Wind Energy Partners Pty Limited

Hills of Gold Wind Farm

Environmental Impact Statement

Developed in Partnership by Clean Energy Partners Pty Limited

Development Management by:

18 November 2020

Project No.:0550690

The business of sustainability

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18 November 2020

Hills of Gold Wind Farm

Environmental Impact Statement

Amanda Antcliff
Principal Consultant

Murray Curtis
Partner

Environmental Resources Management Australia Pty Ltd
Level 15 309 Kent Street
SYDNEY NSW 2000

CERTIFICATION

This Environmental Impact Statement (EIS) has been prepared to accompany a development application for State Significant Development in accordance with the *Environmental Planning and Assessment Act 1979*.

Prepared by

Amanda Antcliff

Bachelor of Environmental Science

Graduate Diploma Urban and Regional Planning

Environmental Resources Management Australia Pty Ltd

Level 1, 45 Watt Street, Newcastle NSW 2300

Murray Curtis ('Responsible Person')

Bachelor of Engineering (Hons Class 1) (Natural Resource Engineering)

Environmental Resources Management Australia Pty Ltd

Level 1, 45 Watt Street, Newcastle NSW 2300

Applicant

Wind Energy Partners Pty Ltd

Level 33, Rialto South Tower

525 Collins Street

Melbourne VIC 3000

ABN: 28 1451 733 24

Description of Development

Hills of Gold Wind Farm: Construction and operation of a wind farm, battery energy storage system and transmission line consisting of 70 wind turbine generators and associated infrastructure near Hanging Rock, NSW.

Refer to Chapter 3 of this EIS for a detailed description of the proposed development.

Land to be developed

The land to be developed is as detailed in Table 4-2 and Table 4-3 of the EIS.

Declaration

We declare that the contents of this EIS has been prepared in accordance with the *Environmental Planning and Assessment Act 1979*, Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* and the Department of Planning and Environment Secretary's Environmental Assessment Requirements issued for the development dated 22 November 2018. The information contained in this EIS, to the best of our knowledge, contains all available information that is relevant to the environmental assessment of the development and the information provided is neither false nor misleading.

Amanda Antcliff

18 November 2020

Murray Curtis

18 November 2020

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Acronyms and Abbreviations

Abbreviation	Description
AAAA	Aerial Agriculture Association of Australia
ABS	Australian Bureau of Statistics
ACMA	Australian Communications and Media Authority
AGL	Above Ground Level
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
ALA	Aircraft Landing Area
ALARP	As Low As Reasonably Practicable
ANZECC	Australian and New Zealand Environment Conservation Council
APZ	Asset Protection Zone
ASA	Air Services Australia
ASS	Acid Sulfate Soil
ATC	Air Traffic Control
BCA	Building Code of Australia
BCD	Biodiversity Conservation Division of DPIE
BC Act	Biodiversity Conservation Act 2016
BFMC	Bushfire Management Committee
BGS	Below Ground Surface
BoM	Bureau of Meteorology
Bulletin	*Wind Energy: Visual Assessment Bulletin*
CAR	Civil Aviation Regulation
CASA	Civil Aviation Safety Authority
CB	Citizens' Band Radio
CCC	Community Consultative Committee
CEP	Community Enhancement Program
CHAR	Cultural Heritage Assessment Report
CLM Act	*Contaminated Land Management Act 1997*
CO_2 –e	Carbon dioxide equivalent
CoRTN	*United Kingdom (UK) – Calculation of Road Traffic Noise*
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTMP	Construction Traffic Management Plan
dB	decibel
DECC	Department of Environment and Climate Change
DNG	Derived Native Grassland

Abbreviation	Description
DoD or Defence	Commonwealth Department of Defence
DoAWE	Commonwealth Department of Agriculture, Water and the Environment
DPIE	NSW Department of Planning, Industry and Environment
DUAP	Department of Urban Affairs and Planning
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EMF	Electromagnetic Field
EMI	Electromagnetic Interference
EMP	Environmental Management Plan
EMR	Electromagnetic Radiation
EMS	Environmental Management Strategy
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPA	NSW Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPI	Environmental Planning Instrument
EPL	Environmental Protection Licence
ERA	Environmental Risk Assessment
ERM	Environmental Resources Management Australia Pty Ltd
ESD	Ecologically Sustainable Development
EVC	Ecological Vegetation Class
FDI	Fire Danger Index
FM	Frequency Modulation
FM Act	*Fisheries Management Act 1994*
FTE	Full time equivalent
GHG	Greenhouse Gas
GIS	Geographic Information System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GWh	Gigawatt hours
ha	hectares
Hz	Hertz
IEC	International Electro technical Commission
INP	*NSW Environmental Noise Management – Industrial Noise Policy*
IPC	Independent Planning Commission
ISEPP	*State Environmental Planning Policy (Infrastructure) 2007*
ISO	International Standards Organisation

Abbreviation	Description
ISP	Internet Service Providers
km	kilometre
kV	Kilovolt
LGA	local government area
LSALT	Lowest Safe Altitudes
LCVIA	Landscape Character and Visual Impact Assessment
LRET	Large-scale Renewable Energy Target
m	metres
Minister	NSW Minister for Planning and Public Spaces
MNES	Matters of National Environmental Significance
MOS	Manual of Standards
Mt	Million tonnes
MW	Megawatt
NEM	National Electricity Market
NHMRC	National Health Medical Research Council
nm	Nautical Miles
NMP	Noise Management Plan
NP&W Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
NSW WFG	DPI Planning Guidelines Appendix B NSW Wind Farm Noise Guidelines 2011
NW Act	*Noxious Weeds Act 1993*
OECD	Organisation for Economic Cooperation and Development
OEH	NSW Office of Environment and Heritage (now BCD)
OH&S	Occupational Health and Safety
OLS	Obstacle Limitation Surface
PA	Project Area
PAD	Potential Archaeological Deposit
PANS-OPS	Procedures for Air Navigation Services – Operations Surfaces
PBP	Planning for Bushfire Protection
PCT	Plant Community Types
PEA	Preliminary Environmental Assessment
PoEO Act	*Protection of the Environment Operation Act 1997*
PSR	Primary Surveillance Radar
RAP	Registered Aboriginal Party
RAV	Restricted Access Vehicles
RBL	Rating Background Level

Abbreviation	Description
REAP	Renewable Energy Action Plan
RECs	Renewable Energy Certificates
RET	Renewable Energy Target
RFS	NSW Rural Fire Service
RMS	Roads and Maritime Services (now Transport for NSW))
RNP	Road Noise Policy
Roads Act	*Roads Act 1993*
RSA	Rotor Swept Area
SA WFG	South Australia EPA Environment Noise Guidelines for Wind Farms
SA EPA	South Australian Environmental Protection Authority
SCADA	Supervisory control and data acquisition
SEARs	Secretary’s Environmental Assessment and Requirements
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
SRD SEPP	*State Environmental Planning Policy (State and Regional Development) 2011*
SRES	Small-scale Renewable Energy Scheme
SSD	State Significant Development
SSR	Secondary Surveillance Radar
SWL	Standing Water Level
SWMP	Soil and Water Management Plan
The Proponent	Wind Energy Partners Pty Ltd
TfNSW	Transport for NSW
vpd	Vehicles per day
WFGGT	Wind Farm Greenhouse Gas Savings Tool
WHO	World Health Organisation
WM Act	*Water Management Act 2000*
WTG	Wind Turbine Generator
ZVI	Zone of Visual Influence

Glossary

Term	Description
Development Corridor	The Development Corridor is the broader investigation area for the Project used in technical assessments to inform design layout and impact mitigation.
Development Footprint	The Development Footprint is the area in which physical disturbance is proposed for the development of the Project, including the Permanent Development Footprint and Temporary Development Footprint.
Direct Employment	Direct employment includes the employees who are directly employed in developing, constructing and/or operating the wind farm.
Endangered Ecological Community (EEC)	An ecological community listed as protected by the NSW *Biodiversity Conservation Act 2016*.
native	Flora or fauna species that existed in NSW before European settlement.
negligible	Small and unimportant, such as to be not worth considering.
Obstacle Limitation Surface	These are a series of surfaces that set the height limits of objects around an aerodrome. Objects that project through the OLS become obstacles.
offset (biodiversity)	One or more appropriate actions put in place in an appropriate location to counterbalance a development's impact on biodiversity values.
PCT ID	An abbreviation meaning Plant Community Type Identification Number as according to the NSW Vegetation Information System.
perennial stream	Stream with a well-defined channel that flows continuously all year during a year of normal rainfall with the aquatic bed located below the water table for most of the year.
Permanent Development Footprint	This is the area of land that will be subject to permanent alteration as a result of installation and operation of Project infrastructure.
Plant Community Type (PCT)	From BBAM (2014): A NSW plant community type identified using the PCT classification system.
population	A group of animals or plants of the same species, potentially capable of interbreeding and sharing the same habitat in a particular area at a particular time.
Procedures for Air Navigation Services – Operations surfaces (PANOPS)	This refers to the rules for designing aircraft instrument approach and departure procedures. The procedures are used to allow aircraft to land and take off when instrumental meteorological conditions impose instrument flight rules.
Project Area	The term Project Area refers to the area in which Wind Energy Partners has applied to develop the Project. The Project Area encompasses the parcels of land associated with the Development Footprint.
WTG Project Area	The parcels of land associated with the WTGs and associated infrastructure, and is the Project Area excluding the transmission line land parcels.
Prudent Avoidance	The avoidance without undue inconvenience and monetary expense to avert the possible human health risks associated with exposure to new high voltage transmission lines.
regeneration	Where native vegetation is allowed to return naturally to an area generally by removing existing impacts such as grazing or slashing.
regrowth vegetation	Defined in the *Native Vegetation Act 2003* as any native vegetation that has regrown since 1 January 1990 (or 1 January 1983 Western Division). Excluding regrowth after illegal clearing or natural events such as bushfire, floods and drought.
remnant vegetation	Any native vegetation that is not regrowth.
riparian	Associated with drainage lines.
Temporary Development Footprint	This is the area of land which will be temporarily disturbed during construction of the Project, and rehabilitated following construction, in order to minimise permanent impacts to biodiversity. Mitigation measures in these areas are to include revegetation, spreading mulched or cleared vegetation and spreading native grass seed with local species.

Term	Description
the Project	In this report, the Project refers to the proposal by the proponent (WEP) to construct and operate the Hills of Gold Wind Farm. The Project will involve the construction of up to 70 wind turbine generators and associated infrastructure as described in this EIS.
the Project Team	The Project Team consists of Wind Energy Partners (the Proponent), ENGIE, Someva (Development Managers), Environmental Resources Management Australia Pty Ltd (ERM) and their in-house and external technical specialists.
Threatened Ecological Community (TEC)	An ecological community listed as protected by the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
threatened flora	A species of plant listed as protected by the EPBC Act or the BC Act
threatened species	A species listed as protected by the EPBC Act or the BC Act
Total Economic Impact	The direct effect of the initial increase in demand and the associated flow-on effects throughout the economy. For example, the direct manufacture of WTGs requires the purchase of steel and other materials from suppliers, these suppliers would then need to restock to meet commitments to other customers creating a production induced flow-on effect in the economy.
Vegetation Information System	A resource held and administered by BCD that contains information on the vegetation types of NSW, mapping products and previous vegetation survey details.
vegetation type	A general term used to describe an association of flora species that are recognisable as a unit or grouping based on observed co-occurrence. Includes both native and non-native vegetation.
vegetation zone	From BBAM (2014): a relatively homogenous area of native vegetation on a development or BioBank site that is the same PCT and broad condition state.

EXECUTIVE SUMMARY

This Environmental Impact Statement (EIS) has been prepared for Wind Energy Partners Pty Ltd (WEP or the Proponent) to assess the environmental matters relating to the proposed development of the Hills of Gold Wind Farm (the Project) located on the ridge line between Hanging Rock and Crawney Pass in the Northern Tablelands region of New South Wales (NSW).

The Project is located approximately 5 km south of Hanging Rock and 8 km south-east of Nundle. The Project is contained within three Local Government Areas (LGA) being the Tamworth Regional LGA, the Upper Hunter Shire LGA, and the Liverpool Plains Shire LGA.

The wind farm site and transmission line route area comprises of 14 freehold landholdings, a Crown land allotment and Crown land paper roads, covering approximately 8,316 hectares (ha) ('Project Area'). Upgrades to the public road network are located outside the Project Area. The total development footprint of all aspects of the Project, including the wind farm site, transmission line route and transport route upgrades is approximately 513 ha.

The Project is declared to be State Significant Development (SSD) under clause 20, Schedule 1 of *State Environmental Planning Policy (State and Regional Development) 2011* and therefore requires development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Environmental Resources Management Australia Pty Ltd (ERM) was commissioned by WEP to prepare this EIS to support the SSD application. This EIS has been prepared in accordance with the requirements of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* and with due regard to the Department Planning and Environment's (DPE) *Wind Energy Guideline for State significant wind energy development* (December 2016) (now Department of Planning, Industry and Environment (DPI&E)) to address the Secretary's Environment Assessment requirements (SEARs) and Supplementary SEARs issued by the Commonwealth Department of Agriculture, Water and the Environment.

The Project is owned by ENGIE ANZ, a joint venture between ENGIE S.A. and Mitsui & Co. Ltd. ENGIE S.A. is a global company with extensive experience in the energy sector and more than 103 gigawatts of installed power generation capacity, including 25% in renewables such as wind and solar photovoltaic technologies. This makes ENGIE S.A. the world's largest independent power producer with a presence in 70 countries and 170,000 employees. ENGIE S.A.'s long-term goal is to accelerate the transition to a carbon-neutral economy. To accomplish this, in Australia and New Zealand, the ENGIE ANZ joint venture has 1,200MW of low-carbon generation capacity and more than 800MW of renewable energy under development including this Project.

E.1 Project Description

The Project involves the construction, operation and decommissioning of a wind farm with 70 wind turbine generators (WTG), together with associated and ancillary infrastructure. The proposed wind farm will have an approximate energy generating capacity of 420 megawatts (MW) and includes a 100MW/400MWh battery energy storage system (providing 4 hours of storage for 100MW).

The Project has been revised and refined over time in response to design and constructability requirements, and in consideration of environmental constraints and the outcomes of community consultation.

The key components of the Project are:

- 70 WTGs, each with:
  - a generating capacity of approximately 6 MW;
  - three blades mounted to a rotor hub on a tubular steel tower, with a combined height of blade and tower limited to a maximum tip height of 230 m AGL (to the blade tip);
  - a gearbox and generator assembly housed in a nacelle; and

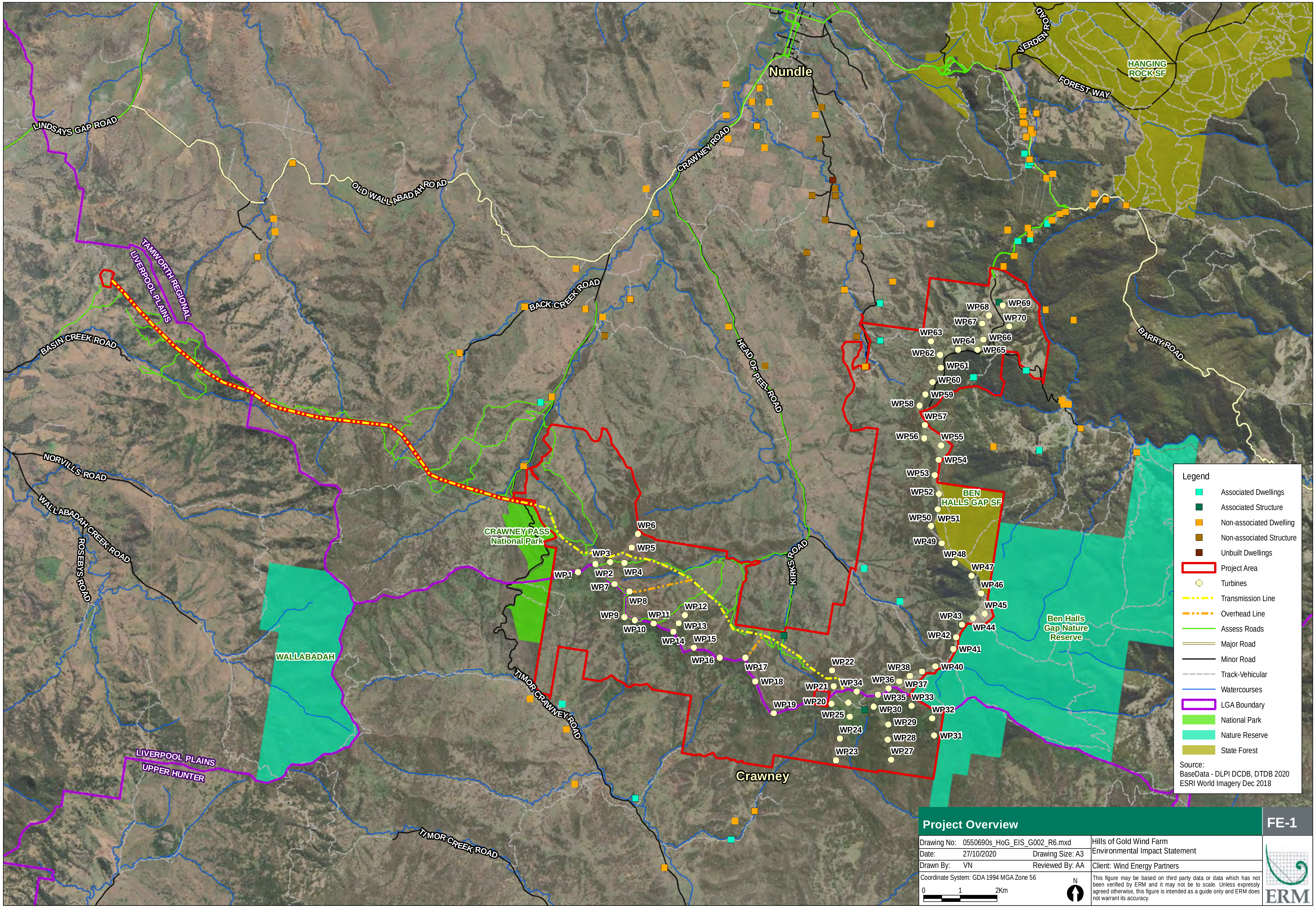
  - adjacent hardstands for use as crane pads and assembly and laydown areas;

- decommissioning of three current monitoring masts and installation of up to five new monitoring masts for power testing. The new monitoring masts will be located close to a WTG location with a maximum height of approximately 150 m AGL, equivalent to the hub height of the installed WTGs. The exact number and location will be determined at the detailed design stage;
- a central 330 kV electrical substation, including transformers, insulators, switchyard and other ancillary equipment;
- an operations and maintenance facility;
- a battery energy storage system (BESS) of 100MW/400 MWh (4 hours of storage for 100MW);
- aboveground and underground 33 kV electrical reticulation and fibre optic cabling connecting the WTGs to the onsite substation (designed to follow site access tracks where practicable) (connection lines);
- a 330 kV single circuit twin conductor overhead transmission line (transmission line). The transmission line will to connect the onsite substation to the existing 330 kV TransGrid Liddell to Tamworth overhead transmission line network, located approximately 18.8 km west of the substation, or approximately 13.5 km from the WTG Project Area;
- a switching station to connect the transmission line to the existing TransGrid Liddell to Tamworth 330 kV transmission line and enable the Project to connect to the gird. The switching station will also be located approximately 18.8 km west of the substation, or approximately 13.5 km from the WTG Project Area;
- an internal private access road network (combined total length of approximately 48 km) connecting the WTGs and other Project infrastructure to the public road network; and
- upgrades to local roads and crossings required for the delivery, installation and maintenance of WTG components and associated materials and structures.

The following temporary elements will be required during construction of the Project:

- temporary site buildings and facilities for construction contractors / equipment, including site offices, car parking and amenities for the construction workforce;
- two temporary concrete batching plants to supply concrete for WTG footings and substation construction works;
- earthworks for access roads, WTG platforms and foundations, potentially including controlled blasting in certain areas;
- potentially rock crushing facilities for the generation of suitable aggregates for concrete batching and/or sized rock for access road and hardstand construction;
- up to seven additional hardstand areas for the temporary storage of construction materials, plant, and equipment during construction;
- external water supply for concrete batching and construction activities;
- the transport, storage and handling of fuels, oils and other hazardous materials for construction and operation of wind farm infrastructure and
- beneficial reuse of materials won from the development footprint during cut and fill and WTG foundation excavation for use in roads, hardstands and foundation material.

A Project overview is provided in Figure E-1.



Nundle
HANGING ROCK SF
VERDEN ROAD
FOREST WAY
BARRY ROAD
LINDSAYS GAP ROAD
OLD WALLABADAH ROAD
CRAWNEY ROAD
BACK CREEK ROAD
BASIN CREEK ROAD
TAMWORTH REGIONAL
LIVERPOOL PLAINS
HEAD OF PEEL ROAD
NORVILLS ROAD
WALLABADAH CREEK ROAD
ROSEBYS ROAD
KIRKS ROAD
TIMOR CRAWNEY ROAD
TIMOR CREEK ROAD
CRAWNEY PASS National Park
WALLABADAH
BEN HALLS GAP SF
Ben Halls Gap Nature Reserve
LIVERPOOL PLAINS
UPPER HUNTER
Crawney
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Minor Road
Track-Vehicular
Watercourses
LGA Boundary
National Park
Nature Reserve
State Forest
Source:
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018
Project Overview
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Drawing No: 0550690s_HoG_EIS_G002_R6.mxd
Date: 27/10/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
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Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partners
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM

E.2 Project Justification

The energy sector in Australia is undergoing a clean energy transition from a centralised system of large fossil fuel generation towards a decentralised system of widely dispersed renewable energy comprising mainly of wind and solar. The share of wind and solar in the NSW electricity generation mix tripled between 2014/15 to 2018/19, with 5.3 per cent of the State's electricity coming from wind in 2018/19.

Australia has one of the highest per capita emissions of carbon dioxide in the world. When emissions from Australia's current coal, oil and gas exports (3.6% of global total) are added to domestic emissions (1.4% of global total), Australia's contribution to the global carbon dioxide equivalent footprint is around 5%.[1] This is significant given that:

- the Australian population represents only around 0.3% of the world's population; and
- Australia is also one of the countries most exposed to the impacts of human induced climate change.

The Commonwealth Renewable Energy Target has set a 2020 target for energy from large scale renewable projects at 33,000 gigawatt hours. Once constructed, the Project will assist the scheme by supplying approximately 1,100 gigawatt hours per annum, the equivalent energy to supply 185,000 average Australian homes.

The NSW Electricity Strategy is the NSW Government's plan to achieve the three objectives of reliability, affordability and sustainability for the NSW electricity system. The Project is consistent with this strategy as it provides renewable energy generation and storage capacity that, together with other renewable generation projects, is expected to result in lower cost of power in comparison to wholesale prices. Further, the Project is uniquely positioned to take advantage of the existing transmission network and committed upgrades associated with the Queensland NSW Interconnector, which will increase the transfer of electricity between states and provide customers with access to reliable lower cost energy.

The Project would have an energy generating capacity of approximately 420 MW to the National Energy Market (NEM) and have an estimated capital investment value of $826 million, providing significant benefits to the Federal, State and local level by:

- **Alignment with Government Policy and Strategic Vision**: aligning with Commonwealth and NSW Government Policy and strategic vision by:
  - supporting the transition being undertaken in the energy sector away from a centralised system of large fossil fuel generation, towards a decentralised system of widely dispersed, renewable energy production;
  - providing necessary alternative electricity production given the forecasted retirement of coal-fired power stations;
  - contributing to GHG emission reductions in the order of 654,500 tonnes per annum, supporting Australia's commitment to the Paris Agreement on climate change;
  - provide a significant amount of new generation capacity which will be required when the 2000 MW Liddell Power Station located in the NSW Hunter Valley closes in 2023; and
  - contributing to NSW and Commonwealth renewable energy targets.
- **Regional and Local Benefits and Economic Stimulus**: delivering significant benefits to the regional and local communities and economic stimulus including:
  - the Project represents a direct investment of over $826 million and will result in the direct injection of approximately $100 million increased income during construction and $16M per year during operations;

[1] See https://climateanalytics.org/publications/2019/evaluating-the-significance-of-australias-global-fossil-fuel-carbon-footprint/

  - providing around 216 direct and roughly 430 on-flow jobs during construction and approximately 31 long-term service and maintenance jobs created during project operation and 53 on-flow jobs providing increased employment opportunities, including for local workers in the New England Region;
  - providing economic stimulus for rural NSW which will mitigate the ongoing economic impacts of the COVID-19 pandemic and the Black Summer Bushfires;
  - providing additional income stream for the involved landholders and diversity of land use;
  - renewable, low cost energy to the national grid, and will contribute to the NSW Government's new zero emissions target by 2050;
  - opportunities for local contractors and businesses, including the development of new skilled labour in the region within the growing renewable energy industry;
  - potential for new educational opportunities associated with construction and operation of the Project which will require a range of skills including engineering, trades (electrical, mechanical, construction), transport, building material providers, equipment operators, consultants and administrative staff;
  - diversifying regional employment opportunities beyond the productive agriculture sector;
  - opportunities for eco-tourism through the attraction of tourism opportunities associated with the wind farm;
  - providing improvements to the local road network, including proposed upgrade works to Barry's Road, Morisons Gap Road and Head of Peel Road;
  - a Voluntary Planning Agreement in the form of a Community Enhancement Fund to improve community assets; and
  - benefit sharing contributions from the Neighbour Benefit Sharing Program providing better diversification of income and a drought proof and post retirement income for farmers and the community.

- **Site Suitability**: the site suitability of the area for a wind farm, includes:
  - the high wind resource of the locality;
  - use of predominantly existing agricultural use and desirable ridge orientation for predominate wind directions with existing access tracks in existence; and
  - proximity to the existing 330 kV TransGrid Liddell to Tamworth transmission line with capacity to accept the generation electrical network.
- **Land Use Consistency**: carrying out development consistent with land use zoning and permissibility under relevant legislative provisions.
- **Community Engagement**: liaising and working with the community and all potentially affected stakeholders in the identification, mitigation and monitoring of any potential environmental effects.
- **Community Enhancement**: establishment of a Community Enhancement Fund. This will be supported by funding of $2,500 per operational wind turbine per year over the operational life of the Project and will be directed to:
  - improved community assets such as recreational facilities, public open space and public amenities; and
  - provide the community with the financial resources to help enhance lifestyle and opportunities for local residents around Hanging Rock, Nundle and communities close to the Project.
- **Environmental Factors**: minimising all potential and adverse environmental impacts and where practical, maximising all potential positive environmental effects. Other environmental benefits associated with the Project include reductions in air quality emissions, waste production (eg coal ash), and water use in comparison to traditional coal fired power stations.

The Project, therefore, will support the Commonwealth and NSW Governments in achieving their respective renewable energy and greenhouse gas emission reduction targets, and it will support a transition to low carbon economy. The Project will also provide much needed economic stimulus and social opportunities in rural regions while contributing to the long-term reduction in the cost of power.

E.3 Community and Stakeholder Engagement

The Project layout has been developed based on extensive community consultation to minimise environmental impacts and maximise benefits to stakeholders.

WEP and ENGIE are committed to effective and genuine engagement with key stakeholders and the local community to seek feedback to help inform the Project. As part of the refinement process for the Project and preparation of the EIS, consultation has been, and will continue to be, undertaken with a range of stakeholders including various local and NSW Government agencies, the local community, special interest groups and neighbouring landholders.

Engagement with stakeholders commenced in 2017 during the preparation of the Preliminary Environmental Assessment (PEA) and following the feasibility stages of the Project. The early consultation provided key community attitudes and special interest group feedback to sensitive issues to be considered as part of the request for SEARs and ultimately in the development of this EIS.

As part of the PEA and prior to the commencement of the EIS, a Stakeholder Engagement Strategy was prepared to guide ongoing consultation during EIS preparation and following EIS lodgement. The engagement and consultation activities have been led by Someva Renewables (Someva) and WEP with the support of ERM for agency consultation and to provide technical input to support community discussions.

The Stakeholder Engagement Strategy included an Action Plan mapping out engagement activities, targeted groups, key objectives and methods throughout the EIS preparation stage. Engagement was tracked via an online platform Simply Stakeholders, which allowed detailed records to be created for all types of interactions, open issues to be prioritised, and technical issues to be filtered for inclusion in the technical reports.

A range of engagement tools were deployed to engage with and seek input from the various government and community stakeholders, including face to face meetings, presentations, site visits, newsletter, community drop in sessions, public forums, Project website, community surveys, emails, phone calls and video calls, direct enquires and media. Technical assessment engagement was also undertaken with regulatory stakeholders.

Overall, feedback from stakeholders on the Project has generally been positive. Many of the issues raised were specific to a geographic location, an individual's views, or views of a special interest group. Key issues raised by stakeholders included concerns regarding visual and landscape, social and economic, flora and fauna (biodiversity), noise and vibration, traffic and transport, heritage, bushfires, aviation, waste, water and soils. The Proponent has taken into account the issues raised and incorporated these into the technical assessments and Project design, as relevant.

The Proponent proposes two key community enhancement and benefits programs:

- a Community Enhancement Fund in lieu of a Voluntary Planning Agreement; and
- a Neighbours' Benefits Sharing Program.

In addition to these, the Proponent will also incorporate road upgrades required for the Project at the Proponent's cost and which will be done in addition to the Community Enhancement Fund.

E.4 Environmental Assessment

A detailed assessment of the likely environmental impacts of the development has been undertaken, including supporting specialist assessments where required. The assessment involved a review of the existing environmental context, an assessment of the likely impacts, and development of measures to minimise and mitigate adverse impacts where possible.

The outcomes of the environmental assessment are summarised below:

Biodiversity

A Biodiversity Development Assessment Report was prepared for the Project (refer to Appendix D) to assess the potential impacts of the Project on biodiversity.

The assessment included vegetation and habitat mapping and flora and fauna surveys.

Field surveys and ground-truthed vegetation mapping confirmed the presence of two threatened ecological communities (TEC) listed under the BC Act and/or the EPBC Act within the development footprint:

- Ribbon Gum-Mountain Gum-Snow Gum Grassy Forest/Woodland of the New England Tableland Bioregion; and
- White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.

One threatened flora species, Broad-leaved Pepperbush *Tasmannia purpurescens*, was identified adjacent to the Development Footprint.

Thirteen threatened terrestrial fauna species were directly observed within the Development Footprint, including Koala, Greater Glider, Spotted-tailed Quoll, Southern Myotis, Large-eared Pied Bat, Little-Pied Bat, Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Little Bent-wing Bat, Large Bent-winged Bat, Greater broad-nosed bat, Eastern Cave Bat, and Grey-headed flying-fox.

In addition to the threatened fauna species directly observed within the Development Footprint, the detailed habitat assessments identified a high likelihood of occurrence for an additional four fauna species; Booroolong Frog, Border Tick-tailed Gecko, Eastern Pygmy Possum and Squirrel Glider.

The field surveys identified two species of raptor most at risk of collision, Nankeen Kestrel and Wedge-tailed Eagle.

Within the total combined Development Footprint of 513 ha, a total of 486.45 ha of vegetation was mapped, which includes vegetation communities classified as native vegetation, exotic grassland and planted/urban vegetation. The majority (58% or 279.75 ha) of the mapped vegetation within the Development Footprint is composed of exotic grassland or planted/urban vegetation, with 42% of the mapped vegetation (206.7 ha) being classified as native. The 206.70 hectares of native vegetation which is contained in the Development Footprint represents 0.95% of the approximately 21,540 ha of native vegetation contained within the biodiversity assessment study area.

The impacts to biodiversity as a result of the Project have been avoided and minimised as much as practicable through design phase refinements. Further mitigation measures are outlined and proposed to be adopted to minimise biodiversity impacts during the construction and operational phases and include the provisions of biodiversity offsets, management measures and monitoring and adaptive management measures.

The BDAR confirms that there are no serious and irreversible impacts from the Project. This is because:

- there is sufficient habitat availability in the wider landscape and study area to continue to support threatened species known to occur within the Development Footprint;
- the Project design has been refined so that the majority of vegetation impacts occur on areas that contain exotic grassland;
- the Project design avoids areas of breeding habitat for threatened microbats, by locating all infrastructure outside of the mapped cliffs and steep areas;

- impacts to high quality vegetation communities, containing higher quality fauna habitat have been minimised through the location of infrastructure; and
- residual impacts associated with the project will be offset in accordance with the NSW Biodiversity Offset Scheme and the EPBC Act Offsets Policy. Once these offsets are applied, no net loss to biodiversity should be achieved.

Noise

A Noise and Vibration Assessment was undertaken for the proposed construction and operation of the Project (refer Appendix E).

The assessment considers wind turbine and ancillary infrastructure operation, construction, temporary batching and traffic associated with the proposal, thereby addressing the environmental noise and vibration requirements of the SEARs.

Background noise monitoring was undertaken at six residential locations and one (1) community location to provide an indication of the existing acoustic environment of the inhabited areas surrounding the Project.

Predictions of the noise from various construction activities have been made based on typical sound power levels and on weather conditions that are the most conducive for the propagation of noise. To provide an indication of the noise level at dwellings, the predictions are based on the distance between turbine locations and dwellings and having line of sight to the construction activity, without the influence of barriers or topography.

The assessment identified that noise from the 70 WTGs will achieve the operational noise criteria in relevant policies and standards at all dwellings in the vicinity of the wind farm, with the exception of four dwellings, where exceedances of up to 3 dB(A) are predicted for some wind speeds. A curtailment regime is proposed to ensure that noise from the wind farm will fully comply with all operational noise criteria at all dwellings and under all wind speeds. The curtailment regime involves operating selected turbines in a noise reduced mode at the wind speeds where the conservative modelling indicates that the criteria will otherwise be exceeded.

All relevant noise and vibration criteria will be achieved under conditions most conducive to noise propagation at all dwellings when the curtailment regime is implemented.

Landscape and Visual

A Landscape and Visual Impact Assessment (LVIA) was prepared to assess the potential visual impacts associated with the Project on the landscape character, landscape values, landscape amenity and any scenic vistas in accordance with the *Wind Energy: Visual Assessment Bulletin* (DPE, 2016) (refer to Appendix F).

It is inevitable that the placement of wind turbines in a rural landscape will alter the existing landscape character of the area and be visible from surrounding dwellings to varying degrees.

The assessment identified 43 non-associated dwellings within 4,550 m of a proposed turbine with potential visual impacts resulting from the Project.

- a total of 22 non-associated dwellings and one dwelling location with a development application lodged (also non-associated) were assessed in detail within the 3,100 m visual magnitude. Of the 23 dwelling locations assessed, the proposed development is likely to be screened by vegetation from eight dwellings.
- 20 non-associated dwellings are located within 3,100 – 4,550 m of a proposed WTG. Views to the Project will be screened by topography from seven of the dwellings and existing vegetation is likely to screen or fragment views from an additional seven dwellings. The visual effect rating identified five dwellings with a moderate visual effect and eight with nil –low or low visual effect. Mitigation measures in the form of supplementary or screen planning have been outlined for these dwellings.

- Seven (7) dwellings were identified within 8km with more than two sectors of turbines using the multiple wind turbine tool. Of the seven dwellings identified, further assessment determined topography would screen views to turbines, reducing the number of turbines visible to an acceptable number of 60º sectors by six dwellings. The remaining non-associated dwelling is likely to have views of proposed turbines in up to three 60º sectors, however this dwelling is located approximately 5.62 km from the nearest turbine reducing the level of visual magnitude.

Further detailed dwelling assessments and mitigation measures were completed for each of the non-associated dwellings within the LVIA (Appendix F).

45 public viewpoints were assessed, taken from varying distances and locations surrounding the Project Area. Each viewpoint was assigned a Visual Influence Zone (VIZ) of High, Medium or Low based on their view sensitivity level, distance zone and scenic quality class combinations. The outcomes of the assessment were:

- Visual Influence Zone 1 (High) (VIZ1): two public viewpoints were identified as VIZ1. These viewpoints were located in Crawney National Park. The Project is unlikely to be visible from these viewpoints and will therefore not impact upon the existing visual features.
- Visual Influence Zone 2 (Medium) (VIZ2): A total of 20 viewpoints were rated as Visual Influence Zone 2 (VIZ2). Each of these were assessed against the performance objectives outlined in the Wind Energy Guideline Visual Bulletin.
- Visual Influence Zone 3 (Low) (VIZ3): 23 viewpoints were rated as VIZ3. There are no performance objectives for VIZ3 as per the Bulletin.

The assessment included photomontages prepared for 27 indicative viewpoints which were selected to best illustrate the potential appearance of the proposed wind farm from varying distances and locations with differing views.

A total of nine (9) dwellings were identified to experience potential shadow flicker, five of these are associated dwellings. Of the four non-associated dwellings with potential shadow flicker, only one has the potential to experience more than 30 hours per year. The assessment is based on a worst case scenario considering topography alone and no cloud cover days. This dwelling is surrounded by dense vegetation which would be likely to mitigate any potentially unacceptable limits of shadow flicker effects.

The results of the Aviation Impact Assessment concludes that the turbines and wind monitoring towers associated with the Project will not require aviation hazard lighting to maintain an acceptable level of safety to aircraft. However, as it is possible that the Civil Aviation Safety Authority or conditions imposed on any development consent granted for the Project may require aviation lighting. If required, aviation lighting is likely to be visible to motorists travelling towards the Project Area, in particular Crawney Road, Timor Crawney Road and Nundle Road. The aviation lighting has the potential to be a noticeable element in the night time landscape from areas around Nundle Village that have exposure to views towards the Project Area. Due to Nundle Village being a populated area, existing light sources from dwellings, buildings and street lights exist in the village which would reduce the visible effect of night lighting. Considering the high elevation of the turbines and implementation of shields, the source of visible light would be reduced to ambient lighting as opposed to direct visibility of the light itself.

The visual impact of the wind turbines are lessened as the distance of the vantage point from the Project Area is lengthened. The topography surrounding the wind turbines significantly alters the visibility of the proposed development from many vantage points. Within the local setting, a combination of the topography and local influences such as existing natural and introduced vegetation, significantly reduces visibility towards the proposed turbine locations.

The LVIA concluded that:

- the greatest visual effect is most likely to be felt by residents in the immediate vicinity of the wind farm;

- amelioration methods incorporated into the design process in conjunction with landscape and visual screening will have a positive effect on reducing any visual impact of proposed wind farm;
- through implementation of appropriate mitigation methods it will be possible to significantly reduce the visual impact to an acceptable level at sensitive viewpoints such as rural residential properties; and
- when implemented with appropriate environmental management, the development of the wind farm can be undertaken with low impact on the surrounding environment whilst providing positive local, regional and national benefits.

Traffic

The Traffic and Transport Impact Assessment was prepared for the Project to assess the ability of the road network, intersection performances and site access arrangements for the Project to cater for additional traffic generation during construction and operation (refer to Appendix G).

The Project will include the delivery to site of the components of the wind turbines and electrical equipment including among other components; blades, tower sections, nacelles, substation, switching station components and cabling. Oversized and over mass loads will be transported from the Port of Newcastle to the Project Area via the New England Highway. Access to the Project Area from the New England Highway would be via Lindsays Gap Road and Nundle Road then divide into two routes. The preferred route to the north is via Barry Road and Morrisons Gap Road and the alternate route to the south is via Crawney Road and Head of Peel Road.

Road upgrades have been identified that would be required to cater for the delivery of blades, nacelles and towers. The upgrades are required to ensure sufficient space for oversized vehicles passage, including intersection widening, trimming and removal of vegetation, removable signs and infrastructure, and the relocation of overhead wires. The upgrades have been identified based on the largest blade length option currently under consideration, being 83.5 m and are based on the worst case turbine design. Should a smaller turbine model be ultimately selected and / or blades are further split for transport purposes, identified road upgrades may not all be required.

Estimates of Project related traffic generation were undertaken. Analysis shows that when these traffic volumes are added to the existing traffic volumes there would be adequate capacity in the road network with the volume to capacity (V/C) ratio of less than 0.25 and Level of Service B or better, on all roads in the peak of the construction. During the operational period, the V/C ratios would be less than 0.09 on all roads.

The forecast traffic volumes are also expected to be less than the environmental capacity goals of 200 vehicles per hour on all roads during the peak of construction. During the operation of the site, the traffic volumes would be even less.

A detailed traffic management plan would be implemented for the transportation of individual items.

Hazards & Risks

Aviation

An Aviation Impact Assessment was prepared to assess the potential aviation safety impacts associated with the Project, provide aviation safety advice in respect of relevant requirements of air safety regulations, and to formally consult with aviation agencies (refer to Appendix H).

The assessment concludes that the Project:

- will not penetrate any Obstacle Limitation Surfaces;
- will penetrate height requirements of the Procedures for Aircraft Navigation services – aircraft operations;
- will have an impact on nearby designated air routes;

- will not have an impact on the grid lowest safe altitude;
- will not have an impact on prescribed airspace;
- is wholly contained within Class G airspace; and
- is outside the clearance zones associated with aviation navigation aids and communication facilities.

The assessed impacts and various recommendations and mitigation measures are detailed in Section 13.1.

Telecommunications – Electromagnetic Interference

An Electromagnetic Interference Assessment was undertaken for the Project to examine radio communication systems, radio links and television and radio broadcasting in the vicinity of the Project Area, and to determine the potential impact, if any, that the Project may have through the introduction of electromagnetic interference (EMI) (refer to Appendix I).

The EMI Assessment indicates that there is one point to point radio link which passes through the Project Area. This is a VHF customer telephone link operated by Telstra. This radio link provides a telephone service to a former dwelling within the Project Area that will not be occupied if the Project proceeds.

Consultation with NBN Co has confirmed that the Project would have no line of sight impact between any nearby NBN base station sites and premises within the current NBN Wireless coverage areas.

Digital TV in the area is provided by Upper Namoi main station transmitters at Mt Dowe, which is expected to provide a patchy service in the wind farm area. Two low power transmitter stations which serve Tamworth and Murrurundi may provide service to some residents if they are close and in reasonable line of site to the stations. There is some risk that a few residents close to the turbines and with digital TV signals coming through the moving turbine blades may experience interference to TV reception. Mitigation such as the installation of more directional receiving antennas or provision of the VAST satellite service are available.

Radio reception is not expected to be affected. Due to the more robust technology AM and FM radio services are unlikely to be affected by wind turbines.

The proposed 330 kV transmission line being constructed as part of the Project is seen as low risk for interfering with AM FM and TV reception at dwellings in the vicinity of the transmission lines. There is also a low risk of the transmission line impacting point to point systems.

Electromagnetic Fields

It has not been established that electro and magnetic fields (EMFs) have any adverse effects on the community. The broadly accepted guideline in both Australia and overseas is to implement a prudent avoidance approach which the Proponent has adopted in the design of the Project, as well as other relevant standards and guidelines.

In line with the prudent avoidance approach, the Project has been designed to provide setbacks between residential dwellings and project components which will generate extremely low frequency (ELF) EMF. The setbacks (as detailed in Section 13.3) and the 60 m easement with for the transmission line provides further assurance that no EMF from the Project will give rise to any unacceptable levels of EMF.

Further to this precautionary approach, a desktop assessment of the potential hazards and risks associated with EMFs in relation to the Project has been undertaken. The desktop assessment confirmed that no adverse impacts are expected due to EMFs.

Bushfire

The Bushfire Risk Assessment identifies potential hazards and risks associated with bushfires / use of bushfire prone land, and contains management and mitigation measures designed to address these obligations (refer to Appendix J).

The Project Area is located along the upper ridgeline that is exposed to prevailing wind directions. These ridgelines and plateaus are flanked by very steep rugged terrain, and a mixtures of cleared farmland and dry sclerophyll forests. The greatest hazard already present in the landscape is a combination of undesirable fire weather (i.e. hot and dry winds and low humidity during summer) and the potential for a fire to spread from the adjacent properties and the National Parks' estates towards farm assets in the surrounding area.

A number of studies have confirmed that wind farms such as the Project present limited bushfire risks. The risk that the wind farm itself will cause a fire is minimal although it is recognised that the proposed development is located within a bushfire prone landscape, and that despite the mitigation measures and treatments that are put in place, bushfire risk will always remain.

Mitigation must be a combination of complementary strategies, all of which are required to provide the best possible protection outcome for the wind farm and the community. The detailed mitigation measures outlined in the bushfire risk assessment have been developed in consultation with key stakeholders including NSW RFS and NPWS to ensure that the wind farm development does not present any increased risk of widespread fire across the landscape. These mitigation measures will be applied for the life of the Project.

Blade Throw

A Blade Throw Risk Assessment has been prepared for the Project to assess blade throw risks in the vicinity of the Project (refer to Appendix K).

A blade throw incident can occur when an entire wind turbine blade becomes separated from its hub at the metal to metal root joint or from a blade fragment separated from the blade itself.

The key mitigation measure is to ensure that wind turbine generators are located a safe distance from dwellings. Studies place the maximum blade fragment throw distance between about 500 and 800 metres under normal operating conditions. All dwellings are located outside of this distance, with the exception of one associated dwelling which is located around 765 m from WTG 65. Whilst this dwelling is located downwind of the turbine, the turbine would be predominantly orientated such that the blades would be heading away from the dwelling in the unlikely event of any blade throw event.

The assessment confirms that the risk associated with a blade throw event is very low and the likelihood of damage to human life or property from a blade throw incident is extremely small and well within risk levels typically deemed acceptable by society.

Hazardous Materials

A screening assessment has been undertaken for the Project in accordance with the requirements of SEPP 33 (refer to Appendix L), which considers relevant hazardous materials and their quantities, and the risk to people, property and the environment.

The Project includes the use small quantities of hazardous materials, such as fuels required for construction, which do not trigger the SEPP33 threshold. With consideration of the insignificant quantity of materials stored on site, along with the significant distance to neighbouring properties, there are no significant risks arising from the storage and transportation of the hazardous materials associated with the Project.

Aboriginal Heritage

A Cultural Heritage Assessment Report (CHAR) was prepared for the Project (refer to Appendix M), which involved field surveys, desktop assessment and consultation. The assessment identified the potential impacts of the Project on Aboriginal cultural heritage and identified mitigation measures to be implemented during construction and operation.

The CHAR confirms that of the seven Aboriginal sites and one potential archaeological deposit (PAD) identified, six sites and the PAD will be partially or fully directly impacted. Of those to be impacted, two (2) were of moderate significance and five (5) were of low significance. The moderately significant finds were one archaeological site and one PAD` expected to have a partial loss of value as a result of the Project. Salvage excavation will be implemented to recover any artefacts within the one archaeological site and one PAD. Artefact collection is recommended for the five low significance Aboriginal archaeological sites where surface artefacts were identified during the assessment.

Recommendations have been developed for the Project to mitigate the impacts of the Project on Aboriginal heritage including the unexpected finds protocol which details the management measures to be undertaken in the event that construction activities identify further Aboriginal objects or possible human skeletal material.

Historic Heritage

A Historic Heritage Assessment (HHA) (Appendix N) was prepared to examine and understand any historic heritage values within the Project Area and transport route. The key findings of this historic heritage assessment were:

- No historic heritage sites have been identified within the Project Area.
- The proposed oversized and over mass transportation route will result in no impacts to identified historic heritage items.
- The proposed oversized components transport route will result in:
    - insignificant indirect impacts to the curtilage of three heritage items, being Merton Cemetery, St Peters Catholic Church and Nundle Shire Offices;
    - minor direct impacts the curtilage of one heritage item, being Kayuga Cemetery; and
    - direct impacts to one heritage item, being Black Snake Gold Mine resulting from road upgrades works at Devil's Elbow (Barry Road), through the listed former Black Snake Gold Mine site. A Statement of Heritage Impact determined that the proposed road construction will have a negligible impact on the setting of the LEP listed Black Snake Gold Mine, however the works have potential to impact potential archaeological remains associated with historical mining operations, such as mine shaft entries and tunnels. The risk of impact can be mitigated during initial investigation and throughout construction, through careful planning and management, including recommendations to undertake early geophysical survey and / or geotechnical investigations.
- No impacts will result from proposed upgrades in proximity to the Jerrys Plains Conservation Area, within the Singleton Local Government Area.
- No impact will result from the transportation of components through Nundle.

Soils and Water

A Soils and Water Assessment was undertaken for the Project to assess the potential impacts of the Project on soil and water and to identify appropriate mitigation and risk management measures for implementation during construction and operation (refer to Appendix O).

Water supply options have been confirmed to be available to meet the needs of the construction phase of the Project. The four viable options available to source the estimated 55 ML of water required for construction include:

- council water supply, with agreement with the relevant Council(s);
- extraction from an existing nearby landowner bore, with agreement from the landowner;
- extraction from a new groundwater bore; and
- extraction from a surface water source (e.g. Chaffey Dam or the Peel River).

Tamworth Regional Council has advised that water for the Project could be purchased from Council. If water is sourced from a bore or surface water source then all required water access licences would be obtained to authorise this.

The Project Area intersects with three catchment areas. The Development Footprint only directly intersects with five waterways associated with creek crossings along the transmission line and the proposed bridge upgrade on Lindsays Gap Road. A field inspection confirmed that the existing condition of these creek crossings is poor. The Project will include enhancement of these creek crossings and will result in an improvement of downstream sediment impacts and water quality.

The majority of the Project Area is considered to present a low-moderate risk of soil erosion.

A number of mitigation measures are proposed for the Project to address potential soil and water impacts, including the preparation of Progressive Erosion and Sediment Control Plans (PESCPs) to address management requirements at individual work sites. A standard suite of erosion and sediment controls may be adopted in most areas.

Air Quality

Potential air quality related impacts associated with the Project were assessed and mitigation measures to manage potential impacts on air quality, predominately dust impacts associated with the construction stage of the Project, are proposed.

The Tamworth region has good air quality, however on occasions the region may experience short-term air quality issues from sources such as bushfires, hazard reduction burning and localised smoke from solid fuel stoves and heaters. The Project Area is located in a rural setting in which primary production and forestry are the predominant land use in the locality. These industries are unlikely to have a significant influence on local and regional air quality.

Emissions to the atmosphere from the Project are predominately associated with construction activities which will be temporary and limited to dust generated by land disturbance, civil construction and vehicle, plant and equipment exhaust emissions. The anticipated construction timeframe for the Project is between 18 and 24 months. Air emissions during operations would be negligible.

Mitigation measures will be implemented to minimise dust generated during construction and it is anticipated that the Project will not generate significant air quality impacts.

Waste

A waste assessment has been prepared to provide guidance on the classification and removal of the wastes generated as a result of the construction and operation of the Project.

The Project will produce a number of various waste streams during the construction, operations and decommissioning stages. All wastes produced by the Project will be classified, handled and managed in accordance with the *Waste Classification Guidelines – Part 1: Classifying Waste* (EPA, 2014).

A Waste Management Plan will be incorporated into the Environmental Management Strategy for the Project and will describe the measures to be implemented to classify, manage, reuse, recycle and safely dispose of waste.

The Project will separate waste streams to maximise recycling and reuse of any excess spoil and vegetative matter where practicable in accordance with resource recovery orders and exemptions. A key objective of the Waste Management Plan will be to ensure that any use of local waste management facilities does not disadvantage local businesses and, more generally, the local community, by exhausting any available capacity at these facilities.

Socio-Economic

A socio-economic impact assessment has been prepared for the Project to consider the social and economic impacts and benefits for both the region and NSW (refer to Appendix P).

The Project includes a wide range of direct and indirect social benefits and economic stimulus including:

- the Project represents a direct investment of over $826 million and will result in the direct injection of approximately $100 million increased income during construction and $16M per year during operations;
- contributing to GHG emission reductions in the order of 654,500 tonnes per annum, supporting Australia's commitment to the Paris Agreement on climate change;
- the renewable electricity generated by the Project could supply up to 185,000 households with energy annually;
- providing around 216 direct and roughly 430 on-flow jobs during construction and approximately 31 long term service and maintenance jobs created during project operation and 53 on-flow jobs providing increased employment opportunities, including for local workers in the New England Region;
- providing additional income stream for the involved landholder and diversity of land use;
- benefit sharing contributions from the Neighbour Benefit Sharing Program providing better diversification of income and a drought proof and post retirement income for farmers and the community;
- economic stimulus for rural NSW which will help mitigate what are likely to be the ongoing economic impacts of the COVID-19 pandemic and the Black Summer Bushfires;
- development of new skilled labour in the region within the growing renewable energy industry;
- diversifying employment opportunities beyond the productive agriculture sector;
- opportunities for eco-tourism through the attraction of tourism opportunities associated with the wind farm;
- potential for new educational opportunities associated with construction and operation of the Project which will require a range of skills including engineering, trades (electrical, mechanical, construction), transport, building material providers, equipment operators, consultants and administrative staff;
- renewable, low cost energy to the national grid, and will contribute to the NSW Government's new zero emissions target by 2050;
- improvements to the local road network, including proposed upgrade works to Barry's Road, Morisons Gap Road and Head of Peel Road (alternate access) with improved long term safety; and
- establishment of a Community Enhancement Fund. This will be supported by funding of $2,500 per operational wind turbine per year over the operational life of the Project and will be directed to: improving community assets such as recreational facilities, public open space and public amenities; and provide the community with the financial resources to help enhance lifestyle and opportunities for local residents around Hanging Rock, Nundle and communities close to the Project.

Socio-economic profiling conducted as part of the study highlighted the relevance of exploring new industries in regional NSW that could provide alternate sources of income for local communities given recent economic downturns as a consequence of drought (reducing agricultural outputs and transport industry movement). This could include wind energy for example. The Project may also offer the opportunity to develop educational or new tourism opportunities for the local community and its economy.

The Project has raised a range of responses from the community (opposition, neutral and support). There is extensive community support for the Project and "Friends of the Wind Farm" signs are visible across up to residences around Nundle and Hanging Rock. However, it is also noted that during community engagement undertaken as part of the socio-economic impact assessment, some members of the community indicated there had been a reduction in social cohesion within the community as a response to the Project. Community views can also change towards a major project overtime.

The proponent has displayed their ongoing commitment to undertaking a collaborative approach with the community as they continue to work with the community on a range of matters. Collaboration to date has resulted in:

- amendment to the Project design and layout;
- ensured a balance of monetary benefits;
- detailing of Community Enhancement Fund governance measures;
- provision of visual montages to overcome visual amenity impact perceptions; and
- detail traffic, transport and safety measures to overcome any local road safety concerns.

Overall, the Hills of Gold Project represents a positive addition to the local and wider NSW economy (with strong economic return in the short-term). It also represents an opportunity for NSW to continue to build its renewable energy capabilities and meet State and local policy objectives.

E.5 Management Measures

The anticipated environmental impacts of the Project have been assessed, and various mitigations measures developed to manage adverse ecological, social and economic impacts where possible. The Project would be constructed and operated in accordance with all conditions imposed on any development consent and environment protection licence granted for the Project and will incorporate the mitigation measures provided in Chapter 21 of this Environmental Impact Statement.

E.6 Conclusion

The Project involves the operation of up to 70 WTG, together with associated and ancillary infrastructure. It will have an energy generating capacity of approximately 420 MW.

Renewable energy projects, such as the Hills of Gold Wind Farm, play a key role in reducing carbon emissions and human induced climate change as part of the necessary and ongoing clean energy transition.

While there are some inevitable impacts associated with all wind farm projects, including biodiversity, visual and noise impacts as outlined above, the impacts associated with the Project have been fully assessed and confirmed to be significantly outweighed by the strong public benefits which the Project will deliver. These include:

- generating enough renewable energy to power approximately 185,000 typical homes on an average day. This will assist in replacing the 1,000 megawatt shortfall identified by the Australian Energy Market Operator as being required for the lost generation capacity which will result from the planned closure of the Liddell Power Station in April 2023. Accordingly, the Project will help ensure security of electricity supply for NSW and help manage the cost of electricity for consumers;
- providing dispatchable energy through the proposed large-scale battery energy storage system of 100MW/400MWh helping to meet peak electricity demands;
- saving 654,500 tonnes carbon emissions per annum, equivalent to removing 290,000 passenger vehicles off the road and assisting the NSW and Federal Government to meet their greenhouse gas targets;

- providing a direct investment in NSW with a $826M total Capital Investment Value;
- creating significant direct and indirect employment opportunities including around 216 direct jobs during construction and around 430 flow on jobs; and
- providing the local community with direct benefits in the form of ongoing landowner payments, community enhancement funds, neighbour benefit sharing programs payments. During construction and 31 ongoing operational jobs and 53 on flow operational jobs.

Appropriate mitigation measures are proposed to ensure that all impacts associated with the Project remain within acceptable limits.

It is considered that this Project is consistent with the objects of the EP&A Act and is in the public interest.

1. INTRODUCTION

1.1 Project Overview

Wind Energy Partners Pty Ltd (WEP or the Proponent) is seeking approval to construct and operate the Hills of Gold Wind Farm, located on the ridge line between Hanging Rock and Crawney Pass in the Northern Tablelands region of New South Wales (NSW) (the Project). A locality plan is provided in Figure 1-1. The Project will supply approximately 420 megawatts (MW) of installed capacity renewable energy directly into the national electricity grid through a proposed connection into the existing TransGrid Liddell to Tamworth transmission line.

The proposed development involves the construction and operation of:

- a maximum of 70 wind generation turbines (WGT) with maximum height of 230 metres (to blade tip); and
- ancillary infrastructure including internal access tracks, road upgrades, battery storage, concrete batching facilities, underground and overhead electricity cabling, substation and a switching station and transmission line connecting to the Liddell to Tamworth transmission line.

A Project overview map is provided in Figure 1-2.

With an expected power output of up to approximately 420MW, the Project will provide regional jobs and economic benefits for communities in and around Nundle, Hanging Rock and Crawney while producing enough renewable electricity to power approximately 185,000 typical homes on an average day.

1.2 Locality Description and Context

The Project is located approximately 5 km south of Hanging Rock, 8 km south east of Nundle and 60 km south-east of Tamworth. The proposed development is located within the Tamworth Regional, Upper Hunter and Liverpool Plains local government areas (LGA).

The general locality includes Ben Halls Gap Nature Reserve / National Park, Crawney Pass National Park, Ben Halls Gap State Forest, Hanging Rock State Forest and Nundle State Forest. The main industries within the area are predominately agriculture, forestry and tourism.

The area is a former gold mining area, with the small scenic village of Nundle containing historic buildings, including the Nundle Woollen Mill and Mount Misery Gold Mine Museum. Services in the village include several cafes and pubs, retail and antique stores and crafting facilities.

The population of Nundle in 2016 (ABS) was approximately 496 people, whilst Hanging Rock had a population of approximately 105 (ABS, 2020; ABS, 2020).

The majority of dwellings in proximity to the proposed wind farm are lifestyle blocks located on Morrisons Gap Road and to a lesser extent Barry Road.

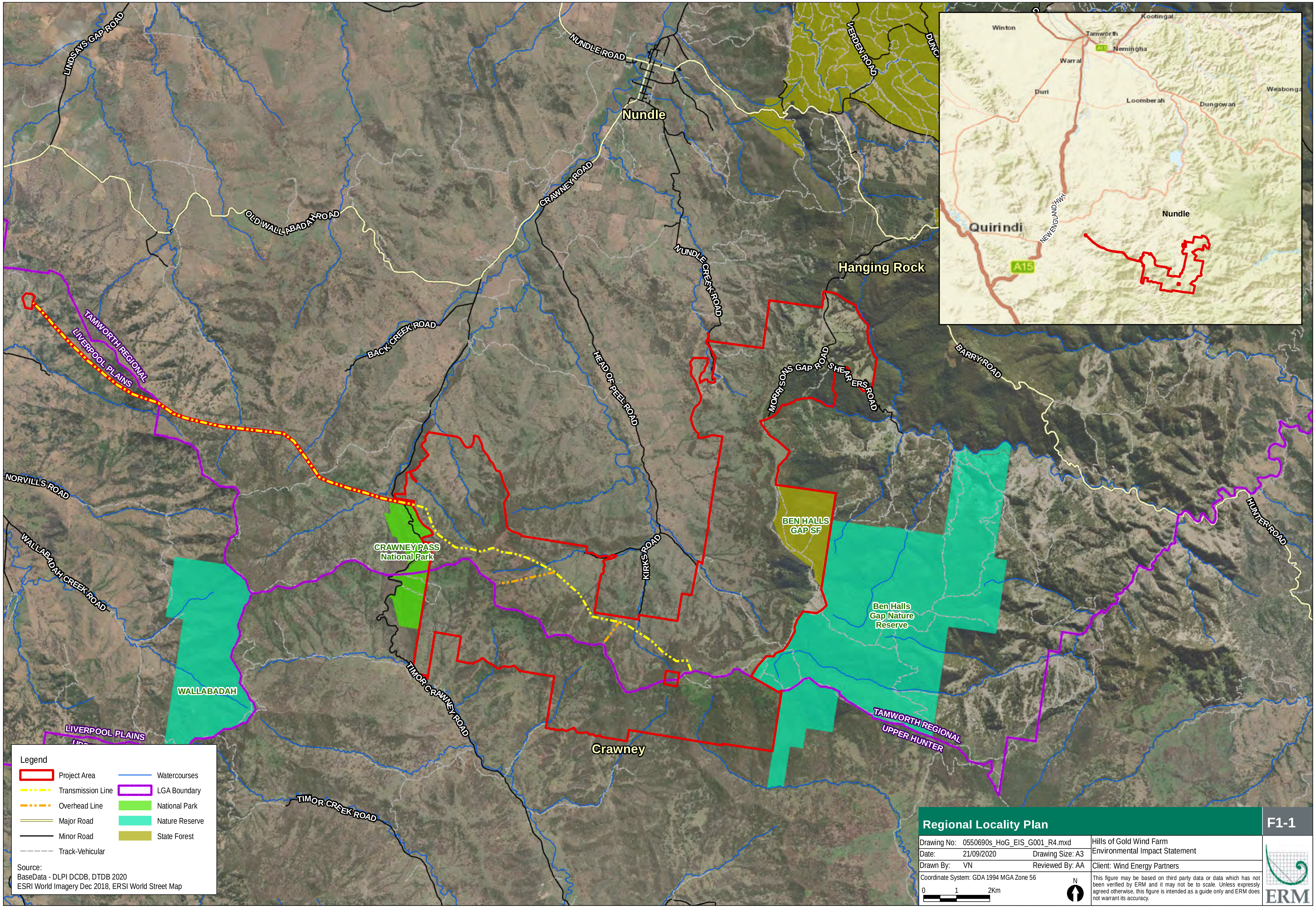
1.3 The Site

The wind farm site and transmission line route area comprises of 14 freehold landholdings, a Crown land allotment and Crown land paper roads, covering approximately 8,316 hectares (ha) (‘Project Area’). The upgrades to the public road network are located outside the Project Area. The total development footprint of all aspects of the Project, including the wind farm site, transmission line route and proposed transport route upgrades is approximately 513 ha.

The Project Area, predominately cleared agricultural land with native vegetation generally located on the outskirts of the Project Area, is used predominately for grazing cattle. Native understorey has been converted to exotic pastures in many locations.

The Project Area contains a number of rural residential dwellings. All dwellings within the Project Area have a lease or agreement with WEP in relation to the Project and so are ‘associated dwellings’.

A detailed description of the Project is provided in Chapter 3 with a detailed site analysis provided in Chapter 4.


LINDSAYS GAP ROAD
NUNDLE ROAD
Nundle
VERDEN ROAD
CRAWNEY ROAD
OLD WALLABADAH ROAD
NUNDLE CREEK ROAD
Hanging Rock
BACK CREEK ROAD
TAMWORTH REGIONAL
LIVERPOOL PLAINS
HEAD OF PEEL ROAD
MORRISONS GAP ROAD
SHEARERS ROAD
BARRY ROAD
NORVILLS ROAD
WALLABADAH CREEK ROAD
CRAWNEY PASS National Park
KIRKS ROAD
BEN HALLS GAP SF
Ben Halls Gap Nature Reserve
HUNTER ROAD
WALLABADAH
TIMOR CRAWNEY ROAD
TAMWORTH REGIONAL
UPPER HUNTER
Crawney
TIMOR CREEK ROAD
Winton
Tamworth
Kootingal
Nemingha
Warral
Duri
Loomberah
Dungowan
Weabonga
Quirindi
NEW ENGLAND HWY
A15
Nundle
Legend
Project Area
Transmission Line
Overhead Line
Major Road
Minor Road
Track-Vehicular
Watercourses
LGA Boundary
National Park
Nature Reserve
State Forest
Source:
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018, ERSI World Street Map
Regional Locality Plan
F1-1
Drawing No: 0550690s_HoG_EIS_G001_R4.mxd
Date: 21/09/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partners
Coordinate System: GDA 1994 MGA Zone 56
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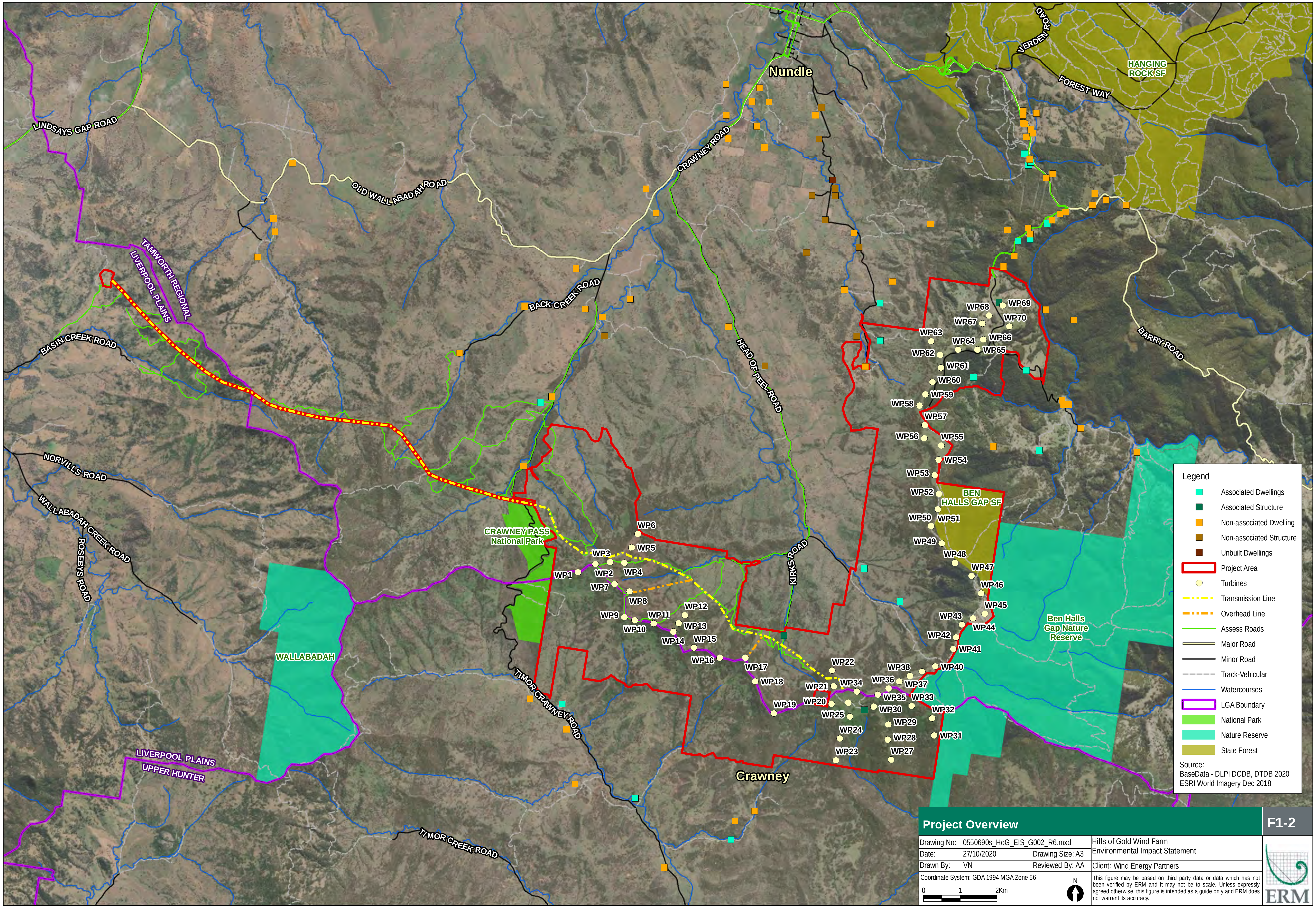
ERM



Project Overview F1-2

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Date: 27/10/2020 Drawing Size: A3
Drawn By: VN Reviewed By: AA
Coordinate System: GDA 1994 MGA Zone 56

Hills of Gold Wind Farm
Environmental Impact Statement

Client: Wind Energy Partners

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly stated otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

1.4 The Proponent

The Proponent is Wind Energy Partners (WEP), an Australian company which develops utility scale renewable energy plants.

The Project is owned by ENGIE ANZ, a joint venture between ENGIE S.A. and Mitsui & Co. Ltd. ENGIE S.A. is a global company with extensive experience in the energy sector and more than 103 gigawatts of installed power generation capacity, including 25% in renewables such as wind and solar photovoltaic technologies. This makes ENGIE S.A. the world's largest independent power producer with a presence in 70 countries and 170,000 employees. ENGIE S.A.'s long-term goal is to accelerate the transition to a carbon-neutral economy. To accomplish this, in Australia and New Zealand, the ENGIE ANZ joint venture has 1,200 MW of low-carbon generation capacity and more than 800 MW of renewable energy under development including this Project.

Globally, ENGIE has been driving innovation in the energy sector for over 180 years. Today, ENGIE employs more than 1,600 people across 30 locations in Australia and New Zealand.

The existing owners of Wind Energy Partners (now Clean Energy Partners) are an Australian company which develops utility scale renewable energy plants. The company's leadership has more than 25 years of renewable energy experience in delivering solar and wind energy projects to regional communities in Australia, Europe and Asia. The team involved in the Project has been involved in development of over 2 GW of renewable energy projects including a number of projects now in operation in New South Wales, Victoria and Queensland and other international markets. Clean Energy Partners remain involved in development management of the Project.

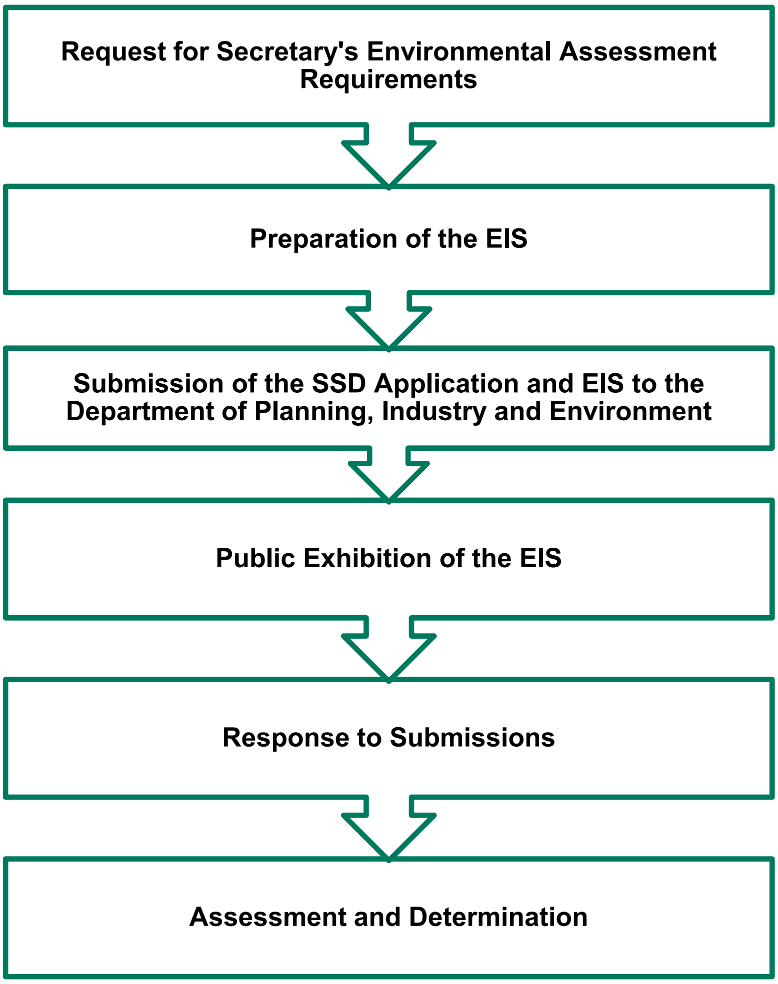
Someva Renewables Pty Ltd (Someva), a specialist renewable energy consultancy, has been engaged by Clean Energy Partners to assist in progressing the Project through the assessment process to construction. Someva has assisted in developing over 1,000MW renewable energy assets in Australia and Asia within private equity, institutional infrastructure funds and multilateral development banks.

1.5 State Significant Development Application

1.5.1 SSD Application Process

The Project is State Significant Development (SSD). An overview of the SSD Application process is outlined in Figure 1-3 and described below.

Figure 1-3 SSD Application Process



- **Secretary's Environmental Assessment Requirements (SEARs) –** a Preliminary Environmental Assessment Report (now called Scoping Report) was prepared and submitted to the NSW Department of Planning and Environment (now Department of Planning, Industry and Environment (DPIE)) in October 2018. Secretary's Environmental Assessment Requirements (SEARs) were issued for the Project on 22 November 2018. The SEARs form the basis of the assessment criteria for the Project. Supplementary SEARs were issued on 18 February 2020 in relation to the determination of the Project as a Controlled Action under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
- **Preparation of the EIS** – the scope of the impact assessment was tailored to address the SEARs and Supplementary SEARs. It also had regard to the environmental scoping stage and risk assessment undertaken in the initial stages of the Project to identify potential impacts, as reported on in the Preliminary Environmental Assessment Report, and ongoing consultation with key stakeholders and the community.

- **Submission of the EIS** – the EIS will be submitted to DPIE for review and comment. If the DPIE are satisfied that it addresses the SEARs and Supplementary SEARs they will proceed to place it on public exhibition.
- **Public Exhibition** – the EIS will be placed on public exhibition by DPIE for a period no less than 28 days. During the exhibition period, submissions from regulatory and other relevant public authorities, the community and neighbouring landowners will be invited.
- **Response to Public Submissions** – All submissions provided will be considered in detail and, if required, responses to the issues raised will be prepared by the Proponent and submitted to DPIE in a timely manner.
- **Assessment and Determination** – DPIE will consult further with the local councils and the relevant State agencies and other authorities on draft conditions of consent. The assessment report will then be finalised and determined by either a delegated officer of DPIE or forwarded to the Independent Planning Commission for determination. If approved, conditions of consent will be provided with the letter of determination.

1.5.2 Secretary's Environmental Assessment Requirements

This EIS has been prepared in accordance with the requirements of Section 4.12 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), Schedule 2 of the Environmental Planning and Assessment Regulations 2000 (EP&A Regulation), the SEARs and Supplementary SEARs issued for the Project. Table 1-1 summarises the SEARs requirements and identifies where responses to each of these are addressed in the EIS. Appendix A summarises the requirements of the relevant NSW agencies and regulators in inputting to the SEARs. The requirements of the Commonwealth under the Supplemental SEARs are detailed Table 1-2.

Table 1-1 SEARs

Issues	Requirements	Document Reference
General EIS Requirements	The Environmental Impact Statement (EIS) for the development must comply with the requirements in Schedule 2 of the Environmental Planning and Assessment Regulation 2000. In particular, the EIS must include: ■ a stand-alone executive summary;	Executive Summary
	■ a full description of the development, including: – details of construction, operation and decommissioning, including any proposed staging of the development or refurbishing of turbines over time; – all infrastructure and facilities, such as substations, transmission lines, construction compounds, concrete batching plants, internal access roads, and road upgrades (including any infrastructure that would be required for the development, but the subject of a separate approvals process); – plans for any buildings; – site plans and maps at an adequate scale with dimensions showing: — the location and dimensions of all project components including coordinates in latitude / longitude and maximum AHD heights of the turbines; — existing infrastructure, land use, and environmental features in the vicinity of the development, including nearby residences and approved residential developments or subdivisions within 3km of a proposed turbine, and any other existing, approved or proposed wind farms in the region; and — the development corridor that has been assessed, including any allowance for micro-siting of turbines and identification of the key environmental constraints that have been considered in the design of the development; – details of the progressive rehabilitation of the site;	Chapter 3
	■ a list of any approvals that must be obtained before the development may commence;	Chapter 6
	■ the terms of any proposed voluntary planning agreement with the relevant local council;	Chapter 6 Chapter 7
	■ an assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including: – a description of the existing environment likely to be affected by the development using sufficient baseline data; – an assessment of the likely impacts of all stages of the development, taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice and including the NSW Wind Energy Guideline for State Significant Wind Energy Development (2016); – a description of the measures that would be implemented to avoid, mitigate and/or offset residual impacts of the development and the likely effectiveness of these measures, including details of consultation with any affected non-associated landowners in relation to the development of mitigation measures, and any negotiated agreements with these landowners; and – a description of the measures that would be implemented to monitor and report on the environmental performance of the development, including adaptive management strategies and contingency measures to address residual impacts;	Chapters 9 - 20

Issues	Requirements	Document Reference
	■ a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS; and	Chapter 21
	■ the reasons why the development should be approved having regard to: – relevant matters for consideration under the Environmental Planning and Assessment Act 1979, including the objects of the Act and how the principles of ecologically sustainable development have been incorporated in the design, construction and ongoing operations of the development; – the environmental, economic and social costs and benefits of the development, having regard to the predicted electricity demand in NSW and the National Electricity Market, the Commonwealth's Renewable Energy Target Scheme, and the greenhouse gas savings of the development; – a detailed consideration of the capability of the project to the security and reliability of the electricity system in the National Electricity Market, having regard to local system conditions and the Department's guidance on the matter; – the suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses, including rural villages, rural dwellings, subdivisions, land of high scenic value, conservation areas (including National Parks / Reserves), strategic agricultural land, state forests, mineral resources, triangulation stations, tourism facilities, existing or proposed wind farms, and the capacity of the existing electricity transmission network to accommodate the development; and – feasible alternatives to the development (and its key components), including the consequences of not carrying out the development.	Chapter 6 Chapter 22 Chapter 2 Chapter 4 Chapter 5
	■ in addition to the matters set out in Schedule 1 of the Environmental Planning and Assessment Regulation 2000, the development application must be accompanied by a signed report from a suitably qualified person that includes an accurate estimate of the capital investment value of the development (as defined in Clause 3 of the Environmental Planning and Assessment Regulation 2000);	Appendix B
Landscape and Visual	■ the EIS must include a detailed assessment of the visual impacts of all components of the project (including turbines, transmission lines, substations, and any other ancillary infrastructure) in accordance with the Wind Energy: Visual Assessment Bulletin (DPE, 2016);	Chapter 11 and Appendix F
Noise and Vibration	■ the EIS must assess wind turbine noise in accordance with the NSW Wind Energy: Noise Assessment Bulletin (DPE, 2016);	Chapter 10 and Appendix E
	■ assess noise generated by ancillary infrastructure in accordance with the NSW Noise Policy for Industry (EPA, 2017);	
	■ assess construction noise under the Interim Construction Noise Guideline (DECC, 2009);	
	■ assess traffic noise under the NSW Road Noise Policy (DECCW, 2011); and	
	■ assess vibration under the Assessing Vibration: A Technical Guideline (DEC, 2006);	
Biodiversity	■ assess biodiversity values and the likely biodiversity impacts of the development including impacts associated with transport route road upgrades in accordance with the *Biodiversity Conservation Act 2016*, including a detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the development over time, and a strategy to offset any residual impacts of the development in accordance with the *Biodiversity Conservation Act 2016*;	Chapter 9 and Appendix D

Issues	Requirements	Document Reference
	■ assess the impact of the development on the National Estate in accordance with the Guidelines for Development Adjoining Land and Water Managed by DECCW (OEH, 2013);	
	■ assess the impact of the project on birds and bats from blade strikes, low air pressure zones at the blade tips (barotrauma), and alteration to movement patterns resulting from the turbines and considering cumulative effects of other wind farms in the vicinity;	
Traffic and Transport	■ assess the construction and operational traffic impacts of the development;	Chapter 12 and Appendix G
	■ provide details of traffic volumes (both light and heavy vehicles) and transport routes during construction and operation, including traffic associated with sourcing raw materials (water, sand and gravel);	
	■ assess the potential traffic impacts of the project on road network function including intersection performance and site access arrangements and road safety, including school bus routes;	
	■ assess the capacity of the existing road network to accommodate the type and volume of traffic generated by the project (including over-mass / over-dimensional traffic) during construction and operation;	
	■ provide details of measures to mitigate and / or manage potential impacts including a schedule of all required road upgrades, road maintenance contributions, and any other traffic control measures, developed in consultation with the relevant road authority;	
Hazard / Risks	■ Aviation Safety: – assess the impact of the development under the *National Airports Safeguarding Framework Guideline D: Managing Wind Turbine Risk to Aircraft;* – provide associated height and co-ordinates for each turbine assessed; – assess potential impacts on aviation safety, including cumulative effects of wind farms in the vicinity, potential wake / turbulence issues, the need for aviation hazard lighting, considering, defined air traffic routes, aircraft operating heights, approach/departure procedures, radar interference, communication systems, navigation aids; – identify aerodromes within 30km of the turbines and consider the impact to nearby aerodromes and aircraft landing areas; – address impacts on obstacle limitation surfaces, and – assess the impact of the turbines on the safe and efficient aerial application of agricultural fertilisers and pesticides in the vicinity of the turbines and transmission line;	Chapter 13 and Appendix H
	■ Telecommunications – identify possible effects on telecommunications systems, assess impacts and mitigation measures including undertaking a detailed assessment to examine the potential impacts as well as analysis and agreement on the implementation of suitable options to avoid potential disruptions to radio communication services; which may include the installation and maintenance of alternative sites;	Chapter 13 and Appendix I
	■ Health – consider and document any health issues having regard to the latest advice of the National Health and Medical Research Council, and identify potential hazards and risks associated with electric and magnetic fields (EMF) and demonstrate the application of the principles of prudent avoidance;	Chapter 13

Issues	Requirements	Document Reference
	■ Bushfire – identify potential hazards and risks associated with bushfires / use of bushfire prone land, including the risks that a wind farm would cause bush fire and any potential impacts on the aerial fighting of bush fires and demonstrate compliance with *Planning for Bush Fire Protection 2006* (if located on bushfire prone land);	Chapter 13 and Appendix J
	■ Blade Throw – assess blade throw risks; and	Chapter 13 and Appendix K
	■ Battery Storage – including a preliminary risk screening in accordance with *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development and Applying SEPP 33* (DoP, 2011), and if the preliminary risk screening indicates the development is “potentially hazardous”, a Preliminary Hazard Analysis (PHA) must be prepared in accordance with *Hazard Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis* (DoP, 2011) *and Multi-Level Risk Assessment* (DP&I, 2011);	Chapter 13 and Appendix L
Heritage	■ assess the impact to Aboriginal cultural heritage impact under the Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (OEH, 2011)) and the Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW (DECCW, 2010);	Chapter 14 and Appendix M
	■ provide evidence of consultation with Aboriginal communities in determining and assessing impacts, developing options and selecting options and mitigation measures (including the final proposed measures), having regard to the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010); and	
	■ assess the impact to historic heritage items under the *NSW Heritage Manual.*	Chapter 15 and Appendix N
Water & Soils	■ quantify water demand, identify water sources (surface and groundwater), including any licensing requirements, and determine whether an adequate and secure water supply is available for the development;	Chapter 16 and Appendix O
	■ access potential impacts on the quantity and quality of surface and groundwater resources, including impacts on other water users and watercourses;	
	■ where the project involves works within 40 metres of the high bank of any river, lake or wetlands (collectively waterfront land), identify likely impacts to the waterfront land, and how the activities are to be designed and implemented in accordance with *the DPI Water Guidelines for Controlled Activities* (DPI, 2012) and (if necessary) *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (DPI, 2003)*;* and	
	■ describe the measures to minimise surface and groundwater impacts, including how works on steep gradient land or erodible soil types would be managed and any contingency requirements to address residual impacts;	
Waste	■ identify, quantify and classify the likely waste streams to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste;	Chapter 18
Social & Economic	■ the EIS must include an assessment of the social and economic impacts and benefits of the project for the region and the State as a whole, including consideration of any increase in demand for community infrastructure services and impacts to tourism.	Chapter 19 and Appendix P

Issues	Requirements	Document Reference
Consultation	■ during the preparation of the EIS, you must consult with relevant local, State and Commonwealth Government authorities, service providers, community groups and affected landowners;	Chapter 7 Appendix C
	■ must establish a Community Consultative Committee for the project in accordance with the Community Consultative Committee Guidelines for State Significant Projects, and consult with the committee during the preparation of the EIS; and	
	■ must carry out detailed consultation with the following: – Tamworth Regional Council; – Upper Hunter Shire Council; – Liverpool Plains Shire Council; – Office of Environment and Heritage; – National Parks and Wildlife Service; – Environment Protection Authority; – Division of Resources and Geoscience; – Department of Industry – Roads and Maritime Services; – Department of Finance, Services and Innovation – Telco Authority; – Local Land Services; – Forestry Corporation; – NSW Rural Fire Service; – Department of Defence; – Civil Aviation Safety Authority; and – Airservices Australia.	
	■ The EIS must include a description of what consultation was carried out during the preparation of the EIS, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS.	
Further consultation after 2 years	■ If you do not lodge a development application and EIS for the development within 2 years of the issue date of these SEARs, you must consult further with the Secretary in relation to the preparation of the EIS.	N/A

Table 1-2 Commonwealth Department of Agriculture, Water and the Environment Assessment Requirements

Issues	Requirements	Document Reference
Relevant Regulations	■ The Environmental Impact Statement (EIS) must address all matters outlined in Schedule 4 of the EPBC Regulations and all the matters outlined below in relation to the controlling provisions.	Chapter 9 and Appendix D
Project Description	■ The title of the action, background to the action of the action and current status.	Chapter 9 and Appendix D
	■ The precise location and description of all works to be undertaken (including associated offsite works and infrastructure), structures to be built or elements of the action that may have impacts on Matters of National Environmental Significance (MNES).	
	■ How the action relates to any other actions that have been, or are being taken in the region affected by the action.	
	■ How the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts on MNES.	
Impacts	■ The EIS must include an assessment of the relevant impacts of the action on the matters protected by the controlling provisions, including: – a description and detailed assessment of the nature and extent of the likely direct, indirect and consequential impacts, including short term and long term relevant impacts; – a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible; – analysis of the significance of the relevant impacts; and – any technical data and other information used or needed to make a detailed assessment of the relevant impacts.	Chapter 9 and Appendix D
Avoidance, mitigation and offsetting	■ For each of the relevant matters protected that are likely to be significantly impacted by the action, the EIS must provide information on proposed avoidance and mitigation measures to manage the relevant impacts of the action including: – a description, and an assessment of the expected or predicted effectiveness of the mitigation measures; – any statutory policy basis for the mitigation measures; – the cost of the mitigation measures; – an outline of an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action, including any provisions for independent environmental auditing; and – the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program.	Chapter 9 and Appendix D
	■ Where a significant residual adverse impact to a relevant protected matter is considered likely, the EIS must provide information on the proposed offset strategy, including discussion of the conservation benefit associated with the proposed offset strategy.	Chapter 9 and Appendix D

Issues	Requirements	Document Reference
	■ For each of the relevant matters likely to be impacted by the action the EIS must provide reference to, and consideration of, relevant Commonwealth guidelines and policy statements including any: – conservation advice or recovery plan for the species or community, – relevant threat abatement plan for a process that threatens the species or community; – wildlife conservation plan for the species; and – any strategic assessment.	Chapter 9 and Appendix D
Biodiversity (threatened species and communities and migratory species)	■ The EIS must identify each EPBC Act listed threatened species and community and migratory species likely to be impacted by the action. For any species and communities that are likely to be impacted, the proponent must provide a description of the nature, quantum and consequences of the impacts. For species and communities potentially located in the project area or in the vicinity that are not likely to be impacted, provide evidence why they are not likely to be impacted.	Chapter 9 and Appendix D
	■ For each of the EPBC Act listed threatened species and communities and migratory species likely to be impacted by the action the EIS must provide a separate: – description of the habitat (including identification and mapping of suitable breeding habitat, suitable foraging habitat, important populations and habitat critical for survival), with consideration of, and reference to, any relevant Commonwealth guidelines and policy statements including listing advice, conservation advice and recovery plans; – details of the scope, timing and methodology for studies or surveys used and how they are consistent with (or justification for divergence from) published Australian Government guidelines and policy statements; – description of the relevant impacts of the action having regard to the full national extent of the species or community's range; – description of the specific proposed avoidance and mitigation measures to deal with relevant impacts of the action; – identification of significant residual adverse impacts likely to occur after the proposed activities to avoid and mitigate all impacts are taken into account; – description of any offsets proposed to address residual adverse significant impacts and how these offsets will be established; – details of how the current published NSW Biodiversity Assessment Methodology has been applied in accordance with the objects of the EPBC Act to offset significant residual adverse impacts; and – details of the offset package to compensate for significant residual impacts including details of the credit profiles required to offset the action in accordance with the NSW Biodiversity Assessment Methodology and/or mapping and descriptions of the extent and condition of the relevant habitat and/or threatened communities occurring on proposed offset sites.	Chapter 9 and Appendix D
	■ Any significant residual impacts not addressed by the NSW Biodiversity Assessment Methodology may need to be addressed in accordance with the Environment Protection and Biodiversity Conservation Act 1999 Environmental Offset Policy.	Chapter 9 and Appendix D

Issues	Requirements	Document Reference
Other approvals and conditions	■ Information in relation to any other approvals or conditions required must include the information prescribed in Schedule 4 Clause 5 (a) (b) (c) and (d) of the EPBC Regulations 2000.	Chapter 9 and Appendix D
Environmental Record of person proposing to take the action	■ Information in relation to the environmental record of a person proposing to take action must include details as prescribed in Schedule 4 Clause 6 of the EPBC Regulations 2000.	Chapter 9 and Appendix D
Information Sources	■ For information given in the EIS, the EIS must state the source of the information, how recent the information is, how the reliability of the information was tested; and what uncertainties (if any) are in the information.	Chapter 9 and Appendix D

1.6 Structure and Content of the EIS

The EIS has been prepared to ensure that the Project is properly described, addresses the SEARs and Supplementary SEARs, assesses the potential environmental impacts, and identifies proposed mitigation measures.

For the purposes of the impact assessment, including biodiversity heritage and visual impacts, these assessments considered analysis and survey of a 'development corridor' to inform the identification of impacts and constraints to the Project, the outcomes of which were utilised in the development of a final layout and the development footprint.

The overall structure of the EIS is outlined in Table 1-3.

Table 1-3 Structure of the EIS

EIS Chapter	Description	EIS Reference
Introduction	Provides an overview of the Proposed project and introduces the Proponent, project history and alternatives.	Chapter 1 Chapter 5
Strategic Justification	Provides a strategic justification of the proposed development focusing on site selection and the suitability of the proposed site.	Chapter 2
Project Description	Provides a detailed description of the proposed development including the key components for both the construction and operational phases of the Project.	Chapter 3
Site Analysis	Describes the existing site attributes, setting and land use analysis.	Chapter 4
Project Alternatives	Describes alternatives to the Project, including site selection and feasibility, and project component alternatives.	Chapter 5
Statutory Framework	Describes the SSD Planning Approval Process and relevant Commonwealth, State and local legislative framework in relation to the Project.	Chapter 6
Community and Stakeholder Engagement	Summarises the consultation activities undertaken with key stakeholders (including landowners, local community, government agencies and authorities.	Chapter 7
Environmental Assessment Approach	Describes the potential environmental impacts of the development and identifying the key issues for further assessment as part of the EIS.	Chapter 8
Environmental Impact Assessment	Describes the methodology, existing environment and assessment associated with the potential and actual environmental risks and impacts of the Project, and mitigation and management measures proposed to minimise these risks and impacts.	Chapter 9 – 19
Cumulative Impacts	Describes the potential cumulative impacts of the Project in combination with existing and other publicly proposed developments in the region.	Chapter 20
Environmental Management Framework	Provides an overview of the environmental management framework to be developed for the Project, including a summary of the mitigation measures and commitments made throughout the EIS to be implemented during the construction, operation and decommissioning of the Project.	Chapter 21
Ecological Sustainable Development	Describe the principles of ecologically sustainable development and their implementation to the Project.	Chapter 22
Evaluation and Conclusion	Presents the conclusions of the EIS.	Chapter 23

The Appendices provide the detailed technical assessments discussed in the EIS and supporting documentation. They include:

Table 1-4 List of Supporting Documentation

Appendix		Author
A	SEARs	NSW DPIE
B	Capital Investment Value Report	Muller Partnership
C	Stakeholder Engagement C.1 Stakeholder Engagement Strategy C.2 Register of Stakeholder Engagement C.3 Stakeholder Engagement Supporting Documentation C.3.1 Agency Consultation C 3.2: Community Consultative Committee C 3.3 Fact Sheets, Flyers and Newsletters C 3.4 Presentations C.3.5 Survey C.4 Community Enhancement Fund Charter C.5 Neighbour Benefits Sharing Program	Various
D	Biodiversity Development Assessment Report	ARUP / Biosis
E	Noise and Vibration E.1 Noise and Vibration Impact Assessment E.2 Background Noise Monitoring	Sonus
F	Landscape and Visual Impact Assessment	Moir Landscape Architects
G	Traffic and Transport Assessment	The Transport Planning Partnership
H	Aviation Impact Assessment	Aviation Projects
I	Electromagnetic Interference (EMI)	Laurence Derrick and Associates
J	Bushfire Assessment	ERM
K	SEPP 33 Screening Assessment	ERM
L	Blade Throw Assessment	ERM
M	Aboriginal Heritage Assessment	Kelleher Nightingale Consulting
N	Historic Heritage Assessment N.1 Historic Heritage Assessment N.2 Statement of Heritage Impact	ERM
O	Soils and Water Assessment	ERM
P	Socio-Economic Impact Assessment	SGS Economics and Planning
Q	Environmental Assessment Approach	ERM

1.7 Environmental Assessment Team

The environmental assessment team consists of ERM's in-house technical experts and sub-consultants. Table 1-5 provides a summary of the environmental assessment team and their contributions to the EIS and supporting specialist assessments.

Table 1-5 Environmental Assessment Team

Company	Technical Component
ERM	■ EIS ■ Bushfire Assessment ■ SEPP 33 Preliminary Screening Assessment ■ Blade Throw Assessment ■ Electromagnetic Fields Assessment ■ Water and Soils Assessment ■ Waste Assessment ■ Historic Heritage Impact Assessment and Statement of Heritage Impact
ARUP & Biosis	■ Biodiversity (Flora & Fauna) Assessment
Kelleher Nightingale Consulting	■ Aboriginal Cultural Heritage Assessment
Moir Landscape Architects	■ Landscape and Visual Impact Assessment and Shadow Flicker
Sonus	■ Noise and Vibration Impact Assessment
SGS Environment and Planning	■ Social and Economic Assessment
The Transport Planning Partnership	■ Traffic and Transport Impact Assessment
Lawrence Derrick and Associates	■ Electromagnetic Interference Assessment
Aviation Projects	■ Aviation Impact Assessment

2. STRATEGIC JUSTIFICATION

This chapter outlines the key objectives and justification for the Project in the context of supporting State and Commonwealth renewable energy targets, as well as international objectives, reducing Australia's greenhouse gas emissions, meeting future energy demands, and contributing to economic development in the region.

2.1 Project Objectives

The objectives of the Project are to:

- provide a source of renewable energy to supplement NSW and National energy requirements and assist in reducing greenhouse gas (GHG) emissions;
- contribute to the additional generating capacity required to meet the growing energy demand in NSW and the generation shortfalls predicted as coal fired power stations reach the end of their operational lives;
- assist in providing network stability through battery storage;
- contribute to NSW and Commonwealth targets for renewable energy;
- provide both direct and indirect employment opportunities during construction and operation;
- provide additional income streams for associated landholders and neighbours;
- provide broader financial benefits to the community through the community enhancement fund and neighbour benefits;
- liaise and work with the community and all potentially affected stakeholders in the identification, mitigation and/or monitoring of any potential environmental effects;
- ensure quality, safety and environmental standards are maintained;
- recycle and reuse materials where practical and economically feasible; and
- minimise all potential adverse environmental impacts.

2.2 United Nations Sustainable Development Goals

The Nations 2030 Agenda for Sustainable Development includes global sustainable development goals (SDG) to build a more sustainable and resilient future. The 17 SDG and 169 individual targets cover measures towards improvements to economic, social and environmental sustainability. All countries of the world have agreed to work towards achieving the SDGs by 2030. Of relevance to the Project are:

- Goal 7: 'Ensure access to affordable, reliable, sustainable and modern energy for all', Target 7.2 which states "By 2030, increase substantially the share of renewable energy in the global energy mix'.
- Goal 11 Sustainable Cities and Communities, Target 11.6 ' *By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management'.*

The Project will provide a source of renewable energy, increasing the portion of renewable electricity generation in Australia. Further it will assist in the reduction of reliance of fossil fuels for electricity generation, resulting in reduction of GHG emissions and improved air quality via reduced air emissions.

2.3 Strategic Context

The Project will support the Commonwealth and the NSW Government in achieving their respective renewable energy and greenhouse gas (GHG) emission reduction targets. It will also provide much needed economic stimulus in rural regions while reducing the cost of power. It will support a transition to low carbon economy and improve the competitiveness of Australian industries.

2.3.1 Federal Context

2.3.1.1 The Commonwealth's Renewable Energy Target

The Renewable Energy Target (RET) is a Commonwealth scheme which has been in operation since 2001. It is designed to reduce emissions of greenhouse gases in the electricity sector and encourage the additional generation of electricity from sustainable and renewable sources.

Since January 2011, the RET has been operated as two schemes, being, the Large-scale Renewable Energy Target (LRET); and the Small-scale Renewable Energy Scheme (SRES). Of these, the LRET is relevant for this Project, as it encourages investment in large-scale renewable energy projects like wind farms. Whereas, the SRES, encourages small-scale installations like household solar panels and solar hot water systems.

The LRET requires high-energy users to acquire a fixed proportion of their electricity from renewable sources. This occurs in the form of large-scale generation certificates (LGCs), which are created by large renewable energy power stations (such as wind farms). One LGC can be created for each megawatt-hour (MWh) of eligible renewable electricity produced by an accredited renewable power station. LGCs can then be sold to high-energy users who must surrender them to the Clean Energy Regulator to meet their obligations under the RET. The Clean Energy Regulator is an Australian independent statutory authority responsible for administering legislation to reduce carbon emissions and increase the use of clean energy.

Amendments to the RET scheme in 2015 set the 2020 target for energy from large sale renewable projects at 33,000 GWh. Sufficient renewable generation was committed by September 2019 to meet this target. The Australia Government's policy is to not increase the target beyond the 2020 requirement, and to not extend or replace the target after it expires in 2030 (Australian Energy Regulator, 2020). Investment in renewables remains strong and the 2020 target has not acted as a cap on new investment (Clean Energy Regulator, 2020) as the competitiveness of renewable energy no longer relies on the generation of LGCs.

This is relevant for this proposed Project, as once constructed, it will assist in exceeding the LRET, as well as an eligible large-scale generation category under RET, supplying approximately 1,100 GWh per annum, or in other terms, power to supply 185,000 average Australian homes.

2.3.1.2 Reducing GHG emissions under the Paris Agreement

Greenhouse gasses (GHGs) in Earth's atmosphere play an important role in regulating the earth's temperature. Anthropogenic activities, such as burning of fossil fuels (e.g. coal and oil), and deforestation have caused GHG concentrations in the Earth's atmosphere to increase significantly. As this occurs, the Earth's surface temperature is increasing (referred to as global warming). Scientific literature defines the impacts experienced from climate change and global warming to sustained drought, floods and other extreme weather events including bushfires, biodiversity loss and sea level rise.

Australia is one of 195 countries that signed on to the United Nations Paris Agreement on climate change (United Nations, 2015). The Paris Agreement sets in place a durable and dynamic framework for all countries to take climate action from 2020, building on existing international efforts in the period up to 2020. The aim of the Paris Agreement is to limit emissions globally to net-zero in the second half of this century.

Australia's current emissions target is to reduce emissions by 26–28 per cent below 2005 levels by 2030 as part of its commitments under the Paris Agreement. This target represents a 50–52 per cent reduction in emissions per capita and a 64–65 per cent reduction in the emissions intensity of the economy between 2005 and 2030 (Commonwealth of Australia, 2015).

The Project will assist in meeting Australia's obligations under the Paris Agreement. It is estimated that once operational, the Project will contribute to annual GHG reductions in the order of 654,500 tonnes per annum. This amount will be dependent on the electricity generating capacity of the Project and the emissions intensity of the grid during the Project's operations.

2.3.2 Contribution to the National Electricity Market

2.3.2.1 Overview

The National Electricity Market (NEM) operates as a power system to deliver electricity from generators to market consumers, through an extensive transmission and distribution network comprising of around 40,000 km of transmission lines and cables. The NEM services the entire eastern and south-eastern coastline of Australia, connecting five states, and providing electricity to approximately nine million customers.

The Quarterly Update of Australia's National Greenhouse Gas Inventory: March 2020 (Quarterly Update) (Commonwealth of Australia, 2020) provides the most recent estimates of Australia's national inventory of greenhouse gas emissions, and emissions from the National Electricity Market (NEM), as being:

- electricity generation was the largest source of emissions in the national inventory, accounting for 32.7 per cent of emissions in the year to March 2020;
- emissions from the NEM account for around 80 per cent of national electricity emissions;
- emissions for the year to March 2020 are estimated to be 528.7 Mt CO2 –e; and
- emissions from the electricity sector are experiencing a long term decline, down 18.3 per cent from the peak recorded in the year to June 2009 mainly due to a reduction in coal generation, and a corresponding increase in supply from renewable sources in the NEM.

Based on the above, it can reasonably be determined that implementing the replacement of traditional coal-fired power stations with renewable energy sources, such as wind (this Project), will form part of the future renewable energy generation portfolio, and assist in reducing national electricity emissions.

"…the most cost-effective replacement, based on current cost projections, is forecast to be a portfolio of utility-scale renewable generation…" (AEMO, 2019).

This is further reflected in the NSW Electricity Strategy discussed in Section 2.2.3.1.

2.3.2.2 Energy Demand

The Australian Energy Market Operator's 2020 Electricity Statement of Opportunities provides forecasts for demand and supply of electicity. Noting that consumer demand will be driven in the short-term (two to five years) by projections of post COVID economic recovery, operational consumption is forecast to remain relatively steady. However, in the longer term (10 – 20 years) many NEM regions are forecast to return to growth in operational energy consumption and maximum demand (AEMO, 2020). The Project will help to meet increasing demand for energy in the NEM.

2.3.2.3 Energy Transition and Security

Traditionally, the electricity system in NSW has been powered by coal. Coal continues to be the primary fuel source for electricity today, generating approximately 77 percent of electricity in the NEM in 2019 (Australian Energy Regulator, 2020).

The share of wind and solar in the NSW electricity generation mix tripled between 2014/15 to 2018/19, with 5.3 per cent of the State's electricity coming from wind in 2018/19, as shown in Figure 2-1.

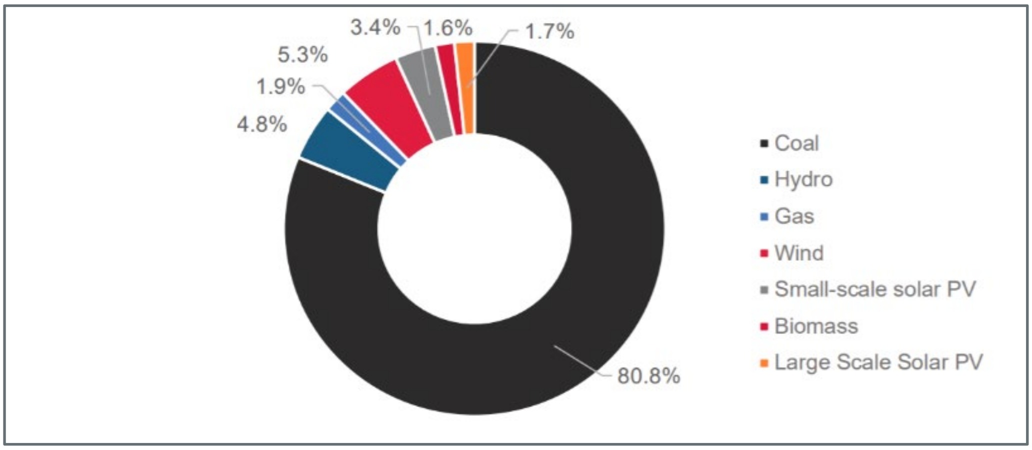
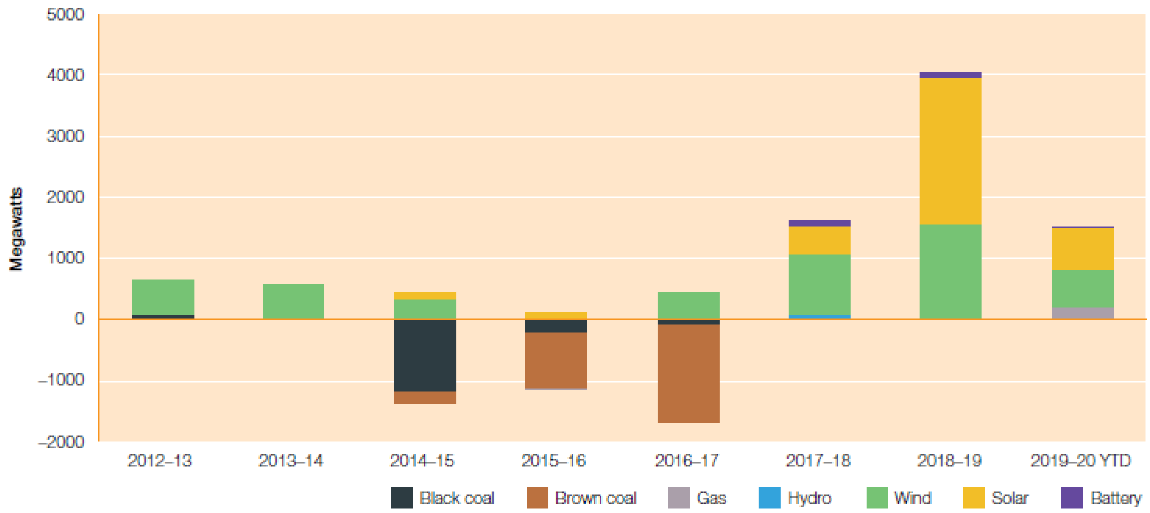


Figure 2-1 NSW Electricity Generated 2018/19 (estimate)

Source: (DPIE, 2019)These figures are forecasted to grow significantly as renewables have become the most economic form of new energy generation (DPIE, 2019). In 2019, renewable energy was responsible for approximately 24 percent of Australia's total electricity generation, an increase of 2.7 percent on 2018 (Clean Energy Council, 2020).

The energy sector in Australia is undergoing a necessary and inevitable transition from a centralised system of large fossil fuel generation towards a decentralised system of widely dispersed, renewable energy (mainly wind and solar) (Australian Energy Regulator, 2020). The Australia Energy Regulator (2020) identifies key drivers for the transition as:

- increasing community concern on the impact of fossil fuel generation of carbon emissions. There has been no energy business investing in new coal fired generation in Australia since 2012, whilst investment in wind, solar and batteries continues to grow, as detailed in Figure 2-2;
- technological advancements and cost reductions in grid scale wind and solar generation facilitating lower cost options for new build generation, including advancements in turbine technology; and
- deteriorating economics of fossil fuel generation associated with aging of the coal fired generation fleet and increase fuel costs.



Note: Capacity includes scheduled and semi-scheduled generation, but not non-scheduled or rooftop PV capacity. 2019–20 YTD includes data to 31 March 2020.

Figure 2-2 Exit and entry of generation capacity in the NEM

Source: (Australian Energy Regulator, 2020)

An underlying trend in the transforming NEM, and especially over the next 20 years (2020-2040), is the retirement of coal-fired baseload capacity and replacement with renewable energy generation, combined with transmission integration and storage technologies, such as batteries (AEMO, 2019). Replacement ensures that there is sufficient capacity in the system to address peak demand events and to ensure price competition in electricity markets. There is also increasing demand from consumers and financiers for greener energy production.

Some recent and proposed coal-fired power station retirements include:

- Wallerawang (NSW, 2014);
- Northern (SA, 2016);
- Hazlewood (VIC, 2017);
- Liddell (NSW, 2023);
- Vales Point (NSW, 2029);
- Eraring (NSW, 2031);
- Bayswater (NSW, 2035); and
- Mt Piper (NSW, 2043).

In total, the power stations planned for retirement by around 2040 produce approximately 70,000 gigawatt hours (GWh), of energy per year. This equates to one-third of total NEM consumption (AEMO, 2019) \.

Reliability in NSW is forecast to continue to deteriorate over the next 10 year outlook due to the impact of increasing forced outage rates as generators age and near retirement (AEMO, 2020). With the retirement of these power stations, plus more into the future, comes an overall significant reduction in electricity generation, necessitating the planning and implementation of alternative, renewable energy electricity production, such as this Project.

AEMO's Integrated System Plan (ISP) (AEMO, 2019) states that:

"The NEM is evolving from a centralised coal-fired generation system, to a highly diverse portfolio dominated by Distributed Energy Resources (DER) and Variable Renewable Energy (VRE), supported by enough dispatchable resources to ensure the power system can reliably meet demand at all times. In that transition to 2040:

- *coal-fired generation is expected to fall from 23 GW to 9 GW, in line with announced retirements;*
- *small-scale DER are expected to double, and in some scenarios triple, by 2040, holding grid demand relatively constant;*
- *over 26 GW of new grid-scale VRE will be needed beyond what is already committed and anticipated… to meet that demand…;*
- *6-19 GW of new dispatchable resources will be needed in support to firm up the inherently variable renewables, and*
- *investments in power system services will be needed to support a system no longer dominated by centralised thermal generation with large spinning generators.'*

AEMO forecasts that to fill the gap created by the retirement of coal fired plants, Australia should invest in a further 26-50 GW of new large-scale Variable Renewable Energy (VRE) beyond existing, committed and anticipated projects – most optimally in Renewable Energy Zones – supported by essential storage, gas-powered generation (GPG), DSP and transmission investments (AEMO, 2019).

This Project represents an investment in a new large scale VRE, providing approximately 420 MW of electricity generating capacity and 100 MW/400 MWh battery energy storage system capacity, thereby providing an essential input into the additional renewable energy sources needed in the transition from coal fired generation to renewable generation.

2.3.2.4 Energy Storage

In AEMO's Integrated System Plan (AEMO, 2019) it was forecasted that the NEM will need 6 – 19 GW of new utility-scale dispatchable resources to firm up support during peak loads or when renewable production is low.

The 2019 Electricity Statement of Opportunities (ESOO) (AEMO, 2019)forecasts a continued elevated risk of expected unserved energy (USE) over the next 10 years, and accordingly states:

> *"… targeted actions must be taken now to provide additional dispatchable capacity to reduce the risks of supply interruptions during peak summer periods".*

A substantial pipeline of generation and storage projects will help mitigate risks associated with unserved energy, in which storage according to AEMO (AEMO, 2019) will have the greatest impact. This includes large-scale battery energy storage systems to help increase minimum demand levels (AEMO, 2020).

The Project includes dispatchable energy through the proposed large scale battery energy storage system (BESS) of 100 MW/400MWh energy storage.

2.3.3 State Context

2.3.3.1 NSW Electricity Strategy

The NSW Electricity Strategy (NSW Department of Planning, Industry and Environment (DPIE), 2019) is the NSW Government's plan to achieve the three objectives of reliability, affordability and sustainability for the NSW electricity system, and will support an estimated $8 billion of private investment in NSW's electricity system over the next decade.

The Strategy is underpinned by the following four strategic propositions:

- new generation, delivered by competitive markets, should reduce electricity prices and protect the environment;
- governments remain ultimately accountable for electricity reliability because electricity is an essential service;
- government action should limit costs to taxpayers and consumers; and
- government action should be consistent with NSW's other policy objectives, including its commitment to the NEM.

An aim of the NSW Government's Electricity Strategy is to improve the efficiency and competitiveness of the NSW electricity market by reducing risk, cost, government caused delays and by encouraging investment in new price-reducing generation and energy saving technology. Identified in the Strategy is the NSW Government's commitment to energy security, including additional capacity increases via interconnector projects (refer Section 2.2.3.4) and the rolling out of Renewable Energy Zones (refer Section 2.2.3.5). The Strategy aligns closely with the NSW Government's Net Zero Plan Stage 1: 2020 – 2030.

The Project is consistent with the Strategy as it provides renewable energy generation and storage capacity that, together with other renewable generation projects, is expected to result in lower cost of power in comparison to wholesale prices. Further, the Project is uniquely positioned to take advantage of the existing transmission network and committed upgrades associated with the Queensland NSW Interconnector, which will increase the transfer of electricity between states and provide customers with access to reliable lower cost energy (TransGrid, 2020).

2.3.3.2 Net Zero Plan Stage 1: 2020-2030

The Net Zero Plan Stage 1: 2020–2030 (DPIE, 2020) sets the foundation for NSW's action on climate change and how the NSW Government will deliver on its objective to achieve net zero emissions by 2050. It acknowledges the rolling out of three renewable energy zones (REZs) in NSW (refer Section 2.2.3.4). This Project will give effect to the Net Zero Plan because the Project will enable electricity generation without emissions.

2.3.3.3 The NSW Transmission Infrastructure Strategy (NTIS)

The NSW Transmission Infrastructure Strategy (NTIS) (DPE, 2018) is the NSW Government's plan to unlock private sector investment in priority energy infrastructure projects, which can deliver least-cost energy to customers to 2040 and beyond. The Strategy forms part of the government's broader plan to make energy more affordable, secure investment in new power stations and network infrastructure and ensure new technologies deliver benefits for consumers. The Strategy aims to:

- boost NSW interconnection with Victoria, South Australia and Queensland and unblock more power from the Snowy Hydro Scheme;
- increase NSW's energy capacity by prioritising Energy Zones in the Central West, South West and New England regions of NSW, which will become a driving force to deliver adorable energy in to the future; and
- work with other states and regulators to streamline regulation and improve conditions for investment.

The Strategy seeks to help meet future energy needs by facilitating new transmission that could support up to 17,700 MW of new electricity generation. Other benefits include improved energy reliability, security, timely project delivery, increased affordability and access to cheaper electricity.

> *"The Australian Energy Market Operator (AEMO), in its July 2018 Integrated System Plan (ISP) identified that greater connection between states could deliver a net benefit across the National Electricity Market (NEM) of $1.2 billion."* (DPE, 2018).

The Queensland – NSW Interconnector is one of four priority transmission projects identified in the Strategy, helping to transport energy from the New England Energy Zone to major demand centres and involves the upgrade of existing transmission lines between Liddell Power Station, Muswellbrook and Tamworth substations (TransGrid, 2020). The Project proposes to connect to the existing Liddell to Tamworth transmission line and will therefore provide electricity that will be transmitted by the interconnector, consistent with the Strategy. The location of the Queensland – NSW Interconnector relative to the Project is shown in Figure 2-3.

