant vegetation within the defined distance of a watercourse;
- REs that intersect with a wetland;
- Connectivity; and
- Essential Habitat.

If a significant residual impact is considered likely to occur to MSES, environmental offsets will be conditioned through the development permit in accordance with the *Environmental Offsets Act 2014* (EO Act).

The State assessment is not undertaken through the bilateral agreement and therefore the Project will be assessed by the State and approved separately to an approval under the EPBC Act.



2.2.1 State Code 23: Wind Farm Development

State Code 23 requires an ecological assessment to identify and assess risks to flora, fauna and associated ecological systems and processes. The results need to inform how these risks can be mitigated or managed through siting and design of the wind farm.

Bird utilisation surveys (BUS) are a mandatory requirement for proposed wind farms in Queensland under State Code 23 and need to be completed over two seasons. The assessment of birds and bats forms a major part of ecological impact assessments for a wind farm project, due to the potential for collisions with wind turbines. The location and migratory paths of bird and bat populations or species may influence the turbine footprint and layout of a wind farm development.

In accordance with State Code 23, field surveys should as a minimum aim to:

- identify bird and bat habitats and habitat components, and validate the results of the desktop review;
- undertake bird utilisation surveys and modelling to identify species at risk of collision or displacement (particularly listed threatened species); and
- undertake bat surveys to identify any species in the area.

Bird utilisation surveys aim to identify the avian species on site, the numbers present, the height that birds fly and the utilisation across the site. Utilisation studies often include a description of bird behaviour, which usually refers to activities such as feeding, resting or moving, as these can aid the understanding of potential impacts of a wind farm development. Data is quantitative and is collected at pre-determined fixed points. The surveys are conducted during relevant seasons with regards to the species being studied and the location of the site, and would normally involve sampling of different relevant habitats on the site. Data is usually recorded in a way that allows a collision risk model to be formulated to estimate the potential collision risk of a species.

The BUS are summarised in this report and impact assessments from bird and bat strike are detailed in the Preliminary Bird and Bat Management Plan (see **Appendix F**).

2.2.2 State Code 16: Native Vegetation Clearing

The purpose of the *Vegetation Management Act 1999* (VM Act) is to regulate the clearing of native vegetation in a way that conserves remnant vegetation in declared areas, ensures clearing does not cause land degradation, prevents the loss of biodiversity and maintains ecological processes.

Under the VM Act regional ecosystems (REs) are assigned three statuses which are:

- Endangered;
- Of Concern; or
- Least Concern.

These statuses are taken from the RE description database, and respective definitions are provided in the Act. Within this report, the definition of a RE follows that described by Sattler and Williams (1999), i.e. a vegetation community in a bioregion that is consistently associated with a particular combination of geology, landform and soil.

Clearing of regulated vegetation associated with the Project will not meet the definitions of "exempt clearing work" or "accepted development" under the Planning Regulation. Therefore, an OPW development permit will be required



for the clearing of regulated vegetation. Prior to the lodgement of the OPW application, a relevant purpose determination must be obtained under s22A of the VM Act from Department of Resources (DoR).

To support the OPW application field ecology surveys have been undertaken to validate the regulated vegetation mapping across the Project area. Numerous discrepancies were identified through this process and therefore the ground-truthed vegetation communities are used as the basis of any impact assessment.

2.3 Queensland Nature Conservation Act 1992

The objective of the *Nature Conservation Act 1992* (NC Act) is the conservation of nature; the Act provides for the gazettal of protected areas including nature refuges, prescribes classes of wildlife and sets out restrictions on the taking or harm to native wildlife without a valid permit. Threatened flora and fauna species have been assessed in terms of those with potential to occur in the Project area.

2.3.1 Protected Plants in High Risk Trigger Mapping

In Queensland, all plants that are native to Australia are protected plants under the NC Act to prevent whole plants or protected plant parts from being illegally removed from the wild or illegally traded. Clearing, growing, harvesting and trading of protected plants in Queensland is regulated by the *Nature Conservation (Wildlife Management) Regulation 2006*.

If an area proposed to be cleared contains native plants in the wild, and there is no relevant exemption, and the area is shown as 'high risk' on the flora survey trigger map, a flora survey of the clearing impact area must be undertaken prior to any clearing. If the flora survey identifies the presence of an endangered, vulnerable or near threatened (EVNT) plant in the clearing impact area (or a 100 m buffer), a clearing permit under the NC Act is required prior to any clearing. A clearing permit authorises the clearing of an area of land rather than individual species of plant present. Clearing that has complied with a permit will not be subject to any further survey or approval requirements once clearing commences. A proponent can then carry out re-clearing or routine maintenance for up to 10 years after the original authorised clearing. Where a significant residual impact to a protected plant is likely to occur, an offset may be required.

If the flora survey of the high risk area does not detect any EVNT plants in the clearing impact area, or the impacts on EVNT plants can be avoided (i.e. clearing will not take place within 100 m of the EVNT plants), a clearing permit is not required but an exempt clearing notification must be submitted to the Department of Environment and Science (DES) within one year of the survey being undertaken, and at least one week prior to the clearing commencing.