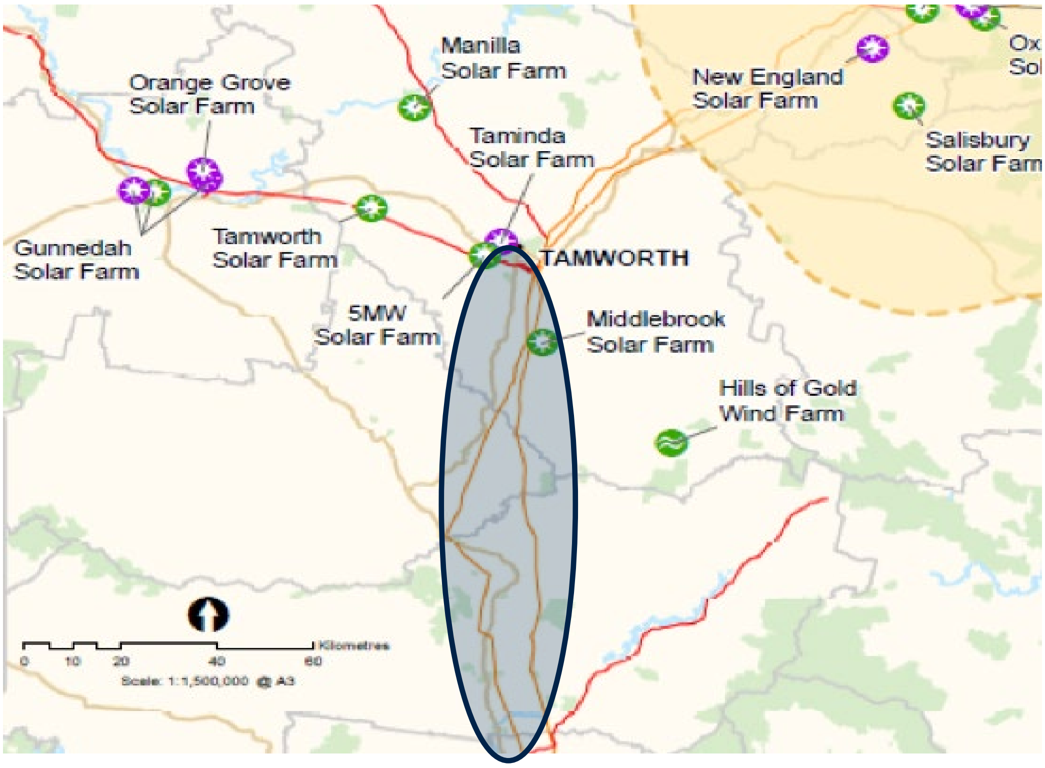


Figure 2-3 Queensland - NSW Interconnector Relative to Project Location

Source: (NSW Government, 2020)

2.3.3.4 New England Renewable Energy Zone

The NSW Government's Electricity Strategy sets out a plan to deliver three Renewable Energy Zones (REZ) in the State's Central-West Orana, New England and South-West regions. This builds on the NSW Transmission Infrastructure Strategy and supports the implementation of the Australian Energy Market Operator's Integrated System Plan. These REZs will play a vital role in delivering affordable energy generation to help prepare the State for the expected retirement of thermal power stations over the coming decades. The REZ are expected to unlock a significant pipeline of large-scale renewable energy and storage projects, while supporting up to $23 billion of private sector investment in our regions and up to 2,000 construction jobs each year (NSW Government, 2020).

The New England Renewable Energy Zone region is proposed to generate up to 8000 MW of electricity, with its indicative location detailed in Figure 2-4.

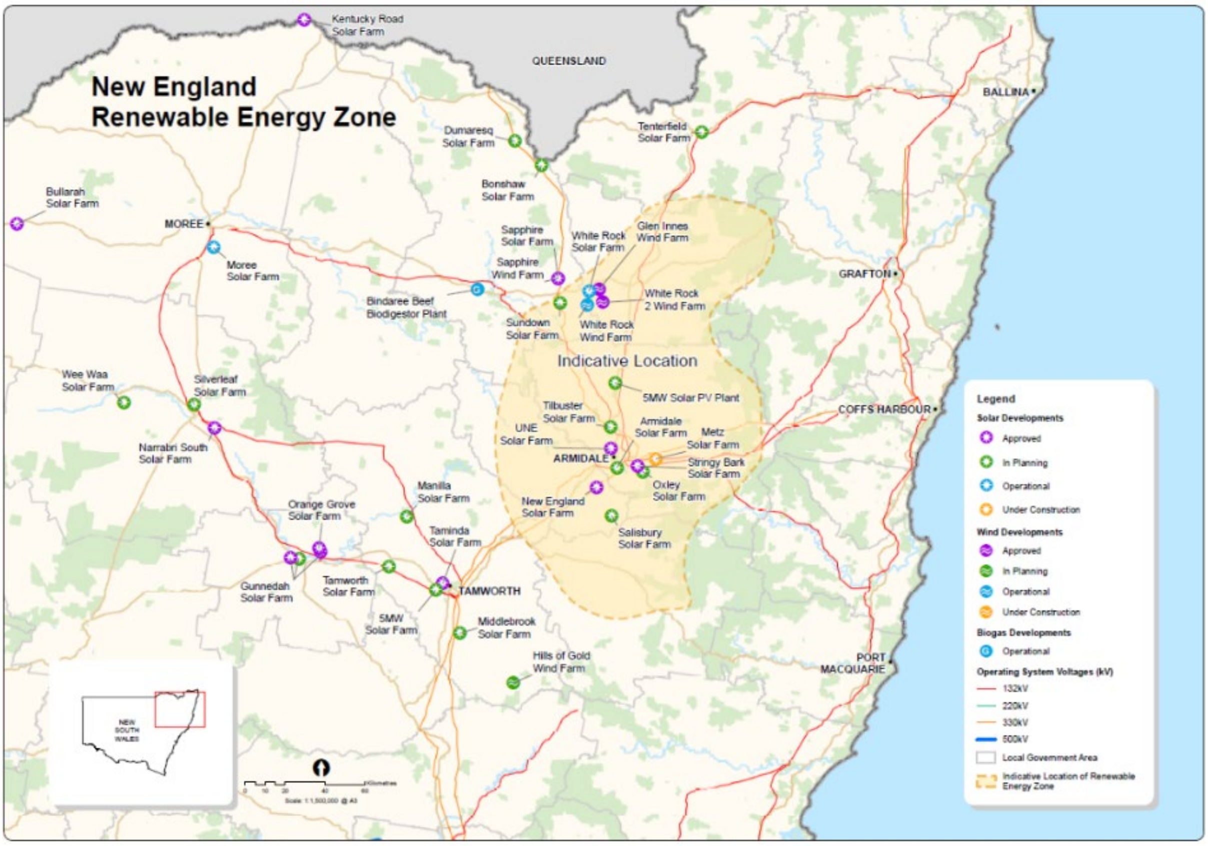


Figure 2-4 New England Renewable Energy Zone Indicative Location relative to Project Location

Source: (NSW Government, 2020)

The Project is located to the south west and in proximity to the indicative location of the New England REZ. The Project will connect to the existing Liddell to Tamworth 330kV transmission line which also dissects the New England REZ, and aligns with the identified Queensland-NSW Interconnector upgrade. As noted in Figure 2-4, the Project is recognised within the New England REZ mapping as being in the planning phase to the south of the current indicative location of the REZ.

2.4 Project Benefits

2.4.1 Key Project Benefits

Australia has one of the highest per capita emissions of carbon dioxide in the world. When emissions from Australia's current coal, oil and gas exports (3.6% of global total) are added to domestic emissions (1.4% of global total), Australia's contribution to the global climate pollution footprint is around 5%.[2] This is significant given that:

- the Australian population represents only around 0.3% of the world's population; and
- Australia is also one of the countries most exposed to the impacts of human induced climate change, as evidenced by the unprecedented bushfires which occurred over 2019/20.

The Project would deliver the following benefits:

- reduction of greenhouse gas emissions by approximately 654,500 tonnes per annum;

[2] See https://climateanalytics.org/publications/2019/evaluating-the-significance-of-australias-global-fossil-fuel-carbon-footprint/

- renewable, low cost energy to the national grid, and will contribute to the NSW Government's new zero emissions target by 2050;
- assist in exceeding the LRET, as well as an eligible generation category under RET, supplying approximately 1,100 GWh per annum, or in other terms, power to supply 185,000 average Australian homes;
- provide a significant amount of new generation capacity which will be required when the 2000 MW Liddell Power Station located in the NSW Hunter Valley closes in 2023;
- the Project represents a direct investment of over $826 million and will result in the direct injection of approximately $100 million increased income during construction and $16M per year during operations;
- benefit sharing contributions from the Neighbour Benefit Sharing Program providing better diversification of income and a drought proof and post retirement income for farmers and the community;
- economic stimulus for rural NSW which will help mitigate what are likely to be the ongoing economic impacts of the COVID-19 pandemic and the Black Summer bush fires;
- the Project will create around 216 direct jobs during construction and around 430 flow on jobs providing increased employment opportunities, including for local workers in the New England Regionimprovements to the local road network, including proposed upgrade works to Barry's Road, Morisons Gap Road and Head of Peel Road (alternate access);
- significant benefits to the regional and local communities, including:
  - electricity reliability and security benefits;
  - downward pressure on electricity prices;
  - benefits to the regional and local communities:
    - significant investment in the New England Region;
    - opportunities for local contractors and businesses; and
    - around 216 direct and roughly 430 on-flow jobs during construction;
  - approximately 31 long term service and maintenance jobs created during project operations and 53 on-flow jobs;
  - development of new skilled labour in the region within the growing renewable energy industry; and
  - diversifying employment opportunities beyond the productive agriculture sector.
  - opportunities for eco-tourism through the attraction of tourism opportunities associated with the wind farm;
  - potential for new educational opportunities associated with construction and operation of the Project which will require a range of skills including engineering, trades (electrical, mechanical, construction), transport, building material providers, equipment operators, consultants and administrative staff; and
- establishment of a Community Enhancement Fund. This will be supported by funding of $2,500 per operational wind turbine per year over the operational life of the Project and will be directed to:
  - improve community assets such as recreational facilities, public open space and public amenities; and
  - provide the community with the financial resources to help enhance lifestyle and opportunities for local residents around Hanging Rock, Nundle and communities close to the Project.

2.4.2 Economic Stimulus

The Project has the following economic stimulus benefits (SGS, 2020):

- capital expenditure of $826M of which $370M is within the local region;
- annual operating costs of $19M;
- total operational costs of $100M;
- changes in output (e.g. the turnover within the economy) can be expected to range between $1.01-$1.14B by 2040;
- value add (e.g. wages and profits) of around $160M in direct value add during the construction phase and $15.8M per year during operation, with on-flow value add of $170M per year during construction and about $30M per year during operation; and
- approximately 650 (i.e., 216 direct jobs and 430 on-flow jobs created during construction and around 84 jobs during its operational life (i.e., 31 direct jobs and 53 on-flow jobs).

This economic injection would also contribute to the local economy through:

- use of local workforce / contractors (where possible) in construction of the wind farm;
- use of local services (for example food and accommodation, fuel etc.) during the construction period;
- ongoing use of these local services during the operation of the wind farm;
- lease and neighbour benefits payments to local landholders; and
- provision of ongoing local jobs in operating and maintaining the wind farm.

2.4.3 Environmental Benefits

A key environmental benefit associated with the Project relates to the GHG emission savings as wind farms do not generate GHG emissions during electricity production (Legislative Council, 2009). The Project would comprise up to 70 WTGs, with a generating capacity of approximately 420 MW. Subject to approval, the Project would therefore equate to savings of approximately 654,500 tonnes of GHGs per annum. The renewable electricity generated by the Project could supply up to 185,000 households with energy annually.

Other environmental benefits associated with the Project include:

- reductions in air quality emissions, waste production (eg coal ash), and water use from wind power generation in comparison to traditional coal fired power stations; and
- improved access and additional water sources will be an advantage for bush fire management protection of property to both the local Rural Fire Service (RFS) and the National Parks and Wildlife Service (NPWS) through the construction and upgrade of internal roads throughout the Project Area and along the ridgeline.

2.4.4 Other Benefits

The Australian Wind Alliance (AWA) recently prepared a report called *Building Stronger Communities: Wind's growing role in regional Australia* (AWA, 2019) , which discusses the many ways wind farms deliver significant financial and social benefits to their host communities. The report also investigates how income and investment from wind farms flow to local communities, from payments to landowners and community sponsorships through to community co-ownership and co-investment.

The AWA report noted:

- in Australia, there are currently 114 operational wind farms, with another 26 in construction and 70 in the pipeline;
- this year between $24.5 and $28.9 million will go directly into regional communities through payments to host landowners and wind farm Community Enhancement Funds (CEFs);
- from 2019, Community Enhancement Funds will make available $4.7 million annually for community projects;
- the wind farms to date have created 5,700 jobs in regional areas with a further 13,300 indirect jobs created in local businesses that supply goods and services to the project; and
- the construction phase of the new wind farms in the pipeline are predicted to deliver $4.8 billion in economic activity.

3. PROJECT DESCRIPTION

This chapter presents a detailed description of the proposed works associated with the construction, operation, maintenance and decommissioning phases of the Project and provides a detailed overview of the proposed wind farm layout and infrastructure components. An analysis of the Project Area is discussed in detail in Chapter 4, Site Suitability.

3.1 Overview

The Project involves the construction, operation and commissioning of a wind farm with up to 70 wind turbine generators (WTG), together with associated and ancillary infrastructure, as detailed in Figure 3-1 to Figure 3-5.

The Project has been revised and refined over time in response to design and constructability requirements, and in consideration of environmental constraints and the outcomes of community consultation (refer Chapter 7 for further discussion of alternatives considered).

The Project consists of the following key components:

- up to 70 WTGs, each with:
  - a generating capacity of approximately 6 MW;
  - three blades mounted to a rotor hub on a tubular steel tower, with a combined height of blade and tower limited to a maximum tip height of 230 m AGL;
  - a gearbox and generator assembly housed in a nacelle; and
  - adjacent hardstands for use as crane pads and assembly and laydown areas;
- decommissioning of three current monitoring masts and installation of up to five additional monitoring masts for power testing. The new monitoring masts will be located close to a WTG location with a maximum height of approximately 150 m AGL, equivalent to the hub height of the installed WTGs. The exact number and location will be defined at the detailed design stage;
- a centrally located 330 kV electrical substation, including transformers, insulators, switchyard and other ancillary equipment;
- an operations and maintenance facility;
- a battery energy storage system (BESS) of 100 MW/400 MWh (4 hours of storage of 100MW of power);
- aboveground and underground 33 kV electrical reticulation and fibre optic cabling connecting the WTGs to the onsite substation (following site access tracks where practicable) (connection lines);
- a 330 kV single circuit twin conductor overhead transmission line (transmission line) to connect the onsite substation to the existing 330 kV TransGrid Liddell to Tamworth overhead transmission line network, located approximately 18.8 km west of the substation;
- a switching station to connect the Project to the 330 kV TransGrid Liddell to Tamworth line and enable the Project to connect to the gird. The switching station will also be located approximately 18.8 km west of the substation, or approximately 13.5 km from the WTG Project Area;

  an internal private access road network (combined total length of approximately 48.65 km) connecting the WTGs and other Project infrastructure to the public road network; and
- upgrades to local roads and crossings required for the delivery, installation and maintenance of WTG components and associated materials and structures.

The following temporary elements will be required during construction of the Project:

- temporary site buildings and facilities for construction contractors / equipment, including site offices, car parking and amenities for the construction workforce;

- two temporary concrete batching plants to supply concrete for WTG footings and substation construction works;
- earthworks for access roads, WTG platforms and foundations, potentially including controlled blasting in certain areas;
- potentially rock crushing facilities for the generation of suitable aggregates for concrete batching and/or sized rock for access road and hardstand construction;
- up to seven additional hardstand areas for the temporary storage of construction materials, plant, and equipment construction;
- external water supply for concrete batching and construction activities; and
- the transport, storage and handling of fuels, oils and other hazardous materials for construction and operation of wind farm infrastructure; and
- beneficial reuse of materials won from the development footprint during cut and fill and WTG foundation excavation for use in roads, hardstands and foundation material.

The Project also includes the subdivision of land to create two new lots for:

- the substation, O&M facility and battery storage; and
- the switchyard.

Please refer to the indicative plans contained in Figure 3-6 and Figure 3-7 showing the currently proposed lots which remain subject to further detailed design and discussions with the relevant landholder and TransGrid. The Project also includes any deemed subdivision, including subdivision for lease purposes, arising from the grant of leases for any other project infrastructure components including turbines and the substation.

The key Project components are discussed in further detail below.

3.2 Project Components and Layout

3.2.1 Overview

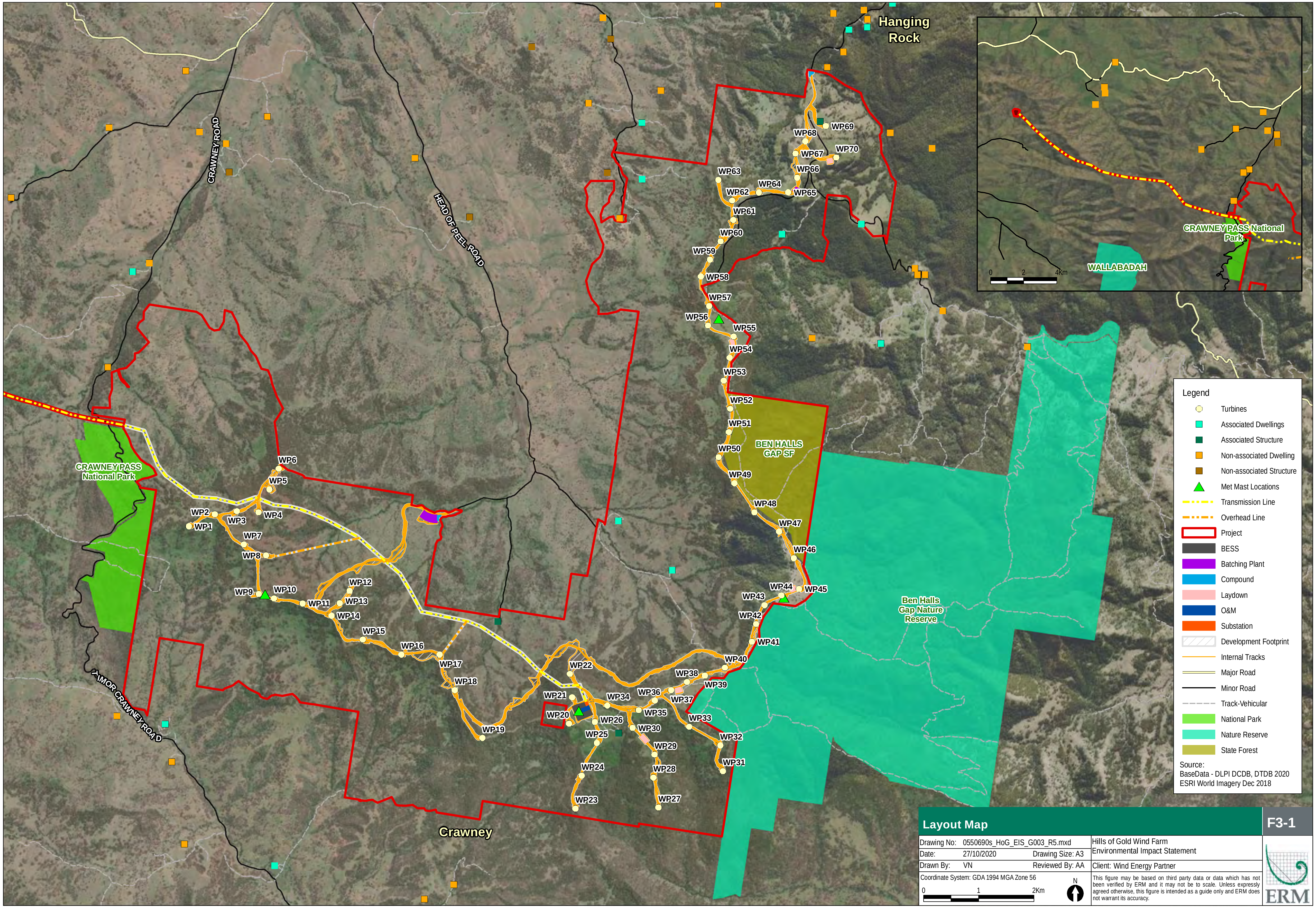
The proposed Project layout including the WTGs, access roads and supporting infrastructure is shown in Figure 3-1 to Figure 3-5. This layout remains subject to ongoing detailed design and micro siting subject to the restrictions outlined below.

The proposed layout of Project infrastructure was developed based on consultation with the community and relevant land owners. The propose layout is intended to:

- maximise exposure to the wind resource through suitable positioning of WTGs onsite including elevated locations along the ridgeline and suitable spacing between WTGs to account for wind sector management; and
- minimise environmental impacts and protect sensitive areas identified through specialists assessments discussed in the later sections of the EIS (including but not limited to biodiversity, heritage, visual and noise related issues).

3.2.2 Iterative Design Process

The layout of the Project and siting of WTGs and other key infrastructure components has been subject to an ongoing iterative design and siting process, taking into account environmental, civil engineering and wind generation constraints and opportunities, as well as consideration of issues raised during ongoing community engagement. This is discussed in detail in Chapter 5.



Layout Map F3-1

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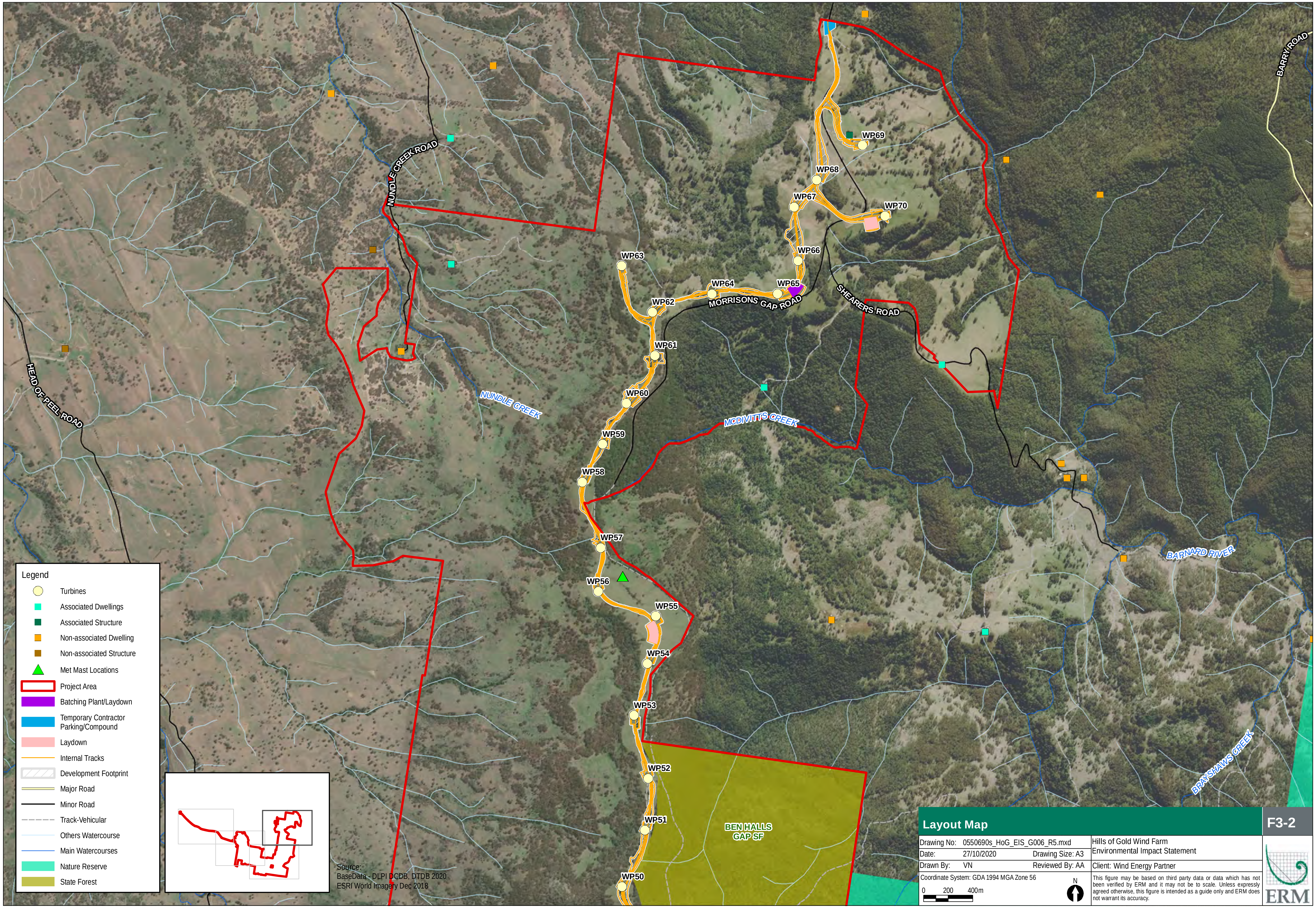
Date: 27/10/2020 Drawing Size: A3
Drawn By: VN Reviewed By: AA
Coordinate System: GDA 1994 MGA Zone 56

Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partner

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.



NUNDLE CREEK ROAD
BARRY ROAD
HEAD OF PEEL ROAD
MORRISONS GAP ROAD
SHEARERS ROAD
NUNDLE CREEK
MCDIVITTS CREEK
BARNARD RIVER
BRAYSHAWS CREEK
BEN HALLS GAP SF
WP50
WP51
WP52
WP53
WP54
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WP56
WP57
WP58
WP59
WP60
WP61
WP62
WP63
WP64
WP65
WP66
WP67
WP68
WP69
WP70
Legend
Turbines
Associated Dwellings
Associated Structure
Non-associated Dwelling
Non-associated Structure
Met Mast Locations
Project Area
Batching Plant/Laydown
Temporary Contractor Parking/Compound
Laydown
Internal Tracks
Development Footprint
Major Road
Minor Road
Track-Vehicular
Others Watercourse
Main Watercourses
Nature Reserve
State Forest
Source:
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018
Layout Map
F3-2
Drawing No: 0550690s_HoG_EIS_G006_R5.mxd
Date: 27/10/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partner
Coordinate System: GDA 1994 MGA Zone 56
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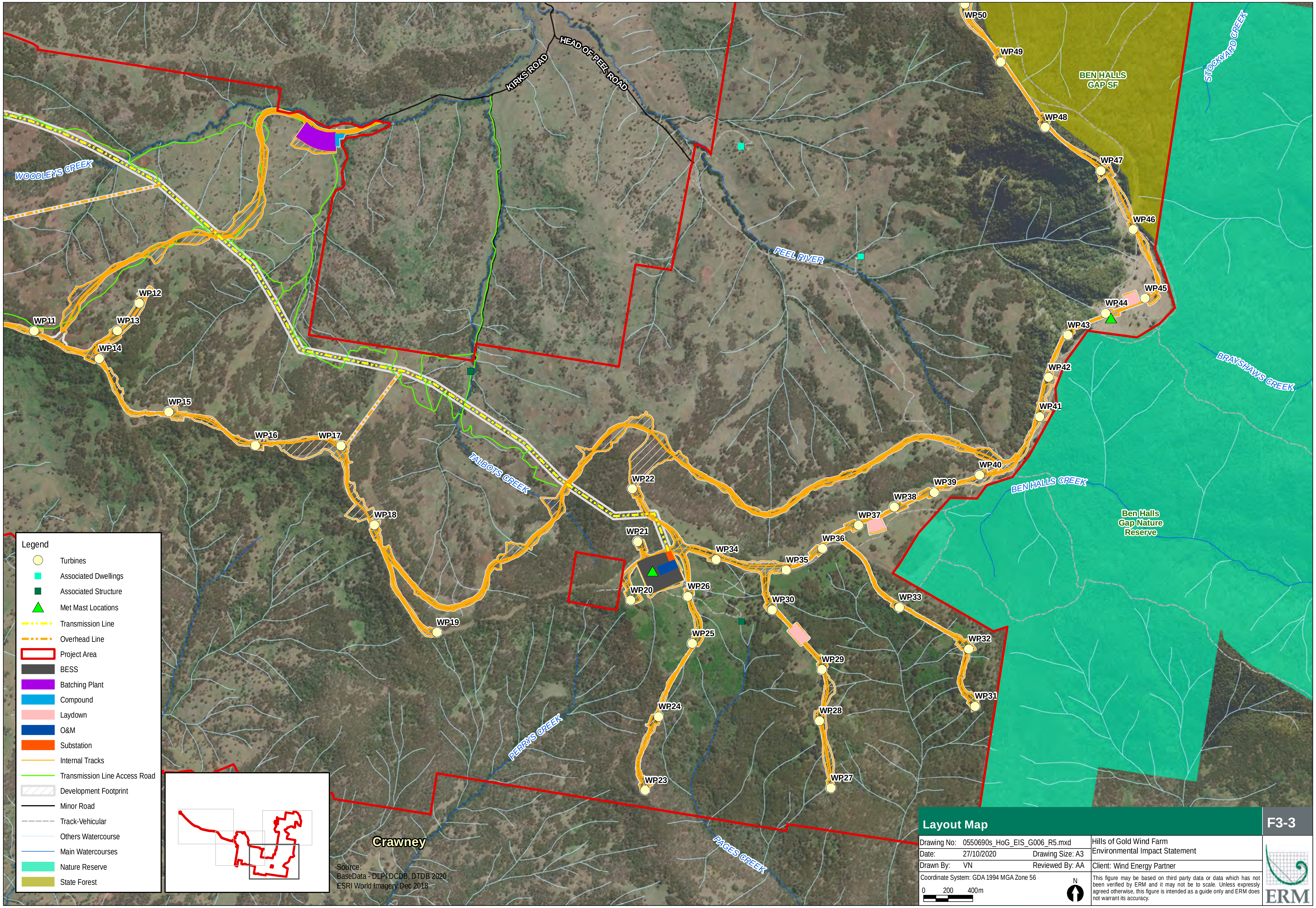

Layout Map
F3-3
Drawing No: 0550690s_HoG_EIS_G006_R5.mxd
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Drawing Size: A3
Drawn By: VN
Reviewed By: AA
Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partner
Coordinate System: GDA 1994 MGA Zone 56
0 200 400m
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This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM
Legend
Turbines
Associated Dwellings
Associated Structure
Met Mast Locations
Transmission Line
Overhead Line
Project Area
BESS
Batching Plant
Compound
Laydown
O&M
Substation
Internal Tracks
Transmission Line Access Road
Development Footprint
Minor Road
Track-Vehicular
Others Watercourse
Main Watercourses
Nature Reserve
State Forest
Source:
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018
Crawney
WOODLEYS CREEK
KIRKS ROAD
HEAD OF PEEL ROAD
PEEL RIVER
TALBOTS CREEK
PERRYS CREEK
PAGES CREEK
BEN HALLS CREEK
BRAYSHAWS CREEK
STOCKYARD CREEK
BEN HALLS GAP SF
Ben Halls Gap Nature Reserve
WP11
WP12
WP13
WP14
WP15
WP16
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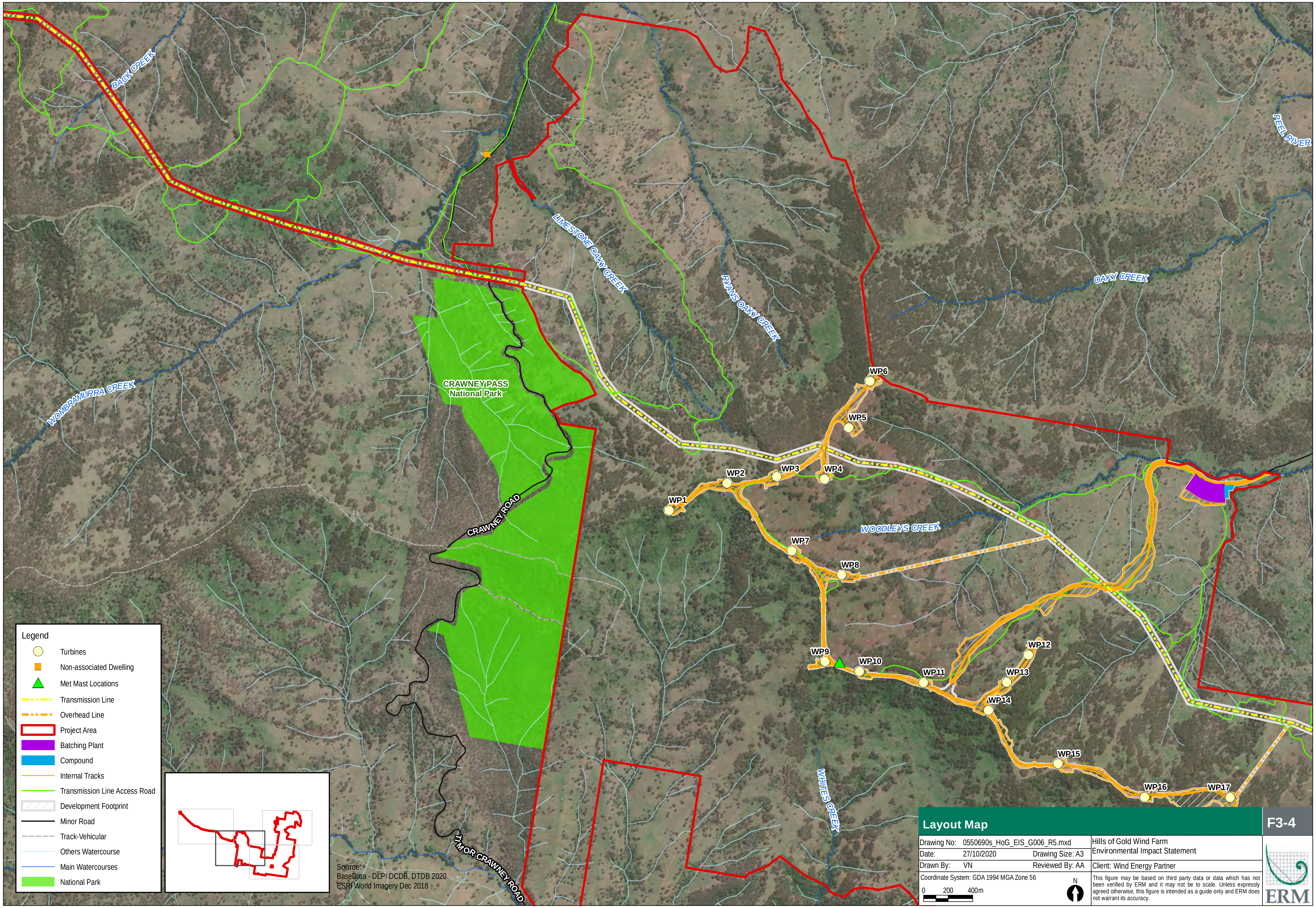

BACK CREEK
LIMESTONE OAKY CREEK
RYANS OAKY CREEK
OAKY CREEK
PEEL RIVER
WOMBRAMURRA CREEK
CRAWNEY PASS
National Park
CRAWNEY ROAD
TIMOR CRAWNEY ROAD
WOODLEYS CREEK
WHITES CREEK
WP1
WP2
WP3
WP4
WP5
WP6
WP7
WP8
WP9
WP10
WP11
WP12
WP13
WP14
WP15
WP16
WP17
Legend
Turbines
Non-associated Dwelling
Met Mast Locations
Transmission Line
Overhead Line
Project Area
Batching Plant
Compound
Internal Tracks
Transmission Line Access Road
Development Footprint
Minor Road
Track-Vehicular
Others Watercourse
Main Watercourses
National Park
Source:
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018
Layout Map
F3-4
Drawing No: 0550690s_HoG_EIS_G006_R5.mxd
Date: 27/10/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partner
Coordinate System: GDA 1994 MGA Zone 56
0 200 400m
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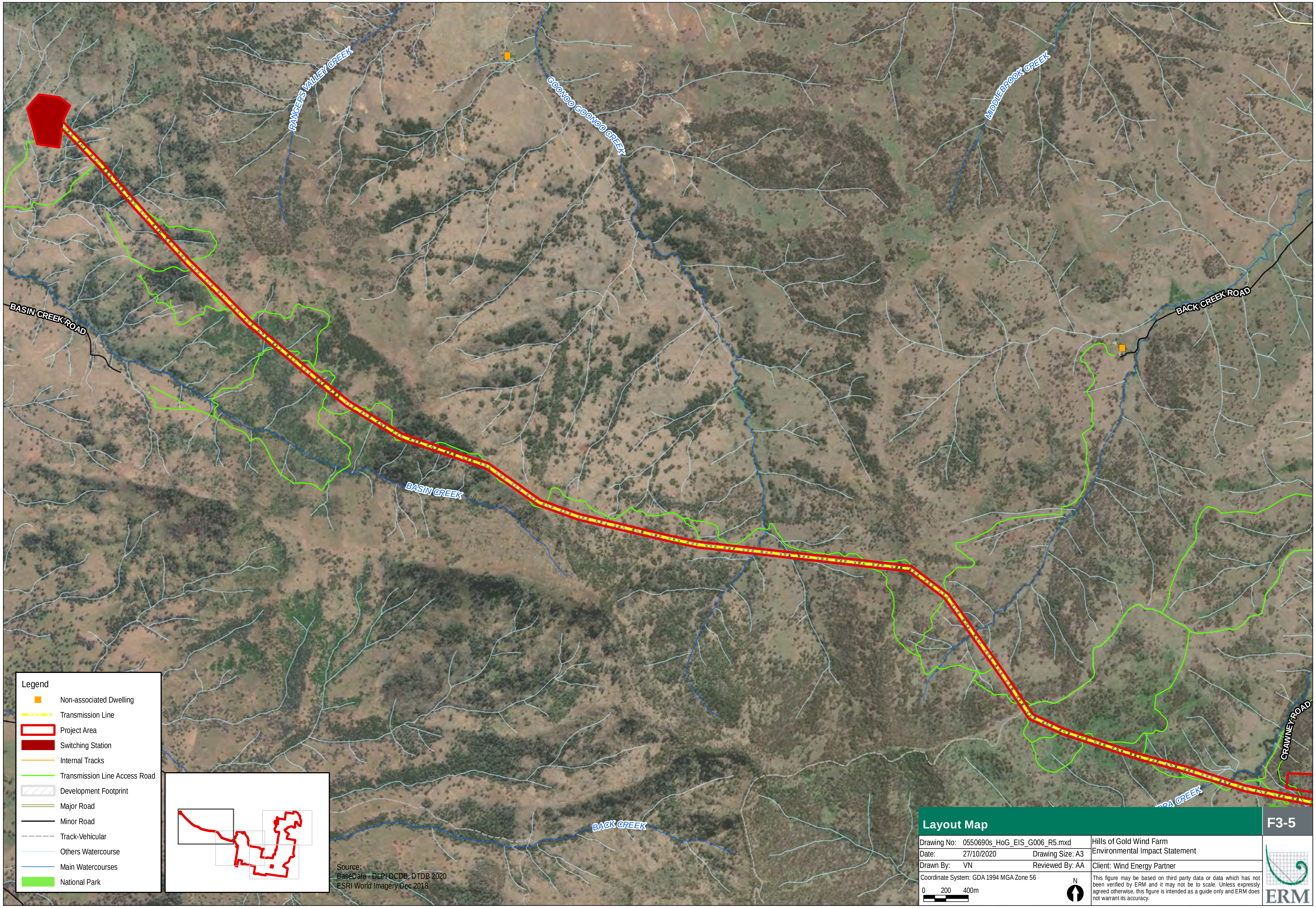
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM


RANGERS VALLEY CREEK
COONOO COONOO CREEK
MIDDLEBROOK CREEK
BASIN CREEK ROAD
BACK CREEK ROAD
BASIN CREEK
BACK CREEK
CRAWNEY ROAD
Legend
Non-associated Dwelling
Transmission Line
Project Area
Switching Station
Internal Tracks
Transmission Line Access Road
Development Footprint
Major Road
Minor Road
Track-Vehicular
Others Watercourse
Main Watercourses
National Park
Source:
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018
Layout Map
F3-5
Drawing No: 0550690s_HoG_EIS_G006_R5.mxd
Date: 27/10/2020
Drawing Size: A3
Drawn By: VN
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Hills of Gold Wind Farm
Environmental Impact Statement
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0 200 400m
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ERM

Indicative Subdivision Plan
Substation, BESS and O&M Facility

F3-6

Drawing No:	0550690s_HoG_EIS_G035_R0.mxd		Hills of Gold Wind Farm Environmental Impact Statement
Date:	28/10/2020	Drawing Size: A3	
Drawn By:	VN	Reviewed By: AA	Client: Wind Energy Partner
Coordinate System: GDA 1994 MGA Zone 56			This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Indicative Subdivision Plan - Switching Station

F3-7

Drawing No: 0550690s_HoG_EIS_G036_R1.mxd	Hills of Gold Wind Farm Environmental Impact Statement
Date: 16/11/2020 Drawing Size: A3	
Drawn By: VN Reviewed By: AA	Client: Wind Energy Partner
Coordinate System: GDA 1994 MGA Zone 56	This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM

3.2.3 Wind Turbine Generators

The Project will involve the construction and operation of up to 70 WTGs within the Project Area. The WTG model for the Project is yet to be selected, with a range of models currently under consideration. Based on current technology, the selected model is expected to have a generation capacity of approximately 6.0 MW. The selected WTG model will be in compliance with the relevant building standards and codes, including:

- IEC WT 01:2001 System for Conformity Testing and Certification of Wind Turbines — Rules and procedures.
- IEC 61400-1:2005 Wind turbines Part 1: Design requirements.
- IEC 61400-12-1:2005 Wind turbines Part 12-1.
- IEC 61400-23 Wind turbine generator systems – Part 23.
- IEC 62305-1/3/4 Protection against lightning.
- IEC 61400-4:2012 Wind turbines — Part 4: Design requirements for wind turbine gearboxes.

The dimensions of the WTG components including blade length, and hub and blade tip heights will vary depending on the final model selected. In order to provide flexibility in selecting the WTG model, the WTG dimensions adopted for assessment as part of this EIS are the largest of the model options being considered for the Project. The assessed dimensions are as follows:

- a WTG with a rotor diameter of up to 170 m (blade length of up to 83.5 m); and
- an overall tip height of 230 m.

Each WTG consists of a tower, nacelle, rotor hub, and blades. The WTGs will have a matt white finish. To achieve visual consistency through the landscape, the Project will include:

- uniformity in the colour, design, height and rotor diameter;
- use simple muted colours and non-reflective materials to reduce visibility and avoid drawing the eye;
- blades, nacelle and towers are to appear as the same colour; and
- avoidance of unnecessary lighting, signage, logos etc.

Typical components of a turbine are detailed in Figure 3-8.

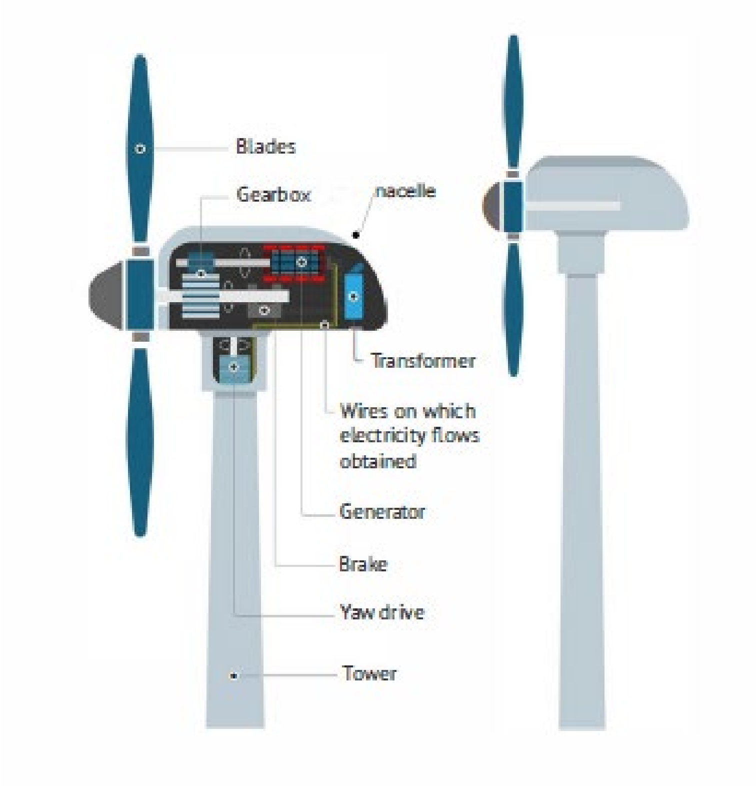


Figure 3-8 Wind Turbine Components

The process of installing the WTGs is outlined in Section 3.3.6. The central coordinates, maximum elevation and siting considerations of the WTGs are provided in Table 3-1.

Table 3-1 WTG Coordinates

WTG No.	Easting (m)*	Northing (m)*	Elevation (m AHD)
WP1	316,190.85	6,502,649.42	1,222.33
WP2	316,660.03	6,502,869.95	1,259.58
WP3	317,061.85	6,502,922.86	1,254.73
WP4	317,449.24	6,502,903.10	1,199.66
WP5	317,646.58	6,503,320.59	1,142.29
WP6	317,817.55	6,503,696.30	1,171.94
WP7	317,184.44	6,502,322.26	1,185.67
WP8	317,588.55	6,502,126.60	1,167.52
WP9	317,453.03	6,501,426.24	1,153.01
WP10	317,732.46	6,501,347.19	1,160.41
WP11	318,250.90	6,501,255.87	1,127.11
WP12	319,102.06	6,501,480.18	1,131.47
WP13	318,924.10	6,501,258.68	1,161.78
WP14	318,777.79	6,501,032.55	1,161.32

WTG No.	Easting (m)*	Northing (m)*	Elevation (m AHD)
WP15	319,341.13	6,500,599.04	1,118.49
WP16	320,042.27	6,500,328.81	1,069.75
WP17	320,736.01	6,500,326.42	1,169.63
WP18	321,007.07	6,499,684.84	1,130.55
WP19	321,513.27	6,498,815.94	1,195.13
WP20	323,082.52	6,499,076.73	1,410.87
WP21	323,138.00	6,499,550.96	1,408.27
WP22	323,095.63	6,499,977.32	1,372.69
WP23	323,198.93	6,497,537.83	1,211.54
WP24	323,308.03	6,498,134.15	1,255.08
WP25	323,580.76	6,498,725.93	1,366.02
WP26	323,545.96	6,499,107.04	1,391.79
WP27	324,703.50	6,497,555.80	1,294.54
WP28	324,612.56	6,498,100.25	1,344.47
WP29	324,632.30	6,498,514.80	1,333.74
WP30	324,229.06	6,498,998.42	1,341.85
WP31	325,872.66	6,498,217.87	1,312.11
WP32	325,818.83	6,498,681.89	1,319.68
WP33	325,257.99	6,499,019.08	1,335.65
WP34	323,773.15	6,499,406.10	1,405.23
WP35	324,341.67	6,499,321.57	1,358.82
WP36	324,635.24	6,499,495.05	1,365.77
WP37	324,927.95	6,499,682.67	1,341.41
WP38	325,216.99	6,499,831.37	1,336.23
WP39	325,542.57	6,499,948.69	1,332.41
WP40	325,908.20	6,500,088.91	1,282.26
WP41	326,393.75	6,500,561.99	1,317.79
WP42	326,467.50	6,500,880.59	1,325.20
WP43	326,624.18	6,501,222.00	1,373.12
WP44	326,929.63	6,501,399.61	1,380.36
WP45	327,248.68	6,501,519.80	1,383.04
WP46	327,153.19	6,502,076.91	1,343.31
WP47	326,890.07	6,502,553.69	1,351.78
WP48	326,439.48	6,502,905.66	1,375.71
WP49	326,079.13	6,503,433.76	1,373.30

WTG No.	Easting (m)*	Northing (m)*	Elevation (m AHD)
WP50	325,789.15	6,503,901.55	1,329.44
WP51	325,975.23	6,504,359.62	1,325.48
WP52	326,001.77	6,504,778.28	1,336.07
WP53	325,887.63	6,505,288.79	1,311.58
WP54	325,995.06	6,505,707.10	1,316.17
WP55	326,064.00	6,506,091.80	1,318.91
WP56	325,597.43	6,506,290.32	1,296.25
WP57	325,618.03	6,506,644.82	1,291.57
WP58	325,468.55	6,507,176.88	1,294.46
WP59	325,632.77	6,507,482.55	1,276.79
WP60	325,827.07	6,507,813.57	1,241.83
WP61	326,056.20	6,508,201.73	1,213.55
WP62	326,035.87	6,508,550.51	1,240.46
WP63	325,787.51	6,508,927.48	1,194.22
WP64	326,518.50	6,508,699.39	1,249.24
WP65	327,050.47	6,508,701.46	1,267.58
WP66	327,215.07	6,508,969.01	1,259.71
WP67	327,184.58	6,509,402.79	1,251.14
WP68	327,366.55	6,509,622.76	1,245.47
WP69	327,737.18	6,509,901.34	1,187.56
WP70	327,921.58	6,509,330.63	1,212.26

** Coordinate System is UTM*
AHD = Australian Height Datum

Towers and Foundations

The wind turbine tower is constructed of composite metals and consists of 4 to 7 segments supporting the wind turbine nacelle, rotor hub and blades. Each tower will be mounted on a concrete foundation approximately 25 m in diameter located adjacent to a constructed all weather hardstand area. The exact type of foundation to be utilised will be based on the results of geotechnical surveys undertaken during the detailed design phase and prior to commencement of construction at each WTG site.

General interest has been received regarding the typical types of turbine foundations used for wind turbines. The three common types of foundations used for wind turbines are Gravity Foundations, Rock Anchors and Pile Foundations or a combination of these three depending on geotechnical conditions.

The most common type of foundation is the Gravity Foundation in which an area is excavated suitable to support the burying of a “pedestal” design of concrete and reinforced steel sufficient to create a gravity foundation. These are typically 3-5 m deep and 25 m in diameter. The volume can be between 500-900 m^3 depending on the turbine, geotechnical conditions and other environmental factors. A cross section of a typical gravity foundation is shown in Figure 3-9.

Figure 3-9 Typical Gravity Foundation for a Wind Farm (ENGIE Willogoleche Wind Farm in construction)

A gravity foundation is then covered so that only the tower section is visible above ground as shown in Figure 3-10:

Figure 3-10 Typical Wind Farm Tower Foundation

Nacelle

The nacelle is the housing that sits on the top of the turbine tower and accommodates the generator, control systems, pitch and yaw drives. The nacelle may also include the transformer and gearbox (if used) and is typically constructed of fibreglass. Oil containment and sound insulation are provided for within each nacelle.

Wind Turbine Rotor

The rotor, which includes the hub that connects the blades to the gearbox, is the portion of the WTG that captures the energy from the wind. The energy captured by the rotating blades is transferred to a generator housed within the nacelle. Blades are generally made of fibreglass reinforced with epoxy and carbon fibre. The rotor is controlled by a central wind turbine control unit (microprocessor). The microprocessor controls the rotational speed of the rotor and the pitch of the blades, therefore enabling the rotor to maximise energy production from the wind resource and ensure the safe and reliable operation of the WTG. When wind speeds get too high the microprocessor controls the pitch of the blades to stop the WTG rotating, which minimises wear on the components from operating at too high wind speeds.

Each WTG will have a transformer located in either within the nacelle or mounted external to the WTG on the hardstand area. The transformer is required to 'step-up' the voltage of the electricity produced by each WTG to the onsite distribution voltage of 33 kV. Each WTG will be connected to the onsite substation via a network of aboveground and underground electricity and communication cables.

Obstacle Lighting

The Project may require obstacle lighting at night time or during periods of reduced visibility. Whilst the Aviation Impact Assessment (Aviation Projects, 2020) provided in Appendix H concluded that the Project will not require obstacle lighting to maintain an acceptable level of aviation safety, the Civil Aviation Safety Authority (CASA) may potentially require lighting where turbines exceed 150 m in tip height, as has been the case for other wind farm developments in NSW.

Although subject to future detail in accordance with CASA requirements and the conditions imposed on any development consent granted; the potential night lighting requirements for the Project may include:

- two flashing red medium intensity obstacle lights per turbine required to be lit;
- mounting of the light fixtures sufficiently above the surface of the nacelle so that the lights are not obscured by the rotor hub, and are at a horizontal separation to ensure an unobstructed view of at least one of the lights by a pilot approaching from any direction;
- sufficient individual wind turbines to be lit to indicate the extent of a group of turbines; and
- interval between obstacle lighted turbines not exceeding 900 m, and the most prominent (highest for the terrain) turbine(s) to be lit.

The Landscape and Visual Impact Assessment (refer Chapter 11 and Appendix F) assesses the impact of night lighting.

3.2.4 Electrical Reticulation

Transmission Line

A 330 kV single circuit twin conductor overhead transmission line connection is proposed to connect the onsite substation to the existing 330 kV overhead transmission line network, a length of approximately 18.8 km.

The proposed 330 kV transmission line is anticipated to comprise a steel pole structure, around 50 m high and spaced up to 150 m - 1,000 m apart. The conductors (wires) will be aluminium and will be designed to be a minimum of 9 m above the ground at maximum operating temperature.

The poles will generally require a concrete pier for the foundation and it will be necessary to establish ‘construction pads’ adjacent to the towers. A crane pad of approximately 10 m x 10 m will be established for the crane assembly and a second steel lay down area for the steel assembly prior to erection. The laydown area will typically be around 20 m x 10 m

Each circuit will include three pairs of conductors, orange balls for visual identification and an earth shield wire, protecting the line from lighting strikes.

Vehicle access to the transmission line will be via Basin Creek Road to the switching station site, with access to the construction sites along the transmission line proposed to be from Crawney Road via local access roads, as shown in Figure 3-4 and Figure 3-5.

Examples of the typical steel pole structures proposed for the transmission line are detailed in Figure 3-11.

Figure 3-11 Typical Steel Pole Structures, Transmission Line

Easements

The 330 kV transmission line will be designed and constructed to meet relevant Australian standards.

The transmission line will be centred on a 60 m wide easement. For the safe operation of the transmission line, certain activities will be restricted within the easement area such as planting and growing trees, construction of buildings, or erection of antennae or masts. The ongoing use of the land for agricultural purposes such as grazing will not be affected by the transmission line.

Onsite Substation

It is proposed that a new 33 kV/330 kV substation compound will be constructed onsite with approximate dimensions of 70 m by 40 m. The primary purpose of the substation will be the reception, transformation and transmission of electrical power and energy. The electrical substation will house a series of transformers, switch gear, and ancillary equipment for the transformation and distribution of energy. The transformers and radiators in the electrical substation will be located on foundations and will be surrounded by concrete bunds and/or collection sumps designed with sufficient capacity to retain 110% of the oil contained within each transformer.

The indicative location of the substation is identified in the wind farm layout plan provided at Figure 3.1. An image of a typical wind farm substation is provided at Figure 3-12.

Figure 3-12 Typical Substation - Gullen Range Wind Farm 33/330kV Substation

(Photo courtesy of Gullen Range Wind Farm)

Battery Energy Storage System (BESS)

The Project includes the installation of a lithium-ion battery energy storage system (BESS). A 6.38 ha footprint area has been set aside for the installation of the BESS. Given the substantive advances in battery storage technologies over time, the exact storage capacity cannot be confirmed at this time, however, it is anticipated that the BESS will have a capacity of between 100MW/ 400MWh. This would allow the optimisation of the Hills of Gold Wind Farm in the NEM.

The major components of the BESS will be batteries, inverters, transformers, heating ventilation air conditioning and fire protection. The specific design details for the BESS will not be finalised until the completion of the detailed design stage of the Project but will not exceed the specifications provided in the SEPP 33 screening assessment discussed in Chapter 13 and Appendix L. An image of a typical BESS is provided in Figure 3-13.

Figure 3-13 Typical Battery Energy Storage System

33 kV Cable and Fibre Optic Network

Each of the 70 WTGs will be connected to the onsite substation via a 33 kV electrical cable and fibre optic network. Whilst the electrical reticulation network will be finalised during the detailed design phase, it is anticipated that the aboveground and underground cabling will generally be located adjacent to the footprint of the internal access roads. However, some deviations away from the access roads may be required given potential topographical or other constraints. The currently identified extent of deviations proposed is included in Figure 3-1 and Figure 3-3. Any deviations will avoid areas of heritage and ecological significance and will remain within the Development Footprint. The trenching for underground electrical cabling will be approximately 1 m wide per circuit by 1.5 m deep, located within a works area of approximately 5 m to accommodate the excavator and stockpiling of spoil and bedding sand. Trenches will be progressively backfilled during the course of the construction works. The aboveground cabling will have orange balls for visual identification if necessary.

Switching Station

A switching station with approximate dimensions of 165 m by 100 m for physical electrical components will be constructed to connect the Project transmission line to the existing 330 kV TransGrid Liddell to Tamworth overhead transmission line network. The switching station will have a total footprint of approximately 5 ha including earthworks. The location of the switching station is identified in the wind farm layout plan provided at Figure 3.1 and 3.5. An image of a typical wind farm switching station is provided in Figure 3-14.

Figure 3-14 Typical Switching Station – Gullen Range Wind Farm 330 kV Switching Station

(Photo courtesy of Gullen Range Wind Farm)

3.2.5 Crane Pads and Assembly Areas

A hardstand will be constructed adjacent to the base of each WTG to enable the assembly and erection of the tower, nacelle and blade components. The final design will depend on the topography of the surrounding land. Each crane pad will consist of crushed rock hardstand of an area between 0.38 ha and 0.53 ha depending on pad design (Figure 3-15).

Nineteen out of the 70 WTG's pad areas will be designed based on a 'Just in time' (JIT) delivery concept. The JIT pad does not require a blade laydown area reducing the area of disturbance per pad by approximately 0.15 ha. Various centralised laydown areas have been considered across the Project Area to allow for nacelle-blade assembly and temporary storage. Once nacelle-blade assembly has occurred at the centralised area, units are transported to the hardstand at each WTG location for erection.

This JIT concept has been adopted to further reduce the biodiversity impacts of the Project as is further explained in Chapter 5.

Figure 3-15 details (A) preliminary design of a simplified hardstand layout including blade pad and access road, and (B) simplified laydown layout without blade laydown area (JIT pad).

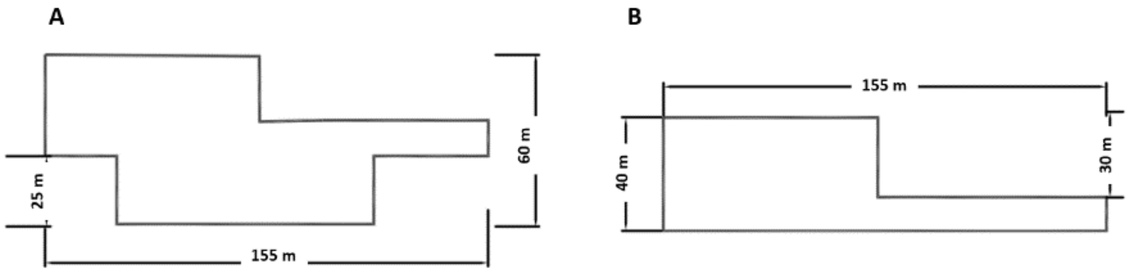


Figure 3-15 Typical Laydowns

Whilst it is anticipated that the majority of crane pads will remain in situ to allow for future maintenance or removal of the WTGs, there may be the opportunity to apply a top soil layer to the laydown portions to allow grazing activities to resume while the turbines are not in use.

3.2.6 Site Access from Nundle

The primary site access is via Morrisons Gap Road, located to the north east of the Project Area. This Tamworth Regional Council road is unsealed for approximately 3 km prior to the Project Area. The alternate access point to the Project Area is via Head of Peel Road, currently unsealed from the junction with Crawney Road (a distance of approximately 12 km).

The location of the Project access points and transport routes of infrastructure are shown in Figure 3.19.

Transport of wind farm components to the Project Area is discussed in Section 3.3.4

3.2.7 Internal Access Roads

The construction and maintenance of the Project will require construction of up to approximately 48.65 km of private access roads within the Project Area. The roads will provide ongoing access to the WTGs and other Project infrastructure including the transmission line. Where practicable, the internal road network will be aligned on the route of existing farm or other access roads. The internal roads will be up to 5.5 m wide (with approximately 1.5 m shoulders on either side), with localised widening where required to support transportation of the WTG components.

For the purposes of this EIS, the Development Footprint (area of disturbance) has been based on preliminary concept civil design for roads and hardstands, including likely cut and fill requirements, batters, cable runs and drainage which is subject to the abovementioned specifications.

Within the biodiversity assessment (Chapter 9 and Appendix B), it has been assumed that the area of impact for roads, drainage, adjacent underground cable runs and cut and fill batters will have an average width of disturbance of 39.87 m (to accommodate drainage and cabling) and a total length of 48.65 km. These assumptions were adopted as the conservative worst case and are expected to be improved in detailed design (refer Chapter 9 and Appendix B).

Included within the internal road network proposed for both construction and ongoing use is the ‘Transverse Track’, which provides internal road access between WTG 18 to WTG 40 to overcome topography challenges for road construction between WTG 19 and WTG 20.

The proposed internal road network is shown in Figures 3-1 to Figure 3-5.

3.2.8 Permanent Operations and Maintenance Facility

A permanent site operations and maintenance facility (O&M), approximately 100 m by 100 m will be constructed to provide for all operations and maintenance activities associated with the Project. An example O&M facility is provided in Figure 3-16 Car parking facilities will also be provided for employee and service vehicles.

During operations, approximately 31 permanent staff will occupy these premises. Whilst most activity is anticipated to occur during business hours Monday to Friday, access to the Project Area will be required on a 24 hour basis, seven days a week.

Figure 3-16 Example O&M Facility – Willogoleche Wind Farm

(Photo courtesy of ENGIE)

3.2.9 Meteorological Monitoring Masts

The Project includes the decommissioning of the three current monitoring masts and installation of up to five new monitoring masts for power testing. The new monitoring masts will be located close to a WTG location and will have a maximum height of approximately 150 m AGL, equivalent to the hub height of the installed WTGs. The exact number and locations will be defined at the detailed design stage. These masts assist in verifying the performance of the WTGs during operation of the Project.

The monitoring masts consist of a buried concrete base foundation and guy wires which are attached to buried anchor points. In accordance with the recommendations of the Aviation Impact Assessment, these will be marked using three dimensional coloured objects attached to the wire or cables (for example spheres or pyramids) if necessary (refer to Appendix H).

3.2.10 Micrositing

The proposed layout is indicative and subject to detailed design, which will incorporate detailed geotechnical investigations and selection of the final wind turbine model.

In order to facilitate refinement of the layout during the detailed design process, an allowance for micrositing of WTGs by up to 100 m radius from the locations identified in the EIS is sought. Other project infrastructure components, including cabling and access tracks, may also be microsited within the assessed study area subject to ensuring that micrositing does not result in greater impacts than assessed in this EIS and complies with all conditions imposed on any development consent granted for the Project. The BESS, substation, switching station and O&M facility will not be microsited within the identified flame zone.

Final layout documentation will be prepared and submitted to DPIE prior to commencement of construction.

3.2.11 Temporary Facilities

Construction of the Project will require a range of temporary buildings and facilities for construction personnel and equipment, including a construction compound (including site offices, car parking, and amenities for the construction work force), mobile concrete batching plants, laydown and storage areas for the temporary storage of construction materials, plant, equipment and wind turbine components, and temporary power supply for construction. An example concrete batching plant is provided in Figure 3-17.

Figure 3-17 Example Concrete Batching Plan – Willogoleche Wind Farm

(Photo courtesy of ENGIE)

The indicative location of temporary facilities and activities associated with the construction of the Project are outlined in Figures 3-1 to Figure 3-5.

3.3 Project Construction

3.3.1 Duration and Staging

Construction activities will be progressive across the Project Area over a period of approximately 18 – 24 months. The anticipated timing of key Project milestones is presented in Figure 3-18.

Construction, operation and decommissioning of the Project may be staged and early works entered into in response to market drivers and specific construction work packages. Where staging is required:

- each of the strategies, plans and programs required by the conditions of consent will be submitted on a progressive basis for each stage of the Project, where appropriate;
- DPIE and Councils will be notified in accordance with any relevant conditions of the development consent; and
- details of final staging and early works timing will be confirmed prior to the construction of each stage.

The Proponent has advised that the construction is likely to be staged with early works awarded shortly after any development approval to commence design, council approvals and road upgrades and associated works.

In addition, construction of the BESS may be included as a subsequent stage to the Project construction timeline based on market demand and the fast-changing economics of battery storage. Allowances will be made during the construction of the main wind farm Substation and O&M Facility such that the BESS can be added at a future point in time. The assessments consider a worst case assumption that the BESS is constructed within the Project schedule.

3.3.2 Construction Hours

Construction of the Project will generally be undertaken in accordance with the DECC (2009) *Interim Noise Construction Noise Guideline*, with the hours of work being:

- Monday to Friday: 7.00am-6.00pm;
- Saturday: 8.00am-1.00pm; and
- no works on Sunday or public holidays.

Some out of hours work may be required, including for:

- logistics and safety requirements imposed by relevant regulatory authorities (e.g. NSW Police);
- weather conditions such as high winds during the day necessitating WTG crane lifts at night;
- temperature conditions requiring concrete pours during the early morning; and
- extended concrete pours into the evening to complete a foundation.

If a need to work outside the recommended standard hours of construction is identified, these would carried out in accordance with the Noise Management Plan to be prepared for the Project.

3.3.3 Construction Workforce

It is anticipated that during construction up to 416 full time equivalent (FTE) construction jobs will be generated based on modelled estimates outlined in Chapter 19.

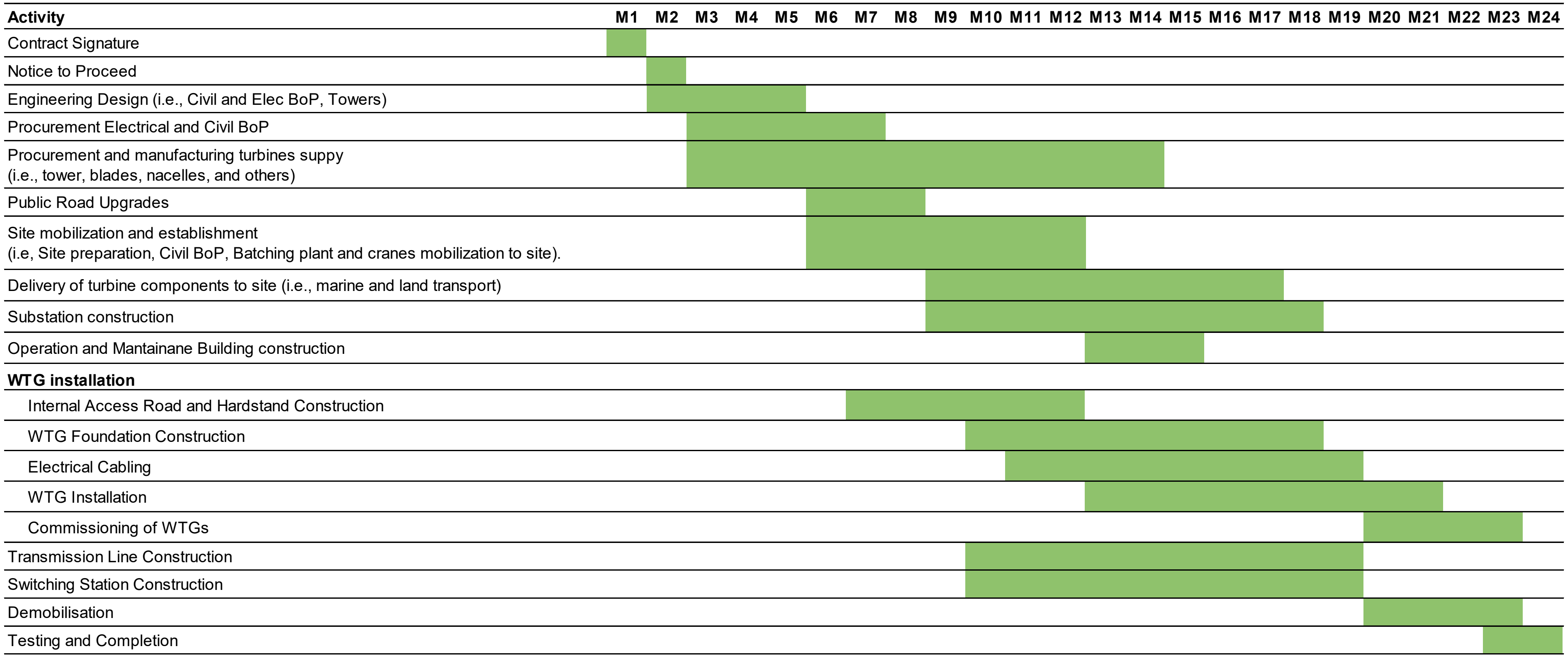


Figure 3-18 Anticipated Approximate Timeline for Construction Phase of the Project

3.3.4 Transport Route, Site Access and Internal Access Roads

The proposed transport route is discussed in Chapter 12 and Appendix G. Figure 3.19 sets out the proposed Transport and Site Access Routes.

To facilitate transportation and ease of installation, the WTG tower will be manufactured in up to seven sections. Due to the size of the WTG components, the truck and trailer configurations to transport the components are classified as Restricted Access Vehicles (RAVs). RAVs require permits that specify the designated route for travel, the number of escorts required and the time in which the RAVs can travel through certain road zones.

In summary, the RAV route from the Port of Newcastle to the Project Area would involve accessing the New England Highway, via Industrial Drive with bypasses of the Singleton and Muswellbrook townships before departing the New England Highway at Lindsay Gap Road near Wallabadah. This general route was used to provide access for RAVs for the Sapphire Wind Farm located further north and has therefore already been subject to a number of modifications to accommodate the RAV movements associated with other wind farm developments.

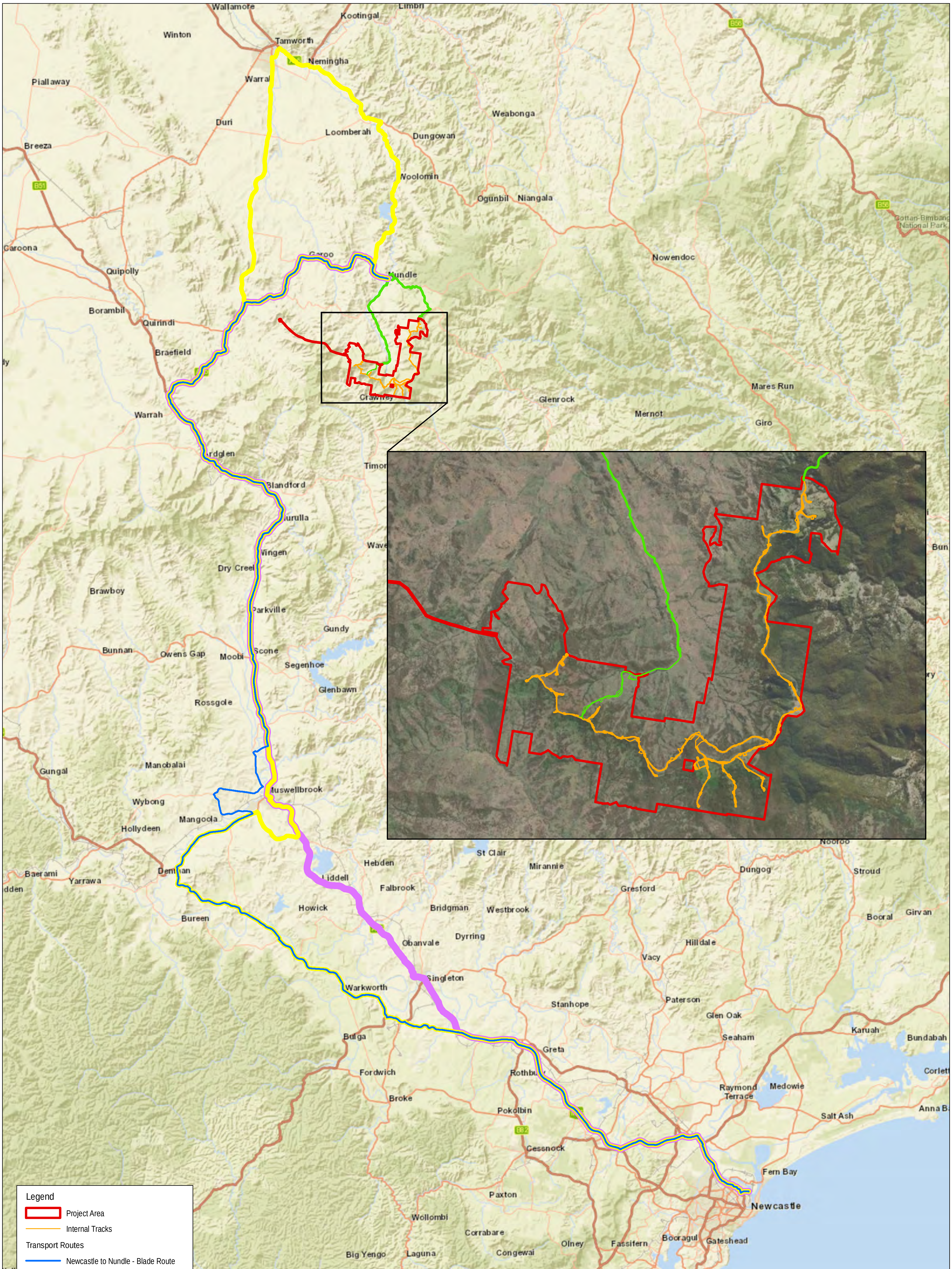
At Lindsay Gap Road the RAV transport continues through to Nundle Road and the village of Nundle and either to Barrys Road and Morisons Gap Road to the north eastern access to the Project Area or to Head of the Peel Road to access the Project Area's western access.

Heavy vehicles will be required to transport materials and equipment associated with the Project construction. It is anticipated that heavy vehicles will consist of vehicles up to and including 19.0 m long semi-trailers and B-Doubles (standard vehicles) and 'truck and dogs', concrete trucks and water tankers. The presence of the temporary concrete batching plant will reduce the number of external concrete truck movements to and from the Project Area.

Light vehicles comprising light trucks for smaller deliveries and cars, four-wheel drives and utility vehicles attributed to Project personnel will also access the Project Area during construction and operation of the Project.

3.3.5 Road Upgrades

Public road upgrades would be required to cater for the delivery of blades, nacelles and towers. The upgrades are required to ensure sufficient space for oversized vehicles passage, including intersection widening, trimming and removal of vegetation, removable signs and infrastructure, and the relocation of overhead wires. The upgrades have been identified based on the largest blade length option, being 83.5 m. The upgrades required are discussed further in Section 12.4.6 and within the Traffic and Transport Assessment in Appendix G. The general areas of public roads requiring upgrades are shown in Figure 12-14 and remain subject to further detailed design and assessment.



Road Transport Route

F3-19

Drawing No: 0550690s_HoG_EIS_G009_R3.mxd		Hills of Gold Wind Farm Environmental Impact Statement
Date: 29/10/2020	Drawing Size: A3	
Drawn By: VN	Reviewed By: AA	Client: Wind Energy Partners
Coordinate System: GDA 1994 MGA Zone 56	0 10 20Km N	This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

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3.3.6 WTG installation

Excavation will be carried out with mechanical equipment for the WTG foundations. The exact design of the WTG foundations will depend on localised geotechnical conditions and the final type of foundation adopt, however will likely consist of concrete gravity foundation based footings. Topsoil and spoil from excavation will be stockpiled for reuse to backfill over the foundation and for vegetation rehabilitation of the Project Area. Excess materials will be utilised at other parts of the Project Area or exported offsite for beneficial reuse at an approved location.

The towers, nacelles and blades will be lifted off delivery trucks using mobile cranes. Cranes will then assist in the assembly of the rotor and the installation of the towers, nacelles and rotors and blades.

3.3.7 Temporary Mobile Concrete Batch Plant

Two temporary mobile concrete batch plants are proposed for the WTG foundations and also potentially for other structures including buildings, the substation switching station foundations, bunding and culverts. The indicative locations for placement of the mobile concrete batch plants are shown in Figures 3-2 and 3-5, each of which will be utilised at various periods during construction works as required. Each concrete batch plant is likely to include a slump stand, water tanks and stockpiles of gravel and sand, and may also include rock crushing facilities depending on the source materials used for construction. Whilst the exact details of the facilities will be determined during the detailed design phase, typically the area required for the plant and storage of materials will be approximately 100 m by 100 m at each of the two proposed locations. The batching plant will be bunded to contain runoff and potential contaminants.

Materials for the plant will be primarily sourced from an external supplier to be determined during the procurement phase of the Project. It is anticipated the cement will be stored in a silo adjacent to the batching process machinery. Concrete agitators will transfer the concrete from the batch plant to the WTG foundation locations.

The concrete batch plants will be removed following the completion of construction of the WTGs and all locations rehabilitated and returned to agricultural use.

3.3.8 Resource Requirements

Construction materials including gravel, aggregate and sand will be required for the concrete batch plant and construction of hardstands to support Project infrastructure, including internal access roads and installation of electrical cabling. It is anticipated that the road formation will be constructed using a cut and fill balance with excavated materials used for the final hardstand surfaces of the roads, crane pads and laydown areas. However, this will need to be confirmed upon geotechnical testing of the excavated material prior to works commencing. Otherwise gravel, along with aggregate and sand for concrete batching will be sourced externally from existing operating quarries.

There are a number of existing quarries located within approximately 80 km of the Project Area, including quarries located at Tamworth, Willow Tree, Currabubula, Ardglen and Crawney Road. The Traffic Impact Assessment has considered vehicle transport of aggregates from roads in these localities for the purposes of the traffic assessment. Construction materials will be transported to the Project Area by trucks and stockpiled within the laydown areas and at the concrete batch plants.

Water supply for the concrete batch plants, dust suppression and other construction activities will also be required onsite. It is anticipated that water required for construction will be supplied from existing onsite dams or bores (subject to seasonal availability and water licencing requirements) or alternatively from an offsite local source (subject to approval). This is discussed further in Chapter 16.

3.3.9 Temporary Site Office, Car Parking and Storage

A temporary construction site office will be erected and maintained for the duration of the construction phase. In addition, temporary contractor parking and facilities and equipment laydown and storage areas are proposed with the indicative locations shown in Figure 3-2 and 3-5.

3.3.10 Post Construction Site Rehabilitation

The Project Area will be progressively rehabilitated throughout the course of construction. When construction is completed, all temporary plant and equipment will be removed, and disturbed areas will be revegetated and rehabilitated in consultation with involved landholders hosting infrastructure. Adequate sediment, soil and erosion controls will be put in place during ground disturbing works and rehabilitation activities in accordance with the *Managing Urban Stormwater: Soils and Construction-Volume 1* (The 'Blue Book') (Landcom, 2004).

Post construction rehabilitation requirements and processes will be detailed in the Environmental Management Strategy (EMS) to be prepared prior to commencement of construction of the Project, and undertaken in accordance with any relevant conditions of the development consent for the Project. Figure 3.21 provides examples of rehabilitation following underground cable installation at the Biala Wind Farm. Figure 3.22 provides examples of rehabilitation of road batters and verges at the Biala Wind Farm.

Figure 3.20 Examples of Rehabilitation following Underground Cable Installation – Biala Wind Farm

(Photos courtesy of BJCE Pty Ltd)

Figure 3.21 Examples of Rehabilitation of Road Batters and Verges – Biala Wind Farm

(Photos courtesy of BJCE Pty Ltd)

3.4 Development Footprint

The Development Footprint for the Project is approximately 513 ha and includes the Permanent and Temporary Development Footprints:

- The Permanent Development Footprint is the area of land that will be subject to permanent alteration as a result of installation and operation of Project infrastructure until the Project is decommissioned at its end of life. The Permanent Development Footprint is approximately 242 ha (of the 513 ha total footprint) and is comprised of:
  - WTG foundations;
  - crane pads;
  - permanent access roads, including the transverse track;
  - transmission line and transmission line access roads;
  - substation, switching station and other facilities; and
  - road upgrades required for the transport haul route.
- Temporary Development Footprint (the area of land that will be temporarily disturbed during construction of the Project and rehabilitated following construction) covers 271 ha (of the 513 ha) and is comprised of:
  - access road construction batters;
  - underground electrical cable footprint;
  - concrete batching plants;
  - transmission line temporary access roads; and
  - laydown and assembly areas adjacent to the crane hardstand and WTG foundation.

It should be noted that the impact assessment has been undertaken based an estimated total worst case Development Footprint which combines the Temporary Development Footprint and the Permanent Development Footprint, notwithstanding that temporary impacted areas will be rehabilitated at completion of construction. The estimated total development footprint for key the Project components is outlined in Table 3-2.

Table 3-2 Estimated Development Footprint of Key Project Components

Project Component		Estimated Total Footprint (ha)[1]	Temporary Footprint (ha)[2]
Wind Farm (WF)	WTGs including crane pad assembly areas and asset protection zones	57.15	
	Internal access roads [3,4,5]	185.26	89.02[6]
	Operations and maintenance building	1.09	
	Substation	0.36	
	BESS	6.38	
	Temporary facilities: parking, storage / laydown areas and batching plants	10.6	10.6
	Wind monitoring masts	0.002	
Total WF		**261**	**100**
Transmission Line (TL)	Transmission line [7]	124.18	111.76[8]
	Switching station	12.29	7.29
	Transmission line access roads	59.50	23.80[9]
Total TL		**196**	**143**
Transport route (TR)	Transport route upgrades	56.20	28.10[10]
Total TR		**56**	**28**
Total WF + TL + TR		**513**	**271**

Notes:

1. *Estimated total footprint includes temporary footprint areas.*
2. *Temporary footprint areas are areas that will be rehabilitated after completion of construction.*
3. *Internal access road calculation includes internal roads between hardstands, access track from Head of Peel Road to Project Area and transverse track.*
4. *Calculation of 48.65 km with assumption the road will accommodate drainage, internal 33 kV underground cable runs, and cut & fill batters*
5. *Underground 33 kV electrical reticulation network will generally be located within the disturbance footprint of the access road network.*
6. *Temporary areas to be rehabilitated include cut and fill, roads Asset Protection Zones (APZ) and buffer for underground cabling.*
7. *330 kV transmission line is 24 km of 60 m easement and 33 kV aboveground power line is 2.46 km of 15 m easement.*
8. *It has been estimated that 90% of the 330kV easement can be rehabilitated using native grasses.*
9. *Access tracks for the transmission line have been developed at a concept level only to provide for a worst-case scenario for biodiversity impacts. The concept alignment of these tracks has followed existing tracks as much as practicable.*
10. *It is estimated that 50% of the transport route upgrades will be rehabilitated with native grass.*

3.5 Project Operation

Upon commissioning, the Project will be operational 24 hours per day, seven days per week. The Project will be controlled by a remote supervisory control and data acquisition (SCADA) from a control room located within the permanent site operations and maintenance facility. Where required, assistance from an offsite SCADA engineering team may be sought. The SCADA system will allow remote operation of all WTGs with the ability to shutdown individual or all WTGs if required. The SCADA system also allows the Project to operate at optimal capacity by synchronising with the internal WTG control systems to alter rotor speed and blade pitch to depending on wind conditions.

3.5.1 Operational and Maintenance Workforce

Regular maintenance will be undertaken on WTGs and other plant and equipment by internal and specialised contractors throughout the operation of the Project. It is anticipated that up to 31 FTE technical personnel and maintenance staff will be employed during operation.

Circumstances may arise where unplanned equipment failure occurs due to environmental events or other factors. The majority of repairs can be undertaken during routine maintenance; however, WTG components requiring replacement would need to be undertaken using a crane in a similar manner to their installation. In addition, replacement of WTGs may occur throughout the operational life of the Project as improved technologies become available.

3.6 Decommissioning and Rehabilitation

The WTGs have an expected operating life between 25-35 years, at the end of which there are three main options for consideration:

- continue the use of the site as a wind farm using the existing WTGs (subject to condition of equipment);
- replace the WTGs with technology current at that time and continue the use of the site as a wind farm for a further term (subject to agreement with landowners); or
- decommission the Project and remove the WTGs and associated infrastructure in accordance with the Environmental Management Strategy.

When decommissioning is required:

- key stakeholders including landholders will be consulted;
- all above ground structures not required for the ongoing agricultural use of the land (some access tracks, for example, may be required to be retained by the landholder to enable ongoing access), including the WTGs and substation will be removed and the land rehabilitated to ensure it can be returned to agricultural use; and
- below ground infrastructure, including the WTG foundations and hardstands, will be left in situ and covered in clean fill material, with the area adequately graded to reflect the slope of the surrounding area and to mitigate the risk of soil erosion.

It is anticipated that the decommissioning and rehabilitation phase would take up to 18 months to complete, with the Project Area being returned, as far as practicable, to its condition prior to the commencement of construction.

The Environmental Management Strategy will include measures for Decommissioning and Rehabilitation in accordance with any project approval requirements.

The Proponent has entered long-term lease agreements with the associated landholders for the construction and operation of the Project. The terms of these agreements make express provision for the Proponent's decommissioning obligations. Until decommissioning is complete, licence fees are also payable to the associated landholders. Therefore, there is a strong incentive for the wind farm owner to properly complete decommissioning when required.

4. SITE ANALYSIS

This chapter identifies the existing conditions and physical setting of the Project Area and surrounding land and provides discussion on the suitability of the Project Area to support the proposed development.

4.1 Project Locality

The Project Area is located within the New England region, approximately 5 km south of Hanging Rock and 8 km south-east of Nundle (refer to Figure 1-1). The Project Area is located over three LGAs, being the Tamworth Regional LGA, Upper Hunter Shire LGA, and the Liverpool Plains LGA. The nearest major township is Tamworth, located approximately 60 km north west. The proximity of the Project Area in relation to other nearby townships and localities is outlined in Table 4-1.

Table 4-1 Proximity to Nearby Townships and Localities

Township/Locality	Approximate Distance and Direction from nearest part of the Project Area
Hanging Rock	5 km north
Nundle	8 km north west
Crawney	6 km south
Tamworth	60 km north west
Glenrock	21 km east
Timor	15 km south

Hanging Rock and Nundle are towns which begun as pastoral runs and transformed into now former mining villages. A newspaper article from 1892 sheds light into the rich mining history of these towns (Australian Town and Country Journal, 1892). The article reports that rich alluvial gold was first discovered in 1852 and 1853 on both banks of the Peel River, which at one point attracted over 3,000 people to camp in where is now the town of Nundle. The gold field in Nundle was described as *“one [of] the oldest, and one which was at one time one of the most productive, gold fields in the country”*. Hanging Rock was similarly reported to be *“enormously rich”* in gold (Australian Town and Country Journal, 1892). The project name of ‘Hills of Gold’ was selected to recognise this history.

4.2 Site Details

4.2.1 Overview

The Project Area including the transmission line easement and switching station covers a total area of approximately 8,316 ha, although the Development Footprint (which also includes the areas impacted by road upgrades outside the Project Area) is far smaller at approximately 513 ha.

The length of the Project Area encompassing the WTGs and associated infrastructure north to south is approximately 14 km at the longest point, and the length east to west is approximately 11 km at the longest point (WTG area), with an additional transmission line of approximately 13.5 km, or approximately 24km in total length from the substation to the switching station. The Project Area is located on predominately RU1 – Primary Production zoned land, with a small amount land proposed for access roads located on RU3 Forestry zoned land, which is compatible with the Project.

Morrisons Gap Road runs north to south through the Project Area, and from the northern tip of the Project Area connects after approximately 3 km to Barry Road. The proposal will involve minor upgrades to Morrisons Gap Road for improved site access to the Project Area. Head of Peel Road runs along the Peel River to connect to the Project Area, and is currently unsealed from the junction with Crawney Road to the north east. Head of Peel Road is the alternate access point to the Project Area (refer Chapter 3 for further discussion on site access) to provide greater flexibility in design and minimising impact.

4.2.2 Land Details

WEP has entered into lease agreements with 14 landholders hosting project infrastructure, including the transmission line and switching station (encompassing 64 individual lots). A summary of the lots comprising the Project Area inclusive of the transmission line is provided in Table 4-2 and cadastral boundaries are shown in Figure 4-1.

There are:

- five (5) associated dwellings located within the Project Area;
- seven (7) associated dwellings and seven (7) non associated dwellings within 2 km of a turbine; and
- seven (7) associated dwellings and 23 non associated dwellings between 2 km and 4 km of a turbine.

There are also a number of other non - residential structures located nearby.

Table 4-2 Land Title details of the Project Area

Landowner Group	Lot number	Deposited Plan	Title
Landowner 1	1	372603	Freehold
	1	1248346	Freehold
	1	339044	Freehold
	64, 66, 67, 68, 137	751023	Freehold
	79, 80	755323	Freehold
	2	226603	Freehold
Landowner 2	2	226064	Freehold
	81	755323	Freehold
	2	1217614	Freehold
Landowner 3	1	204315	Freehold
Landowner 4	105	750935	Freehold
	1	137052	Freehold
	189, 199	750922	Freehold
	2	204315	Freehold
	1, 3	1178261	Freehold
	184	750922	Freehold
Landowner 5	90	755349	Freehold
	1	1083462	Freehold
Landowner 6	119, 120	603365	Freehold
	20, 21, 22, 77, 78, 79, 80, 81, 82, 83, 84, 85, 91, 92, 93, 94, 97, 98, 100, 102, 103, 115,	755349	Freehold
	2	1196186	Freehold

Landowner Group	Lot number	Deposited Plan	Title
Landowner 7	201	1260690	Freehold
Landowner 8	2	1171688	Freehold
Landowner 9	1, 2	362665	Freehold
	32	1044255	Freehold
Landowner 10	1	1171688	Freehold
Landowner 11	200, 201, 202, 203	750922	Freehold
	1	1227118	Freehold
Landowner 12	48	753722	NSW Government*
Landowner 13	3	1103716	Freehold
Landowner 14	210	819485	Freehold

** Crown land under Perpetual Lease*
Crown paper roads are also located within the Project Area as discussed in Section 4.2.3.

Additional allotments associated with the road access for the transmission line access are detailed in Table 4-3. Further road upgrades have been identified as being required along the proposed transport route from the Port of Newcastle to the Project Area. The cadastral data of the allotments associated with these are detailed in Table 4-3.

Table 4-3 Land Title details of Proposed Road Upgrades and Transmission Line Access Roads

Lot /Section/DP	Lot /Section/DP	Lot /Section/DP	Lot /Section/DP
6/16/DP758798	2//DP1097368	271//DP755335	9//DP249183
127//DP755335	7350//DP1178939	91//DP755335	41//DP1191982
2/4/DP758798	440//DP822503	92//DP755335	42//DP1191982
8//DP250813	51//DP1134671	8//DP1120827	1/22/DP758798
1/29/DP758798	428//DP755335	9//DP1120827	10/20/DP758542
1/19/DP758542	7017//DP96513	7//DP755349	21//DP1044936
1/17/DP758554	170//DP755335	8//DP755349	7//DP1244305
1//DP835733	13//DP249183	176//DP755335	365//DP755335
2//DP835733	171//DP755335	5/19/DP758542	2/30/DP758798
30//DP804711	3//DP809879	31//DP804711	2//DP786993
12//DP509516	2//DP852531	95//DP755335	1//DP786993
11//DP509516	272//DP755335	1//DP1137094	2/19/DP758542
7018//DP96513	3//DP1119113	1//DP999525	224//DP755335

Lot /Section/DP	Lot /Section/DP	Lot /Section/DP	Lot /Section/DP
10//DP794661	399//DP755335	4/27/DP758798	3/19/DP758542
1//DP794661	1//DP665599	1//DP1067837	11//DP249183
2//DP794661	47//DP755335	12//DP249183	1//DP226603
8//DP794661	10/18/DP758542	100//DP1148907	107//DP755349
9//DP794661	13//DP27346	290//DP1141655	14//DP1151059
15//DP1151059	19//DP755349	4//DP755323	40//DP755323
45//DP755323	57//DP755323	87//DP755323	99//DP755349
439//DP822503	1//DP1097993	1//DP1106079	1//DP133398
10//DP1120827	11//DP1120827	2//DP1097993	2//DP1103716
2//DP1106079	5//DP133398	9//DP755349	97//DP755335
2//DP133398	3//DP133398	4//DP133398	8//DP249183
2//DP712947			

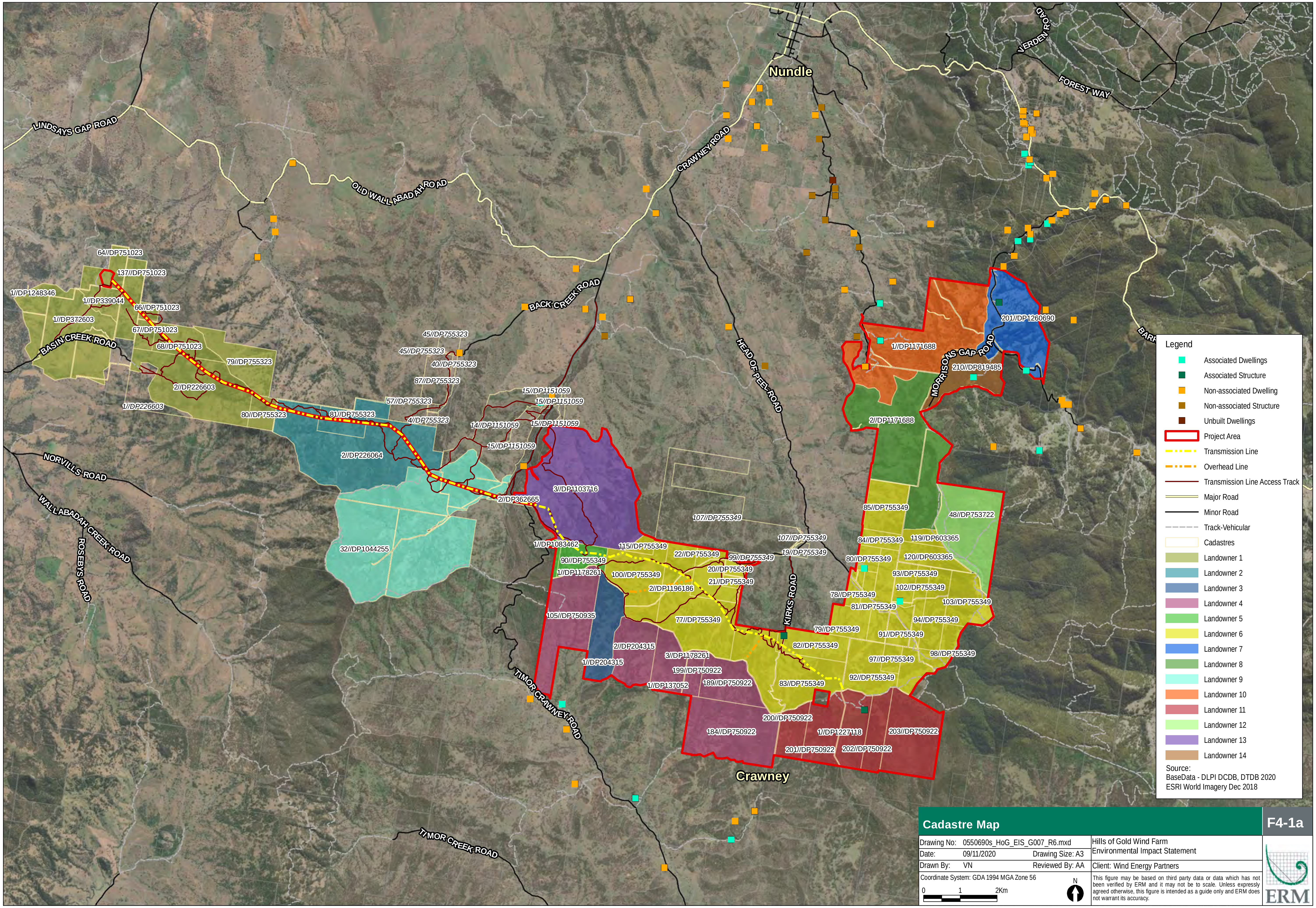
4.2.3 Crown Land

Consultation with Crown Lands has confirmed mapped crown land in the vicinity of the Project. Crown Lands has provided advice on procedures to allow the Project to secure the required tenue over the crown roads to enable works or structures associated with the Project.

The Project Area includes a number of Crown land paper roads. These are identified in Figure 4-2 and include some Crown land paper roads under acquisition by associated wind farm landowners. The Project has excluded use of Crown Reserves.

The Project Area also includes one Crown land allotment under perpetual lease, forming Ben Halls Gap State Forest. Consultation has occurred with NSW Forestry Corporation who are responsible for managing the Ben Halls Gap State Forest currently under a perpetual lease. An agreement is in place with the leaseholder and advice from Forestry Corporation of NSW (Forestry Corpoation) has been received that this lease is allowed. The lease will require final sign-off from Forestry Corporation upon final design for registration of the lease. .

Two triangulation stations (trig stations) are located in proximity to the Project Area (Wombramurra trig station (TS6152) and Wombramurra East trig station (TS4827). Wombramurra trig station (TS6152) has been excluded from the Project Area. Wombramurra East trig station (TS4827) has a recorded status of ‘unknown’ within the government database. Inspections of the recorded location of the trig station did not identify any evidence of the trig station. Based on its recorded location, it is located on privately owned land. No works associated with the Project will be carried out in the trig reserves.


Nundle
Crawney
LINDSAYS GAP ROAD
OLD WALLABADAH ROAD
CRAWNEY ROAD
BACK CREEK ROAD
HEAD OF PEEL ROAD
BASIN CREEK ROAD
NORVILLS ROAD
WALLABADAH CREEK ROAD
ROSEBYS ROAD
TIMOR CRAWNEY ROAD
TIMOR CREEK ROAD
KIRKS ROAD
MORRISONS GAP ROAD
FOREST WAY
VERDEN ROAD
64//DP751023
137//DP751023
1//DP1248346
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98//DP755349
92//DP755349
Legend
Associated Dwellings
Associated Structure
Non-associated Dwelling
Non-associated Structure
Unbuilt Dwellings
Project Area
Transmission Line
Overhead Line
Transmission Line Access Track
Major Road
Minor Road
Track-Vehicular
Cadastres
Landowner 1
Landowner 2
Landowner 3
Landowner 4
Landowner 5
Landowner 6
Landowner 7
Landowner 8
Landowner 9
Landowner 10
Landowner 11
Landowner 12
Landowner 13
Landowner 14
Source:
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018
Cadastre Map
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Date: 09/11/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partners
Coordinate System: GDA 1994 MGA Zone 56
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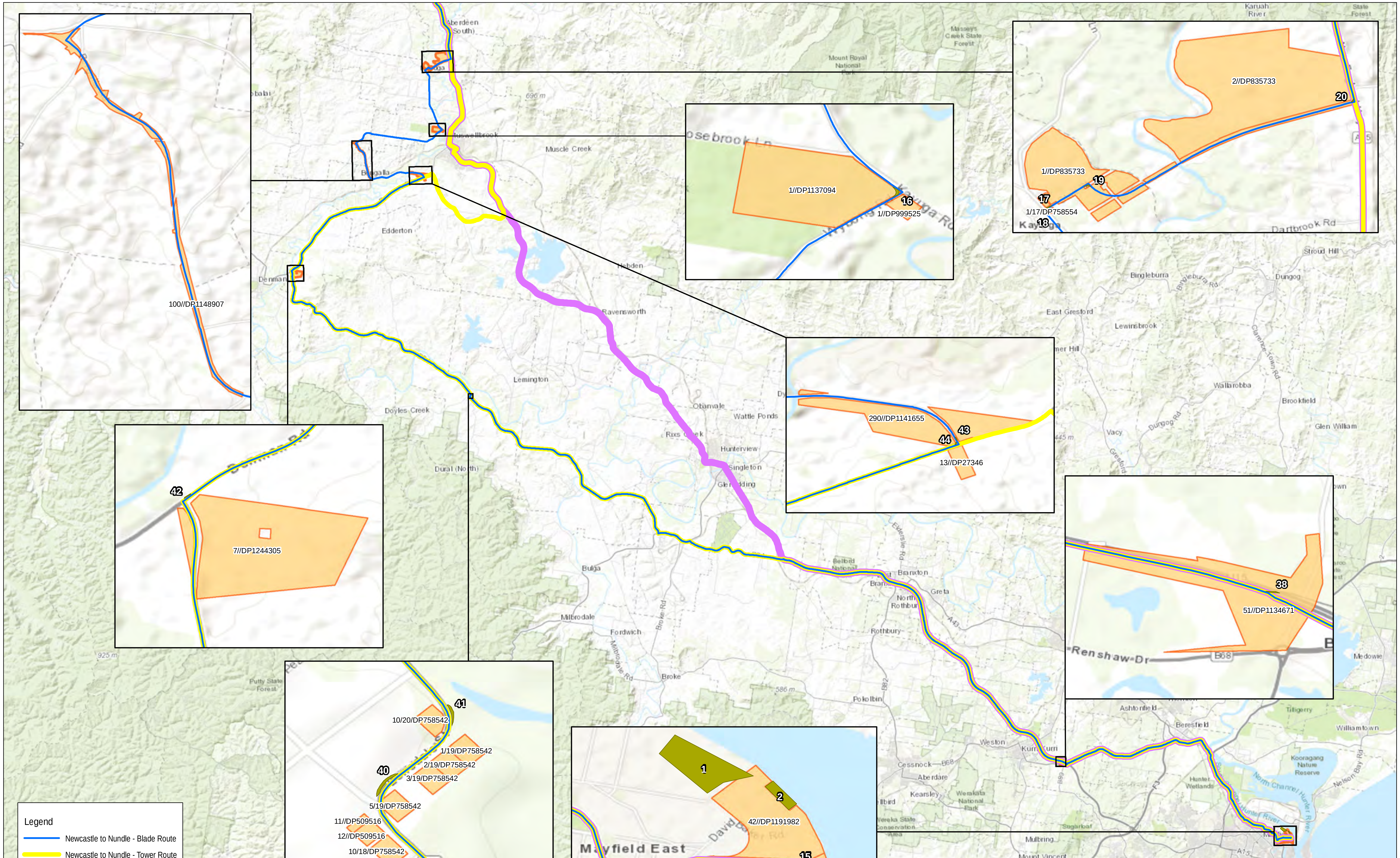

Cadastre Map

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Date:	09/11/2020	Drawing Size: A3	
Drawn By:	VN	Reviewed By: AA	Client: Wind Energy Partners

Coordinate System: GDA 1994 MGA Zone 56

0 5 10Km

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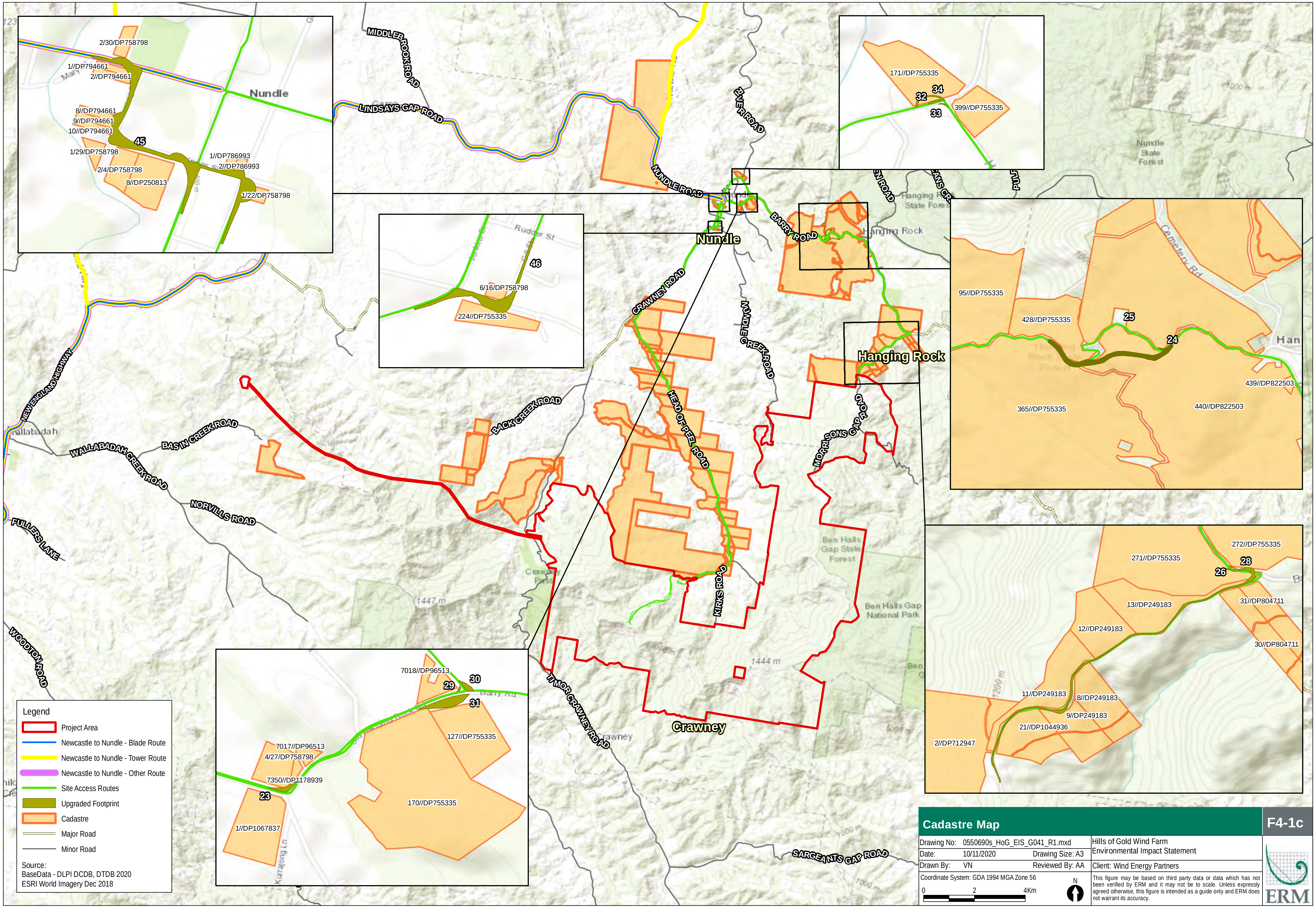

Nundle
Hanging Rock
Crawney
MIDDLEBROOK ROAD
LINDSAYS GAP ROAD
NUNDLE ROAD
BARRY ROAD
CRAWNEY ROAD
HEAD OF PEEL ROAD
NUNDLE CREEK ROAD
KIRKS ROAD
TIMOR CRAWNEY ROAD
MORRISONS GAP ROAD
BACK CREEK ROAD
BAS IN CREEK ROAD
WALLABADAH CREEK ROAD
NORVILLS ROAD
NEW ENGLAND HIGHWAY
FULLERS LANE
WOODTON ROAD
SARGEANTS GAP ROAD
Ben Halls Gap State Forest
Ben Halls Gap National Park
Nundle State Forest
Hanging Rock State Forest
2/30/DP758798
1//DP794661
2//DP794661
8//DP794661
9//DP794661
10//DP794661
45
1/29/DP758798
2/4/DP758798
8//DP250813
1//DP786993
2//DP786993
1/22/DP758798
46
6/16/DP758798
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171//DP755335
32
34
33
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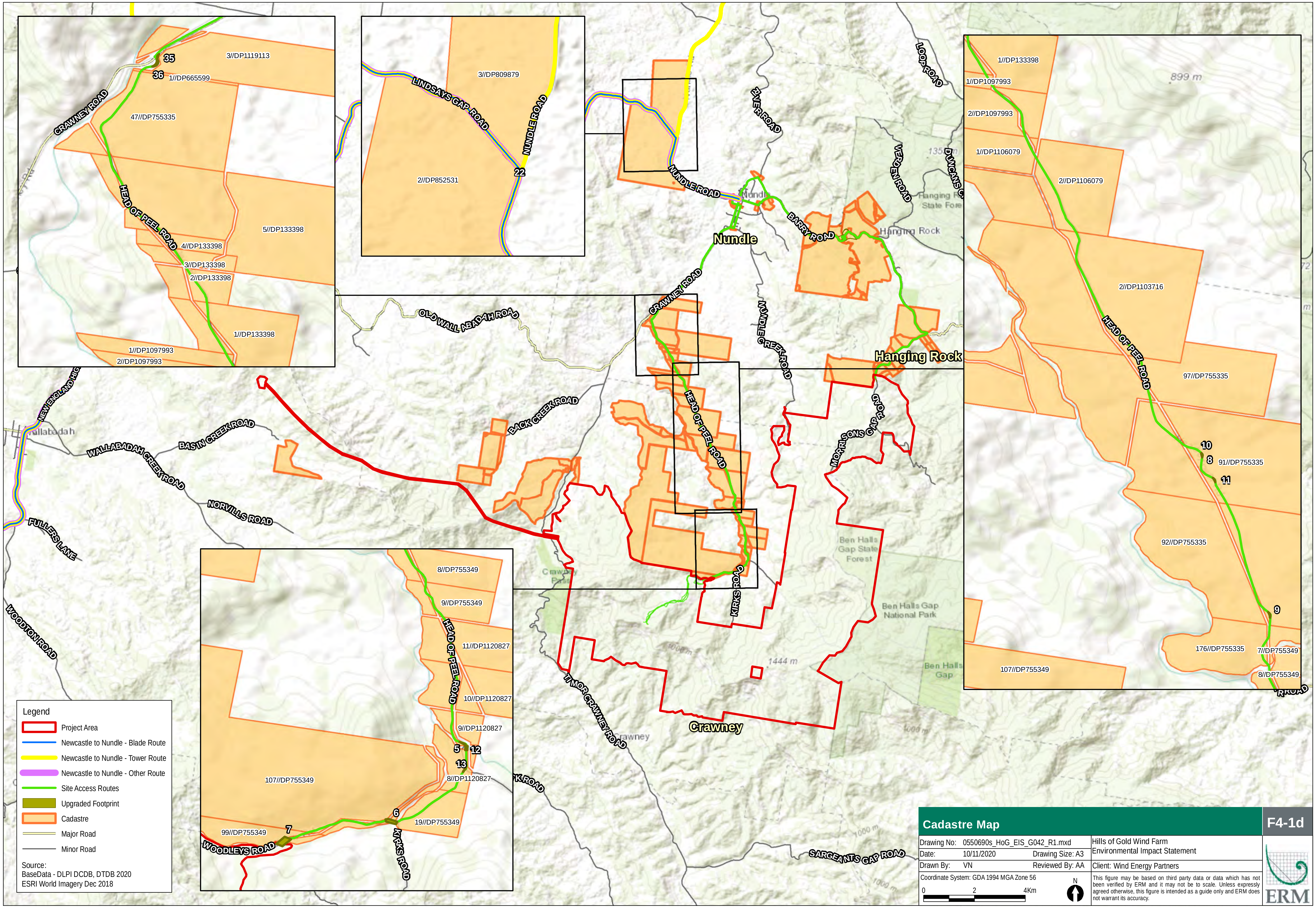
29
30
31
7017//DP96513
4/27/DP758798
127//DP755335
7350//DP1178939
23
170//DP755335
1//DP1067837
Legend
Project Area
Newcastle to Nundle - Blade Route
Newcastle to Nundle - Tower Route
Newcastle to Nundle - Other Route
Site Access Routes
Upgraded Footprint
Cadastre
Major Road
Minor Road
Source:
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018
Cadastre Map
F4-1c
Drawing No: 0550690s_HoG_EIS_G041_R1.mxd
Date: 10/11/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
Coordinate System: GDA 1994 MGA Zone 56
0 2 4Km
N
Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partners
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM



Cadastre Map
F4-1d
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Date: 10/11/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
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ERM
Legend
Project Area
Newcastle to Nundle - Blade Route
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Newcastle to Nundle - Other Route
Site Access Routes
Upgraded Footprint
Cadastre
Major Road
Minor Road
Source:
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018
Nundle
Hanging Rock
Crawney
CRAWNEY ROAD
HEAD OF PEEL ROAD
NUNDLE ROAD
LINDSAYS GAP ROAD
BARRY ROAD
OLD WALLABADAH ROAD
BACK CREEK ROAD
BASIN CREEK ROAD
WALLABADAH CREEK ROAD
NORVILLS ROAD
FULLERS LANE
WOODTON ROAD
NEW ENGLAND HIGHWAY
TIMOR CRAWNEY ROAD
KIRKS ROAD
WOODLEYS ROAD
MORRISONS GAP ROAD
NUNDLE CREEK ROAD
RIVER ROAD
LOOP ROAD
VEREN ROAD
SARGEANTS GAP ROAD
Ben Halls Gap State Forest
Ben Halls Gap National Park
Ben Halls Gap
1444 m
899 m
3//DP1119113
1//DP665599
47//DP755335
5//DP133398
4//DP133398
3//DP133398
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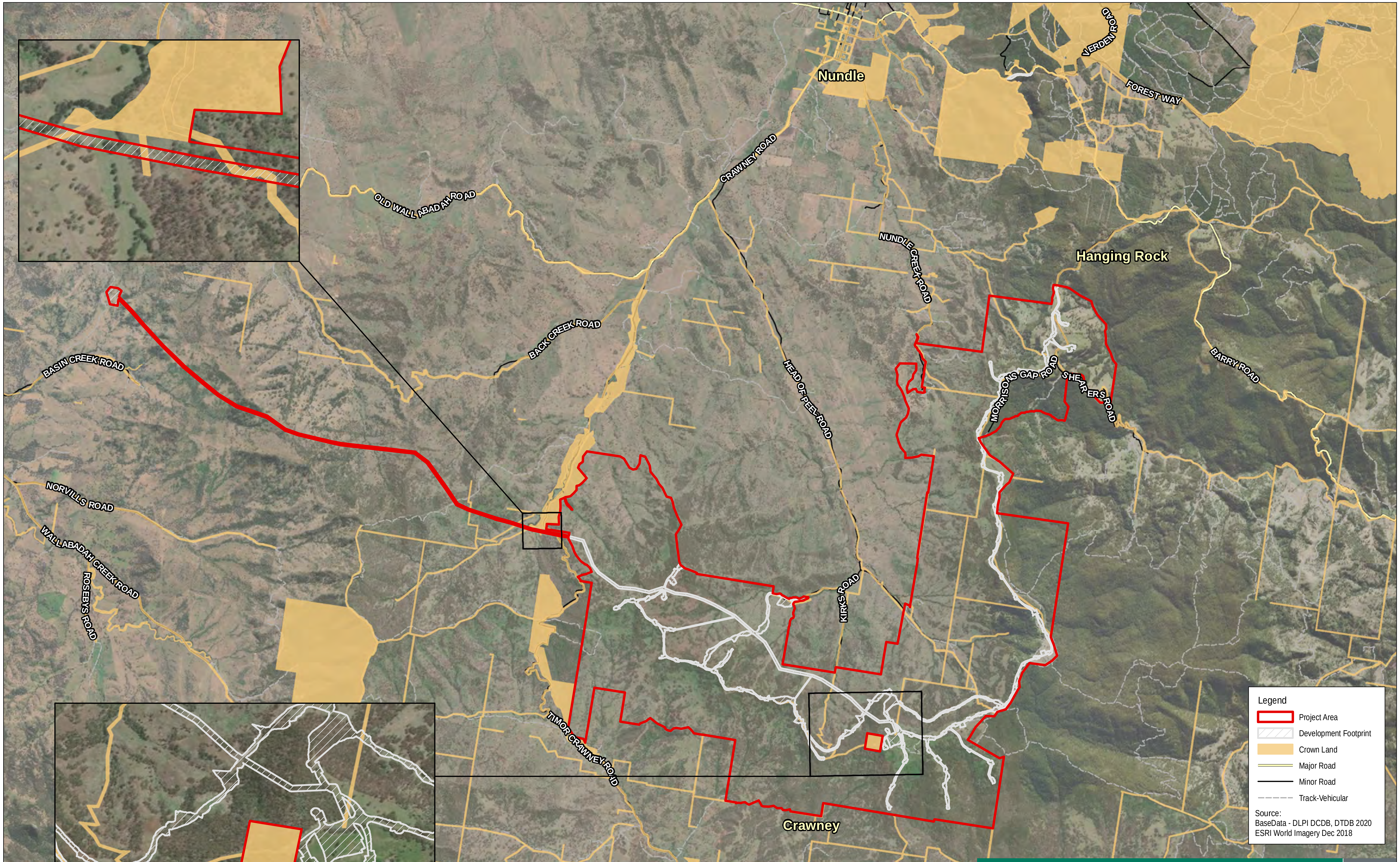

Crown Land and Paper Roads

F4-3

Drawing No:	0550690s_HoG_EIS_G004_R0.mxd		
Date:	13/10/2020	Drawing Size: A3	
Drawn By:	VN	Reviewed By: AA	

Hills of Gold Wind Farm
Environmental Impact Statement

Client: Wind Energy Partners

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4.3 Site Setting and Surrounding Land Use

4.3.1 Environmental Setting

The Project Area sits within the Liverpool Range which is part of the Great Dividing Range. The Liverpool Range forms the northern boundary of the Hunter Region. The centre of the Project Area has a range of plateaus, ridgelines and escarpments broadly positioned in a north-south direction. Undulating foothills decline towards the centre of the Project Area.