There are some areas of high risk trigger mapping that intersect the Project's disturbance footprint. Some formal protected plant surveys have been carried out at discrete locations within the Project area in order to facilitate the installation of meteorological monitoring masts as described in **Section 4.2.2**. It is proposed that the remainder of the Project footprint within high risk trigger mapping is surveyed at a later date, closer to the start of construction, due to the 12 month validity period of the surveys.

If clearing of protected plants (both within and outside high risk trigger mapping) is unavoidable, a protected plants clearing permit under the NC Act will be required.

2.3.2 Fauna Breeding Places

For a proposed activity that will have an unavoidable impact on breeding places of protected animals (which include all classes of native wildlife, including least concern), a Species Management Program (SMP) is required to be prepared by the proponent and approved by DES under the NC Act. DES has prepared an Information Sheet that



outlines when a SMP is required. Animal breeding places are defined in this document as a bower, burrow, cave, hollow, nest, or other thing that is commonly used by the animal to incubate or rear the animal's offspring.

A Low Risk SMP can authorise tampering with animal breeding places for least concern species. A High Risk SMP will authorise tampering for all fauna breeding places including colonial breeders, special least concern and EVNT species. The duration of the SMP must be identified and must be relevant to the activity being undertaken and allow for a periodic review of the program. The standard term for a SMP is three years.

The purpose of a SMP is to:

- assess the threats to native animal breeding places resulting from a planned activity;
- incorporate management actions that will avoid or minimise both the immediate and the long-term impact or removing or altering an animal breeding place; and
- set monitoring and reporting requirements that demonstrate the management actions in the SMP are effectively implemented and produce the intended results.

The seasonal terrestrial ecology surveys have included habitat assessments and identification of animal breeding places. This information has been used to inform an evaluation of species likelihood of occurrence on the site, habitat mapping and an assessment of potential impacts to threatened fauna species. The field survey results would inform the preparation of a High Risk SMP due to the occurrence of EVNT fauna species.

2.4 Queensland Environmental Offsets Act 2014

In Queensland there is an offsets framework governed by a range of legislation, policies and guidelines to support a determination as to when environmental offsets are required, and how they are to be delivered. A summary of the framework and guiding principles that apply is summarised below.

The Queensland Offsets Framework includes:

- *Environmental Offsets Act 2014* (EO Act);
- *Environmental Offsets Regulation 2014* (EO Regulation);
- Queensland Environmental Offsets Policy (QEOP) (version 1.9); and
- Significant Residual Impact Guideline – for MSES and prescribed activities assessable under the *Sustainable Planning Act 2009* (DSDIP 2014)¹.

Under the Queensland Environmental Offsets Framework an environmental offset may be required when a significant residual impact occurs to a MSES. MSES are prescribed in Schedule 2 of the EO Regulation and include:

- Endangered and vulnerable flora and fauna species under the NC Act and their habitats;
- Special least concern fauna species under the NC Act and their habitats;
- Endangered and of concern REs under the VM Act;
- Essential habitat (mapped by DES);

¹ Note – whilst the *Sustainable Planning Act 2009* is superseded by the *Planning Act 2016*, this SRI Guideline remains the relevant guideline for the purposes of assessing projects under State Code 23 and State Code 16.



- REs that intersect with wetlands and watercourses;
- Connectivity values;
- Wetlands of high ecological significance;
- Protected areas (including nature refuges);
- Declared fish habitat areas and waterways providing for fish passage; and
- Legally secured offset areas.

Impacts to the above MSES have been assessed in this report. An assessment of significant residual impacts to MSES has been completed for those prescribed matters relevant to the Project under State Code 16 and applying criteria from the SRI Guideline (DSDIP 2014). Environmental offsets will only be required if it is determined that there are significant residual impacts to the following listed matters:

- Endangered or Of Concern REs;
- REs within a defined distance of a watercourse;
- REs that intersect with a wetland;
- Connectivity; and
- Essential Habitat.

2.5 Biosecurity Act 2014

The *Biosecurity Act 2014* provides a legislative framework to manage pest flora and fauna, diseases and environmental contaminants, to address the impacts they have on the economy, environment, agriculture, tourism and society. The Act prohibits or restricts the introduction and spread of declared plant and animal pests within Queensland.

Field ecology surveys have identified the presence of pest plants and animals, including those with classifications under the Act. Weeds listed as weeds of national environmental significance (WoNS) were also noted during survey activities.

2.6 Fisheries Act 1994

Development that has potential to impact on fish passage may require an approval under the Planning Act. Waterway barrier works may inhibit the free movement of fish along waterways and onto floodplains, injure fish and affect fish health and habitat. Waterways for the purposes of the *Fisheries Act 1994* are defined by the Queensland Government mapping layer *Queensland Waterways for Waterway Barrier Works*. It is recognised this layer may not always be accurate on the ground; therefore, the responsibility for ensuring appropriate procedures are employed rests with the proponent. Waterways are colour-coded based on level of risk. Streams higher in the catchment generally have reduced habitat area and steeper slopes supporting smaller populations of fish, therefore these are of lower risk than larger streams lower in the catchment.

Where access roads for the Project may need to cross waterways a waterway barrier work permit may be required if the proposed works do not meet the *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (DAF 2018). An operational works permit for waterway barrier work includes activities such as the construction of dams and weirs, culverts, bridges, bed level crossings, causeways or bunds.