Figure 4-3 View of Project Area

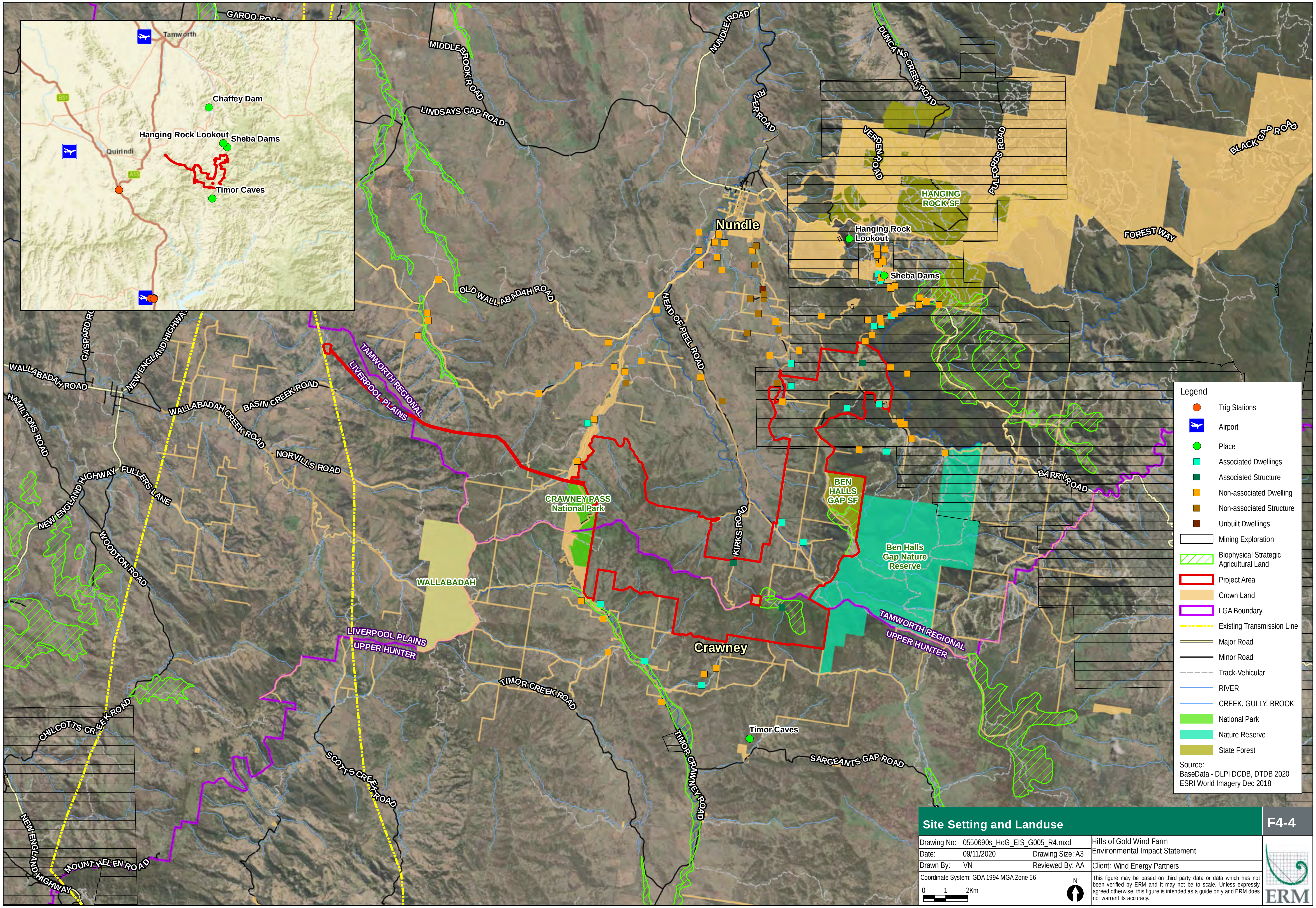
Fourteen (14) named waterways exist within the Project Area, mostly 1st order. Nine waterways, generally located in the north-western portions of the Project Area, are tributaries of the Peel River which is the main river system running through the town of Nundle as part of the Namoi catchment area. Four waterways in the southern portion of the Project Area flow south as part of the Hunter catchment area. The remaining waterway is located in the north eastern section of the Project Area and flows east as part of the Manning catchment area (refer to Figure 4-4).

4.3.2 Adjacent Land Uses

The main land uses of Nundle and Hanging Rock are agriculture, timber, and tourism. Directly east of Nundle is Hanging Rock State Forest which includes land zoned as forestry (RU3 – Forestry). Nundle is the closest locality to the Project Area which has residential and commercial land use zonings. The surrounding land is predominately zoned for agricultural purposes (RU1 – Primary Production).

Ben Halls Gap National Park / Nature Reserve and Ben Halls Gap State Forest occur in the eastern side of the Project Area and Crawney Pass National Park occurs on the western side.

Surrounding the Project Area is steep, partially cleared country predominately used for grazing.



Tamworth
Chaffey Dam
Hanging Rock Lookout
Sheba Dams
Quirindi
Timor Caves
Nundle
Hanging Rock Lookout
Sheba Dams
HANGING ROCK SF
BEN HALLS GAP SF
Ben Halls Gap Nature Reserve
CRAWNEY PASS National Park
WALLABADAH
Crawney
Timor Caves
TAMWORTH REGIONAL
LIVERPOOL PLAINS
UPPER HUNTER
GAROO ROAD
MIDDLEBROOK ROAD
LINDSAYS GAP ROAD
NUNDLE ROAD
DUNCANS CREEK ROAD
RIVER ROAD
VERDEN ROAD
PULFORDS ROAD
BLACK GAP ROAD
FOREST WAY
OLD WALLABADAH ROAD
HEAD OF PEEL ROAD
GASPARD ROAD
NEW ENGLAND HIGHWAY
WALLABADAH ROAD
BASIN CREEK ROAD
WALLABADAH CREEK ROAD
NORVILLS ROAD
HAMILTONS ROAD
FULLERS LANE
WOODTON ROAD
KIRKS ROAD
BARRY ROAD
TIMOR CREEK ROAD
TIMOR CRAWNEY ROAD
SARGEANTS GAP ROAD
SCOTTS CREEK ROAD
CHILCOTTS CREEK ROAD
MOUNT HELEN ROAD
Legend
Trig Stations
Airport
Place
Associated Dwellings
Associated Structure
Non-associated Dwelling
Non-associated Structure
Unbuilt Dwellings
Mining Exploration
Biophysical Strategic Agricultural Land
Project Area
Crown Land
LGA Boundary
Existing Transmission Line
Major Road
Minor Road
Track-Vehicular
RIVER
CREEK, GULLY, BROOK
National Park
Nature Reserve
State Forest
Source:
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018
Site Setting and Landuse
F4-4
Drawing No: 0550690s_HoG_EIS_G005_R4.mxd
Date: 09/11/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partners
Coordinate System: GDA 1994 MGA Zone 56
0 1 2Km
N
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ERM

4.3.3 Agricultural Land

4.3.3.1 Biophysical Strategic Agricultural Land

Indicative Biophysical Strategic Agricultural Land (BSAL) maps identify the inherent land and water resources that are important on a national and state level for agriculture. The lands identified intrinsically have the best quality soil and water resources, topography, and are naturally capable of sustaining high levels of agricultural productivity and require minimal management practices to maintain this. Mapping of BSAL in the Project Area is provided in Figure 4-4.

Approximately 313 ha of the Project Area is mapped within a broad, regional area of BSAL as defined by two Strategic Agricultural Land Maps, being the New England North West and Upper Hunter land maps, as presented in the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (the Mining SEPP).

A total of 2.8 million ha of BSAL has been identified and mapped at a regional scale across NSW, including over 1.74 million ha within the New England North West Region and Upper Hunter regions, which encompasses a total of 20 LGAs in regional NSW including the Upper Hunter, Tamworth Regional and Liverpool Plains LGAs (DPE, 2020).

The Development Footprint (the area subject to impact during construction / operation) encompasses approximately 39.8 ha of BSAL, approximately 0.000014% of the total land area mapped as BSAL within NSW. The use of the BSAL mapped area will have limited impacts as the current use of the land as the current grazing activities can continue concurrently with the operation of the wind farm.

Once the Project reaches the end of its operational life, the Project infrastructure will be decommissioned and the Development Footprint returned to its pre-existing land use, or other land use in consultation with the landholders, as far as practicable.

4.3.4 Forestry and Conservation Areas

There are no designated conservation areas within the Project Area. Ben Halls Gap Nature Reserve /National Park is located east of the Project Area and is located at the junction of the Liverpool and Mount Royal Ranges. It has an area of approximately 2,500 ha. The area has limits placed on the number of group visits per year and recreational opportunities. There is no public vehicle access to the reserve and existing access tracks are located on private property and are of 4WD standard (NPWS, 2002). The reserve lies at the head of the catchments of the Hunter, Barnard and Peel Rivers and has an important role in contributing to clean water and minimising the spread of weeds between catchments. The reserve is located in the lands of the Gumaroi Aboriginal people and is now in the area of the Nungaroo Local Aboriginal Land Council. Much of the land around the reserve has been cleared and it is largely isolated from other large forested areas. The ecology of Ben Halls Gap National Park/Nature Reserve is further discussed in Chapter 9.

Crawney Pass National Park (Crawney Pass NP) partially bounds the western edge of the Project Area. Crawney Pass lies on the Liverpool Range. The park encompasses an area of steep topography and terraced landscape with scenic values typical of the Liverpool Range. To the north, the park drains into the Murray–Darling Basin and to the south it rains to the coast via the Hunter River. The park has an area of 311 ha and has a linear shape, approximately four kilometres long and between 300 metres and one kilometre wide (DPIE, 2019). A large area of Crawney Pass was formerly Crown land and subject to grazing, however the steep terrain has assisted in protecting certain areas from past land clearing. The ecology of Crawney Pass is further discussed in Chapter 9.

Other forestry and conservation areas within vicinity of the Project Area include Ben Halls Gap State Forest (349 ha) and Nundle State Forest, which is approximately 5 km north and north east of the Project Area, and covers an area of 12,308 ha. Further west, approximately 5.5 km from the Project Area is Wallabadah Nature Reserve which covers an area of 1,132 ha.

The Project proposes to use several transport routes which are currently utilised by Forestry Corporation of NSW, including Barry Road. The final Restricted Access Vehicle (RAV) route for the transportation of turbine and substation components will be dependent on further consultation and approval from Transport for NSW, Tamworth Regional Council and private property owners along the route. This is discussed further in Chapter 12.

4.3.5 Mineral Resources

A search of the NSW Department of Planning, Industry and Environment MinView mapping tool was undertaken in July 2020. The search indicated that there is one exploration licence EL8692 held by PTR RESOURCES PTY LTD located on the northern portion of the Project Area (refer to Figure 4-4).

4.3.6 Tourism and Viewpoints

The locality includes a number of tourist destinations and viewpoints overlooking the valley. These popular landmark areas include; the town of Nundle, Hanging Rock, Nundle State Forest, Ben Halls Gap Nature Reserve/National Park, Ben Halls Gap State Forest, Sheba Dams, Chaffey Dam and Timor Caves.

Approximately 8 km north west of the Project Area is Nundle, a small historic gold mining village, and popular tourist destination. Services in Nundle include several cafes, retail and antique shops, historic buildings, a local pub and other attractions, including the historic Nundle Woollen Mill.

Approximately 5 km north of the Project Area, Hanging Rock offers a number of tourist attractions, primarily being the Hanging Rock Lookout which overlooks the valley to the west, and Sheba Dams which is a popular family outing location for picnics and camping, with barbeque facilities provided.

Recreational facilities at the Nundle State Forest range from four-wheel driving, mountain biking, fishing, hunting and picnic facilities. The Ben Halls Gap Nature Reserve/ National Park is largely an undisturbed area with high quality habitat, specifically managed to conserve and protect its significant ecological values, with public access limited to a number of organised tours (NPWS, 2002).

Chaffey Dam, an 18 km drive north from Nundle, offers a local recreational area for swimming, boating, fishing and camping activities. Timor Caves, approximately 5 km south of the Project Area, contains more than 80 caves, although only four main caves are generally accessible for equipped groups, requiring permission for access and camping by the property owner (Karst and Geodiversity Unit, 2010).

4.3.7 Existing Electricity Transmission Network

The existing 330 kV TransGrid Liddell to Tamworth transmission line is located approximately 13.5 km west of the WTG Project Area and provides the Project with access to the national electricity grid. This transmission line is subject to upgrade as part of the Queensland – NSW Interconnector upgrade as discussed in Chapter 2.

4.3.8 Aviation Activities

Aerial firefighting, surveys, agricultural applications, spraying and dog baiting activities are undertaken in the nearby nature reserve / national park, forestry estates and agricultural lands. The ridgeline has also been used in strategic aerial firefighting for the locality.

4.3.9 Residential Properties

For the purpose of this EIS, dwellings whose owners are hosting Project infrastructure or have entered into an agreement in relation to the Project are referred to as ‘associated dwellings’ with all other dwellings in proximity to the Project Area are referred to as ‘non-associated dwellings’. Within the Project Area, there are five (5) associated dwellings.

The location of associated and non-associated dwellings in relation to the Project Area is shown in Figure 4-4 and the respective distance to the nearest WTG is outlined in Table 4-4.

Table 4-4 Distances from Nearest Proposed WTG to Residential Dwellings

WTG No.	Easting (m)*	Northing (m)*	Nearest Dwelling ID	Nearest Dwelling Type	Distance to nearest turbine (m)
WP1	316190.846	6502649.423	NAD_21	Non-associated Dwelling	3,235.95
WP2	316660.033	6502869.954	NAD_21	Non-associated Dwelling	3,294.01
WP3	317061.845	6502922.861	NAD_21	Non-associated Dwelling	3,506.16
WP4	317449.239	6502903.104	NAD_21	Non-associated Dwelling	3,789.73
WP5	317646.578	6503320.59	NAD_21	Non-associated Dwelling	3,668.60
WP6	317817.553	6503696.303	NAD_21	Non-associated Dwelling	3,601.26
WP7	317184.441	6502322.26	AD_7	Associated Dwelling	3,550.99
WP8	317588.545	6502126.598	AD_7	Associated Dwelling	3,562.02
WP9	317453.026	6501426.236	AD_7	Associated Dwelling	2,901.49
WP10	317732.464	6501347.185	AD_7	Associated Dwelling	3,012.58
WP11	318250.898	6501255.867	AD_7	Associated Dwelling	3,313.65
WP12	319102.057	6501480.181	AD_7	Associated Dwelling	4,119.95
WP13	318924.1	6501258.676	AD_7	Associated Dwelling	3,846.76
WP14	318777.791	6501032.549	AD_7	Associated Dwelling	3,599.21
WP15	319341.128	6500599.035	AD_7	Associated Dwelling	3,892.99
WP16	320042.268	6500328.808	NAD_1	Non-associated Dwelling	4,278.11
WP17	320736.01	6500326.421	AD_3	Associated Dwelling	4,047.83
WP18	321007.066	6499684.836	NAD_1	Non-associated Dwelling	3,527.33
WP19	321513.273	6498815.938	NAD_1	Non-associated Dwelling	2,708.96
WP20	323082.517	6499076.731	AD_8	Associated Dwelling	3,350.46
WP21	323138.002	6499550.962	AD_8	Associated Dwelling	2,933.86
WP22	323095.633	6499977.322	AD_8	Associated Dwelling	2,641.30
WP23	323198.929	6497537.828	NAD_1	Non-associated Dwelling	2,602.73
WP24	323308.03	6498134.149	NAD_1	Non-associated Dwelling	3,044.57
WP25	323580.758	6498725.926	AD_8	Associated Dwelling	3,418.90
WP26	323545.962	6499107.037	AD_8	Associated Dwelling	3,089.09
WP27	324703.502	6497555.803	NAD_1	Non-associated Dwelling	3,965.83
WP28	324612.564	6498100.249	AD_8	Associated Dwelling	3,773.81
WP29	324632.3	6498514.803	AD_8	Associated Dwelling	3,359.19
WP30	324229.061	6498998.423	AD_8	Associated Dwelling	2,949.84
WP31	325872.662	6498217.873	AD_8	Associated Dwelling	3,756.42
WP32	325818.826	6498681.887	AD_8	Associated Dwelling	3,293.99

WTG No.	Easting (m)*	Northing (m)*	Nearest Dwelling ID	Nearest Dwelling Type	Distance to nearest turbine (m)
WP33	325257.989	6499019.076	AD_8	Associated Dwelling	2,856.68
WP34	323773.148	6499406.095	AD_8	Associated Dwelling	2,720.28
WP35	324341.665	6499321.566	AD_8	Associated Dwelling	2,609.17
WP36	324635.236	6499495.047	AD_8	Associated Dwelling	2,384.73
WP37	324927.945	6499682.672	AD_8	Associated Dwelling	2,176.45
WP38	325216.988	6499831.368	AD_8	Associated Dwelling	2,045.25
WP39	325542.572	6499948.689	AD_8	Associated Dwelling	2,000.36
WP40	325908.197	6500088.913	AD_8	Associated Dwelling	2,013.19
WP41	326393.749	6500561.993	AD_8	Associated Dwelling	1,941.39
WP42	326467.498	6500880.587	AD_8	Associated Dwelling	1,806.25
WP43	326624.181	6501222.002	AD_8	Associated Dwelling	1,792.02
WP44	326929.625	6501399.61	AD_8	Associated Dwelling	2,033.01
WP45	327248.683	6501519.799	AD_8	Associated Dwelling	2,324.37
WP46	327153.191	6502076.909	AD_8	Associated Dwelling	2,214.73
WP47	326890.069	6502553.69	AD_8	Associated Dwelling	2,061.44
WP48	326439.481	6502905.657	AD_8	Associated Dwelling	1,821.10
WP49	326079.134	6503433.761	AD_8	Associated Dwelling	1,938.19
WP50	325789.146	6503901.545	AD_3	Associated Dwelling	2,146.13
WP51	325975.227	6504359.619	NAD_67	Non-associated Dwelling	2,275.16
WP52	326001.772	6504778.277	NAD_67	Non-associated Dwelling	1,961.58
WP53	325887.628	6505288.792	NAD_67	Non-associated Dwelling	1,775.08
WP54	325995.059	6505707.101	NAD_67	Non-associated Dwelling	1,532.39
WP55	326064	6506091.801	NAD_67	Non-associated Dwelling	1,422.44
WP56	325597.428	6506290.322	NAD_67	Non-associated Dwelling	1,902.58
WP57	325618.03	6506644.815	AD_5	Associated Dwelling	1,856.71
WP58	325468.553	6507176.882	AD_5	Associated Dwelling	1,663.51
WP59	325632.774	6507482.547	AD_5	Associated Dwelling	1,390.69
WP60	325827.066	6507813.573	AD_5	Associated Dwelling	1,125.26
WP61	326056.198	6508201.729	AD_5	Associated Dwelling	925.29
WP62	326035.871	6508550.506	AD_5	Associated Dwelling	1,092.85
WP63	325787.51	6508927.482	AD_6	Associated Dwelling	1,377.87
WP64	326518.5	6508699.386	AD_5	Associated Dwelling	867.63
WP65	327050.469	6508701.461	AD_5	Associated Dwelling	765.10

WTG No.	Easting (m)*	Northing (m)*	Nearest Dwelling ID	Nearest Dwelling Type	Distance to nearest turbine (m)
WP66	327215.065	6508969.014	AD_5	Associated Dwelling	1,060.34
WP67	327184.579	6509402.788	AD_5	Associated Dwelling	1,478.66
WP68	327366.554	6509622.758	NAD_11	Non-associated Dwelling	1,399.71
WP69	327737.176	6509901.339	NAD_11	Non-associated Dwelling	1,064.75
WP70	327921.575	6509330.633	NAD_8	Non-associated Dwelling	1,081.38

NB: Distance between WTG and dwellings were calculated by a GIS specialist using the 'spatial join function' of the ArcGIS Mapping Tool. The distance calculation does account for terrain

4.4 Site Suitability

The Project Area has been carefully selected to balance the assessed social, environmental and economic aspects of the Project to enable an outcome which benefits the community, the region, and NSW as a whole. This section and Table 4-5 demonstrates a summary of the site selection criteria of the Project Area and why the Project Area is the right place for the Project.

Table 4-5 Site Selection Criteria Summary

Preferable Site Condition	Summary
✓ Alignment with NSW Government policy and strategic vision	Aligns with: ■ NSW Transmission Infrastructure Strategy (NSW Department of Planning and Environment (NTIS), 2018) ■ NSW Electricity Strategy (DPIE, 2019) ■ New England North West Regional Plan 2036 (DPE, 2017)
✓ Optimal wind resources	The Project Area is considered feasible as it exhibits a high wind resource for NSW.
✓ Suitable land	Use of predominately existing agricultural use ridgelines and desirable ridge orientation for predominate wind directions with existing access tracks in existence.
✓ Low population density and minimal local impacts	Relative isolation of the site and low population density in the region reducing the potential impact particularly around noise, visual and potential shadow flicker impacts. There are limited residents located within 4 km of the site boundary and commitments to investigate impacts on those living within 4 km.
✓ Capacity to rehabilitate	The Project Area can be restored to existing agricultural land capability or similar use, after decommissioning.
✓ Support from community members	The Project has received community support from members of the Hanging Rock and Nundle community demonstrated with the formation of the Friends of the Wind Farm Group.
✓ Proximity to electrical network and connection capacity	13.5 km from 330 kV TransGrid Liddell to Tamworth transmission line, with capacity to accept the generation capacity following consultation with TransGrid. Optimal location to connect to the existing transmission network via a new overhead transmission line.
✓ Regional Skills	Tamworth has been identified as a potential source of skills for construction and operation due to the existence of a variety of sectors and industries as well as strong population of approximately 60,000.

4.4.1 Alignment with NSW Government Policy, Strategic Vision and REZ

The NSW Government has declared that the New England region is 'energy rich' and is among the best known regions for wind energy in NSW. As such, the New England region has been identified in the NSW Transmission Infrastructure Strategy (DPE, 2018) as one of the three Renewable Energy Zones (REZs) to be created and fast-tracked in NSW, others being the Central-West and the South-West regions.

Specifically, the New England region has a high potential to be a REZ as it has 3,660 MW resource potential, and could support about 2,000 MW of new renewable generation connections following the augmentations proposed between New South Wales and Queensland, and between Bayswater and Northern New South Wales (AEMO, 2018).

The New England REZ aligns with the New England North West Regional Plan 2036 (DPE, 2017), which has a vision for fast-tracked renewable energy development in the region.

While the extent and details of the New England REZ are still being finalised, it confirms that the region is suitable for renewable energy projects. The draft New England REZ map identifies the Project as being outside but in proximity to the indicative New England REZ. The location of the Project with respect to the new England REZ is detailed in Figure 2-4.

4.4.2 Optimal Wind Resources

The Project Area sits on an elevated ridgeline which has an orientation with good exposure to prevailing wind directions. The CSIRO (2012) have stated that in Australia, most wind farms are situated along highly visible ridgelines or coastal cliffs to take advantage of the strong wind resources offered along the high terrain and costal cliffs respectively. Ridgelines take advantage of the acceleration of the wind due to the sudden change in topography.

The wind turbines are proposed to be positioned along the ridgeline, forming a "J" shape which spans approximately 24 km in length. The wind resource for the locality is detailed in Figure 4-5 which demonstrates that the Project is located within an area of high wind resources. A site photograph which depicts the ridgeline feature of the Project Area is illustrated in Figure 4-6.

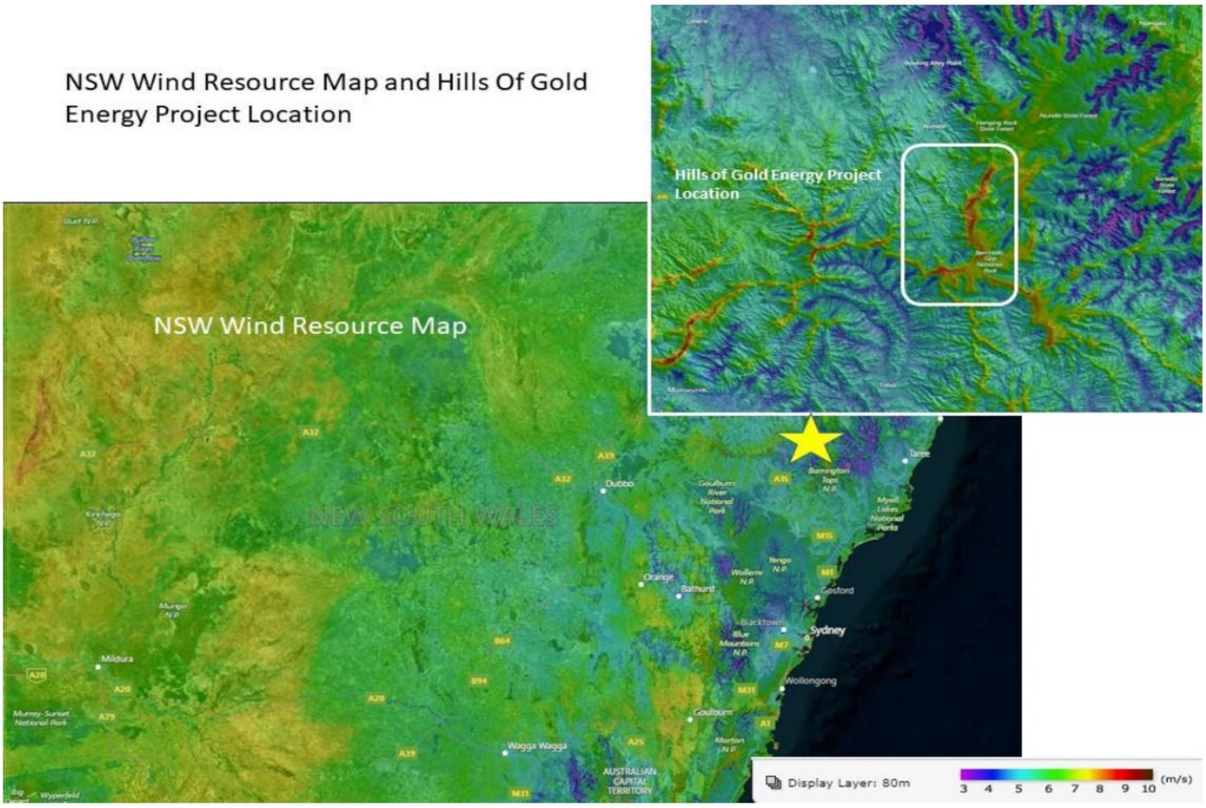


Figure 4-5 Wind Resources

Figure 4-6 Ridgeline in the Project Area

4.4.3 Suitable Land

The Project Area is predominantly zoned for agricultural purposes (RU1 – Primary Production), which reflects the primary use of the land for agricultural grazing of cattle. A small portion of the Project Area is zone RU3 Forestry, which is the Ben Halls Gap State Forest, under perpetual lease. Development within this zoning is limited to an internal access road for the wind farm. There is also no previous history of other uses that could be considered to be potentially contaminating and therefore it is considered that the Project Area has a low contamination risk.

As mentioned above, the land is also suitable because of an elevated ridgeline on the site which has a desirable orientation. Finally, the land is suitable as it hosts existing roads (Morrisons Gap Road and Head of Peel Road) which can be used as access roads, with some upgrades to meet the needs of the Project, which are also beneficial to the existing community and surrounding land uses.

4.4.4 Compatibility with Other Land Uses

The Project Area has historically been used for agricultural purposes, noting land clearing of the area to allow for agricultural utility. The main land uses of the surrounding area are agriculture, timber, and tourism. Surrounding land uses are described in detail in Chapter 4 and is predominately zoned for agricultural purposes.

In understanding compatibility with other land uses, identifying and assessing the potential for land use conflict to occur between neighbouring land uses is a key process. It helps land managers and consent authorities assess the possibility for and potential level of future land use conflict.

In accordance with the Land Use Conflict Risk Assessment (LUCRA) Guide (DPI, 2011), a risk ranking matrix is used to rank the identified potential land use conflicts, by assessing the environmental, public health and amenity impacts according to both the 'probability of occurrence' and the 'consequent of the impact'.

This LUCRA process (refer Appendix O) has identified and assessed the potential for activities associated with the Project to potentially cause land use conflict. The mitigation measures and management strategies identified in the EIS ensure potential conflict items are managed to meet the required performance targets.

4.4.5 Low Population Density and Minimal Local Impacts

The Project Area also has relative isolation and low population density in the region which will reduce the potential for human impacts such as noise, visual and shadow flicker. The Australian Bureau of Statistics (2019) profile area of Nundle (Rural South) includes the townships and localities in and beyond the Project Area, as illustrated in Figure 4-7,

The profile area is identified as having an approximate population of 1,340 across a land area of 160,027 ha, which gives a population density of 0.01 persons per hectare. Within the profile area, Nundle itself was recorded as having a population of 496 persons and Hanging Rock 105 persons at the 2016 census.

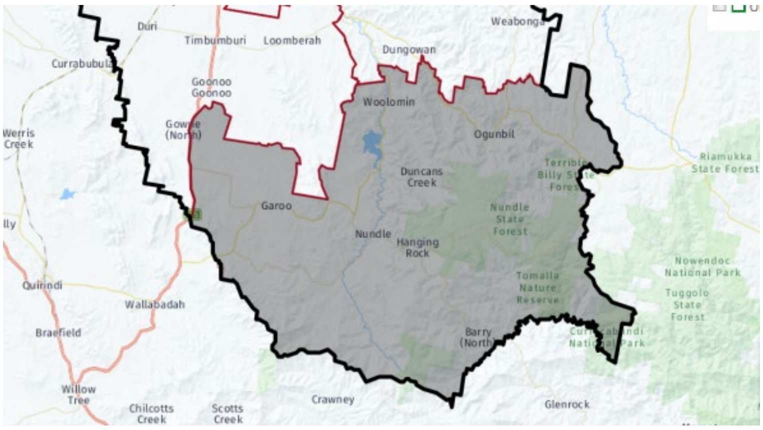


Figure 4-7 Nundle (Rural South) Profile Area (ABS, 2019)

4.4.6 Capacity to Rehabilitate

An additional preferable condition of the Project Area is that it can be restored to existing agricultural land capability or similar use, after decommissioning. A Decommissioning and Rehabilitation Plan will be prepared for the Project in accordance with conditions of development consent. Post construction rehabilitation requirements and processes will be prepared prior to commencement of construction of the Project, and undertaken in accordance with any relevant conditions of any development consent issued by DPIE.

4.4.7 Support from Community Members

The Proponent has engaged with the community extensively since 2017, as discussed in Chapter 7.

While it is common for wind farms to create opposing views within communities there is strong support from residents within Nundle and Hanging Rock, visible from 'Friends of the Wind Farm' support signs commonly viewed and as depicted in Figure 4-8. It is understood that in the order of 80 support signs have been displayed.

Figure 4-8 Project Support Signage, Nundle

4.4.8 Proximity to Electrical Network and Connection Capacity

The existing 330 kV TransGrid Liddell to Tamworth transmission line is located approximately 13.5 km west of the WTG Project Area. The Project will connect to the existing Liddell to Tamworth 330 kV transmission line at a location north of Basin Creek Road which also dissects the New England REZ, and aligns with the identified Queensland-NSW Interconnector upgrade.

4.4.9 Regional Skills

Tamworth has been identified as a potential source of skills for construction and operation due to the existence of a variety of sectors and industries as well as strong population of approximately 60,000.

Tamworth Regional, Liverpool Plains and Upper Hunter LGAs have a significant proportion of resident population working in Industrial related jobs (this includes jobs types such as manufacturing, transport and utilities employment). There are also a fair proportion of people working in Population Serving industries in each LGA which includes construction related jobs. The skillsets of these local residents may be beneficial for the construction of a renewable energy development in the region. People also tend to live and work in close proximity in the region which indicates that new, local job opportunities may be welcomed by local residents. The Tamworth Regional LGA has a self-sufficiency rate of 94 %, meaning 94 % of jobs in the LGA are taken by people who both live and work in the LGA (SGS, 2020).

5. PROJECT ALTERNATIVES

This chapter provides an overview of the alternatives considered for the Project, including the alternatives to not carrying out the Project; the site selection process for the wind farm; the site layouts investigated; and the transmission line connection options investigated.

5.1 Overview

The Project and its siting has been carefully designed to balance the environmental, social and economic aspects of the proposed development. The suitability of the Project Area has been discussed in detail in Section 4.4, and includes:

- alignment with Government policy and strategic vision;
- optimal wind resource;
- suitability of land including wind resource exposure and orientation;
- proximity to and capacity within the national electrical network;
- availability of regional skills;
- low population density and site isolation while close to large electricity demand between Tamworth and Newcastle;
- capacity to rehabilitate to pre development or similar agricultural land capability;
- community support; and
- regional employment and economic benefits.

Throughout the assessment of the Project in accordance with the SEARs, a range of variations for the Project layout were developed and considered in the context of technical, environmental, social, and commercial constraints. Concept design has been continuously updated to reflect constraints and alternatives for the following aspects of the Project were considered and assessed:

- WTG layout;
- transmission line route;
- location of associated onsite infrastructure; and
- transport routes on public roads leading to the Project Area.

These are discussed further below:

5.2 'Do Nothing' Approach

The 'Do Nothing' approach, ie not proceeding with the Project, will lead to the following outcomes:

- the local area and wider region would not realise the economic and social benefits of the Project, including a capital investment of $826M ($100M in income (value-add)), creation of direct and indirect employment opportunities during the construction and operational phases, upskilling of local workforce, improvements to the local road network and contributions to local community facilities and infrastructure though the Community Enhancement Fund; and
- a missed opportunity in terms of reducing Australia's dependency on fossil fuels for energy generation and the consequential emissions of GHGs. As discussed in Chapter 2, the Project is expected to result in savings of approximately 654,500 tonnes of GHGs per annum. This equates to an equivalent of taking approximately 290,000 passenger vehicles off the road. The electricity generated by the Project could also supply up to 185,000 households with renewable energy annually.

5.3 Alternative Energy Sources

One of the main alternatives to wind energy is the continued use of fossil fuels, including coal (both black and brown coal) and natural gas. The reliance on these energy sources however, results in the release of GHGs emissions such as CO2 and contributes to the harmful effects of climate change. The RET discussed in Chapter 2 outlines the commitment by Australia to reducing greenhouse gas emissions and has set targets for increasing the supply of renewable energy.

Other forms of large-scale renewable energy accounted for in the LRET include hydro, biomass, solar and tidal energy. With the exception of solar and hydro energy, these alternative sources are in the early stages of development and are generally not 'market ready'. More importantly, these energy sources have not had the benefit of the decades of research and development that has gone into the generation of energy by wind power. To this end, wind and solar power currently remain the most economical and mature form of large-scale renewable energy capable of replacing existing fossil fuel generation. BESS is also an emerging alternative to firming power and the incorporation of a BESS in the Project will allow greater penetration of renewables by dispatchable generation

5.4 Site Selection Process

5.4.1 Overview

Selection of an appropriate site is an integral part of a wind farm development. A suitable wind farm site is generally considered to exhibit the following key characteristics:

- consistently high wind speeds;
- connection to the national electricity grid in close proximity to the wind farm site;
- minimal land clearing required to support wind farm infrastructure;
- suitable road access available to the wind farm site;
- large land parcels consisting of low levels of residential development;
- willingness for landholders to support wind farm infrastructure; and
- minimisation of impact on local amenity .

5.4.2 Siting Benefits

The location of the Hills of Gold Wind Farm provides the following key strategic siting benefits:

- **Optimal wind resource**: measured strong wind resource based on 12.6 met mast (since 2010) years of site specific data from onsite meteorological monitoring masts.
- **Suitable land:** ridgelines and orientation exposed to prevailing wind directions.
- **Minimal land use conflicts**: predominantly agricultural land use which can continue in parallel with the wind farm operations.
- **Proximity to national electrical network and connection capacity**: proximity to existing Liddell to Tamworth national transmission line infrastructure, noting planned closure of Liddell Power Station in 2022 / 2023.
- **Site isolation**: whilst the Project Area is relatively isolated in the context of low population density and minimal dwellings, thereby reducing potential impacts, predominately associated with noise, visual, blade throw and shadow flicker, it is located in proximity to larger regional centres such as Tamworth , the Hunter Valley and Newcastle, all major centres and regions connected to the grid.
- **Rehabilitation:** rehabilitation of disturbance areas following decommissioning to pre development agricultural land capacity or similar can be achieved.

- **Community support:** the Project has received support from the local communities of Nundle and Hanging Rock.
- **Regional Benefits**: Tamworth and surrounding areas are a source of skills for construction and operations based on existing renewable energy project experience and other varied industries.

Preliminary investigations commenced in 2010 and have since determined the Project Area to have strong potential for a wind farm development. Negotiations with landholders commenced in 2010, with 14 landholders signing agreements to host wind farm infrastructure during the course of concept design and Project layout development between 2017 and 2020.

5.5 Project Design and Component Alternatives

5.5.1 Project Layout Considerations

5.5.1.1 Concept Design Approach

At the conceptual design stage, a multivariable and iterative design approach was undertaken taking into consideration and range of technical, environmental, social, and economic opportunities and constraints, as outlined in Figure 5-1. Based on identified opportunities and constraints, a range of variations for the conceptual Project layout were developed.

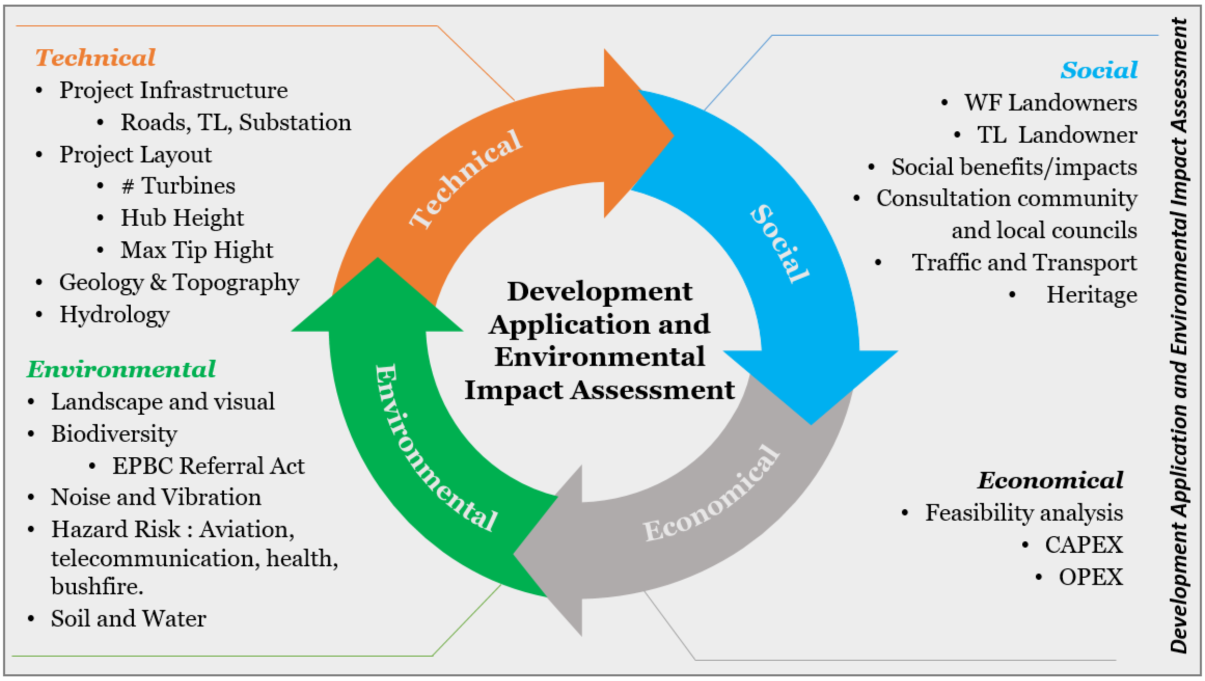


Figure 5-1 Multivariable and Iterative Design Approach

Progressive design iterations for the WTGs, ancillary infrastructure and the transmission line corridor have progressed with key drivers being measures to minimise and avoid impacts to biodiversity and heritage values. The following design refinements have been undertaken:

- preliminary biodiversity fieldwork in November 2019 and March 2020 and subsequent identification and mapping of biodiversity constraints prior to the development and ongoing amendments of a wind farm layout and transmission line corridor;
- preliminary heritage desktop and field assessment in July 2019 and sensitivity mapping of cultural heritage values prior was assessed for location of met masts and as input into wind farm and transmission line layout consideration;

- consideration of significant biodiversity constraints, such as Threatened Ecological Communities (TECs) and threatened fauna habitat, was made when selecting design solutions and development corridor;
- during the design development phase a wider landscape was reviewed for the potential transmission line corridor. Desktop and field assessments validated vegetation and habitat maps and transmission line options were assessed for likely impacts to significant biodiversity features, with a focus on minimising impacts to TECs;
- seven potential transmission line corridors of 60 m were refined down to two line route corridors (a preferred and alternate). Desktop reviews, high resolution imagery and select field surveys were undertaken to assess potential impacts of each route. Aboriginal heritage assessments of the preferred and alternate route were undertaken and due to heritage values the preferred option was progressed with the landowner of the preferred option. Further ecological, heritage and engineering assessments were undertaken for a 200 m wide transmission line corridor to provide flexibility in the siting of the final 60 m easement; and
- existing road infrastructure and alignment has been prioritised for construction access and operational tracks to minimise vegetation clearing and biodiversity impacts, including the use of existing farming tracks to access transmission line and wind farm infrastructure, including the use of the existing Morrisons Gap Road and Head of Peel Road;

The main goal of this exercise was to find an “Impact Optimized Project Footprint” that was compliant with Project’s planning framework and engaged with the community and local landowners. A key objective was to significantly reduce impacts to biodiversity from early Project layouts while ensuring strong social and economic outcomes. The multivariable analysis resulted in a “78 WTG Layout” which was introduced to the community during the Community Consultative Committee held on March 2020 and subsequently further refined down to 70 WTGs as set out below.

5.5.1.2 Multidisciplinary Workshop Methodology

A multidisciplinary ‘freeze design’ workshop was undertaken in May 2020 with the Project ecologists, community consultants, civil engineers and wind modellers to confirm optimal WTG layout and ancillary infrastructure locations to avoid impacts to significant biodiversity features such as fauna habitat and microbat breeding areas. The main goal of the workshop was to capture all participants’ feedback and brought all areas of expertise together to select the best possible location for each WTG where biodiversity impacts were avoided and/or mitigated without negatively impacting feasibility from the civil engineering, planning and wind modelling perspectives. As shown in Figure 5-2, the workshop discussion revolved around biodiversity inputs.

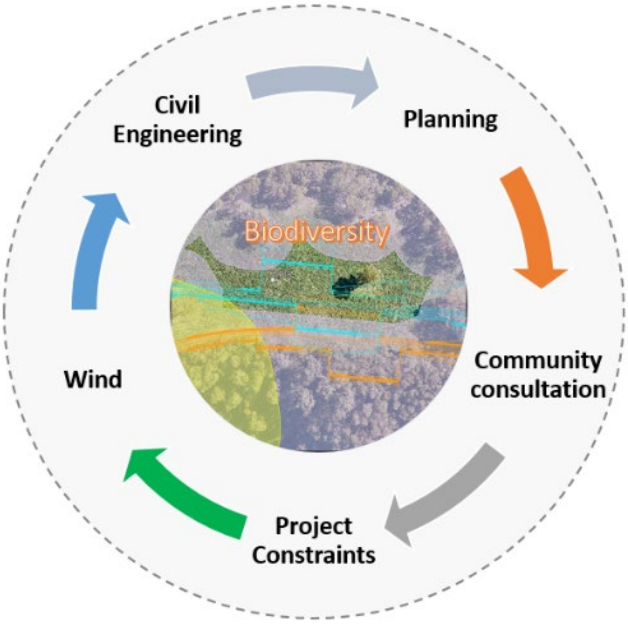


Figure 5-2 Design Freeze Workshop Methodology

The workshop methodology consisted in analysing turbine by turbine hardstand (i.e., 78 WTG), areas and connecting roads, and a technical expert from each area providing feedback into the how biodiversity constraints could be taken into account without affecting other aspects of the project.

As an example, one of turbines might have needed a relocation for a setback to hollow-bearing tree constraints as recommended by the Biodiversity team. Civil Engineering (Turnbull Engineering) provided feedback on an area that looked suitable by checking topography of pads areas and connecting roads. At the same time, the Someva and ERM teams were ensuring that the new proposed areas were still compliant with other project constraints (e.g., minimum distance to dwellings, waterways setbacks, and land rights, noise, and turbine spacing).

Using this approach, every single 78 WTG pad and internal connecting roads between pads was analysed during the day long workshop.

The outcome of the workshop was the rationalisation of the wind farm layout down to the 70 WTGs currently proposed, resulting in large reduction of direct and indirect impacts associated with the Project. The outcomes included:

- removal of turbine locations located within 100 m of identified microbat roosting habitat on rocky outcrops;
- relocation of 19 turbines including adjusting the orientation of hardstand areas and roads connecting WTGs;
- relocating temporary blade storage areas to reduce the adjacent hardstand and impact on surrounding PCTs;
- realigning roads, hardstands and ancillary infrastructure around the site to minimise earth works, take advantage of existing topographic features and avoid direct impact to high quality condition PCTs and suitable habitat; and
- relocating a site road to avoid a sensitive heritage area identified.

The following images provide examples of reduction in impacts that were able to be achieved across technical disciplines during the freeze design workshop. Final design optimisation will be undertaken as part of the detailed design prior to construction in order to further minimise impacts where practicable, including by limiting earth works.

Figure 5-3 shows an example of an outcome from the workshop. Prior to the workshop a pad area was impacting a PCT habit polygon. During the workshop, the advice from the experts was a realignment of the road as the pad can help to minimise/avoid biodiversity impacts. Post-workshop pad location shows a new pad and road area (blue), which should have a minimised impact on microbat 100 m buffer zone and PCT habitat mapping.

Pre-Workshop	**Post-Workshop**
• Wanted to move pad out of PCT Habitat • Realigned road and pad to fit better into already cleared land, thereby minimising impact	• New layout in light blue • Pad and road have less impact on microbat 100m buffer zone and PCT Habitat mapping zones

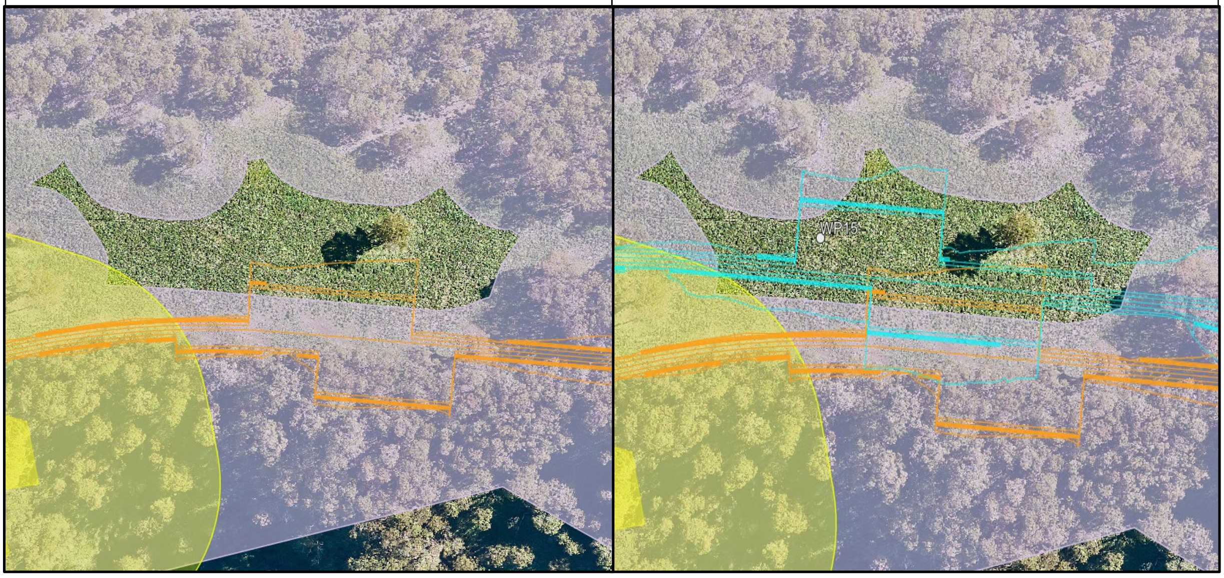


Figure 5-3 Workshop Outcome: pad relocation example to avoid biodiversity impacts

Turbine Number 63	
Pre-Workshop	Post-Workshop
	
Post Workshop The above images show a before (left) and after (right) of the feasibility concept designs for a road leading up to turbine 63 and its hardstand. A “just-in-time” hardstand has been used as it requires less space due to not needing to accommodate for blade storage. As can be seen in the above images, this has substantially reduced the area required for the hardstand and the associated cut and fill requirements from earthworks, reducing the overall area required and avoiding vegetation clearance. This type of assessment was undertaken on all turbine locations, and the quality of vegetation and suitability of habitat was considered in making layout adjustments.	

Figure 5-4 Workshop Outcome: conversion to ‘just in time’ hardstand to reduce biodiversity impacts

Turbine Numbers 54-56 including access tracks
Pre-Workshop

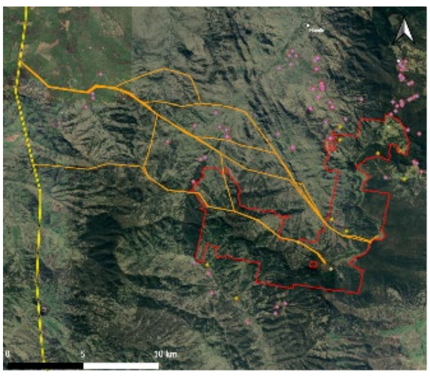
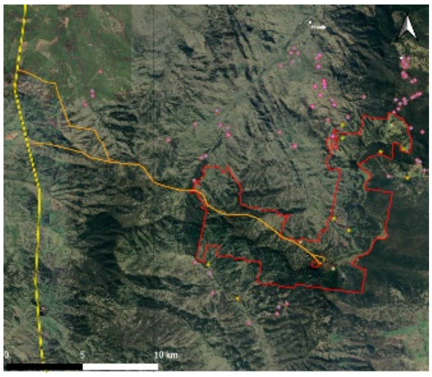
Post-Workshop: The initial design for this area consisted of a laydown area and three turbine hardstands, with one being on a separate "finger". The feasibility concept design took into account a high risk aboriginal heritage constraint (identified in red shading), noise constraints and some earthworks reduction where possible to reduce the impact. The roads and turbine hardstands were moved to the south-west to avoid the heritage item and creekline. This also had the benefit of reducing the noise impact to landowners to the east. The combining of the laydown area with a turbine hardstand, along with the removal of one of the other turbines and not using a "finger" have all reduced the impact from earthworks.


Figure 5-5 Workshop Outcome: realignment of access track, layout and removal of WTG

5.5.2 Project Component Considerations

Alternate considerations for the Project components have been considered and are discussed in Table 5-1.

Table 5-1 Project Component Considerations

Wind Farm Component	Description of Considerations
Turbine Type	As indicated in Chapter 3, the exact model of WTG has not yet been selected, with a range of models currently under consideration within the parameters of the environmental conditions assessed as part of consideration of site suitability. The selected model will have a generation capacity of approximately 6MW, however the dimensions of the WTG components including blade length, and hub and blade tip heights will vary depending on the model selected. In order to provide flexibility in selecting the WTG model, the WTG dimensions adopted for assessment as part of this EIS are the largest of the model options being considered for the Project, including a WTG with a rotor diameter of up to 170 m (blade length of up to 83.5 m) giving an overall tip height of up to 230 m. This approach ensures that the most suitable and cost effective technology can be deployed at the time the Project moves to construction.
Turbine Locations and Hardstands	A first pass technically feasible layout was produced based on the wind resource and required turbine spacing, identify up to 97 turbines. This was made publically available during in the Preliminary Environmental Assessment to request the SEARs. Subsequent iterations of this layout reduced the layout to 78 turbines and then finally 70 turbines. These new layouts assessed updated turbine technology and the results of the most up to date environmental survey information available. Various design rounds were held with civil, wind and biodiversity expertise, while incorporating community feedback. A final design freeze workshop was held in May 2020 in which detailed assessment was undertaken and civil engineers provided with direction to reflect opportunities to reduce direct biodiversity impact while maintaining a feasible layout. The following sections describes the approach undertaken to minimise impact during the design freeze workshop. Hardstand changes incorporated construction methods to reduce the direct impacts of temporary storage resulting in 19 hardstand design changes to “just in time” designs. Eight (8) turbines were also removed during this time, several to avoid potential bat breeding habitat. In total 30 hectares of mapped PCT including bat breeding habitat was avoided.
Transmission Line structures and connections	All residents were consulted along the seven (7) transmission line routes identified and to understand visual impact and willingness to reach land agreements. The number of dwellings within 500 m of each route was assessed and the topographic influences to visual impact. During this process biodiversity impacts associated with the seven (7) transmission line options were assessed and the least impact routes identified. Input to reduce visual impact was also considered. The transmission line options assessed are detailed below  

Wind Farm Component	Description of Considerations
	Following this, an optimisation of a 200 m corridor was undertaken to adjust the routes to minimise further impact around mapped PCTs. This allowed landowner discussions to progress to finalise an agreed land option which is the final alignment proposed, as detailed in Figure 1-12. A Concept Analysis was completed by Aecom (2020) to assess preferred and alternate transmission connection options, siting, layout and structure type options for the transmission line and associated structures and the switching station. Outcomes of the analysis included the selection of a steel pole, providing reduced visual and ground disturbance impacts in comparison to a lattice tower. The result provided a shorter route, low visual impact, reduced direct biodiversity impact and confirmation of the constructability and appropriate construction methods and structures for assessment in the EIS.
Substation	A concept layout initially included three (3) identified substation locations consistent with the initial seven (7) transmission line options being considered in 2019. The final option was selected based on minimising overhead internal sections, centralised location to reduce line losses, suitable flat ground with low biodiversity sensitivity, bushfire risk and increasing the distances from neighbouring dwellings. The final location is not expected to have any visual impact on nearby neighbours.
Switching Station	Initially four (4) switching station locations were considered based on interest from local landowners and suitable connection points along the Liddell to Tamworth TransGrid owned lines. Biodiversity surveys of the switching station location, heritage and construction access feasibility was carried out to provide greater input to site suitability. The preferred and alternate transmission line route refined this to two (2) switching station locations. The final selection was based on reduced heritage impact, biodiversity, and good access tracks for construction.
BESS	Consideration of the BESS was undertaken as part of the substation and O&M facility consideration due to operational requirements. The BESS was considered most suitable adjacent to the substation to minimise additional cable runs and provide direct access to the facility from the O&M facility. The BESS site is also located within a flat predominately cleared area.
Concrete batching plants	Concrete batching plant locations were selected once biodiversity surveys of the development corridor and Project Area, and high resolution aerial images and contours had been completed. This allowed siting to consider full project constraints and contours to minimise earthworks. The location of batching plants was considered based on their ability to operate within close proximity to clusters of turbines. This involved consideration for a batching plant to the south-west portion of the Project Area and north east portion of the Project Area, minimising traffic and time between concrete pours.
Laydown areas	Laydown areas were also identified in the same manner and timeframe as the concrete batching plants but are required to be located near access tracks with larger areas for temporary storage. During the workshop these were located to minimise biodiversity impacts and locate in areas that minimised earth works and provided convenience for temporary storage to those turbines hardstands that were reduced to the just-in-time concept.
O&M Facility	Consideration of the O&M was undertaken as part of the substation and BESS location. Sufficient flat land without biodiversity sensitivity and outside of bushfire risk areas were the driving environmental factors. In additional consideration for the BESS, substation and O&M facility also considered construction access and long-term staffing access requirements and ability to access the Project Area most conveniently for maintenance purposes.
Internal access roads	The network of internal access roads is generally aligned with the existing access roads, where practicable subject to key topographical and environmental constraints. The use of the Transverse Track has been incorporated in the Project to overcome topographical constraints and avoid impacting land subject to native title claims.

5.5.3 Transport Route and Site Access Options

An assessment of transport routes and access options has been undertaken during the Project conceptual design and traffic impact assessment phases, taking into account:

- transport route options from the Port of Newcastle to the Project Area, including alternative route via Tamworth to Nundle Road;
- alternative route through Nundle to Jenkins Street based on consultation with and suggestions by Tamworth Regional Council to minimise heavy vehicle traffic within the township;
- access route via Barry Road and Morrisons Gap Road (preferred and main access route) and alternate route via Crawney Road and Head of Peel Road, an alternative route for oversize and some construction related traffic; and
- options for road alignment and upgrades to the Devil's Elbow to facilitate transport of the oversize vehicles and reducing impacts to road users, including consideration of engineering, biodiversity and heritage impacts of the design options.

These options have been subject to consultation with Tamworth Regional Council and other key stakeholders including Forestry Corporation of NSW and landowners on areas of major upgrade. These options are considered in the Traffic Impact Assessment (refer Chapter 12 and Appendix G).

5.6 Conclusion

The design and location of the Development Footprint within the Project Area has undergone a number of significant revisions in response to environmental values, engineering assessments and social considerations. The final Project design incorporates an optimum Development Footprint which ensures that the Project will provide strong benefits to the region, NSW and Australia while minimising local and regional impacts as much as practicable.

6. STATUTORY FRAMEWORK

This section outlines the planning context of the Project including Commonwealth, State and Local Government legislation and additional policies of relevance to the EIS.

6.1 Commonwealth Legislation

6.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999 (*EPBC Act) is the primary Federal legislation relating to the environment, heritage protection and biodiversity conservation.

Under the EPBC Act, any action (defined as a project, development, undertaking, activity (or series of activities), or alteration to any of these) that has, or is likely to have, a significant impact on a Matter of National Environmental Significance (MNES) requires referral to the Commonwealth Minister for the Environment. MNES in relation to the Project Area are addressed in Table 6-1.

Table 6-1 Relationship of the Project to MNES

MNES	Application to the Project Area	Relevant Sections of EIS
World heritage properties	None identified within the Project Area	Not Applicable
National heritage places	None identified within the Project Area	Not Applicable
Ramsar wetlands of international importance	Search results listed four Wetlands of International Importance, however these all occur 100 km or greater downstream of the Project Area, being: ■ Banrock Station Wetland Complex ■ Hunter Estuary Wetlands ■ Riverland ■ The Coorong, and Lakes Alexandrina and Albert Wetland	Not Applicable
Listed threatened species and communities	The Project impacts on 1 listed threatened ecological community being White Box-Yellow Box-Blakely's Red Gum Grassy Woodland, and 3 listed fauna species being Koala, Large-eared Pied Bat, and Spotted-tailed Quoll.	Chapter 9
Internationally protected migratory species	Migratory species identified as potentially occurring within the Project Area	Chapter 9
Commonwealth marine areas	None identified within the Project Area	Not Applicable
The Great Barrier Reef Marine Park	None identified within the Project Area	Not Applicable
Nuclear actions	Not Applicable	Not Applicable
A water resource, in relation to coal seam gas development and large coal mining development	Not Applicable	Not Applicable

The Project was referred under the EPBC Act on 16 September 2019 (EPBC Ref: 2019/8535) and was determined to be a controlled action on 23 December 2019. As a result, the Project requires approval under the EPBC Act and will be assessed for the purposes of the EPBC Act via the DPIE under the terms of the bilateral agreement between the Commonwealth and NSW Government. Supplementary SEARs were issued detailing the requirements of the Commonwealth for the EIS.

The controlling provisions that apply to the Project under the EPBC Act were determined to be:

- Listed threatened species and communities (sections 18 and 18A); and
- Listed migratory species (sections 20 and 20A).

Consideration of the impact of the Project on each of these MNES is provided in the Biodiversity Development Assessment Report (refer to Appendix D) and summarised in Chapter 9.

6.1.2 Renewable Energy (Electricity) Act 2000

The *Renewable Energy (Electricity) Act 2000* establishes the large-scale and small-scale renewable energy schemes, including the liability framework, certificate generation and administrative arrangements.

The objects of this Act are:

(a) to encourage the additional generation of electricity from renewable sources; and

(b) to reduce emissions of greenhouse gases in the electricity sector; and

(c) to ensure that renewable energy sources are ecologically sustainable.

Chapter 2 details the important role that the Project will play in reducing Australia's greenhouse gas emissions, meeting future energy demands, supporting State and Commonwealth renewable energy targets, and contribution to the economic development in the region, consistent with the objectives of the *Renewable Energy (Electricity) Act 2000*.

6.1.3 Civil Aviation Safety Regulations 1998

The *Civil Aviation Safety Regulations 1998* (Volume 4, Part 139.E) (made under the *Civil Aviation Act 1988*) require that the Civil Aviation Safety Authority (CASA) must be informed of proposals to build a structure greater than 110 - m above ground level (AGL). This is required to allow assessment of whether the structure may represent a hazard to aircraft, and to provide any associated mitigation measures including any requirements for markings or lighting.

An Aviation Impact Assessment has been completed by Aviation Projects Pty Ltd (refer Appendix H) to inform this EIS. Section 13.1 provides a summary of the findings of the assessment with respect to potential for hazard to aircraft, including consideration of requirements for hazard lighting, along with future consultation to be undertaken with CASA and other proposed mitigation measures.

6.1.4 Radio Communications Act 1992

Part 4.1 of the *Radio Communications Act 1992* establishes the legislative framework for the regulation of equipment that uses or is affected by radio emissions.

Given WTGs and associated infrastructure produce electromagnetic fields, the Project has the potential to impact radiocommunications in the region. An assessment of the potential for the Project to interfere with telecommunication signals has been undertaken by Lawrence Derrick and Associates Pty Ltd to inform this EIS (refer to Appendix I). Section 13.2 provides a summary of the findings of the assessment and potential impacts to radiocommunications.

6.2 NSW Legislation

6.2.1 Environmental Planning and Assessment Act 1979

6.2.1.1 Overview

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the primary piece of legislation governing development in NSW. The EP&A Act establishes when and how a development or activity is to be assessed and who is the relevant approval or determining authority.

6.2.1.2 Objects of the EP&A Act

Section 1.3 of the EP&A Act defines the objects of the Act, being:

(a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,

(b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,

(c) to promote the orderly and economic use and development of land,

(d) to promote the delivery and maintenance of affordable housing,

(e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,

(f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),

(g) to promote good design and amenity of the built environment,

(h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,

(i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,

(j) to provide increased opportunity for community participation in environmental planning and assessment.

The Project is consistent with the relevant objects outlined in Section 1.3 of the EP&A Act by:

- facilitating the development of further natural wind resources within the New England Tablelands and the inherent environmental benefits associated with displacing greenhouse gas emissions and reducing the potential impacts of climate change;
- promoting the orderly and economic use of the land through the provision of a use and development that is compatible with the existing agricultural use on ridgelines occurring within the Project Area;
- supporting economic welfare of the local community through the establishment of a Community Enhancement Fund, a Neighbour Benefits Scheme, and through the creation of construction and operational jobs;
- minimising potential ecological impacts through the design and layout of the Project and supporting infrastructure. An assessment of impacts to flora and fauna, including threatened species, populations and ecological communities is provided at Chapter 9 and the Biodiversity Development Assessment Report (ARUP, 2020) provided at *Appendix D*;
- promoting ecologically sustainable development (ESD) in the manner described at Chapter 22;

- enabling the sharing of responsibility for environmental planning between the various levels of government through the consideration of State and local environmental planning instruments. Tamworth Regional Council, Upper Hunter Shire Council, and the Liverpool Plains Shire Council has also been consulted throughout the assessment process and will be represented on the Community Consultative Committee (CCC) which has been established for the Project; and
- establishing a community consultation strategy that will continue to be implemented throughout the planning approvals process and construction and operational phases of the Project. The EIS will be placed on public exhibition and submissions will be considered by the Minister for Planning and Public Spaces during the assessment of the Project.

6.2.1.3 Approval Pathway

The Project is State Significant Development (SSD) under Schedule 1, Clause 20 of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP), being:

> *'Electricity generating works and heat or co-generation: Development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, biofuel, distillate, waste, hydro, wave, solar or **wind power**) that—*
>
> *(a) **has a capital investment value of more than $30 million**, or*
>
> *(b) has a capital investment value of more than $10 million and is located in an environmentally sensitive area of State significance'.*

The Project is classified as 'electricity generating works'. Under clause 34(1) of the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP), electricity generating works are permitted with consent under a prescribed rural zone.

Clause 33 of ISEPP defines a prescribed rural zone as including RU 1 Primary Production, RU 2 Rural Landscape, RU 3 Forestry, and RU 4 Primary Production Lots. The Project Area is located primarily on land zoned RU 1 Primary Production with a small portion zoned RU 3 Forestry. As such, the Project is permissible with consent under the ISEPP.

As stated in Chapter 1, SEARs were issued for the Project on 22 November 2018, with Supplementary SEARs issued by the Commonwealth Department of Agriculture, Water and the Environment on 18 February 2020 following the Controlled Action determination. The SEARs and Supplementary SEARs form the basis of the assessment criteria for the Project. These requirements incorporate input from the various government agencies that will contribute to the assessment of the Project by DPIE.

The Minister for Planning and Public Spaces (or delegate) determines applications for SSD under Part 4 of the EP&A Act. The Independent Planning Commission is delegated authority to determine SSD applications where:

- there are 50 or more unique pubic objections to the SSD application; and / or
- the Applicant has made a reportable political donation; and / or
- the local council has objected to the SSD application and has not rescinded that objection following exhibition.

6.2.1.4 Section 4.15 Considerations

When undertaking an assessment of a development application, a consent authority is required, pursuant to Section 4.15 of the EP&A Act, to take into consideration a range of matters. The EP&A Act requires that both the natural and built environments and the social and economic impacts in the locality are considered.

The matters outlined in Section 4.15(1) have been considered in Table 6-2 in order to summarise the likely impacts of the Project on the natural and built environment.

Table 6-2 Section 4.15(1) Assessment

Matter for Consideration	Comment
a) the provisions of – *(i) any environmental planning instrument.*	The provisions of relevant environmental planning instruments (EPIs) relating to the Project are summarised and addressed in Section 6.2.2 and 6.2.3.
a) the provisions of – *(ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Planning Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved).*	There are no draft environmental planning instruments relevant to the Project.
a) the provisions of – *(iii) any development control plan.*	Development control plans do not apply to SSD under the provisions of Clause 11 of SEPP SRD. Nonetheless, in the interests of completeness, the specific wind farm provisions of the Upper Hunter Development Control Plan 2015 have been considered and addressed below (refer to Section 6.2.4.4). It is noted that the Tamworth Regional Development Control Plan 2010 and the Liverpool Plains Shire Council Development Control Plan 2012 do not contain guidance on wind farm development and these DCP's have not been considered further.
a) the provisions of – *(iiia) any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4.*	A Community Enhancement Fund in lieu of voluntary planning agreements has been negotiated with Tamworth Regional, Upper Hunter and Liverpool Plains councils. This is further discussed in Section 6.2.4.5.
a) the provisions of – *(iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph).*	The provisions of the *Environmental Planning and Assessment Regulations 2000* as they relate to the Project have been addressed within Table 6.3.
(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality.	Assessment of the key environmental and social impacts relating to the Project is provided in *Chapter 9* through to *Chapter 23*, and the corresponding specialist assessments that accompany the EIS.
(c) the suitability of the site for the development.	The suitability of the Project Area for the purposes of a wind farm is discussed in *Chapter 4*.
(d) any submissions made in accordance with the Act or the regulations.	The EIS will be placed on public exhibition by DPIE for a minimum period of to 28 days and submissions will be considered by the consent authority during the assessment of the Project.
(e) the public interest.	The EIS and supporting specialist assessments have concluded that the Project is compatible with the existing agricultural uses evident in the area, can appropriately manage potential environmental and social impacts, and accords with the planning and environmental provisions relevant to the Project Area. As a result, the Project is regarded to be in the public interest.

6.2.1.5 EIS Requirements

The SEARs refer to Schedule 2, Clauses 6 and 7 of the EP&A Regulation which specify the form and content of an EIS. Compliance with these requirements are detailed in Table 6-3.

Table 6-3 EP&A Regulation Schedule 2, Clause 6 and 7 Requirement Compliance

Clause	Requirement	Compliance Comment
Cl 6	An environmental impact statement must contain the following information: (a) the name, address and professional qualifications of the person by whom the statement is prepared, (b) the name and address of the responsible person, (c) the address of the land— (i) in respect of which the development application is to be made, or (ii) on which the activity or infrastructure to which the statement relates is to be carried out, (d) a description of the development, activity or infrastructure to which the statement relates, (e) an assessment by the person by whom the statement is prepared of the environmental impact of the development, activity or infrastructure to which the statement relates, dealing with the matters referred to in this Schedule, (f) a declaration by the person by whom the statement is prepared to the effect that— (i) the statement has been prepared in accordance with this Schedule, and (ii) the statement contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure to which the statement relates, and (iii) that the information contained in the statement is neither false nor misleading.	Certification Page of EIS
Cl 7	(1) An environmental impact statement must also include each of the following:	
	(a) a summary of the environmental impact statement,	Executive Summary
	(b) a statement of the objectives of the development, activity or infrastructure,	Section 6.2.1.2
	(c) an analysis of any feasible alternatives to the carrying out of the development, activity or infrastructure, having regard to its objectives, including the consequences of not carrying out the development, activity or infrastructure,	Chapter 5
	(d) an analysis of the development, activity or infrastructure, including— (i) a full description of the development, activity or infrastructure, and (ii) a general description of the environment likely to be affected by the development, activity or infrastructure, together with a detailed description of those aspects of the environment that are likely to be significantly affected, and (iii) the likely impact on the environment of the development, activity or infrastructure, and (iv) a full description of the measures proposed to mitigate any adverse effects of the development, activity or infrastructure on the environment, and (v) a list of any approvals that must be obtained under any other Act or law before the development, activity or infrastructure may lawfully be carried out,	Chapter 3 Chapters 9 – 20 Chapter 21 Section 6.2.1.6
	(e) a compilation (in a single section of the environmental impact statement) of the measures referred to in item (d) (iv),	Chapter 21
	(f) the reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development set out in subclause (4).	Chapters 2, 22 and 23

6.2.1.6 Application of other Provisions and Approvals

Under Section 4.41(1) of the EP&A Act, the following authorisations relevant to the Project are not required for SSD projects which have been granted development consent:

- *National Parks and Wildlife Act 1974:* an Aboriginal heritage impact permit under section 90*; and*
- *Water Management Act 2000:* a water use approval under section 89, a water management work approval under section 90 or an activity approval under section 91.

Further, under Section 4.42 of the EP&A Act, the following authorisations relevant to the Project cannot be refused for a SSD project if they are necessary for the carrying out of a project which has been granted development consent, and must be substantially consistent with the SSD consent:

- *Protection of the Environment Operations Act 1997:* an Environment Protection Licence under Chapter 3; and
- *Roads Act 1993:* a consent under Section 138.

As discussed in Table 6-4, the Project will require the following additional environmental approvals:

- an Environment Protection Licence for scheduled development work and the Scheduled Activity of '*Electricity Generation – electricity works (wind farms)*' under Clause 17, Schedule 1 of the POEO Act;
- consents under Section 138 of the *Roads Act 1993* for works within the road reserve; and
- approval under Section 68 of the *Local Government Act 1993* for the onsite sewage management system to be installed at the O&M facility.

6.2.2 Other Applicable Legislation

Other applicable NSW legislative provisions relating to the Project, including other approvals and authorisations are discussed in Table 6-4.

6.2.3 State Environmental Planning Policies

State Environmental Planning Policies (SEPPs) relevant to the Project are discussed further below in Table 6-5.

Table 6-4 Other Applicable Legislation

Statutory Requirement	Description	Relevance to the Project	Reference
NSW Legislation			
Protection of the Environment Operations Act 1997 (POEO Act)	The POEO Act is the primary piece of legislation regulating pollution control and waste disposal in NSW. The NSW Environment Protection Authority (EPA) is the regulatory authority for the Project under the provisions of the POEO Act. Part 3.2 of the POEO Act provides guidance to licencing requirements for scheduled development work and scheduled activities, specifically including licences required for certain premises-based and non-premises-based activities, as outlined in Clause 48 and 49. Scheduled activities and their licencing thresholds are listed in Schedule 1 of the Act.	■ Schedule 1 activities requiring an EPL include 'Electricity Generation - electricity works (wind farms)' that are the subject of State significant development consent granted under the EP&A Act which have a capacity to generate more than 30 megawatts of electrical power. An environment protection licence (EPL) will be required for the Project. It is understood that extractive activities associated with the construction of the development of the Project would not require separate listing as a scheduled activity under the EPL as an 'extractive activity', however this would be subject to further discussion and application to the EPA should this be required by the EPA. Under the provisions of Section 4.42 of the EP&A Act, an EPL cannot be refused if it is necessary for carrying out State significant development that is authorised by a development consent under Division 4 of the EP&A Act and is to be substantially consistent with any approved SSD project.	This section
Biodiversity Conservation Act 2016 (BC Act)	The BC Act came into effect on 25 August 2017. The BC Act replaced the NSW Threatened Species Conservation Act 1995, the NSW Nature Conservation Trust Act 2001 and parts of the NSW National Parks and Wildlife Act 1974. The BC Act establishes mechanisms for: ■ the management and protection of listed threatened species of native flora and fauna (excluding fish and marine vegetation) and threatened ecological communities (TECs); ■ the listing of threatened species, TECs and key threatening processes;	In terms of the proposed wind farm, the proposed development must take into account species likely to occur within available habitat based on existing records of threatened species and ecological communities, as well as those species likely to occur based on geographic distribution and presence of potential habitat. A licence to pick or harm listed threatened species or communities is not required if the Project is authorised by a development consent.	Biodiversity Development Assessment Report (Appendix D) and Chapter 9.

Statutory Requirement	Description	Relevance to the Project	Reference
	■ the development and implementation of recovery and threat abatement plans; ■ the declaration of critical habitat. ■ the consideration and assessment of threatened species impacts in development assessment process; and ■ Biodiversity Offsets Scheme, including the Biodiversity Values Map and method to identify serious and irreversible impacts (SAII).		
National Parks and Wildlife Act 1974 (NPW Act)	The object of the NPW Act is to consolidate and amend the law relating to the establishment, preservation and management of national parks, historic sites, certain other area, and the protection of certain fauna, native plants and Aboriginal objects. The recent biodiversity conservation and land management reforms repeal several existing Acts, including the animal and plant provisions of the NPW Act.	The proposed development must assess and take into account Aboriginal cultural heritage values. Under the provisions of Section 4.41 of the EP&A Act, a Section 90 Aboriginal heritage impact permit is not required for SSD projects. Consultation has been undertaken in accordance with the requirements of Clause 60 of the *National Parks and Wildlife Regulations 2019.*	Aboriginal Cultural Heritage Assessment Report (Appendix M) and Chapter 14
Heritage Act 1977 (Heritage Act)	The Heritage Act protects the cultural and natural history of NSW with emphasis on historic (European) heritage items, including places, buildings, works, relics, moveable objects or precincts with significance to the State or a local area. It provides blanket protection for surface and sub-surface relics and for heritage items of state significance listed on the State Heritage Register. The Act defers to local planning instruments under the EP&A Act for the protection of items of local significance.	The proposed development must assess and take into account historic heritage values associated with the Project. `	Historic Heritage Assessment (Appendix N) Chapter 15

Statutory Requirement	Description	Relevance to the Project	Reference
Water Management Act 2000 (WM Act) and *Water Act 1912* (Water Act)	The WM Act regulates the use and interference with surface and groundwater where a water sharing plan has been implemented. For areas outside the limits of water sharing plans, licensing provisions of the Water Act are still in force. Section 4.41 of the EP&A Act confirms that approved SSD does not require approvals under WM Act Section 89 (water use), Section 90 (water management work) or Section 91(2) (controlled activity).	Six water sharing plans intersect with the Project Area: ■ Water Sharing Plan for the Namoi and Peel Unregulated Rivers Water Sources 2012; ■ Water Sharing Plan for the Lower North Coast Unregulated and Alluvial Water Sources 2009; and ■ Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009. ■ Water Sharing Plan for the Peel Valley Regulated, Unregulated, Alluvium and Fractured Rock Water Sources 2010; ■ Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020; and ■ Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016. The provisions of these water sharing plans apply where water supply for the Project is to be accessed via surface water and/or groundwater. All required water access licences will be obtained as required following confirmation of the final selected water sources for the Project.	Soil and Water Report Appendix O Chapter 16
Roads Act 1993 (Roads Act)	The Roads Act addresses authorities, function and regulation of activities relating to the use and type of roads. Approval under section 138 of the Roads Act is required to impact or carry out work on or over a public road.	The Project will require consent from the appropriate roads authority under Section 138 of the Roads Act for works within the road reserve, as described in the traffic and transport assessment.	Traffic and Transport Impact Assessment (Appendix G) Chapter 10
Rural Fires Act 1997 (RF Act)	The main objectives of the RF Act are to: ■ prevent, mitigate and suppress bush and other fires in NSW; ■ co-ordinate bush firefighting and bushfire prevention throughout the State; ■ protect people from injury or death and property from damage as a result of bushfires; and ■ protect the environment.	A Section 100B bushfire safety authority is not required as the development does not involve subdivision for residential or rural residential development. Bushfire risk considerations for the Project are discussed in Section 13.4	Bushfire Assessment Appendix J) Chapter 13

Statutory Requirement	Description	Relevance to the Project	Reference
Local Government Act 1993 (LG Act)	Outlines processes for local government and sets out the powers of local councils. Approval is required under section 68 of the LG Act to install an onsite sewerage system.	An onsite sewage management system will be installed at the O&M Facility and approval from Tamworth Regional Council will be sought.	This Section
Crown Land Management Act 2016 (CLM Act)	The objects of the CLM Act are: ■ to provide for the ownership, use and management of Crown land of NSW; ■ to provide clarity concerning the law applicable to Crown land; ■ to require environmental, social, cultural heritage and economic considerations to be taken into account in decision-making about Crown land; ■ to provide for the consistent, efficient, fair and transparent management of Crown land for the benefit of the people of NSW; ■ to facilitate the use of Crown land by the Aboriginal people of NSW because of the spiritual, social, cultural and economic importance of land to Aboriginal people and, where appropriate, to enable to co-management of dedicated or reserved Crown land; and ■ to provide for the management of Crown land having regard to the principles of Crown land management.	The Project Area includes Crown paper roads. The Project Area also includes a Crown land lot under a perpetual lease (Lot 48 DP 753722) (refer to Figure 4-2), as discussed in Chapter 4. Access rights, in the form of easements or licences, will be obtained as required in relation to all Crown paper roads and land in accordance with the processes contained in the CLM Act.	Section 4.2.3
Fisheries Management Act 1994 (FM Act)	The objectives of the FM Act are to conserve key fish habitats, threatened specifies and populations, and promote ecologically sustainable development through conservation of biological diversity. Further, it aims to promote viable commercial fishing, aquaculture industries and recreational fishing opportunities.	Mapping by the Department of Primary Industries identifies key fish habitat within the Project Area, primarily associated with the tributaries of the Peel River and Pages River. Impacts on fish habitat as a result of the Project are largely associated with waterway crossings along the access / transport routes. Assessment of these impacts is detailed in the Biodiversity Development Assessment Report.	Biodiversity Development Assessment Report (Appendix D) and Chapter 9.
Forestry Act 2012	This act sets out the establishment of the Forestry Corporation of NSW. The objectives of the Act are to facilitate forestry activities with due regard to environmental and public access requirements.	The Project Area incorporates land zoned as RU3 Forestry, being Ben Halls Gap State Forest, managed by NSW Forestry Corporation. Consultation with NSW Forestry Corporation has been undertaken regarding access and road upgrades associated with the Project. The Project is generally consistent with the objectives of the *Forestry Act 2012*.	

Table 6-5 Consideration of State Environmental Planning Policies

SEPP	Description	Relevance to the Project	Reference
State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP)	Schedule 1 of the SRD SEPP identifies categories of SSD, including Clause 20 being for electricity generating works and heat or co-generation, which states: *"Development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, biofuel, distillate, waste, hydro, wave, solar or wind power) that:* *(a) has a capital investment value of more than $30 million."*	The estimated capital value of the Project is $826 million, which exceeds the $30 million threshold. The SRD SEPP is therefore applicable and the Project is to be assessed as SSD under Part 4 of the EP&A Act.	This Section
State Environmental Planning Policy (Infrastructure) 2007 (ISEPP)	The ISEPP provides development controls for infrastructure and services and permissibility. Provisions relevant to the Project include: ■ Clause 34 (1)(b): Development for the purpose of electricity generating works may be carried out by any person with consent on any prescribed rural, industrial or special use zone, ■ Electricity generating works means a building or place used for the purpose of making or generating electricity or electricity storage;	As outlined above, the Project is classified as 'electricity generating works'. Under clause 34(1) of the ISEPP, electricity generating works are permitted with consent under a prescribed rural zone. The development is permissible with consent under the ISEPP.	This Section
State Environmental Planning Policy (Coastal Management) 2018 (Coastal Management SEPP)	The aim of the Coastal Management SEPP is to promote an integrated and co-ordinated approach to land use planning in the coastal zone in a manner consistent with the objects of the Coastal Management Act 2016.	Whilst approximately 34.82 ha of coastal wetlands, mapped under the State Environmental Planning Policy (SEPP) (Coastal Management) 2018 occur within the biodiversity assessment study area around areas of road upgrades required in Newcastle and include the Southern Hunter River and Throsby Creek, the Project Area itself does not occur within 1 km of any coastal wetland and no works are proposed in any coastal wetland. Consideration of coastal wetlands is detailed in the Biodiversity Development Assessment Report.	Biodiversity Development Assessment Report (Appendix D. (Chapter 9)

SEPP	Description	Relevance to the Project	Reference
State Environmental Planning Policy (Koala Habitat Protection) 2019 (Koala Habitat Protection SEPP)	The Koala Habitat Protection SEPP aims to encourage the conservation and management of areas of natural vegetation that provide habitat for koalas to support a permanent free living population over their present range and reverse the current trend of koala population decline. The Koala Habitat Protection SEPP includes a new definition for 'core koala habitat', two maps to help protect koalas across NSW, and the most up-to-date tree species data.	The Koala Habitat Protection SEPP applies to the Tamworth Regional, Upper Hunter and Liverpool Plains LGAs as defined in Schedule 1 of the SEPP. Along the transport route, Newcastle, Maitland, Cessnock, Singleton and Muswellbrook LGAs are also listed in Schedule 1. The biodiversity assessment study area is located within the Northern Tablelands Koala Management Area (KMA), and the proposed works include the removal of a total of 186.73 hectares of native vegetation. Of this, 35.48 hectares is considered to be Koala breeding habitat, encompassing 18 PCTs. The impact of the Project on the koala and koala habitat is detailed and assessed in the Biodiversity Development Assessment Report.	Biodiversity Development Assessment Report (Appendix D. (Chapter 9)
State Environmental Planning Policy No.33 – Hazardous and Offensive Development (SEPP 33)	SEPP 33 aims to ensure that in considering any application to carry out potentially hazardous or offensive development, the consent authority has sufficient information to assess whether the development is hazardous or offensive and to impose conditions to reduce or minimise any adverse impact. SEPP 33 applies to any development which falls under the policy's definition of 'potentially hazardous industry' or 'potentially offensive industry'.	A screening assessment has been prepared for the Project to identify associated risks and hazards, in accordance with the 'Hazardous and Offensive Development Application Guidelines: Applying SEPP 33' (DoP, 2011).	SEPP 33 Screening Assessment (Appendix L) Chapter 13.
State Environmental Planning Policy No.55 Remediation of Land (SEPP 55)	Under Clause 7 of SEPP 55, a consent authority is required to consider whether a proposed development site is affected by soil or other contaminants before granting consent.	The Project Area is zoned for agricultural purposes, which reflects the primary use of the land for agricultural grazing. There is no previous history of other uses that could be considered to be potentially contaminating and therefore it is considered that the Project Area has a low contamination risk. The Project Area is considered unlikely to be contaminated and suitable for the proposed development and is therefore considered consistent with SEPP 55. A search of the EPA Contaminated Land Record and the EPA List of Notified Sites revealed there are no records of contamination in the Project Area.	Appendix O and Chapter 16.

6.2.4 Local Statutory Context

The Project Area intersects three LGAs, being the Tamworth Regional, Upper Hunter and Liverpool Plains LGA's, and as such, constitute the local statutory context of the Project that will be discussed in this section.

It is noted that the transport route intersects a number of other LGAs, including Newcastle, Maitland, Cessnock, Singleton and Muswellbrook. The Project activities associated with these LGAs are limited to transport activities along the road corridors and identified upgrade works to these localities will be undertaken in accordance with Section 138 permits under the *Roads Act 1993*, as discussed in Section 6.2.2.

6.2.4.1 Tamworth Regional Local Environmental Plan 2010

The Tamworth Regional Local Environment Plan 2010 (Tamworth Regional LEP) is the principal environmental planning instrument which regulates land use within the Tamworth Regional LGA. The central aims of the Tamworth Regional LEP are:

a) *"to encourage the orderly management, development and conservation of natural and other resources within the Tamworth region by protecting, enhancing or conserving—*
   - i) *important agricultural land, and*
   - ii) *timber, minerals, soil, water and other natural resources, and*
   - iii) *areas of significance for nature conservation, and*
   - iv) *places and buildings of archaeological or heritage significance,*

b) *to allow flexibility in the planning framework so as to encourage orderly, economic and equitable development while safeguarding the community's interests and residential amenity*

c) *to manage and strengthen retail hierarchies and employment opportunities, promote appropriate tourism development, guide affordable urban form and provide for the protection of heritage items,*

d) *to promote ecologically sustainable urban and rural development and control the development of flood liable land, and*

e) *to secure a future for agriculture by expanding Tamworth's economic base and minimising the loss or fragmentation of productive agricultural land".*

The majority of the Project Area is located within the Tamworth Regional LGA to which the provisions of the Tamworth Regional LEP apply. The wind farm site is located on land zoned RU1 – Primary Production. The objectives of this zone is as follows:

- *To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.*
- *To encourage diversity in primary industry enterprises and systems appropriate for the area.*
- *To minimise the fragmentation and alienation of resource lands.*
- *To minimise conflict between land uses within this zone and land uses within adjoining zones.*
- *To permit subdivision only where it is considered by the Council to be necessary to maintain or increase agricultural production.*
- *To restrict the establishment of inappropriate traffic generating uses along main road frontages.*
- *To ensure sound management of land which has an extractive or mining industry potential and to ensure that development does not adversely affect the extractive industry.*
- *To permit development for purposes where it can be demonstrated that suitable land or premises are not available elsewhere.*

A small portion of the Project Area is located in RU3 – Forestry zone. The objectives of this zone are as follows:

- *To enable development for forestry purposes.*
- *To enable other development that is compatible with forestry land uses.*

The Project is generally consistent with these objectives, demonstrating the suitability of the site for the Project.

In relation to land zoned as RU1 – Primary Production, clearing and excavation will be required for a network of turbine footings, hardstand areas, access tracks, substation, BESS and control buildings, road works associated with the transport and access routes and clearing and excavation for the 330 kV overhead transmission line and poles to connect the Project to the existing 330 kV Liddell to Tamworth overhead transmission line network.

Having a dispersed and small overall impact footprint in comparison to the land available for agriculture within the Project Area, allowing for mixed agricultural activities concurrent with the wind farm operation and being highly reversible at the end of the Project's life, the proposal is considered compatible with this land zoning.

Project activities within the RU 3 Forestry zone are limited to access tracks for the Project. No permanent Project infrastructure will be located within the RU 3 zone. The Project will improve access to the RU3 – Forestry zoned area through the proposed upgrades to Morrisons Gap Road and other Project access tracks. This will be an operational benefit to the Ben Halls Gap State Forest and Ben Halls Gap Nature Reserve / National Park estates. It will also improve vehicular response time and access in the case of a bushfire in the area.

6.2.4.2 Upper Hunter Shire Local Environmental Plan 2013

The Upper Hunter Shire Local Environment Plan 2013 (Upper Hunter LEP) is the principal environmental planning instrument regulating land use within the Upper Hunter LGA. The central aims of the Upper Hunter LEP are:

a) *"to encourage the proper management, development and conservation of natural and human-made resources in the Upper Hunter by protecting, enhancing and conserving the following—*
   i) *important agricultural resources,*
   ii) *timber, minerals, soil, water and other natural resources,*
   iii) *the environmental, scenic and cultural heritage of the Upper Hunter,*

b) *to protect and conserve—*
   i) *soil stability by controlling development in accordance with land capability, and*
   ii) *remnant native vegetation, and*
   iii) *water resources, water quality and wetland areas, natural flow patterns and their catchments and buffer areas,*

c) *to establish a pattern of broad development zones as a means of—*
   i) *separating incompatible uses, and*
   ii) *minimising the cost and environmental impact of a development, and*
   iii) *maximising efficiency in the provision of utility, transport, retail and other services,*

d) *to manage the urban areas of the Upper Hunter by strengthening retail centres and employment opportunities, promoting appropriate tourism development, guiding affordable urban form and providing for the protection of heritage items and precincts,*

e) *to promote ecologically sustainable urban and rural development and control the development of flood liable land,*

f) *to secure a future for agriculture by expanding the Upper Hunter's economic base and minimising the loss or fragmentation of productive agricultural land,*

g) *to protect, enhance and provide for biological diversity, including native threatened species, populations and ecological communities, by long-term management and by identifying and protecting habitat corridors and links throughout the Upper Hunter".*

A small portion of the Project Area is located within the Upper Hunter LGA to which the provisions of the Upper Hunter LEP apply. The Project Area is located on land zoned RU1 – Primary Production. The objectives of this zone is as follows:

- *To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.*
- *To minimise the fragmentation and alienation of resource lands.*
- *To minimise conflict between land uses within this zone and land uses within adjoining zones.*
- *To protect the agricultural value of rural land.*
- *To maintain the rural landscape character of the land in the long term.*
- *To ensure that development does not unreasonably increase demand for public services or public facilities.*
- *To ensure that development for the purposes of extractive industries, underground mines (other than surface works associated with underground mines) or open cut mines (other than open cut mines from the surface of the flood plain) will not:*
    a) *destroy or impair the agricultural production potential of the land or, in the case of underground mining, unreasonably restrict or otherwise affect any other development on the surface, or*
    b) *detrimentally affect the quantity, flow and quality of water in either subterranean or surface water systems, or*
    c) *visually intrude into its surroundings, except by way of suitable screening.*

The Project is generally consistent with these objectives.

Within the Upper Hunter LGA, Project activities include clearing, excavation, construction and operation of a network of turbine footings, hardstand areas, internal access tracks, substation, BESS and control buildings.

Having a dispersed and small overall impact footprint in comparison to the land available for agriculture within the Project Area, allowing for mixed agricultural activities concurrent with the wind farm operation and being highly reversible at the end of the Project's life, the Project is considered compatible with this land zoning.

6.2.4.3 Liverpool Plains Local Environmental Plan 2011

The Liverpool Plains Local Environment Plan 2011 (Liverpool Plains LEP) is the principal environmental planning instrument which regulates land use within the Liverpool Plains LGA. The central aims of the Liverpool Plains LEP are:

a) *"to encourage the proper management of the natural and man-made resources of Liverpool Plains by protecting, enhancing or conserving—*
    i) *productive agricultural land, and*
    ii) *timber, minerals, soils, water and other natural resources, and*
    iii) *areas of significance for nature conservation, and*
    iv) *areas of high scenic or recreational value, and*
    v) *places and buildings of archaeological or heritage significance,*

b) *to manage the urban areas of Liverpool Plains by strengthening retail hierarchies and employment opportunities, promoting appropriate tourism development, guiding affordable urban form and providing for the protection of heritage items and precincts,*

c) *to promote ecologically sustainable urban and rural development,*

d) *to provide a secure future for agriculture by expanding Liverpool Plains' economic base and minimising the loss or fragmentation of productive agricultural land,*

e) *to minimise land use conflict,*

f) *to ensure that development has regard to the capability of the land,*

g) *to provide a choice of living opportunities and types of settlement within Liverpool Plains,*

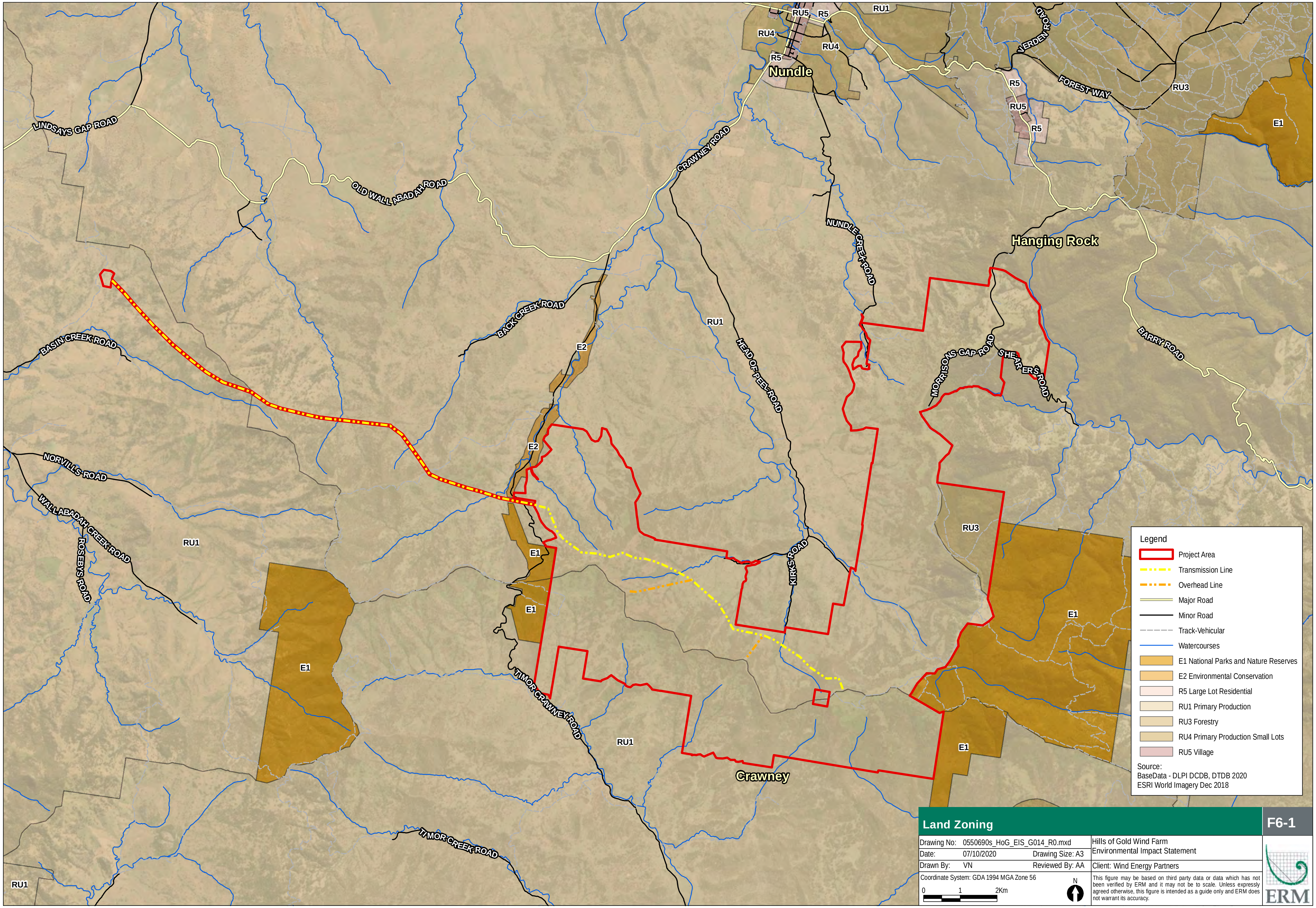
h) *to ensure that the efficiency of arterial roads is not adversely affected by development on adjacent land,*

i) *to enable development that has proper regard to the environmental constraints of the land and minimises impacts on biodiversity, water resources and natural landforms".*

The Project is generally consistent with these objectives.

Project activities occurring within the Liverpool Plains LGA is limited to clearing and excavation for the 330 kV overhead transmission line and poles to connect the Project to the existing 330 kV Liddell to Tamworth overhead transmission line network; switching station and limited road works associated the transport route.

Having a dispersed and small overall impact footprint in comparison to the land available for agriculture within the Project Area, allowing for mixed agricultural activities concurrent with the wind farm operation and being highly reversible at the end of the Project's life, the proposal is considered compatible with this land zoning.



Land Zoning
F6-1
Drawing No: 0550690s_HoG_EIS_G014_R0.mxd
Date: 07/10/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partners
Coordinate System: GDA 1994 MGA Zone 56
0 1 2Km
N
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM
Legend
Project Area
Transmission Line
Overhead Line
Major Road
Minor Road
Track-Vehicular
Watercourses
E1 National Parks and Nature Reserves
E2 Environmental Conservation
R5 Large Lot Residential
RU1 Primary Production
RU3 Forestry
RU4 Primary Production Small Lots
RU5 Village
Source:
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018
Nundle
Hanging Rock
Crawney
LINDSAYS GAP ROAD
OLD WALL ABADAH ROAD
CRAWNEY ROAD
NUNDLE CREEK ROAD
VERDEN ROAD
FOREST WAY
BARRY ROAD
BACK CREEK ROAD
BASIN CREEK ROAD
HEAD OF PEEL ROAD
MORRISONS GAP ROAD
SHEARERS ROAD
NORVILLS ROAD
WALLABADAH CREEK ROAD
ROSEBYS ROAD
KIRKS ROAD
TIMOR CRAWNEY ROAD
TIMOR CREEK ROAD
RU1
RU3
RU4
RU5
R5
E1
E2

6.2.4.4 Development Control Plans

Development control plans do not apply to SSD under the provisions of Clause 11 of SEPP SRD. Nonetheless, in the interests of completeness, the specific wind farm provisions of the Upper Hunter Development Control Plan 2015 have been considered and addressed below. It is noted that the Tamworth Regional Development Control Plan 2010 and the Liverpool Plains Shire Council Development Control Plan 2012 do not contain guidance on wind farm development and these DCP's have not been considered further.

Upper Hunter Development Control Plan 2015

Section 8c of the Upper Hunter Development Control Plan 2015 outlines assessment criteria for wind energy systems which apply to any land where electricity generating works are permissible with consent, either through Upper Hunter LEP 2011 or through SEPP Infrastructure 2007.

The objectives of section 8c are that wind energy systems:

- *"do not interfere with the health and amenity of the community within the proposed locality*
- *have a consistent approach in their design and the positioning of wind turbines*
- *adequately consider environmental issues prior, during and in the operation phase*
- *achieve a built form that does not interfere with the surrounding context*
- *do not have an adverse impact on Council's infrastructure*
- *are afforded an adequate level of public consultation during the development assessment stage".*

A performance-based approach has been adopted in the assessment of wind farm development applications by Upper Hunter Shire Council which considers design, construction and operation, as depicted in Table 6-6 below.

Table 6-6 Wind Farm Provisions from the Upper Hunter DCP 2015

DCP Requirement	Design Guidelines	Response
A. General design, construction & operation • *The proposal shall meet the requirements of the following guidelines and documents (as amended or updated):* ○ *Draft NSW Planning Guidelines – Wind Farms (Department of Planning and Infrastructure, 2011).* ○ *Draft EIS Guideline "Network Electricity systems and Related Facilities" (Planning NSW, February 2002).* ○ *Best Practice Guidelines for implementation of Wind Energy Projects in Australia (Auswind, 2006).* ○ *Draft National Wind Farm Development Guidelines (The Environment Protection and Heritage Council July 2010).* *The proposals demonstrates knowledge, awareness and reference to the publications (as amended) as listed in section 8c.8 Supplementary guidance.*	*N/A*	The Project and the EIS has been prepared with due regard to DPIE's current NSW Wind Energy Framework, including the Wind Energy Guideline, Visual Assessment Bulletin and Noise Assessment Bulletin, as stipulated in the SEARs.
B. Surrounding environment • *The proposal takes into account the surrounding environment. All elements of the proposal are sited and carried out to minimise impacts on the locality, and do not conflict with adjoining or nearby development.*	*N/A*	Chapter 4 considers site suitability and respective technical assessments have considered impacts to the locality.
C. Cumulative impact • *The cumulative impact of the proposal in connection to existing or approved undeveloped wind power generation has been considered.*	Ridgelines dominated with wind turbines will not be favoured	Chapter 20 considers cumulative impacts.

DCP Requirement	Design Guidelines	Response
D. Distances from dwellings & surrounding development • Distances between proposed wind turbine locations in relation to any dwellings shall give due consideration to the issues of excessive noise, shadow flicker, infrasound and visual amenity.	The requirements of Draft NSW Planning Guidelines – Wind Farms (DPI, 2011) (or the appropriate updated document) should be met with regard to distances to neighbouring dwellings and properties.	Chapter 4 details the distances from the nearest proposed WTG to residential dwellings. Chapter 10 and Appendix E details the noise assessment. Chapter 11 and Appendix F details the visual assessment, including shadow flicker.
E. Distances from public roads & boundaries • The proposal is not located within a distance equivalent to 2 times the height of the turbine (including the tip of the blade) from the boundary of a formed public road or a non-host property boundary.	*N/A*	There are a number of WTGs located within 460 m, being two times the height of the turbine) of an allotment boundary, however there are no non associated dwellings located within that distance. The EIS and associated technical assessments have considered the environmental impacts of the Project on the locality in accordance with relevant guidelines. In accordance with Clause 11 of SEPP SRD, the provisions of DCPs do not apply to SSD projects.

DCP Requirement	Design Guidelines	Response
F. Visual impact • The visual impact of the proposal on surrounding development and on the locality is minimised.	The requirements of Draft NSW Planning Guidelines – Wind Farms (DPI, 2011) (or the appropriate updated document) should be met with regard to visual impact to neighbouring dwellings and properties. Refer to 'Visual' references listed in the 'Supplementary Information section below	Chapter 11 and Appendix F details the visual assessment.
G. Acoustic impact • The acoustic impact of the proposal on surrounding development and on the locality is minimised.	Refer to 'General' references listed in the 'Supplementary Information section below.	Chapter 10 and Appendix E details the noise assessment.
H. Ecological impact • The development considers the provisions of section 11b Biodiversity conservation.	Refer to 'Ecology' references listed in the 'Supplementary Information section below.	Chapter 9 and Appendix D details the biodiversity assessment
I. Water quality • The development considers the provisions of section 11f Soil & water management and the provisions of UHSC Draft Engineering Guidelines for Subdivisions and Developments, as amended.	*N/A*	Chapter 16 and Appendix O details the soils and water assessment.
J. Bush fire hazard • The development considers the provisions of section 10b Bushfire risk.	*N/A*	Chapter 13 and Appendix J details the bushfire assessment
K. Impacts on communications networks • Impacts communications networks (television, radio, mobile phones and two way radios) are minimised. Any reduction in either quality or service has been suitably addressed to overcome the loss.	*N/A*	Chapter 13 and Appendix I details the assessment on telecommunications.

DCP Requirement	Design Guidelines	Response
L. Impacts on aviation facilities • Likely impacts on aviation facilities is minimised. Note: Upper Hunter Shire Council operates a regional airport in Scone. In addition it is likely that there are other airstrips, helipads and aviation facilities within the Shire.	Refer to 'Aviation hazard' references listed in the 'Supplementary Information' section below.	Chapter 13 and Appendix H details the aviation assessment, including consideration of the Scone Airport.
M. Tourism • Where a proposal includes 25 or more wind turbines, an area where vehicles and pedestrians (the public) can manoeuvre safely is provided in a position which allows for the safe viewing of the wind farm and provides information on the development. Consultation with Council and the RMS (where applicable) must be undertaken to identify a suitable location.	*N/A*	Tourism is considered in the Socio-Economic Assessment within Chapter 19 and Appendix P.
N. Environmental management • If development consent is granted for the proposal, an environmental management plan (EMP) for the proposal is prepared. It will comprise in detail the construction, commissioning, operation and post monitoring of the development. Note: It is likely that if development consent is granted for the proposal, a condition of approval relating to the above will be included. The exact requirements of the EMP will be identified in the condition.	*N/A*	Chapter 21 summarises the environmental management measures for the Project, including of a commitment to develop a Construction Environmental Management Plan and Operational Environmental Management Plan.
O. Decommissioning • In the event of the wind farm or any wind turbines becoming redundant (not used for generation of electricity for a continuous period of 12 months or more), the dismantling and removal of all structures associated with the development and subsequent site rehabilitation will be required within a period of six months. Note: It is likely that if development consent is granted for the proposal, a condition of approval relating to the above will be included.	*N/A*	Chapter 3 discusses decommissioning.

6.2.4.5 Contributions

The following contributions are to be made by the Project:

- A Voluntary Planning Agreement (VPA) in the form of a Community Enhancement Fund is being negotiated with Tamworth Regional, Upper Hunter and Liverpool Plains councils. The fund is sought to be operated broadly around the framework in the draft Community Enhancement Fund Charter, provided in Appendix C. The operation of the Fund in accordance with the Charter includes:
  - annual contributions of $2,500 per WTG per year from the Project into the Fund;
  - establishment of a Community Enhancement Fund Committee to administer and oversee the operation of the Fund, and includes membership from the community, indigenous member, and representatives from each of the three councils; and
  - a process for the assessment and funding approval of projects with a direct benefit to the community within 20 km of the Project, based on established eligibility criteria across four key areas, being community upgrades, social / environment, education and flexible projects.
- road upgrades required by the Project will be undertaken at the Project's cost and fall outside of the Community Enhancement Fund. These upgrades have been negotiated with Tamworth Regional Council, with Council's support of the works provided in Appendix C.

6.3 Policies, Guidelines and Strategies

6.3.1 Wind Energy Planning Framework

6.3.1.1 Overview

The Wind Energy Framework (DPE, 2016) provides the community, industry and regulators with guidance on the planning framework for the assessment of large-scale wind energy development proposals that are SSD. The Framework consists of:

- Wind Energy Guideline;
- Wind Energy: Visual Assessment Bulletin; and
- Wind Energy: Noise Assessment Bulletin.

6.3.1.2 Wind Energy Guideline

The Wind Energy Guideline identifies the key planning considerations relevant to wind energy development in NSW and assist in the design and siting of SSD wind energy projects. It is not intended to be a comprehensive 'how to' manual for wind energy development, nor will all issues be relevant for every proposal. The Guideline is the key reference document for decision-making on SSD wind energy development in NSW.

The objectives of the Guideline are to:

- *"provide clear and consistent guidance to the community, industry and regulators about how to measure and assess key environmental impacts of SSD wind energy development in NSW;*
- *facilitate better outcomes by requiring early identification of impacts to drive better siting and design;*
- *facilitate meaningful, respectful and effective community and stakeholder engagement across the development assessment process, from pre-lodgement to post-approval;*
- *encourage benefit-sharing between wind energy operators and the communities in which they operate, where appropriate; and*

· *provide greater accountability for the management of impacts over the life of a project by linking commitments to conditions and / or appropriate monitoring and adaptive management strategies".*

A compliance matrix for this report and its adherence to the Wind Energy Guideline is provided in Table 6-7.

Table 6-7 Wind Energy Guideline EIS Requirements

EIS Requirements	Location
Describing the design of your project, including: ■ all development activities that may be undertaken as part of the project, including ancillary infrastructure which could include concrete batching plants, substations and access to construction materials, as well as access tracks and roads, and any transmission lines associated with the project (see section 2.3.1 above); and ■ • the timing of each key phase of the project.	Chapter 3
Describing the likely impacts and mitigation and management measures, including: ■ an analysis of the likely impacts of the project; ■ completed technical studies, including an accurate noise impact assessment for relevant dwellings undertaken consistent with the requirements of the Noise Assessment Bulletin; ■ a visual assessment of the project in accordance with the Visual Assessment Bulletin, and, in particular, an analysis of the project against the performance objectives as well as photomontages showing the impacts at highly affected dwellings (subject to access considerations); ■ details of community consultation undertaken, including any steps taken to check that the views and input of potentially affected people and groups have been faithfully and accurately captured and considered, and / or explain how their views and inputs have been taken into account; ■ consultation with landowners with regard to impacts and mitigation, including negotiated agreements (subject to confidentiality considerations); and ■ description of the measures that will be used to avoid, minimise, mitigate or otherwise manage impacts associated with the project – this should include an assessment of the effectiveness and reliability of the measures and any residual impacts and their acceptability after these measures are implemented.	Chapters 9 – 22 Appendices C - P
Micro siting and environmental envelopes	Chapter 3
Refurbishment and decommissioning	Chapter 3
Noise and health	Chapter 7 and Appendix E Chapter 13

6.3.1.3 Wind Energy Visual Bulletin

This Visual Assessment Bulletin has been developed to guide the appropriate location of wind energy development in NSW and to establish an assessment framework for the assessment of visual impacts associated with wind energy. The Bulletin will apply to all new development applications for SSD wind energy projects through the SEARs issued after December 2016.

The objectives of the Bulletin are to:

· *"Provide the community, industry and decision-makers with a framework for visual impact analysis and assessment that is focused on minimising and managing the most significant impacts;*

- *Facilitate improved wind turbine and ancillary infrastructure siting and design during the pre-lodgement phase of a project, and encourage early consideration of visual impacts to minimise conflicts and delays where possible, and provide for a better planning outcome;*
- *Provide the community and other stakeholders with greater clarity on the process along with an opportunity to integrate community landscape values into the assessment process; and*
- *Provide greater consistency in assessment by outlining appropriate assessment terminology and methodologies".*

The steps as noted in the Bulletin for visual assessment during the EIS Phase include:

- prepare a Visual Baseline Study as part of the EIS;
- undertake community consultation on aspects of the visual baseline study and describe mitigation and management options in the EIS;
- establish Visual Influence Zones from viewpoints using inputs from the visual baseline study; and
- undertake an evaluation of the project against the Visual Performance Objectives.

These steps have been addressed in Chapter 11 and Appendix F.

6.3.1.4 Wind Energy Noise Assessment Bulletin

This Noise Assessment Bulletin provides proponents of wind energy projects and the community with advice about how noise impacts are assessed for large-scale wind energy development projects that are SSD. This Bulletin applies to all new SSD wind energy proposals that obtain SEARs after the date of publication of this Bulletin. The Bulletin also applies to all modification applications made after December 2016.

The Bulletin notes that as a minimum, the noise assessment report must include the following information:

- *"The model used to predict the wind energy project noise levels and input assumptions and factors used in the model, noting that noise management mode or sector management should not be used in the primary modelling or predicting of noise levels. Any modelling and predictions which incorporate noise management mode or sector management must be reported separately;*
- *Background noise measurement locations including time and duration of the background noise monitoring program;*
- *Wind speed monitoring locations within the project area, heights above ground and graphical correlation plot of hub height wind speed versus background noise level data;*
- *A summary of the environmental noise criteria for the project at each integer wind speed based on the above correlation;*
- *Make and model of the representative wind turbine(s) along with the positions of the wind turbines;*
- *Predicted noise levels at the closest non-associated dwellings to the wind energy project at each integer wind speed;*
- *Comparison of the predicted noise levels against the criterion at each integer wind speed for the closest non-associated dwellings to the wind energy project; and*
- *Modifications or operating strategy that would be employed to address any unforeseen non-compliances. The error margins of the noise model used should be considered in developing such modifications or strategies".*

These requirements have been addressed in Chapter 10 and Appendix E.

6.3.2 New England North West Regional Plan

6.3.2.1 Overview

New England North West Regional Plan 2036 applies to the Tamworth and Liverpool Plains LGAs. The plan is the NSW Government's 20 year strategy for guiding land use planning decisions for the New England North West. The plan replaced the previous strategic plan for the region, the New England North West Strategic Regional Land Use Plan. The plan sets regional planning priorities and provides guidance and direction for regional and local planning decisions for the region and each local government area. A Government direction has been issued to councils so that new planning proposals or updated local planning controls are consistent with the directions and actions outlined in the plan. The NSW Government has established the New England North West Delivery, Coordination and Monitoring Committee to deliver, coordinate and be accountable for achieving the vision and goals of the Plan. Every five years, or as necessary, the Plan will be reviewed and adjusted to make sure the vision for 2036 is realised.

A key direction under 'Goal 1: A strong and dynamic regional economy', is '*Direction 5: Grow New England North West as the renewable energy hub of NSW*'. The Plan states:

- new opportunities for employment will be offered in emerging renewable energy and green technology industries, and positions the new renewable energy generation and 'green' industries as eco-friendly alternatives and solutions to environmental issues and challenges, noting that the region can be a leader in renewable energy;
- that existing proposals for large wind and solar farms will generate employment and investment from construction, operations and connection to the State's electricity grid; and
- incorporating small-scale cogeneration measures into the design of new developments and providing employment lands for research and development opportunities will further support the sector's growth.

Relevant actions of the plan include:

- 5.1: Diversify the energy sector by identifying renewable energy resource precincts and infrastructure corridors with access to the electricity network.
- 5.2: Facilitate appropriate smaller-scale renewable energy projects using biowaste, solar, wind, hydro, geothermal or other innovative storage technologies.

The Project will assist in achieving these actions and is consistent with Goal 1 Direction 5 of the Plan.

6.3.3 Hunter Regional Plan

6.3.3.1 Overview

The Hunter Regional Plan 2036 applies to the Upper Hunter LGA. The plan is the NSW Government's 20 year strategy for guiding land use planning decisions for the Hunter region. .

A key direction under 'Goal 1: The leading regional economy in Australia' is '*Direction 12: Diversify and grow the energy sector'*. The plan states that:

- the Hunter region accounts for 44 per cent of power generation in NSW, however prospective closures of power stations in the region mean the transformation in the energy sector that is under way will need to be accelerated; and
- the Hunter region has the wind resources to deliver large-scale projects, and subsequently the Hunter region has the potential to be a major hub for next-generation power.

Relevant actions of the plan include:

- Action 12.1: Diversify and grow the energy sector by working with stakeholders, including councils, communities and industry, to identify and support opportunities for smaller-scale renewable energy initiatives such as those using bioenergy or waste coalmine methane.
- Action 12.2: Enable opportunities for renewable energy industries by reviewing local planning controls.

The Project will assist in achieving these actions and is consistent with Goal 1 Direction 12 of the Plan.

6.3.4 Guidelines for Developments Adjoining Land Managed by the Office of Environment and Heritage 2013

The *Guidelines for Developments Adjoining Land Managed by the Office of Environment and Heritage* (OEH, 2013) are for use by councils and other planning authorities when assessing development applications that may impact on land and water bodies managed by the former Office of Environment and Heritage (now Biodiversity Conservation Division or BCD). The Project is adjacent to the Ben Halls Gap Nature Reserve /National Park and Crawney Pass National Park. Consultation with BCD has occurred, as detailed in Chapter 7 and Appendix C. Issues to be considered when assessing proposals adjoining OEH land as noted in the guidelines, are discussed in Table 6-8.

Table 6-8 Issues to be considered when assessing proposals adjoining OEH land (OEH, 2013)

Issue	Aim	How it has been addressed in EIS
Erosion and Sediment Control	To prevent erosion and the movement of sediment onto OEH land, and ensure no detrimental change to hydrological regimes.	Erosion and sediment control measures have been assessed and detailed in the Soils and Water Assessment (Appendix O) and Chapter 16.
Stormwater Runoff	Nutrient levels are minimised, and stormwater flow regimes and patterns mimic natural levels before it reaches OEH land.	Runoff diversion and mitigation measures are detailed in the Soils and Water Assessment (Appendix O) and Chapter 16.
Wastewater	There are no adverse impacts on OEH land due to wastewater from adjacent development.	All wastewater associated with the Project will be collected in onsite systems and transported offsite by licenced waste contractors.
Management implications relating to pests, weeds and edge effects	Adjoining development does not: ■ lead to increased impacts from invasive species (weeds and pests), domestic pets and stock; ■ facilitate unmanaged visitation, including informal tracks, resulting in negative impacts on cultural or natural heritage values; ■ lead to impacts associated with changes to the nature of the vegetation surrounding the reserve; nor ■ impede OEH access for management purposes, including inappropriate fencing.	The Environmental Management Strategy will include pest and weed management measures.
Fire and the location of asset protection zones	All asset protection measures are within the development area, and there is no expectation for OEH to change its fire	Asset protection measures are detailed in the Bushfire Assessment, Appendix J and Section 13.4

Issue	Aim	How it has been addressed in EIS
	management regime for the land it manages.	
Boundary encroachments and access through OEH land	No pre-construction, construction or post-construction activity occurs on land managed by OEH. Any access that does occur must be legally authorised and comply with park management objectives.	The Project Area has been carefully designed to avoid any access to, or encroachment on, Ben Halls Gap Nature Reserve. Site suitability is discussed in Chapter 4.
Visual, odour, noise, vibration, air quality and amenity impacts	There is no reduction of amenity on OEH land due to adjacent development.	Amenity impacts have been assessed through specialist assessments (refer to Appendix E and F) detailed in Chapters 10, 11 and 17.
Threats to ecological connectivity and groundwater dependent ecosystems	Native vegetation and other flora and fauna habitats that provide a linkage, buffer, home range or refuge role on land that is adjacent to reserves are maintained and enhanced, where possible. Groundwater-dependent ecosystems in OEH land are protected.	An assessment of groundwater-dependent ecosystems has formed part of the Biodiversity Assessment for the Project .Refer to the Biodiversity Development Assessment Report (Appendix D) and Chapter 9.
Cultural heritage	Aboriginal heritage values on OEH land, and areas and sites of heritage value that are World Heritage listed, on the National Heritage Register, or the State Heritage Register are protected.	An assessment of Aboriginal Cultural heritage values and historic heritage values has been undertaken. Refer to Appendix M and N, and Chapters 11 and 15.

7. COMMUNITY AND STAKEHOLDER ENGAGEMENT

This chapter provides an overview of the engagement activities carried out before and during the preparation of the EIS. Early consultation with community groups and agencies identified areas for the EIS to focus on.

7.1 Introduction

Community and stakeholder engagement is an integral part of any major development. Wind Energy Partners and ENGIE are committed to effective and genuine engagement with key stakeholders and the local community to seek feedback to help inform the Project design. As part of the refinement process for the Project and preparation of the EIS, consultation has been, and will continue to be, undertaken with a range of stakeholders including various local and NSW Government agencies, the local community, special interest groups and neighbouring landholders.

Pre-feasibility assessment of the Project prior to lodgement of the Preliminary Environment Assessment (PEA) seeking the SEARs identified the number and proximity of nearby residents. The *NSW Wind Energy Guidelines* (DPE, 2016) were used as a basis to establish the Project sensitivity to nearby local residents. It was established that there were 42 residences or proposed residences (with development applications approved or lodged) within 3 km of the then proposed development corridor. For a project of this scale and in comparison to other projects in Australia it was determined this was a relatively low number to progress with further consultation and the preparation of a PEA.

Engagement with stakeholders commenced in 2017 during the preparation of the PEA and following the feasibility stages of the Project. The early consultation provided key community attitudes and special interest group feedback to sensitive issues to be considered as part of the request for SEARs and ultimately in the development of this EIS.

As part of the PEA and prior to the commencement of the EIS, a Stakeholder Engagement Strategy ((Inclusive Engagement, 2018), refer Appendix C.1) was prepared to guide ongoing consultation during EIS preparation and following EIS lodgement. The engagement and consultation activities have been led by Someva Renewables (Someva) and WEP with the support of ERM for agency consultation and to provide technical input to support community discussions.

This chapter of the EIS describes the consultation process that has been undertaken to date and addresses the SEARs consultation requirements. This chapter includes:

- the Project's consultation objectives (Section 7.2);
- an overview of the Project's Stakeholder Engagement Strategy including identification of stakeholders and engagement approach (Section 7.3);
- a summary of the engagement activities performed with regulatory, community, industry and other stakeholders (Section 7.4);
- identification of key issues raised during engagement and the Project's response to those issues and discussion relating to how engagement outcomes have informed Project design and refinement (Section 7.5); and
- next steps in terms of ongoing stakeholder engagement (Section 7.5).

Further details on stakeholder engagement activities are provided in **Appendix C**, which contains:

- Stakeholder Engagement Strategy (Appendix C.1);
- Consultation Register, which provides a record of consultation undertaken as part of the preparation of the EIS and provides key outcomes of this consultation (Appendix C.2);
- copies of consultation materials, including fact sheets, presentations, government and regulatory agency consultation materials (where relevant) (Appendix C.3 – C.5).

7.2 Engagement Objectives

The key objectives of the Project's consultation and engagement process are to:

- develop and maintain positive working relationships with Project stakeholders;
- proactively identify, understand and manage issues and concerns raised by stakeholders through effective two way engagement;
- ensure stakeholders have access to balanced, objective, timely and up-to-date information about the Project and the planning and environmental assessment process;
- identify and respond to stakeholder issues and concerns, ensuring there are various mechanisms and multiple opportunities for stakeholders to provide feedback on the Project and to inform the Project design;
- identify long-term community needs and design initiatives that can lead to well-designed support programs for the long-term benefit of the community;
- ensure compliance with consultative requirements under the SEARs, the Draft Guideline 6 on Community and Stakeholder Engagement and other relevant planning instruments and guidelines; and
- develop a social licence to operate.

The specific objectives of stakeholder engagement for the Project are to ensure stakeholders are educated and have sufficient understanding of:

- the justification and need for the Project;
- the importance of the location of the Project to the existing National Electricity Grid and capacity available on the Liddell to Tamworth TransGrid 330kV transmission line;
- the maturity and well proven technology proposed as part of the Project;
- how the Project may affect them and how they can be involved in the approval process;
- how their views are considered in a meaningful way and used in Project planning, refinement, mitigation measures and monitoring and management frameworks;
- the benefits of the Project, including local investment and employment, reduced GHG emissions, replacement of aging coal fired generation in the NSW context;
- how the Project can contribute to the local community;
- how the Project complies with relevant regulatory requirements and policies; and
- how the requirements of the SEARs and technical surveys lead to further information to be taken into consideration to remove, reduce and offset impacts and improve social and environmental outcomes while maintaining a viable Project.

7.3 Engagement Strategy

7.3.1 Overview

A Stakeholder Engagement Strategy (Inclusive Engagement, 2018) was prepared to guide consultation with stakeholders during EIS preparation and following EIS lodgement (refer Appendix C.1). The Strategy was updated several times to reflect an updated understanding of the priorities of the community and stakeholders. The purpose of the Strategy was to guide effective consultation by identifying:

- stakeholders of relevance to the Project;
- an engagement approach to ensure targeted and effective consultation;

- timing and methods for engagement which each stakeholder; and
- community attitudes and the priority issues of influential community members in order to progress technical studies and address key areas of interest.

The Stakeholder Engagement Strategy included an Action Plan mapping out engagement activities, targeted groups, key objectives and methods throughout the EIS preparation stage. Engagement was tracked via an online platform Simply Stakeholders, which allowed detailed records to be created for all types of interactions, open issues to be prioritised, and technical issues to be filtered for inclusion in the technical reports. An engagement register provides a summary of these interactions (summarised in Appendix C.2).

7.3.2 Stakeholder Identification

Stakeholders are *persons or groups who are directly or indirectly affected by a project as well as those who have interests and/ or the ability to influence its outcomes either positively or negatively*[3].

Key stakeholders identified as potentially having an interest in the Project are listed in Table 7-1.

Table 7-1 Key Stakeholders

Stakeholder Type	Stakeholder
Government	■ Government agencies ■ Tamworth Regional Council ■ Upper Hunter Shire Council ■ Liverpool Plains Shire Council ■ Elected Government representatives both State and Federal
Community / Special Interest Groups	■ Nearby landholders and occupiers identified as host landowner for any part of the proposed infrastructure ■ Nearby landowners and occupiers identified as neighbours to the Project ■ Nearby communities including Nundle, Hanging Rock and Crawney ■ Environmental and other special interest groups including the Hills of Gold Preservation Inc. ■ Local community and business groups including the Nundle Business and Tourism Marketing Group and Country Women's Association ■ Local business owners ■ Traditional Owners ■ Media
Industry	■ NSW Forestry Corporation (as a state owned enterprise and neighbour to the Project) ■ Australian Wind Alliance who provided support in hosting community information sessions in 2019 and 2020

7.3.3 Engagement Approach

A range of engagement tools were deployed to engage with and seek input from the various stakeholders, as detailed in Table 7-2.

[3] International Finance Corporation. 2009. Stakeholder Engagement Handbook.

Table 7-2 Engagement Approach

Approach	Project Inclusion
Face to face meetings	Specific, targeted meetings were held to discuss the Project and facilitate in-depth engagement and transfer of Project information. This included meetings with various regulatory authorities, as well as with individuals, special interest groups, sensitive receptors and neighbouring properties. An open invitation was offered to community members and a number of local residents sought home visits from the Project team through the preparation of the EIS.
Presentations	Presentations were a useful tool for creating awareness about the Project, together with raising awareness of the Project proponents, WEP and ENGIE. Presentations were also used to help guide face-to-face meetings with stakeholders and ensure that specific issues or initiatives are addressed. Presentations have been used in engagement activities with government agencies and various community stakeholders.
Site Visits	Regulatory authorities, local registered Aboriginal parties and the Community Consultative Committee have undertaken site visits to the Project Area. In some cases, neighbours were also provided with one-on-one site visits to help understand the proximity of the Project to their property.
Newsletter	Newsletters help ensure that there is a consistent external message presented on key issues and progress of the Project. Newsletters were sent directly to stakeholders who had signed up to the email list, posted on the Hills of Gold website and distributed through the Nundle and Murrurundi Post Office throughout the EIS preparation.
Community drop-in sessions	An open invitation was extended to the community to drop in or for home visits throughout the EIS preparation phase. These were announced in January 2020 and available every month over 2-3 days depending on public interest. The sessions were an open invitation to give stakeholders the opportunity to discuss their interest and speak to members of the Project team and provide feedback.
Public Forums	The Project was presented in two sessions at the Nundle War Memorial Hall Community Information Evening held on 22nd March 2018 and the Hanging Rock Community Hall on the 23rd of March 2018. The events were attended by 250 and 80 people respectively and this provided an opportunity for WEP / Someva to provide information to and receive feedback from the community. The events held following requests from special interest groups to provide more information to the community and the timing and venue was collaboratively organised. The events were promoted by media releases and radio, print and TV media were present on the evening and the following days to provide information to the community.
Website	In March 2018, prior to the lodgement of the PEA, WEP launched a Project website. The website is specific to the Project, inclusive of links to fact sheets, updates, CCC meeting minutes and presentation and frequently asked questions: The website is: www.hillsofgoldenergy.com.
Community Surveys	A survey was prepared to support the PEA in 2018. The purpose of the survey was to provide insights for submission and to support the request for SEARs process. This survey was posted through the Nundle post office to residences. A second survey was prepared in 2019 and extended into March 2020 to allow for more time and a greater distribution of the surveys. The purpose of the second survey was to seek input into the preparation of the EIS. This survey was emailed through the email database and posted through the Nundle and Murrundi post office to residences in the area. The outcomes of the initial 2018 survey were prepared and presented in the PEA in 2018. The survey specific outcomes of the 2019/2020 survey are detailed in Appendix C.3.
Technical Specialist Engagement	Specific technical issues raised during consultation have been considered as part of the technical studies, as relevant. Specific engagements are summarised in the Appendix C.2.

Approach	Project Inclusion
Emails, Phone Calls and Video Calls	The Project team has liaised with relevant government agencies and community stakeholders via email correspondence and phone calls throughout the duration of the EIS preparation. Video calls and phone calls became an important medium to communicate during the COVID 19 lock-down and periods of restricted regional travel.
Direct Enquiries	Someva has been a direct point of contact for community stakeholders, seeking out and responding to community enquires. Contact details of key Someva staff have been available through the Hills of Gold website, in newsletters and provided directly during phone calls, emails, one-on-one meetings and presentations.
Media Engagement	Media engagement through media releases, events and responding to media enquiries.

7.4 Engagement Activities

Engagement with stakeholders commenced in 2017 following the pre-feasibility stage and during the preparation of the PEA of the Project for submission to the DPIE. Following the issue of the SEARs and engagement of technical consultants to prepare the EIS and associated technical assessments, engagement has been regular and ongoing. Further details regarding specific engagement actions are detailed in the engagement register (Appendix C.2). A summary of stakeholder engagement is detailed in Table 7-3 for Government stakeholders and Table 7-4 for community stakeholders.

Table 7-3 Government Stakeholder Engagement

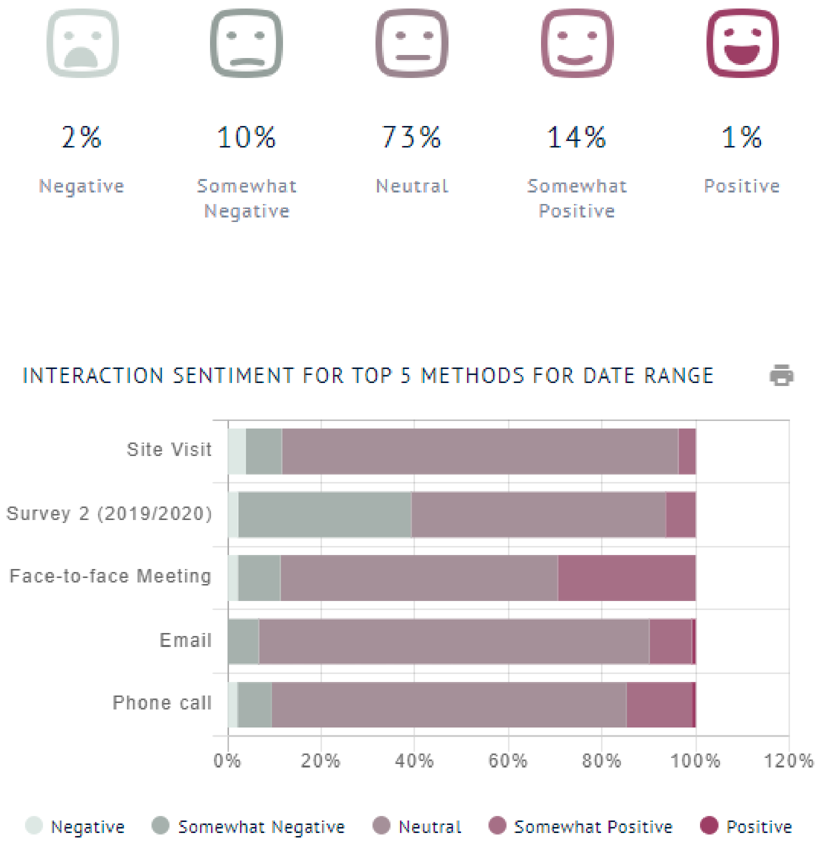
Stakeholder	Engagement Activities
Department of Planning, Industry and Environment (DPIE)	DPIE has been engaged comprehensively during the SEARs scoping and EIS phases of the Project. This has included various face to face meetings and presentations relating to the Project status, as well as numerous email and phone discussions over the last three years since early consultation was made in preparation of the PEA. The need for the Project to undertake comprehensive community and stakeholder engagement was clearly communicated by DPIE. DPIE coordinated a site visit for government agencies as part of consultation during the assessment for SEARs. This occurred on the 18th of October 2018 and was followed by a DPIE hosted a community focused Information Evening that WEP did not attend.
EPA	The EPA are a key stakeholder relating to compliance and licencing requirements. The EPA attended the DPIE coordinated site visit on 18 October 2018 andhas been consulted during the preparation of the EIS, noting that they had no further requirements above that stated in the SEARs.
DPIE Water	DPIE Water are a key agency relating to the application of water policy in NSW, and provide assessment of SSD projects during the assessment process. DPIE Water were consulted during the preparation of the EIS to confirm requirements for the EIS.
WaterNSW	WaterNSW are a key agency specifically relating to water management, allocation and licencing. WaterNSW was consulted during the preparation of the EIS to confirm requirements for the EIS.
Natural Resources Access Regulator (NRAR)	NRAR are also a key agency specifically relating to water management, allocation and licencing. NRAR were consulted during the preparation of the EIS to confirm requirements for the EIS.
Biodiversity Conservation Department (BCD) (within DPIE)	Consultation undertaken by ARUP and WEP through in person meetings and via email and phone correspondence relating to the approach for biodiversity and heritage assessments. BCD officers attended a site visit on the 18th of October 2018 and Someva and ARUP travelled to the BCD Dubbo office on 22nd August 2019 to consult on the approach to biodiversity assessment. Through this consultation the survey efforts were agreed to progress. BCD was further consulted via a video conference on the 12th of June 2020 to present survey efforts, interim results and seek feedback to survey efforts and methodology.

Stakeholder	Engagement Activities
Department of Primary Industries (DPI) - Agriculture	DPI-Agriculture is a key agency relating to agricultural land use and biosecurity management. DPI-Agriculture was consulted during the preparation of the EIS to confirm requirements for the EIS and any other matters of concern.
Department of Primary Industries (DPI) - Fisheries	DPI-Fisheries is a key agency relating to fisheries management. DPI-Fisheries was consulted during the preparation of the EIS to confirm requirements for the EIS and any other matters of concern.
Crown Lands	Crown Lands were consulted as there are Crown paper roads within the Project Area, including identification of licencing / leasing requirements.
Local Land Services	Local Land Services was consulted during the preparation of the EIS to confirm requirements for the EIS and any other matters of concern. They were provided a copy of the draft Aviation Assessment given potential interest associated with aerial baiting programs.
Resources and Geosciences NSW	Resources and Geosciences NSW was consulted during the preparation of the EIS to confirm requirements for the EIS and any other matters of concern. They were also consulted relating to offsite quarry locations that may provide construction materials for the Project.
Transport for NSW (TfNSW) formally Roads and Maritime Services (RMS)	Email and telephone correspondence with TfNSW (formally RMS) was undertaken seeking feedback on traffic assessment methodology and approach and proposed transport route and upgrade requirements.
Forestry Corporation NSW	Forestry Corporation NSW were engaged regularly through the preparation of the EIS via phone and email correspondence. A range of matters were discussed which are summarised in the Engagement Register in Appendix C-2, including traffic and transport, bushfire and aviation. Forestry Corporation have provided constructive input into the EIS and associated assessments.
NSW Rural Fire Service (RFS)	Phone conversation and email correspondence was undertaken with RFS relating to the bushfire assessment and outcomes, including flame throw modelling outcomes and provided an opportunity for feedback.
Tamworth Regional Council	Tamworth Regional Council are a key stakeholder for the Project. WEP engaged the Mayor, councillors and senior planning officers prior to lodgement of the PEA. Regular engagement has occurred since 2017 with Tamworth Regional Council via in person meetings, video conferences, a site visit with other key agency stakeholders, emails and telephone conversations. Council has also been invited to and kept abreast of community information sessions for the Project. Specific face to face meetings have also been undertaken with councillors and technical staff throughout the preparation of the EIS, in particular for the transport assessment and the Community Enhancement Fund.
Liverpool Plains Shire Council	Various face to face meetings and email correspondence with Liverpool Plains Shire Council has been undertaken primarily to discuss key issues of traffic movements and the Community Enhancement Fund.
Upper Hunter Shire Council	Various face to face meetings and email correspondence with Upper Hunter Shire Council has been undertaken primarily to discuss the Community Enhancement Fund.
Councils on Transport Route	As part of the Traffic and Transport Assessment, all councils along the proposed transport route have been consulted, including details of the proposed upgrades required along the route. This has included the LGAs of Newcastle, Cessnock, Singleton and Muswellbrook,
Department of Defence	The Department of Defence was consulted during the Aviation Assessment including provision of the draft Aviation Assessment report for review and comment relating to any issues or concerns relating to Defence activities or sites.
Air Services Australia	Air Services Australia was consulted during the Aviation Assessment including provision of the draft Aviation Assessment report for review and comment.
CASA	CASA will review the Aviation Assessment during the exhibition stage of the development and provide comment to DPIE.

Stakeholder	Engagement Activities
Department of Finance, Services and Innovation – Telco Authority	Department of Finance, Services and Innovation – Telco Authority was consulted during the preparation of the EIS to confirm requirements for the EIS and any other matters of concern.
NBN Co	NBN Co was consulted during the preparation of the EIS to discuss any maters of concern relating to telecommunications impacts.
National Wind Farm Commissioner	WEP engaged with the National Wind Farm Commissioner and staff in 2018 prior to lodgement of the PEA. Regular engagement has occurred since 2018. Engagement has included presentations, a site visit, emails and telephone conversations throughout the preparation of the EIS.
Members of Parliament	In the course of various business activities, including activities not directly associated with the Project, representatives of the Project including ENGIE in some cases have met with elected Members of Parliament or their staff. Elected members who have had briefings or discussions about the Project include: ■ NSW Member for New England, Kevin Anderson MP ■ Federal Member for New England, Barnaby Joyce MP ■ The NSW Office of Energy and Environment, Matt Kean MP Given meetings with elected members generally covered a range of activities, not specific to the Project, these have not been included in the Engagement Register in Appendix C.2.

Table 7-4 Community / Industry Stakeholder Engagement

Stakeholder	Engagement Activities
Nearby Landowners and Occupiers	In addition to engagement at the community level, specific targeted engagement was undertaken with nearby landholders and occupiers, including face to face meetings, phone and email correspondence, targeted letter box drops and door knocks. These engagements were targeted where there was understood to be concern of particular residents to one or several potential impacts. The purpose of the engagement was to inform the stakeholder of the Project, and specific matters (such as the Morrisons Gap Road community and road traffic concerns), encourage them to ask questions and seek their feedback. It was also to understand the specific concern and what information could be provided to inform the potential extent of the impact (if there was indeed an impact). In a number of circumstances community "gossip" has created concern to issues that some residents were not going to experience. The consultation and sharing preliminary results including photomontages, noise results, shadow flicker results, allowed these concerns to be addressed early and a more open attitude towards the Project to be explored.
Communities/ Townships	A series of Community information sessions were held in March 2018 in Nundle and Hanging Rock. These sessions were supported by Inclusive Engagement (a local community consulting firm) and a presentation by WEP. The sessions were held to connect with the local communities proximate to the Project Area, provide factual information about the Project, obtain feedback about public perceptions of the Project and answer any questions from the communities. Members of the public were encouraged to ask questions and provide feedback. The community information sessions were advertised in the local papers, through a media release and in local newsletters and notice boards. Additional walk-in information sessions are planned for the public exhibition period of the Project application and will include dates in which technical specialists are available to meet community members. Community perception of the Project was gauged by mapping of attitudes towards the Project during interactions recorded using Simple Stakeholders. The software allowed for a sentiment of the attitude towards the Project to be recorded to map the general consensus of the community towards the Project. The results allowed WEP to optimise engagement and communication strategies for stakeholders around the Project. A summary of sentiment as at 21st of September 2020 is presented below:

Stakeholder	Engagement Activities
	
Community Members / Individuals	In addition to engagement at the community level, specific one on one engagement was undertaken with interested community members, including face to face meetings, phone and email correspondence and provision of fact sheets and tailored emails to community member's interests. Community members were encouraged to ask questions and provide feedback. Regular updates were provided throughout the EIS preparation.
Environment Groups	Email correspondence and responses to detailed technical questions and interactions through the Community Consultative Committee were ways the Project team interacted with environmental specialist interest groups. The Project team actively engaged with these stakeholders via various medium and sought opportunities to present to the groups and their members and seek their feedback. Regular updates were provided to these groups through their involvement in the Community Consultative Committee and through mailing lists. An example of a special interest group who took an active interest in the Project is the Hills of Gold Preservation Inc.
Local Community and Business Groups	Early consultation was completed and continued with business groups via face to face meetings, presentations and phone and email correspondence. The Project team actively engaged with these stakeholders via various medium and sought opportunities to present to the groups and seek their feedback. Regular updates were provided throughout the EIS preparation and their involvement and active participation in the Community Consultative Committee. Technical questions were provided to WEP and specialist consultants met with members of the Nundle Business and Tourism Marketing Group to better understand how their concerns could be addressed, of particular focus was in surveys completed by SGS in their Social and Economic Impact Assessment (SEIA). An example of an active business group includes the Nundle Business and Tourism Group and the Friends of the Wind Farm Group.

Stakeholder	Engagement Activities
Traditional Owners	Consultation through KNC was undertaken with Traditional Owners. The Project team actively engaged with these stakeholders, providing a week-long opportunity to survey the Project Area and provide input in the Cultural Heritage Assessment Report (CHAR) and other areas of significance to the Project.
Industry	Specific face to face meetings were held with the nearby Forestry Corporation, large agricultural property owners and local tourism businesses. These stakeholders were provided an opportunity to interact directly with technical consultants to provide feedback on the Project and areas required to be addressed in the EIS.
Media	Media engagement has occurred for both print, radio and television via media releases, media briefings, use of media advertising and media coverage, including the Northern Daily Leader, local TV (7Prime) and radio (ABC).

7.5 Issues Raised and Project Response

Overall, feedback from stakeholders on the Project has generally been positive. Many of the areas of interest raised were specific to a geographic location, an individual's views, or views of a special interest group. Figure 7-1summarises over 842 interactions, across 63 organisations and 365 individuals and the key areas of interest raised.

Table 7-5 summarises the key areas of interest raised, provides a summary of the Proponent's response and identifies where each issue is addressed in the EIS. The summary below is listed in order of priority based on the analysis of interactions with stakeholders over the course of the community engagement. A summary of this analysis is provided below:

Figure 7-1 Key Stakeholder Issues

Table 7-5 Key Issues Raised and Project Response

Theme / Topic	Key Issue Raised	Project Response	Where addressed in EIS
Landscape and Visual	View of turbines from local residences given specific local context including topography and vegetation.	The *NSW Wind Energy; Visual Assessment Bulletin* has been used as the basis for assessing visual impact. A full Landscape and Visual Impact Assessment (LVIA) was prepared as part of this application. In addition to this, ongoing consultation has been undertaken with local residents concerned about visual impact. This has included provision of Zone of Visual Influence heat maps to help understand the extent of impact based on the initial layout presented in the PEA of 97 turbines. Where concerns remained, a visual assessment from their dwelling and a site visit was offered. Other tools used to assist in consultation that were in addition to the LVIA included the development of photomontages or wireframes. A number of dwellings which had no development application lodged or approved were still assessed and photomontages or wireframes will be shared for consultation purposes during the assessment process.	Chapter 3 Chapter 11 and Appendix F
	View of turbines from areas of public interest.	The *NSW Wind Energy; Visual Assessment Bulletin* has been used as the basis for assessing visual impact. An LVIA is prepared as part of this application. This has included the assessment of impacts at key public viewpoints including the preparation of photomontages. The photomontages have been used in community consultation. Ongoing consultation has relied on these to better explain the visual impact to engaged residents.	
	Size, location, type and colour of the turbines and how this is selected to ensure minimal visual impact.	The Project Description provides a detailed overview of the Project layout and association infrastructure. Stakeholders have been kept up to date as the Project layout has changed based on the iterative design process discussed in Chapter 5. The LVIA details the various visual aspects to the turbines and has taken this into account in the assessment. It is noted that the visual assessment has been done based on blue sky days to create a worst case against clear blue sky background. Turbines colour choices have been researched to provide minimum visual impact in a range of weather conditions.	
	Impacts associated with shadow flicker	Shadow Flicker was assessed in accordance with the guidelines, the outcomes of which are detailed in the LVIA. Residents effected have been consulted. Residents who raised concerns prior to the results have also been consulted with in relation to the results.	

Theme / Topic	Key Issue Raised	Project Response	Where addressed in EIS
	Impact of aviation night lighting	The Aviation Assessment concludes no aviation lights are required. However given the potential from CASA to require night lighting as has been the case for other wind farm developments, a night lighting visual assessment was included in the LVIA.	
	The ranges provided a backdrop for the tourism image of Nundle and there was concern to the impact this would have on tourism.	Visual assessment has been carried out at local tourism businesses and their surrounds. The SEIA included the results of interviews of local tourism business operators and literature reviews. These results are assessed in the LVIA and SEIA.	Chapter 11 and Appendix F Chapter 19 and Appendix P
Social and Economic	Clarification on job numbers through construction and operation and how these jobs and economic opportunities would be captured in local economies.	Job numbers and examples of the types of jobs were provided through community presentations and in various forms of consultation. In addition examples of tourism opportunities and flow-on job opportunities based on literature review was provided through the preparation of the EIS. The SEIA includes an economic modelling section based on an Input-Output model. Project costs are broken down to allow an assessment of how local communities will benefit from this spending and the types of jobs during both construction and operation. A “value-add” assessment has been included to particularly point out the wages and profit component that will be maintained within local economies. The timeframes for jobs is based on a Project plan in which construction commences in 2022. Jobs and the economics of this are provided in the assessment.	Chapter 19 and Appendix P
	Division in the community with views being formed for and against the project and how have WEP managed misinformation in the community.	This is assessed in the SEIA based on interviews with the community and literature views. It is common to have a range of views with major projects and WEP have provided factual information to residents.	Chapter 19 and Appendix P
	Potential increase in crime as a result of an increase in population during the construction and operation period.	A qualitative analysis has been completed and is included in the SEIA.	Chapter 19 and Appendix P

Theme / Topic	Key Issue Raised	Project Response	Where addressed in EIS
	Concern for the ongoing tourism industry and tourism operators in Nundle Eco-Tourism was raised by local businesses as an opportunity and asked how the Proponent would support ideas to start these initiatives.	This is assessed in the SEIA based on interviews with the community and literature views. Views diverge within the business community on the opportunities depending on the type of business being operated. WEP is open to supporting where possible new eco-tourism initiatives that can be safely integrated with the operation of the wind farm. Interest has been received to host open days, support local tours and host annual fun runs.	Chapter 19 and Appendix P
	Concern regarding how the town will support the influx of construction workers, particularly around accommodation.	This is assessed in the SEIA as to where workers are likely to come from. Tamworth is considered a source of labour and within commuting distance and is expected to be able to support any workers not able to stay in Nundle, Hanging Rock or surrounds.	Chapter 19 and Appendix P
	Concern was raised regarding potential reduction in property values	The SEIA provides peer reviewed information and elsewhere in the EIS provides details on various aspects for those concerned to review during public exhibition. WEP are committed to ongoing consultation during this public exhibition period.	Chapter 19 and Appendix P
Flora and Fauna (Biodiversity)	Impacts on biodiversity, including threatened species, particularly given proximity to Ben Halls Gap National Park and Crawney National Park	Detailed biodiversity surveys and assessment have been undertaken and detailed in the Biodiversity Development Assessment Report (BDAR). The assessment has been undertaken in accordance with the NSW Biodiversity Assessment Methodology (BAM), including surveys across various seasons. The assessment included surveys within the Ben Halls Gap National Park. The BDAR considered all threatened and endangered species listed under the NSW Biodiversity Conservation Act and the Commonwealth EPBC Act as relevant to the Project and locality.	Chapter 9 and Appendix D
	Extent of vegetation and habitat clearing and mitigation of impacts	An expected Project design and footprint have been prepared to assess the impact to mapped plant community types and ecological communities. A detailed assessment has been included in the BDAR. The Development Footprint was subject to various design iterations to minimise impacts to biodiversity values and land clearing as discussed in Chapter 5.	Chapter 5 Chapter 9 and Appendix D
	Impacts associated with bird strike and local bat habitat	The BDAR includes a collision risk model for identified bird specifies. Surveys were undertaken including the installation of bat microphones on the existing met masts. This data has been used in the creation of a bird and bat collision risk model which is detailed in the BDAR.	Chapter 9 and Appendix D

Theme / Topic	Key Issue Raised	Project Response	Where addressed in EIS
Neighbour Benefit Sharing Program	What was the basis for the Neighbour Benefit Sharing Program? Further information regarding the Benefit Sharing Agreement and what this means for landowners.	In developing the program, WEP took advice from: ■ Clean Energy Council – A guide to Community Benefit Sharing Options for Renewable Energy Projects (2019); ■ Australian Wind Alliance – Building Stronger Communities (2019); and ■ National Wind Farm Commissioner – Neighbour Consultation and Agreements sections on its website. Best practice has been achieved by incorporating the recommendations where possible into the agreements. Further details on the Neighbour Benefits Sharing Scheme is provided in Section 7.6.	Section 8.6.2
Community Enhancement Fund	Clarity to the funding commitment, assurances this will be paid, type of entity or structure, governance, administration, funding types and eligibility.	A draft Community Enhancement Fund Charter has been developed in consultation with Tamworth Regional, Upper Hunter and Liverpool Plains councils. Further consultation has occurred with CCC Members in its development. The purpose and processes around the operation of the fund including funding commitment, type of entity or structure, governance, administration, funding types and eligibility is detailed in Section 7.6.	Section 8.6.1
Noise and Vibration	Increased noise associated with construction and operation of the wind farm, including road traffic noise on Morrisons Gap Road.	A Noise and Vibration Impact Assessment (NVIA) has been prepared in accordance with relevant guidelines. This included construction and operational noise as well as road traffic noise.	Chapter 10 Appendix E
	Methodology and approach to the Noise and Vibration Impact Assessment	The methodology for the NVIA included: ■ *NSW Wind Energy: Noise Assessment Bulletin* (DPE, 2016) ■ *NSW Noise Policy for Industry* (EPA, 2017) ■ *Interim Construction Noise Guideline* (DECC, 2009) ■ *NSW Road Noise Policy* (DECCW, 2011) ■ *Assessing Vibration: A Technical Guideline* (DEC, 2006)	Chapter 10 Appendix E
Traffic and Transport	Increased traffic volumes and safety for residents. Considerations to existing Forestry Corporation traffic. Suggested sealing the road and adding safety features for improved visibility and road etiquette.	A Traffic and Transport Impact Assessment (TTIA) has been completed to assess the traffic and transport impacts of the project. This included a review of: ■ background traffic and road safety material, including road accident history (crash data) for potential restricted access vehicle (RAV) routes and historical traffic count data; ■ site inspection of the road network and proposed vehicular access routes to the Project;	Chapter 12 and Appendix G

Theme / Topic	Key Issue Raised	Project Response	Where addressed in EIS
		■ assessment of traffic impacts during Project construction and operation phases, with regard to: – vehicle types; – nominated transport routes to/from the Project; – traffic volumes and potential impacts on local and regional roads; and – site access arrangements (with regard to applicable Austroads and Australian Standards); ■ assessment of traffic capacity based on the volume capacity ratio, rural road Level of Service and the environmental capacity for urban areas based on the *Guide to Traffic Generating Development* (RTA, 2002); ■ a swept path analysis of the largest vehicle to access the site, to identify any constraints at intersections along the nominated transport route, including detailing required road upgrade works; and ■ consultation with relevant roads authorities and stakeholders. This has included consideration of Forestry Corporation traffic movements, bus routes. Mitigation and management measures have been incorporated, including road upgrades, layovers, protocols and collaboration with Forestry Corporation and sealing of Morrisons Gap Road.	
Heritage	Interest in the significance of the Project Area to Indigenous Communities. Consultation with the community regarding heritage.	Aboriginal and Historic Heritage assessments have been completed, and included consultation with relevant stakeholders.	Chapters 14 and 15 Appendices M and N
Bushfires	Risk of increase in bushfire as a result of the Project and impacts on firefighting abilities. Impact of bushfire on the Project.	A bushfire assessment has been completed in consultation with the local and regional RFS. Overall, the Project is not expected to increase bushfire risk but can play a role in supporting firefighting through improved infrastructure. Ongoing consultation and a bushfire management plan will include agreements on supporting RFS and NPWS by making operational changes to turbines to ensure safety in operating aircraft or firefighting services in the area.	Chapter 13 and Appendix J

Theme / Topic	Key Issue Raised	Project Response	Where addressed in EIS
Aviation	Impacts to existing aerial activities, including aerial application, wild dog baiting, surveys and inspections on neighbouring farming operations, the national park and forestry estates.	An Aviation Impact Assessment (AIA) has been completed which has considered existing airfields and aerial activities. The AIA provides detailed assessment of landing and take-off procedures for these runways. Consultation with relevant stakeholders has also been completed. There is not expected to be any impact to the use of the runways or impacts to existing aerial activities as a result of the Project.	Chapter 13 Appendix H
	Need for aviation lighting.	Aviation lighting is not recommended in the AIA. However, subject to further consultation with CASA, there is a chance it may still be required and this has been assessed in the visual impact assessment.	Chapters 11 and 13 Appendices F and H
Waste	Waste generation and increase in traffic movements. What waste will be generated by the Project and is this considered in the Transport Assessment?	Chapter 18 of the EIS provides a summary of waste streams and relevant management approaches including consideration of need to export waste to appropriately approved destinations. The TTIA includes traffic volumes generated by the Project during construction and operation including transportation of waste from the Project Area.	Chapters 12 and 18 Appendix G
Water and Soil	Water use volumes and sources.	The Soil and Water Assessment has calculated the estimated amount of water use required to construct and operate the project. This is broken down by activities. The assessment includes potential sources of water and required permitting to be secured.	Chapter 16 Appendix O
	Risk of erosion as a result of construction?	The Soil and Water Assessment includes consideration of erosion risk during construction. It includes recommendations for management and mitigation measures, including the preparation of a Soil and Water Management Plan as part of the Construction Environmental Management Plan and in accordance with relevant guidelines and best practice for erosion and sediment control.	Chapter 16 Chapter 21 Appendix O
	How large and deep will the turbine foundations go and will this affect the water table?	The Project Description chapter provides an explanation of the potential types of foundation expected for a project of this nature.	Chapter 3
	The Project is proposed on the boundary of three water catchments and there was interest in how the Project infrastructure would affect these watercourses.	The Soils and Water Assessment identifies the catchments within which the Project occurs, as well as consideration to the relevant Water Sharing Plans that apply. The assessment considers the impact of construction and operation on the water sources and recommended management and mitigation measures.	Chapter 16 Appendix O

7.6 Community Enhancement and Benefits

7.6.1 Overview

The Project proposes two key community enhancement and benefits programs:

- a Community Enhancement Fund in lieu of a Voluntary Planning Agreement; and
- a Neighbours Benefits Sharing Program.

In addition to these, the Project will also incorporate road upgrades required by the Project at the Project's cost and which will fall outside of the Community Enhancement Fund.

7.6.2 Community Enhancement Fund

As discussed in Section 6.2.4.5, the Project proposes a Voluntary Planning Agreement in the form of a Community Enhancement Fund. A draft Community Enhancement Fund Charter has been consulted with Tamworth Regional, Upper Hunter and Liverpool Plains councils. The operation of the Fund commits to the following in accordance with the draft Charter:

- annual contributions of $2,500 per WTG per year from the Project into the Fund;
- establishment of a Community Enhancement Fund Committee to administer and oversee the operation of the Fund, and includes membership from the community, at least one indigenous member, and representatives from each of the three councils; and
- protocols for the assessment and funding approval of projects with a direct benefit to the community within 20 km of the Project, based on established eligibility criteria across four key areas, being community upgrades, social or environment, education and flexible projects determined by majority of the committee.

7.6.3 Neighbour Benefits Sharing Program

A Neighbour Benefit Sharing Program was announced in May 2020. The program identified residents within 5 km of a proposed turbine and invited residents to enter into voluntary agreements regarding the Project and setting out a process for raising any concerns directly with the Proponent during the life of the Project. The program was designed based on the following resources:

- Clean Energy Council – *A guide to Community Benefit Sharing Options for Renewable Energy Projects* (2019);
- Australian Wind Alliance – *Building Stronger Communities* (2019) and
- National Wind Farm Commissioner – Neighbour Consultation and Agreements sections on its website.

Through the preparation of the EIS, residents greater than 5 km from a proposed turbine were also included based on the outcomes of assessment. This resulted in one dwelling outside of the 5 km identified boundary being included in the Neighbour Benefit Sharing Program on account of the multiple sector tool (visual impacts). WEP continues to liaise with the community relating to the program. Consultation with the community regarding the scheme has been incorporated in the stakeholder register (Appendix C.2).

7.7 Future Engagement Approach

Ongoing engagement with stakeholders will be undertaken during the EIS exhibition and assessment phase. This engagement will include:

- ongoing meetings with Tamworth regional, Upper Hunter and Liverpool Plains councils;

- Project updates to the Hills of Gold CCC (meetings held quarterly);
- engage with the local media;
- updates to local business chamber and other special interest groups; and
- continuation of consultation with community and regulatory stakeholders via various forums (for example meetings, presentations etc).

7.8 Conclusion

The proponent and their advisors have gone to significant lengths to explain the Project to all interested stakeholders and seek their input on the Project.

Consultation has resulted in the Project design being refined and additional mitigation measures being identified, like safety upgrades, sealing a public road, laybys and a voluntary Drivers Code of Conduct for construction traffic.

The Proponents will continue to engage with stakeholders during the assessment process, and if approved, during construction and operation.

8. ENVIRONMENTAL ASSESSMENT APPROACH

This chapter presents the results of the Environmental Risk Assessment undertaken to rate the Project's environmental issues with respect to the risks they pose. The purpose of the assessment was to address the potential environmental impacts of the development, identifying the key issues for further assessment in the EIS.

8.1 Introduction

Whilst not specifically requested by the SEARs, for completeness, an analysis of environmental and community risks was undertaken in order to identify key risks for further detailed assessment within the EIS. Such analyses of the potential environmental and community risks associated with SSD projects is now typically completed as part of the scoping report prior to the submission of requests for SEARs. For completeness, an analysis of potential environmental and social risks was undertaken to inform the environmental assessment approach and assignment of effort to each of the environmental and community issues identified, with a greater depth of analysis being allocated to those issues identified as being of very high, high or medium risk in the absence of mitigation or management measures. The assessment was also guided by the Project SEARs.

The format of the risk assessment was similar to that routinely used in NSW, and was consistent with past practice in EISs for SSDs. The purpose of the risk assessment is to ensure that all key issues are identified early in the process in order to ensure that they are fully addressed in the EIS. The individual technical assessments forming the EIS provide detailed assessment of the identified risks and include management and mitigation measures. Cross references to the respective chapters are provided.

8.2 Methodology

The key risks identified for the Project were assessed generally in accordance with the methodology outlined in Standards Australia's *HB 203:2012 Managing Environmental Related Risk* and *AS/NZS ISO 31000:2018 Risk Management – Principles and Guidelines*.

The Environmental Risk Assessment (ERA) categorised the level of risk for a given event based on the significant effect (consequence) and the probability (likelihood) of the event occurring, assuming that no control measures had been applied. The likelihood and consequences categories used in the ERA are outlined in Table 8-1 and Table 8-2 respectively. Each negative environmental risk was then ranked as low, medium, high or very high using the risk matrix in Table 8-3. Positive outcomes were also ranked as low, medium or high using the risk matrix in Table 8-4.

Table 8-1 Probability Categories for Environmental Risk Assessment

Rank	Probability	Description
A	Almost Certain	Happens often and is expected to occur
B	Likely	Could easily happen and would probably occur
C	Possible	Could happen and has occurred elsewhere
D	Unlikely	Unlikely to happen but may occur
E	Rare	Could happen, but only in extreme circumstances

Table 8-2 Consequence Categories for Environmental Risk Assessment

Rank	Consequence	Description
Negative Consequences		
1	Extreme	Permanent and catastrophic impacts on the environment; large impact area: reportable incident to external agency; substantial community concern.
2	Major	Permanent and detrimental impacts on the environment; large impact area: reportable incident to external agency; high level of community concern.
3	Moderate	Substantial temporary or minor long term detrimental impacts on the environment; moderate impact area; reportable incident to external agency; some community concern.
4	Minor	Limited detrimental impacts on the environment; small impact area; not reportable incident; limited community concern.
5	Low	Nil or temporary impacts to the environment, small or isolated impact area; not reportable incident; no community concern.
Positive Consequences		
1	Major	Permanent beneficial impacts on the environment or population; large impact area.
2	Moderate	Substantial temporary or minor long term beneficial impacts on the environment or population; moderate impact area.
3	Minor	Limited beneficial impacts on the environment or population; small impact area.

Table 8-3 Risk Matrix for Environmental Risk Assessment – Negative Consequences

Likelihood	Negative Consequences				
	1. Extreme	2. Major	3. Moderate	4. Minor	5. Low
A. Almost certain	VH	VH	H	H	M
B. Likely	VH	H	H	M	M
C. Possible	H	H	M	M	L
D. Unlikely	H	M	M	L	L
E. Rare	H	M	L	L	L

VH – Very High, H – High, M – Medium, L – Low

Table 8-4 Risk Matrix for Environmental Risk Assessment – Positive Consequences

Likelihood	Positive Consequences		
	1. Major	2. Moderate	3. Minor
A. Almost certain	H	H	M
B. Likely	H	M	M
C. Possible	M	M	L
D. Unlikely	M	L	L
E. Rare	L	L	L

H – High, M – Medium, L – Low

8.3 Findings of the Environmental Risk Assessment

The findings from the ERA are presented in Appendix Q and indicate that in the absence of control measures, the majority of identified environmental and community issues incurred medium levels of risk, whilst others demonstrated a low level of risk. Biodiversity as well as landscape and visual impacts were assessed as presenting a high and very high level of risk respectively.

All potential impacts with inherent risk ratings of low to very high were considered and addressed in this EIS, however a higher degree of assessment was undertaken for the environmental issues with risk levels ranging from medium to very high. A detailed assessment of the potential environmental issues identified in the ERA is discussed in Chapters 9 through to 20. Where appropriate, mitigation and management measures have been developed to reduce the risk to as low as reasonably practical. These measures are described in each chapter and collated in full in Chapter 21.

9. Biodiversity

9.1 Introduction

Arup prepared the Biodiversity Development Assessment Report (BDAR) at Appendix D to assess the potential impacts of the Project on biodiversity and identify mitigation and risk management measures during construction and operation.

The BDAR was prepared to address the requirements of the SEARs, and in accordance with the:

- *Biodiversity Conservation Act 2016* (BC Act);
- *Biodiversity Conservation Regulation 2017*;
- Biodiversity Assessment Method (BAM) (OEH 2017) which applies to the Project under the transitional provisions in clause 6.31 of the *Biodiversity Conservation Regulation 2017*; and
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act).

The BDAR includes consideration of:

- impacts to native vegetation, including threatened ecological communities listed under the BC Act and the EPBC Act;
- impacts to listed threatened species under the BC Act and the EPBC Act;
- impacts of blade strike on birds and bats, with specific focus on listed threatened bats and raptors observed in accordance with *Natural England Technical Information Note TIN051 (as advised by BCD)*;
- impacts associated with development near to National Parks or State Reserves, including the adjacent Ben Halls Gap Nature Reserve in accordance with the Guidelines for Development Adjoining Land and Water Managed by DECCW (OEH, 2010);
- management of identified impacts (including details of adaptive management protocols and biodiversity offsets); and
- measures to avoid, mitigate and offset impacts, with the objective of an overall 'improve or maintain' environmental outcome for the Project.

9.2 Methodology

9.2.1 Study Area

The study area for the biodiversity assessment includes the Development Footprint, plus a 1,500 m buffer around all parts of the Development Footprint which is referred to as the Study Area. The 1,500 m buffer has been applied in accordance with Section 4.2 of the Biodiversity Assessment Methodology (BAM), which requires landscape attributes to be assessed for a 1,500 m buffer around the development footprint (refer to Section 1.3 of the BDAR, provided in Appendix D).

Consideration has also been given to known karst systems (caves) within 50 km of the Project that support potential habitat for roosting and/or breeding microbats.

For the purpose of assessing impacts to biodiversity, a single development footprint has been prepared covering five project elements that comprise the overall project infrastructure, including:

- wind farm infrastructure, consisting of wind turbine generators, hardstands for construction and ancillary sites including operations and maintenance buildings, substation, BESS, switching station and parking/storage/laydown areas;
- internal roads connecting wind farm infrastructure;
- transmission line and switching station;
- transmission line access tracks; and
- transport haul route from Port of Newcastle to the wind farm site.

A detailed description of these project elements is provided in Chapter 3 of this EIS.

Concept design work was completed to confirm a conservative maximum Development Footprint to be assessed. The Project layout presented in this EIS and the Development Footprint derived from it was developed by the Project team, which included wind farm designers and civil designers, with input from ecologists and other specialists to minimise impacts as much as practicable (this is further discussed in Section 5.5.1).

The Development Footprint has included areas of both permanent and temporary impacts associated with the construction and operation of the Project. Areas subject to temporary impacts will be rehabilitated with native grasses, at a minimum, with consideration for incorporating native shrubs and trees where possible.

9.2.2 Desktop Assessment and Background Sources

The BDAR was based on detailed desktop assessment of key maps, tools and guidelines and the Preliminary Environmental Assessment, as detailed in Section 1.6 of Appendix D.

9.1.1 Field Surveys

Field surveys were carried out between November 2018 and August 2020 by ecologists from Arup and Biosis. A full description of the survey methodology is provided in the BDAR (Appendix D) and is summarised below.

9.2.2.1 Vegetation and Flora Surveys

Plant community delineation and mapping of vegetation zones involved review and field validation of OEH mapped vegetation communities based on a field survey events over a total of 24 days, as follows:

- an initial survey of the wind farm Development Footprint from 12 November 2018 to 15 November 2018 by two ecologists totalling 60 person hours;
- subsequent Winter survey of the wind farm Development Footprint over 5 days in August 2019 by two ecologists totalling 80 person hours;
- subsequent Spring survey over 5 days in November 2019 for the proposed transmission line and wind farm development footprints by two ecologists totalling approximately 80 person hours;
- subsequent Summer survey over 5 days in February 2020 for the proposed transmission line and wind farm development footprints totalling approximately 50 person hours; and
- supplementary Winter survey completed 17-21 August 2020 for the proposed access/transportation routes, adjusted transmission line corridor and within Ben Halls Gap Nature Reserve, extending 100 m buffer from the development footprint, by two ecologists totalling 100 person hours.

Each field event incorporated the survey of vegetation at locations where distinct Plant Community Types (PCTs) were observed within the Development Footprint, noting the extent and structure of existing vegetation and dominant species within each stratum. Signs of disturbance such as clearing, fire damage or weed invasion were also noted.

A full detailed description of the survey methodology and the criteria used to assign the vegetation condition classes is detailed in the BDAR (Appendix D).

Surveys for candidate threatened flora species were carried out over two seasons and a total of 10 days, as follows:

- survey of the wind farm Development Footprint over 5 days from 18-22 November 2019; and
- survey of the wind farm Development Footprint and accessible parts of the transmission line corridor over 5 days in February 2020.

Targeted surveys involved active searches for each of the target species in areas of suitable habitat, depending on the density of vegetation.

9.2.2.2 Fauna Surveys

A range of targeted terrestrial fauna survey methods were implemented over all four seasons between November 2018 and August 2020 to detect the candidate threatened species assessed as likely to occur on the site. Field surveys were carried out during optimal seasonal conditions and weather conditions as detailed within the BDAR (Appendix D).

Survey methods included:

- ultrasonic bat call recording, deployed at ground level, canopy height and 60m above ground level;
- Koala Spot Assessment Technique (SAT);
- diurnal bird surveys and bird utilisation surveys;
- nocturnal spotlight surveys and transects;
- nocturnal and diurnal waterbody searches;
- nocturnal and diurnal call playback;
- arboreal and terrestrial camera trapping (spring, summer and winter);
- frog surveys (winter and spring);
- targeted searches for reptiles;
- hollow-bearing tree density assessment and searches for stick nests; and
- habitat condition assessment and photopoint collection.

Based on the desktop review, 33 species were identified as candidate threatened fauna, including 28 species credit species and five ecosystem credit species, requiring targeted surveys in accordance with the BAM and provisions of the EPBC Act.

9.3 Existing Environment

9.3.1 Landscape Features

Landscape context for the Project was assessed within the study area according to Part 4 of the BAM, as detailed in Table 9-1. This applies a 1,500 m buffer area to the Development Footprint for all Project components.

Table 9-1 Landscape context for the Study Area

Landscape feature	Description
Interim Biogeographic Regionalisation for Australia (IBRA) bioregion and sub-region	The study area intersects four Interim Biogeographic Regionalisation for Australia (IBRA) regions and subregions: ■ New England Tablelands, Walcha Plateau ■ Nandewar, Peel ■ NSW North Coast, Tomalla ■ Sydney Basin, Hunter
NSW Landscape Regions (Mitchell Landscapes)	■ Mount Royal Tops ■ Mount Royal Ridges ■ Manning Great Escarpment Southern Aspects ■ Manning Great Escarpment Western Aspects ■ Nundle Hills ■ Peel Channels and Floodplain ■ Slippery Rock Range ■ Tamworth- Keepit Slopes and Plains ■ Central Hunter Alluvial Plains ■ Central Hunter Foothills ■ Lower Hunter Channels and Floodplains ■ Newcastle Coastal Ramp ■ Upper Hunter Channels and Floodplain ■ Gosford-Coorangbong Coastal Slopes ■ Moonbi-Walcha Granites ■ Niangala Plateau and Slopes ■ Nowendoc- Yarras Serpentinite ■ Sydney- Newcastle Barriers and Beaches ■ Watagan Ranges
Rivers and streams	Most of the streams that occur within the Development Footprint are first-order watercourses, which is characteristic of the location of the Project on a ridgeline. The majority of these flow north and west of the ridgeline into the Namoi catchment area. The southern portion of the development footprint for the wind farm and transmission line flows south to the Hunter catchment area. A small portion of the eastern portion of this development footprint flows east to the Manning Catchment Area. There are fourteen named streams within the Project Area for the wind farm and transmission line (refer to Soil and Water Chapter 16 and Figure 16-4).
Wetlands	No Ramsar Wetlands or Nationally Important Wetlands have been mapped within the study area. . The study area supports 388.51 ha of mapped NSW wetlands. These wetlands occur within the Greater Hunter region within the 1,500 m buffer to the transport route and will not be impacted by the Development Footprint. Mapped wetlands include the Hunter River, Southern Hunter River, Throsby Creek and the Kooragang Nature Reserve. There are no mapped wetlands within the study area for the wind farm infrastructure or transmission line.
Areas of geological significance	Habitat features including karsts, caves, crevices and cliffs or other areas of geological significance are known and likely to occur within and adjacent to the study area. Field surveys have identified a number of areas of steep, rocky crevices on either side of the escarpment that provide potential roosting habitat for microbats. The location of steep cliff lines on the edge of the escarpments in the study area have been mapped as potential microbat roosting and breeding habitat in the BDAR (Appendix D).

Landscape feature	Description
Protected areas	Within the study area, there are two protected NSW state conservation areas, the Ben Halls Gap Nature Reserve which is adjacent to the project area and Crawney Pass National Park, located 50 m from the maximum clearing boundary for the transmission line corridor (refer to Figure 3-1 of the BDAR).
Percent high quality native vegetation cover	49% of the 42,316 ha study area has been cleared of native vegetation. However approximately 21,540 ha (or 51% of the study area) consists of native vegetation which is classified as having a cover class of between 30-70% meaning that this is the percentage of native vegetation cover within the study area.
Biodiversity links and connectivity value	Biodiversity links supported within the study include ridgelines and altitudinal corridors linking areas of vegetated ridgeline and escarpment with lower areas.

9.3.2 Native Vegetation

Within the total combined Development Footprint, a total of 513 ha, a total of 486.45 ha of vegetation was mapped, which includes vegetation communities classified as native vegetation, exotic grassland and planted/urban vegetation.

The majority (58% or 279.75 ha) of the mapped vegetation within the Development Footprint is composed of exotic grassland or planted/urban vegetation, with 42% of the mapped vegetation (206.7 ha) being classified as native (Table 9-2).

The native vegetation within the development footprint comprises isolated patches of vegetation in a predominantly agricultural land-use matrix. While isolated, patches were generally within 100 m of other patches of native vegetation and in some locations directly connected to areas of larger, contiguous areas of native vegetation.

The condition of these patches of native vegetation ranges from low, with heavy weed infestation (especially Blackberry *Rubus fruticosus)* supporting little native species richness or diversity, to high condition areas with high native species floristic and structural diversity and low weed infestation. Zones in lower condition also show high levels of modification and fragmentation.

Poor condition vegetation zones are characterised by a canopy of mature and semi mature native trees over an understorey dominated by exotic pasture grasses. Resilience in the understory in these zones was seen to be low, with a low cover and abundance of native species. Higher condition vegetation condition zones are characterised by complex vegetation structure with a high diversity and abundance of native species within each strata.

Table 9-2 Vegetation condition class within combined development footprint

Vegetation condition class	Area (ha)	Percentage of mapped vegetation in the Development Footprint
Planted or urban vegetation	7.39	2%
Exotic grassland	272.36	56%
Derived Native Grasslands	30.91	6%
Native vegetation – Low condition	37.11	8%
Native vegetation – Moderate condition	73.80	15%
Native vegetation – High condition	64.88	13%
TOTAL	**486.45**	**100%**

This summary shows that most of the impacts associated with the wind farm turbines (including associated hardstands) (74%), internal roads (64%) and transmission line access tracks (68%), are to non-native vegetation, with exotic grassland being the most common vegetation community mapped in these areas. This reflects the history of disturbance on the ridgeline from the historical and ongoing use as a grazing property and the extent to which the Project has been designed to minimise impacts to native vegetation as much as practicable. The concept alignment for the transmission line access tracks have also been designated using existing farm tracks and trails as much as possible.

Within the transmission line corridor, 62% of the vegetation has been mapped and classified as native vegetation. This is due to the requirement for the transmission line to traverse steeper areas of terrain where open eucalypt forest and woodland has been retained. The current concept design has proposed full clearing of the required 60 m wide easement corridor along the transmission line, however this will be revised during detailed design and clearing limited where required operational and safety clearances to the wires can be achieved, enabling further clearing reductions to be achieved. The majority of the clearing for the construction of the transmission line will also be temporary, with rehabilitation works consisting of native grass seeding to be completed. Opportunities to include taller trees and shubs representative of impacted PCTs will also be considered during detailed design.

There is also a majority of native vegetation mapped within the road upgrade areas adjoining the existing formed public roads on the transport route. Most of these impacts are associated with works required on Morrisons Gap Road and Head of Peel Road, where curve realignments are necessary to transport the turbine infrastructure up the existing steep roads.

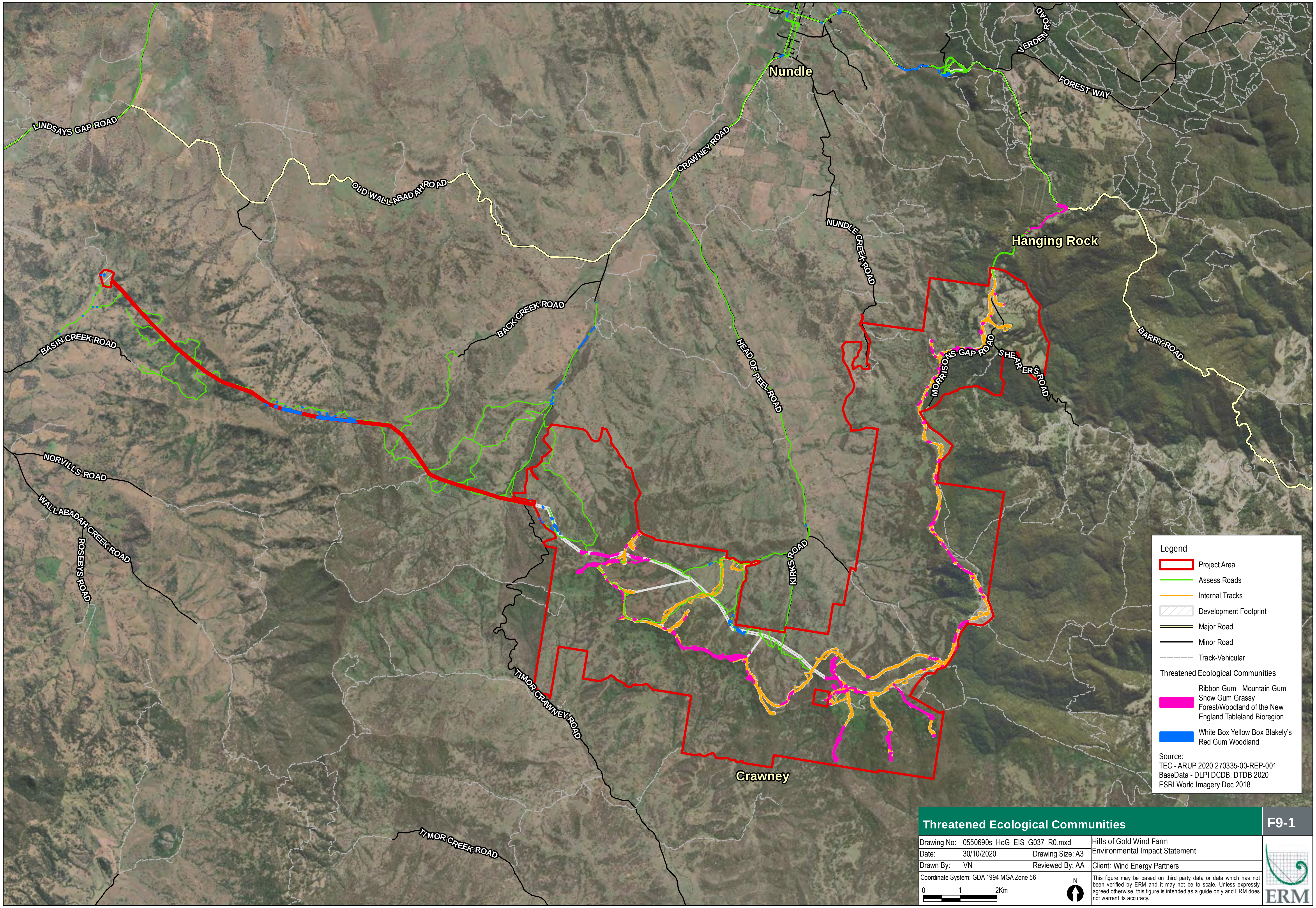
The 206.70 ha of native vegetation mapped within the Development Footprint, occurs across 22 separate PCTs with varying levels of disturbance and condition, stratified into 48 vegetation zones (refer BDAR, Appendix D).

9.1.2 Threatened Ecological Communities

Field surveys and ground-truthed vegetation mapping confirmed the presence of two threatened ecological communities (TEC) listed under the BC Act and/or the EPBC Act within the development footprint and detailed in Table 9-3**)**.

Table 9-3 Threatened Ecological Communities within the Development Footprint

PCT	TEC scientific name	Conservation status		Area (ha)
		EPBC	BC Act	
PCT 1194: Snow Gum - Mountain Gum - Mountain Ribbon Gum open forest on ranges of the NSW North Coast Bioregion and eastern New England Tableland Bioregion PCT 1192: Snow Gum - Mountain Gum - Mountain Ribbon Gum grassy open forest of the New England Tableland Bioregion	Ribbon Gum-Mountain Gum-Snow Gum Grassy Forest/Woodland of the New England Tableland Bioregion	Not listed	E	57.43
PCT 492 - Silvertop Stringybark - Yellow Box - Apple Box - Rough-barked Apple shrub grass open forest mainly on southern slopes of the Liverpool Range, Brigalow Belt South Bioregion PCT 599- Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions	CE	CE	13.33


Nundle
Hanging Rock
Crawney
LINDSAYS GAP ROAD
OLD WALLABADAH ROAD
CRAWNEY ROAD
NUNDLE CREEK ROAD
VERDEN ROAD
FOREST WAY
BACK CREEK ROAD
BASIN CREEK ROAD
HEAD OF PEEL ROAD
MORRISONS GAP ROAD
SHEARERS ROAD
BARRY ROAD
NORVILLS ROAD
WALLABADAH CREEK ROAD
ROSEBYS ROAD
KIRKS ROAD
TIMOR CRAWNEY ROAD
TIMOR CREEK ROAD
Legend
Project Area
Assess Roads
Internal Tracks
Development Footprint
Major Road
Minor Road
Track-Vehicular
Threatened Ecological Communities
Ribbon Gum - Mountain Gum - Snow Gum Grassy Forest/Woodland of the New England Tableland Bioregion
White Box Yellow Box Blakely's Red Gum Woodland
Source:
TEC - ARUP 2020 270335-00-REP-001
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018
Threatened Ecological Communities
F9-1
Drawing No: 0550690s_HoG_EIS_G037_R0.mxd
Date: 30/10/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partners
Coordinate System: GDA 1994 MGA Zone 56
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This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
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9.3.3 Threatened Flora Species

One threatened flora species, Broad-leaved Pepperbush *Tasmannia purpurescens,* was identified adjacent to the Development Footprint. The species was recorded in two locations adjacent to the north-eastern section of the wind farm Development Footprint, as shown in Figure 9-2**.** These plants and populations will not be subject to direct impacts as a result of the Project.

The northern-most record of this species was located in an area of PCT 934, with Messmate *Eucalyptus obliqua as* the dominant canopy tree and an open shrub cover with Broad-leaved Pepperbush being locally abundant in areas. The second, more southerly record for Broad-leaved Pepperbush was within an area of good quality PCT 1194 dominated by Snow Gum *Eucalyptus pauciflora* with a grassy understory and an open shrub layer. The Development Footprint avoids direct impacts to both of these recorded locations of Broad-leaved Pepperbush.

9.3.4 Threatened Fauna Species

Based on the desktop review, 33 species were identified as candidate threatened fauna requiring targeted surveys in accordance with the BAM and provisions of the EPBC Act.

Seventeen threatened terrestrial fauna species were confirmed during the field investigations for this Project as summarised in Table 9-4 and Figure 9-3. Under the BAM all threatened entities are allocated to one of two biodiversity credit classes: 'ecosystem' or 'species' credit species:

Ecosystem credit species are species where the likelihood of occurrence of a species or elements of the species' habitat can be predicted by PCT and landscape features, or for which targeted survey has a low probability of detection.

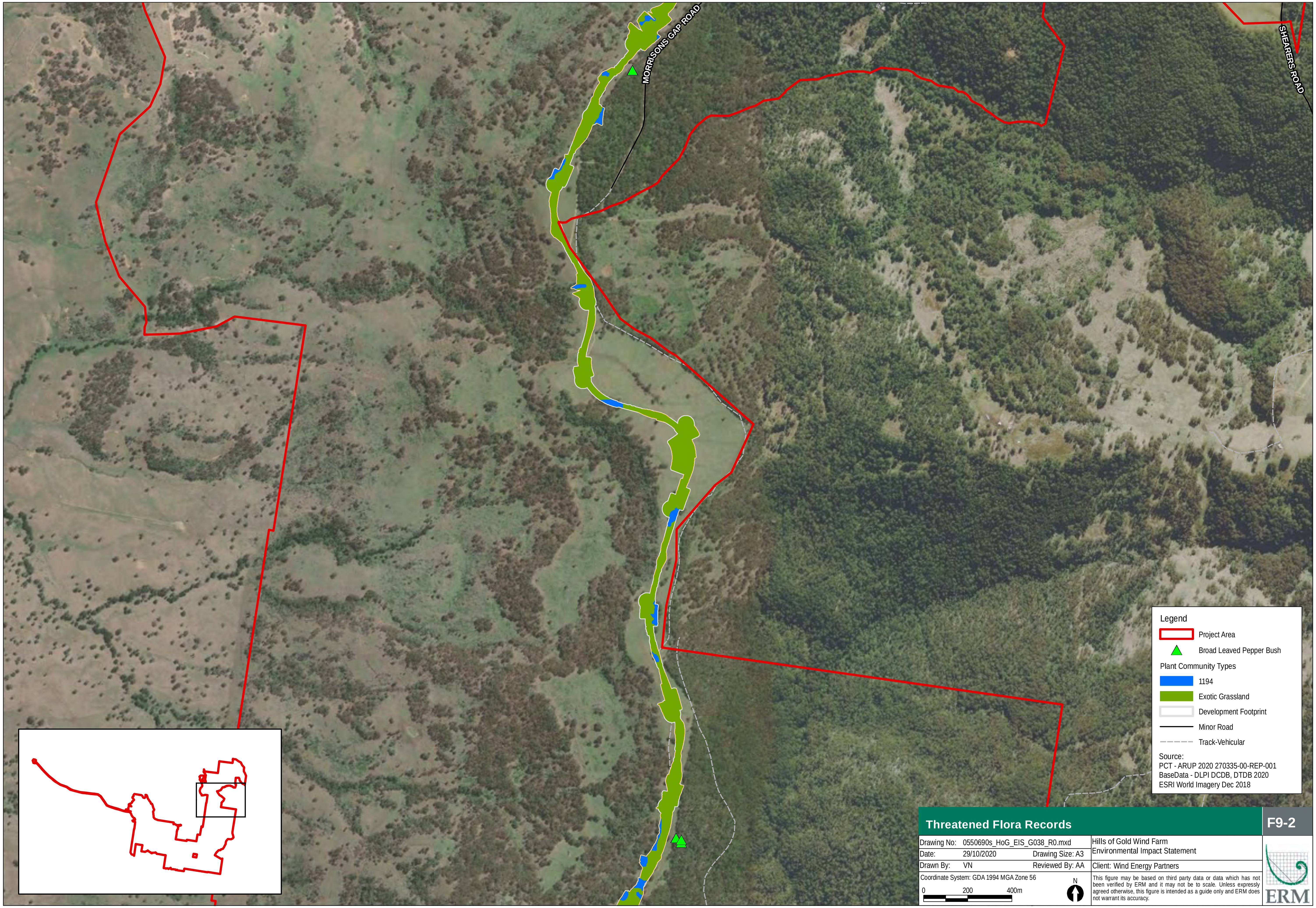
Species credits species are species where the likelihood of occurrence of a species or elements of suitable habitat for that species cannot be confidently predicted by PCT and landscape features, and can be reliably detected by survey. The BAM requires either a targeted species survey or an expert report to determine the presence of a species credit species.

Table 9-4 Threatened Fauna Habitat for Species Directly Observed within the Development Footprint.

Species name	Habitat within the Development Footprint	Area of habitat (ha)
Koala*	Habitat polygons include impacted areas of the species' associated PCTs, as listed in BioNet, and mapped in moderate and high condition states. Field captured habitat assessments were used to refine the polygons, with the following characteristics excluded: ■ Areas supporting >50% rock outcropping; and ■ Areas mapped as being subject to high severity clearing. of the tree canopy.	50.76
Greater Glider	Species observed during spotlighting within the wind farm Development Footprint. High condition PCTs within the wind farm infrastructure and internal roads Development Footprint only due to reliance on large tree hollows for breeding.	25.54
Spotted-tailed Quoll#	High condition PCTs within the wind farm infrastructure and internal roads Development Footprint only due to reliance on large tree hollows for breeding.	25.54
Southern Myotis*	Dams more than 3 m wide were mapped and a 200 m buffer applied. All PCTs forming habitat associations for the species, as listed in the BioNet database, were included within the habitat polygons where they where located with 200 m of the dams. No waterways >3 m wide were identified.	2.21

Species name	Habitat within the Development Footprint	Area of habitat (ha)
Large-eared Pied Bat*	Species polygons for 'Forage habitat' include PCTs associated with the species in the BioNet database, in moderate and high condition states, where they occur within 2 km of 'High Potential - Microbat breeding polygons', and/or within 2 km of Mount Royal Tops soil landscape (Mitchell, 2002). Species polygons for "Breeding habitat' include all potential breeding habitat, which for the current assessment is deemed as 'High Potential - Micobat breeding polygons' and the area immediately surrounding this feature. Species polygon boundaries have a 100 m radius buffer around the 'High Potential - Microbat breeding polygons' which were captured on site using GIS data. All impacted native vegetation within the buffer areas is captured.	61.08
Little Pied Bat#	Foraging over associated PCTs in Development Footprint	5.67
Eastern False Pipistrelle#	Foraging over associated PCTs in Development Footprint	70.03
Eastern Coastal Free-tailed Bat#	Foraging over associated PCTs in Development Footprint	17.86
Little Bent-wing Bat*	All potential breeding habitat, which for the current assessment is deemed as 'High Potential - Microbat breeding polygons' and the area immediately surrounding this feature. Species polygon boundaries have a 100 m radius buffer around the 'High Potential - Microbat breeding polygons' which were captured on site using GIS data. All impacted native vegetation within the buffer areas is captured.	23.12
Large Bent-winged Bat*	All potential breeding habitat, which for the current assessment is deemed as 'High Potential - Microbat breeding polygons' and the area immediately surrounding this feature. Species polygon boundaries have a 100 m radius buffer around the 'High Potential - Microbat breeding polygons' which were captured on site using GIS data. All impacted native vegetation within the buffer areas is captured.	23.12
Greater broad-nosed bat#	Foraging over associated PCTs in Development Footprint	70.03
Eastern Cave Bat*	Species polygons for 'Forage habitat' include PCTs associated with the species in the BioNet database, in low, moderate and high condition states, where they occur within 2 km of 'High Potential - Microbat breeding polygons', and/or within 2 km of Mount Royal Tops soil landscape (Mitchell 2002). Species polygons for "Breeding habitat' include all potential breeding habitat, which for the current assessment is deemed as 'High Potential - Microbat breeding polygons' and the area immediately surrounding this feature. Species polygon boundaries have a 100 m radius buffer around the 'High Potential - Microbat breeding polygons' which were captured on site using GIS data. All impacted native vegetation within the buffer areas is captured	62.49
Grey-headed flying-fox#	Foraging over development footprint, no roost sites within the Development Footprint. Species is considered to be highly vagrant, with only one observation of a single animal flying over the site during the field surveys.	80.67

** Species credit species*
 # Ecosystem credit species


MORRISONS GAP ROAD
SHEARERS ROAD
Legend
Project Area
Broad Leaved Pepper Bush
Plant Community Types
1194
Exotic Grassland
Development Footprint
Minor Road
Track-Vehicular
Source:
PCT - ARUP 2020 270335-00-REP-001
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018
Threatened Flora Records
F9-2
Drawing No: 0550690s_HoG_EIS_G038_R0.mxd
Date: 29/10/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partners
Coordinate System: GDA 1994 MGA Zone 56
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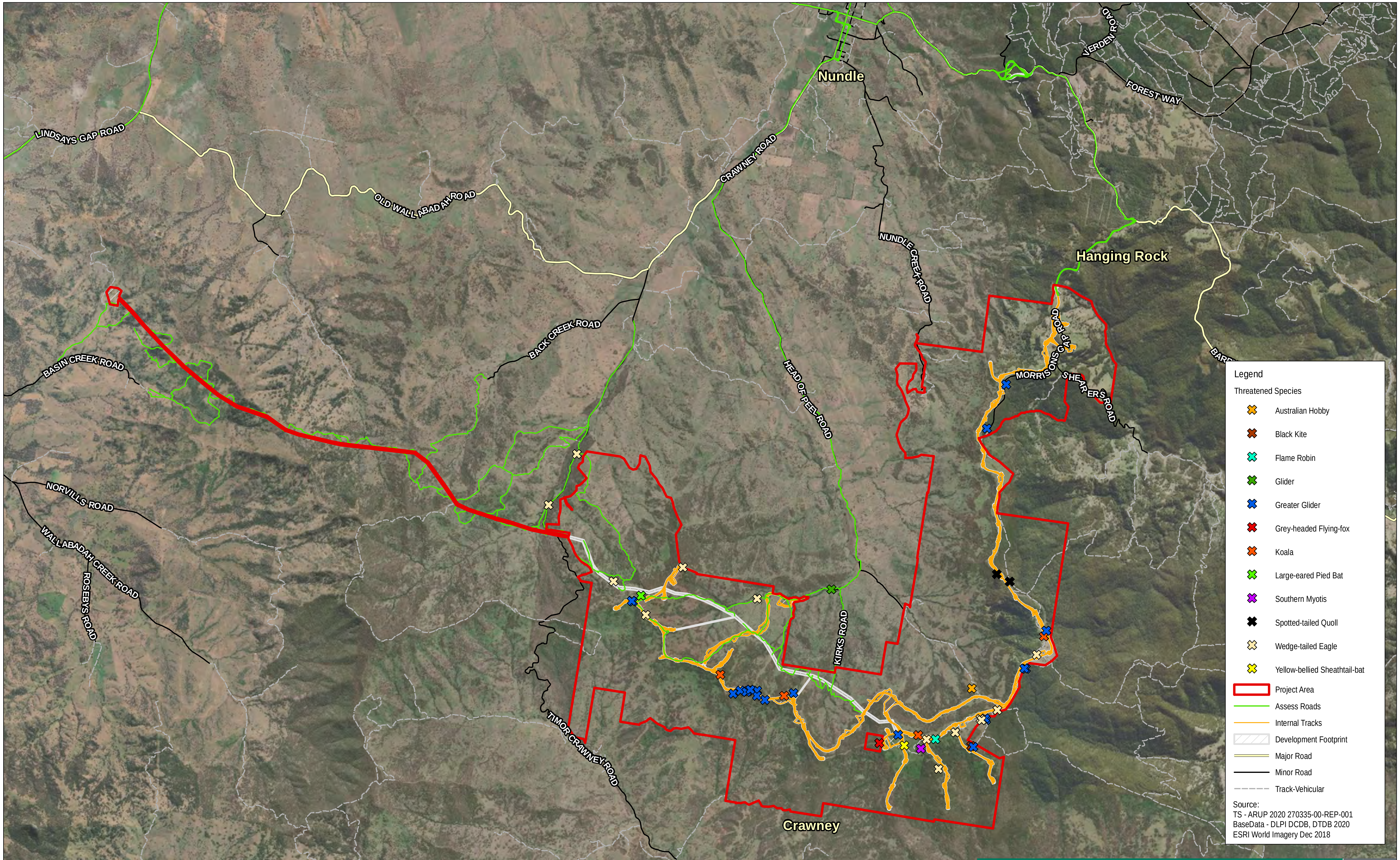

Threatened Fauna Records

F9-3

Drawing No: 0550690s_HoG_EIS_G039_R0.mxd	Hills of Gold Wind Farm Environmental Impact Statement
Date: 29/10/2020 Drawing Size: A3	
Drawn By: VN Reviewed By: AA	Client: Wind Energy Partners
Coordinate System: GDA 1994 MGA Zone 56	This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

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In addition to the threatened fauna species directly observed within the Development Footprint, the detailed habitat assessments identified a high likelihood of occurrence for an additional four fauna species (**Table 9-5**) that were not directly observed but their presence could not be discounted following the field survey effort. These species have also been subject to habitat mapping and impact assessment to complete a thorough and detailed review of biodiversity impacts associated with the Project.

Table 9-5 Threatened Fauna with a High Likelihood of Occurrence within the Development Footprint.

Species name	Habitat within the Development Footprint	Area of habitat (ha)
Booroolong Frog*	Habitat polygons include impacted areas of native vegetation in High and Moderate condition where they occurred within a 40 m riparian buffer from Wombramurra Creek (centreline/hydroline). PCTs not listed in the BioNet database as associated with the species were also included in the habitat polygons due to the presence of a high density of records in the area and the known SOS population along the creekline. A 40 m buffer was selected as it represents the BAM riparian buffer for a 5th order watercourse, which Wombramurra exists as in this location.	1.59
Border Thick-tailed Gecko*	Habitat polygons include impacted areas of the species' associated PCTs as listed in BioNet, and mapped in Moderate and High condition states, where they are associated rocky areas mapped on site as potentially suitable to support the species, and within the species' known elevation range of 500 – 1000 m altitude.	0.17
Eastern Pygmy Possum*	Habitat polygons include impacted areas of the species' associated PCTs, as listed in BioNet, and mapped as in 'High" condition. Field captured habitat assessments were used to refine the polygons, with the following characteristics excluded: ■ Areas supporting <5% characteristic understorey feed species; ■ Areas mapped as not supporting any tree hollows; ■ Areas mapped as being subject to high severity clearing of the tree canopy; and ■ Areas mapped as being subject to highly or moderately severe agriculture impacts such as cropping, grazing, exotic pasture, soil disturbance.	30.42
Squirrel Glider*	Habitat polygons include impacted areas of the species' associated PCTs, as listed in BioNet, and mapped in Moderate and High condition. Field captured habitat assessments were used to refine the polygons, with the following characteristics excluded: ■ Areas supporting <5% characteristic understorey feed species; ■ Areas mapped as not supporting any tree hollows; ■ Areas mapped as being subject to high severity clearing of the tree canopy; and ■ Areas mapped as being subject to high severity agriculture impacts such as cropping, grazing, exotic pasture, soil disturbance. Furthermore areas where sufficient survey in the form of arboreal camera trapping has been undertaken for the species have been removed from the habitat polygons (as the species was not recorded). Areas retained are considered to have undergone less intensive survey and include the central-southern portion of the wind farm corridor, due to camera traps being burnt in bushfire in this area, and along the transmission line corridor, where nocturnal surveys did not occur.	26.20

9.3.5 Bird Utilisation

An assessment of three potential turbine designs was undertaken to determine which had the greatest impact for potential collision on the target species recorded flying at the rotor swept height. The results of the bird utilisation surveys showed that Wedge-tailed Eagle *Aquila audax* was the species of concern for bird strike that had the greatest number of flights recorded at the rotor swept height. 36 turbine parameters were assessed as variables such as rotor speed can have a greater impact than tip height to collision risk. It was determined the following parameters be used:

- Tower height 139 m
- Rotor diameter 162 m
- Rotor swept height between 58 and 220 m
- Rotational speed of 12.1 rpm

During the bird utilisation surveys, 51 bird species were recorded with 18 of these species recorded flying at the rotor swept height. During the bird utilisation surveys, 224 bird movements (flights) were recorded comprising 33 different bird species. Of the 224 flights recorded, 190 (or 85%) were recorded at between 5 and 20 metres vertical distance (height), indicating that the majority of bird activity within the Development Footprint will not be at risk of blade strike.

Average flight height assessment showed that only four species have an average recorded flight height that is within the rotor swept height, including Australian Raven, Brown Goshawk, Wedge-tailed Eagle and White-breasted Woodswallow. This indicates that for most flights, there are only a small number of native birds that are considered at risk of collision with turbines. All of these birds considered most at risk are listed as least concern under the NSW BC Act and are not listed as listed threatened species or migratory species under the EPBC Act. The SEARs and the BAM require a more detailed assessment of collision risk for resident raptors. The field surveys identified two species of raptor most at risk of collision, Nankeen Kestrel and Wedge-tailed Eagle.

Information from the field surveys and published sources of information was used to estimate the likely number of Wedge-tailed Eagles and Nankeen Kestrels that are likely to occupy the Development Footprint. This determined that the average site population of Wedge-tailed Eagles would be 9 birds and Nankeen Kestrel average population of 33 birds.

Taking into account the likely population at risk, the model returned a likely range of between 0.07 and 0.36 collisions for that species per annum for Nankeen Kestrel and between 0.98 and 5.86 collisions per annum for Wedge-tailed Eagles. Further consideration is provided in Appendix D.

9.1.3 Matters of National Environmental Significance

Based on the results of the desktop investigations, field surveys and the likelihood of occurrence assessments, significant impact assessments were found to be required for the following EPBC Act listed species and TECs.

Threatened Ecological Communities

- White Box-Yellow Box-Blakely's Red Gum Grassy TEC Woodland and Derived Native Grassland (critically endangered)

Listed threatened fauna species

- Spotted-tailed Quoll (endangered)
- Greater Glider (vulnerable)
- Koala (vulnerable)
- Large-eared Pied Bat (vulnerable)

9.4 Assessment of Potential Impacts

9.4.1 Avoidance and Minimisation

Measures to avoid and minimise impacts have been included throughout the development of the design for the Project, including the selection of wind farm layouts, location of ancillary infrastructure such as the O&M facility and substation, access roads and the transmission line based on the results of ecological investigations and ongoing design iterations to minimise biodiversity impacts. In particular:

- the amount of WTGs has been significantly reduced from the initial proposed maximum of 97 turbines down to the current Project layout of up to a maximum of 70 turbines;
- the layout of the wind farm was refined on an going basis to minimise biodiversity impacts;
- the transmission line route was designed and optimised to minimise biodiversity impacts; and
- access roads were designed to be located on existing cleared land and follow existing access track alignments as far as practicable.

The preliminary identification and mapping of biodiversity constraints occurred before the development of the wind farm layout and the selection of the preferred transmission line corridor, with preliminary biodiversity fieldwork completed in the wind farm and transmission line area in November 2018 before concept engineering design commenced. By collecting ecological data early, this allowed for consideration of biodiversity constraints during the concept design development.

Measures to minimise impacts associated with construction and operation have also been considered, with further detail on these provided in Section 8 of the BDAR (Appendix D).

9.4.1.1 Wind Farm Layout

An analysis of the wind farm infrastructure layout between the original 78 and 70 turbine configuration, shows that there is an approximately 30% reduction in native vegetation clearing extents (**Table 9-6**).

Table 9-6 Review of Native Vegetation Impacts after Design Refinements to Minimise Biodiversity Impacts

PCT	78 Turbine Layout	70 Turbine Layout	Change (ha)	Change (%)
1194	100.17	75.65	-24.52	-32%
507	0.35	0.19	-0.17	-89%
927	3.64	0.00	-3.64	-100%
931	5.13	6.30	1.17	19%
934	22.46	17.96	-4.50	-25%
954	2.15	2.73	0.58	21%
TOTAL	**133.90**	**102.82**	**-31.08**	**-30%**

The wind farm layout was also amended to avoid any direct impacts to areas of roost habitat for cave-dwelling bats and no infrastructure is proposed within these important areas. To further avoid impacts a 100m buffer was applied to these areas of roosting habitat on steep cliffs, and as much as possible, the placement of turbines was excluded from this buffer. The assessment has used the formula for required buffers to areas of vegetation developed in *Natural England Technical Information Note TIN051 – Bats and onshore wind turbines interim guidance.* This method takes into consideration the hub height and blade length of adjacent turbines and identifies the required horizontal distance a turbine should be placed to maintain a suitable buffer.

Based on an assumed ground clearance of 58 m from the blade tip, the project wind turbine layout can achieve a minimum of 36 m clearance from top of canopy to blade tip. The assessment shows that:

- 34% of turbines provide a buffer of 30-40 m
- 43% of WTGs provide a buffer of 40-50 m
- 23% of WTGs provide a buffer of > 50 m.

Accordingly, the Project provides an average buffer of 51 m from the tip of blades and the closest area of tree canopy.

9.4.1.2 Transmission Line Selection

During the design development phase a wider landscape was reviewed for potential transmission line corridor. Seven potential transmission line routes were identified and to understand visual impact and willingness to reach land agreements. Desktop and field validated vegetation and habitat maps where reviewed and transmission line options assessed for likely impacts to significant biodiversity features, with a focus on minimising impacts to TECs. A desktop assessment was undertaken to identify the potential impacts to native vegetation communities for each of the seven options using the State Vegetation Mapping for the alignments. Following the review of the seven options an optimisation of a 200 m corridor was undertaken to adjust the routes to minimise further impact around mapped PCTs.

An initial concept transmission line alignment was selected based on route optimisation only and this option was assessed to result in over 150 ha of impact to TECs listed under the BC Act and 55 ha of EPBC Act critically endangered TEC.

Following recommendations to amend the alignment, these impacts have been reduced to 53 ha of impact to BC Act listed TEC and 14 ha of impact to EPBC Act TECs with potential to avoid some of this based on suitable vertical clearance required across gullies that have been assessed as cleared in the BDAR, Upon final pole locations and spanning vertical elevations, these impacts are expected to reduce.

9.4.1.3 Access Roads – Construction and Operation

Existing road infrastructure has been prioritised for construction access and operational tracks. This includes locating primary construction access routes along existing public access roads Head of Peel Road and Morrisons Gap Road. The alignment of access tracks within the Project Area largely follows existing cleared sections.

9.4.2 Impacts on Existing Environment

9.4.2.1 Native Vegetation

A total of 206.70 hectares of native vegetation is contained in the development footprint. It has been conservatively assumed for the purpose of this assessment that all of this native vegetation will need to be cleared although, as noted above, ongoing detailed design will be carried out to further minimise the extent of native vegetation required to be cleared during construction.

The 206.70 hectares of native vegetation which is contained in the Development Footprint represents 0.95% of the approximately 21,540 ha of native vegetation contained within the study area.

The 206.70 hectares of native vegetation includes:

- 19.59 ha for the wind turbine (including lay down areas and hardstands) Development Footprint;
- 65.99 ha for the internal access roads Development Footprint;
- 85.75 ha for the transmission line Development Footprint;
- 18.32 ha for the transmission line access tracks Development Footprint; and
- 17.00 ha for the road upgrades along the transport haul route Development Footprint.

There is substantial variation in the composition of the vegetation communities within the five broad infrastructure types that compose the development footprint. To show the contribution that each infrastructure element has to the overall impacts within the Development Footprint a breakdown of the area of each condition class of vegetation is provided in **Table 9-7.**

Table 9-7 Summary of Vegetation and Condition Type for each Infrastructure Type

Vegetation condition class	Infrastructure element vegetation extent (ha and percentage within each infrastructure type)				
	Wind farm infrastructure	Internal roads	Transmission line	Transmission line access tracks	Transport route
Planted or urban vegetation	0.01 (<1%)	1.27 (1%)	13.18 (10%)	0.009 (<1%)	5.72 (19%)
Exotic grassland	55.70 (74%)	117.55 (64%)	52.11 (38%)	38.90 (68%)	7.67 (25%)
Derived Native Grasslands	4.75 (6%)	8.43 (5%)	13.18 (10%)	3.67 (6%)	0.89 (3%)
Native vegetation – Low condition	1.60 (2%)	8.33 (5%)	22.27 (16%)	4.04 (7%)	0.87 (3%)
Native vegetation – Moderate condition	7.54 (10%)	31.24 (17%)	26.46 (19%	6.47 (11%)	3.90 (13%)
Native vegetation – High condition	7.54 (10%)	18.00 (10%)	23.86 (17%)	4.14 (7%)	11.35 (37%)
Total native vegetation (ha)	19.59 (26%)	65.99 (36%)	85.76 (62%)	18.32 (32%)	17.00 (56%)
Total area planted or exotic (ha)	55.71 (74%)	118.81 (64%)	52.48 (38%)	38.91 (68%)	13.39 (44%)

To mitigate impacts to native vegetation as a result of temporary impacts, site rehabilitation and ecological restoration works will be completed in areas such as batters for access tracks, temporary construction laydown areas and trenching for underground cabling. The biodiversity management plan for the site will also look at opportunities for revegetation and restoration plans to buffer areas of important habitat, such as the adjacent Ben Halls Gap Nature Reserve and to provide for biodiversity corridors through the Development Footprint.

Estimates of areas to be subject to rehabilitation works through seeding or planting with native species, includes a total of 271 hectares and includes:

- 10.60 hectares within the wind farm infrastructure development footprint;
- 89.02 hectares for internal access roads development footprint;
- 119.05 hectares for the transmission line development footprint;
- 23.80 hectares for the transmission line access tracks development footprint; and
- 28.10 hectares for the transport haul route development footprint.

These rehabilitation works will contribute towards minimising the impacts to native vegetation and fauna habitats within the Development Footprint. During detailed design, opportunities to include trees and shrubs in the rehabilitation species mix will be considered where site constraints regarding safety and operation permit. Based on these current estimates for areas to be subject to rehabilitation, the loss of 206.70 hectares of native vegetation can be compensated by the 271 hectares of restoration within the Development Footprint.

9.4.2.2 Threatened species

Table 9-8 presents a summary of directed impacts to habitat for threatened fauna within the Development Footprint as assessed in the BDAR. These are species defined as ‘species credit species’ under the BAM and habitat is mapped separately, as their occurrence in an area cannot be reliably predicted from PCT mapping.

Table 9-8 Direct impacts to habitat for species credit species

Species	Habitat Polygons Impacted (ha)					
	Wind farm infrastructure	Internal roads	Transmission line	Access tracks	Transport haul route	TOTAL
Large-eared Pied Bat (foraging and breeding)	13.07	35.86	10.78	0.94	0.43	**61.08**
Eastern Cave Bat (foraging and breeding)	13.14	37.19	10.78	0.94	0.43	**62.49**
Large Bent-winged Bat (breeding)	3.59	16.97	2.47	0.09	0.00	**23.12**
Little Bent-winged Bat (breeding)	3.59	16.97	2.47	0.09	0.00	**23.12**
Southern Myotis	0.61	1.49	0.00	0.00	0.12	**2.21**
Koala	11.35	25.46	10.02	1.10	2.83	**50.76**
Eastern Pygmy-possum	7.04	15.32	6.16	0.47	1.43	**30.43**
Squirrel Glider	6.76	13.30	3.45	0.17	2.52	**26.20**
Border Thick-tailed Gecko	0	0	0.06	0.111441	0	**0.17**
Booroolong Frog	0	0	0.55	1.591997	0	**2.14**

9.1.4 Collision and Barotrauma Risk (Microchiropteran Bats)

The Project has the potential to cause indirect impacts to the identified threatened microbats recorded within the Development Footprint, primarily through mortality associated with collisions with turbine blades. The Project is considered unlikely to result in any serious and irreversible impacts to threatened microbats due to potential indirect impacts associated with these indirect impacts.

There are no known maternity roost sites for threatened bats within the Development Footprint, however there is a known winter roost for Large Bent-winged Bat at Timor Caves, approximately 5 km from the development footprint. The Development Footprint is also located within 150-280 km to the south and east of four known maternity roosts for Large-eared Pied Bat, which is known to disperse around 200 km from these maternity roosts. As no maternity roosts will be impacted, the project is not considered to result in an impact to the lifecycle or population dynamics of threatened microbat species.

The assessment of bat activity at canopy height and rotor swept height indicates that there is a relatively low potential for microbats to forage in an area subject to collision risk with blades. Based on the data obtained on this site, it is considered likely that the species are more likely to forage directly above the canopy or closer to the ground. There is limited published data on the heights that microbats will fly and forage. It is generally understood that they will fly above the canopy while foraging. A study by Mills and Pernay (2017) recorded very low levels of Eastern Bent-wing Bats flying at 100 m above ground level, only where there was a relatively higher call detection at ground level. In sites where there was lower calls detected at ground level, Mills and Pernay (2017) did not record any Eastern Bent-wing bats flying at the 100 m height range.

The spacing of wind turbines will also allow for substantial locations for migrating and foraging bats to pass through the landscape, with spacing ranging from 300 m to over 500 m between turbines. The layout also retains areas of preferred foraging habitat in steeper areas of terrain, with more densely vegetation gullies. The layout of the turbines are generally on areas of more elevated terrain, providing increased clearance from the areas of foraging habitat above the tree canopy.

An Operational Bird and Bat Management Plan will be prepared prior to construction to assess any bat mortality and to continually assess the assumptions of this impact assessment. The plan will include methods for monitoring bat mortality, acceptable thresholds for mortality and adaptive management regimes if thresholds are exceeded.

9.4.2.3 Collision Risk (Birds)

The SEARs and the BAM require an impact assessment to migratory species and any resident raptors that may be subject to indirect impacts associated with blade strike during the operational phase of the project. The results of the bird utilisation survey and the Collision Risk Model (**BDAR, Appendix D**) indicate that there are no migratory bird species at risk of collision with turbines during the operation of the wind farm. Three resident raptors were identified, including Wedge-tailed Eagle, Nankeen Kestrel and Brown Goshawk.

During field investigations of the site, field staff documented one instance each in which three, four and five Wedge-tailed Eagles were observed simultaneously.

Informed assumptions were able to be developed and employed for the potential site-population sizes of Nankeen Kestrels and Wedge-tailed Eagles and this permitted the model to provide projections expressed as average numbers of potential collisions per annum for those two species. Depending upon avoidance capacity and all other assumptions used for Nankeen Kestrels the model returned a likely range of between 0.07 and 0.36 collisions for that species per annum. Under the same caveats for Wedge-tailed Eagles, the likely range was between 0.98 and 5.86 collisions per annum.

9.4.2.4 Matters of National Environmental Significance

The results of the assessment in the BDAR at Appendix D identified the potential for a significant impact to the following MNES.

- Yellow Box-White Box-Blakely’s Red Gum Grassy Woodland and Derived Native Grassland;
- Koala;
- Large-eared Pied Bat; and
- Spotted-tailed Quoll.

A detailed assessment against the EPBC Act significant assessment criteria is provided in Appendix D.

9.5 Mitigation Measures

Impact	Proposal area	Mitigation measures	Timing	Responsibility
General	Entire development footprint	An Environmental Management Strategy (EMS) will be prepared and implemented, including industry standard measures for the management of soil, surface water and pollutants, weeds, pests and pathogens, as well as site-specific measures and relevant sub-management plans.	Pre-construction/ construction	Contractor
	Entire development footprint	All site workers would be trained to ensure awareness of requirements of the EMS, relevant sub-plans and statutory responsibilities. Site-specific training would be provided when specific work activities were taking place near areas of identified biodiversity value that are to be protected.	Construction	Contractor
Clearing of native vegetation, threatened ecological communities and habitat for threatened flora and fauna	Entire development footprint	Prepare and implement a biodiversity offset strategy, in accordance with the requirements of the BC Act and the EPBC Act Offsets Policy.	Pre-construction	Proponent
Direct impacts to native vegetation	Entire development footprint	Opportunities to further minimise impacts to native vegetation will continue to be explored during the detailed design. This would include measures to minimise the construction footprint and clearing requirements with a particular focus on the protection of hollow bearing trees and fauna movement corridors.	Pre-construction	Proponent
Impacts to native vegetation, threatened ecological communities and habitat for threatened species	Entire development footprint	Opportunities to further minimise impacts to native vegetation will continue to be explored during the detailed design. This would include measures to minimise the construction footprint and clearing requirements with a particular focus on the protection of hollow bearing trees and fauna movement corridors. Upon final design and an understanding of detailed impact, a Biodiversity Management Plan would be prepared and implemented. It would address terrestrial and aquatic matters by including: ■ Plans for the development site and adjoining area showing updated and current extents of native vegetation, flora and fauna habitat, threatened species and threatened ecological communities and measures to minimise impacts to these features. ■ Plans showing areas to be cleared and areas to be protected, including exclusion zones and protected habitat features, and areas for native vegetation rehabilitation or re-establishment.	Pre-construction/ construction	Contractor

Impact	Proposal area	Mitigation measures	Timing	Responsibility
		■ Mapping and identification of individual tree hollows and termite mounds and measures to minimise impacts to these features; ■ Process for communicating biodiversity features to the design team during any turbine micro-siting and design refinements to minimise and avoid impacts. ■ Pre-clearing protocols, including pre-clearing inspections, establishment of exclusion zones and on-ground identification of specific habitat features to be retained and/ or relocated. ■ Vegetation clearing protocols, including staged habitat removal and any specified seasonal limits on clearing activities. ■ Protocols for the salvage and relocation of woody debris, tree hollows and bush rock. ■ Requirements for temporary fencing to minimise the risk of fauna injury / mortality due to vehicle strike or entrapment in deep excavations. ■ Proposed temporary measures for maintaining habitat connectivity for koala and other fauna during construction. ■ Fauna handling and unexpected threatened species finds procedures. ■ Rehabilitation, revegetation, reuse of soils and other habitat management actions. ■ Weed, pest and pathogen management requirements ■ Monitoring during construction and post-construction ■ Adaptive management measures to be applied if monitoring indicates unexpected adverse impacts.		
Impacts to threatened flora	Entire development footprint	A pre-clearing survey is to be carried out to confirm the presence/absence of threatened flora within lands that have not been surveyed within and adjacent to the Development Footprint. As a part of the survey, the size and extent of confirmed threatened flora populations must be determined. The results of the survey are to inform the development of the Biodiversity Management Plan and specific measures for the protection and management of threatened flora. This is to include at a minimum, specific requirements for the clearing process, any proposed translocation opportunities and associated contingency measures.	Pre-construction	Proponent

Impact	Proposal area	Mitigation measures	Timing	Responsibility
	Entire development footprint	An *unexpected finds procedure* is to be prepared and implemented. This would describe the process for identifying, dealing with, and managing any unexpected threatened flora species found during the construction process. It would include the measures for stopping work, engaging a qualified ecologist, contacting the regulators and restarting work.	Construction	Contractor
Impacts to threatened fauna and karst, caves, crevices, cliffs and other geological feature of significance	Entire development footprint	As a part of the Biodiversity Management Plan, opportunities for the salvage and re-use of important habitat features, including tree-hollows and bush rock, are to be identified. The plan is to include detailed procedures for the implementation of these activities.	Pre-construction and construction	Contractor
	Entire development footprint	Opportunities to further minimise any impacts to fauna habitat are to be fully explored through detailed design phase including any strategies for habitat restoration augmentation post-work. Habitat avoidance should prioritise the retention of karst and caves offering potential habitat for threatened fauna.	Pre-construction	Proponent
Impacts to National Park estate	Wind farm corridor	An appropriate buffer must be maintained to National Park estate where possible. Opportunities for increased set-backs to National Park estate are to be fully explored as a part of the detailed design to minimise impacts to resident flora and fauna and their habitats. Instating vegetated buffers between the access tracks and wind turbine pads is to be considered during detailed design. The selection of areas of buffer plantings and species to be planted will be carried out in consultation with the Area Manager, Barrington Tops National Parks and Wildlife Service.	Pre-construction	Proponent
Edge effects and impacts to habitat viability	Entire development footprint	Restore and rehabilitate all areas subject to temporary clearing within the development footprint. Priority should be given to movement corridors for fauna, significant habitats and threatened ecological communities.	Post-construction	Contractor

Impact	Proposal area	Mitigation measures	Timing	Responsibility
Disturbance from weeds, pests and pathogens	Entire development footprint	Management measures would be prepared and implemented to avoid and minimise the environmental risks associated with weeds, pests and pathogens. As a minimum, these would include: ■ Completion of a site weed assessment and development of a Weed Management Plan. The Weed Management Plan would sit as a sub-plan to the Environmental Management Strategy. ■ Implementation of appropriate weed control and weed disposal in accordance with Biosecurity protocols. ■ Any soil or other materials imported to the site for use in restoration or rehabilitation would be certified free from weeds and pathogens or obtained from sources that demonstrate best practice management to minimise weed and pathogen risks. ■ Disposal of any weed material at an appropriately licensed facility. ■ Implementation of appropriate hygiene protocols where there are potential or known pathogen risks.	Construction	Contractor
Habitat disturbance from light	Entire development footprint	Proposal design and construction to minimise light impacts as much as possible through the use of sensor lighting and/ or directional lighting for more heavily utilised parts of the site.	Pre-construction and construction	Contractor/ Proponent
Impacts of wind turbine strikes on protected animals	Wind farm corridor	Bird and bat activity within the site is generally concentrated around areas of vegetation. Maintain a minimum safe distance of 30 m from the turbine blade tip to the adjacent tree canopy to minimise any risk of bird or bat strike.	Pre-construction, post-construction	Proponent
	Wind farm corridor	Prepare and implement an operational Biodiversity Management Plan detailing ongoing measures for the protection and management of flora and fauna during the operational phase of the proposal. The plan is to identify at a minimum: ■ Target species, important habitats and ecological features to be monitored and managed within the site ■ Specific management measures to be implemented during operations including a proposed schedule for implementation ■ Requirements for the monitoring of target species, important habitats and ecological features within the site and processes to be implemented to ensure an adaptive management approach ■ Specific requirements for the monitoring and management of bird and bat mortality from blade strike including any considerations for the timing of species seasonal movements and/ or breeding periods.	Post-construction	Proponent

Impact	Proposal area	Mitigation measures	Timing	Responsibility
		■ Suitable measures (such as adjusting turbine cut in/ cut out speeds, or temporary shut-down) must be identified for the minimisation and management bird and bat strike risks during operation. ■ Performance objectives and proposed contingency measures. ■ Roles, responsibilities and reporting requirements		
		Prepare and implement a Bird and Bat Management Plan (BBMP). The BBMP will include: ■ A description of measures to be implemented on the wind farm site for minimising bird and bat strike ■ Suitable measures must be identified for the minimisation and management bird and bat strike risks during operation. ■ Trigger levels for further investigation and mitigation measures to be implemented ■ An adaptive management plan to be implemented if the monitoring determines threatened or at risk species are subject to adverse impacts. A detailed monitoring and reporting plan to assess the potential impacts and effectiveness of design and operational measures to mitigate bird and bat strike	Pre-construction and operation	Proponent
Impacts to water quality and hydrology	Entire development footprint	Prepare and implement a Soil and Water Management Plan outlining measures for the management and monitoring of surface water quality and hydrology during construction. The plan would also address any requirements for the management of potential acid sulfate soils or contaminated lands during construction so as to minimise impacts to terrestrial and aquatic habitats. The plan would include the implementation of a construction surface water quality monitoring to minimise impacts to surface water quality.	Construction and operation	Contractor/ Proponent
	Entire development footprint	Prepare and implement an Erosion and Sediment Control Plan outlining measures for the prevention of erosion and sedimentation during construction.	Pre-construction and construction	Contractor/ Proponent
Impacts to aquatic habitats and fish passage	Access/ transport routes	Proposed waterway crossings associated with access / transport routes are to minimise impacts to aquatic habitat and address Fisheries requirements for maintaining fish passage.	Pre-construction and construction	Contractor/ Proponent

Impact	Proposal area	Mitigation measures	Timing	Responsibility
Fauna injury / mortality	Entire development footprint	The Biodiversity Management Plan is to include the following specific requirements to minimise and manage any risk of fauna injury mortality during construction: ■ Strategies for fauna management during construction including any identification roles, responsibilities and contingency measures such as temporary stop works and engagement of fauna specialist. ■ Requirements for temporary fencing to minimise the risk of fauna injury / mortality due to vehicle strike or entrapment in deep excavations. ■ Protocols for fauna handling and management of adverse incidents.	Construction	Contractor
Impacts to habitat connectivity	Entire development footprint	The following opportunities are to be fully explored as a part of the detailed design: ■ Opportunities to further minimise the disturbance footprint and clearing within important movement corridors for fauna. ■ Opportunities for post-works restoration of habitat connectivity within important movement corridors for fauna.	Pre-construction	Proponent
Impacts to habitat connectivity	Transmission line	The following measures should be implemented post-construction to minimise impacts to flora and fauna within the transmission line easement: ■ Promote the growth of vegetation under the transmission line to the maximum allowable height to maintain habitat connectivity for fauna. ■ Understorey vegetation in easements should be managed to maintain composition and quality and to prevent weed invasion. ■ Install glider poles for glider species in areas where the width of the transmission line easement exceeds minimum requirements for species movement.	Post-construction	Proponent
Effectiveness of mitigation and management measures	Entire development footprint	Consistent with any specific requirements of the Biodiversity Management Plan, a monitoring program would be implemented during construction to assess the effectiveness of mitigation and management measures implemented, to identify any unexpected impacts and appropriate contingency measures necessary for the protection of biodiversity. A register of inspections will be established.	Construction and post-construction	Contractor/ Proponent

9.6 Impact Summary and Biodiversity Offset Requirements

For residual impacts that cannot be avoided or fully mitigated, offsets will be required to ensure no net loss of biodiversity.

The summary below in Table 9-9 represents a worst case calculation of potential impacts which may be required to be offset. Table 9-10 sets out the maximum offsets that may be required.

During the detailed design phase of the project refinements to the BAM Calculator will be required to assess impacts and offsets and confirm final biodiversity credit requirements.

Table 9-9 Summary of proposal impacts subject to assessment and offset under the BOS

Relevant matter	Details	Direct impacts (ha)
Native vegetation communities	Direct loss of native vegetation communities associated with site clearing	206.7
Threatened ecological communities	Direct loss of Ribbon Gum—Mountain Gum—Snow Gum Grassy Forest/Woodland of the New England Tableland Bioregion	57.43
	Direct loss of White Box Yellow Box Blakely's Red Gum Woodland and derived native grassland	13.33
Habitat for threatened fauna species	Large-eared Pied Bat	61.08
	Little Bent-winged Bat	23.12
	Large Bent-winged Bat	23.12
	Eastern Cave Bat	62.49
	Southern Myotis	2.21
	Koala	50.76
	Eastern Pygmy-possum	30.43
	Squirrel Glider	26.20
	Booroolong Frog	2.14
	Border Thick-tailed Gecko	0.17

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Table 9-10 Biodiversity offsets required to address residual impacts

Credit class	Relevant matter	Associated TEC	Direct impacts (hectares)	Estimated number of credits
Ecosystem	PCT 84: River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion		0.17	6
	PCT 433: White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region, BBS Bioregion	White Box Yellow Box Blakely's Red Gum Woodland and derived native grassland	0.08	4
	PCT 434: White Box grass shrub hill woodland on clay to loam soils on volcanic and sedimentary hills in the southern Brigalow Belt South Bioregion		0.02	1
	PCT 450: PCT 450 - Smooth-barked Apple - White Cypress Pine grass shrub woodland on lower slopes and sandy flats, north-western Brigalow Belt South Bioregion		1.5	64
	PCT 486 - River Oak moist riparian tall open forest of the upper Hunter Valley, including Liverpool Range		7.55	278
	PCT 490- Silvertop Stringybark - Forest Ribbon Gum very tall moist open forest on basalt plateau on the Liverpool Range, Brigalow Belt South Bioregion		3.1	116
	PCT 492: Silvertop Stringybark - Yellow Box - Apple Box - Rough-barked Apple shrub grass open forest mainly on southern slopes of the Liverpool Range, Brigalow Belt South Bioregion	White Box Yellow Box Blakely's Red Gum Woodland and derived native grassland	9.81	371
	PCT 507: Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion		0.15	5
	PCT 510: Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	White Box Yellow Box Blakely's Red Gum Woodland and derived native grassland	0.25	2
	PCT 526 - Mountain Ribbon Gum - Messmate - Broad-leaved Stringybark open forest on granitic soils of the New England Tableland Bioregion		0.5	22

Credit class	Relevant matter	Associated TEC	Direct impacts (hectares)	Estimated number of credits
	PCT 538: Rough-barked Apple - Blakely's Red Gum open forest of the Nandewar Bioregion and western New England Tableland Bioregion	White Box Yellow Box Blakely's Red Gum Woodland and derived native grassland	0.01	1
	PCT 540 - Silvertop Stringybark - Ribbon Gum - Rough-barked Apple open forest on basalt hills of southern Nandewar Bioregion, southern New England Tableland Bioregion and NSW North Coast Bioregion		69.6	2,610
	PCT 541 - Silvertop Stringybark - Rough-barked Apple grassy open forest of southern Nandewar Bioregion, southern New England Tableland Bioregion and NSW North Coast Bioregion		30.0	1,142
	PCT 591: White Box shrubby open forest on hills mainly in the Nandewar Bioregion		0.65	24
	PCT 599: Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	White Box Yellow Box Blakely's Red Gum Woodland and derived native grassland	3.35	157
	PCT 931 - Messmate - Mountain Gum tall moist forest of the far southern New England Tableland Bioregion		5.62	226
	PCT 934 - Messmate open forest of the tableland edge of the NSW North Coast Bioregion and New England Tableland Bioregion		15.52	581
	PCT 954 - Mountain Ribbon Gum - Messmate open forest of escarpment ranges of the NSW North Coast Bioregion and New England Tableland Bioregion		1.4	32
	PCT 1192- Snow Gum - Mountain Gum - Mountain Ribbon Gum grassy open forest of the New England Tableland Bioregion	Ribbon Gum—Mountain Gum—Snow Gum Grassy Forest/Woodland of the New England Tableland Bioregion	1.0	51
	PCT 1194 - Snow Gum - Mountain Gum - Mountain Ribbon Gum open forest on ranges of the NSW North Coast Bioregion and eastern New England Tableland Bioregion	Ribbon Gum—Mountain Gum—Snow Gum Grassy Forest/Woodland of the New England Tableland Bioregion	56.5	2,321

Credit class	Relevant matter	Associated TEC	Direct impacts (hectares)	Estimated number of credits
Species	Large-eared Pied Bat	NA	61.08	3,767
	Little Bent-winged Bat	NA	23.12	1,465
	Large Bent-winged Bat	NA	23.12	1,465
	Eastern Cave Bat	NA	62.49	4,134
	Southern Myotis	NA	2.21	99
	Koala	NA	50.76	2,182
	Eastern Pygmy-possum	NA	30.43	1,307
	Squirrel Glider	NA	26.20	1179
	Booroolong Frog	NA	2.14	77
	Border Thick-tailed Gecko	NA	0.17	8

9.7 Conclusion

The impacts to biodiversity as a result of the Project have been avoided and minimised as much as practicable through design phase refinements. Further mitigation measures are outlined and proposed to be adopted to minimise biodiversity impacts during the construction and operational phases and include the provisions of biodiversity offsets, management measures and monitoring and adaptive management measures.

The BDAR confirms that there are no serious and irreversible impacts from the Project. This is because:

- there is sufficient habitat availability in the wider landscape and study area to continue to support threatened species known to occur within the development footprint;
- the Project design has been refined so that the majority of vegetation impacts occur on areas that contain exotic grassland;
- the Project design avoids areas of breeding habitat for threatened microbats, by locating all infrastructure outside of the mapped cliffs and steep areas;
- impacts to high quality vegetation communities, containing higher quality fauna habitat have been minimised through the location of infrastructure; and
- residual impacts associated with the project will be offset in accordance with the NSW Biodiversity Offset Scheme and the EPBC Act Offsets Policy. Once these offsets are applied, no net loss to biodiversity should be achieved.

10. NOISE AND VIBRATION

10.1 Introduction

A Noise and Vibration Assessment was undertaken by Sonus for the construction and operation of the proposed Project (refer Appendix E). Sonus contributed to the preparation of this chapter.

The SEARs for the assessment of noise and vibration from the Project require the EIS to:

- assess wind turbine noise in accordance with the *NSW Wind Energy: Noise Assessment Bulletin* (DPE, 2016) (**the Bulletin**);
- assess noise generated by ancillary infrastructure in accordance with the *NSW Noise Policy for Industry* (EPA, 2017) (**the NPI**);
- assess construction noise under the *Interim Construction Noise Guideline* (DECC, 2009) (**Construction Noise Guideline**);
- assess traffic noise under the *NSW Road Noise Policy* (DECCW, 2011) (**Road Noise Policy**); and
- assess vibration under the *Assessing Vibration: A Technical Guideline* (DEC, 2006).

Reference is also made to the South Australian Environment Protection Authority *Wind Farms – Environmental Noise Guidelines* (EPA SA, 2009) (the **SA Noise Guidelines**) as the Bulletin adopts the SA Noise Guidelines as the basis of the assessment methodology in NSW.

In addition to the above requirements, the NSW EPA provided a letter outlining its requested Environmental Assessment Requirements (EARs). The EARs are generally addressed by the requirements under the SEARs, with the exception of the following regarding potential blasting:

> If blasting is required for any reasons during the construction or operational stage of the proposed development, blast impacts should be demonstrated to be capable of complying with the guidelines contained in Australian and New Zealand Environment Council – *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (ANZEC, 1990).