Any assessment of potential waterway barrier works will occur subsequent to the primary Project approvals under State Code 23 and State Code 16, and will be informed by further design.



3.0 Project Description

3.1 Project Area Description

The Project area is located across two properties: Glen Gordon Station (31SP288862) is a freehold property and Wooroora Station (1CWL3298) is a leasehold property. Both properties are primarily used for grazing and there are several easements intersecting them associated with roads and high-voltage electrical infrastructure. The Project area ranges from degraded (in the north) to relatively undisturbed (in the south).

Surrounding properties are used for grazing and conservation purposes, with National Parks and Timber Reserve abutting the northern and eastern boundaries of Wooroora Station. The Kennedy Highway is within 600 m of the Project area (approximately 3.7 km north-west of the Project area) whilst Tully Falls Road is within 5 km of the Wooroora Station eastern boundary.

The Project area is predominantly characterised by remnant vegetation with existing impacts generally limited to agricultural activities and electrical infrastructure.

The primary natural feature that is associated with the Project area is Blunder Creek (see **Plate 3-1**); a stream order four waterway on the Wooroora property that becomes a stream order 5 waterway on the Glen Gordon property as it runs east to west towards the Herbert River. 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 majority of infrastructure associated with the Project will avoid direct and indirect impacts to Blunder Creek.

Another natural feature within the Project area is Arthurs Seat, a large granite rock formation in the north-west of the Glen Gordon property. This site is reported to have importance as a local natural and cultural landmark. The Project footprint has been designed to avoid this feature.











Plate 3-1 Blunder Creek within Glen Gordon Property

3.1.1 Bioregion

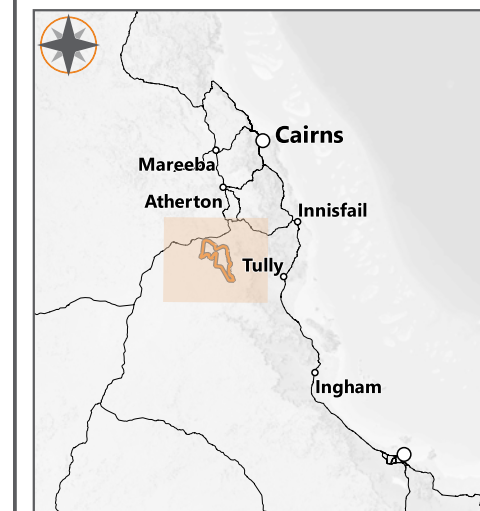
The Project area is located along the boundary between the Wet Tropics bioregion (to the east) and the Einasleigh Uplands bioregion (to the west). The eastern and southern parts of the Project area are within the Kirrima-Hinchinbrook sub-bioregion (7.6) and the north-western part is within the Herberton-Wairuna sub-bioregion (9.6) (**Figure 3-1**).

Chalumbin Wind Farm Bioregion and Sub-bioregion

Figure 3.1

-  Project Area
-  Project Footprint
-  Town
-  Peak
-  Major Road
-  Road
-  Biogeographic Region
-  Biogeographic Subregion

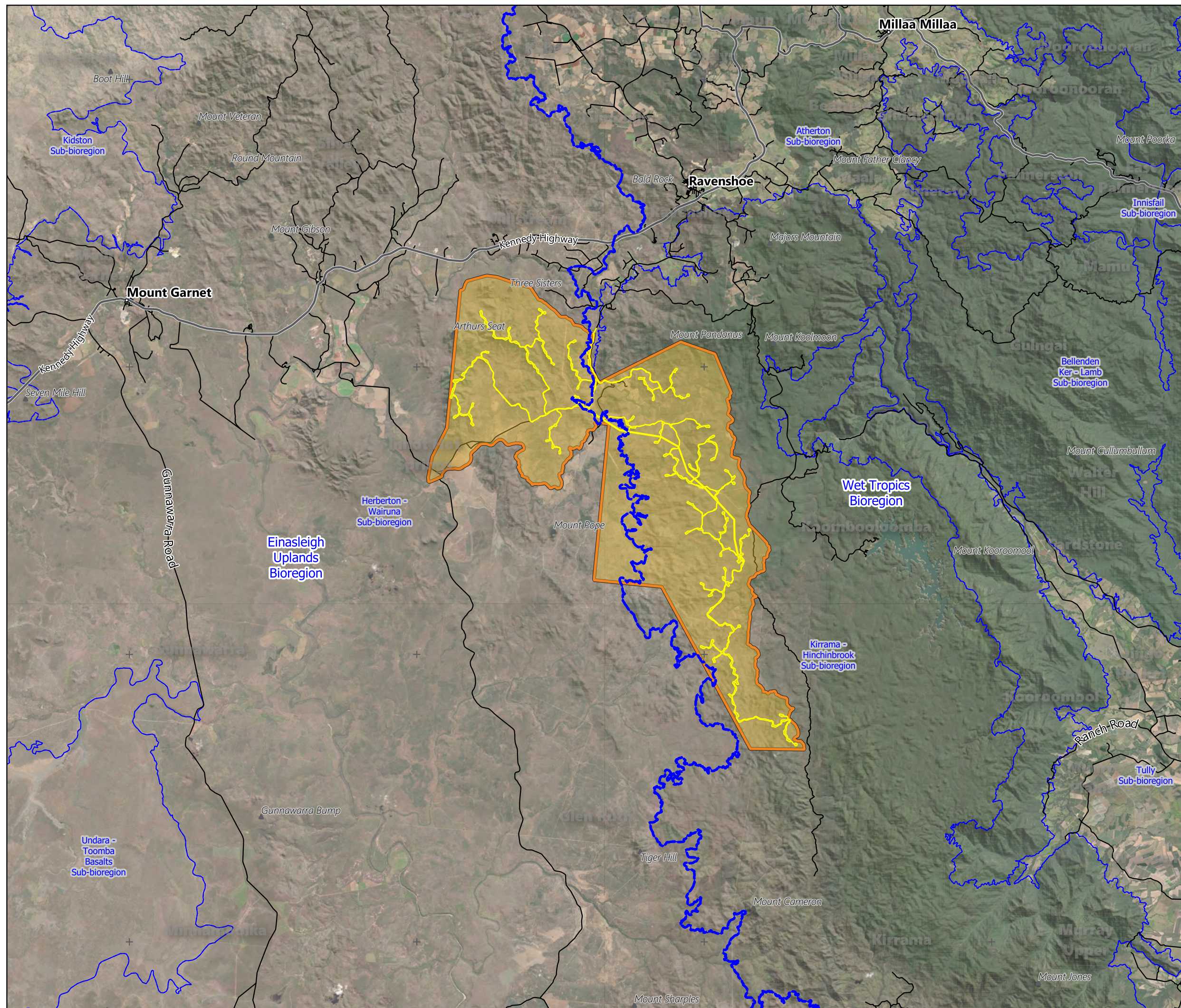
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 Author: TOD
 Reviewed: CC
 Project: EPU-004