The noise and vibration assessment (Appendix E) addresses the SEARs and EARs for the project. The assessment provides conservative predictions of the noise and vibration resulting from the construction and operation of the wind farm and compares the levels predicted to be received at surrounding dwellings with relevant criteria under the applicable noise and vibration policies and standards.

10.2 Existing Environment

Background noise monitoring was undertaken at six (6) residential locations and one (1) community location over approximately six weeks from May to June 2020 to provide an indication of the existing acoustic environment of the inhabited areas surrounding the Project. The monitoring locations were selected by Sonus based on review of the Project layout and nearby dwellings, previous experience with similar projects and access to the locations being granted. These include three locations (NAD33, NAD12 and Nundle Township) which were specifically requested by members of the community during consultation. The locations are detailed in Table 10-1.

Table 10-1 Noise Monitoring Location Coordinates.

Measurement Location	Coordinates (UTM WGS84 56 J)	
	Easting	Northing
AD_2	328741	6505957
NAD_5	324010	6508244
NAD_11	327750	6510937
NAD_12	328026	6511246
NAD_33	320268	6509243
NAD_74	315164	6507289
Nundle Township	321826	6516741

The background noise levels were measured in 10 minute intervals with Rion Class 1 sound level meters, with microphones positioned approximately 1.5 m above ground level. The wind speed at the microphone was also measured at each noise monitoring location, as well as rainfall at two of the locations.

In accordance with the procedures of the Bulletin and SA Noise Guidelines, periods have been excluded when rain or high wind speeds at the microphone may have affected the background noise measurements. Specifically, periods have been excluded when rainfall was measured and when the wind speed exceeded 5 m/s at the microphone height for more than 90 % of the measurement period. These periods have been excluded because there is the potential for wind and rain on the microphone to artificially increase the background noise level in the environment.

During the noise monitoring, wind speed data was collected at four measurement locations within the Project Area, in 10 minute intervals, at heights between 60 m and 200 m. The noise data at each monitoring location was correlated with the wind speeds measured at the nearest weather monitoring location at an indicative hub height of 150 m. The 150 m wind speed reference data used corresponds to approximately the hub height of the tallest turbine being considered and enables a conservative assessment of background noise levels against wind speeds. A least squares regression analysis of the data was undertaken to determine the line of best fit for the correlations. Based on the line of best fit, the background noise levels ($L_{A90,\ 10min}$) were determined for each integer hub height wind speed.

Table 10-2 summarises the background noise levels determined for each integer wind speed at an indicative hub height of 150 m between 3 and 12 m/s.

Table 10-2 Background Noise Levels ($L_{A90,\ 10\ min}$) at Monitoring Locations (dB(A))

Measurement Location	Wind Speed (m/s) at 150 m									
	3	4	5	6	7	8	9	10	11	12
AD 2	21	22	22	23	23	24	24	25	25	26
NAD 5	22	22	23	24	25	26	27	28	30	31
NAD 11	22	23	24	25	26	28	30	32	35	38
NAD 12	20	21	22	23	25	27	29	31	33	35
NAD 33	24	25	25	25	25	25	26	26	26	26
NAD 74	24	25	26	26	26	25	25	25	25	25
Nundle Township	26	26	26	27	27	26	26	26	26	25

10.3 Assessment of Impacts

10.3.1 Wind Turbine Operation

The criteria for the assessment of wind turbine operational noise are contained in the Bulletin and the SA Noise Guidelines. These require that operational noise impacts from wind farms at non-associated dwellings should not exceed an outdoor noise level of 35 dB(A) or the background noise ($L_{A90,\ 10\ minute}$) by more than 5 dB(A), whichever is the greater.

Where a dwelling is associated with the wind farm, because the landowner has entered into a commercial agreement with the developer, the Bulletin and SA Noise Guidelines require less onerous noise criteria and reference the sleep disturbance levels in the World Health Organisation (WHO) *Guidelines for Community Noise* (**WHO Guidelines**). The WHO Guidelines set an outdoor level of 45 dB(A) to protect against sleep disturbance and this level has been applied to all associated dwellings.

Each of the residential receivers in the vicinity of the proposed Project has been considered and the most representative background noise measurement location assigned. The operational noise criteria has then been determined based on the background noise level assigned at each dwelling location. The Project operational noise criteria for each dwelling in the vicinity are provided in Table 10-3 as well as the monitoring location which has been assigned to that dwelling.

Table 10-3 Wind Farm Operating Noise Criteria (dB(A))

Representative Measurement Location	Associated / Non-Associated	Receiver Locations	Wind Speed (m/s) at 150 m									
			3	4	5	6	7	8	9	10	11	12
AD 2	Y	AD 2, AD 11	45	45	45	45	45	45	45	45	45	45
	N	NAD 3, NAD 4a, NAD 4b, NAD 4c, NAD 48, NAD 67	35	35	35	35	35	35	35	35	35	35
NAD 5	Y	AD 3, AD 6, AD 8, AD 13	45	45	45	45	45	45	45	45	45	45
	N	NAD 5, NAD 10, NAD 10a, NAD 17, NAD 66	35	35	35	35	35	35	35	35	35	36
NAD 11, NAD 12	N	NAD 7, NAD 8, NAD 11	35	35	35	35	35	35	35	36	38	40
NAD 12	Y	AD 5	45	45	45	45	45	45	45	45	45	45
	N	NAD 12, NAD 13, NAD 14, NAD 15, NAD 16, NAD 18, NAD 19, NAD 20, NAD 23, NAD 24, NAD 25, NAD 26, NAD 30, NAD 32, NAD 38, NAD 39, NAD 40, NAD 44, NAD 35, NAD 36, NAD 37, NAD 57, NAD 58, NAD 59, NAD 60, NAD 61, NAD 62, NAD 63, NAD 64, NAD 65	35	35	35	35	35	35	35	36	38	40
NAD 33	N	NAD 33, NAD 45, NAD 47, NAD 68, DAD 10	35	35	35	35	35	35	35	35	35	35
NAD 74	Y	AD 7, AD 10	45	45	45	45	45	45	45	45	45	45
	N	NAD 1, NAD 21, NAD 22, NAD 34, NAD 41, NAD 49, NAD 50, NAD 51, NAD 52, NAD 53, NAD 54, NAD 55, NAD 56, NAD 69, NAD 70, NAD 71, NAD 72, NAD 73, NAD 74	35	35	35	35	35	35	35	35	35	35
Nundle Township	N	NAD 75, NAD 76, NAD 77, Nundle Township	35	35	35	35	35	35	35	35	35	35

Predicted WTG operational noise has been modelled based on the following:

- A candidate wind turbine for the Project, with a hub height of 150 m. [4]
- Sound Power Levels for the representative wind turbine, as provided in Table 10-4 for the "Normal" operating mode.

Table 10-4 WTG Sound Power Level – "Normal" Operating Mode

Hub Height Wind Speed (m/s)	Sound Power Level (dB(A) re 1 ρW)
3	93.5
4	93.7
5	94.3
6	97.3
7	100.2
8	102.9
9 and above	104

The noise modelling is intended to provide a conservative worst case assessment of operational noise and therefore includes a number of assumptions corresponding to the worst case conditions (resulting in the highest noise level at dwellings). These include:

- weather category 6 (representing a temperature inversion and wind conditions that assist with the propagation of noise);
- atmospheric conditions at 10°C and 80% relative humidity (representing conditions that result in low levels of noise absorption from the atmosphere);
- assuming the wind is blowing from all turbine locations towards the particular dwelling under consideration, even in circumstances where sources are located in opposite directions from the dwelling (representing the absolute worst-case noise propagation from the wind). This will overestimate the predicted noise level where receptors have WTGs located around them in more than a singular direction or quadrant as wind is not able to blow in more than one directional quadrant simultaneously;
- acoustically soft ground (representing the pastoral nature of the land); and,
- maximum barrier attenuation from topography of 2 dB(A) (representing a conservative assessment of any shielding provided by topography).

The operational noise level from the Project outside each of the dwellings in the vicinity of the wind farm was predicted for each integer wind speed from cut in to rated power. The predictions have been compared with the relevant criterion at each dwelling outlined in Table 10-3. Table 10-5 provides the predictions and criteria for dwellings where the noise level is 30 dB(A) or greater. Where the modelled noise level exceeds the noise criteria, it is shown in **BOLD** in Table 10-5**.**

[4] The assessment is based on the highest hub height being considered and is a conservative approach. For lower hub heights, the noise criteria which are adjusted for background noise would be less onerous.

Table 10-5 Wind Farm Noise Predictions at Dwellings

Dwelling ID	Noise Level at Hub Height integer wind speeds, 150 m AGL (dB(A))																			
	3 m/s		4 m/s		5 m/s		6 m/s		7 m/s		8 m/s		9 m/s		10 m/s		11 m/s		12 m/s	
	Criterion	Prediction	Criterion	Prediction	Criterion	Prediction	Criterion	Prediction	Criterion	Prediction	Criterion	Prediction	Criterion	Prediction	Criterion	Prediction	Criterion	Prediction	Criterion	Prediction
Associated Dwellings																				
AD_2	45	<25	45	<25	45	<25	45	25	45	28	45	31	45	32	45	32	45	32	45	32
AD_3	45	<25	45	<25	45	<25	45	27	45	30	45	33	45	34	45	34	45	34	45	34
AD_5	45	33	45	33	45	34	45	37	45	39	45	42	45	43	45	43	45	43	45	43
AD_6	45	26	45	26	45	27	45	30	45	33	45	36	45	37	45	37	45	37	45	37
AD_8	45	28	45	28	45	29	45	32	45	34	45	37	45	38	45	38	45	38	45	38
AD_11	45	28	45	28	45	29	45	32	45	34	45	37	45	38	45	38	45	38	45	38
AD_13	45	<25	45	<25	45	<25	45	27	45	30	45	33	45	34	45	34	45	34	45	34
AD_27	45	<25	45	<25	45	<25	45	26	45	29	45	32	45	33	45	33	45	33	45	33
Non Associated Dwellings																				
NAD_4a	35	<25	35	<25	35	<25	35	<25	35	26	35	29	35	30	35	30	35	30	35	30
NAD_4b	35	<25	35	<25	35	<25	35	<25	35	26	35	29	35	30	35	30	35	30	35	30
NAD_4c	35	<25	35	<25	35	<25	35	<25	35	26	35	29	35	30	35	30	35	30	35	30
NAD_5	35	25	35	25	35	26	35	29	35	32	35	35	35	**36**	35	**36**	35	**36**	36	36
NAD_7	35	<25	35	<25	35	<25	35	27	35	29	35	32	35	33	36	33	38	33	40	33
NAD_8	35	27	35	27	35	28	35	31	35	34	35	**36**	35	**38**	36	**38**	38	38	40	38
NAD_10a	35	<25	35	<25	35	<25	35	26	35	29	35	32	35	33	35	33	35	33	36	33
NAD_11	35	27	35	27	35	28	35	31	35	34	35	**36**	35	**37**	36	**38**	38	38	40	38
NAD_12	35	<25	35	<25	35	26	35	29	35	31	35	34	35	35	36	35	38	35	40	35

Dwelling ID	Noise Level at Hub Height integer wind speeds, 150 m AGL (dB(A))																			
	3 m/s		4 m/s		5 m/s		6 m/s		7 m/s		8 m/s		9 m/s		10 m/s		11 m/s		12 m/s	
	Criterion	Prediction	Criterion	Prediction	Criterion	Prediction	Criterion	Prediction	Criterion	Prediction	Criterion	Prediction	Criterion	Prediction	Criterion	Prediction	Criterion	Prediction	Criterion	Prediction
NAD_13	35	<25	35	<25	35	<25	35	26	35	29	35	31	35	33	36	33	38	33	40	33
NAD_14	35	<25	35	<25	35	<25	35	<25	35	28	35	31	35	32	36	32	38	32	40	32
NAD_15	35	<25	35	<25	35	<25	35	<25	35	27	35	30	35	31	36	31	38	31	40	31
NAD_16	35	<25	35	<25	35	<25	35	<25	35	26	35	29	35	30	36	30	38	30	40	30
NAD_67	35	26	35	27	35	27	35	30	35	33	35	**36**	35	**37**	35	**37**	35	**37**	35	**37**

Based on the modelling provided in Table 10-5, the noise from the 70 WTGs will achieve the operational noise criteria at all dwellings in the vicinity of the wind farm, with the exception of dwellings NAD_5, NAD_8, NAD_11 and NAD_67, where there are modelled exceedances of up to 3 dB(A)for certain wind speeds only.

To ensure that these modelled exceedances do not arise:

- a curtailment regime based on operating specific WTG's in noise reduced modes is provided in Section 10.4, which will enable full compliance with the noise criteria at all locations;
- the noise from the final WTG selection and layout will be modelled prior to construction of the wind farm commencing. The modelling will confirm the need for a curtailment regime based on the final Project details; and
- operational noise monitoring will be carried out once a final turbine model has been selected and installed at the Project and following the commencement of operations.

It is also noted that since the assessment of noise impacts, the owners of eight dwellings have entered into commercial agreements with the wind farm developer and these dwellings should now be considered as Associated Dwellings. Based on the assessment, these locations are predicted to achieve the noise criteria assigned to non-associated dwellings and therefore will easily achieve the criteria for an associated dwelling.

10.3.2 Ancillary Infrastructure

The *NSW Noise Policy for Industry* (NPI) establishes noise trigger levels which are based on:

- the existing background noise environment (intrusiveness noise levels); and
- the amenity for particular land uses (amenity noise levels).

For ancillary infrastructure that may operate at any time of the day, the noise trigger level is 35 dB(A).

No significant noise sources are proposed at the switching station and the noise from transmission line (Corona or Aeolian noise) is generally addressed by the separation distance required for other factors with the lines. Accordingly, only the operational noise from the proposed substation requires further assessment.

The proposed substation will include a transformer which has been assessed against the objective noise criteria. Predictions have been made based on a high-voltage transformer with an overall capacity of 500 MVA.

Based on the predictions and the assumed size of the substation, a noise level of less than 20 dB(A) is predicted for the closest non-associated dwelling, therefore easily achieving the criteria.

10.3.3 Construction

The *Interim Construction Noise Guideline* (ICNG) provides an emphasis on implementing "feasible" and "reasonable" noise reduction measures and does not set mandatory objective criteria. The ICNG establishes a quantitative approach, whereby "management levels" are defined based on the existing Rating Background Level (RBL), as determined through measurements of the existing noise environment.

Based on the above, the construction noise management levels and the requirement for "feasible" and "reasonable" noise reduction measures are summarised in Table 10-6.

Table 10-6 ICNG Requirements.

<table>
<tr><th>Time of Day</th><th>Management level
$L_{Aeq, 15 min}$</th><th>How to Apply</th></tr>
<tr><td rowspan="2">Recommended standard hours:

Monday to Friday
7 am to 6 pm

Saturday
8 am to 1 pm

No work on Sundays or public holidays</td><td>Noise affected
RBL + 10 dB = 45 dB(A)</td><td>The noise affected level represents the point above which there may be some community reaction to noise.
■ Where the predicted or measured $L_{Aeq, 15min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.
■ The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.</td></tr>
<tr><td>Highly noise affected
75 dB(A)</td><td>The highly noise affected level represents the point above which there may be strong community reaction to noise.
■ Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account:
○ times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences.
○ if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.</td></tr>
<tr><td>Outside recommended standard hours</td><td>Noise affected
RBL + 5 dB = 35dB(A)</td><td>A strong justification would typically be required for works outside the recommended standard hours.
■ The proponent should apply all feasible and reasonable work practices to meet the noise affected level.
■ Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.</td></tr>
</table>

Predictions of the noise from various construction activities have been made based typical sound power levels and on weather conditions that are the most conducive for the propagation of noise. To provide an indication of the noise level at dwellings, the predictions are based on the distance between turbine locations and dwellings and having line of sight to the construction activity, without the influence of barriers or topography. This represents a conservative assessment approach. The predictions indicate that construction:

- during standard hours will potentially be greater than 45 dB(A) for some activities at a limited number of non-associated dwellings (7 locations). However, the predicted noise levels are significantly less than 75 dB(A), which represent the point where there may be strong community reaction to noise; and
- outside of standard hours, the noise from construction will potentially be greater than 35 dB(A) for some activities. That is, noise from temporary batching may exceed 35 dB(A) at 2 dwellings (NAD_8 and NAD_11) and concrete pouring at 7 locations (NAD_5, NAD_7, NAD_8, NAD_11, NAD_12, NAD_13 and NAD_67) (NAD_13 is now AD_13 following agreement under the Neighbour Benefits Sharing Program).

For construction with noise levels as detailed above, the ICNG requires the developer to apply all feasible and reasonable work practices, and to inform the residents of the proposed construction work. Details of the feasible and reasonable mitigation measures which will be implemented are provided in Section 10.4.

10.3.4 Blasting

The separation distances between any potential blasting activity associated with construction and the nearest dwellings are of the order of magnitude for which ground vibration and airblast levels have been adequately controlled at other sites.

Given the range of factors associated with both the generation and control of blasting, it is recommended that in the event of blasting occurring, a monitoring regime will be implemented to ensure compliance with the Australian and New Zealand Environment Council – *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (ANZEC, 1990).

10.3.5 Traffic

The restricted access vehicle (RAV) route from the Port of Newcastle to the Project Area would involve accessing the New England Highway, via Industrial Drive, Newcastle, onto the Hunter Expressway, with bypasses of the Singleton and Muswellbrook townships before departing the highway at Lindsay Gap Road near Nundle. At Lindsay Gap Road the RAV transport continues through to Nundle Road and the village of Nundle and to Barry Road and Morisons Gap Road to the northern access for the Project Area or to a potential alternate route for some plant and deliveries via Crawney Road and Head of Peel Road to the Project Area's southern access.

The *NSW Road Noise Policy* (RNP) criteria for "Local Roads - Existing residences affected by additional traffic on existing local roads generated by land use developments" are equivalent ($L_{Aeq,\ 1hour}$) noise levels of 55 dB(A) during the day-time (7 am to 10 pm) and 50 dB(A) during the night-time (10 pm to 7 am).

The traffic noise assessment in Appendix E considers the noise at the closest (worst case) dwelling to any road/track, based on a setback distance in the order of 25 m from a highway (or rural road with 100 kph speed limit) and 10 m within any township, including Nundle and Hanging Rock.

It is predicted that for a dwelling set back 25 m from a highway, the 55 dB(A) criterion will be achieved in all hours when the project related vechile movements do not exceed 20 passenger vehicle movements and 6 heavy vehicle movements. For a dwelling within the township of Nundle (dwellings assessed based on a 10 m set back from the roadside), the criterion will also be achieved in all hours when the project related vechile movements do not exceed 20 passenger vehicle movements and six (6) heavy vehicle movements in one hour.

The above assessment demonstrates that the RNP can be satisfied with relatively large number of vehicle movements. It is also noted that roads such as highways and Barry Road would already be exposed to levels of traffic which exceed these trip numbers.

Notwithstanding, during the peak of construction (from month 6 to 14) the number of vehicles associated with the wind farm development, using the preferred access route is predicted to exceed the above traffic volumes. During this specific time, which is limited in duration, peak morning traffic levels are expected to reach up to 109 light vehicle trips and 18 large vehicles within one hour. For this level of activity, a noise level of 60 dB(A) is predicted at 25 m from a highway and 62 dB(A) at 10 m from the road within a township.

It is noted that during operation of the wind farm, the levels of traffic associated with the site are expected to be far less and would achieve the criteria by a significant margin. Section 10.4 outlines the steps that will be adopted to reduce traffic noise impacts during the construction stage of the project.

10.3.6 Construction Vibration

For construction activity occurring during the day-time, *Assessing Vibration: A Technical Guideline* (Technical Guideline) can be interpreted to provide the vibration criteria in the following Table 10-7 at the dwellings, based on the core document used as the technical basis for the Technical Guideline, the British Standard BS 6472-1992 "*Evaluation of human exposure to vibration in buildings (1-80Hz)*".

Table 10-7 Vibration Criteria

Continuous Vibration Vertical (rms)		Impulsive Vibration Vertical (rms)		Vibration Dose Value for Intermittent Vibration	
Preferred	Maximum	Preferred	Maximum	Preferred	Maximum
0.01 m/s2	0.02 m/s2	0.3 m/s2	0.6 m/s2	0.2 m/s1.75	0.4 m/s1.75

It is expected that the main sources of construction vibration will be the rock trenching equipment and roller operation, during the civil construction. The level of vibration at a distance will be subject to the input of the equipment and the local ground conditions. Typically, the distances required to achieve the construction vibration criteria provided in the Technical Guideline are in the order of 20 m. At a distance of 100 m, vibration from these activities is unlikely to be detectable.

Based on the separation distances between the construction activities and the nearest dwellings being well in excess of 100 m, vibration levels are predicted to easily achieve the criteria.

10.4 Mitigation Measures

In order to ensure compliance with the SEARs, mitigation measures will be implemented for each of the noise and vibration related aspects of the Project.

10.4.1 Wind Turbine Operation

Based on the modelled exceedances of wind turbine noise of up to 3 dB(A) at up to four non-associated dwellings during certain wind speeds, a curtailment regime has been developed in order to ensure the noise from the wind farm will practically achieve the criteria at all dwellings and all wind speeds. The curtailment regime involves operating selected turbines in a noise reduced mode at the wind speeds where the predictions indicate that the criteria will be exceeded.

Based on the above, the curtailment strategy has been developed using the five available reduced noise modes of the representative turbine (ranging from a small reduction in output to a large reduction and identified below as A to E).

Table 10-8 provides the noise modes and applicable turbines which are required to operate in the modes in order to ensure the criteria are achieved. This curtailment strategy has been developed based on the maximum 70 turbine layout proposed and the reference turbine model assessed.

Table 10-8 Curtailed Operating Strategy

<table>
<tr><th></th><th colspan="5">Noise Reduced Mode Operation @ Hub Height (m) Integer Wind Speeds</th></tr>
<tr><th>Turbine</th><th>8 m/s</th><th>9m/s</th><th>10 m/s</th><th>11 m/s</th><th>12 m/s
(and above)</th></tr>
<tr><td>WP55</td><td colspan="5">E</td></tr>
<tr><td>WP54</td><td>B</td><td colspan="4">C</td></tr>
<tr><td>WP57</td><td>A</td><td colspan="4">C</td></tr>
<tr><td>WP53</td><td>N/A</td><td colspan="4">B</td></tr>
<tr><td>WP52, WP56, WP58</td><td>N/A</td><td colspan="4">A</td></tr>
<tr><td>WP69</td><td>B</td><td>D</td><td>C</td><td colspan="2">N/A</td></tr>
<tr><td>WP70</td><td>D</td><td>E</td><td>C</td><td colspan="2">N/A</td></tr>
<tr><td>WP68</td><td>B</td><td>B</td><td colspan="3">N/A</td></tr>
</table>

As set out in Table 10-9 below, the modelling confirms that if the curtailment strategy is implemented for wind speeds of 8m/s and above, the noise levels from the wind farm are predicted to fully comply with the noise criteria at all dwellings in the vicinity. . Given that the noise assessment is based on the proposed turbine layout, an assessed representative turbine model and that both the project layout and turbine model selection may change during the detailed design of the Project, the need for curtailment and the final operating strategy will be determined during a pre-construction noise assessment. This assessment will consider the final turbine selection, layout and guaranteed sound power levels. Operational noise monitoring will also be carried out following commissioning of the Project to verify compliance with the noise criteria

Table 10-9 Predicted noise level for curtailed operating strategy.

Dwelling ID	Noise Level at Hub Height integer wind speeds, 150 m AGL (dB(A))									
	8 m/s		9 m/s		10 m/s		11 m/s		12 m/s and above	
	Criterion	Prediction	Criterion	Prediction	Criterion	Prediction	Criterion	Prediction	Criterion	Prediction
NAD_5	35	35	35	35	35	35	35	35	36	35
NAD_8	35	35	35	35	36	36	38	38	40	38
NAD_11	35	35	35	35	36	36	38	38	40	38
NAD_67	35	35	35	35	35	35	35	35	35	35

10.4.2 Ancillary Infrastructure

Should the ancillary infrastructure in the final layout materially change from that assessed, then further assessment will be conducted and mitigations will be implemented if necessary.

10.4.3 Construction Activity

The mitigation measures for construction noise set out in Appendix E will be adopted to minimise impacts and ensure compliance with the ICNG, including:

- scheduling of noise generating activities within standard construction hours (except for certain specified works with prior consent of the relevant authority);
- locating fixed noise sources such as crushing and screening plant, concrete batching plant, generators and compressors the maximum practicable distance away from dwellings;
- providing acoustic screens around fixed noise sources;
- enclosing generators and compressors;
- finding alternative processes where feasible and reasonable;
- managing site activities to minimise noise;
- managing equipment and vehicles with mufflers and silencers, or using quieter machinery, where possible; and
- community consultation and notification of construction works.

10.4.4 Traffic

Where the RNP criteria are exceeded (during the peak construction period), the following mitigation measures will be employed to reduce the impact of construction traffic noise:

- communicate with the affected community;
- establish and maintain a route into the Project Area so that heavy vehicles do not enter noise sensitive areas for access where practicable;
- take care, particularly around Project Area entry and exit points, to avoid excessive acceleration of trucks and the use of truck engine brakes in close proximity to dwellings;
- incorporate information regarding the route to all drivers prior to accessing the Project Area and the need to minimise impacts through driver operation at certain locations;
- schedule construction traffic deliveries such that it is as evenly dispersed as practicable and where possible outside the morning and afternoon peak hours; and
- restrict construction to the day-time operating hours, subject to the justifications for activity outside of this time as detailed in the Construction Noise Management Plan.

10.4.5 Construction Vibration

For any construction activities producing high levels of vibration occur within 100 m of a non-associated dwelling, such as upgrading existing roads (which may be within 25 m of the closest dwelling), a monitoring regime will be implemented during these times to ensure compliance with the Technical Guideline.

10.5 Conclusion

A noise and vibration assessment has been made of the construction and operation of the Hills of Gold Wind Farm.

The assessment considers wind turbine and ancillary infrastructure operation, construction, temporary batching and traffic associated with the proposal, thereby addressing the environmental noise and vibration section of the Secretary's Environmental Assessment Requirements (SEARs) issued for the Project.

Based on the assessment, all relevant noise and vibration criteria will be achieved under conditions most conducive to noise propagation at all dwellings on the basis that the turbines will be operated in accordance with an operating strategy and construction activities will be managed in accordance with the recommendations.

11. LANDSCAPE AND VISUAL

11.1 Introduction

A Landscape and Visual Impact Assessment (LVIA) was undertaken by Moir Landscape Architecture (MLA) to assess the potential visual impacts associated with the Project in accordance with the *Wind Energy: Visual Assessment Bulletin* (DPE, 2016) (the **Bulletin**). A copy of the LVIA is provided in Appendix F.

The assessment addresses the requirements specified in the SEARs and was completed in conjunction with community consultation. The assessment identified key landscape features and valued viewpoints from both within 8 km and extending as far as 15 km from the Project Area. The report details the results of the field work, documents the assessment of the landscape character and visual setting, and makes recommendations to assist in the mitigation of the visual impacts resulting from the proposed development.

11.1.1 Methodology

11.1.1.1 Relevant guidelines and policies

This LVIA was prepared in accordance with the *Wind Energy: Visual Assessment Bulletin* December 2016 (the Bulletin).

In addition to the Bulletin, the following literature was also used to prepare the LVIA:

- Scottish Natural Heritage, *Visual Representation of Wind Farms - Good Practice Guidance* (Scottish Natural Heritage, 2017).
- Environment Protection and Heritage Council, *Draft National Wind Farm Development Guidelines* (Environment Protection and Heritage Council, 2010)
- Landscape Institute and Institute of Environmental Management & Assessment, *Guidelines for Landscape and Visual Impact Assessment* Third edition (Landscape Institute and IEMA, 2013).
- Landscape Institute *Residential Visual Amenity Assessment* (RVAA) LI Technical Guidance Note, 2019.
- Clean Energy Council, *Best Practice Guidelines for Wind Energy Development* (June, 2018).
- Guidelines for developments adjoining land managed by the Office of Environment and Heritage (OEH, 2013).

11.1.1.2 Assessment Methodology

The LVIA considered the following Project design elements:

- Wind Turbine Design: as the WTG model has not yet been selected for the Project, the largest of the WTG model options were consisted for the visual analysis to represent a worst case scenario, This is detailed in Table 11.1.
- Associated Infrastructure, including substation, switching station, O&M facility, BESS, transmission line and aboveground cabling; meteorological monitoring masts, internal private access road network and off site road upgrades.
- Temporary elements, including temporary site buildings, car parking and amenities, concrete plants earthworks, potential rock crushing facilities, seven hardstand laydown areas , external water supply and aggregates and transport and storage of materials.

Table 11.1 Wind Turbine Dimensions for Assessment in the LVIA

Project Component	Approximate Dimensions	Quantity
Uppermost Blade Tip	230 metres above ground level	70
Rotor Diameter	160 metres	
Tower (hub) Height	150 metres	

The assessment involved a range of methodologies. A summary of each methodology used is described below. Further information is provided in Appendix F.

- Visual Baseline Study: providing a detailed assessment of the landscape character and key features of the region through descriptions, mapping and photographic representations.
- Visual Catchment: defined the visual catchment and involved two preliminary assessment tools: (1) visual magnitude and (2) multiple wind turbine effect.

  Visual magnitude involves mapping dwellings and key public viewpoints and proposed turbines at scale to establish the potential visual magnitude of a turbine to that dwellings or public viewpoint. Figure 5 of the Bulletin (DPE, 2016) defines the visual magnitude thresholds for visual assessment based on distance and turbine heights. For a turbine of 230 m the thresholds are 3,100 m (referred to as the black line – this provides an indication of where proponents should give detailed consideration to the visual impacts on dwellings or key public viewpoints from turbines) and 4,550 m (referred to as the blue line, an additional threshold distance line which identifies potentially high visual magnitude impacts to allow more detailed assessment). The blue and black lines are not determinative of acceptability, instead they provide the basis for the assessment to be undertaken.

  The multiple wind turbine tool provides a preliminary indication of potential cumulative impacts by mapping into six sectors of 60° any proposed turbines and any existing or approve turbines within eight kilometres of each dwelling or key public viewpoints.
- Zone of Visual Influence (ZVI): creating two diagrams to illustrate the theoretical visibility of the proposed Project from (1) hub height and (2) blade tip. The ZVI represents the area over which a development can theoretically be seen, and is based on a Digital Terrain Model (DTM) and hence does not include the screening influence of vegetation and existing infrastructure such as houses, sheds, businesses or signs.
- Viewpoint Analysis: identified key public viewpoints and individual dwellings within the visual catchment. Viewpoints have been carefully selected to be representative of the range of views within the Study Area (refer Section 11.3.4). A total of 45 viewpoints were identified as being representative of the range of views within the Study Area. The visual impact was assessed onsite, through community consultation and through a desktop assessment utilising the topographic and aerial information. Visual Influence Zones were then established from dwellings and key viewpoints, providing relative landscape significance against which the potential impacts of wind turbines may be assessed.
- Photomontages and Wire Frame Diagrams: illustrated the likely view of the Project as it would be seen in a photograph (not as it would appear to the human eye in the field). Wire frame diagrams are a computer generated image based on a digital terrain model that allow the comparison of the positon and scale of turbines to the existing view of a landscape. They are considered a worst case scenario as they do not take into account factors such as vegetation, building structures etc. There were 28 indicative viewpoints (11 public and 17 private) selected for the preparation of photomontages to best illustrate the potential appearance of the Project from varying distances and locations with differing views. Additional photomontages were produced to support WEP's consultation efforts where dwellings did not fall within the Visual Catchment but interest was received.

- Dwelling Assessment: included site inspections and photographic assessments. The assessment was undertaken within 3,100 m of the Project location and with the potential impacts within 3,100 and 4,550 m of a proposed turbine. A number of dwellings to 8 km were also assessed as they held multiple sector views to the Project Area. A total of 43 dwellings were considered in the dwelling assessment.
- Shadow Flicker and Blade Glint Assessment: included modelling of the shadow flicker, to assess the visual effect that occurs when rotating turbines cause moving shadows as the blades pass in front of the sun. The assessment also included consideration of blade glint, a reflection off one or more blades is considered in the context of low reflectivity surface treatment on the blades in accordance with the Bulletin.
- Night Lighting Assessment: the results of the Aviation Impact Assessment concludes that the turbines and wind monitoring towers associated with the Project will not require aviation hazard lighting (AHL) to maintain an acceptable level of safety to aircraft. However, as it is potentially possible that the Civil Aviation Safety Authority or conditions imposed on any development consent granted for the Project may require AHL, an assessment of the visual effects of potential night-time obstacle lighting was completed with reference to the recently installed lighting on the wind turbines at the Biala Wind Farm as an example. Representative images of aviation lighting was also assessed to best illustrate the potential visual appearance of aviation lighting.
- Cumulative Visual Impacts: included the assessment of likely impacts of cumulative landscape effects, taking into consideration of nearby approved or proposed wind farm developments including, Liverpool Range Wind Farm (over 100 kilometres south east), Bowmans Creek Wind Farm (70 kilometres south), Winterbourne Wind Farm (75 kilometres to the north), and Valley of the Winds (in excess of 100 kilometres south east)
- Community Consultation; was undertaken to establish landscape values, key landscape features, key public viewpoints important to the community and the community's perception of the Project.

11.1.2 Study Area

The Study Area for the purposes of the LVIA is defined as the land surrounding the Project Area. This also included residences and key viewpoints within 8 kilometres of turbine locations.

11.2 Existing Environment

11.2.1 Existing landscape and key features

The Project Area is located within the Tamworth Regional, Upper Hunter Shire and Liverpool Plains LGAs. The Project Area and surrounding areas are predominately zoned RU1 – Primary Production. In regards to landscape and visual impact within the Upper Hunter Shire LGA, the objective is 'to maintain the rural landscape character of the land in the long term'.

Areas of land to the north, east and west of the Project Area have been zoned as E1 - National Parks and Nature Reserves and include; Crawney Pass National Park, Ben Halls Gap National Park, Back River Nature Reserve and Wallabadah Nature Reserve. These areas are reserved under the National Parks and Wildlife Act 1974 to protect their environmental significance.

A range of key features have been identified within the Project Area and its surrounds. These include:

- Crawney Pass National Park: is located west of the Project Area on the Liverpool Range at 980 metres above sea level and is approximately 250 ha. The National Park has steep inclines, terraced landscapes and dense vegetation, with some areas cleared for grazing activities. Access to the Park is via Timor Crawney Road which connects to two fire trails within the boundaries of the National Park. The elevated position provides distant views to the north and east, though usually filtered by vegetation.

- Ben Halls Gap National Park: is located to the east of the Project Area at the junction of the Liverpool and Mount Royal Ranges. The Park is covered with dense vegetation and eucalyptus trees, which are key features of the National Park. There is no public access to the Park, which has resulted in limited disturbance.
- Nundle State Forest: is located approximately 7.5 km to the north east of the Project Area and is mostly cleared due to logging and hunting activity.
- Hanging Rock State Forest: located approximately 5 km north of the Project Area has a range of steep sections. The forest is zoned RU3 Forestry and has been cleared for a conifer plantation. The Ponderosa Picnic Area and the Hanging Rock Lookout are located in the south of the State Forest.
- Ben Halls Gap State Forest: adjoins a portion of the Project Area to the east and is approximately 350 ha in size. The State Forest is zoned RU3 Forestry and is primarily used for hardwood forestry activities.
- The Liverpool/Mount Royal Ranges: are part of the Great Dividing Range and is densely populated. The Project is located on the ridge associated with the Ranges.

11.2.2 Landscape Character

Nearby Towns and Villages

There are three towns located in proximity to the Project Area:

- Nundle: is a historic village with an estimated population of 496 people and a total of 287 dwellings in 2016 (ABS, 2020). The Project Area is located approximately 8 km south east of Nundle. The presence of the ridge and rolling hillsides surrounding the village contributes to the sense of ‘place’ and village identity. Nundle also attracts a steady stream of tourists each year. Nundle is generally accessed via Nundle Road or Lindsays Gap Road, which are sealed and connect to Tamworth and the New England Highway.
- Hanging Rock: a small community, is located approximately 6.5 km south east of Nundle, within the Tamworth Regional Council LGA. The Project Area is located approximately 5 km south of Hanging Rock. A popular look out is located within the Hanging Rock State Forest. Hanging Rock is accessed via Barry Road (accessed off Nundle Road) which is a sealed and winding road.
- Crawney, a small community, is located south of the Project Area, within the Upper Hunter Shire Council LGA. Crawney is located approximately 15 km south of Nundle and 5 km south of the Project Area consists of a limited number of isolated properties accessed from Timor Crawney Road.

Dwellings are mainly concentrated around Nundle and Hanging Rock. Isolated dwellings exist along Sargeants Gap Road, Mountain View Road and Head of Peel Road. These dwellings are accessed by Timor Crawney/Crawney Road and Barry Road. A cluster of rural residential dwellings are situated along Morrisons Gap Road, Shearers Road and Barry Road. There are also scattered rural residential dwellings situated along Crawney Road, Timor Crawney Road, Old Wallabadah Road, Back Creek Road and Nundle Creek Road. Old Wallabadah Road provides an alternate link for a handful of homesteads to the New England Highway.

Agriculture

Agriculture, specifically cattle is the predominant land use in the Study Area. Crop farming is also known to occur. Nature conservation and forestry also occur within the Study Area as described in Section 11.2.1.

Landform

The Project Area is located along the Liverpool Range which forms part of the Great Dividing Range. The ridgeline runs generally north-south, bordered to the east by Ben Halls Gap National Park, and then wrapping west towards Crawney Pass National Park. The undulating landform falls toward the centre of the Project Area converging at the Peel River and Nundle Creek along the Nundle Valley floor. The topography surrounding the Project Area is variable and ranging from: steep/sloping in sections around Crawney Pass National Park and Hanging Rock Lookout; sloping in areas along creeklines; and undulating on the foothills of the surrounding ranges.

Vegetation

Areas around the Project Area have generally been cleared for grazing and to create farming access roads, track lines and fence lines. There is scattered vegetation within the grazing areas. Areas that are steeper and less fertile remain well vegetated with grassy woodlands. There is dense canopy cover on the mountain tops associated with Ben Halls Gap National Park to the east, Hanging Rock to the north and Crawney Pass National Park to the west. Forestry plantations located within the Hanging Rock State Forest and Ben Halls State Forest provide visual contrast to the native vegetation occurring elsewhere in the area.

Water Form

The Project Area is located along three catchments: the Namoi Catchment; the Hunter River Catchment; and the Manning River Catchment. There are a few rivers and creeks that flow in the surrounding area of the Project Area; the Peel River to the north west, the Isis River to the south, the Barnard River to the north west, Pages Creek to the south east and Wombramurra, Nundle and Back creeks, to the north east and north west of the Project Area. There are a number of ephemeral creeks and streams which run through the landscape into the rivers and creek lines.

Landscape Character Unit Classification

Due to the large scale of the Study Area and the varying landscape character, the Study Area was categorised into seven Landscape Character Units (LCUs) to assist in the landscape and visual assessment. The Landscape Character Units (LCU) were classified by slight variations in the landscapes geology, topography, land use and vegetation which create distinct character areas within the Study Area. These seven LCUs are: Nundle Village, Wallabadah, Nundle Valley Pastures, Nundle Rolling Foothills, Forested Mountain Ranges, Crawney and Nundle Creek. These are discussed further in the LVIA in Appendix F, including scenic quality ratings.

11.2.3 Community Landscape Values

Community consultation was undertaken to establish an understanding of the key landscape features, areas of scenic quality and key public viewpoints valued by the community. To assist in gaining an understanding of the landscape values held by the local and boarder community, a survey was undertaken in May 2018 and in Dec 2019. Specific areas of value to the community from which the visual amenity was requested to be assessed included:

- Sheba Dams - which are an important tourism destination and historically significant area located on Barry Road south of Hanging Rock;
- the Hanging Rock lockout and descending the road from Hanging Rock;
- from within the town of Nundle (specifically from Jenkins St, Oakenville St, and the cemetery);
- from Hanging Rock;
- from residences along Morrisons Gap Road;
- from the intersection of Lindsays Gap Road and Nundle Road;

- from the Golf Course and Bowling Club in Nundle;
- historic homesteads including: Wombramurra, Koobah, the DAG Sheep Station and Cottage on the Hill;
- the road over Crawney Pass looking north towards the ridge;
- the homestead on Head of the Peel Road; and
- homesteads on the other side of the Crawney Pass near Timor.

11.3 Assessment of Impacts

11.3.1 Visual Magnitude

As discussed in Section 11.1.1.2, the analysis of visual catchment included the use of two preliminary assessment tools: (1) visual magnitude and (2) multiple wind turbine effect in accordance with the Bulletin.

Visual magnitude is based on 2D assessment and does not take into account topography, vegetation or other screening factors which may reduce the potential for viewing turbines. The assessment of visual magnitude identified dwellings which require further assessment in accordance with the Bulletin.

The visual magnitude preliminary assessment is detailed in Figure 11-1. The assessment identified:

- 22 non associated dwellings and one (1) dwelling location with a development application lodged (also non associated) within 3,100 m (black line) of a proposed WTG location; and
- 20 non associated dwellings within 3,100 – 4,550 m (blue line) of a proposed WTG. Seven (7) of the dwellings identified will have no visibility of the proposed development due to topography (NAD_25, NAD_26, NAD_35-38 and NAD_40).

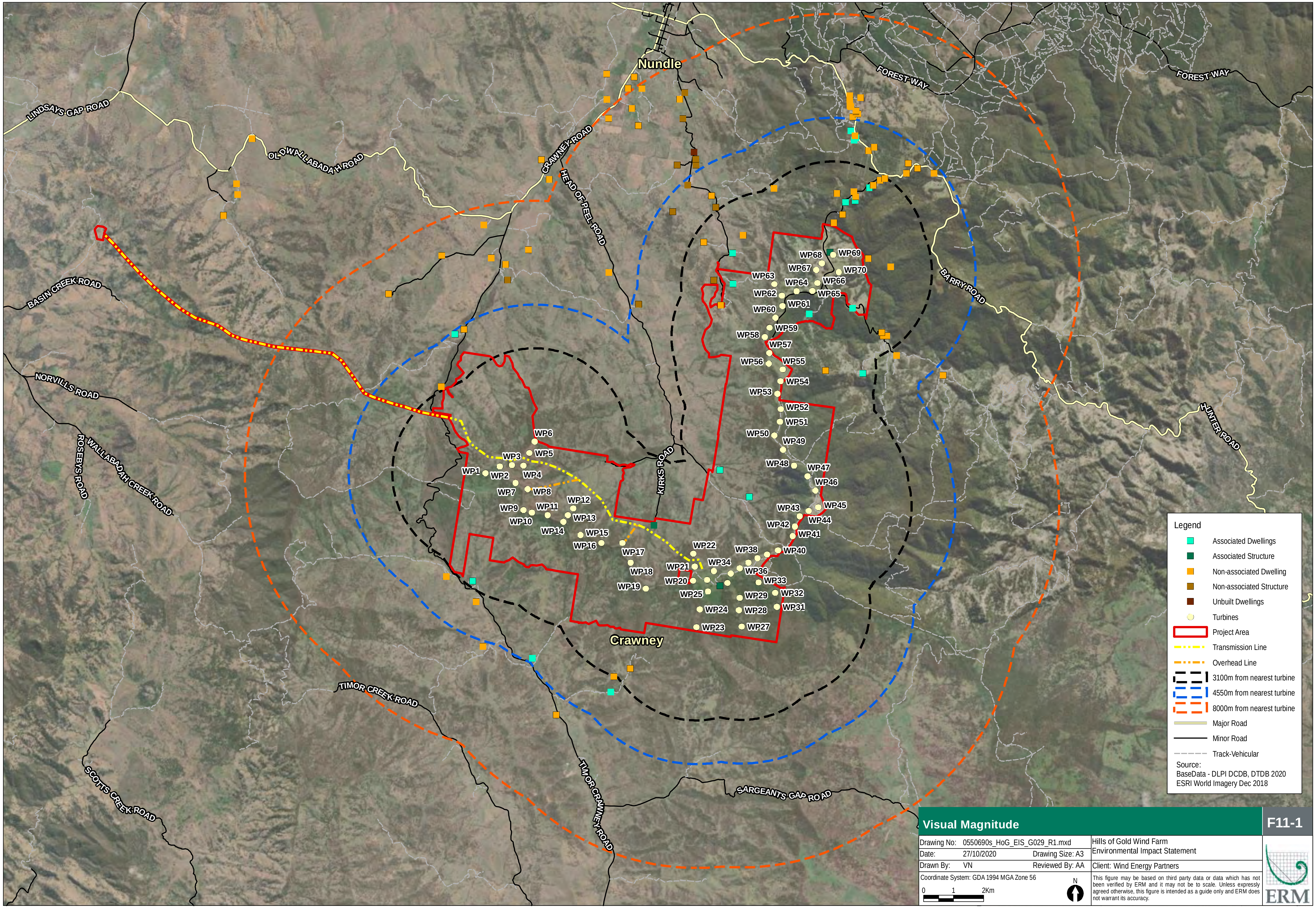
A summary of the dwelling assessments is provided in Table 11-1 and Table 11-2. Further discussion on the dwelling assessments is provided in Section 11.3.6 and detailed assessments of the dwellings are provided in Appendix E of the LVIA (refer to Appendix F of the EIS).

11.3.2 Multiple Wind Turbine Tool

The multiple wind turbine tool in the Bulletin provides a preliminary indication of potential cumulative impacts by mapping into six sectors of 60° any proposed turbines and any existing or approve turbines within eight kilometres of each dwelling or key public viewpoint. The analysis identified seven (7) non-associated dwellings with more than two sectors of turbines visible within 8,000 m. Of the seven dwellings identified, further assessment determined topography would screen views to turbines, reducing the number of turbines visible to an acceptable number of 60º sectors from six dwellings.

It was identified that one non-associated dwelling, NAD_33, is likely to have views of proposed turbines in up to three 60º sectors. This dwelling is located approximately 5.62 km from the nearest turbine. For further information refer to Appendix D of the LVIA (refer Appendix F of the EIS).

Figure 11.2 provides an overview of the number of 60º sectors visible from each of the dwellings identified within 8 000 m. A summary of the dwelling assessments is provided in Table 11-1 and Table 11-2.

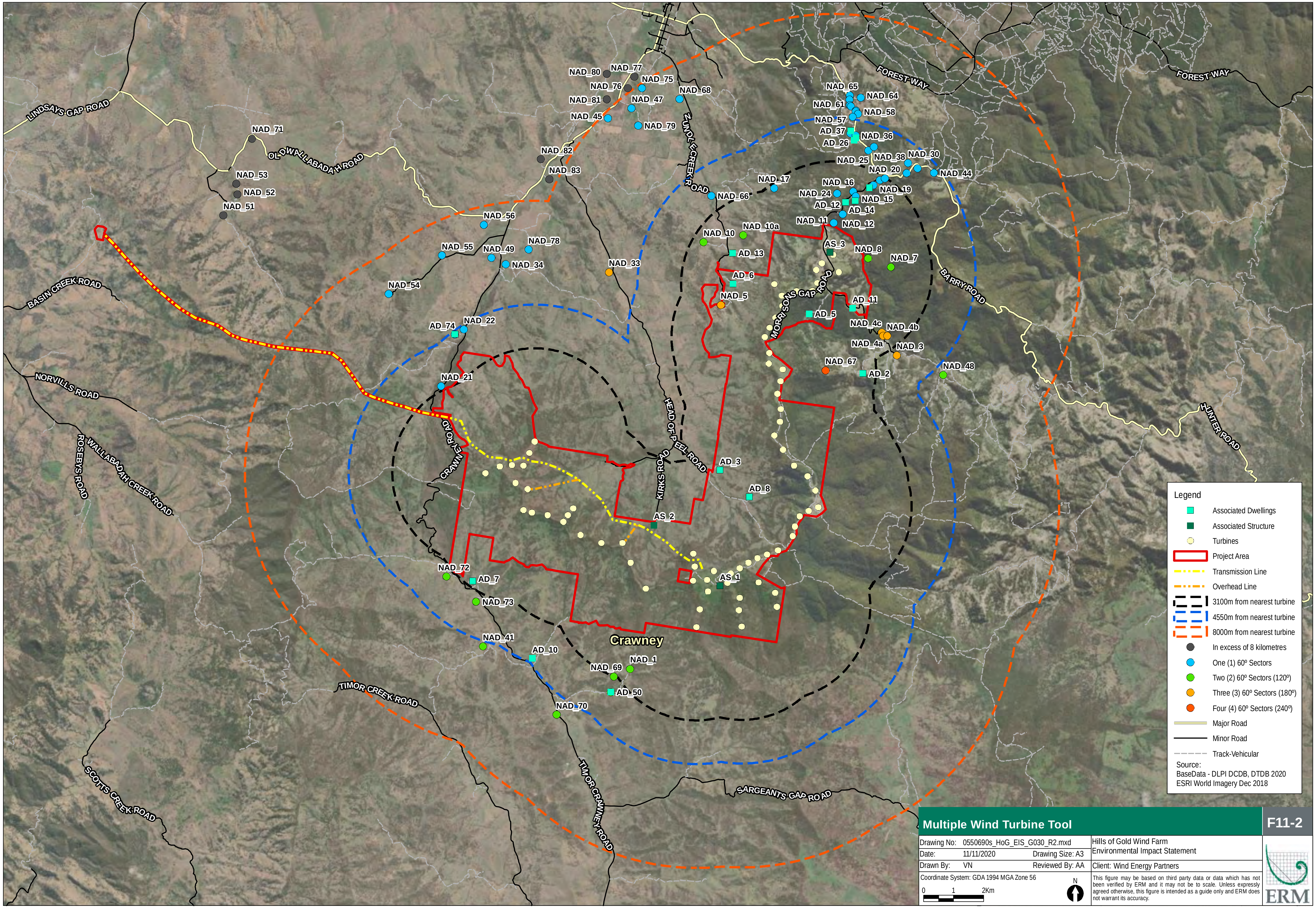


Visual Magnitude | **F11-1**

Drawing No: 0550690s_HoG_EIS_G029_R1.mxd
Date: 27/10/2020 Drawing Size: A3
Drawn By: VN Reviewed By: AA

Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partners

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.



Legend
Associated Dwellings
Associated Structure
Turbines
Project Area
Transmission Line
Overhead Line
3100m from nearest turbine
4550m from nearest turbine
8000m from nearest turbine
In excess of 8 kilometres
One (1) 60º Sectors
Two (2) 60º Sectors (120º)
Three (3) 60º Sectors (180º)
Four (4) 60º Sectors (240º)
Major Road
Minor Road
Track-Vehicular
Source:
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018
Multiple Wind Turbine Tool
F11-2
Drawing No: 0550690s_HoG_EIS_G030_R2.mxd
Date: 11/11/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
Coordinate System: GDA 1994 MGA Zone 56
0 1 2Km
N
Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partners
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM
Crawney
LINDSAYS GAP ROAD
OLD WALLABADAH ROAD
BASIN CREEK ROAD
NORVILLS ROAD
ROSEBYS ROAD
WALLABADAH CREEK ROAD
CRAWNEY ROAD
HEAD OF PEEL ROAD
KIRKS ROAD
ZUNDL CREEK ROAD
MORRISONS GAP ROAD
FOREST WAY
BARRY ROAD
HUNTER ROAD
TIMOR CREEK ROAD
TIMOR CRAWNEY ROAD
SARGEANTS GAP ROAD
SCOTTS CREEK ROAD
NAD_80
NAD_77
NAD_75
NAD_76
NAD_68
NAD_81
NAD_47
NAD_45
NAD_79
NAD_71
NAD_82
NAD_83
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NAD_78
NAD_34
NAD_54
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NAD_11
NAD_12
NAD_10
NAD_10a
AS_3
NAD_8
NAD_7
AD_13
AD_6
NAD_5
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AD_5
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NAD_48
AD_3
AD_8
AS_2
AS_1
NAD_72
AD_7
NAD_73
NAD_41
AD_10
NAD_1
NAD_69
AD_50
NAD_70

11.3.3 Zone of Visual Influence

Two Zone of Visual Influence (ZVI) diagrams were prepared for the Hills of Gold Wind Farm to illustrate the theoretical visibility of the proposed Project from hub height, and from blade tip. The ZVI does not consider the potential screening effect of structures or vegetation which may screen views to the Project. Figure 11.3 depicts the areas of land from which the Project Area may be visible and provides an indicative number of wind turbines based on the tip (230 m). Figure 11.4 illustrates the areas of land from which the Project Area would be visible at hub height (150 m).

The ZVI has been assessed to approximately 10 km from the Project Area. Although it is possible for the Project to be visible from further than 10 km away, it is generally accepted that beyond 10 km visibility is diminished.

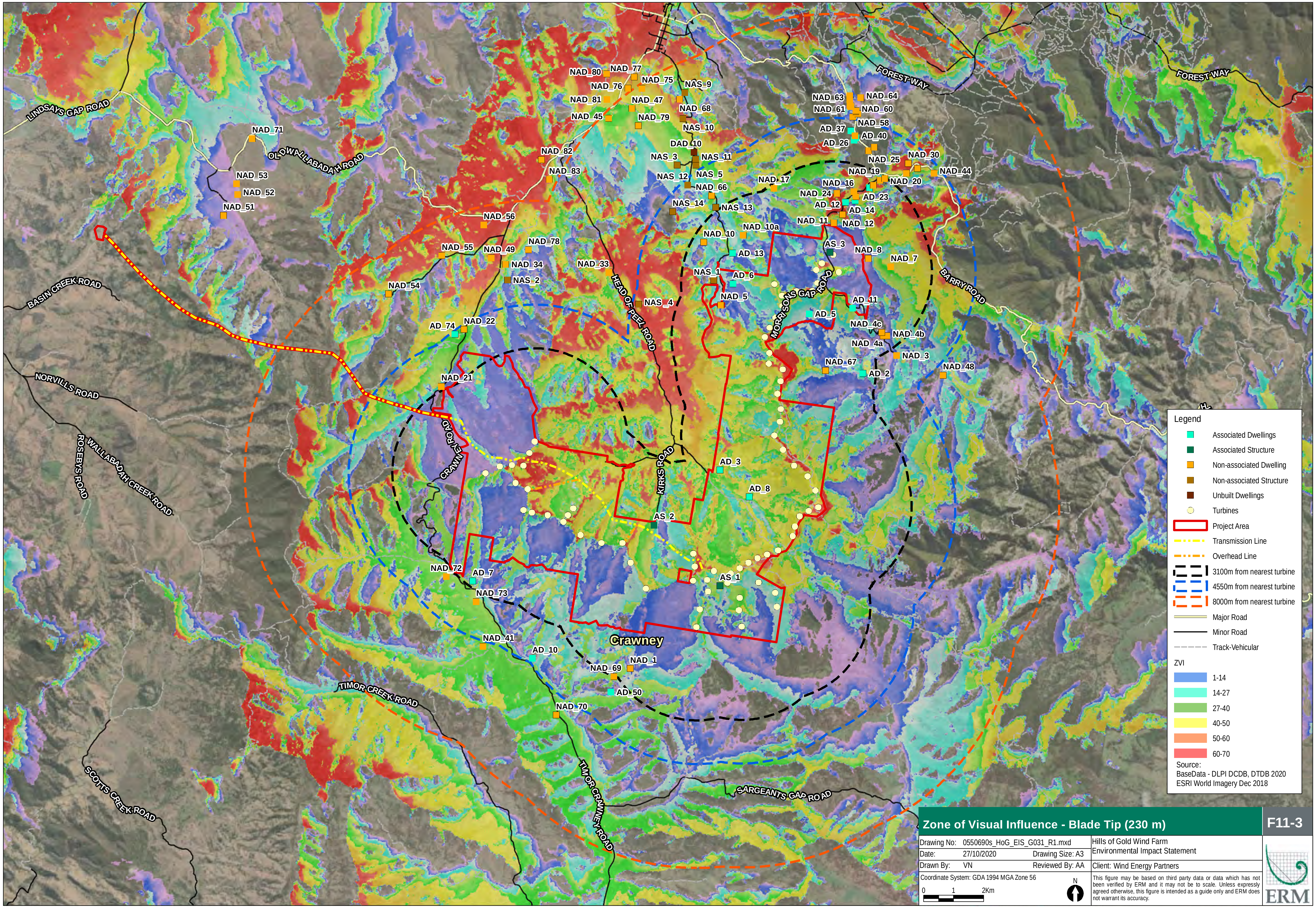
11.3.4 Viewpoint Analysis

In accordance with the Bulletin '*all key public viewpoints and individual dwellings within the 'visual catchment'* should be identified and assessed'. The 45 viewpoints assessed were taken from varying distances and locations surrounding the Project Area, as detailed in Figure 11.5. Each viewpoint was assigned a Visual Influence Zone (VIZ) of High, Medium or Low based on their view sensitivity level, distance zone and scenic quality class combinations. Further information is provided in Appendix F.

In accordance with the objectives of the Bulletin, each viewpoint was assessed against the objectives for the VIZ. The following provides a brief overview of the viewpoint analysis:

- Visual Influence Zone 1 (High) (VIZ1): In accordance with the methodology, two public viewpoints were identified as VIZ1. These viewpoints were located in Crawney National Park. The Project is unlikely to be visible from these viewpoints and will therefore not impact upon the existing visual features.
- Visual Influence Zone 2 (Medium) (VIZ2): A total of 20 viewpoints were rated as Visual Influence Zone 2 (VIZ2). Each of these were assessed against the performance objectives outlined in the Bulletin.
- Visual Influence Zone 3 (Low) (VIZ3): 23 viewpoints were rated as VIZ3 in accordance with the methodology in the Bulletin. There are no performance objectives for VIZ3 as per the Bulletin.

Detailed assessment of each viewpoint is provided in Appendix C of the LVIA (refer Appendix F of the EIS).



Zone of Visual Influence - Blade Tip (230 m)
F11-3
Drawing No: 0550690s_HoG_EIS_G031_R1.mxd
Date: 27/10/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partners
Coordinate System: GDA 1994 MGA Zone 56
0 1 2Km
N
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM
Legend
Associated Dwellings
Associated Structure
Non-associated Dwelling
Non-associated Structure
Unbuilt Dwellings
Turbines
Project Area
Transmission Line
Overhead Line
3100m from nearest turbine
4550m from nearest turbine
8000m from nearest turbine
Major Road
Minor Road
Track-Vehicular
ZVI
1-14
14-27
27-40
40-50
50-60
60-70
Source:
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018
Crawney
LINDSAYS GAP ROAD
OLD WALLABADAH ROAD
BASIN CREEK ROAD
NORVILLS ROAD
ROSEBYS ROAD
WALLABADAH CREEK ROAD
TIMOR CREEK ROAD
SCOTTS CREEK ROAD
TIMOR CRAWNEY ROAD
SARGEANTS GAP ROAD
CRAWNEY ROAD
KIRKS ROAD
HEAD OF PEEL ROAD
MORRISONS GAP ROAD
BARRY ROAD
FOREST WAY
NAD_80
NAD_77
NAD_76
NAD_75
NAS_9
NAD_81
NAD_47
NAD_68
NAD_45
NAD_79
NAS_10
NAD_71
DAD_10
NAD_82
NAS_3
NAS_11
NAD_83
NAS_12
NAS_5
NAD_53
NAD_66
NAD_52
NAS_14
NAS_13
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NAD_56
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NAD_78
NAD_34
NAD_33
NAS_2
NAS_1
AD_13
AD_6
NAD_54
NAD_5
NAS_4
AD_74
NAD_22
NAD_21
AD_3
AD_8
AS_2
NAD_72
AD_7
NAD_73
AS_1
NAD_41
AD_10
NAD_1
NAD_69
AD_50
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NAD_63
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NAD_60
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AD_26
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NAD_20
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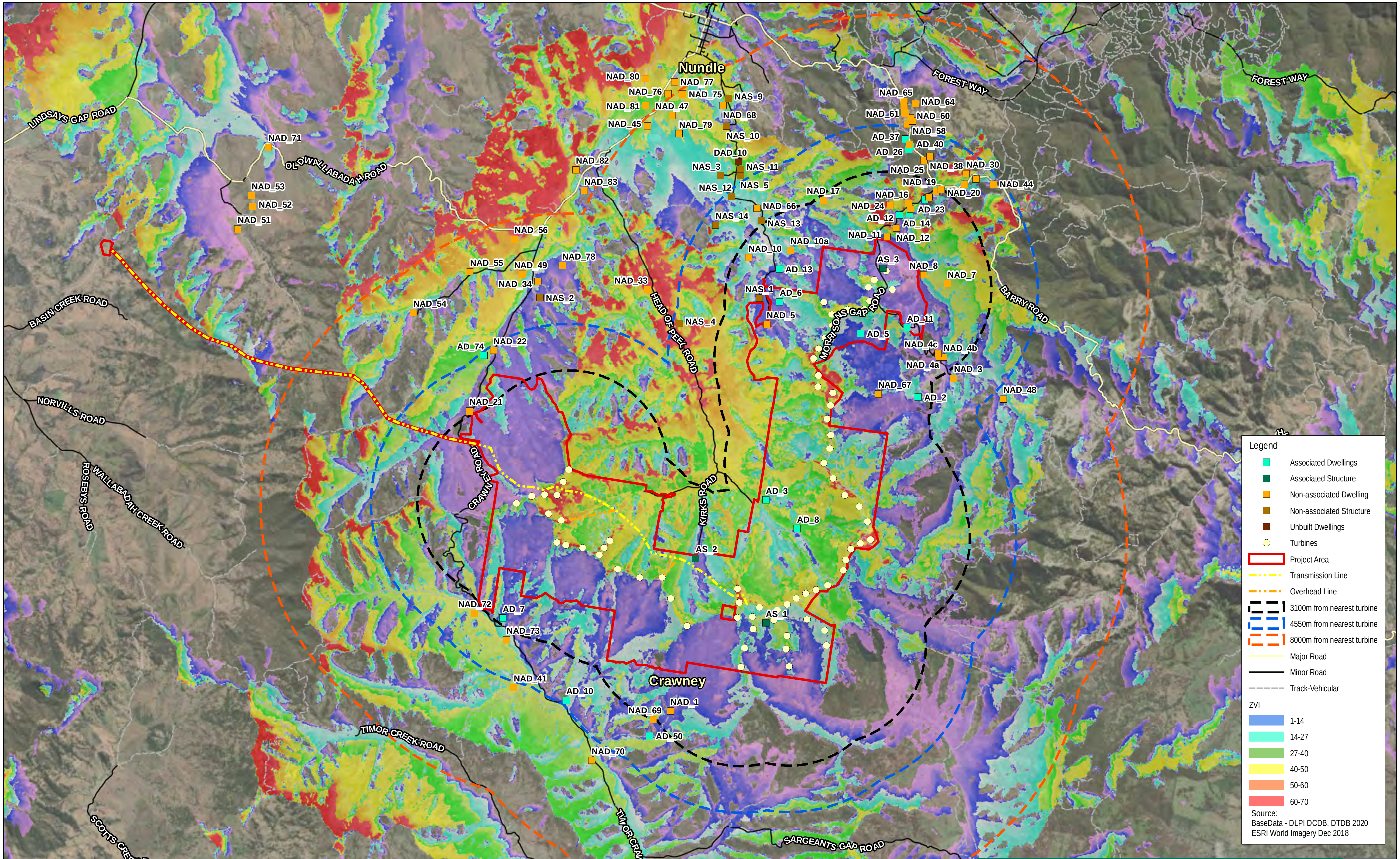
AD_5
NAD_4c
NAD_4b
NAD_4a
NAD_3
NAD_67
AD_2
NAD_48



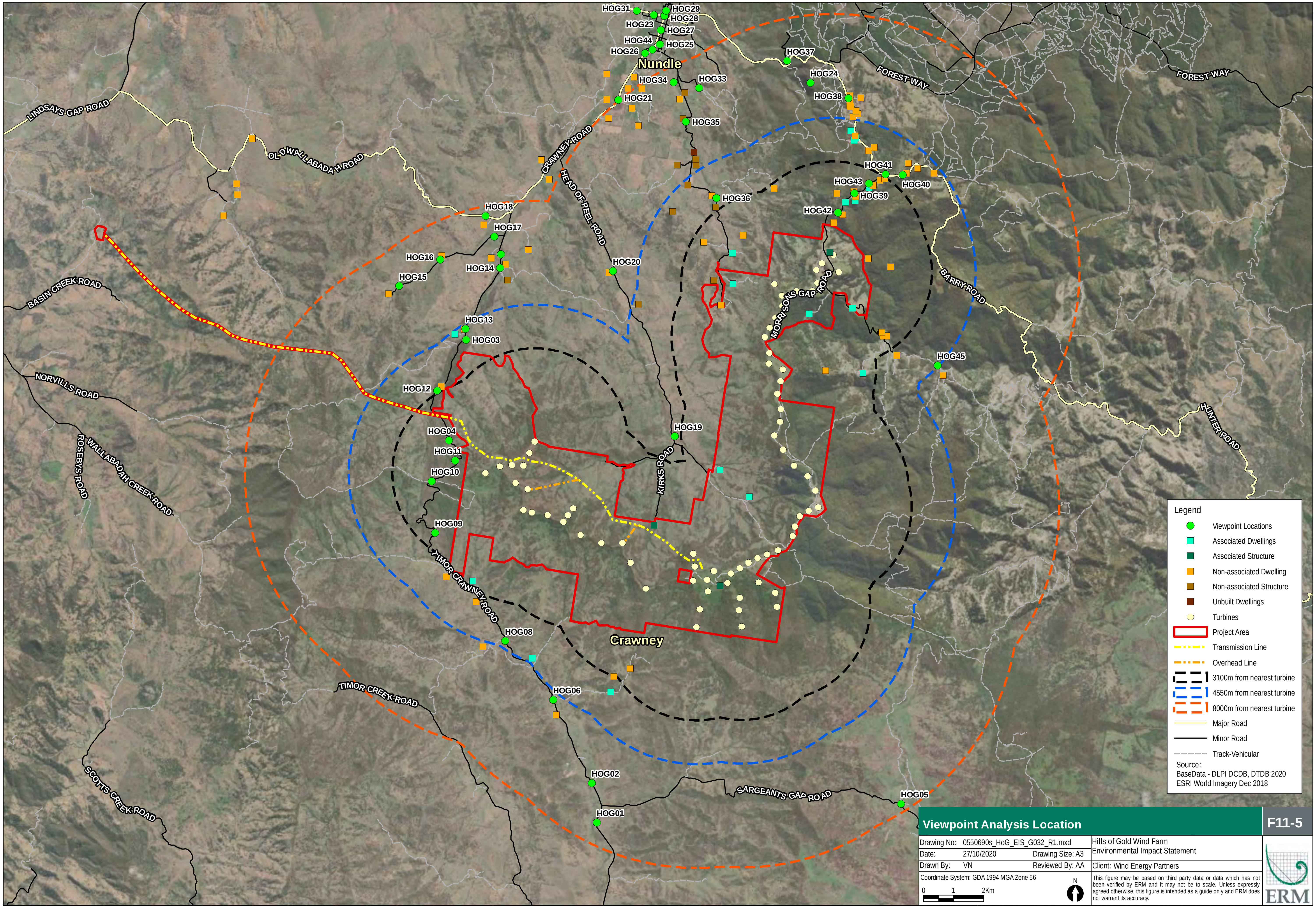
Zone of Visual Influence - Blade Tip (150 m)

F11-4

Drawing No:	0550690s_HoG_EIS_G034_R1.mxd		Hills of Gold Wind Farm Environmental Impact Statement
Date:	27/10/2020	Drawing Size: A3	
Drawn By:	VN	Reviewed By: AA	Client: Wind Energy Partners

Coordinate System: GDA 1994 MGA Zone 56

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.


Nundle
Crawney
HOG01
HOG02
HOG03
HOG04
HOG05
HOG06
HOG08
HOG09
HOG10
HOG11
HOG12
HOG13
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HOG36
HOG37
HOG38
HOG39
HOG40
HOG41
HOG42
HOG43
HOG44
HOG45
LINDSAYS GAP ROAD
OLD WALLABADAH ROAD
CRAWNEY ROAD
HEAD OF PEEL ROAD
FOREST WAY
BARRY ROAD
MORRISONS GAP ROAD
KIRKS ROAD
BASIN CREEK ROAD
NORVILLS ROAD
WALLABADAH CREEK ROAD
ROSEBYS ROAD
TIMOR CRAWNEY ROAD
TIMOR CREEK ROAD
SCOTTS CREEK ROAD
SARGEANTS GAP ROAD
HUNTER ROAD
Legend
Viewpoint Locations
Associated Dwellings
Associated Structure
Non-associated Dwelling
Non-associated Structure
Unbuilt Dwellings
Turbines
Project Area
Transmission Line
Overhead Line
3100m from nearest turbine
4550m from nearest turbine
8000m from nearest turbine
Major Road
Minor Road
Track-Vehicular
Source:
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018
Viewpoint Analysis Location
F11-5
Drawing No: 0550690s_HoG_EIS_G032_R1.mxd
Date: 27/10/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
Coordinate System: GDA 1994 MGA Zone 56
0 1 2Km
N
Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partners
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM

11.3.5 Photomontages and Wireframes

Photomontages prepared for the Project are detailed in Appendix D of the LVIA (refer Appendix F of the EIS). During the preparation of the photomontages, 27 indicative viewpoints were selected to best illustrate the potential appearance of the proposed wind farm from varying distances and locations with differing views. These included:

- Public Photomontage Locations: A total of 10 public viewpoint locations selected for the preparation of visual photomontages based on feedback received from the community.
- Private Photomontage Locations: 17 photomontages were prepared from private properties where access was granted. The photomontages selected were based on those within close proximity to the Project. In some cases, wireframe diagrams have been utilised to illustrate potential visual impacts from dwellings where access was not available.

The photomontages were based on a worst case scenario of a maximum turbine height of 230 m with a hub height of 150 m and rotor diameter of 170 m. These were used as representing worst case for the production of the ZVI, wireframes and photomontages.

In addition to the dwellings identified in the Visual Catchment, additional photomontages and wireframes were produced for residents interested in understanding specific visual impact. WEP provided opportunity for those within the community to express interest in an individual visual impact assessment even if this was not required by the guidelines.

11.3.6 Dwelling Assessment

The LVIA includes a detailed dwelling assessment of 43 dwellings identified within the visual catchment. A summary of the outcomes of the assessment including mitigation measures are detailed below and in Table 11.2 and Table 11.3. Further detail is provided in Appendix E of the LVIA (refer Appendix F of the EIS).

11.3.6.1 Dwellings within 3100 metres (Black Line)

A total of 22 non-associated dwellings and one with DA location were assessed in detail within the 3,100 m visual magnitude (black line). Of the 23 dwelling locations assessed, the proposed development is likely to be screened by vegetation from eight dwellings.

- **Morrisons Gap Road:** The majority of dwellings within 3,100 m of the Project Area are located on Morrisons Gap Road. Morrisons Gap Road is part of the Forested Mountain Ranges LCU which is characterised by high vegetation coverage. As a result, of the 14 dwelling assessed, only three dwellings (NAD_23, NAD_18 and NAD_67) are likely to have uninterrupted views to the Project Area. Due to the undulating topography typical of the forested mountain ranges these views are likely to be of a small portion of the Project. A Neighbour Agreement has been signed with NAD 23.
- **Nundle Creek Road:** Four dwellings associated with Nundle Creek Road are located within 3,100 m of the Project Area. The Project is likely to be visible from all dwellings identified. Generally the Project occupies a small portion of views from these dwellings and the mitigation methods suggested for these dwellings could be employed to significantly reduce potential impacts. From NAD_10A, 15 turbines will be visible to the south east of the dwelling along the vegetated ridgeline, 10 of which are located within 3100 m of the dwelling. The closest photomontage to that dwelling is Photomontage 14, presented in Figure 11.6. Further photomontage detail is provided in Appendix D of the LVIA (refer Appendix F of the EIS).
- **Shearers Road:** Three dwellings located on Shearers Road are located within 3,100 m of the nearest turbine. Detailed assessment of these dwellings identified limited opportunities to view the Project due to a combination of topography and vegetation (typical of the landscape character in this area).

- **Mountain View Road**: Two dwellings were identified and assessed on Mountain View Road. NAD_1 is located at the base of the valley and views to the Project are limited. NAD_69 is likely to have views to a large portion of the Project which will likely occupy a large portion of the views toward which the house is orientated.

Detailed assessments of the dwellings are provided in Appendix E of the LVIA (refer to Appendix F of the EIS).

11.3.6.2 Dwellings within 3,100 – 4,550 metres (Blue Line)

A total of 20 non-associated dwellings were identified and assessed between 3,100 to 4,550 m. Views to the Project will be screened by topography from seven of the dwellings and existing vegetation is likely to screen or fragment views from an additional seven dwellings. The visual effect rating identified five dwellings with a moderate visual effect and eight with nil –low or low visual effect. Mitigation measures in the form of supplementary or screen planning have been outlined for these dwellings (refer Table 11.3).

Detailed assessments of the dwellings are provided in Appendix E of the LVIA (refer to Appendix F of the EIS).

11.3.6.3 Dwellings in excess of 4,550 metres

Dwellings in excess of 4,550 m from the Project have the potential to view the Project. The Viewpoint Analysis (refer Section 11.3.4 and LVIA Appendix C) and photomontages (Section 11.3.5 and LVIA Appendix D) prepared from public viewpoints seek to assist DPIE and landowners in determining potential visual impacts from dwellings in excess of 4550 m. This includes various viewpoints that are near various non associated dwellings, including NAD_75 (Wombramurra Homestead), NAD_76, NAD_77, NAD_21, NAD_70 and NAD_48.

NAD_33 located on the Head of Peel Road was identified as having the potential to view turbines in up to three 60 º sectors and a dwelling assessment was completed. Existing vegetation surrounding the dwelling may assist in fragmenting views to the turbines. Mitigation measures in the form of supplementing planting are recommended. Figure 11.8 provides the photomontage for this dwelling (NAD_33) (Photomontage 21). Further detail is provided in Appendix E of the LVIA (refer Appendix F of the EIS).

Table 11.2 Dwelling Assessment Summary, Non-associated Dwellings within 3,100 m of WTG

Dwelling ID	Location	Nearest WTG Distance (km)	Number of 60° Sectors (2D assessment)	Number of 60° Sectors (3D assessment)	Number of Visible WTGs (topography alone)	Assessment Summary (refer Appendix E of the LVIA for further detailed assessment)	Visual Influence Zone (VIZ from Appendix E)	Recommended Mitigation	Visual Effect Rating
NAD_1	Mountain View Road	2.58	2	1	10	Views from the dwelling are largely contained by topography and vegetation. Up to 10 WTGs may be visible to the NNE. Three visible turbines are within 3,100 m. Desktop Assessment: Refer to Appendix E1 of Appendix F.	VIZ 2	N/A - existing vegetation is likely to sufficiently screen the Project	Low
NAD_4A	Shearers Road	2.79	3	1	7 blades	Views to the majority of the project from the dwelling is contained by topography and vegetation, with the exception of up to 7 blade tips. Existing vegetation to the south west of the dwelling is likely to screen views to the blade tips. Site Assessment: Refer to Appendix E2 and Photomontage 12 (Wireframe) of Appendix F.	VIZ 2	N/A - existing vegetation is likely to sufficiently screen the Project	Nil - Low
NAD_4B	Shearers Road	2.89	3	2	10	From this dwelling, the majority of the Project is likely to be screened by topography with the exception of the tips of 1 turbine to the north west and up to nine turbines to the WSW. Existing vegetation is located in this direction and is likely to screen views to the turbines. Site Assessment: Refer to Appendix E3 and Photomontage 12 (Wireframe) of Appendix F.	VIZ 2		Nil - Low

Dwelling ID	Location	Nearest WTG Distance (km)	Number of 60° Sectors (2D assessment)	Number of 60° Sectors (3D assessment)	Number of Visible WTGs (topography alone)	Assessment Summary (refer Appendix E of the LVIA for further detailed assessment)	Visual Influence Zone (VIZ from Appendix E)	Recommended Mitigation	Visual Effect Rating
NAD_4C	Shearers Road	2.66	3	1	1	From this dwelling, the Project will be screened by topography with the exception of one turbine located in a generally south west direction in excess of 5 km from the dwelling. Site Assessment: Refer to Appendix E4 and Photomontage 12 (Wireframe) of Appendix F.	VIZ 2		Nil - Low
NAD_5	Nundle Creek Road	1.79	3	2	10*	Views to the Project from this dwelling are largely screened by topography. Up to 10 proposed turbines are likely to be visible (based on topography alone) to the east of the dwelling. Site Assessment: Refer to Appendix E5 and Photomontage 13 of Appendix F.	VIZ 1	Consider screen planting	Moderate
NAD_7	Morrisons Gap Road	1.74	2	2	25* *Within 8 km*	This dwelling is in an elevated position, surrounded by vegetation. The 3D modelling suggests up to 40 turbines would be visible, however due to vegetation surrounding the property the reality would be much less. Desktop Assessment: Refer to Appendix E6 of Appendix F.	VIZ 1	N/A - existing vegetation is likely to sufficiently screen the Project	Low
NAD_8	Morrisons Gap Road	1.16	2	1	8*	Dwelling is located in a valley associated with Barnard River and appears to be surrounded by vegetation. The 3D modelling suggests up to 8 turbines would be visible (based on topography alone). Vegetation is likely to	VIZ 1	Consider supplementary planning if deemed necessary	Low

Dwelling ID	Location	Nearest WTG Distance (km)	Number of 60° Sectors (2D assessment)	Number of 60° Sectors (3D assessment)	Number of Visible WTGs (topography alone)	Assessment Summary (refer Appendix E of the LVIA for further detailed assessment)	Visual Influence Zone (VIZ from Appendix E)	Recommended Mitigation	Visual Effect Rating
						screen views to the turbines from this dwelling. Desktop Assessment: Refer to Appendix E7 of Appendix F.			
NAD_10	Nundle Creak Road	2.27	2	1	22	Approximately 22 proposed turbines are likely to be visible e to the south east, the nearest turbine is approximately 2.74 km from the dwelling. Existing scattered vegetation located in the foreground may assist in fragmenting views of the turbines from the dwelling. Desktop Assessment: Refer to Appendix E8 and Photomontage 14 in Appendix F (from nearby land – not representative of dwelling).	VIZ 2	Consider screen planting	Moderate
NAD_10A	Nundle Creak Road	1.88	2	2	15	From this dwelling it is likely 15 turbines will be visible to the south east of the dwelling along the vegetated ridgeline. Ten of these visible turbines are located within 3,100 m of the dwelling. Desktop Assessment: Refer to Appendix E9 in Appendix F.	VIZ 1	Consider screen planting	High
NAD_11	Morrisons Gap Road	1.05	1	1	22* *Within 8 km*	Based on 3D modelling considering topography alone it is likely up to 22 turbines would be visible. However, 90 m of vegetation is located to the south of the dwelling. It is likely views to the Project would be screened by the vegetation, however some very	VIZ 1	Consider supplementary planting	Low

Dwelling ID	Location	Nearest WTG Distance (km)	Number of 60° Sectors (2D assessment)	Number of 60° Sectors (3D assessment)	Number of Visible WTGs (topography alone)	Assessment Summary (refer Appendix E of the LVIA for further detailed assessment)	Visual Influence Zone (VIZ from Appendix E)	Recommended Mitigation	Visual Effect Rating
						small filtered views may be available. Desktop Assessment: Refer to Appendix E11 in Appendix F.			
NAD_12	Morrisons Gap Road	1.38	1	1	21* *Within 8 km*	Approximately 60 to 70 turbines would be visible (based on topography alone), with seven turbines within 3100 m. Limited filtered views are available through the vegetation towards the Project Area. Site Assessment: Refer to Appendix E11 and Photomontage 15 (Wire frame) of Appendix F.	VIZ 1	Consider supplementary planting	Low
AD_12	Morrisons Gap Road	1.79	1	1	13* *Within 8 km*	Based on topography alone, up to 40 turbines would be visible to the SSW, however it is likely views to the Project will be screened by vegetation to the south. Site Assessment: Appendix E12 of Appendix F.	VIZ 1	N/A - existing vegetation is likely to sufficiently screen the Project	Nil-Low

Dwelling ID	Location	Nearest WTG Distance (km)	Number of 60° Sectors (2D assessment)	Number of 60° Sectors (3D assessment)	Number of Visible WTGs (topography alone)	Assessment Summary (refer Appendix E of the LVIA for further detailed assessment)	Visual Influence Zone (VIZ from Appendix E)	Recommended Mitigation	Visual Effect Rating
AD_14	Morrisons Gap Road	1.94	1	1	20* *Within 8 km*	The dwelling is surrounded by dense vegetation in the direction of the Project Area. An assessment based on topography alone indicates approximately 30 turbines would be available to the south west. The dense vegetation is likely to screen views to the Project. Site Assessment: Appendix E13 of Appendix F.	VIZ 1	N/A - existing vegetation is likely to sufficiently screen the Project	Nil-Low
NAD_15	Morrisons Gap Road	2.08	1	1	20* *Within 8 km*	Based on topography alone, up to 59 turbines would be visible from this dwelling. However, vegetation to the south west will screen views to the Project. Site Assessment: Refer to Appendix E14 and Photomontage 16 (Wire frame) of Appendix F.	VIZ 1	N/A - existing vegetation is likely to sufficiently screen the Project	Nil-Low
NAD_16	Morrisons Gap Road	2.20	1	1	19* *Within 8 km*	Based on topography alone, up to 23 turbines have the potential to be visible from this dwelling. However, dense vegetation to the south west of the property and the south west of Morrisons Gap Road is likely to screen views to the Project. Desktop Assessment: Refer to Appendix E15 of Appendix F.	VIZ 2	N/A - existing vegetation is likely to sufficiently screen the Project	Nil-Low

Dwelling ID	Location	Nearest WTG Distance (km)	Number of 60° Sectors (2D assessment)	Number of 60° Sectors (3D assessment)	Number of Visible WTGs (topography alone)	Assessment Summary (refer Appendix E of the LVIA for further detailed assessment)	Visual Influence Zone (VIZ from Appendix E)	Recommended Mitigation	Visual Effect Rating
NAD_17	Nundle Creek Road	2.94	1	1	15* *Within 8 km*	Based on topography alone, up to 15 turbines are likely to be visible (within 8 km) to the south east. Approximately 20 turbines may be visible to the south and south west (in excess of 10 km from the dwelling). Intervening vegetation to the south east may fragment views to the turbines. Desktop Assessment: Refer to Appendix E16 of Appendix F.	VIZ 2	Consider screen planting	Moderate
NAD_18	Morrisons Gap Road	2.69	1	1	12 *Within 8 km*	An opening in the vegetation to the south west of the property with framed views of vegetated ridgeline associated with the Project Area. Approximately 30 turbines (most of which are in excess of 5 km from the dwelling) will be visible in this view. Site Assessment : Refer to Appendix E17 of Appendix F.	VIZ 2	Consider screen planting	Moderate
NAD_19	Morrisons Gap Road	2.93	1	1	11* *Within 8 km*	Based on an assessment of topography alone, approximately 32 turbines would be visible to the SSW. Existing intervening vegetation in this direction is likely to screen views to the Project. Desktop Assessment: Refer to Appendix E18 of Appendix F.	VIZ 2	Consider supplementary planting	Moderate

Dwelling ID	Location	Nearest WTG Distance (km)	Number of 60° Sectors (2D assessment)	Number of 60° Sectors (3D assessment)	Number of Visible WTGs (topography alone)	Assessment Summary (refer Appendix E of the LVIA for further detailed assessment)	Visual Influence Zone (VIZ from Appendix E)	Recommended Mitigation	Visual Effect Rating
NAD_20	Morrisons Gap Road	3.05	1	1	7* *Within 8 km*	An assessment based on topography alone identified seven turbines visible to the south west. A combination of existing shed / structure and vegetation to the south west of the property will screen views to the Project from this dwelling. Desktop Assessment: Refer to Appendix E19 and Photomontage 17 of Appendix F.	VIZ 2	Consider screen planting	Low
NAD_23	Morrisons Gap Road	2.52	1	1	3 *Within 8 km*	Vegetation to the SSE may assist in screening some turbines. Three turbines are located within 3,100 m, however only one of these is visible. The remaining visible turbines are in excess of 8 km from the dwelling. Site Assessment: Refer to Appendix E20 and Photomontage 19 of Appendix F.	VIZ 2	N/A – elevated position and majority of visible turbines are in excess of 8 kms.	Moderate
NAD_67	Morrisons Gap Road	1.45	4	1	10*	Although within close proximity to the Project Area, the majority of turbines are screened by topography. Based on topography alone it is likely 10 wind turbines will be visible to the north, the closest visible turbine is 2.39 km from the dwelling. Desktop Assessment: Refer to Appendix E21 and Photomontage 26 (Wire frame) of Appendix F.	VIZ 2	Consider screen planting	Moderate

Dwelling ID	Location	Nearest WTG Distance (km)	Number of 60° Sectors (2D assessment)	Number of 60° Sectors (3D assessment)	Number of Visible WTGs (topography alone)	Assessment Summary (refer Appendix E of the LVIA for further detailed assessment)	Visual Influence Zone (VIZ from Appendix E)	Recommended Mitigation	Visual Effect Rating
NAD_69	Mountain View Road	3.10	2	2	31	The dwelling is sited in an elevated position with expansive, uninterrupted views in all directions. The dwelling is orientated to the north, views to the vegetated hills associated with the Project Area. There will be 31 turbines visible along the ridge to the north. Site Assessment: Refer to Appendix E22 and Photomontage 22 of Appendix F.	VIZ 2	Consider screen planting	High
** Based on an assessment of topography alone. Screening factors such as vegetation may reduce the potential visibility of the proposed turbines*									
DA Location:									
NAD_24	Morrisons Gap Road	2.06	1	0	0	The Project will not be visible due to topography. No further assessment required.	VIZ 2 (near HOG 39, 41, 42, 43 viewpoints)	N/A - topography will sufficiently screen the Project	Nil

*** Based on VIZ from Appendix C, nearest viewpoint.*

Table 11.3 Dwelling Assessment Summary, Non-associated Dwellings between 3,100 and 4,550 m of nearest WTG

Dwelling ID	Location	Nearest WTG Distance (km)	Number of 60° Sectors (2D assessment)	Number of 60° Sectors (3D assessment)	Number of Visible WTGs (topography alone)	Assessment Summary (refer Appendix E of the LVIA for further detailed assessment)	Visual Influence Zone (VIZ from Appendix C**)	Recommended Mitigation	Visual Effect Rating
NAD_03	Shearers Road	3.52	3	1	10*	Owner was not concerned about visual impacts. Based on topography alone, it was identified 10 turbines would be visible to the north west. Existing vegetation in this direction would screen views to the Project. Site Assessment undertaken.	VIZ 2 (HOG 45)	N/A – existing vegetation is likely to sufficiently screen the Project	Low
NAD_21	Crawney Road	3.23	1	1	7*	The property is located in a cleared area of land between Crawney Road and Wombramurra Creek. Based on a 3D assessment (topography alone), six turbines and one blade would be visible to the south east of the property. Vegetation along the south eastern side boundary of the property and on the south eastern side of Crawney Road is likely to sufficiently screen views to the Project from this property. The proposed transmission line which crosses Crawney Gully to the south west of the dwelling is likely to be screened by vegetation to the south of the property. Site Assessment undertaken Refer to Photomontage 18 (Wireframe) of Appendix F.	VIZ 3 (HOG 12)	Consider supplementary planting	Low

Dwelling ID	Location	Nearest WTG Distance (km)	Number of 60° Sectors (2D assessment)	Number of 60° Sectors (3D assessment)	Number of Visible WTGs (topography alone)	Assessment Summary (refer Appendix E of the LVIA for further detailed assessment)	Visual Influence Zone (VIZ from Appendix C**)	Recommended Mitigation	Visual Effect Rating
NAD_22	Crawney Road	4.40	1	1	8 *Within 8 km*	The dwelling is orientated to the east with views across land defined as 'nundle valley pastures' towards distant vegetated ranges. From this dwelling up to eight turbines will be visible within 8 km to the south west of the property. The proposed transmission line and associated vegetation clearing would be noticeable to the south west. 22 turbines will be discernible in excess of 10 kilometres to the east. Site Assessment and Photomontage 24 , refer Appendix F.	VIZ 3 (HOG 13)	Consider screen planting	Moderate
NAD_25	Barry Road	3.87	1	0	0	Not visible due to topography. No further assessment required. Site Assessment undertaken.	VIZ 2 (HOG 38, 40, 41)	N/A – topography will sufficiently screen the Project	Nil
NAD_26	Barry Road	3.87	1	0	0	Not visible due to topography. No further assessment required.	VIZ 2 (HOG 38, 40, 41)	N/A – topography will sufficiently screen the Project	Nil

Dwelling ID	Location	Nearest WTG Distance (km)	Number of 60° Sectors (2D assessment)	Number of 60° Sectors (3D assessment)	Number of Visible WTGs (topography alone)	Assessment Summary (refer Appendix E of the LVIA for further detailed assessment)	Visual Influence Zone (VIZ from Appendix C**)	Recommended Mitigation	Visual Effect Rating
NAD_30	Barry Road	3.95	1		25	Views from the dwelling are contained by a combination of vegetation and existing sheds and greenhouse. It is possible that up to 25 turbines would be visible to the south east (from the back fence of the property). Views to the Project in this one particular location would occupy a very small portion of the view from this location. Site Assessment and Photomontage 20, refer Appendix F.	VIZ 2 (HOG 38, 40, 41)	N/A – existing vegetation is likely to sufficiently screen the Project from the dwelling	Low
NAD_32	Barry Road	3.65	1		14 *Within 8 km*	Based on topography alone, up to 14 turbines are likely to be visible within 8 km. Dense vegetation surrounding the dwelling is likely to screen views to the turbines. Desktop Assessment and Viewpoint HOG40.	VIZ 2 (HOG 38, 40, 41)	N/A – existing vegetation is likely to sufficiently screen the Project	Low
NAD_35	Barry Road	4.08	1	0	0	Not visible due to topography. No further assessment required.	VIZ 2 (HOG 38, 40, 41)	N/A – existing topography will sufficiently screen the Project	Nil
NAD_36	Barry Road	4.03	1	0	0	Not visible due to topography. No further assessment required.	VIZ 2 (HOG 38, 40, 41)	N/A – existing topography will sufficiently screen the Project	Nil

Dwelling ID	Location	Nearest WTG Distance (km)	Number of 60° Sectors (2D assessment)	Number of 60° Sectors (3D assessment)	Number of Visible WTGs (topography alone)	Assessment Summary (refer Appendix E of the LVIA for further detailed assessment)	Visual Influence Zone (VIZ from Appendix C**)	Recommended Mitigation	Visual Effect Rating
NAD_37	Barry Road	4.16	1	0	0	Not visible due to topography. No further assessment required.	VIZ 2 (HOG 38, 40, 41)	N/A – existing topography will sufficiently screen the Project	Nil
NAD_38	Barry Road	3.85	1	0	0	Not visible due to topography. No further assessment required.	VIZ 2 (HOG 38, 40, 41)	N/A – existing topography will sufficiently screen the Project	Nil
NAD_39	Barry Road	4.00	1	1	50*	Based on topography alone, up to 50 turbines may be visible to the south west. Aerial imagery indicates the dwelling is orientated to the north and surrounded by vegetation. Vegetation to the south west of the dwelling is likely to sufficiently screen views to the Project from this dwelling. Desktop assessment.	VIZ 2 (HOG 38, 40, 41)	Consider supplementary planting	Low
NAD_40	Barry Road	3.96	1	0	0	Not visible due to topography. No further assessment required.	VIZ 2 (HOG 38, 40, 41)	N/A – existing topography will sufficiently screen the Project	Nil

Dwelling ID	Location	Nearest WTG Distance (km)	Number of 60° Sectors (2D assessment)	Number of 60° Sectors (3D assessment)	Number of Visible WTGs (topography alone)	Assessment Summary (refer Appendix E of the LVIA for further detailed assessment)	Visual Influence Zone (VIZ from Appendix C**)	Recommended Mitigation	Visual Effect Rating
NAD_44	Barry Road	4.32	1	1	10 *Within 8 km*	Based on topography alone, up to 10 turbines may be visible to the south west. Aerial imagery indicates the dwelling is orientated to the north and surrounded by vegetation. Vegetation to the south west of the dwelling is likely to sufficiently screen views to the Project from this dwelling. Desktop assessment.	VIZ 2 (HOG 38, 40, 41)	N/A – existing vegetation is likely to sufficiently screen the Project	Nil - Low
NAD_48	Shearers Road	4.50	2	1	6	Based on topography alone, it is likely up to six turbines may be visible to the north west. Dense vegetation to the north west of the dwelling location is likely to sufficiently screen views to these turbines from the dwelling. Desktop Assessment and Viewpoint HOG45.	VIZ 2 (HOG 38, 40, 41)	N/A – existing vegetation is likely to sufficiently screen the Project	Nil - Low
NAD_50	Mountain View Road	3.52	2	1	9*	Based on topography alone, up to nine turbines may be visible to the north east. Aerial imagery indicates the dwelling is orientated to the north and surrounded by vegetation. Vegetation to the north east of the dwelling is likely to sufficiently screen views to the Project from this dwelling. Desktop assessment.	VIZ 3 (HOG 6)	N/A – existing vegetation is likely to sufficiently screen the Project	Nil - Low

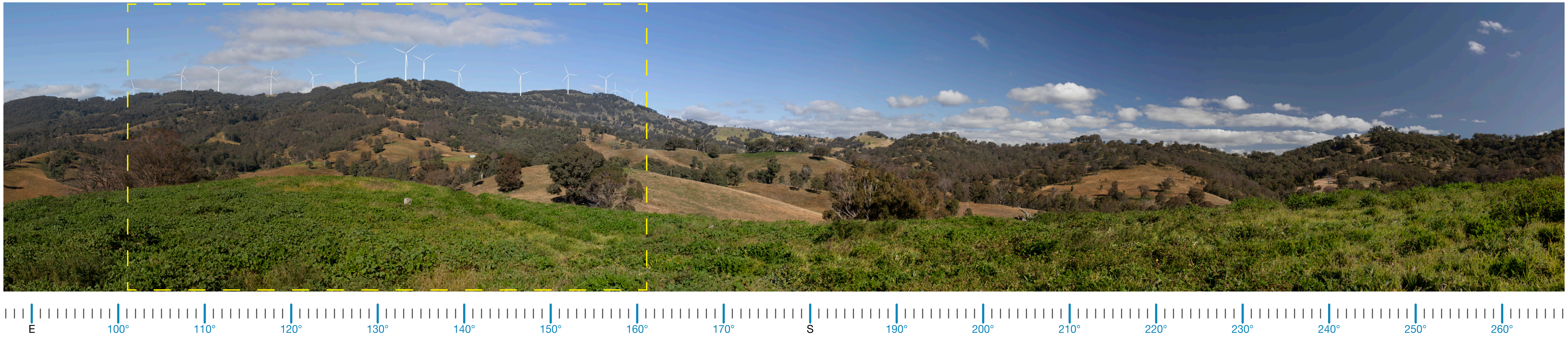
Dwelling ID	Location	Nearest WTG Distance (km)	Number of 60° Sectors (2D assessment)	Number of 60° Sectors (3D assessment)	Number of Visible WTGs (topography alone)	Assessment Summary (refer Appendix E of the LVIA for further detailed assessment)	Visual Influence Zone (VIZ from Appendix C**)	Recommended Mitigation	Visual Effect Rating
NAD_66	Nundle Creek Road	3.65	1	1	20* *Within 8 km*	The dwelling is located in a cleared area of land and orientated to the north east. Based on an assessment of topography 20 turbines associated with the Project are likely to be visible to the south east. Desktop Assessment and Viewpoint HOG36.	VIZ 3 (HOG 36)	Consider supplementary planting	Moderate
NAD_72	Timor Crawney Road	3.37	2	2	30 *Within 8 km*	Based on topography alone, up to 30 turbines will be visible to the north east. It is understood the owner is not concerned about visual impacts. Desktop assessment.	VIZ 3 (HOG 6, 8, 9)	Consider screen planting	Moderate
NAD_73	Timor Crawney Road	3.41	2	2	25 *Within 8 km*	Based on topography alone, up to 25 turbines will be visible to the north east. It is understood the owner is not concerned about visual impacts. Desktop assessment.	VIZ 3 (HOG 6, 8, 9)	Consider screen planting	Moderate
NAD_74	Crawney Road	4.44	1	1	7 *Within 8 km*	The dwelling is orientated to the north. From this dwelling up to seven turbines will be visible within 8 km to the SSW of the property. The transmission line and associated vegetation clearing will be noticeable to the south of the property. Approximately 22 turbines will be discernible in excess of 10 kilometres to the east.Site Assessment and Photomontage 24, refer Appendix F.	VIZ 3 (HOG 13)	Consider screen planting	Moderate

** Based on an assessment of topography alone. Screening factors such as vegetation may reduce the potential visibility of the proposed turbines*

*** Based on VIZ from Appendix C, nearest viewpoint.*

Existing View

Refer to cropped 60° image

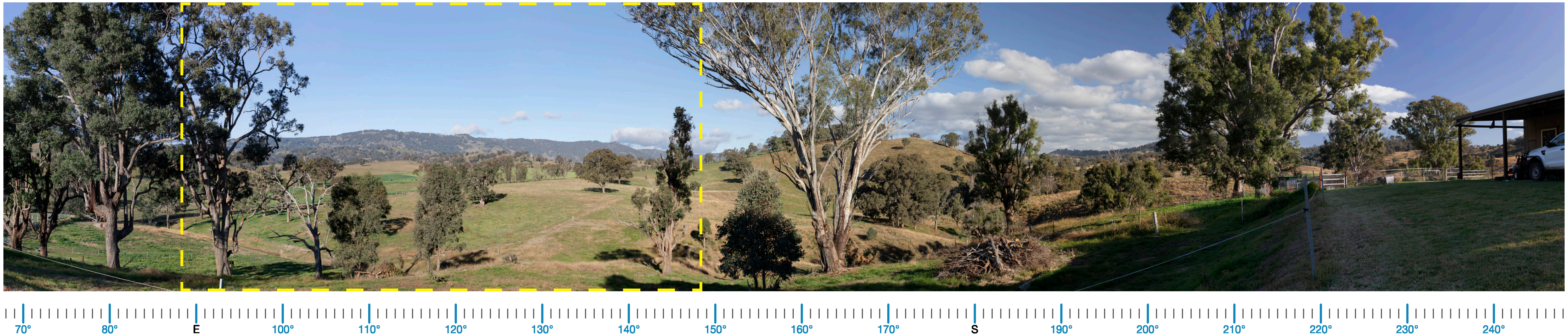


Proposed View

Figure 11.6 Photomontage 14 (closest to NAD_10A)

Existing View

Refer to cropped 60° image



Proposed View

Figure 11.7 Photomontage 21 - NAD_33

11.3.7 Landscape Character

The proposed development will be located within a predominantly rural landscape that has not been identified as significant or rare. The broad landscape character is dominated by established rural land which consists primarily of modified undulating hills. Generally, the Scenic Quality Classes of the LCU within the Study Area have been rated as moderate with some areas defined as low-moderate, and moderate - high.

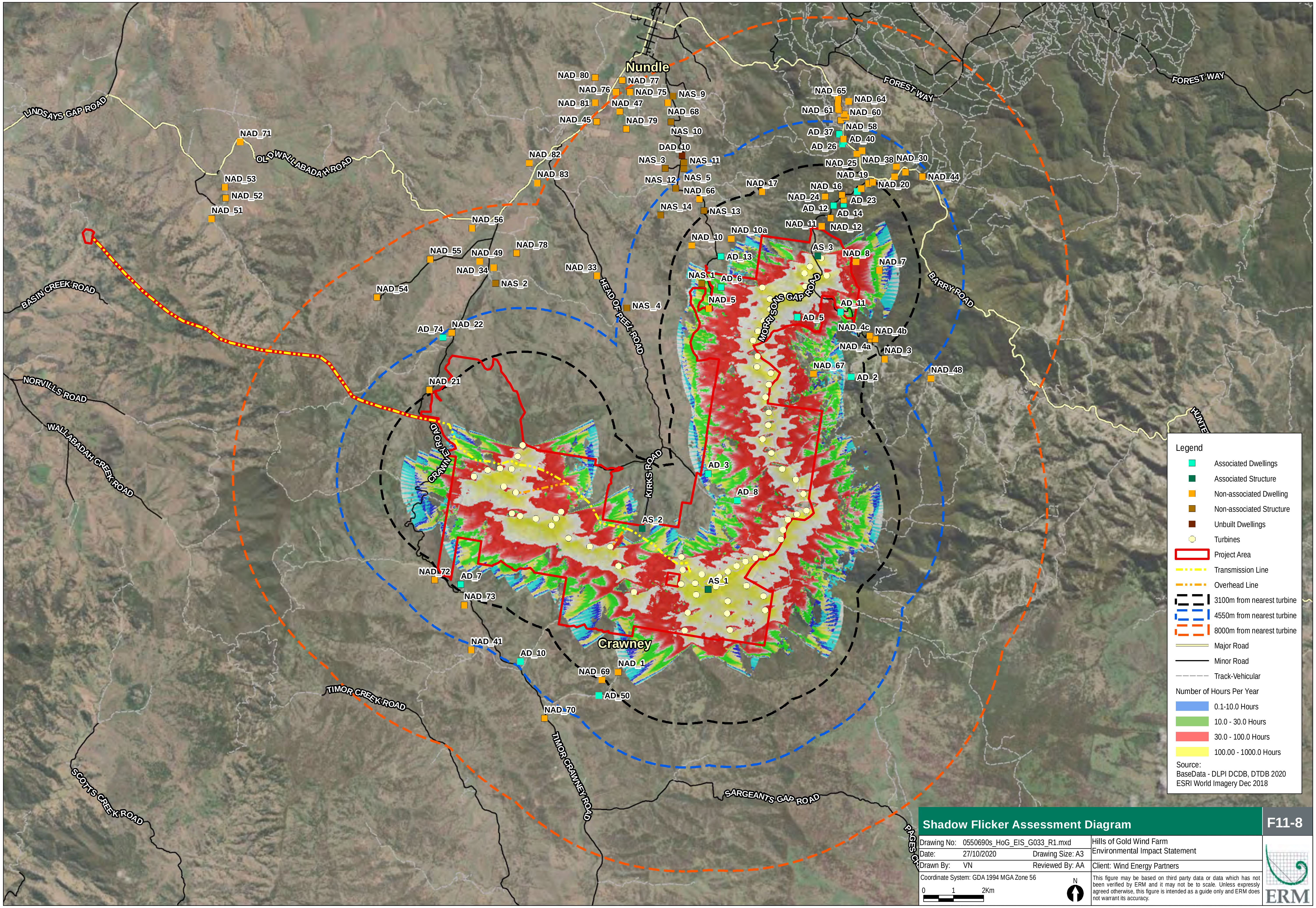
The proposed development positioned in a landscape that has remained largely unchanged and would become a feature of the visual landscape. However, it is likely the character of areas which are valued for their high landscape quality and utilised for recreation and tourism will remain intact. Regionally, significant landscape features would remain dominant features of the landscape and it is unlikely the proposed development would degrade the scenic value of these landscape features (refer Section 5.2 of the LVIA, Appendix F).

Of the seven LCU's identified and assessed, the Project is likely to be visible from all, to varying degrees. However, due to the undulating topography surrounding the Project Area, there are limited opportunities to view the Project in its entirety. Further details on the LCUs are provided in Section 15 of the LVIA (Appendix F).

11.3.8 Shadow Flicker and Blade Glint

A total of nine (9) dwellings were identified to experience potential shadow flicker based on a worst case scenario considering topography alone and not considering the screening impacts of vegetation or cloud cover which will reduce shadow flicker. Of these nine (9) dwellings, five (5) are associated dwellings (AD_3, AD_5, AD_6, AD_8, AD_11) (Figure 11.8). Of the four (4) non-associated dwellings with potential shadow flicker, only one (NAD_8) was identified as having the potential to experience more than 30 hours per year. As NAD_8 is surrounded by dense vegetation this would be likely to mitigate any potentially unacceptable limits of shadow flicker effects.

The shadow flicker assessment identified a small extent of Crawney Pass Road which may experience shadow flicker. However, dense vegetation would be likely to limit potential to experience shadow flicker. Further analysis of shadow flicker is detailed in Section 10 of the LVIA (Appendix F).



Shadow Flicker Assessment Diagram

F11-8

Drawing No: 0550690s_HoG_EIS_G033_R1.mxd
Date: 27/10/2020 Drawing Size: A3
Drawn By: VN Reviewed By: AA

Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partners

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM

11.3.9 Night Lighting

The requirement of aviation hazard lighting (AHL) on wind turbines for the proposed development is subject to the advice of the Civil Aviation Safety Authority (CASA). It is noted that the turbines proposed will possibly be up to 230 m in height and CASA generally recommends night lighting if an obstacle exceeds 150 metres above ground level.

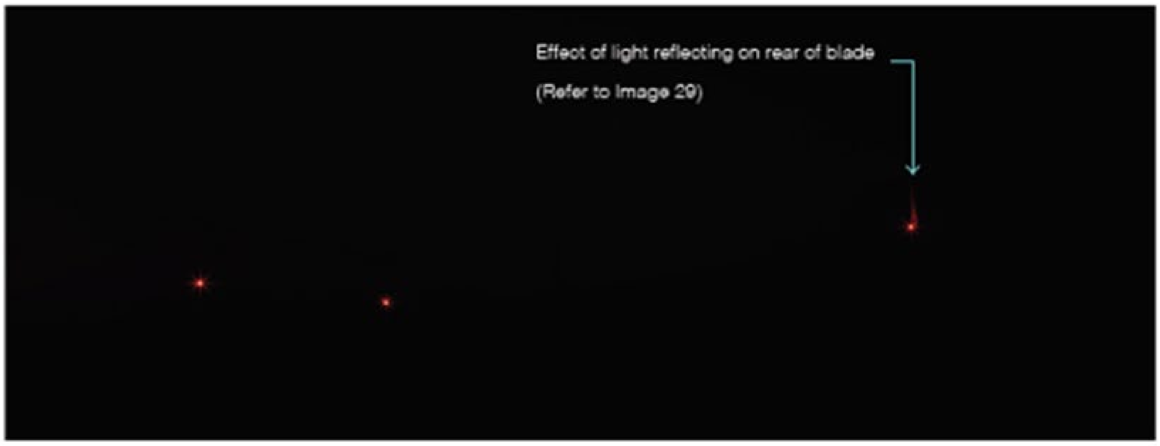
Night lighting of turbines and associated infrastructure has the potential to extend the visual effect into the night time. Aviation hazard lighting has the potential to be visible from distances in excess of 20 kilometres (Scottish Natural Heritage).

As the requirement for any aviation hazard lighting and the intensity and location of any proposed obstacle lights are yet to be confirmed , representative images of aviation lighting (installed in August 2020) on turbines at Biala Wind Farm have been included to best illustrate the potential visual appearance of aviation lighting. Detailed analysis of night lighting impacts is provided in Section 11 of the LVIA (refer Appendix F).

Photographs of the aviation lighting at varying distances and times are provided in Figure 11.9.

View towards Biala Wind Farm - 2.0 Kilometres from turbine at 6:20pm (30 minutes after sunset)

View towards Biala Wind Farm - 1.75 Kilometres from turbine at 6:35pm (45 minutes after sunset)



View towards Biala Wind Farm - 1.85 Kilometres from turbine at 6:50pm (60 minutes after sunset)

Figure 11.9 Aviation Lighting at Varying Distances and Times, Biala Wind Farm

If required, aviation lighting is likely to be visible to motorists travelling towards the Project Area, in particular Crawney Road, Timor Crawney Road and Nundle Road. Generally due to headlights reflecting on elements in the foreground, although visible, night lighting is not likely to cause major visual impacts to motorists travelling throughout the Study Area.

Nundle is located approximately 8 kilometres from the Project Area. Any aviation lighting has the potential to be a noticeable element in the night time landscape from areas around Nundle Village that have exposure to views towards the Project Area. It is important to note the effect of night lighting is reduced when existing light pollution surrounds the viewer. Due to Nundle Village being a populated area, existing light sources from dwellings, buildings and street lights exist in the village and will reduce the visual effect of night lighting associated with the Project. Figure 11.10 illustrates the visual appearance of night lighting at a distance of 8.5 km (with no light pollution influence), which is representative of the potential visual appearance from areas around Nundle but does not consider existing light pollution impacts.

Considering the high elevation of the turbines and implementation of shields, the source of visible light would be reduced to ambient lighting as opposed to direct visibility of the light itself.

Figure 11.10 View at night towards Biala Wind Farm - 8.5 km from a Turbine

Due to the relatively isolated location of the Project, very little existing sources of lighting are present in the night time landscape of the Project Area. Some existing lighting associated with homesteads and motor vehicles is dispersed around the Project Area. Isolated receptors within the Project Area experience a dark night sky with minimal light sources. The impact of night lighting is unlikely to be experienced from inside of a dwelling as internal lights reflect on windows and limit views to the exterior at night time.

The highest visual impact is likely to be people who experience the night landscape outdoors. Dark sky is a valued quality of the rural landscape due to the lack of light pollution. Aviation lighting has the potential to impact on receptors who view the landscape at night, in particular night-sky enthusiasts, photographers, star gazers, campers and some landowners.

The visual impact of aviation lighting (if required) could be reduced by employing mitigation methods outlined in Section 11.4.3 below.

In addition to the potential for aviation hazard lighting on wind turbines, night lighting is likely to be required on ancillary infrastructure including switching stations, collector substations and facilities buildings. At this stage of the Project design, the location and type of lighting required on the proposed substation, switching station and operations and maintenance buildings is yet to be confirmed. Due to such lighting being low to the ground it is unlikely the proposed night lighting associated with the ancillary infrastructure would create a noticeable impact on the existing night time landscape.

11.3.10 Associated Infrastructure

In addition to the proposed wind turbines, the associated infrastructure is likely to contrast with the existing visual landscape. Due to the large scale and elevated siting of the proposed wind farm, access roads, transmission lines and other ancillary structures have been assessed for their potential to alter the existing visual landscape.

11.3.10.1 Access Roads

From a visual impact perspective, the proposed internal access roads have been sited to reduce potential vegetation loss and limit earthwork requirements. Due to the existing agricultural land use of the Project Area, farm roads traversing the landscape form a significant part of the existing landscape character. Once disturbed areas such as batters are revegetated, the proposed access roads are likely to be viewed as part of the existing character of the landscape and therefore visual impact would be low.

11.3.10.2 Transmission Lines

Each of the 70 WTGs will be connected to an onsite substation via a 33 kV electrical cable and fibre network, which (subject to detailed design) will comprise a mix of underground and overhead power lines connecting to an onsite substation. The underground electrical cables are likely to be located adjacent to the footprint of internal access roads. The proposed internal 33 kV overhead power lines are in keeping with the scale and appearance of existing power lines which are a common element throughout the existing rural landscape.

A 330 kV overhead transmission line is proposed to connect the onsite substation to the existing overhead 330 kV transmission line network to the north west of the Project Area. The proposed 330 kV transmission line will include a steel pole structure, typically 50 m high and spaced up to 100-900 m apart.

A 60 m cleared easement will be required underneath the transmission line where required vertical clearance from top of vegetation to predicted conductor sag cannot be achieved. Generally the 330 kV transmission line transverse a large area of uninhabited land surrounded by undulating topography. Opportunities to view the transmission lines are limited due to distance, topography and vegetation. WEP undertook extensive consultation and mapping of residential dwellings to site the transmission line route away from dwellings. Potential visual impacts for individual dwellings were considered in the LVIA (refer Appendix F). Opportunities to view the transmission line are limited due to distance, topography and vegetation.

11.3.10.3 Switching Station

The proposed switching station is located on a valley floor to the north of Basin Creek Road. Basin Creek Road is an isolated road which is accessed off Wallabadah Creek Road. There are no dwellings that will have visibility of the Switching Station. Existing transmission lines are an element in the landscape. Opportunities to view the switching station are limited to receptors travelling along Basin Creek Road

11.3.10.4 Ancillary Structures

BESS and Substation

The proposed BESS and substation are likely to be screened by topography and vegetation. If deemed necessary during the detailed design phase, mitigation methods such as screen planting will be employed to reduce any potential visual impacts, where practicable with due regard to asset protection zone requirements.

Site Operations and Maintenance Facility

A permanent site operations and maintenance (O&M) facility will be constructed to provide for all operations and maintenance activities associated with the Project. Car parking facilities will also be provided for employee and service vehicles. The O&M facility is proposed adjacent to the substation and BESS. It is unlikely the O&M facility would be visible from any nearby dwellings. The nearest dwelling with visibility of the ridge is NAD_69, although the O&M facility is situated in excess of 4 kilometres from the dwelling. The O&M is set back and screened by vegetation to the south west and it is therefore unlikely to be visible.

Meteorological Monitoring Masts

The visual impacts of the new monitoring masts are negligible because the masts are difficult to discern from a distance and are an existing element in the visual landscape.

11.3.11 Cumulative Visual Impact

The nearest constructed and operating wind farm to the Project is the White Rock Wind Farm, which is located in excess of 190 km from the Project Area. The nearest approved wind farm to the Project is the Liverpool Range Wind Farm which is located over 100 kilometres south east of the Hills of Gold Project.

Several proposed wind farms within the wider regional context include:

- Bowmans Creek Wind Farm (70 kilometres south)
- Winterbourne Wind Farm (75 kilometres to the north)
- Valley of the Winds (in excess of 100 kilometres south east)

Due to distance there are no opportunities to view any additional wind farms simultaneously from a static viewpoint in the foreseeable future. Further, the Project is set back from major travel routes which prevents any opportunities to view wind farms in succession along travel routes.

The New South Wales Government have identified three key Renewable Energy Zones (REZ) in the State’s Central-West Orana, New England and South-West regions. These zones are still in the early stages of planning and the zone boundaries are yet to be finalised. However, publicly available indicative location maps show that the New England REZ is located in close proximity but outside the Project Area. This confirms the suitability of the broader region for wind farm projects and also gives rise to the possibility that further wind farms will be developed in the region in the future. As the Project is located approximately 60 km south west of the indicative New England REZ it is considered unlikely that the perceptions of the regions’ broad landscape character would be altered as a result of the Project.

11.4 Mitigation Measures

The mitigation measures described below are designed to lessen the visual impact of the proposed wind farm whilst enhancing the visual character of the surrounding environment. These are discussed in detail in Section 16 of the LVIA (refer Appendix F).

11.4.1 Project Layout and Design

The Project has been designed to significantly reduce visual impacts as outlined in the following section.

11.4.1.1 Wind farm layout and size

The layout and size of the wind farm is a significant factor in the visual impact on the landscape. The following principles were considered during the design process of the wind farm:

- controlling the location of different turbine types, densities and layout geometry to minimise the visual impacts including removal of turbines due to proximity to dwellings and layering impacts from specific dwellings;
- turbine locations reflecting the contours of the natural landscape as best as possible; and
- ensure turbines are evenly spaced to give a regular pattern creating a better balance within the landscape.

The above design principles have been considered in the siting of the proposed turbines to provide a balanced appearance along the ridgeline.

It is important to note that as a result of community consultation during the development period as discussed in Chapter 7, the Project has undergone many changes. The resulting layout has a substantially smaller development footprint to those previously considered and increases distances between turbines along the ridgeline. This is further discussed Chapter 5. Civil engineering concept designs identified the most suitable location for roads and hardstands to avoid earth works where practicable. The benefits this brings to the Project is that the ancillary infrastructure is integrated into the existing contours where possible.