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Data Source(s):
 Digital Cadastral Database - Department of Natural Resources, Mines and Energy (2021)
 Queensland Imagery Whole Of State
 Satellite Public Basemap Service



3.1.2 Vegetation

Vegetation within the Project area is generally of remnant status and dominated by various communities associated with woodlands or open forests. Some areas have been cleared for grazing, generally within close proximity to the homesteads. The most common vegetation community within the Project area is Regional Ecosystem (RE) 9.12.2, a woodland community dominated by a mix of *Corymbia citriodora*, *C. intermedia* and *Eucalyptus portuensis* that occurs on the slopes and ridges of hills across both Wooroora and Glen Gordon Stations (**Plate 3-2**). Within the Einasleigh Uplands bioregion portion of the Project area, the equivalent vegetation community (RE 7.12.34) is the second most dominant. At the tops of many of these hills, scattered rocky scarps and rocky granite pavements contain shrubland and closed forest communities of *Acacia* spp. and *Lophostemon suaveolens* associated with RE 7.12.65k (**Plate 3-3**). Other communities that occur across these hills include the *Eucalyptus reducta* dominated RE 7.12.21, *Eucalyptus resinifera* and *Corymbia intermedia* woodland associated with RE 7.12.52, and occasional patches of vine thicket.

The most common communities within the low-lying areas of the Project area are RE 9.5.5a, a mixed woodland of *Eucalyptus crebra*, *Corymbia clarksoniana* and *C. citriodora* (**Plate 3-4**), and RE 9.3.16, a *Eucalyptus tereticornis* and *E. platyphylla* woodland occurring on alluvial flats.



Plate 3-2 *Corymbia citriodora* woodland on ridgeline



Plate 3-3 Rocky pavement shrub complex



Plate 3-4 Mixed Eucalypt woodland



3.1.3 Hydrology






The Project area is located on the north-eastern edge of the Herbert River catchment, the largest catchment of the Wet Tropics region (**Figure 3-2**). 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 km² (Heiner & Grundy 1994). Blunder Creek flows east to west across both Wooroora and Glen Gordon Stations 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. There is a series of stream orders 1, 2 and 3 across the site, including within the Project footprint. Waterways include creeks with a soft substrate bottom, and rocky gullies with distinct water holes and densely vegetated riparian vegetation. A number of farm dams also occur within the Project area.

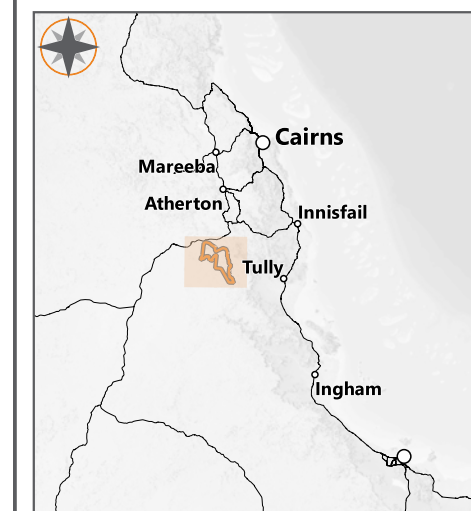
The majority of the lower order waterways within the Project area were not running or were holding stagnant water at the time of the dry-season flora surveys (October 2020). During the wet-season fauna surveys (January-March 2021), all waterways were at the upper limit of their capacity with scattered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

Chalumbin Wind Farm Hydrology

Figure 3.2

-  Project Area
-  Major Road
-  River
-  Creek/Watercourse
-  Catchment Boundary

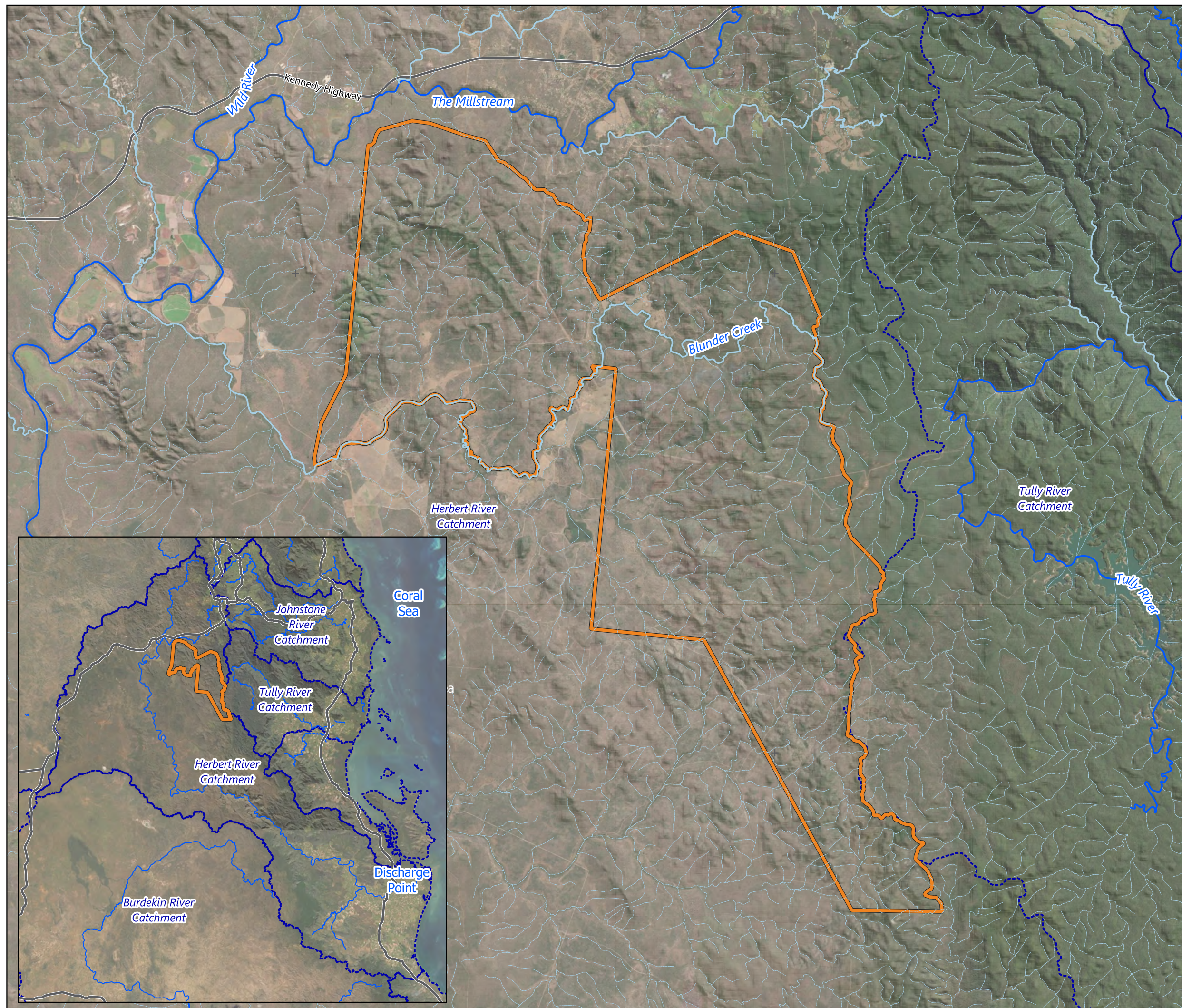
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 Project: EPU-004



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Data Source(s):
 Digital Cadastral Database - Department of Natural Resources,
 Mines and Energy (2021)
 Queensland Imagery Whole Of State
 Satellite Public Basemap Service










3.1.4 Soils and Geology

The Project area displays characteristics associated with both the Wet Tropics and Einasleigh Uplands bioregions, with a mix of soils and 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 (**Figure 3-3**).

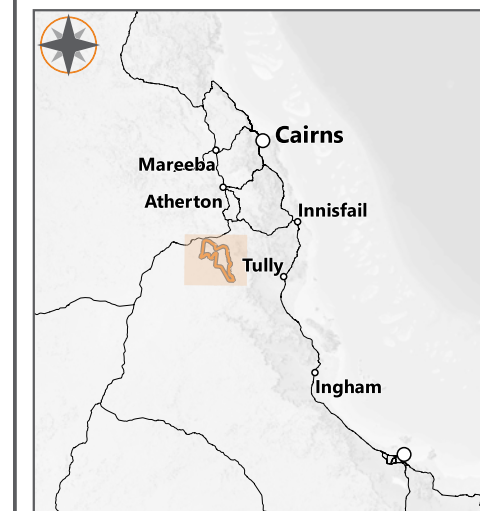
Lower areas within the Project area range from the imperfectly or poorly drained soils in the north, to the non-sodic soils on alluvia that dominate the central and southern extent. Glen Gordon Station is defined by broad areas of weakly to moderately pedal yellow and grey soils formed after sediments 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 Station 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 (**Figure 3-3**).