11.4.1.2 Wind turbine design and colouring

Turbine design and colouring are an important factor. The turbines will have a matte white finish and consist of three blades which is consistent with the current turbine models being considered. The following important factors to achieving a visual consistency through the landscape have been considered in the Project design:

- uniformity in the colour, design, height and rotor diameter;
- the use of simple muted colours and non-reflective materials to reduce distant visibility and avoid drawing the eye;
- blades, nacelle and tower to appear as the same colour; and
- avoidance of unnecessary lighting, signage, logos etc.

11.4.2 Screen Planting

The standard conditions imposed on all NSW wind farms development consents require wind farm proponents, upon request by the owner of a non-associated residences within 4 km of any wind turbine, to implement reasonable and feasible visual impact mitigation measures such as landscaping and vegetation screening to mitigate the visual impacts of the wind farm.

A total of 18 residences were identified through the visual assessment as having the potential to benefit from the application of mitigation methods. In circumstances where residences are subject to significant visual impacts, screen planting will be implemented where practicable to mitigate visual impacts on residential properties where required.

Due to the vegetated character of areas surrounding the Project Area (particularly to the north along Morrisons Gap Road) the Project is likely to be screened by vegetation from a number of dwellings. Where turbines are located close to the dwelling or existing intervening vegetation is thin, supplementary planting will be implemented where practicable. Supplementary planting in keeping with the existing landscape character would further reduce potential visibility and ensure longevity of the intervening vegetation.

Table 11.2 and Table 11.3 provide an overview of the potential mitigation options for the 18 residences within the 4550 m of the nearest turbine. Additional consideration of NAD_33 is discussed in Section 11.3.6.3.

Screen planting has been identified as a potential mitigation measure for 11 dwellings and supplementary planting has been identified for seven dwellings.

11.4.3 Night Lighting

If night lighting is ultimately required, the following proposed mitigation measures will be used to reduce visual impacts subject to CASA requirements:

- air navigation lights will be spaced over the array, particularly at the extremities. Where possible, careful consideration will be given to turbines upon which aviation lighting is installed to avoid unnecessary impact upon residences;
- treatment of the rear of blades with a non-reflective coating to reduce reflection off the rotating blade at night;
- use of the lowest candela intensity allowed by CASA;
- shielding will be provided to restrict the downward spill of light to the ground plane by ensuring that no more than 5 % of the nominal light intensity should be emitted at or below 5° below horizontal; and
- no light will be emitted at or below 10° below horizontal.

11.4.4 Associated Infrastructure

The proposed mitigation measures considered to reduce residual visual impact resulting from the construction of access roads include:

- where possible, existing roads, trails or tracks will be utilised or upgraded to provide access to the proposed turbines to reduce the need for new roads;
- all batters and disturbed areas outside of the active road formation will be revegetated;
- any new roads will minimise cut and fill and will avoid the loss of vegetation; and
- local materials where practicable will be utilised.

The proposed mitigation methods considered to reduce residual visual impact resulting from transmission lines include:

- where practicable underground cabling is to be used to connect wind turbines to the electricity grid;
- existing transmission lines will be utilised where practicable;
- the route for any proposed overhead transmission lines will be chosen to reduce visibility from surrounding areas;
- routes will be planned to minimise vegetation loss; and
- subtle colours and a low reflectivity surface treatment will be used on power poles to ensure that glint is minimised.

The smaller scale of ancillary structures including the proposed substation and O&M building will be screened by topography, existing vegetation and if necessary proposed screening vegetation. The following mitigation measures will be adopted where necessary to reduce any residual visual impacts:

- siting to ensure minimal vegetation loss;
- building materials will have a recessive colour palette which blends into the existing landscape where practicable;
- unnecessary lighting, signage on fences, logos etc will be avoided;
- any proposed buildings will be sympathetic to existing architectural elements in the landscape; and
- the cut and fill and loss of existing vegetation will be minimised throughout the construction process.

Boundary screen planting will be utilised to effectively mitigate potential visual impacts resulting from the construction of ancillary structures with a small vertical scale such as collector substations, switching stations and the operations facilities building.

11.5 Conclusion

It is inevitable that the placement of wind turbines in a rural landscape will alter the existing landscape character of the area to some degree. The proposed wind farm contrasts with the existing landscape character of the region which is typically rural, pastoral land with large expanses of vegetation.

Although this impact assessment quantifies the visual impact of the proposed wind turbines, the overall visual impact of the wind farm will vary greatly depending on the individual viewer's sensitivity to and acceptance of change. The sensitivity towards change varies greatly depending on the user's connection with the landscape. For example visitors to the area travelling into Nundle from the west may perceive the wind farm as an interesting feature of the landscape. This may contrast with a resident who passes the wind farm daily who may have a more critical perception of the visual presence of the wind farm.

The visual impact of the wind turbines are lessened as the distance of the vantage point from the Project Area is lengthened. The topography surrounding the wind turbines significantly alters the visibility of the proposed development from many vantage points. Within the local setting, a combination of the topography and local influences such as existing natural and introduced vegetation, significantly reduces visibility towards the proposed turbine locations.

The greatest visual effect is most likely to be felt by residents in the immediate vicinity of the wind farm. Amelioration methods incorporated into the design process in conjunction with landscape and visual screening will have a positive effect on reducing any visual impact of proposed wind farm. Through mitigation methods described it will be possible to significantly reduce the visual impact to an acceptable level at sensitive viewpoints such as rural residential properties.

When implemented with appropriate environmental management, the development of the wind farm can be undertaken with low impact on the surrounding environment whilst providing positive local, regional and national benefits.

12. TRANSPORT AND TRAFFIC

12.1 Introduction

A Traffic and Transport Assessment (TTA) was prepared by The Transport Planning Partnership (TTPP, 2020) to assess the ability of the road network, intersection performances and site access arrangements for the Project. The TTA assessed the construction and operational traffic impacts of the Project and other requirements specified in the SEARs for traffic impacts. The assessment also considered feedback from consultation with the community and relevant roads authorities including Transport for NSW and councils. A copy of the TTA can be found in full as Appendix G.

12.2 Methodology

The TTA incorporated the following scope of works:

- review of existing traffic and road safety data, including road accident history (crash data) for potential oversized and over mass vehicle routes and historical traffic count data;
- site inspection of the road network and proposed vehicular access routes to the Project. The site inspection focused on the intersection design, sight distances, and suitability of the proposed routes for the delivery of construction materials and turbines;
- assessment of traffic impacts during Project construction and operation phases, with regard to:
  - vehicle types;
  - nominated transport routes to/from the Project;
  - traffic volumes and potential impacts on local and regional roads; and
  - site access arrangements.
- assessment of traffic capacity based on the volume capacity ratio (V/C), rural road Level of Service and the environmental capacity for urban areas based on the RTA Guide to Traffic Generating Development (RTA, 2002);
- a swept path analysis of the largest RAV to access the site, to identify any constraints at intersections along the nominated transport route, including detailing required road upgrade works; and
- consultation with key stakeholders.

12.3 Existing Environment

12.3.1 Road Network

This section describes the local road network that would be used by standard light and heavy vehicles for access to the Project Area. The proposed route for oversize and over mass vehicles also known as restricted access vehicles (RAV) is detailed in Section 12.4.4.

New England Highway – This is the Highway connecting Hexham (Newcastle) and Toowoomba in Queensland and is part of an inland route connecting Sydney to Brisbane. It is an important freight route as well as connecting inland towns such as Muswellbrook, Tamworth and Armidale.

The section of Highway between Wallabadah and Tamworth is single carriageway with sections of overtaking lanes. The highway is of a higher standard road with centre line and lane markings as well as edge line marking. Horizontal curves generally have safety barriers (Figure 12-1).

The New England Highway has been used as the transport route for other wind turbine projects.

Figure 12-1 New England Highway (100 m South of Lindsays Gap Road)

Lindsays Gap Road is the main route from the New England Highway to Nundle. It is a rural road that features two one-lane bridges at Goonoo Goonoo Creek and Middlebrook Creek. Lindsays Gap Road has sections of winding road through undulating hills. It is currently frequently used by Forestry vehicles travelling between the state forests east of Nundle and the intermodal connection at Werris Creek. The road has sections without road markings (see Figure 12-2).

Figure 12-2 Lindsays Gap Road (10 km east of New England Highway)

Nundle Road – Nundle Road connects Nundle to Tamworth. It is a two way rural road on an undivided carriageway. The road does not have a posted speed limit and therefore has the default 100 km/h speed limit for a rural road. Nundle Road is used as an alternative route from Nundle to the New England Highway. The section of road between Nundle and Lindsays Gap Road is frequently used by forestry trucks on route to the intermodal terminal at Werris Creek (See Figure 12-3).

Figure 12-3 Nundle Road (100 m South of Lindsays Gap Road)

Barry Road (primary route to Project Area from Nundle, 'northern route') is a rural road that connects Nundle with Hanging Rock and beyond. The road features sections of steep and winding sections of road. This road is frequently used by forestry trucks travelling to and from the Werris Creek intermodal (see Figure 12-4).

Figure 12-4 Barry Road (3 km east of Happy Valley Road)

Morrisons Gap Road (primary route to Project Area from Nundle, 'northern route') is an unsealed rural access road that runs from Barry Road and terminates in the Project Area. There is no posted speed limit, but drivers generally drive to the conditions. The road features sections of winding road through forested areas. The road is used as a shared access to various rural properties (see Figure 12-5).

Figure 12-5 Morrisons Gap Road (2 km west of Barry Road)

Crawney Road (secondary route from Nundle 'southern route') is a sealed rural road to the south of Nundle that runs in a north south direction. It has the default 100 km/h speed limit. The road has a single carriageway with limited line marking (see Figure 12-6).

Figure 12-6 Crawney Road (3.5k m south of Oakenville Street)

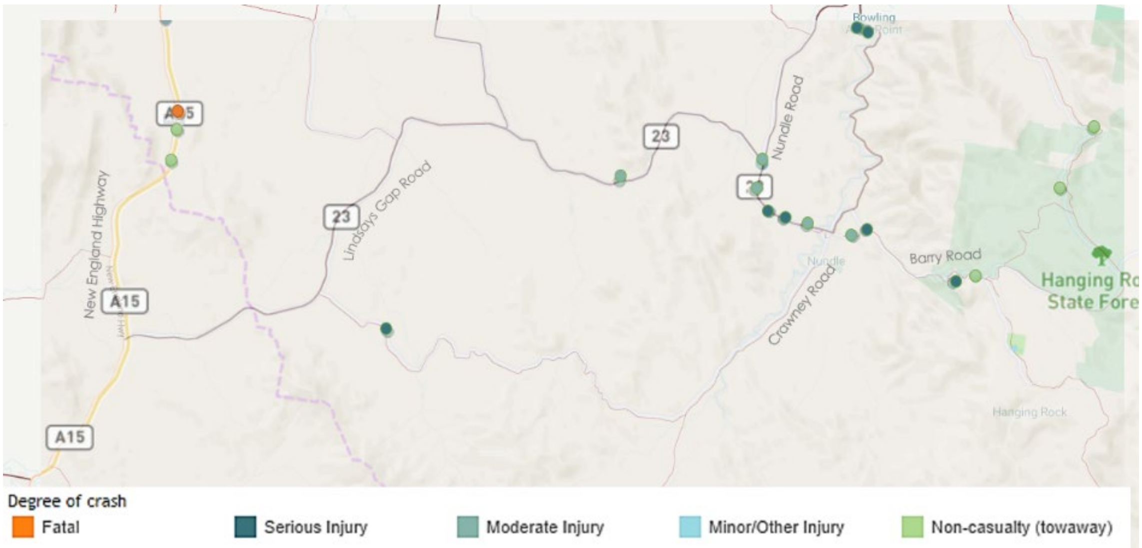
Head of Peel Road (secondary route from Nundle 'southern route') from Crawney Road, is an unsealed rural road that provides access to local farms. It is proposed to extend the road up a steep hill to meet the Project's internal access tracks providing a loop with Morrisons Gap Road at the top of the ridge. The Head of Peel Road features a bridge, and a number of causeway creek crossings and cattle grids (see Figure 12-7).

Figure 12-7 Head of Peel Road (600 m south east of Crawney Road)

It is assumed that most of the light vehicle traffic would use the route from Tamworth via either Nundle Road or the New England Highway Lindsays Gap Road. Plant, equipment and materials for construction is likely to travel from the New England Highway to the south and then Lindsays Gap Road and Nundle Road.

12.3.2 Crash History

The location of crashes for the five year period from 2014 to 2018 is shown in Figure 12-8 (Centre for Road Safety, 2020). Crashes are recorded when reported to Police and include crashes that involve vehicles being towed or a reported injury.



Source: (Centre for Road Safety, 2020)

Figure 12-8 Crash History 2014 - 2018

The data shows that in general, the number of crashes is consistent with a typical rural road. However, the 4.2 km section of Nundle Road between Lindsays Gap Road and Nundle has had a significant number of crashes. The intersection of Lindsays Gap Road and Nundle Road where two crashes were recorded has adequate sight distance for the rural speed limit. Lindsays Gap Road intersects with Nundle Road at an angle. This may contribute to the crashes, as drivers are required to turn their heads over their shoulder to see traffic approaching on Nundle Road from the north. The section of Nundle Road from Lindsays Gap Road to Nundle has been considered in the TTA (refer to Appendix G).

12.3.3 Existing Traffic Volumes

Traffic volumes provided by Tamworth Regional Council at key times are shown in Figure 12-9, Figure 12-10 and Figure 12-11 for the morning construction peak, morning peak and evening peak hours, respectively. The daily traffic volumes are shown in Figure 12-12. The daily traffic volumes within the Nundle township are shown in Figure 12-13. These dates were before the current COVID 19 restrictions and associated reductions in traffic volumes generally across the road network. Morning, evening and peak traffic volumes for Nundle township are detailed in Figures 2.16 – 2.18 of the TTA (Appendix G).

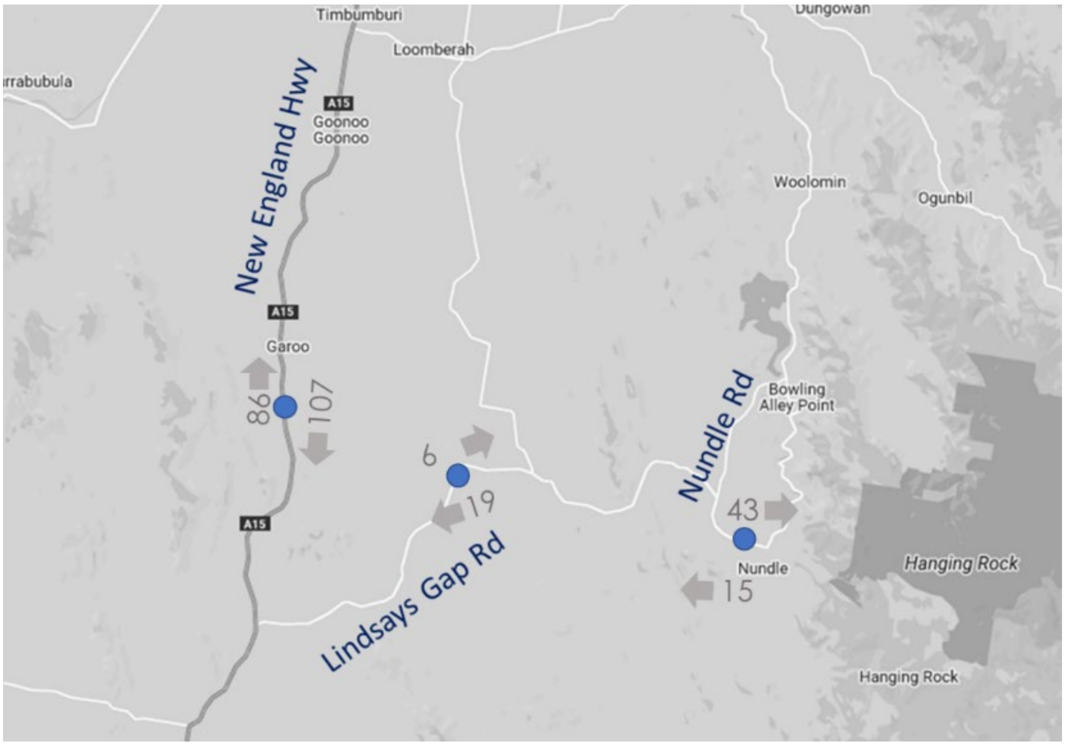


Figure 12-9 Construction Morning Peak (7:00am – 8:00am)

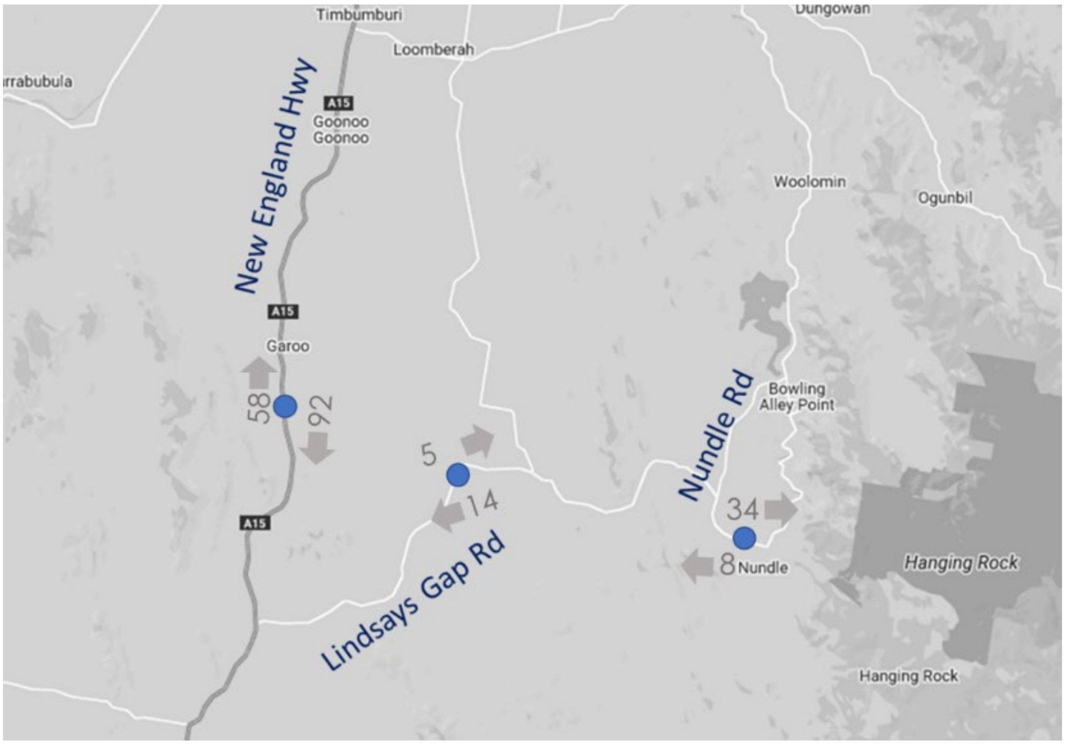


Figure 12-10 Morning Peak (8:00am – 9:00am)

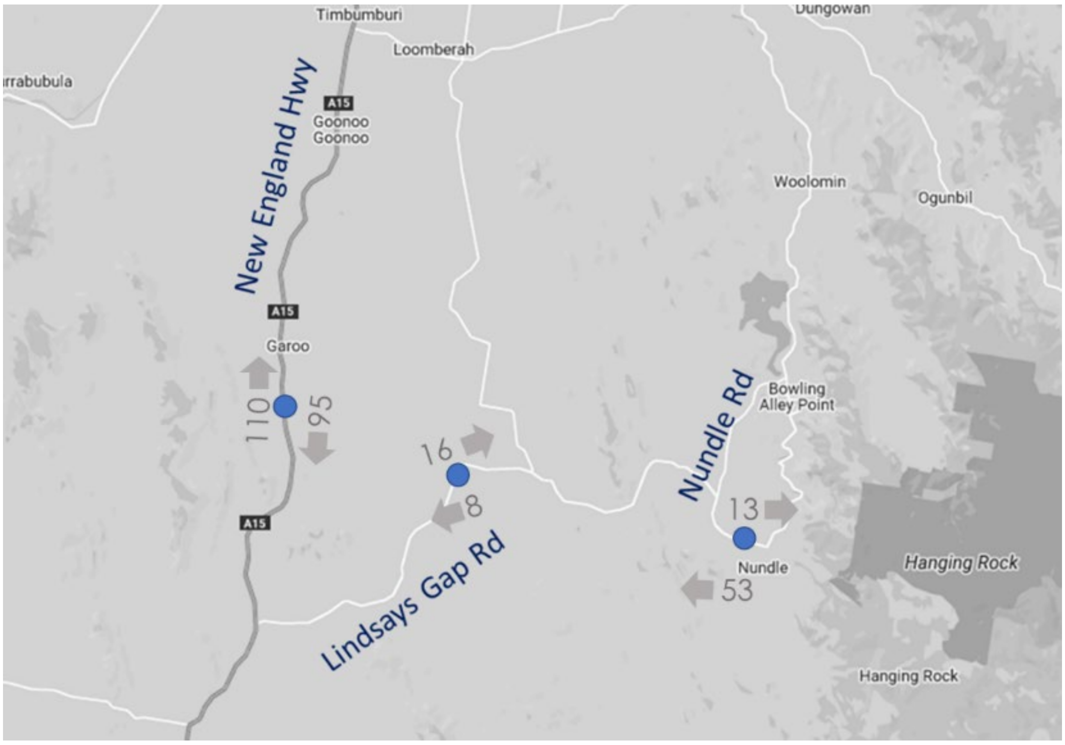


Figure 12-11 Evening Peak (5:00pm – 6:00pm)

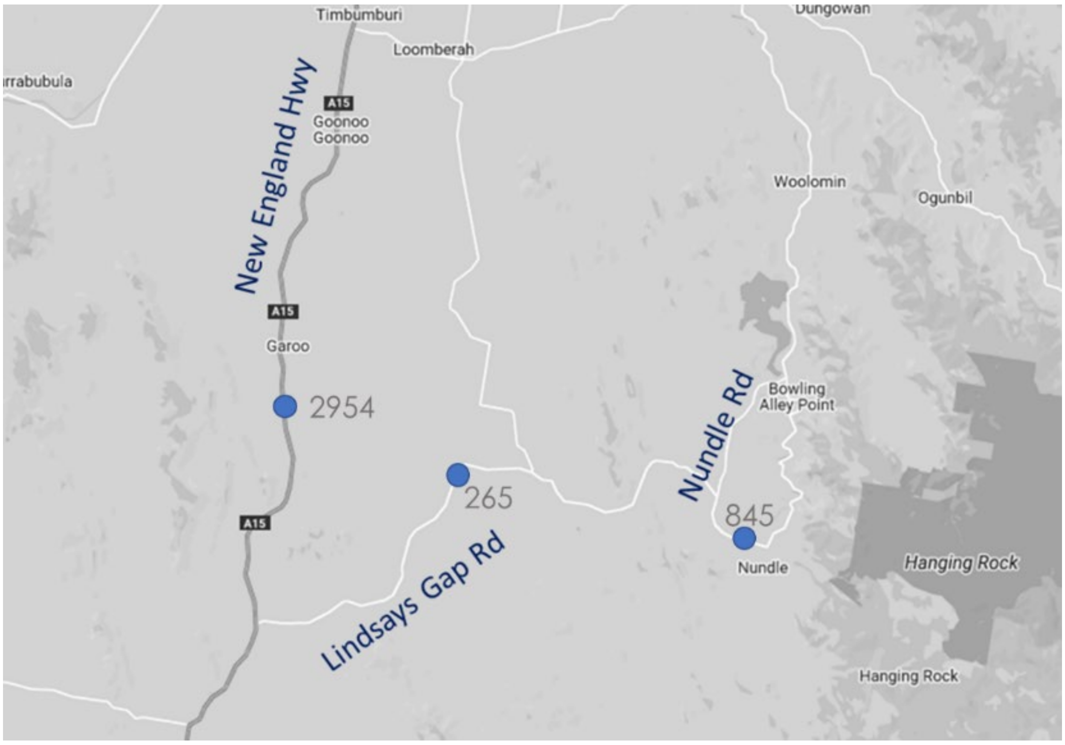


Figure 12-12 Daily Traffic Volumes (bi-directional)

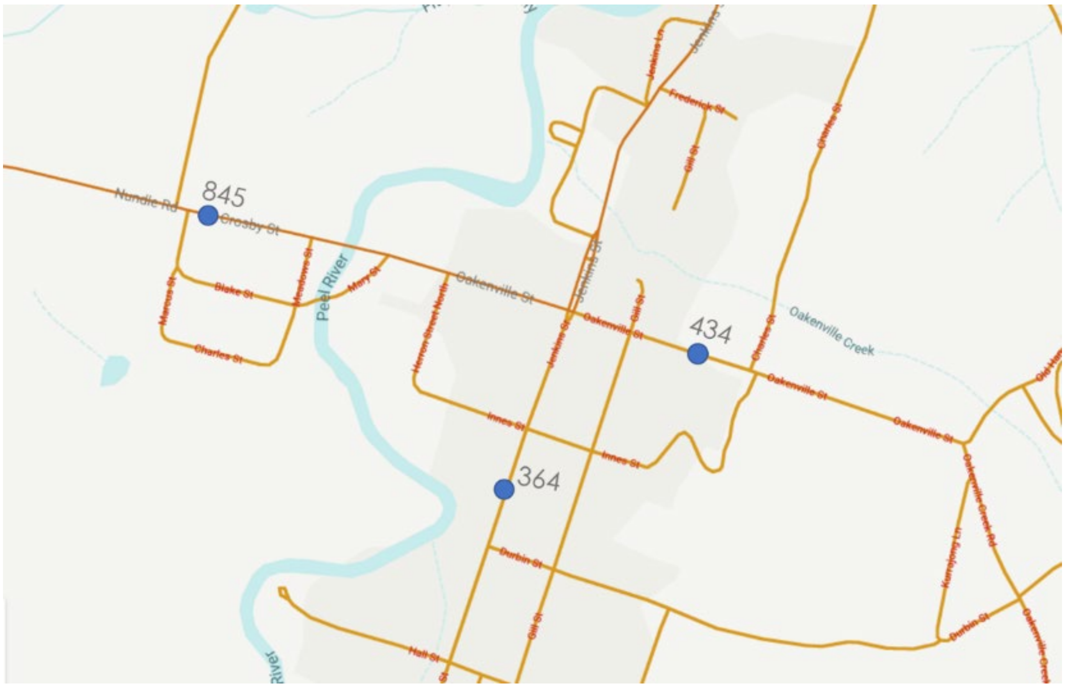


Figure 12-13 Daily Traffic Volumes (bi-directional) – Nundle

The data shows that the traffic volumes in the area are relatively low. Observations during site visits indicate that most heavy vehicles travelling through Nundle are associated with loaded NSW Forestry trucks travelling westbound along Nundle Road and Lindsays Gap Road and returning empty eastbound. In the morning peak and evening peak volumes are in the order of six (6) laden trucks and six (6) returning trucks per hour.

12.3.4 Bus Routes

A bus service operates from Nundle to Tamworth on Thursdays only with services leaving Nundle at 9:00 am and arrives in Tamworth at 10:00 am. The return trip departs Tamworth at 2:00 pm and arrives in Nundle at 3:15 pm.

There are also school bus services. These buses provide services to high school students travelling to Tamworth and provide services to Nundle Public School from outlying areas. The school buses drop-off and pick up from outside the Nundle Public School located on Jenkins Street. The buses are usually mini-buses or 24 seater type buses. School buses operate in the mornings between 7:30 am – 8:30 am and in the evenings from 3:00 pm – 4:00 pm including on roads proposed for transport:

- Barry Road Route (bus goes four (4) km past the Morrisons Gap turn-off) between 6:20 am and 7:05 am and 7:40 am and 8:35 am in the morning and 3:30-4:15 pm and 4:40-5:20 pm in the afternoon.
- Crawney Road Route up to the end of the bitumen between 8 am and 8:15 am and 3:30 pm and 4 pm.

12.4 Assessment of Impacts

12.4.1 Traffic Capacity Assessment Measures

Sections 12.4.2 and 12.4.3 below detail the traffic capacity assessment for the Project in accordance with the following assessment measures:

- **volume capacity ratio** - the assessment of traffic capacity was based on the volume capacity ratio, rural road Level of Service and the environmental capacity for urban areas based on the *Guide to Traffic Generating Development* (RTA, 2002). The volume capacity ratio indicates the level of congestion by comparing the forecast traffic volumes to the theoretical lane capacity. For the assessment rural roads were assumed to have a capacity of 1000 vehicles per hour per lane. As volume capacity ratios approach 0.9 it should be expected that flow would become significantly interrupted.
- **Level of Service:** level of service is a measure of traffic efficiency. The Level of Service is a six-level rank (Level of Service A to F) which considers factors such as speed, volume of traffic, geometric features, traffic interruptions, delays and freedom to manoeuvre. The desirable Level of Service is a Level of Service C or greater, as recommended by the *Guide to Traffic Generating Developments* (RTA, 2002)
- **Environmental capacity:** the environmental capacity is an assessment of the impact on the amenity of an environment (e.g. acceptable level of noise). The environmental capacities were estimated by considering a range of differing perceptions of traffic impacts in a particular area. The assessment has used the performance standards tables provided in in the *Guide to Traffic Generating Developments* (RTA, 2002).

12.4.2 Traffic Generation

The construction period is expected to be the peak traffic generation period for the Project. Traffic generation estimations for the changing Project phases were conservatively estimated based on based on the project elements, indicative construction program and assumptions outlined in the TTA as detailed below.

Site Establishment

The estimated traffic generation during the site establishment phase is shown in Table 12-1. It is assumed that there are some construction workers coming and going from site throughout the day and that 50% of the workforce are provided a shuttle bus service to and from Tamworth.

Table 12-1 Site Establishment Traffic Generation

Vehicle type	Units	Morning Construction Peak (7:00am – 8:00am) (Vehicles per hour)			Daily Trips (Vehicles)
		To Site	From Site	Total	
Light vehicles	65 workers	65	0	65	130
Buses	60 workers	3	3	6	12
Water trucks	11 per day	2	2	4	22
Trucks	20 per day	3	2	5	40

Construction Period

The traffic generation for the peak construction period is shown in Table 12-2. This would occur over a period of 13 months.

Table 12-2 Peak Construction Period Traffic Generation

Vehicle type	Units	Morning Construction Peak (7:00am – 8:00am) (Vehicles per hour)			Daily (trips)
		To Site	From Site	Total	
Light vehicles	87 workers	87	15	102	210
Buses	87 workers	4	3	7	12
Water trucks	20 per day	3	3	4	40
Trucks	120 per day	14	14	28	240

Operational Phase

During the operational period of the Project it is estimated that there would usually be 31 workers on site to maintain the facility. The estimated traffic generation during a typical period is shown in Table 12-3.

Table 12-3 Typical Operational Period Traffic Generation

Vehicle type	Units	Morning Peak (7:00am – 8:00am) (Vehicles per hour)			Daily (trips)
		To Site	From Site	Total	
Light vehicles	31 workers	25	0	25	50
Heavy Vehicles	2 per day	2	1	-	4

At times additional workers may be required for specific tasks. The upper estimate for the number of staff on site is 33 workers during short one-week periods. The traffic generation during peak activity periods is shown in Table 12-4.

Table 12-4 Peak Operational Period Traffic Generation

Vehicle type	Units	Morning Peak (7:00am – 8:00am) (Vehicles per hour)			Daily (trips)
		To Site	From Site	Total	
Light vehicles	33 workers	33	0	33	66
Heavy Vehicles	4 per day	2	1	-	8

12.4.3 Traffic Impacts

12.4.3.1 Construction

The assessment shows that almost all the roads would operate at Level of Service A during the peak of construction. If we consider Oakenville Street as mountainous and includes Barry Road, then this would be revised to Level of Service B. In all cases the level of service is below the recommended desirable Level of Service C.

In terms of environmental capacity, the forecast volumes would be less than the maximum 300 vehicles for collector roads and less than 200 vehicles per hour for local roads. Thus, the Project related traffic would operate within environmental capacity guidelines.

12.4.3.2 Operations

The volume capacity on the subject roads are forecast to be less than 0.05 which indicates that there would be excellent levels of service and capacity on the road network. All roads analysed would be Level of Service A and have better performance than the minimum recommended. The forecast traffic volumes would be less than the target environmental capacities for local streets.

12.4.3.3 Decommissioning

As discussed in Section 3.6, the WTGs have an expected operating life between 25-35 years, at the end of which there are three main options for consideration:

- continue the use of the site as a wind farm using the existing WTGs (subject to condition of equipment);
- replace the WTGs with technology current at that time and continue the use of the site as a wind farm for a further term (subject to agreement with landowners); or
- decommission the Project and remove the WTGs and associated infrastructure in accordance with the Environmental Management Strategy.

When decommissioning is required all above ground structures not required for the ongoing agricultural use of the land (some access tracks, for example, may be required to be retained by the landholder to enable ongoing access), including the WTGs and substation will be removed and the land rehabilitated to ensure it can be returned to agricultural use. Below ground infrastructure, including the WTG foundations and hardstands, will be left in situ, covered in clean fill material and revegetated, with the area adequately graded to reflect the slope of the surrounding area and to mitigate the risk of soil erosion.

All decommissioning work would be the responsibility of the Proponent. The Proponent has entered long-term lease agreements with the associated landholders for the construction and operation of the Project. The terms of these agreements make express provision for the Proponent's decommissioning obligations.

It is anticipated that the decommissioning and rehabilitation phase would take up to 18 months to complete, with the Project Area being returned, as far as practicable, to its condition prior to the commencement of construction. The Environmental Management Strategy will include measures for Decommissioning and Rehabilitation in accordance with any project approval requirements.

Traffic generated during decommissioning would be similar to traffic generation during site establishment. Based on the assessment of road capacity during construction (refer Section 12.4.3.1), the level of service is below the recommended desirable Level of Service C.

Whilst road network conditions at the completion of the Project in 25 - 35 years – is unknown, based on current conditions, it is considered that the road network would have sufficient capacity to accommodate the heavy vehicles to be used during decommissioning.

A Traffic Management Plan will be prepared prior to the decommissioning phase in consultation with relevant road authorities.

12.4.3.4 Intersection Capacity

Observations onsite indicate that intersections in the area operate with minimal delay and spare capacity. The existing traffic volumes are low and the estimated future traffic volumes for both construction and operation are such that intersection traffic modelling was not warranted. It is expected that, given the Volume Capacity (V/C) ratio indicate that there would be a generous amount of capacity in the road network, intersections would also continue to perform satisfactorily with a Level of Service of A during construction and in the operational period.

12.4.4 Restricted Access Vehicle Traffic Routes

The main traffic routes for oversize and over mass vehicles (RAVs) to and from the Project Area are discussed in the following sections and shown on Figure 12-14.

12.4.4.1 Oversized Loads Transportation

The Project will include the delivery to site of the components of the wind turbines and electrical equipment including among other things:

- blades;
- tower sections;
- nacelles;
- substation and switching station components; and
- cabling.

A summary of the estimated oversized and over mass trucks is shown in Table 12-5.

Table 12-5 Oversized and Overmass Vehicles

Component Type	Vehicle Types	No. of Trips to Site	Daily No. of Trips to Site	Duration of Deliveries
Blades (root section)	Prime mover with 1x4 dolly with 4x4 extendable blade trailer	210	0.9 (2 WTGs/week)	35 weeks
Blades (tip section)*	Prime mover with 2x4-4x4 platform trailer	70	0.3	35 weeks
Nacelles	Prime mover with 8x8 Platform trailer	70	0.3	35 weeks

Component Type	Vehicle Types	No. of Trips to Site	Daily No. of Trips to Site	Duration of Deliveries
Drivetrain	Prime mover with 2x8-4x8 Platform Low loader	70	0.3	35 weeks
Hubs	Prime mover with 2x8 4x8 Low Loader	70	0.3	35 weeks
Tower Sections	Prime mover with 10x8 platform trailer (lower sections) Prime mover with 3x4-2x8 Dolly jinker (upper sections)	490 (7 section tower)	2.0	35 weeks
Other (2 x 40ft Shipping Container per WTG)	Prime mover with 1x4-3x4 platform trailer	140 (2 per WTG)	0.6	35 weeks
Substation	Prime mover with 1x4-3x4 platform trailer	20	0.1	10 – 19 months
Switching station	Prime mover with 1x4-3x4 platform trailer	20	0.1	10 – 19 months
Overhead Cabling	Prime mover with 1x4-3x4 platform trailer	120	0.5	10 – 19 months
Underground Cabling	Prime mover with 1x4-3x4 platform trailer	20	0.1	10 – 19 months
Battery System	Standard Semi – trailer	158	2	35 weeks
Mobile Concrete Batch Plant	Standard Semi – Trailer	2	1	1 week
Transformers	2 x Low Loaders	2	1	2 weeks

** Blades (tip section) – these movements would only occur if blades are split into two units. Note: Three tips can be transported on one truck.*

It is proposed that oversized and over mass loads will be transported from the Newcastle Port to the Project Area. A detailed traffic management plan will be implemented for the transportation of individual items.

Port of Newcastle to Nundle:

From the Port of Newcastle to Nundle, the traffic routes, depending on the oversize plant and equipment being transported are described below and detailed in Figure 12-14:

- **Blade Route:** via Selwyn Street, George Street, Industrial Drive, Maitland Road, New England Highway, John Renshaw Drive, Hunter Expressway, New England Highway, Golden Highway, Denman Road,(Muswellbrook bypass via Bengalla Road, Wybong Road, Kayuga Road, Ivermein Street, Dartbrook mine access Road), New England Highway, Lindsays Gap Road, Nundle Road, Crosby Street, Oakenville Street.
- **Tower Route:** via Selwyn Street, George Street, Industrial Drive, Maitland Road, New England Highway, John Renshaw Drive, Hunter Expressway, New England Highway, Golden Highway, Denman Road, Thomas Mitchell Drive, New England Highway (Muswellbrook bypass via Bell Street, Victoria Street, Market Street), New England Highway to either:
  - New England Highway, Lindsays Gap Road, Nundle Road, Crosby Street, Oakenville Street; or alternatively
  - Tamworth bypass (via Scott Street, Marius Street), New England Highway, Nundle Road, Crosby Street, Oakenville Street.
- **Remaining components:** via Selwyn Street, George Street, Industrial Drive, Maitland Road, New England Highway, John Renshaw Drive, Hunter Expressway, New England Highway, (Muswellbrook bypass via Bell Street, Victoria Street, Market Street), New England Highway, Lindsays Gap Road, Nundle Road, Crosby Street, Oakenville Street.

Nundle to the Project Area

Once in Nundle RAV traffic would continue to Morrisons Gap Road via Barry Road as the preferred access (northern route), or travel south on Jenkins Street, Crawney Road to Head of Peel Road (alternative, southern route).

The route for blades and towers that may utilise the southern (alternative) access is Oakenville Street, Old Hanging Rock Road, Happy Valley Road, River Road, Jenkins Street, Crawney Road and Head of Peel Road. A potential optional route has been considered to bypass the centre of town by turning into Herron Street and Innes Street then Gill Street and Point Street to Crawney Road and Head of Peel Road.

The assessment has been carried out assuming all traffic utilising the Northern Route to present a worst case if this option is finally selected. An assessment is also completed whereby the route is split and some RAVs use the alternate Southern Route.

This is further detailed in Section 3.6 of the TTA (Appendix G).

12.4.5 Road Upgrades

Road upgrades have been identified that would be required to cater for the delivery of blades, nacelles and towers. The upgrades are required to ensure sufficient space for oversized vehicles passage, including intersection widening, trimming and removal of vegetation, removable signs and infrastructure, and the relocation of overhead wires. The upgrades have been identified based on the largest blade length option currently under consideration, being 83.5 m.

The road upgrades will also increase road safety and amenity for the local community.

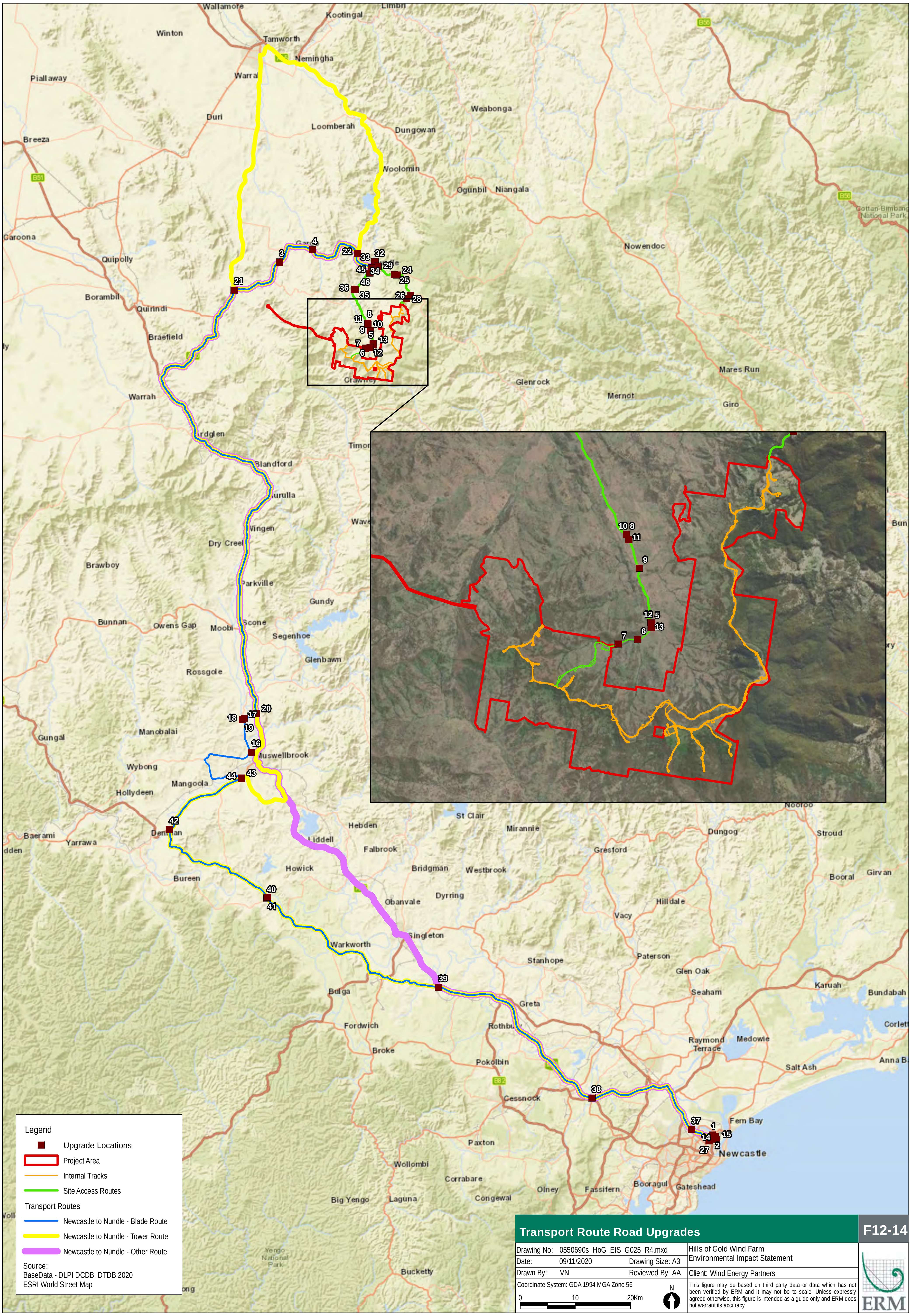
The following road upgrade works have been identified as being required (refer Table 12-6 and Figure 12-14), as detailed further in Section 3.7 of the TTA (Appendix G). Should a smaller turbine model be ultimately selected and / or blades are further split for transport purposes, identified road upgrades may not all be required.

Table 12-6 Proposed Road Upgrades

ID	Type*	Location	Works
Port of Newcastle to Lindsays Gap Road			
1 – 2, 14 - 15	RU	Mayfield # 4 Port Storage Area; Mayfield # 4 Berth; Mayfield # 4 onto Selwyn Street	Additional hardstand required and fence relocated
27	RU	Selwyn Street onto Industrial Drive (via George Street)	Signs need to be made removable, traffic signals relocated and additional hardstand.
37	RU	Industrial Drive onto Maitland Road	Minor alteration to concrete median strip.
38	RU	John Renshaw Drive onto the Hunter Expressway	May require additional hardstand and adjustment to the median on the Hunter Expressway.
39	RU	New England Highway onto Golden Highway at Whittingham	Modifications to the centre island and removable signs
40 - 41	RU	Golden Highway through Jerrys Plains village	Signs need to be made removable and additional hardstand required
42	RU	Golden Highway to Denman Road	Additional hardstand required and signs made removable
43 - 44	RU	Denman Road onto Bengalla Road	Additional hardstand required and signs made removable
16	RU	Wybong Road onto Kayuga Road	Signs to be made removable, additional hardstand and adjustment of fences on private land
17 - 18	RU	Ivenmein Street onto Dartbrook Mine Access Road	Signs made removable and additional hardstand including culvert extension required
19	RU	Dartbrook Road	Additional hardstand required, and signs made removable
20	RU	Dartbrook Road to New England Highway	Signs to be made removable and some hardstand added
New England Highway to Nundle via Lindsays Gap Road			
21	RU	New England Highway and Lindsays Gap Road	Widening of hardstand area and make signs removable to allow vehicles to turn from the New England Highway
3	BU	Goonoo Goonoo Creek Bridge	Bridge needs widening and upgrading for loads with axles exceeding 3.5 m
4	BU	Middlebrook Creek Bridge	4.5 m clearance, bridge may need upgrading
22	RU	Lindsays Gap Road to Nundle Road	Requires some intersection widening and additional hardstand, signs made removable and a power pole relocation
Nundle to the Project Area via Morisons Gap Road (preferred access, ‘Northern Route’)			
23	RU	Oakenville Street and Old Hanging Rock Road	Requires road widening and additional hardstand and removable signage and street furniture. Barry Road Layover – It has been identified that an area at the base of the hill where additional road shoulder may need to be constructed to provide a staging area for trucks about to negotiate the gradient up to Hanging Rock. This would be used if multiple prime movers are required.

ID	Type*	Location	Works
24 / 25	RU	Nundle to Hanging Road via Barrys Road	Currently investigating civil engineering solutions to straighten the curves on Barry Road to Hanging Rock ('Devils Elbow'). The preferred option would result in a significant gradient that may require combination of push pull truck arrangements to negotiate the slope. The swept path for the preferred option is shown in Figure 3.29 of the TTA (refer Appendix G). Barrys Road widening requires cutting back of vegetation to allow the longest loads to negotiate the road.
26	RU	Barrys Road onto Morrisons Gap Road	Requires additional widening and hardstand, fence relocation and removal of trees.
28	RU	Morrisons Gap Road	Requires upgrade with widening 5.5m width and widening on bends and clearing vegetation on bends. The Proponent is also proposing to seal Morrisons Gap Road to improve road safety and the amenity of local residents.
Nundle to the Project Area via Crawney Road and Head of Peel Road (alternate access, 'Southern Route')			
29 / 30 / 31	RU	Old Hanging Rock Road onto Happy Valley Road	Additional hardstand and widening as well as crossing private land requiring fence relocation. Some trees will need to be trimmed/cleared and signs relocated.
32 / 33 / 34	RU	Happy Valley Road onto Jenkins Street	Additional widening of the road and hard stand. Crossing into private land requiring fence relocation. Some trees will need to be trimmed/cleared and signs relocated.
35 / 36	RU	Crawney Road onto Head of Peel Road	Additional widening of the road and hardstand. Crossing into private land requiring fence relocation, power pole relocation, some trees will need to be trimmed/cleared and signs relocated.
5 - 13	BU / CC / GU	Head of Peel Road Upgrades	General upgrade of the road to 5.5 m wide. Significant work on bridges, causeways and upgrading roads and horizontal and vertical curves. Existing bridge over the Peel River needs to be duplicated. Bridge currently has abutment for a second lane and could be easily widened to two lanes.
Nundle to the Project Area via Crawney Road and Head of Peel Road (alternate access, 'Southern Route') – alternative Route South Options			
45	TTPP	Oakenville Street onto Herring Street, onto Innes Street, into Jenkins Street.	Intersection up grades, additional hard stand, modifications to drainage structures and use of private land may be required.
46	TTPP	Oakenville Street onto Herring Street, onto Innes Street, onto Gill Street, onto Point Street, ono Crawney Road	Intersection up grades, additional hard stand, modifications to drainage structures and use of private land may be required.

** Type Abbreviations: GU: General Upgrade; RU: Road Upgrade; BU: Bridge Upgrade; TTPP: TTPP Swept Path Design; CC: Creek Crossing*



Transport Route Road Upgrades

F12-14

Drawing No:	0550690s_HoG_EIS_G025_R4.mxd		Hills of Gold Wind Farm Environmental Impact Statement
Date:	09/11/2020	Drawing Size: A3	
Drawn By:	VN	Reviewed By: AA	Client: Wind Energy Partners
Coordinate System: GDA 1994 MGA Zone 56			This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM

12.5 Consultation

Key stakeholders were consulted as part of the study this included:

- Tamworth Regional Council;
- Transport for NSW (TfNSW);
- Forestry Corporation NSW; and
- Muswellbrook Shire Council.

In addition, consultation was undertaken by TTPP with other local councils along the route:

- Liverpool Plains Council;
- Cessnock City Council;
- Newcastle City Council; and
- Upper Hunter Council.

Responses from these stakeholders are provided in the TTA (refer to Appendix G).

Consultation outcomes include Project commitments to undertake the following:

- sealing of Morrisons Gap Road and introduction of voluntary speed limits for construction related traffic;
- improved signage on Morrisons Gap Road;
- communication with landowners around the Traffic Management Plan and working with landowners around stock movement plans;
- further agreements with key landowners once final design and routes are selected;
- laybys and an upgrade to the Devils Elbow to allow traffic to pass;
- recommendation to avoid oversized deliveries during peak commute times;
- recommended avoidance of the transportation of oversized and over mass vehicles during school bus periods; and
- Traffic Management Plan to include communication strategy to include consideration for these landowners.

12.6 Mitigation Measures

In addition to the above listed consultation outcome commitments, the following measures will be implemented to reduce traffic impacts of the Project.

12.6.1 Traffic Management Plan

Oversized and over mass vehicles will be governed by a detailed Traffic Management Plan that will be developed before approval for transport is granted. The Traffic Management Plan will include:

- procedures for escorts of oversized and over mass vehicles;
- traffic control plans for temporary road closures to allow vehicles to cross to carriageway;
- safe work methods and strategies for working on roadways;
- dates and times for transporting loads;
- location and use of rest stops and layovers along the journey;
- communication strategy to affected communities;

- notification and consultation of key stakeholders including:
  - police and emergency services;
  - local councils along the route;
  - public and school bus operators that may be affected;
  - advertising in local newspaper and media releases;
- contact details of foreman or project manager throughout operations to be shared with emergency services and road authorities;
- timing of operations and measures to avoid commuter peaks and school peaks through populated areas;
- consideration of cumulative impacts of other projects along the route including mine and forestry related transport;
- upgrading the two bridges along Lindsays Gap Road would avoid the need to use Tamworth route for towers and mitigate impact along the Nundle Road;
- layby proposed to alleviate concern for being stuck behind oversized vehicles going up Barry Road just before Devils Elbow; and
- Project commitment to seal Morrisons Gap Road and improve safety along this road.

12.6.2 Reducing Traffic Volumes

To reduce the number of light vehicles generated by the Project, shuttle bus services will be implemented to and from key worker accommodation sites. This will significantly reduce the volume of light vehicles and reduce the impact on the road network. The assessment has assumed the use of 24-seater minibuses, though higher capacity vehicles may be considered if feasible to reduce the amount of traffic.

12.6.3 Road Safety

The Project will implement a holistic approach to road safety, focusing on Safe Roads, Safe Speeds, Safe People and Safe Vehicles. Measures to manage road safety which will include:

Safe People

- safe people will be enhanced by education of workers and policies of the work site. To this end worker site induction will include driver education of the local road conditions. This may include:
  - training on drivers respect private property and farm gates;
  - driving to the conditions on unsealed roads;
  - avoid speeding and other dangerous behaviour;
  - identification and communication of known road crash cluster locations. Also, identification and warning of when roads may be affected by black ice;
  - a drug and alcohol policy to reduce incidents of drunk and drug driving;
  - additional caution when driving at dawn and dusk of kangaroos and other wildlife;
  - driving around livestock;
  - measures to reduce the risk of workers driving while tired (the use of shuttle bus services would reduce the number of workers driving from the site while tired);
- a number of road upgrades will be completed as part of the Project including the widening of two-lane bridges;

- vehicle layovers will be implemented to allow vehicles to wait until appropriate times also coordinating these times with the forestry trucks; and
- heavy vehicle movements will be restricted to daylight hours avoiding dawn and dusk where practicable.

Safe Vehicles

Contractors will ensure that all vehicles used are roadworthy and in good working condition with lights, brakes, tire pressure etc.

Safe Roads

A road safety audit of the identified routes to the Project Area will be conducted to identify any road safety deficiencies that could be corrected before the Project begins.

Safe Speeds

As part of managing the Project the staff will be required to drive to the conditions and respect speed limits. Temporary construction speed limits may be implemented on Morrisons Gap Road to reduce the risk and severity of potential crashes, to be addressed in the Traffic Management Plan.

Sensitive Land Uses

To minimise the impacts on schools, temporary road closures will be avoided during school peaks where practicable.

To this end vehicle layovers have been identified to allow vehicles to wait until appropriate times also coordinating these times with the forestry trucks.

Likewise impacts on Nundle will be reduced by restricting heavy vehicle movements to daylight hours and avoiding dawn and dusk where practicable.

12.6.4 Road Enabling Works

Enabling works have been identified that would be required to cater for the delivery of blades, nacelles and towers. Road upgrades are required to ensure sufficient space for oversized vehicles passage, including intersection widening, trimming and removal of vegetation, removable signs and infrastructure, and the relocation of overhead wires. All required road enabling works have been detailed in the TTA (refer to Appendix G) and listed in Section 12.4.6 above.

12.6.5 Dilapidation Surveys

Dilapidation reports covering the pavement, drainage and bridge structures will be undertaken in consultation with Transport for NSW and local Councils for the proposed transport routes before and after construction. Regular inspections and consultation with local Councils and the Proponent would be developed.

12.6.6 Communications with Forestry Corporation

Communications protocols would be developed to allow communication between the NSW Forestry Corporation trucks and the Project trucks. The Project will maintain communication with NSW Forestry Corporation to coordinate the movement of oversized and over mass vehicles.

12.6.7 Road Authority Approvals for Over-sized and Over-mass Vehicles

Over-mass and Over-sized vehicles would require permits from the National Heavy Vehicle Regulator (NHVR). This replaces the approvals that were granted from Transport for NSW and Councils. Applications are to be submitted to the NHVR.

12.7 Conclusion

The site is located to the south east of the township of Nundle. Access to the site from the New England Highway would be via Lindsays Gap Road and Nundle Road then divide into two routes. One route to the north is via Barry Road and Morrisons Gap Road and the alternate route to the south is via Crawney Road and Head of Peel Road.

Estimates of Project related traffic generation were undertaken. Analysis shows that when these traffic volumes are added to the existing traffic volumes there would be adequate capacity in the road network with the volume capacity (V/C) ratio of less than 0.25 and Level of Service B, on all roads in the peak of the construction. During the operational period, the V/C ratios would be less than 0.09 on all roads.

The forecast traffic volumes are also expected to be less than the environmental capacity goals of 200 vehicles per hour on all roads during the peak of construction. During the operation of the site, the traffic volumes would be even less.

The Project will include the delivery to site of the components of the wind turbines and electrical equipment. It is proposed that oversized and over mass loads will be transported from the Port of Newcastle to the site. A detailed traffic management plan will be developed for the transportation of individual items.

Road upgrades form part of the Project and will create ongoing benefits to the local community in terms of improved road safety and amenity.

13. HAZARDS AND RISKS

13.1 Aviation Safety

13.1.1 Introduction

Aviation Projects prepared an Aviation Impact Assessment (AIA) to assess the potential aviation safety impacts associated with the Project and formally consult with aviation agencies.

The AIA assesses the potential aviation impacts, provides aviation safety advice in respect of relevant requirements of air safety regulations and procedures, and informs and documents consultation with relevant aviation agencies. The AIA report also includes an Aviation Impact Statement (AIS) and a qualitative risk assessment to determine the need for obstacle lighting and of applicable aspects.

The assessment has been prepared to address the requirements specified in the SEARs for aircraft safety and having regard to the following:

- *Civil Aviation Safety Regulations 1998*; and
- *NASF Guideline D Managing the Risk of Wind Turbine Farms as Physical Obstacles to Air Navigation.*

The AIA can be found in full at Appendix H (Aviation Projects, 2020).

13.1.1.1 Methodology

The assessment incorporated the following scope of work:

- a site visit conducted on 10 June 2020 to properly investigate aviation safety aspects of the proposed Project and meet neighbouring landowners for input;
- review of relevant regulatory requirements and information sources;
- prepare a draft AIA and supporting technical data that provides evidence and analysis for the planning application to demonstrate that appropriate risk mitigation strategies have been identified. The draft AIA report includes an AIS and a qualitative risk assessment to determine need for obstacle lighting and of applicable aspects for client review and acceptance before submission to external aviation regulators;
- identification of risk mitigation strategies that provide an acceptable alternative to night lighting in accordance with the guidelines in ISO 31000:2018 Risk Management –Guidelines;
- consultation with Liverpool Plains, Upper Hunter and Tamworth Regional councils, Part 173 procedure designers (Airservices Australia), other stakeholders including the Aerial Agriculture Association of Australia (AAAA), Commonwealth Department of Defence (DoD), and representatives of nearby aerodromes and aircraft operators; and
- engagement with other stakeholders.

13.1.1.2 Study Area

The study area for the Aviation Impact Assessment included the Project Area and extending approximately 30 nautical miles (nm) (55.6 km) beyond the Project to encompass aerodromes and an area of interest within a 3 nm radius of an aircraft landing areas (ALA), to assess potential impacts of the proposed development on aircraft operations which may be affected by the Project.

13.1.2 Existing Environment

The aviation impact assessment identifies the following aviation facilities ALAs in proximity to the Project Area:

- Aviation Facilities:
  - the Project Area is located approximately 55.56 km (within 30 nautical miles (nm)) of the following two registered airports:
    - Quirindi Airport, located approximately 52.5 km (28.3 nm) to the west of the Project Area; and
    - Scone Airport, located approximately 52 km (28 nm) to the south of the Project Area.
  - Tamworth Regional Airport (YSTW) is located approximately 59 km (32 nm) north west of the Project Area, outside of the 30 nm (55.56 km) radius and will not be impacted by the proposed Project in terms of issues associated with airspace protection.
- Nearby aircraft landing areas:
  - a search on OzRunways returned with three nearby non-regulated aerodromes: Wallabadah ALA (YWBH), Woolomin ALA (YWOM) and Goonoo Goonoo (YGGO). The Project Area is located outside of the nominal 3 nm buffer associated with these ALAs;
  - a search on Google Earth also showed that there are another five private ALAs located nearby the Project Area. Activities associated with these private ALA's may include aerial agricultural operations. These include:
    - ALA 1 which is located on the eastern side of Head of Peel Road and downhill of Ben Halls Gap Nature Reserve / National Park and is mainly used by helicopters, but occasionally fixed wing aerial aircraft lands at this ALA;
    - ALA 2 which is not documented in OzRunways, there is no information published regarding operating procedures and use of this ALA. It is located approximately 2.7 km (1.4 nm) east of WTG 55;
    - ALA 3 and ALA 4 which are located outside a nominal 3 nm buffer and will not be impacted by the Project (refer Figure 26 of the Aviation Impact Assessment, Appendix H); and
    - ALA 5 which is not documented in OzRunways. There is no information published regarding operating procedures and use of this ALA. It is located in proximity to proposed transmission infrastructure for the Project and the existing 330kV TransGrid Liddell to Tamworth overhead transmission line.
- Aerial firefighting, surveys and dog baiting activities are undertaking in the nearby national park and forestry estates and the ridgeline has been used in strategic firefighting for the locality.
- Airspace: the Project Area is located:
  - within the horizontal extent but below Tamworth Airport's controlled airspace (lower limit of 6500 ft Average Mean Sea Level (AMSL));
  - within close proximity to Danger Area D523B and other restricted and danger areas associated with the Royal Australian Air Force (RAAF) Base Richmond; and
  - outside of controlled airspace (wholly within Class G airspace) and is not located in any Prohibited, Restricted and Danger areas.
- Air routes and lowest safe altitude (SALT):
  - the Project is solely located in the area with a grid lowest safe altitude of 2011 m AHD (6600 ft AMSL) with a minimum obstacle clearance surface of 1707 m AHD (5600 ft above mean sea level (AMSL); and

- the highest wind turbine is WP20, with a maximum overall height of 1646 m AHD (5400 ft AMSL) and is below the LSALT minimum obstacle clearance of 5600 ft AMSL by 61 m (200 ft AMSL).

- Radar: the closest radar is the Round Mountain Route Surveillance Radar (RSR), which is located approximately 158 km (85 nm) north east of the Project Area. The proposed Project Area is located in Zone 4 and outside the radar line of sight of the Secondary Surveillance Radar (SSR).
- Bureau of Meteorology: the closest weather radar is the Namoi Black Jack Mountain DWSR 8502S 2° S-band Doppler radar located at Black Jack Mountain near Gunnedah approximately 104 km (56 nm) north east of the Project.

13.1.3 Assessment of Impacts

Overview

Based on the Project layout, overall turbine blade tip height limit of 230 m AGL and the blade tip elevation of the highest wind turbine (WTG WP20) of 1646 m AHD (5400 ft AMSL), the AIA concluded that the proposed Project will not have any adverse impacts to air safety subject to implementing the mitigation measures to the 25 nm MSA and instruments procedures at Scone Airport and air route H99 LSALT .

In particular, the assessment concluded that the Project:

- will not penetrate any Obstacle Limitation Surfaces (OLS);
- will penetrate PAN-OPS surfaces as discussed above;
- will have an impact on nearby designated air routes, as discussed above;
- will not have an impact on the grid LSALT;
- will not have an impact on prescribed airspace;
- is wholly contained within Class G airspace; and
- is outside the clearance zones associated with aviation navigation aids and communication facilities.

Aviation Projects undertook a safety risk assessment of the Project, concluding that obstacle lighting to WTGs and the monitoring masts were not required to maintain an acceptable level of safety to aircraft.

Registered Airports

The Project Area is located beyond 30 nautical miles (nm) (55.56 km) (area used to identify possible constraints) from Tamworth Airport (YSTW), however is located within 30 nm of Scone Airport (YSCO) and Quirindi Airport (YQDI). Obstacles within 15 nm (10 nm MSA + 5 nm buffer) and within 30 nm (25 nm MSA + 5 nm buffer) of Scone Airport's Aerodrome Reference Point (ARP) define the height at which an aircraft can fly when within 10 nm and 25 nm in accordance with the *Procedures for aircraft navigation services – aircraft operations* (PAN-OPS). The Project is located outside the 10 nm minimum safe altitude (MSA) of Scone Airport but within the 25 nm MSA (inclusive of 5 nm buffer) of Scone Airport with an MSA of 6300 ft AMSL. The Project will impact the 25 nm MSA at Scone Airport in the sector bounded by bearings 070º and 290º, thus penetrating the PAN-OPS surfaces. The initial approach altitude for area navigation – global navigation satellite system (RNAV GNSS) approach procedures for runway 29 at Scone Airport will be impacted by the Project, also penetrating the PAN-OPS surfaces.

The Project Area is located outside the 10 nm MSA of Quirindi Airport but within the 25 nm MSA of Quirindi Airport in the sectors bounded by bearings of 245º and 065º. The 25 nm MSA of Quirindi Airport will not be impacted.

The Project is located beyond the horizontal extent of aerodrome circling areas at Scone Airport and Quirindi Airport.

Aircraft Landing Areas (ALAs)

As a guide, an area of interest within a 3 nm radius of an aircraft landing area (ALA) is used to assess potential impacts of proposed developments on aircraft operations at or within the vicinity of the ALA.

There are three ALAs located within proximity to the Project Area and associated infrastructure. ALA 1 which is located approximately 1.8 km (1 nm) west of the Project, ALA 2, which is located approximately 2.79 km (1.5 nm) east of the Project and ALA 5 which is located approximately 300 m east of the proposed infrastructure (switching yard and power line) of the Project. Dependent on the wind direction and wind speed at the time, if wind turbines are operating when ALA 1 and ALA 2 are used, the potential extent of downstream wake turbulence could be noticeable from some of the proposed wind turbines at these ALAs.

Obstacle Limitation Surfaces

The approach and take-off surfaces of Scone and Quirindi Airports will not be impacted.

Air Routes and Lowest Safe Altitude

The Project is solely located in the area with a grid lowest safe altitude of 2011 m AHD (6600 ft AMSL) with a minimum obstacle clearance (MOC) surface of 1707 m AHD (5600 ft AMSL).

The highest wind turbine, which is WP20, is below the lowest safe altitude (LSALT) MOC of 5600 ft AMSL by approximately 61 m (200 ft). Therefore, the Project will not affect the grid LSALT MOC of 5600 ft AMSL.

The Project will impact the air routes H99 and W130 LSALT MOC.

Airspace

The Project Area is located outside of controlled airspace (wholly within Class G airspace).

Aviation Facilities

The wind turbines of the Project will not penetrate any protection areas associated with aviation facilities.

Radar

The Project Area is located in Zone 4 (accepted zone) and outside the radar line of sight of Round Mountain Route Surveillance Radar (RSR) and will not interfere with the serviceability of this aviation facility.

It is unlikely that the Project will impact Namoi Black Jack Mountain DWSR 8502S 2° S-band Doppler radar located at Black Jack Mountain near Gunnedah, as the project is located beyond 104 km from this meteorological radar.

Obstacle lighting risk assessment

Aviation Projects undertook a safety risk assessment of the Project and concludes that WTGs and wind monitoring towers will not require obstacle lighting to maintain an acceptable level of safety to aircraft.

Aerial application of fertilisers, pesticides and aerial baiting

Safe aerial application operations would be possible on properties within the Project Area and neighbouring the Project Area, subject to final turbine locations and by implementing recommendations as discussed below. The use of helicopters enables aerial application operations to be conducted in closer proximity to obstacles than would be possible with fixed wing aircraft due to their greater manoeuvrability.

Aerial firefighting

Aerial firefighting operations (firebombing in particular), under certain conditions visibility may be reduced/limited by smoke/haze. During periods of bushfire it is difficult to establish the exact directions that helicopter pilots would be flying in due to smoke, wind and visibility at each particular time.

An existing Dam located adjacent to WTG 26 has been historically used for firefighting efforts by NSW National Parks and Wildlife Service (NSW NPWS), and NSW Rural Fire Service.

Most aerial firefighting organisations have formal risk management programs to assess the risks associated with their operations and implement applicable treatments to ensure an acceptable level of safety can be maintained.

13.1.3.1 Consultation Outcomes

The outcomes of consultation with relevant stakeholders is discussed in detailed in Section 5 of the Aviation Impact Assessment (Appendix H).

13.1.4 Mitigation Measures

Based on the information contained in Appendix H – Aviation Impact Assessment (Aviation Projects, 2020) and the analysis conducted, the following key mitigation measures and recommendations are made:

The Proponent will enter into a commercial agreement with Airservices Australia to amend flight procedures. This includes:

- 125 nm MSA at Scone Airport in the sector bounded by bearings 070º and 290º should be increased by 100 ft to 6400 ft AMSL.
- The initial approach altitude for RNAV GNSS approach procedures for runway 29 at Scone Airport should be amended to 6400 ft AMSL to safeguard the approach procedure.
- Air route H99 LSALT should be increased by 300 ft from 6100 ft to 6400 ft AMSL.
- Air route W130 LSALT should be increased by 200 ft from 6200 ft to 6400 ft AMSL.

Further, the following will also be undertaken:

- Consultation with aerial operators of ALA 1 and ALA 2 to address potential impacts on the aircraft operations.
- Overhead transmission lines and/or supporting poles that are located where they could adversely affect aerial application operations should be identified in consultation with local aerial agriculture operators and marked in accordance with MOS 139 Chapter 8 Division 10 section 8.110 (7) and section 8.110 (8).
- To facilitate the flight planning of aerial application operators, the location and height of wind turbines and wind monitoring towers should be provided to landowners so that, when asked for hazard information on their property, the landowner may provide the aerial application pilot with all relevant information.
- ‘As constructed’ details of wind turbine and wind monitoring tower coordinates and elevations should be provided to Airservices Australia, using the following email address: vod@airservicesaustralia.com.
- Details of the final wind farm layout should be provided to local and regional aircraft operators prior to construction in order for them to consider the potential impact of the wind farm on their operations. Specifically, details should be provided to the New South Wales Regional Airspace and Procedures Advisory Committee (rapac@casa.gov.au) for consideration by its members in relation to visual flight rules (VFR) transit routes in the vicinity of the wind farm.

- Engagement with local aerial agricultural operators and aerial firefighting operators will be undertaken in developing procedures for such aircraft operations in the vicinity of the Project where necessary.
- The rotor blades, nacelles and towers of the wind turbines will be painted in matt white.
- Marking the temporary and permanent wind monitoring towers will be undertaken according to the requirements set out in Manual of Standards (MOS) 139 Chapter 8 Division 10 (as modified by the guidance in NASF Guideline D).

13.2 Telecommunications - Electromagnetic Interference

13.2.1 Introduction

This section draws on the assessment of potential electromagnetic interference (EMI) issues associated with the Project, which is detailed in the EMI Assessment undertaken by Lawrence Derrick & Associates (2020) and provided at Appendix I. The assessment was undertaken to address the SEARs for EMI and had regard to the NSW Planning and Environment *Wind Energy Guideline for State Significant Wind Energy Development* (2016).

13.2.2 Methodology

The EMI assessment examined the radiocommunications systems and radio links in the vicinity of the wind farm, and determined the potential impact if any that the wind turbines may have on the operation of these radiocommunication systems. Potential impacts on television and radio broadcasting were also examined. A new 330 kV transmission line associated with the wind farm project was also examined for potential interference.

The EMI assessment incorporated the following scope of work:

- a review of the Australian Communications and Media Authority (ACMA) Register of Radiocommunications Licences (RRL) held within 50 km of the Project Area relating to fixed point-to-point links, fixed point-to-multipoint links and radiocommunications assets belonging to emergency services;
- a review of the air serviced and aviation radar within 50 km of the Project Area;
- a review of the following communications:
  - broadcast television;
  - radio broadcasting;
  - radio site buffer zones
  - broadband internet services;
  - cellular and private mobile phones;
  - satellite television and internet; and
  - agricultural or other precision position GPS.
- liaison with organisations that have or may have communication equipment in the region (i.e. telecommunication companies, media companies, emergency services and government agencies).

13.2.3 Existing Environment and Assessment of Impacts

Telecommunications systems used for radio, radar, broadcast, television, mobile networks as well as mobile and fixed radio transmission sites transmit electromagnetic signals (radio waves). These work best when there is a clear line of unobstructed sight along the path from the transmitter to the receiver.

Large structures, such as WTGs have the potential to affect the performance of radiocommunication services through the introduction of EMI when they occur close to or within the signal path. Services most likely to be affected include terrestrial broadcast signals and fixed point-to-point microwave signals. Terrestrial broadcast signals are commonly used to transmit domestic television, while microwave links are used for line-of-sight connections for data, voice and video.

Point to Point Systems

Point to Point radiocommunication systems are communication connections between two end points or nodes, for example a telephone call.

Radio terminal/repeater sites that may be impacted by turbines due to their proximity to the wind farm were considered in the EMI assessment. Three links were identified, all but one link are set back by a considerable distance from the Project Area, as detailed in Table 13-1. Calculations of horizontal clearance were made to ensure there is sufficient clearance to the nearest turbine. The calculated clearance zone is compared to the actual clearance available in Table 13-1 and further detailed in Attachment 8 of the EMI assessment (refer Appendix I). The assessment confirms the available clearance exceeds the required clearance zones.

One Very High Frequency (VHF) link (ID: 6386) passes through the Project Area (refer to Figure 13-1). This link is operated by Telstra and is a customer telephone link to a property within the Project Area. This link aligns to a former dwelling identified as associated structure AS_1, which will not be occupied should the Project proceed.

Table 13-1 Point to Point Systems Link Clearances

Site 1	Site 2	Operator	Freq (MHz)	Nearest Turbines	Required Clearance (m)	Actual Clearance (m)
6386	6508	Telstra	160	WP30	141.64	200
6416	7461	NSW Elec. Networks	45	WP23	345.73	2700
6404	6486	NSW RFS	450	WP1	137.65	3240

Point to Multipoint Systems

Point to Multipoint (PMP) communication is accomplished via a distinct type of one-to-many connections, providing multiple paths from a single location to multiple locations.

The EMI Assessment (Appendix I) notes that there are no Point to Multipoint (PMP) class of licence for base stations registered in the ACMA RRL database that located within a 50 km radius of the Project Area. However, NBN Co has Spectrum Licences that are understood to be used for PMP services to connect customers to the broadband network. These services are discussed further below.

Air Services and Aviation

Tamworth Airport is located about 50 km from the wind farm and there are a number of aviation communications facilities on the airport site including DME, Ground – Air Communications and Radar. The sites and services are listed in Table 13-2.

Table 13-2 Air Services and Aviation Communications

ACMA Site ID	Distance to nearest Turbine	Frequency MHz	Type	Operator
9010989	27.5 km	133	Ground - Air	Air Services Australia
9010989	27.5 km	1090	Radar Receiver	Air Services Australia
10013103	52 km	134.55	Ground - Air	Scone Airport
6510	59 km	129.15	Ground - Air	Tamworth Airport
6513	59 km	131.65	Ground - Air	Tamworth Airport

The VHF services are considered to be at a sufficient distance to not be impacted by the Project.

The Aviation Impact Assessment (refer Appendix H) considered impact on radars with regard to the NASF Guideline G, Protecting Aviation Facilities – Communication, Navigation and Surveillance (CNS). The Project is located outside of the area of interest (2,000 m radius) from the Mt Sandon VHF Radar (ACMA Site 9010989). Additionally the Project is located outside of the area of interest for the radars at Tamworth, Quirindi and Scone Airports. The Project will not impact on these radars.

TV Broadcasting

'MySwitch' is an Australia Government online prediction tool which provides information on digital television reception across Australia following the Digital TV Switchover. From the "My Switch" TV prediction tool, reception of terrestrial TV is patchy or in places non-existent due to the terrain around the wind farm. The Upper Namoi main TV station on Mt Dowe appears to be received in high elevation locations around the Project Area. There are two low/medium power TV Stations operating (Site ID: 6402 and 6401) which services Murrurundi and one (Site ID: 6531) which services Tamworth (refer to Table 13-3). Some residents near the wind farm may receive these stations where they are in close proximity. Some residents may have satellite TV services, either a pay TV service or the Viewer Access Satellite Television (VAST) free satellite service. Interference to satellite TV services are low due to the high elevation angle of the antennas and their narrow reception beam width.

Table 13-3 TV Radio Transmitter Sites

ACMA Site ID	Distance to nearest Turbine	Frequency (MHz)	Licensee	Power	Coverage Impact	Station
6402	40 km	578.5	Prime	Low	Negligible	Murrurundi
6402	40 km	685.5	NBN	Low	Negligible	Murrurundi
6402	40 km	606.5	Network Invest	Low	Negligible	Murrurundi
6401	40 km	592.5	ABC	Low	Negligible	Murrurundi
6401	40 km	571.5	SBS	Low	Negligible	Murrurundi
6531	39.3 km	627.5	Prime	Medium	Negligible	Tamworth
6531	39.3 km	643.5	NBN	Medium	Negligible	Tamworth
6531	39.3 km	641.5	Network Invest	Medium	Negligible	Tamworth
6531	39.3 km	620.5	ABC	Medium	Negligible	Tamworth
6531	39.3 km	613.5	SBS	Medium	Negligible	Tamworth

FM Sound Broadcasting

Table 13-4 below lists the FM Radio transmitter sites within a 50 km radius of the Project Area. There are six FM Radio transmitter sites identified on the ACMA RRL database.

Table 13-4 FM Radio Transmitter Sites

ACMA Site ID	Distance to nearest Turbine	Frequency MHz	Power	Coverage Impact
6531	42.4 km	91.7, 93.9, 94.7, 103.1	Medium	Negligible
6532	43 km	92.9	Medium	Negligible
6553	39.2 km	96.3	Low	Negligible
6401	25.1 km	96.9, 104.1	Low	Negligible
6405	25 km	100.1	Low	Negligible
153057	31.4 km	98.5	Low	Negligible

No interference impact from the Project wind turbines is expected due to the significant separation distances as detailed in Table 13-4.

AM Sound Broadcasting

There are two AM Stations in the area, 141452 is an ABC 648 KHz Station 110 km from the nearest turbine and 151289 is a commercial station (2TM) about 8 km South of Tamworth. AM broadcasting reception is not known to be affected by wind turbines.

NBN Point to MultiPoint Services

NBN have many Spectrum Licences on approximately 40 sites within 50 km of the Project Area, which are used for Point to Multipoint (PMP) services to connect customers to the broadband network. Consultation with NBN Co has confirmed that the Project would have no line of sight impact between any nearby NBN base station sites and premises within the current NBN Wireless coverage areas. NBN coverage areas of base stations relative to the Project Area is detailed in Attachment 16 of the EMI assessment (refer Appendix I). .

Radio Site Buffer Zones

The radio sites and link maps, as available on the ACMA RRL, indicate that there is one radio site within the Project Area and the nearest external site being 4.0 km from the nearest turbine. The radio sites in the vicinity of the Project Area are listed in Table 13-5.

Table 13-5 Radio Site Buffer Distances

Site / Service	Operator	Frequency Band (MHz)	Distance to Nearest Turbine	Buffer Zone (Km)
6386	Telstra	160	0.23 km	0.5
6420	Telstra	8000	4.0 km	1.0
9011509	Various	700 - 8000	9.0 km	1.0
6419	Various	160 - 8000	6.6 km	0.5 – 1.0
405164	Met Bureau	150	6.7 km	0.5
52893	Water NSW	160	6.7 km	0.5

The only potential issue is the closeness of one or two turbines to the Telstra 160 MHz customer link antenna within the Project Area. This is due to potential interference from reflection scattering. As previously mentioned this customer telephone link is related to associated structure AS_1, a former dwelling that will not be used as a dwelling should the Project proceed.

DGPS Systems

No radio licences for agricultural or other precision position GPS systems using local base stations within a 50 km radius of the Project Area were identified in the ACMA RRL.

Cellular Mobile Services

Optus Vodafone and Telstra have Cellular mobile base stations at sites in the region, including sites 9018869 and 9011863. These closest sites are 10 km and 12.9 km from the nearest turbine. As these distances exceed a 1 km recommended clearance, no impact on cellular radio coverage is expected.

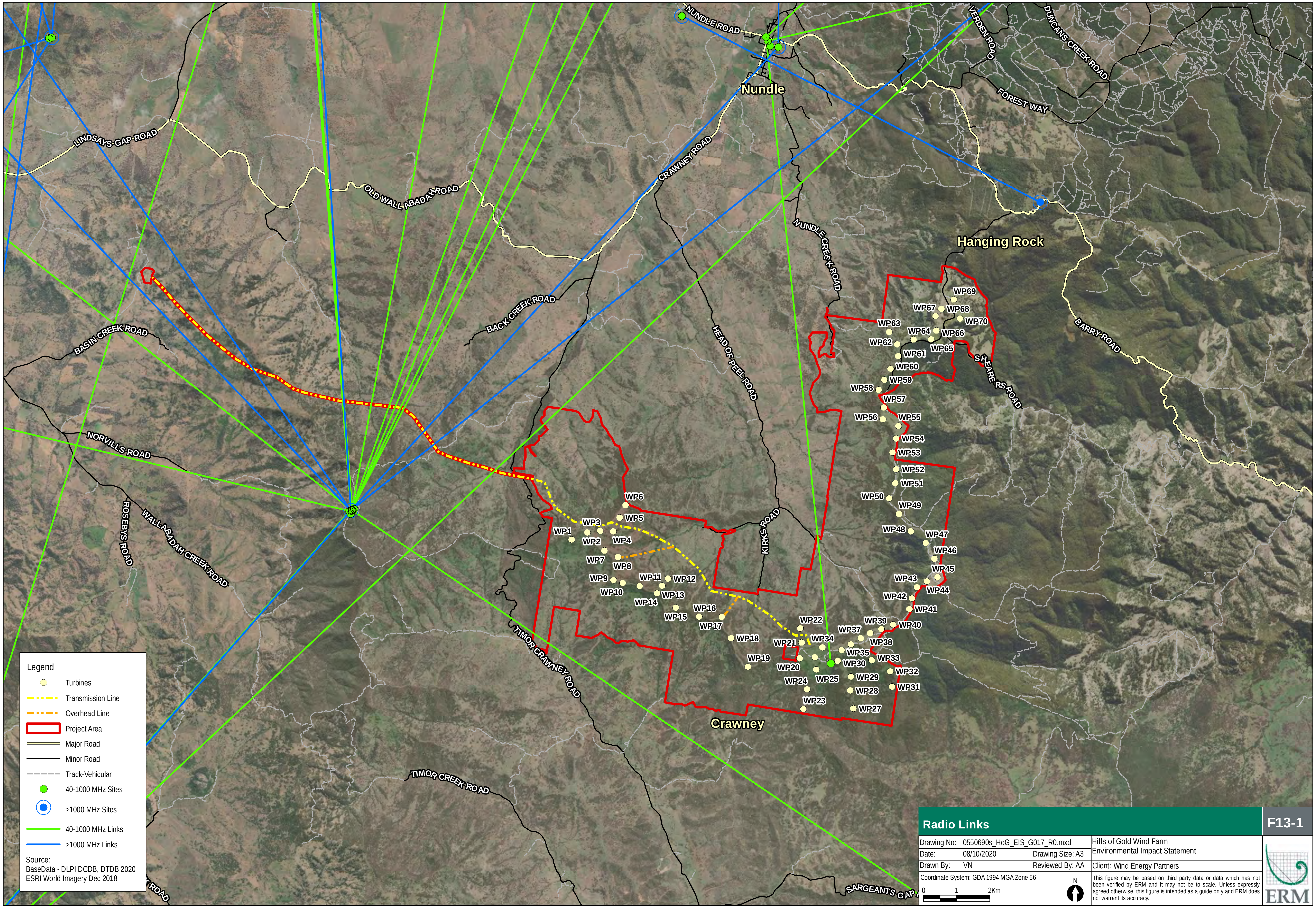
Private Mobile Services Radio Site Buffer Zones

There are a number of private mobile base station sites within 50 km of the Project, but all are set back in excess of 1km from turbines and therefore no impact to coverage is expected.

High Voltage 330 kV Power Line EMI and Hardware Impacts

It is expected that the 330kV transmission line being constructed as part of the Project will be built to TransGrid standards and typical of other 330 kV transmission lines in NSW. Two potential issues exist for domestic TV and radio reception. One is the EMI emitted from the lines because of ‘corona effect’ and the other is the hardware (eg poles and lines causing shadowing for TV reception).

For point to point links the 50 m tall poles and the conductor spans could be in the TV / FM, AM radio ray line. As dwellings will be located outside the standard transmission line easements (60 m) emissions at AM, FM frequencies are expected to be low with not noticeable interference to these services. As the poles and the lines are static the impact on digital TV is expect to be low and ghosting is not considered a problem in comparison with analogue TV services, which have ceased in Australia. The risk of the poles and lines being in the ray lines of point to point systems is low.



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Hanging Rock
Crawney
NUNDLE ROAD
VERDEN ROAD
DUNCANS CREEK ROAD
FOREST WAY
LINDSAYS GAP ROAD
OLD WALLABADAH ROAD
CRAWNEY ROAD
NUNDLE CREEK ROAD
BACK CREEK ROAD
BASIN CREEK ROAD
HEAD OF PEEL ROAD
BARRY ROAD
SHEARERS ROAD
NORVILLS ROAD
ROSEBYS ROAD
WALLABADAH CREEK ROAD
KIRKS ROAD
TIMOR CRAWNEY ROAD
TIMOR CREEK ROAD
SARGEANTS GAP
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Legend
Turbines
Transmission Line
Overhead Line
Project Area
Major Road
Minor Road
Track-Vehicular
40-1000 MHz Sites
>1000 MHz Sites
40-1000 MHz Links
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ESRI World Imagery Dec 2018
Radio Links
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Drawing No: 0550690s_HoG_EIS_G017_R0.mxd
Date: 08/10/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partners
Coordinate System: GDA 1994 MGA Zone 56
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This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM

13.2.4 Mitigation Measures

Pre-Construction Assessment of TV and Radio Reception

A pre-construction assessment of TV and radio reception will establish a base line of reception strength for comparison with any complaints relating to reception post-construction. This assists with determining whether any reception interference issues were pre-existing. The assessment should be carried out at a representative sample of dwellings in the vicinity of the Project Area.

In the event that reception impacts are experienced, mitigation measures will be implemented to reduce impacts. This may include the installation of more directional receiving antennas or provision of the available VAST satellite service.

13.2.5 Conclusion

The EMI Assessment indicates that there is limited impact on telecommunications associated with the Project. One point to point radio link passes through the Project Area, howeverthis radio link provides a telephone service to a former dwelling within the Project Area that will not be occupied if the Project proceeds (associated structure AS_1).

Consultation with NBN Co has confirmed that the Project would have no line of sight impact between any nearby NBN base station sites and premises within the current NBN Wireless coverage areas.

TV in the area is provided by Upper Namoi main station transmitters at Mt Dowe, which is expected to provide a patchy service in the Project Area. Two low power transmitter stations, which serve Tamworth and Murrurundi, may provide service to some residents if they are close and in reasonable line of site to the stations. There is some risk that a few residents close to the turbines and with TV signals coming through the moving turbine blades may experience interference to TV reception. Mitigation such as the installation of more directional receiving antennas or provision of the VAST satellite service will be implemented if required.

Radio reception is not expected to be affected. Due to the more robust technology AM and FM radio services are unlikely to be affected by wind turbines.

The proposed 330 kV transmission line being constructed as part of the Project is seen as low risk for interfering with AM FM and TV reception at dwellings in the vicinity of the transmission lines. There is also a low risk of the hardware being in the ray lines of point to point systems. Path profiles of a sample of the paths crossing indicate that there is little risk of the link ray lines being impacted by transmission lines or poles/towers due to the vertical clearance where the ray lines cross the transmission line and structures.

13.3 Electro Magnetic Field

13.3.1 Introduction

This assessment considers the potential hazards and risks associated with Electro Magnetic Fields (EMF). The EMF assessment was prepared to address the requirements of the SEARs which state the following:

> *"Health – consider and document any health issues having regard to the latest advice of the National Health and Medical Research Council (NHMRC), and identify potential hazards and risks associated with electric and magnetic fields (EMF) and demonstrate the application of the principles of prudent avoidance".*

The NSW Governments Wind Energy Guideline (DPE, 2016) state that an issue which is specifically relevant for wind energy development and must be considered in an environmental assessment, is:

> *"Health – consider any health issues having regard to the latest advice of the NHMRC and consider potential hazards and risks associated with electric and magnetic fields and demonstrate the application of the principles of prudent avoidance".*

13.3.2 Overview of Electric and Magnetic Fields

EMFs are associated with all electrical wiring and equipment. The electric field is caused by the voltage of the equipment and the magnetic field is caused by the current flowing (amperage). Electric fields and magnetic fields are essentially independent of one another and, in combination, cause energy to be transferred along electric wires.

13.3.2.1 Electric Fields

Electric fields are the result of an electric charge on an object. The strength of this force is related to the voltage, or pressure, which forces electricity along wires. Electric fields are strongest close to their source, and their strength diminishes rapidly with distance from the source, in much the same way as the warmth of a fire decreases with distance. Many common materials, (such as brickwork or metal), block electric fields, so they are readily shielded and, for all practical purposes, do not penetrate buildings. Electric fields are also shielded by human skin, such that the electric field inside a human body will be at least 100,000 times less than the external field. The units commonly used to describe electric field strength are volts per metre (V/m) or kilovolts (1,000 Volts) per metre (kV/m).

To demonstrate the range of electric fields that exist day-to-day, electric fields at normal user distance from appliances are generally of the order of tens of volts per metre. On the other hand, electric fields produced by electric blankets have been reported ranging from a few hundred to more than a thousand volts per metre.

13.3.2.2 Magnetic Fields

Magnetic fields result from the movement of electric charges, that is, an electric current. The strength of a magnetic field depends on the size of the current (measured in amps), and decreases with distance from the source. Because magnetic fields are related to the current rather than the voltage, high voltage equipment is not the only source of magnetic fields encountered in everyday life. In fact, modern life involves frequent contact with magnetic fields from a variety of sources such as appliances and electrical machinery. While electric fields are blocked by many common materials, this is not the case with magnetic fields. This is one reason why power lines may contribute to the overall magnetic fields in the environment and why burying power lines will not necessary eliminate these fields.

Magnetic fields are often described in terms of their flux density which is commonly measured in units of Tesla (T) or the older unit of Gauss (G) where:

- 1 Tesla (T) = 1,000 milliT (mT) = 1,000,000 microT (μT);
- 1 μT = 10 mG; and
- 1 Gauss (G) = 1,000 milliG (mG).

Typical Values of Magnetic Fields

Dwellings usually have negligible background electric fields, while magnetic fields are usually in the order of 2 mG. Magnetic fields may reach into the tens of milligauss within dwellings, depending on the location of electrical wiring. The magnetic fields in the vicinity of a selection of appliances are indicated in Table 13-6.

Table 13-6 Typical Magnetic Fields of Household Appliances

Appliance	Typical Range at Normal User Distance	
	Microtesla (µT)	Miligauss (mG)
Electric Stove	0.2 - 3	2 - 30
Computer	0.2 - 2	2 - 20
Television	0.002 - 0.2	0.2 - 2
Electric Blanket	0.5 - 3	5 - 30
Hair Dryer	1 - 7	10 - 70
Refrigerator	0.2 - 0.5	2 - 5
Toaster	0.2 - 1	2 - 10
Electric Kettle	0.2 - 1	2 - 10
Pedestal Fan	0.002 - 0.2	0.2 - 2

Source: ARPANSA 2020c

Magnetic field measurements associated with overhead power lines and substations are shown in Table 13-7. The magnetic field from power lines will vary with configuration, phasing and load.

Table 13-7 Typical Values of Magnetic Fields Measured Near Overhead Power Lines and Substations

Source	Location of Measurement (1m above the ground)	Range of Measurements*	
		Microtesla (µT)	Milligauss (mG)
Distribution Line (street power lines)	Directly underneath	0.2 - 3	2 - 30
Distribution Line (street power lines)	10m away	0.05 - 1	0.5 - 10
Substation	At substation fence	0.1 - 0.8	1 - 8
Transmission Line (high voltage power lines)	Directly underneath	1 - 20	10 - 200
Transmission Line (high voltage power lines)	At edge of easement	0.2 - 5	2 - 50

*Notes: * Levels of magnetic fields may vary from the range of measurements shown.*
*** Switching stations contain substantially less sources of magnetic fields than substations (such as power transformers) and thus would be even less of a source of exposure than substations.*
Source: ARPANSA 2020c

13.3.2.3 Difference between EMF and EMR

Energy Networks Association (2016) note that it is common for EMF to be confused with electromagnetic radiation (EMR), in which they summarise that:

> *"EMR is a term used to describe the movement of electromagnetic energy through the propagation of a wave. This wave, which moves at the speed of light in a vacuum, is composed of electric and magnetic waves which oscillate (vibrate) in phase with, and perpendicular to, each other. This is in contrast to EMF, where the electric and magnetic components are essentially independent of one another.*
>
> *Whereas EMR causes energy to be radiated outward from its source e.g. light from the sun or radiofrequency signals from a television transmitter, EMFs cause energy to be transferred along electric wires"* (ENA, 2016).

Examples of EMR include (in order of frequency of its wave) radio waves, microwaves, terahertz radiation, infra-red radiation, visible light, ultraviolet radiation, X-rays and gamma rays. This assessment considers EMF associated with wind farms.

13.3.2.4 Standards and Guidelines

This section summarises the extremely low frequency (ELF) EMF standards and guidelines which are relevant to the Project.

13.3.2.5 Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)

The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) is the Australian Government's primary authority on radiation protection and nuclear safety. ARPANSA regulates Commonwealth entities using radiation with the objective of protecting people and the environment from radiation. Established by the Australian *Radiation Protection and Nuclear Safety Act 1998* (ARPANS Act), ARPANSA commenced operation on 5 February 1999. ARPANSA replaced the Nuclear Safety Bureau and Australian Radiation Laboratory.

The ARPANS Act states that the CEO of ARPANSA must take into account international best practice in relation to radiation protection and nuclear safety when making licensing decisions. ARPANSA considers the publications produced by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) to reflect an international consensus on what constitutes a high level of safety for the purpose of protecting people and the environment from the harmful effects of radiation. The ICNIRP is further discussed in Section 13.3.7.

13.3.2.6 Radiation Health Committee

The Radiation Health Committee (RHC) advises the CEO of ARPANSA and the Radiation Health & Safety Advisory Council on matters relating to radiation protection, including formulating draft national policies, codes and standards for consideration by the Commonwealth, states and territories.

In June 2015, the Radiation Health Committee agreed that it would withdraw the existing *Interim Guidelines on Exposure to 50/60 Hz Electric and Magnetic Fields (1989),* and the guidelines to date have not been superseded. The guideline was issued by the National Health and Medical Research Council (NHMRC) and was based on guidelines developed by the International Non-ionising Radiation Committee of the International Radiation Protection Association (IRPA). IRPA has since been replaced by ICNIRP. In the case of magnetic fields, the *Interim Guidelines on Exposure to 50/60 Hz Electric and Magnetic Fields (1989),* had stipulated a limit of 1000 mG for general public exposure for up to 24 hours per day. The corresponding limit for electric fields was 5000 Volts/metre (5 kV/m).

13.3.2.7 International Commission on Non-Ionizing Radiation Protection (ICNRP)

ICNIRP is a body of independent scientific experts who provide information and advice on the potential health hazards from exposure to non-ionising radiation. Much of ICNIRP’s guidance is published in the form of scientific reviews and reports and the proceedings of scientific meetings. As previously mentioned in Section 13.3.5, ARPANSA considers the publications produced by ICNIRP to reflect an international consensus on what constitutes a high level of safety for the purpose of protecting people and the environment from radiation. ARPANSA is also a contributor to the work of ICNIRP.

ICNIRP has issued *Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz -100 kHz) (2010)* which are aimed at preventing the established health effects resulting from exposure to extremely low frequency (ELF) EMF. As previously stated in Section 13.3.2, exposure to high levels of ELF EMF is extremely rare and does not occur in people during their day-to-day living (ARPANSA, 2020).

As recognised by ARPANSA, the ICNIRP ELF guidelines are consistent with ARPANSA's and the RHC's understanding of the scientific basis for the protection of people from exposure to ELF EMF.

In Australia, EMFs associated with the use of electricity are generated at a frequency of 50 hertz (Hz). This frequency falls within the extremely low frequency (ELF) range of 0–3,000 Hz, as defined by ARPANSA. Table 13-8 below summarises reference levels for exposure to external magnetic fields and electric fields respectively at 50 Hz as contained in ICNIRP 2010.

Table 13-8 Reference Levels for Exposure to Magnetic Fields and Electric Fields Respectively at 50 Hz (ICNIRP, 2010)

	Magnetic Fields Reference Levels at 50 HZ	Electric Field Reference Levels at 50 HZ
General Public (general exposure)	200 μT	5 kV/m
Occupational (general exposure)	1,000 μT	10 kV/m

13.3.3 Risk Assessment

13.3.3.1 Extremely Low Frequency EMF

The process in which an electron is given enough energy to break away from an atom is called ionisation (ARPANSA, 2020). X-rays and gamma rays are in the ionising part of the spectrum and have enough energy to damage DNA (Energy Networks Association, 2016; ARPANSA, 2020).

ELF EMF occupy the lower part of the electromagnetic spectrum and is non-ionising radiation, or in other terms, there is insufficient energy to cause ionisation and there is not enough energy to damage DNA (ARPANSA, 2020).

Exposure to high levels of ELF EMF is extremely rare apart from medical exposures to patients and some specialised occupational exposures (ARPANSA, 2020). Therefore exposure to high levels of ELF EMF will not occur in people during their day-to-day living.

13.3.3.2 EMF and Human Health

Over the past 50 years, concerns have been expressed that the EMFs associated with electrical equipment might have adverse health effects. The issue has been the subject of extensive research throughout the world, which includes more than 2,900 studies at a cost of more than $490 million (Energy Networks Association, 2016). There are known health effects from very high levels of EMFs and health standards have been established to protect against these effects.

The WHO (WHO, 2020) recognise that to date, no adverse health effects from ELF, long-term exposure to radiofrequency or power frequency fields have been confirmed.

While some researches however believe there is a need for further scientific research, the WHO considers the existing body of research on EMF to be extensive. This assessment however recognises that while adverse health effects from exposure to ELF EMFs have not been established, the possibility remains that such effects may exist.

13.3.3.3 EMF and Wind Farms

There has been some research conducted on wind turbine emissions of EMF from both the turbines themselves, or from the power lines required for distribution of the generated electricity. Researchers (McCallum, Whitfield Aslund, Knopper, Ferguson, & Ollson, 2014) have associated fears about exposure to EMF from wind turbines to internet sources and misunderstanding of science, as opposed to actual measurements of EMF exposure surrounding existing wind turbines. The available evidence at large does not find EMF from wind turbines to be a likely causative agent for negative health effects in the community (Knopper, et al., 2014).

A study (McCallum, Whitfield Aslund, Knopper, Ferguson, & Ollson, 2014) conducted at the Kingsbridge Wind Power Project located near Goderich in Canada contributes to this body of research. In this study, magnetic field measurements were collected in the proximity of 15 Vestas 1.8 MW wind turbines, two substations, various buried and overhead collector and transmission lines, and nearby homes. In total, over 600 magnetic field measurements were collected. The findings were summarised as below:

> *"The results suggested that there is nothing unique to wind farms with respect to EMF exposure; in fact, magnetic field levels in the vicinity of wind turbines were lower than those produced by many common household electrical devices and were well below any existing regulatory guidelines with respect to human health".*

Another study (Israel & Ivanova, 2011) conducted EMF, sound, and vibration measurements surrounding one of the largest wind energy parks in Bulgaria, located along the Black Sea. The wind park consisted of 55 Vestas V90 3MW towers. The study found that the EMF levels measured within 2–3 m of the wind turbines were between 0.133 and 0.225 mG. It was concluded that the EMF levels from wind turbines were at such a low level they were insignificant compared to values found in residential areas and homes.

13.3.3.4 EMF and Transmission Lines, Substations and Switching Stations

Energy Networks Association (2016) note that large substations such as zone and transmission substations vary greatly in size, configuration and loading. Key sources of magnetic fields within the substation include the transformer secondary terminations, cable runs to the switch room, capacitors, reactors, bus-bars, and incoming and outgoing feeders. Energy Networks Association (2016) continue that in most cases the highest magnetic fields at the boundary come from the incoming and outgoing transmission lines, and the magnetic field decrease to background levels within a few metres of the substation. For this reason, Energy Networks Association (2016) conclude that distribution substations are not a significant source of exposure. Switching stations contain substantially less sources of magnetic fields than substations (such as power transformers) and thus would be even of a source of exposure than substations.

Table 13-7 demonstrates that the typical magnetic field of a transmission line at the edge of easements and a substation at the substation fence measures 0.2 - 5 μT (or 2 - 50mG) and 0.1 - 0.8 μT (or 1 - 8mG) respectively (ARPANSA, 2020). Table 13-8 provided reference levels for exposure to magnetic fields at 50 Hz, which is the frequency at which electricity is generated in Australia. Table 13-8 showed that the reference level for magnetic field exposure to the general public and occupational is 200 μT and 1,000 μT respectively (ICNIRP, 2010). Hence, EMF from transmission lines at the edge of the easement, and substations at the substation fence, are well within the acceptable level of exposure.

Further, the location of Project infrastructure (ie substation, switching station, transmission line) is some distance from dwellings and community locations.

13.3.3.5 EMF and Underground Transmission Cable

Electric fields are shielded by most objects, and for this reason there are negligible electric fields above underground cables (Energy Networks Association, 2016).

In terms of magnetic fields, a typical 33 kV underground cable will produce a maximum magnetic field of approximately 1 μT at one metre above ground level. As magnetic fields drops off with distance, the magnetic field density will be indistinguishable from the background magnetic field at distances greater than 20 m away from the source (Energy Networks Association, 2016; National Grid, 2020).

13.3.3.6 EMF and BESS

BESS comprise batteries, inverters, transformers, heating ventilation, air conditioning and fire protection. There is limited information on typical measurement of magnetic fields around BESS. The magnetic field associated with a BESS will vary depending on a number of factors including configuration, capacity and type of housing. The BESS for the Project is located adjacent to the substation, with the BESS to be housed in enclosures or buildings. The specific details of the BESS housing are subject to detailed design, however they are likely to be either modified shipping containers, pre-fabricated structures, buildings or smaller cabinets, mounted on concrete slabs / footings. It is assumed that the typical magnetic field associated with a BESS will be not too dissimilar to that of a substation based on material components of the infrastructure. The BESS for the Project will be designed in accordance with relevant electrical safety standards and codes, thus excluding general public exposure from BESS EMF sources.

13.3.4 Mitigation Measures

The Project has been designed to implement prudent avoidance by ensuring appropriate setbacks consistent with setbacks as detailed below.

13.3.4.1 Prudent Avoidance

While compliance with standards and guidelines is important, because they are based on established effects only, such compliance does not imply absolute safety. Therefore it is generally considered that the prudent avoidance approach is the most appropriate response in these circumstances. Under this approach, power utilities should design their facilities to reduce the intensity of the fields they generate, and locate them to minimise the fields that people encounter over prolonged periods. Provision of setbacks and easements are discussed below in Section 13.3.14.2.

The practice of 'prudent avoidance' has been adopted by the (Australian) Energy Networks Association (ENA) and most Australian power utilities. ENA is the national industry body representing Australia's electricity transmission and distribution and gas distribution network.

The WHO (WHO, 2007) also advocates this response while addressing prudent avoidance in these terms:

- *"…it is not recommended that the limit values in exposure guidelines be reduced to some arbitrary level in the name of precaution. Such practice undermines the scientific foundation on which the limits are based and is likely to be an expensive and not necessarily effective way of providing protection;*
- *Electric power brings obvious health, social and economic benefits, and precautionary approaches should not compromise these benefits; and*
- *Provided that the health, social and economic benefits of electric power are not compromised, implementing very low-cost precautionary procedures to reduce exposure is reasonable and warranted."*

While prudent avoidance will be a mitigation measure implemented for the Project, evidence does not to date suggest that it is essential or that it will result in any health benefit.

13.3.4.2 Provision of setbacks and easements

In line with the above approach of prudent avoidance, the Project incorporates significant setbacks between residential dwellings and project components which will generate ELF EMF. The current setbacks based on the indicative Project layout are outlined in Table 13-9 and provide further assurance for the community in relation to all ELF EMF generated from the Project:

Table 13-9 Distance between dwellings and project components

Project Component	Approximate Distance to Nearest Dwelling (m)	Dwelling ID
Switching Station	3,939	NAD_51
Substation / BESS	2,839	AD_8
Wind turbine generator (WTG)	765	AD_5
Transmission line	800	NAD_21

13.3.5 Conclusion

It has not been established that EMFs have any adverse effects on the community. The broadly accepted guideline in both Australia and overseas is to implement a prudent avoidance approach which WEP has adopted in the design of the Project, as well as other relevant standards and guidelines as outlined in this document.

Due to the low exposure likely to be generated from the proposed activity and the findings of the scientific community, no adverse impacts are expected due to EMFs.

13.4 Bushfire

13.4.1 Introduction

The SEARs required assessment of bushfire risk, and the *Rural Fires Act 1997* imposes obligations on land occupiers to take practicable steps to prevent the occurrence of bushfires on or from land.

The Bushfire Risk Assessment (ERM, 2020) is included in Appendix J and identifies potential hazards and risks associated with bushfires / use of bushfire prone land, and contains management and mitigation measures designed to address these obligations. It does not assess the individual design or engineering components of the turbines (or other infrastructure) themselves.

Given the steep slopes and existing fire history within the adjacent National Parks estates, the risk assessment is also undertaken with due consideration of the potential flame zone that may impact on the Project infrastructure as requested by the NSW RFS in their agency advice dated 1 November 2018.

13.4.2 Methodology

The Bushfire Risk Assessment aims to address the requirements identified by the SEARs to identify potential hazards and risks associated with bushfires / use of bushfire prone land, including the risks that a wind farm would cause bush fire and any potential impacts on the aerial fighting of bush fires, and demonstrate that the proposed wind farm can be designed, constructed and operated to minimise ignition risks and provide for asset protection consistent with relevant NSW Rural Fire Service (RFS) design guidelines (Planning for Bushfire Protection (PBP) 2019 and Standards for Asset Protection).

The following steps were undertaken in the assessment process:

- determine whether the Project Area has been mapped as bushfire prone land and whether the Project is in compliance with NSW Rural Fire Service (RFS) guidelines including *Planning for Bush Fire Protection* (2019) , which replaced the 2006 guidelines referred to in the SEARs;
- identification of the assets within and surrounding the Project Area requiring protection;
- identification of the bushfire risk factors such as bushfire history and known bushfire behaviour in the Project Area and within the surrounding lands;

- consultation with key stakeholders to discuss the recent fires affecting the Project Area and immediate surrounds to gain a better understanding of the local fire conditions and to ensure that suitable management and mitigation measures are developed in consultation with the NSW RFS and the NSW NPWS;
- identification of infrastructure that may be subject to direct flame contact. Calculations of Bushfire Attack Levels (BAL) and flame length have been undertaken using Method 2 as outlined within Appendix B of AS3959; and
- produce risk mitigation and management treatments and satisfy PBP 2019 requirements.

It is recognised that eastern Australia is one of the most bushfire-prone areas in the world and human induced climate change is influencing the frequency and severity of dangerous bushfire conditions, influencing temperature, environmental moisture, weather patterns and fuel conditions. Observed changes in southern and eastern Australia include more extreme conditions during summer, as well as an earlier start to the bushfire season with dangerous weather conditions occurring significantly earlier in spring than they used to.

While climate change might not ignite the fire, it is giving fires the chance to turn into catastrophic fires by creating warmer temperatures, increasing the amount of fuel (dried vegetation) available, and reducing water availability due to higher evaporation. Bushfire weather conditions in future years are projected to increase and have also been considered throughout the bushfire assessment. These changes will result in:

- an earlier start to the bushfire season;
- reduced opportunities for fuel reduction burning;
- management of fire risk to property, people and biodiversity will become increasingly challenging; and
- an increase in the number of extreme fire danger days.

The energy sector in Australia is undergoing a necessary and inevitable transition from a centralised system of large fossil fuel generation towards a decentralised system of widely dispersed, renewable energy. The Project will result in a reduction of greenhouse gas emissions by approximately 654,500 tonnes per annum.]

13.4.3 Consideration of Planning for Bushfire Protection 2019

PBP 2019 is a planning document to link responsible planning and development control with the protection of life, property and the environment. It was legislatively adopted in the *Environmental Planning & Assessment Regulations* on 1 March 2020.

The guidelines apply to all development applications on land that is classified as bushfire prone land on a council's Bushfire Prone Land Mapping. The Tamworth Regional Council Bushfire Prone Land mapping shows the Project Area as bushfire prone land and consideration has been given to the following overall aims and objectives of PBP 2019:

- afford buildings and their occupants protection from exposure to a bushfire;
- provide for a defendable space to be located around buildings;
- provide appropriate separation between a hazard and buildings which, in combination with other measures, minimises material ignition;
- ensure that appropriate operational access and egress for emergency service personnel and residents is available;
- provide for ongoing management and maintenance of bushfire protection measures; and
- ensure that utility services are adequate to meet the needs of firefighters.

The guidelines provide specific requirements for wind farm development and notes that wind and solar farms require special consideration and should be provided with adequate clearances to combustible vegetation as well as firefighting access and water. The following minimum standards have been applied for the Hills of Gold Project:

- 10m APZ from the structures/associated buildings/ infrastructure; and
- the APZ must be maintained to the standard of an inner protection area (IPA) for the life of the development to provide adequate access for firefighting purposes.

As a minimum, and to enable access for RFS all roads will be maintained to the minimum standards as outlined within the NSW RFS Fire Trail Standards and the NSW RFS Fire Trail Design, Construction and Maintenance Manual.

13.4.4 Existing Environment

The Tamworth Regional Council Bushfire Prone Land mapping identifies the Project Area as bushfire prone land. The Project Area is located along the upper ridgeline that is exposed to prevailing wind directions. These ridgelines and plateaus are flanked by very steep rugged terrain, and a mixtures of cleared farmland and dry sclerophyll forests. Based on the information provided in Appendix J, the greatest hazard already present in the landscape is a combination of undesirable fire weather (ie. hot and dry winds and low humidity during summer) and the potential for a fire to spread from the adjacent properties and the National Parks' estates towards farm assets in the surrounding area. Fire under the influence of wind may travel upslope very fast, reaching these assets before firefighters can attend the scene. This is noted to be an existing hazard and is not directly influenced by the proposed wind farm development.

A review of the NSW RFS Fire History Mapping available via SEED maps shows three major fires within the Project Area during the past 20 years. The largest and most recent was the 2019 Pages Creek Road Fire which is reported to have burnt over 7,494 hectares and was the result of a lightning strike within the adjacent Ben Halls Gap National Park. In addition to aerial support, the National Parks and Wildlife Service (NPWS) and NSW RFS used the Project Area and the ridgeline as a containment line and were able to back burn in advance of the fire front. This action successfully stopped the Pages Creek Road Fire and reinforces that this ridgeline is strategically important in terms of ongoing bushfire mitigation and co-ordinated access arrangements and has been considered within the detailed design of the Project.

The existing risk of fire starting as a result of a lighting strike, which is reported to be common in the region, may actually be reduced by the presence of wind turbines, particularly if they are located along a ridgeline (AFAC, 2018). A built-in lightning protection system is reported to attract lighting and safely dissipate the electricity from the blades or the nacelle into the ground and may assist to reduce the existing hazard in the Project Area.

13.4.5 Assessment of Impacts

13.4.5.1 Summary of Bushfire Risk Factors

The risk that the Project itself will cause a fire is minimal. While the PBP 2019 specifies an asset protection zone (APZ) of 10 m for wind farm assets, given the steep slopes and existing fire history within the adjacent National Parks' estates, this risk assessment is also undertaken with due consideration of the potential flame zone that may impact on the Project infrastructure. AS3959 *Construction of buildings in bushfire –prone areas* and the PBP 2019 describe flame zone as:

> *the distance from a bushfire at which there is considered to be significant potential for sustained flame contact to a building or other infrastructure.*

The Bushfire Attack Level (BAL) Method 2 calculations within Appendix B of AS3959 have been used to identify those assets at risk of direct flame contact. This assessment identifies that 45 of the 70 turbines have the potential for direct flame contact. In some instances, this risk can be avoided by micro-siting wind turbines (WP3, WP29, WP46, WP49, WP52, WP65). This will result in 39 turbines, the access road and the transmission line easement remaining within the flame zone. Consultation with RFS has confirmed that as the WTG towers are made from non-combustible material and do not present a significance risk, efforts would be concentrated on defending those assets that could contribute to widespread fire.

The assets that are at greater risk in the event of a bushfire are:

- the switching station;
- the substation;
- the BESS; and
- the O&M buildings.

All of these key infrastructure will all have an increased 20 m wide asset protection (twice that required by PBP 2019) to ensure adequate defendable space is maintained in all directions. To ensure that these significant assets are not at risk of direct flame contact, and based on the results of the flame length modelling presented in Appendix J, the switching station will have a larger 33 m APZ to east, and the BESS will have a 23 m APZ to the west.

A summary of the Bushfire Risk Factors considered in Bushfire Risk assessment is presented in Table 13.10 and the application of recommended mitigation measures are outlined in Table 13.11.

Table 13.10 Summary of Bushfire Risk Factors

Risk Factor	Description of Risk	Analysis of the Risk
Loss of Life	Populated Area	Consultation between the Proponent and Brian Tomalin (RFS Hanging Rock) has indicated that fires in the Nundle and Hanging Rock area, under extreme conditions are uncontrollable. Hanging Rock village is particularly vulnerable to fires due to limited escape options and limited fire trails to defend the village. The village would have been lost if the Pearson's trail and Pages creek fires joined during the 2019/2020 bushfire season (Brian Tomalin pers. comm.). This is noted to be an existing hazard and is referred to here to recognise that bushfire is a key concern for the local community and the risk to life should not be discounted. It is not a direct result of the proposed wind farm, nor will the wind farm result in further isolation or access restrictions. It is also important to note that there are residential dwellings on rural properties scattered throughout the landscape that may be at risk from fire and the steep, rugged topography within the adjacent National Parks estate is considered to present an additional existing hazard that will also be considered in the Bushfire Emergency Management and Operations Plan to be prepared for the Project. The proposed upgrade of the internal road network would increase the level of access available to fire fighters along the entire length of this ridgeline (which forms a strategic fire containment line) and would assist to reduce the likelihood of a widespread fire. Site access points will be constructed as the first stage of development and the design of the access roads will enable safe access and egress for residents attempting to leave the area at the same time that emergency service personnel are arriving to undertake firefighting operations including back burning down the slopes in advance of a fire. Natural ignitions such as lightning strikes are likely and historically common across the region. Human induced ignitions (both accidental and arson) are also known to occur. The risk of fire starting as a result of a lighting strike is actually reduced by the presence of wind turbines as the turbines have a built-in lightning protection system. Wind turbines also have a variety of on-board control systems specifically designed to mitigate the risk of fire. Each wind turbine is connected to a control centre which constantly monitors the wind turbine and shuts down the

Risk Factor	Description of Risk	Analysis of the Risk
		turbines if there is a risk of overheating. Turbines also automatically shut down if they are close to functioning outside their design conditions such as wind speeds greater than 25 m/s. The risk that wind farm itself will cause a fire or increase the risk already present in the region is minimal. Wind farms are an infrastructure development that should be considered by fire and land management agencies through the preparation of incident action plans for the suppression of bushfires in their vicinity. These considerations are routine and wind farms are not expected to present elevated risks to operations compared to other electrical infrastructure (AFAC, 2018).
	Aerial Fire Fighters	Fire suppression aircraft only operate in areas where there is no smoke and during daylight hours (CFA, 2015). Wind turbines, similar to high voltage transmission lines, are part of the landscape and would be considered in the incident action plan, thus not resulting in any increased risk to aerial fire fighters. The NSW RFS and Australasian Fire and Emergency Services Council (AFAC) have worked together to develop a national position on wind turbines (AFAC, 2018). This position paper concludes that wind farms are not expected to adversely affect fire behaviour in their vicinity. Local wind speeds and direction are already highly variable across landscapes affected by turbulence from ridgelines, tall trees and buildings. Any risk of wake turbulence from wind turbines influencing fire behaviour will be mitigated through the shutting down of wind turbines in a bushfire event. Sufficient planning for access roads and the increased APZ around key assets will reduce the risk of wind farm ignitions spreading beyond the property and reduce the risk of external fire impacting wind farm infrastructure. As reported by AFAC (2018), the bushfire at the Waterloo Wind Farm demonstrated that if conditions are clear and wind turbines are turned off, wind turbines are clearly visible from aircraft and are not likely to constrain aerial firefighting operations (Clean Energy Council 2017). However, during this event transmission infrastructure, meteorological towers and guy-ropes were difficult to see; this infrastructure does have potential to limit the effectiveness of aerial firefighting operations. As noted above, all of the windfarm infrastructure including the transmission lines will need to be considered in any incident action plan and as outlined within the Hills of Gold Wind Farm Aviation Impact Assessment (Aviation Projects, 2020), further consultation will be held with RFS and WEP to ensure that appropriate mitigation methods are in place, so that in the event of a bushfire in the area, pilots are aware of the turbine locations and can respond appropriately. In the unlikely event that a fire did spread from the wind farm to surrounding properties, the turbines would not limit aerial firefighting capabilities on other properties in the surrounding area.
	Firefighter	The firefighters likely to respond to a bushfire in this area would be volunteers from the NSW RFS and or individual property owners. Brigades from NSW Fire and Rescue and NPWS could also respond. As evidenced during the recent fires, the track along the ridgeline is used as a strategic containment line and allows the response agencies to back burn ahead of the fire. The proposed upgrade of the internal road network would provide safer increased access along the entire length of this strategic fire containment line and would assist to reduce the likelihood of a widespread fire. In the event that a fire does breach any containment lines and threatens the windfarm assets, it is likely that firefighting will require aerial support. Aerial support was used during the 2109/2020 fires and use of this vital resource would not be the result of the wind farm itself although it is recognised that the wind farm would result in additional assets that would need to be protected. As reported by AFAC (2018) wind farms can interfere with local and regional radio transmissions by physical obstruction and radio frequency electromagnetic radiation (Australian Wind Energy Association 2004). This has been considered in the Hills of Gold Windfarm EMI Study (Lawrence Derrick and Associates, 2020) and communications is not expected to be affected.