Chalumbin Wind Farm Surface Geology

Figure 3.3

-  Project Area
-  Wind Turbine
-  Met-mast
-  Project Footprint
-  Major Road

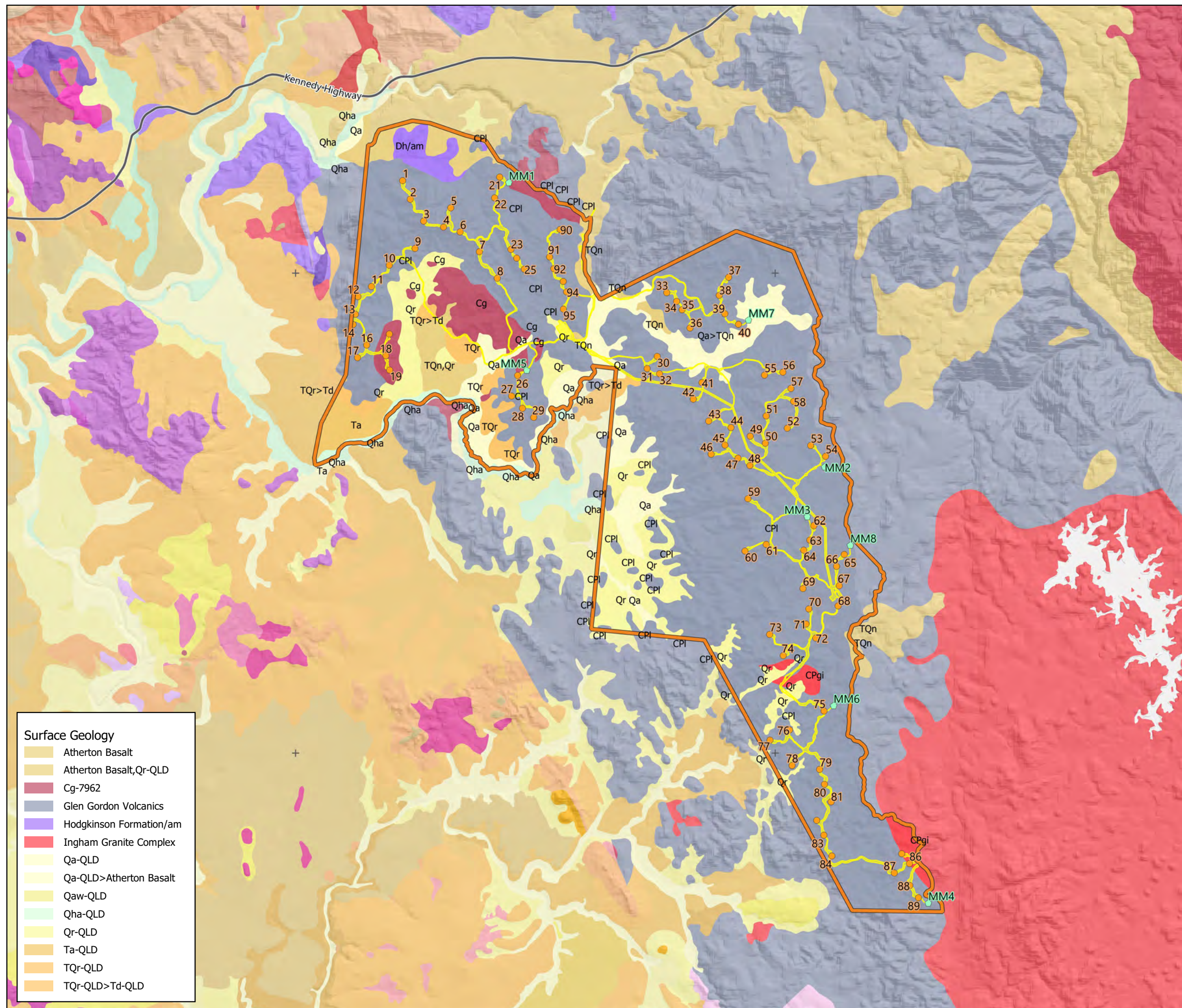
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 Reviewed: CC
 Project: EPU-004

















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Data Source(s):
 Digital Cadastral Database - Department of Natural Resources,
 Mines and Energy (2021)
 Queensland Imagery Whole Of State
 Satellite Public Basemap Service



- Surface Geology**
-  Atherton Basalt
 -  Atherton Basalt, Qr-QLD
 -  Cg-7962
 -  Glen Gordon Volcanics
 -  Hodgkinson Formation/am
 -  Ingham Granite Complex
 -  Qa-QLD
 -  Qa-QLD>Atherton Basalt
 -  Qaw-QLD
 -  Qha-QLD
 -  Qr-QLD
 -  Ta-QLD
 -  TQr-QLD
 -  TQr-QLD>Td-QLD

3.1.5 Elevation

The Project area is located on the southern edge of the Atherton Tablelands, a fertile plateau forming part of the northern extent of the Great Dividing Range in Queensland. This plateau sits at an average of 600 m Australian Height Datum (AHD), rising to 800 m AHD in the west and reaching over 1000 m AHD on the tops of the remnants of shield volcanoes (Whitehead 2003). Landscape formations across the Atherton Tablelands are derived from a range of lithologies but the most important are rhyolite, granite and fine-grained sedimentary rocks (Heiner & Grundy 1994).