Risk Factor	Description of Risk	Analysis of the Risk
		The increased risk of arcing in dense smoke has been considered by the Proponent. In terms or arcing potential, the turbines have a detection system that protects them from surges, arcing and other electrical hazards. Arcing would be detected and electrical systems shut off if these persisted over several split seconds. The majority of the internal power lines are underground however where these are overhead, the Proponent has confirmed that similar detection systems will be installed to monitor changes over split seconds and within tight bands. Automatic Circuit Breakers at either end of the lines would open to stop transmission of electricity in the event that any arcing is detected.
	Workers and Visitors	All employees and visitors involved in the operation and maintenance of the wind farm will be routinely trained. Construction and maintenance staff will also be trained in the basic first response firefighting techniques and appropriate communication and firefighting equipment will be maintained onsite. Provided that appropriate firefighting equipment, training in initial response, and water supplies are maintained onsite the likelihood of fire adversely impacting the safety of site personnel is very low although the potential consequences are recognised as being major.
Damage to infrastructure within the Project Area	Extensive and widespread loss of infrastructure	45 of the 70 turbines have the potential for direct flame contact. These assets are all located within the potential flame zone. Wind turbines are a relatively passive technology that use few flammable materials and together with the maintenance of an adequate defendable space results in a low risk of damage to the turbines in the event of a bushfire within the surrounding lands. The assets that are at greater risk in the event of a bushfire are the switching station, substation, BESS, and the O&M buildings. All of these key infrastructure will all have an increased 20 m wide asset protection (twice that required by PBP 2019) to ensure adequate defendable space is maintained in all directions. To ensure that these significant assets are not at risk of direct flame contact, and based on the results of the flame length modelling presented in Appendix J, the switching station will have a larger 33 m APZ to east, and the BESS will have a 23 m APZ to the west. It is also recognised that 43 of 62 transmission line poles (or 69% of the proposed 330 kV transmission line) are located within the flame zone. All poles will be either concrete or galvanised steel poles and the maintenance of the transmission line easement including reduced fuel loads beneath transmission lines will be the responsibility of the asset owner.
Damage to surrounding properties	Extensive and widespread loss of infrastructure and or property	Wind farm projects generally require upgrades to existing road infrastructure, increasing the accessibility of farms to emergency vehicles should a bushfire break out in the vicinity of the wind farm. As outlined by AFAC (2018) and considered during project design,, appropriately planned access roads can increase the ability of fire and land management agencies to successfully undertake firefighting operations by allowing increased accessibility for emergency vehicles. Access roads and other infrastructure can also reduce the likelihood of fire moving through or leaving the property and can act as an effective firebreak in many circumstances. Site access points will be constructed as the first stage of development and the final design of access roads will enable safe access and egress for residents attempting to leave the area at the same time that emergency service personnel are arriving to undertake firefighting operations. Site access points will be maintained for the life of the project and include appropriate signs throughout the windfarm to assist emergency response crews determine track names, location and turbines etc. In the unlikely event that a fire did spread from the wind farm to surrounding properties, the turbines would not limit aerial firefighting capabilities on other properties in the surrounding area.

Risk Factor	Description of Risk	Analysis of the Risk
	Localised damage to infrastructure and or property	The risk that the wind farm itself will cause a fire is minimal. The proposed upgrade of the internal road network would increase access along the entire length of this ridgeline (which forms a strategic fire containment line) and would assist to reduce the likelihood of a widespread fire. Localised damage is unlikely to require external assistance to recover in the short-term. In the unlikely event that a fire did spread from the wind farm to surrounding properties, the turbines would not limit aerial firefighting capabilities on other properties in the surrounding area.
Damage to ecological values/assets	Threatened species and ecological communities	The risk that wind farm itself will cause a fire is minimal. The proposed upgrade of the internal road network would increase access along the entire length of this ridgeline (which forms a strategic fire containment line) and would assist to reduce the likelihood of a widespread fire. The wind farm is also unlikely to increase the frequency of fires across the landscape and so will not increase the fire related impacts to threatened species and ecological values. .

13.4.6 Mitigation Measures

Table 13.11 summarises the bushfire mitigation strategies and recommendations that will be implemented for the Project. These mitigation strategies are guided by the following factors that contribute to bushfire risk:

- fuels, weather, topography and predicted fire behaviour including the calculated flame length;
- suppression resources (air and ground), access (roads, tracks) and water supply; and
- values and assets.

Mitigation must be a combination of complementary strategies, all of which are required to provide the best possible protection outcome for the wind farm and the community. These include the identification of fire management zones. These are defined as:

- An Asset Protection Zone (APZ) is typically designed to separate a vulnerable asset from the bushfire hazard (vegetation/fuel). APZs do not eliminate the fire risk, but may lower it to an extent where fire control is more feasible or damage to the asset is reduced or eliminated. It also provides a defendable space for firefighting operations.
- Strategic Fire Advantage Zones (SFAZ) provide a strategic fire advantage for the management of bushfires. They aim to complement the APZ and limit the spread of bushfires across the landscape. In this case, they have been design to link with the SFAZ in the adjacent National Park.

Indicative Fire Management Zones are provided in Figure 13-2.

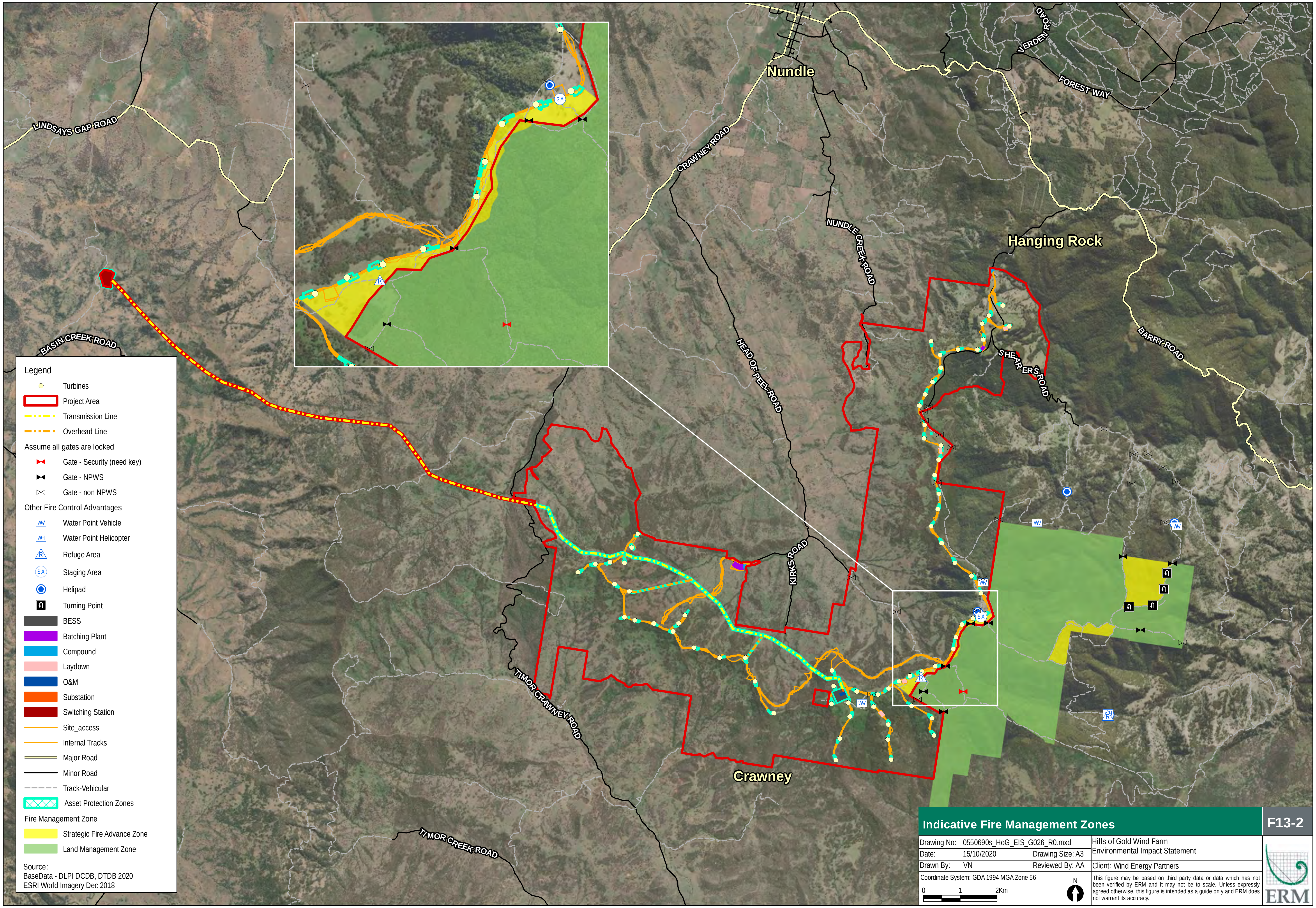

Nundle
Hanging Rock
Crawney
LINDSAYS GAP ROAD
BASIN CREEK ROAD
CRAWNEY ROAD
NUNDLE CREEK ROAD
HEAD OF PEEL ROAD
KIRKS ROAD
TIMOR CRAWNEY ROAD
TIMOR CREEK ROAD
SHEARERS ROAD
VERDEN ROAD
FOREST WAY
BARRY ROAD
Legend
Turbines
Project Area
Transmission Line
Overhead Line
Assume all gates are locked
Gate - Security (need key)
Gate - NPWS
Gate - non NPWS
Other Fire Control Advantages
Water Point Vehicle
Water Point Helicopter
Refuge Area
Staging Area
Helipad
Turning Point
BESS
Batching Plant
Compound
Laydown
O&M
Substation
Switching Station
Site_access
Internal Tracks
Major Road
Minor Road
Track-Vehicular
Asset Protection Zones
Fire Management Zone
Strategic Fire Advance Zone
Land Management Zone
Source:
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018
Indicative Fire Management Zones
F13-2
Drawing No: 0550690s_HoG_EIS_G026_R0.mxd
Date: 15/10/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partners
Coordinate System: GDA 1994 MGA Zone 56
0
1
2Km
N
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM

Table 13.11 Summary of Mitigation Strategies

Mitigation Strategy	Action
Asset Protection Zone (APZ)	A minimum 10 m APZ will be established around each wind monitoring masts; ■ each WTG will be mounted on a concrete foundation (approximately 25 m in diameter) located on a cleared hardstand area; and ■ an increased APZ of 20 m will be established around the O&M buildings, BESS, substation and switching station. This will be increased as required to ensure that these assets are located outside of the flame zone. ■ the switching station will have a larger 33 m APZ to east, and the BESS will have a 23 m APZ to the west. The specifications recommended for the APZ in accordance with the Standard for Asset Protection (NSW RFS) are as follows: ■ APZ must not extend beyond the property boundary or rely on actions being undertaken by adjacent landowners. This includes the neighbouring National Parks' estates; ■ mineral earth fire break i.e. dirt or gravel; ■ no trees and shrubs planted within the APZ; and ■ where possible, increase the distance between the trees and the APZ. These have been incorporated into the APZ design for the Project.
Strategic Fire Advantage Zone (SFAZ)	■ An existing SFAZ as shown in Figure 13-2 has already been established within the adjacent Ben Halls Gap Nature Reserve / National Park as currently mapped in the Ben Halls Gap National Park Fire Management Strategy (dated 2005). This will be extended along the eastern side of the access road to provide a larger, more accessible area to back burn down the slope in the event of a major fire within the adjacent National Park. This area will be maintained (within the bounds of the Project Area only) with an overall reduce fuel load for the life of the Project. This may also present an opportunity (in co-ordination with the NSW RFS and NSW NPWS) to explore additional options and integrate Indigenous land and fire management practices. ■ The location of all fire control advantages within the Project Area (water points, helipad, staging area and refuge area) currently mapped on the Ben Halls Gap National Park Fire Management Strategy (dated 2005) will also be reviewed and updated in consultation with the NSW RFS and NSW NPWS as part of the recommended Bushfire Emergency Management and Operations Plan.
Flame zone	■ WTG3, WTG29, WTG46, WTG49, WTG52 and WTG65 will be microsited out of the flame zone. ■ The O&M buildings, BESS, substation and switching station will be located outside of the flame zone and a minimum 20m APZ maintained in all directions for the life of the Project, with the switching station having a larger 33 m APZ to east, and the BESS having a 23 m APZ to the west. ■ Non-combustible construction materials will be used for WTGs and the transmission infrastructure, including those which were unable to be microsited out of the flame zone.
Monitoring masts	■ Monitoring masts will be recorded in the Tall Structures Database maintained by Air Services Australia (Civil Aviation Safety Authority 2018) and visible markers (such as orange balls) will be installed on all masts to minimise risks during aerial firefighting operations. . Aviation Projects (2020) has confirmed that the Project will not require obstacle lighting to maintain an acceptable level of safety to aircraft.
Wind farm construction	■ The following measures will be implemented during the entire period of construction: ■ the APZ and perimeter road will be constructed at the first stage of the development; ■ appropriate bunding will be put in place in areas where there is potential for flammable fuels and oils to leak and create bushfires or other environmental risks; ■ appropriate signs will be installed to assist emergency response crews determine track names, location and turbines etc; ■ any necessary permits will be obtained for work during First Danger Periods; ■ adhere to restrictions on Total Fire Bans or days of high fire danger;

Mitigation Strategy	Action
	■ suitable firefighting equipment (specific requirements to be confirmed in consultation with NSW RFS) will be present onsite; ■ fire extinguishers or firefighting equipment will be carried in vehicles where required; ■ emergency communications equipment will be carried; ■ where practicable, all site vehicles during the construction phase will have diesel engines and/ or will use the site access roads (where available) to minimise the likelihood of igniting dry grass; ■ smoking will be restricted to prescribed areas, and suitable ash and butt disposal facilities will be provided; ■ all plant, vehicles and earth moving machinery will be cleaned of any accumulated flammable material (e.g. vegetation); and ■ on days when Very High fire danger or worse is forecast, relevant fire information will be checked regularly for the occurrence of any fires likely to threaten the site.
Access roads and road network	■ Site access points will be constructed as the first stage of development and the final design of access roads will enable safe access and egress for residents attempting to leave the area at the same time that emergency service personnel are arriving to undertake firefighting operations. The proposed road upgrades including the transverse track, logging track and Head of Peel Road upgrades will support more options to evacuate within the local area. ■ Site access points will be maintained for the life of the Project and include appropriate signs throughout the wind farm to assist emergency response crews determine track names, location of turbines and location of any locked gates. ■ Roads will provide sufficient width and other dimensions to ensure safe unobstructed access and allow firefighting crews to operate equipment around the vehicle. Dead-end roads will be avoided where practicable. Where they are present, they will incorporate a sufficient turn-around area to minimise the need for vehicles to make multipoint turns. As a minimum, and to enable access for NSW RFS, all roads will be maintained to the following minimum standards outlined within the NSW RFS Fire Trail Standards and the NSW RFS Fire Trail Design, Construction and Maintenance Manual. ■ Where practicable, all site vehicles during the construction phase will have diesel engines and/or will use the site access roads (where available) to minimise the likelihood of igniting dry grass.
During operation	■ The Project will be controlled by a remote supervisory control and data acquisition (SCADA) from a control room located within the permanent site operations and maintenance facility. The SCADA system will allow remote operation of all WTGs with the ability to shut-down individual or all WTGs if required. ■ NSW RFS will be provided with maps of the final wind turbine layout and identification information for individual wind turbine sites for their internal response planning. ■ The Civil Aviation Safety Authority (CASA) and the RAAF Aeronautical Information Service will be consulted as outlined within the Hills of Gold Wind Farm Aviation Impact Assessment (Aviation Projects, 2020). ■ Safe working and emergency response procedures for all work tasks will be developed and implemented. ■ Maintenance staff will be trained in the basic first response firefighting techniques. ■ Firefighting equipment will be provided and maintained capable of controlling and suppressing small initial outbreaks of fire. As a minimum, these will be located on the outside of the switching station, substation, BESS and O&M buildings.
Firefighter safety	A Bushfire Emergency Management and Operations Plan will be prepared and stored at 'Emergency Information Cabinet' at main entrance to the wind farm and provided to local emergency responders. The ERP will include: ■ a safe method of shutting down and isolating the WTG if required (noting that the turbines automatically shut down if they are close to functioning outside their design conditions); ■ control and coordination arrangements for emergency response (eg evacuation procedures, emergency assembly areas and procedures for response to hazards); ■ location of all fire control advantages within the Project Area (access road, gates, water points, helipad, staging area and refuge area);

Mitigation Strategy	Action
	■ agreed roles and responsibilities of onsite personnel (eg equipment isolation, liaison, evacuation management); ■ up-to-date contact details of site personnel and any relevant off-site personnel who could provide technical support during an emergency; ■ a manifest (and safety data sheets) for any battery, diesel or other dangerous goods storage/handling, including the class identification, quantity, type (bulk or packaged) and location. Appropriate material (including absorbent, neutralisers, equipment and personal protective equipment) for the clean-up of spills is to be provided and available onsite; ■ clearly states work health safety risks and procedures to be followed by firefighters, including personal protective clothing; ■ minimum level of respiratory protection; ■ minimum evacuation zone distances; ■ activation of water spray/foam systems and any other response/protection measures; and ■ any other risk control measures required to be followed by firefighters. A schedule for ongoing site familiarisation to account for changing personnel, site infrastructure and hazards will be developed in conjunction with the local RFS.
Transmission lines	Parts of the transmission line have been mapped within the flame zone. For the safe operation of the transmission line, certain activities will be restricted within the easement such as planting and growing trees, construction of buildings, or erection of antennae or masts. While it has not be confirmed how the easement will be formally registered, for the purposes of this bushfire risk assessment, key responsibilities and management measures will be applied in accordance with the TransGrid Bushfire Risk Management Plan and ISSC3 Guide for the Management of Vegetation in the Vicinity of Electricity Assets which requires assets to be maintained to minimise the risk of fire ignition and to ensure that vegetation clearance are maintained. Visible markers (such as orange balls) will also be installed on transmission lines where they span long distances between valleys to minimise risks during aerial firefighting operations. Aviation Projects (2020) has confirmed that the Project will not require obstacle lighting to maintain an acceptable level of safety to aircraft.
Water storage	Water supply will be designed to provide filling points for fire tanker units near the windfarm entrance. A storage of 50,000 litres is recommended, based on refilling six tanker units (4,000 litres) twice each although the required capacity will be confirmed in consultation with RFS. As the wind farm development aims to increase the accessibility of the ridgeline to fire fighters and improve strategic fire advantages that already exist, access to water will be maintained such that existing water resources will remain available at all times to support firefighting activities. The requirement for any additional open water supplies (i.e large dams) to be provided along the ridgeline will be confirmed in consultation with the NSW RFS.

13.4.7 Conclusion

The risk that the wind farm itself will cause a fire is minimal although it is recognised that the proposed development is located within a bushfire prone landscape, and that despite the mitigation measures and treatments that are put in place, some bushfire risk will always remain. It is also recognised that some of the proposed wind farm infrastructure, including WTG, the transmission line and the main access road will be located within the flame zone. It is therefore important that a Bushfire Emergency Management and Operations Plan is prepared in conjunction with relevant stakeholders, including NSW RFS, NSW Fire and Rescue, NPWS, Forestry Corporation of NSW (FCNSW), adjoining property owners and employees.

It is also important to note that the access road is already located within the flame zone and the proposed wind farm assets will not increase this existing hazard. The improved access and additional water sources will be an advantage to both the local RFS and the NPWS for back burning down the slopes in advance of the fire front as was undertaken in 2019 and successfully stopped the Pages Creek Road Fire along this ridgeline. In the event that a fire does breach any containment lines and threatens the wind farm assets, it is possible that the wind farm infrastructure will sustain direct flame contact and that firefighting will require aerial support.

The detailed mitigation measures outlined in the bushfire risk assessment have been developed in consultation with key stakeholders including NSW RFS and NPWS to ensure that the windfarm development does not present any increased risk of widespread fire across the landscape.

These mitigation measures will be applied for the life of the project and are compliant with the NSW RFS Planning for Bushfire Protection Guidelines (2019).

13.5 Blade Throw

13.5.1 Introduction

ERM prepared a Blade Throw Risk Assessment for the Project to assess blade throw risks in the vicinity of the Project in accordance with the requirements of the SEARs.

The Blade Throw Risk Assessment can be found in full at Appendix K (ERM, 2020).

13.5.2 Methodology

The Blade Throw Risk Assessment incorporated the following scope of works:

- assessment of the likelihood of occurrence for a blade throw event;
- assessment of theoretical distance radii for a blade fragment throw event;
- review of distances between turbines and nearby dwellings;
- review of historical blade throw occurrences in Australian wind farms; and
- provision of relevant mitigation measures for Project implementation.

13.5.3 Blade Throw Overview

A blade throw incident can occur when a wind turbine blade becomes separated from its hub at the metal to metal root joint. Such events are rare.

There are a number of possible causes of such events. One possible cause is the instantaneous failure of the bearing or hub flange fastening system (MMI Engineering Ltd, 2013) which can possibly result in the blade being released if the control system fails to detect an abnormality (e.g. vibration, imbalance, under power). However the progression of such failures are generally slow enough to ensure that the control system detects an abnormality and the machine will fault and shut down, preventing a blade throw event (MMI Engineering Ltd, 2013).

Ensuring turbines are constructed to preventing structural failures, such as fatigue resistance of wind turbine subassemblies can also prevent the possibility of a blade throw event (MMI Engineering Ltd, 2013). Subassembly failure frequencies have been established to be reducing over time as improvements in wind turbine design and manufacturing continue to occur (Ribrant & Bertling, 2007).

The causes for wind turbine blade failures may also include extreme environmental conditions, incorrect design for ultimate or fatigue loads, extremely low strength of the materials, failure of turbine control system, and human error (Carbone & Afferrante, 2013; Rastayesh, Long, Dalsgaard Sorensen, & Thons, 2019).

A diagram of wind turbine subassemblies and components is depicted in Figure 3-6.

13.5.4 Assessment of Impacts

Likelihood and Distance of Blade Throw Event

In order to quantify the likelihood of a blade throw event, researchers have examined historical data sets of incidents on wind farms. Comprehensive and detailed blade throw data sets are not typically available to the public. Where databases have been compiled, the data is typically held in confidence by manufacturers or industrial bodies (Larwood & Simms, 2018; MMI Engineering Ltd, 2013). The limited data available includes a database of over 200 wind turbine incidents which occurred in Germany and Denmark from 1980 until 2001. Using this database, researchers (Braam & Rademakers, 2002) were able to establish rates of incidents as depicted in Table 13-12 below. Documented blade failures and blade throw distances were also reported. The maximum throw distance for an entire blade and blade fragment recorded were 150 metres and 500 metres respectively.

Table 13-12 Blade Throw Probabilities – Frequencies of Occurrences

Scenario	Recommended Value (1 / year)
Collapse of an entire tower from base	$3.2 \cdot 10^{-4}$
Loss of an entire blade	$8.4 \cdot 10^{-4}$
Loss of a blade tip	$2.6 \cdot 10^{-4}$

Source: Braam & Rademakers 2002

A public testimonial from a managing engineer at wind turbine manufacturer Vestas further contributes to the blade failure rate data (Larwood, California Wind Energy Collaborative, & University of California, 2005). The managing engineer declared that there had been only one blade failure in ten-thousand units manufactured by Vestas over the preceding twelve year period. The failure occurred in 1992 on a V39- 500kW turbine and a blade was thrown 50-75 metres. It has been estimated that if an average of six years of total operation for the entire fleet is assumed, the failure rate would be $1.6 \cdot 10^{-5}$ blade failures per turbine per year (Larwood, California Wind Energy Collaborative, & University of California, 2005).

Using an extensive database compiled by Caithness Windfarm Information Forum (CWIF) entitled *Wind Turbine Accident and Incident Compilation* (last updated 30 June 2020, available at: http://www.caithnesswindfarms.co.uk/fullaccidents.pdf) and through using web search engines, four incidents of blade throw are estimated to have occurred at the following Australian wind farms:

- Bald Hills Wind Farm, VIC (2020);
- Lal Wind Farm, VIC (2019);
- Wonthaggi Wind Farm, VIC (2012); and
- Windy Hill Wind Farm, QLD (2005).

A more recent blade throw event was reported at the Dundonnell Wind Farm in Victoria (October 2020), the cause of the event is subject to investigation.

Limited information is publically available on these occurrences, however in all occurrences no damage to human life or property were reported.

Blade Fragment Throw

Blade fragment throw has also been estimated through use of a dynamic model of blade failure and Monte Carlo simulation techniques examined using three models of wind turbines (Rogers, Slegers, & Costello, 2011). The study found that the critical factor in determining the maximum distance fragments are likely to travel is the release velocity of the blade fragment. This leads to a conclusion that standards for wind turbine setback distances should not be based on turbine height or radius, but instead, will be far more effective when based upon the mass centre velocity of the minimum sized blade fragment (Rogers, Slegers, & Costello, 2011). Models based on release velocity, wind turbine dimensions, and acceptable risk, also found that theoretical lateral throw distance of a fragment was up to 526 metres for a 3.0MW wind turbine (Rogers, Slegers, & Costello, 2011). A supporting study has shown that smaller blade fragments consistently fly farther than larger fragments because of higher initial release velocity (Sledgers, Rogers, Costello, Puga, & Arons, 2009).

Another study conducted a trajectory analysis using Newton's and Euler's equations of motion and rotation and found that while at tip speeds of about 70m/s (normal operating conditions), pieces of blade (with weights in the range of approximately 7-16 ton) would be thrown out less than 700 metres for the entire range of wind turbines (Sarlak & Sorensen, 2016).

A more recent study on blade fragment throw used turbine height as a metric for establishing safe setback distances. They found that for a six turbine wind generator site the probability for a fragment impacting a road was between $1 \cdot 10^{-5}$ and $1 \cdot 10^{-6}$ when the road was twice the turbine height away from the site. The risk of fragment impact for a dwelling was below $1 \cdot 10^{-6}$ when the dwellings were placed 3.5 times the turbine height away from the site (Larwood & Simms, 2018).

The studies discussed in this section together place the maximum blade fragment throw distance between about 500 and 800 metres under normal operating conditions.

Risk Statement

The studies establish that there is a very small likelihood of a blade or fragment being thrown a significant distance. Accordingly, the risk associated with a blade throw event can be considered very low. It is acknowledged, however, that while the risk of a blade event occurring is very low it has a potentially significant consequence (e.g. damage to human life or property).

13.5.5 Mitigation Measures

The key mitigation measure is to ensure that WTGs are located a safe distance from dwellings. The Project layout ensures that all dwellings are located outside of the potential worst-case blade throw distance radii of 800 metres, with the exception of one associated dwelling (dwelling AD_5) which is located 765 m from WTG 65). In order to address this, WTG 65 is predominantly orientated such that the blades would be heading away from the dwelling in the unlikely event of any failure.

Distances between WTGs and dwellings are presented in the assessment (refer to Appendix K) with the WTG layout and dwellings are shown in Figure 2-1 of the Blade Throw Report.

While the risks are very low, a high quality, comprehensive and robust operations and maintenance program will be implemented to ensure that WTG faults are prevented or detected and rectified quickly, further minimising any risk. In the absence of Australian or New Zealand Standards for large wind turbines, the International Electrotechnical Commission (IEC) Standards are accepted as the default for wind turbine design.

13.5.6 Conclusion

The Blade Throw Risk Assessment has demonstrated that there is a very small likelihood of a blade or fragment being thrown a significant distance. There is general agreement throughout the literature that the likelihood of damage to human life or property from a blade throw incident is extremely small and well within risk levels typically deemed acceptable by society.

13.6 SEPP 33

13.6.1 Introduction

ERM prepared a Screening Assessment for the Project to identify any risks and hazards associated with the Project, as well as mitigation measures to address any identified issues, in accordance with the *State Environmental Planning Policy No.33 – Hazardous and Offensive Development* (SEPP33). The Screening Assessment was prepared to address the requirements of the SEARs, and with consideration of government policies, primarily:

- SEPP 33; and
- *Hazardous and Offensive Development Application Guidelines: Applying SEPP 33* (DoP, 2011) (Applying SEPP 33).

The SEPP 33 Screening Assessment can be found in full at Appendix L (ERM, 2020).

13.6.2 Methodology

A desktop assessment was conducted for the Project, including:

- review of all relevant materials to identify environmental hazards and risks that could arise during the construction and operation of key infrastructure components of the Project (i.e. BESS, Substation and O&M Workshop);
- identification of classes and quantities of all dangerous goods to be used, stored or produced onsite;
- consideration of the following relevant policies and guidelines:
  - SEPP 33 and the supporting Applying SEPP 33 guideline (DoP, 2011) (Applying SEPP 33);
  - Hazardous Industry Planning Advisory Paper No 6: Hazard Analyses (DoP, 2011);
  - Multi-level Risk Assessment (DP&I, 2011);
  - Australian Standard 1940: The storage and handling of flammable and combustible liquids (AS 1940:2017);
  - Australian Standard 4332: The storage and handling of gases in cylinders and welding gases (AS 4332:2004);
  - Australian Standard 4839: The safe use of portable and mobile oxy-fuel gas systems for welding, cutting, heating and allied processes (AS 4839:2001);
  - International Standard (ISO / IEC 31010) Risk Management – Risk Assessment Technique;
  - Australian Code for the Transport of Dangerous Goods by Road and Rail (7.5th edition) (National Transmission Commission, 2020); and
  - Storage and Handling of Dangerous Goods Code of Practice (WorkCover, 2005).
- assessment of proximity to neighbouring properties; and
- identification of relevant mitigation measures to address identified hazards and risks.

The assessment focused on hazards and risks with the potential to adversely affect the quality of the surrounding environment, land uses and communities.

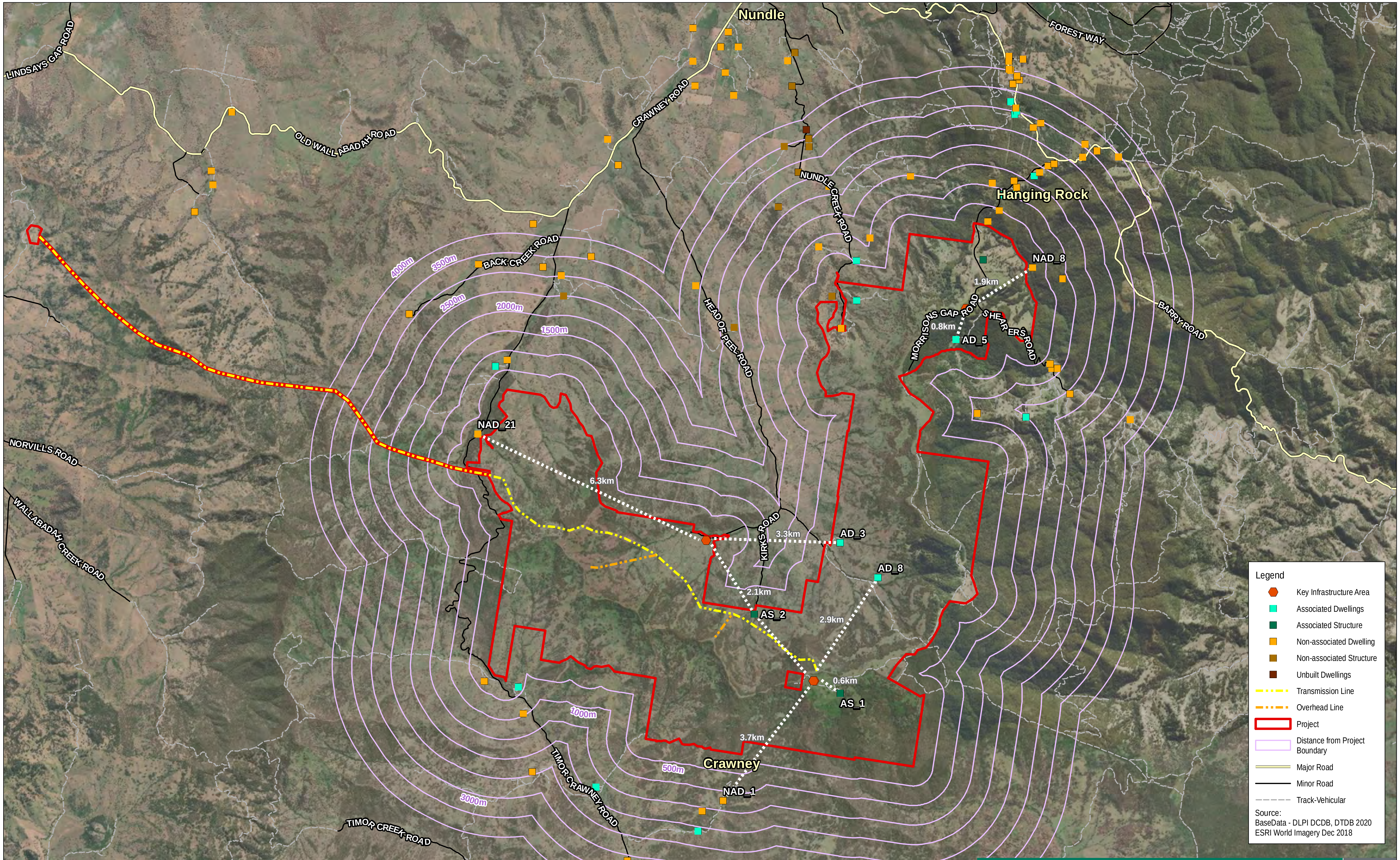
13.6.3 Existing Environment

The screening assessment recognises the relative proximity of neighbouring properties to key infrastructure containing potentially hazardous materials (i.e. BESS, Substation, O&M Workshop) in order to assess the likely significance of impacts upon neighbours of the Project. Given the rural setting of the area, neighbouring landowner dwellings are scattered over a vast area, with the closest as detailed in Table 13-13 and Figure 13-3. Associated structures AS 1 and AS 2 are located 730 m south east and 2.3 km north west of the key infrastructure(BESS, substation and O&M) respectively.

Table 13-13 Proximity of Closest Associated and Non Associated Dwellings to Key Project Components

Key Infrastructure (BESS, Substation, O&M)			Key Infrastructure (Batching / Laydown Area South)			Key Infrastructure (Batching / Laydown Area North)		
Closest Dwelling	Direction	Approximate Distance	Closest Dwelling	Direction	Approximate Distance	Closest Dwelling	Direction	Approximate Distance
AD_8	North east	3.1 km	AD_3	East	3.3 km	AD_5	South west	0.8 km
NAD_1	South west	3.9 km	NAD_21	North west	6.3 km	NAD_8	North east	1.9 km

Applying SEPP 33 also requires consideration of the immediate neighbouring land uses, or activities, as part of the risk screening process. The Project Area is zoned ‘RU1 – Primary Production’ for agricultural purposes, which reflects the primary use of the land for agricultural grazing of cattle. The surrounding land is predominately zoned as ‘RU1 – Primary Production’. Directly east of the Project Area there is land zoned ‘RU3 – Forestry’ and ‘E1- National Parks and Nature Reserves’, aligning to Ben Halls Gap State Forest and Ben Halls Gap Nature Reserve, respectively.



Proximity to Neighbours

F13-3

Drawing No: 0550690s_HoG_EIS_G019_R1.mxd
Date: 27/10/2020 Drawing Size: A3
Drawn By: VN / GR Reviewed By: AA
Coordinate System: GDA 1994 MGA Zone 56

Hills of Gold Wind Farm
Environmental Impact Statement

Client: Wind Energy Partners

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM

13.6.4 Assessment of Impacts

In assessing the proposed Project, the emphasis is on preventing hazardous incidents onsite or offsite, such as spontaneous combustion and fire, or the contamination of land by the use of significant quantities of toxic or biologically harmful materials that could result in substantial effects.

Definitions of 'potentially hazardous industry' and 'potentially offensive industry' are provided in SEPP 33:

> '*potentially hazardous industry'* means a development for the purposes of any industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality:
>
> a. To human health, life or property, or
>
> b. To the biophysical environment, and includes a hazardous industry and a hazardous storage establishment.
>
> '*potentially offensive industry'* means a development for the purposes of an industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would emit a polluting discharge (including for example, noise) in a manner which would have a significant adverse impact in the locality or on the existing or likely future development on other land, and includes an offensive industry and an offensive storage establishment.

13.6.4.1 Potential Hazards and Risks

Potential hazards and risks during construction and operation include (but are not limited to):

- the onsite storage, use and transport of dangerous goods and hazardous substances; and
- risk of damage to existing infrastructure due to ground movement and geotechnical instability.

An indicative list of the types of potentially hazardous materials anticipated to be used, stored and transported during construction and operation of the Project is provided in Table 13-13 along with the relevant storage and transport thresholds established under *Applying SEPP 33*.

Table 13-14 Proposed Hazardous Materials at Hills of Gold Wind Farm (Construction and Operation) – Storage and Transport

Material	Australian Dangerous Goods Class	Storage Location	Storage Method	Quantity (T)	Applying SEPP 33 threshold		
					Min Quantity	Min. storage distance from sensitive receptors	Transport
Chemicals	Various	Batching / laydown areas, O&M Compound	Domestic Storage	Domestic Quantities	N/A	N/A	N/A
Welding Cylinders	Class 2.1, 2.2	Batching / laydown areas, O&M Compound	Cylinders (AS 4332, AS 4839)	5 Welding Sets (<0.1 T)	0.5 T	N/A	N/A
Lithium Batteries	Class 9	Battery Energy Storage System	Container	2,200 T	N/A	N/A	N/A
Diesel	Combustible	Batching / laydown areas	Self bunded tank AST (AS 1940)	100 T	5000 T	3 m (AS 1940)	N/A
Oils	Combustible	Batching / laydown areas, O&M Compound	Domestic Storage (AS 1940)	<10 T	N/A	N/A	N/A

It is concluded that the risks associated with storage and transportation of hazardous materials are unlikely to be significant or pose a risk to public safety. Given that *Applying SEPP 33* thresholds are not exceeded, the Project is not considered to be a hazardous or potentially hazardous industry under SEPP 33. Therefore a Preliminary Hazard Analysis is not required to be undertaken for the Hills of Gold Wind Farm.

13.6.4.2 Hazard Identification

Hazard identification aims to identify all reasonably foreseeable hazards and associated events that may arise due to the operation of the Project. Appendix L details all identified hazards and recommended safeguards for hazard management.

13.6.4.3 Potentially Offensive Assessment

The assessment of the suitability of the Project Area to accommodate existing or proposed development of a potentially offensive nature is based on consideration of the:

- nature and quantities of materials stored and processed on the site;
- type of plant and equipment in use;
- adequacy of proposed technical, operational and organisational safeguards;
- surrounding land uses or likely future land uses; and
- interactions of these factors.

The potential polluting discharges a development of this type could generate that would be deemed offensive and cause adverse impacts if unmitigated are outlined in Table 13-6-2. Discussion of where these issues are addressed within the EIS and hence why they are considered to be mitigated is also outlined.

Table 13-15 Potentially Offensive Assessment

Potential Impacts	Discussion
Noise	Based on the Noise and Vibration Assessment (NVA) prepared for the Project, compliance with relevant policies and guidelines will be achieved (including the *NSW Wind Energy: Noise Assessment Bulletin*, the *NSW Noise Policy for Industry* and the *Interim Construction Noise Guideline*) at all dwellings where the Project is constructed and operated accordance with the recommendations outlined in the NVA. The Project will require an Environment Protection Licence under the *Protection of the Environment Operations Act 1997*, which will include the regulation of noise. Refer Chapter 10 and Appendix E of the EIS.
Odour	Given the nature of the Wind Farm, any odour is unlikely to arise and is therefore not required to be assessed as a requirements of the SEARs. Refer Chapter 17.
Air emissions	Given the nature of the Wind Farm, any air emissions are predominately associated with construction activities. The construction environmental management plan will managed and mitigate construction related air quality issues. Refer Chapter 17.
Water discharge/runoff	No issues identified. Refer Chapter 16.
Ground contamination	No issues identified. Refer Chapter 16.

13.6.5 Mitigation Measures

A range of mitigation and management measures will be implemented as discussed in the SEPP 33 Assessment Report (Appendix L) and summarised below.

Battery and Key Infrastructure Protection and Management

The following controls and safeguard will be implemented associated with the BESS and other key infrastructure, ie substation:

- locating the BESS system in an appropriate location on the site that considers both the bushfire hazards surrounding the Project and the logistical needs of the Project;
- install bollards/protective barriers at the interface between the BESS and vehicle movement areas;
- batteries to be stored as per suppliers specifications;
- implement a regular inspection and maintenance regime;
- provide ventilation system within BESS;
- minimising build-up of combustible materials onsite;
- quality assurance checks to be carried out routinely by qualified personnel;
- provide insulation around batteries;
- installation as per AS/NZS 5139:2019 or other relevant standards;
- ensuring that there are external fire protection systems where relevant; and
- ensuring that the BESS system is relevant to the appropriate standards.

Chemical and Spill Management

Ann Environmental management Strategy will be prepared that will include appropriate safe work procedures will be implemented for the handling of all chemicals, including transfer, storage and spill prevention and clean up requirements.

Chemicals brought onsite for should be stored in accordance with the relevant Australian Standards which dictate requirements for handling, use, storage and disposal of chemicals. Safety Data Sheets (SDS) will be kept onsite for the purpose of reference and use, and in the event that emergency services require access to the register of chemicals onsite. A regular inspection and maintenance schedule will be developed and implemented for chemical store areas.

A Pollution Incident Response Management Plan will also be a requirement of the Environment Protection Licence to apply to the Project.

Fire Risk Management

A Bushfire Emergency Management and Operations Plan will be prepared in consultation with the RFS as outlined in Section 13.4.

Security System

All relevant procedures in relation to a high voltage installation will be adhered to throughout the life of the Project, including work statements, approving permits to work, maintenance schedules, WHS adherence etc.

Restricted public access to the construction and operational areas and security will be maintained via surveillance equipment to restrict access throughout the construction and life of the Project. These will be maintained throughout the construction and operation, to provide safe exposure distances to the public.

Transport

Transport of dangerous goods will comply with the requirements of the Australian Code for the Transport of Dangerous Goods by Road and Rail (the ADG Code).

13.6.6 Conclusion

The screening assessment has taken into account the relevant materials, quantities and details as provided by WEP for the Hills of Gold Wind Farm.

With consideration of the insignificant quantity of materials stored onsite, along with the significant distance to neighbouring properties, it can be concluded that the risks associated with storage and transportation of hazardous materials are unlikely to be significant or pose a risk to public safety. Given that Applying SEPP 33 thresholds are not exceeded, the Project is not considered to be a hazardous or potentially hazardous industry under SEPP 33. Therefore a Preliminary Hazard Analysis has not been required for the Hills of Gold Wind Farm.

With the nature of the material stored, proposed mitigation measures for the Project to be implemented, proximity to neighbouring properties considered, and the impacts that are assessed within the EIS, it can be concluded that the potentially offensive impacts associated with the Project are unlikely to be significant either to neighbouring properties or on the existing or likely future development.

14. INDIGENOUS HERITAGE

This chapter summarises the Aboriginal cultural heritage assessment of the Project, identifies any potentially affected heritage items and provides recommendations for mitigation and / or management during construction and operation.

14.1 Introduction

Kelleher Nightingale Consulting Pty Ltd (KNC) prepared an Aboriginal Cultural Heritage Assessment Report (CHAR) to assess the potential impacts of the Project on Aboriginal cultural heritage and identify mitigation and risk management measures during construction and operation. The CHAR was prepared to address the requirements of the SEARs, and in accordance with the following government policies:

- *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010);
- *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011); and
- *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW, 2010).

The CHAR can be found in full at Appendix M (KNC, 2020).

14.2 Methodology

The CHAR incorporated the following scope of works:

- consultation with Aboriginal communities in relation to the Project;
- review of the landscape and natural resources of the Project Area in order to establish background parameters;
- research of local and regional context of Aboriginal cultural heritage literature and archaeological records;
- review of the Aboriginal Heritage Information Management System (AHIMS) database and other relevant database; and
- archaeological surveys within the Project Area.

14.3 Existing Environment

14.3.1 Previously Recorded Sites

The search of the Aboriginal Heritage Information Management System (AHIMS) database revealed seven (7) Aboriginal sites recorded near the Project Area. No Aboriginal places have been declared in or near the Project Area. The seven previously recorded Aboriginal sites are detailed in Table 144-1 and Figure 144-1 below. None of these previously recorded sites will be impacted by the Project but they are recorded below as they provide an overview of the type of Aboriginal sites which may exist in the vicinity of the Project Area.

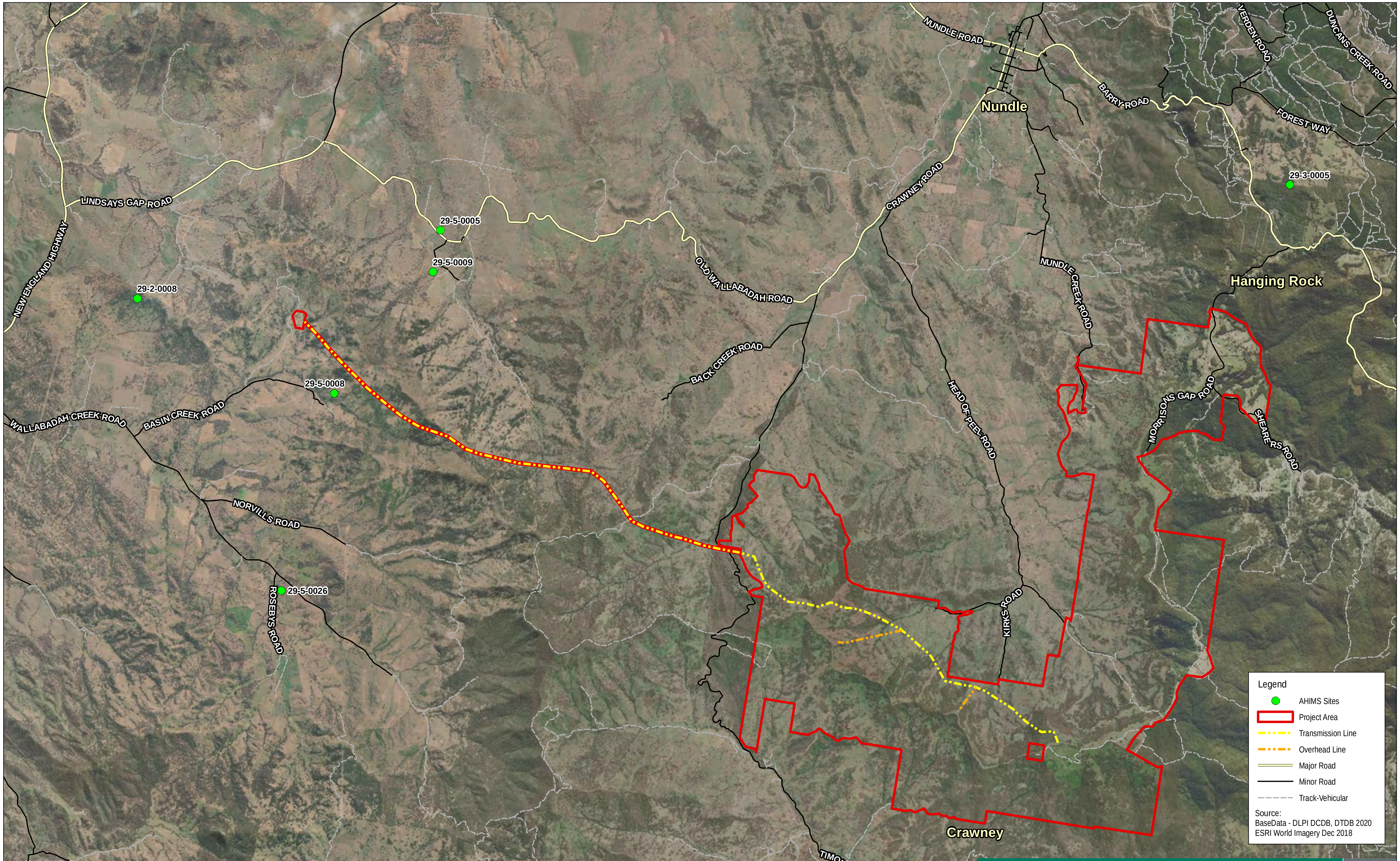
Table 14-1 Recorded AHIMS Sites

AHIMS Site	Site Type	Site Description	Proximity to Project
AHIMS 29-3-0005	Closed - Art (Pigment or Engraved)	The site card states the art is comprised of human figures in a dry pigment paint.	Approx. 1.5 km north of the northern extent of proposed works on Morrisons Gap Road
AHIMS 29-5-0005	Open - Grinding Groove	The site card describes at least 12 grooves located on sandstone. The grooves measured approximately one foot in length and were two inches wide.	The site is not located in proximity to the Project.
AHIMS 29-5-0008	Open - Artefact; Stone Quarry	The recording is based on an interview with the landowner of Wallabadah Station in 1960 who stated that Aboriginal people used ochre from deposits along Basin Creek east of Wallabadah for personal adornment and as trade goods.	Approx. 800m south of the proposed overhead transmission line route.
AHIMS 29-5-0009	Open - Grinding Groove	The site card describes a report of an 'axe-grindery' in the eastern hills at the head of Rangers Valley where Aboriginal people would sharpen their axes.	Approx. 4 km north of the proposed overhead transmission line route.
AHIMS 29-5-0026	Open - Modified Tree (Carved or Scarred)	The tree was an Apple Box (Eucalyptus bridgesiana) located on the bank of Wallabadah Creek within the Clydesdale property. The scar measured 50cm x 30cm.	Approx. 7.1 km south of the western end of the proposed overhead transmission line route.
AHIMS 29-2-0008	Open - Artefact	The site card described 'various implements' including an axe head, 10-12 'skinning pieces' of local stone, a pointed stone and an oval stone.	The site is not located in proximity to the Project.
AHIMS 29-5-0007	Open - Artefact	The site features a 'half-finished axe-head, grinder and scrapers'.	The site is not located in proximity to the Project

In addition to searches of the AHIMS database, searches were undertaken of the following statutory and non-statutory heritage registers for Aboriginal heritage items:

- Tamworth Regional Local Environmental Plan 2010;
- Upper Hunter Local Environmental Plan 2013;
- Liverpool Plains Local Environmental Plan 2011;
- State Heritage Register;
- State Heritage Inventory;
- Section 170 Heritage and Conservation Registers;
- National Heritage List;
- Commonwealth Heritage List;
- Australian Heritage Database;
- Australian Heritage Places Inventory; and
- Register of the National Estate – (Non-statutory archive).

No Aboriginal heritage sites or items of Aboriginal heritage were identified on these registers within the Project Area.



Previously Recorded AHIMS Sites F14-1

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Date: 14/10/2020	Drawing Size: A3	
Drawn By: VN	Reviewed By: AA	Client: Wind Energy Partners
Coordinate System: GDA 1994 MGA Zone 56 0 1 2Km	N	This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM

14.4 Assessment of Impacts

14.4.1 Desktop Review

Based on information from previous archaeological investigations, landscape context and regional character, site predictions for the Study Area (defined below) include the following:

- archaeological sites are likely to consist of culturally modified trees, artefact scatters, and isolated finds. Ceremonial sites and stone arrangements may also occur on the ridge tops;
- a wide range of raw materials may be expected given the complex underlying regional geology, including tuff, chert, quartz, chalcedony, fine grained volcanics, quartzite and igneous materials;
- old growth trees may be present in the Study Area and have the potential to display scars of Aboriginal origin; and
- the identification of surface artefacts is likely to be affected by differential visibility of the ground surface, but successful assessment of areas of potential archaeological deposit can be made based on landform and other environmental factors such as disturbance and distance to water.

14.4.2 Survey Efforts

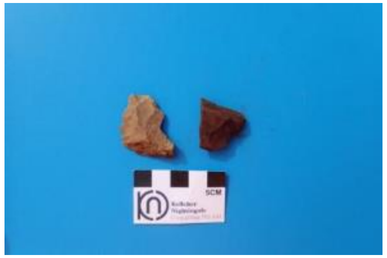
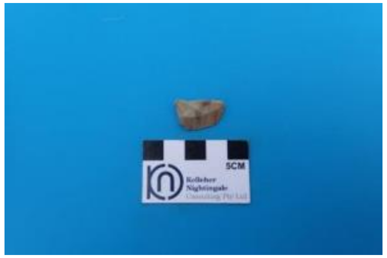
The aim of the archaeological survey was to conduct a comprehensive field inspection of the Study Area and to record any Aboriginal archaeological sites or areas with potential to contain Aboriginal objects.

The Study Area for the CHAR survey the proposed wind farm development corridor and turbine locations, ancillary infrastructure (substation, switching station and O&M facility), access tracks, the proposed overhead power line route, proposed access upgrades at Morrisons Gap Road, Head of Peel Road, Transverse Track, and Barry Road from Nundle to Hanging Rock - Devil's Elbow, and intersection adjustments around Nundle and on Lindsays Gap Road. Assessment was also undertaken of additional locations requiring minor transport infrastructure adjustments between the Project Area and Newcastle.

Targeted surveys of the Study Area were undertaken on separate occasions by KNC Archaeologist/Director Dr Matthew Kelleher, Senior Archaeologist Mark Rawson, Archaeologists Tristram Miller and Laura Patterson, a representative from Wanaruah Local Aboriginal Land Council and Nungaroo Local Aboriginal Land Council (David Horton) and the Gomeroi People Native Title Claimant group (Rose Nean). Based on the archaeological background and landform context of the Study Area, the survey closely inspected any areas of surface exposure for artefacts, evidence of intact soils and subsurface archaeological potential and any mature trees for evidence of Aboriginal bark removal.

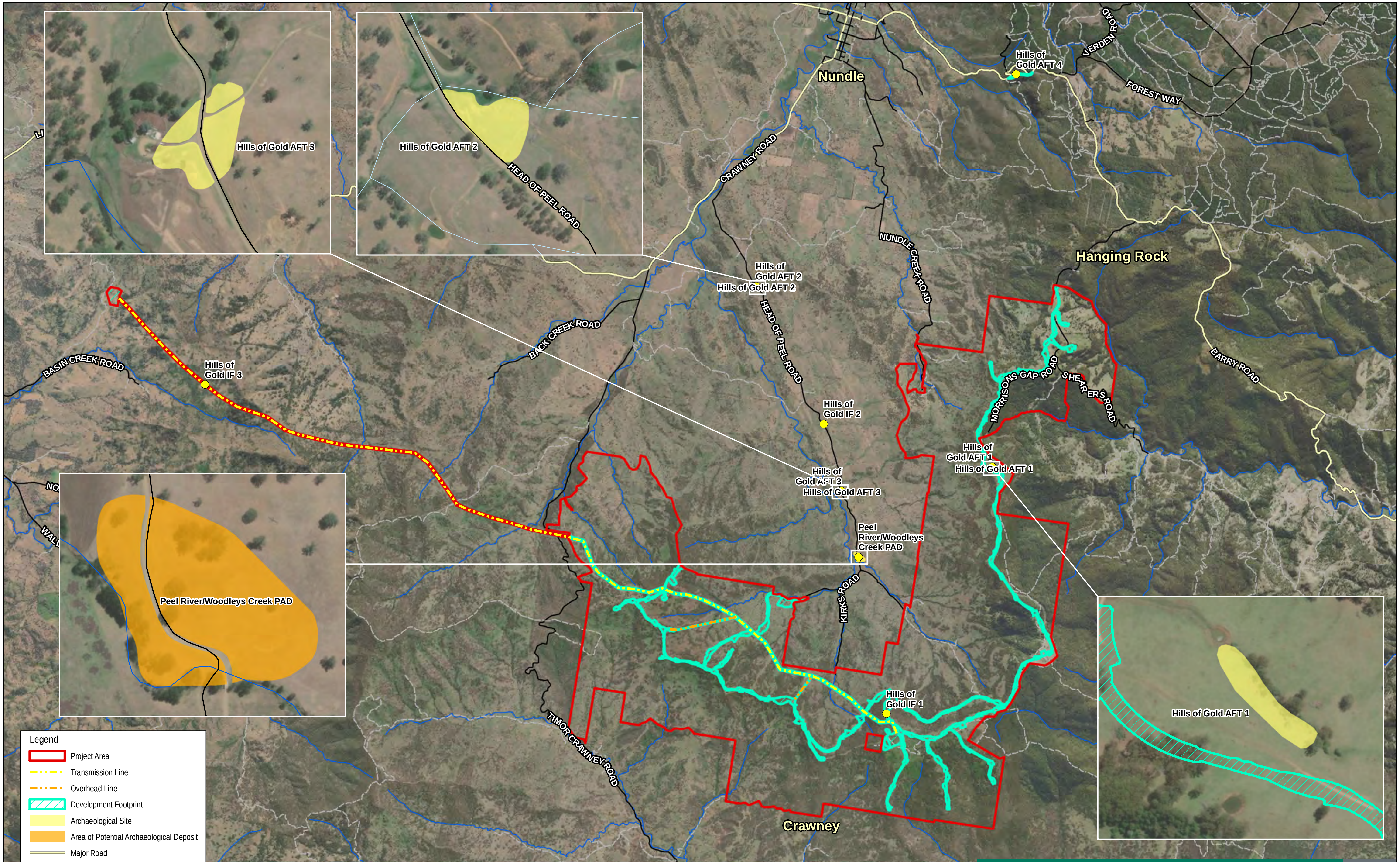
The archaeological surveys resulted in the identification of seven Aboriginal archaeological sites and one area of Potential Archaeological Deposit (PAD) within the Study Area. The newly identified Aboriginal sites and PAD are detailed in Table 14-2 and Figure 14-2 below.

Table 14-2 Newly Identified Aboriginal Sites

Site Name	Site Type	Significance[1]	Site Description and Features	Proximity to Project Features	Photograph of Artefact or PAD
Hills of Gold AFT 1	Open - Artefact Scatter	moderate	Two artefacts (flake and distal fragment) were found on soil exposed in front of a wombat burrow near the creek bank of a tributary to Wardens Brook. Other flakes and flake fragments of fine grained grey volcanic, red chert and quartz were identified in exposures along the edge of the bank. The site area extends along the creek to the east, west and south, and is associated with the slightly more elevated ground bordering the water source.	Located between turbine WP55 and WP56.	
Hills of Gold AFT 2	Open - Artefact Scatter	low	Three artefacts (flakes) were identified in a partially disturbed context. Artefacts were exposed on the southern side of the creek (an unnamed westerly-running tributary of the Peel River), on a 25m x 3m graded mound, next to an area of gully and sheet erosion.	Located near Head of Peel Road, approx. 3.3 km south of the Crawney Road intersection.	
Hills of Gold AFT 3	Open -– Isolated Artefact	moderate	Artefact site (distal fragment) located where Head of Peel Road crosses Wardens Brook, a tributary of the Peel River. One artefact was on the eastern side of the road, 8 metres from the edge, where the road has cut the natural slope and is sheet eroded. The site extends on both sides of the road.	Approx. 9.2 km south of the Crawney Road intersection.	
Hills of Gold AFT 4	Open - Artefact Scatter	low	An artefact scatter site (retouched proximal fragment and utilised flake) . Archaeological potential for associated intact subsurface deposit was considered low, due to the vehicle track disturbance, and shallow soils with abundant rock content.	Located south of Barry Road at Devils Elbow within the area identified for upgrade.	

Site Name	Site Type	Significance[1]	Site Description and Features	Proximity to Project Features	Photograph of Artefact or PAD
Hills of Gold IF 1	Open – Isolated Artefact	low	The artefact (core / tool) was found 8 metres east of the stock fence. Potential for subsurface archaeological deposit in this location is considered low.	Approx. 30m east of turbine WP22.	
Hills of Gold IF 2	Open – Isolated Artefact	low	Two fragments of a broken flake (split flake (left)) were found on a sheet erosion exposure. Potential for intact sub-surface deposit is considered low.	On Head of Peel Road, approx. 7 km south of Crawney Road intersection.	
Hills of Gold IF 3	Open – Isolated Artefact	low	The artefact (proximal fragment) was identified on western part of the study area along the proposed overhead transmission line route in a patchy exposure along a cattle track. Archaeological potential for subsurface deposit within the proposed overhead power line route corridor is low.	45 m south east of a proposed transmission tower located on the south western slopes of the Peel Range spur leading to Snowden Mountain.	
Peel River / Woodleys Creek PAD	Potential Archaeological Deposit (PAD)	moderate	The PAD was located on an elevated hill crest landform near the Head of Peel Road crossing of the Peel River. The PAD did not have any apparent surface archaeology (zero visibility) but based on landform and the extent of visible disturbance the archaeological potential for subsurface deposit within the PAD area is considered to be moderate.	Near the Head of Peel Road crossing of the Peel River.	

[1]*Levels of significance have been ascribed to the sites based on the significance assessment undertaken as part of the Aboriginal Cultural Heritage Assessment, as recorded in Chapter 8 of the CHAR* (KNC, 2020) .



Identified Aboriginal Heritage with the Study Area

F14-2

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Date: 14/10/2020 Drawing Size: A3	
Drawn By: VN Reviewed By: AA	Client: Wind Energy Partners

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14.4.3 Significance Assessment

The CHAR provides an assessment of significance for the cultural heritage sites located within the Project Area (refer to Appendix M). The assessment of significance is a key step in the process of impact assessment for a proposed activity as the significance or value of an object, site or place will be reflected in resultant recommendations for conservation, management or mitigation.

The *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010) requires significance assessment according to criteria established in the Australia ICOMOS Burra Charter (Australia ICOMOS, 2013). The Burra Charter and its accompanying guidelines are considered best practice standard for cultural heritage management, specifically conservation, in Australia. Guidelines to the Burra Charter set out four criteria for the assessment of cultural significance:

- Aesthetic value
- Historic value
- Scientific value
- Social value

The significance assessment for each of the seven identified Aboriginal archaeological sites and the one potential archaeological deposit is provided in Chapter 8 of the CHAR (refer to Appendix M). The level of significance attributed to each of the sites is shown in Table 14-3 below.

14.4.4 Impacts to Aboriginal Heritage

The CHAR conservatively assumes that the entirety of the Study Area would be impacted by the Project, presenting the most comprehensive and conservative option for determining appropriate management and mitigation of Aboriginal heritage impacts, as potential changes within the assessed impact area prior to Project approval are likely to represent avoidance or reduction of harm.

Based on this assessment, proposed impacts to Aboriginal sites are detailed in Table 14-3. As detailed in Chapter 5, the site selection process and iterative design process has mitigated the impact to AFT 1 such that it is not located with the area of disturbance (Development Footprint).

Table 14-3 Assumed Degree of Impact to Aboriginal Sites/PAD

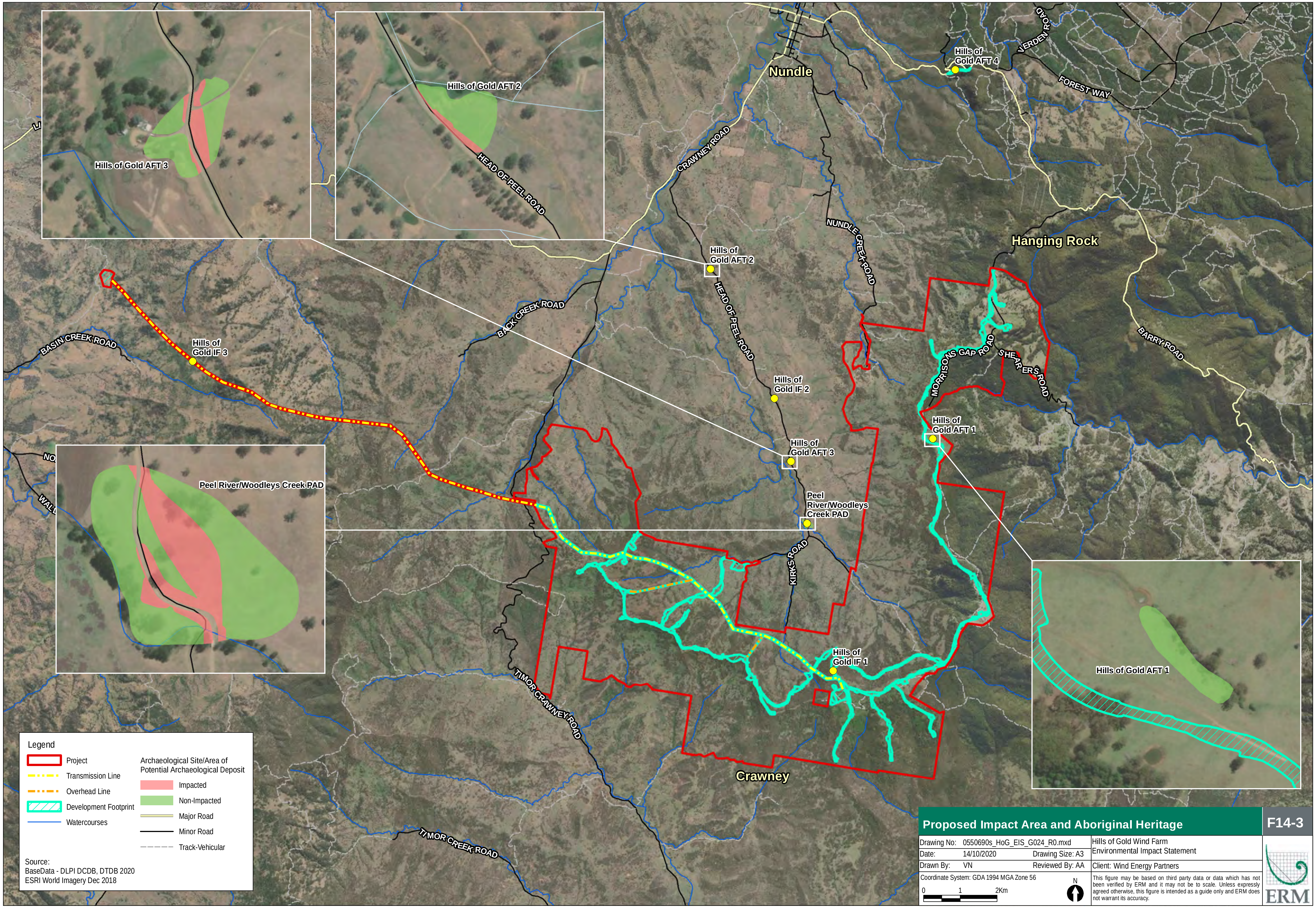
Site Name	Site Feature	Significance[1]	Type and Degree of Impact[2]	Consequence of Impact
Hills of Gold AFT 1	Artefact	Moderate	None	N/A
Hills of Gold AFT 2	Artefact	Low	Direct, Partial	Partial loss of value
Hills of Gold AFT 3	Artefact	Moderate	Direct, Partial	Partial loss of value
Hills of Gold AFT 4	Artefact	Low	Direct, Total	Total loss of value
Hills of Gold IF 1	Artefact	Low	Direct, Total	Total loss of value
Hills of Gold IF 2	Artefact	Low	Direct, Total	Total loss of value
Hills of Gold IF 3	Artefact	Low	Direct, Total	Total loss of value
Peel River / Woodleys Creek PAD	Potential Archaeological Deposit	Moderate Archaeological Potential	Direct, Partial	Partial loss of value

[1] *Levels of significance have been ascribed to the sites based on the significance assessment undertaken as part of the Aboriginal Cultural Heritage Assessment, as recorded in Chapter 8 of the CHAR* (KNC, 2020).

[2] *Impact is based on Study Area impacts. . As detailed in Chapter 5, the site selection process and iterative design process has mitigated the impact to AFT 1 such that is not located with the development footprint and will not be impacted by the development.*

Where required impacts are identified, these are likely to be unavoidable due to the scale of the Project and complex environmental, topographical and logistical requirements. Appropriate management procedures and mitigation for unavoidable impacts have been developed and aim to minimise harm caused to Aboriginal heritage sites as described in Section 14.4.

Additional locations requiring minor transport infrastructure adjustments were also assessed for the Project. No actual or potential impact to Aboriginal objects were identified at any of these locations.



Nundle
Hills of Gold AFT 4
VERDEN ROAD
FOREST WAY
Hanging Rock
BARRY ROAD
CRAWNEY ROAD
NUNDLE CREEK ROAD
HEAD OF PEEL ROAD
Hills of Gold AFT 3
Hills of Gold AFT 2
BACK CREEK ROAD
BASIN CREEK ROAD
Hills of Gold IF 3
Hills of Gold IF 2
MORRISONS GAP ROAD
SHEARERS ROAD
Hills of Gold AFT 1
Peel River/Woodleys Creek PAD
KIRKS ROAD
TIMOR CRAWNEY ROAD
Hills of Gold IF 1
Crawney
TIMOR CREEK ROAD
Legend
Project
Transmission Line
Overhead Line
Development Footprint
Watercourses
Archaeological Site/Area of Potential Archaeological Deposit
Impacted
Non-Impacted
Major Road
Minor Road
Track-Vehicular
Source:
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018
Proposed Impact Area and Aboriginal Heritage
F14-3
Drawing No: 0550690s_HoG_EIS_G024_R0.mxd
Date: 14/10/2020
Drawing Size: A3
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Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partners
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14.5 Aboriginal Community Consultation

The aim of consultation is to integrate cultural and archaeological knowledge and ensure registered Aboriginal stakeholders have information to make decisions on Aboriginal cultural heritage. The formal consultation process has included:

- notification of Aboriginal persons, including register of native title determinations search and government agency notification letters;
- advertising for registered stakeholders in local print media Northern Daily Leader (refer to Appendix B of the CHAR, located in Appendix M);
- notification of closing date for registration (04/05/2020);
- record of registration of interest (DPIE (now Heritage NSW) and LALC notified 05/05/2020);
- provision of project information (20/04/2020 and 05/05/2020);
- provision of assessment methodology for review (28 day review period ending on 02/06/2020);
- invitation to advise on Aboriginal cultural value of the study area;
- provision of draft CHAR for review (28 day review period); and
- ongoing consultation with the local Aboriginal community including regular project updates and continuing to register stakeholders on the project.

Aboriginal people who hold knowledge relevant to determining the cultural heritage significance of Aboriginal objects and Aboriginal places in the Study Area were invited to register an interest in a process of community consultation. A total of 27 groups or individuals registered as Aboriginal stakeholders for the Project. Engagement with these Aboriginal stakeholders has informed the assessment methodology for the CHAR and identified some of Aboriginal cultural heritage values of the wider local area.

14.6 Mitigation Measures

14.6.1 Heritage Management Plan

A Heritage Management Plan will be prepared prior to the commencement of construction as part of Environmental Management Strategy detailing measures to protect Aboriginal heritage sites outside the area of disturbance, minimisation and management measures including test excavations and salvage (if required), a strategy for the long term management of any Aboriginal heritage items collected from the test excavations or salvage works, an unexpected finds procedure and other contingency and reporting procedures.

14.6.2 Mitigating Harm

All identified Aboriginal archaeological sites identified within the Study Area are being considered by WEP in relation to the development and ongoing design of the Project. The first priority is to avoid harming Aboriginal cultural heritage where possible. This was taken into consideration in the reduction of turbines and during a design workshop in which early heritage survey results were considered. WEP has, during subsequent iterations of the design process, taken Aboriginal heritage into consideration by avoiding sites of moderate significance. The overall construction footprint has also been limited as much as practicable to reduce the cumulative harm to Aboriginal heritage. As discussed in Chapter 5 and detailed in Figure 5-5 impacts to a moderately significant find (AFT 1) has been avoided through the iterative design process.

A summary of mitigation measures for the Project relating to aboriginal heritage is detailed in Table 14-4.

Table 14-4 Mitigation Measures for Identified Aboriginal Sites/PAD (Study Area)

Site Name	Significance	Mitigating Harm
Hills of Gold AFT 1	Moderate	Design has shown the impact can be avoided. The Project can commit not to impact this AFT. .[1]
Hills of Gold AFT 2	Low	Collection of surface artefacts required prior to impact.
Hills of Gold AFT 3	Moderate	Archaeological salvage excavation c.25m^2 required prior to impact.
Hills of Gold AFT 4	Low	Collection of surface artefacts required prior to impact.
Hills of Gold IF 1	Low	Collection of surface artefacts required prior to impact.
Hills of Gold IF 2	Low	Collection of surface artefacts required prior to impact.
Hills of Gold IF 3	Low	Collection of surface artefacts required prior to impact.
Peel River/Woodleys Creek PAD	Moderate	Archaeological salvage excavation c. 50m^2 required prior to impact.
[1] *As stated in Table 14-3, based on the location of Hills of Gold AFT1, this site falls outside of the development footprint and the Project should avoid harm to the site.*		

14.6.3 Continued Consultation with Aboriginal Stakeholders

Should a material alteration be made to the design of the Project that changes the assessed impact on Aboriginal cultural heritage, further assessment will be carried out in continued consultation with Aboriginal stakeholders depending on the level of impact and whether the area was assessed as part of the original CHAR. Potential changes to impacts and continued consultation with Aboriginal stakeholders is detailed in Table 14-5.

Table 14-5 Continued Consultation Requirements

Level of Impact	Description	Consultation Requirement
Reduced or Neutral Impact	As a result of alterations to the project design (e.g. during detailed design phase) a previously identified impact to an Aboriginal heritage item is reduced or neutral.	No further consultation is required.
	As a result of alterations to the project design an impact to an Aboriginal heritage item is proposed that results in a reduced impact on the overall heritage significance of the project area (i.e. the cumulative impact is reduced).	No further consultation is required.
Increased Impact	As a result of alterations to the project design an impact on Aboriginal heritage is considered to be greater than identified by the Project.	Consultation required – entail either a site visit or the provision of a report for comment (10 working days).
Unknown Impact	A proposed change is in an area located outside of the study area assessed, as a result the impact on Aboriginal cultural heritage is considered to be unknown and further assessment to determine any impacts upon Aboriginal heritage will be carried out.	Should no impacts be identified then no consultation is required. However, should potential impacts be identified consultation with Aboriginal stakeholders will be undertaken. This will entail a site visit and the provision of a report for stakeholder comment detailing the impacts and mitigation strategies proposed.

14.7 Conclusion

The CHAR has assessed the impact to Aboriginal cultural heritage associated with the Project. It has also included consultation with Aboriginal communities to assess impacts and develop mitigation measures. Mitigation of a direct impact to a moderately significant archaeological site (AFT 1) has been undertaken by redesigning roads to avoid this area (refer Section 5.5.1).

The CHAR has identified that there are no existing AHIMS sites within, or in close proximity to, the Project Area. The seven newly recorded sites and one PAD present were identified during the comprehensive field inspection of the Study Area, all assumed to be impacted by the Project with the exception of AFT 1. If impact is unavoidable, salvage excavation would be required for one archaeological sites and one PAD: Hills of Gold AFT 3 and Peel River/Woodleys Creek PAD. Surface artefact collection is recommended for low significance Aboriginal archaeological sites where surface artefacts were identified during the assessment: Hills of Gold AFT 2, Hills of Gold AFT 4, Hills of Gold IF 1, Hills of Gold IF 2 and Hills of Gold IF 3.

A Heritage Management Plan will be prepared prior to the commencement of construction as part of Environmental Management Strategy, inclusive of an unexpected finds protocol.

15. HISTORIC HERITAGE

This chapter provides a summary of the methodology, existing environment, impacts and mitigation measures associated with historic heritage.

15.1 Introduction

A Historic Heritage Assessment (HHA) was prepared to assess potential impacts of the Project on historic heritage to provide management and mitigation measures to avoid or minimise impacts on any identified historic heritage values.

For additional information, refer to Appendix N.

15.2 Methodology

15.2.1 Overview

The survey methodology adopted for the HHA incorporated:

- background research and heritage database searches, including
  - Australian Heritage Database, which includes:
    - Commonwealth Heritage List (CHL);
    - Register of the National Estate (RNE); and
    - National Heritage List (NHL);
  - NSW State Heritage Register and State Heritage Inventory;
  - Tamworth Regional LEP 2010;
  - Liverpool Plans Shire LEP 2011;
  - Upper Hunter LEP 2013;
  - Cessnock LEP 2011;
  - Singleton LEP 2013;
  - Muswellbrook LEP 2009;
  - Newcastle LEP 2012; and
  - The National Trust of Australia (NSW).
- a targeted survey and site inspection across the Development Footprint targeting those sites identified by the desktop review and discussions with locals;
- consideration of *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance (Adopted 31 October 2013)* (The Burra Charter) and *NSW Heritage Manual* (Heritage Office and Department of Planning 1996); and
- consultation with the Nundle History and Heritage Research Committee.

15.2.2 Survey and Recording

An inspection of the Project Area was undertaken between by 29 September to 2 October 2020 by ERM. The site inspection included a visual inspection of the transportation route between Newcastle and the Project Area, and a physical inspection at the location of potential direct impacts to listed heritage items, including:

- Jerrys Plains Conservation Area;
- Merton Cemetery;
- Kayuga Cemetery; and
- Black Snake Gold Mine,

Site inspections throughout Nundle and surrounds included examination of the proposed road amendment locations and a general inspection of Nundle and Hanging Rock, to ascertain if there were any unidentified heritage items that would be impacted by the proposed works.

A guided inspection of the Project Area was also undertaken on 30 September 2020, including general overview of the Project Area, including the proposed road upgrade at Devil's Elbow, within the listed curtilage of Black Snake Gold Mine. A further inspection of the Devil's Elbow road upgrade locations was undertaken on 28 October 2020.

15.2.3 Existing Environment Previously Identified Heritage Sites

There are a number of previously identified heritage sites along the proposed transport route that are listed on each LGA's respective Schedule 5 of their LEP. Table 15-1 below provides an overview of the known heritage items along the transport route, and their assessed significance levels, and the heritage criteria under which the place has been assessed as significant.

Table 15-1 Heritage Significance Summary

Site Name	LGA	Listing / ID #	Significance Criteria	Significance Level
South Maitland Railway System	Cessnock	LEP – I212	Historical	Local
Collieries of the South Maitland Coalfields/Greta Coal Measures Group (1340721) (Neath Colliery)	Cessnock	LEP – I215	Historical	Local
Great Northern Railway Network	Cessnock	LEP – I216	Historical	State
Jerrys Plains Conservation Area	Singleton	LEP – C1	Historical, Aesthetic	Local
Singleton Conservation Area	Singleton	LEP – C2	Historical, Aesthetic	Local
Merton Cemetery	Muswellbrook	LEP - I18	Historical, Social	Local
Kayuga Cemetery	Muswellbrook	LEP – I43	Historical, Social	Local
Fitzgerald/Olympic Park Gates	Muswellbrook	LEP – I124	Historical, Social	Local
Residential Heritage Conservation Area	Muswellbrook	LEP – C2	Historical, Aesthetic	Local
Muwellbrook Business Heritage Conservation Area	Muswellbrook	LEP – C3	Historical, Aesthetic	Local
Central Scone Conservation Area	Upper Hunter	LEP – C2	Historical, Aesthetic	Local
Murrurundi Conservation Area	Upper Hunter	LEP – C4 REN (Reg) - 1374	Historical, Aesthetic	Local
Black Snake Gold Mine	Tamworth	LEP - I134	Historical	Local
St Peters Catholic Church	Tamworth	LEP – I269	Historical	Local
Nundle Shire Offices	Tamworth	LEP – I271	Historical	Local

In addition to the locally listed heritage items, a series of locations and buildings in Nundle and its surrounds were identified by local historian, Geoff Cummins (member of the Nundle History and Heritage Committee). These additional sites are included as Appendix D of the HHA (Appendix N of the EIS). As none of these sites will be directly impacted by the proposed works, they have not been subject to significance assessment in this report.

15.3 Assessment of Impacts

This section provides a summary of the potential impacts for each heritage item identified, and includes a preliminary analysis of consequence. Heritage items listed in the following tables that follow are identified at their highest level of protection. The sections below outline the metrics utilised to undertaken the impact assessment.

15.3.1 Site Inspection Summary

Physical inspection of the Project Area identified no previously unknown heritage items. The inspection also confirmed that only two known heritage sites will be directly impacted by the proposed works – Kayuga Cemetery and Black Snake Gold Mine. At Kayunga Cemetery the road hardstand extension will require minimal groundworks, although potential extension of culvert and associated piping may require limited excavation that may extend slightly into the listed LEP curtilage of the item, though not at the location of known burial sites. Pedestrian survey within the LEP listed curtilage of Black Snake Gold Mine identified one remnant mineshaft, which presents contributory evidence of the LEP listing. Identification of the mineshaft also indicates potential for further evidence or prior mining use to be found during construction of road upgrades.

15.3.2 Consequence Ratings

The following 'consequence ratings' are used to provide an assessment of level of impact to the heritage item. The consequence ratings have been devised to illustrate the level of impact, and provide a framework against which mitigation and management recommendations can be made.

Table 15-2 Consequence Ratings

Rating	Consequence or Impact to heritage item
5 - Major	Permanent detrimental impact to the heritage item would occur, beyond salvage and where replacement is not possible. The impact would cause irreversible negative impact to the overall heritage significance of the heritage item or place.
4 - Major	Permanent detrimental impact on one or more of the following would occur, but may be reduced through mitigation measures: the significance, any of the values that contribute to significance, the functionality of the item or place, and / or the item or place's availability for access.
3 - Significant	Some damage or change may occur that would require remedial action, and permanent impact would occur to one or more of the following: the significance, any of the values that contribute to significance, the functionality of the item or place, and / or the item or place's availability for access.
2 - Minor	Minor damage or change could be relatively and easily remedied or repaired, with no permanent negative impact to the heritage item's significance or heritage values contributing to significance, the functionality of the item or place, or the item or place's availability for access.
1 - Insignificant	Damage or change, if it occurred at all, would be of an extremely slight or minor nature.

15.3.3 Type of Impact

The following impact definitions (**Table 15-3**) have been utilised in the impact assessment to demonstrate the effect of the proposed works on identified heritage items. **Table 15-4** below provides details of proposed project impacts at all locations where known heritage items have been identified in proximity to proposed works.

Table 15-3 Types of Impact

Type of Impact	Description
Direct	Direct impact is defined as physical impact on the heritage item or its listed curtilage. Direct impact may result from construction activities, proposed road upgrades, or transportation of materials.
Indirect/Potential	Indirect or temporary impact may include reduction of the listed curtilage of an item, temporary visual impact, or temporary modification of the item. Potential impact is identified where an item has been identified in proximity to works, and has been flagged for further review.
No impact	The heritage item will not be impacted by the proposed works

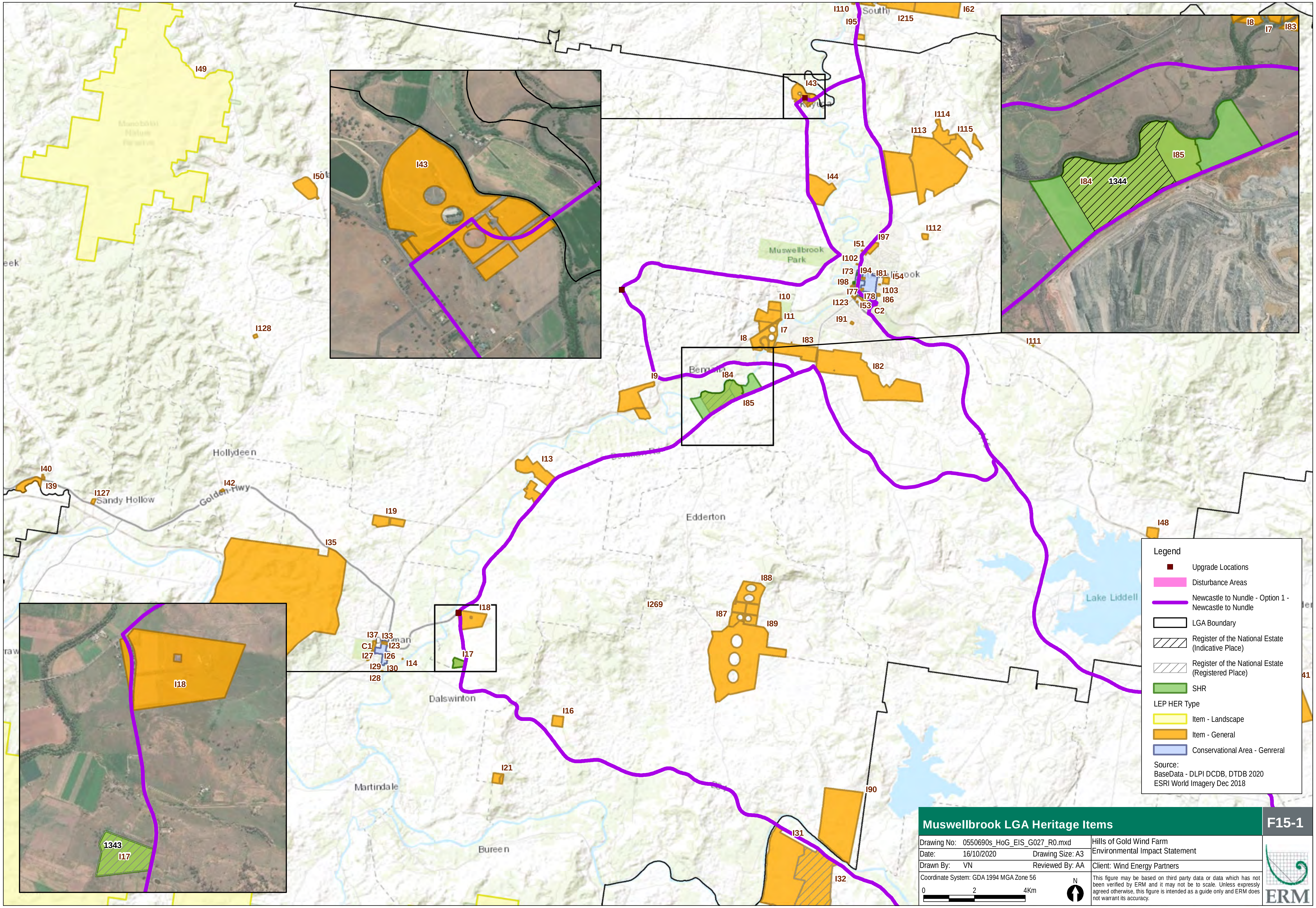
Table 15-4 Heritage Impact Assessment

LGA	ID #	Heritage item	Impact Type	Potential Impact	Consequence Rating	Assessment
Cessnock	I212	South Maitland Railway System	No Impact	Curtilage of heritage item intersects transport route. No road upgrades/amendments proposed.	1 - Insignificant	No impact will result from transport of components through the heritage curtilage of this item.
Cessnock	I215	Collieries of the South Maitland Coalfields/Greta Coal Measures Group (1340721) (Neath Colliery)	No Impact	Curtilage of heritage item intersects transport route. No road upgrades/amendments proposed.	1 - Insignificant	No impact will result from transport of components through the heritage curtilage of this item.
Cessnock	I216	Great Northern Railway Network	No Impact	Curtilage of heritage item intersects transport route. No road upgrades/amendments proposed.	1 - Insignificant	No impact will result from transport of components through the heritage curtilage of this item.
Singleton	C1	Jerrys Plains Conservation Area	No impact	Proposed road impacts/upgrades at the north western end of Jerrys Plains, approximately 80 m north west of the LEP Conservation Area. Some signs to be made removable and some hardstand added.	1 - Insignificant	As there are no heritage items or conservation area at the location of proposed hardstand installation, no direct impact to heritage will result from the proposed works.
Singleton	C2	Singleton Conservation Area	No Impact	Curtilage of heritage item intersects transport route. No road upgrades/amendments proposed.	1 - Insignificant	No impact will result from transport of components through this heritage conservation area.
Muswellbrook	I18	Merton Cemetery	Indirect Impact	Blade swing only over mapped LEP curtilage. Hardstand to be installed on north side of Denman Road.	1 - Insignificant	Proposed impact is located some distance from the known burial locations at Merton Cemetery. Installation of hardstand will require no significant groundworks. Blade swing only over mapped LEP curtilage No further assessment or monitoring required.

LGA	ID #	Heritage item	Impact Type	Potential Impact	Consequence Rating	Assessment
Muswellbrook	I43	Kayuga Cemetery	Direct Impact	The existing corner will require hardstand to be added and signs made removable. No ground excavation proposed.	3 – Minor	Proposed impact is located in proximity to the location of known burials at Kayuga Cemetery. Previous work by Dartbrook Mine has resulted in significant ground impacts in the area, although the full extent of this is unknown. Hardstand installation will require minimal groundworks. Should be managed in accordance with recommendations in Section 8 of the Historic Heritage Assessment report (Appendix N).
Muswellbrook	I124	Fitzgerald/Olympic Park Gates	No Impact	Curtilage of heritage item intersects transport route. No road upgrades/amendments proposed.	1 - Insignificant	No impact will result from transport of components through the heritage curtilage of this item.
Muswellbrook	C2	Residential Heritage Conservation Area	No Impact	Curtilage of heritage item intersects transport route. No road upgrades/amendments proposed.	1 - Insignificant	No impact will result from transport of components through this heritage conservation area.
Muswellbrook	C3	Business Heritage Conservation Area	No Impact	Curtilage of heritage item intersects transport route. No road upgrades/amendments proposed.	1 - Insignificant	No impact will result from transport of components through this heritage conservation area.
Upper Hunter	C2	Central Scone Conservation Area	No Impact	Curtilage of heritage item intersects transport route. No road upgrades/amendments proposed.	1 - Insignificant	No impact will result from transport of components through this heritage conservation area.
Upper Hunter	C4	Murrurundi Conservation Area	No Impact	Curtilage of heritage item intersects transport route. No road upgrades/amendments proposed.	1 - Insignificant	No impact will result from transport of components through this heritage conservation area.

LGA	ID #	Heritage item	Impact Type	Potential Impact	Consequence Rating	Assessment
Tamworth	I134	Black Snake Gold Mine	Direct Impact	As the hairpin corners at the Devil's Elbow (Barry Road) are too tight to accommodate the transport of large components, it is proposed to clear a new portion of road through the LEP listed Black Snake Mine. This will involve vegetation clearance, cut and fill activity, and road construction.	4 – Major	The proposal would result in major impact to the listed heritage item. Although no objects associated with the former mine have been identified along the proposed route, the proposed road will impact upon the LEP listed curtilage of the Black Snake Gold Mine. A Statement of Heritage Impact (SoHI) will be submitted as part of the Project assessment documentation
Tamworth	I269	St Peters Catholic Church	Indirect Impact	Blade swing will overlap LEP heritage curtilage at southeastern corner of the site.	2 – Insignificant	No direct impact to the heritage item (the church). Works will result in the removal of one tree, although this is not a historic planting associated with the establishment of the church.
Tamworth	I271	Nundle Shire Offices	Indirect Impact	Blade swing will overlap LEP heritage curtilage at north eastern corner of the site.	1 – Insignificant	No direct impact to structures within the curtilage, temporary overhang of blades only.

Figure 15-1 and Figure 15-2 identify the location of the Kayuga Cemetery and Black Snake mine and proposed road upgrades respectively.


Muswellbrook LGA Heritage Items
F15-1
Drawing No: 0550690s_HoG_EIS_G027_R0.mxd
Date: 16/10/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partners
Coordinate System: GDA 1994 MGA Zone 56
0 2 4Km
N
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM
Legend
Upgrade Locations
Disturbance Areas
Newcastle to Nundle - Option 1 - Newcastle to Nundle
LGA Boundary
Register of the National Estate (Indicative Place)
Register of the National Estate (Registered Place)
SHR
LEP HER Type
Item - Landscape
Item - General
Conservational Area - Genreral
Source:
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018
Muswellbrook Park
Hollydeen
Sandy Hollow
Golden Hwy
Edderton
Dalswinton
Martindale
Bureen
Lake Liddell
I110
I95
I215
I62
I49
I43
I114
I113
I115
I50
I44
I112
I51
I97
I102
I73
I94
I81
I54
I98
I77
I103
I78
I86
I123
I53
C2
I10
I11
I91
I7
I8
I83
I111
I128
I9
I84
I82
I85
1344
I13
I40
I39
I127
I42
I19
I48
I35
I88
I269
I87
I89
I18
I37
I33
C1
I23
I27
I26
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I17
1343
I16
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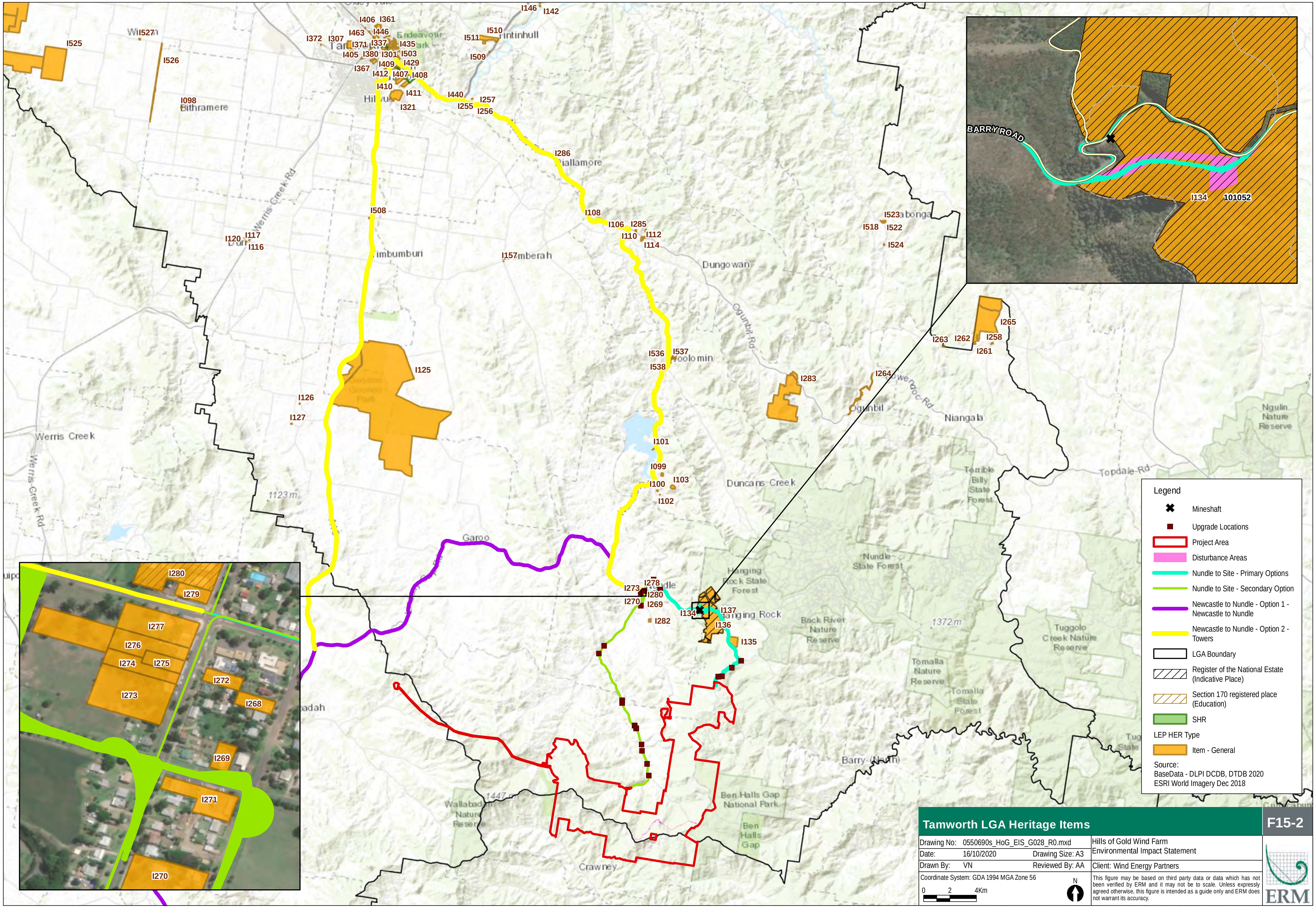
I32
I41



Tamworth LGA Heritage Items
F15-2
Drawing No: 0550690s_HoG_EIS_G028_R0.mxd
Date: 16/10/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
Coordinate System: GDA 1994 MGA Zone 56
Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partners
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
0 2 4Km
N
ERM
Legend
Mineshaft
Upgrade Locations
Project Area
Disturbance Areas
Nundle to Site - Primary Options
Nundle to Site - Secondary Option
Newcastle to Nundle - Option 1 - Newcastle to Nundle
Newcastle to Nundle - Option 2 - Towers
LGA Boundary
Register of the National Estate (Indicative Place)
Section 170 registered place (Education)
SHR
LEP HER Type
Item - General
Source:
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018
BARRY ROAD
I134
101052
Werris Creek
Werris Creek Rd
Timbumburi
Bithramere
Piallamore
Dungowan
Woolomin
Duncans Creek
Niangala
Ogunbil
Garoo
Hanging Rock State Forest
Hanging Rock
Nundle State Forest
Back River Nature Reserve
Tomalla Nature Reserve
Tomalla State Forest
Tuggolo Creek Nature Reserve
Terrible Billy State Forest
Ngulin Nature Reserve
Topdale Rd
Ogunbil Rd
Ben Halls Gap National Park
Ben Halls Gap
Wallabadah Nature Reserve
Crawney
Barry (North)
1123m
1372m
1447m
Tintinhull
Goonoo Goonoo Park
I525
I526
I527
I098
I120
I117
I116
I125
I126
I127
I508
I157
I286
I108
I106
I285
I110
I112
I114
I536
I537
I538
I101
I099
I100
I103
I102
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I137
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I275
I272
I268
I271

15.3.4 Statement of Heritage Impact

As identified in Table 15-4, a Statement of Heritage Impact (SoHI) has been undertaken to assess the potential impact of the proposed Devils Elbow road upgrade works upon the LEP listed curtilage of the 'Black Snake Gold Mine' heritage item. The SoHI is provided Appendix N of the EIS.

The SoHI determined that the proposed road construction will have a negligible impact on the setting of the LEP listed Black Snake Gold Mine, however the works have potential to impact potential archaeological remains associated with historical mining operations, such as mine shaft entries and tunnels. The risk of impact can be mitigated during initial investigation and throughout construction, through careful planning and management, as recommended in Section 15.4.

15.4 Mitigation Measures

The following mitigation measures will be adopted:

- All works will be undertaken in accordance with an Non-Aboriginal Heritage Unexpected Finds Procedure, replicated below.
- Early geophysical survey and/or geotechnical investigation of the Devil's Elbow road upgrade 'Assessment Area' (as defined in the SoHI) be undertaken to determine if there are any subsurface voids beneath the 'Devil's Elbow' proposed upgrade, or other anomalies that may be indicators of archaeological features. The aim of this investigation is to identify and where possible prevent inadvertent impact to potential archaeological remains. It is anticipated that geophysical assessment will be undertaken as part of the detailed design process.

  The geophysical assessment during the detailed design phase should be utilised to determine:

  - if tunnels are present beneath the proposed road alignment;
  - if impacts to any identified tunnels can be avoided through mitigation or alternative construction methodologies; and
  - whether any identified tunnels will be impacted by the proposed construction.

  Where tunnels are identified and avoidance is possible, this should be documented in a letter report to the approval authority. The letter report would detail the location of the identified tunnel and the proposed avoidance measure. No further assessment of the archaeological item would be required at this stage.

  Where suspected tunnels cannot be avoided, archaeological inspection and archival recording should be undertaken prior to the commencement of construction works. The archival recording should be lodged with Tamworth Regional Council and potentially utilised to develop interpretive signage at an appropriate location at Black Snake Gold Mine, Nundle and/or Hanging Rock. This signage can contribute to existing historical and interpretive signage.

  If backfilling is required, the methodology for this should be developed in consultation with the proponent, construction contractors, and heritage specialists. Decisions around appropriate methodology would be made based on the type and condition of any findings.
- Any extensive ground works (beyond grading and installation of hardstand) proposed at the location of Kayuga Cemetery would trigger the need for archaeological investigation or monitoring. The proposed works are in proximity of known burial sites, and documentary evidence suggest that additional unmarked graves may be located in the surrounding areas.

Unexpected Finds Procedure

Historical artefacts or material may be unearthed unexpectedly around the proposed works. These could potentially be located on the ground surface or subsurface. In the event of the discovery of any historical artefacts or material during project activities, the steps presented below should be followed.

As some of the proposed roadworks are occurring in proximity to known cemeteries, there is potential (although unlikely) that human remains may be identified. If suspected human remains are identified, the following procedure should be followed:

1. cease work in the immediate area;
2. notify site supervisor and protect the suspected remains until an initial assessment can be undertaken by a technical specialist;
3. preliminary notification to NSW Police; and
4. no works to recommence in the area until cleared by the relevant authorities.

15.5 Conclusion

The key findings of this historic heritage assessment are summarised below:

- No historic heritage sites have been identified within the Project Area.
- The proposed construction equipment and traffic transportation route will result in no impacts to identified historic heritage items.
- The proposed oversized turbine equipment transport route will result in insignificant indirect impacts to one identified heritage item, being:
  - Merton Cemetery (Muswellbrook LEP Item I18).
- The proposed alternate large transport route through Nundle to the south will result in insignificant indirect impacts to two identified heritage items, being:
  - St Peters Catholic Church (Tamworth LEP I269); and
  - Nundle Shire Offices (Tamworth LEP I271)
- The proposed large components transport route will result in minor direct impacts to one identified heritage items, being:
  - Kayuga Cemetery (Muswellbrook LEP Item I43).
- The proposed large components transport route will result in direct impacts to one identified heritage item, being:
  - Black Snake Gold Mine (Tamworth LEP Item I134).
- No impacts will result from proposed upgrades in proximity to the Jerrys Plains Conservation Area (Singleton LEP Item C1).

16. WATER AND SOILS

16.1 Introduction

ERM prepared a Soils and Water Assessment for the Project to assess the potential impacts of the Project on soil and water and to identify appropriate mitigation and risk management measures for implementation during construction and operation. The Soils and Water Assessment was prepared to address the requirements of the SEARs, and with consideration of the following government policies:

- *DPI Water Guidelines for Controlled Activities* (DPI, 2012) ; and
- *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterways Crossings* (DPI, 2003).

The Soils and Water Assessment can be found in full at Appendix O (ERM, 2020).

16.2 Methodology

The Soils and Water Assessment incorporated the following scope of works:

- a desktop investigation of soil profile, soil mapping and available water data;
- review of available WaterNSW data for registered groundwater bores and river flows;
- review of climatic background data research from the Bureau of Meteorology;
- quantification of expected water demands and identify available water supply options;
- identification of statutory licencing requirements and consultation with relevant NSW government stakeholder and Councils; and
- a site visit was conducted along the transmission line route to confirm availability of access tracks to the route and inspect locations where the transmission line will span creeks.

16.3 Existing Environment

16.3.1 Topography and Bioregions

Landform and Elevation

The landform and topography of the Project Area is defined by the substantial mountains of the Great Dividing Range, with a range of plateaus, ridgelines and escarpments broadly positioned in a north-south direction, wrapping around with the southern extent forming the eastern end of the Liverpool Ranges. The steep ridgeline decline to the north undulating foothills with creeks and tributaries carving through the landscape, converging at the Peel River and Nundle Creek along Nundle Valley floor.

The elevation across the site ranges from 776 m to 1418 m Australian Height Datum (AHD). This elevation range highlights the significantly variable topography across the site. The ridgeline slopes dramatically downhill, generally forming a valley towards the Peel River. Topography of the Project Area is presented in Figure 16-1.

Bioregions

The Project Area intersects with three sub-regions being; the Peel IBRA Sub-region of the Nandewar Bioregion, the Walcha Plateau IBRA Sub-region of the New England Tableland Bioregion, and the Tomalla IBRA Sub-region of the North Coast Bioregion (refer Figure 16-1). Features of two of these Sub-regions are described by the NSW National Parks and Wildlife Services (2003) and is presented in Table 16-1 and Table 16-2.

(Note: descriptions were not available for the third subregion, being the Tomalla IBRA Sub-region of the North Coast Bioregion).

Table 16-1 Peel IBRA Sub-region of the Nandewar Bioregion

Feature	Description
Geology	Fine grained Silurian to Devonian sedimentary rocks. Strongly folded and faulted with marked northwest alignment. Areas of sub-horizontal Carboniferous shales and sandstones in the north. Limited areas of basalt cap from the Nandewar and Liverpool Ranges are included. Linear outcrops of serpentinite and scattered bodies of limestone.
Characteristic Landforms	Low peaked hills with north-westerly alignment. Basalt caps of dissected flows, moderate slopes and flat river valleys with alluvium. Karst landscapes in limestone.
Typical Soils	Shallow stony soils on ridges. Texture contrast soils on almost all slopes shifting in colour from red brown on upper slopes to yellow on lower slopes. Black earths on basalt. Dark, alkaline, pedal clays on limestone. Serpentinites have shallow stony profiles with concentrations of elements that are toxic to many plants. Alluvial loams and clays with moderate to high fertility in alluvium.
Vegetation	White box grassy woodlands, with yellow box and Blakely's red gum on lower slopes. Rough-barked apple and yellow box on flats. River oak and some river red gum along major streams. Patches of red stringybark and red ironbark on steeper slopes in the east. Silver-leaved ironbark on basalt caps, white cypress pine and kurrajong on stony areas in the west and north. Very large grass trees on serpentinite

Table 16-2 Walcha Plateau IBRA Sub-region of the New England Tableland Bioregion

Feature	Description
Geology	Faulted inliers of Devonian and Carboniferous sandstone, conglomerate, minor limestone, slate, schist, amphibolite and volcanics. Small stock of granodiorite and central peak and ridge top fingers of Tertiary basalt.
Characteristic Landforms	Eastern and southern margin is the Great Escarpment. High central plateau capped by basalts. General topography undulating with small rugged areas often related to geology.
Typical Soils	Mellow and harsh texture contrast soils on sediments and granite. Red brown to black structured loams on basalt, thin in places and often stony.
Vegetation	Snow gum and black sallee on coldest wet ridges. Ribbon gum, mountain gum, silvertop stringybark, New England blackbutt, narrow-leaved peppermint, in moist high areas. New England stringybark, ribbon gum, and cool temperate rainforest elements in moist sheltered gullies.

16.3.2 Soils

Land and Soil Capability

The OEH (2017) have established the land and soil capability (LSC) to inform the inherent physical capacity of the land to sustain a range of land uses and management practices in the long-term without degradation to soil, land, air and water resources. The LSC assessment scheme uses biophysical features of the land and soil, including landform position, slope gradient, drainage, climate, soil type and soil characteristics, to derive detailed rating tables for a range of land and soil hazards. These hazards include water erosion, wind erosion, soil structure decline, soil acidification, salinity, waterlogging, shallow soils and mass movement. The mapping is based on an eight class system with values ranging between 1 and 8 which represent a decreasing capability of the land to sustain productive agricultural land use. Class 1 represents land capable of sustaining most land uses including those that have a high impact on the soil (e.g., regular cultivation), whilst class 8 represents land that can only sustain very low impact land uses (e.g., nature conservation), as shown in Table 16-3.

Table 16-3 Land and Soil Capability Scheme Classification (OEH, 2012)

LSC Class	General Definition
Land capable of a wide variety of land uses (cropping, grazing, horticulture, forestry, nature conservation).	
1	**Extremely high capability land**: Land has no limitations. No special land management practices required. Land capable of all rural land uses and land management practices.
2	**Very high capability land**: Land has slight limitations. These can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping and cultivation.
3	**High capability land**: Land has moderate limitations and is capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation.
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, gazing, some horticulture, forestry, nature conservation)	
4	**Moderate capability land**: Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.
5	**Moderate–low capability land:** Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.
Land capable for a limited set of land uses (grazing, forestry and nature)	
6	**Low capability land**: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation
Land generally incapable of agricultural land use (selective forestry and nature conservation)	
7	**Very low capability land**: Land has severe limitations that restrict most land uses and generally cannot be overcome. On-site and off-site impacts of land management practices can be extremely severe if limitations not managed. There should be minimal disturbance of native vegetation.
8	**Extremely low capability land:** Limitations are so severe that the land is incapable of sustaining any land use apart from nature conservation. There should be no disturbance of native vegetation.

The LSC mapping identifies a large variation in Classes mapped across the Project Area, as shown in Figure 16-2.

The north and west facing slopes of the Project ridgeline are attributed the highest limitation class, being assessed under the LSC scheme to be rated Class 8, having extreme limitations. Class 8 land includes precipitous slopes (>50% slope) and cliffs or areas with a large proportion of rock outcrop (>70% area). Recommended uses are restricted to those compatible with the preservation of natural vegetation including water supply catchments, wildlife refuges, national and State parks, and scenic areas.

The western portion of the Project Area has been rated as a mixture of LSC Class 8 and Class 7, having severe limitations. Class 7 is unsuitable for any type of cropping or grazing, as it would result in severe erosion and degradation. The land may be suitable for commercial timber plantations or for native timber on undeveloped land. Class 7 land includes slopes of 33–50% and also includes areas with extreme soil erodibility (often sodic soils, or prior stream sand dunes), catchments where salinity and recharge are a serious problem, severely scalded areas and where rock outcrop, stoniness and shallow soils are a severe problem.

The eastern ridgeline, which stretches in a north-south direction, is classified as a mixture of LSC classes, being Class 3, Class 4 and Class 6 having moderate to very severe limitations:

- Class 3 land has limitations that must be managed to prevent soil and land degradation. However, a range of widely available and readily implemented land management practices can overcome the limitations. Included are sloping lands (3–10%) with slopes longer than 500 m. It is important to minimise soil disturbance, maintain stubble cover and maintain good organic matter levels. This class includes other soils with acidification and soil structure limitations that are sufficient to require the application of specific management practices.
- Class 4 land has moderate to severe limitations for some land uses that need to be consciously managed to prevent soil and land degradation. The limitations can be overcome by specialised management practices with high levels of knowledge, expertise, inputs, investment and technology. This class includes sloping lands (10–20% slope).
- Class 6 land has very severe limitations for a wide range of land uses and few management practices are available to overcome these limitations. Land generally is suitable only for grazing with limitations and is not suitable for cultivation. Class 6 land includes steeply sloping lands (20–33% slope) that can erode severely even without cultivation, or land that will be subject to severe wind erosion when cultivated and left exposed.

The south-eastern corner of the Project Area is classified predominately as being Class 6 and Class 7, with pockets of Class 3 and Class 4. These Classes have been described above.

Consideration of any proposed works on land identified as biophysical strategic agricultural land (BSAL), which generally aligns to Class 3 in the Project Area (refer Figure 16-2), is discussed in Section 4.3.3.

Australian Soil Classification

A search of the ASC Soil Type Map of NSW (OEH, 2017) reveals that the Ferrosols soil type dominates the Project Area. Ferrosols are characterised by their deep red friable soils that lack strong texture contrast, which are high in free iron oxide and generally have a high clay content. Ferrosols have high agricultural potential because of their good structure and moderate to high chemical fertility and water-holding capacity. Water filtration rates are high, unless significant compaction has occurred.

The ASC Soil Type Map of NSW also revealed, to a lesser extent, the presence of Podosols, Chromosols and Hydrosols soil types. The extent of soil types, according to the ASC Soil Type mapping, is shown in Figure 16-3.

Acid Sulfate Soils

A review of acid sulfate soil risk mapping has identified that no potential acid sulfate soils (PASS) are expected to occur across the Project Area (Naylor, et al., 1998).

Soils Summary

Overall, the soil character of the Project Area is identified as having low to moderate erodibility and generally permeable soils which reduces runoff potential. The primary concern for soil management is the disturbance of steep sloped areas. Detailed design has avoided proposed disturbance of steep sloped areas, with the primary ground excavation works associated with work pads located on the ridgeline.

16.3.3 Hydrology

Surface Water and Watercourse Crossings

The Soils and Water Assessment adopts the Strahler system of stream ordering. This is explained as follows:

- starting at the top of a catchment, any watercourse that has no other watercourses flowing into it is classed as a first-order watercourse;
- where two first-order watercourse join, the watercourse becomes a second-order watercourse;
- if a second-order watercourse is joined by a first-order watercourse – it remains a second-order watercourse;
- when two or more second-order watercourses join they form a third-order watercourse; and
- a third-order watercourse does not become a fourth-order watercourse until it is joined by another third-order watercourse, and so on.

Numerous first-order watercourses are located in the Project Area, characteristic of its ridgeline nature. The majority of these flow north and west of the ridgeline into the Namoi catchment area. The southern portion of the Project area flows south to the Hunter catchment area. A small portion of the eastern portion of the Project Area flows east to the Manning Catchment Area. Table 16-4 details the extent of the Project Area within each of these catchment areas and the percentage of the catchment area which the Project Area intersects with.

Table 16-4 Area of Project within Catchment Areas

Catchment	Project Area within Catchment (ha)	Project Area as % of Catchment Area
Namoi	5180.9	0.00123 %
Hunter	2254.6	0.00105 %
Manning	880.0	0.00105 %

There are fourteen named tributaries within the Project Area (refer to Figure 16-4.), including those spanned by the transmission line. There are no third-order streams or larger which are directly impacted upon by the Development Footprint.

The transport route along Lindsays Gap Road requires bridge upgrades at Goonoo Goonoo Creek and Middlebrook Creek. Further, should the Head of Peel Road be required for access of oversize / over-mass vehicles, upgrades to causeways and a bridge will be required at 13 locations along Head of Peel Road (refer to Figure 16-4).T

Typically, first and second order streams are ephemeral gullies that will require culvert installations in the access tracks and the DPI guideline *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (2003) and DPI Water *Guidelines for watercourse crossings on waterfront land* (2012) are not required to be considered during detailed design. However, at the location of the two creek crossings at Woodleys Creek, the existing bridge over the Peel River upstream of its confluence with Woodleys Creek, and crossings at two tributaries of Peel River (Wardens Brook and an unnamed tributary) are at third order streams or greater. The highest stream order is at the second creek crossing with Woodleys Creek at which point Talbots Creek joins and forms a fourth order stream.

Consultation with Council has confirmed that any causeway and bridge upgrade works will require a Section 138 of the Roads Act 1993 approval and are to be designed and constructed in accordance with Council's Development Control Plan and Tamworth Regional Council's Engineering Design Guidelines for Subdivisions and Developments (dated March 2019). The DPI guidelines Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (2003) and Guidelines for watercourse crossings on waterfront land (2012) will also be considered during detailed design.

Water Supply Options

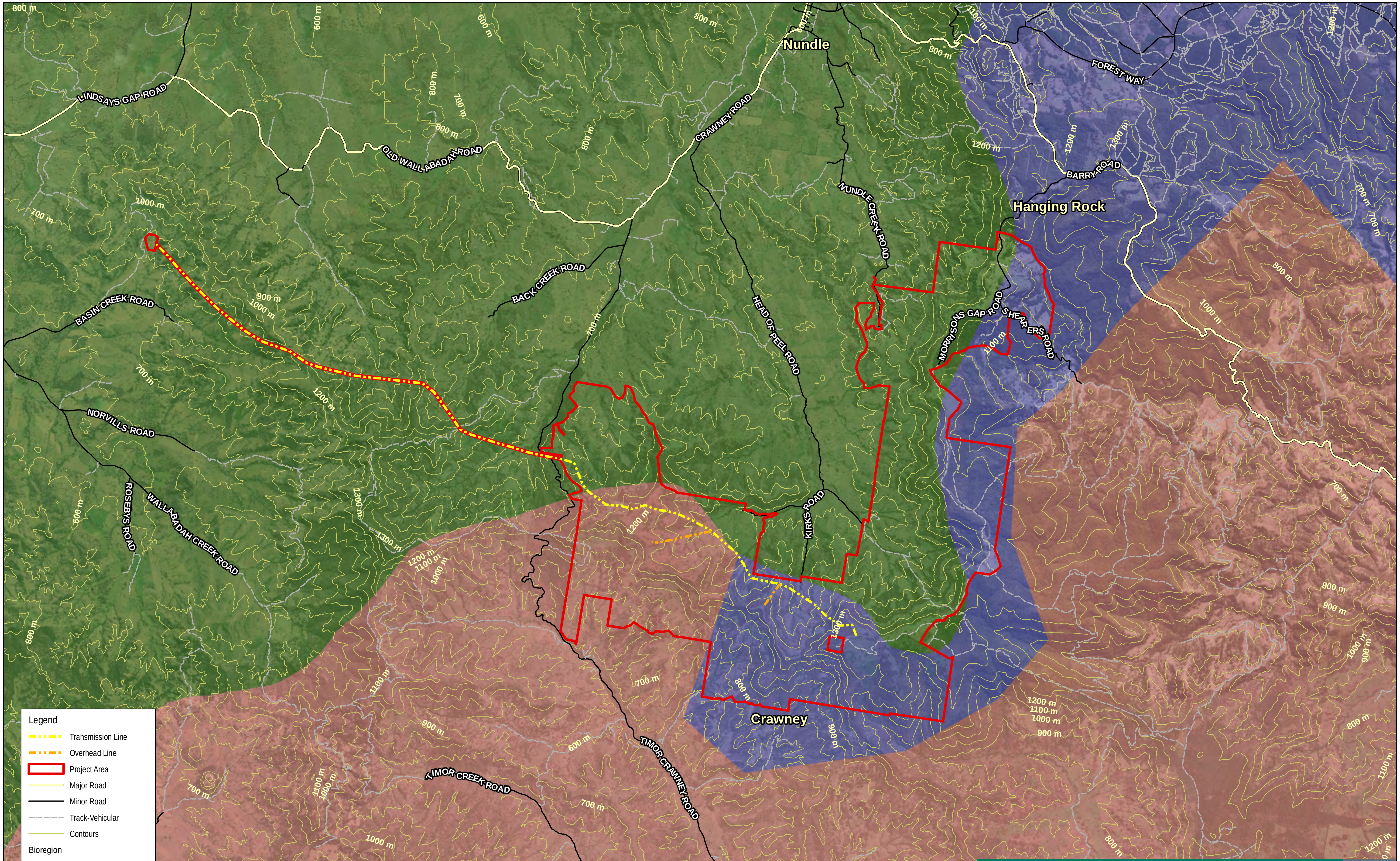
There are feasible options for the supply of water for the 24-month Project construction period. The four viable options available to source the estimated 55 ML of water required for construction include:

- council water supply, with agreement with the relevant Council(s);
- extraction from an existing nearby landowner bore, with agreement from the landowner;
- extraction from a new groundwater bore; and
- extraction from a surface water source (e.g. Chaffey Dam or the Peel River).

Tamworth Regional Council has advised that water for the Project could be purchased from Council.

If water is sourced from any bore or surface water source then all required water access licences would be obtained to authorise this.All options involve different considerations and different water licencing and approval requirements. More detail is provided in Appendix O.

Confirmation of the proposed water source will be determined following detailed design, however, it has been confirmed that adequate water supply is available for the development.



Topography and Bioregions of the Project Area F16-1

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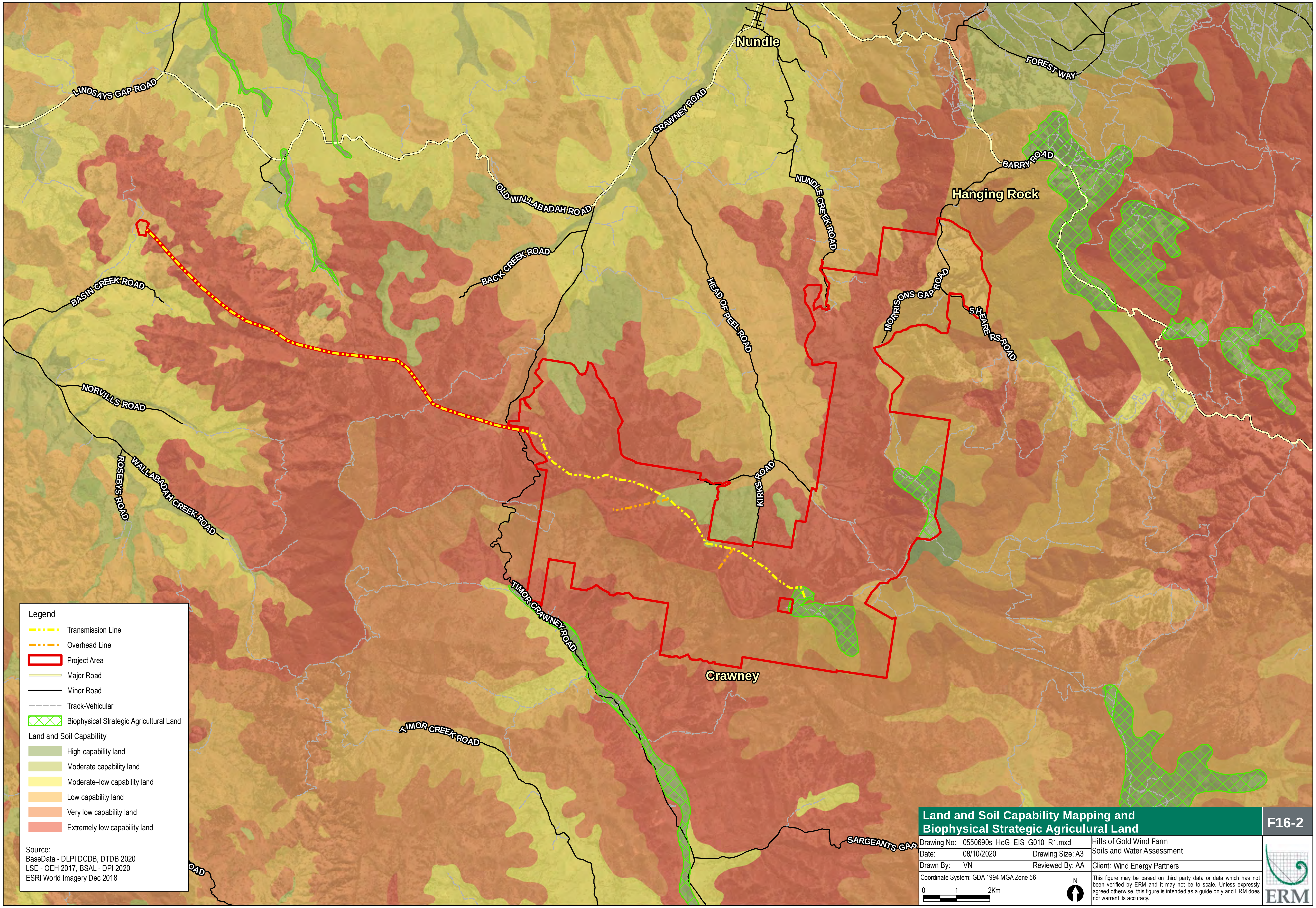
Date: 08/10/2020	Drawing Size: A3	
Drawn By: VN	Reviewed By: AA	Client: Wind Energy Partners
Coordinate System: GDA 1994 MGA Zone 56		This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.



Nundle
Hanging Rock
Crawney
LINDSAYS GAP ROAD
CRAWNEY ROAD
FOREST WAY
BARRY ROAD
OLD WALLABADAH ROAD
NUNDLE CREEK ROAD
BACK CREEK ROAD
BASIN CREEK ROAD
HEAD OF PEEL ROAD
MORRISONS GAP ROAD
SHEARERS ROAD
NORVILLS ROAD
ROSEBYS ROAD
WALLABADAH CREEK ROAD
KIRKS ROAD
TIMOR CRAWNEY ROAD
TIMOR CREEK ROAD
SARGEANTS GAP
Legend
Transmission Line
Overhead Line
Project Area
Major Road
Minor Road
Track-Vehicular
Biophysical Strategic Agricultural Land
Land and Soil Capability
High capability land
Moderate capability land
Moderate–low capability land
Low capability land
Very low capability land
Extremely low capability land
Source:
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LSE - OEH 2017, BSAL - DPI 2020
ESRI World Imagery Dec 2018
Land and Soil Capability Mapping and
Biophysical Strategic Agricultural Land
F16-2
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Date: 08/10/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
Coordinate System: GDA 1994 MGA Zone 56
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N
Hills of Gold Wind Farm
Soils and Water Assessment
Client: Wind Energy Partners
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
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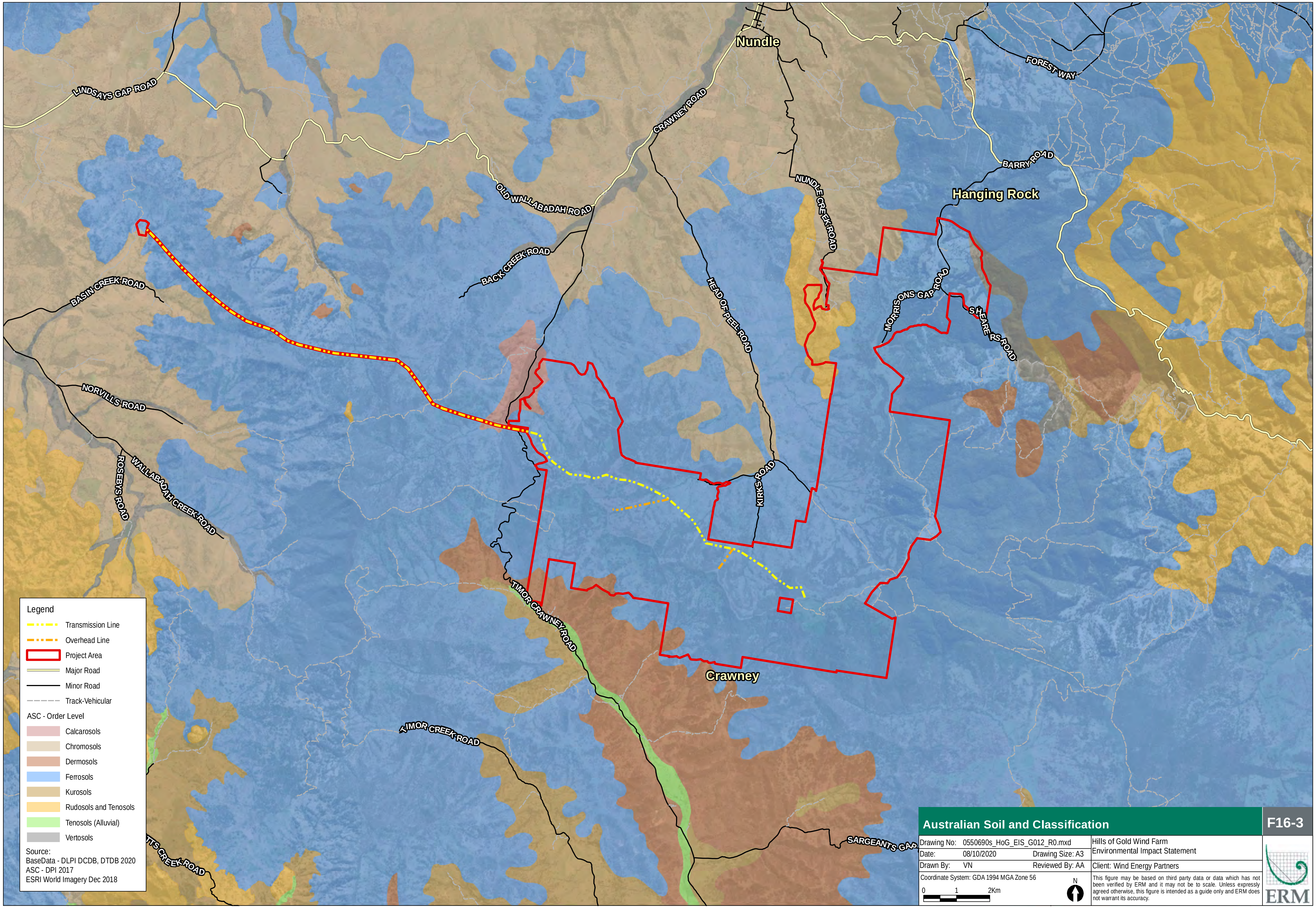
Nundle
Hanging Rock
Crawney
LINDSAYS GAP ROAD
CRAWNEY ROAD
FOREST WAY
BARRY ROAD
OLD WALLABADAH ROAD
NUNDLE CREEK ROAD
BACK CREEK ROAD
BASIN CREEK ROAD
HEAD OF PEEL ROAD
MORRISONS GAP ROAD
SHEARERS ROAD
NORVILLS ROAD
KIRKS ROAD
ROSEBYS ROAD
WALLABADAH CREEK ROAD
TIMOR CRAWNEY ROAD
TIMOR CREEK ROAD
SARGEANTS GAP
Legend
Transmission Line
Overhead Line
Project Area
Major Road
Minor Road
Track-Vehicular
ASC - Order Level
Calcarosols
Chromosols
Dermosols
Ferrosols
Kurosols
Rudosols and Tenosols
Tenosols (Alluvial)
Vertosols
Source:
BaseData - DLPI DCDB, DTDB 2020
ASC - DPI 2017
ESRI World Imagery Dec 2018
Australian Soil and Classification
F16-3
Drawing No: 0550690s_HoG_EIS_G012_R0.mxd
Date: 08/10/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partners
Coordinate System: GDA 1994 MGA Zone 56
0 1 2Km
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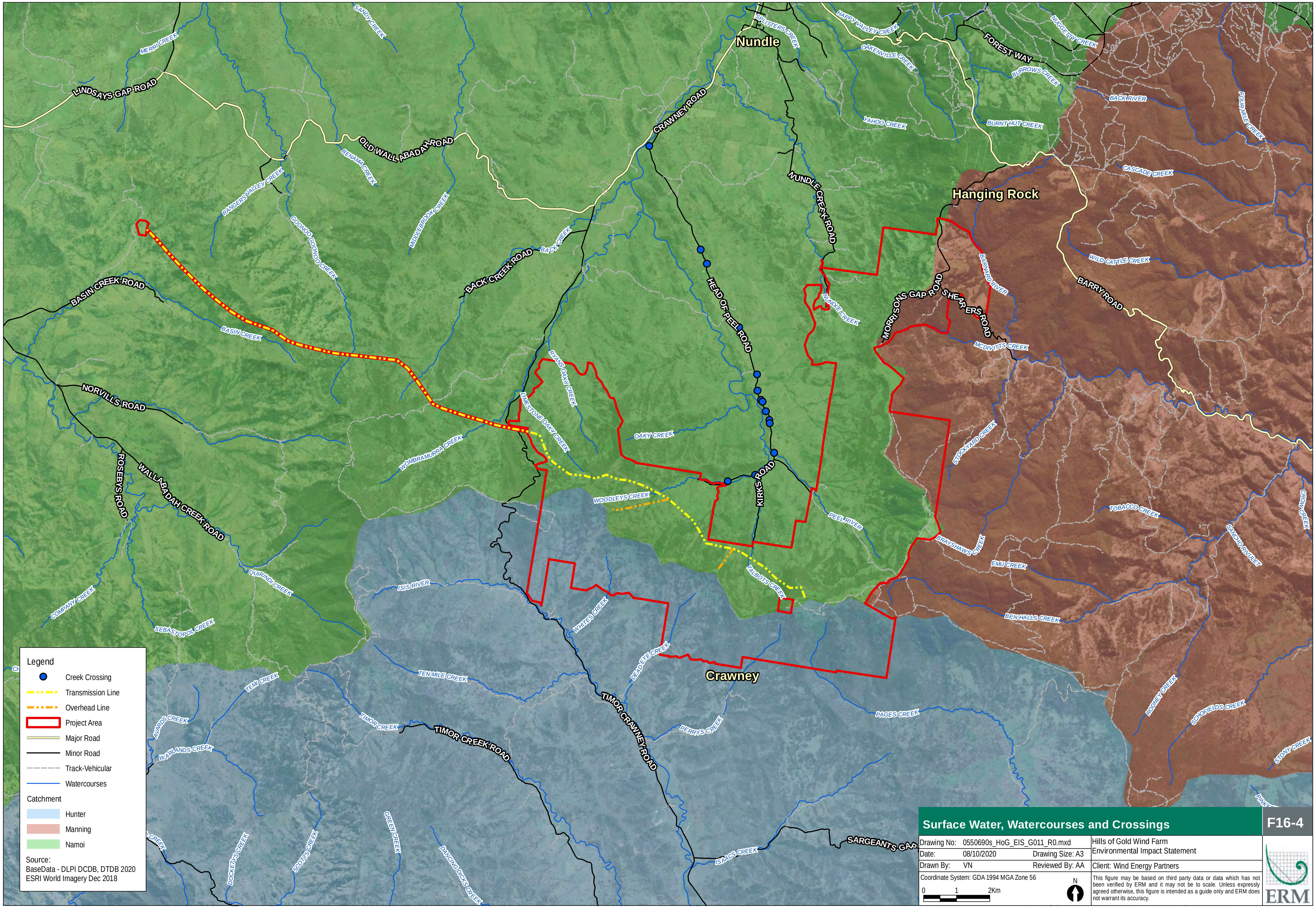
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM



Nundle
Hanging Rock
Crawney
LINDSAYS GAP ROAD
OLD WALL ABADAH ROAD
CRAWNEY ROAD
NUNDLE CREEK ROAD
HEAD OF PEEL ROAD
BACK CREEK ROAD
BASIN CREEK ROAD
NORVILLS ROAD
ROSEBYS ROAD
WALLABADAH CREEK ROAD
KIRKS ROAD
MORRISONS GAP ROAD
SHEARERS ROAD
BARRY ROAD
FOREST WAY
TIMOR CRAWNEY ROAD
TIMOR CREEK ROAD
SARGEANTS GAP
MERRI CREEK
SANDY CREEK
SPLITTERS CREEK
HAPPY VALLEY CREEK
NUGGETTY CREEK
OAKENVILLE CREEK
BURROWS CREEK
BACK RIVER
FOUR MILE CREEK
YAHOO CREEK
BURNT HUT CREEK
CASCADE CREEK
BENAMA CREEK
RANGERS VALLEY CREEK
GOONOO GOONOO CREEK
MIDDLEBROOK CREEK
BACK CREEK
WILD CATTLE CREEK
BARNARD RIVER
NUNDLE CREEK
BASIN CREEK
MCDIVITTS CREEK
RYANS OAKY CREEK
LIMESTONE OAKY CREEK
OAKY CREEK
WOMBRAMURRA CREEK
STOCKYARD CREEK
WOODLEYS CREEK
PEEL RIVER
TOBACCO CREEK
CROW CREEK
BRAYSHAWS CREEK
SANDHOR RIVULET
EMU CREEK
TALBOTS CREEK
QUIRINDI CREEK
ISIS RIVER
COMPANY CREEK
SEBASTOPOL CREEK
WHITES CREEK
BEN HALLS CREEK
DEAD EYE CREEK
TEN MILE CREEK
TEMI CREEK
PAGES CREEK
RODNEY CREEK
SCHOFIELDS CREEK
AVARDS CREEK
TIMOR CREEK
PERRYS CREEK
WARLANDS CREEK
STONY CREEK
GREEN CREEK
DOCKERYS CREEK
SCOTTS CREEK
DAYLING DICKS CREEK
ISAACS CREEK
Legend
Creek Crossing
Transmission Line
Overhead Line
Project Area
Major Road
Minor Road
Track-Vehicular
Watercourses
Catchment
Hunter
Manning
Namoi
Source:
BaseData - DLPI DCDB, DTDB 2020
ESRI World Imagery Dec 2018
Surface Water, Watercourses and Crossings
F16-4
Drawing No: 0550690s_HoG_EIS_G011_R0.mxd
Date: 08/10/2020
Drawing Size: A3
Drawn By: VN
Reviewed By: AA
Coordinate System: GDA 1994 MGA Zone 56
0 1 2Km
N
Hills of Gold Wind Farm
Environmental Impact Statement
Client: Wind Energy Partners
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ERM

16.4 Assessment of Impacts

Construction Impacts

Soils will be subject to disturbance during construction activities to allow for site establishment, installation of infrastructure and replacement of soils for revegetation. Specific construction activities that will potentially impact soils, and resultant potential downstream watercourse impacts, are outlined in Table 16-5.

Table 16-5 Potential Construction Impacts to Soils and Water

Construction Activities	Potential Impacts to Soils and Water
All-weather Unsealed Road Network	■ creation of fugitive dust due to vehicle movements; ■ creation of fugitive dust due to onsite livestock movements; ■ erosion of unsealed roadways and resultant sedimentation of run-off from road surfaces; ■ erosion of roads and roadside drainage in areas of steep terrain or in inappropriately 'finished' locations; ■ insufficient compacting of the road surface which could lead to erosion or batter slips in areas of steep terrain; and ■ mud tracking at the confluence of internal access roads with the public road network.
Watercourse Crossings	■ erosion of drainage lines and subsequent sedimentation; ■ removal of vegetation and subsequent increased erosion potential; ■ any vehicle movement across unaltered watercourses during construction phase leaving wheel tracks and causing damage to creek beds; ■ potential for any unstable steep banks collapsing under weight of vehicles/machinery; and ■ bank erosion at creek crossings from culvert installations.
Water Supply	■ over-extraction of surface water or groundwater resulting in reduced environmental flows, reduced water availability for existing licensed users and impacts on water dependent ecosystems.
Establishment of Pad Sites (e.g. Laydown Area, Batching Area)	■ erosion of relatively large disturbed areas during establishment and subsequent sedimentation of run-off.
Turbine and Transmission Pole Foundations	■ erosion of soils around turbine/pole foundations; ■ potential increase to water filtration and subsequent impacts to groundwater; and ■ erosion from spoil stockpiles and subsequent sedimentation should it reach a waterway.
Dewatering of Site	■ potential interception of groundwater during construction of turbine foundation, requiring dewatering.
Ancillary Infrastructure (e.g. substation, operations and maintenance facility)	■ erosion of relatively large disturbed areas during establishment and subsequent sedimentation of run-off; and ■ erosion from spoil stockpiles and subsequent sedimentation should it reach a waterway.
Stockpile Management	■ erosion of stockpiles and loss of soil resource; and ■ subsequent sedimentation impacts.
General Construction Activities (e.g. Machinery Operations)	■ erosion of soil stockpiles created during excavation works; ■ hydrocarbon spills from machinery (burst hoses, mechanical failures, leaking machinery, etc); ■ contamination of soils from poor refuelling practices; and ■ discovery of previously contaminated sites.

Operational Impacts

Specific operational activities that will potentially impact soils, and resultant potential downstream watercourse impacts, are outlined in Table 16-6.

Table 16-6 Potential Operational Impacts to Soils

Operational Activities	Potential Impacts to Soils and Water
Driving on All-weather Unsealed Road Network	■ creation of fugitive dust due to vehicle movements; ■ creation of fugitive dust due to onsite livestock movements; ■ erosion of roads and roadside drainage in areas of steep terrain or in inappropriately 'finished' locations; and ■ mud tracking at the confluence of internal access roads with the public road network.
Watercourse Crossings	■ any vehicle movement across unaltered watercourses during operational phase leaving wheel tracks and causing damage to creek beds; and ■ bank erosion at culvert crossings.
Pad Sites	■ potential for erosion and subsequent sedimentation of run-off during heavy rainfall.
General Operational Activities (e.g. Machinery Operations)	■ hydrocarbon spills from machinery (burst hoses, mechanical failures, leaking machinery, etc); ■ contamination of soils from poor refuelling practices; and ■ increased soil erosion following heavy rainfall and potential subsequent sedimentation.

Project Water Demands

During the construction period, water will need to be sourced for the following purposes:

- concrete production (batching plant);
- construction of roads and turbine hardstands; and
- dust suppression.

Based on a worst-case scenario, the total water demand over the 24 month construction period is approximately 55 ML, as detailed in Table 16-7.

Table 16-7 Water Demand by Activity (ML)

Project Stage	Activity	Water Requirement
Construction	Concrete Production	3.5 ML
	Dust Control and wash down	41 ML
	General Use including earthworks compaction and potable water	10.5 ML
	TOTAL	55 ML

In addition to the key construction water demands, potable water will also be required for site amenities during construction and operation of the Project.

16.5 Mitigation Measures

The following measures will be implemented to address potential soil and water impacts:

- preparation of a detailed Soil and Water Management Plan (SWMP) prior to construction commencing. The SWMP should be prepared by a suitably qualified person, such as a soil conservationist;
- Progressive Erosion and Sediment Control Plans within the SWMP as the Project progresses to address management requirements at individual work sites;
- design and construct the Project to minimise land disturbance and therefore reduce the erosion hazard;
- stage construction activities to minimise the duration and extent of land disturbance;
- manage topsoil resources to minimise the risk of erosion and sedimentation, and maximise reuse of topsoil during rehabilitation;
- rehabilitate areas of disturbance promptly and progressively as works progress;
- inspect and maintain erosion and sediment control devices for the duration of the Project construction stage;
- avoid land disturbance beyond that identified in the assessment within 20 m of minor streams (first and second order watercourses) and 40 m of third order or higher watercourses;
- ensure appropriate procedures are in place for the transport, storage and handling of fuels, oils and other hazardous substances, including availability of spill clean-up kits;
- construct required access tracks at any early stage to minimises disturbance during construction
- obtain all necessary water access licences; and
- ensure appropriate stormwater, collection, treatment and recycling at the concrete batch plant, in accordance with good practice and any requirements of the NSW Environmental Protection Authority.

16.6 Conclusion

The Soils and Water Assessment has been undertaken to assess soil and water related impacts of the Project and confirmed that:

- overall constraints are relatively minor due to the low to moderate erosion hazard over the majority of the Project Area to be impacted by construction. A standard suite of erosion and sediment controls may be adopted in most areas;
- review of groundwater wells within the Project Area identifies that the groundwater aquifer occurs at depths greater than would be intercepted by earthworks associated with the Project construction.

Water supply options are available to meet the needs of the construction phase. The four viable options available to source the estimated 55 ML of water required for construction include:

- Council water supply, in agreement with the relevant Council(s);
- extraction of water collected from existing (or new) dams using landowner harvestable rights or from an existing nearby landowner bore, in agreement to use their allocation;
- extraction from a new groundwater bore, which will require a WAL in consultation with WaterNSW; and
- extraction from a surface water source (e.g. Chaffey Dam), which will require a WAL in consultation with WaterNSW.

Water access licencing requirements will be confirmed in consultation with WaterNSW and all required licences obtained once the preferred option has been determined.

The Project Area intersects with three catchment areas. It is highlighted that the Project Area comprises less than 0.00123% of each catchment area. The Development Footprint only directly intersects with five waterways associated with creek crossings along the transmission line and the proposed bridge upgrade on Lindsays Gap Road. The site visit has confirmed that the existing condition of existing creek crossings is poor. The Project will include enhancement of these creek crossings, including regular management measures, which will result in an improvement of downstream sediment impacts and water quality.

A number of mitigation measures are proposed for the Project to address potential soil and water impacts, including the preparation of progressive ESCP's to address management requirements at individual work sites. A detailed Soil and Water Management Plan should also be prepared for the project prior to construction commencing that incorporates the measures identified within this assessment.

17. AIR QUALITY

17.1 Introduction

This chapter discusses the potential air quality related impacts associated with the Project and summarises the mitigation measures to manage impacts on air quality predominately associated with the construction stage of the Project.

17.2 Existing Environment

17.2.1 Locality Overview

The Project Area is located in a rural setting in which primary production and forestry are the predominant land use in the locality. These industries are unlikely to have a significant influence on local and regional air quality.

The closest concentration of receptors are dwellings located on Morrisons Gap Road and in Hanging Rock approximately 1-5 km to the north of the Project Area, and the township of Nundle, located approximately 8 km north west.

There are:

- five (5) associated dwellings located within the Project Area;
- seven (7) associated dwellings and seven (7) non associated dwellings within 2 km of a turbine; and
- seven (7) associated dwellings and 23 non associated dwellings between 2 km and 4 km of a turbine.

The Project Area also has relative isolated and low population density in the region of 0.01 persons per hectare (ABS, 2020), as discussed in Chapter 4.

17.2.2 Local Air Quality

The Tamworth region has good air quality, however, on occasions the region may experience short term air quality issues from sources such as bushfires, hazard reduction burning and localised smoke from solid fuel stoves and heaters. Other causes of air quality impacts include vehicle emissions, backyard burning, dust from unsealed roads and emissions from extractive and other industries (Tamworth Regional Council, 2020).

An air quality monitoring station exists in Tamworth, and produces data for hourly pollutant concentrations, 24-hour summaries and an Air Quality Index (AQI). The data is published by DPIE (DPIE, 2020), with quarterly reports based on seasonal results prepared at the regional level (Namoi / North West slopes) inclusive of the Tamworth LGA.

Results from the most recent monitoring for the Namoi / North West slopes region, inclusive of Tamworth are reported as:

- for Autumn 2020 regional population centres in the region met national benchmarks on 100% of autumn days during the reporting period (1 March 2020 to 31 May 2020). There were no days over the daily PM10 and PM2.5 benchmarks in the Namoi/North West Slopes region (DPIE, 2020);
- for the Summer period 1 December 2019 to 29 February 2020, air quality at regional population centres in the Namoi/North West Slopes met national benchmarks on 64 % of summer days (58 days) from 1 December 2019 to 29 February 2020. The Air Quality Index was poor to hazardous on 33 % of summer days (36 %). Air quality was affected by dust storms and bushfire smoke, intense drought and extreme bushfire weather conditions;
- for the Spring period 1 September 2019 – 30 November 2019, air quality at regional population centres in the Namoi/North West Slopes met national benchmarks on 59 % of spring days (54 days). The Air Quality Index was poor to hazardous on 37 spring days (41 %). Air quality was affected by dust storms and bushfire smoke, during the prolonged, intense drought and extreme bushfire weather conditions; and

- for the Winter 2019 period, air quality at regional population centres in the Namoi/North West Slopes met national benchmarks on 96 % of winter days from 1 June to 31 August 2019. The Air Quality Index was good to very good for 53 % of the season and fair for 43 % of the season. Air quality in population centres was poor to hazardous on four days during winter 2019.

17.3 Assessment of Impacts

The Project will contributed to positive air quality outcomes through reductions in air quality emissions from wind power generation in comparison to other electricity generating sources including traditional coal fired power stations;

Emissions to the atmosphere from the Project are predominately associated with construction activities which will be temporary and limited to dust generated by land disturbance, civil construction and vehicle, plant and equipment exhaust emissions. The anticipated construction timeframe for the Project is between 18 and 24 months.

During construction, dust particles and other emissions may be released from a range of activities including:

- upgrades of access tracks and roads;
- vegetation clearing;
- stockpiles;
- open exposed areas;
- excavation works;
- mobile concrete batching plants;
- rock crushing;
- processing and handling of material;
- construction activities and associated earthmoving and construction equipment;
- transfer points;
- loading and unloading of material; and
- haulage activities along unsealed roads.

Air emissions are unlikely during operations. It is anticipated that provided mitigation measures are implemented (as discussed below), the Project will not generate significant air quality impacts.

17.4 Mitigation Measures

The Environmental Management Strategy will include consideration of the management and mitigation of off-site dust emissions, and provide guidance on how those environmental management measures will be implemented. Such measures may include, where appropriate:

- watering roadways or preparing roadways with coarse gravel or other road coverings where required to minimise wheel-generated off-site dust emissions;
- commitment to the sealing of Morrisons Gap Road following consultation with the local community, subject to Tamworth Regional Council acceptance;
- covering and/or stabilising material loads which may generate dust, such as aggregates, during transport into and within the construction site where practicable;
- managing soil stockpiles through stabilisation, light watering or the use of covers;
- minimising vegetation clearance, including clearing vegetation in stages, and the stabilisation of cleared areas where practicable;

- controlling the speed of dumping from tip trucks;
- minimising vehicle movements where practicable;
- cleaning and wash of vehicles, plant and equipment;
- progressive revegetation and stabilisation of disturbance areas no longer required for construction;
- regular inspection and maintenance of all vehicles, plant and equipment to ensure operational efficiency; and
- regular monitoring of environmental conditions during construction, such as wind, that may result in dust generation and implementation of control measures as specified above, as relevant.

17.5 Conclusion

Air quality impacts associated with the project are considered to be temporary and low. It is anticipated that the Project will not generate significant air quality impacts and appropriate measures will be implemented to minimise the potential for off-site dust impacts resulting from the construction and operation of the Project.

18. WASTE MANAGEMENT

18.1 Introduction

This waste assessment has been prepared to provide guidance on the classification and removal of wastes generated as a result of construction, operation and decommissioning of the Project. The assessment has been undertaken to address the SEARs, as outlined in Chapter 1. The SEARs require the EIS to:

'identify, quantify and classify the likely waste streams to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste'.

Regulatory guidelines and instruments referred to in the preparation of this assessment include:

- Waste Classification Guidelines (EPA, 2014); and
- Resource Recovery Orders and Exemptions issued by the NSW EPA.

The requirements of the following legislation will be adhered to during construction and operation of the Project, to ensure the effective management of wastes on-site:

- *Protection of the Environment Operations Act 1997* (POEO Act);
- *Protection of the Environment Operations (Waste) Regulation 2014*; and
- *Waste Avoidance and Resource Recovery Act 2001* (WARR Act).

Best practice for waste management is to implement the resource management hierarchy principles, in accordance with the WARR Act and the principles of ecologically sustainable development:

- avoidance of unnecessary resource consumption;
- resource recovery (including reuse, reprocessing, recycling and energy recovery); and
- disposal.

18.2 Assessment of Impacts

The anticipated waste types generated by the Project are detailed inTable 18-1.

Table 18-1 Waste Streams and Classifications

Waste Type	Source	Classification
Green waste	Site establishment and clearing of development footprint	General solid waste (non-putrescible)
Spoil	Site earthworks	General solid waste (non-putrescible)
Concrete	Construction waste, footings and laydown construction, decommissioned turbine footings and laydown areas	General solid waste (non-putrescible)
Timber (inc. pallets)	Construction and packaging waste, store, workshop	General solid waste (non-putrescible)
Plastic packaging	Construction and packaging waste, store, workshop, O&M office	General solid waste (non-putrescible)
Plastics (PET)	Construction waste, store, workshop, O&M office	General solid waste (non-putrescible)
Cardboard packaging	Construction waste, store, workshop, O&M office	General solid waste (non-putrescible)
Paper waste	Construction waste, store, workshop, O&M office	General solid waste (non-putrescible)
Glass	Construction waste, store, workshop, O&M office	General solid waste (non-putrescible)
Empty chemical drums	Construction waste, store, workshop, site maintenance	General solid waste (non-putrescible)
Paint	Construction waste, store, workshop, site maintenance	General solid waste (non-putrescible)
Oil spill clean-up material	Construction waste, store, workshop, site maintenance	General solid waste (non-putrescible)
Waste oils, lubricants and liquids	Construction waste, store, workshop, site maintenance, decommissioned turbines and substation transformers	Liquid waste
Metals (ferrous and non-ferrous)	Offcuts; damaged items, site maintenance, decommissioned turbines, O&M building, substation and switching station	General solid waste (non-putrescible)
Electronics and electrical infrastructure	Offcuts, damaged items, site maintenance, decommissioned turbines, transformers, conductors, switches.	General solid waste (non-putrescible)
Recyclable domestic waste	Construction offices, O&M office	General solid waste (non-putrescible)
PPE	Construction and operational offices	General solid waste (non-putrescible)
Sewage waste	Ablutions during construction, operations and decommissioning	Liquid waste
Domestic wastes	Construction, operational and decommissioning offices.	General solid waste (putrescible)

Further detailed breakdown of the waste types and quantities will be included in a Waste Management Plan (WMP) that will form part of the Environmental Management Strategy for the Project.

18.3 Mitigation Measures

In order to mitigate the potential impacts of poorly managed waste, a WMP will be prepared and will describe the measures to be implemented to manage, reuse, recycle and safely dispose of waste. Specific measures to be included in the WMP will include the following:

- removal of packaging waste ;
- separation of recyclable and non-recyclable materials where possible;
- separation of materials that meet Resource Recovery Orders for reuse at locations with appropriate planning approvals and managed under the relevant Resource Recovery Exemptions;
- waste receptacles will be collected on a regular basis by licensed contractors or Council collection service and transported for off-site disposal at an appropriately licenced landfill or recycling facility;
- all waste disposal will be in accordance with the POEO Act and *Waste Classification Guidelines* (EPA, 2014);
- waste tracking will occur for any types and quantities of waste that trigger the requirement for tracking;
- an objective of ensuring that any use of local waste management facilities does not exhaust available capacity, nor disadvantage the local community.

Targeted management strategies have been identified for each waste type, including indicative quantities, as detailed in Table 18-2.

Table 18-2 Waste Generation and Management Strategies

Waste Type	Indicative Quantities	Waste Stream	Management Strategies
Green waste	N/A (reuse)	Reuse	Onsite reuse where possible or reused offsite in accordance with the Mulch Resource Recovery Order and Exemption..
Spoil	N/A (reuse)	Reuse	Onsite reuse; or reused offsite as Virgin Excavated Natural Material or the Excavated Natural Material Resource Recovery Order and Exemption (as applicable).
Concrete	14 tonnes	Recyclable	Source separated and stored in separate receptacles / storage areas. Reused onsite where feasible; reused offsite in accordance with the Recovered Aggregate Resource Recovery Order and Exemption; or transported off site for recycling.
Timber	200 kg	Reuse / General Waste	Pallets will be reused where possible. Stored in separate receptacles / storage areas. Reused onsite where feasible or offsite transport for recycling. Unused pallets returned to source.
Plastic packaging	50 kg	Recyclable	Source separated and stored in separate receptacles / storage areas. Offsite transport for recycling.
Plastics (PET)	100 kg	Recyclable	Source separated and stored in separate receptacles / storage areas. Offsite transport for recycling.
Cardboard packaging / paper waste	100 tonnes	Recyclable	Source separated and stored in separate receptacles / storage areas. Offsite transport for recycling.
Glass	250 kg	Recyclable	Source separated and stored in separate receptacles / storage areas. Offsite transport for recycling.
Empty chemical drums	200 drums	Reuse or Recycling	Reused onsite, recycled via contractor or sent back to supplier.
Paint	100 litres	General waste	Transported from site and disposed of in accordance with the Waste Classification Guidelines (EPA, 2014).
Oil spill clean-up material	50 kg	Hazardous waste	Collected oily rags and spill clean-up material will be collected in regulated waste bins and transported by a licenced regulated waste contractor to a licenced regulated waste receiver for disposal.
Waste oils, lubricants and liquids	1,500 litres	Hazardous waste	Stored separately and transported by a licenced regulated waste contractor to a licenced regulated waste receiver for disposal.
Metals (ferrous and non-ferrous)	100 tonnes	Recyclable	Scrap metal will be stored in for periodic transportation offsite to applicable recycling facilities.
Electronics and electrical infrastructure	50 kg	Reuse, Recyclable, General solid waste	Stored in dedicated areas prior to offsite transport. As far as possible, all materials and components will be reused, sold as scrap, recycled or re-purposed to the maximum amount economically practicable. Where not practicable, transported from site and disposed of in accordance with the Waste Classification Guidelines (EPA, 2014).
Recyclable domestic waste	3 tonnes	Recyclable	Stored in dedicated recyclable bins for periodic transportation offsite to applicable recycling facilities.
PPE	700 kg	Recyclable	Recyclable PPE will be stored in large industrial bins for periodic transportation offsite to applicable recycling facilities.
Septic tank waste	420 kL	Sewage	Collected waste will be transported by a licenced regulated waste contractor to a licenced regulated waste receiver for disposal.
Domestic wastes	8 tonnes	General solid waste	Transported from site and disposed of in accordance with the Waste Classification Guidelines (EPA, 2014).

18.4 Conclusion

The Project will produce a number of various waste streams during the construction, operations and decommissioning stages. All wastes produced by the Project will be classified, handled and managed in accordance with the *Waste Classification Guidelines – Part 1: Classifying Waste* (EPA, 2014).

A WMP will be prepared prior to construction. The WMP will detail all appropriate measures to be incorporated, in order to avoid potential contamination to land and water, and human and wildlife health impacts. The Project will separate waste streams to maximise recycling and emphasise reuse of any excess spoil and vegetative matter in accordance with resource recovery orders and exemptions. A key objective of the WMP will be to ensure that any use of local waste management facilities does not disadvantage local businesses and, more generally, the local community, by exhausting any available capacity at these facilities.

A Decommissioning and Rehabilitation Plan will be prepared in accordance with any project approval requirements.

19. SOCIAL AND ECONOMIC

19.1 Introduction

SGS Economics and Planning Pty Ltd (SGS) prepared a socio-economic impact assessment for the Project to consider the social and economic impacts and benefits for both the region and NSW. The assessment included a consideration of any increase in the demand for community infrastructure services and tourism impacts. The socio-economic impact assessment was prepared to address the requirements specified in the SEARs pertaining to social and economic matters. A copy of the socio-economic impact assessment can be found in full as Appendix P (SGS, 2020).

19.2 Methodology

In preparing the socio-economic assessment, SGS used qualitative and quantitative methods to evaluate the social and economic impacts of the Project, including:

- socio-economic profiling of the Tamworth Regional Local Government Area (LGA), Upper Hunter LGA and Liverpool Plains LGA, using Australian Bureau of Statistics (ABS) Census data;
- literature review of the current strategic planning context and relevant case studies;
- consultation with a small sample of stakeholders;
- economic impact assessment of construction and operations; and
- net community benefit assessment.

19.3 Existing Environment

Regional Geographies

The New England North West region refers to the northern central portion of NSW. Within this region are Tamworth Regional LGA and Liverpool Plains LGA. A significant portion of the wind farm Project Area falls within the boundary of Tamworth Regional LGA. The southern portion of the Project Area and further south is the Hunter Valley region which includes the Upper Hunter Shire LGA.

Regional NSW

Regional NSW contains approximately 40% of the state's population. It is Australia's largest and most diverse regional economy. Between 2018-19, the Gross Domestic Product (GDP) for regional NSW was approximately $152,969 million.

In the 1990's, regional NSW's contribution to GDP was approximately 9.2 % which dropped to about 5.2 % in the 2010's. Decline of the regional NSW economy is attributed to contractions in agriculture, transport, manufacturing, and retail industries. With the decline of the regional NSW economy in recent decades and the impact of drought and climate change on regional communities and agricultural production, the exploration and development of other industries provides opportunities to contribute to regional economies and provide employment.

Tamworth Regional LGA

The population of the Tamworth Regional LGA was 59,662 people as of the ABS 2016 Census. The population grew by 6,070 people in the ten years between 2006 and 2016, representing a Compounded Annual Growth Rate (CAGR) of 5.51 %. Comparatively, the New England North West region grew by only 2.63 %, indicating that Tamworth Regional LGA contributes the majority of growth in the region.

At the time of the ABS 2016 Census, the largest age group in the Tamworth Regional LGA was mature males (25.67 %), followed by Youth (20.06 %) and the retirees (18.7 %). SGS note that given the aging profile and local resident movement out of the workforce, additional industries that bring a source of income or younger workers may provide opportunities for local economic growth.

Most of the labour force were employed and working full-time (37.74 %) or part-time (18.30 %) in the Tamworth Regional LGA. At the time of the ABS 2016 Census,about 3.35% of the population were employed away from work, 2.35% unemployed looking for fulltime work and 1.32% unemployed looking for part-time work. There is a significant proportion that are not in the labour force at approximately 37%.

Based on the ABS 2016 Census, there were 21,936 jobs available in the LGA. Population serving jobs (including construction, retail trade, accommodation and food services, arts and recreation services and other services) were the largest broad industry that employs Tamworth Regional's resident workforce (32.13 %), followed by Health and Education (25.01 %) and Industrial (24.93 %). Of the 10 years between 2006 and 2016, Health and Education jobs in Tamworth Regional increased the most as a share of total jobs in the LGA (+5.31 %), while Industrial declined the most (-4.98 %).

Tourism data indicates there was 1,138,000 visitors in 2018, mostly Domestic Day visitors (633,000) and Domestic Overnight visitors (492,000). Approximately 39% of trips to the LGA were attributed to holiday purposes, which is greater than the 30% attributed to visiting friends and relatives, indicating that there is a small tourist market that is coming to the region to explore and see tourist attractions. Additional tourist attractions to cater to these visitors may be of value to the region.

On the Visit NSW website, the town of Nundle is listed as a small, historic mining village. It is one of the nine stops on the Fossickers Way tour route. Two annual events occur including a Chinese Easter festival, and the Great Nundle Dog Race. Other sites of interest include Chaffey Dam for outdoor activities, Nundle Woollen Mill and small local boutique stores in town.

Liverpool Plains Shire LGA

Liverpool Plains Shire was home to 7,689 people as of the ABS 2016 Census. The population grew by 152 people in the ten years between 2006 and 2016, representing a CAGR of 1.00 %.

Most of the labour force are employed and working full-time (33.07%) or part-time (16.63%). At the time of the ABS 2016 Census, about 3.51% of the population were employed, away from work; 2.79% were unemployed looking for full-time work; and 1.46% were unemployed looking for part-time work. Almost half of the local population is not in the labour force (42.53%).

There were 2,878 working residents of the Liverpool Plains Shire LGA. Industrial jobs were the largest broad industry of Liverpool Plains Shire's resident workforce (43.54 %), followed by Population Serving (24.36 %) and Health and Education (19.84 %). Liverpool Plains Shire had a much higher proportion of Industrial jobs (43.54 %) compared to New England and North West (30.19 %) and Hunter Valley exc. Newcastle (28.16 %).

The Liverpool Plains Shire LGA is one of the most productive agricultural regions in Australia, with numerous opportunities present in the agri-tourism space. In 2016 the LGA had 33,000 visitors, with an average length of stay of about 2 nights. Overall, the total value of tourism related output for Liverpool Plains is estimated to be at $13.154 million. Its key attractions included museums, heritage walks, guided agri-tours and bushwalking.

Upper Hunter Shire LGA

Upper Hunter Shire was home to 14,112 people as of the ABS 2016 Census. The population grew by 1,138 people in the ten years between 2006 and 2016, representing a CAGR of 4.29 %.

Most of the labour force are employed and working full-time (38.99%) or part-time (19.33%). At the time of the ABS 2016 Census, about 3.49% of the population were employed, away from work; 1.98% were unemployed looking for full-time work; and 1.14% were unemployed looking for part-time work. Approximately 35.07% were not in the labour force.

There were 6,060 working residents of the Upper Hunter Shire LGA. Industrial jobs were the largest broad industry of the Upper Hunter Shire's resident workforce (44.64 %), followed by Population Serving (25.87 %) and Health and Education (15.87 %).

There were 259,000 visitors in 2018, mostly Domestic Day visitors (136,000) and Domestic Overnight visitors (120,000). The total estimated spend in the Upper Hunter Shire LGA for 2018 was $46 million. Approximately 55 % of trips were estimated to be for holidays, while 45 % of visits were for visiting friends and relatives. Similar to Tamworth, this suggests that there is a market for additional tourist attractions to cater to these visitors.

Profiling Summary

A summary of relevant social and economic factors in the existing environment is provided as follows:

- **Regional NSW:** With the decline of the regional NSW economy in recent decades and the impact of drought and climate change on regional communities and agricultural production, the exploration and development of other industries (such as wind energy) provides opportunities to that could contribute to regional economies and provide employment.
- **Population change:** Between 2006 and 2016, the New England North Region experienced low growth with a compound annual growth rate of 2.63 %, far lower than the neighbouring Hunter Valley region (excluding Newcastle) at 8.01 %. Most growth could be attributed to Tamworth Regional LGA which grew by 6,070 persons. The Upper Hunter Shire grew by 1,138 persons and Liverpool Plains Shire grew by only 152 persons. Large development projects may help attract more people to live and work in the region resulting in economic benefits.
- **Age Profiling:** the region has an ageing profile which is typical of most areas in regional NSW. Given the ageing profile of the region, new industries that bring a younger workforce to the region, or provide a source of income for retired landholders, such as wind farming could be positive for the New England North West region.
- **Resident workforce (Place of Usual Residence data):** all three LGAs have a significant proportion of resident population working in industrial related jobs (this includes manufacturing, transport and utilities). There is also a fair proportion of people working in Population Serving industries in each LGA (this job category includes retail trade and food services but also construction jobs). For Tamworth Regional LGA approximately 32 % work in Population Serving industries and 25 % in Industrial; for Liverpool Plains Shire LGA approximately 24 % work in Population Serving and 44% in the Industrial sector; and for Upper Hunter LGA approximately 26 % work in Population Serving jobs and 45 % in the Industrial section. The skillsets of these local residents may be beneficial for the construction of a renewable energy development in the region.
- **Jobs in the LGA (Place of Work data):** For the Liverpool Plains Shire there are significantly more jobs in the Industrial sector than any other industry type, at about 47 %. Similarly, Upper Hunter Shire has more Industrial related employment for local residents or people travelling into the LGA than any other industry at 38 %. This indicates that local residents or workers commuting into the three LGAs may have skillsets that could be utilised in the development of a renewable energy project. Tamworth has a different profile with a higher presence of Population Serving and Health and Education industries, noting that construction jobs fall into the Population Serving category. The employment profile of Tamworth Regional LGA can be attributed to the regional city of Tamworth being located in the LGA. Tamworth regional city is the location of a number of public administration entities (for example Service NSW and a northern office for the Department of Planning, Industry and Environment) which therefore raises the number of Knowledge Intensive jobs in the LGA slightly above that of the greater New England North West region.

  The rate of self-containment (the proportion of residents that work locally) and self-sufficiency (proportion of local jobs filled by local residents) was high for all three LGAs (between 75-91 %). This indicates that the propensity to live and work locally is widespread in the region and that new, local job opportunities may be welcomed by local residents.

- **Climate Change and Bushfires:** Australia is also one of the countries most exposed to the impacts of human induced climate change as evidenced by the unprecedented bushfires which occurred over 2019/20, withrural communities significantly affected by these impacts. The Project will bring improved firefighting access, opportunities to the rural surrounds and contribute to mitigating the effects of climate change.
- **Tourism:** both Tamworth LGA and the Upper Hunter Shire LGA had more visitors to the region for the purpose of a ‘holiday’ than for ‘visiting friends and relatives’. For Tamworth, this may be a result of the Tamworth Music Festival held in town each year, however, it also indicates that there is a tourist market that is coming to the region to explore and see tourist attractions, beyond just seeing family. Additional tourist attractions to cater to these visitors may be of value to the region and the Project could be considered as an additional attraction for some tourists.

19.3.2 Literature Review

A literature review documenting the size of the wind energy sector globally and in Australia, and the reported social and economic impacts associated with wind farms was completed. In summary, the literature review revealed there can be a variety of responses and impacts associated with wind farms when considering socio-economic issues.

Social Literature Review

Communities Attitudes - Public reaction to wind farm developments are complex where an individual can often hold conflicting views. They may understand and generally support the growth of renewables as it can produce more sustainable outcomes for society at large, however, at the same time, these individuals can be opposed to having the development in their immediate surrounds particularly while the impacts are not clearly understood at early stages of a project proposal. It has been observed that overtime these attitudes can become neutral as familiarities with the project becomes better understood.

Visual Amenity – visual amenity is subjective with some considering the turbine impressive and majestic while others value the natural landscape. The NSW Visual Guidelines provide a framework for assessing visual amenity which provides the best approach for assessing the specific impacts of this Project. More information is summarised in Chapter 11.

Safety – Wind farm are constructed in remote locations, as is the case with the Project and overall has one of the best safety records in the energy industry and a low risk to the general public.

Human Health – NSW has adopted some of the most stringent noise criteria in the world. Despite an increase in the number of wind turbines installed the Office of the National Wind Farm Commissioner noted a reduction in noise complaints from 48 in 2016 to 35 in 2018. A range of studies have concluded there is little scientific infrasound and low frequency sound from wind farms pose health hazards. Vibro-accoustic disease or “wind turbine syndrome” are not scientifically supported as a result of living near a wind turbine. Strict regulation and guidelines in Australia protect residents from health impacts associated with the construction and operation of a wind farm.

Education Opportunities - potential for new educational opportunities associated with construction and operation of the Project which will require a range of skills including engineering, trades (electrical, mechanical, construction), transport, building material providers, equipment operators, consultants and administrative staff. Education tourism opportunities could be further explored with local educational institutional as other wind farms have undertaken.

Economic Literature Review

Direct Financial Gain – CSIRO research indicated that wind farms help "drought proof hosting landowners farms, provide an ability pay long term incomes to rural landowners, support land protection and conserve biodiversity, support local businesses and community initiatives (CSIRO, 2012).

Job Creation and Value Add – Direct jobs will come from employment associated with project development, construction of foundations and hardstands, construction of access roads between turbine and installation of turbines and electrical equipment. Further indirect employment will be created in business supporting direct employment such as motels, local cafes, services, accommodation. Wind farms also create local value-added, through increased profits and worker wages.

Property Prices – The CSIRO (2012) has suggested there does not appear to be negative impact on neighbour property prices to wind farms, drawing on an assessment completed for the NSW valuer general. The assessment looked at property sales transaction data for 45 properties near six wind farms in Australia. 40 of the 45 properties did not show any reduction in value.

Tourism – Research suggests wind farms can attract tourism if managed correctly. In Australia one off events have encouraged people to visit during open days or fun runs. Global studies largely suggest wind farm don't have a serious negative impact from wind farms on tourism. For example, in Scotland a study of tourists was conducted who had recently had an experience with a wind farm. The aim of the survey was to determine whether the experience would alter future return trips to Scotland. Four key tourism areas with rich natural landscapes were chosen as survey sites. A wind farm was either present or in construction. 99% of those tourists surveyed indicated the presence of the wind farm would not affect their future visitation to Scotland.

19.3.3 Consultation

In preparation of the socio-economic impact assessment, SGS undertook consultation with a small sample of 11 local community members to understand the key issues that the Project presents. Due to the impact of COVID-19, it was not possible to visit the site or hold face-to-face meetings. Instead, 11 phone interviews were conducted during March and April 2020 with people from the local community and region. Several participants are members of the Community Consultative Committee (CCC) and some additional participants were independently selected by SGS to broaden the sample.

There was an acute range of opinions from respondents, particularly in relation to the impact on natural amenity, tourism and local businesses as well as forecast economic benefits of the proposal. Key issues and impacts discussed with the community during the eleven interviews are summarised as follows:

- **Community:** Nine respondents felt that the principle social impact was the division that the wind farm has created within the community.
- **Visual amenity:** Three respondents suggested that the proposal has had a material impact on wellbeing for some members of the community, especially people who have come to live in Nundle to enjoy natural amenity. Two respondents felt the wind farm was 'industrialising' the natural landscape. In contrast, two respondents felt the wind farm represented progress. Two respondents were awaiting clarification on the final layout of the construction site.
- **Human health:** Two respondents raised mental health and wellbeing as issues. Noise and light pollution were identified as other potential impacts to human health by three respondents. Two respondents raised the issue of local road safety.
- **Education opportunities:** Six respondents suggested skilled workers would be required and are likely to be 'drive-in, drive-out' and that educational opportunities to train unskilled workers were not available in the area.

- **Direct financial gain:** Two respondents indicated that direct financial gain was not spread evenly amongst adjoining owners and wind farm hosts. A respondent supported the proposal as they would be able to expand and diversify their income stream. Two respondents from adjoining properties to wind farm hosts suggested they would endure net direct financial loss because of the loss of visual amenity and the impact of the industrialised landscape. The Community Enhancement Fund was seen by a respondent as a major positive impact for Nundle. However, two other respondents questioned the governance structure and certainty over the long-term.
- **Job creation and income (value-add):** there were divergent opinions as to whether Nundle would benefit from new job opportunities from the construction and operations of the wind farm. Two respondents believed that construction jobs would benefit the Nundle area. While six others believed that workers would be imported for the project and/or that people seeking jobs in Nundle did not possess the necessary skills for such jobs. Five respondents suggested that construction jobs would benefit Tamworth centre over the local centre. Once construction was complete, three respondents agreed that activity to the local area would recede. One respondent believed that operational workers and their families would locate in Nundle.
- **Tourism:** Respondent opinions were highly divergent in relation to the impact on visitation and tourism. Two respondents suggested key tourism operators would close their businesses. Five respondents believed that the wind farm would damage the tourist economy, especially for activities and events that rely on scenic beauty and ambience, such as weddings that overlook pristine natural settings. One respondent felt tourists would continue to come to the area, but it would be at a diminished capacity. Two respondents noted that the fossicking tourism activities are unlikely to be impacted by the proposal. Two other respondents suggested that Project workers may consume all available accommodation in the local area leaving tourists no options. Two respondents thought some visitors may come to view the wind farm as a visitation site but it may be a one-off visit.
- **Property prices:** Two respondents agreed there were not enough vacant rentals available to support a population of incoming construction workers. Three respondents felt the wind farm would decrease property prices especially outside the village of Nundle itself where turbines would be highly visible, detracting from the natural amenity and landscape. Although it is important to note that the literature review suggested that property prices, on the whole, are not dramatically affected by the presence of a wind farm
- **Agriculture and revenue:** One respondent supported the proposal because farm hosts for turbines would receive regular lease payments, thereby expanding and diversifying their revenue streams. One respondent felt the wind farm could result in ‘no fly zones’ which could materially affect aerial farming operations and increase operational costs to farming businesses.

The results from these engagements represent a small sample of the community and was undertaken as part of the preliminary stakeholder consultation prior to the finalisation of this EIS. Therefore, these results may not necessarily reflect the majority of views (or align with the findings of the literature review and data analysis) held in the community towards the project and the community members who participated had not yet had the opportunity to review the information relevant to this Project contained in this EIS. The outcomes of this consultation have been considered in further refining the contents of the Social and Economic Study in Annexure P to support assessment of impacts.

19.4 Assessment of Impacts

A net community benefit rating has been applied to the identified social and economic impacts in consideration of the proposed wind farm project (refer to Table 19-1). A rating has been given based on an assessment of the projects context and review of relating literature as either positive/negative and low/medium/high.

These qualitative descriptions are defined as follows:

- **High:** the impact is expected to have a significant effect that could be local or throughout the wider region, driven by the provision of services or infrastructure not currently within the region.
- **Medium**: the impact is expected to have a moderate impact through the region and be driven by a marginal change in infrastructure or services already provided.
- **Low:** the impact is likely to have negligible impact, be appropriately mitigated to remove its impact or have local or temporary impacts.

. Further consideration has been given to each of the identified socio-economic impacts through the provision of relevant mitigation measures designed to reduce the ranking (and impact) of each item (refer to Section 19.5).

Table 19-1 Summary of Impacts

Socio-Economic Impact	Project Impacts	Rating
Social		
Impact on community attitudes and sense of community	Engagement demonstrated a mix of attitudes are held towards the Project within the community (opposition, neutral, support). Division in the community is likely to remain, however the depth of this may reduce overtime. Since engagement was completed, the proponent has continued to collaborate with the community, particularly in the area of road safety, visualisations and compensation.	Low (negative)
Perceived impact on visual amenity of the surrounding natural landscape	Visual amenity is a site-specific issue (e.g. the turbines will not be visible from many sites) which is difficult to aggregate up into a single rating. See the detailed landscape and visual impact assessment report (Appendix F) for more details.	-
Impact on local safety	The key safety concern raised during engagement by two respondents was local road safety during the construction period. The proponent is preparing a traffic and transport assessment (Appendix G) and has consulted with Morrison Gap Road residents to ensure a balanced distribution of benefits aligned to level of impact.	Low (negative)
Perceived impacts on human health	There is some uncertainty around health impacts as suggested by the literature review, however it is suggested that many health impacts are subjective based on individual human physiology and development context. Adherence to NSW guidelines for wind farm development to reduce potential health impacts. These guidelines are noted as being some of the most stringent in the world.	-
Creation of education opportunities	University of New England (UNE) Armidale offers degrees in sustainability and environmental science. The literature review indicated there are examples of links made between educational institutions and wind farms. No current links could be determined between this project and developing education opportunities at this point in time. Stakeholders can collaborate in the future to develop opportunities.	No impact
Potential impact on local financial gain (eg: community funds)	Community Enhancement Fund Charter has been created to ensure proper management of funds. The Neighbour Benefit Sharing Program has been established. Meetings held with Morrison Road Gap residents to ensure balance distribution of benefits. Local road upgrades by the Project to benefit the local community.	Medium (positive)

Socio-Economic Impact	Project Impacts	Rating
Social		
Potential negative impact on local businesses	One respondent suggested the Project could result in direct financial loss. Others felt the Project could bring more activity to local business. Economic modelling indicates there may be 430 on-flow jobs during construction and 53 during operational life.	Low (negative)
Creation of local jobs/local skill creation	Economic modelling indicates in the short term (construction period) the project has potential to introduce 216 direct and 430 on-flow jobs to the local economy. In the long term (operation period) there is potential for 31 direct and 53 on-flow jobs during project life.	Low (positive)
Impact on existing local tourism	There was a mix of responses from respondents during engagement as to how the project may impact the current tourism industry.	Low (negative)
Creation of new tourism opportunities	Would require stakeholders to collaborate to determine opportunities. The Community Enhancement Fund Charter (dated: 15/04/20) indicates one of the social/environmental criteria supports new tourism opportunities. The literature review indication that tourism opportunities can develop in relation to a wind farm.	Low (positive)
Impact on property prices	Impact could differ based on whether the property is a residence or lifestyle property. Proponent has been working with the community to provide visual montages.	Low (negative)
Impact on the local natural environment	Local policy directives state development must be balanced and sensitive to the natural environment and town centres.	Medium (negative)
Impact on sustainability/wider environment	The Project will contribute to renewable energy sources in NSW. State and local strategic policy supports the development of renewable energy in the NENW region.	Medium (positive)
Economic		
Increased income (value-add) during construction	Estimated to be around $150 million ($100M discounted) in value-add	Medium (positive)
Increased employment during construction	During construction, project is projected to provide around 216 direct and roughly 430 on-flow jobs.	High (positive)
Increased income (value-add) during operation	Estimated to be around $16.0 million per year during operation	Low (positive)
Increased employment during operation	During operation, project is projected to provide approximately 31 direct and 50 on-flow jobs	Low (positive)

19.5 Mitigation Measures

Further consideration has been given to each of the identified socio-economic impacts (identified in Table 19-1) through the provision of relevant mitigation measures designed to reduce the ranking (and impact) of each item (refer to Table 19-2). An amended rating has been given as a potential post-mitigation rating if, and as, mitigation measures are rolled out and completed.

Table 19-2 Mitigation Measures

Socio-Economic Impact	Mitigation Measures	Potential Post-Mitigation Rating
Social		
Impact on community attitudes and sense of community	Transparency and collaboration during the wind farm development process. Compensation, contributions, careful planning and management of infrastructure between the developer, local residents, the operator and tourism providers during and post-construction.	Low (negative) - neutral
Impact on local safety	Appropriate safety measures should be determined in relevant construction management plans (i.e. Road upgrades such as sealing of Morrison Gap Road to improve road safety and local infrastructure).	Low (positive)
Creation of education opportunities	Working with local education providers and authorities to develop future opportunities.	Low (positive)
Potential impact on local financial gain (eg: community funds)	Having appropriate governance structures in place to ensure proper financial management of funds and for benefits realisation for the local community.	High (positive)
Potential negative impact on local businesses	Consideration during the design phase to minimise visual impact to property or land holders. Work with affected stakeholders.	Low-medium (positive)
Creation of local jobs/local skill creation	Working with local authorities to promote and develop relevant skills/programs to engage community in local employment opportunities.	Medium (positive)
Impact on existing local tourism	Work with local tourism operators and local authorities to minimise impacts.	Neutral
Creation of new tourism opportunities	Work with local tourism operators and local authorities to develop new opportunities.	Medium (positive)
Impact on property prices	Consideration during the design phase to minimise visual impacts to properties and work with neighbours through Neighbour Benefit program.	Neutral
Impact on the local natural environment	Consideration during the design phase to reduce impact. Adherence to NSW guidelines. Local policy directives state development must be balanced and sensitive to the natural environment and town centres.	Low (negative)
Impact on sustainability/wider environment	Conduct appropriate planning, design and construction studies to reduce environmental/sustainability impacts.	-
Economic		
Increased income (value-add) during operation	Local stakeholders work to enhance local economy which may capture more skills/investment	Medium (positive)
Increased employment during operation	Local stakeholders work to enhance local economy which may capture more skills/investment	Medium (positive)

Additionally, a Community Enhancement Fund Charter[5] has been created in collaboration with the local community aiming to enhance and enrich community initiatives throughout the local community. The CEF was developed to enhance the community's quality of life and wellbeing. The Charter identifies the roles, member eligibility, election process as well as scope, reporting and administration of the Community Enhancement Fund. There will be two funding rounds per year (projects to be approved May and November each year) and applications must align to one of four themes: community upgrades, social/environment, education, or flexible projects[6]. These themes were derived from community feedback. There will be a written application process and applicants are to prove eligibility against a set framework. Key requirements for projects stipulate they must directly benefit the community within 20 km of the Project; incorporate social or environmental improvement that could include tourism opportunities; and improve wealth and the lifestyle of the community. This is further discussed in Section 7.6.2.

19.6 Conclusion

The Hills of Gold Project, in the short-term (construction phase), would have a significant positive economic impact with guaranteed financial gains. In the longer-term (operation phase), the Project would continue to have a positive economic impact on the local economy. The Project is expected to include capital expenditure of roughly $370 million (local regional economy) with approximately 646 jobs created during construction (i.e., 216 direct jobs and 430 on-flow jobs)and around 84 jobs during its operational life. (i.e., 31 direct jobs and 53 on-flow jobs)

Socio-economic profiling conducted as part of the study highlighted the relevance of exploring new industries in regional NSW that could provide alternate sources of income for local communities given recent economic downturns as a consequence of drought (reducing agricultural outputs and transport industry movement). This could include wind energy for example. The Project may also offer the opportunity to develop educational or new tourism opportunities for the local community and its' economy.

Profiling also indicated that there are local residents who have industrial and construction skillsets that may be relevant to the development of a wind farm locally, noting some specialist skillsets may be required.

There was an acute range of opinions from respondents, particularly in relation to the impact on the natural amenity, tourism and local businesses as well as forecast economic benefits of the Project.

It was identified in the literature review that collaboration with the local community is a critical part of any wind farm development project. Since SGS engagement was conducted, the proponent has displayed their ongoing commitment to undertaking a collaborative approach with the community as they continue to work with the community on a range of matters. Collaboration to date has resulted in:

- amendment to the Project design and layout;
- ensured a balance of monetary benefits;
- detailing of Community Enhancement Fund governance measures;
- announcing a Neighbour Benefit Sharing Program;
- provision of visual montages to overcome visual amenity impact perceptions; and
- detail traffic, transport and safety measures to overcome any local road safety concerns.

Overall, the Hills of Gold Project represents a positive addition to the local and wider NSW economy (with strong economic return in the short-term). It also represents an opportunity for NSW to continue to build its renewable energy capabilities and meet State and local policy objectives.

[5] V.15/04/20. This is still a draft charter (13th of October) and it is currently under consultation with council.

[6] Covers emergency projects related to flood, fire or other natural disasters

20. CUMULATIVE IMPACTS

This chapter discusses the potential cumulative impacts arising from the Project and outlines the required mitigation measures to manage any adverse cumulative impacts.

20.1 Introduction

The NSW Wind Energy Guideline (DPE, 2016) states that:

> *"cumulative impacts: the consent authority will give consideration as to whether any other proposed, approved or operating wind energy projects in the vicinity are likely to increase the impacts of the wind energy project the subject of the DA, especially in regard to landscape, noise, biodiversity and traffic impacts".*

With reference to the above, cumulative impacts are an additional way in which a specific environmental aspect may be affected by a new wind farm project or another development. Cumulative impacts have two key characteristics:

- they occur over a geographical area; and
- they occur over time.

This chapter draws on the relevant assessments undertaken as part of the preparation of this EIS, which have identified and addressed potential cumulative impacts. These include biodiversity (refer Chapter 9); noise and vibration (refer Chapter 10); landscape and visual (refer Chapter 11, traffic and transport (refer Chapter 12) and socio-economic (refer *Chapter 19*), as well as the specialist assessments which informed these chapters.

There is the potential for some impacts to intersect and potentially increase as a result of additional wind farm or other developments, including the Hills of Gold Wind Farm.

A cumulative impact assessment has been undertaken for the following key environmental aspects:

- agricultural production and land use;
- biodiversity impacts;
- landscape and visual impacts;
- noise impacts;
- traffic impacts;
- aviation impacts; and
- socio-economic.

An assessment of the potential cumulative impacts on other environmental aspects including: cultural heritage, shadow flicker and blade glint, soil and water, and EMI has not been undertaken as it is considered that these potential impacts are primarily confined to the Project Area and considered negligible.

20.2 Existing Environment

An understanding of other developments (existing or proposed) in the locality is required in order to ascertain the potential for cumulative impacts resulting from the Project. Table 20-1 outlines the proximity and status of other SSD developments in the locality that are operational, approved or proposed to understand and inform any cumulative impacts likely to be experienced.

Table 20-1 Operational, Approved and Proposed Major Projects

	Project[1]	Description	LGA	Current Status[2]	Distance from the Project
Proximal Major Developments	Chaffey Dam Upgrade	Safety upgrade and augmentation. Increased capacity to 100,000 ML.	Tamworth LGA	Operational (Constructed 2016) All works complete	21 km
Proximal Major Developments	Dungowan Dam	Construction of a new dam (approx. 22.5 gigalitres capacity), 33 km pipeline and associated infrastructure.	Tamworth LGA	In Planning (Prepare EIS)	22 km
Proximal Major Developments	Middlebrook Solar Farm	Up to 500 MW proposed solar farm, battery storage (100 MW) and associated infrastructure.	Tamworth LGA	In Planning (Prepare EIS)	30 km
Wind Farm Developments	Kyoto Energy Park	Up to 113 MW renewable energy facility, comprising: ■ 42 Wind Turbines ■ 3 Solar Photovoltaic Array ■ a mini-hydro plant.	Upper Hunter LGA	Under Construction (Approved Jan 2010)	47 km
Wind Farm Developments	Bowmans Creek Wind Farm	Approx. 400 MW proposed wind farm with up to 80 turbines and associated infrastructure.	Muswellbrook, Singleton and Upper Hunter LGA's	In Planning (Prepare EIS)	59 km
Wind Farm Developments	Winterbourne Wind Farm	Approx. 700 MW wind farm, with up to 126 turbines and associated infrastructure.	Walcha and Uralla LGA's	In Planning (Prepare EIS)	75 km
Wind Farm Developments	Liverpool Range Wind Farm	Approx. 960 MW wind farm, with up to 267 turbines and ancillary infrastructure.	Upper Hunter, Mid-Western, and Warrumbungle LGA's	Preparing Modification Application (Approved Mar 2018)	116 km
Wind Farm Developments	Valley of the Winds Wind Farm	Approx. 800 MW wind farm, with up to 175 turbines and associated infrastructure.	Warrumbungle LGA	In Planning (Prepare EIS)	133 km

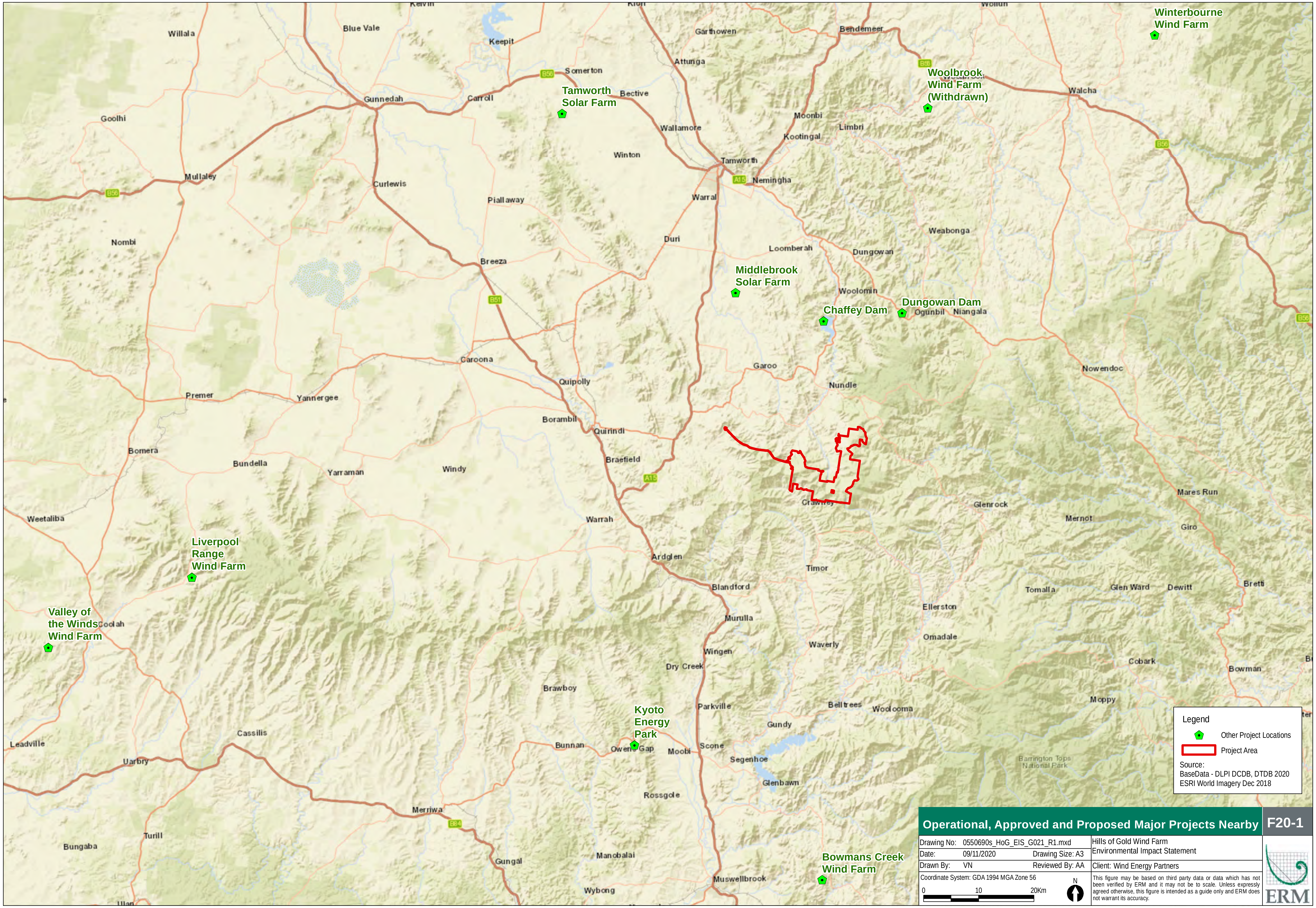
[1] *Woolbrook Wind Farm has been excluded. Director General Requirements (DGRs) for this project were issued January 2014 and the Major Project's website lists this application as withdrawn.*

[2] *Project status current as of 9 October 2020 based on DPIE's Major Projects website.*

There are three (3) major projects identified within 30 km of the Project, of which one has been constructed and is now operational (Chaffey Dam Upgrade), whilst the remaining two are in the planning phase and planning approval for these has not yet been obtained (Dungowan Dam and Middlebrook Solar Farm).

Given the requirements of the NSW Wind Energy Guideline to consider other wind energy projects in the vicinity, a larger radius has been adopted to provide greater consideration for wind farm developments in proximity to the Project, with five (5) wind farm developments in various stages of development located within an approximated distance of between 50 km and 130 km.

Collectively, the proximity of these major projects have been mapped and are outlined in Figure 20-1.



Operational, Approved and Proposed Major Projects Nearby | **F20-1**

Drawing No:	0550690s_HoG_EIS_G021_R1.mxd		Hills of Gold Wind Farm Environmental Impact Statement
Date:	09/11/2020	Drawing Size: A3	
Drawn By:	VN	Reviewed By: AA	Client: Wind Energy Partners
Coordinate System: GDA 1994 MGA Zone 56			This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM

The Project is located approximately 50 km south-west of the New England REZ indicative boundary (refer to Figure 2-4). With consideration of the closest wind farm being the proposed Winterbourne Wind Farm (EIS in preparation) located approximately 75 km north east of the Project Area, the distance provides a significant separation whereby potential impacts associated with both developments, primarily visual and noise, would not be simultaneously observed by dwellings or other sensitive receptors. The distance to other wind farm projects, with the exception of the proposed Winterbourne Wind Farm, is in excess of 150 km from the Project Area.

During construction, there is the potential for renewable projects within the New England region to utilise a similar transportation route as the Project, ie. the New England Highway for the transport of materials from the Port of Newcastle to the New England region. The New England Highway is a major inland transport route from the Port, and has been utilised for various large scale projects, including the Sapphire and White Rock wind farms located west of Glen Innes, NSW. Given the likely differences in timing for approvals and the limited construction period, in addition to the capacity of the New England Highway as a State Road, it is unlikely that the concurrent construction of the Project and another renewable development would have a significant increase in traffic generation for the available capacity of the New England Highway.

The Project will connect to the existing Liddell to Tamworth 330kV transmission line which also dissects the New England REZ. The line is identified for upgrade as part of the Queensland-NSW Interconnector upgrade project. Further, the line currently services the Liddell Power Station, which is programmed for decommissioning in 2023. These two factors will ensure sufficient capacity exists for the Project and other proposed renewable projects in the region.

20.3 Potential Cumulative Impacts and Mitigations

20.3.1 Agricultural Production and Land Use Impacts

The Project has a potential cumulative impact on agricultural land use by using the Project Area for the purposes of a wind farm. Approximately 313 ha of the Project Area is mapped within a broad, regional area of BSAL, of which the Development Footprint encompasses approximately 39.8 ha of BSAL.

However, the area subject to impact equates to approximately 0.000014% of the total land area mapped as BSAL within NSW and the current use of the land for grazing can continue concurrently with the operation of the wind farm.

Once the Project reaches the end of its investment and operational life, the Project infrastructure will be decommissioned and the development footprint returned, as far as practicable, to its pre-existing land use, which is predominately for cattle grazing activities.

Any cumulative impact to agricultural utilisation as a result of the Project has been managed and mitigated by:

- site selection and refinement processes, as described in Chapter 5, which has reduced the total area of BSAL to be impacted by the Development Footprint;
- not preventing ongoing use of the land for other purposes, such as ongoing cattle grazing activities during operation of the wind farm;
- rehabilitating the development footprint – the development footprint can be returned to agricultural land use at the completion of the Project’s operations; and
- implementation of land management practises to avoid or minimise potential impacts to neighbouring agricultural operations. Management measures have been identified in the Soils and Water Assessment (refer to Appendix O).

20.3.2 Biodiversity Impacts

Cumulative impacts on biodiversity associated with wind farm developments are commonly associated with the increased risk of avifauna strikes and the alteration of flight paths for migratory species as more WTGs are constructed across the landscape, as well as clearing of naïve vegetation associated project construction .

As outlined in Figure 20-1, other wind farm developments in the region are beyond 40 km from the Project Area. The BDAR considered cumulative impacts of proposed and current wind farm projects within a 200 km buffer of the Project Area. The assessment concluded:

- Kyoto Energy Park: the project is unlikely to have a significant impact on threatened species and communities.
- Bowmans Creek Wind Farm: The Bowmans Creek windfarm is in a different soil landscape than the Hills of Gold Project and there is no PCTs that are common to both.
- Winterbourne Wind Farm: The Winterbourne windfarm is in a different soil landscape than the Hills of Gold Project and there are few PCTs that are common to both.
- Potential impacts to Wedge-tailed Eagle as a results of collision risk, however unlikely to be significant with a similar outcome as assessed for this Hills of Gold project
- Liverpool Range Wind Farm: Assessment of collision risk for microbats determined that species unlikely to be significantly impacted by blade strike due to foraging heights within or below canopy.

The Project will include biodiversity offsets as defined in the BDAR resulting in no net loss to biodiversity.

20.3.3 Landscape and Visual Impacts

The presence of multiple wind farms has the potential to result in cumulative visual impacts. This can occur when either 'combined visibility' and/or 'sequential effects' are available to WTGs and can lead to a change in perception of a region.

Combined visibility occurs where two or more developments can be seen from one viewpoint. Combined visibility may either be in combination (where several wind farms are within the observer's arc of vision at the same time) or in succession (where the observer has to turn to see the various wind farms).

Cumulative visual impacts were assessed as part of the LVIA (Chapter 11 and Appendix F), and considered several proposed wind farms in the wider regional context, including Bowens Creek, Winterbourne, Woolbrook (withdrawn) and Valley of the Winds.However, due to distance between this Project and other wind farms, there are no opportunities to view any additional wind farms simultaneously from a static viewpoint in the foreseeable future. Further due to the relative isolated location, the Project is set back from major travel routes which prevents any opportunities to view wind farms in succession along travel routes.

Accordingly, cumulative visual impacts are not considered to arise.

20.3.4 Noise Impacts

As all other major projects and wind farm developments in the region are an extended distance from the Project Area, it is anticipated that there will be no cumulative noise impacts.

20.3.5 Traffic Impacts

There are a number of developments in the vicinity of the Project that may be constructed or operational concurrently with the construction of the proposed wind farm. These are identified in Table 20-1above, the majority of which are in the 'planning' stage, whereby planning approval has not been granted and timing for future construction, should approval be granted is unknown.

There is the potential for renewable projects within the New England REZ to utilise a similar main road transportation route as the Project. The New England Highway is a major inland transport route from the Port to inland northern NSW. Given the likely differences in timing for approvals and the limited construction period, in addition to the capacity of the New England Highway as a State Road, it is unlikely that the concurrent construction of the Project and another renewable development would have a significant increase in traffic generation for the available capacity of the New England Highway. Other renewable projects are unlikely to use the local rural roads proposed by the Project.

20.3.6 Aviation Impacts

The AIA identifies the Project is located within 30 nm (55.56 km) of two certified airports, being Quirindi Airport and Scone Airport. The Kyoto Wind Farm is located in the immediate vicinity of the Scone Airport and within 30 nm of the Quirindi Airport. The Bowmans Creek Wind Farm is located within the 30 nm buffer area for Scone Airport.

The Aviation Impact Assessment assessed the density of WTGs in the surrounding area and how this may potentially impact on low flying aircraft and other aviation related activities and services. As detailed in the AIA, the Project will maintain an acceptable level of safety to aircrafts.

20.3.7 Socio-economic Impacts

Wind farms can provide a significant economic boost to local communities, both during the construction and operational phases. The economic benefits provide flow-on social benefits, particularly in the provision of a range of employment opportunities for the region, upgrades to local infrastructure and increasing value to agricultural land.

At a broader social level, the development of additional wind farms reduces the community’s reliance on energy derived from fossil fuels and supports the community’s growing desire for renewable energy sources and a reduction in greenhouse emissions.

The Project is expected to have a positive socio-economic benefit by facilitating the economic growth of the region that is occurring through the development of the wind industry, while at the same time contributing to local, State, National and international objectives to reduce greenhouse emissions. The socio-economic impacts of the Project are discussed in Chapter 19.

Housing and accommodation for the construction workforce is available at the nearby regional centre of Tamworth.

20.4 Conclusion

The cumulative impact assessment detailed above has identified major developments either in operation, approved or in planning. It has considered any likely cumulative impacts associated with these projects and the Project in relation to the key environmental aspects, being:

- agricultural production and land use;
- biodiversity;
- landscape and visual;
- noise;
- traffic;
- aviation; and
- socio-economic.

The findings of the cumulative impact assessment have determined that the Project will not significantly involve any material cumulative impacts in relation to other wind farms in the region, nor any proximal major developments.

21. ENVIRONMENTAL MANAGEMENT STRATEGY

This chapter provides an overview of the Environmental Management Strategy to be developed for the Project and includes an overview of the mitigation measures recommended in the specialist assessments contained in Appendix D to P and as summarised in Chapters 9 - 19.

21.1 Environmental Management Strategy

An Environmental Management Strategy (EMS) will be developed to provide the overall framework for environmental management during the construction, operation, decommissioning and rehabilitation of the Project to ensure that appropriate measures and processes are in place to manage identified environmental risks and provide for ongoing continual improvement. The EMS would incorporate mitigation measures that have been identified throughout this EIS and technical assessments and would include relevant management plans.

Table 20-1 provides a summary of the environmental management commitments of the Project which will be implemented to avoid, minimise and where necessary, offset the potential environmental impacts associated with the Project.

Prior to the commencement of construction, final detailed design and layout plans will be submitted to DPIE. Environmental mitigation and management measures outlined in the EMS and the associated environmental management plans will be prepared prior to each stage of the Project and submitted to DPIE for approval.

Table 21-1 Environmental Management and Mitigation - Statement of Commitments

Environmental Aspect	Mitigation Measure	Responsibility	Stage
General	■ The Project will be designed and constructed in a manner as to minimise or mitigate harm to the environment as a result of the Project construction, operation or decommissioning through the implementation of all reasonable and feasibly mitigation measures.	Proponent and Construction Contractor	Construction, Operation and Decommissioning
	Environmental Management Strategy ■ An Environmental Management Strategy (EMS) will be developed to guide proposed activities associated with the construction, operation and decommissioning and rehabilitation of the Project. The EMS will: ▪ provide the strategic framework for environmental management of the Project; ▪ identify statutory approvals required to be obtained for the Project; ▪ define the roles, responsibilities, authority and accountability of all key personnel involved in environmental management for the Project; ▪ describe stakeholder and community engagement measures to be implemented, including: • measures to inform the local community and relevant stakeholder regarding the environmental performance of the Project; • procedures for the receipt handling, response and recoding of complaints • dispute resolution procedures • non compliance response procedures • and emergency response procedures ▪ include management plans as detailed below ▪ include a plan depicting any monitoring to be carried out.	Proponent and onstruction Contractor	Construction, Operation and Decommissioning
Biodiversity	**Biodiversity Management Plan** ■ A Biodiversity Management Plan will be prepared for the Project, in agreement with DPIE, including an unexpected finds procedure. The procedure will describe the process for identifying, dealing with, and managing any unexpected threatened flora species found during the construction process. The Biodiversity Management Plan will include: ▪ A Biodiversity Offset Strategy that will be prepared and implemented in accordance with the requirements of the BC Act and the EPBC Act Offsets Policy; ▪ A Bird and Bat Adaptive Management Plan that will be prepared for the Project prior to the commissioning of any WTGs; and ▪ A Weed Management Plan will be prepared and implemented as part of the EMS to implement weed control and weed disposal in accordance with Biosecurity protocols.	Proponent and Construction Contractor	Construction, Operation and Decommissioning
	Biodiversity mitigation measures for the Project include: ■ the Proponent will implement reasonable and feasible measures to further minimise the clearing of native vegetation within the Development Footprint, ■ A pre-clearing survey is to be carried out to confirm the presence/absence of threatened flora within lands that have not been surveyed within and adjacent to the Development Footprint, ■ rehabilitation of all areas subject to temporary clearing within the Development Footprint.	Proponent and Construction Contractor	Construction, Operation and Decommissioning
Noise	**Noise Management Plan and Mitigation Measures** ■ A Noise Management Plan will be prepared incorporating the mitigation and management measures outlined below. ■ Construction works will be restricted to the hours between 7am and 6pm Monday to Friday, and between 8am and 1pm on Saturdays. No construction activities will be undertaken on Sundays or NSW public holidays; ■ Works carried outside of these hours will only entail: ▪ works that do not cause noise emissions above 35 dB(A) at any nearby dwellings not located on the site; or, ▪ the delivery of materials as requested by Police or other authorities for safety reasons; or, ▪ emergency work to avoid the loss of lives, property, and/or to prevent environmental harm; or, ▪ works where the Proponent demonstrates and justifies a need to operate outside the recommended standard hours, in agreement with DPIE. If any other works are required outside of the specified hours, they will only be carried out with the prior consent of the relevant authority; ■ Fixed noise sources, such as crushing and concrete batching plant, will be located at the maximum practicable distance to the nearest dwellings, and where practicable, use existing topography to block line of sight between the fixed noise source and the dwelling; ■ Given the range of factors associated with both the generation and control of blasting, in the event that blasting is necessary, a monitoring regime will be implemented to ensure compliance with the blasting criteria detailed in the Noise and Vibration Impact Assessment; and ■ A curtailment regime will be implemented during Project operations in order to ensure the noise from the wind farm can practically achieve the noise criteria at all dwellings and under all wind speeds. The curtailment regime involves operating selected turbines in a noise reduced mode at the wind speeds where the predictions indicate that the criteria will be exceeded, as detailed in the NVIA.	Proponent and Construction Contractor	Construction and Operation

Environmental Aspect		Mitigation Measure	Responsibility	Stage
Landscape and Visual		■ **Screen Planting** will be implemented where non-associated residences are subject to a high level of visual impact, as an option proposed to assist in mitigating views of turbines from residential properties. In order to achieve visual screening planting between the intrusive element and the homestead, tree planting could be undertaken in consultation with the relevant landowners to ensure that desirable views are not inadvertently eroded or lost in the effort to mitigate views of the turbines; ■ **Supplementary Planting** will be implemented where turbines are located close to the non-associated dwelling or where existing intervening vegetation is thin (particularly for areas surrounding the Project Area to the north along Morrisons Gap Road). Supplementary planting in keeping with the existing landscape character would further reduce potential visibility and ensure longevity of the intervening vegetation; ■ The Proponent will apply visual screening measures for any associated dwellings through agreement with the relevant owner(s) of associated residences; ■ Where possible a recessive colour palette is to be used for associated infrastructure which blends into the existing landscape, including the use of subtle colours and a low reflectivity surface treatment on power poles to ensure that glint is minimised; ■ The turbines will have a matte white finish and consist of three blades which is consistent with the current turbine models being considered; ■ Avoid the use of any unnecessary lighting, signage on fences, logos etc.	Proponent	Operation
Traffic		**Traffic Management Plan and mitigation** ■ Prior to the commencement of construction, a Traffic Management Plan (TMP) will be prepared in consultation with TfNSW and the relevant Councils. The TMP will be subject to approval of DPIE. The TMP will include a drivers code of conduct and detailed transportation route for the Project. Traffic and transport mitigation measures include: ■ Relevant permits will be obtained for over-mass and over-sized vehicles from the National Heavy Vehicle Regulator; ■ Road upgrades will be undertaken to ensure sufficient space for oversized vehicles passage, including intersection widening, trimming and removal of vegetation, removable signs and infrastructure, and the relocation of overhead wires. All required road enabling works have been detailed in the TTA (refer to Appendix G) and listed in Section 12.4.6 above; ■ Dilapidation reports covering the pavement, drainage and bridge structures will be undertaken in consultation with Transport for NSW and local Councils for the proposed transport routes before and after construction. Regular inspections and consultation with local Councils and the Proponent would be developed; and ■ A communications protocols will be developed to allow communication between the NSW Forestry Corporation trucks and the Project trucks. The Project will maintain communication with NSW Forestry Corporation to coordinate the movement of oversized and over mass vehicles.	Proponent and Construction Contractor	Construction, operation and decommissioning
Hazards and Risks	Aviation	■ The Proponent will enter into a commercial agreement with Airservices Australia to amend flight procedures for Scone Airport as detailed in Section 13.1.4; ■ 'As constructed' details of wind turbine and wind monitoring tower coordinates and elevations will be provided to Airservices Australia, using the following email address: vod@airservicesaustralia.com; ■ The rotor blades, nacelles and towers of the wind turbines will be painted in matt white; ■ Marking the temporary and permanent wind monitoring towers will be undertaken according to the requirements set out in Manual of Standards (MOS) 139 Chapter 8 Division 10 (as modified by the guidance in NASF Guideline D); and ■ Prior to the construction of any wind turbines or meteorological monitoring masts, the Proponent will provide relevant details to CASA, Airservices Australia, Defence, NSW Regional Airspace and Procedures Advisory Committee, and any relevant landowners or local aerial agricultural or firefighting operators. Information will include; co-ordinates, final heights, confirmation of compliance with any OLS and aviation hazard light.	Proponent	Prior to Construction
	Telecommunications	■ A pre-construction assessment of TV and radio reception will be undertaken to establish a base line of reception strength for comparison with any complaints relating to reception post-construction and to assist with determining whether any reception interference issues were pre-existing. The assessment will be carried out at a representative sample of dwellings in the vicinity of the Project Area; and ■ In the event that reception impacts are experienced, the Proponent will implement reasonable measures to reduce impacts as soon as practicable.	Proponent	Prior to Construction
	Human Health / EMF	■ Detailed design will consider the prudent avoidance and incorporation of significant setbacks between residential dwellings and project components as discussed in Section 13.3.5.	Proponent	Prior to Construction
	Bushfire	**Bushfire Emergency Management and Operations Plan** ■ A Bushfire Emergency Management and Operations Plan will be prepared that will detail procedures, processes and mitigations to manage potential fires on site during construction, operation and decommissioning, in consultation with the RFS and as outlined in Sections 6.3 – 6.7 of the Bushfire Management Plan. Bushfire mitigation measures to be implemented include: ■ a minimum 10 m APZ will be established around each wind monitoring masts. The APZ for WTGs will comprise of the concrete foundation (approx. 25 m in diameter); ■ an increased APZ of 20 m will be established for the around the O&M buildings, BESS, substation and switching station. This will be increased as required to ensure that these assets are located outside of the flame zone. Further, the switching station will have a larger 33 m APZ to east, and the BESS will have a 23 m APZ to the west; ■ The risks associated with Flame Zones will be avoided to some infrastructure by: ▪ Micro site WTG3, WTG29, WTG46, WTG49, WTG52 and WTG65 out of the flame zone; and ▪ The remaining 39 WTG, the access road and the transmission line easement are currently located within the flame zone. Non-combustible construction materials will be used; and ■ All poles will be either concrete or galvanised steel poles and the maintenance of the transmission line easement including, reduced fuel loads beneath transmission lines, will be the responsibility of the asset owner. For the safe operation of the transmission line, certain activities will be restricted within the easement such as planting and growing trees, construction of buildings, or erection of antennae or masts.	Proponent and Contractors	Construction and Operation

Environmental Aspect		Mitigation Measure	Responsibility	Stage
	Blade Throw	■ WTG components will be manufactured and certified in accordance with the current best practice IEC Standards; and ■ WTGs are to be equipped with sensors that identify structural fatigue and enable early maintenance and management measures which will also assist in mitigating structural failures such as blade throw risks.	Proponent and Contractors	Prior to Construction and Operation
	SEPP 33	■ The BESS and other key infrastructure will be installed in as per AS/NZS 5139:2019 or other relevant standards; ■ Restricted public access to the construction and operational areas and security will be maintained via surveillance equipment to restrict access throughout the construction and life of the Project; ■ Appropriate safe work procedures will be implemented for the handling of all chemicals, including transfer, storage, spill prevention and clean up requirements; and ■ Transportation of dangerous goods will comply with the requirements of the Australian Code for the Transport of Dangerous Goods by Road and Rail (the ADG Code).	Proponent and Contractors	Construction, Construction, Operation
Aboriginal Heritage		**Aboriginal Heritage Management Plan** ■ A Aboriginal Heritage Management Plan will be prepared in consultation with Heritage NSW and Aboriginal stakeholders. Heritage mitigation measures include: ■ If impacts to identified Aboriginal archaeological sites is unable to be avoided, surface collection or archaeological salvage efforts will be undertaken in accordance with the *Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010); ■ All employees, contractors, subcontractors and agents carrying out any development on site will undertake a Project induction (including the distribution of a construction heritage site map) to ensure that they have an understanding of and are aware of the Aboriginal and historic heritage issues affecting the activity; and ■ In the event that works on site reveal either possible human skeletal remains or possible Aboriginal or historical heritage objects, all work will cease and the measures detailed in the Unexpected Finds Protocol will be implemented.	Proponent and Construction Contractor	Construction
Historic Heritage		■ All works will be undertaken in accordance with an Non-Aboriginal Heritage Unexpected Finds Procedure. ■ Early geophysical survey and/or geotechnical investigation of the Devil's Elbow road upgrade 'Assessment Area' (as defined in the SoHI) will be undertaken to determine if there are any subsurface voids beneath the 'Devil's Elbow' proposed upgrade, or other anomalies that may be indicators of archaeological features. ■ Where suspected tunnels cannot be avoided, archaeological inspection and archival recording will be undertaken prior to the commencement of construction works. The archival recording will be lodged with Tamworth Regional Council and potentially utilised to develop interpretive signage at an appropriate location at Black Snake Gold Mine, Nundle and/or Hanging Rock. This signage can contribute to existing historical and interpretive signage. ■ If backfilling is required, the methodology for this will be developed in consultation with the proponent, construction contractors, and heritage specialists. Decisions around appropriate methodology will be made based on the type and condition of any findings.	Proponent and Construction Contractor	Construction
Soils and Water		Soils and Water Management Plan ■ a Soils and Water Management Plan (SWMP) will be prepared, inclusive of Progressive Erosion and Sediment Control Plans (ESCPs) to address management requirements at individual work sites and will be prepared in accordance with the 'Blue Book' (Landcom, 2004). Soils and water mitigation measures include: ■ water licences for the development will be obtained in accordance with the Water Management Act 2000; ■ appropriate stormwater, collection, treatment and recycling will be implemented at the concrete batch plant, in accordance with relevant best practice guidelines and any requirements of the NSW Environmental Protection Authority; ■ all waterway crossings will be constructed in accordance with the: ▪ *Water Guidelines for Controlled Activities on Waterfront Land* (DPI, 2012); and ▪ *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (DPI, 2003); ■ appropriate procedures will be in place for the transport, storage and handling of fuels, oils and other hazardous substances, including availability of spill clean-up kits; ■ areas disturbed during construction will be promptly rehabilitated as works progress; and ■ additional measures to be included in the progressive ESCP to appropriately mitigate impacts associated with the identified sensitive location in the adjacent National Park. Measures are to either: ▪ direct disturbed runoff away from the catchment area identified to contain the sensitive location, or ▪ process runoff through additional sediment controls (e.g. sumps and/or sediment basins) and discharge at a low, non-erosive velocity.	Proponent and Construction Contractor	Construction

Environmental Aspect	Mitigation Measure	Responsibility	Stage
Air Quality	The following mitigation measures will be implemented where practicable to minimise air quality impacts: ■ watering roadways or preparing roadways with coarse gravel or other road coverings where required; ■ the sealing of Morrisons Gap Road following consultation with the local community and subject to Tamworth Regional Council acceptance; ■ covering and/or stabilising material loads which may generate dust, such as aggregates, during transport into and within the construction site where practicable; ■ managing soil stockpiles through stabilisation, light watering or the use of covers; ■ minimising vegetation clearance, including clearing vegetation in stages, and the stabilisation of cleared areas where practicable; ■ controlling the speed of dumping from tip trucks; ■ minimising vehicle movements where practicable; ■ cleaning and wash of vehicles, plant and equipment; ■ progressive revegetation and stabilisation of disturbance areas no longer required for construction; ■ regular inspection and maintenance of all vehicles, plant and equipment to ensure operational efficiency; and ■ regular monitoring of environmental conditions during construction, such as wind, that may result in dust generation and implementation of control measures as specified above, as relevant.	Proponent and Construction Contractor	Construction
Waste	**Waste Management Plan** ■ A Waste Management Plan (WMP) will be prepared and will describe the measures to be implemented to classify, manage, reuse, recycle and safely dispose of waste.	Proponent and Contractors	Construction, Operation and Decommissioning
Socio Economic	■ The Proponent will implement the following two key community enhancement and benefits programs: ▪ a Voluntary Planning Agreement in the form of a Community Enhancement Fund; and ▪ a Neighbours Benefits Sharing Program. ■ The Proponent will to work closely with local authorities to promote and develop relevant skills/programs in an effort to engage the community in local employment opportunities.	Proponent	Construction, Operation and Decommissioning

22. SUSTAINABLE DEVELOPMENT

This chapter provides a summary of the application of relevant ecologically sustainable development principles (ESD). ESD requires the effective integration of the social, economic and environmental considerations into the decision-making processes.

22.1 Background

The Commonwealth Government defines ecologically sustainable development in the *National Strategy for Ecologically Sustainable Development* (1992) as:

> *'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased'*

The Commonwealth Government recognises the need for development to apply careful management measures to ensure both current and intergenerational quality of life is enhanced.

For the purposes of this EIS, the relevant definition is found in the EP&A Regulation, which defines the principles of ecologically sustainable development as follows:

> *(a) **the precautionary principle**—namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:*
>
> *(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and*
>
> *(ii) an assessment of the risk-weighted consequences of various options,*
>
> *(b) **inter-generational equity**—namely, that the present generation should ensure that the **health**, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,*
>
> *(c) **conservation of biological diversity and ecological integrity**—namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,*
>
> *(d) **improved valuation, pricing and incentive mechanisms**—namely, that environmental factors should be included in the valuation of assets and services, such as:*
>
> *(i) polluter pays—that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,*
>
> *(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,*
>
> *(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.*

The application of these principles, in respect to the Project, are discussed in more detail in Section 22.2.

22.2 Application to the Project

22.2.1 The Precautionary Principle

The environmental impacts of the Project have been carefully evaluated in this EIS and environmental impacts have where practicable been avoided, mitigated, managed or offset. Various options have been considered for the WTGs, ancillary infrastructure and the transmission line corridor having regard to environmental risks and, ultimately, options with lower environmental impacts and risks have been selected to avoid and minimise potential biodiversity and heritage impacts.

The site suitability and project alternatives selection process, as detailed in Chapters 4 and 5 of this EIS, have thoroughly considered and sought to minimise the likely impacts to the local environment.Where uncertainty exists, measures have been suggested to address the uncertainty.

During operations, management plans incorporating adaptive management principles will be implemented to ensure that necessary care is taken where there are threats of serious or irreversible environmental harm.

22.2.2 Inter-generational Equity

The Project is consistent with the principle of inter-generational equity because it involves a new renewable energy resource which will result in estimated savings of approximately 654,500 tonnes of GHGs per annum, thereby mitigating the effects of climate change for future generations.

Other environmental benefits associated with the Project include reductions in air quality emissions and water use from wind power generation in comparison to traditional coal fired power stations.

During decommissioning, the Project Area will be made suitable for agricultural or other uses by future generations.

22.2.3 Conservation of Biological Diversity and Ecological Integrity

Conservation of biodiversity has remained a fundamental consideration throughout the lifecycle of the Project to date. Extensive biodiversity assessment has been undertaken to understand the anticipated impacts. The findings of the biodiversity assessment have informed an ongoing iterative design for the layout of the Project and siting of WTGs and other key infrastructure.

Impacts to biodiversity will be avoided, mitigated and offset where necessary to ensure that there is no net loss in biological diversity and that ecological integrity is maintained (Appendix D).

22.2.4 Improved Valuation, Pricing and Incentive Mechanisms

The Project enables the utilisation of a valuable resource, wind energy, which is otherwise lost if the Project did not proceed.

An EPL will be required for the Project in accordance with the POEO Act, which will include fees to regulate pollution control and waste disposal associated with the Project.

A Community Enhancement Fund and Neighbour Benefits Sharing Program to provide broader financial benefits to the community.

When the Project is decommissioned, the Project Area will be rehabilitated as far as practicable to pre-construction condition.

22.1 United Nations Sustainable Development Goals

The Nations 2030 Agenda for Sustainable Development includes global sustainable development goals (SDG) to build a more sustainable and resilient future. The 17 SDG and 169 individual targets cover measures towards improvements to economic, social and environmental sustainability. All countries of the world have agreed to work towards achieving the SDGs by 2030. Goal 7: 'Ensure access to affordable, reliable, sustainable and modern energy for all'. Target 7.2 states "By 2030, increase substantially the share of renewable energy in the global energy mix'.

23. EVALUATION AND CONCLUSION

This chapter provides an overall evaluation of the Project with regard to the strategic need for the Project and its environmental, social and economic impacts.

23.1 Strategic Benefits

The Project would have an energy generating capacity of approximately 420 MW to the NEM and have an estimated capital investment value of $826 million, providing significant benefits to the Federal, State and local level by:

- aligning with Commonwealth an NSW Government Policy and strategic vision by:
  - supporting the transition being undertaken in the energy sector away from a centralised system of large fossil fuel generation, towards a decentralised system of widely dispersed, renewable energy production,;
  - providing necessary alternative electricity production given the forecasted retirement of coal-fired power stations;
  - contributing to GHG emission reductions in the order of 654,500 tonnes per annum, supporting Australia’s commitment to the Paris Agreement on climate change;
  - provide a significant amount of new generation capacity which will be required when the 2000 MW Liddell Power Station located in the NSW Hunter Valley closes in 2023
  - contributing to NSW and Commonwealth renewable energy targets;
- delivering significant benefits to the regional and local communities, including:
  - the Project represents a direct investment of over $826 million and will result in the direct injection of approximately $100 million increased income (value add) during construction and $16M per year during operations;
  - providing around 216 direct and roughly 430 on-flow jobs during construction and approximately 31 long term service and maintenance jobs created during project operation and 53 on-flow jobs providing increased employment opportunities, including for local workers in the New England Region;
  - providing economic stimulus for rural NSW which will mitigate the ongoing economic impacts of the COVID-19 pandemic and the Black Summer Bushfires;
  - providing additional income stream for the involved landholder and diversity of land use;
  - renewable, low cost energy to the national grid, and will contribute to the NSW Government’s new zero emissions target by 2050;
  - opportunities for local contractors and businesses, including the development of new skilled labour in the region within the growing renewable energy industry;
  - potential for new educational opportunities associated with construction and operation of the Project which will require a range of skills including engineering, trades (electrical, mechanical, construction), transport, building material providers, equipment operators, consultants and administrative staff;
  - diversifying regional employment opportunities beyond the productive agriculture sector;
  - opportunities for eco-tourism through the attraction of tourism opportunities associated with the wind farm; and
  - providing improvements to the local road network, including proposed upgrade works to Barry’s Road, Morisons Gap Road and Head of Peel Road;

- establishment of a Community Enhancement Fund. This will be supported by funding of $2,500 per operational wind turbine per year over the operational life of the Project and will be directed to:
  - improve community assets such as recreational facilities, public open space and public amenities; and
  - provide the community with the financial resources to help enhance lifestyle and opportunities for local residents around Hanging Rock, Nundle and communities close to the Project.
- benefit sharing contributions from the Neighbour Benefit Sharing Program providing better diversification of income and a drought proof and post retirement income for farmers and the community;

- the site suitability of the area for a wind farm, including;
  - the high wind resource of the locality;
  - use of predominantly existing agricultural use and desirable ridge orientation for predominate wind directions with existing access tracks in existence;
  - proximity to the existing 330kV TransGrid Liddell to Tamworth transmission line with capacity to accept the generation electrical network
- carrying out development consistent with land use zoning and permissibility under relevant legislative provisions;
- liaising and working with the community and all potentially affected stakeholders in the identification, mitigation and monitoring of any potential environmental effects; and
- minimising all potential and adverse environmental impacts and where practical, maximising all potential positive environmental effects.

Other environmental benefits associated with the Project include reductions in air quality emissions, waste production (eg coal ash), and water use in comparison to traditional coal fired power stations.

The Project, therefore, will support the Commonwealth and NSW Governments in achieving their respective renewable energy and greenhouse gas emission reduction targets, and it will support a transition to low carbon economy. The Project will also provide much needed economic stimulus and social opportunities in rural regions while reducing the cost of power.

23.2 Design Principles

The Project has been designed and refined on the basis of environmental constraints, stakeholder engagement, and Project design considerations. This has ensured the Project has been designed with a scope and Development Footprint that minimises environmental impacts whilst maximising Project benefits.

23.3 Environmental Outcomes

Detailed technical environmental assessments support the EIS. The key assessments and impacts include:

- **Biodiversity:** removal of native vegetation within the Development Footprint and other indirect impacts. The Project has been designed to avoid and minimise impacts to biodiversity. To compensate for unavoidable disturbance of native vegetation, biodiversity offsets are proposed.

- **Visual**: the Project Area was selected in part due to the limited number of residences in close proximity and the Project has been designed to avoid visual impacts as far as practicable. However, the development of the Project will result in changes to the landscape and visual impacts will occur during the construction and operational phases of the development. A range of mitigation measures including supplementary planning and screen planning is proposed at various non-associated dwellings to minimise impact. Landscaping will reduce the visibility of Project infrastructure.
- **Traffic**: traffic generation analysis shows that there would be adequate capacity in the road network to accommodate the Project. The forecast traffic volumes are also expected to be less than the environmental capacity goals of the road network. The Project will include the delivery to site using restricted access vehicles of the components of the wind turbines and electrical equipment including among other components; blades, tower sections, nacelles, substation, switching station components and cabling. A detailed traffic management plan would be needed for the transportation of individual items.
- **Aboriginal Cultural Heritage**: Project design refinements have avoided some sites of moderate significance. However, some other sites of low and moderate significance will be impacted by the Project. Six (6) sites and one potential archaeological deposit (PAD) were identified during archaeological survey effort as part of the Aboriginal cultural heritage assessment which may be impacted as a result of the Project. Impacts to sites within the Development Footprint will be managed through a Management Policy for Aboriginal Heritage.
- **Historic Heritage**: The Project Area does not include any historic heritage sites. Impacts to heritage items will occur along the transportation route of oversized and over mass infrastructure components. Insignificant direct impacts are anticipated on the Merton Cemetery, St Peters Catholic Church and Nundle Shire Offices. Minor direct impacts will result to the Kayuga Cemetery. Major direct impacts are anticipated to the Black Snake Gold Mine due to the proposed road upgrade works at Devil's Elbow (Barry Road), which will require further assessment in a Statement of Heritage Impact.
- **Hazards and Risks**:
  - Aviation: The assessment concludes that the Project will not penetrate any Obstacle Limitation Surfaces; will penetrate height requirements of the *Procedures for aircraft navigation services – aircraft operations*; will have an impact on nearby designated air routes; will not have an impact on the grid lowest safe altitude; will not have an impact on prescribed airspace; is wholly contained within Class G airspace; and is outside the clearance zones associated with aviation navigation aids and communication facilities. Various recommendations and mitigation measures have been detailed for the Project, as detailed in Section 13.1.
  - EMI: The EMI Assessment indicates that there is one point to point radio link which passes through the Project Area. This is a VHF customer telephone link operated by Telstra. The link has sufficient horizontal clearance for a normal line-of-site link. This radio link provides a telephone service to a former dwelling within the Project Area that will not be occupied if the Project proceeds (associated structure AS_1).
  - Bushfire: The risk that the wind farm itself will cause a fire is minimal although the proposed development is located within a bushfire prone landscape. Some of the proposed wind farm infrastructure, including WTGs, the transmission line and the main access road will be located within the flame zone. A Bushfire Emergency Management and Operations Plan will be prepared in conjunction with relevant stakeholders, including NSW RFS, NSW Fire and Rescue, NPWS, NSW Forestry, adjoining property owners and employees. The improved access and additional water sources will be an advantage to both the local RFS and the NPWS.

  - Blade throw: The Blade Throw Risk Assessment has demonstrated that there is a very small likelihood of a blade or fragment being thrown a significant distance. The assessment therefore establishes that the risk associated with a blade throw event can be considered very low. Although the predictions for blade throw likelihoods and maximum throw distances vary, studies place the maximum blade fragment throw distance between about 500 to 800 metres under normal operating conditions, and there is general agreement throughout the literature that the likelihood of damage to human life or property from a blade throw incident is extremely small and well within risk levels typically deemed acceptable by society.
  - SEPP 33: It is recognised that the Project is to include small quantities of hazardous materials which do not trigger the SEPP 33 threshold. With consideration of the insignificant quantity of materials stored onsite, along with the significant distance to neighbouring properties, the risks associated with storage and transportation of hazardous materials are unlikely to be significant or pose a risk to public safety. Given that Applying SEPP 33 thresholds are not exceeded, the Project is not considered to be a hazardous or potentially hazardous industry under SEPP 33

- **Soils and Water**: The Project Area intersects with three catchment areas. The development footprint only directly intersects with five waterways associated with creek crossings along the transmission line and the access road. The existing condition of these creek crossings is poor. The Project will include enhancement of these creek crossings and will result in an improvement of downstream sediment impacts and water quality. In addition, bridge upgrades are proposed along Lindsay Gap Road and Head of Peel Road to cater for oversize and over mass deliveries. Overall constraints are relatively minor due to the low to moderate erosion hazard over the majority of the Project Area to be impacted by construction. A suite of erosion and sediment controls will be adopted to manage areas disturbed during construction followed by progressive and revegetation for long-term stabilisation of these areas.

23.4 Community Consultation and Benefits

WEP is committed to ongoing and thorough community engagement with all stakeholders. A community consultation program has been implemented including community information sessions and individual meetings with stakeholders, the distribution of newsletters, and a Project website. Community engagement will continue throughout the public exhibition of the EIS, post approval, and during construction and operation of the Project. Throughout this time the Community Consultative Committee (CCC) will assist in raising and addressing community concerns and will provide ongoing information and support to the community.

The Project proposes two key community enhancement and benefits programs:

- a Voluntary Planning Agreement in the form of a Community Enhancement Fund; and
- a Neighbours Benefits Sharing Program.

In addition to these, the Project will also incorporate road upgrades required by the Project at the Project's cost and which will fall outside of the Community Enhancement Fund.

23.5 Socio Economic Outcomes

The Hills of Gold Wind Farm Project, in the short-term (construction phase), would have a significant positive economic impact with guaranteed financial gains. In the longer-term (operation phase), the Project would continue to have a positive economic impact on the local economy. The Project is expected to include capital expenditure of roughly $370 million (local regional economy) with approximately 650 (i.e., 216 direct jobs and 430 on-flow jobs created during construction and around 84 jobs during its operational life (i.e., 31 direct jobs and 53 on-flow jobs).

23.6 Summation

The Hills of Gold Wind Farm involves the operation of up to 70 WTG, together with associated and ancillary infrastructure, which will have an approximate energy generating capacity of 420 MW which will contribute to the NEM. Renewable energy projects, such as the Project, play a key role in reducing carbon emissions and human induced climate change as part of the necessary and ongoing clean energy transition.

The Project has been carefully designed and sited to minimise environmental impacts in consultation with the local community and relevant landholders. While, as with all wind farm projects, there are some inevitable impacts associated with the Project, including biodiversity, visual and noise impacts as outlined above, these impacts have been fully assessed and confirmed to be significantly outweighed by the strong public benefits which the Project will deliver.

The Project will:

- assist the Commonwealth and NSW Government to fulfil their targets and policies to increase renewable energy supply and reduce carbon emissions;
- assist in meeting energy demand and providing network stability through battery storage as part of the energy transition; and
- deliver economic stimulus to regional NSW which will assist in the economic recovery from the Black Summer Bushfires and COVID-19 pandemic.

The Project represents a positive addition to the local and wider NSW economy and the NEM. Through the implementation of proposed mitigation and management measures, it is considered that this Project is consistent with the objects of the EP&A Act, and is in the public interest.

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