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 (**Plate 3-5**). These ridges form the boundary of the local watershed formation, draining south-west 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.

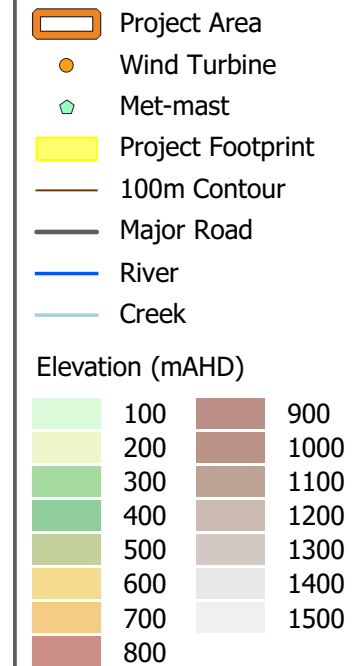
The proposed wind turbine locations are predominantly situated on the eastern and northern ridgelines described above, or occasionally located on other isolated scattered hills within the properties, with elevations ranging from 730 m to 990 m (**Figure 3-4**).



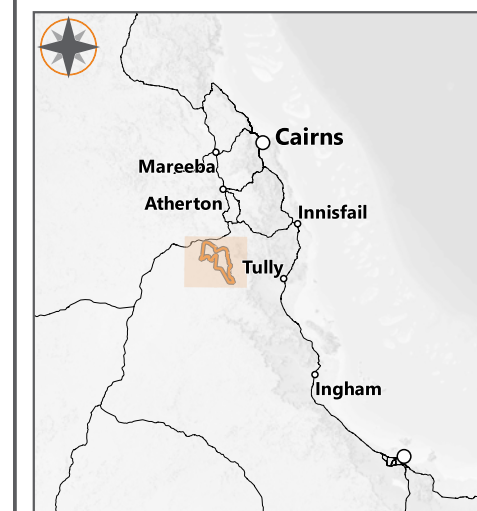
Plate 3-5 Glen Gordon ridgeline

Chalumbin Wind Farm Elevation

Figure 3.4

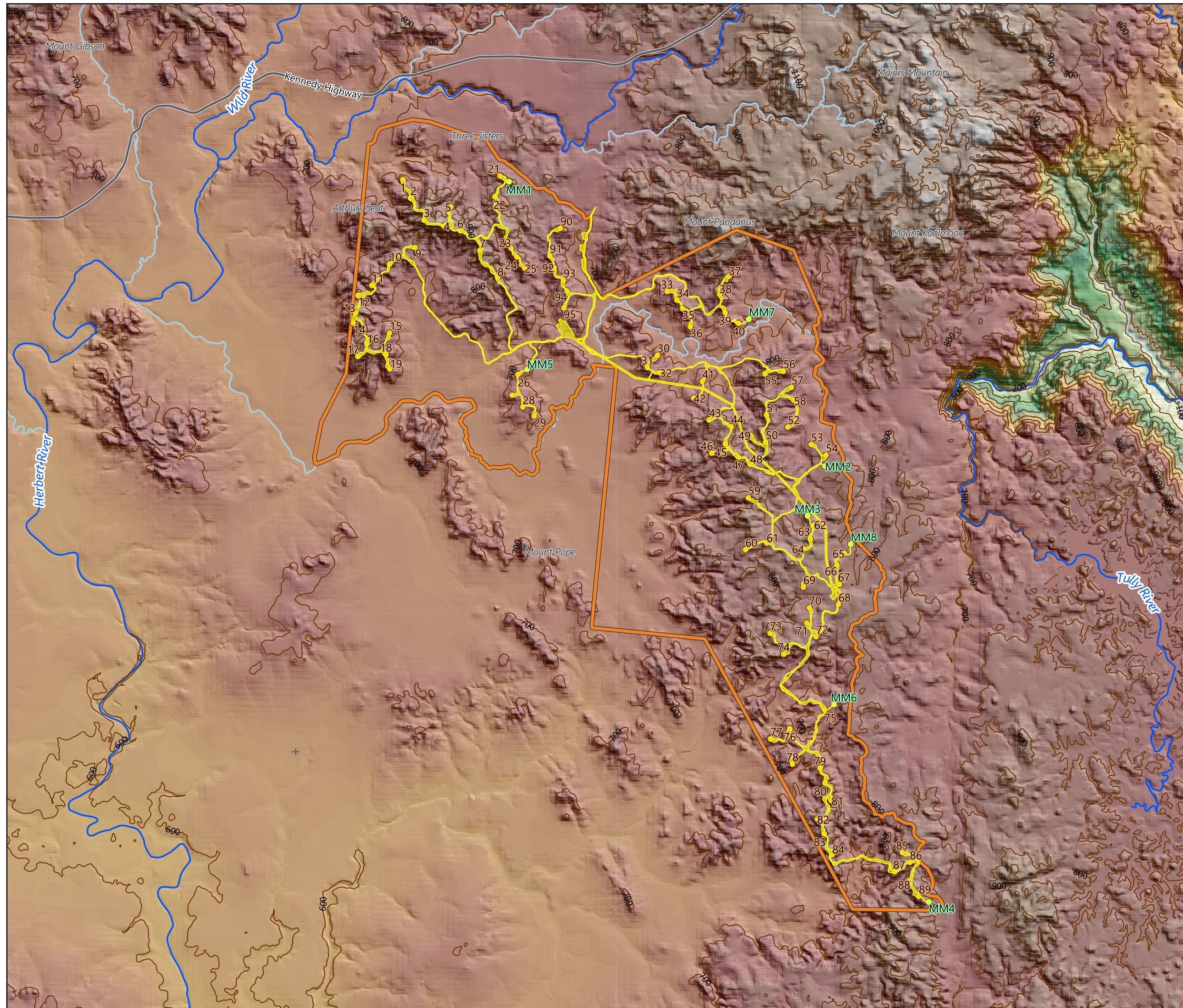


Date: 2021-12-10
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Data Source(s):
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 Queensland Imagery Whole Of State
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3.2 Project Components

Key project components are shown in **Figure 3-5** and include:

- Up to 94 wind turbines, each up to 7 MW with a total potential nameplate wind farm generating capacity of 658 MW or 2,170 GWh/annum. Turbine towers will be up to 160 m tall and turbine blades may be as long as 90 m. Each turbine will require a handstand area to allow for the turbine foundation, laydown of components and area for crane use. This area will also encompass firebreaks around the turbine foundation.
- A new Powerlink connection substation adjacent to the existing 275 kV Powerlink line in the central north of the Project area. This may be collocated with a combination of other electrical infrastructure such as a battery energy storage system (BESS), statcom, cap banks and/or synchronous condenser.
- Two wind farm collector substations (one adjoining the Powerlink switching yard and one towards the east of the Project area) which will bring together the ≤ 66 kV powerlines from the surrounding wind turbine locations. Here, main transformers will convert the electricity to high voltage (≤ 275 kV). For the transformers, the heaviest infrastructure on the Project, special foundations are installed to ensure the safety and durability of the substation.
- Medium-voltage (≤ 66 kV) overhead and underground powerlines – wind turbines generate at low voltage (approx. 3 kV) and have a transformer to convert into medium voltage (≤ 66 kV). The turbines are then connected in strings of 4-5 turbines per string, and the string is typically buried alongside wind farm access tracks. In order to reduce electrical losses, and to simplify construction, once a few strings are running in parallel they are converted to overhead and run toward the central collector substation where the power is collected and converted to high voltage (≤ 275 kV). Underground powerlines will be constructed running in parallel with access tracks wherever practicable.
- High voltage (≤ 275 kV) overhead powerlines – overhead line is proposed from the substation to the connection switchyard and into the wider grid. This high voltage powerline corridor is proposed to be 60 m wide, accounting for easement width requirements and incorporating firebreaks around poles (once detailed design is undertaken).
- Permanent wind monitoring masts – up to 8 are expected to be installed. The base of each mast will consist of a concrete foundation and will be installed for approximately 30 years.
- Unsealed access tracks – access tracks are required to each turbine and supporting infrastructure such as the substation. Initial road design estimates a total of 149 km of access tracks are required. Where practicable existing cleared tracks will be used and upgraded where needed to minimise vegetation clearing and fragmentation. New tracks will also be placed in cleared areas where possible and clearing widths minimised. Watercourse crossings are generally expected to be at bed level, aside from one or two major watercourse crossings. Due to the steep, complex terrain across the Project area clearing widths will vary based on earthworks required at key locations. Widths of the access track disturbance area will vary, dependent on the complexity of the terrain and the ability to safely construct the required earthworks.
- Temporary and permanent site entrance – the proposed main access to the Project is from the north off Wooroora Road, south of Ravenshoe.
- New fencing with grids and gates (within the Project footprint).
- Two concrete batching plants are proposed to be located within the Project footprint. These areas will either be rehabilitated post-construction, or used for alternative long-term infrastructure as they are only required during construction phase.
- A temporary construction compound/laydown and stockpile area will be located in the north of the Project area near the site entrance in an existing cleared area. This area will be rehabilitated post-construction. Additional



laydown is provided for at each turbine location (as described above). Another satellite construction compound is proposed in the east of the Project area.

- Temporary site offices, workshops, warehouses and amenities (located in the construction compound/laydown areas).
- Permanent site offices for asset management and operation and maintenance facilities.

These Project components are described in further detail in section 3.3 of the Project's Planning Report, submitted as part of the development application under the Planning Act.

Construction activities associated with the Project will broadly consist of:

- site establishment and preparation, including access tracks and internal electrical reticulation;
- turbine installation using cranes;
- permanent meteorological mast installation;
- medium voltage underground cabling interconnecting wind turbine sites;
- construction of substation and control room and battery energy storage system;
- construction of overhead powerlines for reticulation;
- construction of the operations and maintenance facility;
- connection of the wind farm to the existing 275 kV overhead powerline; and
- testing and commissioning of the wind farm.

The Project layout and main components are illustrated in **Figure 3-5**.